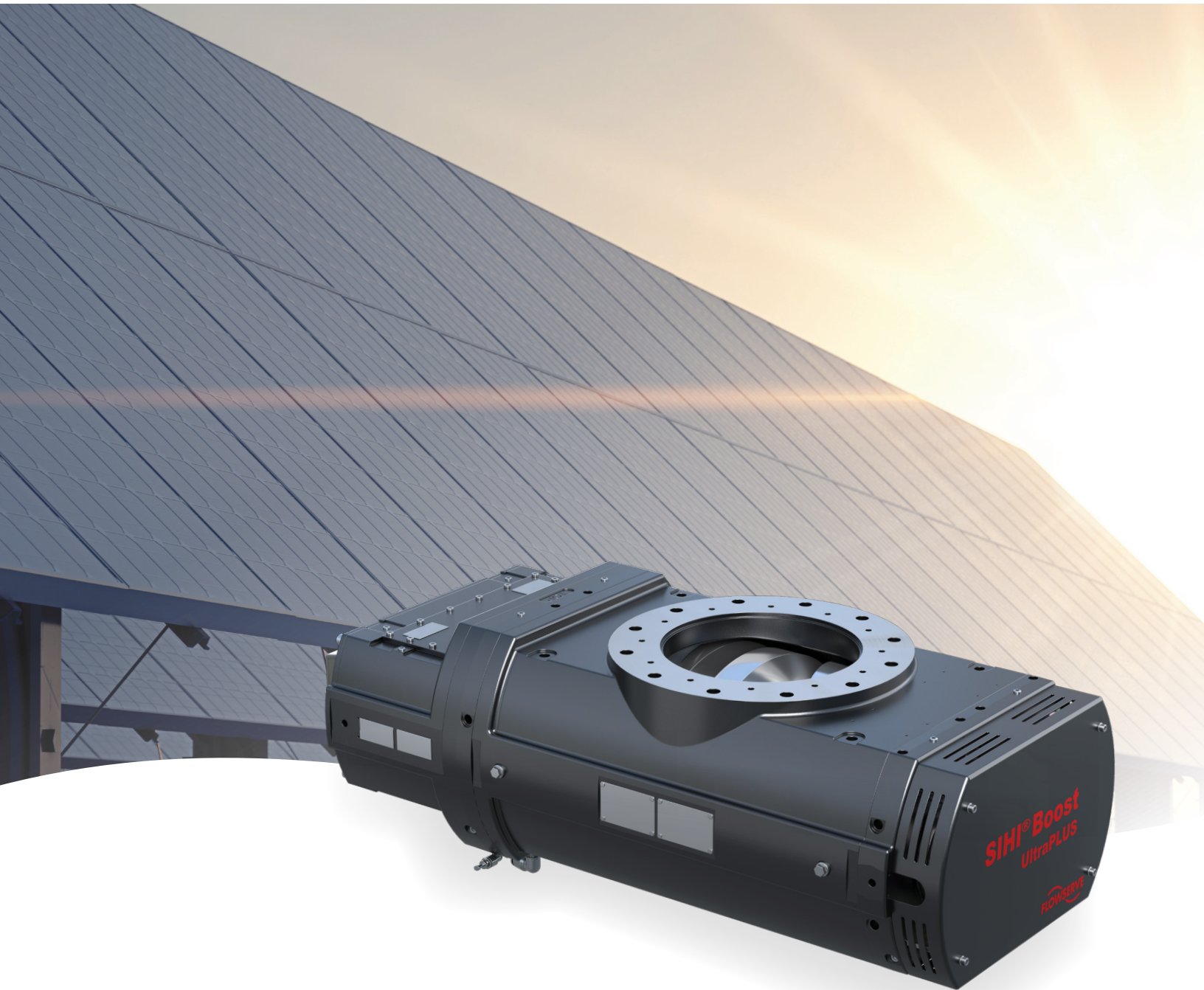




SIHI® Boost UltraPLUS Dry-running vacuum pump

Significantly faster pump-down times
boost profitability of load lock applications

