Study on cause analysis and detection method of inter-turn short circuit fault of large turbine generator rotor

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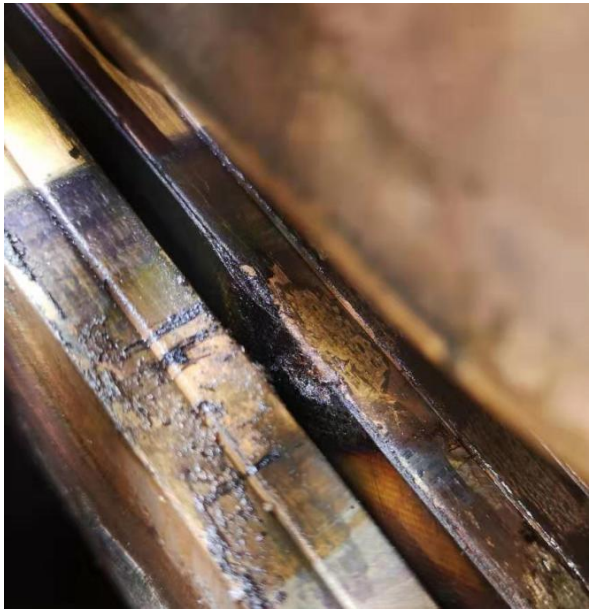
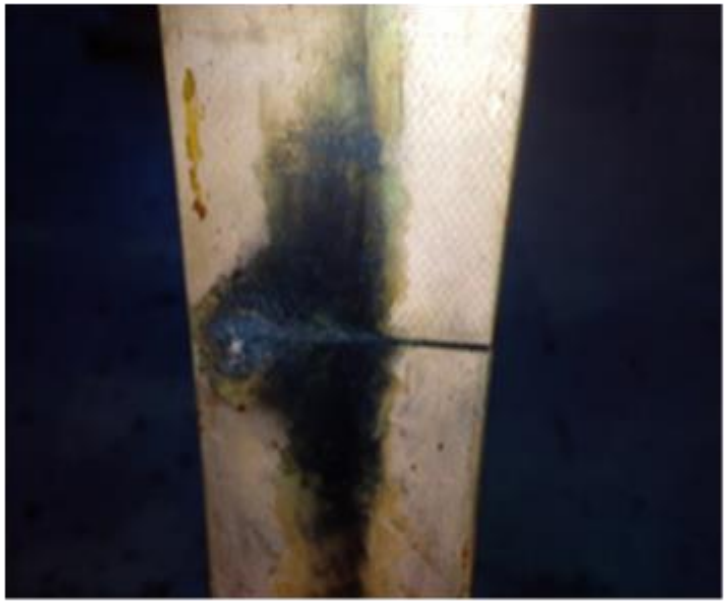
Introduction

Introduction

The inter-turn short circuit fault of rotor winding is a common fault.





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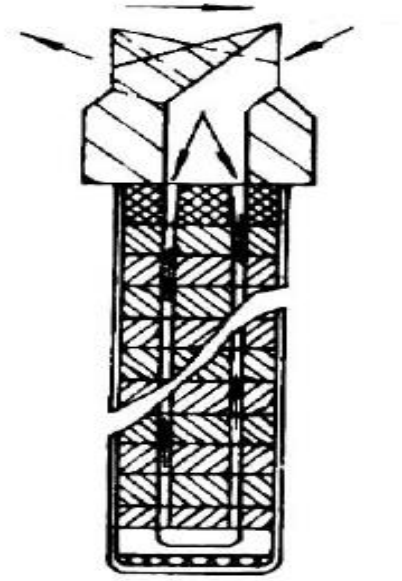
Analysis of rotor insulation

Analysis of rotor insulation



The cooling design of the rotor winding grooves of large turbine generators with 600MW and above capacity class is shown。

Analysis of rotor insulation

As to in-slot windings, the general inter-turn failure occurs mostly near the cooling duct or at the inter-turn insulation stitching region

Analysis of rotor insulation

Failure spot aroud the corner

Displacement of the inter-turn insulation

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Analysis of detection methods

Detection methods

Off-line

- DC resistance
- AC impedance test
- Polar voltage balance method
- RSO test
- Other

