



CIGRE WG A3-06

Reliability of High Voltage Equipment - Instrument Transformers

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Previous Surveys

- First survey 1970 –1986
 - 2 310 000 IT-years but included manufacturer data so not used for comparison
- Second survey 1985 – 1995
 - 1 312 070 IT-years over 10 years
- This (third) survey 2004 – 2007
 - 1 288 695 IT-years over 4 years

NB: 2nd Survey “major” = 3rd survey F&E

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Review of the instrument transformer population reported in the survey

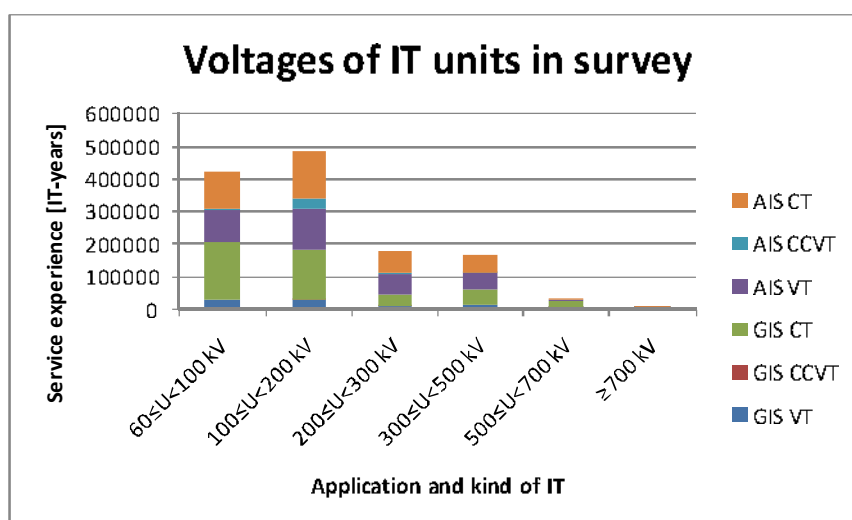
SERVICE EXPERIENCE

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Service Experience



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Service Experience

Comparison with previous 2nd survey for service experience by voltage

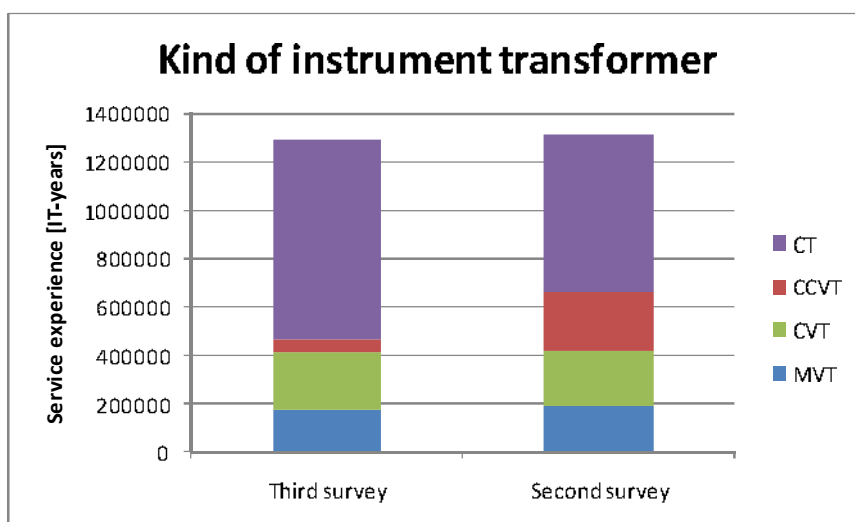
3rd CIGRE IT Survey		2nd CIGRE IT Survey	
Voltage class	Number of IT-years	Voltage class	Number of IT-years
60≤U<200 kV	908 566	60<U<220 kV	735 490
200≤U<500 kV	342 519	220≤U<380 kV	400 740
≥500 kV	37 610	≥380 kV	175 840
Total	1 288 695	Total	1 312 070