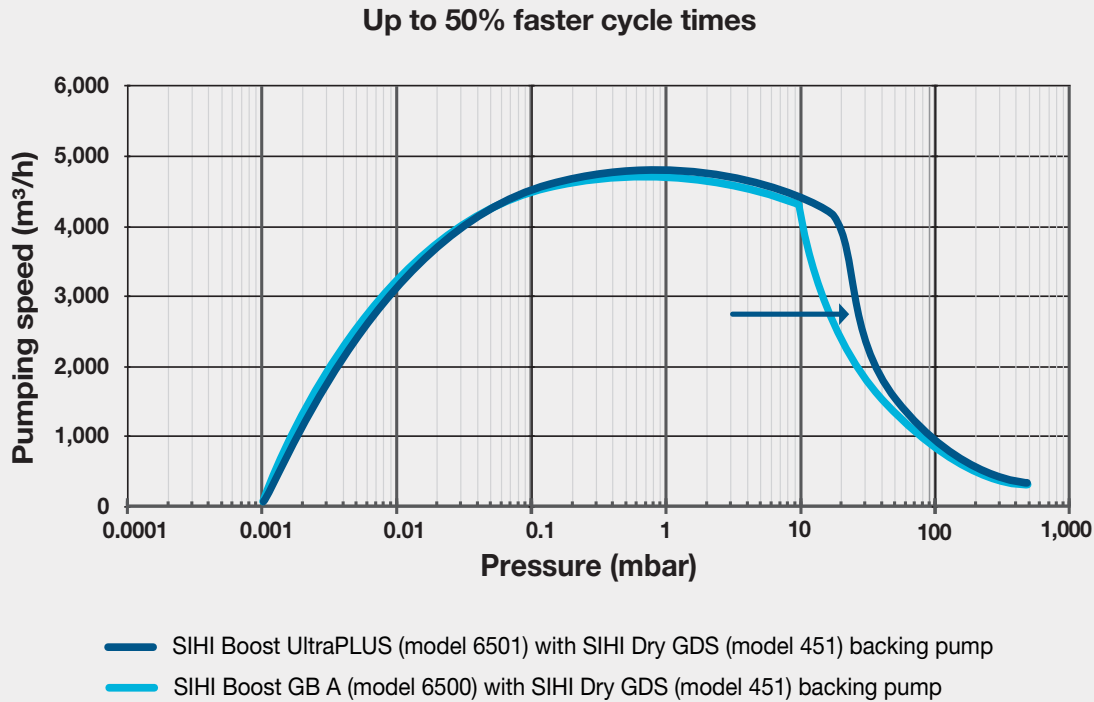


Experience In Motion

Boost profitability with the fastest load lock cycle times

The SIHI Boost UltraPLUS vacuum pump was developed with the goal of dramatically increasing the continuous output of SIHI Boost units.

This improved design retains all the advantages of the original SIHI Boost pumps — including oil-free operation and full electronic synchronization — while cutting re-acceleration time up to 50% or more and without increasing the footprint of the unit or modifying the drive electronics.

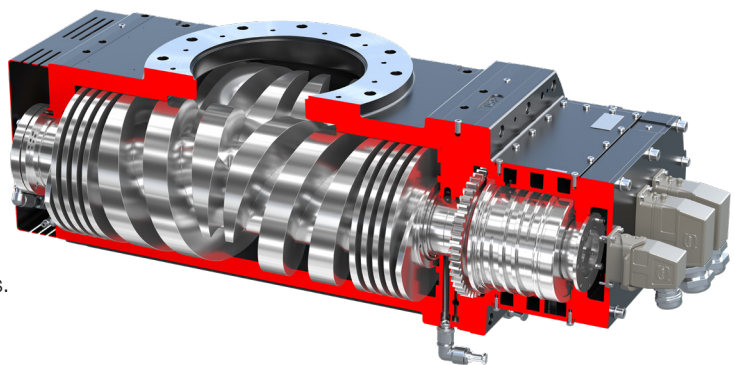


The performance improvements of the SIHI Boost UltraPLUS pump more than double the speed of a technology that was already unrivaled in the industry.

Reduce cycle times by up to 50%

Replacing Roots-type blower systems with SIHI Boost UltraPLUS units can enable existing production equipment to achieve the industry's fastest load lock cycle times to date. The unit delivers 20% shorter pump-down times while requiring only half of the backing pump capacity of the original SIHI Boost pumps. This can result in 50% less energy consumption compared to standard vacuum systems.

Like all Flowserve products, SIHI Boost UltraPLUS pumps are designed for simple operation and long-term reliability.



Increased power delivers the world's fastest evacuation speed

Flowserve SIHI Boost dry-running vacuum pump systems, introduced in 2013, were developed specifically to meet the requirements of industrial applications in the medium and fine vacuum pressure ranges. The original design remains unrivaled in the industry, delivering significant competitive advantages that traditional Roots-type blowers simply can't provide.

The SIHI Boost UltraPLUS dry-running vacuum pump takes this technology to an even higher level, more than doubling the evacuation speed of the pump — without increasing the unit's footprint. This was made possible by three key modifications:

- Improved cooling
- Materials upgrades that withstand the highest load scenarios
- A new gap distribution strategy

Together, these improvements dramatically increased the machine's performance, enabling the original SIHI Boost vacuum pump's continuous power limit of 12.5 kW to be more than doubled to 28 kW in SIHI Boost UltraPLUS pumps.

