DigiVac
Scientific Measurement & Control

Automated High Vacuum Pump-down System with SNAP Vacuum Controls

Operation Manual

YOU MUST READ THIS MANUAL BEFORE USE

June 2024

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SECTION 1: Overview

The purpose of this document is to describe the functions, installation, maintenance and use of the **High Vacuum Turbo Cart**.

> This High Vacuum Turbo pump down system is designed to work with existing vacuum chambers. It is meant to evacuate the chamber to high vacuum after it has been roughed to a pressure that is less than 1 Torr. There is a built-in SNAP vacuum controller used to control the rough vacuum levels in the chamber. Finally, there is also a Turbo control panel that can be used to power on or off the Turbo pump on the cart.

System Specifications

Operating Temperature: +5°C to +35°C
Power: 120V with Nema 5-20 plug (requires 20-amp service connection)
Current: 18.5 Amps
Wheels: 10” Diameter, Pneumatic, 50 PSI Max. Front wheels are locking-type, swivel. Rear are fixed.
Physical Dimensions: 56” H x 27” W x 29” D
Weight: 366 lbs
Shipping Dimensions: 68” H x 28” W x 47” D
Shipping Weight: 580 lbs
System Connection Type: KF40 flange on rear of cart for High Vacuum connection.
SNAP Vacuum Controller: Vacuum gauge to control Roughing and High vacuum pumps
Turbo Pump: <1 x 10^{-10} mBar, < 5.0 x 10-7 Torr if used with KF-type connections.

System Features

- **SNAP Vacuum Controller** - Automated vacuum measurement and system control
- **Turbo Controller**- Powers on/off the Turbo, controls turbo venting automatically
- **Cart Power On/Off Switch**- Powers on/off the entire Pump-down System, once plugged in it is ready to use.
- **Gas Regulator**- Reads and regulates inert gas flow into the Turbo Pump-down System. Make sure gas flow stays below 1 PSIG.

SNAP Vacuum Controller Information

The SNAP is a vacuum controller with touch screen mounted to the console of the cart with the capabilities of Recipe Control, Ramping, Setpoints, Venting, Isolating the System and high vacuum pump actuation.

SNAP Features Specific to Cart

- High Vacuum Gauge Card + DPCP
- Additional vacuum valve driver card + Turbo Isolation Valve

.

Displays Readings

- The actual system pressure
- The crossover point (threshold) and turbo isolation valve state
- Recipe selected with progress

SECTION 2: Quick Start Guides-

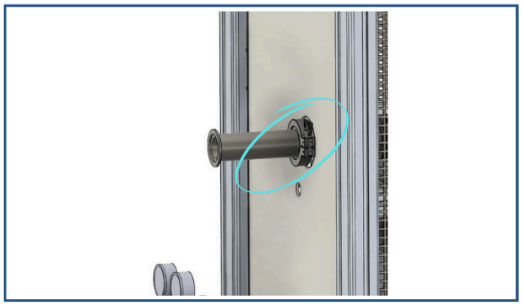
1. Connect the cart to your system via KF40 connection. ***Note: Smooth connections are better for flow.***
2. Connect the Gas Regulator to the nitrogen or other inert gas tank to the Hose Barb Vent Port in the back of the cart. Or leave open to air. ***Note: Make sure that the regulator does not exceed 1 PSIG.***
3. Plug cart into a 20 amp 110V receptacle outlet. ***Note: Only the cart can be plugged into the outlet, no other devices. Extension cords cannot be used either.***
4. Turn the switch on the front to the power on the cart
5. Verify that the SNAP is also switched on.
6. Press "**Start/Stop**" on the Turbo Controller to power on the Turbo and wait 5 minutes for the turbo to spin up.
7. The cart is now ready to control vacuum via the SNAP screen.

Note: Two KF-16 connections at the rear of the cart facilitate collection of rough/backing pump exhaust gasses. If desired your in-house gas reclamation system could be connected to either to prevent introducing pumped gasses to the local environment.

