
Installation and Fixing of the Machine

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1. Installation of the Machine

To fully utilize the extensive possibilities of the balancing machine an optimal installation is required. This comprises in particular:

- a rigid foundation provided for loading capacity in accordance with the specific requirements;
- a rigid non-shrinking grout as contact layer between machine base and foundation;
- a good friction-locked fastening of the machine base¹ on the foundation.

1.1 Installation Possibilities

Depending on local site conditions there are three installation possibilities:

- on the workshop floor (go on to section 1.1.1);
- on upper stories (go on to section 1.1.2);
- on an special foundation block (go on to section 1.1.3).

1.1.1 Installation on the Workshop Floor

This most frequent installation possibility can be used if the following requirements are met:

- The workshop floor consists of concrete tightly resting on a grown or well consolidated soil;
- The workshop floor is not interrupted by floor joints near the balancing machine;
- The workshop floor is designed for a static load capacity in accordance with the max. rotor weight and the weight of the machine.

Table 1 shows the load capacity and thickness of the workshop floor required for the specified balancing machine types.

Static safe floor load t/m ²	Thickness of concrete layer mm	Suitable for balancing machines including size
3	150	H4/40 or V3 resp.
5	200	H6/60 or V5 resp.
8	300	H80

Table 1

If these requirements are not fulfilled, refer to 1.1.3.

1.1.2 Installation on Upper Stories

This kind of installation is more difficult due to resonance frequencies of the building structure and low damping effect. As it is not possible to give general rules here some information on this item:

- For balancing machines up to size H3/30 or V2 resp. usually no difficulties occur with a thickness of the concrete floor of at least 200 mm.

¹ The term *Maschine base* used in this instruction is generally defined as base (e. g. for horizontal balancing machine type H) or machine housing (e. g. for vertical balancing machines type V).

- Machines up to size H5/50 or V4/40 resp. can in most cases be installed if the floor has a corresponding thickness.
- For machines from size 6 onward an installation in upper stories is usually impossible.
- When installing balancing machines on upper floors it is sometimes necessary to lock a small speed range because of resonance frequencies of the building structure. The machine should, if possible, be placed on the mounting plates and not on pillars and ceiling joists.

1.1.3 Installation on a Special Foundation Block

If the workshop floor is not designed for the load capability and stiffness required a separate foundation block will be provided. Any kind of vibration insulation of the separate foundation block is not allowed.



For the dimensions of this foundation block refer to the installation plan.

1.2 Make the Foundation

The machine's foundation has to be made exactly following the instructions of the installation plan.

- One has to use concrete of a minimum pressure strength of 25 N/mm².
- The reinforcement of steel has to be related to the expected load.
- The foundation's surface should be flat and as horizontal as possible.
- Installation, placement and alignment of the machine must not be made before the concrete is absolutely set and hardened.

1.3 Positioning of the Machine

Place all individual assemblies in the right position and mark the outline.

The min. distance between the floor joints and the machine base shall be 6 x the thickness of the concrete slab.

1.4 Preparation of the Foundation

- **Cleaning:** Clean thoroughly the floor in the machine base area;
- **Painting:** Plastic paint is not required to be removed;
- **Coating:** Remove plastic coating (thickness of some mm);
- **Floor Pavement:** Remove pavement, fill the resulting clearance up to floor level with some sealing compound like *PAGEL V1*.

2. Installation of the machine

Refer to your installation plan:

Installation of the machine using anchoring screws → chapter 2.1

Installation of the machine using adhesive anchor bolts → chapter 2.2

2.1 Installation of the Machine using anchoring screws

The machine bed is put onto the foundation and is supported by wedges. The bed is aligned with the help of a spirit level by means of the wedges or adjusting screws. The differences in height between the front and back upper edge is not to be above 1 mm.

Subsequently the machine bed is undercast with fluid concrete. After firming up the concrete the anchoring screws will be tightened. It is recommended that an oil-tight coating is applied onto the foundation surface as a protection against the effect of oil, emulsion etc. This is not part of our scope of supply.

