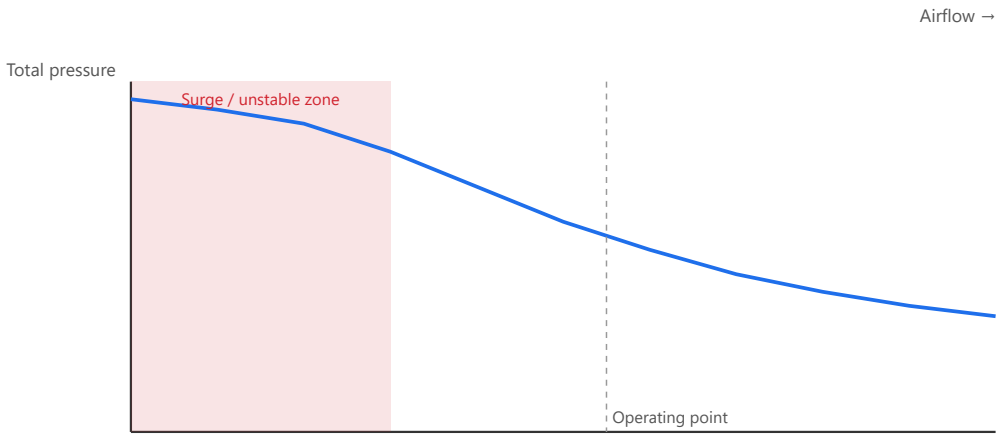
FM303 Air Staging / Unstable Operation in Parallel

Chapter 3: Selection & Use — Fault model & typical case

DOCUMENT	CHAPTER	RELATED Q&A	PUBLISHER
FM303	**Selection & Use**	**3-04, 3-22**	**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).



FM303 Air staging in parallel operation: the left-hand region is the surge / unstable zone (hump). Operating inside it causes surge, pressure pulsation and damage; selection and regulation must avoid it.

Failure Mechanism

When two fans of similar performance run in parallel, entering the hump or unstable region (3-04 performance curves, 3-22 regulation) produces air staging, flow reversal and large fluctuations.

Common Causes

- Parallel operation enters the unstable region
- Improper outlet check valve / regulation

Failure Symptoms

- Periodic flow reversal between the machines
- Current swing

Diagnosis & Evaluation

- Superimpose the combined operating curve

Corrective Actions

- Keep away from the unstable region and add proper regulation

Preventive Measures

- Carry out a combined-duty analysis before parallel operation

Typical Failure Case (Summary)

Case 1 (Real Case)

Case 2 (Real Case)

- Source unit / industry, time, duty: Jiangsu Ligang Electric Power Co., Ltd. phases III and IV (4×600MW units), equipped with two Howden L3N2412 double-inlet centrifugal primary-air fans for a medium-speed mill direct-pressure direct-firing pulverising system.
- Failure symptoms: with five mills running, "air staging" occurred frequently once the inlet damper opening exceeded 70%, especially at high air temperature, affecting stable unit operation; one fan carried a very large flow while the other carried a very small one, and their operating points exchanged repeatedly.
- Root cause: the double-inlet centrifugal fan performance curve is S-shaped / saddle-shaped; when the parallel operating point falls into the figure-eight unstable region, air staging occurs. Duct resistance and damper opening are the main influencing factors.
- Corrective actions and result: a method for identifying air staging was proposed (observing the mutual exchange of flow / current), and air staging was eliminated by adjusting the inlet damper opening, balancing the duct resistance and keeping away from the unstable region; the literature summarises the corresponding solutions.
- Source unit / industry, time, duty: a sinter plant, 2 of the 6 sinter exhaust fans running in parallel, single-fan airflow 18000m^3/min, total pressure 17kPa.
- Failure symptoms: during operation the flow, pressure and current fluctuated sharply, and the machine noise and vibration increased markedly.
- Root cause: the parallel operation fell into the unstable region, producing "air staging".
- Corrective actions and result: good application results were achieved through CFD duct flow-field simulation and optimisation of the operating mode (avoiding operation in the unstable region).

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