See Diagram on the next page

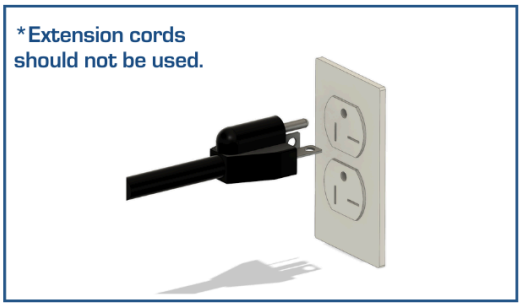
Quick Start

Automated High Vacuum Pump-down System with SNAP Vacuum Control

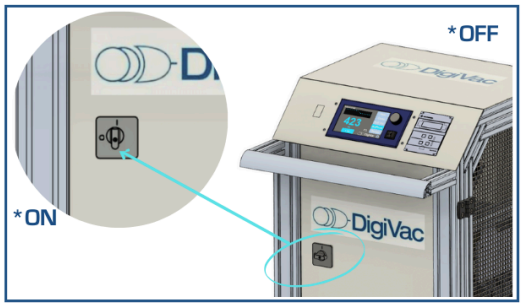


Connect the cart to your system via KF40 connection. *Note: Smooth connections are better for flow.

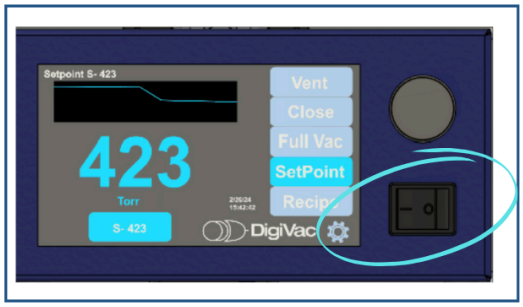
Connect the Gas regulator on the nitrogen or other inert gas tank to the KF16 venting port on the back of the cart via silicon hose. Or leave open to air.



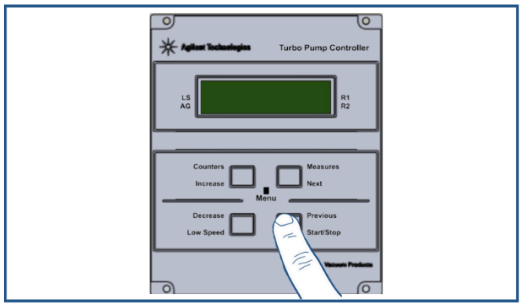
Plug cart into a 20 amp 110V receptacle outlet. *Note: Only the cart can be plugged into the outlet, no other devices.



Turn on the power to the cart via the switch on the front.



Verify that the SNAP is also switched on.



Press “Start” on the Turbo Controller and wait 5 minutes for it to spin up.

The cart is now ready to control vacuum via the SNAP screen.

Quick Start

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Automated High Vacuum Pump-down System with SNAP Vacuum Control

How to Install the Nitrogen/Inert Gas Tank:

1. On the back of the cart where the system connects, take the tape off the shelf that is folded up.
2. Place the tank (customer supplied, 40 ft³ recommended) on the rubber pad that is attached to the shelf.
3. Use the strap of the bracket around the tank and tighten it to secure the tank in place.
4. Attach the Regulator to the top of the tank. Make sure that the Regulator is set at no more than 1 psig.
5. Connect the regulator via hose to the KF16 fitting on the cart.

Quick Start

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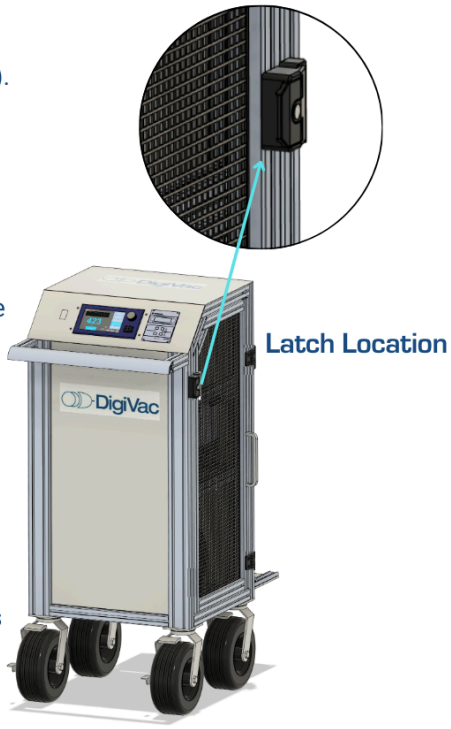
Automated High Vacuum Pump-down System with SNAP Vacuum Control

How to Install the Door Handle/Latches:

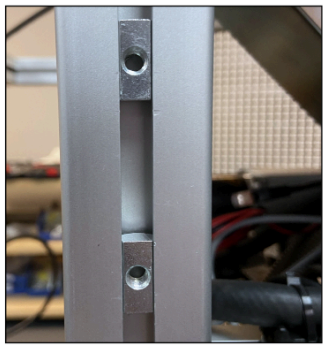
There are 2 door latches on either side of the cart (Left and Right).

