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Manufacturer of Opto-Mechanical equipment for research, industry and education

Vibration isolation system *1VIS22*

User manual

Standa
2012

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1. General information

1.1 Introduction

The pneumatic vibration isolation system is an ideal work platform for equipment which is sensitive to vibration, e.g. microscopes, scales, interferometers, and similar devices.

The work surface of the table is separated from the floor by means of a highly effective system of pneumatic supports, i.e. pneumatic springs with hydraulic (oil) dampers.

The system features solid and light optical tables of different sizes, which enable the production of a wide selection of systems for a variety of tasks requiring different sizes and loads. A dimensional drawing of a pneumatic support is presented in fig. 1. A specification of a pneumatic support is presented in fig. 2.

Although each support is intended for a load of up to 1,000 kg, you should prevent overloads of the table at the edges, otherwise any one pneumatic support may become overloaded even if the total weight fits within the limits set. Loads with the centre of gravity located very high may result in instability of the entire system. Please refer to section 3.2 of the manual.

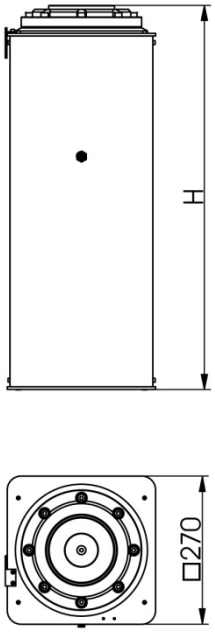

Fig. 1. Pneumatic support

Specification

Height of the vibration isolation system	*H= 400, 500, 600, 700 mm*
Vertical movement range	*14 mm*
Precision of automatic level control	*±0.3 mm*
Vertical resonance frequency	*1.5 Hz (average load)*
Vertical isolation at 5 Hz	*85–93%*
Vertical isolation at 10 Hz	*90–98%*
Horizontal resonance frequency	*1.7 Hz (average load)*
Horizontal isolation at 5 Hz	*85–93%*
Horizontal isolation at 10 Hz	*90–97%*
Pressure from source of air	*600 KPa (6 bar) (87 PSI)*
Air supply opening	*Ø 6 mm*
Operating humidity (max)	*90%*
Operating temperature range	*10–50 ºC*
Load-bearing capacity (at 6 bar)	*1,000 kg per isolator*

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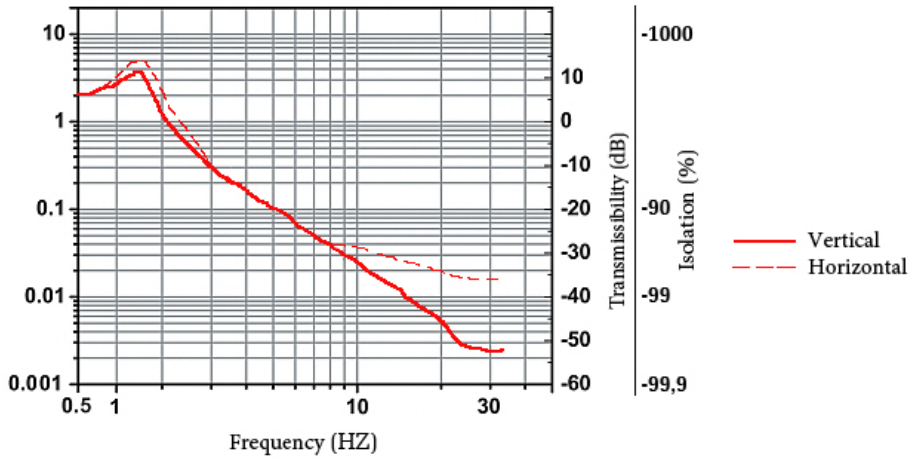

Fig. 2. Specification of 1VIS22

The system is managed by means of level controls; there are 3 controls per system. Please see fig. 3.