SIHI Boost GB A vs. SIHI Boost UltraPLUS

| Parameter | | SIHI Boost GB A | SIHI Boost UltraPLUS |
|--|--------------|-----------------|----------------------|
| Maximum power | Steady state | 12.5 kW | 28 kW |
| | Load lock | 15.5 kW | 28 kW |
| Maximum motor current | | 28 A | 33 A |
| Maximum bearing temperature | | < 100°C (212°F) | < 70°C (158°F) |
| Relative load lock cycle time (for a given volume) | | 100% | < 60% |

Reduce production costs per item

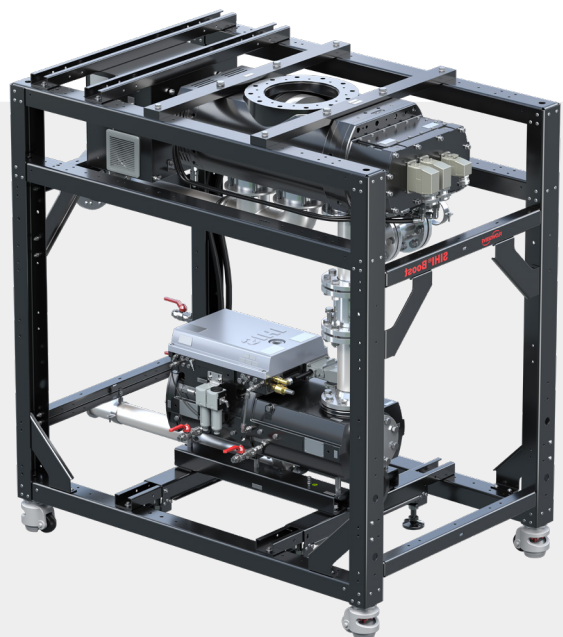
SIHI Boost UltraPLUS dry-running vacuum pumps offer significant opportunities to increase the throughput of existing production tools for vacuum coating and other load lock processes.

Key applications

- Industrial vacuum
- Thin film deposition
- Batch coating
- Inline coating
- Roll-to-roll coating
- Load lock
- PECVD/PVD
- Test chambers
- Vacuum furnace VD/VOD
- Vacuum welding

Key industries

- Architectural glass
- High-barrier films
- Lighting/deco/optics
- Photovoltaic
- Flat-panel display
- Secondary metallurgy
- Heat treatment
- Medical
- Laboratory
- Aerospace



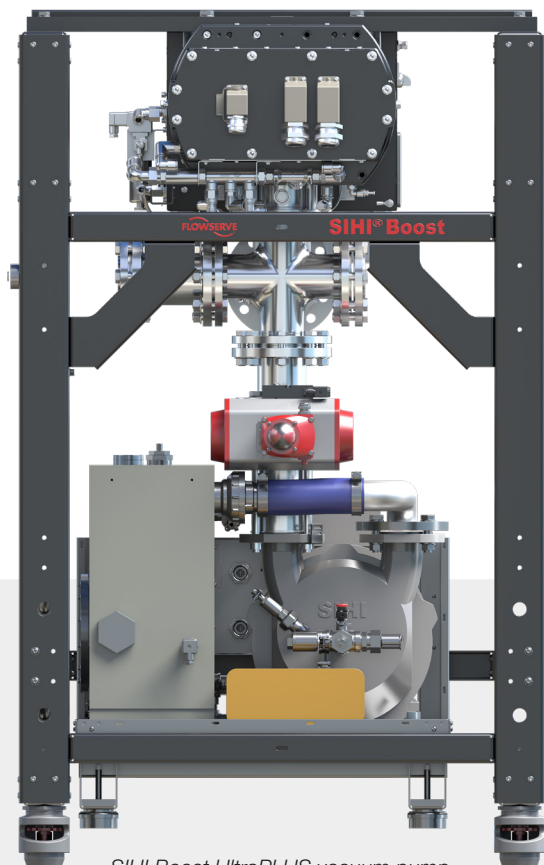
SIHI Boost UltraPLUS vacuum pump with SIHI Dry model GDS backing pump

Deep vacuum with less power and maintenance

The SIHI Boost UltraPLUS dry-running vacuum pump is an innovative unit offering unique performance and cost advantages in glass-coating processes as well as other chemical and industrial applications.

Even with a step-down ratio of 50:1 to the backing pump, the unit delivers significantly faster vessel evacuation than any other booster unit in the industry. A single unit can easily replace two or three Roots-type blowers — plus any interstage cooling units they might require — and deliver superior performance, even when paired with smaller backing pumps.

In addition, the SIHI Boost UltraPLUS pump consumes less electricity in a smaller footprint.



SIHI Boost UltraPLUS vacuum pump
with SIHI LEMD liquid ring backing pump

The SIHI Boost UltraPLUS advantage

No other manufacturer offers the revolutionary performance of SIHI Boost UltraPLUS dry-running vacuum pumps:

Higher differential pressure

- Up to 350 mbar versus 20 to 50 mbar for standard Roots-type pumps
- 10 times faster pumping speed than any other two-stage vacuum system
- Smaller, less complex backing pumps
- Deep vacuum level down to 10^{-4} Torr

Higher shaft speed (up to 15,000 rpm)

- Superior performance in a smaller footprint
- Significantly shorter pump evacuation cycle times

More efficient compression

- Requires 50% less backing pump capacity compared to the original SIHI Boost units
- Lower power consumption
- Virtually silent operation
- Designed to eliminate axial and radial forces

Minimal maintenance and downtime

- No oil of any kind
- No rotating shaft or wearing seals
- Fast in-situ service on-site
- Condition monitoring replaces preventive maintenance

The SIHI Boost UltraPLUS pump consumes less electricity in a smaller footprint.

