CIGRE / US NATIONAL COMMITTEE

GRID OF THE FUTURE (GOTF) SYMPOSIUM, OCTOBER 29, 2018, PAPER SESSION 1A

Impact of GIC on noise performance of power transformers

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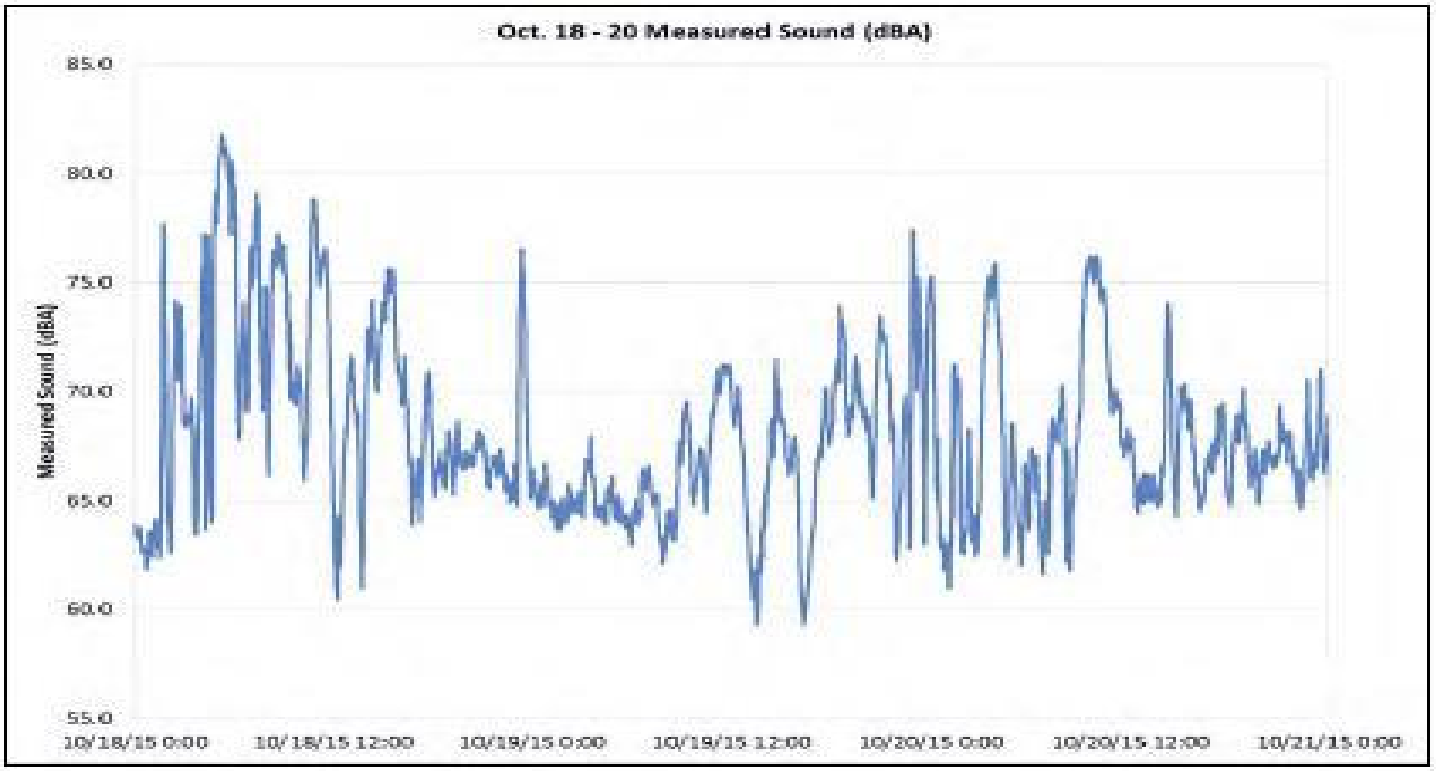
Measured Sound Pressure levels around one transformer – 3 days duration



