

**A VERY BRIEF HISTORY:**

**LARGE PRESSURE RELIEF  
DEVICES (PRDs) AND THEIR USE  
ON POWER AND DISTRIBUTION  
TRANSFORMERS AND RELATED  
EQUIPMENT**

TF - Tank Rupture and Mitigation -  
March 2006 J.Herz

# BEFORE THERE WERE RE-SEALABLE PRDS...



# Rupture Discs

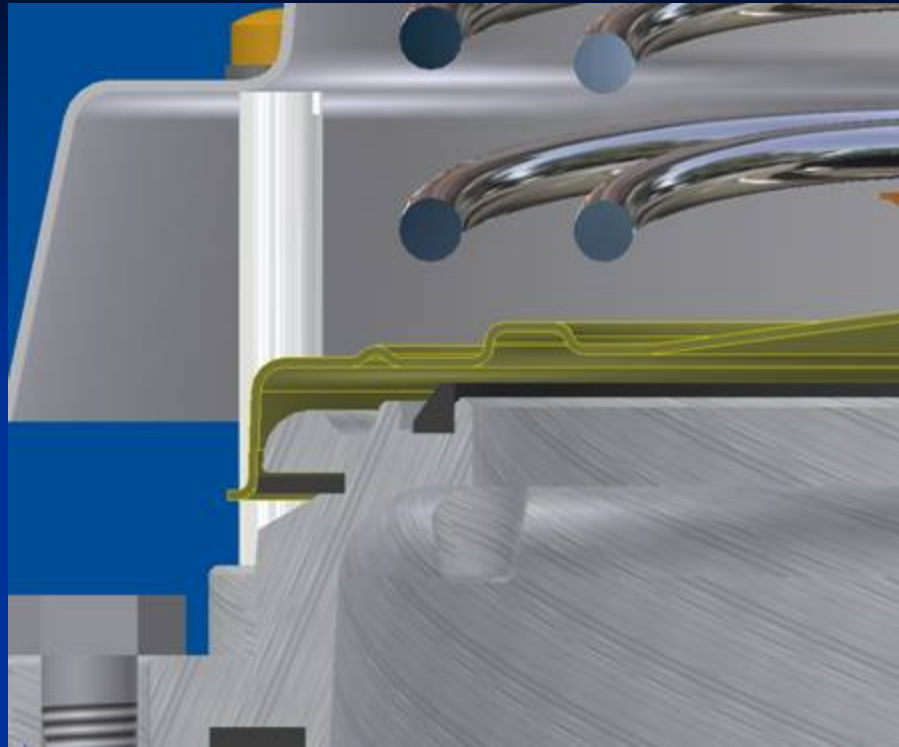
- HAD TO BE REPLACED AFTER OPERATION
- LEFT THE TRANSFORMER OPEN TO ATMOSPHERIC MOISTURE IN THE INTERIM

