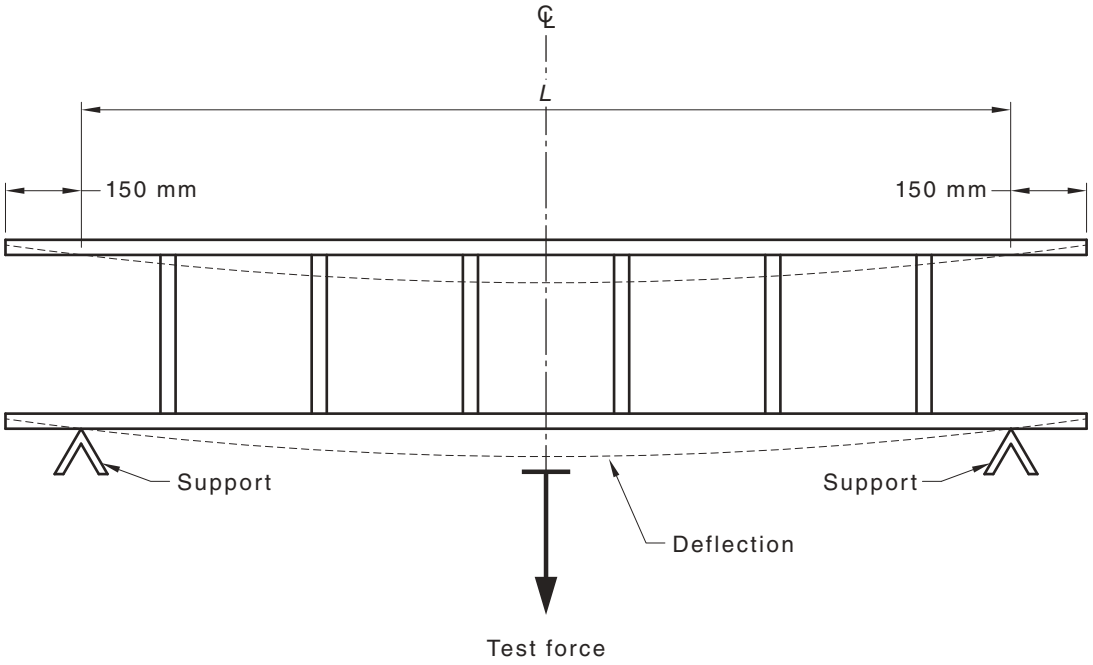


NOTE: The deflection is the difference between the height of the lower edge of the ladder side when unloaded (solid line) and when loaded (dotted line). *L* is the test span (in millimetres).

FIGURE J1 LADDER LATERAL STIFFNESS AND STRENGTH TEST

APPENDIX K

LADDER STILE CANTILEVER BENDING STRENGTH TEST

(Normative)

K1 SCOPE

This Appendix sets out a method for determining the strength in cantilever bending of the end of a ladder stile resulting from lateral loading to the foot. This test is applicable to single ladders, extension ladders and ladders of equivalent configuration.

K2 PRINCIPLE

A ladder is placed on its side, with the rungs vertical. The section between the working surface bottom rung and the foot of the ladder is unsupported. A specified vertical force is applied for a specified time to the foot of the unsupported section of the stile.

K3 APPARATUS

The following apparatus is required:

(a) A means of supporting the ladder on its edge along its length.

(b) A means of securely clamping the ladder to the support.

(c) A means of applying the vertical test force appropriate to the ladder load rating given in Table K1.

(d) A means of applying the vertical proof force appropriate to the ladder load rating given in Table K1.

(e) A 50 mm long bearing block.

(f) A means of measuring permanent set to ±0.5 mm.

(g) A means of measuring a time interval of between 60 s and 90 s.

K4 PROCEDURE FOR LADDERS WITH METAL STILES

The procedure shall be as follows (see also Figures K1 and K2):

(a) Position the ladder on the support with the rungs vertical. The section of stile between the working surface bottom rung and the foot of the ladder shall be unsupported and positioned such that the force in Step (d) can be applied vertically to the stile.

(b) Firmly clamp the ladder to the support.

