

**TESTING AND ASSESSMENT OF 'KLAN' SPIRAL STAIRCASE TO
BS 5395: 'STAIRS, LADDERS AND WALKWAYS :PART 2: 'CODE OF PRACTICE FOR
THE DESIGN OF HELICAL AND SPIRAL STAIRS':1984**

REPORT NO. BP 2383/2/IC/98

Prepared for:

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For the attention of:

Mr Enzo Fontanot

Date:

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TESTING AND ASSESSMENT OF 'KLAN' SPIRAL STAIRCASE TO BS 5395: 'STAIRS, LADDERS AND WALKWAYS :PART 2: 'CODE OF PRACTICE FOR THE DESIGN OF HELICAL AND SPIRAL STAIRS':1984

SUMMARY

A 1600mm diameter self assembly modular spiral staircase named 'Klan', manufactured by Albin and Fontanot and intended for private dwellings only, has been tested and assessed and found to comply with the relevant requirements of BS 5395:Part 2: for spiral stairs. The 1600mm diameter 'Klan' is the largest size of this particular range, with 1500mm and 1400mm diameters also available.

As the product is modular for all three sizes, many of the tests carried out on the 1600mm would be repeated on the two smaller sizes. Therefore, only the individual components unique to the 1500mm and 1400mm diameters have been assessed to the relevant requirements of BS 5395:Part 2.

The 1500mm components would comply with the standard. The 1400mm would comply, except that the minimum clear width produced during complete assembly would be approximately 566.5mm. The minimum requirement of the standard is 600mm.

Neither a complete 1500mm or 1400mm spiral stair has been structurally load tested to the recommendations of the standard. This load testing was carried out on the 1600mm sample, which as for the smaller sizes with their cantilever treads, would be subjected to the most onerous combinations of loading. The 1600mm complied with the deflection limits of the standard.

A landing baluster kit produced by Albin and Fontanot has also been tested. For single dwelling domestic use the kit complies with the standard when a reaction leg is positioned no more than every six balusters. The testing of this structure is detailed in report BP 2383/1/IC/98 and the results of which are shown in summary in Appendix 3 of this report.

The results of this test programme apply to the samples tested in the laboratory only and cannot accommodate assemblies by the general public.

1. INTRODUCTION

Building Investigation and Testing Services (Redhill) Ltd were requested by Mr Enzo Fontanot, of Albin and Fontanot S.p.A, to test and assess a self assembly modular spiral staircase named 'Klan', which incorporates timber treads, to the recommendations of BS 5395: 'Stairs, ladders and walkways: Part 2: 'Code of practice for the design of helical and spiral stairs'. We understand from the manufacturer that this staircase is intended for private domestic use, which is a Category A stair in accordance with the standard.

This work formed part of a test programme, which included another modular self assembly spiral staircase manufactured by Albin and Fontanot named 'Civik'. This product was constructed with steel treads. Both products tested were 1600mm in diameter. As many of the components were the same for both products, i.e the balustrading and handrails, these components were tested only once and are detailed in our report BP 2383/1/IC/98. The results of the balustrade tests are summarised in



Photo 1. 1600mm stair kit

Appendix 3 of this report. This report gives details of the testing and assessment carried out on components not associated with the Civik product.

This work was carried out in July and August 1998 and was authorised by Albini and Fontanot fax dated 1/7/98. Our confirmation form also of 1/7/98 refers.

2. SAMPLE SUBMITTED

A crated sample was received on 26/6/98. This consisted of a 1600mm diameter stair kit, an assembly video and assembly instructions (see appendix 1 for details).

The stair kit supplied is one of three sizes that Albini and Fontanot produce. In addition to the 1600mm diameter there is also a 1500mm and 1400mm diameter stair kit. We were informed by Albini and Fontanot that all three kits are constructed identically the same, as the system is modular. The only difference is in the length of the treads and the landing size. For this project we were requested to test and assess one size of kit and to comment on the conformance of the 1500mm and 1400mm kits to the recommendations of BS 5395.

❖B.I.T.S.❖ therefore selected the largest 1600mm diameter kit for testing, as this size would be subject to the most onerous test regime, i.e loading and deflections. For the 1500mm and 1400mm sizes of kit the components which varied from the 1600mm kit were selected for assessment. This included the receipt of a landing and a stair from each of the 1500mm and 1400mm kits.

For all three sizes of kit the treads and landing consisted of a four layer plywood producing a total thickness of approximately 45mm.

The distancial rings between the treads were made of plastic and came with spacer rings for height adjustment.

3. TEST PROCEDURE

The stair kit was erected by Albin and Fontnot personnel in August 1998. The landing of the sample was secured to a timber shelf supplied by ❖B.I.T.S❖, (See photo 1), which was used to simulate an installation landing. In practice the top of the stair would be connected to a length of the manufacturer's baluster kit at landing level to completely guard against falling. However, as the laboratory is not built to a typical dwelling height, the stair only was installed for testing. The baluster kit supplied by the manufacturer was tested separately. This was carried out previously as already stated.

The following programme was then carried out on the installed sample and the individual components supplied, to the recommendations of BS 5395: 'Stairs, ladders and walkways: Part 2: 'Code of practice for the design of helical and spiral stairs,' as is required in the Building Regulations for England and Wales;

a) 1600mm stair kit

Clause 5. Design

5.2) Relationship between rise and going	Calculation
5.3) Rise	Measurement
5.4) Going	Measurement
5.5) Clear headroom	Measurement
5.6) Clear width	Measurement
5.7) Landings	Measurement
5.8) Guarding of stairs and landings	100mm gap assessment Slip resistance testing
5.9) Passage of large objects	Observation only
5.10) Deflection	Review of results from 5.8) to relevant British material specifications.
5.11) Accuracy	Measurement and assessment to BS 5606
5.12) Nosings	Measurement

Clause 6. Fire

Assessment to BS 5395 and the Building Regulations for this Category A staircase.

Appendix A

1) Uniformly distributed load to each tread.	Measure deflections.
2) Load lower 180° segment of stairs.	Measure deflections.
3) Double load application to centre tread only	Measure deflections.
4) Load each tread with two 91kg loads.	Measure deflections.

BS 5395:Part 1.

In addition to the requirements of BS 5395:Part 2, the stairs have to satisfy the recommendations of the following (where applicable):

Clause 11.2 Accuracy	Measurement and assessment to BS 5606
Clause 12 Safety	Assessment to Building Regulations
	Accident potential
	Safety measures
	Treads and goings
	Steps
	Guarding
	Windows and doors
	Surface finish
Clause 14 Acoustics	Comment only
Clause 15 Lighting	Comment only
Clause 16 Durability	General assessment

c) 1500mm and 1400mm stair kitsClause 5. Design

5.6) Clear width	Measurement
5.7) Landings	Measurement
5.11) Accuracy	Measurement and assessment to BS 5606

The above work was carried out at the ❖B.I.T.S❖ laboratories, except for the fire assessment and the slip resistance testing which was carried out independently by Roger Perryman Ltd and SGS UK Ltd respectively.

