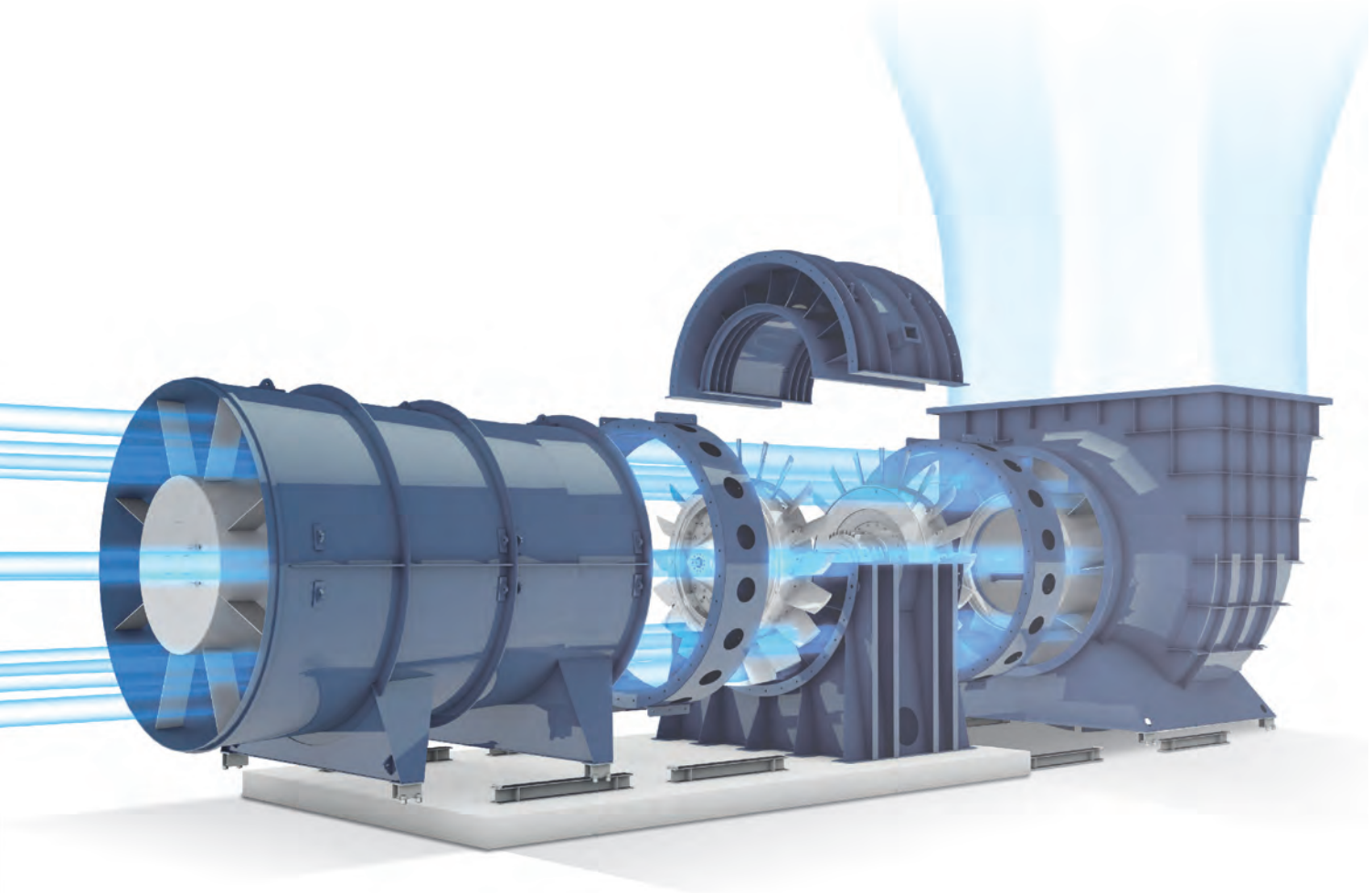
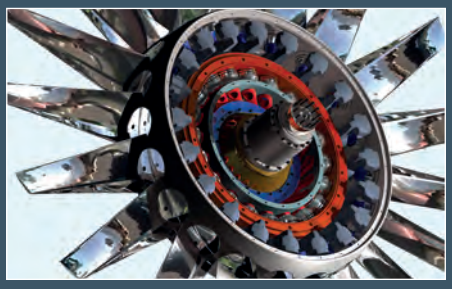
L&T Howden

VARIAX® Axial Flow Fans

Continually setting new standards



The VARIAX® variable pitch axial fan combines one of the highest efficiency levels available today with an exceptionally flexible, customer focused design, manufacturing and aftermarket service.



