Rotor Bar % Continuity Tests Using the El-Cid Equipment.

(Highlights of over 290 tests)

J McMurdo

The ‘Extreme’

Major Damage to:

- **Rotor Winding**
- **Rotor Core**
- **Stator Core**
- **Stator Winding**

Rotor Bar Types

- Bar profile:
  - T
  - L
  - Rectangular
  - Round
  - Pyramid
  - Square.
- Material:
  - Copper
  - Brass
  - Aluminium
  - Silicon-Bronze
  - Steel

Approaching the ‘Extreme’

Bars de-brazed from s/c ring, eroded through the slot bridge,

Being rubbed down by contact with the stator core

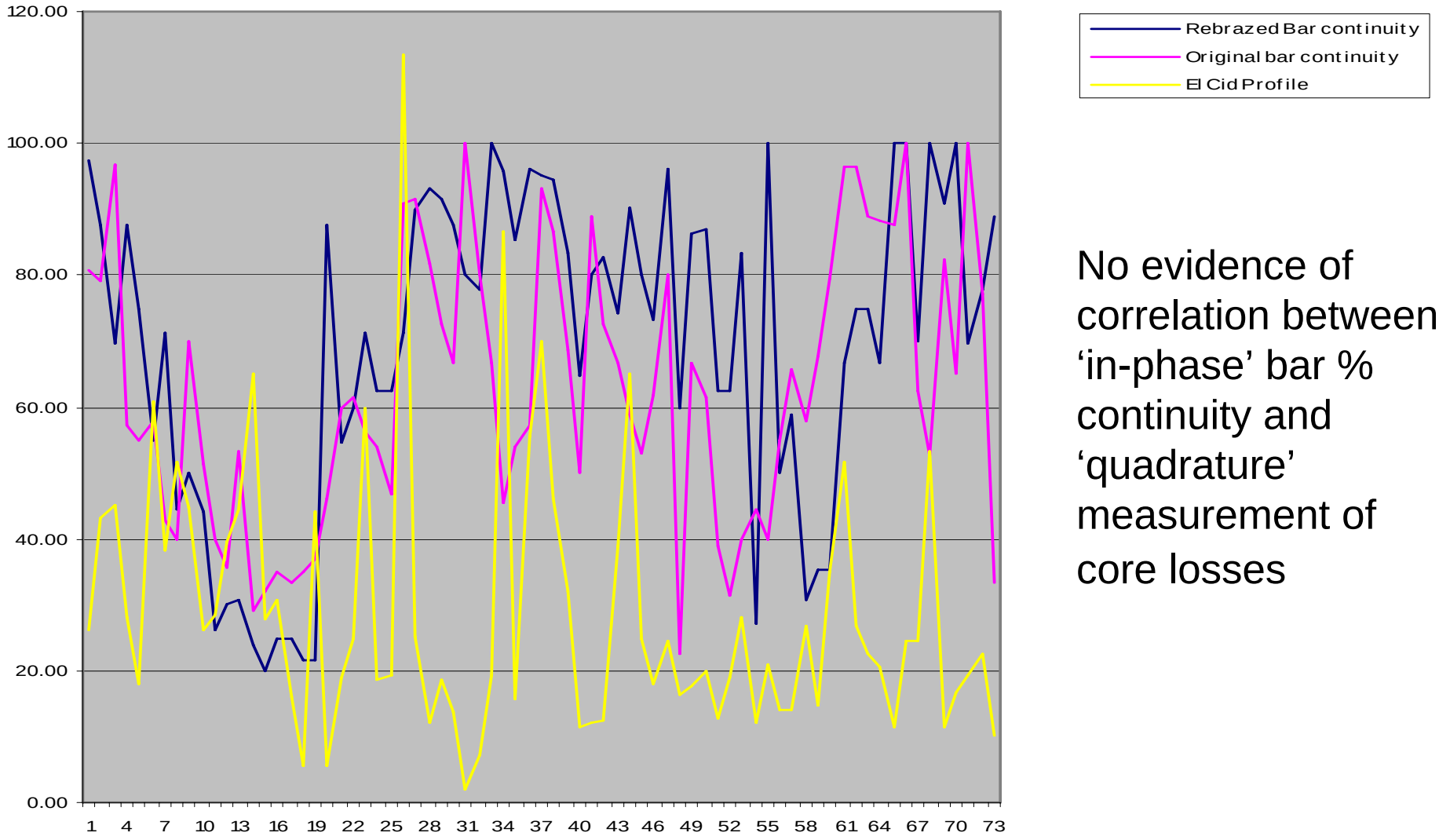
Broken Rotor Bars

Numerous broken bars, erosion of slot bridges in progress

Inadequate Brazing [A]