On-line

- Detecting coil waveform method
- Operation parameter comparison method
-

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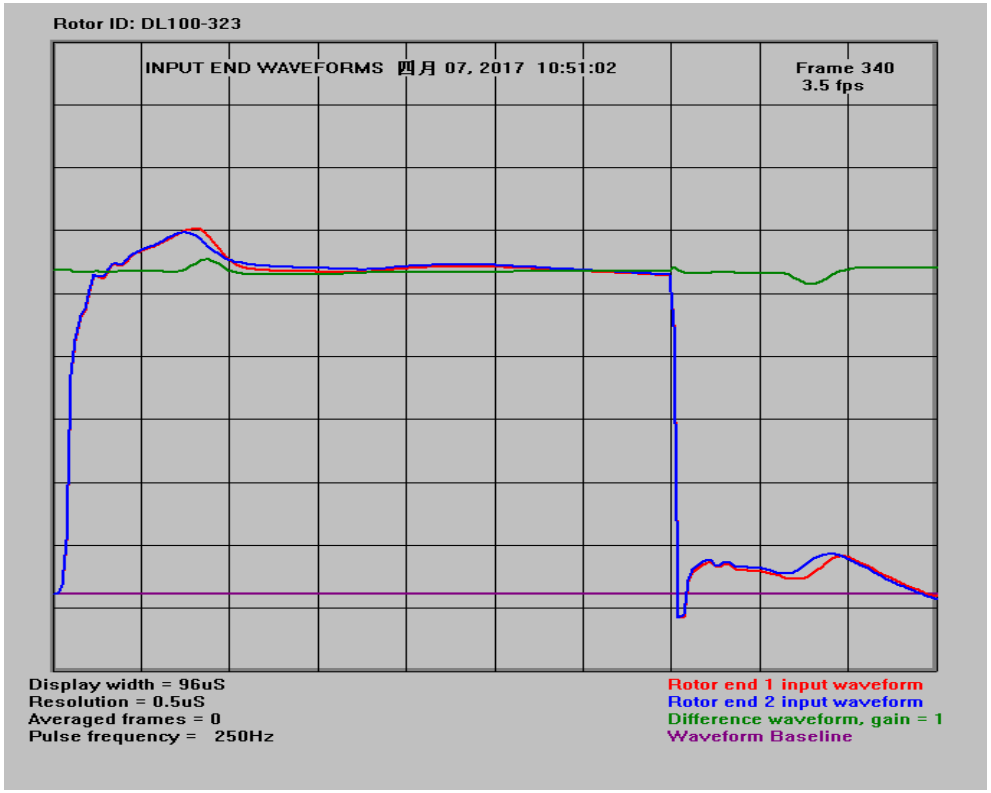
Diagnosis case

Fault diagnosis process

model	Rated capacity
QFSN-600-2-220	667MVA/600MW
Rated rotor voltage	Commissioning time
431V	2010年11月