Since the formation of the joint venture company between Larsen & Toubro and Howden to meet the requirement of variable pitch axial fans (VARIAX®) and rotary heat exchangers in coal-based thermal power plants, L&T Howden Private Limited has emerged as a prominent player in the market.

Within a short span of seven years of starting the business in India, L&T Howden has supplied over 200 VARIAX® fans, which are operational in various power plants of unit sizes ranging from 100 MW to 1200 MW. Around 200 fans are under various stages of execution.

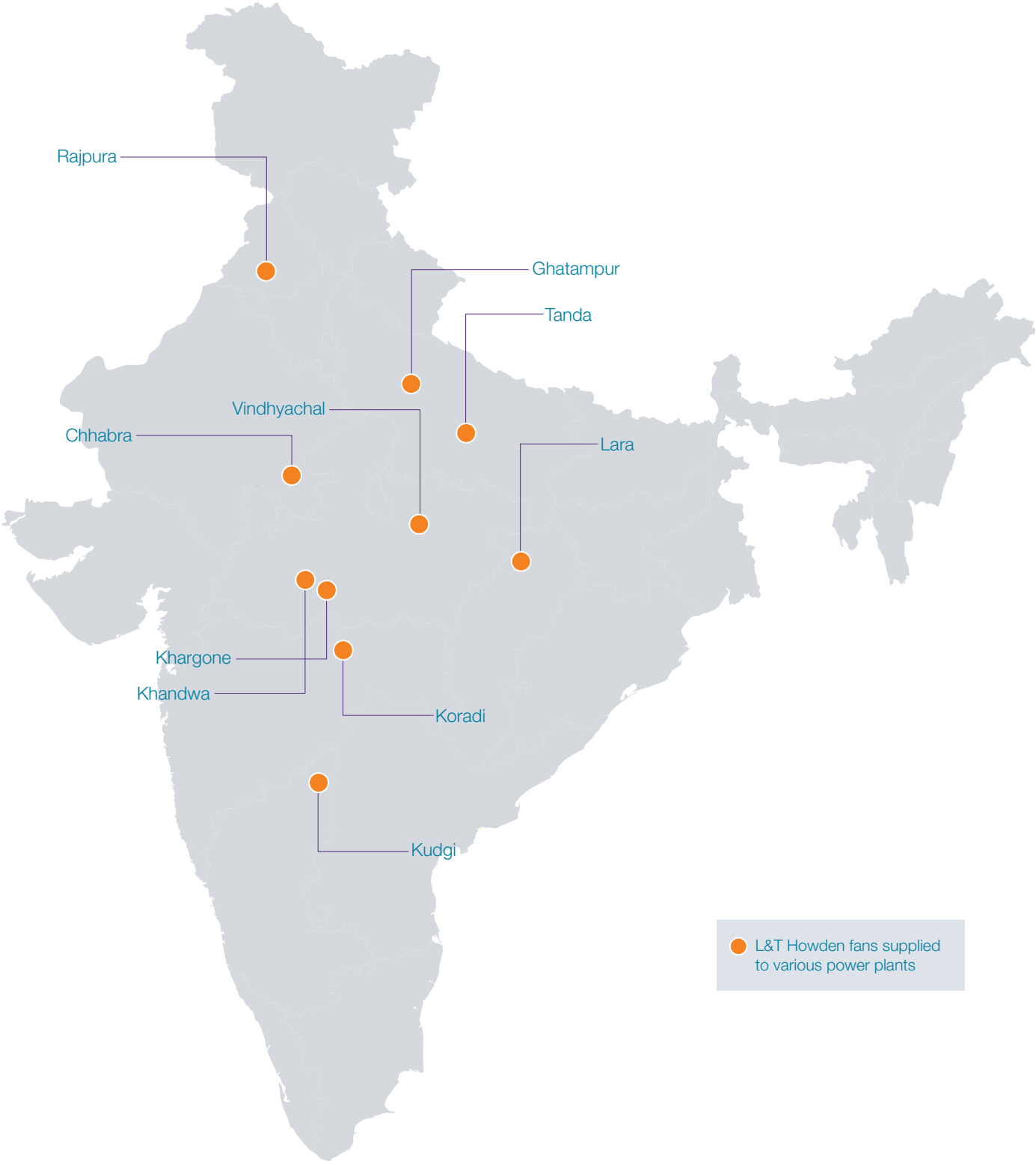
Be it boiler application, booster application in power plants, VARIAX® fans have proved their superior performance.

