

***CENTRIFUGAL
BLOWERS
AND EXHAUSTERS***

SPENCER . . . THE MARK OF QUALITY IN CENTRIFUGAL BLOWERS AND EXHAUSTERS

Since Spencer built its first centrifugal blower a century ago, we have designed, manufactured and put into operation over a **half million** machines, for practically every application, in all types of industry. As a matter of interest we have passed the **three million** installed horsepower mark world-wide, a record by any standard in the midrange centrifugal air/gas blower industry.

Spencer blowers and exhausters can meet the requirements for a wide range of applications in such industries as:

Chemical and Petrochemical

Air/gas boosters, combustion air, carbon black, sulfur recovery, waste incineration, coal gasification, fluidization, fermentation, spillage and material recovery.

Metal Processing and Mining

Ore floatation, cupola blowers, coke oven gas, combustion air, metal strip drying, vacuum cleaning, electro-plating.

Food and Beverage

Washing, yeast agitation/fermentation, can and jar drying, vacuum cleaning, aquaculture.

Waste Water Treatment

Municipal and industrial, sludge clarification, pond and channel aeration, grit chambers aeration.

Pulp, Paper and Textile

Fluidization, paper dewatering, textile drying, black liquor oxidation, chip conveying, waste tow conveying.

Our long and consistent history of being at the forefront of compressor design and innovation is no accident. It comes from:

- **Building quality products that will meet the reliability demanded by the process.**

Spencer products are designed and manufactured to meet the specified performance as well as the physical reliability demand of the process. A century of blower manufacturing know-how supported by thousands of installations, has resulted in a Spencer design and

manufacturing approach yielding the most cost effective and reliable line of blowers and exhausters in the entire air-moving industry. Efficiency and reliability is *built in* to our products without added expense to the customer.

We hope that you will become a Spencer customer and assure you that the product which you will purchase will be of high quality, backed by SPENCER, THE MARK OF QUALITY IN BLOWERS AND EXHAUSTERS.

CONSTRUCTION HIGHLIGHTS

Spencer blowers and exhausters cover an extensive line of multi-stage machines used in a wide range of applications for air/gas services. These high precision and reliable machines are available in over-hung, four-bearing overhung, and four-bearing outboard construction; all meeting the process specifications and Spencer's toughest quality standards in the air moving industry. Some of the outstanding features of our units are:

Housing, Inlet and Outlet Heads

The blowers and exhausters are manufactured of high grade, heavy gauge, cold rolled steel with a tensile strength of 50,000 psi, welded and reinforced, resulting in extremely durable and rugged construction. Inlet, outlet and housing are of a single unit frame, providing higher strength. Fabricated housing also permits easier application of special alloys where corrosion resistant material is required. Flanged connections are drilled to 125 lb. ANSI standard.

Impeller Shaft Assembly and Seals

The rotating assembly within the housing has ample clearance — no less than 1/8-inch. The composite impellers fabricated of high-strength aluminum alloy or steel are mounted on a polished, selected carbon steel shaft designed to operate at a minimum of 20 percent removed from its first critical speed. To minimize shaft leakage, depending on the application, we utilize (1) Vellumoid seals, (2) lead/graphite die formed packing, (3) stuffing box, (4) mechanical seals and/or (5) inert gas injection. To further reduce leakage Spencer also manufactures its uniquely designed hermetically sealed gas booster. The entire rotor assembly is dynamically balanced to ensure mechanical operation below 1.5 mil total amplitude on the bearing housing at design speed. Tip speed

of the rotating assembly does not exceed 475 FPS.