For the loading tests to Appendix A, we understand from the manufacturer that the 1600mm diameter stairs would have two wall brackets securing the balusters of the stairs to the surrounding wall structure. These would be positioned at approximately a third of the way up the stair and a third of the way from the top of the stair. These brackets are used to reduce oscillation of the stair and provide support for the cantilever treads. We understand from the manufacturer that for the 1500mm and 1400mm stairs, only a single wall bracket is used at the mid point of the stairs at midheight of a baluster. It was agreed with Mr Giangolini of Albini and Fontanot that this same single bracket installation would be used for the 1600mm to a) simulate this a worst case installation and b) use the results to cover the installation method for the two smaller diameters, which in theory should deflect less with their shorter cantilever treads. For this wall bracket ❖B.I.T.S❖ provided a steel upstand to simulate a wall and to facilitate fixture.(as shown in photo 1).

4. RESULTS

BS 5395 requirement	Result	Comment
<p><u>Clause 5 Design</u></p> <p><u>Clause 5.1 General.</u></p> <p>Except where shown in 5.2 to 5.12 in BS 5395: Part 2, the recommendations for straight stairs in clauses 11.2,12,14,15 and 16 of BS 5395:Part 1, shall be followed.</p> <p><u>BS 5395:Part 1</u></p> <p><u>11.2.3 Accuracy</u></p> <p>BS 5606 lists the permissible deviations that may be expected to occur in practice.</p> <p><u>12. Safety</u></p> <p><u>12.3 Safety measures</u></p> <p>The going for every tread has to remain constant. The tread has to be horizontal and should be firmly fixed and have a nosing that does not become slippery when in use.</p> <p>There shall be not fewer than three and not more than 16 risers in any one flight.</p> <p>Where a stair has open rises, the nosing of the tread of any step or landing has to overlap, on plan, the back edge of the step below by not less than 16mm.</p> <p>In stairs having open rises or part rises and use regularly by children, no opening between adjacent treads should be large enough to permit a sphere of 100mm diameter to pass through it.</p>	<p>See later section</p> <p>System is modular and constant for each tread. The treads are horizontal and adhered firmly to the timber of the steps. The anti slip nosing material was tested and confirmed to be suitable.</p> <p>12 risers</p> <p>Minimum overlap = 85mm</p> <p>The system uses a horizontal riser barrier in the open gap forming the riser. The resulting gaps were measured between 90mm and 91mm. A 100mm sphere could not pass through the gaps.</p>	<p>See later section</p> <p>Satisfactory</p> <p>Complies</p> <p>Complies</p> <p>Complies</p>

BS 5395 requirement	Result	Comment
<p>Guarding of stairs and landings. Guarding can take the form of a securely fixed balustrade or railing or a wall and should extend vertically above the pitch line for a height of not less than 840mm in stairs within a single dwelling and not less than 900mm in other cases.</p>	<p>The stair balustrade was measured at a finished height of 900mm to 1000mm. Balustrade kit see report BP 2383/1/IC 98</p>	<p>Complies</p>
<p>In buildings which are likely to be frequented by small children, gaps in the stair or landing balustrade should not be such as to permit the passage of a sphere of 100mm diameter and balustrades should not provide a toe hold that would enable a small child to climb them.</p>	<p>Gaps between balusters were measured at 90mm to 91mm. A 100mm diameter sphere could not pass between the balusters. There were no horizontal elements that could provide a toe hold for small children.</p>	<p>Complies Complies</p>
<p>It is recommended that every flight of stairs having an aggregate rise of more than 600mm should have a continuous handrail fixed securely at a height of not less than 840mm or more than 1000mm, measured vertically above the pitch line.</p>	<p>Continuous handrail of stair climb measured at 970mm to 985mm, from pitch line through nosing of treads.</p>	<p>Complies</p>
<p>The handrail section which provides the most comfortable grip is circular and between 45mm and 50mm in diameter.</p>	<p>Handrail section measured at 43mm in diameter.</p>	<p>43mm is just under what is deemed to be the most comfortable grip. Satisfactory.</p>
<p>Whatever the shape, the handrail section should be capable of being readily gripped by the hand and sharp arrises should be avoided.</p>	<p>Handrail made of grippable polyurethane. No sharp arrises.</p>	<p>Complies</p>
<p>Stairs and landings should be usable at all times without risk of tripping or slipping. A minimum coefficient of friction of 0.4 between the finishes of steps or landings and the sole of the shoe is required if slipping is to be avoided. Unless the surface is rough, many surfaces that have a good slip resistance when dry will tend to become slippery and unsafe when wet.</p>	<p><u>Treads and landing</u> Dry - greater than 0.4 Self adhesive tape - greater than 0.4 wet For details see independent report in Appendix 2.</p>	<p>Complies</p>

BS 5395 requirement	Result	Comment
<p><u>Clause 14. Acoustics</u></p> <p>Stairs of lightweight construction will give rise to more noise under foot than stairs of heavy construction. Open treads of stiff construction tend to resonate disturbingly. Care should be taken in the design and construction of stairs so that they do not vibrate and thus cause excessive noise.</p>	<p>The dense construction of the timber treads gave little noise when used. The erection in a dwelling situation will probably reduce any noise further with the presence of internal walls and soft furnishings. No excessive noise caused by stair deflection.</p>	<p>Satisfactory.</p>
<p><u>Clause 15. Lighting</u></p> <p>Windows and artificial lights should be situated so that they light towards the stairs with the light directed roughly at right angles to the pitch line.</p>	<p>Will depend upon each installation. It is assumed that the installer will have common sense to ensure there is sufficient light to enable safe passage using the stairs.</p>	<p>Dictated by end user</p>
<p><u>Clause 16. Durability</u></p> <p>Stairs are expected to withstand a considerable amount of wear and tear and often abuse.</p> <p>The materials should be sufficiently resistant to deterioration and wear, having regard to the conditions to which they will be subjected and the intended life of the building and the stair.</p>	<p>Materials and construction of the system appears to be well made and likely therefore to satisfy the requirement of the standard.</p> <p>Wear may occur eventually on anti slip material. Depends on volume of traffic</p>	<p>Satisfactory</p>

BS 5395 requirement	Result	Comment
<p><u>Clause 5.2 Relation between rise and going</u></p> <p>The rise and going should be determined using values for $(2r + g)$. Where $r =$ rise and $g =$ going</p> <p>From table 2 of the standard a Category A stair should have a minimum value of 480mm and a maximum value of 800mm.</p> <p>(For the 1600mm diameter sample this could be calculated from measurements. For the 1500mm and 1400mm diameters one step only was received. As the system is modular a second step was made from cardboard using the relevant steps as templates. The steps were then positioned over each other as would occur and measurements made of the goings.)</p>	<p><u>1600mm</u> The riser and goings measured provide values between the limits.</p> <p><u>1500mm and 1400mm</u> The risers would be as for the 1600mm. The goings measured plus the riser would provide values between the limits</p>	<p>Complies</p> <p>Complies</p>
<p><u>Clause 5.3 Rise</u></p> <p>Recommended rises for this Category of stair is 170mm to 220mm.</p>	<p><u>1600mm</u> Measured at 215mm on sample installed.</p> <p><u>1500mm and 1400mm</u> Modular system, would be same as for the 1600mm</p>	<p>Complies</p> <p>Complies</p>
<p>Maximum number of risers = 16</p>	<p>12 risers for all three sizes</p>	<p>Complies</p>