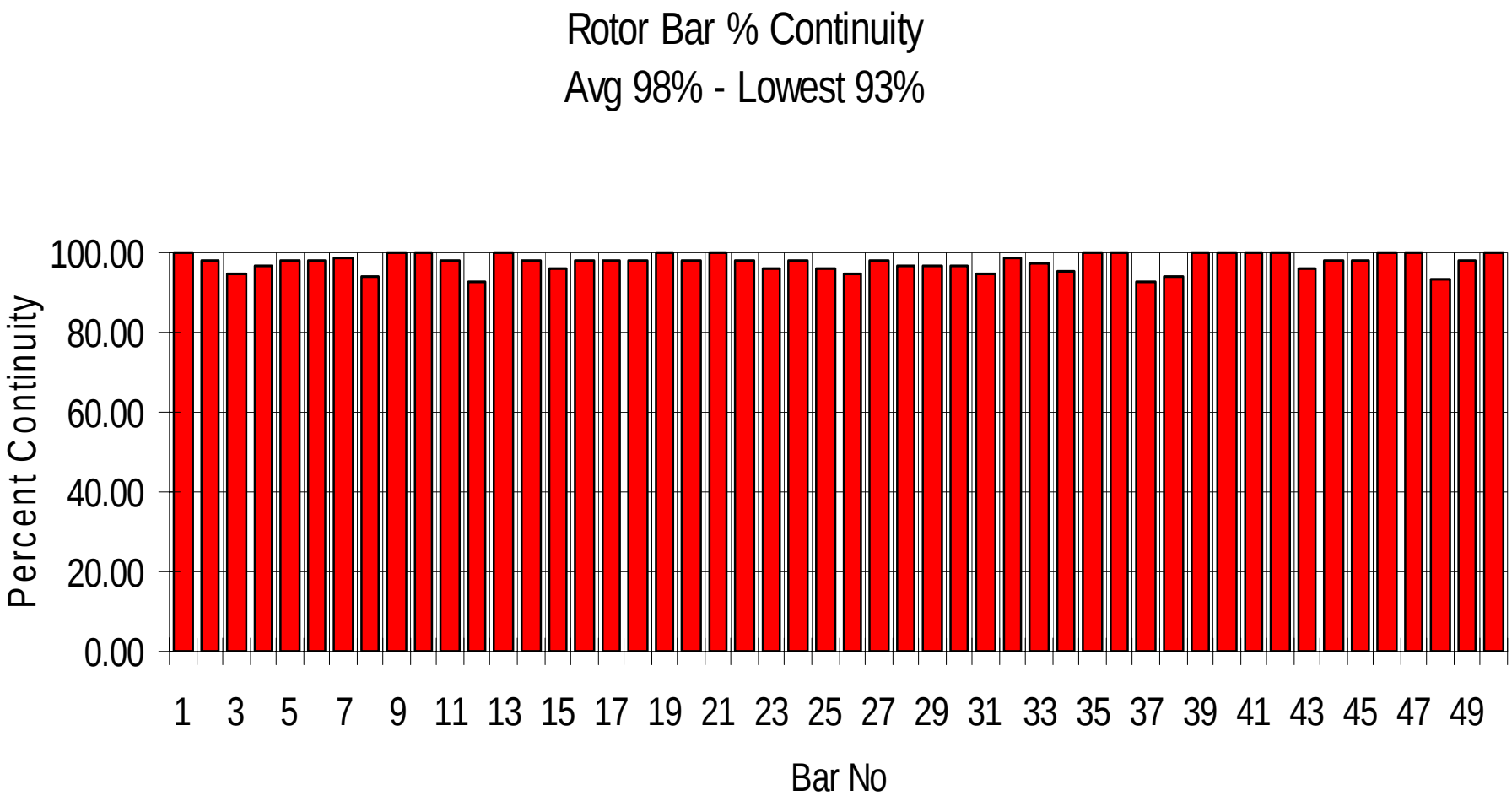
Inadequate Brazing [B]

