



# QUALITY ASSURANCE FOR SAFETY IN SUBMARINES – VICTORIA CLASS

(ENGLISH)



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Mr. Richard Nelson / DMEPM(SM) Sponsoring Director/PMO – Directeur/BP		12 Aug 09 Date	
<b>Mat GCOL recommendation</b> I recommend that these documents be kept in English only. There is no requirement at this time to have them translated. Tracy Howe Mat GCOL – CGOL Mat		<b>Recommandation du CGOL Mat</b> 12 Aug. 2009 Date	
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<sup>1</sup> Due to the significant number of changes incorporated in this document there are no edit highlights used in this version.

## FOREWORD

1. The purpose of Quality Assurance for Safety in Submarines (C23-VIC-000/AM-001) is to define first level systems and components, their procurement, through life maintenance management and final disposition.
2. In concert with C23-VIC-000/AG-001 and in support of the Naval Material Management System (NaMMS) the document provides the policy to ensure full traceability of quality records for designated first level components in use, awaiting use or, removed from use in a submarine.
3. Originally developed from the MoD UK SSCP 25, it has retained some of the historical data associated with that document and tailored it to Canada's approach to submarine quality assurance management. It represents a starting point for the future management of the Victoria Class.



M.J.M. Hallé  
Commodore  
Director General  
Maritime Equipment Program Management

## NOTES TO USERS

1. This publication defines the Quality Assurance (QA) policy and requirements for items affecting safety in submarines. Service Providers (SPs) shall comply with these requirements.
2. The requirements of this publication apply to the Victoria Class Submarines. General QA requirements are summarized in Part 1; the remainder of the document provides specific safety requirements for QA in submarines.
3. The QA policy and requirements for submarine safety in this publication were developed from the MoD (UK); SSCP 25.
4. The requirements of this document shall not limit any organization's responsibility for the satisfactory performance of a contract, a purchase order or a work package.
5. No departure from the requirements expressed in the text shall occur without formal sanction in writing from Director General Maritime Equipment Programme Management (DGMEPM).
6. In this publication, reference to any related document in any pre-contract solicitation, contract or work-package means the most current, approved edition complete with current amendments. The only exception is where a specific edition is mentioned.
7. Any comments regarding this document should be referred to DMEPM(SM) 2. Amendment proposal information can be found in Part 9 - Quality Assurance for Safety in Submarines – Victoria Class.
8. Standards and specifications quoted within this document are called up by their base identities without version information. For particular issues and amendments applicable to a contract, the appropriate contract documentation shall be consulted.

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## PART 1

### GENERAL QUALITY MANAGEMENT POLICY FOR SUBMARINES

#### SCOPE

1. This part details DND's general approach to quality management for safety in submarines. It is relevant to all phases of a submarine's life cycle, including disposal, and provides a succinct introduction to DND QA policy as it pertains to Victoria Class Submarines.
2. The policy is supported by specific QA and safety management requirements.

#### POLICY REQUIREMENTS

3. Quality management is defined as all activities and functions concerned with the attainment of quality.
4. DND shall implement the requirements of this document and formally delegate authority to verify compliance as required.
5. It is DND Procurement Policy that Service Providers (SPs) shall demonstrate that they have quality management systems to the applicable ISO standard. A DND Quality System Evaluation (QSE), third party registration or both may verify conformance.
6. ISO 9001 determines the minimum requirements for quality management systems for Defence contracts. Process controls may vary according to the criticality of the product and the scope of the work.
7. The responsibility for quality rests with the SP supplying the product or service. Management of the organization is responsible for ensuring that work is properly controlled and that quality requirements are met. Most SPs will sub-contract some work. The responsibility for ensuring that all levels of sub-contract meet the requirements of the main agreement or contract lies solely with the contracting SPs.
8. In complying with the ISO 9001, all SPs shall demonstrate that:
  - a. they have a Quality Manual. The Quality Manual shall contain a detailed management structure and company quality procedures; and
  - b. they have a quality plan that will satisfy both the requirements of ISO 10005 for the quality plan and the prescriptive Objective Evidence (OE) defined in the remaining parts of this document.
9. DND assures the adequacy of a SP's, and occasionally subcontractor's, quality management systems during execution of a contract in a number of ways:
  - a. DND or a designated representative shall scrutinize design and development activity;
  - b. DND or a designated representative will verify records and Certificates of Conformity (C of C). Many of the procedures within the SP's quality system or the quality plan will give rise to records, e.g., dimensional inspections and checks on design calculations. A C of C (DND 2513) is required to indicate that OE or records exist to prove that the product complies with the contractually specified requirements, including any deviation properly authorized by configuration change action. The SP is to ensure that the C of C is delivered to DND or a designated representative, including copies of any related configuration change documents (deviations, waivers, engineering changes) and an index of the principal checks and tests;

- c. DND reserves the right to accept / demand the use of specific processes in the quality plan and ask for internal records, evaluations, or audits to demonstrate acceptable performance, e.g., welding, Non-Destructive Evaluation (NDE), crimping, etc;
- d. DND or a designated representative may require a manufacturer to set an item to work after installation. Setting to work test procedures and completed test forms shall form part of the QA documentation; and
- e. The manufacturer or DND's designated representative may perform tests and trials on prototypes and production materiel to confirm compliance with the contract requirements.

10. In the case of Fleet Maintenance Facility (FMF) work, the designated representative is the Formation Technical Authority (FTA). In the case of contracted work, the designated representative is the appropriate National Defence Quality Assurance Region (NDQAR).

#### **FORMATION LOGISTICS / BASE SUPPLY**

11. Although the supply organizations supporting the Victoria Class Submarines on the East and West Coast may not be assessed to a Quality Management System Standard (ISO 9001:2008), they shall conform to the intent of the general policy detailed in this part. Supply organizations shall have processes and procedures in place to satisfy both the requirements and the intent of this policy, as well as, an auditable process for implementing Continual Improvement Activities.

#### **SHIPS' STAFF**

12. Although ships' staff are not currently assessed to a Quality Management System Standard (ISO 9001:2008); they shall comply fully with the specific materiel management requirements specified in this publication. The Victoria Submarine Technical Instruction (VSTI) 101 provides detailed operating principles and procedures for maintenance and repair activities undertaken for First Level work by ships' staff.

## PART 2

### THE PARTICULAR APPROACH FOR VICTORIA CLASS SUBMARINES

#### SCOPE

1. For the majority of items, the confidence given by the general approach outlined in Part 1 is sufficient. Where the consequences of failure of a hull area, system or equipment are such that it would lead to loss of the submarine, these areas, systems and equipment shall be classified First Level and additional QA measures must be implemented.
2. First Level QA covers two main areas:
  - a. safety of the submarine; and
  - b. personnel safety insofar as it affects the safety of the submarine.
3. This section provides background and guidance on the selection criteria and consideration for determining First Level hull areas, systems, equipment and boundaries for the Victoria Class. First Level systems are defined and determined in Quality Assurance for First Level Systems and Areas C-23-VIC-87X/ND-001 (commonly known as FLADS). Annex A2, B2 and C2 give general guidance on First Level boundaries.
4. Computer software resident within a First Level system shall be treated as a system component of a First Level system.
5. First Level QA is not always necessary for all components of a First Level item, only those components affecting safety. For example, when a valve is part of a First Level system, but failure of the valve to function (open or shut) does not affect safety, then only those valve components comprising the pressure boundary need to be classified First Level.

#### FIRST LEVEL DEFINITIONS

6. First Level systems affecting submarine safety include hull areas, systems and equipment where a single failure would, under particular accident conditions, prevent the submarine from surfacing due to the following hazards:
  - a. **uncontrollable flooding;**
  - b. **loss of control;** or
  - c. **loss of main propulsion.**

#### NOTE

The safety of individual members of the crew is part of the normal requirements of design, manufacture and upkeep; therefore, personnel safety is not in itself a reason for First Level QA. **Cases of hull areas, systems and equipments in which a single failure would constitute a major hazard to personnel and indirectly lead to de-facto loss of the submarine will be considered First Level.** Nonetheless, personnel safety should continue to be considered in future equipment Hazards and Risk Identifications (HAZID) to ensure that departures from the design intent do not affect the mitigation instituted to address hazards which may lead to undesirable or intolerable risk.

## SELECTION CRITERIA FOR FIRST LEVEL ITEMS

### GENERAL

7. While hull integrity is of paramount importance, submarine safety also depends on the integrity of a wide range of systems and equipment. First Level systems and equipment are defined as those systems and equipment which may affect the watertight integrity, control surfaces and/or main propulsion which, in turn, could affect the ability to surface. Each submarine's Quality Assurance for First Level Systems and Areas (C-23-VIC-87X/ND-001) (FLADS) document outlines the specific First Level systems and areas for each Victoria Class submarine and shall be considered the Design Authority's (DA's) approved definition of First Level systems and areas for each Victoria Class submarine. This document (C-23-VIC-000/AM-001) is then used to provide the DA and System Authority (SA) with the parameters and specifications necessary to determine which systems and areas qualify for placement in each FLADS. The FLADS may be referred to for authoritative guidance on First Level systems for the Victoria class.

### SUBMARINE SAFETY ASPECTS

8. In normal operating circumstances every submarine has the ability to surface in the event of a limited ingress of seawater. However, the ability to surface following a larger failure is dependent on a number of factors, including but not limited to:

- a. the size of the leak;
- b. the ability to isolate the leak;
- c. the submarine's depth, speed and pitch;
- d. the availability of propulsive power;
- e. the continued operation of control surfaces; and
- f. the ability to blow main ballast tanks.

### NOTE

The Victoria Class submarine Manoeuvring Limitation Diagrams (MLDs) take into consideration such factors as depth, speed, pitch and crew reaction times when used to determine safe operating limitations.

9. Submarine safety relies on the integrity of a wide range of systems that reduce the probability of an incident occurring, reduce the consequences, and assist recovery should an incident occur. These criteria are considered below.

### SIZE OF LEAK

10. The pressure hull structure and fittings, the hull and back-up valves and pipe work between them, and the systems and tanks, which will normally be open to the sea at diving depths, form the pressure envelope. They are often referred to as hard systems.

11. While any failure in the pressure envelope at depth raises great concern, a limited size of hole exists below which the submarine can still be brought to the surface if all recovery systems work as intended. The Manoeuvring Limitation Diagram determines the safe operating envelope within which the submarine can be operated. It takes into account the effect on buoyancy and trim caused by the ingress of sea water and consequently what speed, depth and control surface angles must be maintained.

12. The limiting (single) hole size, above which recovery is not possible, is called the Critical Hole Size (CHS). It is the diameter of the hypothetically largest single unsecured hole in the pressure envelope from which the submarine could recover successfully if operating within the assumed operating envelope. Each compartment can have a different CHS.

13. In deciding the size of pipe work and fittings down to which First Level QA requirements will apply, the following factors are considered:

- a. the assumed operating envelope as determined by the MLD;
- b. that complete pipe work failure will normally cause a double-ended leak; and
- c. that there are secondary effects of the ingress of seawater at high pressure, such as equipment failure leading to loss of propulsion, loss of communication, or reduced operator effectiveness.

14. The diameter of the smallest hole in the pressure envelope for which First Level QA is specified is called the Specified Hole Size (SHS). For Victoria Class submarines the SHS is ‘**above 45.0 mm bore**’. Therefore, based on the originally established design intent in STP331/89, any nominal hole in the pressure envelope greater than 45.0 mm in diameter shall be subject to First Level QA. Only the nominal hole size, and not its related tolerances, is to be used for comparison to SHS. Therefore, for any non-First Level hole in the pressure envelope that exceeds 45.0 mm in diameter due to a design tolerance specified for that particular hole (i.e. general drawing-level tolerances are excluded from this consideration) can remain non-First Level. In the event that a non-First Level hole in the pressure envelope exceeds the design tolerance and repair is not practicable, then a deviation or waiver shall be raised. Note that holes in the pressure envelope of 45.0 mm or less in diameter may be classified as First Level if required for another aspect of submarine safety as described below (for example components that provide hydraulic power to First Level systems). If the System Authority deems that the requirement exists to reclassify the hole as First Level, SMTI 211 provides guidance on implementing this change. Additionally, if a permanent welded bobbin or Monel sleeve is fitted to a penetration that reduces the hole size to less than SHS, then the sleeve and bobbin are to be treated as First Level while components located downstream of the penetration are not.

15. SHS applies to hull areas and associated valves and fittings subjected to deep diving depth pressure (DDDP).

16. Service Providers shall provide full QCA documentation for all work performed on all pressure hull penetrations and fittings that are greater than SHS. Such OE includes:

- a. chemical composition;
- b. mechanical properties;
- c. heat treatment records, unless physical properties are determined after heat treatment, or cannot be affected by heat treatment;
- d. non-destructive examination, test results and reference numbers of NDE records (radiography, ultrasonic tests, dye penetrate or magnetic particle inspections, etc.);
- e. shop pressure tests;
- f. dimensional inspections;
- g. performance or function tests;

- h. OQE documenting that correct installation or assembly procedures were followed including but not limited to:

- (1) all applicable record cards;
- (2) fasteners;
- (3) bobbin or Monel sleeves;
- (4) tapped holes;

- i. validation and/or revalidation certificates for Nickel Aluminum Bronze (NAB) castings.

17. First Level QA is required for the integrity of the pressure boundary for all components contributing to the strength and integrity of the pressure hull where failure would result in a hole in the envelope greater than the SHS. This includes the tail shaft.

18. For hull and back-up valves kept shut while dived, the First Level requirement is limited to those components that form the pressure boundary and those components that maintain the valve shut.

### **FLOOD ISOLATION**

19. In the event of serious flooding it will be necessary to immediately isolate the flood using the appropriate hull and/or system valves.

20. First Level QA is required for those parts of hydraulic systems that supply or maintain hydraulic power to First Level equipment on the pressure boundary (including the boundary valves). First Level QA is also required for those mechanical and electrical components of these hydraulic systems essential to operation, including power systems providing energy.

### **NOTE**

If analysis shows that sufficient energy is stored in accumulators to cycle boundary valves one time, then the First Level boundary may be limited accordingly.

### **AVAILABILITY OF PROPULSIVE POWER**

21. The availability of propulsive power is vital to submarine safety in the event of a serious flood or a hydroplane jam at depth.

22. Loss of main propulsion alone does not pose an immediate threat to submarine safety, but the propulsion system is essential to facilitate recovery from a flood or an inoperable control surface. For the Victoria Class the basic propulsive power requirement is to maintain the electrical supply from the batteries to the propulsion motor via the related switchboards and cable/bus bar runs. Core main propulsion components facilitating recovery are classified First Level. They include the main motor, the shaft line (the tail shaft is First Level in **all** respects), and the propeller. Since these components are in continuous use at sea, this First Level requirements will be satisfied through installation checks and functional test results after modification, refit or repair and by regular in-service operating checks and maintenance routines. Installation checks and functional test results shall be kept in QA Live Files as OE of QA.

### **ELECTRICAL SYSTEMS AND EQUIPMENT**

23. First Level QA of electrical systems (including control and indication) focuses on response to inputs from sensors or operators or both. The conditions for failure of items or equipment that make up electrical systems are not readily defined in terms of mechanical failure or mechanical integrity. The



diversity of materiel and the complexity of the processes involved in the manufacture of components (e.g., resistors, capacitors, transistors, integrated circuits, etc.) for electrical and electronic equipment precludes, for practical reasons, recording of material composition and manufacturing process controls. C of C (DND 2513) shall be provided as OE that these components have been overhauled and tested to design requirements. The DND 2513 may be substituted by a suitable manufacturer's C of C.

24. Float switches, alarm relays, fuse panels and cabling associated with the Flood Alarm Warning System are First Level and is to be supported by a C of C (DND 2513). Replacement of any of these items requires a C of C (DND 2513). The DND 2513 may be substituted by a suitable manufacturer's C of C.

25. Fuse panels, junction boxes, connecting panels, switches and the cabling of the 24 V DC system are to be supported by a C of C. It was originally agreed to between MoD (UK) and VSEL (BAE Systems) that the 24V DC system would be First Level for the control of Flood Alarms and Hull Control. However, the system has since been declared important but not First Level. The acceptability of this system will now be satisfied by installation checks and functional tests after installation.