BS 5395 requirement	Result	Comment
<p><u>Clause 5.4 Going</u></p> <p>From table 2 of the standard.</p> <p>Minimum inner going = 120mm Minimum centre going = 145mm Maximum outer going = 350mm</p>	<p><u>1600mm</u> Inner going = 150mm Centre going = 180mm Outer going = 211mm</p> <p><u>1500mm</u> Inner going = 160mm Centre going = 180mm Outer going = 203mm</p> <p><u>1400mm</u> Inner going = 170mm Centre going = 180mm Outer going = 190mm</p>	<p>All three going measurements comply.</p> <p>All three going measurements comply.</p> <p>All three going measurements comply.</p>
<p><u>Clause 5.5 Clear headroom</u></p> <p>The clear headroom should not be less than 2000mm.</p>	<p><u>1600mm</u> Clear headroom between landing and floor = 2720mm</p> <p><u>1500mm and 1400mm</u> System is modular the same value should apply to these sizes also.</p>	<p>Complies</p>
<p><u>Clause 5.6 Clear width</u></p> <p>From table 2 of the standard. Minimum clear width = 600mm</p>	<p><u>1600mm</u> Measured at 665mm minimum</p> <p><u>1500mm and 1400mm</u> Measured using samples received with components of test sample. 1500mm = 611.5mm 1400mm = 566.5mm</p>	<p>Complies</p> <p>Complies Non compliance</p>
<p><u>Clause 5.7 Landings</u></p> <p>Landings at storey levels should subtend an angle of not less than 60° at the geometric centre on plan.</p>	<p>All three sizes measured at 60°</p>	<p>Complies</p>

BS 5395 requirement	Result	Comment
<p><u>Clause 5.8 Guarding of stairs and landings</u></p> <p>Protection against falling should follow the recommendations of 12.3 of BS 5395: Part 1.</p> <p>For safety reasons any gap between the end of a tread and the centre of the column of a stair should never exceed 100mm.</p> <p>In areas frequented by children, the widest gap in a balustrade should not permit a sphere of 100mm diameter to pass through.</p> <p>Balustrades and handrails should follow the recommendations of BS 6180.</p>	<p>(See in this report pages 7 and 8)</p> <p>Not applicable for this design.</p> <p>Maximum gap measured = 95mm. Sphere could not pass through any openings.</p>	<p>Complies</p> <p>Complies</p> <p>Complies</p>
<p><u>Clause 6.3 Loading</u></p> <p>Building use categories and barrier loads from annex A;</p> <p>Category 1A = Single family dwelling (house, maisonette, etc).</p> <p>a) UDL = 0.36 kN/m length of handrail b) Concentrated load = 0.25 kN</p> <p><u>6.3.4 Infill panels and balusters</u></p> <p>Each baluster should be designed to resist half the concentrated load in annex A, when applied at mid height.</p> <p><u>6.4 Deflection</u></p> <p>A barrier for the protection of people that is structurally safe should not possess sufficient flexibility to alarm the building users when subjected to normal use.</p> <p>The horizontal displacement of any part of the barrier should not exceed 25mm</p>	<p>Full test details in report BP 2383/1/IC/98. Maximum deflection was in baluster kit = 4.51mm.</p> <p>There is some flexibility in the system. Not unduly sufficient to cause alarm.</p> <p>Maximum deflection in report BP 2383/1/IC/98 was 24.06mm, in the stair handrail.</p>	<p>Complies. No damage. Maximum deflection allowed 25mm</p> <p>Complies</p> <p>Complies</p>

BS 5395 requirement	Result	Comment
<p><u>Clause 5.11 Accuracy</u></p> <p>The maximum permissible deviation for any size should not exceed the appropriate value of table 2 of BS 5606.</p> <p>Consistency of rise and going are of prime importance for user confidence and safety</p>	<p>A selection of components were selected for measurement. The results of these measurements were compared with the manufacturers drawings. The relevant dimensions assessed were the length of the steel components and the location of holes within the component. All dimensions measured were within the tolerance and accuracy requirements of BS 5606.</p> <p>Sample uses a modular system which automatically provides consistency.</p>	<p>Complies</p> <p>Complies</p>
<p><u>Clause 5.12 Nosings</u></p> <p>Nosings should be horizontal and straight between the pitch lines corresponding to the inner and outer goings.</p>	<p>Measured as virtually horizontal. The nosings were straight between goings.</p>	<p>Complies</p>
<p><u>Clause 6 Fire protection and means of escape</u></p> <p>Stairs in most buildings form the main escape vertical escape routes and are often in the first protected areas reached by people escaping in fire. The recommendations for planning, construction and protection of escape routes to prevent rapid spread of fire are given in BS 5588:Part 1.</p> <p>In addition the requirements of the most current Building Regulations have been referred to.</p>	<p>With the small private stair category classification, it is intended that the stair is not the main fire escape for a small number of people.</p> <p>It has been concluded that the Klan stair complies with the recommendations of BS 5395.</p> <p>See Appendix 4 for full independent assessment report.</p>	<p>Although there is no requirement in the Building Regulations, it has been recommended that the landing is tested for surface spread of flame. This is because it may be considered that when erected the landing forms a type of ceiling, which has a requirement.</p>



Photo 2. Stair loaded with 4kN/m^2 .

Note manufacturers single wall bracket fixed to metal upstand to simulate actual installation details
(testing witnessed by Mr C.Giangolini of Albini and Fontanot)

BS 5395 requirement	Result	Comment
<p><u>Appendix A</u></p> <p>The following procedure may be used to test helical and spiral stairs.</p> <p>a) Apply a uniformly distributed load of 3 kN/m² to 5kN/m²* to each tread. Check deflections and displacements.</p> <p>*This range of udl is taken from BS 6399:Part 1 and should be chosen to suit the stair category and the intended function of the stair. From BS 6399 this has been taken as 4kN/m² for 'stairs and landings in all other buildings'.</p> <p>b) Remove the load from all treads forming the lower 180° segment of the stair. Check deflections and displacements.</p> <p>c) Remove the load from all remaining treads except one tread at mid height. Increase load on this tread to double the previous load. Check deflections and displacements.</p> <p>d) Check individual treads by placing on them two loads of 0.9kN spaced 300mm apart and placed symmetrically about the centre line of the tread.</p>	<p>See Appendix 5 indicating dial gauge positions and detailed test results.</p> <p><u>Deflection of landing</u> 3.95mm</p> <p><u>Deflection of 7th tread</u> 1.57mm</p> <p><u>Deflection of 4th tread</u> 0.05mm</p> <p>(Deflections after 5 minutes at full load.)</p> <p><u>Deflection of landing</u> 1.04mm</p> <p><u>Deflection of 7th tread</u> 1.30mm</p> <p><u>Deflection of 4th tread</u> 0.09mm</p> <p><u>Deflection of landing</u> 0.39mm</p> <p><u>Deflection of 7th tread</u> 1.56mm (at centre of tread)</p> <p><u>Deflection of 4th tread</u> 0.02mm</p> <p>A number of treads were selected and loaded. The maximum deflection noted was 2.9mm. There was no visible signs of any failure of distress.</p>	<p>Allowable deflection, see note 1 = 4.67mm</p> <p>Complies</p> <p>Complies</p> <p>Complies</p> <p>Complies</p>

Note 1

From clause 5.10 of BS 5395: Part 2 and detailed earlier in this report, the maximum allowable deflection for a cantilever structure is length/150, which for the landing and treads of the 1600mm diameter stair is $700/150 = 4.66\text{mm}$. (distance measured between the centre column and the balusters).

Note 2

The deflections have been adjusted to allow for any slight movement at the column, so the cantilever deflection only is given.

