DEKKER pumps are at the heart of every system:

Explaining Vacuum as a Holding Force on CNC Routers

Determining how much vacuum is needed to hold down parts on your CNC router is a very important step when preparing to purchase a vacuum pump or system.

Vacuum Level and Hold-Down Force are Critical

The purpose of this explanation is to demonstrate the relationship between vacuum level and hold-down force. These are two important factors for CNC router users who typically use one or more vacuum pumps to hold down work pieces on the router table. In general, the smaller the work piece, the more leakage through the MDF board, which requires a larger vacuum pump capacity to achieve the required vacuum level. In addition, the leakage will increase as more parts are routed and more of the MDF board is exposed.

Determining the proper hold-down force therefore is critical.

The hold-down force depends on the type and quality of the router tools and the force generated by the depth of cut and feeding speed. As a rule of thumb the average hold-down force on a single piece should be around 2000 lbs.

DEKKER TIP:

Ask a DEKKER vacuum expert to assist you as you consider these other application variables:

- Altitude: Altitude has an effect on the hold-down force and must be taken into consideration especially on smaller parts.
- Leaks: Minimizing of leaks and regular cleaning of the table will improve performance.
- Inlet Filtration: Dusty operating conditions require efficient and proper inlet filtration and proper maintenance with regular cleaning. Ask a DEKKER vacuum expert to perform a vacuum performance assessment or visit our website at www.dekkervacuum.com.

The hold-down force can be calculated by the following formula:

\[ \text{Hold-down force} = \frac{\text{Atmospheric Pressure (inches of Hg) \times 14.7 \times \text{Area of workpiece (square inches)}}}{20} \]

For example:

- Atmospheric Pressure = 29.92 inches of Hg
- Depth of cut = 20 inches of Hg
- Area of workpiece = 12 x 36 square inches

\[ \text{Hold-down force} = \frac{29.92 \times 14.7 \times (12 \times 36)}{20} = 4245 \text{ Lbs} \]

Calculating the hold-down force:

DEKKER Woodworking Vacuum Solutions

The Experts in Vacuum Solutions

888.925.5444 dekkervacuum.com

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DEK Teleengineering from Start-To-Finish

GOLD STANDARD SUPPORT

Your Knowledge-Backed Guarantee. Need help sizing a vacuum pump? Having application problems? With over 100 years of combined experience, our team of vacuum experts has made it our business to know your needs as well as our systems capabilities. With DEKKER, you get a team of vacuum experts dedicated to helping you resolve system challenges, create competitive processes, and optimize results.

Maintenance, service and repair so you keep operating at maximum efficiency.
The DEKKER difference means reliable performance, maximum efficiency, custom solutions and the longest warranties in the vacuum industry.

The one problem nearly every wood manufacturing application has in common is sawdust. You cannot completely eliminate it, so your vacuum system or pump should be sawdust tolerant. No one makes tougher vacuum systems and pumps than DEKKER.

The Perfect Solution: The Titan Air-assisted liquid ring vacuum pump system with the Titan liquid ring pump at its heart can handle some carryover of soft solids without damage to the internal parts of the pump. Because Titan grease-lubricated external bearings isolated from the pumping chamber and non-metallic material inside the pumping chamber, for cost-effective ways to maximize efficiency and reduce operating costs, consider the DEKKER system with Variable Frequency Drive (VFD).

Call DEKKER for a FREE Vacuum Performance Assessment. At DEKKER, our wide range of vacuum pumps and systems configure perfect solutions for any high-volume application in the woodworking and furniture-making industries. Wherever you apply your vacuum, we can design custom vacuum pump systems that work to your equipment and environment.

One consultation with our vacuum experts will demonstrate the DEKKER difference. We will find vacuum solutions that increase productivity and deliver a rapid return on investment due to reduced downtime and increased maintenance.

The Best Vacuum Solutions for Woodworking and Furniture Manufacturing Applications

Solutions presentation

Case for vacuum chucking and clamping

Lubricated Rotary Vacuum Pumps and Systems

Lubricated rotary pumps with oil-lubricated scroll, 1-stage or 2-stage, non-lubricated direct drive or 2-stage, Variable Frequency Drive (VFD) and enclosed, air-cooled, condensing units.

High efficiency, 1-stage, compact units for large volume applications. Ultimate hold-down force eliminates parts slippage.