Adapting to Indian power plant operational conditions

The presence of high ash content in domestic coal, going up to maximum of 40 to 42%, throws a challenge to design suitable fan blade and select suitable metallurgy. L&T Howden, backed by Howden design team, has successfully overcome this challenge by suitably designing the fans with lower rotational speed, hard coating of ID fan blades for longer operational hours and other features.

Serving India: The VARIAX® advantage

With more than 200 fans supplied in India, the VARIAX® fan is the proven, reliable and robust choice across a wide range of applications.



The benefits

Every fan we supply is designed and built to unique specifications. In the initial planning of the project, in consultation with the customer, we carry out a full analysis of the duties of the equipment and the performance required. Each customer is assured of a fan engineered precisely to their requirements of the individual application both now and in the future.

Importantly, for every VARIAX® installation we maintain a complete, detailed record of specification and any subsequent maintenance or retrofits, to allow us to offer a guaranteed spares and service program. We can carry out regular monitoring and inspections as well as offer a troubleshooting and emergency service.

Partial reference list of fans supplied

Client	Project / Power Plant	Unit Size (MW)	Application	Total Nos.	Design Capacity / Flow (m^3/s)	Design Pressure / Head (mmwg)
LMB	MahaGenco - Koradi	660	FD, PA, ID	18	FD Fan: 284 PA Fan: 203 ID Fan: 663	FD Fan: 490 PA Fan: 1474 ID Fan: 550
LMB	NPL, Rajpura TPP	700	FD, PA, ID	12	FD Fan: 298 PA Fan: 193 ID Fan: 695	FD Fan: 420 PA Fan: 1470 ID Fan: 490
Doosan	NTPC - Kudgi Super TPP	800	FD, PA, ID	18	FD Fan: 402 PA Fan: 279 ID Fan: 926	FD Fan: 579 PA Fan: 1501 ID Fan: 640
LMB	RRVUNL - Chhabra	660	FD, PA, ID	12	FD Fan: 258 PA Fan: 165 ID Fan: 555	FD Fan: 380 PA Fan: 1400 ID Fan: 443
Doosan	NTPC - Lara Super TPP	800	FD, PA, ID	12	FD Fan: 405 PA Fan: 245 ID Fan: 920	FD Fan: 520 PA Fan: 1465 ID Fan: 581
LMB	MPPGCL-Malwa	660	FD, PA, ID	12	FD Fan: 280 PA Fan: 220 ID Fan: 640	FD Fan: 480 PA Fan: 1520 ID Fan: 520
LMB	NTPC-Tanda	660	FD, PA, ID	12	FD Fan: 300 PA Fan: 193 ID Fan: 720	FD Fan: 489 PA Fan: 1350 ID Fan: 555
LMB	NTPC-Khargone	660	FD, PA, ID	12	FD Fan: 311 PA Fan: 203 ID Fan: 718	FD Fan: 479 PA Fan: 1320 ID Fan: 543
LMB	NUPPL - Ghatampur	660	FD, PA, ID	18	FD Fan: 292 PA Fan: 228 ID Fan: 705	FD Fan: 339 PA Fan: 985 ID Fan: 450
Alstom	NTPC - Vindhyachal WFGD Stage V	500	FGD-Booster Fan	2	631.7	451.9
MHPS	NTPC Mouda	660	FGD-Booster Fan	4	720	361.7
GE Power	NTPC Solapur	660	FGD-Booster Fan	4	814	388.4
GE Power	NTPC Meja	660	FGD-Booster Fan	4	774	381.7
GE Power	NTPC Tanda	660	FGD-Booster Fan	4	720	390.3
GE Power	NTPC Sipat	660	FGD-Booster Fan	6	762	233.7
GE Power	NTPC Unchahaar	500	FGD-Booster Fan	2	607	335.3
LTEP	NTPC-Vindhyachal I NTPC-Vindhyachal II NTPC-Vindhyachal III & IV	210 500 500	FGD-Booster Fan	16	752 607 607	380.4 464.1 462.0
LTEP	NTPC-Lara	800	FGD-Booster Fan	4	872	578.1
LTEP	NTPC-Khargone	660	FGD-Booster Fan	4	720	599.9