(c) Measure and record the distance L_1 between the stiles at the foot of the ladder (see Figure K3).

(d) Apply the vertical test force appropriate to the load rating of the ladder given in Table K1, via the bearing block to the upper stile located at a point 25 mm from the end of the stile, for a period of not less than 60 s and not more than 90 s.

(e) Release the testing force.

(f) Measure and record the distance L_2 between the stiles at the foot of the ladder (see Figure K3).

(g) Determine the permanent set, i.e. the difference between the measurements taken in Steps (c) and (f).

(h) Apply the vertical test force appropriate to the load rating of the ladder given in Table K1, via the bearing block to the lower stile located at a point 25 mm from the end of the stile, for a period of not less than 60 s and not more than 90 s.

(i) Release the testing force.

(j) Measure and record the distance L_3 between the stiles at the foot of the ladder (see Figure K3).

(k) Determine the permanent set, i.e. the difference between the measurements taken in Steps (f) and (j).

K5 PROCEDURE FOR LADDERS WITH NON-METAL STILES

The procedure shall be as follows (see also Figures K1 and K2):

(a) Position the ladder on the support with the rungs vertical. The section of stile between the working surface bottom rung and the foot of the ladder shall be unsupported and positioned such that the force in Step (d) can be applied vertically to the stile.

(b) Firmly clamp the ladder to the support.

(c) Apply the vertical proof force appropriate to the load rating of the ladder given in Table K1, via the bearing block to the upper stile located at a point 25 mm from the end of the stile, for a period of not less than 60 s and not more than 90 s.

(d) Release the proof force.

(e) Apply the vertical proof force appropriate to the load rating of the ladder given in Table K1, via the bearing block to the lower stile located at a point 25 mm from the end of the stile, for a period of not less than 60 s and not more than 90 s.

(f) Release the proof force.

(g) Examine the ladder for visible signs of structural damage.

K6 CRITERIA FOR LADDERS WITH METAL STILES

The stiles shall not exhibit any sign of tearing and permanent set, either (L_2–L_1) or (L_3–L_2) of the stiles shall not exceed 6 mm (see Figure K3).

NOTE: Stiles may be distorted without evidence of tearing during this test. Distortion alone is permitted.

K7 CRITERIA FOR LADDERS WITH NON-METAL STILES

There shall be no visible signs of structural damage to the stiles as a result of the proof force.

TABLE K1

LADDER STILE CANTILEVER BENDING STRENGTH TEST AND PROOF FORCES

Load rating	Test force—Metal stiles		Proof force—Non-metal stiles	
kg	N	kgf	N	kgf
100	980	100	1225	125
110	1078	110	1348	138
120	1176	120	1470	150
130	1274	130	1593	163
140	1372	140	1715	175
150	1470	150	1838	188
160	1568	160	1960	200

NOTE: The magnitude of the vertical test force and vertical proof force may be determined from the following equations:

(a) For metal stiles:

$F_n = 9.8 \times R_l$; or

$F_k = R_l$

(b) For non-metal stiles:

$P_n = 9.8 \times 1.25\ R_l$; or

$P_k = 1.25\ R_l$

where

F_n = test force, in newtons

F_k = test load, in kilograms force

P_n = proof force, in newtons

P_k = proof load, in kilograms force

R_l = rated load, in kilograms

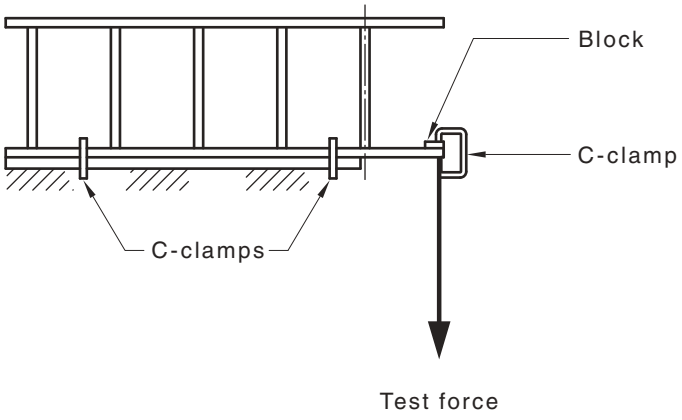


FIGURE K1 LADDER STILE CANTILEVER BENDING STRENGTH TEST

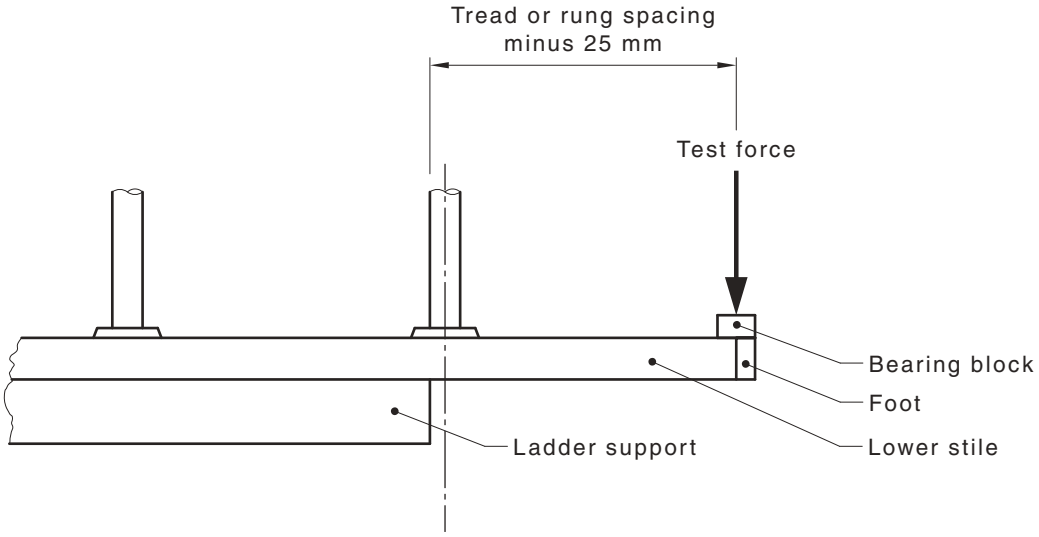


FIGURE K2 FORCE APPLICATION POINT

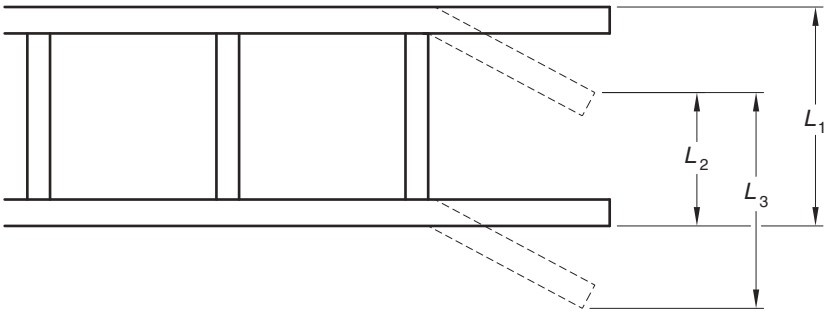


FIGURE K3 DETERMINATION OF PERMANENT SET

APPENDIX L

FOOT FRICTION TEST

(Normative)

L1 SCOPE

This Appendix sets out a method for determining the coefficient of static friction between the foot of a ladder and a test surface. Alternate established methods as the inclined plane method are deemed acceptable.

L2 PRINCIPLE

A ladder foot is placed on a specified test surface and a specified vertical force applied to the foot. A horizontal force sufficient to initiate slipping of the foot along the test surface is applied and the coefficient of static friction determined.

L3 APPARATUS

The following apparatus is required (see also Figure L1):

(a) A horizontal, flat, rigid, smooth, dry and unwaxed, vinyl floor tiled test surface.

(b) A means of applying a vertical force of 200 N (20.4 kgf) to the foot.

(c) A means of applying a horizontal force without impact and of increasing magnitude required to initiate slip.

(d) A means of measuring the horizontal force, e.g. a load cell.

L4 PROCEDURE

The procedure shall be as follows:

(a) The test shall be carried out at a temperature of 23 ±3°C.