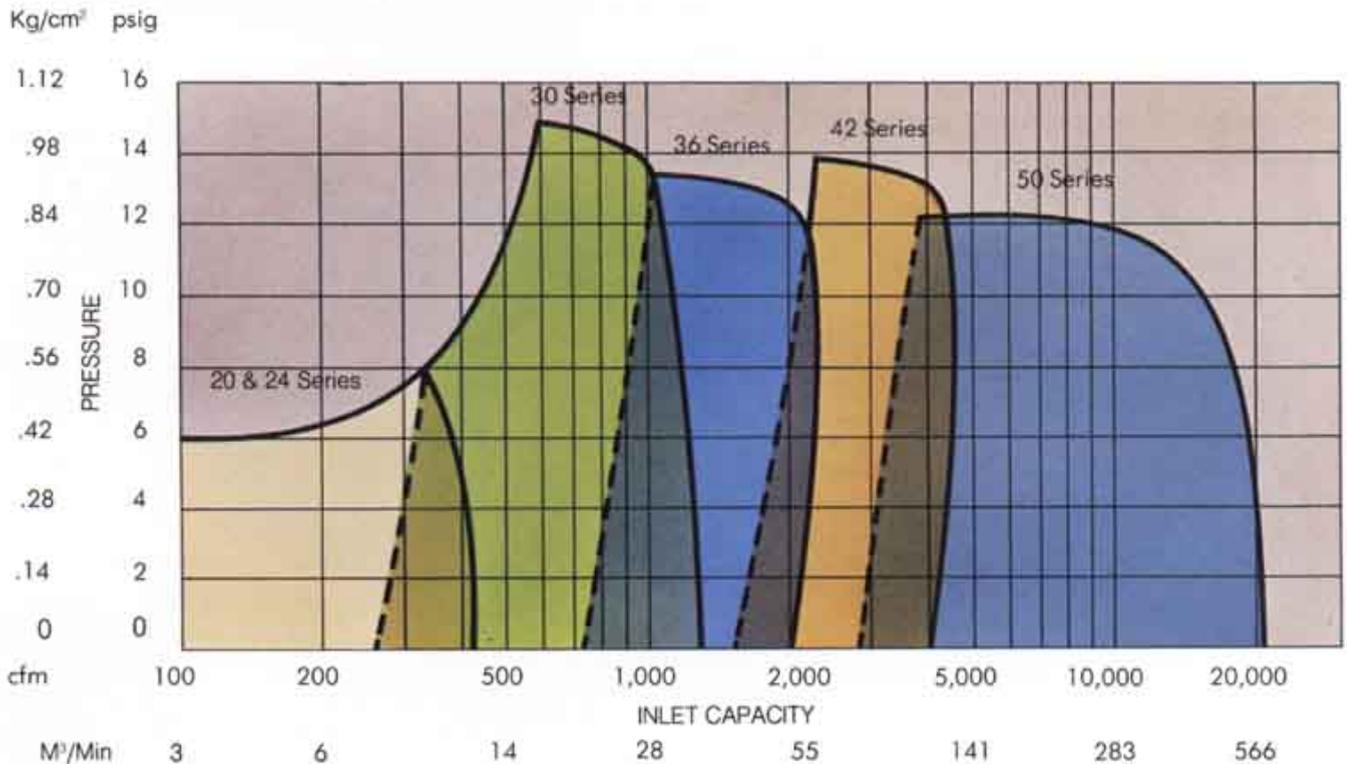
Bearings and Lubrication

The anti-friction precision-fit ball bearings are selected to operate under maximum load without undue heating, thus minimizing possible costly down-time. They are sized and selected to L-10 rating life per AFBMA Standard 9. Bearing lubrication is accomplished through a simple grease system.

Performance and Testing

Spencer blowers and exhausters are rigidly tested for performance, in addition to mechanical run-in. Actual performance ratings conform with the latest addition of the ASME Power Test Code. Spencer can provide Spin and Dye Tests, Sound Level Tests and Signature Vibration Analysis.

CAPACITIES AND OPERATION



Capacities of Spencer blowers and exhausters range to 20,000 cfm (622 M³/min) with pressure to 15.5 psig (1.08 kg/cm²) and vacuum to 13" Hg (4470 mm H₂O). They are designed for direct drive, two pole motors turning at nominal speed of 3500 rpm. The units are also available for direct drive operation at 1750 rpm with flow rates to 25,000 cfm. We utilize a wide range of impeller configurations and constructions — from a full radial to full backward curved blade designs in an unlimited range of diameters and widths to meet any specific volume, pressure, vacuum, or horsepower within our range. The

machines are most suitable for higher flow rates in parallel operation, and in series for increased pressure or vacuum. Air volume variations can be obtained through the entire range of machine by throttling of an inlet valve.

