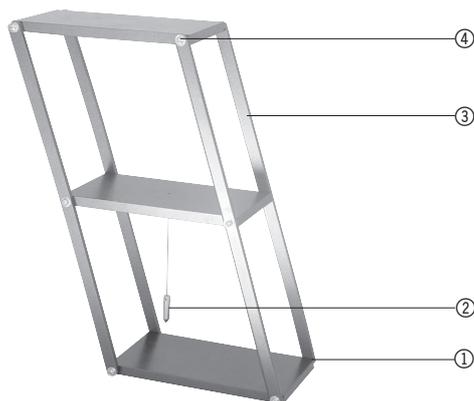


## U15033 Stability apparatus with integrated plumb

### Instruction sheet

6/03 ALF



- ① Steel plate
- ② Plumb line
- ③ Steel rod
- ④ Hinge

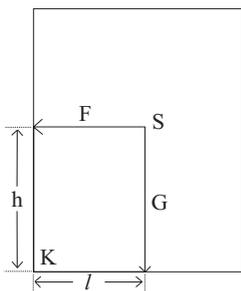
The stability apparatus is used to demonstrate the stability of an object depending on the position of its center of gravity above the supporting surface.

#### 1. Description, technical data

The stability apparatus consists of 3 steel plates connected by hinges to a frame made up of four steel rods so that the vertical separation between the plates is equal. A plumb line hangs suspended from the center of gravity of the apparatus at the mid-point of the middle plate. Dimensions: 180 mm x 150 mm x 290 mm

#### 2. Principle

For a standing object the centre of gravity is only stable if the plumb line is directly above the centre-point of the surface at the base of the object. The force of gravity acts effectively through the centre of gravity of the object and is equally matched by the reaction of the surface. If the plumb line is not above the centre of the base, the force of gravity through the centre of gravity of the object produces a moment which makes the object tend to tip over.



At the center of gravity S there are two forces being exerted, gravity G and the lateral force F, which tends to tilt the body over the edge K. It causes a moment  $M_{\text{tilt}} = Fh$  about an axis formed by K. This moment is counteracted by the moment due to the gravity  $M_{\text{gravity}} = Gl$ . As long as  $Fh = Gl$ , the object remains in equilibrium and does not tip over. The force  $F = Gh/l$  serves as a measure for the stability of an object resting on a surface. The greater the gravity G, the lower the height h of the center of gravity above the supporting surface and the greater the distance l from the edge K to the point at which the plumb line would cross the surface, the more stable the object will be.

#### 3. Operation

- The stability apparatus is placed on a horizontal supporting surface.
- The device is then tilted at various angles.
- Equilibrium is stable if the center of gravity is located above the support base.
- Equilibrium is unstable if the center of gravity is located directly above the edge that forms the axis of rotation. (a slight push is enough to tip the apparatus over.)
- If the center of gravity is no longer located over the support base or over the tipping edge, the stability apparatus tips over of its own accord.
- The position of the center of gravity can always be surmised by the line of the plumb bob.
- To determine the force required to tip the apparatus over, attach a 10 N dynamometer into the eyelet on the side of the apparatus.