(b) Position the foot to be tested on the test surface.

(c) Apply the vertical force to the top of the foot.

(d) Apply a horizontal force of increasing magnitude until slip occurs.

(e) Measure and record the maximum value of the applied horizontal force.

(f) Calculate the coefficient of static friction by dividing the horizontal force to initiate slip by the vertical force.

L5 CRITERIA

The coefficient of static friction shall be not less than 0.5.

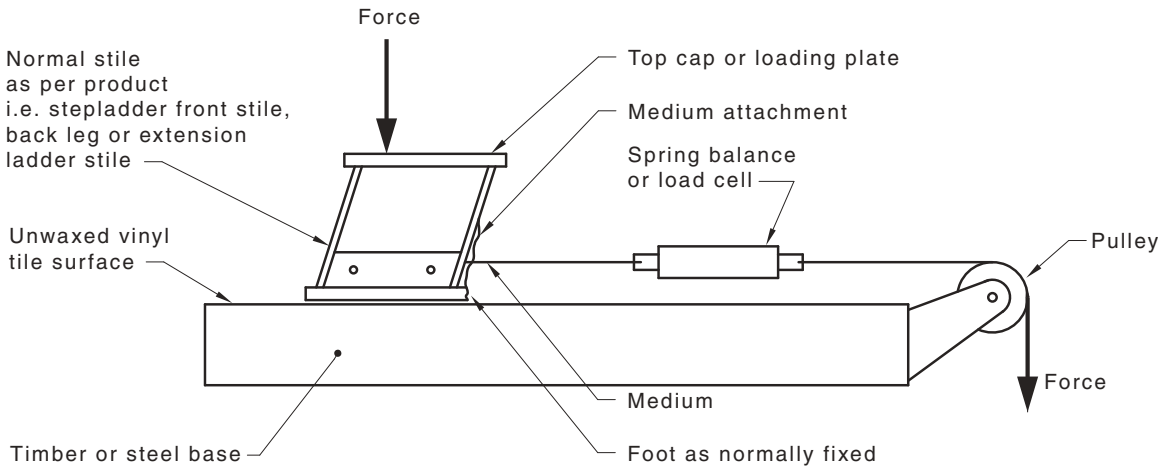


FIGURE L1 FOOT FRICTION TEST

APPENDIX M

LADDER DROP TEST

(Normative)

M1 SCOPE

This Appendix sets out a method for determining the ability of a single ladder, extension ladder or ladder of equivalent configuration to survive having one end dropped on edge.

M2 PRINCIPLE

A ladder is supported on edge above a test surface and one end of the ladder is permitted to free fall onto the test surface. The resulting permanent deformation is measured.

M3 APPARATUS

The following apparatus is required:

(a) A roller on a stand, capable of supporting one end of a ladder 600 mm above the test surface.

(b) A means of guiding the ladder and retaining its orientation while in free fall.

(c) A support for the lower end of the ladder incorporating a quick-release device capable of supporting the lower end of the ladder on edge 600 mm above the test surface.

(d) A means of measuring permanent set with an accuracy of ±0.5 mm.

(e) A level concrete floor test surface.

M4 PROCEDURE

The procedure shall be as follows (see also Figure M1):

(a) Configure the ladder as follows:

  (i) Dual purpose ladders, combination ladders and multi-purpose ladders shall be extended to their maximum working length.

  (ii) Extension ladders shall be extended by one rung.

(b) Support the top end of the ladder on its edge such that—

  (i) both ends of the lower stile are 600 mm above the test surface; and

  (ii) the roller support at the top end of the ladder is positioned 100 mm in from the end of the top of the lower stile.

(c) Place the bottom end of the ladder in the guide mechanism so that when released the bottom end of the ladder will free fall vertically a minimum of 600 mm to strike the test surface.

(d) Measure the width between the stiles at the bottom of the ladder.