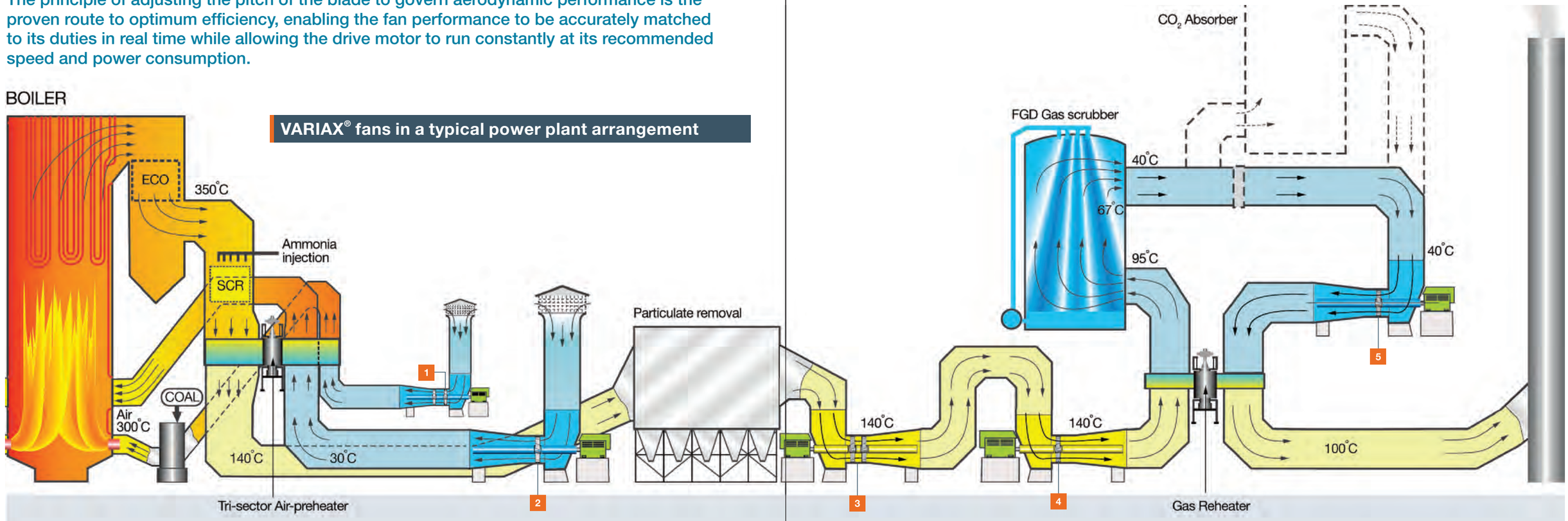
*LMB: L&T-MHI Power Boilers Private Limited
*Doosan: Doosan Power Systems India
*Alstom: Alstom India Limited (GE Power)
*MHPS: Mitsubishi Power Ltd
*LTEP: L&T Energy-Power

Built on experience

The principle of adjusting the pitch of the blade to govern aerodynamic performance is the proven route to optimum efficiency, enabling the fan performance to be accurately matched to its duties in real time while allowing the drive motor to run constantly at its recommended speed and power consumption.

