FLOWSERVE

available in the Carolinas + Virginia through

PP&S

an otp industrial solutions company

www.pp-s.com

SIHI® Boost CL

Sizes 3500, 5000, 6500, 8000

Dual Stage Vacuum System - Compact Design

Dry running Screw Booster Vacuum Pump with
Liquid Ring Vacuum Backing Pump

BPMA

PUMP INDUSTRY AWARDS 2016 WINNER

Experience In Motion

SIHI® Boost … WON AWARD AS TECHNICAL INNOVATION PRODUCT OF THE YEAR

Dramatically faster evacuation down to deep vacuum levels with less power, smaller footprint, quieter, safer, and cleaner by harvesting the Kinetic Energy of heavier rotors which run five-times faster than usual machines.

Mass inertia is stored during idle periods and then released immediately when demanded. Game-changing hydraulic optimization allows pump pressure gradients of one-million-to-one while in the rough pressure area. This is unique and would normally need a high number of pressure stages.

Mechatronically synchronized, contact-free, moving parts removes the need for oil-centric lubrication and associated mess.

Simple operation and long-term reliability are at the center of all Flowserve innovative designs.

Technical Innovation of the Year - Products

BPMA PUMP INDUSTRY AWARDS 2016 WINNER

- **Highest pumping speed with two stages only**
- **Fastest evacuation**
- **Deep vacuum level**
- **Lowest power consumption**
- **No oil at all**
- **Smaller footprint**
- **Lowest noise level**
- **Easiest service on site**

Pressure range: **< 0.003 to 1013 mbar**
< 0.0023 to 760 torr

Suction Speed: **2700 to 5700 m³/h**
1589 to 3354 cfm

DESIGN

SIHI® Boost CL Vacuum systems have been developed for the requirements of industrial applications in fine vacuum pressure range. The compact skid consists of a **SIHI® Boost** Screw Booster Vacuum Pump combined with a Liquid Ring Vacuum Backing Pump.

Particles from process carry over are being washed out in the Liquid Ring Vacuum Pump which acts like a scrubber in order to provide a pre-cleaned discharge flow.

This dual stage system solution offers the following unique features:

- Handling of gases and condensable vapours
- Optimized for process and load lock applications
- Capable of handling solid carry over
- Entirely oil free operation
- Simple to maintain
- Highly reliable
- Low noise and vibration
- Condition monitoring options adaptable

The compact design of **SIHI® Boost CL** Vacuum systems have been especially designed for user-optimised handling and connection. With its superior and fully-integrated control, **SIHI® Control** offers:

- Autonomous supervision and control of all integrated actors and sensors
- Local control via HMI touch interface
- Condition monitoring
- Pre failure detection

AVAILABLE DRIVE VERSIONS

Standard: Especially for process applications
This version has been designed specifically for remarkably high performance combined with low power consumption.

Ultra: Especially for load lock applications
This version is based on the concept of the Standard-Version however specifically tuned for load lock applications, when the most prominent focus is on cycle time and pump down time.

APPLICATION

Load lock and process applications

Processing of gases and condensable vapours, capable of handling particles.

NOTE

In contradiction to conventional shaft synchronisation via a mechanic gear box in Roots Blowers, the **SIHI® Boost** spindles are electronically synchronized. This well established, innovative concept enables a silent operation of the vacuum system; it also makes all efforts for maintaining and changing gear oil obsolete.

SIHI® Liquid Ring Vacuum Pumps are simple, single shaft pumps wit outstanding reliability and robustness.

GENERAL TECHNICAL DATA

Booster		**3500**	**5000**	**6500**	**8000**
Max. Pump Speed with Backing Pump Speed:		Air or N_2 with 0.5 mbar inlet pressure / 20°C (Air or N_2 with 0.38 torr inlet pressure / 68°C)			
160 m³/h	m³/h (cfm)	≤ 2700 (1589)	≤ 3500 (2060)	≤ 4500 (2648)	≤ 5600 (3296)
250 m³/h	m³/h (cfm)	≤ 2800 (1648)	≤ 3600 (2118)	≤ 4600 (2707)	≤ 5600 (3296)
500 m³/h	m³/h (cfm)	≤ 2900 (1706)	≤ 3700 (2177)	≤ 4800 (2825)	≤ 5700 (3354)
Ultimate Pressure	mbar a (mtorr)	< 0.02 (15.01)	< 0.007 (5.26)	< 0.005 (3.76)	< 0.003 (2.26)
Max. discharge pressure					
static	mbar g (torr g)	± 200 (± 150)			
Noise level					
acc. DIN ISO 9614 / 21680	dB (A)	< 75			
Weight	kg (lbs)	1200 with 160 m³/h backing pump – 1350 with 500 m³/h backing pump (2646 with 160 m³/h backing pump – 2976 with 500 m³/h backing pump)			

NOT JUST A PUMP!
YOUR SOLUTION FOR ...

