VG10

Datasheet

22nd November 2019

VG10

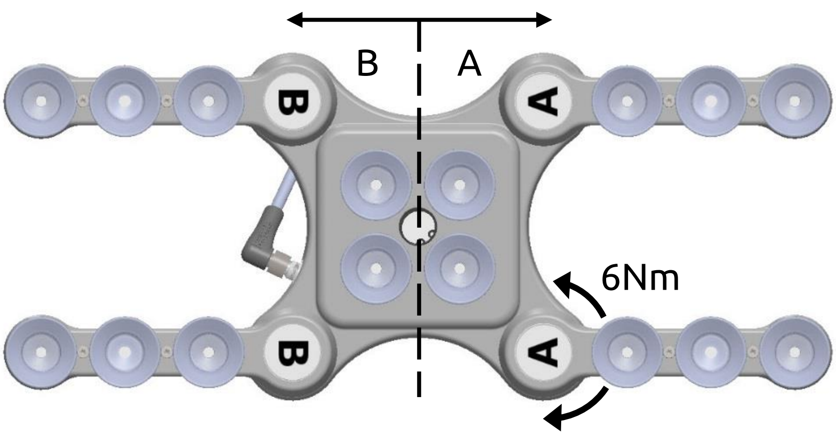
General Properties		Minimum	Typical	Maximum	Unit
Vacuum		5 % -0.05 1.5	- - -	80 % -0.810 24	[Vacuum] [Bar] [inHg]
Air flow		0	-	12	[Nl/min]
Arms adjustment		0	-	270	[°]
Arm holding torque		-	6	-	[Nm]
Payload	Rated	10 22			[kg] [lb]
	Maximum	15 33			[kg] [lb]
Vacuum cups		1	-	16	[pcs.]
Gripping time		-	0.35	-	[s]
Releasing time		-	0.20	-	[s]
Foot-inch-foot		-	1.40	-	[s]
Vacuum pump		Integrated, electric BLDC			
Arms		4, adjustable by hand			
Dust filters		Integrated 50µm, field replaceable			
IP Classification		IP54			
Dimensions (folded)		105 x 146 x 146 4.13 x 5.75 x 5.75		[mm] [inch]	
Dimensions (unfolded)		105 x 390 x 390 4.13 x 15.35 x 15.35		[mm] [inch]	
Weight		1.62 3.57		[kg] [lb]	

Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20.4	24	28.8	[V]
Current consumption	50	600	1500	[mA]
Operating temperature	0 32	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[hours]

Positioning the VG10 arms

The arms can be folded to the preferred position simply by pulling in the arms. The torque needed to overcome the friction in the rotatable joints of the arm is high (6 N/m) to ensure that the arms do not move when handling 10 kg payloads.

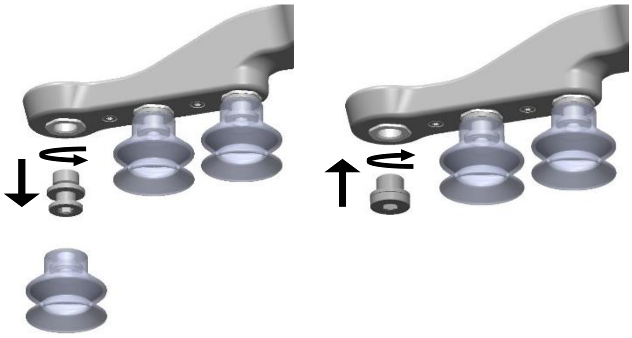
The VG10 suction cups are grouped into two independent channels.



When the four arms are adjusted to preferred angles, it is recommended to add the accompanied arrow stickers. This allows for easy realignment and exchanging between different work items.

Vacuum cups and fittings

It is possible to change suction cups simply by pulling them off the fittings. Unused holes can be blinded using a blind screw, and each fitting can be changed to a different type to match the desired suction cup. Use a 3 mm Allen key for changing to blind screws or another type of fitting.



The thread size is the commonly used G1/8"; allowing for standard fittings, blinders and extenders to be fitted directly to the VG10 arms and housing, see mechanical details in the 7.2.

Choosing the right vacuum cups for your application is essential. The VG10 comes with common 30 mm silicone vacuum cups which are good for hard and flat surfaces, but not good for uneven surfaces and it might leave microscopic traces of silicone on the workpiece which can cause issues with some types of painting processes afterwards. Below is a table with general recommendations.