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Service Experience

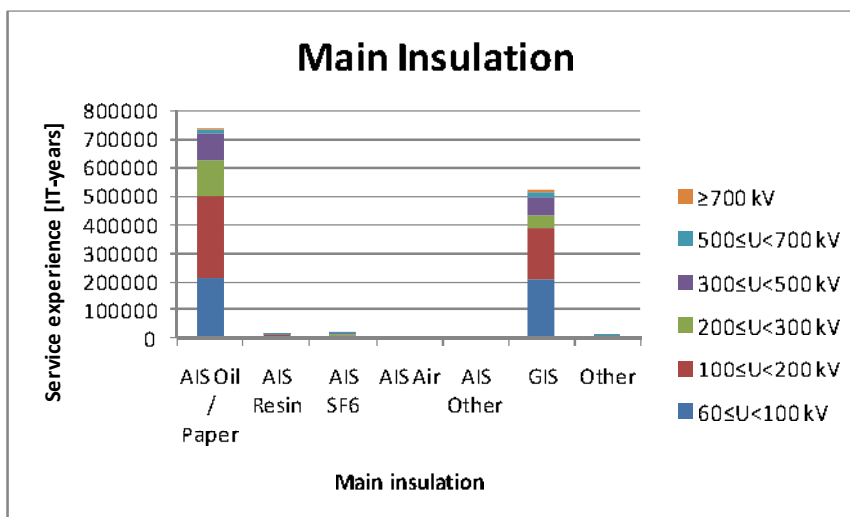


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Service Experience



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Review of the instrument transformer failure frequency reported in the survey

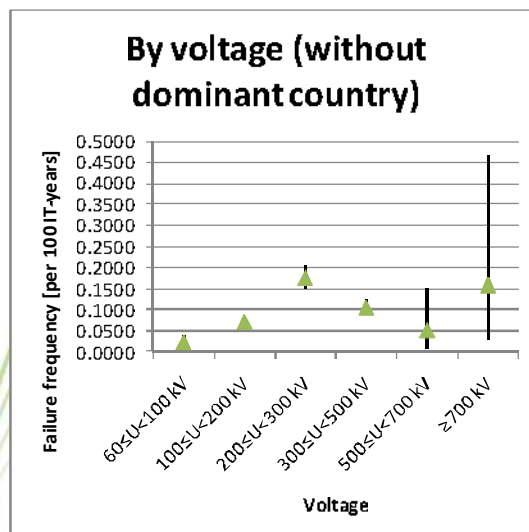
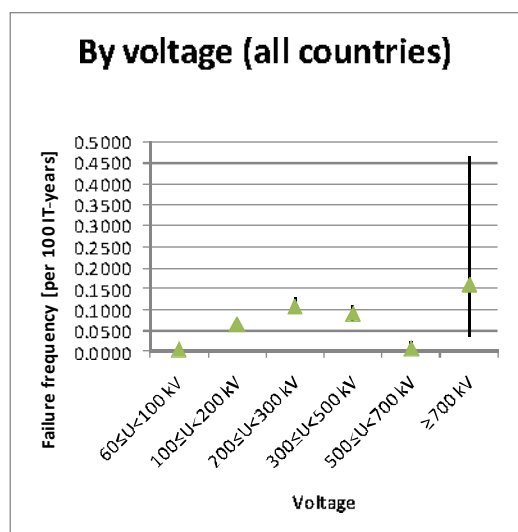
FAILURE FREQUENCY

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Major Failure Frequency



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F&E Failure Frequency

Comparison with previous 2nd survey for failure frequency by voltage

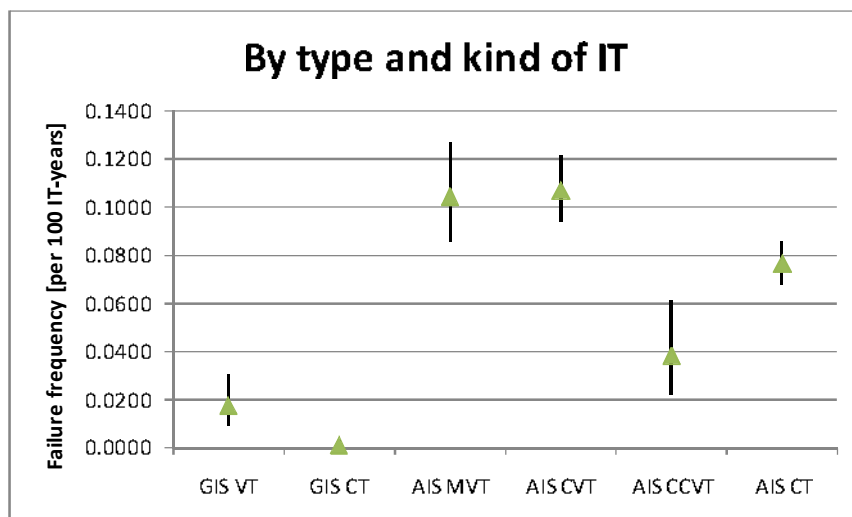
3rd CIGRE IT Survey		2rd CIGRE IT Survey	
Voltage	Failure frequency [per 100 IT-years]	Voltage	Failure frequency [per 100 IT-years]
60≤U<200 kV	0,0055	60<U<220 kV	0,0332
200≤U<500 kV	0,0149	220≤U<380 kV	0,0352
≥500 kV	0,0531	≥380 kV	0,0427
Overall	0,0079	Overall	0,0351