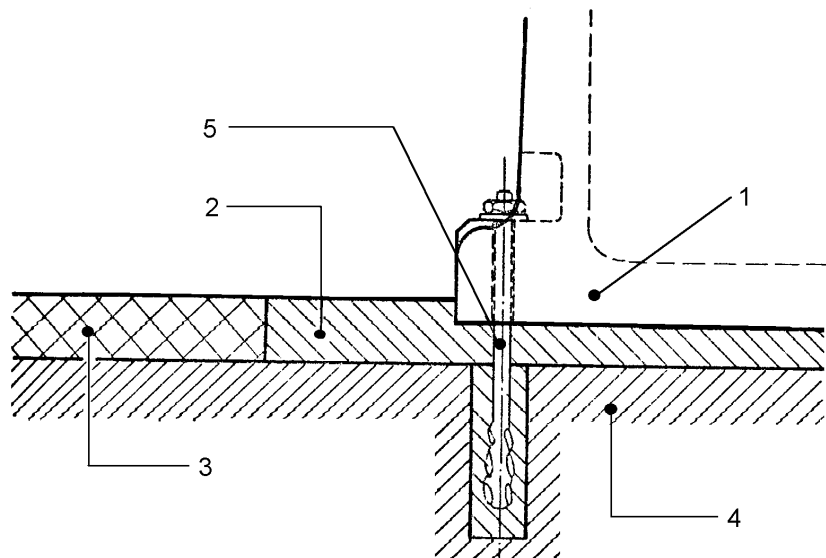


Figure 1: Construction of the foundation with anchors

- | | |
|----------------------|--------------------|
| 1 = Machine bed | 2 = Concrete |
| 3 = Workshop floor | 4 = Concrete floor |
| 5 = Foundation screw | |

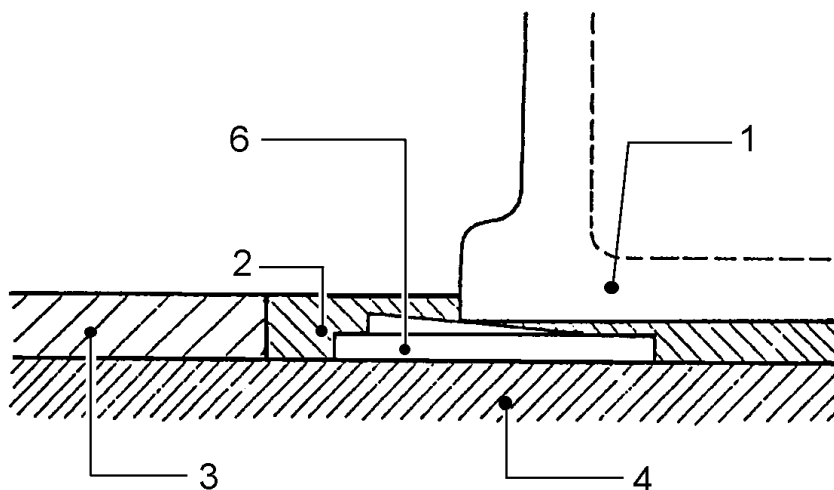


Figure 2: Construction of the foundation with levelling pieces

- | | |
|----------------------|--------------------|
| 1 = Maschine bed | 2 = Concrete |
| 3 = Workshop floor | 4 = Concrete floor |
| 6 = Levelling pieces | |

2.2 Fixing the Machine using adhesive Anchor Bolts

2.2.1 Marking of Drill Holes

Place balancing machine in final position on the workshop floor. Plant the holes for the fastening anchors as exactly as possible. Outline the floor area provided for installation of the machine base. Put machine aside, use coloured pencil to mark the hole centers with two lines located at right angle to each other: these crosses facilitate exact positioning of the *drilling pattern* (see fig. 3).