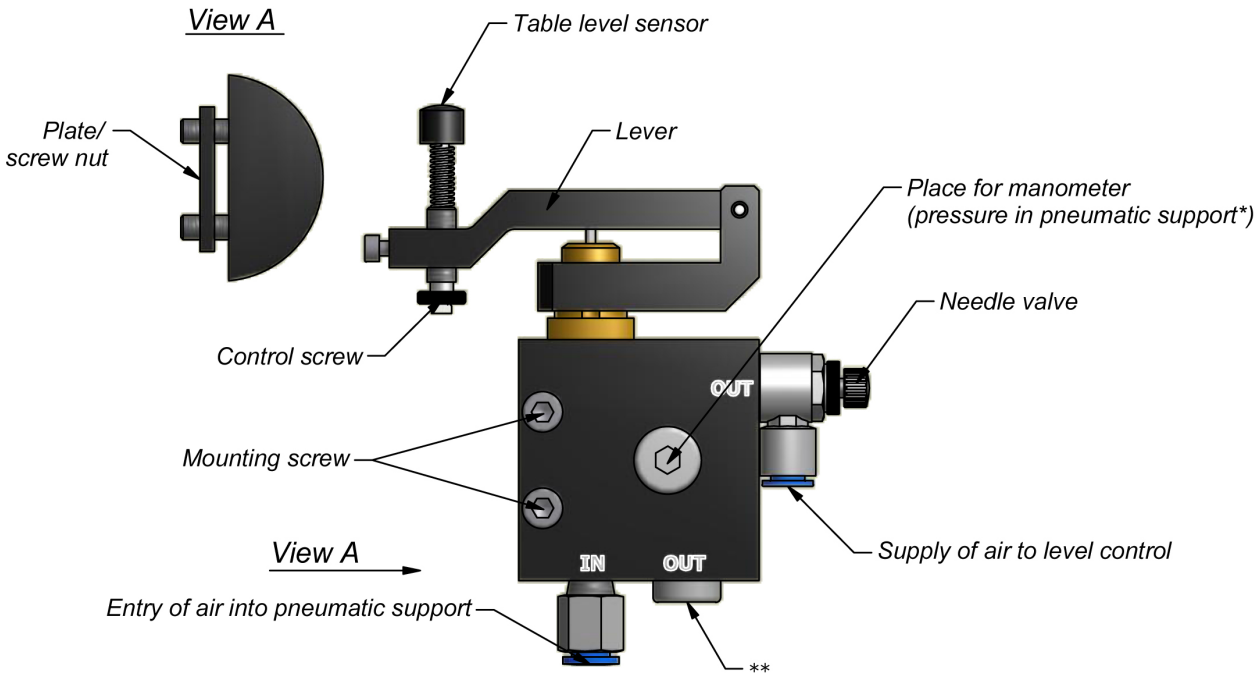

Fig. 3. Level control, model 1LV-1WM

* Optional.
** An overpressure relief valve can be provided.

1. Precision of level setting: ±0.3 mm.
2. Materials:
   Body and lever: anodised aluminium, brass, steel, plastic.

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A typical vibration isolation system is shown in fig. 4.