26. The integrity of the entire Variable Potential Direct Current (VPDC) and propulsion telegraph systems are essential to the operation of the propulsion motor in all modes. Fortunately, there are numerous levels of redundancy that will allow for propulsion in various modes if some form of system damage occurs. The manipulation of propulsion mode, of battery groups, the use of links or of power breakers will permit supply of power and control of the motor from various sources. As a result, complete loss of propulsion due to a single point failure would be difficult to achieve in normal operation without the onset of a major failure due to some other catastrophic failure, such as a flood or fire for example. The weakest point is the VPDC System between the main power breaker and the main motor. For this reason, any VPDC cabling work that involves disruption or change of main power breakers/motor breakers, VPDC cabling, or work on the main motor or the propulsion switchboard is designated as First Level.

27. Having designated these as First Level, all Preventive Maintenance (PM) and Corrective Maintenance (CM) will only be carried out based on an approved job instruction. The job instruction will specifically identify the OQE to be included in the job folder and in turn become part of the QA Live File. The difficulty associated with providing material property OQE for electrical systems, breakers, or components fitted to the main motor, shall be addressed through the provision of C of C's by the Repair and Overhaul (R&O) contractor. The C of C is a declaration that the material specified in the Technical Data Package (TDP) or approved deviations for material substitution was used in the overhaul, and that the system authority approved procedures were followed in the overhaul process. To further satisfy the requirements of the references noted, any work on these First Level Areas are to be proven through special test instructions prepared specifically for the work that was carried out and based on the main propulsion installation inspection (TF 365-1) and on main propulsion system operation (TF 365-6).

## **OPERATION OF CONTROL SURFACES**

28. In the event of serious flooding it is vital to retain depth control. Correct functioning of the forward hydroplanes, after hydroplanes and rudder are essential.

First Level QA is therefore required for:

- a. the installation and operation of the hydroplanes and rudder;
- b. those parts of the air and hydraulic systems which supply or maintain power to the hydroplanes and rudder under normal and emergency conditions;
- c. control and indication components essential to the operation of these systems; and
- d. the integrity of the pressure boundary.

## BLOWING TANKS

29. In the event of serious flooding it will be necessary to blow main ballast tanks using emergency and possibly normal blowing systems to control pitch and bring the submarine to the surface.

First Level QA is therefore required for:

- a. the integrity of the pressure boundary of the normal and emergency blow systems that supply and maintain pressure; and
- b. those components necessary for the correct functioning of the HP Bilge and Ballast systems.

30. In the event of serious flooding, failure of a vent valve in the main ballast tank could result in delay and possibly loss of control in subsequent recovery action. First Level QA is therefore required for those parts of the vent valves which either affect function and/or buoyancy.

## WEAPONS EQUIPMENT

31. Submerged Signal Ejectors (SSE) and torpedo tubes can be open to sea at deep diving depth causing an exchange of inner and outer pressure envelope boundaries during these operations. Both the SSE and torpedo tubes also utilize ancillary systems to support their operation which either breach the pressure envelope and/or maintain an inner boundary above SHS. The SSE, torpedo tubes, and their ancillary systems and fittings form part of the pressure envelope and are therefore tested to DDSTP. Accordingly, these items have been identified as First Level and require the appropriate QA and OQE documentation to be retained in the submarines QA Live File.

## PRESSURE HULL WORK

32. Where work is specified for the pressure hull, specific QA and OQE requirements will form part of the specification. All documentation that will be retained in the submarines QA Live File will be similarly identified. No work shall be undertaken on the pressure hull without a written specification that has been approved by the Design Authority.

## PERSONNEL SAFETY ASPECTS - PRESSURE VESSELS

33. Hydraulic system accumulator bottles are of limited capacity and few in number. The release of High Pressure Nitrogen into confined submarine environments could present a localized asphyxiation hazard, however residual stored energy in High Pressure Air bottles could also present a serious hazard to personnel in the event of bottle failure. **All air storage bottles, hydraulic accumulator bottles, and nitrogen charging bottles will, therefore, be procured to a First Level QA Standard, irrespective of whether or not they are fitted in a First Level System.** The presence of the First Level Standard pressure vessel does not require the adjoining system components to be upgraded to First Level Standards if they are currently not defined as First Level in Quality Assurance for First Level Systems and Areas (C-23-VIC-87X/ND-001) for that specific submarine.

## Annex A2 Quality Assurance for Safety In Submarines – Victoria Class

## OUTLINE OF FIRST LEVEL AREAS / SYSTEMS / EQUIPMENT

System / Part System or  Area / Part Area	Reasons for Inclusion		
	(Refer to Para 6)		
	Uncontrollable Flooding	Loss of Control	Loss of Main Propulsion
Air Turbine Pump	✓		
BIBS, HIS & SBS Hull Valves	✓		
D Tank Auxiliary Vent & Blow Systems	✓		
Diesel Exhaust Hull & BU Valves	✓		
Diesel Generator Sea Water System Hull & BU Valves	✓		
Diesel Oil Fuel Filling Hull & BU Valves	✓		
DSRV & Conning Tower Systems	✓		
Escape Towers Fwd & Aft	✓		
External Salvage & Compartment Test System	✓		
Fwd Stern Tube Seal Housing	✓		
Garbage Ejector	✓		
HP Air		✓	
HP Air Hull Valves	✓		
HP Direct Blow	✓		
Hydroplanes & Steering Control Systems Including Power Plant		✓	
Main Battery Vent Hull Valve	✓		
Main Hydraulic System Including Power Plant	✓	✓	

System / Part System or Area / Part Area	Reasons for Inclusion (Refer to Para 6)		
	Uncontrollable Flooding	Loss of Control	Loss of Main Propulsion
Masts & Periscopes	✓		
MBT Vent Valves	✓	✓	
Pressure Hull Structure, Fittings & Electrical Hull Glands Affecting Strength & Water Tightness	✓		
Sanitary System Hull & BU Valves	✓		
Ships Controls, Hydroplane Steering Gear, Rudder & associated operating gear		✓	
Ships Sea Water Cooling	✓		
Snort Induction System	✓		
Submerged Signal Injectors	✓		
Tailshaft Assembly	✓		✓
Torpedo Tubes, Bow Cap, Rear Door, & Slide Valve	✓		
Torpedo Tube Flood & Drain Valves	✓		
Trim, Bilge & Ballast System, including D Tank	✓		
Ventilation Exhaust, LP Blow Hull & BU Valves	✓		
Voice Pipe Hull & BU Valves	✓		
WHDS External Hydraulics	✓		

## Annex B2 Quality Assurance for Safety In Submarines – Victoria Class

## OUTLINE OF FIRST LEVEL AREAS / SYSTEMS / EQUIPMENT-SUMMARY

System	System Code	First Level Summary
24V Battery		Although this system is important to mitigate uncontrollable flooding it is <b>NOT</b> designated First Level.
Air Turbine Pump	ATP	<p>The areas designated First Level associated with the ATPs are confined to those affecting watertight integrity i.e. the pump body, fasteners and fixing that attached it to the pressure hull, and any other item that could leave a breach in the ATP greater than SHS. These items are to be capable of withstanding seawater pressure down to MCD.</p> <p>The ATP Firing Reservoirs (ATP 1801, 1802) are procured to First Level standards, however the connecting system is <b>NOT</b> First Level.</p> <p>The WTT Pressure Transducer Pressure Hull penetration inserts and sleeves are designated First Level.</p>
Auxiliary Vent & Blow	AV	<p>The AV&amp;B pipe work from 'D' Tank up to and including the first isolation valve is designated First Level to mitigate uncontrollable flooding from 'D' Tank.</p> <p>Hull valves associated with the Conning Tower Flood and Drain and the Ships Siren are First Level along with the Conning Tower drain pipe work to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD.</p>
AZL Mast	AZL	<p>The AZL Mast from the AZL Pod down to and including the Waveguide Gland is designated First Level to mitigate uncontrollable flooding and is to be capable of withstanding seawater pressure down to MCD.</p> <p>The AZL pod drain line and hull valve are <b>NOT</b> First Level.</p>
Bilge System	BS	<p>The HP Bilge system is designated First Level to mitigate uncontrollable flooding during pumping / flooding operations down to DDDP. Due to the limited HP Bilge pump discharge capacity and the time required to commence pumping operations pumping capability is <b>NOT</b> a First Level function. However the HP Bilge system pumping capability does provide mitigation, when surfaced, for maintaining buoyancy during a flooding incident and also for reducing flooding rates in a DISSUB scenario for which the system is expected to be able to discharge sea water down to DDD when in series with the Ballast System to provide a salvage capability at depths in excess of DDDP.</p> <p>The First Level boundary is those equipments and fittings necessary to support pumping and flooding operations. Flow meters are First Level from a WTI perspective only.</p>
Built-in Breathing	BB	<p>BIBs hull valves are First Level to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD.</p> <p>The BIBs HP air bottles are procured to First Level standards, however the connecting system is <b>NOT</b> First Level.</p>
Buoyant Wire Aerial	BWA	There are no First Level areas associated with the Buoyant Wire Aerial system with the exception of the Pressure Hull penetration insert.
Chilled Water	AC	There are no First Level areas associated with the Chilled Water system with the exception of the Pressure Hull penetration inserts, bobbins and sleeves.

System	System Code	First Level Summary
Depth Gauge System	DG	There are no First Level areas associated with the Depth Gauge System with the exception of the Pressure Hull penetrations inserts and sleeves.
Diesel Engine Exhaust	DE	The Diesel Exhaust Hull and Backup valves and hull glands, inserts, bobbins and sleeves associated with the Diesel Exhaust system are First Level to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD.
Diesel Fuel Oil Filling	OFS	There are no First Level areas associated with the Diesel Fuel Oil Filling system with the exception of the Hull and Back Up valves which are designated First Level to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD.
Diesel Generator Seawater Cooling	DSW	The Hull and Back Up valves, make up pieces and pipe work between the Hull and Back Up valves is designated First Level to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD. There are no First Level areas associated with the remainder of the Diesel Generator Seawater Cooling system.
Domestic Fresh Water	FWC	There are no First Level areas associated with the Domestic Fresh Water system with the exception of the Pressure Hull penetration insert, bobbin and sleeve.
Escape Tower Aft Flooding	ETA	The Escape Tower structure including the upper hatch and lower lid are designated First Level in addition to the flood valves, pipe work and tower penetrations. This is to mitigate uncontrollable flooding during Escape Tower evolutions and is to be capable of withstanding seawater pressure down to MCD. The operating gear is <b>NOT</b> First Level.
Escape Tower Fwd Flooding	ETF	
External Hydraulic Power Plant	EHP	There are no First Level areas associated with the External Hydraulic Power Plant The accumulators are procured to First Level standards, however the connecting system is <b>NOT</b> First Level.
External Hydraulics	EHS	There are no First Level areas associated with the External Hydraulics system with the exception of the Pressure Hull valves, Pressure Hull penetration inserts, bobbins and sleeves.
External Salvage	SAL	There are no First Level areas associated with the External Salvage system with the exception of the Hull valves which are designated First Level to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD.
Flood Alarm		Although this system is important to mitigate uncontrollable flooding it is <b>NOT</b> designated First Level.
Foam Firefighting	AFF	There are no First Level areas associated with the Foam Firefighting system with the exception of the Pressure Hull penetration insert, bobbin and sleeve.
Garbage Ejector	GE	The Garbage Ejector and system are designated First Level to mitigate uncontrollable flooding during Garbage Ejector evolutions. The First Level boundary encompasses the Garbage Ejector Tube, Breach, Muzzle, Operating Gear, and Interlock, Hull valve and Flood and Drain Valves. These equipments / components are to be capable of withstanding seawater pressure down to MCD. Note: Failure of the operating gear could cause the muzzle door to open as no other mechanical interlocks are fitted.

System	System Code	First Level Summary
Hood Inflation	HH	There are no First Level areas associated with the Hood Inflation system with the exception of the Pressure Hull penetration inserts and sleeves.
Hydroplane and Steering Gear Hydraulic Power Plant	HHP	First Level designation is applied to the Hydroplane and Steering Gear Hydraulic Power Plant to mitigate loss of control. The First Level area includes the accumulators (HHP 300, 301, 302) and the supply pipe work to the Hydroplane and Steering Control system via fire isolation valve HHP 212. First Level designation is applied only to those parts of the Hydraulic Power Plant operating under accumulator pressure, therefore the hydraulic pumps and associated valves and pipes are <b>NOT</b> First Level. This part of the plant is to be capable of providing hydraulic power down to MCD for the operation of the After Hydroplanes and Rudder.
High Pressure Air	HPA	The HPA ring main supplied from the HPA main bottle groups is designated First Level to mitigate loss of control. HPA is used for normal surfacing and for control air to operate the Emergency Blow system. In addition a bottle is dedicated as an emergency air supply for the After Hydroplanes operation. To provide hydraulic power to the HSD and HS systems in the event of total power plant failure those systems are fitted with Nitrogen backed accumulators. This Nitrogen supply is classified as part of the HPA system and is designated First Level from the Nitrogen bottle to the first system isolation valve (HPA 615, 619, 279, 283 and 287). All HPA bottles are designated First Level. The HPA system is to be capable of providing high pressure air down to MCD. The HPA hull valves have a First Level status to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD.
High Pressure Blow	HPB	The HPB system is designated First Level to mitigate uncontrollable flooding. In the event of sea water ingress into the submarine the HPB system must be operable to recover the submarine to the surface in an emergency. Therefore those parts of the HPB system necessary for operation are designated First Level. All HPB bottles are designated First Level. The HPB system is to be able to provide an emergency blow capability down to DDD.
Hydraulic Transfer	HT	There are no First Level areas associated with the Hydraulic Transfer system with the exception of the Pressure Hull penetration insert and sleeve.
Hydroplane and Steering Control	HSD	The supply side of the Hydroplane and Steering Control system is designated First Level to mitigate loss of control. Those components required for HSD functionality on the supply side to these systems / equipments is designated First Level. The Rudder, Aft Hydroplanes and Fwd Hydroplanes operating gear and guide sleeves are also First Level however the control surfaces are <b>NOT</b> . The HSD system is to be capable of providing hydraulic power to, and functionality of, the Aft Hydroplanes and Rudder down to MCD.



System	System Code	First Level Summary
Main Hydraulics	HS	The supply side of the Main Hydraulic system is designated First Level to mitigate loss of control and uncontrollable flooding. Many systems and equipments rely on Main Hydraulic power for their primary motive force, including; Fwd Hydroplanes, Main Ballast Tank vent valves, Hull and Back Up valves, HPB Selector valves, HPA GIVs, Tank Isolating valves, Fwd hydroplanes and SSE's. Under emergency conditions Main Hydraulics supply the following systems; Emergency Steering, and Accumulator back up for Hull and Back Up valves. Those components required for HS functionality on the supply side to these systems / equipments is designated First Level. The Main Hydraulic system is to be capable of providing hydraulic power to the designated systems down to MCD.
Main Lube Oil	DO	There are no First Level areas associated with the Main Lube Oil system with the exception of the Pressure Hull penetration insert, bobbin and sleeve.
Main Ballast Tank Vent Valves	MBT	The Main Ballast Tank vents are designated First Level to mitigate loss of control. Failure of the vent valves or jamming of operating gear may result in the vent valves remaining open while dived with the potential for delay in response and/or loss of control during surfacing. The MBT vent valves are Functionally First Level only, there is no pressure boundary associated with the vent valves.
Main Hydraulic Power Plant	MHP	First Level designation is applied to the Main Hydraulic Power Plant to mitigate loss of control and uncontrollable flooding. The First Level area includes the accumulators (MHP 681, 682) and the supply pipe work to the Hydroplane and Steering Control system via emergency fire isolation valve MHP 612. First Level designation is applied only to those parts of the Hydraulic Power Plant operating under accumulator pressure, therefore the hydraulic pumps and their associated valves and pipes are <b>NOT</b> First Level. This part of the plant is to be capable of providing hydraulic power down to MCD for the operation of the Fwd Hydroplanes.
Pressure Vessels		All pressure vessels have a risk to personnel safety due to the large amounts energy they store. To mitigate this risk, all pressure vessels are treated as First Level items. Therefore, all pressure vessels are to be procured and maintained to First Level standards. The presence of the First Level pressure vessel does not require the adjoining system components to be upgraded to First Level if they are currently not defined as First Level in this document.
Reverse Osmosis Plant (Made Water)	MW	There are no First Level areas associated with the Reverse Osmosis Plant. The accumulators are procured to First Level standards only.
Rescue Vehicle Seat Drain	RVD	Structural aspects of the DSRV seat and pipe 0801 RVD are First Level to mitigate uncontrollable flooding during DSRV operations. Failure of the seat structure or drain pipe could lead to loss of vacuum between the DSRV and submarine leading to DSRV separation, thus resulting in uncontrollable flooding through open hatches. Note that during DSRV ops both the upper hatch and lower lid of the Aft Escape Tower or the ATP/Battery Shipping Tower are in the open position. Pen 609 is below SHS and therefore Hull Valve RVD 801 is <b>NOT</b> First Level. These parts of the system are to be capable of operating down to MCD to support DSRV operations.