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Major Failure Frequency

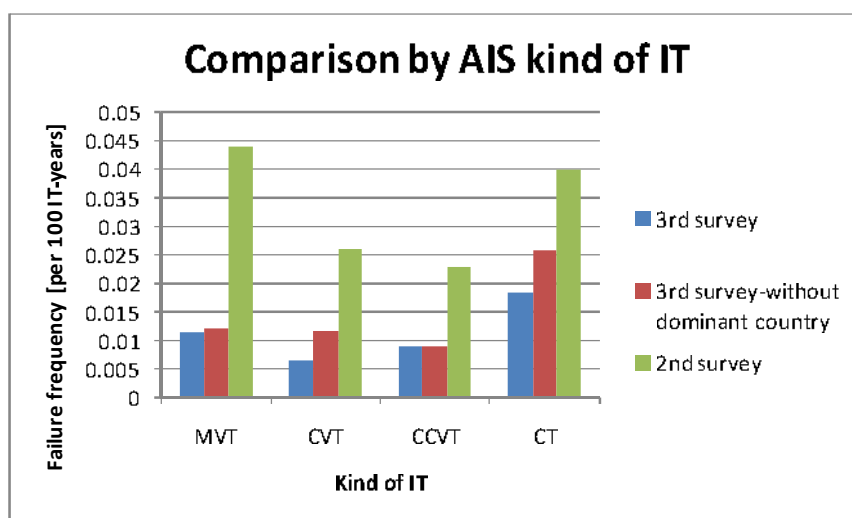


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F&E Failure Frequency

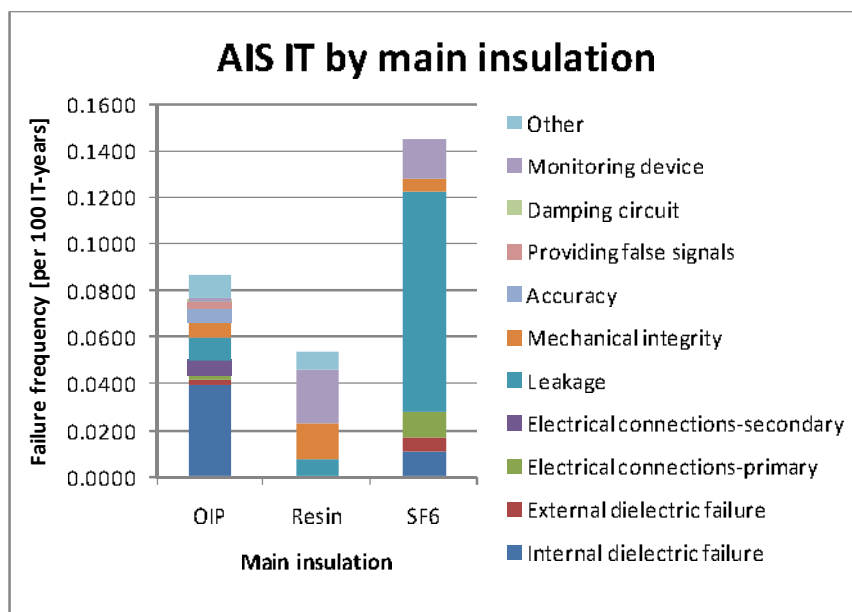