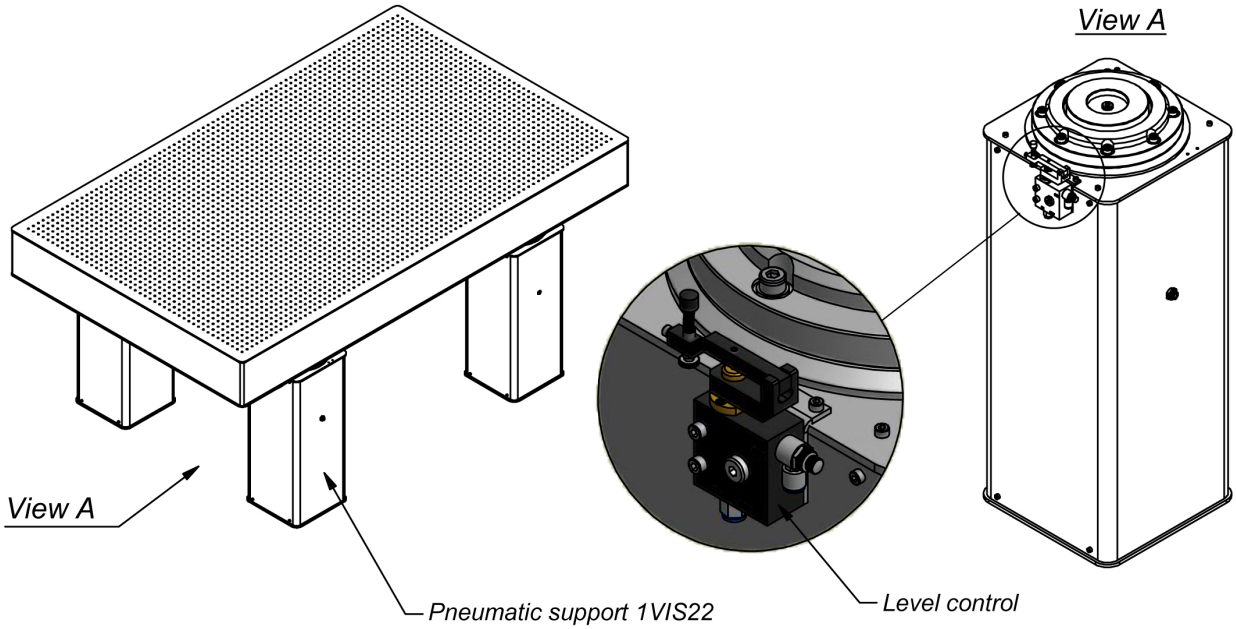

Fig. 4. A typical vibration isolation system

1.1.1 Safety

This manual uses certain terms that are important for your safety.

Warning

Used to denote a danger that may result in injury.

Attention

Used to denote a situation that may result in damage to components of the system.

1.2 Location of the table

To ensure optimal operation of the system, it must be installed on a surface that satisfies certain requirements.

The surface must be even and the height discontinuity of the surface within all supports of the system may not exceed 3 mm. The surface slope in the places for placement of the supports may not exceed 0.5° horizontally. Note: 0.5° equals 2.36 mm for a length of 270 mm.

Adherence to the aforementioned requirements is required for normal functioning of each of the pneumatic supports. If the floor on which the supports are placed has a greater than allowed height discontinuity or slope, these must be eliminated or pads must be placed under the supports.

It is important that an appropriate location for the system is chosen. The system must be installed in the vicinity of bearing walls or columns, where the impact of low-frequency oscillation is smaller. Furthermore, it is advisable to avoid placing the system in the vicinity of other sources of vibration such as elevators, ventilation systems, industrial equipment, and airflows.

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Warning

The system is a metal-made current conductor. If used together with electrical devices, the table must be earthed.

Warning

The optical table is placed onto the supports without any additional fasteners, which means that great horizontal loads on the system may lead to the table sliding away from the supports or to the entire system tipping over.

1.3 Air supply requirements

The operation of the system requires a constant supply of air. After the system has been filled in and set, air is used only for the operation of level controls when the load on the table changes.

Compressed air tanks (receivers) may be used for keeping the system operative.

The air entering the system must be filtered through a filter with a filtering degree of at least 10 μm. The filter prevents impurities and water from entering the level controls, thus preventing them from clogging.

The working pressure of the system is 0.5–6 atm (bar). The required minimum working pressure for the support with the maximum load may be computed using the following formula:

$$P = \frac{Q}{176.7} + 0.5$$

Where:
P means the required pressure in atm (bar).
Q means the load on the support with the maximum load (kg).

Example:
Q = 200 kg

$$P = \frac{200}{176.7} + 0.5 = 1.63 atm(bar)$$

The air supply system must be provided with a valve (plug) for complete stoppage of air supply in the case of maintenance and/or resetting of the system, or in cases of major changes in loads of the system.

Attention

It is not advisable to use compressed carbon dioxide (CO_2) tanks because rapid filling of pneumatic supports may result in their icing up.

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2. Mounting of the system

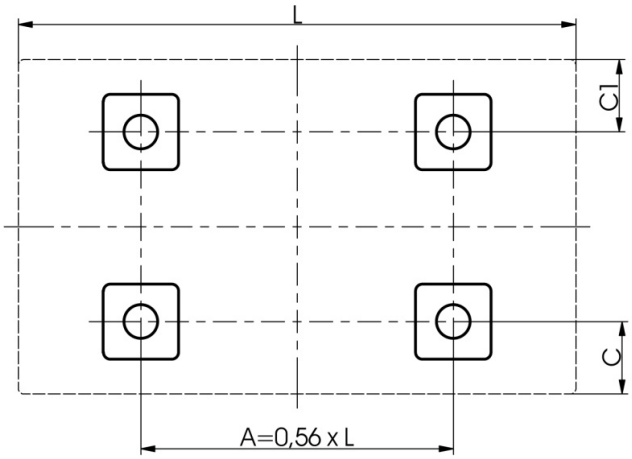
2.1. Assembly of the system

2.1.1. Safety

The weight of $1m^2$ of the optical table on average is over 100 kg. For this reason, to prevent injuries during assembly of the system, lifting mechanisms (a loader) and technological supports must be prepared in advance.