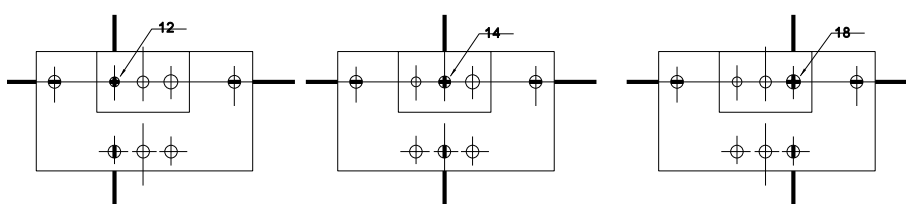


Figure 3: Marking the drilling holes using drilling pattern

2.2.2 Drilling

Drill the holes for the fastening anchors using the drilling pattern supplied with the equipment. For hole dimensions see installation plan.



During drilling the fitter shall stand on the drilling pattern to prevent its displacement.

2.2.3 Fastening of Anchor Bolts

For fastening adhesive anchors are provided. Adhesive anchors, adhesive material (cartridges) and screwing device will be included with equipment delivery.

To ensure firm adhesion of the anchor bolt remove dust from the holes after drilling (e.g. by collection via hose down to the bottom of the drill hole).



Do not water the drill holes.

Fix screwing device (will be supplied with balancing machine) in the percussion drill. Select speed as low as possible (below 300 1/min). Place a cartridge with adhesive material in a drill hole, insert adhesive anchor and shake it in.

The rotating anchor rod will destroy the cartridge and mix the components contained. With anchor rod reaching the drill hole bottom stop the shaking-in operation immediately; otherwise the adhesive material will be pressed out of the drill hole.



The marking (knurls) on the adhesive anchor is now on floor level.

As soon as the reaction mixture is sufficiently hard the anchor rod can be submitted to full load. The cure time of the mixture is dependent on temperature (see table 2).

Cure Times		
Ground temperature °C	Waiting Times	
	Hours	Minutes
over 20	---	10
10 - 20	---	20
0 - 10	1	---

Table 2

Enclosed in the packs with the adhesive cartridges you will find general instructions and recommendations for fastening the adhesive anchors. For special information on drill-hole dimensions which can differ from those in the a.m. instructions see installation plan.

2.2.4 Watering for Grouting

Water the workshop floor to be grouted until saturation.

If the floor is covered with plastic paint, watering is not required.

2.2.5 Placing of Machine Base

Next to each adhesive anchor wedge washers to DIN 434 (included with equipment delivery) must be positioned:

1 pair for compensation of clearance 6 – 11 mm

2 pairs for compensation of clearance 12 – 22 mm (see fig. 4).

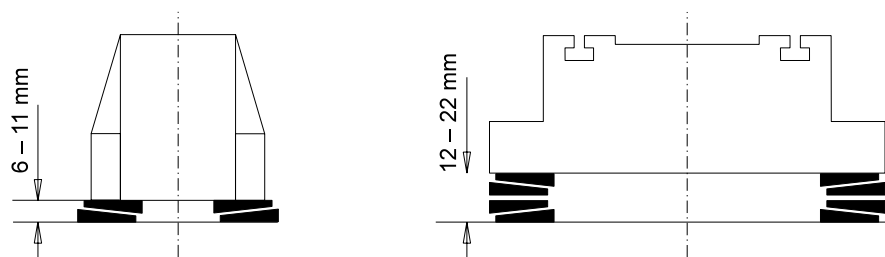


Figure 4: Compensation using anchor wedge washers



For clearance refer to the installation plan

Thereafter the balancing machine will be placed in final position.

2.2.6 Alignment

For final alignment use adjusting wedges and slightly tighten of the nuts of the anchor bolts if necessary.



Ensure that on the operator's side the adjusting wedges do not exceed the dimensions of the machine base.

Admissible tolerances:

2.2.6.1 Horizontal Balancing Machine

- Deviation of machine-base surface at any point from the horizontal position:
± 0,25 mm for bases with a length up to 5000 mm
± 0,50 mm for bases with a length of more than 5000 mm

- Inclination of surface at any point in longitudinal as well as in transverse direction: 0,2 mm per 1000 mm machine length

If the machine base consists of several parts the tolerances for the joint(s) in longitudinal direction are:

- Height misalignment of the surfaces at joint:
0,1 mm
- Misalignment of the front surfaces of "T" slots to each other in transverse direction: 0,1 mm
- Angular deviation of the "T" slots in longitudinal direction:
0,2 mm per 1000 mm length



Make sure that the bearing support can easily be moved over the joints. This should be tested before grouting of the base.

