location where they are to be placed into service. Such integrity tests typically include connecting a test volume of a component specimen to be tested to a high-pressure testing system and surrounding or encapsulating the specimen in some form of containment vessel in the event that the component specimen experiences a catastrophic failure during the test. At such elevated pressures, tests performed with compressible fluids (*e.g.*, gasses) may produce catastrophic results in the event of such a failure as the compressible nature of the fluid allows the build-up of significant potential energy (in the form of the compressed gas) that may experience an explosive kinetic release should the hydraulic and/or pneumatic integrity of the component specimen fail the pressure test.

[0005] As a result, elevated pressure tests are often performed in strictly controlled environments (*e.g.*, in shielded and reinforced bunkers or subterranean facilities) such that should a component specimen exhibit a failure, damage to the surrounding structures, assets, and people may be reduced or prevented. However, as should be understood by those having ordinary skill, various components that are tested and verified at the regional facility may become damaged or may require additional service after they been delivered to a remote location. Such supplemental tests may be necessary because the component may require modification or repair before they are placed into service or, in certain circumstances, they have failed in service and must be repaired on-site quickly before a replacement can be obtained. With operating costs aboard many offshore rigs exceeding several hundred thousand U.S. dollars per day, the potential economic loss associated to shipping a mission-critical component back to the regional facility for repair and re-verification can be significant. With the potential economic cost of a component failure being so significant, operating companies would consider a portable, remote location-based pressure testing and verification solution to be highly desirable.

SUMMARY OF THE CLAIMED SUBJECT MATTER

[0006] In one aspect, the present disclosure relates to a portable containment vessel to perform a pressure test to a test specimen, the portable containment vessel ~~including~~comprising a base skid, a ballistic outer enclosure connected to the base skid

and ~~including~~ comprising a plurality of walls, a door, and a lock to maintain the door in a closed position, a sample tray

configured to support the test specimen, wherein the sample tray is operable through a doorway of the ballistic outer enclosure between a retracted position and an extended position, a containment fluid to surround the test specimen while a pressurized fluid is ~~applied~~ supplied to the test specimen, and a sensor to indicate escape of the pressurized fluid from the test specimen; and at least one fluid tight membrane positioned within the ballistic outer enclosure~~a failure of the pressure test~~.

[0007] In another aspect, the present disclosure relates to a method to test the internal pressure integrity of a test specimen including positioning the test specimen inside a ballistic outer enclosure, connecting the test specimen to a test fluid supply, sealing the test specimen within the ballistic enclosure, filling the ballistic enclosure with a containment fluid, increasing a pressure of the test fluid supply to a desired test pressure, and monitoring the test specimen to determine its internal pressure integrity.

[0008] In another aspect, the present disclosure relates to a containment vessel to perform a pressure test to a test specimen, the containment vessel including a base skid, a ballistic outer enclosure connected to the base skid, at least one fluid-tight membrane positioned within the ballistic outer enclosure, a manifold assembly configured to selectively apply a pressurized test fluid to the test specimen, a containment fluid to surround the test specimen within the ballistic outer enclosure and at least one fluid-tight membrane while the pressurized test fluid is applied to the test specimen, and a sensor to indicate a failure of the pressure test.

BRIEF DESCRIPTION OF DRAWINGS

[0009] Features of the present disclosure will become more apparent from the following description in conjunction with the accompanying drawings.

[0010] Figure 1 is an isometric-view drawing of a containment vessel shown with its door in a closed position in accordance with one or more embodiments of the present disclosure.

[0011] Figure 2 is an isometric-view drawing of the containment vessel of Figure 1 shown with its door in a fully-open position in accordance with one or more embodiments of the present disclosure.