Workpiece surface	Vacuum cup shape	Vacuum cup material
Hard and flat	Normal or dual lip	Silicone or NBR
Soft plastic or plastic bag	Special plastic bag type	Special plastic bag type
Hard but curved or uneven	Thin dual lip	Silicone or soft NBR
To be painted afterwards	Any type	NBR only
Varying heights	1.5 or more bevels	Any type

NOTE:

It is recommended to consult a vacuum cup specialist to find the optimal vacuum cup where the standard types are insufficient.

Payload, vacuum and air flow

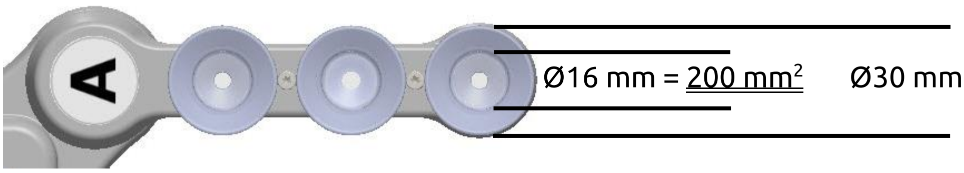
The lifting capacity (payload) of the VG10 depends primarily on the following parameters:

- Suction area
- Vacuum
- Air flow

These three parameters are explained in the following subsections.

Suction area

The higher suction area, the higher lifting capacity. Be aware that the actual suction area is smaller than the outer diameter of your vacuum cups, as the vacuum cup libs forms around the workpiece, the actual suction area is reduced (see figure below)



With a typical vacuum of 60% and one vacuum cup with a 200 mm2 suction area, the lifting force is:

$$F_{cup} = p \cdot A = [\Delta Pa] \cdot [m^2] = 60\% \cdot 101.3kPa \cdot 10^3 \cdot 200\ mm^2 \cdot 10^{-6} = 12.2\ N$$

With this force per vacuum cup, to lift 10 kg and accelerate with 2g's, this many vacuum cups are needed:

$$Number\ of\ cups = \frac{m \cdot a}{F_{cup}} = \frac{[kg] \cdot [m/_{s^2}]}{[N]} = \frac{10 \cdot 2 \cdot 9.81}{12.2} = \text{16 vacuum cups}$$

It is often a good idea to use more vacuum cups than needed, to accommodate for vibrations, leaks and other unexpected conditions. However, the more vacuum cups, the more air leakage (air flow) is expected and the more air is moved in a grip resulting in longer gripping times.

Vacuum

Vacuum is defined as the percentage of absolute vacuum achieved relative to atmospheric pressure, i.e.:

% vacuum	Bar	kPa	inHg	Typically used for
0%	0.00rel. 1.01 abs.	0.00rel. 101.3 abs.	0.0rel. 29.9 abs.	No vacuum / No lifting capacity
20%	0.20rel. 0.81 abs.	20.3rel. 81.1 abs.	6.0rel. 23.9 abs.	Cardboard and thin plastics
40%	0.41rel. 0.61 abs.	40.5rel. 60.8 abs.	12.0rel. 18.0 abs.	Light workpieces and long suction cup life span
60%	0.61rel. 0.41 abs.	60.8rel. 40.5 abs.	18.0rel. 12.0 abs.	Heavy workpieces and strongly secured grips
80%	0.81rel. 0.20 abs.	81.1rel. 20.3 abs	23.9rel. 6.0 abs.	Max. vacuum. Not recommended

The vacuum percentage setting is the target vacuum. The pump will run at full speed until the target vacuum is achieved, and then run at a lower speed necessary to maintain the target vacuum.

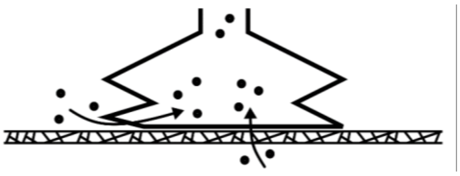
The pressure in the atmosphere varies with weather, temperature and altitude. The VG10 automatically compensates for altitudes up to 2km, where the pressure is about 80% of sea level.

Air flow

Air flow is the amount of air that must be pumped to maintain the target vacuum. A completely tight system will not have any air flow, whereas real life applications have some smaller air leakages from two different sources:

- Leaking vacuum cup lips
- Leaking workpieces

The smallest leak under a vacuum cup can be hard to find (see picture below).

