The Colt Group
Power Services Division

September 10, 2014

REPORT ON SF6 LEAK REPAIR COMPLETED AT SOUTHERN CALIFORNIA EDISON (SCE) VALLEY 115kV GIS - SECTION 119C

The Colt Group, Power Services Division was contacted by the Manufacturer in July 2014 to repair an SF6 leak on a GIS bus flange at Southern California Edison's Valley GIS (Gas Insulated Substation). Colt's leak repair solution was determined to be the best solution, as alternatives would have increased down time and cost, and the site is scheduled to be shut down in two years. The buswork had originally been installed in 2003, so the repair was within the 10 year manufacturer warranty.

Description of leaking flange joint

Joint consists of two painted aluminum flanged sections mated vertically with an approximate 0.5 inch thick insulator sandwiched between the flanges. Since this is considered an insulated joint, the Colt clamp will need to be non-conductive. Diameter of each flange is 25 inches x 2" thick. Diameter of pipe is 20 inches. Internal pressure is 67 psig SF6.

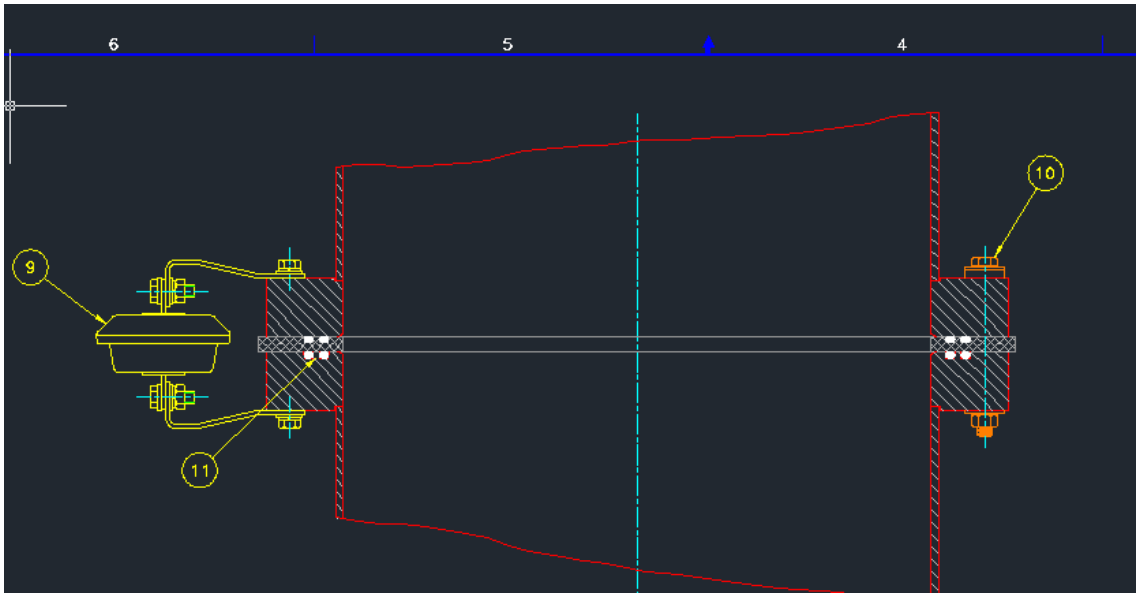
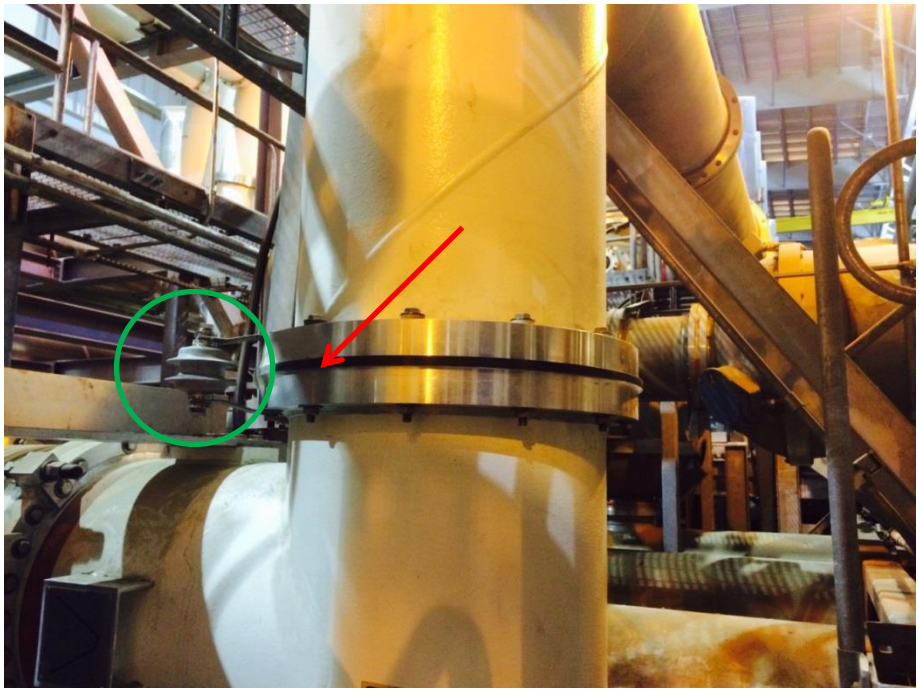


