Annex VIII

Description of manikin

1 Requirements of the manikin

1.1 General

The main characteristics of the manikin are indicated in the following figures and tables:

fig. 1: side view of head, neck and torso;

fig. 2: front view of head, neck and torso;

fig. 3: side view of hip, thighs and lower leg;

fig. 4: front view of hip, thighs and lower leg;

fig. 5: principal dimensions:

fig. 6: manikin in sitting position, showing:

- location of the centre of gravity,
- location of points at which displacement shall be measured,
- shoulder height;

table 1: references, names, materials and principal dimensions of the components of the manikin;

table 2: mass of head, neck, torso, thigh and lower leg.

1.2 Description of the manikin

1.2.1 **Lower leg structure** (see figs 3 and 4)

The lower leg structure consists of three components:

- a sole plate (30),
- a shin tube (29),
- a knee tube (26).

The knee tube has two lugs which limit the movement of the lower leg in relation to the thigh.

The lower leg can rotate rearwards about 120° from the straight position.

1.2.2 **Thigh structure** (see figs 3 and 4)

The thigh structure consists of three components:

- a knee tube (22),

– a thigh bar (21),

– a hip tube (20).

Movement of the knee is limited by two cut-outs in the knee tube (22) which engage with the lugs of the leg.

1.2.3 **Torso structure** (see figs 1 and 2)

The torso structure consists of the following components:

– a hip tube (2),

– a roller chain (4),

– ribs (6) and (7),

– a sternum (8),

– chain attachments (3 and, partly, 7 and 8).

1.2.4 **Neck** (see figs 1 and 2)

The neck consists of seven polyurethane discs (9). The degree of stiffness of the neck can be adjusted by means of a chain tensioner.

1.2.5 **Head** (see figs 1 and 2)

The head (15) is hollow, the polyurethane is reinforced by steel bands (17). The chain tensioner which enables the neck to be adjusted consists of a polyamide block (10), a tubular spacer (11) and a tensioning component (12 and 13). The head can rotate at the joint between the first and second cervical vertebrae (the atlas-axis joint), which consists of an adjuster assembly (14 and 18), a spacer (16) and a polyamide block (10).

1.2.6 **Knee joint** (see fig. 4)

The lower leg and thighs are connected by a tube (27) and a tensioner (28).

1.2.7 **Hip joint** (see fig. 4)

The thighs and torso are connected by a tube (23), friction plates (24) and a tensioner (25).

1.2.8 **Polyurethane**

Type: PU 123 CH compound

Hardness: 50 to 60 shore A

1.2.9 **Overall**

The manikin is covered by a special overall.

2 Correction of the mass

In order to calibrate the manikin to certain values and its total mass, the mass distribution must be adjusted by means of six correction masses of 1 kg each which can be fitted to the hip joint. Six other polyurethane masses of 1 kg each can be fitted to the back of the torso.

3 Cushion

A cushion shall be positioned between the chest of the manikin and the overall. This cushion must be made of polyethylene foam complying with the following specification:

– hardness: 7 to 10 shore A,

– thickness: 25 ± 5 mm.

It shall be replaceable.

4 Adjustment of the joints

4.1 General

In order to achieve reproducible results, it is necessary to specify and control the friction at each joint.

4.2 Knee joint

Tighten the knee joint.

Set the thigh and lower leg vertical.

Rotate the lower leg through 30°.

Gradually slacken the tensioner until the lower leg starts to fall under its own weight.

Lock the tensioner in this position.

4.3 Hip joints

Increase the rigidity of the hip joints for the purposes of adjustment.

Place the thighs in a horizontal position and the torso in a vertical position.

Rotate the torso forwards until it forms an angle of 60° with the thighs.

Gradually slacken the tensioner until the torso starts to fall under its own weight.

Lock the tensioner in this position.

4.4 Atlas-axis joint

Adjust the atlas-axis joint so that it just resists its own weight in the fore and aft directions.

4.5 Neck

The neck can be adjusted by means of the chain tensioner (13).

When the neck is adjusted, the upper end of the tensioner shall be displaced between 40 and 60 mm when subjected to a horizontal load of 100 N.