2.1.2. Location of pneumatic supports

Fig. 5 shows the correct layout of pneumatic supports for tables with standard dimensions.



C=C1=160…200 mm

Fig. 5. Location of pneumatic supports for standard-size tables

2.1.3. Preparation of pneumatic supports for operation

Attention

Prior to placing the optical table on the pneumatic supports, they must be filled with oil. (The oil is provided for each of the supports in 0.3-liter containers.)

Fig. 6 shows the opening into which oil must be poured.

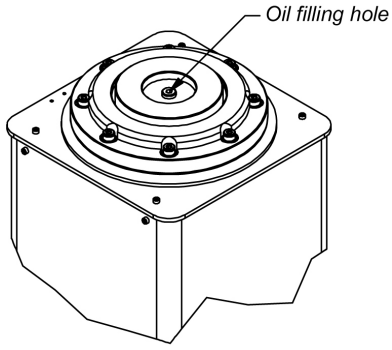


Fig. 6. Opening into which oil must be poured

Oil pouring procedure:

- Loosen and remove the thread plug.
- Pour 0.3 litre of oil from the container.
- Replace the plug and fasten it properly.

Attention

After filling a support with oil, the support must not be inclined more than by 45° vertically; this is to prevent the oil passing from the damper to the operating spaces of the support.

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2.1.4. Assembly of the table

Place the table accurately on top of the pneumatic supports. If you need to adjust the location of the table, lift the table over the supports.

2.2. Preparation of the system for operation and vibration isolation of the table

2.2.1. Assembly of level controls

A level control is shown in fig. 3.

All systems, regardless of the number of pneumatic supports used in them, are provided with 3 level controls that form a triangle. The greater this triangle of a specific optical table is, the more stable is the operation of the system. If 2 or more pneumatic supports are controlled by means of a single level control, then they operate as one large support with the total load-carrying capacity applied to the centre of the shape formed by the pneumatic supports. Groups of pneumatic supports serve as three supports for the system. The aggregate centre of gravity of the optical table and of the useful load present on the table must be within the boundaries of the triangle formed by force centres.

Schemes of connection of level controls for different numbers of pneumatic supports in the system are shown in fig. 7.