System	System Code	First Level Summary
Sanitary	SAN	The Hull and Back Up valves and the pipe work in between are designated First Level to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD. There are no First Level areas associated with the remainder of the Sanitary system.
Sea Water Cooling	SW	The Sea Water Cooling system is designated First Level to mitigate uncontrollable flooding. The system is to be capable of supplying sea water cooling down to DDD and therefore those parts of the system which may be exposed to DDDP are designated First Level. The First Level areas / equipments are defined in Sections 2, 4 and 5. Note: - Despite being designated "SW" the Shaft Seal cooling System is <b>NOT</b> First Level.
Snort Induction	SN	The Snort Induction system is designated First Level to mitigate uncontrollable flooding. The Hull and Back Up valves and pipe work between SN603 and SN604 must be capable of withstanding seawater pressure down to MCD.
Special Boat Service	SBS	SBS hull valves are First Level to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD. The SBS HP air bottle (where fitted) is procured to First Level standards, however the connecting system is <b>NOT</b> First Level.
Submerged Signal Ejector	SE	The SSEs are designated First Level to mitigate uncontrollable flooding during SSE evolutions through all depths to MCD. The SSE casting and those components that form the inner and outer watertight boundary are First Level. The Hull Valve penetrations insert, bobbin and sleeve are also First Level although the Hull Valves are <b>NOT</b> . The SSE interlocks operations are critical to mitigating the risk of uncontrollable flooding. Therefore the operation/ function of the SSE interlocks are First Level.
Torpedo Tube Flood and Drain	TFV	The Torpedo Tube Flood and Drain system is designated First Level to mitigate uncontrollable flooding during Torpedo Tube evolutions down to DDD. The First Level Area is restricted to those areas that may be exposed to DDDP; the Hot Run Equalising Hull Valve (TFV 817), Embarkation Slot Drain Hull valve (TFV 818), the torpedo tube flood and drain valves (TFV 801 – 806) and associated bend assembly (TFV 839 – 842) and the Equalizing and Vent valves. The drain plates are not First Level even though they were installed to mitigate uncontrollable flooding and support the Option 5 safety case which identified potential for failure of the drain valve drive train due to ingress of debris into the valve. The function of the drain plate was two fold, firstly to act as a screen to reduce the size of debris and secondly act as an orifice plate to reduce and flooding path to less than SHS (Upholder Class Weapon Handling and Discharge System Option 5 Modification State Zero Final Design Safety Endorsement [D/SSC/DNA/1400 dated 11 Jan 1994] refers). However, the implementation of this modification did not meet the First Level fastener requirements for length of fastener and depth of hole. Therefore, the Flood and Drain valve and associated pipe work remain the First Level boundary. These areas are to be capable of withstanding seawater pressure down to MCD.

System	System Code	First Level Summary
Ventilation Exhaust and Low Pressure Blow	LPB	The Hull and Backup valves greater than SHS and hull glands, inserts, bobbins and sleeves associated with the Ventilation Exhaust and Low Pressure Blow system are First Level to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD.
Voice Pipe	VP	The Voice Pipe system is designated First Level to mitigate uncontrollable flooding. The Hull and Back Up valves and pipe work in between are to be capable of withstanding seawater pressure down to MCD.
Ship and Battery Ventilation	VV	The Ship and Battery Ventilation system is designated First Level to mitigate uncontrollable flooding. The external blanking plate (VV 9601), distance piece and Hull Valve must be capable of withstanding seawater pressure down to MCD. No other parts of the Ship and Battery Ventilation system are First Level.
Weapons Handling and Discharge	WH	<p>The Weapons Handling and Discharge hydraulic system is designated First Level to mitigate uncontrollable flooding during torpedo tube evolutions.</p> <p>Three notional states exist for the tubes:-</p> <ol style="list-style-type: none"> <li>1) Inner and outer boundary shut (rear door shut, slide valve shut, bow caps shut). Tubes may be either flooded or dry.</li> <li>2) Inner boundary shut, outer boundary open (rear door shut, slide valve open, bow caps open). Tubes flooded.</li> <li>3) Inner boundary open, outer boundary shut (rear door open, slide valve shut, bow caps shut). Tubes dry.</li> </ol> <p>The WTI boundaries are assured by mechanical interlocks, however, the hydraulic supply and associated pipe work are classified First Level at this time to ensure positive control of the WHDS inner and outer boundaries. Until such time as when all issues encompassing the Option 5 solution have been fully investigated and resolved, the hydraulic control of these boundaries will remain First Level. The First Level boundary includes those components / equipments that maintain the WTI envelope of the torpedo tubes; actuators (incorporating mechanical interlocks) for the slide valves and bow caps, rear door interlock, bow cap hinge and linkage, top stop and rear catch housing. These items are to be capable of withstanding seawater pressure down to MCD.</p>
Trim and Ballast	WS	<p>The Ballast system is designated First Level to mitigate uncontrollable flooding during pumping / flooding operations down to DDDP. Due to the limited HP Ballast pump discharge capacity and the time required to commence pumping operations pumping capability is <b>NOT</b> a First Level function. However the HP Ballast system pumping capability does provide mitigation, when surfaced, for maintaining buoyancy during a flooding incident and also for reducing flooding rates in a DISSUB scenario for which the system is expected to be able to discharge sea water down to DDD when in series with the Bilge System to provide a salvage capability to depths in excess of DDDP.</p> <p>The First Level boundary is limited to those equipment and fittings required to support flooding and pumping operations. Flow meters are First Level from a WTI perspective only.</p>

## Annex C2 Quality Assurance for Safety In Submarines – Victoria Class

**OUTLINE OF FIRST LEVEL AREAS / SYSTEMS / EQUIPMENT STRUCTURAL ASPECTS**

<b>Structure</b>	<b>First Level Summary</b>
'D' Tank	'D' tank structure (including manhole covers) is designated First Level to mitigate uncontrollable flooding. 'D' tank is to be capable of flooding and discharging seawater down to DDD and must be able to withstanding seawater pressure down to MCD.
Fwd Stern Tube Housing	The Fwd Stern Tube Housing is designated First Level to mitigate uncontrollable flooding. It is to be capable of withstanding seawater pressure down to MCD.
Masts & Periscopes	The Masts and Periscopes are designated First Level to mitigate uncontrollable flooding and are to be capable of withstanding seawater pressure down to MCD.
Pressure Hull	The Pressure Hull structure and fittings affecting strength and WTI are designated First Level to mitigate uncontrollable flooding. Any item penetrating the Pressure Hull of size greater than SHS is also designated First Level. All Pressure Hull inserts, bobbins and sleeves. Pressure Hull Penetrations as defined in Section 3 are also designated First Level to mitigate uncontrollable flooding.
Tailshaft Assembly	The Tailshaft Assembly (including Loose Coupling, Split Thrust Ring, Propeller and Pilgrim Nut) is designated First Level to mitigate uncontrollable flooding and loss of main propulsion. This assembly is to be capable of withstanding seawater pressure and remaining functional down to MCD.
Torpedo Tubes	The Torpedo Tubes are designated First Level to mitigate uncontrollable flooding during torpedo tube evolutions. The First Level WTI boundary includes the pressure hull dome castings, rear doors, ship builder's lengths, inner and outer lengths, slide valves and bow caps.



## PART 3

### QUALITY ASSURANCE REQUIREMENTS FOR FIRST LEVEL SYSTEMS AND EQUIPMENT

#### SCOPE

1. This part identifies the additional QA requirements for First Level hull areas, systems and equipment. These requirements supplement the requirements in Parts 1 and 2.
2. This part specifies the requirements for conducting a detailed evaluation and for recording the First Level boundaries and other information of those hull areas, systems and equipment that affect submarine and personnel safety. This part also specifies the requirements for Service Providers/ Contractors (SPs) to document OE to meet the requirements of materiel, performance and traceability for First Level components in Victoria Class Submarines.
3. The First Level quality requirements provide DND authorities responsible for the Submarine Safety Document Register and the Materiel Certification (MatCert) aspect of the SUBSAFE Programme additional assurance that SPs have:
  - a. in design and development:
    - (1) subjected the documentation package to rigorous scrutiny and maintained a high level of surveillance of their own and subcontractors activities;
  - b. in production and maintenance work:
    - (1) verified quality records and documentation including subcontractor records;
    - (2) maintained a high level of surveillance of their own and subcontractors activities;
    - (3) compiled a record which can be updated through the life of an item to provide a means of tracing items at risk should a failure pattern emerge; and
    - (4) taken measures to secure and sustain the confidence of an item's materiel state throughout its life, which may extend beyond 20 years and include a number of refits, refurbishments and repairs.

#### GENERAL REQUIREMENTS

4. SPs shall, unless otherwise agreed with the Design Authority, forward a copy of the required level of OE to the custodian of the QA Live File in order to demonstrate conformity of an item with its requirement.
5. For work that is subcontracted, the Prime Contractor shall define the detailed affirmation of OE required as described in the Statement of Quality Requirements (SOQR) DND 2328. This shall be required in addition to any requirement for a quality plan invoked in a contract. The Prime Contractor shall be responsible for ensuring that the requirement for OE from subcontractors is fulfilled. The SP shall provide the cure date and batch management Data on all Elastomeric materials used / procured / provided with the item(s). SP's shall ensure that such information is retained and can be traced to the item at all times. Upon installation of the materiel, this information shall be included in the QA live files in order to meet traceability requirements.

6. All software associated with First Level items shall be delivered with a DND 2513 C of C. The DND 2513 may be substituted by a suitable manufacturer's C of C. This document must state that the software has been tested to prove that its relationship with associated First Level systems maintains the limitations outlined within the MLD and the policies contained within C-23-VIC-000/AM-001. Documentary evidence of compliance shall be raised and maintained in through-life QA records for the software. The management of software for Victoria Class submarines is to be IAW MARCORD 4-30.

## QUALITY ASSURANCE IN DESIGN

7. The concept of quality starts with the specification and subsequent design process, and passes through development, manufacture, installation, test and in-service maintenance. The designer must take into consideration and incorporate all First Level requirements to ensure quality in manufacture, installation, test and in-service maintenance. Equally, the design process itself must be disciplined and controlled, particularly where submarine and personnel safety are affected.

8. Particular emphasis shall be placed on the selection, specification, development and validation of design documentation, manufacturing process control, inspection, test, installation and maintenance requirements for First Level hull areas, systems and equipment. This emphasis shall extend to the management procedures that will be applied to ensure these requirements are met.

9. To meet the requirements of First Level QA in design, SPs shall demonstrate that they have:
- a. undertaken a review of the contract, standards, regulatory requirements and procedures;
  - b. identified the need for any additional standards, specifications, procedures and instructions commensurate with the scope of the requirement and have implemented a programme for their production which ensures that standards are available before work commences;
  - c. identified specific procedures for determining First Level areas, systems and equipment;
  - d. identified review points and undertaken regular analysis of the methods identified in subparagraphs b. and c. above to assure their continued effectiveness;
  - e. prescribed methods for verification of designs and design data including the use of alternative methods, development or testing and assessment by technical personnel who are independent of those executing the original design;
  - f. rigidly applied release procedures for design review and approval to ensure that items cannot be passed for manufacture without certification that drawings, specifications, procedures, instructions, acceptance criteria, etc., are available;
  - g. identified OE requirements to satisfy the requirements of Parts 2 and 3;
  - h. identified the presence of hazardous material;
  - i. identified all proposed materials and determined their suitability for submarine use IAW established DMEPM(SM) review processes;
  - j. understood the requirements for First Level welding/brazing processes;
  - k. understood the requirements for First Level materials for safety critical system applications;
  - l. documented computer software assurance methods and procedures for systems analysis and design for both system or equipment operation and safety calculations;
  - m. conducted all necessary verification and validation testing on computer software. Specified levels for software integrity shall be achieved and demonstrated (refer to paragraph 6 above);

- n. addressed requirements for availability, reliability and maintainability analysis including analysis of failure mechanisms and identification of requirements for redundancy to reduce common mode failures;
- o. identified First Level items on drawings and against basic part numbers in spares documentation;
- p. documented change control methods and procedures on First Level systems to track all Engineering Changes (ECs) (from commencement to completion) and deviations / waivers raised against the Engineering Change Process (ECP); and
- q. made arrangements for the control, review, update and transfer of design disclosure information for use in-service (refer to Part 5).

## **FIRST LEVEL DESIGN DISCLOSURE IN ENGINEERING CHANGES**

10. EC Project Managers or Principal Service Providers, as appropriate, shall update First Level design disclosure documentation for First Level hull areas, systems, and equipment under their authority subjected to configuration change action. The Design Authority shall use the design disclosure documentation to maintain an accurate configuration record of First Level systems and boundaries in individual Quality Assurance for First Levels Systems and Areas (C-23-VIC-87X/ND-001).

11. Design disclosure documentation (e.g., system design descriptions) shall include a brief technical and safety statement recording how the operation or failure of an equipment, system or structure affects submarine or personnel safety, and what calculations, assumptions and limitations were considered when determining First Level boundaries. The Principal Service Provider shall submit this design disclosure documentation to the Design Authority for acceptance. The Design Authority will hold copies of the design records for configuration control.

12. First Level definition diagrams and fittings lists shall be updated as follows:

- a. schematic drawings for each First Level system or structure part must indicate the extent of First Level systems modification and areas affected and clearly define the revised First Level boundaries realised through any configuration changes; and
- b. a list of equipment, pipes, cables, structural assemblies, valves, fittings, components, etc., for each First Level system or structural part which may have been added or modified by any configuration changes.

## **PROCEDURAL REQUIREMENTS**

13. SPs undertaking the analysis to determine the extent of the change to the First Level boundary from structure and systems to component level shall use a formal procedure compliant with ISO 9001:2008, Principle 7.3. The procedure shall identify responsibilities for conducting the analysis, the methodology to be employed, the scope and format of the records. The procedure shall also contain an independent review process to assure compliance with this publication. Any proposed changes affecting First Level Area Diagrams will be reviewed / analyzed using the reclassification process (SMTI 211) contained in Quality Assurance for First Level Systems and Areas (C-23-VIC-87X/ND-001).

14. All SP procedures that determine the extent of a First Level boundary change shall be subjected to review and approval by DMEPM(SM) prior to their implementation:

- a. on the first occasion this publication is invoked in a contract; and
- b. on the first occasion thereafter that a revised edition of this publication is invoked in a contract; or
- c. if requested.

15. SPs shall generate OE of compliance with the agreed procedure and that evidence shall be available for review.
16. SPs must ensure that all requirements are passed to subcontractors. SPs are responsible for providing the necessary assurance that subcontractors meet these requirements.
17. SPs shall format and maintain documentation generated in accordance with this publication as detailed in agreements arising from the requirements of paragraphs 13, 14, 15 above.

## LEGACY DOCUMENTATION FOR VICTORIA CLASS SUBMARINES

18. The initial First Level documentation generated for the Victoria Class submarine was compiled in accordance with the requirements of the MoD (UK) DG Ships specification 245a. MoD (UK) updated the documentation during reactivation. At that time they were commonly referred to as “FLADS” and now they are referred to as Quality Assurance for First Levels Systems and Areas and they are the authoritative document that defines first level systems and boundaries. A unique document exists for each submarine and includes:

- a. Schematic drawings for the following: First Level systems: mechanical equipment, electrical equipment, weapons equipment, structural equipment; and
- b. A list of equipment, pressure hull penetrations, pipes and fittings and First Level definition diagrams for each system.