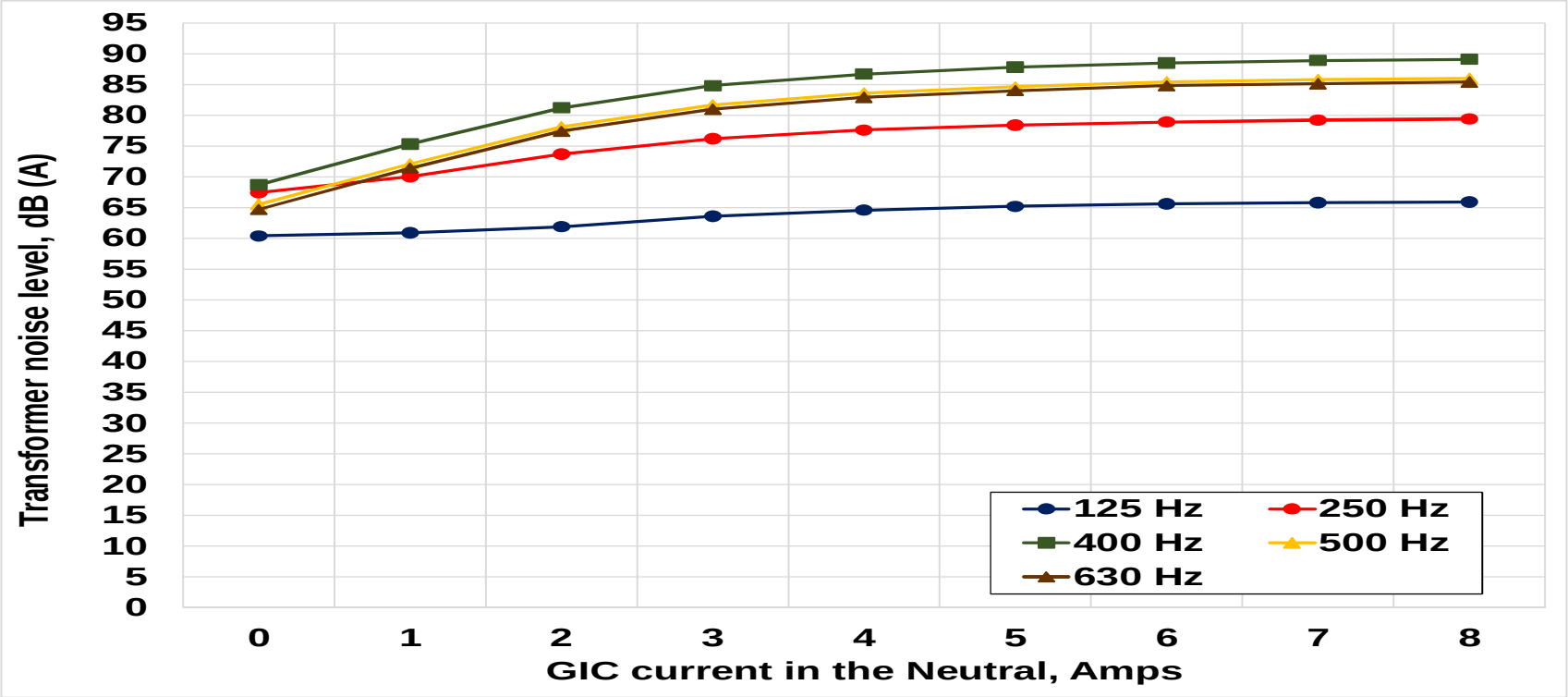
– Sound level variations of up to 23 dB

Calculated impact of GIC on core excitation and core sound level

GIC current in the Neutral, Amps	Flux Density, T	Incremental increase in core flux density, T	Core sound level, dB (A)	Incremental increase in core sound level, dB
0	1.698	--	74	--
1	1.829	0.131	80	6
2	1.902	0.073	86	6
3	1.937	0.035	90	4
4	1.954	0.017	92	2
5	1.963	0.009	93	1
6	1.969	0.006	93.6	0.6
7	1.972	0.003	94	0.4
8	1.974	0.002	94	0