Raising the industry standard

The SIHI Boost UltraPLUS pump design is unique to the industry, delivering significant advantages that traditional Roots-type blowers simply can't provide.

Industry-leading cycle times with less energy

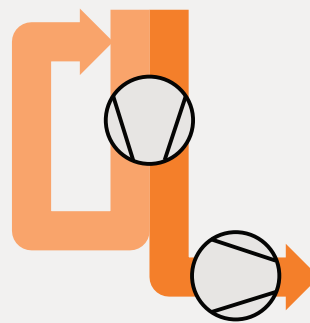
The unique design of the SIHI Boost UltraPLUS vacuum pump allows the unit to harvest kinetic energy stored in the spindles, which can be exposed to atmospheric pressure at their full speed of 15,000 rpm — five times faster than traditional Roots-type machines — with less electricity. An integrated pressure-relief system allows the SIHI Boost UltraPLUS vacuum pump to be used with smaller backing pumps while still achieving rapid pump-down times, further reducing energy consumption.

Together, these innovations reduce cycle times for batch processes up to 50%, potentially doubling the output of existing process equipment.

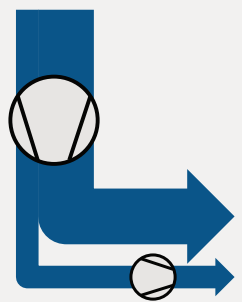
Fast evacuation in a space-saving design

SIHI Boost UltraPLUS vacuum pumps provide a compression ratio (K0) of up to 100,000:1, which is exponentially higher than the rate of the highest-performing, Roots-type blower (maximum 75:1). A single compact SIHI Boost UltraPLUS pump can replace two or three conventional units while eliminating the need for interstage cooling. In addition, the unit can be oriented horizontally or vertically, eliminating unnecessary pipework by allowing a direct connection to the vacuum chamber.

Roots-type blower



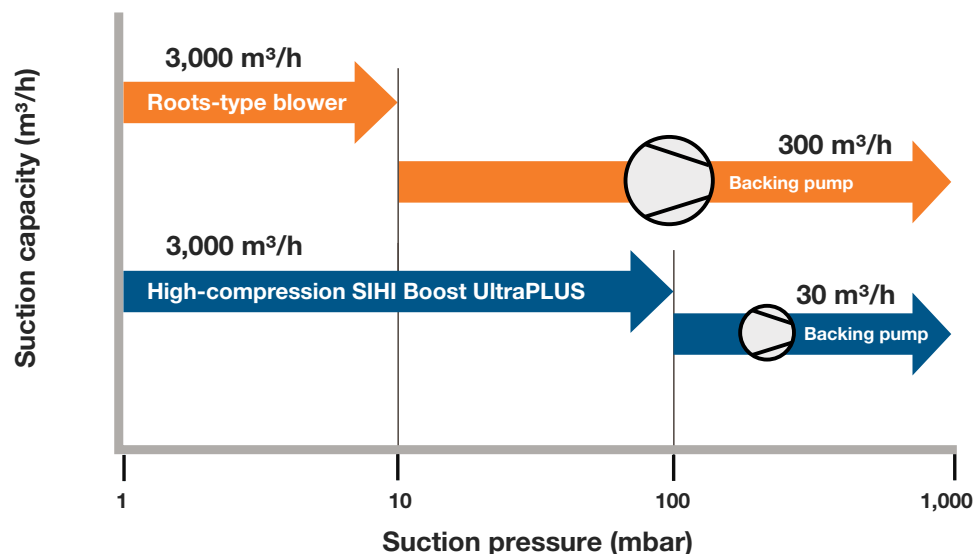
High-compression
SIHI Boost UltraPLUS



SIHI Boost UltraPlus delivers significantly shorter cycle times

Roots-type blowers must be bypassed at high pressure, creating a needless bottleneck in the process. SIHI Boost UltraPLUS dry-running vacuum pumps offer full capacity from the moment the load lock valve opens, resulting in significantly faster pump-down and cycle times.

Compression ratio impacts backing pump size



SIHI Boost UltraPLUS vacuum pumps have a compression ratio at least 10 times greater than a typical Roots-type blower, so they can use much smaller backing pumps.

Raising the industry standard (continued)



Increased productivity and product quality

High pump-down speed with kinetic energy recovery optimizes your cycle times at high pressures. At low pressure, remarkably high pump speed enables a higher flow rate of process gases and better ultimate pressure. Zero process contamination is ensured by truly dry operation, which prevents any contact with service liquids and eliminates the need for gear oil.