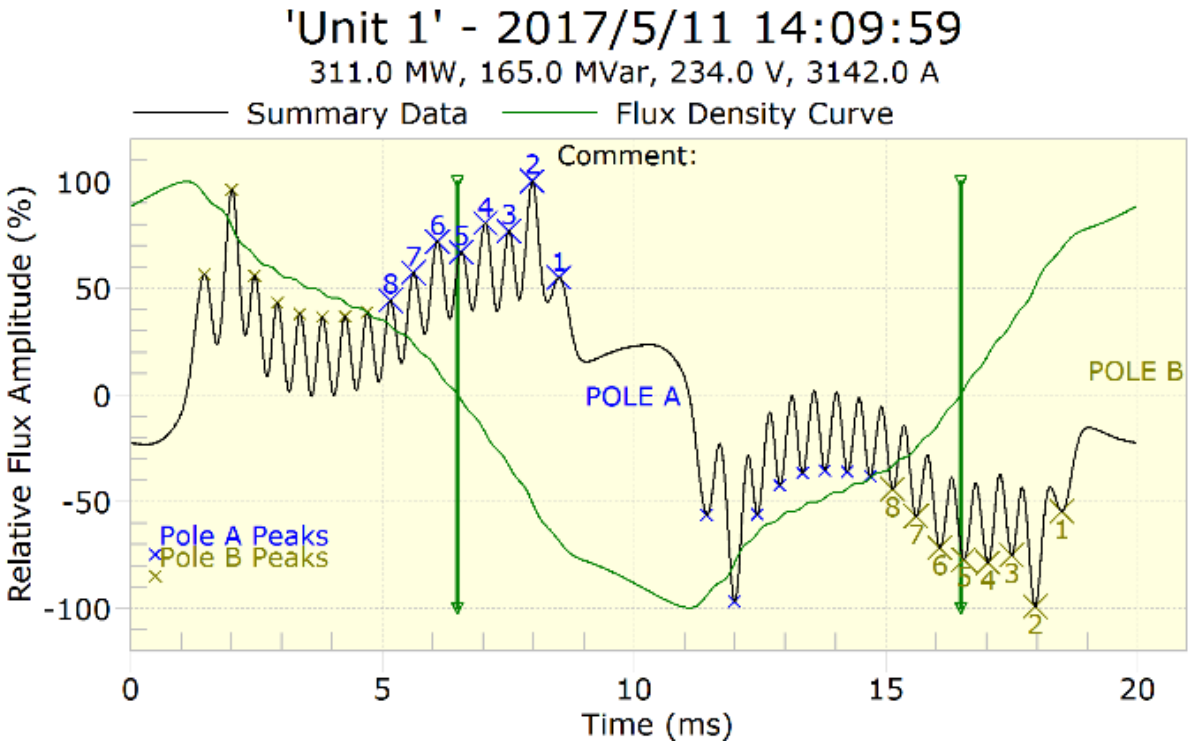
Fault diagnosis process

RSO test



Fault diagnosis process

Detection coil waveform method



Fault diagnosis process

Detection coil waveform method

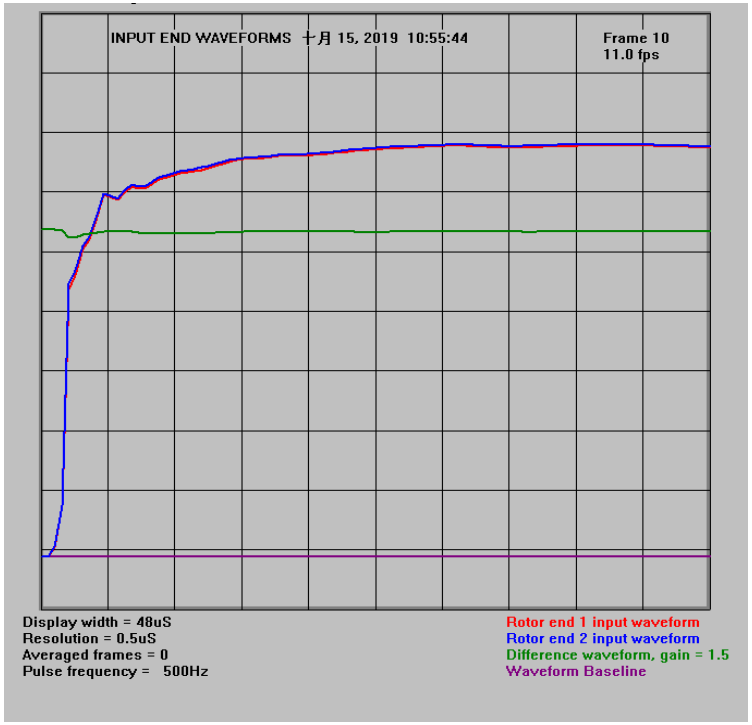
Table 1 Result of the rotor flux test

Coil	Pole-1	Pole-2	Feature value	limit
1	55.2	-54.9	0.47%	15%
2	99.9	-99	0.88%	8%
3	83.2	-81.2	2.41%	8%
4	86.7	-85.5	1.42%	8%
5	78.5	-79.5	1.18%	8%
6	67.1	-66	1.68%	8%
7	49.4	-49.1	0.49%	8%
8	33.9	-40.1	15.18%	8%

NOTE: The feature value and limit in the table are calculated according to formula (6) and (7)

Failure spot

Test after repair



Test after repair

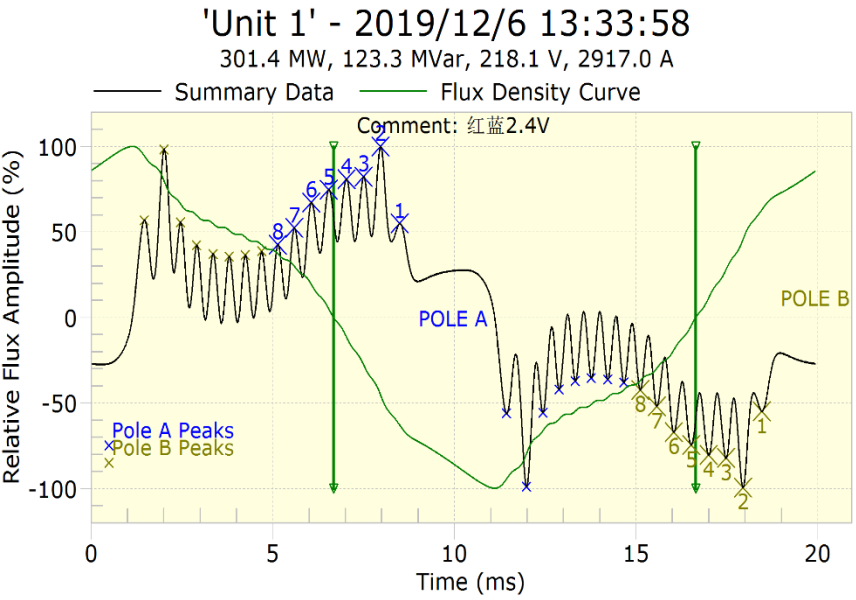


Table 2 Result of the rotor flux test after repair

Coil	Pole-1	Pole-2	Feature value	limit
1	54.9	-55	0.32%	15%
2	99.9	-99.5	0.44%	8%
3	82.2	-82.1	0.04%	8%
4	80.8	-80.6	0.33%	8%
5	74.5	-74.7	0.17%	8%
6	67.1	-67.0	0.13%	8%
7	52.2	-52.1	0.21%	8%
8	42.5	-42.4	**0.19%**	8%

NOTE：The feature value and limit in the table are calculated according to formula (6)and(7)

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Conclusion

Conclusion

1 The RSO is sensitive and accurate in the diagnosis method of the insulation failure between the rotor turns in the shutdown state.

2 The detection coil waveform method is accurate and effective. It is recommended that the power plant be equipped with a detection coil sensor, which is carried out regularly during operation.

3 Other methods, such as operating parameter comparison method, AC impedance method, etc., can be used as auxiliary methods for fault diagnosis.


Thank
You!