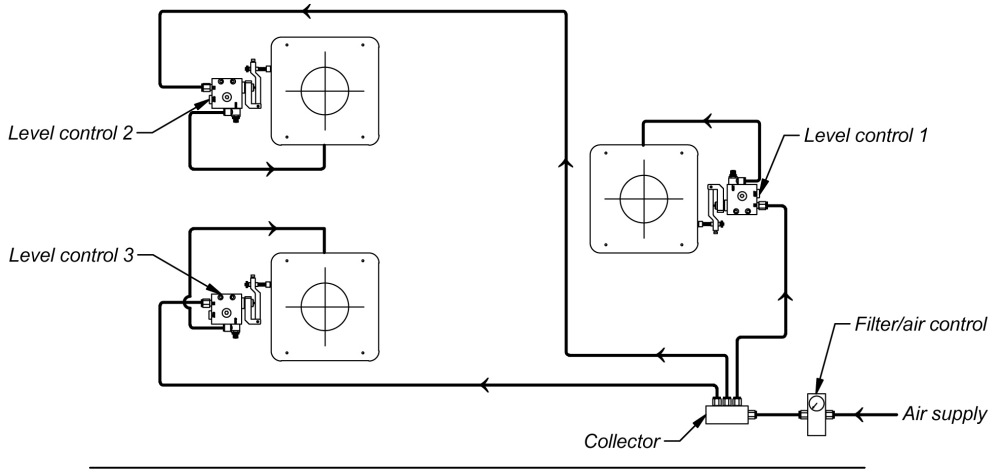

Fig. 7.1. A system with 3 pneumatic supports

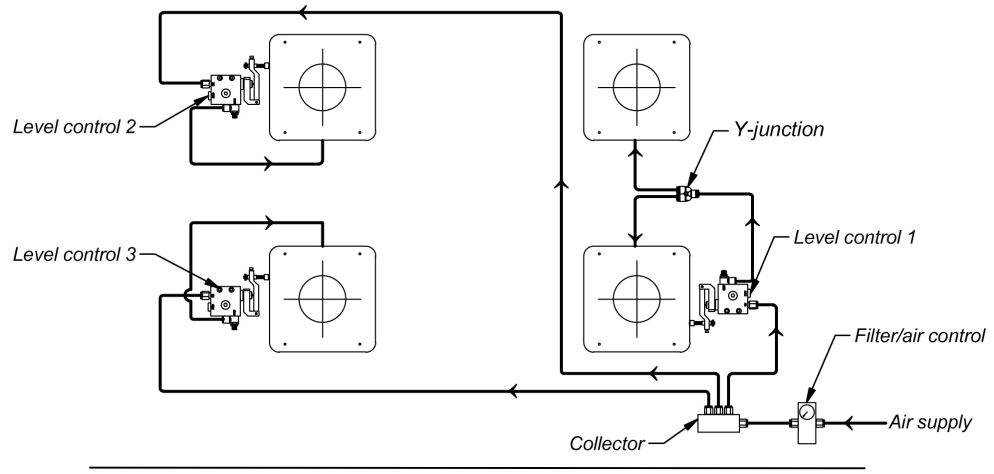

Fig. 7.2. A system with 4 pneumatic supports

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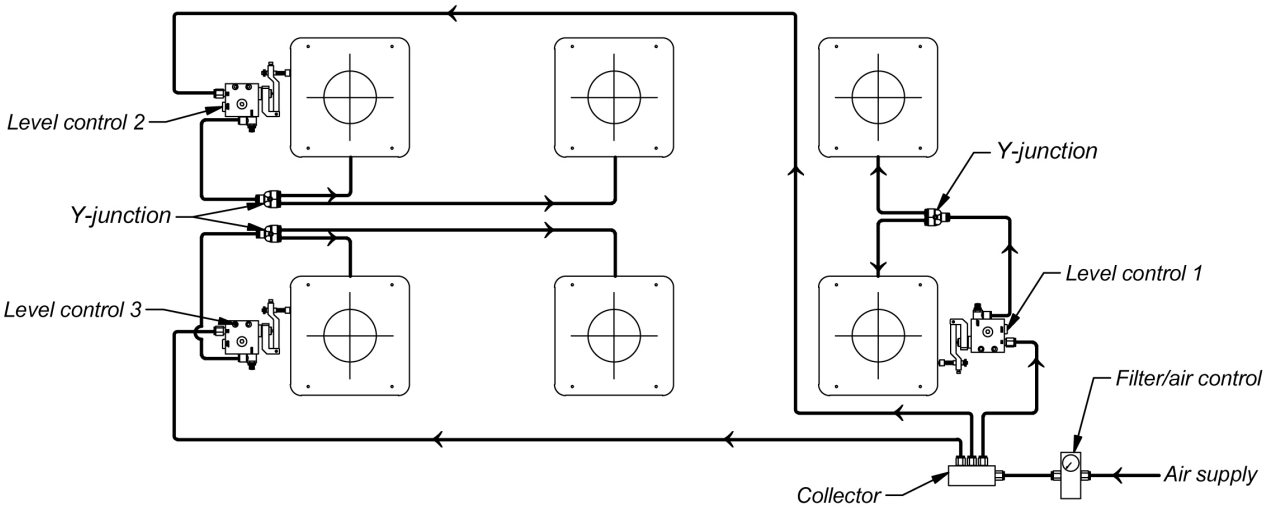