(e) Release the ladder—

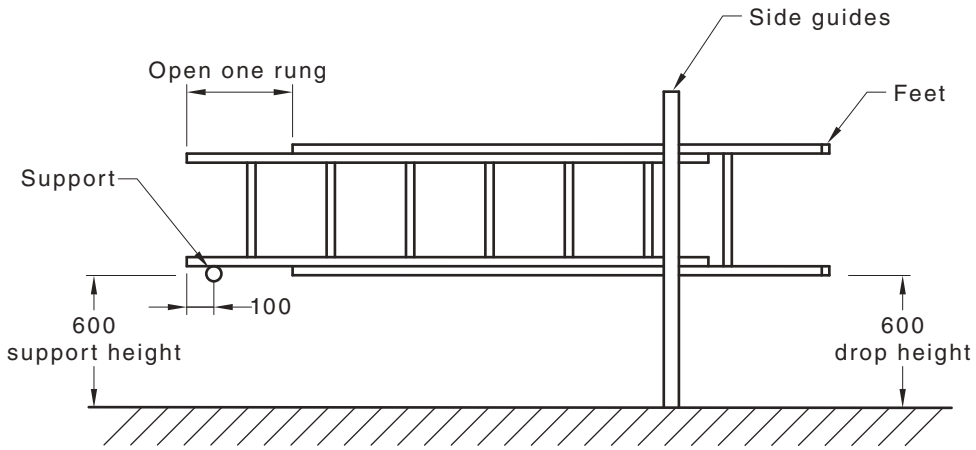
  (i) where the ladder is rated ‘Domestic’, perform the test once; and

  (ii) where the ladder is rated ‘Industrial’, repeat the test twice more.

(f) Measure the width between the stiles at the bottom of the ladder.

(g) Determine the permanent set in the ladder at the point of contact with the test surface.

(h) Examine the ladder and ladder bracing for visible signs of structural damage.



DIMENSIONS IN MILLIMETRES

FIGURE M1 LADDER DROP TEST

M5 CRITERIA

The permanent set of the ladder stile shall not exceed 6 mm and there shall be—

(a) no visible signs of structural damage of the ladder bracing;

(b) no visible signs of structural damage of the ladder; and

(c) no stretching of rivets.

APPENDIX N

LADDER TORSIONAL STIFFNESS TEST

(Normative)

N1 SCOPE

This Appendix sets out a method for determining the torsional stiffness of a ladder. The test is applied to single ladders, the base section of extension ladders and, in the case of other ladders that can be used in a single ladder configuration, such as dual purpose ladders, to the ladder in its single ladder configuration.

N2 PRINCIPLE

A section of ladder is supported at one end and a specified axial torque applied for a specified time at the other end. The angle through which the ladder twists is determined as a measure of torsional stiffness.

N3 APPARATUS

The apparatus shall be as depicted in Figure N1, and as follows:

(a) The torque may be applied either with a torque wrench to the central pivot, or by a suitable force applied at a constant radius from the ladder axis. The test may be performed with the ladder either horizontal or vertical.

(b) A means of measuring angular rotation in degrees.

(c) A means of measuring a time interval of between 60 s and 90 s.

N4 PROCEDURE

The procedure shall be as follows (see also Figure N1):

(a) Mount the ladder in a test rig clamping one end of the ladder in position at a distance of 150 mm from the end of the stile to prevent torsional movement. Restrain the remaining portion of the ladder with a minimum distance of 150 mm from the end of the stile. The minimum test ladder section shall be 2 m in length.

Where a dual purpose ladder or other ladders that can be used in a single ladder configuration is under test, the ladder shall be in its single ladder configuration and the test section shall include the joint between the base and extended section. The base and extended section shall be of equal lengths.

(b) To determine a datum, apply a torque of 130 Nm about the axis of the ladder to the unrestrained end of the ladder, for a period of not less than 30 s and not more than 60 s.

(c) Measure and record the angular rotation in degrees of the end of the ladder to which the torque was applied.

(d) Reverse the direction of the 130 Nm applied torque, for a period of not less than 30 s and not more than 60 s.

(e) Measure and record the angular rotation in degrees of the end of the ladder to which the torque was applied.

(f) Divide one half of the difference in angular rotation determined in Steps (c) and (e) by the length of the ladder test section (i.e. the distance between the restraints), to give the total torsional deflection in degrees per metre.