THERE WERE SEVERAL DIFFERENT  
DESIGN APPROACHES TO RE-SEALING  
PRDs MADE BY VARIOUS  
MANUFACTURERS

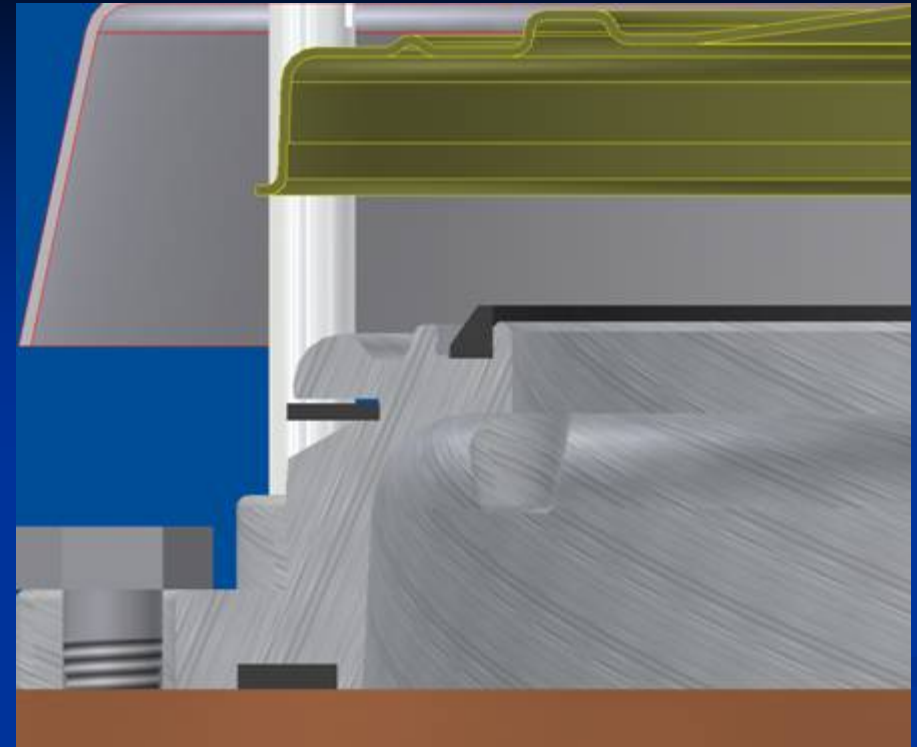
IN THE LATE 1950's THE INDUSTRY  
SETTLED OVERWHELMINGLY ON ONE  
DESIGN.

THE DESIGN IS STILL BEING USED TODAY AND OFFERS SIMPLICITY AND DURABILITY IN ADDITION TO RE-SEALABILITY.

REFINEMENTS SINCE HAVE TO DO WITH IMPROVING THE SEAL, SHIELDING AND PROTECTION, SWITCH CAPACITY, CORROSION RESISTANCE, ETC.



WHEN OPERATING PRESSURE IS REACHED, TOP SEAL OPENS WHILE SIDE SEAL REMAINS BRIEFLY CLOSED



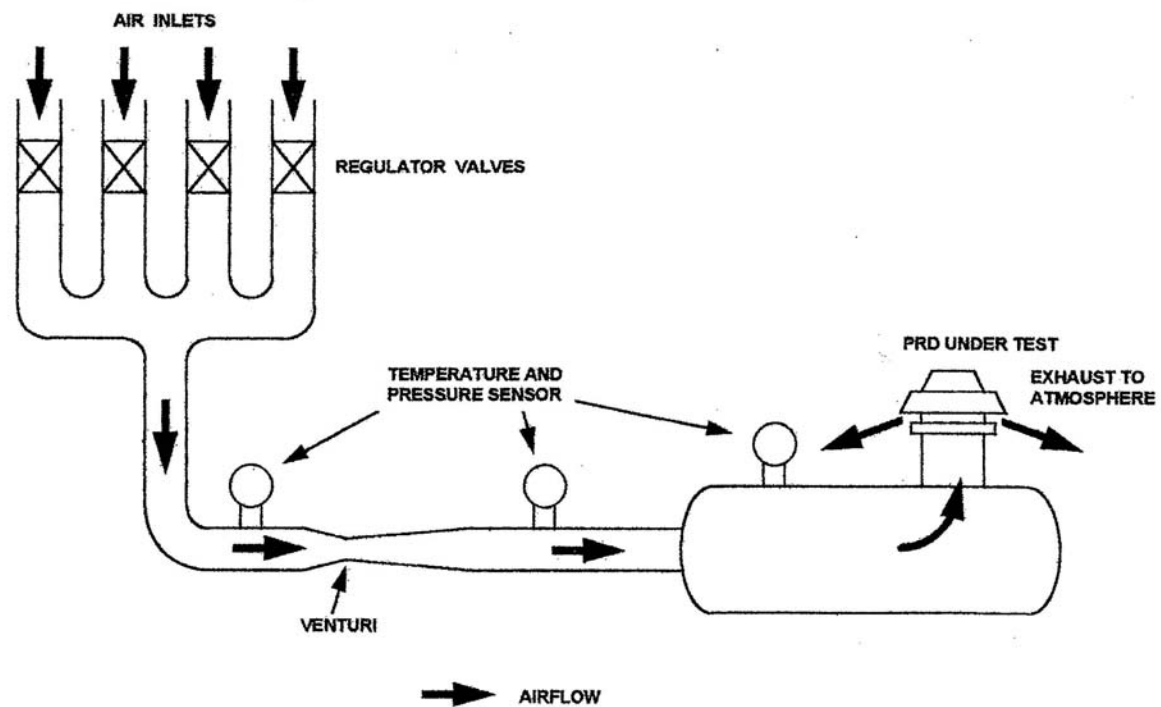
WITH OPERATING PRESSURE ACTING ON THE LARGER AREA CIRCUMSCRIBED BY THE SIDE SEAL, THE SPRING IS RAPIDLY COMPRESSED AND THE VALVE EXHAUSTS QUICKLY