Bar % Continuity and Core Losses



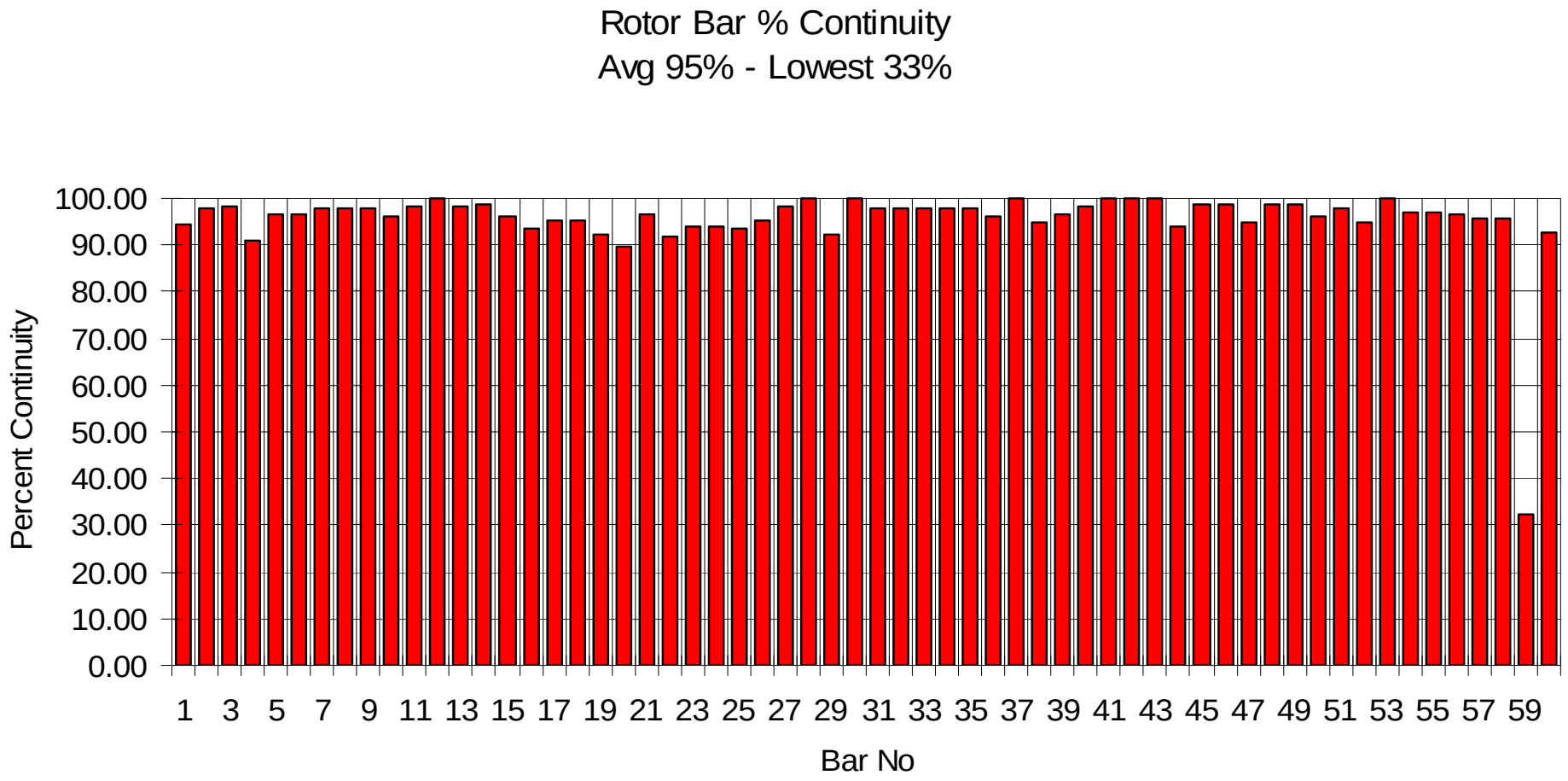
No evidence of correlation between ‘in-phase’ bar % continuity and ‘quadrature’ measurement of core losses