5. DISCUSSION

The assessment of the 1600mm diameter Klan spiral stairs has shown that the system would satisfy the requirements of BS 5395. For general public installation the following should be noted and applied;

- a) At least one wall to stair baluster bracket should be used at approximately the centre height of the stair for increasing rigidity.
- b) For the treads and landing the anti slip self adhesive tape should be applied at 25mm intervals as shown in the manufacturers literature.
- c) For the landing baluster kit a reaction leg should be fitted no more than every 6 balusters. The height of this leg to be greater than half way up the baluster its fitted to.

The same items noted would also apply to the 1500mm and 1400mm diameter stairs.

6. CONCLUSION

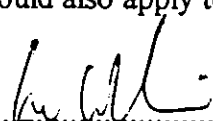
A 1600mm diameter self assembly modular spiral staircase named 'Klan' has been tested and assessed and found to comply with the requirements of BS 5395, for use in private dwellings.

Components of two smaller sizes, namely the 1500mm and 1400mm diameter staircases, unique to these stairs have been assessed to BS 5395 and in our opinion comply with the standard with one exception. The minimum clear width of the 1400mm diameter would be 566.5mm. The recommended minimum clear width of BS 5395 is 600mm.

The results of this test programme apply to the samples as tested. For assembly by the general public the following should be applied;

- a) At least 1 wall to stair baluster bracket should be used at approx. centre height for increasing rigidity.
- b) The treads and landing should have the anti-slip self applied at 25mm intervals as shown in the manufacturers literature.
- c) With the installation of any landing baluster kit a reaction leg should be fitted no more than every 6 balusters. The height of this leg to be greater than half way up the baluster fitted to.

The same items noted would also apply to the 1500mm and 1400mm diameter stairs.

REPORTED AND
AUTHORISED BY 

CHECKED AND
APPROVED BY 

I COLLINS
Building Consultant

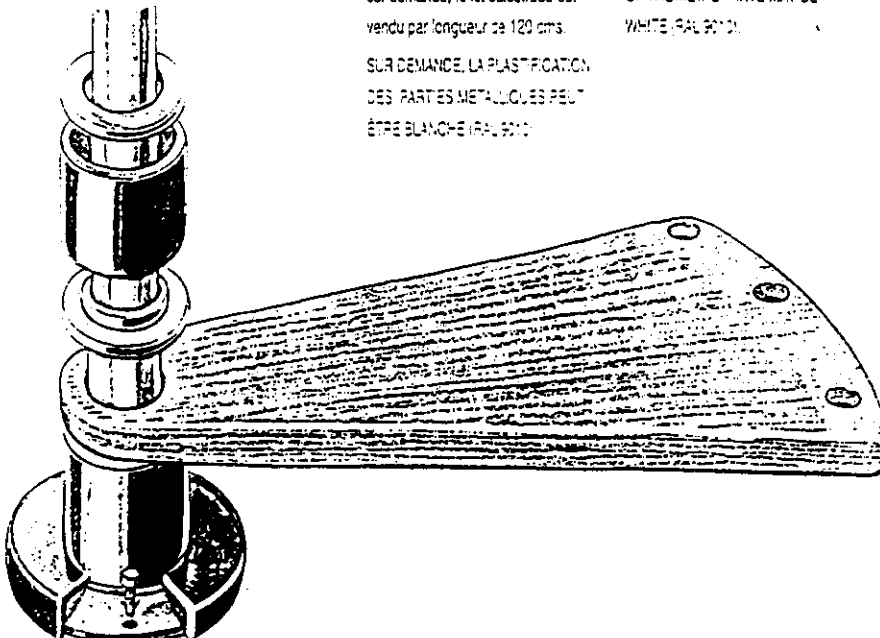
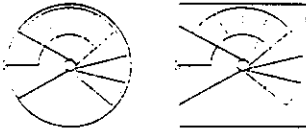
R FRYER
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APPENDIX 1

Manufacturers Literature

Manufacturers assembly instructions

NUMÉRO HAUTEURS DE MARCHE NUMBER OF THE RISERS AANTAL STUPEHOOGTES	HAUTEUR ESCALIER STAIR HEIGHT TRAPPHOOGTE	cm in
10	210 - 235	
11	232 - 258	
12	253 - 282	
13	274 - 306	
14	296 - 330	
15	317 - 353	
16	338 - 377	



PALIER UNIVERSEL

Le KLAN est adaptable à une trémie circulaire ou quadrilatère:
modèle avec un diamètre 120: adaptable jusqu'à 144 cms de trémie
modèle avec un diamètre 140: adaptable jusqu'à 174 cms de trémie
modèle avec un diamètre 160: adaptable jusqu'à 174 cms de trémie

HAUTEUR VARIABLE

Les entretoises noires mises entre les marches, permettant les variations de la hauteur indiquées dans le tableau.

SENS DE ROTATION

Le KLAN peut être monté indifféremment soit en sens horaire soit en sens antihoraire.

MARCHES

sont réalisées en bouclier lamellaire.

COLONNETTES

en acier traitées avec des résines polyesterées noires (RAL 9017).

MAIN COURANTE

noyau flexible métallique revêtu de polyuréthane intégral noir. Elle peut prendre n'importe quel type de courbure.

KIT BALUSTRADE

(garde-corps horizontal) Disponible sur demande, le kit balustrade est vendu par longueur de 120 cms.

SUR DEMANDE, LA PLASTIFICATION DES PARTES MÉTALLIQUES PEUT ÊTRE BLANCHE (RAL 9010)

UNIVERSAL LANDING

KLAN is adaptable to round or square ceiling openings with this measure:
model with a diameter of 120 cm is adaptable until 144 cm of opening
model with a diameter of 140 cm is adaptable until 174 cm of opening
model with a diameter of 160 cm is adaptable until 174 cm of opening

ADJUSTABLE RISER

The black distancial rings put between the treads permit the height variation indicated in the table.

WINDING DIRECTION

KLAN may be assembled indifferently in clockwise or anti-clockwise direction.

TREADS

in birch plywood.

UPRIGHTS

made of steel, worked with black (RAL 9017) polyester resins.

HANDRAIL

flexible metal core coated by black integral polyurethane. it can take any type of curvature.

KIT BALUSTRADE

A kit balustrade of 120 cm is available.

ON REQUEST, THE PLASTIFICATION OF THE METAL PARTS MAY BE WHITE (RAL 9010).

UNIVERSELE OVERLOOP

KLAN kan worden geïnstalleerd in ronde of vierkante openingen met de volgende afmetingen:

het model met de diameter 120 cm kan worden aangepast aan een opening met een diameter van max. 144 cm

het model met de diameter 140 cm kan worden aangepast aan een opening met een diameter van max. 174 cm

het model met de diameter 160 cm kan worden aangepast aan een opening met een diameter van max. 174 cm

REGELBARE OPTREDE

Darkzij de zwarte afstandsrings die tussen de treden worden aangebracht, kunnen de optreden variëren zoals uit de tabel kan worden afgeleid.

DRAAIRICHTING

KLAN kan zowel met de wijzers van de klok mee als tegenin worden gemonteerd.

TREDEN

van gelamelleerd berkenhout.

SPIJLEN

van staal, behandeld met zwartkleurige polyesterresins (RAL9017).

TRAPLEUNING

flexibele metalen kern, bedekt met zwart integraal polyurethaan. Kan elke willekeurige soort buiging aannemen.

