

WHAT IS CLAIMED IS:

1. A scaffold (30, 230) comprising:

a plurality of spaced lower support members (31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235), each of the plurality of lower support members including a plurality of first routing supports (53, 56, 253, 256) for spacing a plurality of turns (51) of an associated first test wire (8), when the first test wire is wound around the plurality of lower support members;

a plurality of spaced upper support members (41, 42, 43, 44, 45, 341, 342, 343, 344, 345), each of the plurality of upper support members including a plurality of second routing supports (61, 63, 261, 263) for spacing a plurality of turns (52) of an associated second test wire (9), when the second test wire is wound around the plurality of upper support members;

a closure member (64, 270) which provides for connections between ends of the first test wire (8) and respective associated external conductors (100, 101) and provides for connections between ends of the second test wire (9) and respective associated external conductors (102, 103);

the closure member (64, 270), or an upper cross member (76) attached thereto, being attached to a first end (48, 348) of each of the plurality of upper support members; and

a second cross member (74, 274), longitudinally spaced from the closure member (64, 270), the second cross member being attached to a first end (38, 238) of each of the plurality of lower support members and attached to a second end (47, 347) of each of the plurality of upper support members to laterally space the plurality of lower support members and the plurality of upper support members.

2. The scaffold (30, 230) according to claim 1, further comprising:

a third cross member (72, 272), longitudinally spaced from the closure member (64, 270) by the second cross member (74, 274), the third cross member being attached to a second end (37, 237) of each of the plurality of lower support members (31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235).

3. The scaffold (30, 230) according to claim 1 or 2, wherein at least

one of the first routing supports (53, 56, 253, 256) on the lower support members (31,

32, 33, 34, 35, 36, 231, 232, 233, 234, 235) includes an aperture (**300**) for receiving the first test wire (**8**) therethrough.

4. The scaffold (**30, 230**) according to any prior claim, wherein the first and second routing supports (**53, 56, 61, 63, 253, 256, 261, 263**) comprise notches.

5. The scaffold (**30, 230**) according to any prior claim, wherein the first and second routing supports (**53, 56, 61, 63, 253, 256, 261, 263**) are longitudinally spaced on the respective upper and lower support members (**31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235**).

6. The scaffold (**30, 230**) according to any prior claim, wherein each of the lower support members (**31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235**) includes at least three, or at least four, or at least five of the first routing supports (**53, 56, 253, 256**) and each of the upper support members includes at least three, or at least four, or at least five of the second routing supports (**61, 63, 261, 263**).

7. The scaffold (**30, 230**) according to any prior claim, wherein each of the lower support members (**31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235**) includes an aperture (**300**) for carrying the first test wire (**8**) therethrough.

8. The scaffold (**30, 230**) according to any prior claim, wherein the closure member (**64, 270**) includes a tapered rim (**114, 278**).

9. The scaffold (**30, 230**) according to any prior claim, wherein the upper and lower support members (**31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235**) are parallel to each other.

10. The scaffold (**30, 230**) according to any prior claim, wherein there are at least four, or at least five, or at least six upper support members (**41, 42, 43, 44, 45, 341, 342, 343, 344, 345**).

11. The scaffold (**30, 230**) according to any prior claim, wherein there are at least four, or at least five, or at least six lower support members (**31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235**).

12. The scaffold (230) according to any prior claim, wherein the upper support members (341, 342, 343, 344, 345) are arcuately offset from the lower support members (231, 232, 233, 234, 235).

13. The scaffold (230) according to any prior claim, wherein the second cross member (274) includes arcuately spaced slots (282), the second ends (347) of the upper support members (341, 342, 343, 344, 345) being received in alternate ones of the slots, the first ends (238) of the lower support members (231, 232, 233, 234, 235) being received in remaining alternate ones of the slots.

14. The scaffold (230) according to any prior claim, wherein the second cross member (274) includes at least one groove (299, 303) for guiding the first test wire (8) from the closure member (64, 270) to the lower support members (231, 232, 233, 234, 235) and back to the closure member.

15. The scaffold (30, 230) according to any prior claim, wherein the closure member (64, 270) includes holes (95, 96, 295, 296) for receiving first and second temperature sensors (104, 105, 297, 298).

16. The scaffold (30, 230) according to any prior claim, wherein the plurality of lower support members (31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235), the plurality of upper support members (41, 42, 43, 44, 45, 341, 342, 343, 344, 345), the closure member (64, 270), the second cross member (74, 274), and the first cross member (72), where present, are formed of plastic.

17. The scaffold (30, 230) according to any prior claim, wherein the plurality of lower support members (31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235), the plurality of upper support members (41, 42, 43, 44, 45, 341, 342, 343, 344, 345), the closure member (64, 270), the second cross member (74, 274), and the first cross member (76), where present, are formed by one of 3D printing and injection molding.