In addition to standard electric motor drive, the Spencer units are adaptable to Steam Turbine, Gear increaser and V-Belt drive arrangements. Only Spencer can provide the exact volume, pressure, vacuum or horsepower needed for specific processes.

STANDARD OVERHUNG

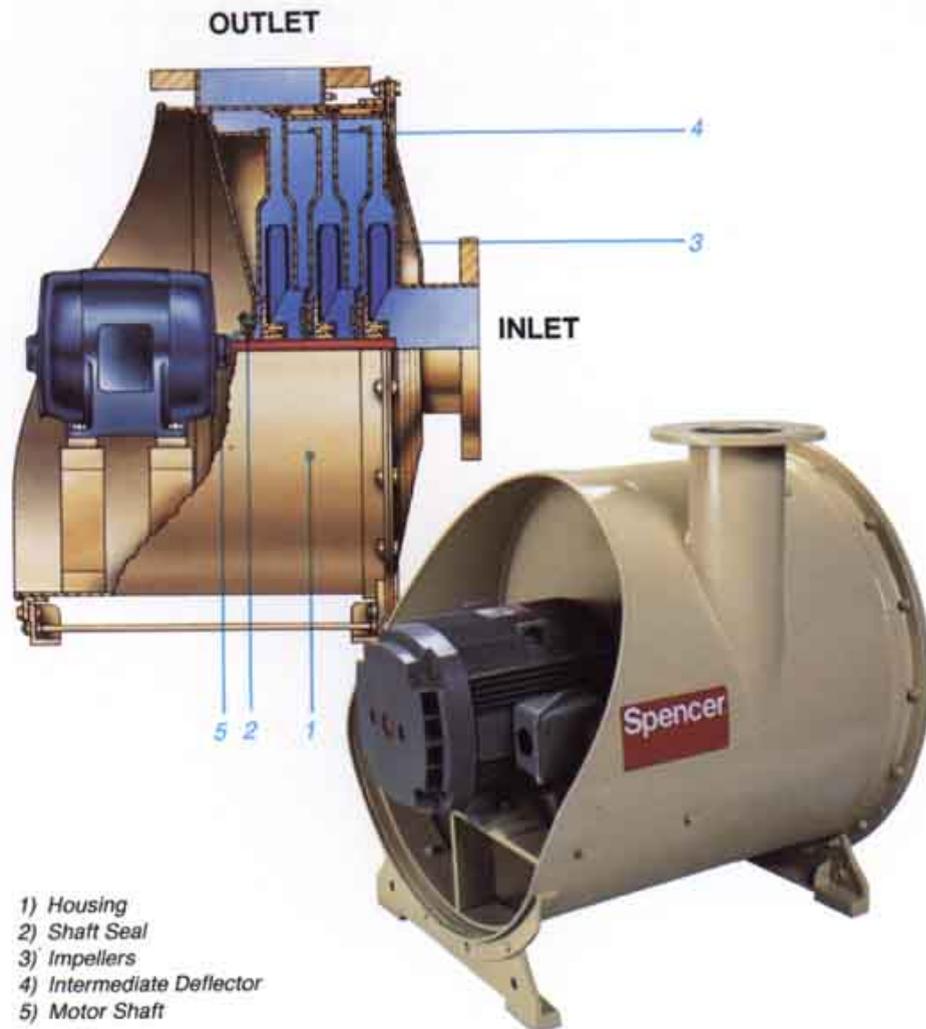
The Spencer Turbine Company is proud of its Standard Overhung design blowers and exhausters. This simplified design and construction approach, with impellers mounted directly on heavy-duty extended motor shaft, results in a compact, low noise, and rugged equipment

suitable for a wide range of pressure or vacuum applications.

The Standard Overhung design is also the basis for Spencer's unique Hermetic blowers, used whenever elimination of shaft leakage is important. The air/gas is delivered clean and pulsation free for requirements tabulated below.