Engineering / Integration

... LOWER INITAL INVESTMENT COSTS

High suction capacity with significantly smaller backing pump
+ High pressure ratio of > 100 mbar in continuous operation allows 10 times smaller backing pump capacity than conventional roots pumps

... LOW EFFORTS IN ENGINEERING & INTEGRATION OF SYSTEM COMPONENTS

Customized solutions
+ Pre engineered modules matches all individual process needs

No acoustic cover necessary
+ Contact free principle offers quiet operation and comfortable environmental conditions

More an integrated solution than just a pump
+ Pre engineered modules are assembled & tested in one vacuum system
+ Small foot print design saves useful space

No PLC control for pump necessary
+ Pre engineered modules are self-controlled by integrated system control
+ Local control via Human Machine Interface (HMI) touch panel
+ Data communication via Ethernet

Easy communication integration due industrial standards
+ Availability of all Bus standards as well as IO interface
+ Equipped with HMI

Pump System Control with HMI

Installation

... FASTEST INSTALLATION & START UP

Plug & Pump concept
+ Equipped with quick connectors for process and supply media as standard

Maintenance

... LOWER COST FOR MAINTENANCE & LOWEST DOWN TIME

No oil checks, exchanges and disposals required
+ Free of oil as service liquid
+ No gear oil

No wearing
+ Consequent touch-less principle
+ Long life bearings
+ Contact-free sealings

Continuous condition analysis
+ Data logging
+ Online monitoring of pump status
+ Simple failure codes

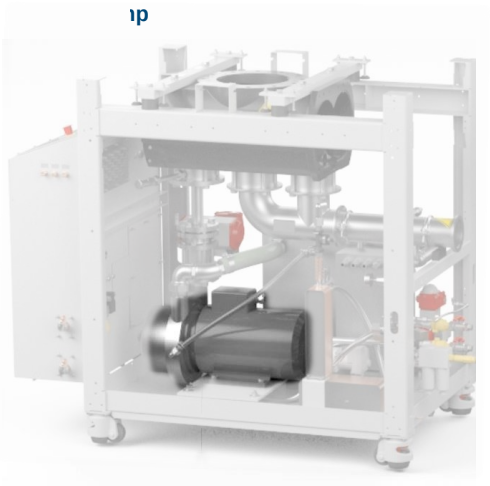
Cleaning

... LOWEST DOWN TIME

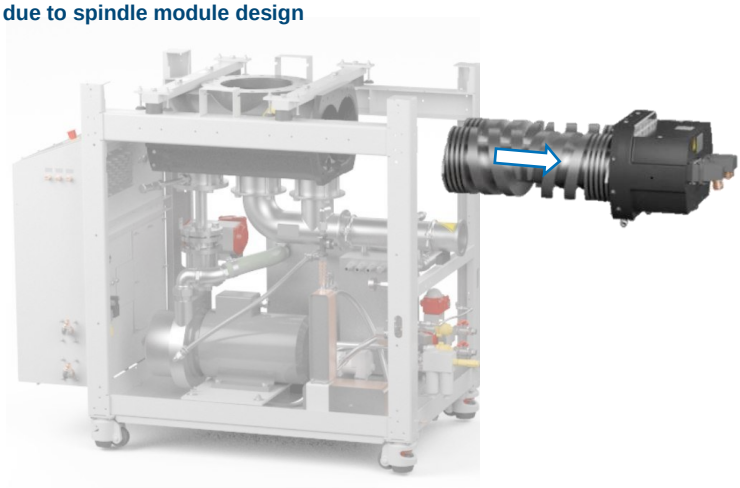
Only cleaning on demand
+ Condition monitoring by independent data record of both shafts
+ Pre failure detection