Good

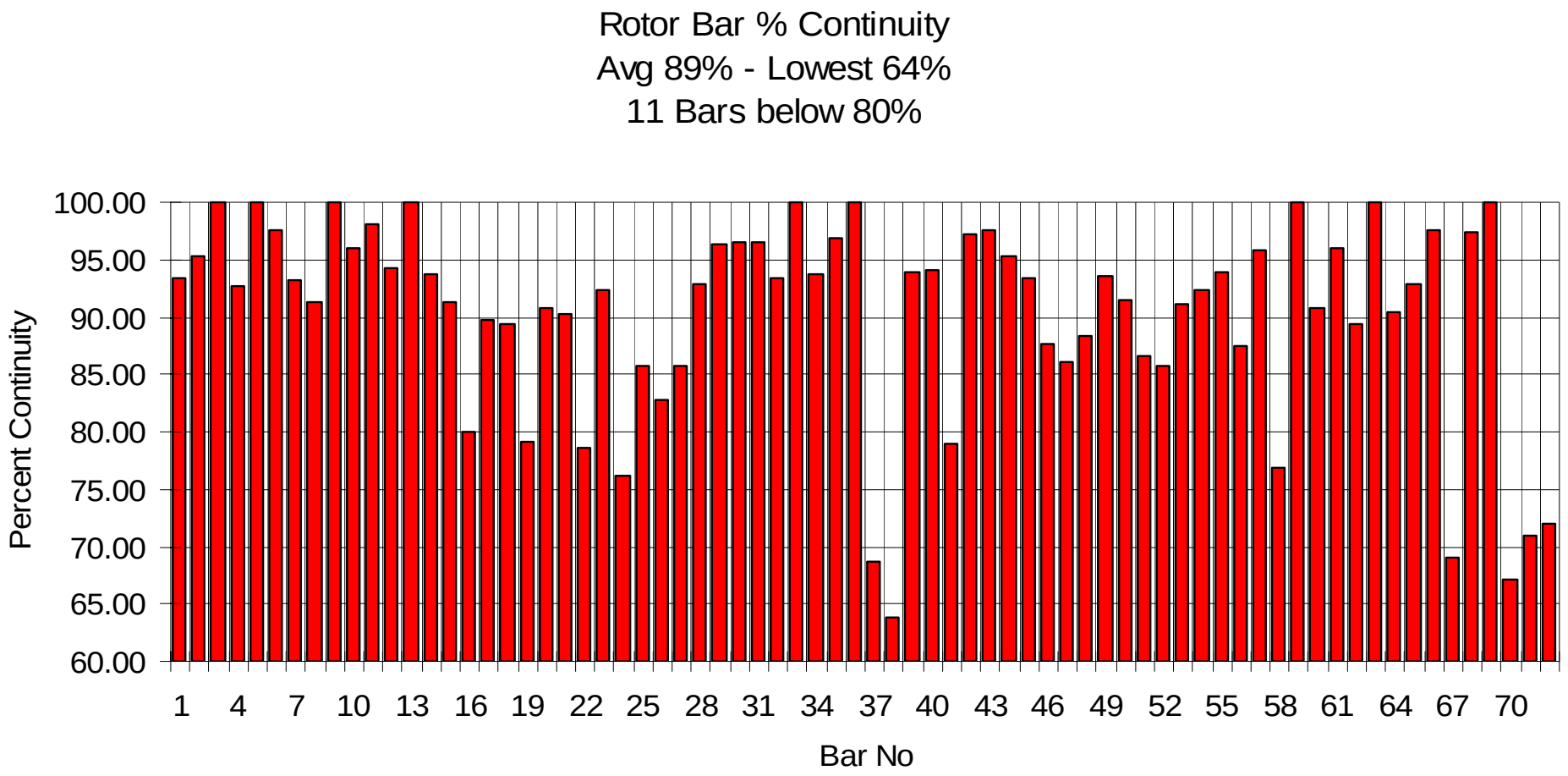

Rotor Bar % Continuity
Avg 98% - Lowest 93%
Percent Continuity
100.00
80.00
60.00
40.00
20.00
0.00
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Bar No