## MAINTENANCE OF IN-SERVICE DOCUMENTATION

19. DMEPM(SM) is responsible for ensuring that the information describing the Design Intent is held under configuration control and that subsequent design change, modifications, deviations or waivers affecting First Level hull areas, systems and equipment are verified against the original design criteria and are reflected in revisions to First Level documentation.

## INSPECTION AND TEST RECORDS

### GENERAL

20. DND requires both material and performance OE of the quality of First Level items. A component may be cast, forged, bent, manipulated, worked, or machined or it may consist of a number of parts welded or brazed together, or assembled with mechanical or electrical joints, which in turn are installed and tested on board. Whatever the process, OE is required for each relevant component part and process where failure could affect the submarine as outlined in Part 2.

21. Where a component is repaired, new OE is not required for the original material but is required for the repair work carried out. It is assumed that the original material met the relevant specifications when first accepted into service. If doubt exists in any particular case then the SP must carry out confirmatory tests and checks on the original material as well. These checks and tests are considered part of the repair work.

22. OE of material conformance for commercial components used in First Level electrical and electronic assemblies is impractical to seek due to the diversity of material used and the manufacturing processes involved. Considerable reliance must be placed on conformance with the requirements for component selection and procurement to ensure that the design intent is maintained. Thereafter, reliance shall be placed on the control and certification of the manufacturing processes that could induce premature failure and on inspection, test and calibration activities. The SP's inspection, test and calibration activities shall ensure that assemblies function in accordance with their design intent, noting particularly that many assemblies are manufactured in batches and that consequently, poor process control could initiate common failure modes.



23. Certification of conformance with the SP's process control requirements is required for electrical and electronic equipment deemed to fall within the First Level boundary. The SP's process control shall provide the OE of achieved quality during installation, inspection, subsequent functional testing and, where appropriate, calibration.

24. Annex A2 indicates where pressure boundary and functional aspects are relevant, but it is essential that SPs consider each submarine individually when deciding which aspect is relevant in the system or component. As a guide, an outline of requirements of parameters to be certified for mechanical, electrical and structural aspects are presented in Annexes A3 to C3 respectively. Annex D3 covers more general requirements, some of which are common to more than one engineering discipline. Where a process parameter is indicated in Annexes A3 to C3, it refers to the relevant part of Annex D3.

#### NOTE

Functional tests of interlocks and other safety features shall be conducted at a time when it is both safe to conduct the tests and when the test environment is realistic. A more detailed indication of the requirements to certify each parameter is given in Annex E3.

25. When interpreting these guidelines for specific items or orders where the mechanical aspects of an electrical item affects submarine or personnel safety (e.g., cables, connectors, or sensors penetrating the pressure hull or the pressure boundary of a pipe work system), then the relevant mechanical properties shall be certified in addition to any electrical parameters.

26. Adequate certification must include, but is not limited to:

- a. the results of the tests of all specified parameters; and
- b. a signature followed by the name in print and the position of the signatory in the organization (the name of the signatory must be clear).

#### UNIQUE OR BATCH IDENTIFICATION

27. In addition to the above requirements, all new procurement of First Level items or assemblies must carry a unique and/or batch marking. The purpose of the Unique Identification Number (UIN) is to directly relate an item or assembly to its source of supply. Because there must be "cradle to grave" traceability, a "smart" UIN fulfills this requirement; otherwise a separate database would have to be maintained to link OEM serial numbers to their respective procurement histories. The difference between unique and batch marking depends on the method of manufacture, test and inspection. A unique identity is associated with every individually supplied component or assembly subject to individual test and inspection. For positive identification the item will be inscribed to carry the unique identifier number preceded by the prefix QCA on the part, as well as on the procurement contract documentation relating to that item.

#### NOTE

Individual parts of an assembly will require item identification and positive traceability with their quality records. The Index of documentation is to contain all serial number modifications and is required for SOQR and QCA requirements.

28. This unique identification of all First Level finished goods must be clearly and permanently marked on the assembly or individual item(s). This Unique Identification marking will be as follows: It will start with the letters QCA / the SOQR "Contract, Order, Tracking No." the line item, followed by the number of item on the contract. FOR EXAMPLE: The SOQR lists the Contract # as W8482-072476 in the "Contract, Order, Tracking No." field and line item no. 0233 in the "Line Item as per order" field. When compiling OQE for Assemblies an additional /1, /2, /3 to help further identify each assembly to its serial number. Therefore the Unique Identification Number in this case would be: **QCA/W8482-072476/0233/1** for the first item and then **QCA/W8482-072476/0233/2** for the second item and so on... Each item and associated OQE Package will have a matching QCA Unique Identification Number. For Batch items the "/1,/2,/3 etc" will be omitted. For the previously stated example, in a batch situation, the UIN would simply

be **QCA/W8482-072476/0233** marked on all items within that batch. UIN are not to be confused with BAE/Vickers part number(s) which sometimes start with the prefix QCA, but in most cases follow with a drawing number.

29. The methods of marking components or equipment or both shall be in accordance with this policy. If no prescribed method is stated the preferred method is by hand engraving or vibro-etching. Chemical etching shall not be used unless prescribed by drawing or specification. Hard stamping of components not prescribed by drawing or specification may be acceptable and will depend on the individual component and the effect the stamping may have on dimensional tolerances, surface finish and material strength, i.e., stress raisers. For coated and plated components, hard stamping before coating or plating provides good visibility of marking but must be acceptable for the particular component.

30. Certain items are impractical to mark. Exceptions to the identification requirement above and acceptable methods for maintaining the configuration of these items are detailed in Annex F3. The Design Authority shall be consulted if other marking methods are proposed.

## **VERIFICATION OF PURCHASED PRODUCT**

31. OE requirements for many of the parameters may be found in Annex D3. However, in repetitive work, the base material identity may not be retained through the manufacturing process provided traceability is retained via QA documentation and a unique identifier is assigned to the manufactured product. When strict control of the production process exists such that only proven and acceptable material is used, the Design Authority may accept the evidence of effective process control together with inspection or test or both of the final product to waive certain parameters in Annex D3, provided that:

- a. the process control arrangements are defined in writing, audited regularly by the manufacturer and demonstrated to the Design Authority when requested. Approval records must be kept;
- b. the deviation and waiver procedure is included in the Quality Management System under control of non-conforming product; and
- c. no reason exists to doubt the effectiveness of the manufacturer's control arrangements.

32. A guide to the requirements for OE of each parameter to be certified in annex A3 to D3 can be found in annex E3.

## **LEVELS OF CERTIFICATION**

33. Normally, tests and inspections shall be conducted and recorded for each individual item or process, e.g., dimensional inspections, NDE following pipe manipulation, weld records, etc. Where information is relevant to a batch then certification appropriate to batch production may be adopted, e.g., chemical analysis, mechanical properties, etc.

## Annex A3 - Quality Assurance for Safety In Submarines – Victoria Class

GUIDE TO QUALITY ASSURANCE REQUIREMENTS FOR  
FIRST LEVEL ITEMS MECHANICAL ASPECTS

Component/Item	Parameters to be Certified												Remarks	
	Chemical Analysis	Mechanical Properties	Heat Treatment	NDE	Dimensional	Installation Check	Pressure Test	Cleanliness	Performance/Function	Process Qualification	NAB Validation (castings)	Dates	Unique Identity	Refer to Annex D3 for general process requirements – welding, brazing, casting, forging, etc.  Refer to Annex E3 for additional information on parameters to be certified.
PIPEWORK SYSTEMS														
Complete System						✓	✓	✓	✓					
Tube as Procured	✓	✓	✓	✓ <sup>1</sup>	✓		✓							✓
Fittings	✓	✓	✓	✓	✓		✓				✓			✓
Pipe – Manipulation/Assembly			✓	✓ <sub>1</sub>	✓		✓	✓		✓				
VALVES														
Complete Unit						✓	✓	✓	✓					✓
Pressure Boundary Items	✓	✓	✓	✓	✓		✓				✓			✓
Functional Items	✓	✓	✓	✓	✓		✓				✓	✓ <sub>2</sub>		✓
ACTUATORS														
Complete Unit						✓	✓	✓	✓					✓
Pressure Boundary Items	✓	✓	✓	✓	✓		✓			✓				✓
Functional Items	✓	✓	✓	✓	✓		✓	✓	✓			✓ <sub>2</sub>		✓
PRESSURE VESSELS														
Complete Unit						✓	✓	✓	✓			✓		✓
Pressure Boundary Items	✓	✓	✓	✓	✓		✓			✓				✓
Functional Items	✓	✓	✓	✓	✓	✓	✓							✓
Bladders						✓	✓		✓			✓ <sub>2</sub>		
PUMPS														
Complete Unit						✓	✓	✓	✓					✓
Pressure Boundary Items	✓	✓	✓	✓	✓		✓			✓	✓			✓
Functional Items	✓	✓	✓	✓	✓		✓			✓	✓	✓ <sub>2</sub>		✓

Component/ Item	Parameters to be Certified													Remarks
	Chemical Analysis	Mechanical Properties	Heat Treatment	NDE	Dimensional	Installation Check	Pressure Test	Cleanliness	Performance/Function	Process Qualification	NAB Validation (castings)	Dates	Unique Identity	Refer to Annex D3 for general process requirements – welding, brazing, casting, forging, etc.  Refer to Annex E3 for additional information on parameters to be certified.
HEAT EXCHANGERS														
Complete Unit						✓	✓	✓	✓				✓	
Pressure Boundary Items	✓	✓	✓	✓	✓		✓			✓	✓		✓	
FLEXIBLE HOSES, RUBBER BELLOWS														
Complete Item				✓	✓	✓	✓	✓	✓	✓		✓ <sup>2</sup>	✓	<sup>2</sup> Cure dates of elastomeric
Couplings	✓	✓	✓	✓										
Elastomeric Materials														
O-rings		✓ <sup>3</sup>			✓							✓ <sup>2</sup>	✓	Manufacturer's C of C (materiel and dimensional inspection aspects).  <sup>2</sup> Cure dates of elastomeric  <sup>3</sup> Hardness
OTHER PRESSURE BOUNDARY COMPONENTS														
Complete Item						✓	✓	✓					✓	
Pressure Boundary Items	✓	✓	✓	✓	✓					✓	✓		✓	
Functional Items								✓	✓	✓	✓		✓	
RE-MACHINED COMPONENTS														
				✓ 5, 4	✓	✓ <sup>6</sup>	✓ <sup>6</sup>	✓ 6	✓				✓	<sup>4</sup> The extent of surface flaw examination to be applied to re-machined components to be agreed upon with the Design Authority.  <sup>5</sup> Ultrasonic examination, magnetic particle or liquid penetrant inspections  <sup>6</sup> Dependent upon the configuration and contract conditions.

## Annex B3 - Quality Assurance for Safety In Submarines – Victoria Class

### GUIDE TO QUALITY ASSURANCE REQUIREMENTS FOR FIRST LEVEL ITEMS ELECTRICAL ASPECTS

Component/Item	Parameters to be Certified																	Remarks	
	Chemical Analysis	Mechanical Properties	Heat Treatment	NDE	Pressure Test	Installation Check	Cleanliness	Performance/Function	Dimensional	NAB Validation (castings)	Process Qualification	Water/Gas Tightness	Electrical Properties		Calibration		Wiring Check	Welding	Refer to Annex D3 for general process requirements – welding, brazing, casting, forging, etc.  Refer to Annex E3 for additional information on parameters to be certified.
ELECTRICAL ASPECTS																			
Cable	✓	✓	✓						✓		✓	✓	✓						
Bulkhead Penetrations	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓						✓
Glands	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓						✓
Shore Supply Connectors	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓						✓
Flow Meters/ Transducers/ Sensors	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓				✓
Connectors/ Terminations	✓	✓	✓			✓			✓		✓		✓					✓	
Motors	✓	✓	✓			✓	✓	✓	✓		✓	✓	✓						✓



## Annex C3 - Quality Assurance for Safety In Submarines – Victoria Class

**GUIDE TO QUALITY ASSURANCE REQUIREMENTS FOR  
FIRST LEVEL ITEMS STRUCTURAL ASPECTS**

Component/Item	Parameters to be Certified																Remarks	
	Radiography	Ultrasonic Examination	Magnetic Particle	Liquid Penetrant	Eddy Current	Chemical Analysis	Mechanical Properties	Heat Treatment	Visual Inspection	Dimensional	Installation Check	Pressure Test	Cleanliness	Performance/Function	Process Qualification	NAB Validation (castings)	Unique Identity	Refer to Annex D3 for general process requirements – welding, brazing, casting, forging, etc.  Refer to Annex E3 for additional information on parameters to be certified.
PLATING AND FRAMES																		
Plating (Q1(N)/Q2(N))		✓		✓		✓	✓	✓	✓	✓	✓				✓		✓	Including principal dimensions of finished items.
Frames	✓	✓				✓	✓	✓	✓	✓	✓				✓		✓	
CASTINGS AND FORGINGS																		
Castings (ferrous)	✓	✓	✓ <sub>1</sub>	✓ <sub>1</sub>		✓	✓	✓	✓	✓	✓	✓ <sub>3</sub>	✓ <sub>3</sub>		✓		✓	<sup>1</sup> Magnetic Particle inspection OR Liquid Penetrant inspection may be used.
Castings (non-ferrous)	✓	✓		✓	✓ <sub>2</sub>	✓	✓	✓	✓	✓	✓	✓ <sub>3</sub>	✓ <sub>3</sub>		✓	✓	✓	
Forgings (ferrous)	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓ <sub>3</sub>	✓ <sub>3</sub>		✓		✓	<sup>2</sup> Requirements for CuNiCr to NES 824 Pt 1.
Forgings (non-ferrous)	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓ <sub>3</sub>	✓ <sub>3</sub>		✓		✓	
Bar Stock (ferrous)		✓	✓			✓	✓	✓		✓							✓	<sup>3</sup> Dependant upon configuration and contract conditions
Bar Stock (non-ferrous)	✓	✓		✓		✓	✓	✓		✓							✓	





## Annex D3 - Quality Assurance for Safety In Submarines – Victoria Class

GUIDE TO QUALITY ASSURANCE REQUIREMENTS FOR  
FIRST LEVEL ITEMS GENERAL ASPECTS

Component/Item	Parameters to be Certified													Remarks	
	Chemical Analysis	Mechanical Properties	Heat Treatment	NDE	Pressure Test	Installation Check	Cleanliness	Dimensional	NAB Validation (castings)	Process Qualification	Operator Qualification	Machine Qualification	Machine Calibration	Machine Validation	Refer to Annex E3 for additional information on parameters to be certified.
PROCESS REQUIREMENTS															
Brazing/Welding (See Note 1)				✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	<b>Note 1:</b> Finished welds: ultrasonic and or radiography and liquid penetration or magnetic particle examination. Weld procedures requirements to apply. Brazes: Ultrasonic for % bond.  <b>Note 2:</b> Dimensional requirements for pipe manipulation. Bends – ovality. Extrusions/bends – compliance with drawing and spec. <sup>1</sup> Ultrasonic test for wall thickness after bending. <sup>2</sup> Ultrasonic test or wall thickness and surface flaw examination. <sup>3</sup> Direction of plate rolling to be indicated
Brazing/Welding Consumables	✓														
Pipe Manipulation/ Assembly (See Note 2)			✓	✓ <sup>1</sup>	✓	✓	✓	✓		✓	✓	✓	✓		
Rolling/Bending/ Pressing Plates		✓	✓	✓ <sup>2</sup>				✓		✓ <sup>3</sup>	✓	✓	✓		
Mechanical Joints – Items Affecting “Pressure Boundary” or “Functional” Aspects	✓	✓	✓	✓	✓	✓	✓								
Crimping	✓	✓						✓		✓	✓	✓		✓	
FASTENERS															
All Fasteners Affecting “Pressure Boundary” or “Functional” Aspects	✓	✓	✓	✓ <sup>4</sup>			✓	✓		✓			✓		<sup>4</sup> Original materiel: ultrasonic and surface flaw. Finished component: surface flaw in accordance with spec.