KIT VOOR BALUSTRADE

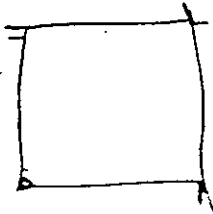
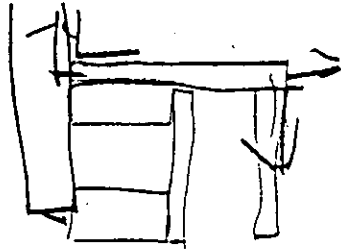
Er is een kit leverbaar voor een balustrade van 120 cm.

OP AANVRAAG KUNNEN DE

METALEN DELEN IN DE KLEUR

WIT (RAL9010) WORDEN

GEPLASTIFICEERD.



KLAN

I

ISTRUZIONI DI MONTAGGIO

F

INSTRUCTIONS DE MONTAGE

GB

ASSEMBLY INSTRUCTIONS

D

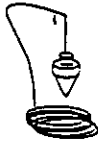
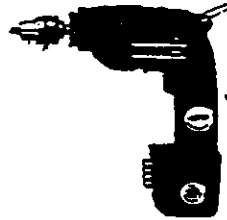
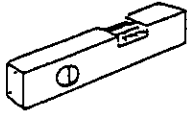
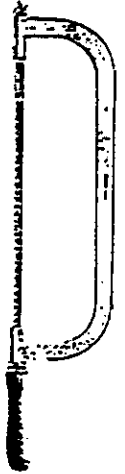
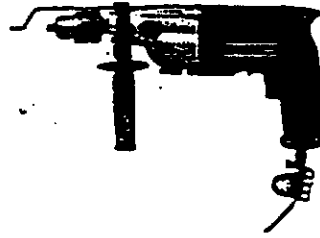
MONTAGEANLEITUNG

E

INSTRUCCIONES PARA EL ENSAMBLAJE

1

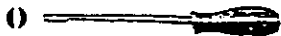
OUTILS



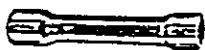
∅ 8x120 12x150 14x150



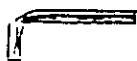
∅ 9 2.5



13 17 19 30



10 13 17



2,5 3 5 12

ASSEMBLY INSTRUCTIONS

Before you begin to assemble the stair read well the included page
- CALCULATIONS SYSTEM OF THE KLAN RISERS -.

STAIR ASSEMBLY

- 1) Determine the point where you will fit the base (G03) of the center pole signing the point between the two extremities of the landing (E02) on the ceiling.

Put the landing on the floor and make attention that it is in correspondence with the two points which had been signed on the ceiling first and determine the middle of the center pole. Mark the three points for the base plugs, pierce and fit definitely the base on the floor after having well blocked the screw (B17) throughout the bush (B46).
- 2) Screw the base to the center pole (G02) and complete the assembly of the art. (G02)- (B47)- (B46).
- 3) Insert the stair components to the center pole in the following order:
 - 1 - cover base (D12).
 - 2 - probable distancial discs (D08): quantity Y for the first riser, quantity X for the following ones.
 - 3 - 1st central distancial (D14-D16) for the first riser (D15-D16) for the following ones.
 - 4 - probable distancial discs (D08): quantity Y for the first riser, quantity X for the following ones.
 - 5 - tread (L03) with threaded inserts (B21) ed i grani (B20) già inseriti.
- 4) Screw the threaded bar (G01) to the end of the center pole (G02) but note that and its upper end will be screwed the final upright (C04).
- 5) Continue to insert the components but in correspondence with the threaded bar (G01), immediately before and after every tread have to be put also the centering insert (D06).
- 6) After the landing (E02) insert the final bush (B05), the spring (B04) and screw the nut (B03) without screwing too much.
- 7) Fit definitely the landing to the ceiling by the stirrup with the "L"-form (F03), by the expansion screws (B13), the 6x40 screws (B11) and the wooden cover stirrup (B18).

RAILING ASSEMBLY

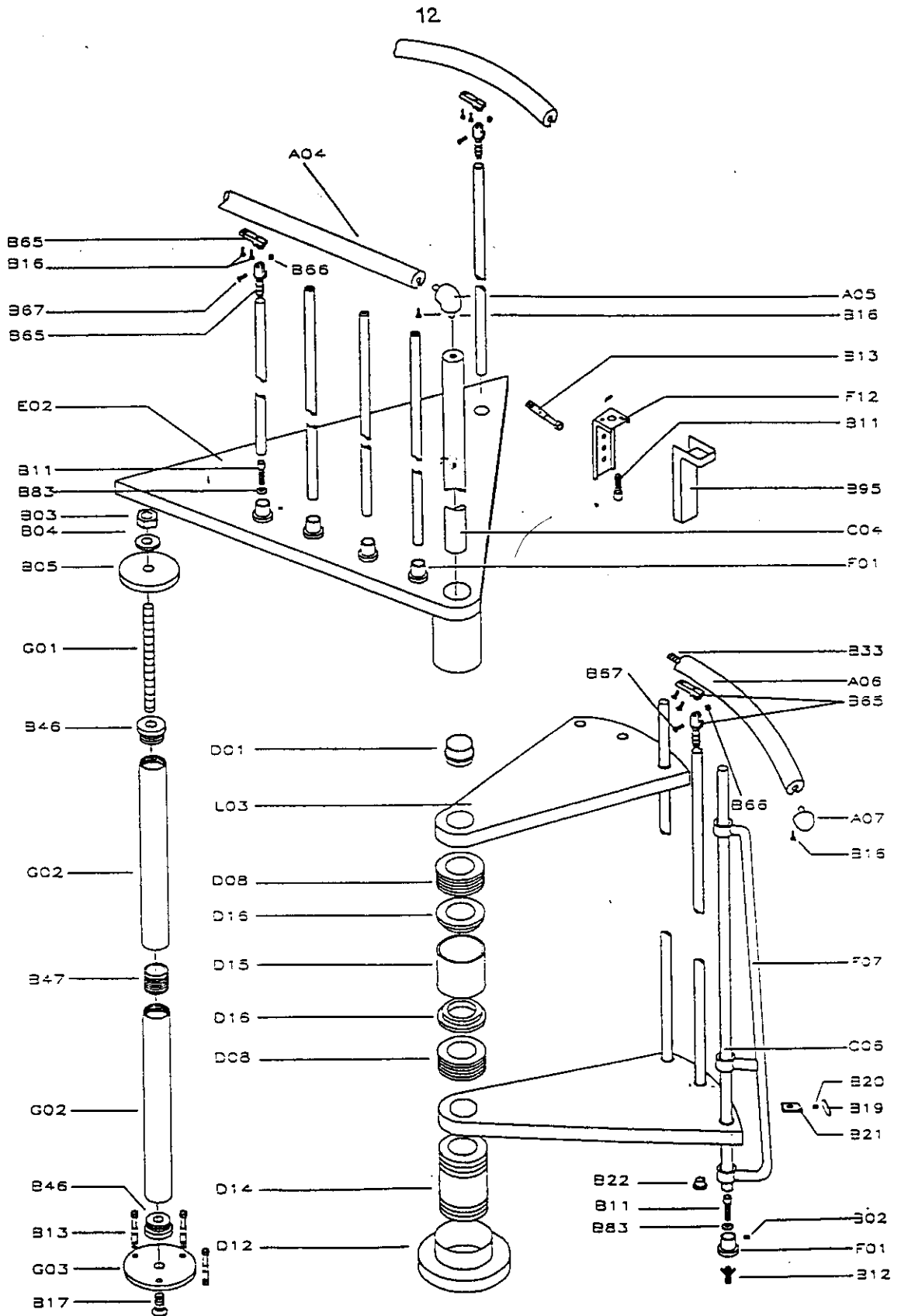
The railing assembly qualifies the good result of the stair assembly and at the same time represents the most difficult part of the work.