One Low Indication

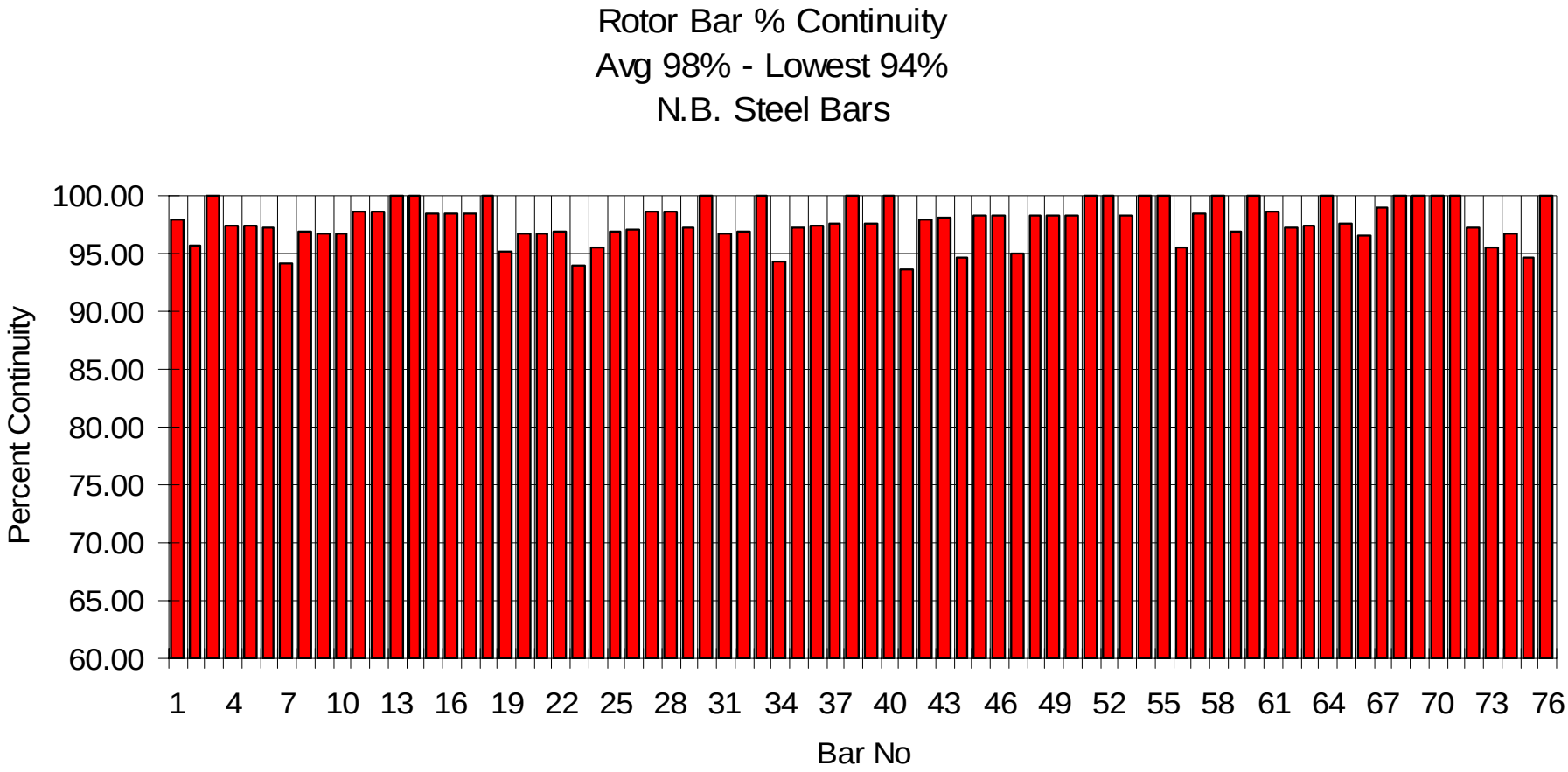
**Localised Repair Possible*



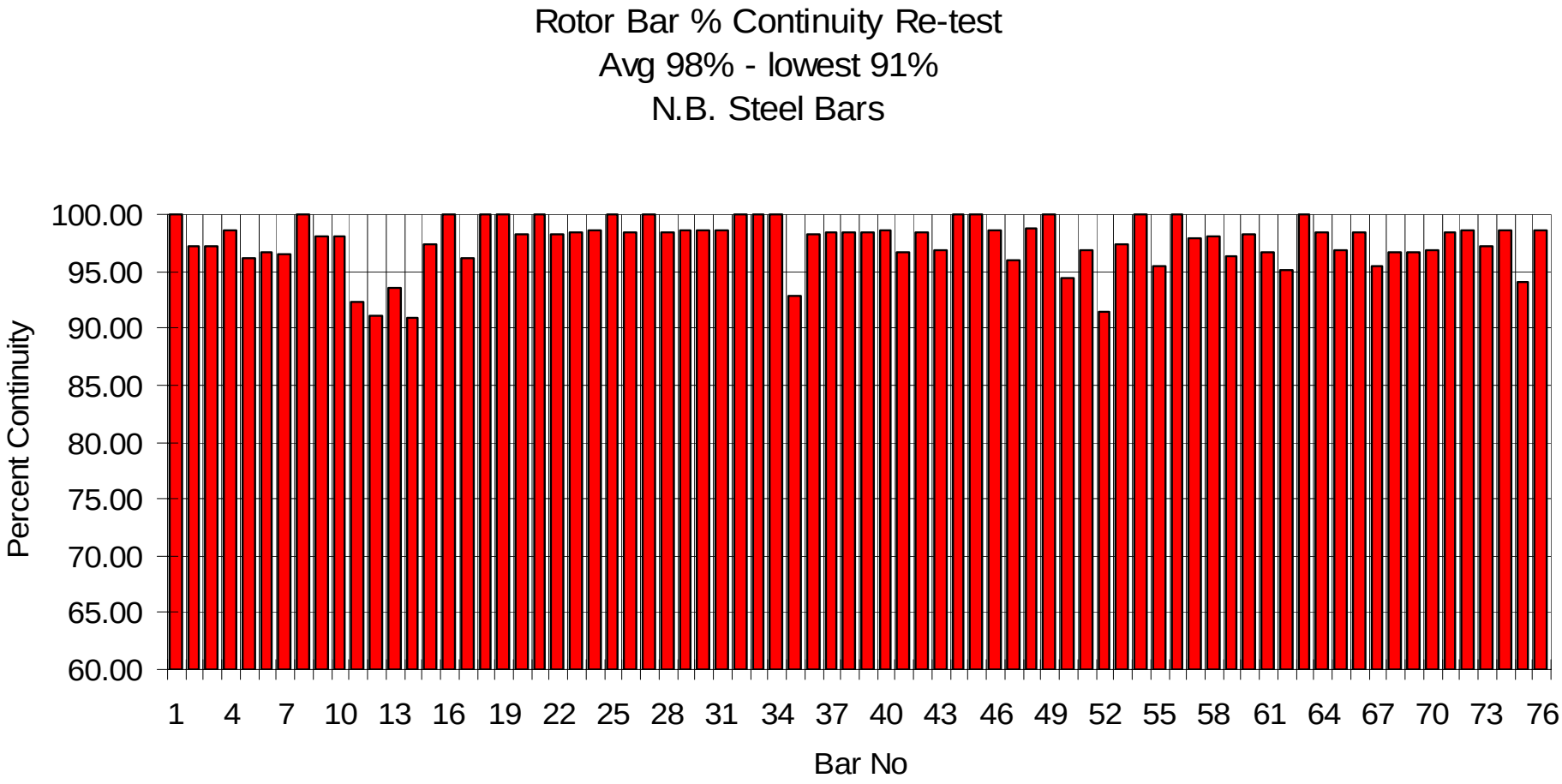
Numerous Low Indications
**Major Repairs Indicated*



Steel Bars to Copper Short Circuit Rings [A]