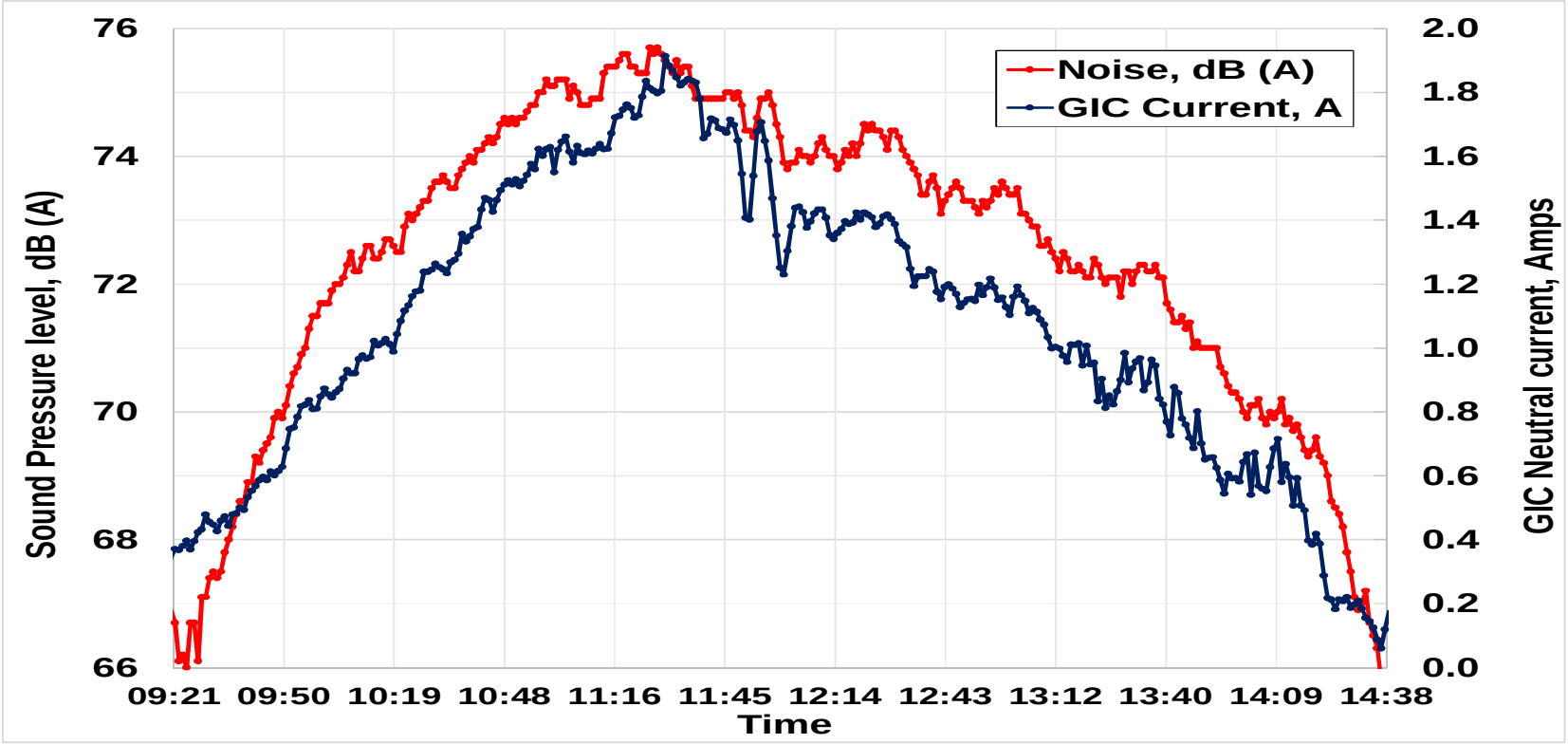
- Incremental increase in core excitation and sound level is highest at low levels of GIC
- The impact slows down significantly beyond 4 Amps GIC as the core reaches the magnetic saturation region

