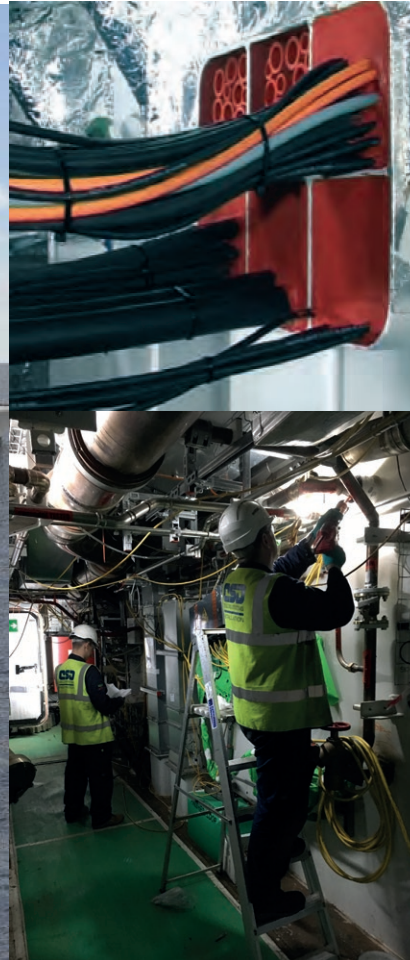




**TECHNICAL
SERVICES**



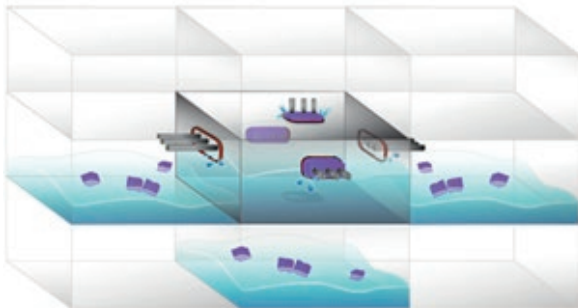
Watertight Integrity Inspection, Survey, Testing & Repair.

Doors, Hatches, Cable & Pipe Penetrations

DAMAGE CONTROL SURVIVABILITY & CONTAINMENT OF FIRE, SMOKE AND FLOODING.

The effective compartmentalisation of a ship is critical to the containment of fire, smoke and flooding to ensure survivability. The containment is only as strong as the weakest link; the operation and performance of WT doors, hatches, escape scuttles, cable and pipe penetrations through a vessel's bulkhead and decks play a critical role in ensuring a vessel's watertight, fire, smoke and toxicity integrity.

The longer a flood can be contained in the space of origin, the greater the chance of survival. Failure of any watertight opening and / or penetration can lead to progressive flooding, therefore the functionality and performance of each component passing through a vessel's watertight deck or bulkhead is critical to ensure the safety of the vessel.



PROGRESSIVE FLOODING THROUGH PENETRATIONS

Type approval alone does not assure performance of penetrations, correct installation as tested and approved, is critical to the effective flood and gas tight performance. Recent incidents have highlighted fundamental systemic failings particularly within cable penetration transits; a full engineering assessment of cable penetrations is often overlooked through the life of the vessel to ensure they are installed and maintained through the life of the vessel. An assessment of all watertight bulkheads and decks may be required through the vessel's service life to ensure associated classification society safety certification.

To maintain the vessels original design safety intent, cable and pipe penetrations must be viewed as a safety critical system with all the associated system controls in place for initial installation and any modifications through life.

WATERTIGHT INTEGRITY INSPECTION, SURVEY, TESTING & REPAIR

CSD have pioneered the use of ultrasound techniques in 2010 testing integrity of AFU radial filters, pipe and cable penetrations on HMS Albion and HMS Bulwark and were engaged to continue testing for Watertight Integrity on Hunt Class mine hunters, Type 23 Destroyers and Astute Submarines.

More recently CSD have used their survey, inspection and testing expertise to test the integrity of CSD's NOFIRNO Cable Transits & Pipe Penetrations installed on the QEC Aircraft Carriers.

Specialist Training in the use of the equipment in Watertight Integrity Surveys

Our fully qualified team of technicians provide a number of services including:

Ultrasound and detailed visual surveys of:

- Watertight doors, hatches and escape scuttles
- Cable and pipe penetrations
- AFU Radial filters

Repairs

The CSD team have the skills and the experience if faults are identified, to be able to carry out the repairs necessary to ensure watertight integrity on cable & pipe penetrations and working with partner companies to rectify defects associated with watertight doors, hatches and escape scuttles.