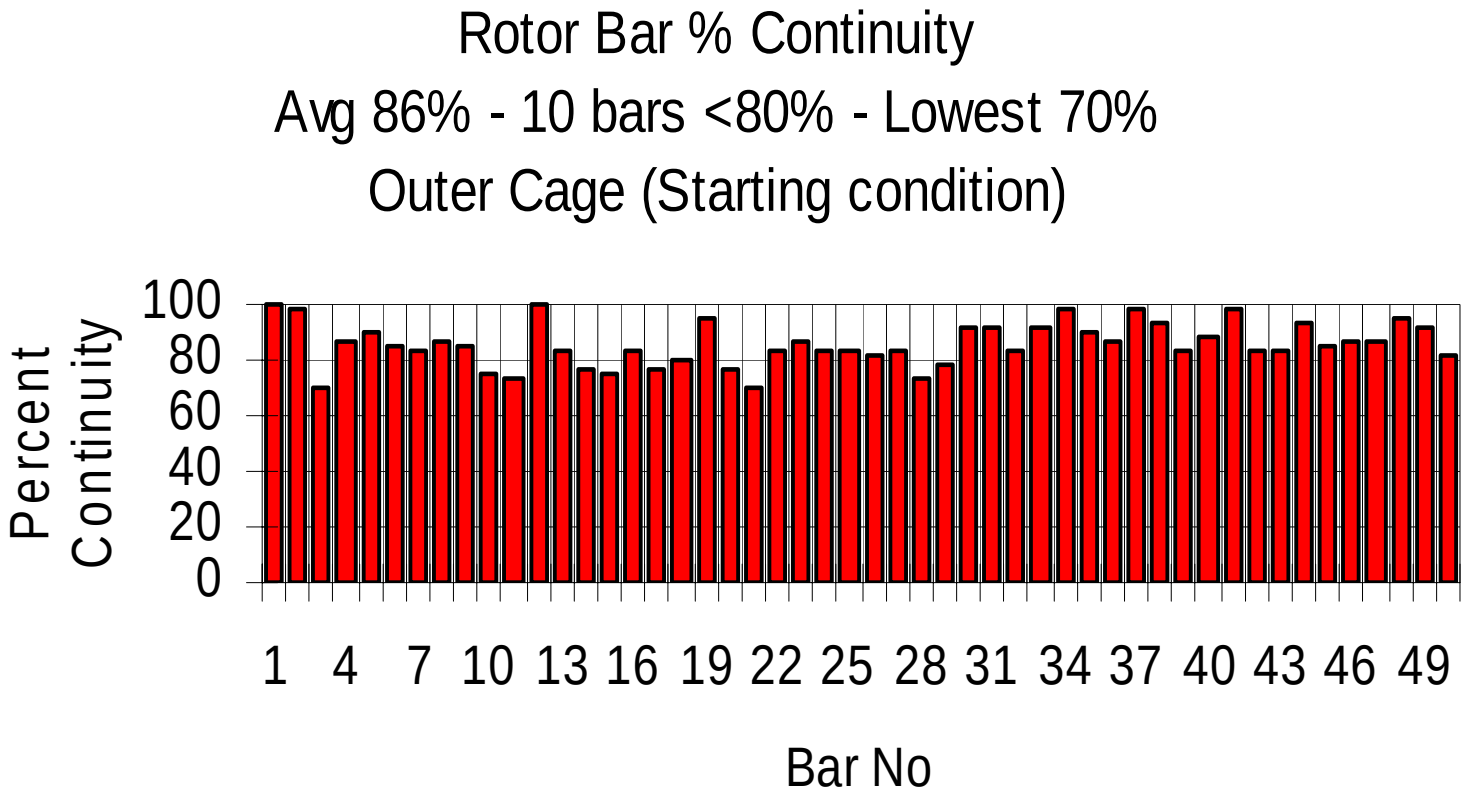
Steel Bars to Copper Short Circuit Rings [B]