BOILER

VARIAX® fans in a typical power plant arrangement



The right choice for all applications

VARIAX® fans are found in a wide spectrum of situations where high volumes, high pressures and precise flow control are required, and where reliability and continuous running for months on end are demanded. They are the fans of choice in critical applications within the power industry, where they are used in both primary air, forced draft and induced draft positions including boiler draft and FGD and SCR booster applications.

1 PA fan

2 FD fan

3 ID fan

4 A-position booster fan

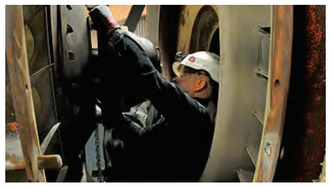
5 C-position booster fan

Custom-built technology

Every fan we supply is designed and built to unique specifications. In the initial planning of the project, in consultation with the customer, we carry out a full analysis of the duties of the equipment and the performance required. We have comprehensive knowledge of power plant design covering both new and revamped installations, and will offer advice and proposals based on our wide-ranging expertise. Each customer is thus assured of a fan engineered precisely to their requirements of the individual application both now and in the future.

Lifetime commitment

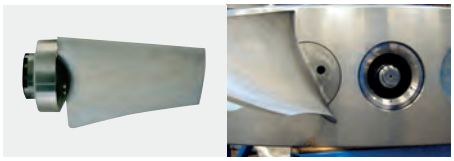
Importantly, for every VARIAX® installation we maintain a complete, detailed record of specification and any subsequent maintenance or retrofits, to allow us to offer a guaranteed spares and service program. We can carry out regular monitoring and inspections as well as offer a troubleshooting and emergency service.



Key features and benefits

All VARIAX® fans are designed to work within an operational temperature range up to 200ºC/392ºF. They are available in single and two-stage versions to suit a wide range of pressures and volumes.

1 Blades



Design adaptability: VARIAX® fan blades can be supplied in a wide range of lengths, profiles and materials including aluminium, nodular cast iron and steel.

Blade attachment: The blade is attached to its pivot by a single threaded connection with a key, and the fit between blade and hub is superbly designed and engineered to the most exacting standards. In addition to facilitating blade replacement, the design reduces the risk of corrosion. The use of a single pawl into the blade root also helps to keep the airstream smooth and brings a measurable increase in efficiency.

Tip clearance: The clearance between the blade tip and the fan casing has a dramatic effect on performance and efficiency, and the clearance at normal running temperature in a VARIAX® fan approaches just 1% of the total diameter of the rotor.

2 Blade bearings

The oil lubricated blade bearings, designed especially for VARIAX® fans, incorporate oversized balls for increased contact area and greater load bearing capacity.

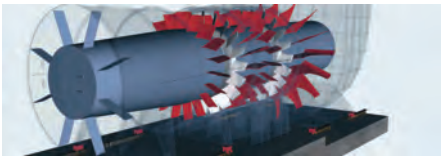
3 Hub

The VARIAX® hub has a spherical surface designed to minimise the gaps between the blade root and hub surface throughout the whole range of blade movement. This offers the best aerodynamic performance and contributes to the exceptional overall efficiency of the VARIAX® fan.

4 Hydraulic cylinder

The unique VARIAX® hydraulic cylinder uses a continual flow of oil through the system even when the blade position is constant, operating like a servo and transmitting charges instantaneously. The large volume of oil circulating through the system moderates the temperature of the hub both while the fan is operating and at standstill.

5 Guide vanes



Guide vanes before and after the impeller are custom designed for the unique combination of fan size and blade profile. The vanes smooth the air flow, reduce vibration and noise and raise overall efficiency.

6 Diffuser

In both single and two-stage VARIAX® fans, the whole diffuser assembly is mounted on a roller merchanism. It can be slid away for maintenance, allowing full access to the rotor without the need for removing it from its casing. All maintenance can thus be carried out easily on site.

Thousands of possible configurations

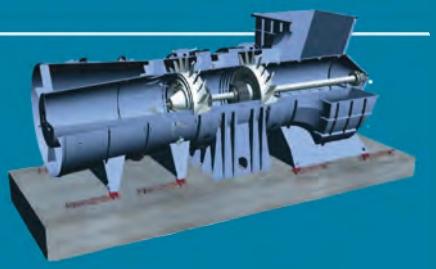
Our possible combinations of blade profile, impeller diameter and material, hub design and size produce a choice of many thousands of configurations. In addition, we can design VARIAX® fans for vertical as well as horizontal alignments, and turn the inlet box to suit particular installations. Specific challenges, such as the complex C-position fans required for flue gases with temperatures close to the acid dew point, are well within our experience.