Low noise level

Low maintenance

Close tolerance on vacuum pressure, high flow rates

NEW Generation of Liquid Ring Technology

Our new oil-sealed liquid ring vacuum pump system is ideal for CNC machining and other woodworking applications that require deep vacuum and powerful hold down force.

- Universal feed-down features eliminates parts damage
- Compact design small footprint
- Extremely low operating noise level
- Smailli footprint
- Anodized in double layer, sealed o-ring for extra savings

The ROI with Variable Frequency Drive Technology

• Control of costs and ROI
• Control of material damage and waste
• Control of vacuum
• Control of current inrush

Cost Savings Example:

In a facility operating a 40 HP vacuum pump system with VFD, let us assume the system would be running at maximum load 50% of the time. The VFD would be in operation the rest of the time at maximum turndown, resulting in reduced power consumption.

The Titan liquid ring pump at its heart can handle some carryover of soft solids without damage to the internal parts of the pump. Because Titan grease-lubricated external bearings isolated from the pumping chamber and non-metallic material inside the pumping chamber, for cost-effective ways to maximize efficiency and reduce operating costs, consider the DEKKER system with Variable Frequency Drive (VFD).

The 40 HP VFD controlled vacuum pump would operate at maximum horsepower for 50% of the time, using the VFD, the pump would operate at maximum load. Power cost is 50% of annual cost before VFD or $8,008.

The other 50% of the time, the unit would be running at maximum load or 40 HP. Power cost is 50% of annual cost before VFD or $8,008.

The VFD would be in operation at maximum turndown, resulting in reduced power consumption. The Titan liquid ring vacuum pump system with the Titan liquid ring pump at its heart can handle some carryover of soft solids without damage to the internal parts of the pump. Because Titan grease-lubricated external bearings isolated from the pumping chamber and non-metallic material inside the pumping chamber, for cost-effective ways to maximize efficiency and reduce operating costs, consider the DEKKER system with Variable Frequency Drive (VFD).

Call DEKKER: The Experts in Vacuum Solutions at 888-925-5444 for application expertise.
Your Factory Doesn’t Work, Unless Your Vacuum Pumps Work…

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The one problem nearly every wood manufacturing application has in common is sawdust. You can never completely eliminate it, so your vacuum pump or system should be sawdust tolerant. No one makes tougher vacuum pumps and systems than DEKKER.

The Perfect Solution: The Vmax oil-sealed liquid ring vacuum pump system with the VFD liquid ring pump at its heart can handle any carryover of soft solids without damage to the internal parts of the pump because Vmax graphite-lubricated external bearings isolated from the pumping chamber and re-maintain metal contact inside the pumping chamber. For more effective ways to maximize efficiency and reduce operating costs, consider the Vmax system with Variable Frequency Drive (VFD).

Call DEKKER for a FREE Vacuum Performance Assessment. At DEKKER, our wide range of vacuum pumps and system configurations provides solutions for any high-temperature application in the woodworking and furniture-making industries. Wherever your application, we can design custom vacuum pump systems that work in your environment.

One consultation with our vacuum experts will demonstrate the DEKKER difference. We will find vacuum solutions that improve performance and deliver a rapid payback on investment due to reduced downtime and decreased maintenance.

Cost Savings Example: Is it making sense for you to operate a 5 HP vacuum pump system with Variable Frequency Drive, let us assume the system would be running at maximum load for only 50% of the time. The VFD would be the system at the price of maximum run-down, resulting in reduced power consumption of 30%.

**EXAMPLE:** Cost savings for a 5 HP vacuum pump system would be $8,004 annually (50% of 0.93 x 0.746 x $0.10 x 2,496)

Cost savings for a 20 HP vacuum pump system would be $4,004 annually (50% of 0.93 x 0.746 x $0.10 x 2,496)
SOLUTIONS
Your Factory Doesn’t Work, Unless Your Vacuum Pumps Work...

DEKKER maintains an extensive domestic and global network of authorized service centers. DEKKER offers a complete range of accessories and carries a comprehensive inventory of pumps and parts. For emergency repairs, DEKKER takes pride in offering same-day shipping of most standard parts. DEKKER’s extensive service capabilities include on-site repairs as well as new sales and replacements.