Reliably handles harsh processes

No filters are required for SIHI Boost UltraPLUS pumps to handle particle or liquid carryover. When mounted for vertical flow, the unit's top-down design prevents deposits from building up inside the pump, and particles don't cause wear, since there are no contacting parts.

- Because the unit absorbs process particles, it can be paired with liquid ring vacuum backing pumps.
- Integrated liquid cleaning is made possible with an optional flushing module.
- An integrated gas dilution module can be equipped to enable particle carryover and pump drying.

These three options also make the SIHI Boost UltraPLUS pump ideal for handling condensable and corrosive media.

Designed for on-site service

Standard spindle exchange modules enable fast, on-site maintenance by your own staff. The unit can be easily disassembled without removing the bearings. There's no need to remove the pump or send it to a workshop.



The unit's design enables easy access to the booster pump for on-site service.

Greater process control

SIHI Boost UltraPLUS pumps feature a double-pitched, twin-fluted spindle design, which creates deep vacuum with much shorter screws. This reduces temperature changes over the length of the screw while enabling greater temperature control overall. The non-contacting screw spindle design also gives you a substantially wider range of performance, enabling the unit to operate at vacuum levels conventional Roots-type blowers are unable to provide.

Low maintenance and downtime

The SIHI Boost UltraPLUS vacuum pump does not use oil in any part of its hydraulic design, including the gearbox. As a result, it requires no oil checks, exchanges or disposals. The unit's touchless design principle features long-life bearings, with no wearing parts or rotating shaft seals.

Moreover, the SIHI Boost UltraPLUS pump provides continuous real-time status monitoring. Independent data logging of both shafts determines when cleaning is required. In addition, intuitive failure codes alert your team to potential issues before they become more significant problems.

Low power consumption

A proprietary spindle design makes the SIHI Boost UltraPLUS pump the most energy-efficient booster on the market. Additional savings are made possible by an integrated drive, which enables the operator to optimize electrical consumption.

Quiet, oil-free operation

Unlike Roots-type blowers, which use oil-lubricated gearboxes to achieve synchronization, SIHI Boost UltraPLUS pump spindles are electronically synchronized. This innovative design enables vibration-free operation while eliminating the needs for oil lubrication and costly mechanical seals.

The unit's contact-free design extends component life and allows wider tolerances, significantly reducing the chance of shutdowns caused by liquid or particulate carryover. It also makes the SIHI Boost UltraPLUS vacuum pump the quietest booster on the market: 72 dB (A). No acoustic cover is necessary.

Built-in predictive maintenance capability

The SIHI Boost UltraPLUS vacuum pump is RedRaven Ready. RedRaven is a predictive maintenance service from Flowserve that improves plant performance by detecting anomalies in pumps, valves and seals, enabling you to predict why your critical assets may experience issues and take preventive action.

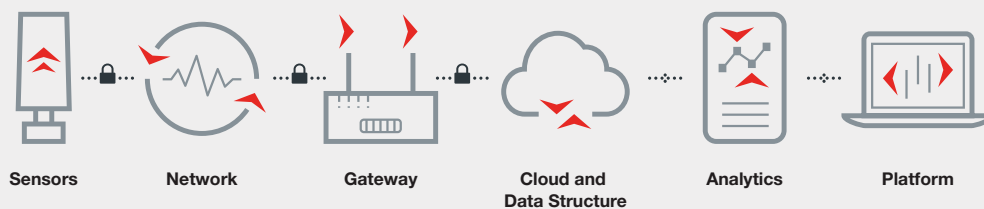
The SIHI Boost UltraPLUS vacuum pump has been designed and built with all the hardware needed to take full advantage of RedRaven capabilities and benefits. No additional sensors or other devices are required.

RedRaven enables SIHI Boost UltraPLUS vacuum pumps to provide clear insights that improve your plant's efficiency, productivity and reliability with a secure IoT platform that includes hazardous area-certified equipment sensors, secure communication, performance analytics and reporting tools — all tailored to your specifications.

Options include:

- **Condition monitoring:** Enables you to capture asset performance data for analysis
- **Predictive analytics:** Helps you identify and diagnose equipment problems before they fail

For more information on RedRaven, contact your Flowserve representative or visit <https://www.flowserve.com/redraven>