Capacities

| RPM | Volume I.C.F.M. | Pressure Range PSIG | Vacuum Range Inches Hg. |
|------|--|-------------------------------|------------------------------|
| 3500 | up to 7,000 (198 M ³ /min) | 5.5 (.39 kg/cm ²) | 8 (2750 mm H ₂ O) |
| 1750 | up to 18,000 (510 M ³ /min) | 2.7 (.19 kg/cm ²) | 4 (1375 mm H ₂ O) |



- 1) Housing
- 2) Shaft Seal
- 3) Impellers
- 4) Intermediate Deflector
- 5) Motor Shaft

FOUR BEARING OVERHUNG

High pressure or vacuum requirements beyond the standard overhung capability influenced the development of these highly efficient and dependable machines.

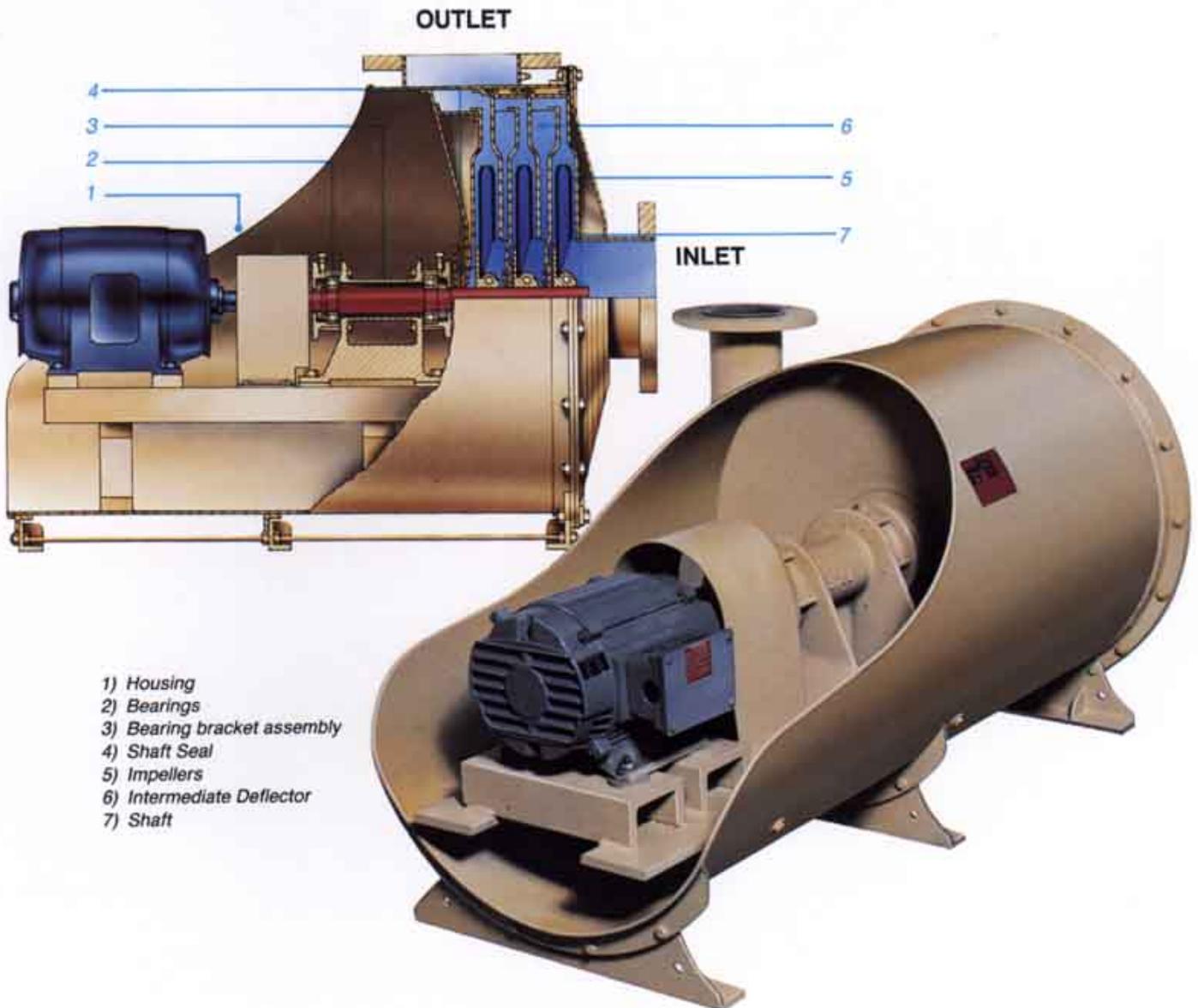
The composite fabricated aluminum alloy or steel impellers are mounted on a polished carbon steel shaft. Statically and dynamically balanced rotating assembly assures smooth and quiet operation.

