

**FORM 2**

THE PATENTS ACT, 1970  
(39 of 1970)  
AND  
THE PATENTS RULES, 2003

**COMPLETE  
SPECIFICATION**

(See Section 10; rule 13)

**TITLE OF THE INVENTION**

**“HIGH VOLTAGE INSULATION SYSTEM AND A HIGH VOLTAGE INDUCTIVE  
DEVICE COMPRISING SUCH AN INSULATION SYSTEM ”**

**APPLICANT**

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The following specification particularly describes  
the invention and the manner in which  
it is to be performed

## CLAIMS

1. An insulation system (1-1; 1-2; 1-3; 1-4) for a winding structure (11), the insulation system (1-1; 1-2; 1-3; 1-4) comprising:

an innermost barrier pair (3) arranged to cover a majority of the winding structure (11) in the axial direction (A) of the winding structure (11) inside and outside the barrier structure (11) relative the curvature of winding turns of windings of the winding structure, wherein at least one barrier of the innermost barrier pair (3) defines a first flow path (3-1) allowing flow of a dielectric fluid (F) mainly in a first axial direction between the winding structure (11) and the at least one barrier of the innermost barrier pair (3) when the insulation system (1-1; 1-2; 1-3; 1-4) is in a assembled state, and

a first outer barrier (5) arranged radially inwards or radially outwards relative each barrier of the innermost barrier pair (3), wherein the first outer barrier (5) defines a second flow path (5-1), parallel to the first flow path (3-1), allowing flow of a dielectric fluid (F) mainly in a second axial direction opposite the first axial direction,

wherein the insulating system (1-1; 1-2; 1-3; 1-4) is arranged such that a dielectric medium (F) is able to flow from the second flow path and enter the first flow path (3-1) at one axial end portion of one of the barriers of the innermost barrier pair (3) and at the other axial end portion of one of the barriers of the innermost barrier pair (3) exit the corresponding first flow path (3-1), wherein each barrier of the innermost barrier pair (3) has a contiguous envelope surface extending between the one axial end portion and the other axial end portion of each barrier of the innermost barrier pair (3).

2. The insulation system (1-1; 1-2; 1-3; 1-4) as claimed in claim 1, comprising a first static shield ring for arrangement at a first end of the winding structure in axial alignment therewith, wherein the one axial end portion of each barrier of the innermost barrier pair (3) is located in a region that is electrically shielded by the first static shield ring.

3. The insulation system (1-1; 1-2; 1-3; 1-4) as claimed in claim 1 or 2, comprising a second static shield ring for arrangement at a second end of the winding structure in axial alignment therewith, wherein the other axial end portion of each barrier of the

innermost barrier pair (3) innermost barrier pair is located in a region that is electrically shielded by the second static shield ring.

4. The insulation system (1-1; 1-2; 1-3; 1-4) as claimed in any of the preceding claims, comprising a second outer barrier (7) arranged radially inwards or radially outwards from the first outer barrier (5), wherein the second outer barrier (7) has a surface defining a third flow path (7-1) for the dielectric fluid (F), wherein at least one of the barriers of the innermost barrier pair (3) is arranged to provide fluid communication between a first flow path (3-1) and the second flow path (5-1), and the first outer barrier (5) is arranged to provide fluid communication between the second flow path (5-1) and the third flow path (7-1) such that dielectric fluid (F) flowing through the insulation system (1-1; 1-2) has axial components in the first axial direction (A) in the first flow path (3-1) and the third flow path (7-1) and axial components in the second axial direction in the second flow path (5-1).

5. The insulation system (1-1; 1-2; 1-3) as claimed in claim 4, wherein the first outer barrier (5) and the second outer barrier (7) are so arranged that dielectric fluid (F) enters and exits the insulation system by means of the third flow path (7-1).

6. The insulation system (1-1; 1-2; 1-3; 1-4) as claimed in any of the preceding claims, wherein at least one of the barriers of the innermost barrier pair (3) has a first opening (3a) at the one axial end portion and a second opening (3b) at the other axial end portion arranged to provide fluid communication between a first flow path (3-1) and the second flow path (5-1).

7. The insulation system (1-1; 1-2; 1-3; 1-4) as claimed in any of claims 4-6, wherein the first outer barrier (5) has a first opening (5a) and a second opening (5b) arranged to provide fluid communication between the second flow path (5-1) and the third flow path (7-1).

8. The insulation system (1-1; 1-2; 1-3; 1-4) as claimed in claim 7, wherein the first opening (5a) and the second opening (5b) of the first outer barrier (5) are axially displaced, wherein the first opening (5a) is arranged in a portion of a first half of the first outer barrier (5) and the second opening (5b) is arranged in a portion of a second half of the first outer barrier (5).

9. The insulation system (1-1; 1-2; 1-3; 1-4) as claimed in claim 7 or 8, wherein the first opening (3a) of the at least one barrier of the innermost barrier pair (3) is axially displaced in relation to the first opening (5a) of the first outer barrier (5).
10. The insulation system (1-1; 1-2) as claimed in any of claims 7-9, wherein the second opening (3b) of the at least one barrier of the innermost barrier pair (3) is axially displaced in relation to the second opening (5b) of the first outer barrier (5).
11. The insulation system as claimed in any of claims 9 or 10, wherein each of the first opening and the second opening of the first outer barrier is arranged upstream of the first opening of the at least one innermost barrier pair of the innermost barrier pair (3) and downstream of the second opening of the at least one barrier of the innermost barrier pair (3) with respect to the first axial direction.
12. The insulation system (1-1; 1-2) as claimed in any of claims 4-11, wherein the first flow path (3-1), the second flow path (5-1), and the third flow path (7-1) define vertical flow paths in the insulation system (1-1; 1-2).
13. The insulation system (1-1; 1-2) as claimed in any of the preceding claims, wherein the innermost barrier pair and the first outer barrier are made of cellulose-based material.
14. A high voltage inductive device (15) comprising an insulation system (1-1; 1-2) as claimed in any of claims 1-13.
15. The high voltage inductive device (15) as claimed in claim 14, wherein the high voltage inductive device (15) is an HVDC transformer.
16. The high voltage inductive device (15) as claimed in claim 14, wherein the high voltage inductive device (15) is an HVDC reactor.

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