Single stage

Designed for pressures of 300Pa/1 InWG to 15,000Pa/60 InWG at volumes between 25m³ and 1600m³ per second/50,000 ACFM and 34,00,000 ACFM.

Two stage

Designed for pressures of 1500Pa/6 InWG to 30,000Pa/120 InWG at volumes between 15m³ and 1600m³ per second/32,000 ACFM and 34,00,000 ACFM. In two-stage VARIAX® fans, the inlet box is also mounted on rollers and tracks to allow access to the first stage impeller unit while the moving diffuser gives access to the second stage.



7 Lubrication system

We recommend that separate oil systems are used for lubrication and hydraulic control. We do, however, offer a combined system as an alternative.

8 Separately balanced impeller units

In all VARIAX® fans, not only is the whole impeller unit precisely balanced, the hub and the blades that make up the unit are separately balanced before the unit is assembled. This means that replacement blades of a different material or profile can be fitted to the fan without removing and rebalancing the impeller unit.

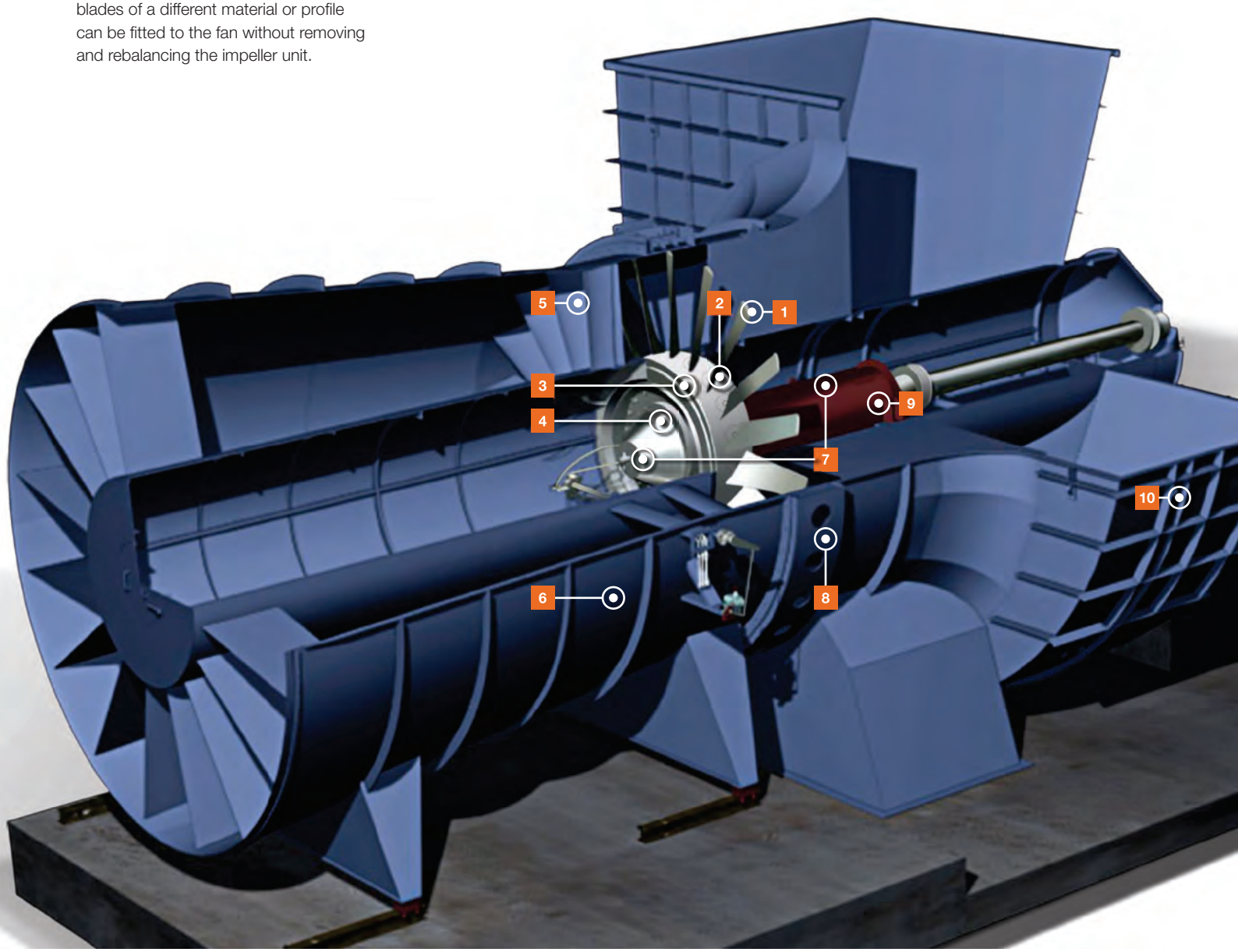
9 Main bearings

Roller bearing Sleeve bearing

In VARIAX® fans, we can supply either roller bearings or sleeve bearings as standard. The bearings are chosen to suit each individual project.

10 Inlet box

The enlarged inlet box leads to lower flow velocity and thus brings a significant documented reduction in inlet losses and a marked increase in efficiency.

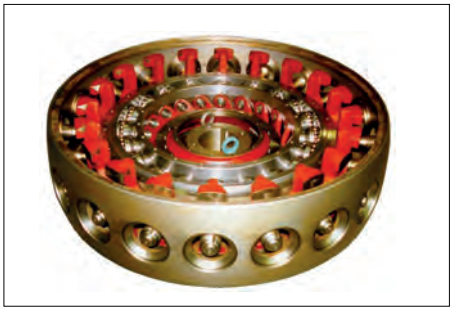


Continual improvement

The VARIAX® fan is the subject of continual research and development, and the interchangeability of parts makes it possible to retrofit, adapt and upgrade with ease.

The recent super high pressure blade profile brought a pressure increase of up to 30% while raising the flow by up to 15% and allowing a smaller hub. In 2009, we introduced a new hub design which makes it possible to design smaller primary air fans and forced draft fans, and to upgrade existing fans to cope with higher pressure.