Calculated impact of GIC on frequency spectrum of core noise



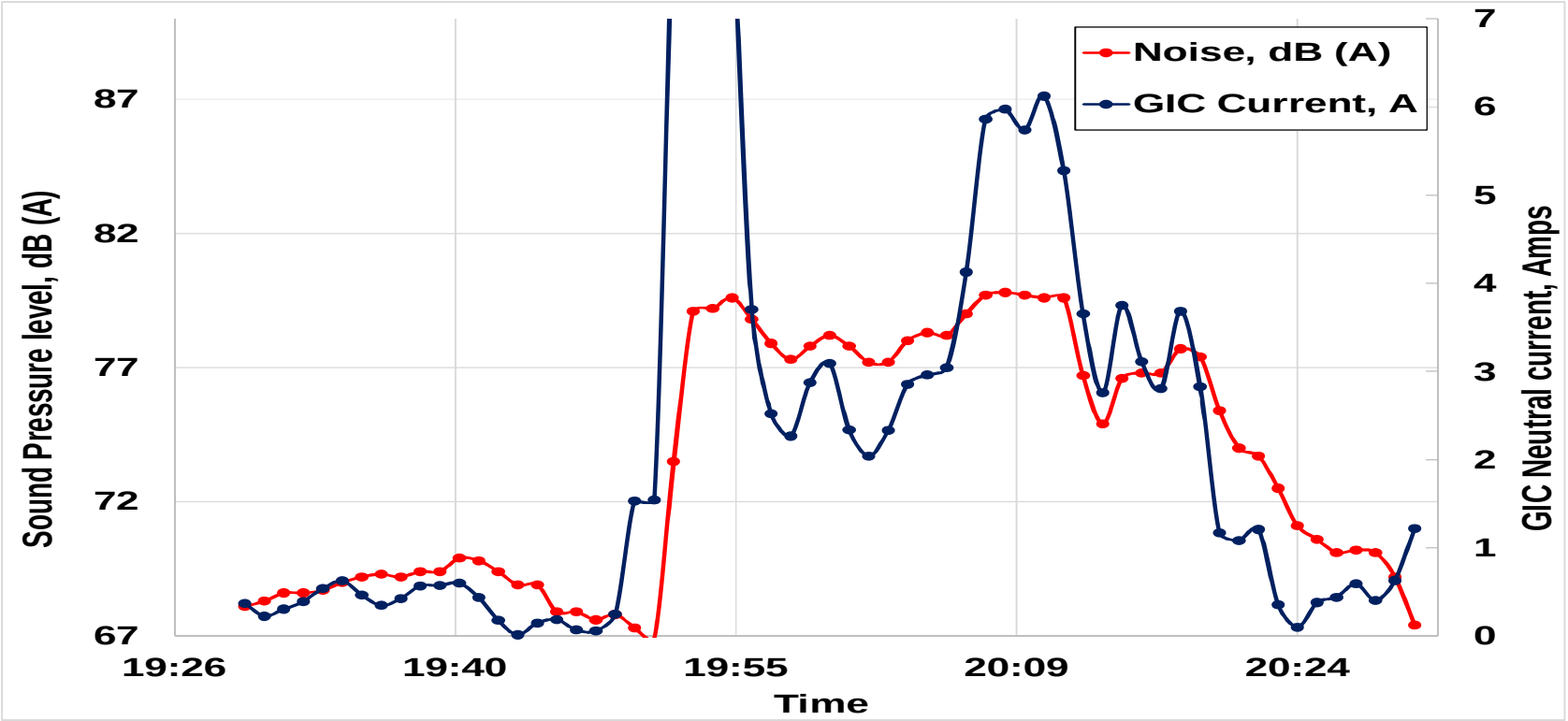
- Impact is highest on higher frequency components (≥ 400 Hz)
- The impact slows down significantly beyond 4 Amps GIC

Correlation between magnitude of GIC and sound level @ low level GIC



– Good correlation between the signature of GIC and the resulting sound levels

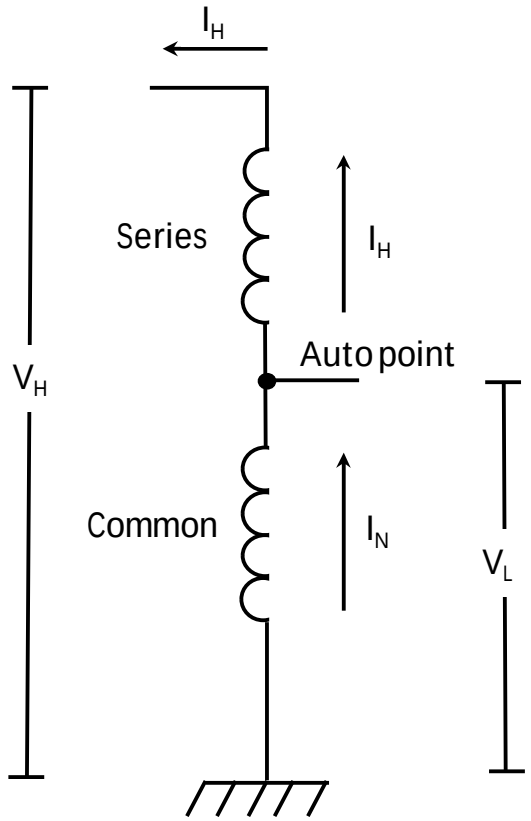
Correlation between magnitude of GIC and sound level