## Annex E3 - Quality Assurance for Safety In Submarines – Victoria Class

**GUIDE TO THE REQUIREMENTS FOR OBJECTIVE EVIDENCE  
OF EACH PARAMETER TO BE CERTIFIED IN ANNEXES A3 TO D3**

**NOTE**

Where results of analyses or tests are called for, the actual results together with a statement of the required results shall be provided. A statement that the result was within specification does not meet the requirements of this document.

<b>Parameter</b>	<b>Requirement</b>
Chemical Analysis	Certification giving the results of chemical analysis of the batch/cast of material from which the component was manufactured.
Mechanical Properties	Certification giving the results obtained for the mechanical tests (as required by the material specification) carried out on the batch/cast of material from which the component was manufactured.
Heat Treatment	Certification including temperature charts, etc., to provide assurance that the heat treatment requirements of the material specification have been met. These records are generally required only where mechanical tests are carried out before heat treatment however; DEF STAN 02-736 (NES 736) requires a complete record and certification for Q1 (N) steels.
NDE	Certification providing details of the equipment, procedure and the operator used to carry out the NDE and, the acceptance standard used to confirm that satisfactory results have been obtained. The type and extent of non-destructive testing required for material or components or both will vary according to the material and method of production (casting, forging, extrusion, etc.). The requirements for welded/brazed joints will vary according to the type of joint (butt, tee, sleeve, etc.). The relevant material and process specifications should be consulted to determine particular requirements. DEF STAN 02-729 Pt 1-5.
Pressure Test	<p>Certification providing evidence that factory or shop pressure tests required by the contract or specification have been carried out with satisfactory results. Also certification of on-board testing to cover installation work.</p> <p>OE of the pressure applied, the duration of the test and the elements tested, shall be provided.</p>
Installation Check	Certification that system components have been installed and orientated in accordance with the relevant drawings and, where system components are not shown on drawings, certification that secondary effects have been avoided, e.g., small bore pipes do not run over switchboards. This certification should also provide evidence that on-board welded, brazed and mechanical joints have been made using the correct procedures, consumables, fasteners, etc.
Cleanliness	OE that the component, item or system has been cleaned to the standard appropriate to the system as required by contract or specification. The evidence provided shall confirm the standard of cleanliness achieved and shall include the signature of the operator who certifies the item as meeting the requirement

Parameter	Requirement
Performance or Functional Test	<p>Certification that the equipment meets the contract or specification requirement with regard to operating conditions, pressures, times, etc. In some instances this test parameter may relate only to the simple hand-operated opening and closing function. For electrical mechanical equipment this also includes specific burn-in requirements.</p> <p>Where this is the only method of verifying conformity, as may be the case for some electrical/mechanical equipment, certification shall include documentation of achieved results and acceptance limits or tolerances or both.</p>
Dimensional	<p>OE of dimensional conformance may be required for a pressure boundary aspect, a functional aspect or in some cases both.</p> <p>When dimensional conformance with pressure boundary requirements is specified, OE shall include the signature of the operator who carried out the inspection, the drawing/specification number and its issue state.</p> <p>Where OE of dimensional conformance with functional requirements is specified, achieved dimensional tolerances related to nominated components or functional parts within the assembly are to be provided together with the signature of the operator who carried out the inspection, the drawing or specification number and its issue state.</p> <p>Where no requirement exists to record the achieved dimensions, certification shall be provided that dimensions are in accordance with the drawing or specification and will meet the dimensional requirements.</p>
Validation Certificate for NAB Castings	<p>The extant MoD(UK) standards are DEF STAN 02-872, Parts 1 and 3 respectively. Both the build and extant specifications require all seawater wetted castings to have a completed casting validation certificate. The required QA documentation shall include this certificate and completion of the appropriate NAB register.</p>
Dates	<p>Most natural and synthetic rubber items degrade with age and rules are prescribed to control this degradation. Restrictions generally relate to cure dates, shelf life and service life. DEF STAN 02-337 (NES 337) outlines the requirements for "O" Rings and Back-up Rings. Requirements for flexible hoses, bellows, etc., are specified in DEF STAN 02-374 (NES 374). Appropriate registers shall be kept for both First Level and non-First Level items as applicable.</p>
Water and Gas Tightness Mechanical Integrity	<p>OE shall be provided that electrical items have been subjected to prescribed fluid tightness tests, where this is a feature of their normal, abnormal or emergency operation. This, together with associated pressure tests, may also be considered to demonstrate mechanical integrity.</p>
Welding	<p>The certification provided shall enable positive traceability to the operator and their qualification(s), equipment, weld procedures and consumables used to complete the weld including all weld repairs.</p>

Parameter	Requirement
Electrical Properties	<p>Certification providing results of all prescribed tests of electrical properties. In addition to the tests prescribed elsewhere in this annex, “electrical properties” may include, but are not necessarily restricted to: continuity and resistance tests, conductor insulation resistance tests, core to core/screen insulation resistance tests, high voltage ionization tests, capacitance and power factor tests, magnetic susceptibility, EMC tests, voltage tests, flash tests, temperature rise/measurement tests, etc.</p> <p>Some equipment certification for some properties may be given as a type approval; tests are not repeated for each item of production equipment. Where this is the case, when a design change is incorporated in the equipment tests shall be repeated and appropriate certification provided.</p>
Calibration	Equipment, tools or measurement devices used in work activity must be calibrated to the degree and standard appropriate to the system as required by process, contract and specification
Process Qualification	Some processes require special approval of their qualification, e.g., welding. Records shall be traceable to the process used. SPs shall retain records for the period stipulated by the contract or as agreed to by the DA.
Operator Qualification	All processes require the operator(s) to be qualified. The records, e.g., weld record cards, shall include the identity of the operator either by name or reference. SPs shall retain records for the period stipulated by the contract or as agreed to by the DA .
Machine Qualification	Many processes require the machine(s) involved to be qualified, e.g., pipe bending machines or mandrels, crimp tools, etc. The records for each process, e.g., pipe bend record cards, shall include a reference to the machine. SPs shall retain records for the period stipulated by the contract or as agreed to by the DA .
Machine Calibration	Many processes require machines to be calibrated, e.g., the current or filler wire feed rate or both of some welding machines. Records shall include a reference to the date of calibration. SPs shall retain records for the period stipulated by the contract or as agreed to by the DA .
Machine Validation	Many processes require machines to be validated, e.g., some welding machines, crimp tools, taper pin insertion/extraction tools, solder baths/tools, etc. Quality records shall include a reference to the current validation. Records may be kept centrally. SPs shall retain records for the period stipulated by the contract or as agreed to by the DA .
Visual Inspection	A visual inspection requires the service provider to indicate the state of the material at the time of inspection. This survey is to verify that no corrosion, surface depressions, gouging, cracks, bends, twists and or any visual defects are present in the material at the time of inspection.



## PART 4

### EXCEPTIONS TO THE GENERAL REQUIREMENTS FOR UNIQUE OR BATCH IDENTIFICATION

#### GENERAL

1. The following requirements shall also be met when specifying purchase data.

#### SPRINGS

2. Springs shall be marked with a label, either attached to the spring or inserted into the package with the spring. The label may be paper or card, with typed unique or batch identification if inserted into the package with the spring, or a metal stamped tally if attached to the spring.

#### SMALL COMPONENTS

3. The term small component is used with respect of the surface area available for marking a unique or batch identity. Fasteners below 0.5 in (12 mm) **nominal** diameter are in this category. This includes studs, stud bolts and nuts.
4. Hexagon headed bolts and screws which have a distance across the flats of 12 mm, or greater but whose nominal size is less than 12 mm may be marked at manufacturers discretion.
5. Small components should be individually packed with a typed paper or card label carrying the identity unless they are fasteners manufactured to DEF STAN 02-862 that have specific marking requirements.

#### SOFT SEATS

6. Soft seats are non-metallic valve seats. They shall be individually packed with a typed paper/card label carrying the unique/batch identity.

#### COATED/PLATED COMPONENTS (EXCLUDING FASTENERS)

7. Hard stamping prior to coating or plating, where acceptable and possible, should identify single components completely coated or plated. Partially coated components are to be identified by vibro-etch engraving in an uncoated area unless impractical. Where identification is not possible on the component, a typed paper or card label carrying the unique or batch identity shall be packed with the component or attached to the component.

#### O-SEALS AND OTHER ELASTOMERIC MATERIALS

8. O-seals and other elastomeric materials (elastomeric packing, shaped gaskets, etc.) shall be sealed into individual polymeric packages with permanent data markings (unique or batch identity, cure date and shelf life) printed on the outside of the package.

#### ACCUMULATOR BAGS

9. Accumulator bags are to be individually packed with a typed paper or card label carrying the unique or batch identity and cure date for all elastomeric material. When installed onboard the boat, the installation date is to be recorded and tracked through the Pressure Vessel Register.

## **WORKING FACES**

10. Working faces are surfaces requiring high finish or close tolerance, which if marked with an identity would cause the component to be outside drawing or specification requirements. If the only surfaces large enough to mark with an identity are “working surfaces” the component shall be individually packed with a typed paper or card label carrying the unique or batch identity.

## **LEGACY ITEMS**

11. Prior to the publication of this document, First Level items may have been procured without the benefit of a smart UIN. These items are generally limited to WHDS and SSE components, which use “SHE” number. The use of non-UIN items is done only with the approval of the DA.



## PART 5

**PROCUREMENT, MANUFACTURE, REPAIR, INSTALLATION  
AND STOCKHOLDING REQUIREMENTS FOR IN-SERVICE SUPPORT****SCOPE**

1. This part outlines responsibilities for defining and assuring quality in-service. It identifies interfaces and transmission routes for procurement information, repair information, repair and overhaul information, and quality records between DND and SPs.
2. First Level Materiel shall be R&O'd by 3<sup>rd</sup> line repair processes for in-service support. However, First Level Materiel may be sent for 2<sup>nd</sup> line R&O processes only in the following circumstances:
  - a. when required for performance testing (i.e. Go/No-Go gauging, testing of circuit cards, pump pressure, volume, flow tests, etc.); or
  - b. when specifically pre-authorized by the LCMM.
3. This part also outlines requirements for formal procedures to control procurement of First Level equipment to ensure that DND obtains OE of achieved quality.
4. The flow-chart in Annex A4 outlines the generic in-service management of First Level items and quality records and the main interfaces for procurement, manufacture, repair and installation in-service. The following paragraphs specify requirements in more detail.

**GENERAL**

5. SPs shall be accountable for monitoring and ensuring that suppliers adequately provide all information for First Level parts or spares procured for submarines. If First Level parts or spares are altered in any way, or their integrity is in question, the SP shall inform the LCMM. All First Level components shall be provided IAW the specification or standard stipulated by the DA. The SP is responsible to ensure that if a standard or referenced specification is different than the one previously used, the DA is contacted for review and direction/authorization prior to delivering any materiel to DND.
6. New construction saw the definition of the QA requirements for all First Level equipment and their components with the SOQR (DND 2328); these documents formed part of the subcontracts for submarine build and the provision of first outfit spares. The initial Canadian ISSC worked with the British Ministry of Defence main contractor for the reactivation of the Victoria Class Submarines (formerly known as the Upholder Class) to compile the QA requirements on forms called Quality Assurance Statement of Requirements (QASOR). SOQR and QASOR are synonymous. The current version of the SOQR can be requested through DMEPM(SM) 2.
7. Manufacture, inspection and test requirements shall be documented in an SOQR (DND 2328) (refer to Annex B4). The requirements shall be specified in accordance with specifically agreed contract standards and specifications, i.e., ASTM, CSA, UK Defence Standards, British Standards, General and Process Specifications or as otherwise agreed.
8. Quality Plans, if called for in contracts, shall detail the contractor's response to SOQRs and Non Conformance Reports (NCR).
9. All the required documentation relating to First Level work for spares or repairs is to be collated in a Quality Records System. This documentation is required for manufacture, inspection, installation or tests. It also includes deviations or waivers (refer to Part 6).

## **OBJECTIVE QUALITY EVIDENCE (OQE) REQUIREMENT FOR FIRST LEVEL QUALITY ASSURANCE ITEMS**

10. When the Victoria Class Submarines (VCS) were purchased from the Government of the United Kingdom (GUK) the platforms were under the Design Authority (DA) responsibility of the RN. Upon acceptance of the platforms, the policies and procedures in place at the time of purchase became the accepted baseline for the Canadian DA. At that time the VCS were operating within a Material Safety Management regime defined by RN policy document SSCP 25. Under this regime, for contracts and work actioned prior to 1994, various forms such as RN Form 32 and QA Document 110 were deemed acceptable OQE for retention in the QA Live File. These forms certified that the OQE requirements defined by the SOQR had been met and the relevant Original Equipment Manufacturer (OEM) retained the supporting OQE. For Contracts placed after 1994 full supporting OQE was required for retention in the QA Live Files for all contracts. Although RN Form 32 and equivalents remained acceptable as legacy OQE, they were no longer acceptable substitutes for new SOQR OQE.

11. Subsequent to Canadian acceptance of the VCS, the Canadian DA converted to a Canadianized Material Safety Management regime. In accordance with this new standard, use of Form 32, or its equivalent, is no longer an acceptable substitute for new OQE. However, Form 32 and equivalent documents remain acceptable legacy OQE.

12. There are two general types of OQE:

- a. Long Life OQE: This encompasses data that remains valid for the life of the item, such as chemical composition. It is often referred to as historic / legacy OQE; and
- b. Post-Acceptance OQE: This is data that is produced every time an item is processed through R&O, such as performance or cleanliness data (new OQE).

## **FIRST LEVEL SPARE PART PROCUREMENT THROUGH THE VICTORIA IN-SERVICE SUPPORT CONTRACT (VISSC)**

13. For procurement through the VISSC contract, the contractor shall raise, for DA approval, an SOQR for each item and shall ensure that the item is manufactured in accordance with the approved configuration definition, process and specification requirements, subject to review to establish their continued validity. The contractor is responsible for assessing the capability and suitability of subcontractors to supply First Level items before placing any subcontract. This shall also apply to any VISSC contractor-owned manufacturing facilities.

14. The VISSC contractor shall survey the item in accordance with specified requirements during (as required by the specification) and on completion of manufacture. For First Level items all documentation raised in accordance with the SOQR shall be assessed for completeness and acceptability and items shall only be considered satisfactory when the results of all analyses and tests are within specification, unless under deviation or waiver.

15. When the VISSC contractor has assessed an item as satisfactory, a DND 2513 (or appropriate manufactures C of C / index of documentation) shall be provided, and the item packed as necessary (for C of C / index of Documentation refer to Annex C4). The C of C / index of Documentation, copies of any deviations and waivers, and all the required documentation identified on the SOQR shall be retained in both electronic and hard copy within the Submarine First Level Assured Quality (SUBFLAQ) system under the Submarine First Level Stores OQE file. The First Level item is then provided with an identification that denotes that the OQE has been filed and a paper copy of the SOQR and C of C is attached. When a SP receives an item from the CFSS, the SP shall ensure that the unique identification number on the item matches the SOQR.