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Major Failure Frequency

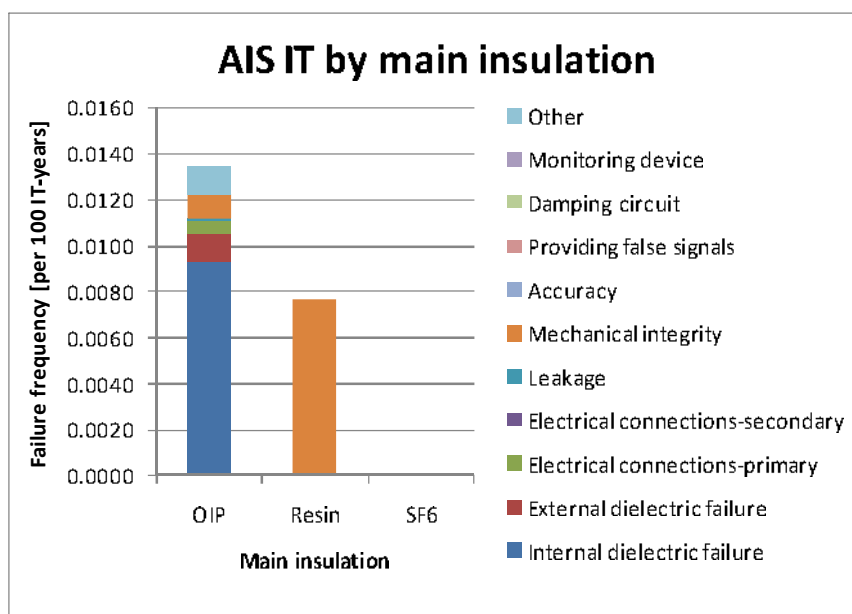


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F&E Failure Frequency

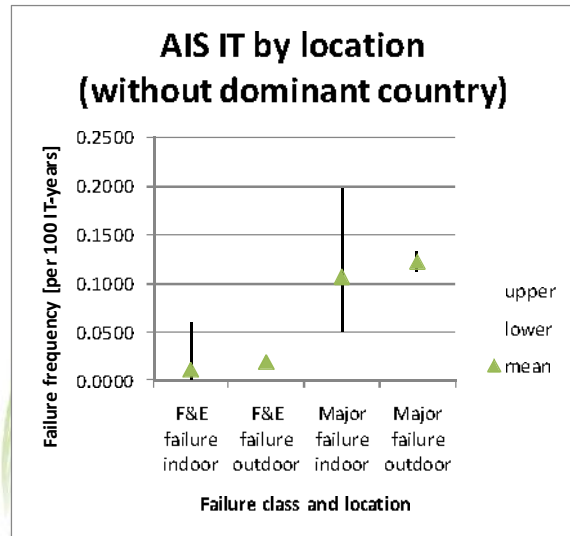
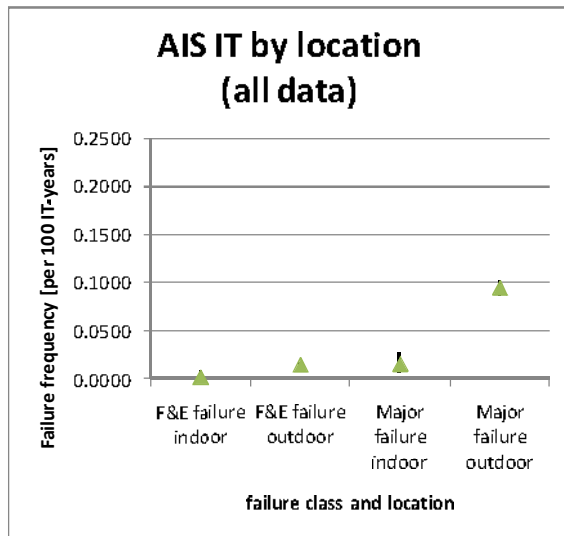