Fabricated hubs for better strength



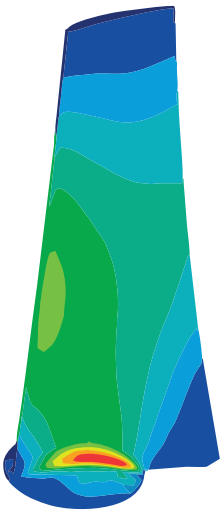
B-type for heavy duty fans (ID/Booster fans)

C-type for clean air applications (PA fans and FD fans)

Blade profiles and pivot connection

Variety of different blade profiles

Single threaded connection



Stress analysis by finite element method

Field services

Our field engineers are well trained to offer complete supervisory service during erection, commissioning, during planned outages and troubleshooting. They will help customers in ensuring maximum availability of equipment.

In addition, field engineers help our customers in planning the procurement of spares so that power plant always has critical spares in stock.

Spares & retrofits

L&T Howden ensures supply of right quality, fully interchangeable spares to our customers on time.

We can retrofit the present operational fans also to satisfy the new performance requirements of flow, pressure which may arise because of change in plant operational conditions due to addition of FGD (flue gas desulphurisation), SCR or change in fuel, etc.

Quality assurance

VARIAX® fans meet all major industry standards, and all of the equipment we supply are backed by an absolute commitment to customer satisfaction. Our quality assurance procedures are underpinned by **ISO 9001** accreditation, our environmental standards are certified to **ISO 14001**, and we have a health and safety program certified to **OHSAS 18001** criteria covering all L&T Howden staff.

Full scale fan testing facility at Hazira

The facility is one of its kind in the industry. Set up in the year 2013, it is equipped with 3.5 MW/1450 RPM test motor.