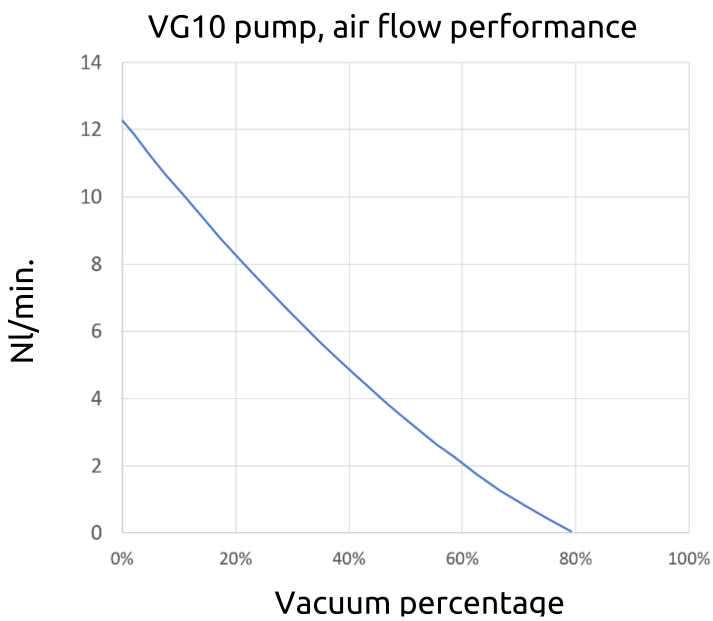


Leaking workpieces can be even harder to identify. Things that look completely tight might not be tight at all. A typical example is coarse cardboard boxes. The thin outer layer is often requiring a lot of air flow to create a pressure difference over it (see figure below).

Therefore, the users must be aware of the following:

- VG10 is not suitable for most uncoated, coarse cardboard boxes.
- Extra attention must be paid to leakages, e.g. vacuum cup shape and surface roughness

The air flow capability of a VG10 is shown in the graph below:



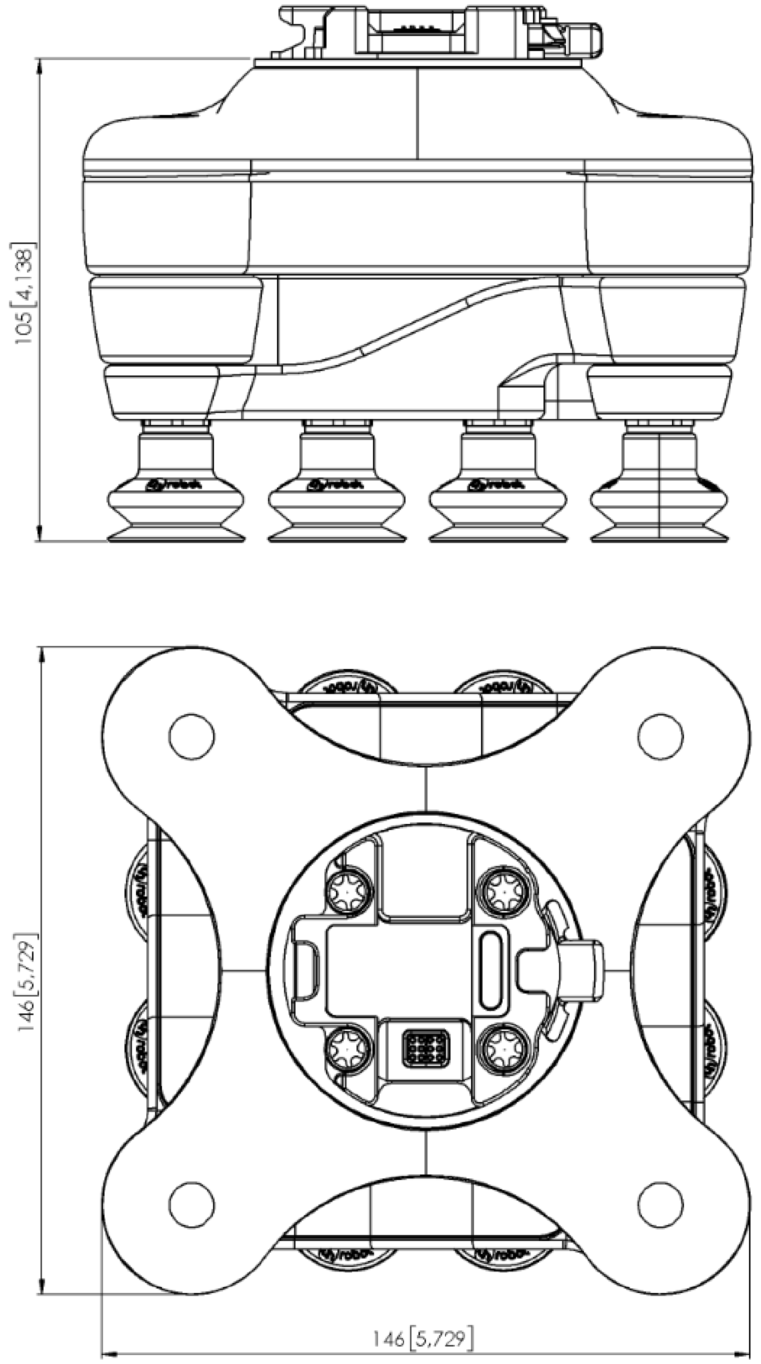
NOTE:

The easiest way to check if a cardboard box is sufficiently tight is simply to test it using the VG10.