The result will be satisfactory if the railing uprights are all perfectly vertical and the handrail well modelled without any humps.

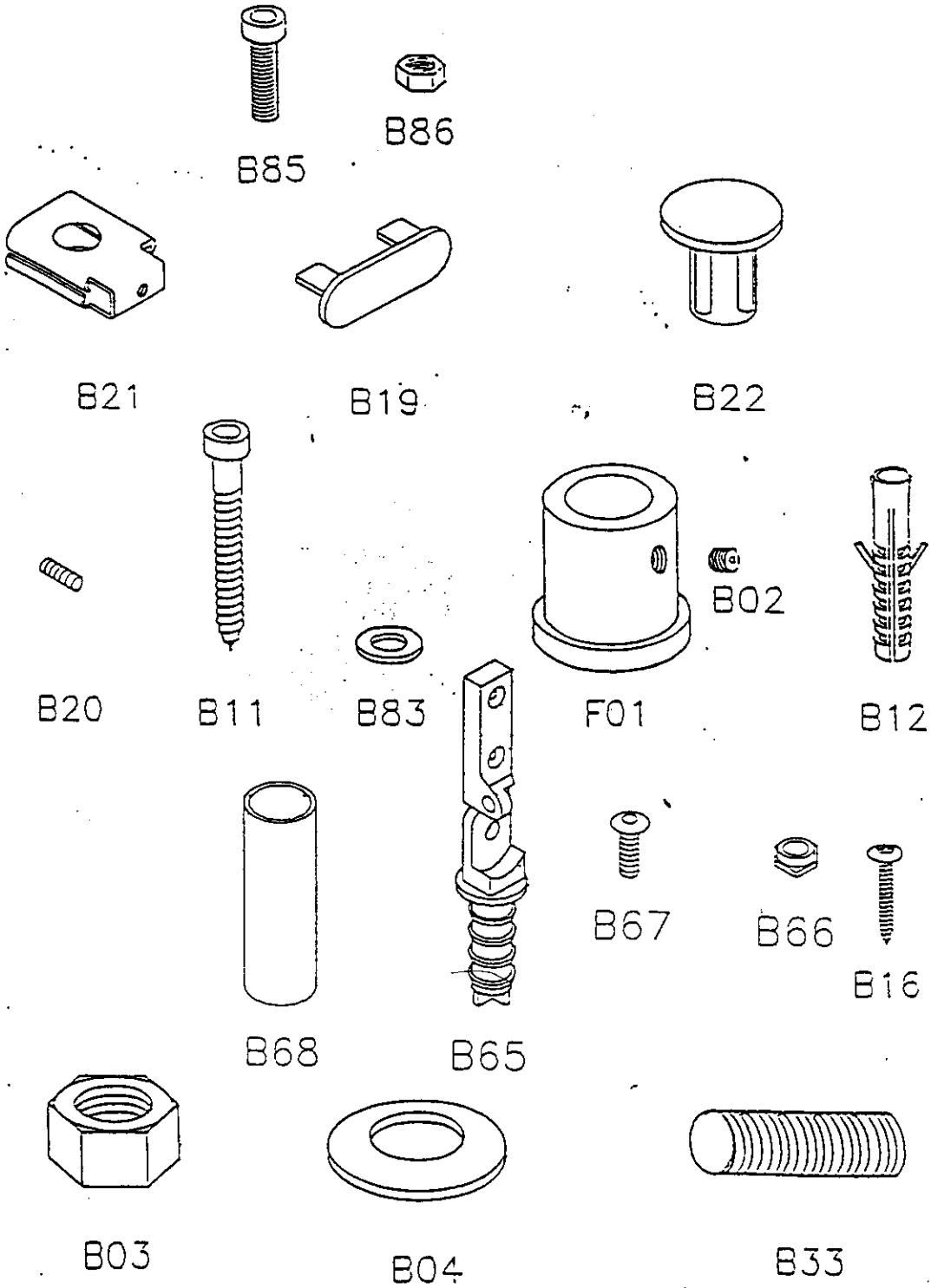
- 8) Open the treads fan-wise.
- 9) Begin by the landing to insert the passing uprights (C03) which connect the treads. Put the article (B65) so that the drilled side upwards (DIS.14).
- 10) Check the verticality of the long uprights and tighten definitely the nut (B03). Screw definitely the dowels (B20) of the superior treads.
- 11) Fit the article (F01) on the floor drilling with the bit $\varnothing 8$ and using the articles (B12)-(B83) and (B11) in correspondence with the first upright. Position the first upright inserting the reinforcing element (F07). Adjust the height of the first upright cutting the end of a long upright.
- 12) Choose the handrail piece with the letter R (this handrail will be used on the landing) among the other ones which have the letter M upon.
- 13) Model the handrail (with the letter M) trying to bend as similar as possible to the final curvature. Start screwing the handrail at the first pole up on the landing using the screws (B16)
- 14) Link the second handrail piece to the first twisting it and glueing it with the help of the article (B33) and the delivered cyano-acrylic glue.
- 15) Insert all the other uprights into the treads and fit them to the handrail, paying close attention to their verticality.
- 16) Having reached the first tread, cut the handrail with an iron saw and plug it with the cap (A07), which has to be glued and screwed with a screw (B16).

ASSEMBLY OF THE LANDING BALUSTRADE

- 17) Drill the landing (E02) with the bit $\varnothing 4.5$ as indicated on the drawing 11, assemble then the articles (F01) using the screw (B11) and the article (B83).
- 18) Drill with the bit $\varnothing 12$ trying to maintain the equidistance fitted by the preceding articles (F01) on the landing (drawing 10) assembling the articles (F01)-(B11) and (B83) on the landing and the articles (F01) and (B87) on the floor.
- 19) The balustrading handrail has to be assembled using the articles (A05)-(A07)-(F09) and (F02) as shown on the drawings 09 and 12 which show the different planned situations.