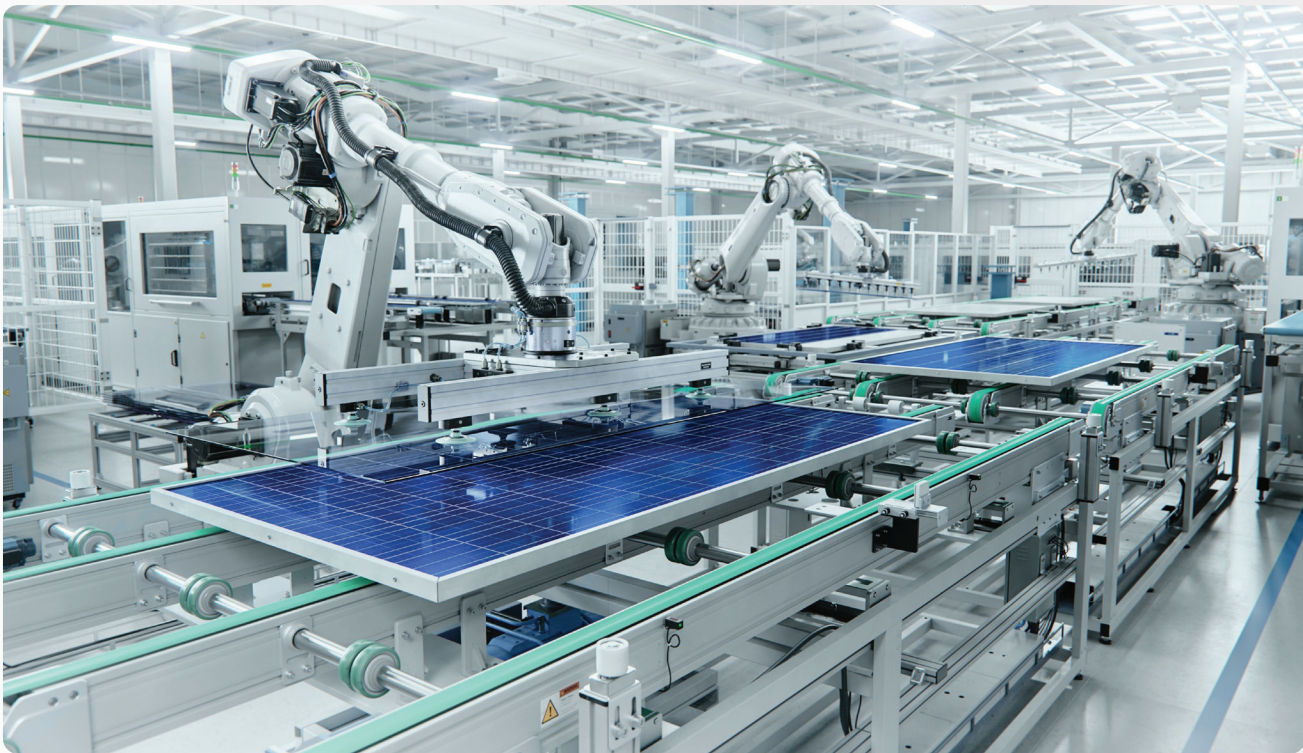
Raising the industry standard (continued)

Versatile performance

Deep process pressure, as well as load-lock applications, can be realized with almost any roughing pump technology, including liquid ring, rotary piston and dry-screw vacuum pumps.

Fastest installation and start-up

The SIHI Boost UltraPLUS vacuum pump is equipped with quick “plug-and-pump” process and utility connections, enabling the fastest setup time in the industry. Pre-engineered modules minimize your engineering time and costs while allowing for easy integration of system components.