Possible to clean in situ
+ Easy dismantling without bearing removal
+ No high-tech workshop required
+ Can be done on site by own staff
+ Independency on 3rd party service performance

the most reliable Liquid Ring Vacuum
ıp



Easy access to booster pump due to spindle module design



Service

... LOWER COST FOR SERVICE

Avoiding consequential damages
+ Pre failure detection

... LOWEST DOWN TIME

Fastest unit exchange on site
+ Fast unit exchange
+ Can be done on site by own staff
+ Quick connectors offers Plug & pump
+ Equipped with wheels and levelling feet

Designed for On-site service
+ Standard spindle exchange modules
+ No high-tech workshop required
+ Can be done on site by own staff
+ Independency on 3rd party service performance

Fastest remote failure analysis
+ Continuous data logging allows comprehensive understanding of system conditions
+ Prepared for online condition monitoring
+ Simple failure codes

Operation

... INCREASED PRODUCTIVITY

Fast pump down
+ High pump speed at high pressure (with kinetic energy recovery system)

... INCREASED PRODUCT QUALITY

High pumping performance
+ Remarkably high pump speed at low pressure allows higher flow rate of process gases
+ Better ultimate pressure

Zero process contamination
+ truly dry and touch-less principle
+ Absolutely free of gear oil due to electrical synchronised shafts

... LOWER COST FOR OPERATION

Low power consumption
+ High-tech screws design is aimed to run with most energy efficiency
+ Frequency control allows to improve energy efficient operation by operators

Robust & reliable
+ Pump design works without any coating on screws
+ Minimal axial force allows high load capacity

... CAPABILITY FOR USE IN HARSH PROCESSES

Tolerates particle & liquid carry over without any suction side filter
+ Top Down flow avoids residues inside of the pump
+ Carrying particles does not result in wear due to consequential contact free principle
+ Utilization of the most reliable Liquid Ring Vacuum Backing Pump
+ Optional integrated liquid cleaning by flushing module
+ Particle carry over & pump drying by optional integrated gas dilution module

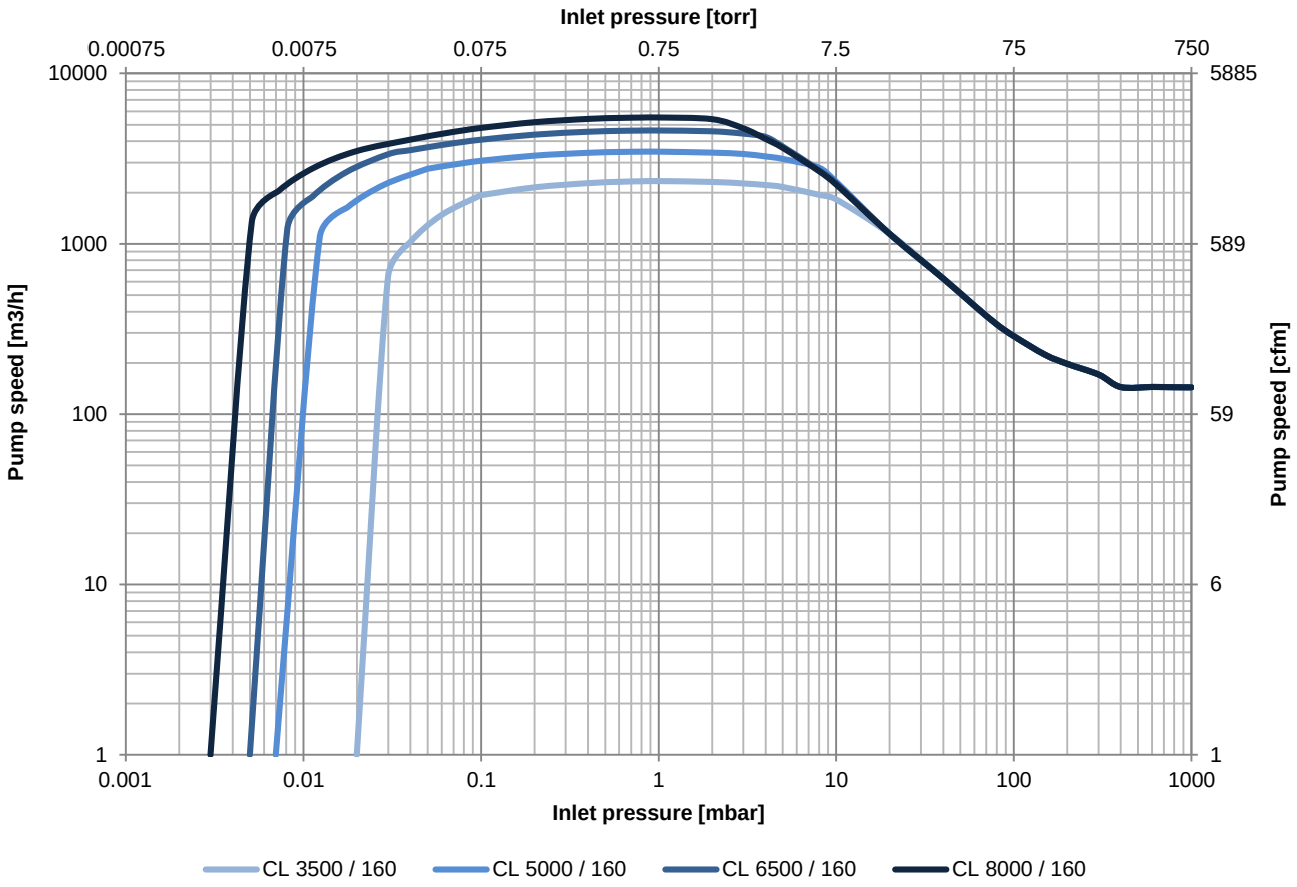
Absorbs process particles
+ Utilization of the most reliable Liquid Ring Vacuum Backing Pump