**FIRST LEVEL ITEMS PROCURED DIRECTLY BY NATIONAL PROCUREMENT**

16. Contractual arrangements for the manufacture, repair, installation and test of items will vary, but compliance with the following requirements is mandatory:

- a. the Life Cycle Quality Manager (LCQM) shall liaise with the System Authority to determine the overall QA requirements for procurement;
- b. the LCMM/LCQM shall determine QA requirements for the manufacture or repair of First Level items. The LCMM shall ensure that an SOQR meeting the requirements of this document accompanies each order for systems and equipment under their purview. In exceptional cases, the creation and approval of SOQRs can be delegated to the Formation for manufacture. The delegation, as in the case of First Level Fasteners manufacture, must be arranged through DMEPM(SM) 2;
- c. suppliers shall ensure that all items are manufactured, inspected and tested in accordance with the requirements of the SOQR and their quality plan. All documentation for First Level items raised in accordance with the requirements of the SOQR shall be presented to the respective NDQAR, including the C of C / index of documentation (DND 2513) or suitable manufactures C of C/ index of documentation, generated by the SP in both electronic and hard copy format;
- d. in addition to the preceding paragraphs for procurement or repair activity at SPs outside Canada, DQA will normally rely on foreign government QA. The representative personnel shall ensure that all QCA requirements have been met and specifically ensure that all First Level items pass inspection and that all QCA documentation / OQE required is compliant, legible, and reproducible prior to being shipped to Canada. An index of documentation (DND 2513 IAW annex C4 or suitable manufactures form) shall also be included in the QCA Package. This in no way removes the requirement for SP's to be responsible for the materiel provided by Sub-Contractors regardless of their geographic location;
- e. DQA shall ensure that QARs conducting surveillance of First Level materiel are appropriately trained. If QCA documentation is not acceptable then the item(s) and its documentation may be sent back to the SP or Supplier(s) at SP or Supplier expense. Due to the high cost, and the critical safety requirements of First Level components, all First Level components, regardless of source, shall also be subjected to receipt inspection, and OQE verification, upon arrival in the DND inventory;
- f. principal SPs shall ensure that any subcontracted First Level work or materiel is provided to DND in accordance with this reference and the approved SOQR. The Principal SP is responsible to provide a correctly completed and certified DND 2513 for all provided work and materiel if a suitable manufacture's form is not provided. In the event that a subcontractor DND 2513 is provided to DND to satisfy the DND 2513 requirement of this reference, the provided DND 2513 must also be certified by the Principal Service Provider. Principal Service Providers shall also retain copies of all sub-contractor provided OQE, DND 2513s, and C of C's etc. Certified True Copies of all originally provided Sub-contractor OQE and C of C's shall be provided to the DND QA authority by the Principal SP as requested by the DND QA authority; and
- g. upon receipt of a First Level item, the receiving SP shall ensure that the unique identification number on the item matches the SOQR and all OQE documents.

**EMERGENCY PROCUREMENT OF REPLACEMENTS OF FIRST LEVEL SPARE PARTS**

17. In exceptional circumstances, and only with the approval of DA, the Formation or submarine may be authorized to procure a replacement for a First Level spare part. Any procurement shall be made with the knowledge and agreement that the purchaser shall undertake the following actions:

- a. obtain from the LCMM the SOQR specifying the current QA requirements for the First Level spare;
- b. impose the QA requirements on the supplier;
- c. First Level requirements which cannot be met shall only be waived by the System Authority (SA)(with info to the DA) through the deviation process (a risk assessment may be required);
- d. arrange receipt inspection; and
- e. verify the QA documentation and arrange for copies to either be held with the item if it is stored or be available for the QA live file if the item is fitted immediately.

## **REPAIR FACILITIES (RF) MANUFACTURE OF FIRST LEVEL SPARE PARTS**

18. To meet an operational requirement, RFs may manufacture First Level items when specifically approved by the System Authority. The RF shall obtain the SOQR for each item and ensure that the item is manufactured in accordance with the approved configuration definition, process and specification. If RF / SP cannot meet the Design intent, a deviation request shall be submitted to the SA.

19. The RF shall survey the item in accordance with specified requirements during and on completion of manufacture. The RF shall assess all documentation raised in accordance with the SOQR for completeness and acceptability and shall release or accept items into service when the results of all analyses, tests and examinations are within specification. The RF shall ensure traceability of documented OE to specific RF manufactured parts, including C of C / index of documentation (DND 2513).

20. The RF shall make available all OQE documentation, including copies of any deviations and waivers and all the required documentation identified on the SOQR for inclusion in the QA Live file (refer to Part 6).

21. The RF shall physically segregate First Level items from non-First Level items to reduce the risk of non-First Level items being used in First Level applications or the stockholding of First Level items depleted for non-First Level use.

## **INSTALLATION REQUIREMENTS FOR FIRST LEVEL ITEMS**

22. The SA defines QA requirements on an SOQR utilizing this document and the JTG defines test requirements through the Test Form Index for installation of First Level items. The System Authority is responsible for defining the specific OE for ECs.

23. All First Level work shall be carried out IAW a specification written by the SP. The specification shall include installation instructions and deliverables, which shall include QA documentation and testing requirements.

24. The SP, having first ensured that the supporting documentation has been supplied with the items, shall ensure that all items are installed and tested in accordance with the specification, quality plan and governing standards. The SP shall inspect all documentation for First Level work and materiel for completeness and acceptability and shall only release items for service when the results of analyses, tests and examinations are satisfactory and within specification, unless under approved deviation or waiver.

25. All the required documentation relating to First Level work shall be collated in a Quality Records System. This may also include deviations or waivers (refer to Part 6). In addition, isometric drawings and fit locations are to be updated.

**CFSS STORES INVENTORIES**

26. Some line items in Illustrated Parts Catalogues (IPC) relate to parts that may have been incorrectly categorized when originally codified or whose QA classification has been changed for other reasons. Where there is doubt regarding the classification of spares, SPs shall contact the System Authority for direction.
27. MoD (UK) identified spare parts for First Level items in IPCs as follows:
- a. ships machinery spares inventory items; and
  - b. marine engineering equipment inventory item.
28. The CFSS shall physically segregate First Level items from non-First Level items to reduce the risk of non-First Level items being used in First Level applications or the stockholding of First Level items depleted for non-First Level use.
29. Where CFSS-supplied materiel does not conform to technical requirements, SPs shall quarantine the materiel and raise a PIF. The materiel shall not be used unless the deficiency has been rectified or the SP seeks and receives a deviation / waiver from the SA.

**FIRST LEVEL SPARES RETURNED TO CFSS STOCKHOLDING POINTS**

30. When items are returned to CFSS unused they shall only be accepted on charge if accompanied by the full documentation as issued, and there are no signs of physical damage. Formation Logistics / Base Supply shall subject all items returned to store to inspection IAW C-02-005-009/AM-000 (Inspection and Conditioning of Material Returned to and Held in the Supply System) and categorize them as serviceable, repairable or beyond economical repair.
31. SPs shall not open packages until the contents are required for fitting on board. Items dismantled or reassembled, or both, shall be clearly labelled as such, with details of work done, parts used, parts replaced, etc. All such work shall be carried out in accordance with the requirements of this document.
32. SPs returning First Level equipment to the CFSS for repair shall obtain and forward the existing QA documentation with the equipment and a SA approved SOQR.
33. Serviceable or repairable items shall not be returned to Formation Logistics / Base Supply without the appropriate QA documentation and a SA approved SOQR unless accompanied by a deviation request which has been approved by the SA. A First Level item may however be sent to BLOG / FLOG REP1 without a SA approved SOQR if the item is accompanied by a QA Live File request form (QALF) which indicates that the item is going to either Repairable Reserve or Disposal.

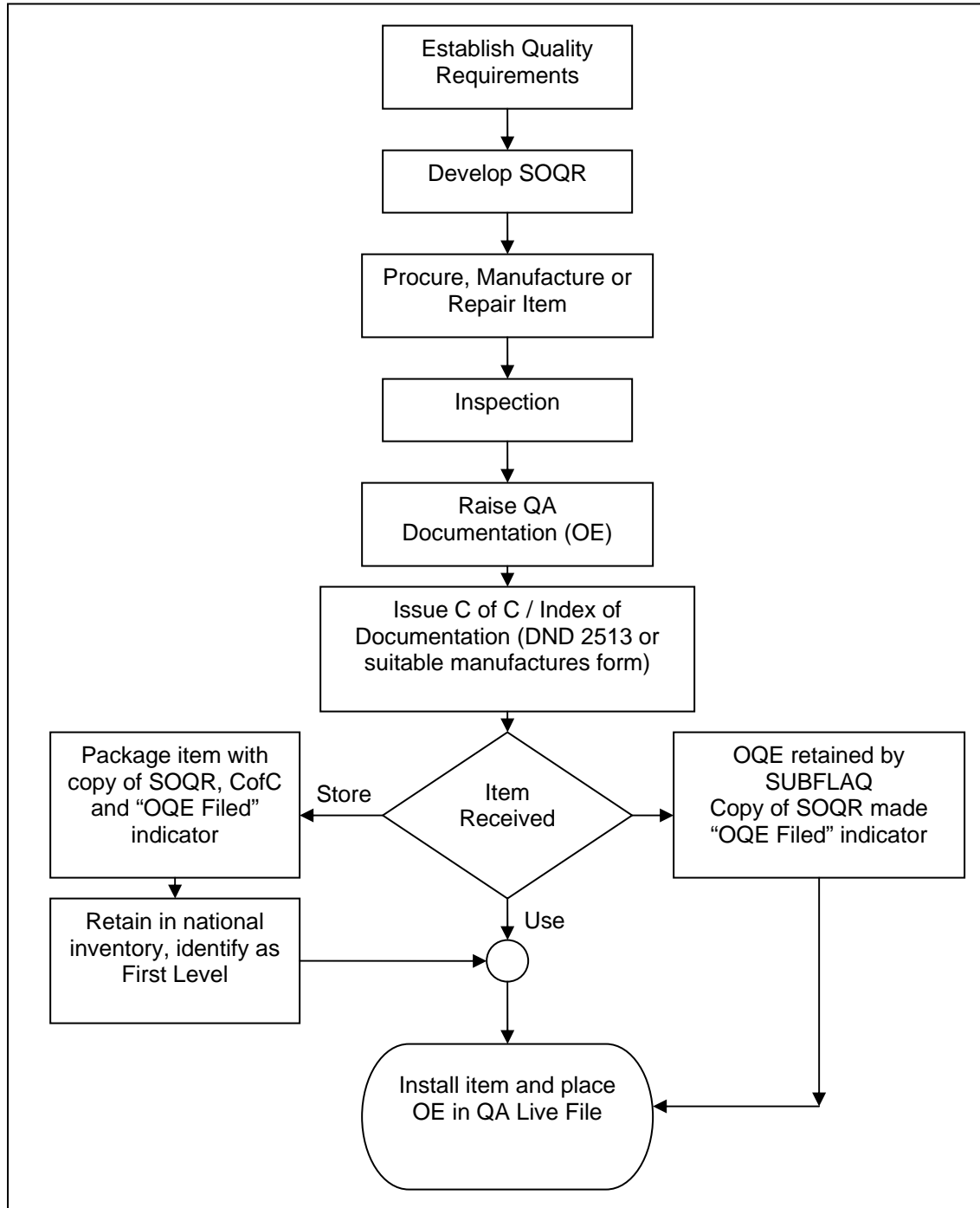
**REPAIR OF FIRST LEVEL ITEMS**

34. Repair requirements are similar to the respective procurement requirements detailed in this part. However, as stated in Part 3, paragraph 21, OE of the repair work undertaken shall be generated.
35. SPs shall ensure that QA documentation for items is complete in all respects and that records no longer relevant to an item's configuration after repair are destroyed, i.e., if a component part is replaced the documentation associated with that part shall be removed from the Quality Records and the documentation for the new part shall be inserted.



Annex A5  
 Quality Assurance for Safety  
 In Submarines – Victoria Class

### IN-SERVICE MANAGEMENT OF FIRST LEVEL ITEMS



The SP or VISSC contractor shall use form DND 2513 or suitable manufactures C of C/ Index of Documentation. The Index of Documentation is one of the key elements in a complete First Level document package.





**Annex B5**  
**Quality Assurance for Safety in Submarines – Victoria Class**

**STATEMENT OF QUALITY REQUIREMENTS**



Guidance Notes on the use of this form

- Inspection and test results additional to those welcomed by A, B and C (see Guidance Notes on the use of this form) should be recorded in the 'Other' column.
- Each item should be positively identified with its Quality records.
- Third Party reference to the inspection and test instructions is to be recorded in the 'Other' column.
- 2008 shall be obtained by the completion contained in the 'Design Authority' column.



**Annex C5**  
**Quality Assurance for Safety in Submarines – Victoria Class**

**CERTIFICATE OF CONFORMITY / INDEX OF DOCUMENTATION**  
**(DND 2513)**



**First Level Submarine Certificate of Conformity and Index of Documentation**  
**Certificat de conformité de sous-marin de 1<sup>er</sup> niveau et index des documents**

<b>Unique identification number - Numéro d'identification unique</b>  <b>QCA</b>  <b>Description</b>	<b>PWGSC contract number:</b> <b>Numéro du contrat du TPSGC :</b>
	<b>PWGSC line item:</b> <b>Ligne d'article du TPSGC :</b>
	<b>NATO stock number:</b> <b>Numéro de nomenclature OTAN :</b>
	<b>Purchase number:</b> <b>Numéro de commande :</b>
<b>Comments – Commentaires</b>	
<b>Raised by:</b> <b>Demandé par :</b>	

## Assembly details - Détails d'assemblage

Quantity - Quantité	Serial no. - N° de série	Deviation / Waivers - Déviation / Exemption
---------------------	--------------------------	---

## Component details - Détails des composantes

[illegible]

### Certification statement - Énoncé de certification

<p>We hereby certify that the goods and documentation as detailed on this form conform to the requirements of the purchase order or contract. Documentation will be retained by _____ and made available for audit.</p> <p>Nous certifions par les présentes que les produits et les documents décrits sur le présent formulaire sont conformes aux exigences du numéro _____ de commande ou du contrat, les documents seront conservés par _____ et seront disponibles à des fins de vérification.</p>			
<b>Date</b>	<b>Name (printed) - Nom (lettres moulées)</b>	<b>Title - Titre</b>	<b>Signature</b>

DND 2513 (11-2008)  
Design: Forms Management 613-993-4050  
Conception : Gestion des formulaires 613-993-4062

# Canada

### Comments/Instructions

Unique Identification Number: A number unique to the assembly or part referenced on the SOQR requisition number. This number shall be preceded by the letter QCA and must include the line number of the item on the SOQR. This unique identification number shall be etched on the materiel IAW C-23-VIC-000/AM-001.

Description: Proper item name IAW CGCS

Contract Number: PWGSC contract number

NATO Stock Number: Self explanatory

Purchase Order Number: Self explanatory

Line Item: Line number of item from the PWGSC contract

Comments: Any and all comments/concerns regarding item being provided under this certificate

Raised by: Who raised the comments and under what authority

QCA: Quality Control Assured. Acronym used to precede unique number for all First Level parts

QTY: Quantity of items manufactured under this specific number. See "Batch Identification" in C-23-VIC-000/AM-001

Serial Number: Any serial number associated with this assembly

Deviations / Waivers: Any and all deviations or waivers associated with the manufacture of this item

SOQR SHT no.: Multiple SOQR sheets may sometimes be necessary

LET: Letter of line associated with SOQR sheet

Serial Number / Deviations / Waivers: Component specific serial numbers or deviations/waivers

Material ID: Numbers associated to the raw manufactured materiel or stock

Material Spec: Specification number used in the manufacture of this materiel

Batch Lot no.: Number assigned to specific batches of materiel

X-Ray no.: Component specific x-ray numbers to include with x-rays taken for NAB castings or similar

Cure Date: The date that rubber components were cured

Validation Date: Completion date of all NAB casting certifications

Certification Statement: To be certified and stamped by approved QA/QC cell

### Commentaires /Instructions

Numéro d'identification unique: Un numéro unique pour l'assemblage ou la pièce ou cité en référence sur l'EEQ. Ce numéro doit être gravé sur l'équipement/matériel conformément à C-23-VIC-000/AM-001 cité en référence sur l'EEQ.

Description : Appellation de l'article conformément au SCGC

Numéro du contrat : Numéro du contrat du TPSGC

Numéro de nomenclature OTAN : Explicite

Numéro de commande : Explicite

Ligne d'article : Numéro de l'article provenant du contrat du TPSGC

Commentaires : Tout commentaire concernant l'article fourni conformément au présent certificat.

Demandés par : Qui a soulevé les commentaires et sous quelle autorité.