CLAIMS

What Is Claimed Is:

1. A portable containment vessel to perform a pressure test to a test specimen, the portable containment vessel comprising:

a base skid;

a ballistic outer enclosure connected to the base skid and comprising a plurality of walls, a door, and a lock to maintain the door in a closed position;

a sample tray configured to support the test specimen, wherein the sample tray is operable through a doorway of the ballistic outer enclosure between a retracted position and an extended position;

a containment fluid to surround the test specimen while a pressurized fluid is applied to the test specimen; and

a sensor to indicate a failure of the pressure test.

2. The portable containment vessel of claim 1, further comprising at least one fluid tight membrane positioned within the ballistic outer enclosure.

3. The portable containment vessel of claim 2, wherein a fluid tight membrane positioned adjacent to the door of the ballistic outer enclosure is retractable to allow access to an interior volume when the door is in an open position.

4. The portable containment vessel of any one of claims 1 to 3, further comprising a manifold assembly to selectively apply the pressurized test fluid to the test specimen.

5. The portable containment vessel of any one of claims 1 to 4, wherein the sensor comprises a camera.

6. The portable containment vessel of any one of claims 1 to 4, wherein the sensor comprises a pressure gauge.

7. The portable containment vessel of any one of claims 1 to 6, wherein the sensor is configured to detect a presence of the test fluid in the containment liquid.

8. The portable containment vessel of any one of claims 1 to 7, wherein the containment fluid comprises water.

9. The portable containment vessel of any one of claims 1 to 7, wherein the containment fluid comprises drilling mud.

10. The portable containment vessel of any one of claims 1 to 7, wherein the containment fluid comprises a gas.

11. The portable containment vessel of any one of claims 1 to 10, further comprising a pump to supply the containment fluid to an interior volume of the ballistic outer enclosure.

12. The portable containment vessel of any one of claims 1 to 11, further comprising a heater to increase the temperature of the test specimen.

13. A method to test the internal pressure integrity of a test specimen, the method comprising:

positioning the test specimen inside a ballistic outer enclosure;

connecting the test specimen to a test fluid supply;

sealing the test specimen within the ballistic enclosure;

filling the ballistic enclosure with a containment fluid;

increasing a pressure of the test fluid supply to a desired test pressure; and

monitoring the test specimen to determine its internal pressure integrity.

14. The method of claim 13, further comprising positioning the test specimen inside the outer enclosure with a extendable sample tray.

15. The method of claim 13 or 14, further comprising sealing the test specimen within the ballistic enclosure with at least one fluid-tight membrane.

16. The method of claim 13 or 14, further comprising monitoring the test specimen through the fluid-tight membrane while a door of the ballistic outer enclosure is open.

17. The method of any one of claims 13 to 16, further comprising monitoring the test specimen with a camera.

18. The method of any one of claims 13 to 17, further comprising monitoring the test specimen with a sensor configured to detect the presence of the test fluid in the containment fluid.

19. The method of any one of claims 13 to 18, further comprising heating the test specimen.

20. The method of claim 13, further comprising:

testing the test specimen at a first test pressure using a first test fluid supply and a first containment fluid; and

testing the test specimen at a second test pressure using a second test fluid supply and a second containment fluid.

21. A containment vessel to perform a pressure test to a test specimen, the containment vessel comprising:

a base skid;

a ballistic outer enclosure connected to the base skid;

at least one fluid-tight membrane positioned within the ballistic outer enclosure;

a manifold assembly configured to selectively apply a pressurized test fluid to the test specimen;

a containment fluid to surround the test specimen within the ballistic outer enclosure and the at least one fluid-tight membrane while the pressurized test fluid is applied to the test specimen; and

a sensor to indicate a failure of the pressure test.

22. The containment vessel of claim 21, wherein a first fluid-tight membrane positioned adjacent to a door of the ballistic outer enclosure is retractable to allow access to an interior volume when the first fluid-tight membrane is in an open position.

23. The containment vessel of claim 21 or 22, further comprising a sample tray to support the test specimen, wherein the sample tray is operable through a doorway of the ballistic outer enclosure between a retracted position and an extended position.