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Failure Frequency

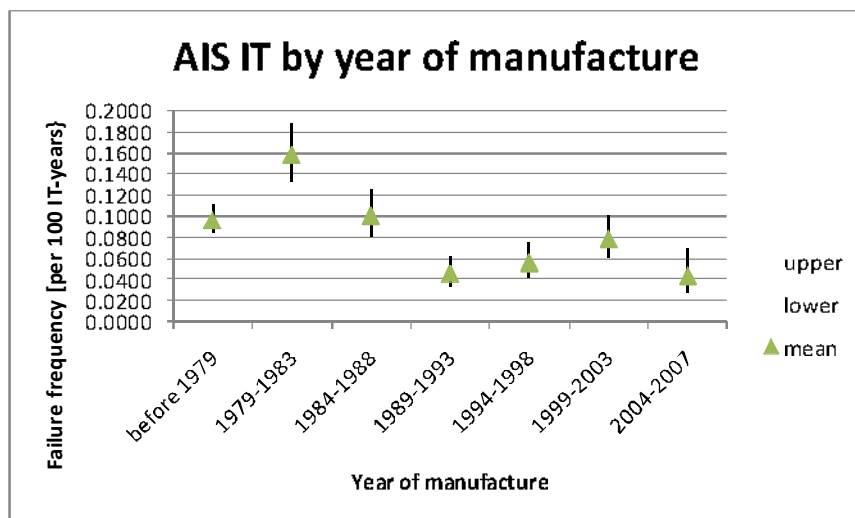


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Major Failure Frequency



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Review of the instrument transformer failure types reported in the survey

FAILURE CHARACTERISTICS

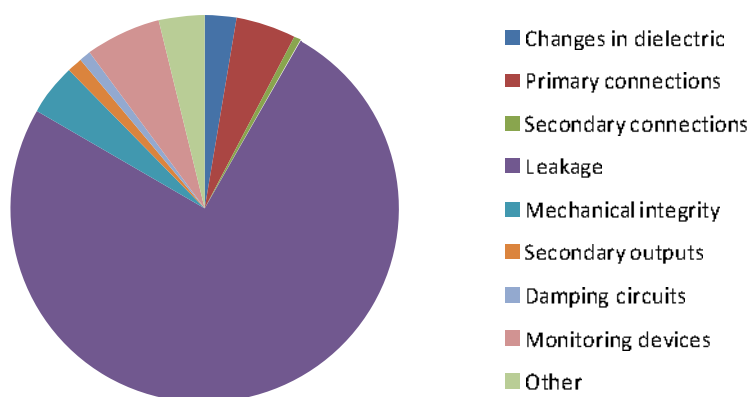
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Number of minor failures