They are mirrors of each other.

1. Take notice of the square nuts in the framing.
2. Insert screws into the receiver part of the latch as shown (bottom middle image).
3. Line it up evenly with the framing so the door can open. If the screws and the nuts do not align, the nuts can slide freely along the framing to slide into position.
4. Tighten the screws to the nuts to secure the receiver side of the latch.
5. Same as before, insert the screws into the Handle part of the latch, lining up the screws in the framing.
6. Before tightening the screws, make sure the handle side lines up correctly with the receiving side.
7. Place the screw inserts to cover the screws.

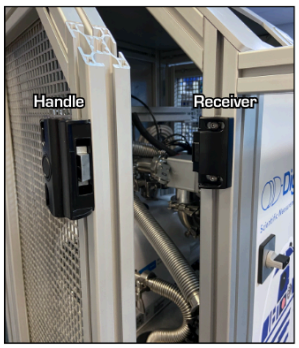


Square Nuts in Framing



Receiver(Left) Handle(Right)

Ex. Open Latch



SECTION 3: Operation

This section describes in more detail about the installation and operation of the cart. The cart was designed to work in a laboratory environment.

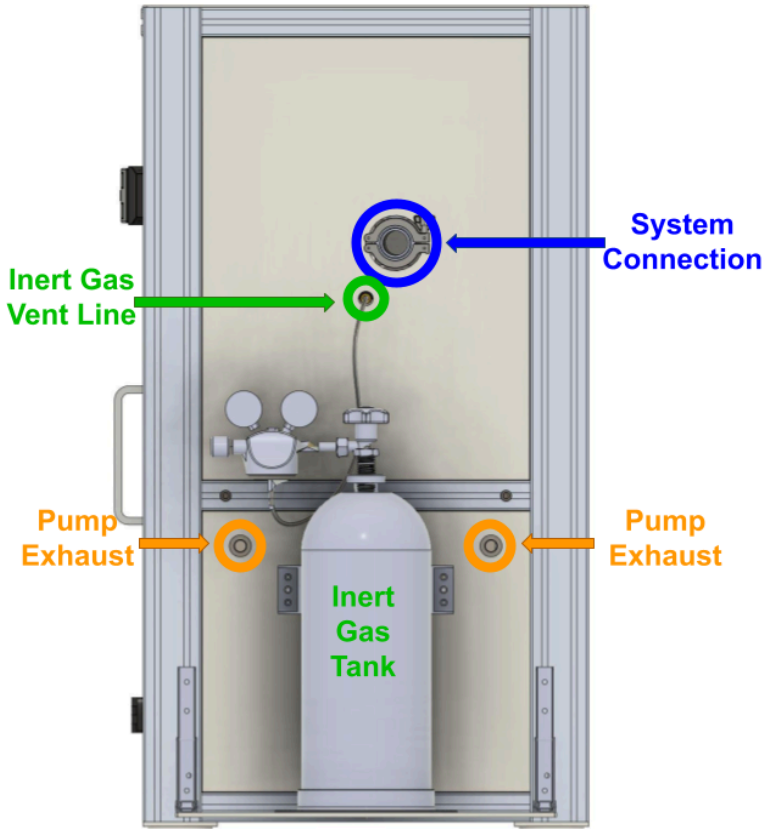
Installation & Operation Guide

Below is a detailed, step by step instruction guide on how to install and operate the cart:

1. Make sure all fittings that will be used for high vacuum are clean. No dust, oil, salt, etc.
    a. *To Clean*: Wipe clean fittings with ethanol or other mild solvent. Ensure all KF centering rings are clean and the Viton rubber on the rings are in good shape.
    b. *Note*: If in doubt, replace. If using vacuum grease, less is better.
2. Connect the Turbo Cart to the desired chamber using the KF40 connection and Clamp on the back of the cart.
3. (Optional) Install Nitrogen or inert gas tank to the back of the cart by strapping it into place.
4. (Optional) Install Gas Regulator to the nitrogen or other inert gas tank.
5. Connect the Gas Regulator on the nitrogen or other inert gas tank to the Hose Barb Vent Port in the back of the cart. Or leave open to air. ***Note: Make sure that the regulator does not exceed 1 PSIG.***
6. Plug the cart into an outlet capable of delivering 20 amps through the NEMA 5-20 plug. ***Note: Only the cart can be plugged into the outlet, no other devices. Extension cords cannot be used either.***
7. Turn the cart on with the black dial switch on the front of the cart (Horizontal is “off” Vertical is “on”).
8. Verify that the SNAP is also switched on.
9. Turn the turbo pump on by pressing “**Start/Stop**” on the Turbo control panel.
10. Wait 5 minutes (you will see RPM in Hz increase).
11. The cart is now ready to control vacuum via the SNAP screen.

Connections & Flow Paths

Cart Rear Connections: The image below depicts the connections and exhaust lines the vacuum cart has. Here you can see where the system chamber would be attached, the venting line to potentially install an inert gas tank, and the two pump exhaust port with easy accessibility to collect any vapors from the process.

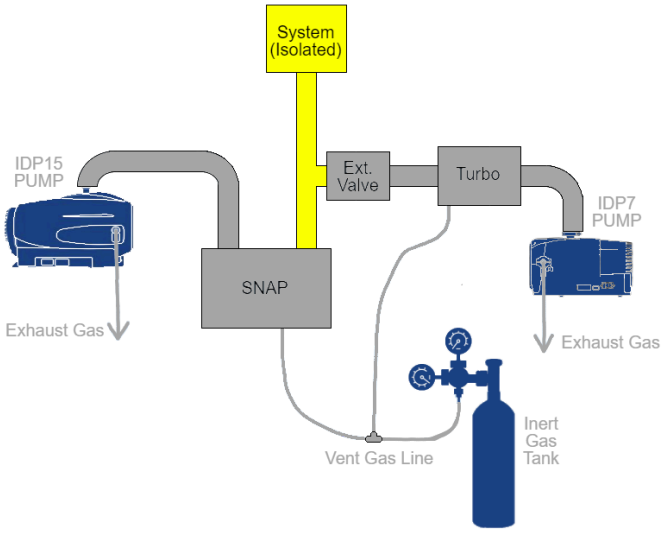


Flow paths: The vacuum system has several chamber control features on how to control the system chamber. It can:

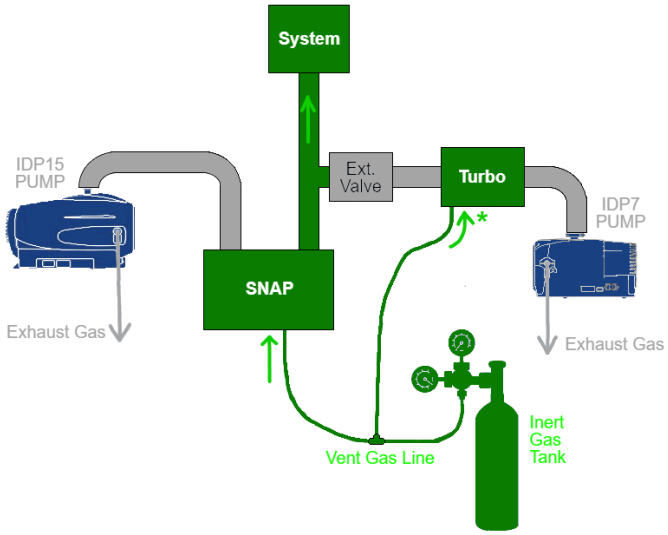
- Isolate and close off the chamber at any desired set point or vacuum level
- Vent in air or inert gas to increase the positive pressure of the system
- Bring the system to medium vacuum range through its rough pump
- Bring the system chamber to high vacuum using the turbo pump

Below are images to show the variety of flow paths the vacuum cart can execute to control the connected chamber:

Chamber Isolation

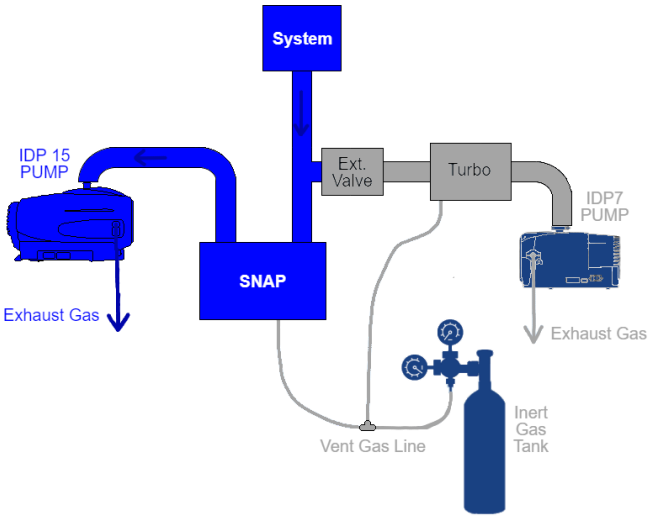


Chamber Venting

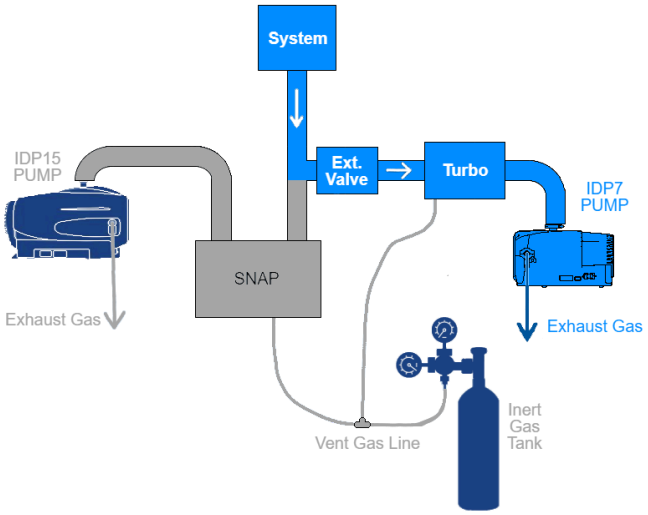


*** Only flowing through the Turbo when it is off**

Chamber Roughing



Chamber High Vacuum



Storage Guide

Below is a detailed, step by step instruction guide on how to Power off and store the cart:

1. Stop the Turbo pump by pressing the "**Start/Stop**" button on the Turbo controller. Wait 5 minutes for turbo "Braking" feature. System will automatically vent the turbo.
2. Press the "**Vent**" button on the SNAP controller to vent the cart to Atmosphere.
3. Disconnect the cart from the chamber once atmospheric pressure is reached. Install plastic caps on all unconnected flanges This will help keep the systems clean, last longer, and improve pump down times.
4. Turn off the High Vacuum Cart with the black dial switch on the front of the cart. The dial should be turned to the left pointing at the "O" symbol (Horizontal is off)
5. Close inert gas tank.
6. Unplug the cart from the wall outlet, and store the vacuum system in a safe place.

Rough Pump Delay Adjustments

1. The IDP15 rough pump has a delay feature to prevent undesirable breaker tripping from occurring during startup. The delay is factory set at 4 seconds.
2. The delay is user-adjustable from 0 to 10 seconds by turning the knob on the Delay Relay mounted on the lower-rear panel, accessible from the inside of the cart. It is recommended that the delay be set to 4 seconds minimum.

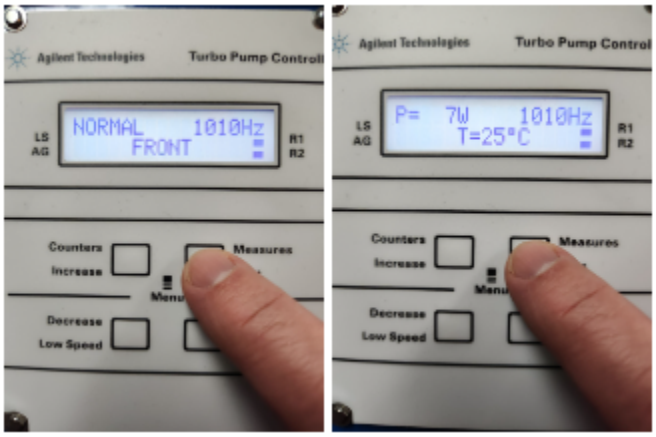
How to Check Temperature

Care should be taken to monitor the Turbopump temperature.

If the temperature indication on the Turbo **exceeds 35°C** or **95°F**, the **Turbo should be turned off**.

1. Press the "**Measure**" button
2. Note the temperature. If the Temperature is greater than **35°C**, shut down the machine.