Handles condensable & corrosive media
+ Utilization of the most reliable Liquid Ring Vacuum Backing Pump
+ Prevention of condensation inside of the pump by optional integrated gas dilution module
+ Optional integrated liquid cleaning by flushing module

Absorbs condensable & corrosive media
+ Utilization of the most reliable Liquid Ring Vacuum Backing Pump

PUMP SPEED CURVES

Example: 160 m³/h backing capacity (additional pump speed curves on request)



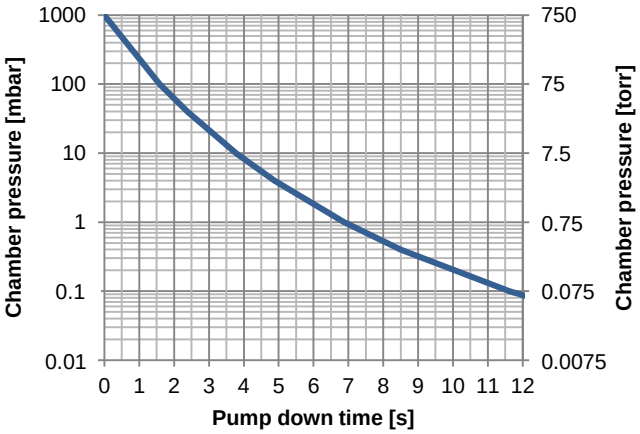
Data valid under following conditions:

- Media : dry air: 20°C (68°F)
- Service Liquid (LRVP) : water: 25°C (77°F)
- Cooling water inlet : water: 25°C (77°F)
- Discharge pressure : 1013 mbar (760 torr)
- The inlet pump speed is related to the inlet pressure

Data deviation tolerance ± 10%

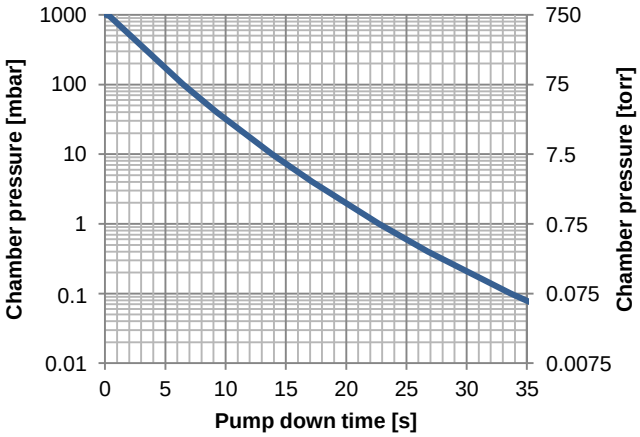
Pump down curve (600 l camber)

Example: **SIHI® Boost** CL 8000 / 160 Ultra



Pump down curve (1.9 m³ camber)