Table 1

Reference No.	Name	Material	Dimensions
1	Body	Polyurethane	–
2	Hip tube	Steel	76 × 70 × 100 mm
3	Chain attachment	Steel	25 × 10 × 70 mm
4	Roller chain	Steel	3/4 mm
5	Shoulder plane	Polyurethane	–
6	Ribs (rolled section)	Steel	30 × 30 × 250 mm
7	Ribs	Perforated steelplate	400 × 85 × 1,5 mm
8	Sternum	Perforated steelplate	250 × 90 × 1,5 mm
9	Discs (6)	Polyurethane	ϕ 90 × 20 mm ϕ 75 × 20 mm ϕ 70 × 20 mm ϕ 65 × 20 mm ϕ 60 × 20 mm
10	Block	Polyamide	60 × 60 × 25 mm
11	Tubular spacers	Steel	40 × 40 × 2 × 50 mm
12	Tensioning bolt	Steel	M16 × 90 mm
13	Tensioner nut	Steel	M16
14	Tensioner for atlas-axis joint	Steel	ϕ 12 × 130 mm (M12)
15	Head	Polyurethane	–
16	Tubular spacer	Steel	ϕ 18 × 13 × 17 mm
17	Reinforcement plate	Steel	30 × 3 × 500 mm
18	Tensioner nut	Steel	M12
19	Thighs	Polyurethane	–
20	Hip tube	Steel	76 × 70 × 80 mm
21	Thigh bar	Steel	30 × 30 × 440 mm
22	Knee tube	Steel	52 × 46 × 40 mm
23	Hip connecting tube	Steel	70 × 64 × 250 mm
24	Friction plates (4)	Steel	160 × 75 × 1 mm
25	Tensioner assembly	Steel	M12 × 320 mm plates and nuts
26	Knee tube	Steel	52 × 46 × 160 mm
27	Knee connecting tube	Steel	44 × 39 × 190 mm
28	Tensioner plate	Steel	ϕ 70 × 4 mm
29	Shin tube	Steel	50 × 50 × 2 × 460 mm
30	Sole plate	Steel	100 × 170 × 3 mm
31	Torso correction masses (6)	Polyurethane	1 kg each
32	Cushion	Polyethylene foam	350 × 250 × 25 mm
33	Overall	Cotton and polyamide straps	
34	Hip joint correction masses (6)	Steel	mass 1 kg each

Table 2

Components of manikin	Mass in kilograms
Head and neck	4,6 ± 0,3
Torso and arms	40,3 ± 1,0
Thighs	16,2 ± 0,5
Lower leg and foot	9,0 ± 0,5
Total mass including correction masses	74,5 ± 1,0