CLAIMS

1. A portable containment vessel to perform a pressure test to a test specimen, the portable containment vessel comprising:

a base skid;

a ballistic outer enclosure connected to the base skid and comprising a plurality of walls, a door, and a lock to maintain the door in a closed position;

a sample tray configured to support the test specimen, wherein the sample tray is operable through a doorway of the ballistic outer enclosure between a retracted position and an extended position;

a containment fluid to surround the test specimen while a pressurized fluid is supplied to the test specimen; and

a sensor to indicate escape of the pressurized fluid from the test specimen; and

at least one fluid tight membrane positioned within the ballistic outer enclosure.

2. The portable containment vessel of claim 1, wherein a fluid tight membrane positioned adjacent to the door of the ballistic outer enclosure is retractable to allow access to an interior volume when the door is in an open position.

3. The portable containment vessel of claim 1, further comprising a manifold assembly to selectively apply the pressurized test fluid to the test specimen.

4. The portable containment vessel of claim 1, wherein the sensor comprises a camera.

5. The portable containment vessel of claim 1, wherein the sensor comprises a pressure gauge.

6. The portable containment vessel of claim 1, wherein the sensor is configured to detect a presence of the pressurized fluid in the containment fluid.

7. The portable containment vessel of claim 1, wherein the containment fluid comprises water.

8. The portable containment vessel of claim 1, wherein the containment fluid comprises drilling mud.

9. The portable containment vessel of claim 1, wherein the containment fluid comprises a gas.

10. The portable containment vessel of claim 1, further comprising a pump to supply the containment fluid to an interior volume of the ballistic outer enclosure.

11. The portable containment vessel of claim 1, further comprising a heater to increase the temperature of the test specimen.

12. A method to test the internal pressure integrity of a test specimen, the method comprising:

positioning the test specimen inside a ballistic outer enclosure;

connecting the test specimen to a test fluid supply;

sealing the test specimen within the ballistic enclosure;

filling the ballistic enclosure with a containment fluid;

increasing a pressure of the test fluid supply to a desired test pressure; and

monitoring the test specimen to determine its internal pressure integrity.

13. The method of claim 12, further comprising positioning the test specimen inside the outer enclosure with an extendable sample tray.

14. The method of claim 12, further comprising sealing the test specimen within the ballistic enclosure with at least one fluid-tight membrane.

15. The method of claim 12, further comprising monitoring the test specimen through the fluid-tight membrane while a door of the ballistic outer enclosure is open.

16. The method of claim 12, further comprising monitoring the test specimen with a camera.

17. The method of claim 12, further comprising monitoring the test specimen with a sensor configured to detect the presence of the test fluid in the containment fluid.

18. The method of claim 12, further comprising heating the test specimen.

19. The method of claim 12, further comprising:

testing the test specimen at a first test pressure using a first test fluid supply and a first containment fluid; and

testing the test specimen at a second test pressure using a second test fluid supply and a second containment fluid.

20. A containment vessel to perform a pressure test to a test specimen, the containment vessel comprising:

a base skid;

a ballistic outer enclosure connected to the base skid;

at least one fluid-tight membrane positioned within the ballistic outer enclosure;

a manifold assembly configured to selectively apply a pressurized test fluid to the test specimen;

a containment fluid to surround the test specimen within the ballistic outer enclosure and the at least one fluid-tight membrane while the pressurized test fluid is applied to the test specimen; and

a sensor to indicate a failure of the pressure test.

21. The containment vessel of claim 20, wherein a first fluid tight membrane positioned adjacent to a door of the ballistic outer enclosure is retractable to allow access to an interior volume when the first fluid tight membrane is in an open position.

22. The containment vessel of claim 20, further comprising a sample tray to support the test specimen, wherein the sample tray is operable through a doorway of the ballistic outer enclosure between a retracted position and an extended position.