26 Jul 2005 16:45 • 1,000 fps • 590,00 ms



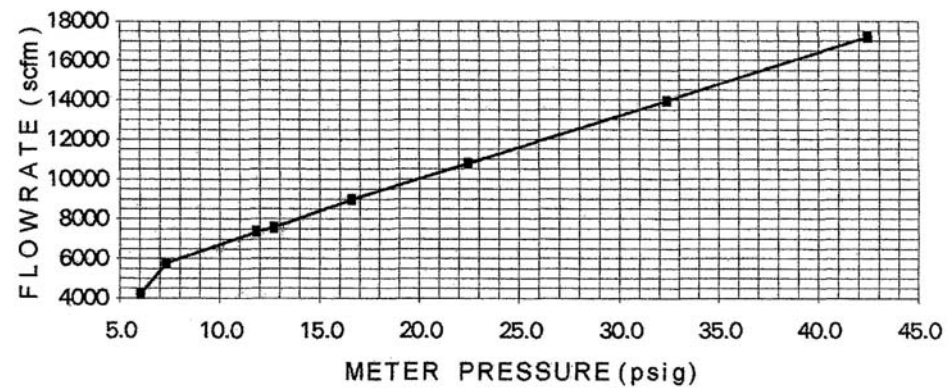
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## TEST EQUIPMENT SCHEMATIC



PRESSURE PSIG	AIRFLOW SCFM
6.092	4215
7.338	5756
11.826	7359
12.074	7551
16.601	8979
22.478	10771
32.389	13930
42.451	17174

**FLOW CURVE**



8400 SCFM AT 50% OVERPRESSURE ON A 10 PSI PRD WAS TYPICAL. NOW THERE ARE DEVICES WHICH GO TO 12,600 SCFM.

**Most frequent question: Will it protect?**

**Most frequent answer is: Depends.**

- **location of fault**
- **magnitude of fault**
- **duration of fault**

## TEST 1: 1958 AT GE SCHENECTADY

- The test tank was approximately 6 ft in diameter and 4 ft deep, with the PRD mounted in the center of the 6 ft. diameter cover.
- The gas space was 10 inches below the cover which resulted in about 700 gallons of oil and 23 cu. ft. of gas (air).
- Ball nosed copper electrodes (2) were threaded with a small copper wire to trigger the arc, the highest of which was 25K amps and 20K volts. Oil, smoke, mist, spray blasted out of the relief device over a radius of about 40 feet.

## TEST 2: 1958 AT GE SCHENECTADY

- In tests performed by Jim Barr on a transformer with NO COVER , the fault was introduced near the bottom of the tank and the bottom of the tank BLEW OUT, at 10K amps and 10K volts.

**There are thousands of events where PRDs have successfully protected transformers:**

**“Internal arcing, breaker insulation break down, load tap changer problems, phase angle regulator problems, and internal winding problems” are some of the more common.**