Diagram 1

Leak location

SF6 leaking from the flange as indicated by red arrow in the photo below (gas zone 119 C phase). It is right behind the surge arrester in the photo. The leak was found using an

SF6 detection camera. Maintenance attempted to slow the leak using epoxy, but it did not work. SCE was adding about 66 lbs of SF6 per month to this section.

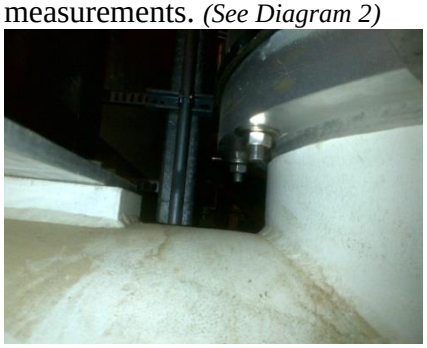


Client photograph of Section 119C

Colt's solution will require the surge arrester to be removed and relocated in order for a custom enclosure to be installed on the flange.

Inspection & Measurements

Colt technician made on-site inspection, took additional photos and precise measurements. *(See Diagram 2)*



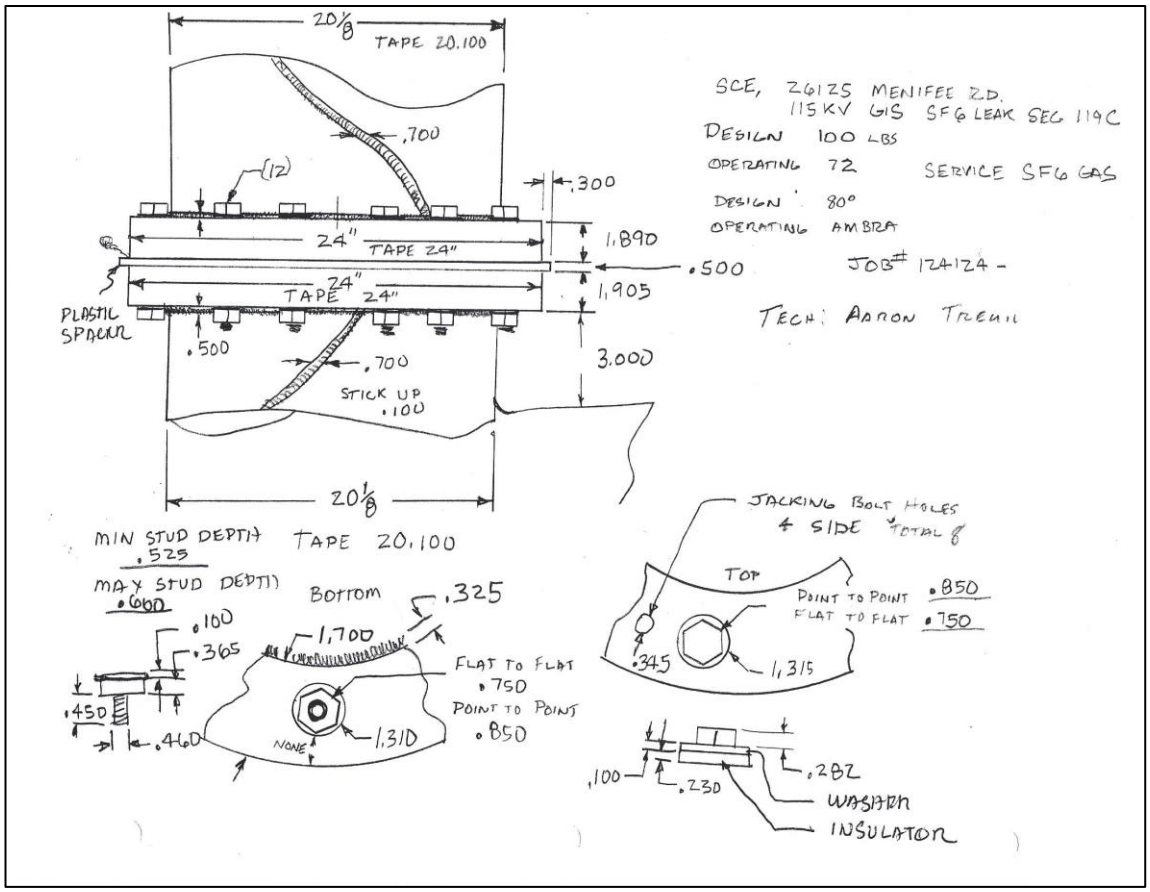


Diagram 2 – Colt technician measurements

Colt custom enclosure design plan

