



# **SIHI<sup>®</sup> Dry Dry-running vacuum pumps for process applications**

M, Mi and H Series Models for North America



*Experience In Motion*

## Deep vacuum in a clean dry-running design

The SIHI Dry vacuum pumps were specifically developed for use in chemical, pharmaceutical and other process applications requiring deep vacuum. Unlike conventional twin-screw vacuum pumps, SIHI Dry pumps do not require fluids for sealing or lubricating. The SIHI Dry pump design eliminates your acquisition and disposal costs of these fluids while allowing you to recover uncontaminated solvent and process vapors downstream. Moreover, their advanced design can help reduce the time required to achieve target vacuum levels, improving your throughput times and process efficiencies.

### Electronically synchronized drive

The key to the SIHI Dry pumps' dry-running design is that the screws are individually driven, VFD-controlled and electronically synchronized. Traditional technology employs a "master-slave" drive arrangement with a gearbox requiring lubrication. In addition, non-contact, non-wearing, labyrinth shaft seals eliminate the need for costly mechanical seals.

This innovative design eliminates the need for sealing and lubricating fluids and enables numerous operational benefits.

- **Vertical orientation** – SIHI Dry pumps incorporate a top-down flow of process gases, using gravity to manage process carryover. This orientation also provides the smallest footprint in the market.
- **Larger clearances** – As a result of the high-speed, electronically synchronized drive system, the clearances between the screws of SIHI Dry pumps are larger than those of conventional twin-screw vacuum pump designs. The larger clearances improve the pumps' ability to manage process carryover. Aided by gravity, both liquids and particulates drain from the pump chamber to the discharge port.
- **Quiet operation** – With their unique drive system, SIHI Dry pumps have no discernable vibration, making them among the quietest on the market.
- **On-site serviceability** – The cantilever design of SIHI Dry pumps allows you to perform most routine service and repair work where the pump is installed, so you can maximize equipment availability.



SIHI Dry pump model M160

## General technical data

Parameter	Model							
	M160	M400	Mi450	Mi650	H400	H630	H1000	
<b>Suction capacity</b> (actual volumetric flow)	160 m <sup>3</sup> /h (95 cfm)	400 m <sup>3</sup> /h (235 cfm)	450 m <sup>3</sup> /h (265 cfm)	680 m <sup>3</sup> /h (383 cfm)	400 m <sup>3</sup> /h (235 cfm)	630 m <sup>3</sup> /h (370 cfm)	1,000 m <sup>3</sup> /h (585 cfm)	
<b>Final pressure</b>	< 0.5 mbar (< 0.37 Torr)	< 0.0013 mbar (< 0.001 Torr)	< 0.005 (< 0.00375)	< 0.001 (< 0.0075)	< 0.1 mbar (< 0.07 Torr)	< 0.1 mbar (< 0.007 Torr)	< 0.01 mbar (< 0.007 Torr)	
<b>Speed range</b>	6,000 to 12,000 rpm		5,000 to 7,500 rpm		500 to 5,500 rpm	500 to 8,000 rpm		
<b>Minimum temperature class</b>	T4	T4	T3	T2	T4	T3	T3	
<b>Lowest discharge temperature</b>	< 135°C (< 275°F)		< 200°C (< 392°F)	< 300°C (< 572°F)	< 135°C (< 275°F)	< 180°C (< 355°F)	< 200°C (< 392°F)	
<b>Process gas inlet temperature</b>	0°C to 100°C (32°F to 212°F)							
<b>Max. nominal discharge pressure</b>	0.103 bar (1.5 psig)							
<b>Sound level</b>	< 54 dB(A)		< 75 dB(A)		< 64 dB(A)	< 70 dB(A)		
<b>Approx. weight</b>	261 kg (575 lb)		400 kg (880 lb)		540 kg (1,200 lb)	590 kg (1,300 lb)	640 kg (1,400 lb)	
<b>Power consumption</b>	<b>At final pressure</b>	3.8 kW (5 BHP)	2.7 kW (3.5 BHP)	< 4.0 kW (5.4 BHP)	< 6.0 kW (8.0 BHP)	5.3 kW (7 BHP)	12.2 kW (16 BHP)	19 kW (25 BHP)
	<b>Max. installed</b>	10 kW (13 BHP)	10 kW (13 BHP)	11.55 kW (15.6 BHP)	12.3 kW (16.7 BHP)	10 kW (13 BHP)	38 kW (50 BHP)	38 kW (50 BHP)
<b>Power supply</b>	360 to 550 VAC, three-phase, 60 Hz, 5 Amp, 24 VDC							
<b>Purge gas supply (N<sub>2</sub>, CO<sub>2</sub>, dry air)</b>	9.85 nL/m (0.35 SCFM)		20 nL/m (0.71 SCFM)		21 nL/m (0.75 SCFM)			
<b>Cooling water supply</b>	< 4.16 Lpm (4.1 gpm)		< 7 Lpm (< 1.85 gpm)		< 7.19 Lpm (< 1.19 gpm)	< 7.57 Lpm (< 2 gpm)		

## Application versatility

SIHI Dry vacuum pumps are engineered to develop deep vacuum under demanding process conditions, including those in classified areas.\*

### Principle industries

- Chemical
- Pharmaceutical
- Electronics
- General industry
- Solar energy

### Key vacuum applications

- Batch reactors
- Chemical deposition
- Distillation
- Drying

\*SIHI also offers models for non-classified areas.