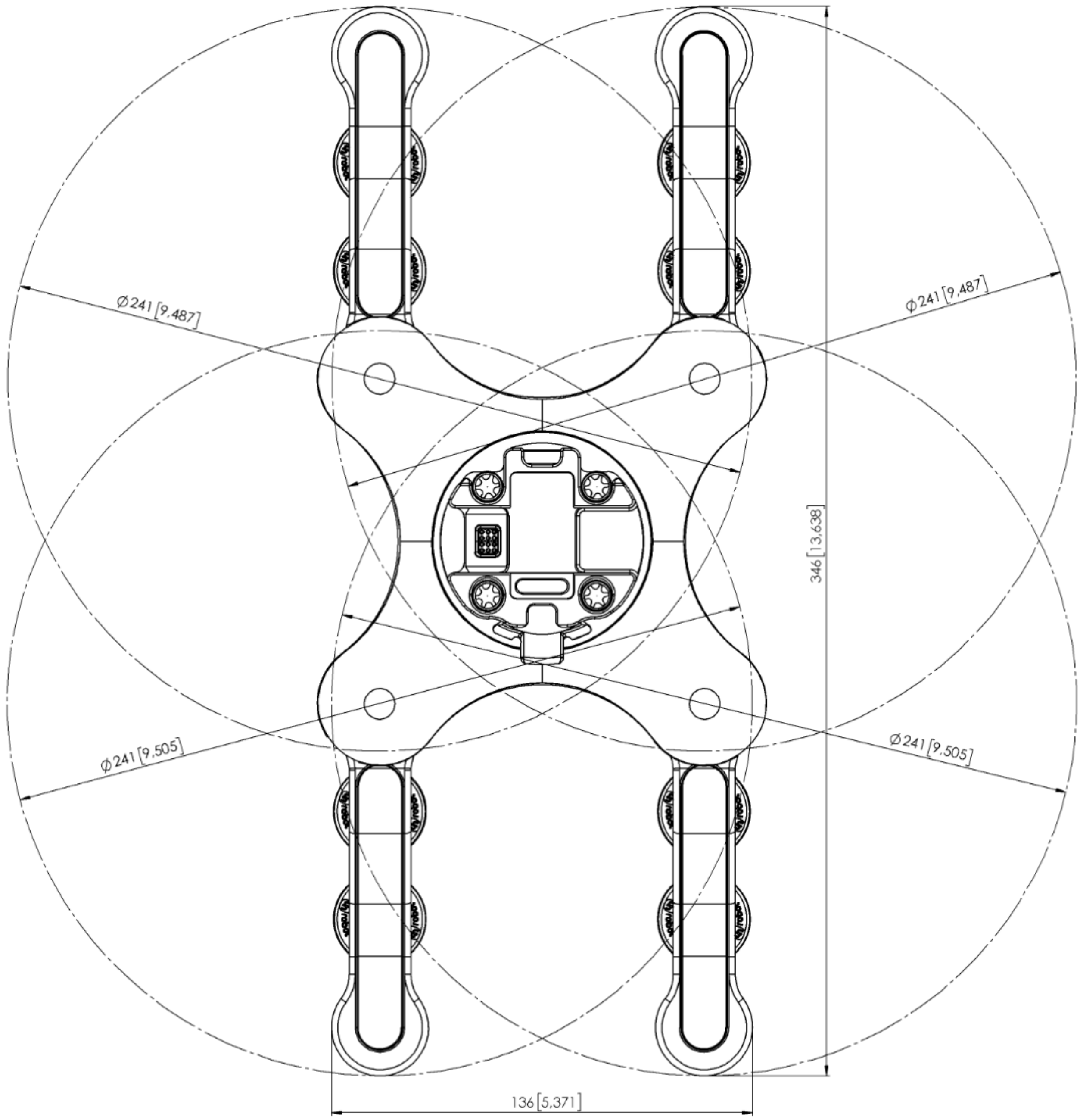
A high vacuum percentage setting does not give a higher lifting capacity on corrugated cardboard. In fact, a lower setting is recommended, e.g. 20%.

A low vacuum setting results in less air flow and less friction below the vacuum cups. This means VG10 filters and vacuum cups will last longer.

VG10



All dimensions are in mm and [inches].



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