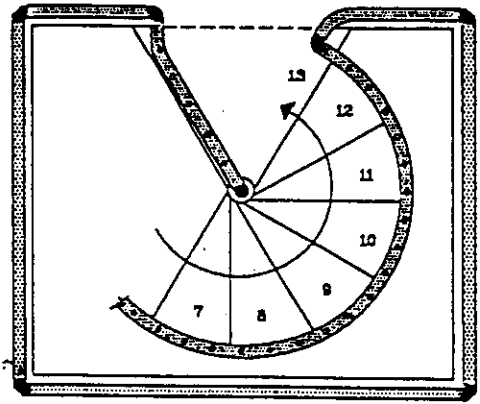
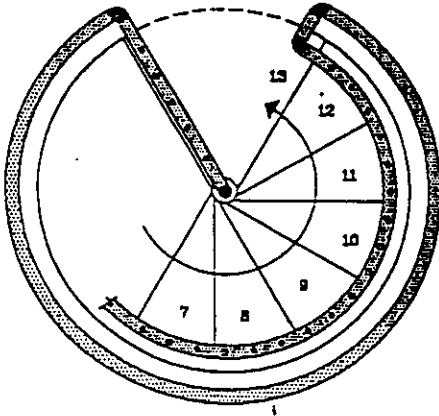


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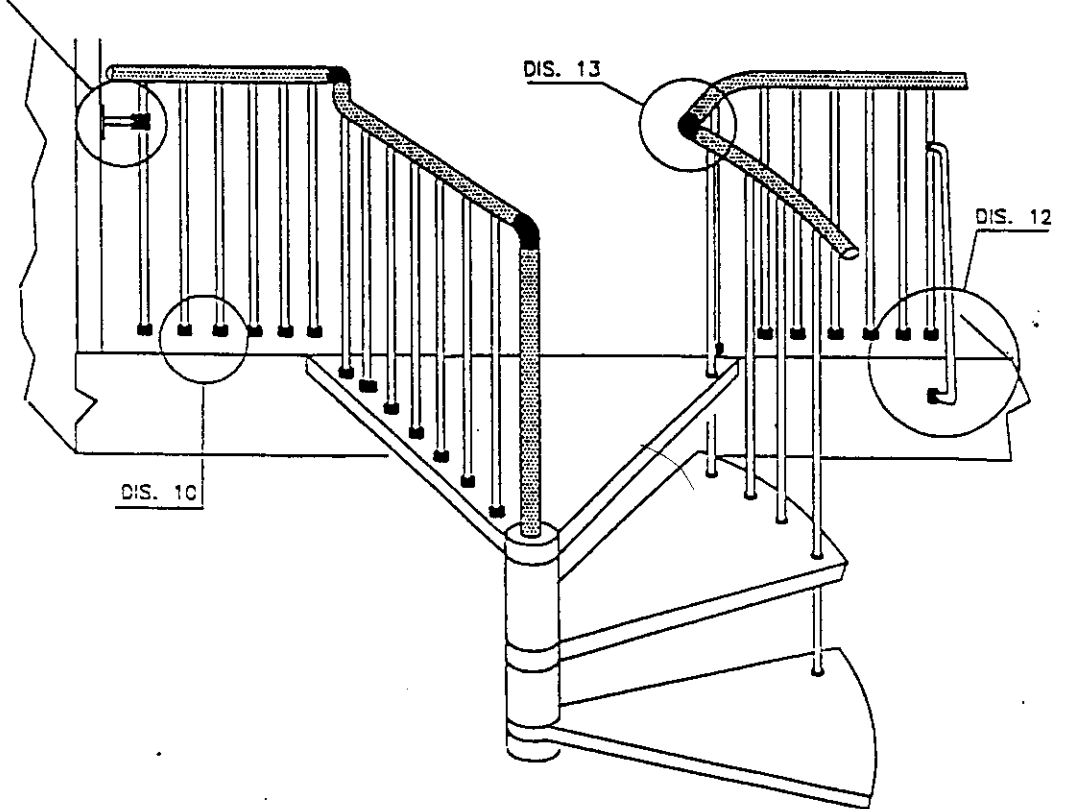