CQA : Contrôle de la qualité assure. Acronyme employé qui précède un nombre unique pour toutes les pièces de 1er niveau

QTÉ : Quantité d'articles fabriqués sous ce numéro spécifique. Voir "Identification du lot" dans le C-23-VIC-000/AM-001

Numéro de série : Tout numéro de série associé avec cet assemblage

Déviations / Exemptions : Toute déviation ou exemption associée à la fabrication de cet article

N° FE EEQ: Plusieurs feuilles EEQ sont parfois nécessaires

LET : Lettre de ligne associée avec la feuille EEQ

Numéro de série / Déviations / Exemptions : Numéros de séries spécifiques des composantes ou des déviations / exemptions

ID du matériel : Numéros associés aux matières premières manufacturées ou aux stocks

Spéc. matériel : Numéros des spécifications utilisées dans la fabrication de ce matériel

N° de lot : Numéros assignés à des lots spécifiques de matériel

N° de rayons X : Composantes de numéros de rayons X spécifiques et incluant les rayons X provenant des coulages NAB ou similaires

Date de vulcanisation : Date à laquelle les composants en caoutchouc ont été vulcanisés

Date de validation : Date d'achèvement de toutes les certifications des coulages NAB

Énoncé de certification : Le fait d'être certifié et estampillé par une cellule AQ/CQ approuvée





## PART 6

### QUALITY RECORDS SYSTEMS – FIRST LEVEL QUALITY ASSURANCE

#### SCOPE

1. This part specifies the Quality Records System requirements for the collation and maintenance of QCA documentation for First Level items. The records system is essential to demonstrate conformance to the correct standards throughout the life of an item. A Quality Records System must:

- a. accurately describe the materiel status of all First Level systems by individual submarine;
- b. allow easy exchange of information between SPs and the Records Holder during procurement, overhaul or repair and maintenance;
- c. allow reassessment of an item's acceptability for service;
- d. provide information necessary for the repair and maintenance of First Level items; and
- e. provide traceability of items in the event of problems being recognised in-service.

2. The centralization of records is an essential part of the Quality Records System for the Victoria Class Submarines. The following paragraphs outline the fundamental requirements. The requirements assume the system has a significant manual component to collate and maintain OE and that record management and retrieval use a computer database. Records Holders shall obtain Records Authority agreement of database format and record fields.

#### GENERAL

3. The Quality Records System provides a through-life record for each submarine. The system has three fundamental elements:

- a. the Technical Data Package;
- b. materiel certification of items fitted to the submarine known as QA Live Files; and
- c. registers required for traceability and historical purposes.

4. The care and custody of QCA documentation for First level items, held in CFSS Inventory, shall reside with Blog / Flog Technical services from the time they are received until the time they are issued. Any reproduction (photocopy) of QCA documentation by Blog / Flog shall indicate "Certified TRUE Copy", stamped in red ink and legibly signed by a qualified Technical Inspector.

5. Once materiel is issued from the CFSS, any reproduction, alteration, addition or deletion of QCA documentation shall be signed and stamped in red ink by the FTA (or SP during 3<sup>rd</sup> line maintenance) in consultation with the appropriate design agent and as documented in the submarine deviation and waiver process IAW C-23-VIC-000/AG-001.

#### TECHNICAL DATA PACKAGE (TDP)

6. MoD (UK) delivered a technical data package comprising a set of publications (Books of Reference (BRs)), test forms, planned maintenance schedules, IPCs, miscellaneous support documentation and the datum pack of drawings as the product baseline for each submarine delivered. The TDP is part of the Submarine Through-Life Record.

7. SPs shall provide performance records for the TDP as required, reflecting the current materiel state after performing maintenance. The Design Authority is responsible to keep the information in the TDP current with the Design Intent. DMEPM (SM) or its delegated agent is responsible for the configuration management of the TDP.

8. The DA shall ensure that any change to the design intent of First Level hull areas, systems and equipment and the justifications for the change are incorporated in the TDP so that the design history and QA datum is current.

## **QA LIVE FILES**

9. DMEPM (SM) is the Records Authority and may designate a Records Agent to manage the QA Live File on their behalf. The QA Live File is a unique set of quality records for items fitted to each submarine. They include all specified OE: pipe packages, welding and brazing records, hull penetration cards, valve and joint record cards, fastener information, radiographs, structural records and process inspection records. Stakeholder support to the QA Live Files is essential to maintain accurate and current records:

- a. the Records Authority is responsible to ensure that the QA Live Files are updated to maintain OE for First Level systems including the transfer or removal of information no longer relevant to that platform;
- b. SPs undertaking work (including ships staff) shall raise appropriate records and pass them to the Records Authority for incorporation into the QA Live File;
- c. the Records Authority shall make QA Live Files readily available as a source of information for repair, maintenance and overhaul work;
- d. SPs shall ensure that the appropriate materiel certification and installation records required by this document are provided to the Records Authority for the QA Live Files; and
- e. the SA shall ensure that the SOQR details reflect the OQE/ QCA records. These records shall be raised and retained in the QA Live Files.

10. For contracted Extended Docking Work Periods (EDWPs), the VISSC contractor shall be contracted to update First Level documentation. The Records Authority may delegate the authority for reviewing the First Level documentation to the NDQAR, or a Records Agent, ships staff, FTA or other entity familiar with the requirements of this document in support of the NDQAR. Arrangements must be formalised by a letter of delegation.

11. Spare parts may remain in CFSS or with the VISSC contractor for many years, during which time the CFSS or VISSC contractor must maintain the Quality Records with their associated spare parts. When spare parts are issued from stores the CFSS or VISSC contractor shall transfer the records with the spare parts to a SP. The SP that uses the spare parts shall ensure that the Quality Records along with all other applicable documentation are provided to the Records Authority or a Records Agent for inclusion in the QA Live File when the parts are fitted.

12. Where parts are removed from the submarine for overhaul or repair, the Records Authority or designated Records Agent shall remove the relevant QCA records from the QA Live File to accompany the parts. Refit or overhaul contractors shall update Quality Records as repair work is done and forward the QCA record or a certified True / stamped copy of the record to the Records Authority or their agent for reintroduction into a QA Live File when parts are reinstalled. If the parts are transferred to the CFSS after repair and overhaul, the refit or repair contractor shall transfer the QCA records to the CFSS for retention with the spare parts.

## TRACEABILITY RECORDS

13. This part of the records system comprises a submarine file and a spares file. The MoD (UK) collated the initial submarine file from manufacturing and installation documents. The MoD (UK) transferred this information to Canada as the Master Records Data Base (MRDB) and the QA Live File. DMEPM (SM) is responsible to maintain this information as part of the Through-Life Record of the submarines.

14. DRMIS is the official configuration management document and drawing index system for the Victoria Class Submarines. The data in DRMIS shall include documentation, drawings, ancillary support equipment, deviations and registers. The currency of any particular record may be verified against DRMIS. Drawings are boat specific, so boat applicability must be verified before use.

## LOCATION OF RECORDS SYSTEMS

Record System	Initial Compilation	Maintenance Through-Life
Submarine TDP	MoD(UK)	Records Authority, via a Records Agent
Spares and Traceability Data (DRMIS)	RF or Overhaul or Repair Contractor or Manufacturer	Records Authority, via a Records Agent (CFSS for spare parts)
Overhaul and Repair – Through-Life (QA Live Files)	RF or Overhaul or Repair Contractor	Records Authority, via a Records Agent
Overhaul and Repair – Spares and Traceability Data	Forwarded from CFSS	Records Authority, via a Records Agent

Figure 6-1 Organizations Responsible for Initial Compilation and Maintenance of Records



**PART 7****USE OF ITEMS NOT FULLY QUALITY ASSURED IN FIRST LEVEL AREAS AND USE OF FULLY ASSURED ITEMS IN NON-FIRST LEVEL APPLICATIONS****SCOPE**

1. Any First Level item not fully assured or not fully meeting specification during manufacture, installation or test shall be either rejected by using a Pre-installation Failure Report (PIF) or subject to the deviation or waiver process and shall follow the materiel safety procedures of C-23-VIC-000/AG-001.
2. This part outlines additional procedures for controlling non-conforming First Level items fitted in First Level systems and for generating records to provide assurance that non-conforming items do not compromise the safe operation of the submarine. This section also outlines the requirements for the use of First Level spares in non-First Level applications.

**RECURRING NON-CONFORMANCES****GENERAL**

3. Cases of non-conforming First Level items in First Level systems occur regularly in both procurement and spares management. The management of non-conforming First Level items must ensure that records are generated to provide sufficient assurance of quality for the associated First Level system. Specific cases include:
  - a. when manufacturers are unable to provide full QA; and
  - b. when First Level stocks are exhausted.

**MANUFACTURERS UNABLE TO PROVIDE FULL QUALITY ASSURANCE**

4. In cases where manufacturers are unable to provide the correct levels of QA for First Level item SPs shall develop special arrangements with the subcontractor appropriate to the items concerned to meet the QA requirements of this document. The SP shall seek Design Authority approval of these special arrangements. In making these arrangements the SP should consider the following points:
  - a. the availability of alternative designs and sources of supply, including the use of non-proprietary items;
  - b. the feasibility of non-destructive examinations or other tests which can be carried out on each item away from the manufacturer's premises;
  - c. the possibility of destructive examination of other items from the same batch; and
  - d. the degree of quality control exercised by the manufacturer and the extent of oversight undertaken by the SP.
5. Each arrangement shall be confirmed in writing with the Design Authority and reviewed annually. Arrangements shall only apply to the specific items and manufacturer concerned. Should the specific items or manufacturer change, then full QA shall be demanded or a new agreement reached. A copy of the recorded deficiencies shall accompany all items. When an item is fitted the record of deficiencies shall be included in QA Live Files.

6. The SOQR relating to the order or item should reflect the agreed arrangements. If the agreed arrangements are not met, the order or item shall be quarantined, and shall not be used unless the System Authority approves a waiver.

#### **FIRST LEVEL SPARE PARTS WITHOUT ASSOCIATED DOCUMENTATION**

7. SPs receiving First Level spares for installation in a submarine shall assess the quality documentation for completeness and acceptability. When materiel does not conform to technical requirements SPs shall quarantine the materiel and raise a Pre-Installation Failure (PIF). The materiel shall not be used unless the documentation deficiency has been rectified or an approved deviation / waiver has been granted by the SA.

8. The item may be subjected to further testing. If such inspection and testing or rework cannot establish conformance, the SA will consider the situation in accordance with C-23-VIC-000/AG-001.

#### **FIRST LEVEL STOCKS EXHAUSTED**

9. When First Level stocks are exhausted, identical non-First Level spares with the SOQR and clearly labelled "NOT FULLY QUALITY ASSURED" may be used in their place, provided that all test requirements specified by the SOQR are completed prior to fitting the item onboard. On receipt of the non-QCA item, the demanding authority shall undertake those tests required by the SOQR for which there is no assurance. Where the tests are successful the demanding authority shall raise a C of C and all OQE documentation for all completed tests. SPs shall not install non-First Level stores until all tests required by the SOQR are complete. Where tests cannot be completed or are not successful, the demanding authority shall apply for a waiver in accordance with the requirements of C-23-VIC-000/AG-001.

#### **SPARES RECLASSIFIED AS FIRST LEVEL**

10. Some line items in IPCs relate to First Level parts that were either incorrectly designated as not being First Level when originally codified or whose classification has been upgraded to First Level for other reasons.

Two parallel courses of action shall be taken:

- a. As a short-term measure, the SP shall obtain SOQRs from the DA or supplier, as appropriate. On demand, the spares shall be issued with the SOQR and clearly labelled "NOT FULLY QUALITY ASSURED". On receipt, the demanding authority shall undertake those tests for which there is no assurance, as required by the SOQR. Where the tests are successful, the demanding authority shall raise a C of C and forward it, along with copies of documentation from all completed tests, to the Records Authority for inclusion in the Quality Records System. This applies whether the item is issued for use or returned to stores. Where tests cannot be completed or are not successful, the demanding authority shall apply for a waiver in accordance with the requirements of C-23-VIC-000/AG-001. In the event that a non-First Level spare is an onboard spare being utilized in replacement of a First Level component while at sea, the unit MSEO or CSEO shall report the usage and request a deviation through FTA, by message, with the intention of rectifying the deficiency at the earliest opportunity; and
- b. The CFSS and the VISSC contractor shall purge their stockholdings of improperly assured items by replacement or obtaining assurance, testing, examination or a deviation from the DA.

## **DISPOSAL OF STOCKHOLDINGS NOT FULLY QUALITY ASSURED**

11. All stockholdings that cannot be fully assured or accepted by the System Authority under deviation or waiver shall be downgraded from First Level status and either re-used in non-First Level applications or removed from the CFSS. The SA shall have the final decision on specific arrangements. Whenever a First Level item has been deemed “unusable” and is sent for disposal, the LCMM shall be contacted to provide the method of destruction required and a Certificate of Disposal shall be provided to BLOG/FLOG by the SP. The Certificate of Destruction and all OQE documentation shall be retained by BLOG/ FLOG/ SUBFLAQ for 5 years.

## **USE OF QUALITY ASSURED ITEMS IN NON-FIRST LEVEL AREAS**

12. Items assured to First Level requirements may be used in non-First Level areas when normal stocks are not available, provided the System Authority approves that the item is suitable. Use of quality assured items in non-First Level areas shall be by exception and with the approval of the System Authority thru DMEPM(SM). This practice not only incurs additional costs for quality assured items, it also depletes quality assured stockholdings.

13. Should the System Authority approve the use of quality assured items in non-First Level areas, the SA shall direct Formation Logistics / Base Logistics or the “holders” of the First Level materiel to:

- a. transfer quality documentation to a “Quality Documentation Holding File (QDHF)” maintained by BLOG/ FLOG Technical Services or the VISSC contractor; and
- b. amend the system of record to indicate the location of the First Level qualified materiel.

### **NOTE**

The QDHF is to be completely segregated from all other submarine contractual and quality documentation.

## **RETURNING FIRST LEVEL QUALIFIED MATERIEL REMOVED FROM NON-FIRST LEVEL SYSTEMS TO FIRST LEVEL STATUS**

14. Once the First Level item is removed from the non-first level system through normal repair and overhaul requirements, it can be returned to First Level standards provided:

- a. the OE associated with the item can be located and reunited with the component;
- b. it is overhauled; and
- c. it successfully completes all tests and inspections called up in the overhaul specification.

If this process is completed, the item is to be returned to the CFSS or the VISSC contractor (as applicable) for future use in First Level Systems.

15. FTA shall track, within DRMIS, the location of all First Level qualified materiel fitted to non-First Level systems. In the preparation for Extended Docking Work Periods (EDWPs), FTA shall specify the location of all First Level materiel on the DND 650 raised for the system affected and direct that the provisions of Para. 13 are completed.

## **DISPOSAL OF USED FIRST LEVEL CONSUMABLES**

16. Disposal of First Level consumables such as fasteners is to be managed locally. At a minimum, immediately upon removal from a submarine system, consumables are to be rendered unusable and disposed of IAW appropriate local legislation.





## PART 8

### AUDITS AND ASSESSMENTS

#### SCOPE

1. Audits and assessments provide assurance to management and to customers that an organization's quality management system, products and services are meeting specified requirements. It also enables initiation of corrective or preventative action should a process require change or if procedures are not being followed. The Quality Management System of every SP shall include a self-auditing function.

#### DND AUDITS AND ASSESSMENTS

##### GENERAL

2. It is DND policy that SPs comply with the requirements of ISO 9001:2008. External audits are mandatory at intervals not exceeding one year. For SPs not registered to ISO 9001:2008 this requirement shall be imposed by agreement or contract, as applicable.

3. It is also DND policy that SPs are responsible for the work of their subcontractors; therefore, their internal auditing function must extend into this area. In addition, independent First Level assessments shall be undertaken to provide confidence that the requirements of this document are being and have been met prior to undocking a submarine, conducting a camber dive or the first time proceeding to sea after a third line maintenance period.

##### FIRST LEVEL ASSESSMENTS

4. Where the consequence of failure is very high, i.e., for First Level items, DMEPM(SM) or a designated representative may carry out assessments as part of the Materiel Certification Process as described in C-23-VIC-000/AG-001. These assessments concentrate on the availability, retrieval, completeness and acceptability of the OE demanded by this document.

5. Although First Level assessments are mainly concerned with providing evidence of achievement of the requirements of this document, the examination of the Quality Management System and its implementation together with the product or service is not to be excluded.

6. For SPs or contractors other than the FMFs, the NDQAR or VISSC On-site Management Team (OSMT) shall conduct quality assessments to confirm that the requirements of this document are being met. For RFs, the NDQAR may conduct quality assessments. DMEPM(SM) may consider other arrangements by the RF for independent QA process audits to confirm that the requirements of this document are being met.



