

## APPENDIX O TUBE RAIL SYSTEMS

Tube rail systems are subject to various safety and stability requirements. The heating installer is responsible for laying the pipes and the effective output of the heating system. Quality requirements related to the load-bearing capacity of the soil, tube trolleys and tests such as a stability test are not part of the work of heating installers. Guidelines for this are given below for information purposes.

### Stability test

- Have the stability of the tube rail trolley tested. This is necessary to assess overturning safety. The test takes into account the properties of the foundation (soil and tube rail supports), the properties of the tube rail system (track width, specification of tubes and supports and support spacing) and the properties of the tube rail trolley. The stability test is derived from NEN-EN 280:2001 and is limited to a test of static stability in the highest position of the platform. Stability is sufficient if the tube rail trolley withstands the test for 60 seconds without overturning;
- Have the test carried out in an arrangement most unfavourable to the overturning hazard:
  - Set up the tube rail trolley on a section of the tube rail system that is inclined sideways by 2.5° for the test;
  - Adjust the tube rail trolley in relation to the tube rail supports in such a way that the greatest deflection of the tube and therefore the greatest overturning effect occurs. The maximum deflection occurs with a support halfway between the axles of the tube rail trolley or - if there is a large difference between the wheelbase of the tube rail trolley and the support spacing of the tube rail system - with the centre of gravity of the tube rail trolley midway between two supports:
    - If the wheelbase is greater than 62.5% and less than 125% of the support distance, the tube rail trolley should be set up with a support halfway between the wheel axles;
    - If the wheelbase is less than 62.5% of the support distance or greater than 125% of the support distance, the tube rail trolley should be set up with the centre of gravity midway between two supports;
  - Set up the tube rail trolley with the platform in the highest raised position, on which there is a test load of 100 kg;
  - Apply a force of 110 N to the tube rail trolley, which engages at 1.10 metres above the platform and operates horizontally in the overturning direction;
- Ensure that the centre of gravity of the test load is horizontally measured from the inside of the fencing at 100 mm, on the low side of the inclined arrangement;
- For simplification, the stability test may be carried out without the horizontal acting force of 110 N, if instead the test is carried out with an additional test load attached to the platform in such a way that an equivalent overturning moment is exerted on the tube rail trolley. An approximate equivalent situation occurs if the additional test load, applied outside the overturn line, causes the same overturning moment as the horizontal force applied at 1.10 metres above the maximum raised platform. The test load on the platform is reduced to compensate for the additional test load.

### Quality requirements for load-bearing capacity of the soil

- The topsoil on which the tube rail system is founded should have a cone value of more than 0.4 MPa (62 psi). In addition, the following conditions apply:

- The topsoil is reasonably homogeneous to a depth of at least 0.5 metres. This is evident from the course of the cone values of the top layer;
  - The tube rail support has a bottom plate no smaller than prescribed;
  - The load on the tube rail support does not exceed 300 kg.
- If it is not clear whether the soil is sufficiently load-bearing, have a soil test carried out. Agree on this with the contractor and record the result of the test. Cone values for load-bearing capacity of the soil are determined by soil testing using a penetrometer or similar measuring device. The cone value is the penetration resistance experienced by a cone-shaped body (with prescribed dimensions) when pushed perpendicularly into the soil. The cone value is the measured resistance expressed in Mpa (Megapascal). Sometimes this value is still expressed in psi (pounds per square inch; 1 Mpa=145psi);
  - Take measurements at several locations to determine the load-bearing capacity of the soil. For tube rail systems, measurement to a depth of about 60 cm is sufficient. For each measurement point, the average of the cone values at depths of 10, 20, 30 and 40 cm is calculated. The soil at a given measurement point is sufficiently load-bearing if the average cone value of that measurement point is greater than 0.4 Mpa and, in addition, the cone values of that measurement point do not show a decreasing trend. As a rule of thumb, the cone value at a depth of 40 cm is greater than or equal to the cone value at a depth of 10 cm;
  - If the load-bearing capacity of the soil is insufficient, soil improvement techniques such as compacting the topsoil should be applied.

#### **Comment**

When the ground/soil is wet/saturated, the load-bearing capacity of the soil is less and the tube rail system cannot be used (temporarily)

#### **Quality requirements for tube rail trolleys**

- Tube rail trolleys should be equipped with a misalignment signal that warns the user if the tube rail trolley is in danger of overturning;
- Tube rail trolleys must be supplied with an EC declaration of conformity;
- Tube rail trolleys should be equipped with a guardrail with an upper handrail at the long sides at least 90 cm above the platform and an intermediate handrail halfway up;
- The handrails at the short sides of the platform are 110 cm high;
- Tube rail trolleys must be labelled with the maximum permissible loads. Include at least the following details:
  - The permissible load in kilograms<sup>1</sup>;
  - The permissible load expressed in the number of persons allowed and the weight of equipment/tools in kilograms<sup>1</sup>;
  - The maximum permitted manual effort in <sup>Newton</sup><sup>2</sup>;
  - If tube rail trolleys are equipped to carry additional loads (packaging and harvested product) up to a limited lifting height, this must also be stated.

<sup>1</sup> The permissible load follows from the manufacturer's data or from the stability test and is at least 100 kilograms. 1 person and 20 kilograms of equipment, respectively.

<sup>2</sup> The maximum permitted manual effort follows from the manufacturer's data or from the stability test. If the test was conducted with a test load of 110 Newton - this includes a 10% allowance, in line with the standard for aerial platforms - then 100 Newton is stated.