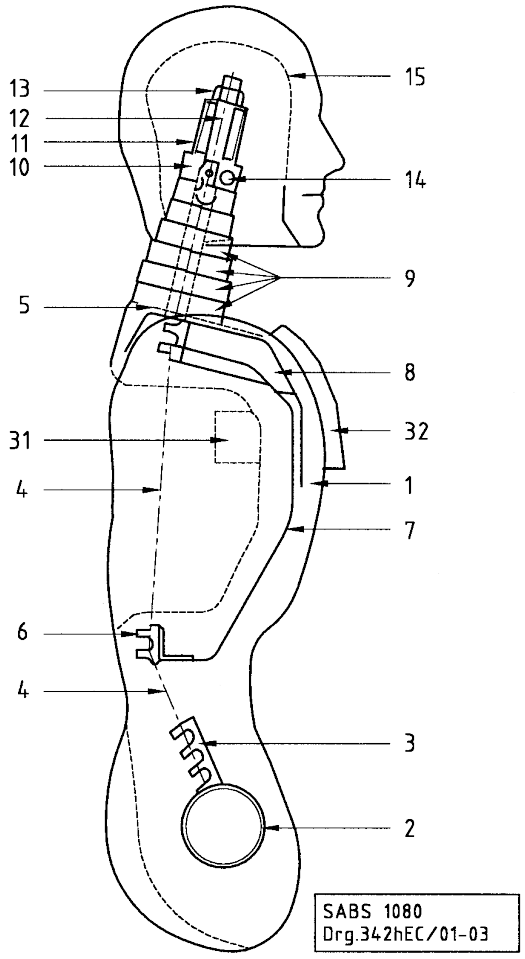

Figure 1

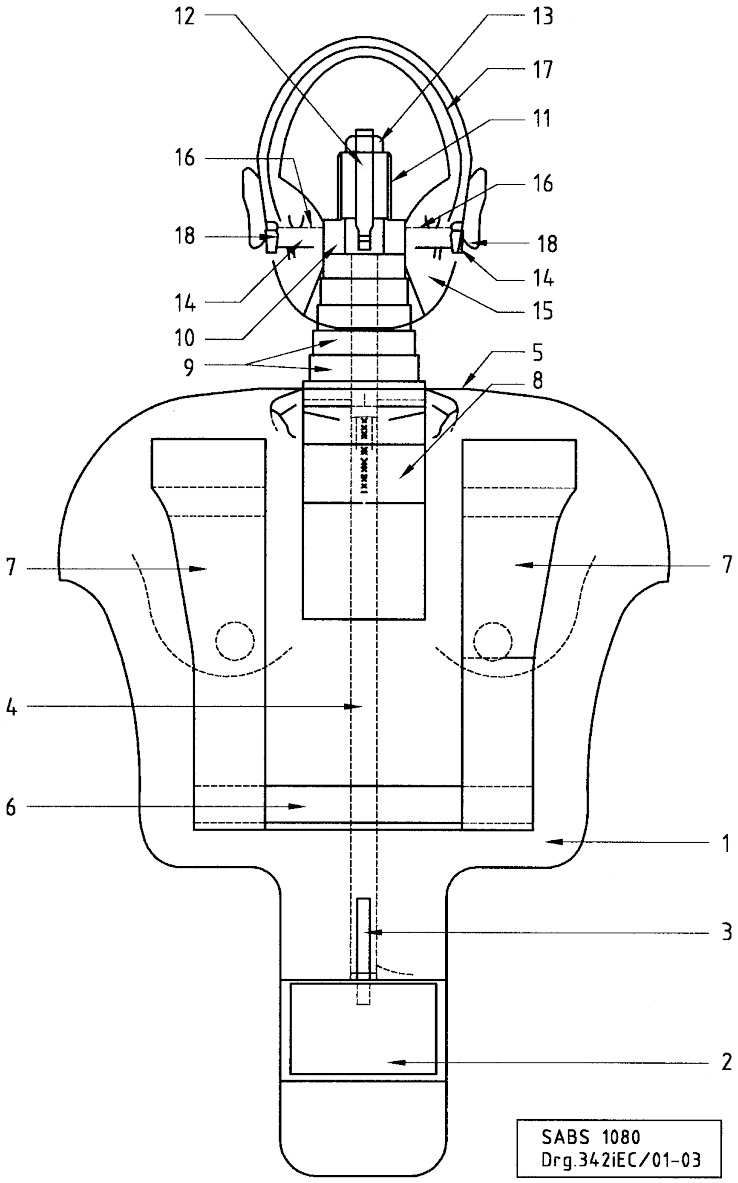

Figure 2

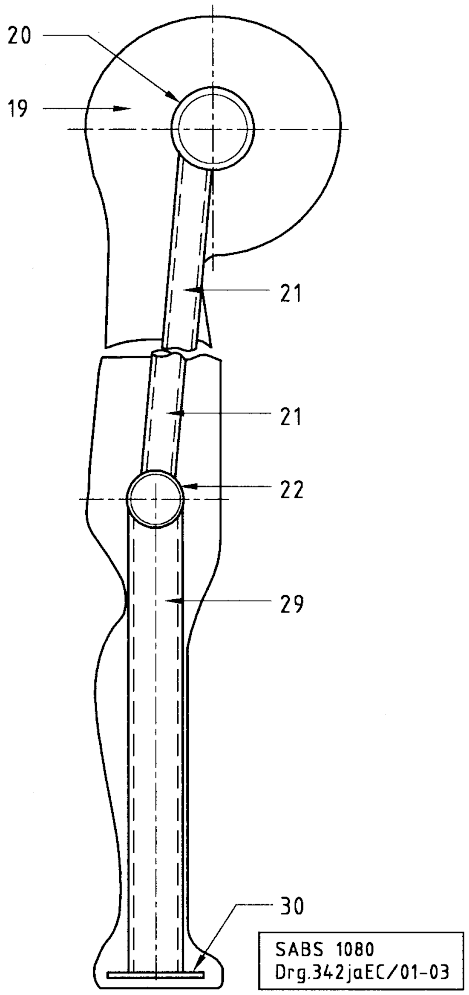

Figure 3

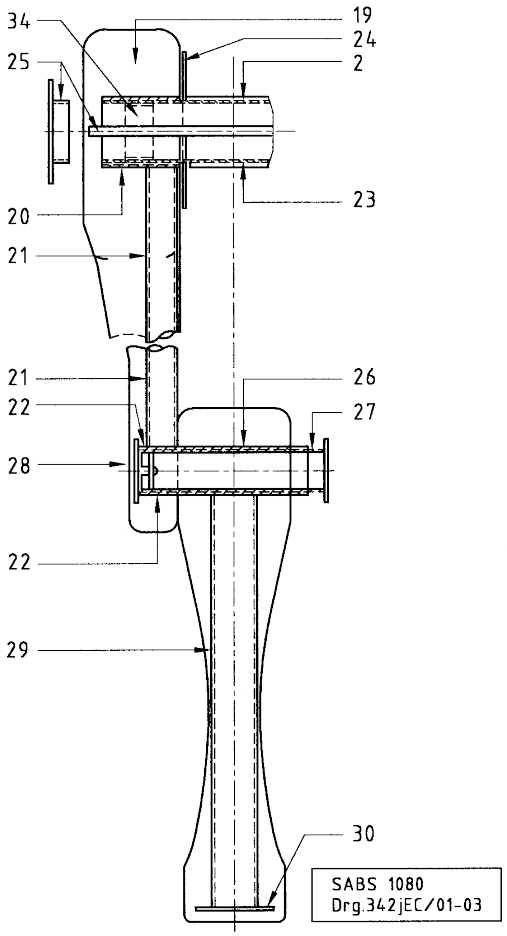

Figure 4

Dimensions in millimetres

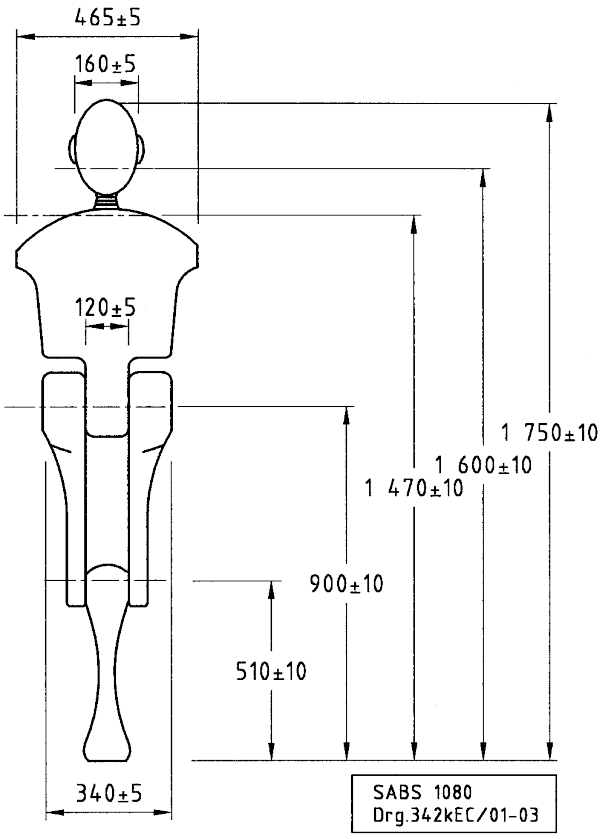

Figure 5

Dimensions in millimetres

