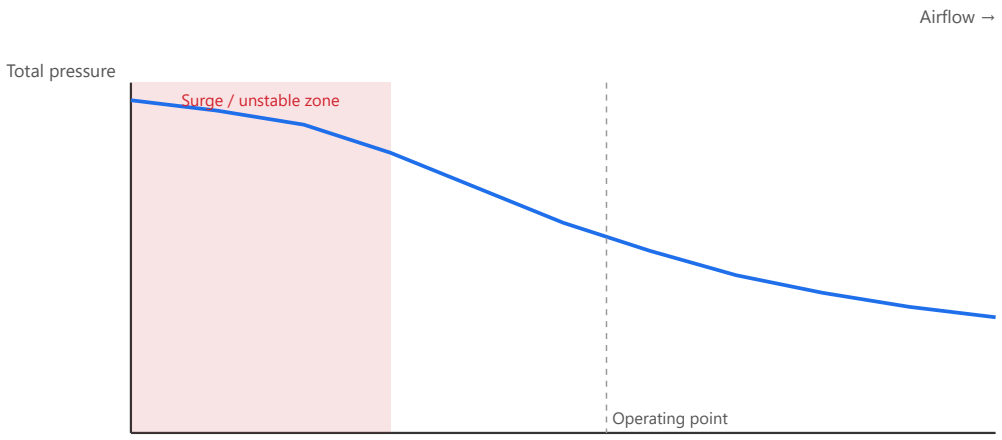
FM103 Medium Temperature Above Design Value → Density Drop, Insufficient Total Pressure

Chapter 1: Gas Properties — Fault model & typical case

DOCUMENT	CHAPTER	RELATED Q&A	PUBLISHER
FM103	**Gas Properties**	**1-09, 1-25, 2-08**	**Kunshan Best Machinery Equipment Co., Ltd.**

Fault model + typical case. Mechanism, causes, symptoms, diagnosis, corrective actions and prevention are all anchored to the relevant entries of the Fan Engineering Q&A (see front matter for question references).



FM103 Medium Temperature Above Design: the left-hand region of the curve is the surge / unstable zone (hump). If the operating point falls inside it, surge, falls pressure pulsation and equipment damage occur; selection and regulation must avoid it.

Failure Mechanism

As the gas temperature rises, its density falls according to the equation of state (1-25). At unchanged speed the fan total pressure drops approximately in proportion to the density, while the volume flow changes little, which appears as insufficient pressure head and inadequate suction.

Common Causes

- Process temperature fluctuates beyond the design value
- Misinterpretation of the inlet standard conditions (2-08)
- Inaccuracy of the temperature sensing element going unnoticed

Failure Symptoms

- Pressure head is low under high-temperature duty
- Motor power actually falls while the output is still insufficient

Diagnosis & Evaluation

- Measure the actual medium temperature and compare it with the design value
- Correct the density for temperature, then re-verify the total pressure

Corrective Actions

- Control the process temperature or re-select the fan for the high-temperature duty
- Increase the speed / impeller size

Preventive Measures

- Define the medium temperature range with margin in the selection specification

Typical Failure Case (Summary)

After the 2008 desulphurisation retrofit of four 130t/h pulverized-coal boilers at a thermal power plant, the forced-draft fans were re-selected; in 2010 the output declined, manifested by the motor already drawing overcurrent before the regulating damper was fully open, the duty still not being met with the damper fully open, and the furnace negative pressure failing to reach the load demand. Cause: the actual flue-gas temperature reached 180 °C, far above the design value of 150 °C, so the flue-gas volume increased by about 10% above design. Because both fan and motor had been selected on the basis of the design flue-gas temperature, the selection was undersized, the unit could no longer operate in the high-efficiency region, and the total pressure was insufficient.

In a power plant deeply blending lignite, the calorific value of the coal fed to the boiler dropped by 15.9% and the flue-gas temperature ran 25 °C above design, so the flue-gas density fell and the volume increased substantially. The forced-draft fan duty increased and the specific power rose, the operating point moved closer to the stall zone, and finally the 1B forced-draft fan stalled. Root cause: the medium temperature exceeded the design value, so the density fell and the volume increased, and the pressure head / power deviated from the design duty.

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