Significant opportunities for glass vacuum coating and other load lock processes

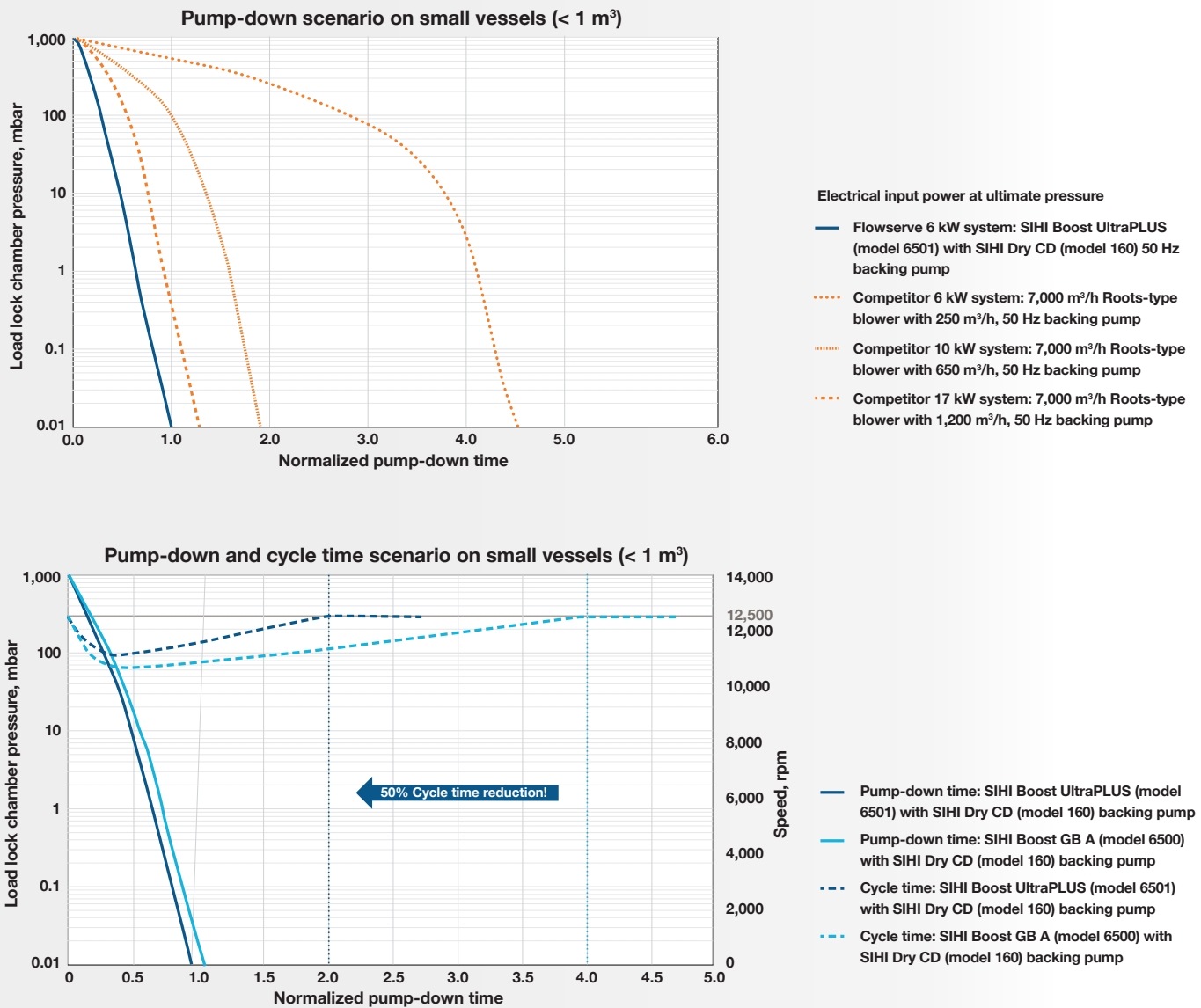
Flowserve developed SIHI Boost UltraPLUS pumps specifically to meet market demands to increase the throughput of existing production tools and reduce production costs per item in load lock applications. Replacing Roots-type blower systems with SIHI Boost UltraPLUS units can enable existing production equipment to achieve significantly shorter pump-down times while requiring only half of the backing pump capacity of the original SIHI Boost pumps. This can result in 50% less energy consumption compared to standard vacuum systems.

Unlike Roots-type blowers, SIHI Boost UltraPLUS vacuum pumps only require backing pumps to achieve the high vacuum pressure range. This means the backing pump capacity can be up to 10 times smaller than using standard Roots-type vacuum pump sets.

Performance data

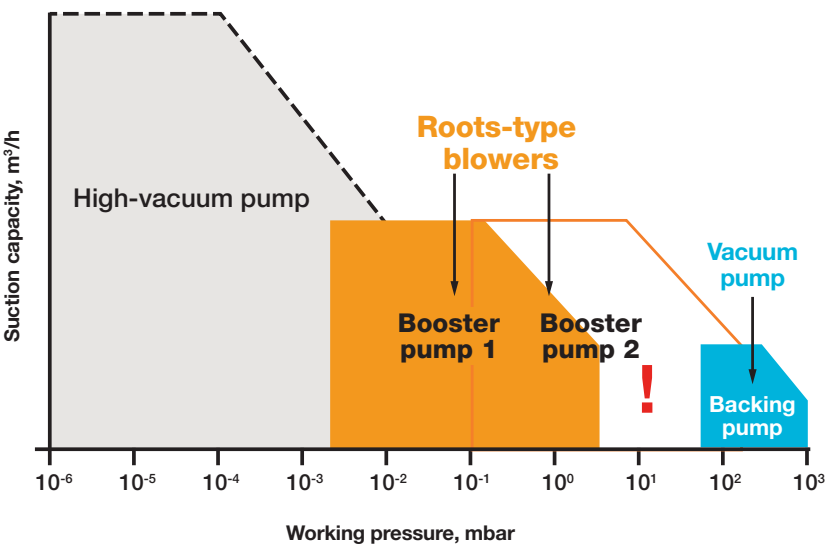
Pump-down timing comparison

These charts illustrate the difference in performance between a Flowserve SIHI S160 screw vacuum pump with a SIHI Boost UltraPLUS unit and several common alternatives offered by competitors, using small vessels (<1 m³ [35 ft³]) as the benchmark. In this example, the pump-down time of the SIHI Boost UltraPLUS system is the lowest with a pumping system that requires only 6 kW of power at ultimate pressure. In the same scenario, the competitor's equal power solution takes more than four times longer. For a comparable pump-down time, the competitor's solution requires more than twice the power and greater backing pump capacity (measured at ultimate pressure).