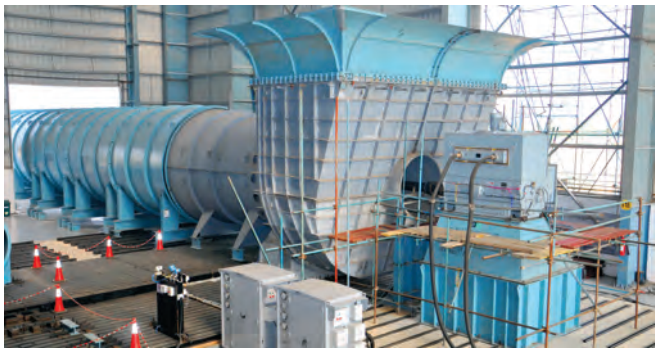
The test is conducted as per ISO 5801:2007 (Part-I) standard. The test bed is suitable for testing all FD, PA, ID booster and combined ID fans (CID) of 1200 MW also.

The testing helps in ensuring that the fan delivers guaranteed performance parameters. Any deficiency in fan performance can be identified during testing and necessary rectification can be done before the fan is put into operation at site.

Localisation of manufacturing

In line with our endeavour to provide cost effective solutions, L&T Howden and Howden have localised manufacturing facilities covering nearly all fan parts in India. Howden's facility at Hosur is a modern machining facility to manufacture critical rotating parts, including hubs and blades, and is available to cater to the Indian power market.

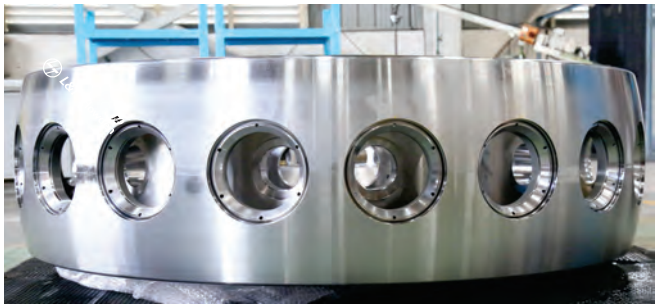
Fan testing control room at L&T Howden's Hazira facility



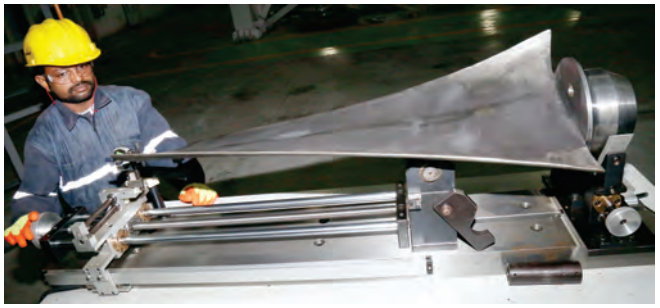
Full scale fan testing at L&T Howden's Hazira facility

Regulating test bed at Howden's Hosur facility

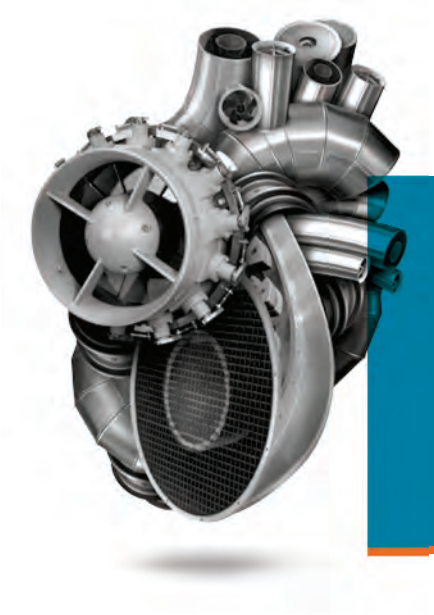
Main bearing assembly test bed at L&T Howden's Hazira facility



Hub manufacturing at Howden's Hosur facility



Blade manufacturing at Howden's Hosur facility



At the heart of your operations

L&T Howden people live to improve our products and services and our world has revolved around our customers. This dedication means our air and gas handling equipment add maximum value to your operations. We have innovation in our hearts and every day we focus on providing you with the best solutions for your vital operations.

L&T Howden

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