Our services, including the supply, installation and inspection of cable transits and pipe penetrations are certified by Lloyds Register QA through ISO 9001:2015 accreditation.

ULTRASONIC WATERTIGHT INTEGRITY TESTING

This test procedure can be used to test all types of weather, water and air tight seals where access to both sides of the seal is possible.

With access to both sides of the seal, the generator which is positioned on one side of the seal, produces an ultrasonic modulated tone at around 40kHz, the receiver, located on the opposite side of the seal to the generator, is then used by the operator and if the seal being tested is imperfect the signal will pass through the leak in the seal and be detected.

CSD survey experience of inspecting cable transits has shown that ultrasound testing should also be coupled with a detailed visual inspection by experienced operators who can identify other defects, which could fail under hydrostatic pressure. Essential ultrasound is combined with a detailed visual inspection, as ultrasound alone could give a false sense of watertight integrity.

The service that CSD provide complements the work of Classification Society Surveyors by providing a thorough detailed inspection of the watertight and fire resistance of all penetrations through bulkheads and decks.

This inspection includes doors, hatches, pipe and cable penetrations ensuring that penetrations are installed correctly in accordance with Type Approval Certification, including insulation detail and any certification limitations.

The ultrasonic watertight integrity test equipment used by CSD can detect leak apertures as small as 0.06 +/- 0.02mm, and as the ultrasonic generator can be held in position by magnetic fixtures and has a range of over 100 metres the generators can fill even the largest compartments with an ultrasonic signal.



Figure 1. Watertight Compartment

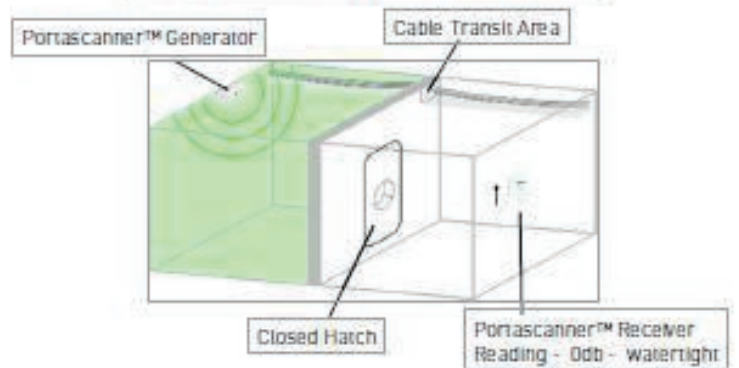
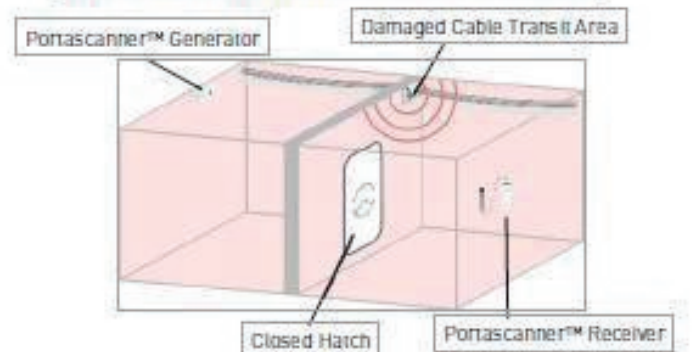


Figure 2. Non-compliant Compartment



Typical defects identified using ultrasound equipment but in some cases found during visual inspection

Doors and Hatches

- Insufficient compression of door/hatch seal
- Poorly fitted door/hatch seal
- Gaps in the door/hatch seal
- Damaged door/hatch seal

Block Cable transits showing gaps between cables, blocks and frames

- Blocks have been incorrectly sized
- Blocks are not putting sufficient compression on cables
- There is compression set problems with blocks beginning to show stress relaxation loss in rubber
- The compression wedge is not sufficiently tightened
- Cables not entering perpendicular to blocks can cause distortion to the rubber seal
- Distortion of the frame holding the block
- Blocks missing
- Stay plates missing
- Blocks protruding beyond stay plates, which can lead to failure
- Blocks pushed out of correct position under pressure
- Mixing of different manufacturers blocks
- Excess tallow on blocks can disguise the fact that blocks are not water-tight

Rise Nofirno

- Gaps between cables and sealant layer
- Sealant not applied between all cables
- Cables disbonding from sealant due to inadequate cleaning
- Cables touching due to not being individually sleeved, or sealant not applied between cables



CSD are happy to provide a listing of the different projects we have been involved with, including submarines, destroyers, offshore oil platforms, yachts, including some foreign owned vessels.



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