Colt's first plan was for a custom aluminum enclosure, with .150" thick nylon shims between the pipe OD and the aluminum of the end plates to insure a .150" insulating gap. These shims would be placed 1-2 inches apart around the OD on both end plates (upper and lower).

This approach evolved into Colt's final design, which was to engineer a nylon ring to fit inside the aluminum enclosure. This strategy ensured more distance and insulation between the aluminum surfaces.
See Diagram 3 and Photo of finished custom enclosure

Rubber seals were set in the nylon rings to attach to the aluminum pipe above and below the leaking flange, providing ample clearance from the aluminum of the Colt enclosure to the aluminum pipe.

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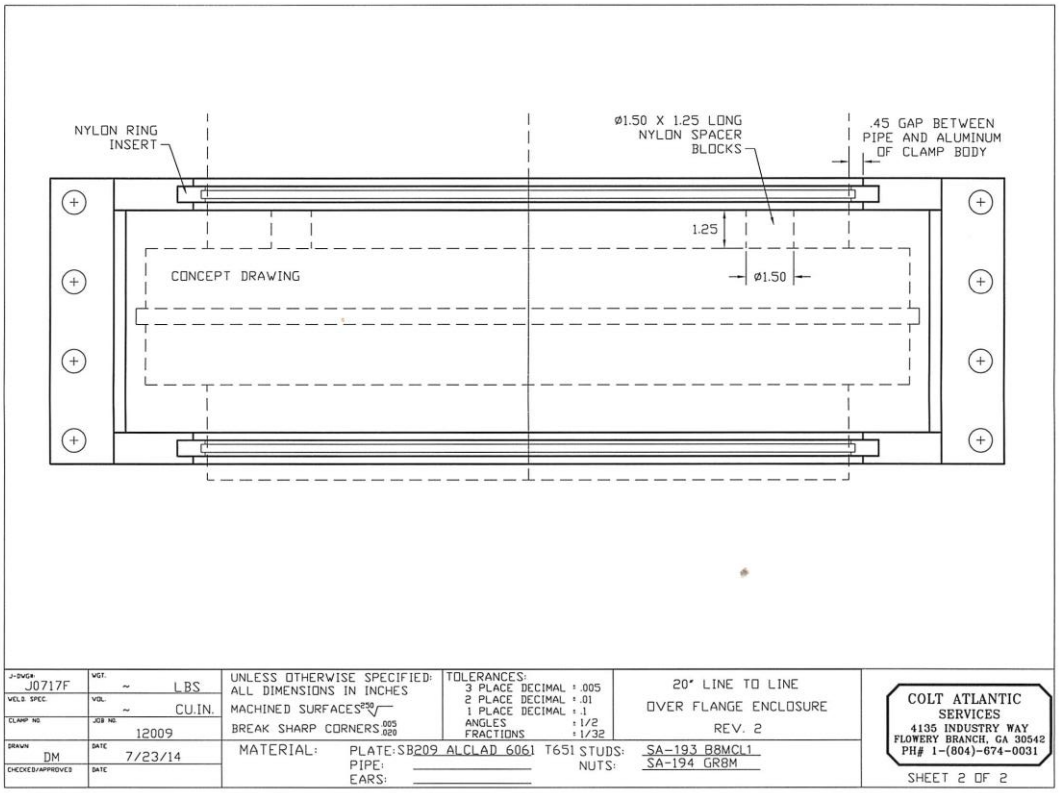

