RESEARCH ARTICLE

Discussion on outage and parallel methods of primary fan frequency conversion failure of thermal power generating units

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Abstract: Large thermal power plants use primary fan frequency converters to control the speed of the primary fan, which brings considerable economic benefits to the power plant. Frequency converter faults often occur during the operation of the frequency converter, causing the primary fan frequency conversion to cut the power frequency or trip, resulting in unstable operation of the thermal power unit or reduction in output. In order to ensure that the primary wind turbine can be safely shut down due to frequency conversion failure and can operate safely in parallel after the frequency converter is inspected, this article discusses this process.

Keywords: Thermal power unit, Primary fan, Frequency converter, Parallel, Combustion stability

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1 Introduction

The 2×330MW thermal power engineering boiler of a thermal power plant is a subcritical, primary intermediate reheat, controlled circulation drum furnace. The boiler adopts a full-swing once-through burner for temperature regulation, with four-corner arrangement and tangential combustion; a double-inlet and double-outlet coal mill cold primary air positive pressure direct-blowing pulverizing system. Equipped with two single-suction double-support centrifugal primary fans, the two primary fans run in parallel[1]. The primary fan is driven by a motor, and each primary fan is equipped with a frequency converter. During normal operation, the output is adjusted by variable frequency, and during power frequency operation, it is adjusted by the inlet static vane.

Since the normal operation of the primary fan is frequency conversion regulation, during the de-parallel operation of the fans, changing the frequency may cause the fan characteristics to change, causing one fan to reverse, thus affecting the stability of the boiler combustion[2]. In this case, this article discusses the shutdown and paralleling process of the primary fan of the thermal power unit.

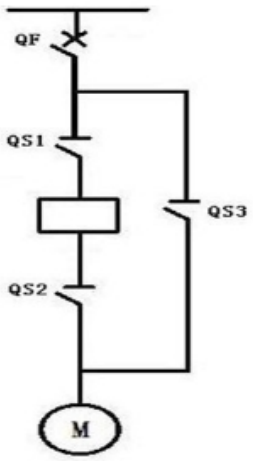

Figure 1 Primary fan wiring diagram

2 Operation mode of A/B primary fan and triggering conditions for frequency conversion switching of primary fan

2.1 Operation mode of A/B primary fan

Primary fan power frequency mode: Primary fan QS1 switch is in the open position, primary fan QS2 switch is in the open position, and primary fan QS3 switch is in the working position. [3]

Primary fan frequency conversion method: Primary fan QS1 switch working position, primary fan QS2 switch working position, and primary fan QS3 switch disconnected position.

2.2 Trigger conditions for frequency conversion switching of primary fan

When the bypass of the primary fan transformer is put into operation (with the primary fan QS1 closed and the primary fan frequency converter running[4], with a delay of 3 seconds) and any of the following 4 conditions are met, the pulse lasts for 4 seconds:

A fan frequency converter malfunction indication with a delay of 500ms; When the current of the primary fan is greater than 5A (quality judgment) and the primary fan frequency converter is running, both signals disappear and the pulse lasts for 1 second[5]; (No fan QS1 has been closed and QS1 has been opened) and (no fan QS2 has been closed and QS2 has been opened); All three conditions are met: (1) the deviation between the frequency command and feedback of the primary fan is greater than 3Hz[6]; (2) the pressure of the hot primary air duct 1 and 2 is both less than 5kPa; (3) there is a minor fault in the primary fan frequency converter.

3 Analysis of dangerous points and matters needing attention when shutting down and resuming operation of primary wind turbines

When shutting down the primary fan, operate it slowly to prevent significant fluctuations in primary air main pipe pressure, unit load, main steam pressure, temperature and drum water level. [7-8]

With permission, the operator on duty can release the primary fan RB protection on the DCS screen to prevent the primary fan from shutting down the RB action.

The oil gun on the A layer of this boiler is igniting normally. If any problems are found, please contact maintenance in time to keep them in good condition.

The unit load is maintained below 60% load and operates stably.

Keep A and B coal mills running, and when combustion is unstable, promptly put in the A layer oil gun to stabilize combustion[9].