Induction Techniques

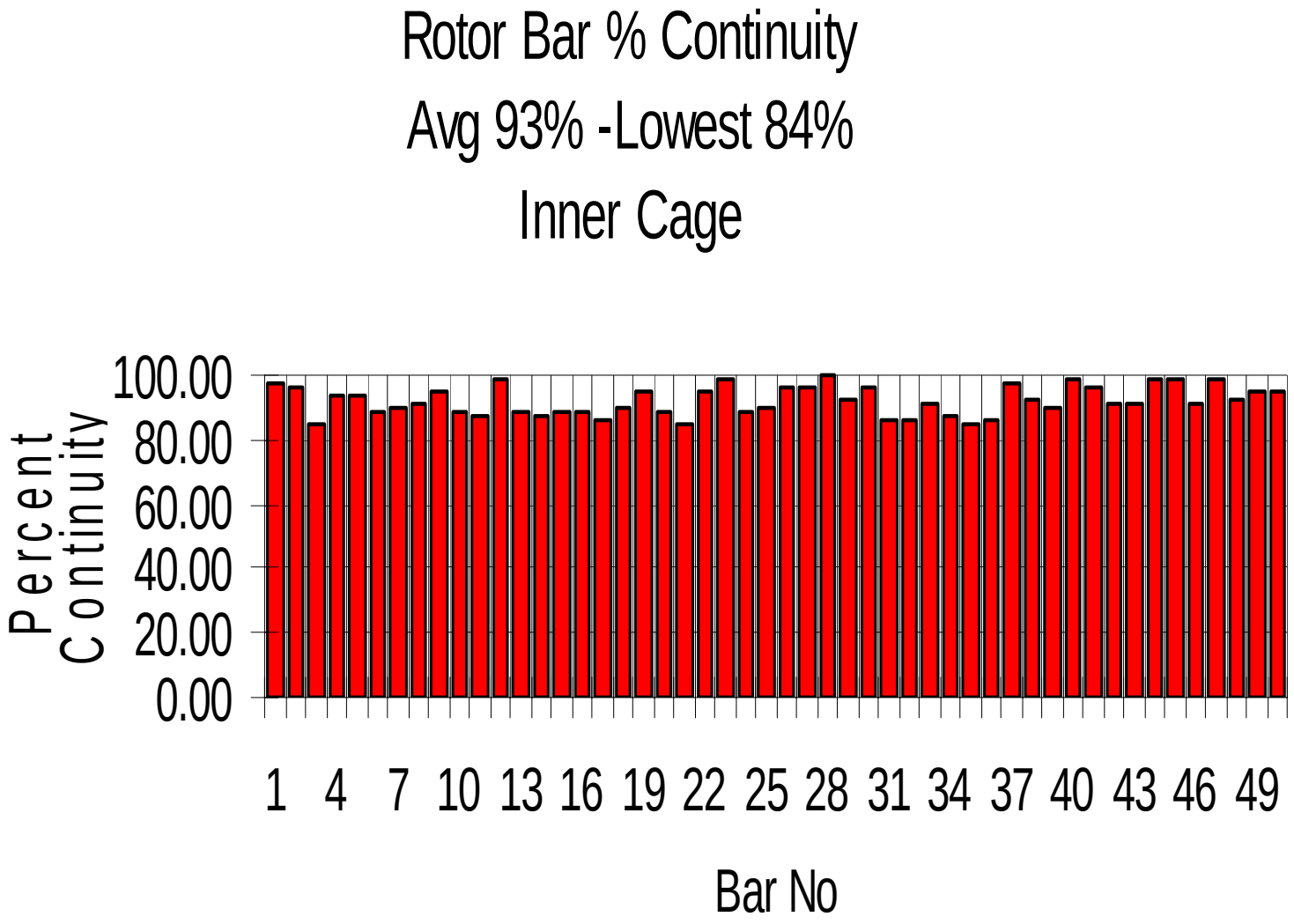
- Work using the ‘Wissink’ tester first performed at Bonnycan and refined during the Author’s continued development work at GEC / Alstom and Wadeville AW
- Induction coil ‘growler’ combined with El-Cid equipment to qualify starting condition [50hz]