Example: **SIHI® Boost** CL 8000 / 500 Ultra



ELECTRICAL DATA

Booster		3500			5000			6500			8000		
Backing pump		**160**	**250**	**500**	**160**	**250**	**500**	**160**	**250**	**500**	**160**	**250**	**500**
Max. Power													
Ultimate pressure	kW	< 5.0	< 5.5	< 14	< 5.5	< 6.0	< 15	< 6.5	< 7.0	< 16	< 7.5	< 8.0	< 17
	(hp)	(6.7)	(7.4)	(18.8)	(7.4)	(8.1)	(20.2)	(8.8)	(9.4)	(21.5)	(10.1)	(10.8)	(22.8)
Max. (***Standard***)													
400V / 50Hz	kW	17.0	18.5	28.0	17.0	18.5	28.0	17.0	18.5	28.0	17.0	18.5	28.0
	(hp)	(22.8)	(24.9)	(37.6)	(22.8)	(24.9)	(37.6)	(22.8)	(24.9)	(37.6)	(22.8)	(24.9)	(37.6)
460V / 60Hz	kW	18.5	20.5	28.0	18.5	20.5	28.0	18.5	20.5	28.0	18.5	20.5	28.0
	(hp)	(24.9)	(27.5)	(37.6)	(24.9)	(27.5)	(37.6)	(24.9)	(27.5)	(37.6)	(24.9)	(27.5)	(37.6)
Max. (***Ultra***)													
400V / 50Hz	kW	20.0	21.5	31.0	20.0	21.5	31.0	20.0	21.5	31.0	20.0	21.5	31.0
	(hp)	(26.9)	(28.9)	(41.6)	(26.9)	(28.9)	(41.6)	(26.9)	(28.9)	(41.6)	(26.9)	(28.9)	(41.6)
460V / 60Hz	kW	21.5	23.0	31.0	21.5	23.0	31.0	21.5	23.0	31.0	21.5	23.0	31.0
	(hp)	(28.9)	(30.9)	(41.6)	(28.9)	(30.9)	(41.6)	(28.9)	(30.9)	(41.6)	(28.9)	(30.9)	(41.6)
Electrical connection													
50 Hz	V AC	400 ± 10 % TN-System (L1, L2, L3, PE (without N))											
60 Hz	V AC	460 ± 10 % TN-System (L1, L2, L3, PE (without N))											
Protection class													
DIN EN 60529		IP 42											

PURGE GAS

Booster		3500	5000	6500	8000
Purge gas connection					
Media		Nitrogen / Argon / CDA see specification (Purge purity following ISO 8573-1:2010: min Class 2.4.2)			
Pressure	bar g (psi)	6 to 8 (87 to 116)			
Max. Flow	Nl/min (SCFM)	30 (1.1)	30 (1.1)	40 (1.4)	54 (1.9)