Fig. 7.3. A system with 6 pneumatic supports

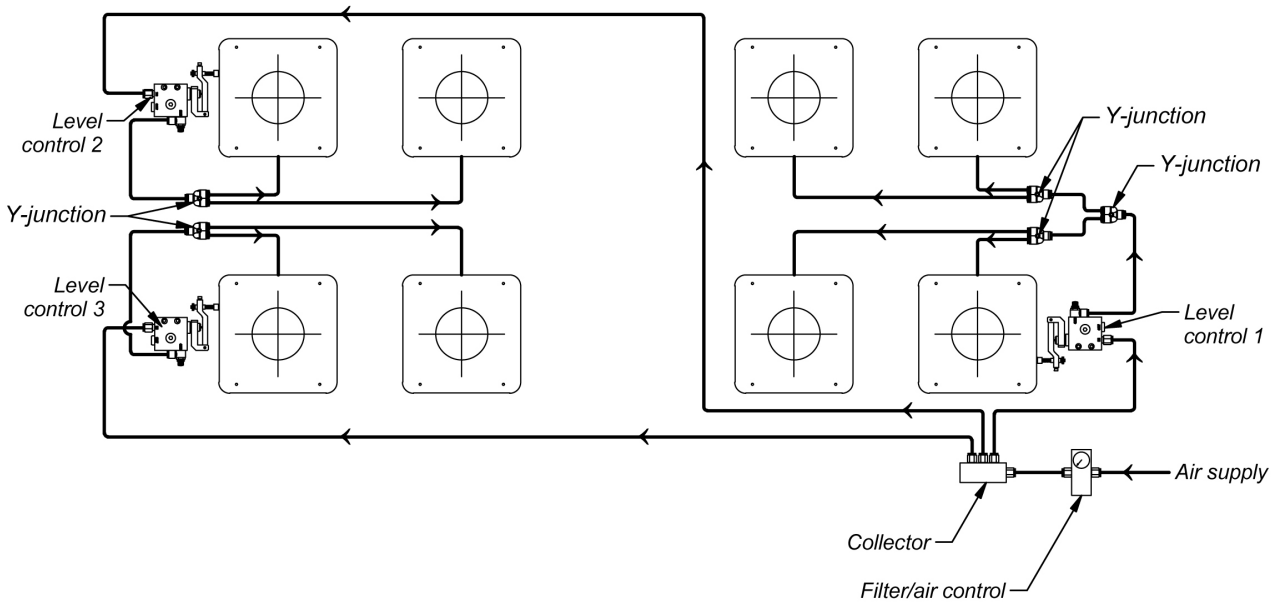

Fig. 7.4. A system with 8 pneumatic supports

After placement of the table, level controls must be fastened to the supports as shown in fig. 8. Align the controls horizontally and set the distance from the bracket of the controls to the table at 5 to 6 mm. The control screw of the lever must be set to the bottom position. The needle valve must be turned counter clockwise until tight. Tighten the two mounting screws carefully.

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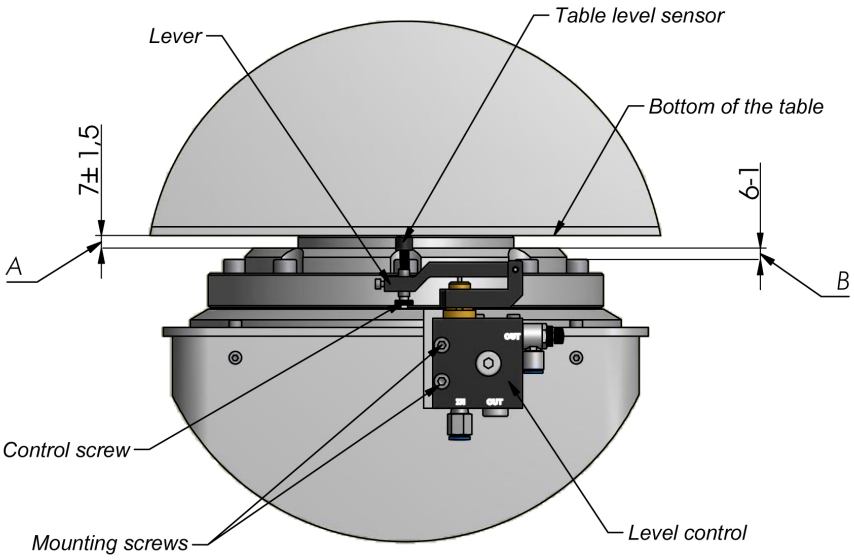

Fig. 8. Installation of level control

After placement of the three controls the system must look as shown in fig. 9.

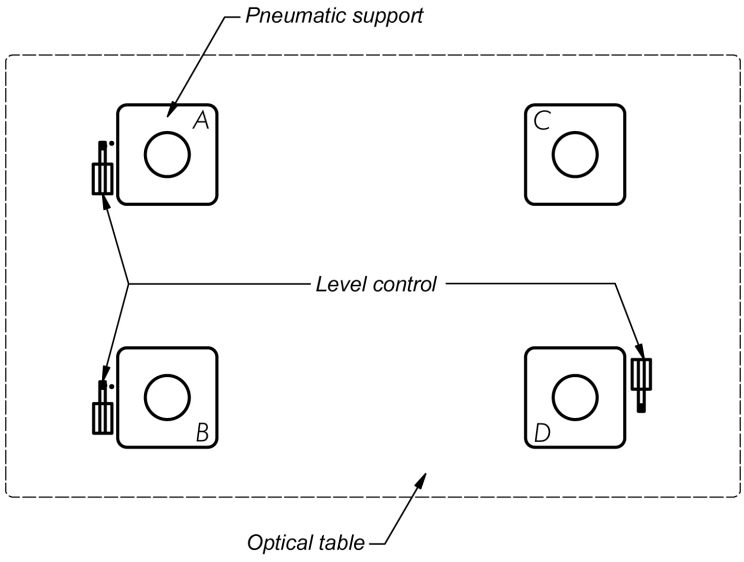

Fig. 9. Vibration isolation system

2.2.2. Connection of air supply pipes

Connect the air supply pipes as shown in fig. 7, fig. 10, and in the scheme of pneumatic connections included in the supplies provided together with the system.

