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# Gas Insulated Switch



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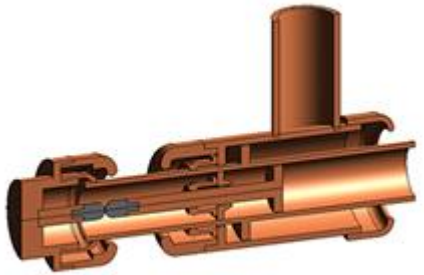
To demonstrate the flexibility of Infolytica's suite of Electromagnetic and Thermal Analysis packages, we have taken this Gas Insulated Switch and simulated it under a variety of different loads and configurations. The analyses that each product is specifically designed to accomplish are as follows:



MagNet is used to determine the AC current flow through the switch in the closed position.

ElecNet is used to analyze the potential distribution in the open positions.

ThermNet is used in two modes to firstly determine the steady state temperature rise under normal current flow, and secondly, to determine the transient temperature after a fault condition where the current increases tenfold.

The switch has two contactors designed to handle the arcing that occurs when the switch is opened under load. The tube connector makes contact first, and very rapidly, when the switch is first closed, whereas the inner graphite connectors make contact more slowly to avoid shattering under impact. The tube connector is also first to break contact when the switch is opened, and the load is carried by the inner graphite connectors. When they open, they can handle the arc without generating gaseous by-products which could otherwise condense on the insulating portions of the switch and compromise them.

# Power Loss in the Copper

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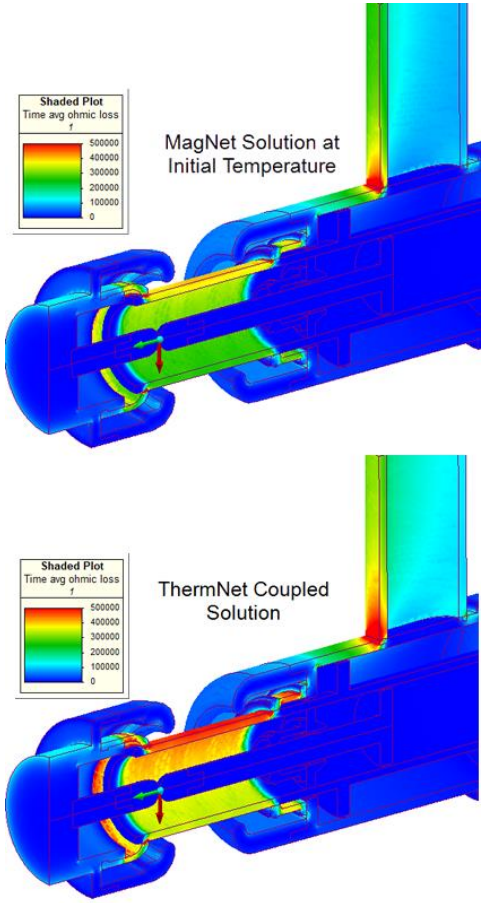
The first field plot is the solution obtained from a Time-Harmonic solve in MagNet at room temperature. The second is the steady-state solution taking into account the variation of electrical resistivity with temperature, obtained with a coupled Static Thermal to Time-Harmonic Magnetic solve in ThermNet, as explained in the next segment.