2.2.6.2 Machine Bases consisting of Beams

In addition the following deviation is permitted:

- Deviation of the distance between the two base beams
± 0,2 mm



A pair of spacers will be supplied with the machine.

2.2.6.3 Vertical Balancing Machines

- Permissible inclination on the end face of the spindle flange in 2 directions at right angle to each other
0,2 mm per 1000 mm length.

2.2.6.4 Sparately Mounted Drive

If the machine has a drive mounted separately from the machine, the machine base should be always installed at first then the drive should be aligned with respect to the base.

■ Permissible deviations on the power take-off flange

0,1 mm in horizontal direction

0,3 mm in vertical direction

0,04° Angular deviation between rotor axle and axle of the power take-off flange (which means an axial runout of the power take-off flange of approx. 0.07 mm within a radius of 100 mm).

For alignment of the joint-shaft drive it is useful to accomodate a shaft in the balancing machine (see fig. 5) with a dial gauge in direction to the joint shaft drive. By means of this dial gauge the power take-off flange can be scanned in radial and axial direction.

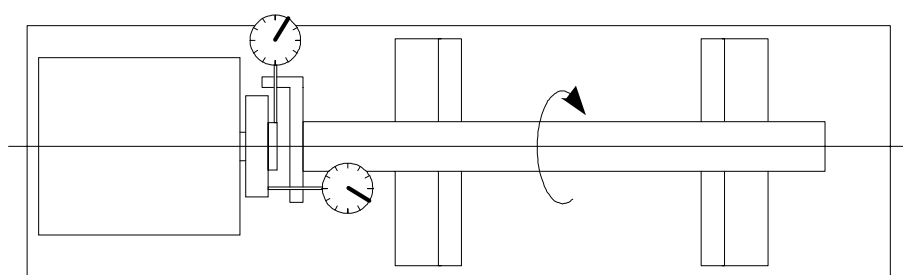


Figure 5: Alignment of shaft using dial gauges

3. Grouting

We recommend the use of non-shrinking grout V13 made by

Fa. Pagel

Postfach 110523

D – 45355 Essen

(or identical product). This grout V 13 is delivered in 25 kg bags as dry mixture ready for immediate use.



The sealing material is not included in equipment delivery and must be provided by customer.

3.1 Amount of Grout required

The amount of grout in kg required will be determined as follows:

$$G = A \cdot h \cdot \rho$$

A = area to be grouted in m^2

h = grouting height in m

ρ = density of grout in kg/m^3 ($\rho \approx 2000 \text{ kg/m}^3$)

Example:

Length of the area to be grouted: is 1600 mm

Width of the area to be grouted: 800 mm.

Grouting height: 20 mm. (For dimensions refer to the installation plan).

$$A = 1.6 \times 0.8 = 1.2 \text{ m}^2$$

$$h = 0.02 \text{ m}$$

$$G = 1.2 \times 0.02 \times 2000 = 48 \text{ kg}$$

In this case 2 bags/25 kg are required.

3.2 Preparations

Provide the workshop floor outside the machine area to be grouted with adhesive film to avoid soiling due to grouting. It is recommended also to provide the machine base in the foot area with adhesive tape (width approx. 60mm).

Provide a frame made of squared timbers (height approx. 40 mm) by loading. (For distance to the machine base according to grout see the installation plan). The squared timbers will be sealed against the workshop floor and at the joints by means of joint sealant.

3.3 Mixing of Grout

For mixing of the grout see manufacturer's instructions.

For Grout V 13 made by PAGEL:

To get 25 kg dry mixture approx. 4 l water are required. Add 3 l to the grout and mix thoroughly. After 3 minutes add the rest of water and mix 2 minutes. Thereafter the material is ready for grouting.

