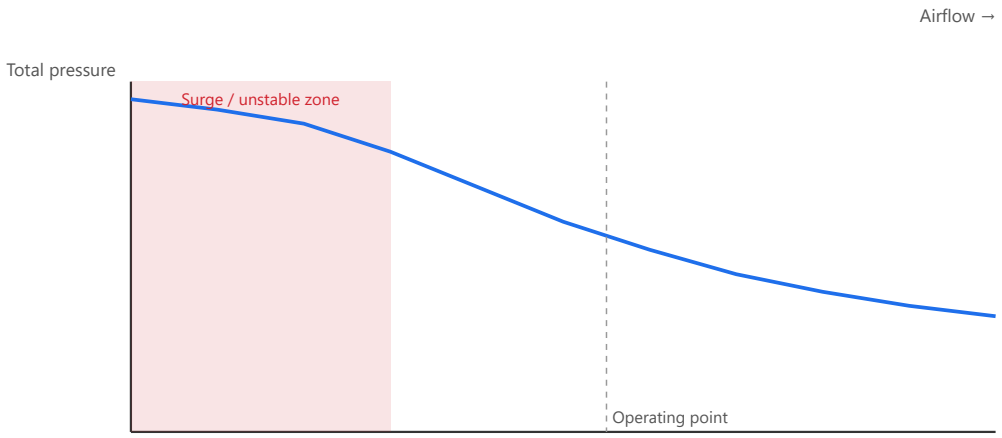
FM101 Gas Density Error → Pressure & Flow Deviation

Chapter 1: Gas Properties — Fault model & typical case

DOCUMENT	CHAPTER	RELATED Q&A	PUBLISHER
FM101	**Gas Properties**	**1-04, 1-11, 1-25**	**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).



FM101 Gas Density Error: the left-hand region of the performance curve is the surge / unstable zone (hump). If the operating point falls inside it, surge, pressure pulsation and equipment damage occur; selection and regulation must avoid it.

Failure Mechanism

Fan catalogue performance is normally stated at the standard inlet condition (ρ=1.2 kg/m^3). If the actual gas density is miscalculated or taken incorrectly, the airflow, total pressure and shaft power obtained from the dimensional performance conversion will deviate as a whole, resulting in insufficient machine output or motor overload.

Common Causes

- No conversion by the actual operating density during the design stage (Q&A 1-25 standard-vs-actual condition conversion)
- Standard-condition volume mistakenly treated as the actual-condition volume (Q&A 1-11 standard cubic metre)
- Solid-phase additional mass not accounted for at high dust concentration

Failure Symptoms

- Actual airflow deviates markedly from the design value
- Motor current is abnormally high, or output falls short
- System resistance does not match expectations

Diagnosis & Evaluation

- Re-verify the gas density ρ and the standard-condition conversion formula
- Compare the catalogue performance curve with the measured operating point
- Recalculate how shaft power varies with density

Corrective Actions

- Re-select the fan based on the actual density, or compensate by VFD speed control
- Verify the motor power margin

Preventive Measures

- Establish a medium-parameter table and incorporate it into the selection calculation sheet
- Re-calculate the hot / actual-condition density for critical duty points

Typical Failure Case (Summary)

In an overseas engineering project, a high-temperature blower (design 55000 m^3/h, 2500 Pa, medium 250 °C) was selected by the fan OEM directly at ambient conditions (55000 m^3/h, 2500 Pa) without any medium-density correction. Performance could still be maintained at ambient temperature, but once the temperature rose to 250 °C the gas density fell far below the standard 1.2 kg/m^3, so the blower could not extract the volatile gas inside the equipment and failed to establish the required system vacuum. Root cause: the actual high-temperature medium density was not substituted into the dimensional performance conversion; the standard-condition catalogue data was applied directly, resulting in insufficient total pressure. The shortfall was ultimately compensated by raising the speed, but long-term overspeed operation poses a service-life hazard.

Another project required conveying 40 °C coke-oven gas (flow 10000 m^3/h, total pressure 4500 Pa) with a gas density of about 0.6 kg/m^3, roughly half that of air. The incorrect practice was to select the fan and rate the motor directly on standard air (ρ=1.2 kg/m^3). Because the actual density is only half, both the pressure head of the fan and the required shaft power deviate severely, readily causing motor overload or insufficient pressure. The correct practice is to recalculate density and pressure head from the actual medium properties.

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