EMT SMARTFILL / ADDING SF6 GAS TO ENERGIZED CIRCUIT BREAKERS

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Past Practice

- Pre 2000, SF6 gas added to circuit breakers using common gas regulator with filter.
  - Initial SF6 circuit breakers are two pressure design.
  - Adding SF6 gas to the low pressure system.
- Early 2000 determination to discontinue adding SF6 gas to energized circuit breakers.
  - Circuit breaker manufactures don't support adding SF6 gas while circuit breaker is energized.
  - Safety concerns that adding SF6 gas will stir up contaminates in circuit breaker tank causing an internal arc flash.
  - Modern circuit breakers are single pressure system. Last two pressure circuit breakers was removed from PG&E system in 2006.

A need to change

- Several factors reflected the need to change our practice of clearing circuit breakers from service to add SF6 gas.
  - Directive to perform more work practices without clearing equipment.
  - Transmission load path restriction make it difficult to clear equipment.
  - Efficiencies gained by not clearing equipment.
  - Possible fines from ISO.

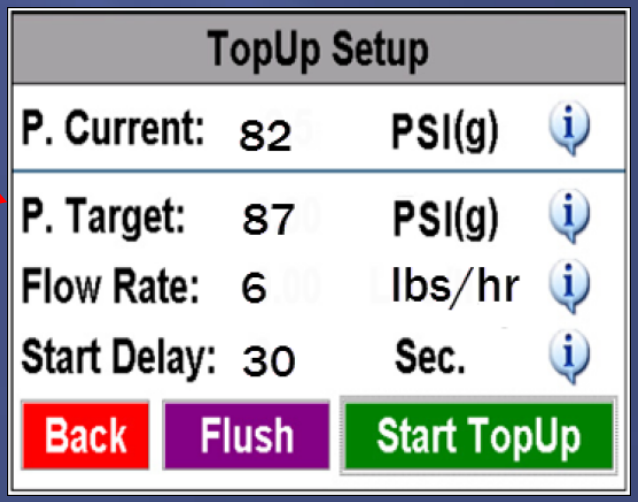
EMT Smartfill Solution

- Approached in late 2013 by Vaughan Williams of EMT to demo the Smartfill unit.
- January 27, 2014 a demo was performed on a energized circuit breaker.
- Work Methods & Procedures group immediately realized the potential in the Smartfill.
  - Clearances are reduced.
  - Reduced cost for adding gas.
  - Operation is safely performed.

Smartfill unit

Implementation process

- Development of a information bulletin detailing steps to safely add SF6 gas.
  - Safety precaution on SF6 gas.
  - Cutting out Low Pressure Tripping.
  - Smartfill unit location and connection.
    - Hose connections and Opening gas valves.
  - Data entry and programing instructions.
    - Target pressure.
    - Flow rate.
    - Start delay.



- Traffic Light indicator.
  - Red, Alarm occurred.
  - Orange, Unit is Filling.
  - Green, Standby

- Completion of filling process.
  - Closing valves .
  - Disconnection of hoses.
  - Clearing alarms on circuit breaker.
  - Resetting and Cutting in the Low Pressure Tripping.

- Development of a training video showing the procedures to add SF6 gas.
  - Follows the guidance in bulletin.
  - 7 minute duration.
  - Stored on PG&E internal video library.
  - Allows review of filling procedure.
- Scheduled training with 21 headquarters.
  - Training needed to demonstrate proper use of unit.
  - Ensure employees that filling while energized is SAFE.
- Smartfill units have been used successfully since 7/2014.

SF6 Reduction/usage program

- Identification of SF6 leaks.
- When SF6 gas needs to be added to a circuit breaker.
  - Work notification is created.
  - Work Methods & Procedure specialist is notified to identify location of leaks.
  - FLIR GF306 camera is used for leak identification.
  - Leak report created and sent to headquarters.
  - Repairs are identified, parts ordered, and circuit breaker clearance is scheduled.
  - Follow-up leak detection is performed after repairs.

- Tracking of SF6 usage is recorded by weight and reported yearly per CCR title 17, subarticle 3.1.
  - SF6 bottles weighed before and after use.
  - Usage is electronical recorded and stored.
- Currently working to procure a SF6 testing device that will capture and return SF6 gas to circuit breaker or storage container.

Questions?