Die-Cast Aluminium Rotor
**Outer Cage*

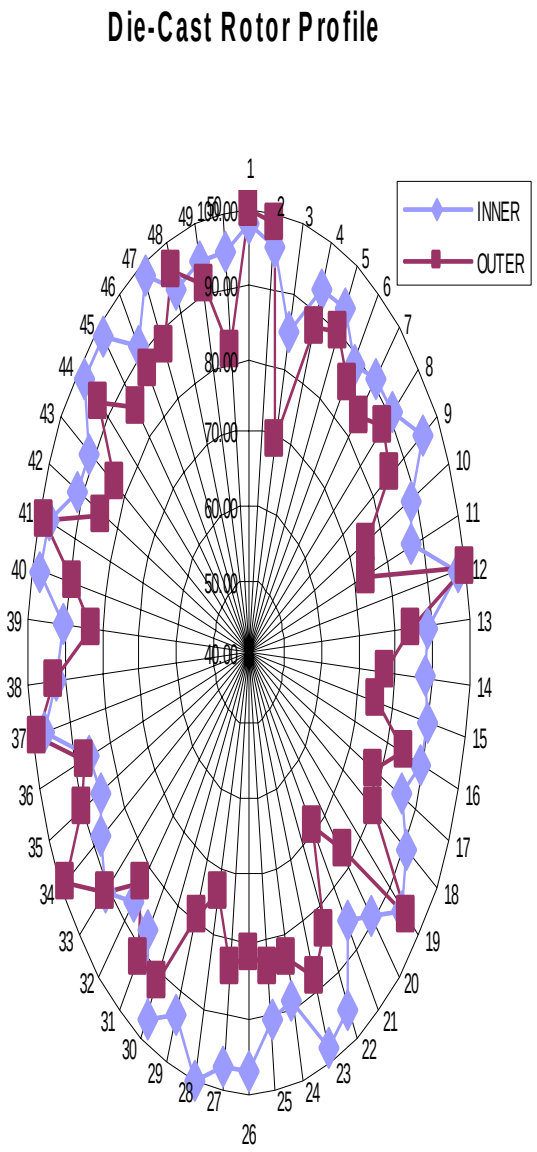


Die-Cast Aluminium Rotor

**Inner Cage*



Die-Cast Rotor Bar
*<u>*Combined*</u> *Profile*



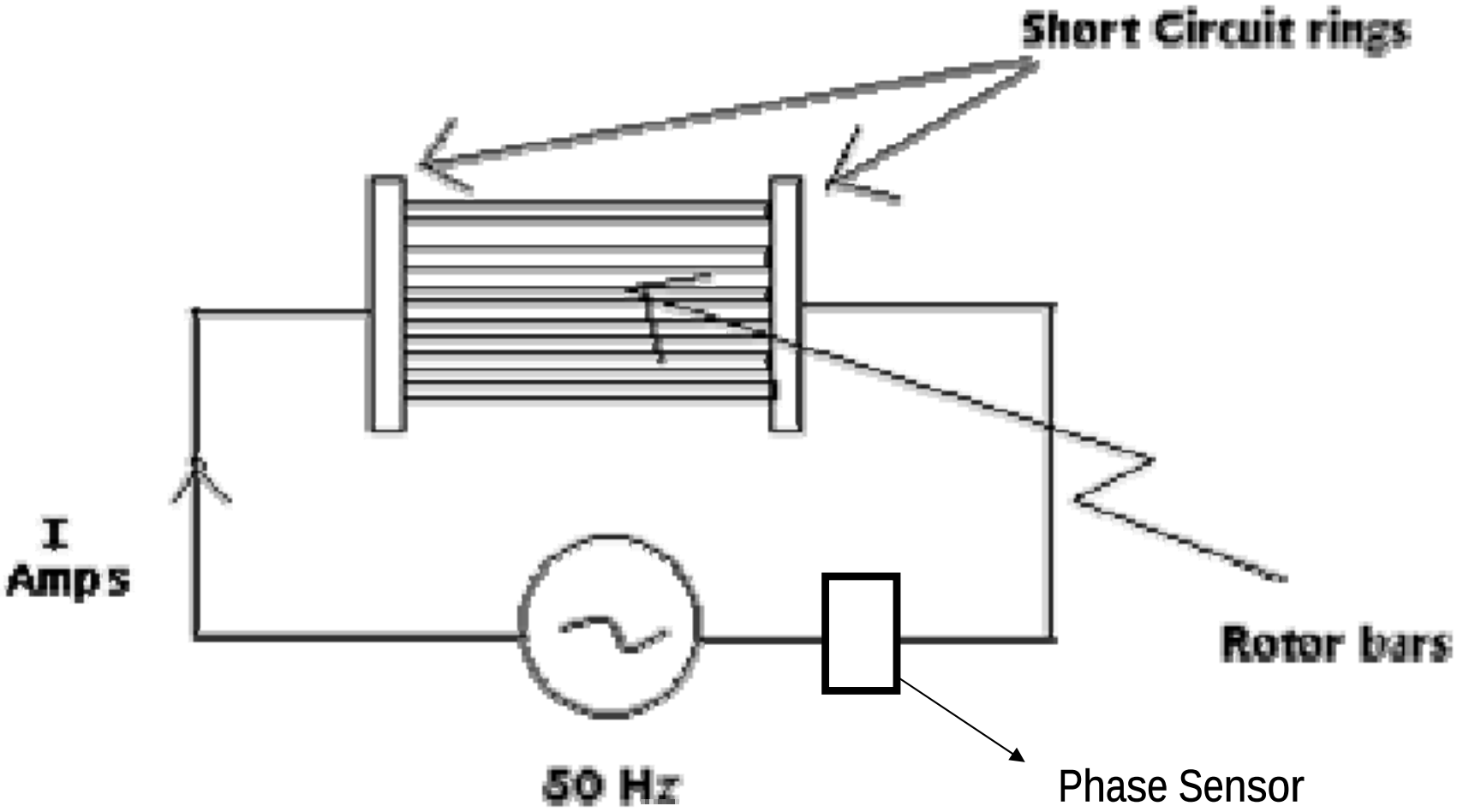
El-Cid Technique

- Direct applied current
- Measurement using the Rogowski coil (Chattock potentiometer) coreless, non-inductively wound sensor.
- In-phase measurement rather than quadrature
- Technique differentiates between
  1. broken bars and
  2. poor ‘bar to short circuit ring’ joints

El-Cid Technique (cont'd)

- Accuracy: Calibrated to within 0.5%
- Repeatability: Bar #1 hard stamped, bar #2 stamped to confirm progression

El-Cid Technique



Conclusion

- *Rotor bar problems still occur*
- *Testing at the assessment stage is of value in preventing the ‘Extreme’*
- *Re-test to prove efficacy after repairs*
- *End-user operational feedback is required to maximise value*

The ‘Extreme’

Major Damage to:

Rotor Winding

Rotor Core

Stator Core

Stator Winding

Acknowledgement: This presentation was produced in collaboration with Ron Scollay