Performance data (continued)

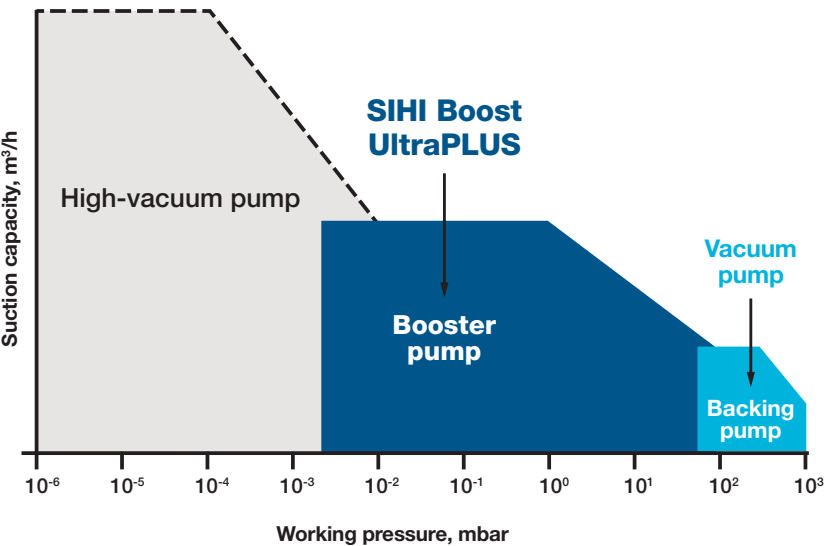
Roots-type blower



Achieve deep process pressure with just one compact unit

A single SIHI Boost UltraPLUS pump easily can compress to pressure levels traditional Roots-type blowers simply can't provide. In addition, it requires only one small backing pump to achieve the high-vacuum pressure range. No additional booster pump is required to fill the gap. In fact, the backing pump capacity can be up to 10 times smaller than in standard Roots-type vacuum pump sets, minimizing your space and significantly reducing energy use.

SIHI Boost UltraPLUS



General technical data

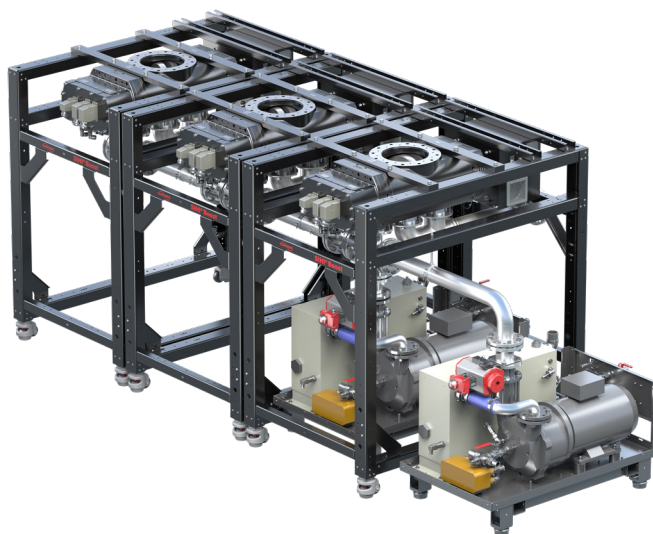
(Air or N₂ with 0.5 mbar [0.38 Torr] inlet pressure @ 20°C [68°F])

| Parameter | | SIHI Boost UltraPLUS |
|--|--------------------|--|
| Maximum speed at indicated backing pump speed | 160 m³/h (95 cfm) | ≤ 5,400 m³/h (3,180 cfm) |
| | 250 m³/h (174 cfm) | ≤ 5,600 m³/h (3,300 cfm) |
| | 500 m³/h (295 cfm) | ≤ 5,700 m³/h (3,350 cfm) |
| Ultimate pressure | | 5x10 ⁻¹ to 8x10 ⁻⁴ mbar a (3.8x10 ⁻¹ to 6x10 ⁻⁴ Torr a) |
| Maximum discharge pressure | Static | 350 mbar a (263 Torr a)* |
| | Dynamic | ≤ 2,000 bar (29 psi); short, load lock pumping |
| Noise level , per DIN 9614/ISO 21680 | | < 65 dB (A) |
| Weight | | 1,300 kg (590 lb) |

*250 mbar a (188 Torr a) for SIHI Boost UltraPLUS 8001

Available accessories

- **Inlet valve** — Enables safe isolation of suction line
- **Inline flush** — Allows liquid cleaning mode on demand without removing pump
- **Gas dilution** — Increases capacity to handle particles or condensable vapor
- **ISO K 160 adaptors** — For connection with ISO K 160 pipework on discharge side
- **Bypass collecting pipe** — Optional bypass manifold for N2.2/N2.3 connections
- **Control unit** — Easy integration with input/output (I/O) interface and all communication standards
- **Power supply connection** — Equips unit with Harting power plugs
- **Cooling water particle filter** — Protects against abrasive particles
- **Service and toolkit** — Enable efficient on-site cleaning of spindles and housing by trained personnel





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