M160

## Operational benefits

### Wide range of performance with greater tolerance to carryover

SIHI Dry vacuum pumps are driven by a matching pair of electronically synchronized, high-speed, VFD-controlled motors. This design enables higher speeds, allowing larger clearances for process carryover. The variable-speed motors enable a substantially wider range of performance.

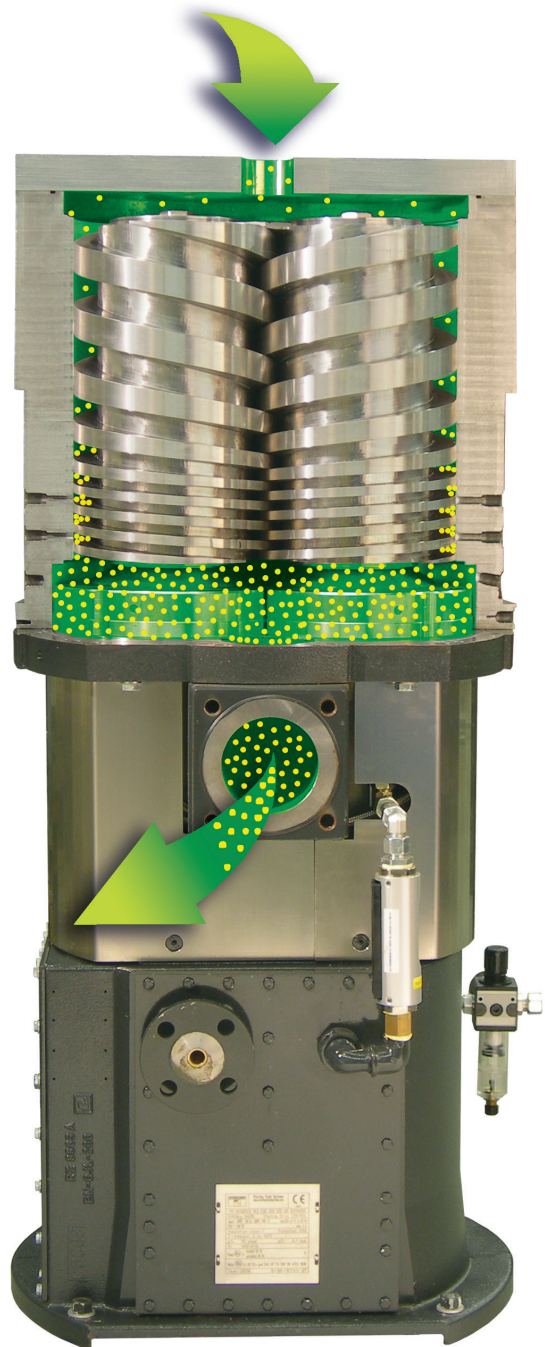
By contrast, conventional twin-screw vacuum pumps use a single motor to drive both screws in a master-slave configuration. This design creates significant speed restrictions and requires tighter screw clearances to achieve the required vacuum levels. The tighter tolerances can be easily overloaded by process carryover. Conventional horizontal process flow of these units allows carryover buildup inside the pump, impeding process flow and over-stressing drive components and seal integrity.

### Improved uptime

The vertical configuration of SIHI Dry vacuum pumps provides a self-draining, top-down flow. This design prevents the buildup of process carryover in the pumping chamber. In the event excessive process carryover or condensation enters the pumping chamber, the pump automatically senses unusual process loading through changes in torque. The system reduces speed, allowing a potential blockage to clear without danger of damage. These factors significantly reduce the potential for catastrophic failure.

### Minimal environmental impact

SIHI Dry vacuum systems run without the need for oil or service liquids. This eliminates the possibility of contaminating your process and/or discharge streams. This enables you to recover uncontaminated solvent and process vapors downstream.