18. The scaffold (30, 230) according to any prior claim, wherein at least one of a length of each wire turn defined by the plurality of lower support members (31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235) and a number of the first routing supports (51, 53, 251, 253) differs from at least one of a length of each wire turn defined by the

plurality of upper support members (**41, 42, 43, 44, 45, 341, 342, 343, 344, 345**), and a number of the second routing supports (**61, 63, 261, 263**) to provide an equal routing length for the first and second test wires (**8, 9**).

19. The scaffold (**30, 230**) according to any prior claim, wherein the plurality of spaced lower support members (**31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235**) are longitudinally aligned with a central axis of the scaffold and the plurality of spaced upper support members (**41, 42, 43, 44, 45, 341, 342, 343, 344, 345**) are longitudinally aligned with the central axis.

20. An assembly (**140, 240**) comprising:
the scaffold (**30, 230**) of any prior claim; and
the first and second test wires(**8, 9**), the first and second test wires being electrically conductive.

21. The assembly (**140, 240**) of claim 20, wherein the first and second test wires (**8, 9**) are of equal length.

22. The assembly (**140, 240**) of claim 20 or 21 wherein the first and second test wires (**8, 9**) are of equal diameter.

23. The assembly (**140, 240**) of any one of claims 20-22, wherein at least one of the first and second test wires (**8, 9**) is formed of copper or an alloy thereof.

24. A testing device (**1**) comprising:
the scaffold (**30, 230**) of any one of claims 1-19 or the assembly (**140, 240**) of any one of claims 20-23; and
a housing (**110, 210**) shaped to receive the scaffold with the closure member (**64, 270**) of the scaffold closing an upper end of the housing to form a vessel (**2**) for holding an associated liquid (**4**) in contact with the first test wire (**8**) such that a vapor phase of the liquid contacts the second test wire (**9**).

25. The testing device (**1**) of claim 24, further comprising:
a solution phase temperature sensor (**104, 297**), positioned in the housing to measure a temperature of the liquid; and

a vapor phase temperature sensor (**105, 298**), positioned in the housing to measure a temperature of the vapor.

26. The solution and vapor wire corrosion testing device (**1**) of claim 25, wherein the solution phase temperature sensor (**104, 297**) and vapor phase temperature sensor (**105, 298**) are connected with external conductors (**101, 102, 103, 104**) through the closure member (**64, 270**).

27. The testing device (**1**) of any one of claims 24-26, further comprising a heater (**112**) configured to heat the liquid in the housing to form the vapor.

28. The testing device (**1**) of any one of claims 24-27, further comprising:

one of first and second electrical systems, the first electrical system comprising:

a first current source (**12**) connected across ends of the first test wire (**8**) to supply an electric current through the first test wire;

a second current source (**18**) connected across ends of the second test wire (**9**) to supply an electric current through the second test wire;

a first voltmeter (**10**) connected across ends of the first test wire (**8**) to measure a voltage across the first test wire; and

a second voltmeter (**16**) connected across ends of the second test wire (**9**) to measure a voltage across the second test wire; and

the second electrical system comprising:

a first voltage source connected across ends of the first test wire (**8**) to generate a voltage through the first test wire;

a second voltage source connected across ends of the second test wire to generate a voltage through the second test wire;

a first ammeter connected across ends of the first test wire (**8**) to measure an electric current across the first test wire; and

a second ammeter connected across ends of the second test wire (**9**) to measure an electric current across the second test wire.

29. The testing device (**1**) of any one of claims 24-28, further comprising at least one of first and second electrodes (**402, 404**), the first electrode being immersed in the solution, the second electrode being immersed in the vapor, a

voltage or current source (410), connected with the first electrode, where present, which causes a current to flow between the first electrode and the first wire, and a voltage or current source (412), connected with the second electrode, where present, which causes a current to flow between the second electrode and the second wire.

30. A testing apparatus comprising the testing device (1) of any one of claims 24-29, further comprising:

a monitoring system (20) which receives signals from the first voltmeter (10) and the second voltmeter (16) or from the first ammeter and the second ammeter and computes and outputs information (22) based thereon.

31. The testing apparatus of claim 30, wherein the monitoring system (20) comprises:

a data acquisition component (24), which acquires at least one of a voltage and an electric current through the test wires over time;

a data analysis component (26), which processes the acquired at least one of the voltage and the electric current at a plurality of times and computes the information (22) based thereon; and

an output component (27), which outputs the information.

32. The testing apparatus of claim 31, wherein the information (22) comprises a measure of the corrosion of each of the test wires (8, 9).

33. The testing apparatus of claim 32, wherein the measure of the corrosion of each of the test wires (8, 9) comprises a computed change in a diameter or radius of the test wires.

