

CLAIMS

What is claimed is:

1. An umbilical-{4}, comprising:
 - a. an outer sheath {2} disposed substantially about the entire length of the umbilical, the outer sheath defining an interior void {3};
 - b. a power core-{20} disposed within the interior void; and
 - c. an open loop forced convection cooling circuit {10}-disposed within the interior void {3}-proximate the power core-{20}, the forced convection cooling circuit {10}-comprising:
 - i. a heat exchange delivery fluid conduit-{11} disposed proximate the power core within the sheath and configured to provide for evacuation of heat energy from the power core within a predetermined operating temperature range along a predetermined length of the power core within the sheath;
 - ii. a heat exchange return fluid conduit-{12} in fluid communication with the heat exchange delivery fluid conduit-{11};
 - iii. an inlet {15}-configured to receive a cooling fluid-{40}, the inlet {15}-in fluid communication with the heat exchange delivery fluid conduit-{11}; and
 - iv. an outlet {16}-configured to vent the cooling fluid {40}-into a body of water at a location along the umbilical length beyond which additional cooling is not required, the outlet {16}-in fluid communication with the heat exchange return fluid conduit-{12}.
2. The umbilical of Claim 1, wherein the cooling fluid {40}-comprising at least one of fresh water, filtered seawater, or a fluid that is already being delivered as an existing hydraulic function within the umbilical.
3. The umbilical of Claim 1, wherein the forced convection cooling circuit {10}-is disposed at location within the interior void {3}-as close as possible to the power core {20}-at a distance that provides an efficient evacuation of heat energy from the power core {20}-to aid

in maximizing an electrical power transfer capacity of the power core (20) within a predetermined operating temperature range.

4. The umbilical of Claim 1, wherein the heat exchange delivery fluid conduit (11) and the heat exchange return fluid conduit (12) comprise a loop juncture (13) at a predetermined length of the umbilical, the loop juncture (13) dimensioned to allow fluid to pass between the heat exchange delivery fluid conduit (11) and the heat exchange return fluid conduit (12).

5. The umbilical of Claim 4, wherein the predetermined length is at a location sufficiently removed from an elevated temperature region of the umbilical (1) such that an additional length of the forced convection cooling circuit (10) provides no further operational heat exchange benefit.

6. The umbilical of Claim 1, wherein the inlet (15) is located at a topside mechanical termination of the umbilical (1).

7. The umbilical of Claim 6, further comprising a source of cooling fluid (40) in fluid communication with the inlet (15).

8. The umbilical of Claim 7, wherein the source of cooling fluid (40) is configured to provide a fluid cooling fluid (40) comprising at least one of fresh water, filtered seawater, or a fluid that is already being delivered as an existing hydraulic function within the umbilical (1).

9. The umbilical of Claim 8, wherein:

- a. the source of cooling fluid (40) comprises a dedicated refrigerant supply and return system; and
- b. the dedicated refrigerant supply and return system is configured to provide a fluid cooling fluid (40) that comprises a refrigerant.