Eaton’s customised aluminium couplings drastically improve fuel cells’ operating efficiency for use in telecom antennas

A manufacturer of methanol fuel cells wanted to develop specialised fuel cells that could stand up to harsh operating environment to power telecom antennas located in remote areas. In the past, the couplings used for fuel cells were made of plastics. However, in this case, plastic was not feasible and the company turned to Eaton for an ideal solution. Eaton spent two years in research to develop a highly customised aluminium coupling that met the objectives of strength and efficiency.

**Background**

The manufacturer is a leading developer and manufacturer of efficient, low-emission methanol fuel cell solutions for e-mobility and stationary power generation. The solutions do not use fossil fuels which helps to reduce greenhouse gases that have been found to be harmful to the environment. Compared to a diesel generator, there is a 50 to 65 percent reduction in carbon dioxide (a greenhouse gas) and 15 to 60 percent fuel cost saving. The company aims to be a turnkey replacement for internal combustion engines.

The fuel cells can be applied in three broad areas: telecom power, distributed power generation and mobility solutions for electric transportation. A recent project involved developing fuel cells for telecom antennas. Because this project was located in a non-urban area that was remote with no electricity and exposed to harsh environment, unique challenges had to be met to achieve stringent in application specifications that required robust solutions.

**Location:**
Scandinavia

**Challenge:**
Traditionally, the couplings connecting the shaft from the methanol in the tank to the fuel cells were made of plastic. However, they did not stand up to the challenges of harsh operating conditions.

**Solution:**
Eaton developed an aluminium coupling that is robust, offers operating efficiency and maximises uptime.

**Results:**
The aluminium couplings offer dramatic improvement to the fuel cells’ efficiency as there are now no more cracking and breakage.

“Eaton’s Aluminium Flat Face coupling helped our end customer to reduce downtime in the application and to eliminate risk of spillage during connection or through broken couplings.”
Ronald Molijn, Business Development Manager, Hansen & Gromelle QD couplings, Hydraulics Group EMEA

**Telecom antennas**

Telecom antennas are used as interfaces for signals between transmitters and receivers. In transmission, the transmitter supplies an electric current to the antenna’s terminals and thereafter, the antenna sends out the energy from the current as electromagnetic waves which carry signals through space. In reception, an antenna intercepts the signals to produce an electric current at its terminals that is then passes on to the receiver to be converted from electricity to sound. Antennas are essential components of all radio equipment and are used in cell phones, satellite communications and broadcasting, among others. The manufacturer, using Eaton’s solution, developed and supplied the fuel cells that powered the antennas.
Challenge
Traditionally, the couplings connecting the shaft from the methanol in the tank to the fuel cells were made of plastic. However, they did not stand up to the challenges of harsh operating conditions as plastic couplings can break and are not heat-resistant. One important factor to take into consideration was that the conversion of methanol into hydrogen that powered the fuel cells produces high temperatures. Also, most of the time, telecom antennas were situated at remote locations and engineers need to be sent out into the field whenever there was any problem. All these issues presented increased maintenance cost and downtime.

Additionally, the plastic couplings also impacted the continuous supply of power to the antennas because of emergency shutdown due to frequent breakage of the plastic. Therefore, the challenge was to design and develop a coupling that could withstand the tough operating condition and at the same time, provide better performance and productivity while reducing downtime and maintenance cost.

Solution
Eaton and the manufacturer worked together over two years to develop a customized aluminium coupling for the 5kW fuel cell with a special integrated filter and color coding. Based on site conditions and constraints it was determined that the 5kW fuel cell was optimum. However, this was not a standard specification and therefore, Eaton had to design an entirely new coupling just for this project. Aluminium conducts away heat so rapidly that it cools off much faster than other metal. It is lightweight but also rigid and to give it more strength, the couplings were also anodised to provide extra durability and corrosion-resistance. What’s more the couplings are designed with a simple and very effective colour coding system for easy identification and to avoid line crossing.

“We worked very closely with the manufacturer’s engineers to first of all, listen to their concerns and understand their pain points. We also took the time and effort to deep dive into the mechanics of the project. We feel that there’s no point in just giving our customers the latest technology that does not address their needs, even though the technology may be best-in-class or is the industry standard. Therefore, we spent about two years to research and develop the ideal solution. During the process, with close customer interaction, we also conducted various test and field trials. The end result was the highly customised aluminium couplings. What Eaton has done went beyond expectations and the aluminium couplings provided value in excess of the original requirements,” said Christian Künstel, Product Manager Connectors EMEA at Eaton.

Results
Eaton’s aluminium couplings improves overall efficiency of the performance of the fuel cells. Because of the special design of flat sealing, it eliminates leaking, reduces pressure drops and decreases energy loss, gives a high flow capacity, and therefore significantly increasing the efficiency of the fuel cells. There is now no more cracking and breakage of couplings because aluminium is both rigid and heat-resistance. This cut down on servicing and repairs drastically and there is now much lesser downtime and maintenance cost. The couplings’ quick disconnect feature maximises ease of use and when disconnecting. So even in the situation that regular maintenance is needed, the technicians do not need to spend much time on it.