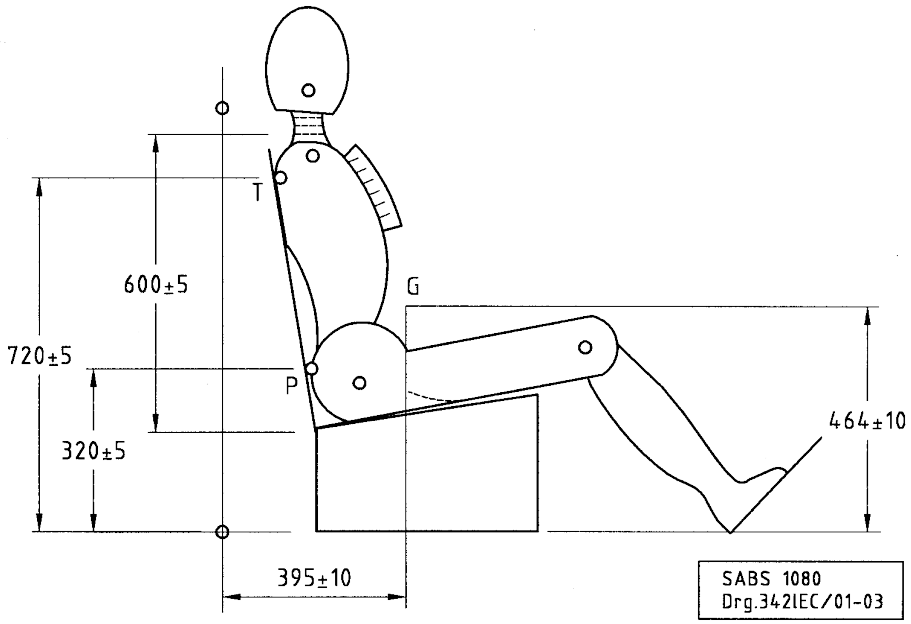

Figure 6

Manikin in sitting position as shown in annex VII, fig. 1.

G = centre of gravity

T = torso reference point (located at the rear, on the centre line of the manikin)

P = pelvis reference point (located at the rear on the centre line of the manikin)