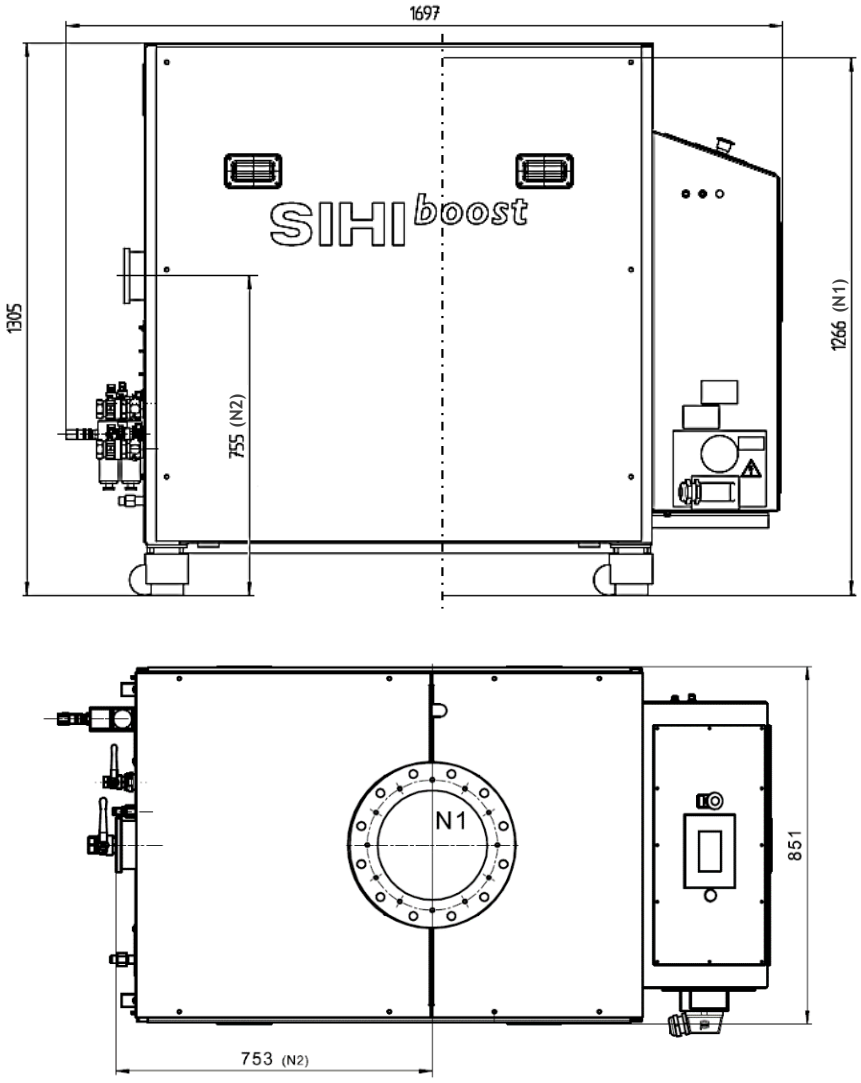
COOLING WATER / SERVICE LIQUID

Backing pump		160	250	500
General requirements				
Cooling water temperature	°C (°F)	10 to 25 (50 to 77)		
Max. stat. supply pressure	bar g (psi)	6 (87)		
Connection N5.1				
Media		Water[1]		
Min. Flow	l/min (gpm)	23 (6.08)	23 (6.08)	10 (2.64)
Connection N5.2				
Media		-	-	Water[1]
Min. Flow	l/min (gpm)	-	-	40 (10.57)
Connection N5.3				
Media		Water[1 2]		

[1] *Water conductivity allowance> 50 µS for closed system / Water conductivity > 300 µS for open system*
[2] *Recommended quality: pH 6.5 to 8.5; carbonate hardness 7°dH to 9°dH*

DIMENSIONS

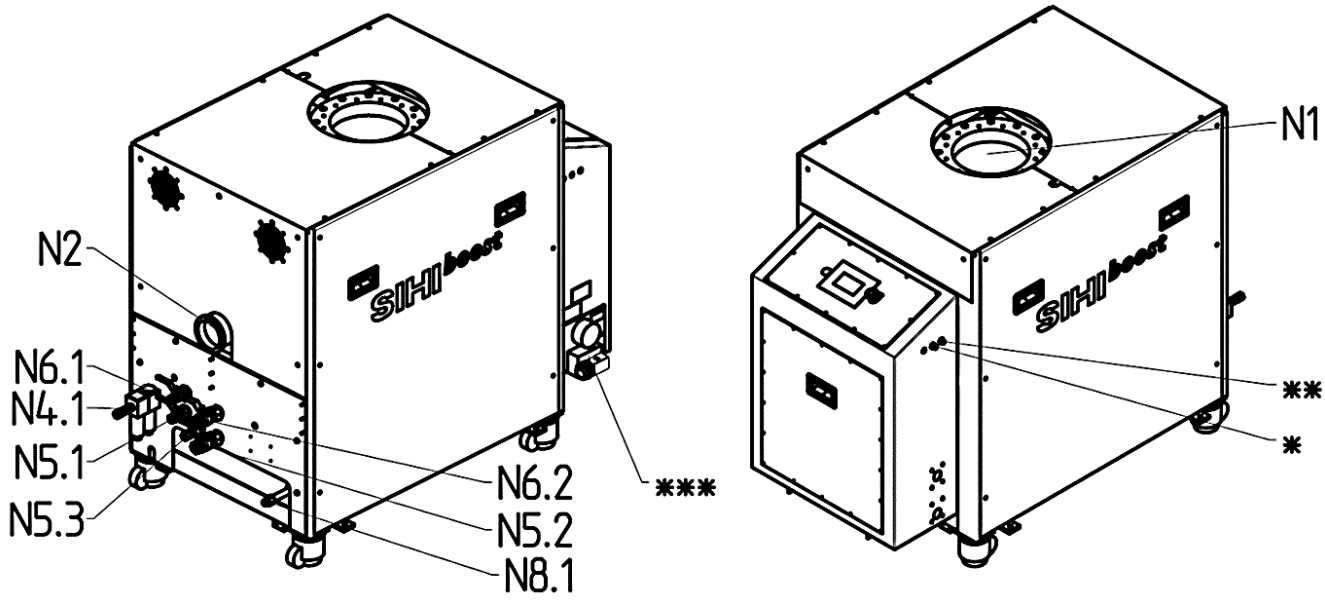
Dimensions in mm



DESIGN MATERIAL

Backing pump	**160**	**250**	**500**
Process exposed parts			
SIHI® Boost	Cast Iron / Ductile Cast Iron / SS - Cr		
Internal piping	PTFE / PVC / SS CrNi		PTFE / SS CrNi
Backing pump	SS-CrNi		
Service liquid loop	ABS / EPDM / PP / PTFE / SS CrNi		
Cooling loop	EPDM / PAN / PUN / SS - CrNi / Brass		
Discharge pipe / valves	Mild Steel / SS - Cr / SS CrNi		