Anti-friction select-fit precision ball bearings support the rotating assembly from a rugged bearing bracket physically isolated from the air stream.

Designed for direct connection to electric motors, they can accommodate other drive arrangements.

Capacities

| RPM | Volume I.C.F.M. | Pressure Range PSIG | Vacuum Range Inches Hg. |
|------|--|-------------------------------|-------------------------------|
| 3500 | up to 9,000 (255 M ³ /min) | 8 (.56 kg/cm ²) | 10 (3436 mm H ₂ O) |
| 1750 | up to 18,000 (510 M ³ /min) | 2.7 (.19 kg/cm ²) | 4 (1375 mm H ₂ O) |



- 1) Housing
- 2) Bearings
- 3) Bearing bracket assembly
- 4) Shaft Seal
- 5) Impellers
- 6) Intermediate Deflector
- 7) Shaft

FOUR BEARING OUTBOARD

Spencer's largest Blowers and Vacuum Producers are of the more traditional Four Bearing Outboard design. These highly efficient and rugged machines suitable for both high flow and pressures are made from heavy gauge material commensurate with elevated operating pressure.

They are built for continuous, low-maintenance,

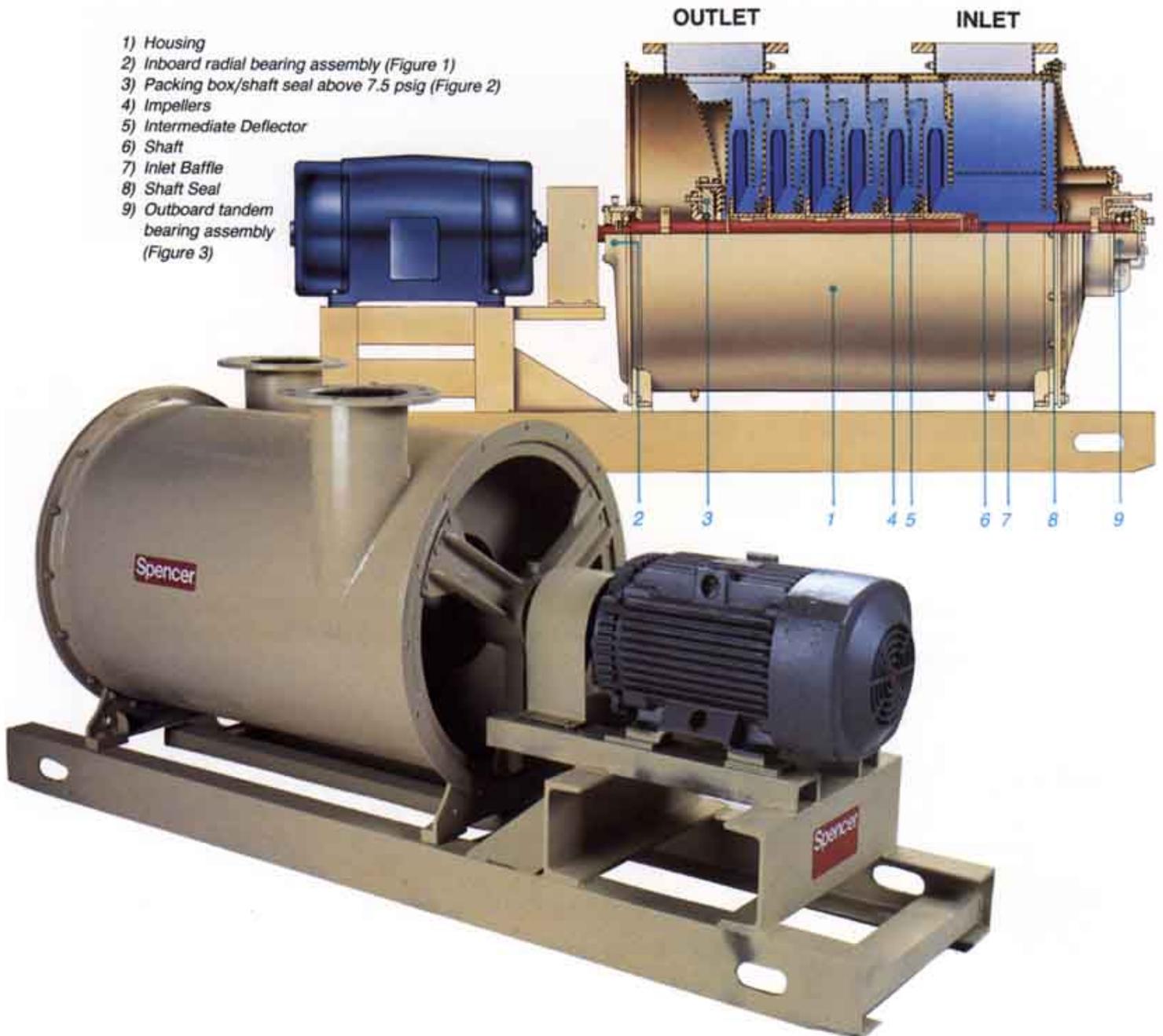
quiet and reliable operation, offering unique features such as self-aligning radial ball bearings at each end of the rotor assembly. The thrust bearing at the inlet side is a special pre-loaded angular contact bearing.

