

Cause Analysis on Vibration Trip of Methanol Synthesis Gas Compressor

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Keywords: compressor vibration bearing trip

Abstract: a methanol synthesis compressor unit in our workshop experienced severe vibration during operation in March. The compressor is a centrifugal compressor manufactured by Shaangu, and its source motor is a three series steam turbine manufactured by Hangqi. The vibration alarm value of compressor support bearing is 62 μm , and the trip value is 76 μm . The rated speed of compressor unit is 11060rpm, and the outlet pressure of compressor is 6.4Mpa.

The specific situation is that the compressor was loaded on March 1, so that the overall vibration of the support bearing of the compressor increased from about 25 μm to 35 μm . On March 5th, due to the company's opportunity to reduce the load, the compressor's thrust pad displacement reached the alarm value, and the thrust pad was replaced. When the compressor set was started on March 15, the displacement value of the compressor was normal, the support bearing at the driving end was in the normal range, the vibration of the support bearing at the non driving end reached the trip value, and the compressor tripped. Before the start-up, the top clearance of the driving end of the compressor is 0.21mm and that of the non driving end bearing bush is 0.25mm. The total thrust clearance is within the design range.

1. Introduction

The analysis shows that the vibration of the compressor before the shutdown on March 5, although the vibration of the compressor increased as a whole due to the addition of volume, it did not fluctuate and was in a stable state. After the compressor was shut down to replace the thrust pad, the compressor was started up again, and the vibration at the non drive end of the compressor was large, resulting in tripping (the support bearing of the non driving end of the compressor and the thrust bearing were on the same side), and the temperature of the bearing bush at the non driving end of the compressor was normal^[1].

2. The Possible Causes Are as Follows

(1) It may be that the clearance of the top of the supporting bearing bush at the non driving end of the compressor is too large (the design value range of the clearance of the supporting bearing bush at the non driving end is 0.18mm-0.25mm), and the measurement error of shaft lifting is large,

and the actual value has exceeded the design value.

(2) It is possible that the back pressure of the bearing bush of the non driving supporting shaft of the compressor is small, and there is no interference or the interference is small.

(3) It is possible that the fastening bolts on the split surface of the upper and lower bearing shells of the non drive end support bearing shells of the compressor are loose, or the bolts of the adjusting block on the upper and lower bearing shells are loose.

(4) According to the compressor waveform spectrum only 1 times high characteristics, there may be rotor dynamic imbalance.

(5) According to the fluctuation of amplitude in the vibration trend of compressor, there may be static and dynamic friction.

(6) There may be compressor surge.

(7) Poor formation of compressor lubricating oil film.

3. How to Check

Firstly, the temperature and pressure of the lubricating oil entering the bearing during the start-up of the compressor were checked, and the oil temperature and pressure were within the normal range. Check the compressor spectrum, there is no half frequency vibration component.

Check the process air intake of the compressor. At that time, the anti surge valve was in full open state, the air intake was not lower than the design value, and the compressor surge was basic, and the vibration of the front and rear support bearings of the compressor would rise rapidly.

Due to the online dynamic balance of the unit under overload condition half a year ago, it is suspected that the counterweight before has fallen or loosened.

If the friction vibration amplitude of the dynamic and static parts of the compressor has obvious periodic changes, the trend of vibration measurement points is searched, and no regular fluctuation is found.

So the most likely situation at present may be on the support bearing. Therefore, the support bearing bush at the non driving end of the compressor was disassembled and inspected. The upper cover of the bearing box at the non driving end was removed, and the bearing pressure bearing cover was removed. It was found that the screw was not loose. Continue to remove the upper half of the support bearing, and the fastening bolts on the split surface are not loose. Remove the upper and lower half bearing shell and check that the bearing back adjusting block is not loose. Then put the bearing at the non driving end into the bearing cylinder of the bearing box again for fastening. Dial indicator is used to measure the top clearance of journal bearing to be 0.22mm. Within the normal range, the measured bearing back tightening force is 0.01mm, which is less than the design value. Adjust the thin stainless steel skin in the whole block of the upper half bearing shell back adjustment, and the final measured bearing back tightening force is -0.04mm, which is within the normal index range. Then install the bearing again. Check the turbine and compressor wheel beating table, the horizontal and vertical direction of the wheel are within the normal index, there is no problem in the alignment. Reassemble all parts of the unit and start up again. When the unit is loaded, the vibration value of the compressor is obviously reduced, which is stable within the vibration index, and the bearing bush temperature is in the normal value^[2].

4. Conclusion

This also shows that the top clearance of the support bearing bush does not exceed the design value. Due to the large measurement error of the inspectors, it has an impact on the judgment, and also eliminates the problem of compressor dynamic imbalance. The main reason is that the back pressure of compressor Bush is too small, which leads to the increase of shaft vibration and the trip.

References

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