CONNECTIONS

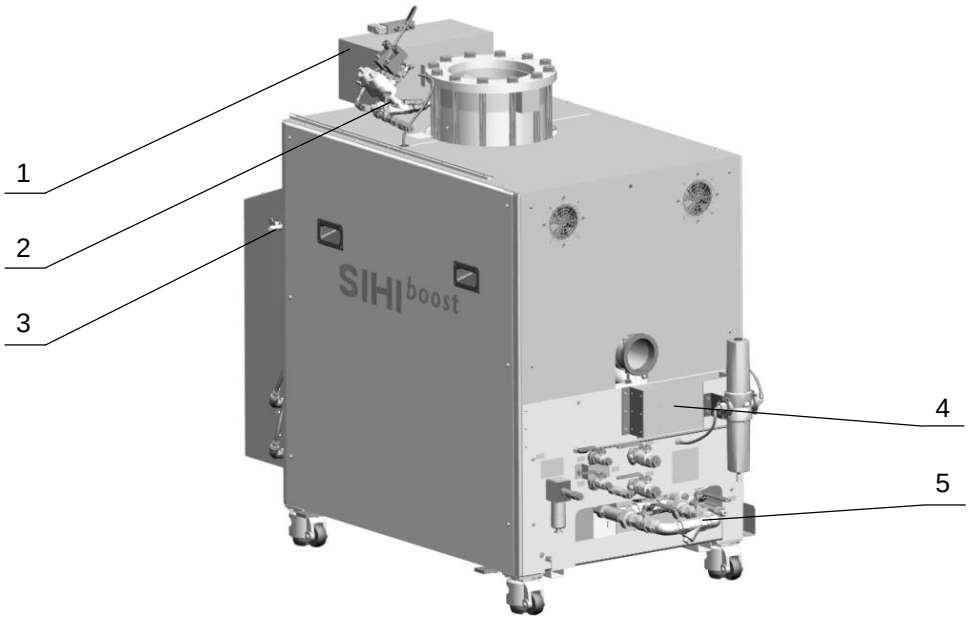


Backing pump	160	250	500
Process media			
N1: Gas inlet	ISO K/F DN250		
N2: Gas outlet	ISO K 100		
Purge gas			
N4.1: Inlet	Quick Connector - G½“ (FT)		
Cooling system			
N5.1: CW inlet	Quick Connector - G½“ (FT)		
N6.1: CW outlet	Quick Connector - G½“ (FT)		
Additional cooling backing pump			
N5.2: Cooling water inlet	-		Quick Connector – G1“ (FT)
N6.2: Cooling water outlet	-		Quick Connector – G1“ (FT)
Service liquid backing pump			
N5.3: Liquid fill	Quick Connector - G½“ (FT)		
N8.1: Liquid drain	G½“ (MT)		
Electrical connection			
* : Process communication	SACCBP – M12FSB – 2CON – M16		
** : Ethernet	VS – DISV – M12FSD/1,0 – RJ45		
*** : Power supply	HAN K4/0 – STI – S MALE		HAN K6/6 - M