### Zero scheduled maintenance

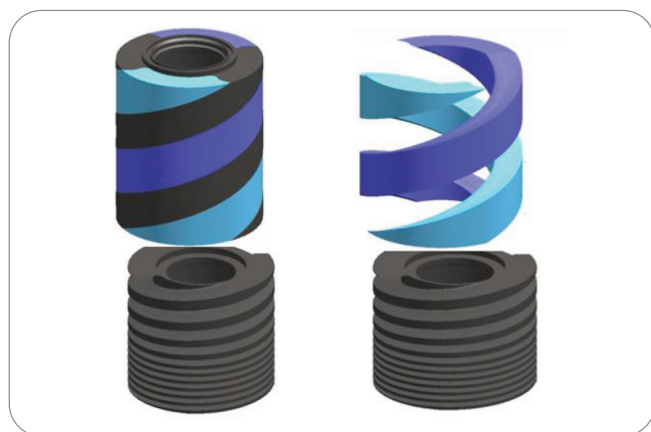
SIHI Dry vacuum pumps don't require scheduled maintenance because the integrated VFD and load control continuously monitor and adjust to key conditions. Temperature, torque and other parameters are tracked in real time. This enables you to incorporate remedial actions, such as flushing, to maximize uptime.

### Low noise and vibration

Operating at maximum noise levels of less than 75 dB(A), the twin-screw design of SIHI Dry vacuum pumps is among the quietest on the market. The twin-fluted design of the screws eliminates radial forces across each screw, achieving a virtually vibration-free installation. These benefits eliminate the need for special foundations while assisting your compliance with industry noise standards.

### Explosion-proof design

SIHI Dry H, M and Mi Series pumps are designed to Class 1, Division 1 and 2, and Zone 1 requirements. With non-contacting screws, temperature control, inert purge gas and integral electronic diagnosis, their design eliminates potential ignition sources.



*The twin-fluted screw design is offset by 180 degrees to fully balance radial forces.*

## Simple on-site service

The vertical design of the screw assembly enables SIHI Dry vacuum pumps to be cleaned in place. SIHI Dry units can be flushed during operation and are specifically designed to allow quick access to the pumping chamber. Most repairs can be performed without removing the pump from the system. The pump casing is easily removed without disturbing the bearings, providing easy access to the screws. The cantilevered orientation of the screws makes them easy to remove for steam cleaning or other basic service.

## Integrated drive control

The innovative drive concept of SIHI Dry pumps enables the pumps to be configured to operate in a basic on/off fashion or provide fully integrated control for the needs of specific processes.

## Space-saving design

Unlike conventional pumps, SIHI Dry process vacuum pumps are installed vertically rather than horizontally. As a result, they have a smaller installed footprint, conserving valuable floor space.

## Bottom line results

SIHI Dry pumps provide faster pump-down from atmosphere to your target vacuum level, improving cycle times and productivity. With no need for lubrication or mechanical seals, maintenance and process downtime are significantly reduced. In addition, the energy-efficient design of the pumps consumes approximately 10% less power than conventional dry pumps. These and other cost-saving innovations ensure that SIHI Dry systems deliver best-in-class ROI.

## Lower waste treatment costs

SIHI Dry vacuum pumps use no lubricating or sealing fluids. This design reduces operating expenses by eliminating procurement and disposal costs. It also means process gas is not contaminated during process operation.

## Corrosion-resistant operation

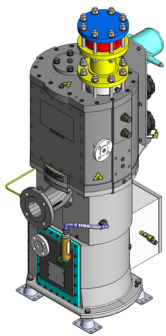
Developed for use in chemical, pharmaceutical and other process applications, SIHI Dry vacuum pumps are designed to maintain a determined process temperature. Operating parameters are controlled to ensure corrosive process gases don't condense, avoiding corrosion of internal components.



# Pre-engineered systems

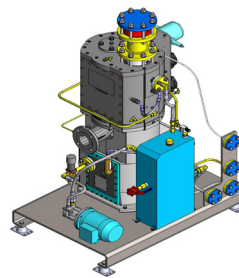
SIHI Dry H400 and M160 pumps are available in five cost-effective standard packages to ensure peak performance in your application. These fully tested and documented pre-engineered systems enable you to quickly deploy a complete SIHI Dry system or upgrade an existing system. Standard drawing and information packages are available. For applications requiring a more tailored solution, custom engineered systems are available.

*Sample systems shown below. Configuration may vary, depending on pump model.*



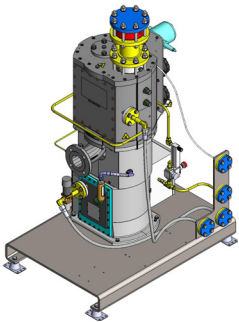
### Standard 1: Stand-alone pump

This package provides all the components needed to incorporate a SIHI Dry H or M Series pump into a larger centralized system, or to replace an existing unit.