High efficiency impeller designs are provided to reduce power consumption. Quiet and stable operation, ease of installation and reliability of performance all have made these units ideal for continuous unattended service. Designed for direct connection to electric motor, they can accommodate other drive arrangements.

Capacities

| RPM | Volume I.C.F.M. | Pressure Range PSIG | Vacuum Range Inches Hg. |
|------|--|---------------------------------|-------------------------------|
| 3500 | up to 20,000 (622 M ³ /min) | 15.5 (1.08 kg/cm ²) | 13 (4470 mm H ₂ O) |
| 1750 | up to 25,000 (778 M ³ /min) | 10 (.7 kg/cm ²) | 8 (2835 mm H ₂ O) |

- 1) Housing
- 2) Inboard radial bearing assembly (Figure 1)
- 3) Packing box/shaft seal above 7.5 psig (Figure 2)
- 4) Impellers
- 5) Intermediate Deflector
- 6) Shaft
- 7) Inlet Baffle
- 8) Shaft Seal
- 9) Outboard tandem bearing assembly (Figure 3)



MACHINES FOR SPECIAL APPLICATIONS

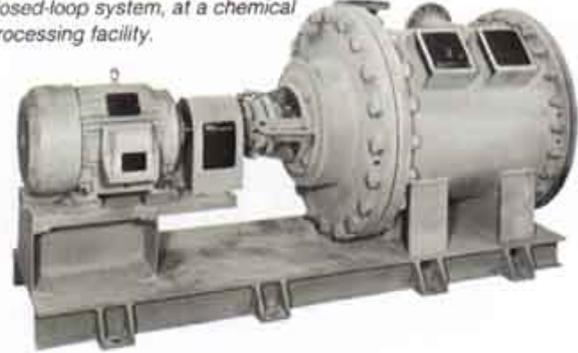
- HIGH TEMPERATURE - TO 1100°F
- HIGH OPERATING PRESSURE - TO 300 PSIG
- LEAKAGE FREE - TO 10^{-9} Cm³/sec
- CORROSIVE - GASES AND ENVIROMENTS

Building from a wide variety of commercially available metals, such as steel, stainless-steel, Cor-Ten steel, aluminum, monel, and hastelloy in forms we use, is where Spencer proves its dominance in the field of special blowers and exhausters. The high pressure blowers can be manufactured to conform to ASME Code specifications. Spencer's special design group is capable of developing and selecting blowers and exhausters for your specific application needs from simple natural gas

boosters to sophisticated blowers conforming with "Quality Assurance Criteria for Nuclear Power Plants." If your process demand falls within the above parameters, we can help you to meet your requirements.