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Warning

Cut the edges of the pipes using a sharp cutter at a straight angle. It is not advisable to use scissors because deformation of the pipe edges may lead to leaks from the system.

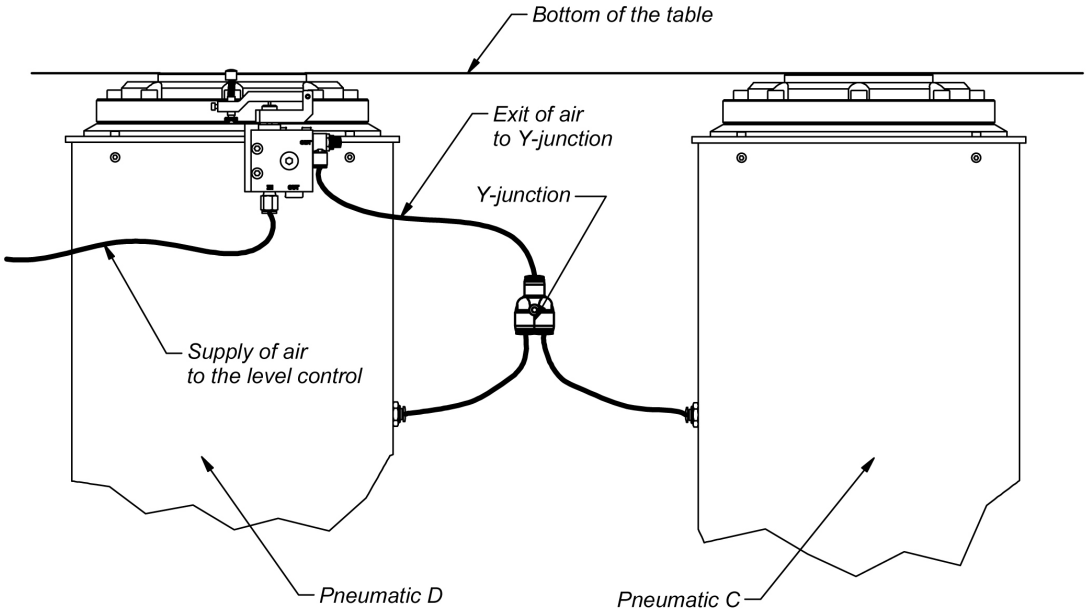

Fig. 10. Connection of air supply pipes

Insert the pipes in the collet fittings until tight. Pull the pipes accurately to make sure that the connection is secure.

The length of the pipes between the fittings must be optimal with a small extra length.

Connect the air supply and set the pressure control based on the computation of its value carried out in advance according to the formula provided in section 1.3.

Attention

The pressure in the system may not exceed 6 atm (bar).

Check all accessible connections for possible leaks. Eliminate any leaks established prior to starting further operation.

If the table does not emerge in a few minutes, increase the air pressure, check whether the needle valve is open and try to adjust the position of the control lever by turning the control screw clockwise.

Note

If the table starts oscillating after emerging, decrease the air pressure in the system and adjust the needle valves by turning them clockwise.

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2.2.3. Setting of level controls

After the table has emerged, check the distance between the table and the support (see fig. 8). Dimension A must be 7±1.5 mm. Set height A of every control by means of the control screws. When all controls are set, check all three dimensions A once again and adjust them, if needed.

Make sure that that the table is floating freely on the supports. Move the table accurately from side to side by approximately 3 mm. Perform the same operation by moving the table up and down by the same distance. The moving of the table must be unimpeded and must not produce any noises.

Press each of the angles of the table one after another for approximately 3 mm and then release the pressure. The table must return to the original position in approximately 3 to 4 seconds. Adjust if necessary by means of the needle valves and pressure in the system.

3. Management of the system

3.1. Main principles

After completing the assembly of the system and once the table has emerged, minor changes may be introduced based on individual requirements for the system. These adjustments include parameters such as air pressure in the system, position of the level control lever, and setting of the needle valve.