3.4 Grouting Operation

Operate grouting according to figure 6. If the grouting depth is up to 300 mm, execute grouting from one side, otherwise from both sides.

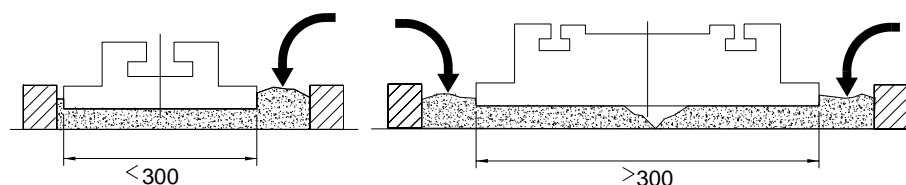


Figure 6: Inserting Grout

If the grouting area is not easily accessible, use a plastic hose or a plastic tube (min. diameter 40 mm), a feed hopper and a bucket.



If several grouting mixtures are required, prepare the next mixture already during grouting of the first one.

Open areas (outside the machine base) will be protected against water evaporation after grouting in order to avoid crack formation. They will be covered by films or moist cloths or alternatively sprayed with water.

Disturbing projecting grout can be cut off flush with the base mount 3 - 4 hours after completion of grouting.

3.5 Tightening of Anchor Bolt Nuts

It takes 24 hours for the grout to cure up to approx. 50 %. The nuts of the adhesive anchors will now be tightened, for torques required see table 3.

Thread diameter of the adhesive anchor mm	Torque Nm
M10	20
M12	30
M16	75

Table 3

3.6 Separately Mounted Drive

If the horizontal balancing machines are equipped with a cardan-shaft drive which is mounted on a concrete base, this concrete base must be tightly fastened to the workshop floor.

- Drill holes in angular direction to the workshop floor and grout reinforcing bars;
- After preparation of the ground (see 1.4) and the respective shuttering grout the concrete base;
- Execute alignment and fastening of the drive according to the same principle as for the machine base (see 2.2.5 ff.).

3.7 Further Assemblies

Align and fasten all other assemblies according to the instructions in the installation plan.



In most cases control cubicles will not be fastened.

4. Appendix

Tools and Additional Equipment for Installation of the Balancing Machine
Experienced personell will execute these operations themselves without any problems. For companies with less experienced personnel we made a list of tools and additional equipment recommended by us.

4.1 For Fastening the Adhesive Anchors

- Hammer drill;
- Hard-metal rock drill. For drill ϕ refer to installation plan, length see table 4.

Drill diameter mm	Free Length mm
12	250
14	280
18	300

Table 4

- Percussion drill with infinitely variable speed;
- Vacuum cleaner;
- 1 m plastic hose (outside diameter 2...3 mm smaller than drill hole diameter);
- Straightedge (steel approx. 1,5 m), only for multi-part bases;
- Angle 90°;
- Browning rod 2...3 m;
- Felt pen, black;
- Marking tool.

4.2 For Preparation of Alignment and Grouting

- Squared and if possible impregnated timber, height approx. 40 mm, for quantity see installation plan;
- Joint sealant (cartridges with press);
- Bucket;
- House-painter brush;
- Scissors;
- Blade knife;
- Film, thickness approx. 0.1 mm;
- Adhesive tape (width 50...60 mm).

4.3 For Alignment of the Balancing Machine

- Spirit level (1/1000 or better);
- Machinist's spirit level (0.1/1000);
- Tape measure (min. 2 m);
- Crowbar;
- Usual tool for mechanics.

4.4 For Grouting the Balancing Machine

- Non-shrinking grout (PAGEL V13 or any identical product);
- Mortar trough (25 l, 2 pieces);
- Water measure;
- Quirl for drill (for larger amounts the use of a concrete mixer is recommended);
- Trowel;
- Filling trowel;
- Plastic hose or tube (diameter approx. 40 mm);
- Feed hopper (for the plastic hose or tube);
- Ladle with handle and spout (to pour in grout);
- Material for keeping the grout moist, e.g. film, moist cloths, water spray.