

CEDM High Temperature Coil Stack/Gripper Coils

Background

Combustion Engineering (CE) Control Element Drive Mechanism (CEDM) coils have been in use for more than 40 years with a respectable operating history. However, the upper gripper coil, which is normally energized continuously in order to hold the control rod at the full out position, has been found to be under particular stress. As a result, the CE CEDM upper gripper coil is prone to early failures, accelerated by excessively high voltage or exposure to temperatures above its design value.

Description

To mitigate the risk of premature failure, Westinghouse has developed a replacement CE CEDM High Temperature (HT) Coil Stack assembly that has a much higher temperature capability than the original CEDM coil design.

The new CEDM HT Coil Stack incorporates those time-proven materials used in the Control Rod Drive Mechanism (CRDM) coil design and repackages them into a fully assembled replacement CEDM coil stack. The result is a coil stack with exceptional performance characteristics and long-life expectancy.

The CEDM HT Coils are superior to the existing CEDM coils through enhanced design features such as:

- Fiberglass filament insulation instead of varnish for much higher temperature resistance between coil wires
- Fiberglass epoxy high-temperature bobbin to support the coil winding
- Lead wires that are potted in the nipple to eliminate fretting wear



CEDM HT Upper Gripper Coil

- Continuous lead wires which extend from the coil to the input connector, without the need for terminal blocks within the wiring trough.
- Each coil fully potted in its coil housing and supplied as one sub-assembly
- Complete coil stack is pre-assembled, and electrically tested to minimize outage time and risk.
- The coil housing for the upper gripper coil has double the surface area for enhanced heat transfer to the external cooling air

The CEDM HT Coil Stack is a form, fit and functional replacement for the standard CEDM coil stack, and is designed with equivalent:

- Number of turns of wire
- Wire gage diameter
- Electrical resistance
- Electrical inductance
- Weight
- Operating characteristics
- Mounting mechanism

Benefits

The CEDM HT Coils provide additional temperature margin, rated for 500°F for 60 years versus the standard coil which is rated at 350°F for 40 years. The HT Coil Stack also requires less effort to replace than failed individual standard coils since they arrive factory-assembled and tested as a complete stack, including Flexible Electrical Conduit and Receptacle.

Deliverables

The CEDM HT Coil Stack is offered in both 4-Coil (SYS-80) Coil Stacks, and 5-Coil style Coil Stacks. The Coil Stack is provided complete with Wiring Trough, Flexible Electrical Conduit and Receptacle. In addition to extensive in-process testing, the completed assembly is tested for Polarity, Insulation Resistance and DC Resistance before it is delivered and ready to install.

Westinghouse also continues to offer the HT Upper Gripper coil as an upgrade to existing coil stacks, on a case-by-case basis. Westinghouse can install these coils/coil stacks and provide the associated design change package.

Experience

Westinghouse is the original equipment manufacturer for the CE CEDM and the Westinghouse CRDM. Westinghouse's CRDM coil design has been in use for more than 40 years and has a nearly perfect operating history, including no reported temperature-related failures.

Westinghouse has HT Upper Gripper coils installed at seven operating nuclear units and will deliver and install HT Coil Stacks to two operating nuclear units in 2022.



CEDM HT Coil Stack 4-Coil (SYS-80)



CEDM HT Coil Stack 5-Coil