Warning

After the table has emerged, the space between the table and the support may become a zone of danger.

Any object present in this zone may be squeezed in the case of changes in the load on the table or in the pressure, which can result in injuries.

3.2. Adjustment of parameters of the system

Stabilisation in the case of a high load weight centre. If a load has a high weight centre, the table may start to oscillate. In this case, you need to reduce the pressure in the system and close the needle valve.

This will improve the stability and reduce the oscillation of the table.

The empirical rule for the determination of the height of the weight centre is shown in fig. 11.

If the overall weight centre of the table and the useful load is in the ‘stable area’, the system will be stable. If the overall weight centre is in the ‘may be stable’ area, the system may be stable. If the overall weight centre is outside of these areas, the system will lack stability.

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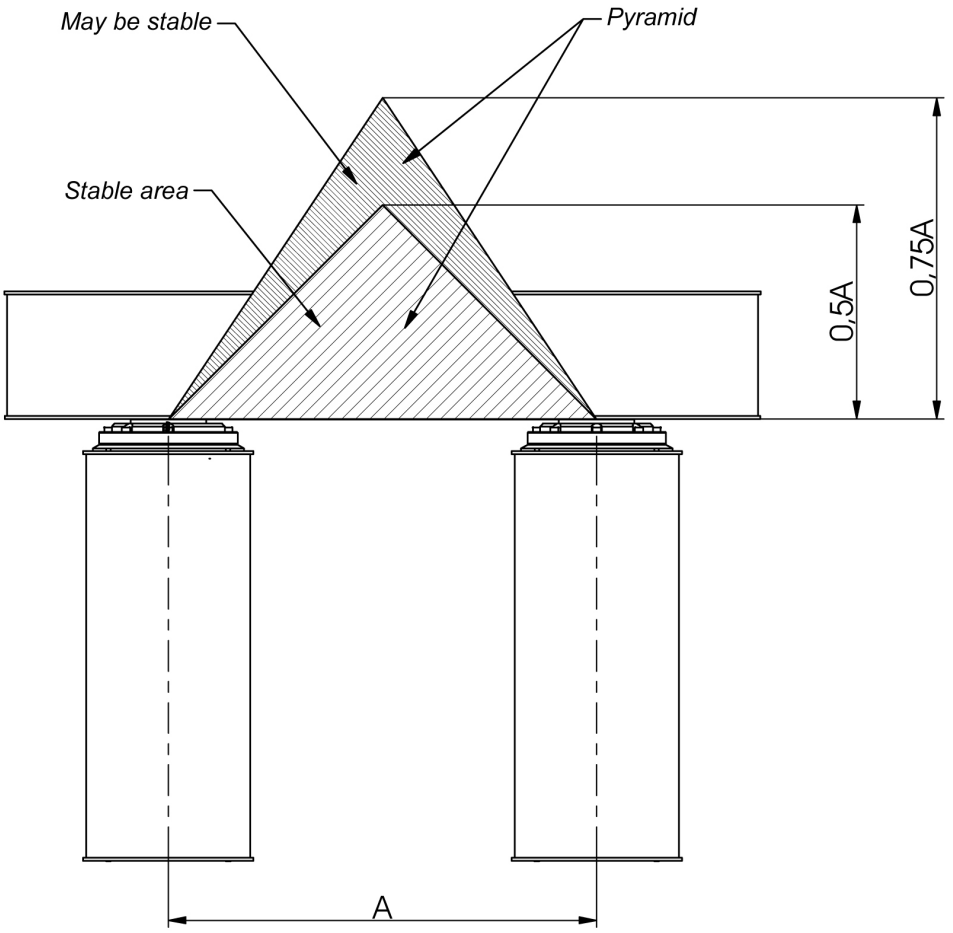

Fig. 11. Empirical rule for the determination of the height of the weight centre

3.3. Maintenance

If operated correctly, the pneumatic vibration isolation system needs minimum maintenance. As a rule, the maintenance includes the assurance of the cleanliness of the air supplied, i.e. replacement of the filter and removal of any water.

3.3.1. Cleaning

The table and other parts of the system may be cleaned using a non-abrasive liquid detergent.

3.3.2. Air quality

Oil, water or impurities contained in the air entering the system may clog level controls and worsen the operation of the system. Use of air treatment filters is obligatory. Please refer to section 1.3.