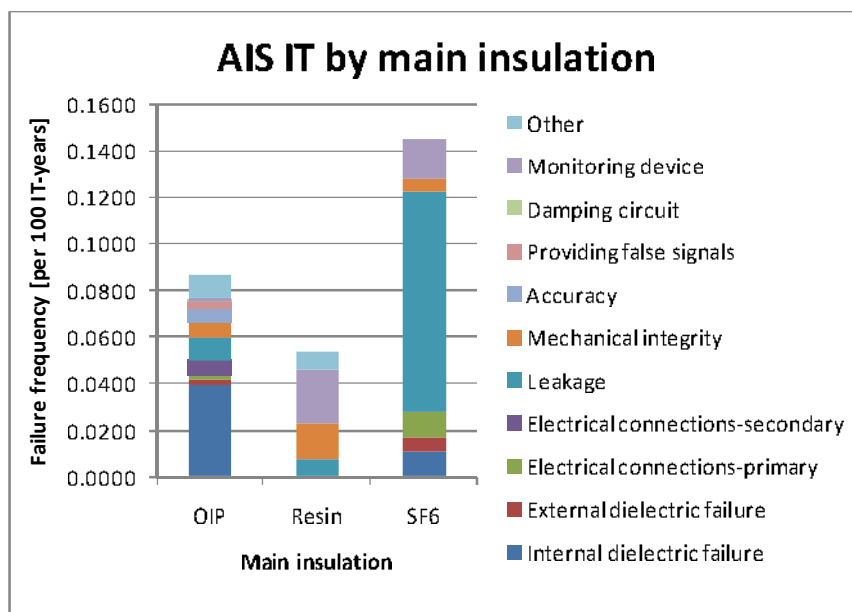
Failure mode for all minor failures



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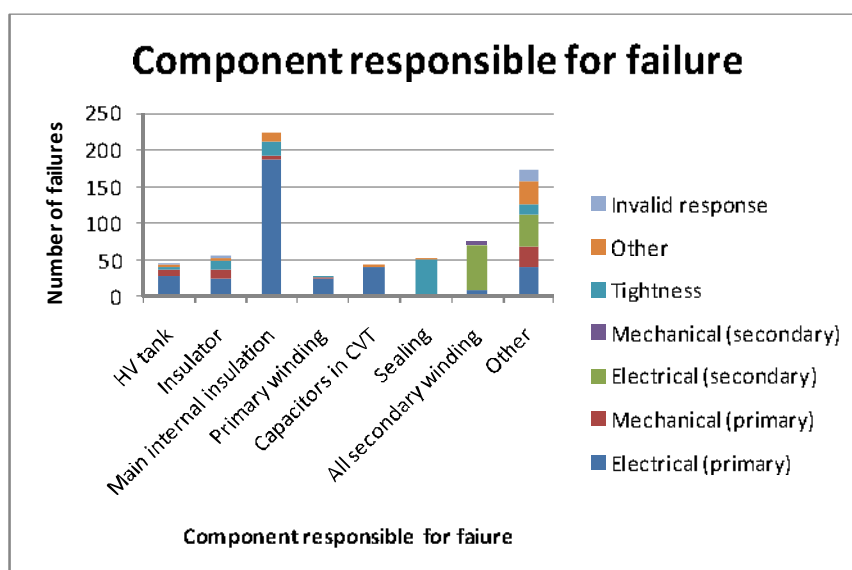
Major Failure Frequency



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Number of major failures

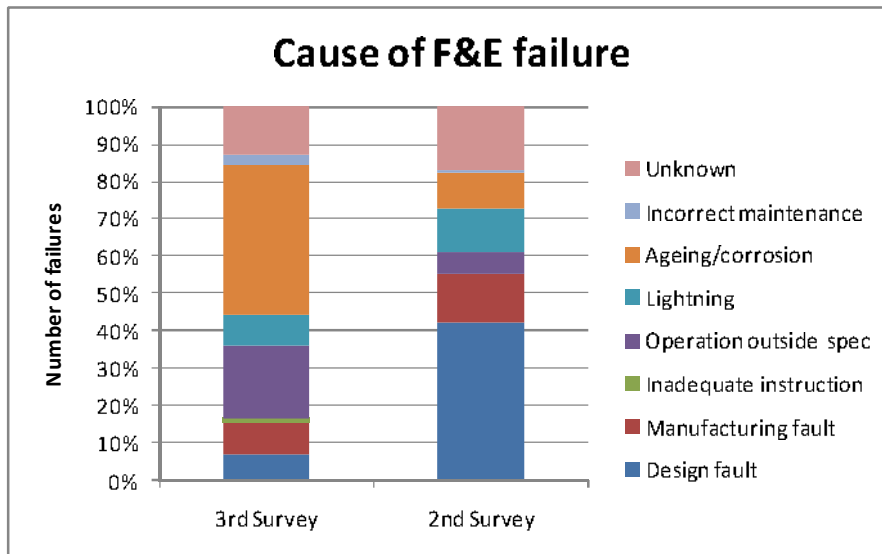


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Number of F&E failures

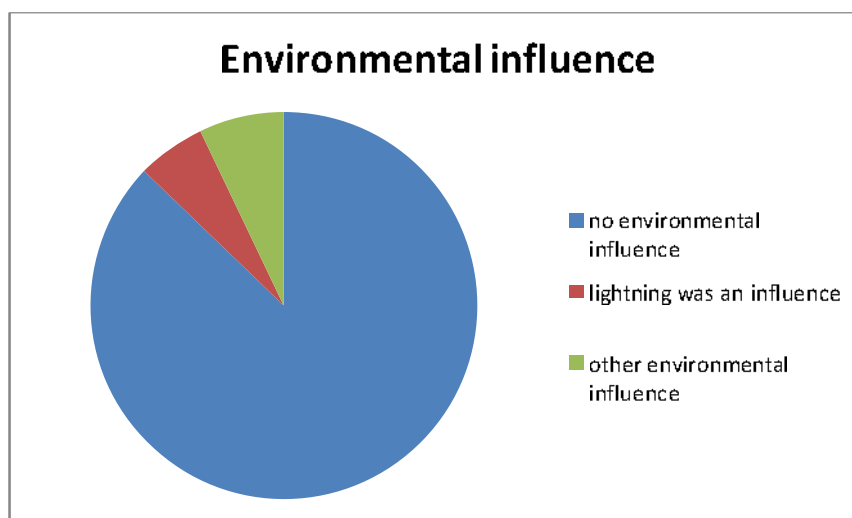


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Number of major failures



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Conclusion

- GIS instrument transformers reported lower failure frequencies than AIS
- Instrument transformers lower than 100 kV reported lower failure frequencies
- For AIS OIP instrument transformer dielectric failures accounted for major failures, particularly fire and explosion
- Minor failures were mainly leaks, SF6 showed more leaks

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