– Sound level increases as much as 10 dB at magnitudes of GIC up to 3 Amps

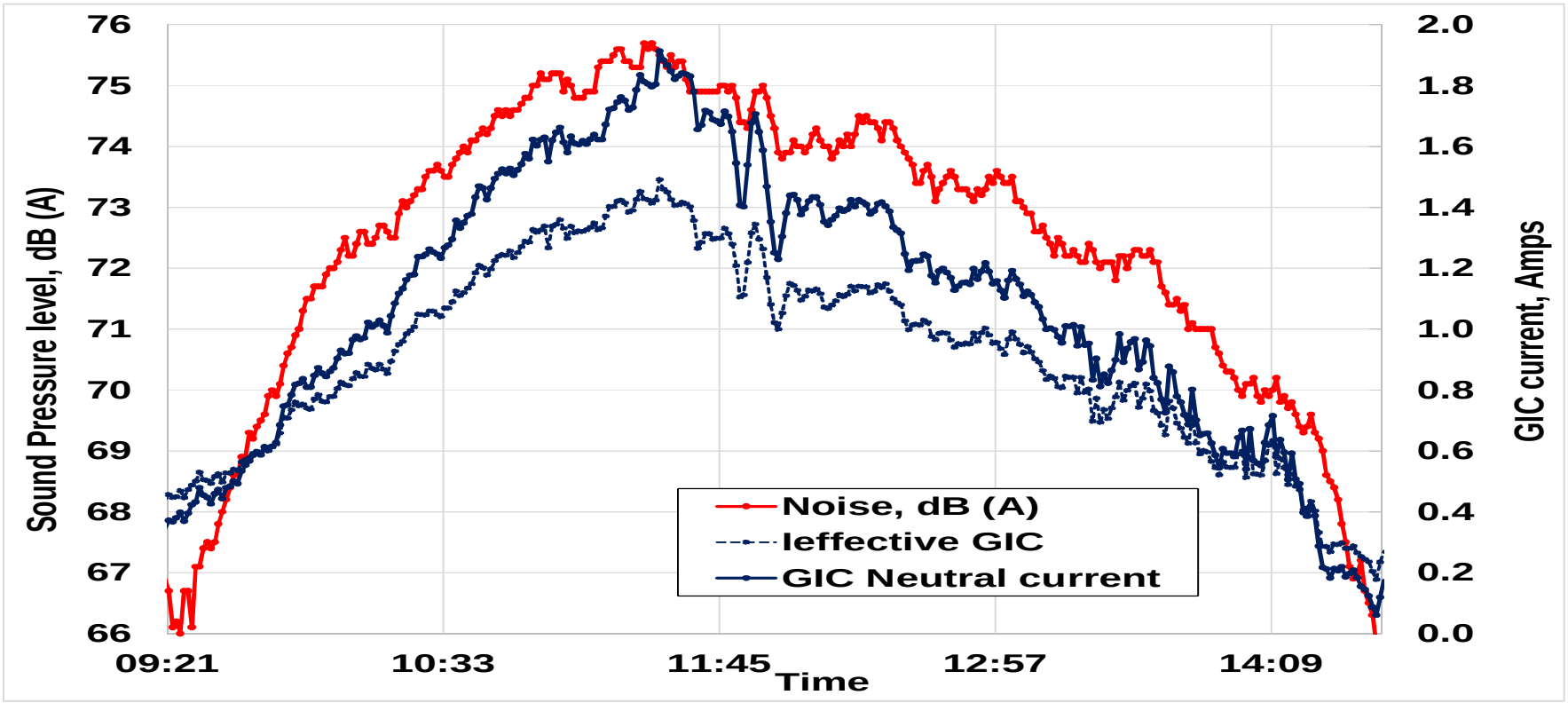
– Insignificant sound level increases at higher magnitudes of GIC