High Temperature

A stainless-steel high-temperature Gas Booster with inlet of 50 PSIG and 900° F in a closed-loop system, at a chemical processing facility.



High Pressure

A shaft-sealed Gas booster with 150 PSIG inlet to a discharge pressure of 157 PSIG, at an industrial gas generating plant.



High Pressure

A Hermetic Gas-Tight Booster (10^{-9} Cm³/sec leakage) with 300 PSIG inlet to a discharge pressure of 310 PSIG, at a high technology electron beam accelerator facility.

Fig. 1
Inboard Radial Bearings

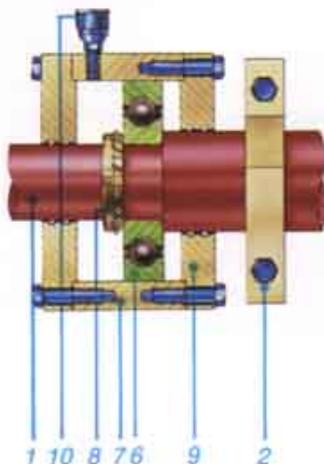


Fig. 2
Packing Box/Shaft Seal

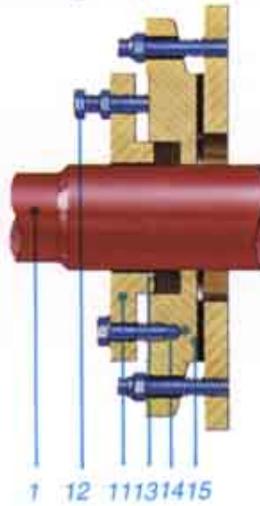
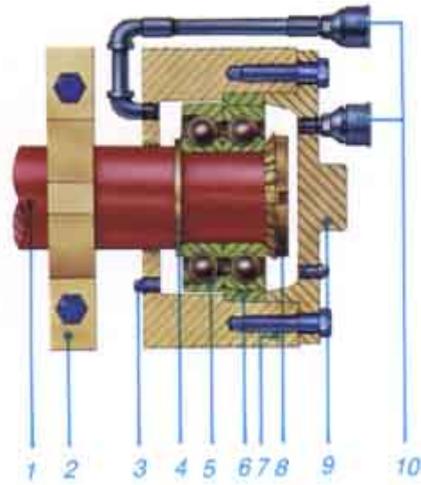


Fig. 3
Outboard Tandem Bearing



1. Shaft 2. Cooling Fan 3. Grease Drain 4. Thrust Washer 5. Thrust Bearing 6. Radial Bearing
7. Bearing Housing 8. Bearing Lock Nut and Washer 9. Bearing Cap 10. Lubrication Cup 11. Follower Cap
12. Adjustment Nut 13. Lead/Graphite Seal 14. Housing Plate 15. Gasket

Sludge clarification — one of the eight blowers on mobile bridges in a large waste water treatment facility.



Aeration — Bank of five blowers in an industrial waste water treatment plant.



Dust control — two exhausters providing suction in a dust control system at a pharmaceutical facility.



Process air — two blowers providing air for flotation cells in a mining operation.



CONSIDER THESE FEATURES...

Stable Operation

The blowers and exhausters have a total range of stable operation with surge occurring at approximately 30%–40% of the machine capacity. Their ideal characteristic curves make them most suitable for parallel operation.

Low Noise

Noise level is at its lowest due to the free passage of air through the rotor assembly, inter-stage housing, the discharge outlet design and the low tip speed.

Oil-Free

The complete absence of internal lubrication guarantees delivery of oil-free air or gas.

Easy Installation

Regardless of compressor size and its driver, there is no need for special support or foundations.

Choice of Drives

Spencer blowers and exhausters are designed for direct drive, two-pole or four-pole motors turning at nominal speeds of 3500 RPM or 1750 RPM.

With the exception of standard overhung machines, all Spencer units are adaptable for drive arrangements with gear increasers, V-belts, steam turbines or gas engines.

Parts and Service

Spencer uniquely guarantees the total availability of standard parts used in its products and of a competent technical customer service department.



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