Do not move or bang the Turbo cart when the Turbo is running. If you need to move the cart, shut down the turbo pump first.



Turbo Venting

The 305FSQ Turbo has an automatic vent upgrade kit. To vent the turbo, press the "**Start/Stop**" button while the turbo is running. It will begin to slow down appropriately. When the turbo is at 0Hz (it will say "**0 Hz**") you can then vent the rest of the system. The Turbo Isolation Valve will remain open as long as the turbo is in **STOP** mode. Note, the air used in venting is taken from the "**vent port**" in the rear of the cart.

SNAP | Pressure Measurement and Control

From the Snap's HOME screen, system pressure is continuously displayed as long as the SNAP is ON.

SECTION 4: Maintenance

This following section describes the various ways to maintain and upkeep the High Vacuum Turbo Cart.

Hose Inspection

When disconnecting or replacing bellows hoses, take caution to avoid sharp bends or abrasions from adjacent equipment.

KF Screen Replacements

KF-type O-Rings (including those with mesh screens) should be cleaned with a dry, lint-free cloth (E.G. "Kim Wipes") when replacement is necessary. Inspect flanges and mating surfaces for nicks or defects which might prevent a proper vacuum seal. Replace as necessary.

Tip Seal Replacements

To replace tip seals refer to sections for IDP15 and IDP7 vacuum pump maintenance on page 9. To install the new seals and O-rings:

1. Unpack the Tip Seal.
2. Install the closed loop portion of the Tip Seal onto the Orbiting Scroll (item 9).
3. Sequentially insert the seal from center to the outer edge of the scroll wall.
4. Cut the Tip Seal about 1/8" (3 mm) from the groove end.
5. Use the remaining Tip Seal material to fill the seal groove on the Scroll Housing and again trim the excess Tip Seal so that a gap of about 1/8" (3 mm) remains.

6. Place the new main O-ring onto the Frame (item 10). Make sure the area where the O-ring sits is clean.
7. Carefully replace the Scroll Housing making sure to line up the Locating Pins. Be sure that the Tip Seal has not fallen out of its groove.
8. Reinstall (4) M5 bolts (item 4). Torque the (4) M5 bolts to 4 N-m (40 in-lbs).
9. Place the front cowling in place and replace the M8 bolts.
10. Reinstall the exhaust adapter.
11. Reconnect the pump to the electrical power mains.

Turbo Maintenance

No general maintenance is necessary. If there is excessive noise, call Agilent to troubleshoot. If used less than once every 6 months, or for other details, consult the following instruction manual: **TwisTorr 305 FS Remote Controller** (See Page 173).

The Turbo is an especially delicate piece of equipment, so sudden movements or direct hits to the device can cause violent failure. So can particles that get in the inlet side of the Turbo. It is recommended to not tamper with the Twistorr 305FSQ Turbo Pump as well as keep the Cryogenic Cart enclosed in order to protect the device.

IDP 15 Scroll Pump Maintenance

When inlet pressure gets above 500 millitorr, replace tip seals. For any excessive noise, contact Agilent for troubleshooting. For further maintenance details, refer to the following instruction manual: **Dry Scroll Vacuum Pump Instruction Manual** (See Page 40).

IDP 7 Scroll Pump Maintenance

In 2-3 year intervals, replace tip seals. For any excessive noise, contact Agilent for troubleshooting. For further maintenance details, refer to the following instruction manual: **Dry Scroll Vacuum Pump Instruction Manual** (See Page 24).

Calibration

To ensure gauge accuracy, return the SNAP unit for calibration to DigiVac once yearly. For cart gauges, we recommend an onsite calibration or validation of the high vacuum gauge (against recently calibrated remote gauge) once every 2 years, or when readings are suspect. Note the internal components of this sealed gauge are in a nitrogen bath to mitigate any moisture concerns and maximize life time. Calibration for this gauge must include evacuation and backfilling of Nitrogen of the enclosure.

For any other maintenance concerns please contact us at DigiVac.

Optimizing PumpDown Times

High vacuum pump down times are optimized with clean smooth surfaces and the largest flow paths possible. To improve high vacuum pump down times, a hard piping solution would yield a better result then the KF40 Bellows hose supplied.

For any additional high vacuum turbo cart or vacuum gauge related troubleshooting, please contact sales@digivac.com or 732-765-0900.

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