# Steady State Temperature Distribution

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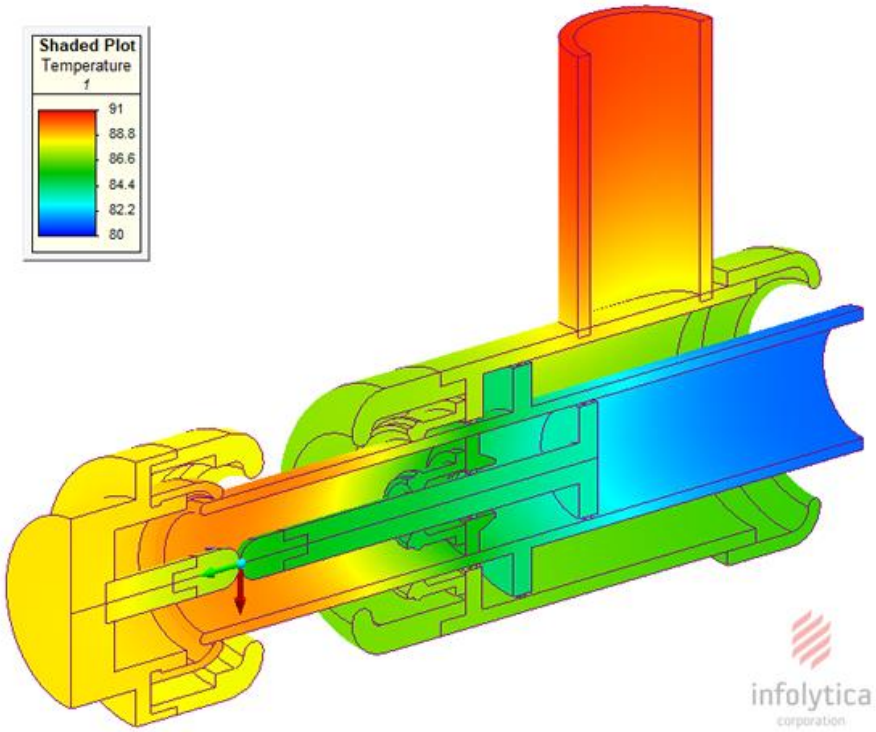
This picture shows the steady state temperature distribution under nominal current at 60 Hz AC, assuming convective cooling. Since the electrical resistivity of copper increases with temperature, and since the thermal properties are also temperature dependent, the thermal and magnetic solvers are run iteratively to find the steady state solution. Thus, the solution process alternates between a time-harmonic magnetic solve to calculate the power dissipation for a given resistivity, followed by a static thermal solve to calculate the temperature rise from this power dissipation. These temperatures are then used to lookup the new resistivities. This whole process is repeated until convergence is achieved.



# Electric Field Strength

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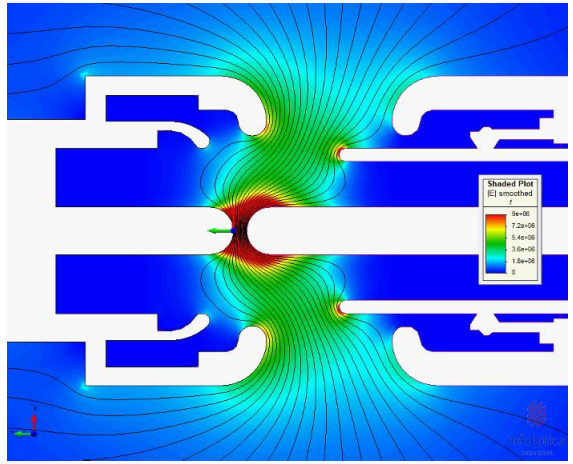
ElecNet can predict the electric field strength before arcing begins. This animation shows the electric field strength at different positions as the switch opens, in the absence of arcing. As designed, the arc should occur between the two graphite electrodes on the tips of the inner conductors.



# Temperature Rise

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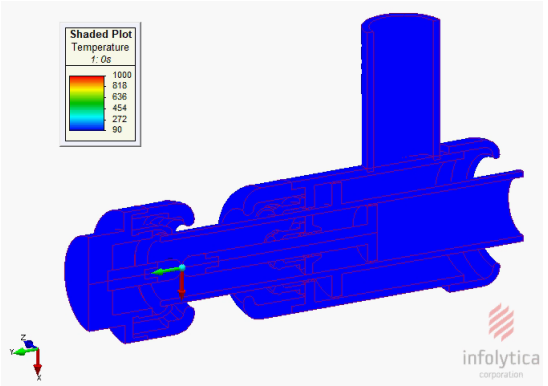
A Transient Thermal 3d coupled to a Time-Harmonic Magnetic 3d solve allows the temperature rise in the switch, as a function of time, to be plotted under fault conditions. This animation shows the temperature rise after the current is increased by a factor of 10 from its steady state nominal value.



# Model Cycle 10 Frames

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