Before shutting down a faulty fan, take measures to prevent the hot and cold air at the outlet and the contact baffle from malfunctioning.

In order to prevent combustion instability caused by large fluctuations in primary air pressure when the primary fans on both sides are operating in parallel[10], the A-layer oil gun should be put in to stabilize combustion before starting the primary fans after maintenance.

4 Operation steps for shutting down a faulty fan to eliminate defects

1. Confirm the cause of the failure of the primary fan inverter;

2. Reduce the load of the unit to below 60% load for stable operation; put the primary fan outlet contact baffle in the open position;

3. Lift the RB protection when the primary fan of this boiler is shut down;

4. Contact the thermal control to test the cold primary air baffle at the primary fan outlet on the fault side;

5. Contact the thermal control to test the hot primary air damper at the outlet of the corresponding side air preheater;

6. Contact the thermal control to test the primary fan outlet contact baffle;

7. Release the "automatic" primary air pressure adjustment of this boiler;

8. Gradually close the inlet adjustment baffle of the faulty primary fan to fully closed, and at the same time increase the frequency of the primary fan inverter on the other side to maintain normal primary air main pipe

pressure;

9. Switch the control mode of the outlet baffle of the failed primary fan to "local"

10. Slowly close the outlet baffle of the failed primary fan;

11. Check the faulty primary fan outlet baffle and close it tightly to stop the primary fan operation; at the same time, adjust the frequency of the primary fan inverter on the other side to maintain the normal pressure of the primary air main pipe;

12. Exit the faulty primary fan to change cutting and baffle override buttons;

13. Send the input switch QS1 of the faulty primary fan inverter to the working position; send the output switch QS2 to the test position; set the bypass switch QS3 to the zero position.

14. Set the outlet baffle of the primary fan on the fault side to "no operation"; contact the thermal control to set the primary fan to the test position;

15. Cooperate with the maintenance to carry out the airlift test of the primary fan frequency converter;

16. After the airlift test of the primary fan inverter, safety measures shall be taken one by one according to the requirements of the maintenance work ticket.

5 Steps for restoring parallel operation after completing the fault elimination of the fan once

After the inspection work of the failed primary fan is completed, the electrical maintenance will be inspected and explained[11]. The boiler professional will take measures to prevent the primary fan from reversing. Only after a comprehensive inspection on the spot is normal can the operation be resumed.

1. Move the input and output switches of the primary fan inverter to the working position; the bypass switch returns to normal.

2. Confirm that the primary fan has the conditions to start;

3. Confirm that the primary fan inlet adjustment baffle and outlet baffle are fully closed;

4. Unlock the "operation prohibition" of the primary fan outlet baffle; contact the thermal control to cancel the primary fan test position;

5. Put in the oil gun on the A layer of the boiler and check for normal operation;

6. The frequency conversion starts the fan operation once and checks the normal operation;

7. Slowly open the fan outlet baffle once on the spot, then open it fully and then turn it to remote control;

8. Gradually increase the frequency of the primary fan to basically the same frequency as the primary fan on the other side.

9. Gradually close the primary fan inlet adjustment baffle on the other side to 80% according to the pressure of the primary air main pipe;

10. Slowly open the primary fan inlet adjusting baffle; at the same time, lower the primary fan inlet adjusting baffle on the other side to maintain normal primary air main pipe pressure;

11. Gradually reduce the frequency of the primary fan according to the output of the primary fan and the pressure of the primary air main pipe;

12. When the frequencies, inlet adjustment baffles, and currents of the two primary fans are basically the same, gradually open the inlet baffles of the primary fans on both sides fully;

13. After the inspection is normal, withdraw the oil gun from the boiler A layer;

14. Put in the primary fan cutting and baffle override buttons;

15. Contact thermal control recovery protection measures and restore unit load according to dispatch requirements.

6 Conclusion

Through the above operations of primary fan inverter outage and frequency conversion parallel process, we can

see the key points in the parallel and decoupling operation of primary fans. During the operation process, only by grasping these key points can the pressure of the primary air main pipe be ensured to be stable, thereby ensuring This ensures the stability of the output of the milling system, thus ensuring the stable operation of the unit.

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