



SF6—Sulfur Hexafluoride Gas...an introduction

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Sulfur Hexafluoride (SF6) is an odorless, colorless gas that is commonly used as an insulating medium and a means of extinguishing the arc during a CB opening cycle. It has a much higher dielectric strength than air or dry nitrogen. Thus, it's an excellent insulator that provides for compactness in design of equipment. Additionally, SF6 gas-filled CBs became more popular in the industry as the issues with oil as a dielectric medium became an environmental concern. SF6 has actually been around the industry since the 1950's.

So, while considered the best insulating medium as an alternative to oil or air, SF6 has a major downside. It has been found to be the most potent greenhouse gas known to-date. Over a 100-year period, SF6 is 22,800 times more effective at trapping infrared radiation than an equivalent amount of carbon dioxide (CO2). SF6 is also such a very stable chemical, that it has an atmospheric lifetime of 3,200 years. If the gas is emitted into the atmosphere, it accumulates in an essentially un-degraded state for many centuries. Thus, a relatively small amount of SF6 can have a significant impact on global climate change. Bottom line, allowing it to leak freely into the atmosphere is not a good thing.

The US EPA has enacted regulations in which companies that are users of greenhouse gases such as SF6 are encouraged to develop an SF6 emissions reduction strategy, which involves creating an inventory of SF6-using equipment and estimating current emissions. After preparing the emissions reduction strategy, the company can then develop and implement a company-wide policy for managing the leak-rates of current equipment and to ensure the proper handling of SF6. Managing the leak rates of your SF6 filled electric apparatus equates to identifying and repairing the leaks. TDS has been providing SF6 circuit breaker leak sealing solutions around the world. Our proven experience and commitment to excellent customer service has made us the leak sealing company of choice for the power industry.

TDS is the only company in the world that specializes in substation leak sealing. TDS devotes 100% of their time to the repair of transformer oil and SF6 gas leaks with over 28 years of work in the leak sealing industry. Our representatives, technicians, and management only work in substations and are extremely knowledgeable about leak sealing on transformers and circuit breakers.

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Our leak sealing technique takes the approach of repairing SF6 gas leaks on equipment while still energized whenever possible. GIS systems, tubing in control cabinet compartments etc. can be repaired usually with the apparatus still in service. Another benefit, many repairs can be made without “degassing” the equipment. Even though an outage may be required for safe clearance from energized components, we can keep the outage short, only the time to switch it out, ground, and get up to make the repair. This results in substantial cost savings over traditional repair methods that require expensive and possibly lengthy equipment outages. TDS leak repair techniques also provide maximum flexibility to Utility Asset Managers when making decisions on replacing or refurbishing equipment.

Our most common repair technique for SF6 leaks is to install a cast aluminum clamp over the leaking component on the device. These cast aluminum clamps are custom made based upon our field measurements in the survey phase of the repair. With our years of experience we have developed a series of standard aluminum clamps for many common leaks on SF6 CBs. If the leak that is identified is one of the commonly occurring leaks on a specific brand/model of CB we can utilize one of these already on the shelf clamps. Thus you will have less down time waiting for the design and fabrication of the clamp. All our clamps, off the shelf or custom made, are very professionally finished with minimal sharp edges to minimize issues with corona on HV CB live parts. After the clamp enclosure is installed, it is pumped full with our TDS proprietary rubber based sealant, thereby controlling the leak. The sealant is a rubber-based nonadhering sealant that typically cures in 20 minutes at 70 degrees F. After the sealant cures, the leak is repaired. Then the clamp stays in place for as long as the utility wants the leak stopped. If for some reason the bushing requires disassembly, the clamp can be removed easily by unbolting it and cutting away the sealant. No damage is done to the circuit breaker unlike other commonly used epoxy repair techniques.

The exact source of the SF6 gas leak must be detected in order for TDS to propose a repair method. For many years, SF6 leak detection was done using a soapy water solution such as "Snoop", hand held gas detectors, or ultrasonic devices. These detection methods while adequate can be impacted by extraneous factors which can interfere with their accuracy. Factors such as wind, noise, or the thoroughness of the leak detection survey sometimes render these techniques unreliable.

The new device that has proved very useful for detecting SF6 leaks is the infrared laser-scanning unit. This detector scans the entire circuit breaker using a laser and detects the specific infrared signature of SF6 gas. The SF6 leak appears as black smoke on the video used to record the scan. This infrared laser-scanning unit is TDS's method of choice for finding SF6 leaks. TDS has a long time relationship with a business partner that uses this infrared laser device and we can arrange for them to survey your equipment for you.

In conclusion, SF6 gas filled electric utility apparatus, while it does have many good applications in the industry, does have its major risks. TDS can help you manage your SF6 risk of release into the atmosphere while continuing to keep this equipment viable and operable within EPA guidelines. Our expertise will allow utility management to develop an action plan to address leaks, and also allow you to effectively demonstrate to regulatory agencies such as the EPA that your utility management has their arms around the problem.

REFERENCES:

USA EPA Electric Power Systems Partnership website:

<https://www.epa.gov/f-gas-partnership-programs/electric-power-systems-partnership>

Other EPA relevant links:

[Greenhouse Gas Reporting Program Subpart DD: Use of Electric Transmission and Distribution Equipment Proposed and Promulgated Rules](#)

[Code of Federal Regulations: Mandatory Greenhouse Gas Reporting \(40 CFR Part 98\)](#)

About the author...Steven H Wickman, PE is a Technical Consultant for TDS-Transmission & Distribution Services. After a 37 year career with Commonwealth Edison, Co. Chicago, IL in various Electrical Engineering positions primarily in the Substation, Testing, Engineering, Construction, Operations areas of the Company, Steve is now providing his expertise to TDS as a Technical Consultant. Steve is a Registered Professional Engineer in the State of Illinois, has a BSEE from Iowa State University-Ames, IA, and an MBA from the Keller Graduate School of Management-Chicago, IL