(FT) : Female Thread
(MT) : Male Thread

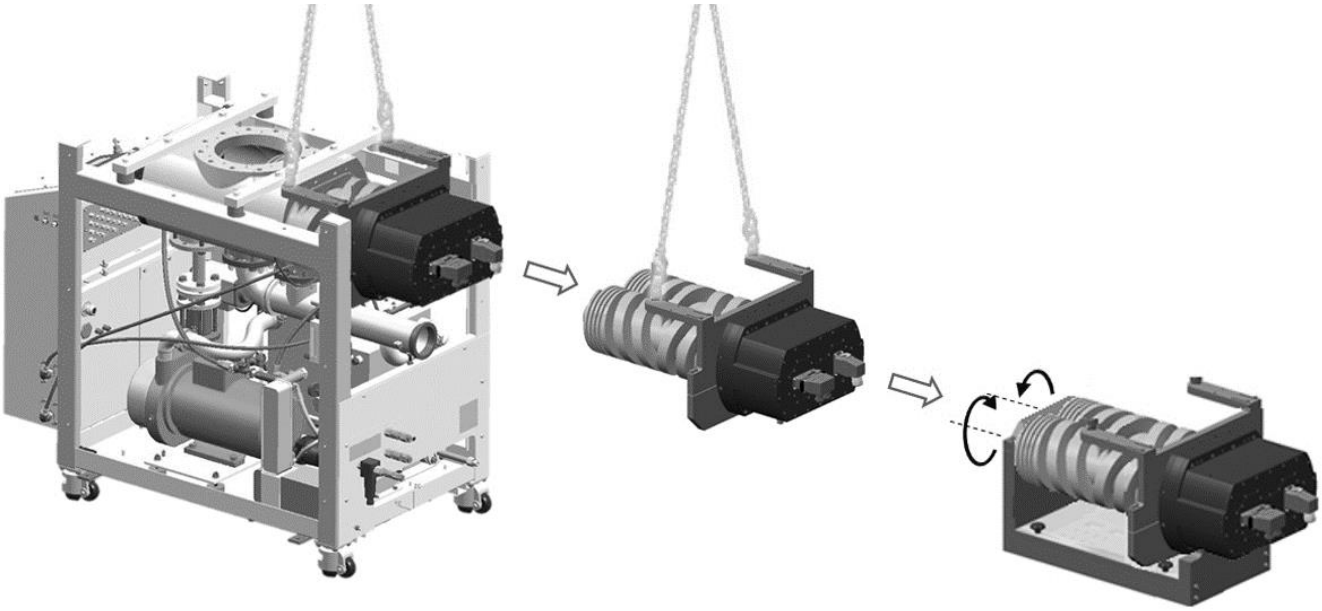
NPT / ANSI on request

ACCESSORIES



Booster	3500	5000	6500	8000
1 Inlet Valve	This optional, pneumatically actuated valve enables a safe isolation of the suction line which prevents residue media to enter the pump as well as back flow from the discharge while pump is shut down. When power and gas supply fails, the valve is automatically closed by an internal spring return (NC). Especially for parallel pump operation, it is recommended to equip each pump with an isolation valve to avoid damages in case of any failures.			
2 Inline Flush	In order to clean the pump chamber of the **SIHI® Boost**, this option allows the introduction of cleaning liquid via an inlet flush module. The compact system can be then operated in a flush mode initiated and controlled by the customer on demand. This measure enables significantly shorter maintenance phases.			
3 Control Unit	On customer demand, the compact system can be optionally equipped with the following control modules: I/O interface, Profibus, PROFINET, EtherCAT, Modbus-TCP, EtherNet/IP, DeviceNET			
4 Membrane - Purge gas module	In case the application requires nitrogen as purge gas or gas dilution, this option can be added to easily generate Nitrogen from CDA.			
5 Cooling water particle filter *(not shown)*	For the protection against rough particles the customer site cooling circuit of the **SIHI® Boost** compact system can be filtered by an inlet particle filter.			
6 Filter unit for service liquid	The Liquid Ring Vacuum Backing Pump offers the advantage of capturing particles from the process in the service liquid. With increasing contamination of the service liquid with solids, the liquids however needs cleaning. This filter enables this continuous cleaning function while operating.			
7 Gas Dilution **SIHI® Boost** - Exhaust *(not shown)*	This optional, additional gas dilution can be added in order to handle larger amounts of particles or excessive amounts of condensable vapour. In order to prevent too high purge gas consumption, this option only gets activated by the control in „Vacuum Mode“. There is no influence on the suction capacity of the **SIHI® Boost** compact system.			

ACCESSORIES



Booster	3500	5000	6500	8000
8 Service-Tool Kit	This service - tool kit enables an efficient and ergonomic cleaning procedure of the **SIHI® Boost** spindle and housing on site via trained personnel. The Service - Lifting device permits the disassembly of the spindle unit. The design is set for the gravity point of the unit for ergonomic and easier handling. The spindle rest is a device to safely place the spindle unit after removal from the casing for better cleaning. The device includes all necessary tools for assembling and disassembling the spindle unit. Additionally a compact transportation case for the device and tools is available.			

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