LIFE SUPPORT EQUIPMENT TEST FACILITY

Description

The ANSTI Life Support Equipment Test Facility is a fully integrated, laboratory system specifically designed to test and measure the dynamic breathing performance of a wide range of life support equipment.

- EN 250: 2014 (Regulators)
- EN15333-1:2008 (Helmets)
- US Navy Unmanned Testing Proc's

The tests are conducted accurately and efficiently at the surface and / or immersed in water to a maximum depth of 100 metres sea water (msw).

The test vessel (nominal internal dimensions Ø1000 x 1300 deep) offered with this system is sufficient to accommodate twin cylinder SCUBA diving equipment and diving helmets / band masks with bailout cylinder (maximum dimensions 850 x 500 mm) in both swim and head upright positions. Additionally, the system will also allow the breathing performance of a wide range of surface equipment e.g. filter masks and fire fighting BA etc to be measured. The facility is supplied with a specially modified Sheffield (anatomically correct) head with adapters to connect other types of life support equipment and a space frame mannequin.

The test vessel lid incorporates a quick and easy lock mechanism, which improves efficiency and minimises operator effort. The test vessel is fitted with a depth controller which allows automatic venting of air to accurately maintain the set depth. The depth controller is capable of discharging > 10,000 litres / min of air safely to atmosphere and therefore acts as an emergency relief valve in the event of a high pressure seal failure. It also fails safe in the event of loss of electrical power / LP air supply.

The Stainless Steel Breathing Simulator utilises a pure sine wave drive linkage. It has variable tidal volume and push button control of breathing rate. The breathing system is fitted with a heating and humidification system and, with an environmental control system to cool / heat the water in the test vessel, the facility will test the extreme range of breathing performance required by the above standards.

The test facility incorporates an integrated CO_2 injection / O_2 mixture removal and measurement system. The system combines a range of instruments to allow fixed ventilation rate/depth simulation for O_2 removal and CO_2 generation whilst monitoring the response of the breathing apparatus under test. The system includes a computerised data acquisition system to allow both real-time monitoring and post test analysis of the CO_2 breakthrough characteristics of CO_2 canisters, breath by breath CO_2 build up in full facemasks / diving helmets and inspired O_2 levels.

The test facility is simple and logical to use and, when combined with the computerised data acquisition system, allows the operator to undertake rapid testing of equipment. The computer is programmed to be a virtual instrument with key operator information, such as depth, cylinder pressure, exhaled gas temperature etc. displayed on the screen. The operator can view equipment performance via a range of multiple real-time displays. The acquired data can then be analysed, reviewed, archived, and / or printed in the form of Test Certificates.

Technical Specification

General

1. The system is CE approved and has 3rd party approval to American and European design codes. It is supplied as an integrated, fully calibrated, turnkey package. The above price includes on-site Installation, Commissioning, and Staff Training. A Technical Manual is supplied with comprehensive details of the equipment and full Operating Instructions.

Test Vessel

2. The test vessel is fully constructed from Stainless Steel and rated to a maximum working depth of 100 msw. The nominal internal dimensions are Ø1000 x 1300 deep. The lid system utilises the latest ANSTI proprietary quick release locking mechanism and incorporates a pneumatic lifting system with safety interlocks. The lid is also fitted with a manual vent / inter-lock safety device to prevent accidental pressurisation.

Environment Control System

3. The test vessel environment conditions are independently controlled by an external chiller / heater system. This will chill / heat the test vessel water prior to the cold / hot water tests and will maintain the set temperature during testing in accordance with EN 250: 2000, EN 14143: 2013 and the US Navy Unmanned Testing Requirements.

Heating / Humidification System

4. The Heating / Humidification system is designed to provide exhaled air temperatures and RH levels in accordance with EN 250: 2000 and EN 14143: 2013.

Breathing Simulator

5. The Breathing Simulator is fully constructed from Stainless Steel and rated to a max working depth of 100 msw. It is of piston design which provides a very accurate / repeatable volume displacement using a pure sine wave drive mechanism. It has adjustable tidal volume settings (1, 1.5, 2, 2.5, 3, 3.5, 4 & 4.5 litres) and push button control of breathing rate (10, 15, 20, 25, 30 & 40 breaths per minute) providing ventilations in the range of 10 to 180 litres per minute.

CO_2 Injection and Measurement System

6. The CO_2 Injection and Measurement System utilises a mass flow controller capable of injecting a calibrated flow of up to 5 lpm CO_2 into the gas stream. The fast response carbon dioxide analyser used for breath by breath measurements is designed to operate from the surface to 100 msw. The output from the analyser is displayed in real-time on a separate PC and the test data archived for post test analysis. The system includes all external pipe work and internal sample tubes but excludes re-breather inspired hose adapters, as they are specific to the apparatus under test.

O_2 Uptake Simulation / Measurement System

7. The simulation of O_2 uptake is achieved via a combination of instruments allowing the removal of gas mixtures from the test apparatus and the injection of a pure or mixed gas diluent. The system includes digital flow meter and mass flow controller as well as the latest fast response oxygen analyser integrated to function with the computerised data acquisition system. The system is again designed to function from 3 msw to 100 msw at 0.5 – 3 l/min of O_2 consumption for a ppO_2 of 1.0 bar and includes all injection, removal, and sample probe tubes.

Computer and Instrumentation

8. The Ansti Compudat PC System is based on an IBM compatible PC linked to the latest USB port high speed data acquisition card. The system generates a range of real time displays of Pressure-Volume diagrams and provides a data archiving and retrieval for visual display and optional printing of test results. The system is controlled via sub menu selection options.

Control Console

9. The main sub-systems are integrated into the control console module. The front fascia panel includes the test vessel lid controls, pre-set automatic depth controller and breathing machine controls etc. Access to the breathing simulator is via twin front panels each fitted with safety inter-locks to automatically isolate the breathing simulator if opened whilst in operation.

Options

1. Hyperbaric Programmable Breathing Simulator is fully constructed from stainless steel and includes fully integrated servo electronics with HMI control panel. It is rated to a max working depth of 100 msw and supplied with sine wave and NIOSH (sedentary) breathing profiles. It has infinitely variable tidal volume (TV) settings from 0.5 to 5 litres, breathing rates from 5 to 60 breaths per minute (BPM) with a maximum ventilation of 180 litres per minute. Bespoke breathing profiles can be uploaded using Excel data.
   Full specification is available on request.
2. 200 msw rated test vessel and breathing machine with upgraded control system.
   Full specification is available on request.