

Claims

1. A method of manufacturing an electrical penetrator assembly (1) comprising:
 - a penetrator housing (3) comprising a through-bore (19) and an internal support surface (20);
 - a ceramic sleeve assembly (2) sealingly providing a feed-through for an electrical conductor (29), which sleeve assembly (2) comprises a first section (7) displaying a first mantle surface (10), a second section (8) displaying a second mantle surface (11), and a central section (9) positioned between the first section (7) and the second (8) section, which central section (9) comprises a first, outer support surface (13) and second, outer support surface (14), and a third, central mantle surface (12), which is positioned between the outer support surfaces (13, 14) and displays a diameter which is larger than the diameters of the first and second mantle surfaces (10, 11); and
 - a compression member (6) comprising a compressions surface (23);said method comprising the steps of:
 - sealingly attaching a first metal, annular sealing member (5) to the second section (8) of the sleeve assembly (2);
 - positioning the sleeve assembly (2) in the through-bore (19) of the penetrator housing (3) such that the first, outer support surface (13) is brought into contact with the internal support surface (20);
 - attaching the compression member (6) to the penetrator housing (3) such that the compression surface (23) is brought into contact with the second, outer support surface (14);
 - by means of the compression member (6), directly or indirectly preloading the sleeve assembly (2) by applying a force onto the sleeve assembly (2) such that a predetermined contact pressure is obtained between the first, outer support surface (13) and the internal support surface (20); and
 - sealingly connecting the first sealing member (5) to the penetrator housing (3) indirectly via the compression member (6) after said step of preloading the sleeve assembly (2).
2. The method according to claim 1, wherein said step of sealingly attaching the first sealing member (5) to the sleeve assembly (2) comprises brazing the first sealing member (5) to the mantle surface (11) of the second section (8) of the sleeve assembly (2).
3. The method according to any one of claims 1 and 2, wherein said step of sealingly connecting the first sealing member (5) to the penetrator housing (3) indirectly via the compression member (6) comprises creating a first seal (41) by welding the first sealing member (5) to the compression member (6), and creating a second seal (42) by welding the compression member (6) to the penetrator housing (3).

4. The method according to any one of claims 1-3, comprising the steps of:
 - sealingly attaching a second metal, annular sealing member (4) to the first section (7) of the sleeve assembly (2); and
 - sealingly connecting the second sealing member (4) directly to the penetrator housing (3) after said step of preloading the sleeve assembly (2).
5. The method according to claim 4, wherein said step of sealingly attaching the second sealing member (4) to the sleeve assembly (2) comprises brazing the second sealing member (4) to the mantle surface (10) of the first section (7) of the sleeve assembly (2).
6. The method according to any one of claims 4 and 5, wherein said step of sealingly connecting the second sealing member (4) directly to the penetrator housing (3) comprises creating a third seal (40) by welding the second sealing member (4) to the penetrator housing (3).
7. The method according to any one of the preceding claims, wherein said step of preloading the sleeve assembly (2) comprises creating a contact stress upon the sleeve assembly (2) which is equal to the contact stress expected to arise during operation of the penetrator assembly (1).
8. The method according to any one of the preceding claims, wherein said compression member comprises an annular bolt (6) which is threaded into the penetrator housing (3), and wherein said step of preloading the sleeve assembly (2) comprises applying a torque onto the annular bolt (6).
9. An electrical penetrator assembly (1) comprising:
 - a penetrator housing (3) comprising a through-bore (19) and an internal support surface (20);
 - a compression member (6) which is attached to the penetrator housing (3) and comprises a compression surface (23); and
 - a ceramic sleeve assembly (2) sealingly providing a feed-through for an electrical conductor, which sleeve assembly (2) is positioned in the through-bore (19) of the penetrator housing (3) and comprises a first section (7) displaying a first mantle surface (10), a second section (8) displaying a second mantle surface (11), and a central section (9) positioned between the first section (7) and the second (8) section, which central section (9) comprises a first, outer support surface (13) interacting with the internal support surface (20), and a second, outer support surface (14) interacting with the compression surface (23), and a third, central mantle surface (12) which is positioned between the outer support surfaces (13, 14) and displays a diameter which is larger than the diameters of the first and second mantle surfaces (10, 11);

characterised in that the that penetrator assembly (1) comprises:

- a first annular sealing member (5) which is sealingly attached to the second section (8) of the sleeve assembly (2);
wherein the compression member (6) is configured to apply a preloading force onto the sleeve assembly (2) such that a predetermined contact pressure is obtained between the first, outer support surface (13) and the internal support surface (20), and wherein the first sealing member (5) is sealingly connected to the penetrator housing (3) indirectly via the compression member (6).
10. The penetrator assembly (1) according to claim 9, **characterised in that** said first sealing member (5) is brazed to the mantle surface (11) of the second section (8) of the sleeve assembly (2).
 11. The penetrator assembly (1) according to any one of claims 9 and 10, **characterised in that** said first sealing member (5) is sealingly attached to the compression member (6) by means of a first weld seal (41), and in that the compression member (6) is sealingly attached to the penetrator housing (3) by means of a second weld seal (42).
 12. The penetrator assembly (1) according to any one of claims 9-11, **characterised in that** that penetrator assembly (1) comprises:
 - a second annular sealing member (4) which is sealingly attached to the first section (7) of the sleeve assembly (2);
wherein the second sealing member (4) is sealingly connected directly to the penetrator housing (3).
 13. The penetrator assembly (1) according to claim 12, **characterised in that** said second sealing member (4) is brazed to the mantle surface (10) of the second section (7) of the sleeve assembly (2).
 14. The penetrator assembly (1) according to any one of claims 12-13, **characterised in that** said second sealing member (4) is sealingly attached directly to the penetrator housing (3) by means of a third weld seal (40).
 15. The penetrator assembly (1) according to any one of claims 9-14, **characterised in that** a spacer (18, 25, 28) is positioned between said first sealing member (5) and a stop surface (16) of the sleeve assembly (2).

Claims

1. A method of manufacturing an electrical penetrator assembly (1) comprising:
 - a penetrator housing (3) comprising a through-bore (19) and an internal support surface (20);
 - a ceramic sleeve assembly (2) sealingly providing a feed-through for an electrical conductor (29), which sleeve assembly (2) comprises a first section (7) displaying a first mantle surface (10), a second section (8) displaying a second mantle surface (11), and a central section (9) positioned between the first section (7) and the second (8) section, which central section (9) comprises a first, outer support surface (13) and second, outer support surface (14), and a third, central mantle surface (12), which is positioned between the outer support surfaces (13, 14) and displays a diameter which is larger than the diameters of the first and second mantle surfaces (10, 11); and
 - a compression member (6) comprising a compressions surface (23);
 said method comprising the steps of:
 - sealingly attaching a metal, annular sealing member (5) to the second section (8) of the sleeve assembly (2);
 - positioning the sleeve assembly (2) in the through-bore (19) of the penetrator housing (3) such that the first, outer support surface (13) is brought into contact with the internal support surface (20);
 - attaching the compression member (6) to the penetrator housing (3) such that the compression surface (23) is brought into contact with the second, outer support surface (14);
 - by means of the compression member (6), directly or indirectly preloading the sleeve assembly (2) by applying a force onto the sleeve assembly (2) such that a predetermined contact pressure is obtained between the first, outer support surface (13) and the internal support surface (20); and
 - sealingly connecting the sealing member (5) to the penetrator housing (3) indirectly via the compression member (6) after said step of preloading the sleeve assembly (2).
2. The method according to claim 1, wherein said step of sealingly attaching the sealing member (5) to the sleeve assembly (2) comprises brazing the sealing member (5) to the mantle surface (11) of the second section (8) of the sleeve assembly (2).
3. The method according to any one of claims 1 and 2, wherein said step of sealingly connecting the sealing member (5) to the penetrator housing (3) indirectly via the compression member (6) comprises creating a first seal (41) by welding the sealing member (5) to the compression member (6), and creating a second seal (42) by welding the compression member (6) to the penetrator housing (3).
4. The method according to any one of claims 1-3, comprising the steps of:

- sealingly attaching a metal, annular sealing member (4) to the first section (7) of the sleeve assembly (2); and
 - sealingly connecting the sealing member (4) attached to the first section (7) of the sleeve assembly (2) directly to the penetrator housing (3) after said step of preloading the sleeve assembly (2).
5. The method according to claim 4, wherein said step of sealingly attaching the sealing member (4) to the first section (7) of the sleeve assembly (2) comprises brazing the sealing member (4) to the mantle surface (10) of the first section (7) of the sleeve assembly (2).
 6. The method according to any one of claims 4 and 5, wherein said step of sealingly connecting the sealing member (4) attached to the first section (7) of the sleeve assembly (2) directly to the penetrator housing (3) comprises creating a third seal (40) by welding the sealing member (4) to the penetrator housing (3).
 7. The method according to any one of the preceding claims, wherein said step of preloading the sleeve assembly (2) comprises creating a contact stress upon the sleeve assembly (2) which is equal to the contact stress expected to arise during operation of the penetrator assembly (1).
 8. The method according to any one of the preceding claims, wherein said compression member comprises an annular bolt (6) which is threaded into the penetrator housing (3), and wherein said step of preloading the sleeve assembly (2) comprises applying a torque onto the annular bolt (6).
 9. An electrical penetrator assembly (1) comprising:
 - a penetrator housing (3) comprising a through-bore (19) and an internal support surface (20);
 - a compression member (6) which is attached to the penetrator housing (3) and comprises a compression surface (23); and
 - a ceramic sleeve assembly (2) sealingly providing a feed-through for an electrical conductor, which sleeve assembly (2) is positioned in the through-bore (19) of the penetrator housing (3) and comprises a first section (7) displaying a first mantle surface (10), a second section (8) displaying a second mantle surface (11), and a central section (9) positioned between the first section (7) and the second (8) section, which central section (9) comprises a first, outer support surface (13) interacting with the internal support surface (20), and a second, outer support surface (14) interacting with the compression surface (23), and a third, central mantle surface (12) which is positioned between the outer support surfaces (13, 14) and displays a diameter which is larger than the diameters of the first and second mantle surfaces (10, 11);

characterised in that the that penetrator assembly (1) comprises:

- an annular sealing member (5, 27) which is sealingly attached to the second section (8) of the sleeve assembly (2);

wherein the compression member (6) is configured to apply a preloading force onto the sleeve assembly (2) such that a predetermined contact pressure is obtained between the first, outer support surface (13) and the internal support surface (20), and wherein the sealing member (5) is sealingly connected to the penetrator housing (3) indirectly via the compression member (6).

10. The penetrator assembly (1) according to claim 9, **characterised in that** said sealing member (5, 27) is brazed to the mantle surface (11) of the second section (8) of the sleeve assembly (2).
11. The penetrator assembly (1) according to any one of claims 9 and 10, **characterised in that** said sealing member (5, 27) is sealingly attached to the compression member (6) by means of a first weld seal (41), and in that the compression member (6) is sealingly attached to the penetrator housing (3) by means of a second weld seal (42).
12. The penetrator assembly (1) according to any one of claims 9-11, **characterised in that** the penetrator assembly (1) comprises:
 - an annular sealing member (4) which is sealingly attached to the first section (7) of the sleeve assembly (2);

wherein the sealing member (4) sealingly attached to the first section (7) of the sleeve assembly (2) is sealingly connected directly to the penetrator housing (3).
13. The penetrator assembly (1) according to claim 12, **characterised in that** said sealing member (4) sealingly attached to the first section (7) of the sleeve assembly (2) is brazed to the mantle surface (10) of the first section (7) of the sleeve assembly (2).
14. The penetrator assembly (1) according to any one of claims 12-13, **characterised in that** said sealing member (4) sealingly attached to the first section (7) of the sleeve assembly (2) is sealingly attached directly to the penetrator housing (3) by means of a third weld seal (40).
15. The penetrator assembly (1) according to any one of claims 9-14, **characterised in that** a spacer (18, 25, 28) is positioned between the sealing member (5, 27) sealingly attached to the second section (8) of the sleeve assembly (2) and a stop surface (16) of the sleeve assembly (2).