Effective GIC in Auto-transformers



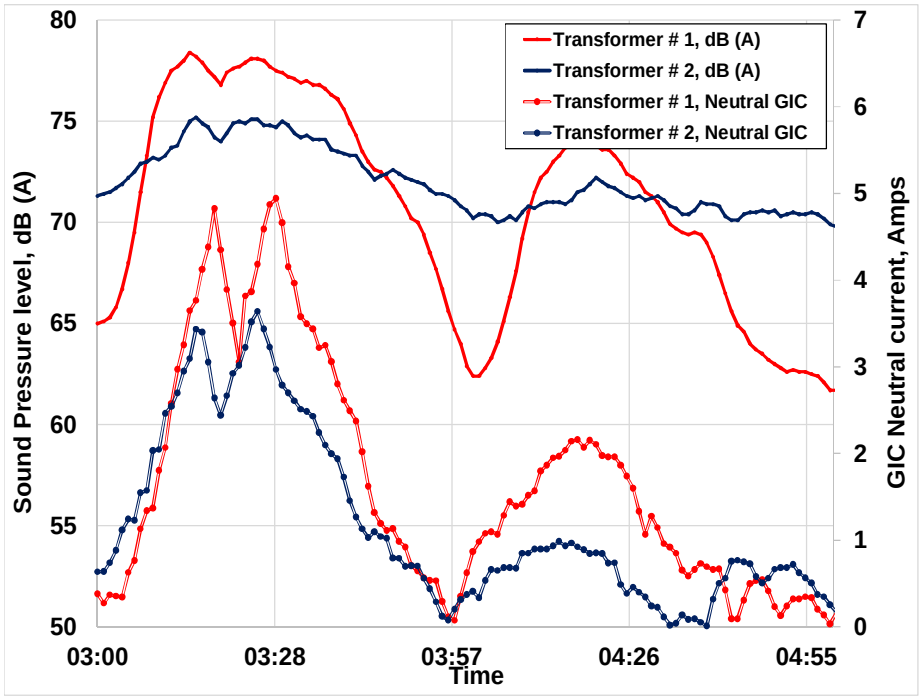
$$Effective\ GIC = GIC_H + \left[(GIC_N - GIC_H) \cdot \left(\frac{V_L}{V_H}\right)\right]$$

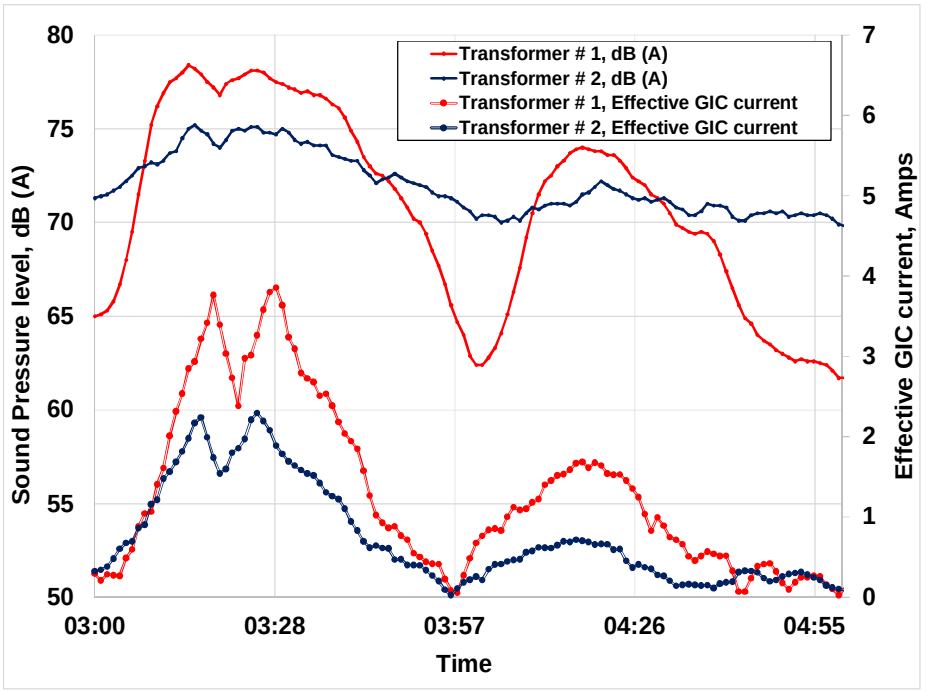
Correlation of sound level with magnitudes of GIC



– High degree of correlation between sound level and both the GIC current flowing through the neutral and the effective GIC

Correlation of sound level with magnitudes of GIC in the neutral and Effective GIC





- Transformer # 1: Peak GIC neutral current of 5 Amps → 13 dB — Peak GIC effective current of 3.8 Amps → 13 dB
- Transformer # 2: Peak GIC neutral current of 3.7 Amps → 5 dB — Peak GIC effective current of 2.3 Amps → 5 dB
  - Ratio of peak neutral currents = 1.35 — Ratio of peak effective currents = 1.65
  - Better correlation of sound level with effective GIC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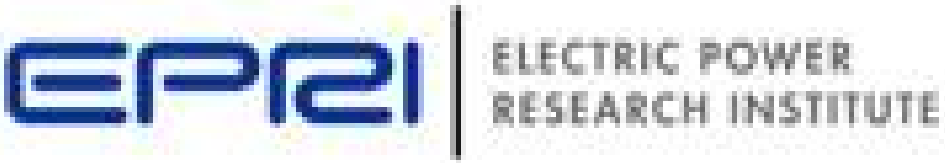
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