DEKKER due to their 100% Oil-Free (Dry) Rotary Vane Vacuum Pumps and Systems. Lubricated rotary vane pumps with an integrated closed loop air-recirculation system in operation ranging from 2 - 700 CFM rugged, reliable, and economical. Oil seal vacuum units are available for wet applications, such as stone and glass cutting. The other 50% of the time, using the VFD, the pump would operate at maximum load or 40 HP. The VFD would be in operation the rest of the time at maximum turndown, resulting in reduced power consumption.

EXAMPLE:

Before a VFD

Using normal across-the-line starting

Power cost = (40/0.93) x 0.746 x ($0.10) x 4,992 = $16,017 annual cost.

WITH A VFD

The other 50% of the time, using the VFD, the pump would operate at maximum load or 40 HP. Power cost = (40/0.93) x 0.746 x ($0.10) x 2,496 = $4,004.

THE VFD SAVINGS: Power cost savings realized is $16,017 - $4,004 = $12,012 yearly.

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DEKKER pumps are at the heart of every system:

They tolerate sawdust and other contaminants far better than other vacuum pumps.

DEKKER pumps are at the heart of every system:

**Process Savings**  **Energy Savings**  **Environmental Savings**  **Optimized**  **Knowledge**

Variable discharge port

High efficiency single-stage design

External sealed bearings

TI TAN

High-Efficiency Liquid Ring Vacuum Pump Systems

Available in single-stage (capacities ranging from 35 to 2000 CFM). For larger capacities, please ask about our Maxima-K series pumps up to 39,000 CFM.

- No metal-to-metal contact
- Low noise levels – only 70-80 dBA
- Bearings mounted external to the pumping chamber
- Designed for heavy-duty applications
- Only one moving part

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**Calculating the hold-down force:**

The hold-down force can be calculated by the following formula:

\[ \text{Hold-down force (Lbs)} = \frac{\text{Atmospheric Pressure (in Hg)} \times 14.7 \times (\text{Square inches of Workpiece})}{20} \]

**Example:**

Atmospheric Pressure = 29.92 in Hg

\[ \text{Hold-down force} = \frac{29.92 \times 14.7 \times (12 \times 36)}{20} = 4245 \text{ Lbs} \]

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**ISO 9001 2015 CERTIFIED**

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**Collaborative Engineering from Start-To-Finish**

**Maxima-C**

Large Capacity Cyclic Liquid Ring Vacuum Pump

1,500 to 39,000 CFM

DuraVane

Air Lubricated and Dry Rotary Vane Vacuum Pump Systems

15-5,000 CFM

ChemSeal

Chemical Process Vacuum Pumps

15-65,000 CFM

AquaSeal

Coil Sealed Water Ring Vacuum Pump Systems

15-10,000 CFM

**TITAN**

Single and Two Stage Liquid Ring Vacuum Pump

6,000 CFM

**Maxima-K**

Large Capacity Cyclic Liquid Ring Vacuum Pump

1,500 to 20,000 CFM

Oil Sealed Liquid Ring Vacuum Pump Systems

20-640 CFM

Hull Vane

Rotary Piston Vacuum Pumps

175 CFM

**AquaSeal**

Coil Sealed Water Ring Vacuum Pump Systems

15-10,000 CFM

**Incorporate TITAN into your Woodworking Vacuum Solutions**

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### Determining the Proper Hold-Down Force

The hold-down force depends on the type and quality of the router tools and the force generated by the depth of cut and feeding speed. As a rule of thumb, the average hold-down force on a single piece should be around 2000 lbs.

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### Calculating the Hold-Down Force:

The hold-down force can be calculated by the following formula:

\[
F = \frac{P_{atm} \times 14.7 \times A}{V}
\]

Where:
- \(F\) is the hold-down force in pounds
- \(P_{atm}\) is the atmospheric pressure (29.92" Hg for standard conditions)
- \(14.7\) is the conversion factor from inches of mercury to pounds per square inch
- \(A\) is the area of the work piece in square inches
- \(V\) is the vacuum applied in inches of mercury

### Example Calculation:

Let's calculate the hold-down force for a work piece with dimensions 12" x 36".

\[
F = \frac{29.92 \times 14.7 \times (12 \times 36)}{20}\]

\[
F = \frac{29.92 \times 14.7 \times 432}{20}\]

\[
F = \frac{112,399.04}{20}\]

\[
F = 5,619.952 \text{ Lbs}
\]

### Increasing Your Industrial Vacuum Knowledge

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