## **PART 9**

### **DOCUMENTATION AMENDMENT OF VICTORIA CLASS – QUALITY ASSURANCE FOR SAFETY IN SUBMARINES**

1. Any individual may originate amendment proposals using the enclosed Documentation Amendment Proposal Form. Amendment proposals should include attachments, diagrams, and references as required substantiating the submission.
2. Submission proposals generated at the NDHQ level are to be directed to DMEPM (SM) while proposals from coastal units are to be submitted to the Formation Technical Authority; Attention SSO Subs, for review prior to onward transmission to DMEPM (SM).
3. Coastal proposals are to be ratified at the unit level to ensure applicability and pertinence as this is the first step in the screening process.
4. As required, before submitting coastal proposals to DMEPM(SM), the Formation Technical Authority (FTA) will hold a working group to consider all proposals. The formation working group, responsible to consider proposals, will be determined by the coastal FTA.
5. On an annual basis or as required, all amendment proposals accepted in principal by DMEPM (SM) 2 will be presented to DMEPM(SM) section heads for review and comment before being submitted to DMEPM(SM) for final endorsement.



Annex A9  
Quality Assurance for Safety  
In Submarines – Victoria Class

**DOCUMENTATION AMENDMENT PROPOSAL FORM**

<b>DOCUMENTATION AMENDMENT PROPOSAL</b>		
DATE:	UNIT:	AMENDMENT No:
ORIGINATOR:		DOCUMENT AMENDED:
COMMANDING OFFICER:		
ARTICLE:		
RELATED ARTICLES:		
PROPOSED AMENDMENT:		
REASON FOR PROPOSAL:		



## REFERENCES

A. C-03-005-012/AM-001	Naval Materiel Management System (NaMMS) Manual
B. ISO 9001:2008(E)	Quality Management System Requirements
C. ISO 9004:2000(E)	Quality Management Systems – Guidelines for Performance Improvements
D. C-23-VIC-000/AG-001	Submarine Material Management and Certification
E. DND 2513	Certificate of Conformity/ Index of Documentation
F. DEF STAN 02-374 (NES 374)	Rubber Flexible Pipes and Bellows for Use in Submarines
G. DND 2328	Statement of Quality Requirements
H. DEF STAN 02-736 (NES 736)	Requirements for QI (Navy) Steel
I. DEF STAN 02-862 part 4 and 5	Submarine first level fastener ferrous and non-ferrous ( to be superseded with the new CFTO on fasteners)
J. C-02-005-009/AM-000	Inspection & Conditioning
K. DEF STAN 02-872, Part 1	Procedures for First Level Nickel Aluminum Bronze Castings, Part 1, Policy
L. DEF STAN 02-872, Part 3	Procedures for First Level Nickel Aluminum Bronze Castings, Part 3, Revalidation
M. MARCORD 4-30	Management of Naval Software
N. DEF STAN 00-56	Safety Management Requirements for Defence Systems
O. DEF STAN 02-136	Design, Testing and Acceptance Requirements for Watertight Integrity of Submarines
P. C-23-VIC-876/ND-001 SSK02 H.M.S. UNSEEN (HMCS VICTORIA FLADS)	Quality Assurance for First Level Systems and Areas (including First Level areas diagrams)
Q. C-23-VIC-878/ND-001 SSK03 H.M.S. URSULA (HMCS CORNER BROOK FLADS)	Quality Assurance for First Level Systems and Areas (including First Level areas diagrams)
R. C-23-VIC-877/ND-001 SSK 04 H.M.S. UNICORN (HMCS WINDSOR FLADS)	Quality Assurance for First Level Systems and Areas (including First Level areas diagrams)

- |    |   |   |
|----|---|---|
| S. | C-23-VIC-879/ND-001<br><br>SSK01 H.M.S. UPHOLDER<br>(HMCS CHICOUTIMI FLADS) | Quality Assurance for First Level Systems and Areas (including<br>First Level areas diagrams)           |
| T. | S/EDD/DES/JKH STP331/89<br>UPHOLDER FLADS Dated Oct<br>1992                 | SSK 01 HMS UPHOLDER Quality Assurance for First Level<br>Systems and Areas (originally captured in TDP) |



## GLOSSARY

### Capability

The ability of an organisation, system or process to realize a product (or service) that will fulfill the requirements for that product (or service).

### Design Authority

The authority vested in one individual at Director level who is responsible for the establishment and maintenance of Design Intent. The Design Authority should have the professional competence and authority to specify design requirements, undertake design tasks, apply configuration management to designs and associated documentation, while continuously monitoring the effectiveness of those activities for a given Materiel state. The Design Authority is also the Class Programme Manager. This will provide the Design Authority the necessary authority and accountability to maintain Design Intent and to enable fully informed decisions on Design Intent that consider programmatic requirements and constraints, e.g. operational, technical, and regulatory requirements; resources (cost); schedule; system integration impacts; and associated risks. This role is filled by DMEPM(SM) for the VCS.

### Design Intent

Design Intent constitutes the sum of all operational requirements, regulatory requirements, technical requirements (specifications, rules, Canadian Forces Technical Orders [CFTOs], etc.), technical policies (NaMMS, Naval Engineering Manuals (NEM), Maritime Command Orders/ Naval Orders [MARCORDs/[NAVORDs], etc.), and intended environmental conditions/limitations which govern the design, maintenance, and operation of naval materiel. Design Intent is normally captured at a platform level in the Statement of Operational Requirements (SOR), the Systems Requirement Document (SRD), the Concept of Operations (CONOPS), the Certification Baseline and Certification Plan, and all design documents.

### Deviation

Canadian term under which a written authorization is granted by an appropriate authority prior to the manufacture of an item, to depart from a particular performance or design requirement of a contract, specification, or referenced document, for a specific number of items, a specified service, or a specific period of time.

### DRMIS

Defence Resource Management Information System. A comprehensive system bringing together financial information system with its materials management system.

### Joint Test Group (JTG)

Joint Test Group is provided with the authority to particularize Blank Test Form Masters from the TDP to suit work called up by the PMRS. This authority also includes the ability to amend the Test Form index so that Test Forms can be added or deleted to suit the requirements of SUBSAFE Materiel Certification. It is the responsibility of the JTG to produce, authorize and issue a maintenance period TF Index; add, amend or delete testing requirements called by individual specifications; produce, authorize and issue controlled working TF copies to PTFG and to evaluate and approve the TF results.

**Materiel Authority**

The SUBSAFE Materiel Authority is ADM(Mat). ADM(Mat) has delegated this responsibility to DGMEPM.

**Materiel State**

The status of a platform, equipment or system in relation to the design intent.

**Principal Service Provider (Prime Contractor)**

A Repair Facility with primary responsibility for a maintenance period or a commercial enterprise in receipt of a contract from Public Works Government Services Canada.

**QA Live File**

The QA Live-File represents the collection of quality related records for all First Level components fitted on the submarine. Full traceability is required from raw material extraction to casting, machining and installation on the submarine.

**(QCA) Unique Identification Number**

Unique identification of all First level finished goods must be clearly and permanently marked as per Standard(s) on the individual item(s). All OQE packages are to contain reference to the same Unique Identification Number which will give positive identification between part and OQE. The Unique Identification Number will start with the letters QCA / the SOQR "Contract, Order, Tracking No." / SOQR line item as per order.

**Quality**

Degree to which a set of inherent characteristics fulfils requirements.

**Quality Document Holding File (QDHF)**

A secure repository for all quality documentation from materiel that has been downgraded from First level status for use in a non-first level application.

**Records Agent**

The Design Authority nominated contractor(s) or Service Provider(s) contractually responsible for maintenance and configuration management of Quality Records.

**Records Authority**

The organization within the Design Authority exercising the responsibility to maintain records generated in accordance with this document. DMEPM(SM), as Class Programme Manager, is the Records Authority for the Victoria Class.

**Records Holder**

Any Service Provider or authority maintaining or storing records required by this document.

**Register**

A tracking tool use to manage the material fitness of like elements. (IE; Those for lifting appliances or flexible hoses.)

**Repair Facility (RF)**

A DND Fleet Maintenance Facility, a repair and overhaul contractor, or a commercial shipyard performing work during a contracted Work Period (WP).

**Requirement**

Need or expectation that is stated, generally implied or obligatory.

**Service Provider (SP)**

Any provider of Second or Third Line Maintenance such as a contractor, repair facility, original equipment manufacturer, field support representative, etc.

**SSDR (Submarine Safety Document Register)**

A risk communication document that establishes the Baseline material State for the SUBSAFE licensing process. It is a foundational document for the SUBSAFE Material Certificate and subsequent licensing.

**Subcontractor**

The commercial enterprise in receipt of a contract from a Principal Service Provider (Prime Contractor) or Service Provider.

**Verified**

Examined in order to establish correctness.

**Waiver**

Written authorizations granted by an appropriate authority after manufacture to permit the acceptance of items that during production or after having been submitted for inspection, are found to depart from the technical data requirements of the contract, but are considered suitable for use "as is" or after approved repair.

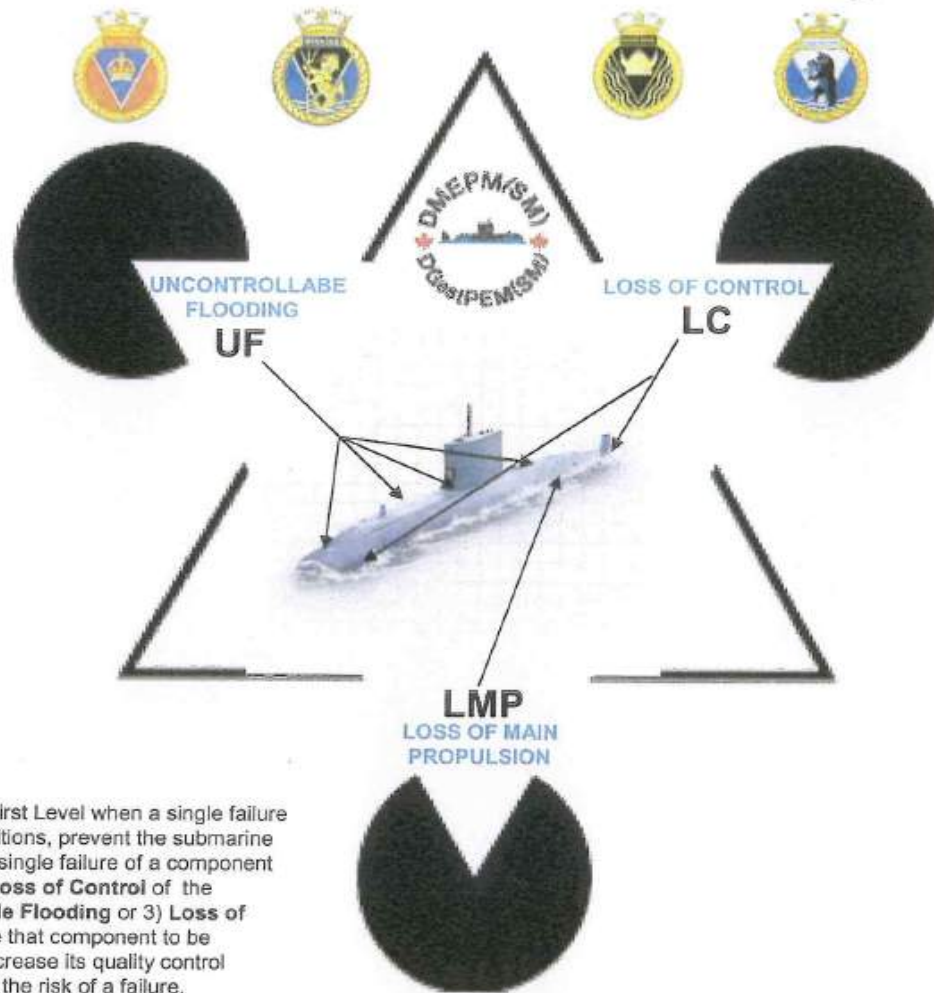


## LIST OF ABBREVIATIONS

<b>BLOG</b>	Base Logistics	<b>ISO</b>	International Organisation for Standardization
<b>BR</b>	Book of Reference	<b>ISSC</b>	In-Service Support Contractor
<b>CFSS</b>	Canadian Forces Supply System	<b>JTG</b>	Joint Test Group
<b>CHS</b>	Critical Hole Size	<b>LCMM</b>	Life Cycle Materiel Manager
<b>C of C</b>	Certificate of Conformity	<b>LCQM</b>	Life Cycle Quality Manager
<b>CuNiCr</b>	Copper Nickel Chrome	<b>MBT</b>	Main Ballast Tank
<b>DA</b>	Design Authority	<b>MoD(UK)</b>	Ministry of Defence (United Kingdom)
<b>DDD</b>	Deep Diving Depth	<b>MLD</b>	Manoeuvring Limitation Diagram
<b>DDDP</b>	Deep Diving Depth Pressure	<b>MRDB</b>	Master Records Data Base
<b>DDSTP</b>	Depth Dependent Systems Test Pressure	<b>NAB</b>	Nickel Aluminum Bronze
<b>DEF STAN</b>	Defence Standard	<b>NCR</b>	Non Conformance Report
<b>DGMEPM</b>	Director General Maritime Equipment Programme Management	<b>NDE</b>	Non-Destructive Evaluation
<b>DMEPM(SM)</b>	Director Maritime Equipment Programme Management (Submarines)	<b>NDHQ</b>	Nation Defence Headquarters
<b>DND</b>	Department of National Defence	<b>NDQAR</b>	National Defence Quality Assurance Region
<b>DQA</b>	Director Quality Assurance	<b>NES</b>	Naval Engineering Standard (obsolete)
<b>DRMIS</b>	Defence Resource Management Information System	<b>OE</b>	Objective Evidence
<b>DSRV</b>	Deep Submergence Rescue Vehicle	<b>OQE</b>	Objective Quality Evidence
<b>DWP</b>	Docking Work Period	<b>PIF</b>	Pre-Installation Failure
<b>EC</b>	Engineering Change	<b>QA</b>	Quality Assurance
<b>ECP</b>	Engineering Change Process	<b>QALF</b>	Quality Assurance Live File
<b>ECP</b>	Engineering Change Proposal	<b>QCA</b>	Unique part number Prefix signifying a First Level Item
<b>EDWP</b>	Extended Docking Work Period	<b>QASOR</b>	Quality Assurance Statement of Requirements (UK version of an SOQR)
<b>EMC</b>	Electromagnetic Compatibility	<b>REP 1</b>	Repair & Disposal
<b>FLAD</b>	First Level Area Diagrams	<b>RFQ</b>	Request For Quote
<b>FLOG</b>	Formation Logistics	<b>R&amp;O</b>	Repair and Overhaul
<b>FMF</b>	Fleet Maintenance Facility	<b>SA</b>	System Authority
<b>FTA</b>	Formation Technical Authority	<b>SHS</b>	Specified Hole Size
<b>HAZID</b>	Hazard Identification	<b>SOQR</b>	Statement of Quality Requirements
<b>HP</b>	High Pressure	<b>SMTI</b>	Submarine Technical Instruction
<b>IAW</b>	In Accordance With	<b>SP</b>	Service Provider
<b>IPC</b>	Illustrated Parts Catalogue		

<b>SSDR</b>	Submarine safety Document Register
<b>SSCP</b>	Sea Systems Controllerate Publication
<b>SSE</b>	Submerged Signal Ejector
<b>SSO Subs</b>	Senior Staff Officer Submarines
<b>SUBFLAQ</b>	Submarine First Level Assured Quality (Contractor QA document holding system)
<b>SUBSAFE</b>	Submarine Safety
<b>TDP</b>	Technical Data Package
<b>UIN</b>	Unique Identification Number
<b>VCS</b>	Victoria Class Submarine
<b>VISSC</b>	Victoria In-Service Support Contract
<b>VSTI</b>	Victoria (Class) Submarine Technical Instruction
<b>WHDS</b>	Weapons Handling and Discharge System

## Victoria Class First Level Designation



### First Level Definition:

A component is defined as First Level when a single failure would, under particular conditions, prevent the submarine from surfacing. Therefore, a single failure of a component which could result in the 1) **Loss of Control** of the submarine, 2) **Uncontrollable Flooding** or 3) **Loss of Main Propulsion** will require that component to be classified as First Level to increase its quality control requirements and to mitigate the risk of a failure.