Diagram 3 – Colt custom enclosure – Final design.
See Attachment A for additional details and engineering calculations

Photo of open enclosure, noting nylon inserts

The installation plan called for the Colt enclosure to be centered so that no electrical contact would be made between it and the pipe on both sides. Nylon spacers were placed in between the bolts on the top flange; the enclosure would rest on these to prevent any metal-to-metal contact.

About the Sealant
Colt's S-22 sealant is a catalyzed system. The leak seal is made by completely filling the void in the enclosure and then adding a small amount of compression.

Note: Colt's sealant has a dielectric strength of 20,000 V / inch.
See Attachments B - E for Independent Lab report, test results and MSDS of Colt sealant

The internal clearance between the flanges of the CGIT and the inside of the clamp, is at least 0.325" - therefore the dielectric strength will be .325 X 20,000V = 6,500 V
The surge arrester rating is 1,130 V - (the voltage which should cause the arrester to conduct) - Therefore the surge arrester will conduct before the sealant will break down

Temperature and Pressure Considerations
Design temperature is 80 degrees C
SF6 pressure of 80 psig, 100 psi maximum

<u>Clamp Installation</u>

Day One

1) Client removes Surge Arrester.
Surge Arrester bracket bent and moved to the left to avoid spiral weld.



Original Surge Arrester location – after removal. Bracket bent and moved to left.

2) Colt installs custom enclosure.

Sections of enclosure- open

Enclosure being installed by Colt technicians

3) Sealant is poured in. The two-part compound is mixed and poured in via one inch ports incorporated into the top of the enclosure.

Sealant being poured in from the top to ensure rapid fill and even curing.

At the end of Day One, there was still an active SF6 leak. The decision was made to wait overnight for additional cure time.

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Day Two

1) Colt hydraulically injects additional sealant through injection valves along the sides of the enclosure.

Colt sealant injection

Leak is checked with SF6 camera.

2) Client re-installs the Surge Arrester in its new location.

3) Status of leak is checked with SF6 camera

Photos of Final Colt Leak Enclosure Installed:

P.O. Box 74396 Richmond, VA 23236 24 HR. 804-674-0031 Fax 804-674-1107
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Day Three

1) SF6 is brought to full pressure.
2) Leak is confirmed to have stopped.
3) Flange is bagged for 12 hour gas leak detection test.

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Day Four
Gas leak detection test performed using a TIF leak detector.
No gas leakage was detected.

Final Observation

Sealant curing
At the end of Day One, additional curing time was needed due to the volume of catalyzing material. Allowing the sealant to cure overnight proved successful.

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Colt Guarantee
The repair will be guaranteed not to leak for a period of two-years from the date of completion. Manufacturer/SCE will not be charged for any cost associated with re-injecting the repair during this two-year period.

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For any questions, contact:

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