34. The testing apparatus of any one of claims 31-33, wherein the monitoring system (20) is in communication with temperature sensors (104, 105, 297, 298), mounted in the liquid and vapor, respectively.

35. The testing apparatus of any one of claims 31-34, wherein the information (22) includes a measure of corrosion as a function of temperature of the liquid.

36. A method comprising:

- wrapping a first test wire (8) around a plurality of spaced lower support members (31, 32, 33, 34, 35, 36, 231, 232, 233, 234, 235) of a scaffold (30, 230);
- wrapping a second test wire (9) around a plurality of spaced upper support members (41, 42, 43, 44, 45, 341, 342, 343, 344, 345) of the scaffold;
- introducing a test fluid to a housing (110, 210);
- inserting the scaffold and first and second test wires into the housing such that the second test wire (9) is spaced from a liquid phase (4) of the test fluid and the closure member (64, 270) closes an open end of the housing;
- heating the test fluid in the housing to generate a vapor phase (6), which contacts the second test wire (9);
- measuring an electrical property of the first and second test wires, which changes over time; and
- determining information (22) based on a change in the electrical property of each wire.

37. The method according to claim 36, wherein the measuring of the electrical property of the first and second test wires (8, 9) over time comprises one of an electric current and a voltage, the other of the electric current and voltage being controlled.

38. The method according to claim 36 or 37, wherein the information (22) comprises a measure of corrosion of the test wires (8, 9).

39. The method according to any one of claims 36-38, further comprising:

- mounting a solution phase temperature sensor (104, 297) to contact the liquid phase;
- mounting a vapor phase temperature sensor (105, 298) to contact the vapor phase; and
- computing a temperature dependence of the measure of corrosion.

40. The method of any one of claims 36-39, wherein the test fluid comprises a lubricant.

41. The method any one of claims 36-40, wherein the test fluid comprises a coolant.

42. The method of any one of claims 36-41, wherein the test fluid comprises a corrosion inhibitor.

43. The method of any one of claims 36-42, wherein at least one of the test wires (8, 9) is formed of copper, or an alloy of copper.

44. The method of any one of claims 36-43, wherein the test wires (8, 9) are of equal length and equal diameter.

45. The method of any one of claims 36-44, wherein the test wires (8, 9) each have a length of at least 50 cm, or up to 500cm.

46. The method of any one of claims 36-45, wherein the test wires (8, 9) each have a diameter of at least 0.05 mm, or up to 5mm.

47. A testing device (1) comprising:
a scaffold (30, 230) for supporting associated first and second test wires (8, 9);
a housing (110, 210) shaped to receive the scaffold, whereby a closure member (64, 270) of the scaffold closes an upper end of the housing to form a vessel (2) for holding an associated liquid (4) in contact with the first test wire (8) such that a vapor phase of the liquid contacts only the second test wire (9).

48. The testing device (1) of claim 47, further comprising:
a solution phase temperature sensor (104, 297), positioned in the housing to measure a temperature of the liquid; and
a vapor phase temperature sensor (105, 298), positioned in the housing to measure a temperature of the vapor.

49. The solution and vapor wire corrosion testing device (1) of claim 48, wherein the solution phase temperature sensor (104, 297) and vapor phase temperature sensor (105, 298) are connected with external conductors (101, 102, 103, 104) through the closure member (64, 270).

50. The testing device (1) of claim 48 or claim 49, further comprising a heater (112) configured to heat the liquid in the housing to form the vapor.

51. The testing device (1) of any one of claims 48-50, further comprising:

one of first and second electrical systems, the first electrical system comprising:

a first current source (12) connected across ends of the first test wire (8) to supply an electric current through the first test wire;

a second current source (18) connected across ends of the second test wire (9) to supply an electric current through the second test wire;

a first voltmeter (10) connected across ends of the first test wire (8) to measure a voltage across the first test wire; and

a second voltmeter (16) connected across ends of the second test wire (9) to measure a voltage across the second test wire; and

the second electrical system comprising:

a first voltage source connected across ends of the first test wire (8) to generate a voltage through the first test wire;

a second voltage source connected across ends of the second test wire to generate a voltage through the second test wire;

a first ammeter connected across ends of the first test wire (8) to measure an electric current across the first test wire; and

a second ammeter connected across ends of the second test wire (9) to measure an electric current across the second test wire.

52. The testing device (1) of any one of claims of 48-51, further comprising:

first and second electrodes (402, 404), the first electrode being immersed in the solution, the second electrode being immersed in the vapor;

a voltage or current source (410), connected with the first electrode, which causes a current to flow between the first electrode and the first wire; and

a voltage or current source (412), connected with the second electrode, which causes a current to flow between the second electrode and the second wire.