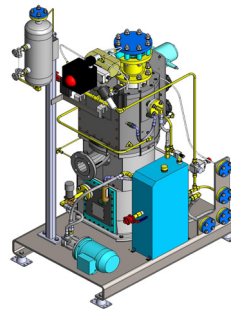
### Standard 3b: Low-quality cooling fluid

Standard 3b packages are designed for applications where cooling media does not meet minimum pump requirements. The integrated heat exchange system enables your facility's utilities to be used to control the cooling of a closed loop system. This configuration is useful for maintaining ideal pump temperatures.



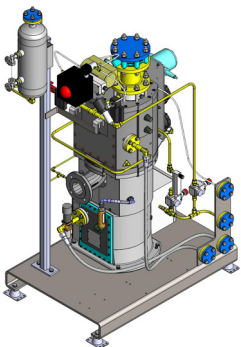
### Standard 2: Corrosive applications

Expanding on the basic pump package, Standard 2 packages include a nitrogen dilution system and thermostatic valve. These additions enable the system to better handle reactive gases. A mounting baseplate is included with all systems of Standards 2 to 4.



### Standard 4: All-inclusive

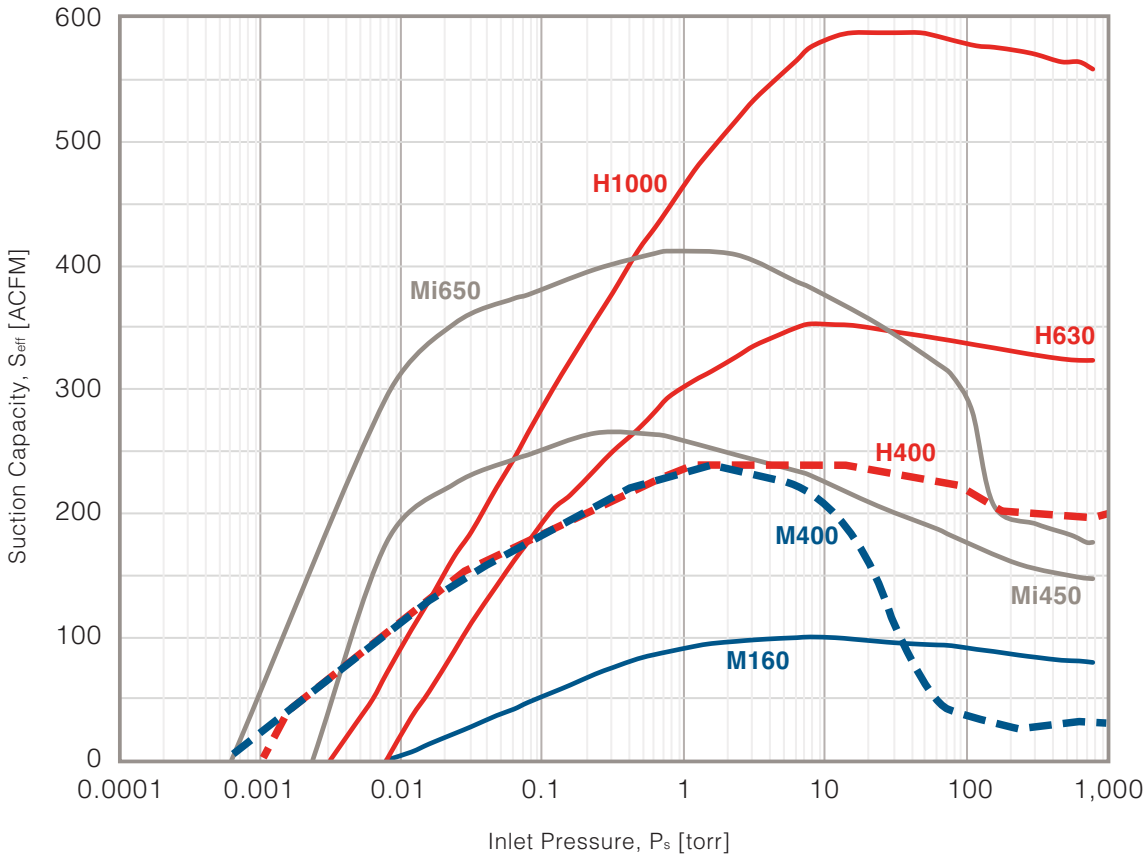
This complete turnkey solution addresses corrosive applications, internal pump cleaning, and low-quality the cooling fluid capabilities. The system requires only six connections: suction, discharge, electrical, inert gas, cooling fluid and cooling water.



### Standard 3a: Includes solvent flush

This configuration includes the ability to self-clean during pre-programmed or manual flush cycles for the purpose of minimizing product buildup on the pump screws.

## Performance range



NOTE: Every operating point below the maximum characteristic curve displayed is possible by varying the speed.

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