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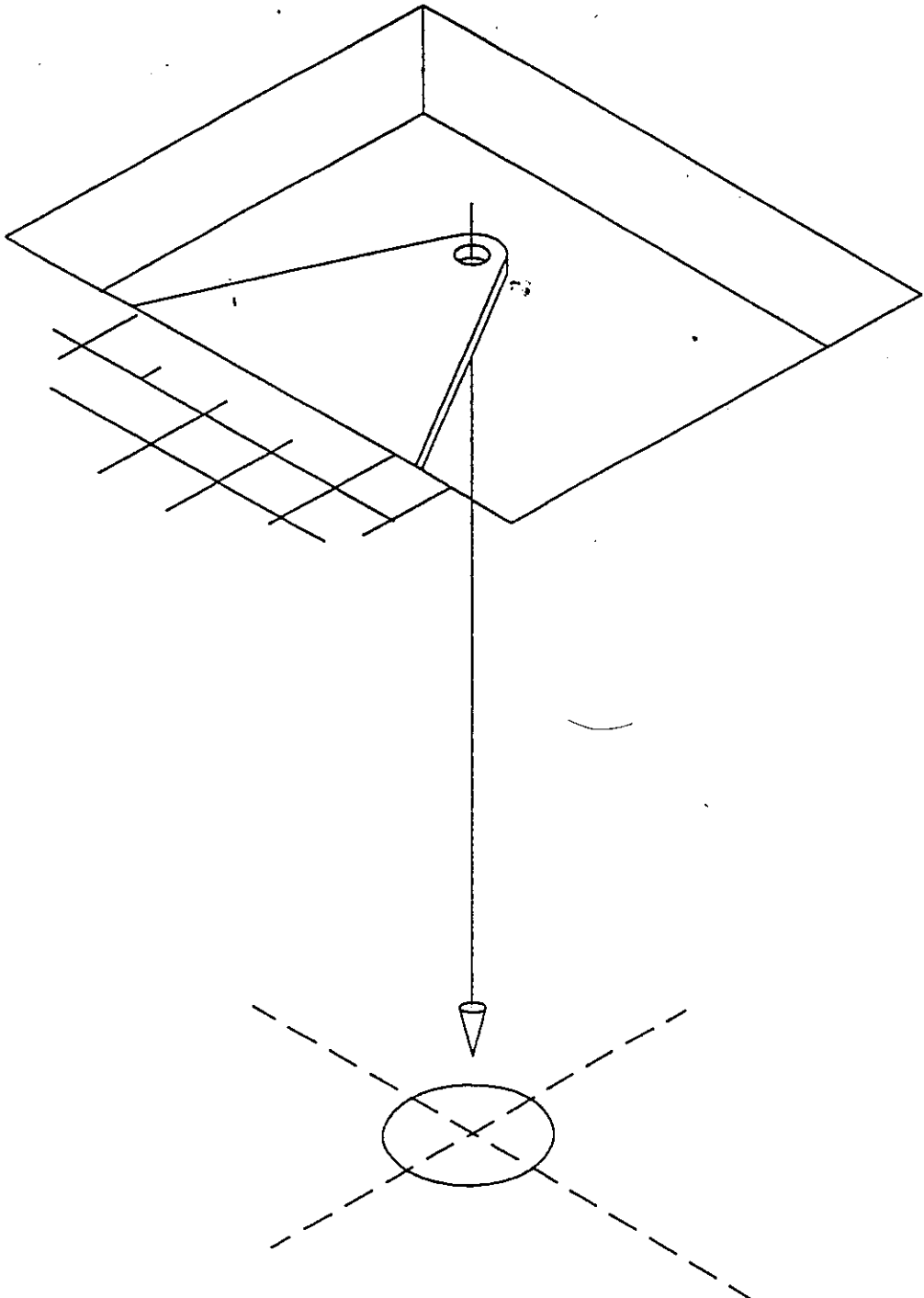
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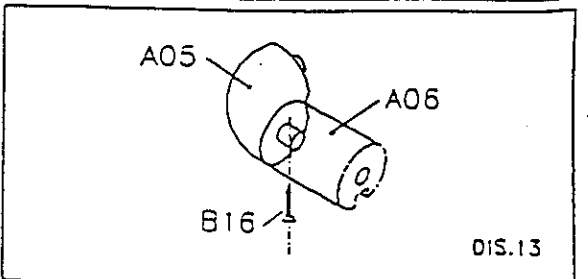
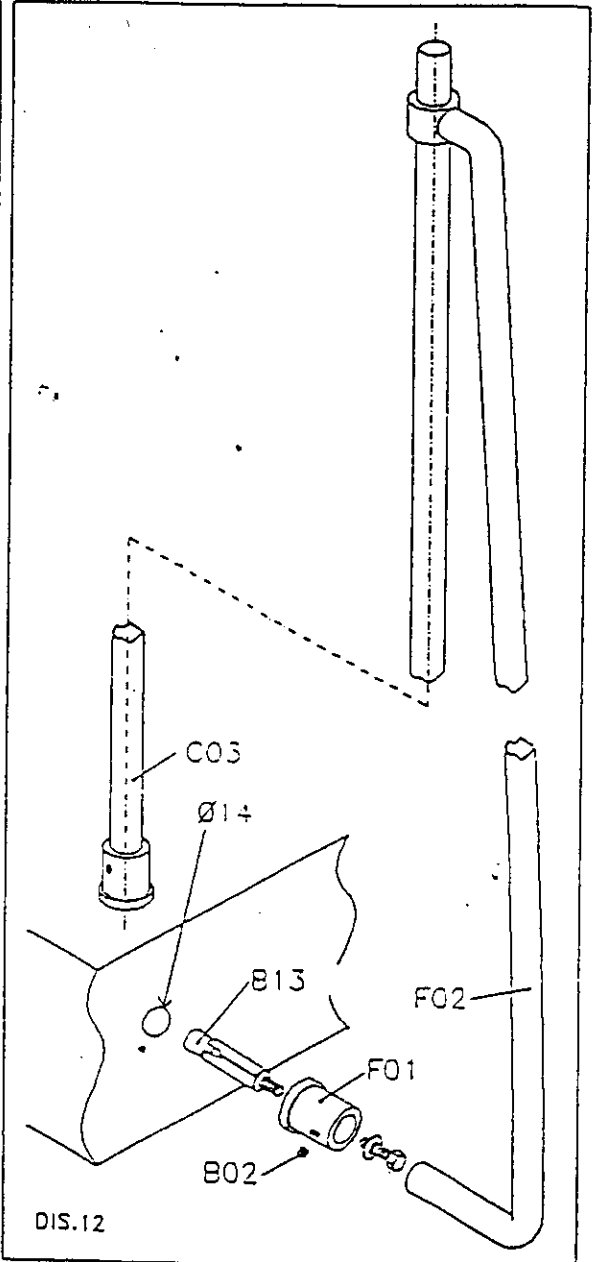
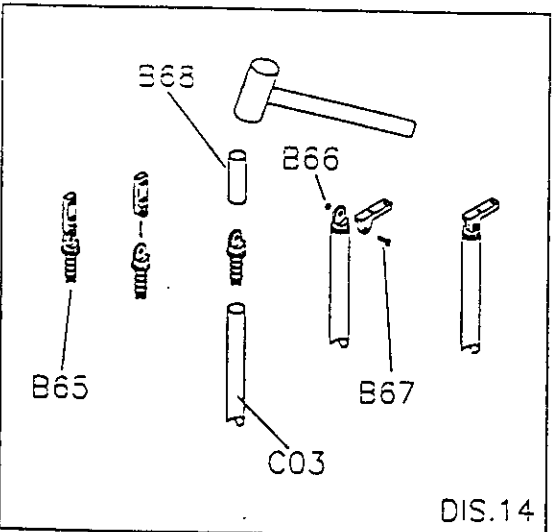
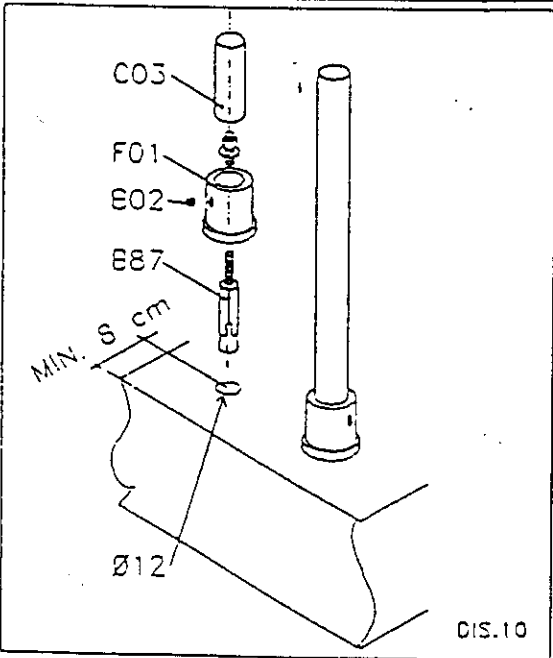
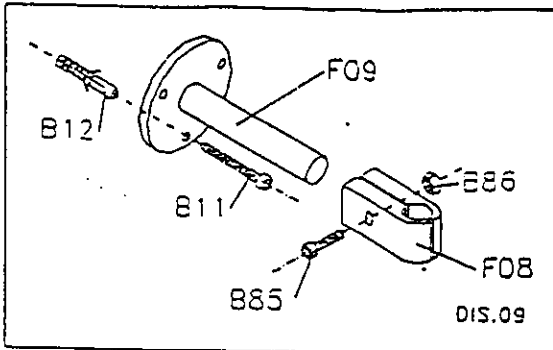


DIS. 09

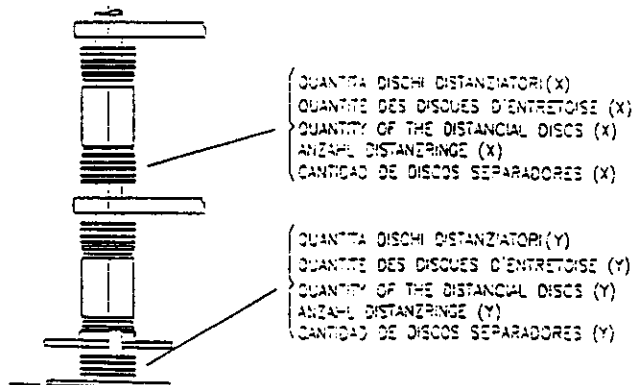


13/1





- I** Questa tabella vi consente di rilevare la quantità dei dischi distanziatori da inserire su ogni alzata. (VEDI DISEGNO)
- A = NUMERO DELLE ALZATE
H = ALTEZZA DELLA SCALA
Y = QUANTITA' DISCHI DISTANZIATORI DA INSERIRE SUL 1° DISTANZIATORE
X = QUANTITA' DISCHI DISTANZIATORI DA INSERIRE SULLE RESTANTI ALZATE
- F** Ce tableau vous permet de relever la quantité des disques d'entretoises à insérer sur chaque hauteur. (VOIR LE DESSIN)
- A = NUMERO DES HAUTEURS
H = HAUTEUR DE L'ESCALIER EN CM.
Y = QUANTITE DES DISQUES D'ENTRETOISES A INSERIR AU-DESSOUS ET AU-DESSUS DE LA 1ERE ENTRETOISE
X = QUANTITE DES DISQUES D'ENTRETOISES A INSERIR AU-DESSOUS ET AU-DESSUS LES HAUTEURS RESTANTES.
- GB** This list shows the quantity of the distancial discs to insert on every riser. (LOOK AT THE DRAWING).
- A = NUMBER OF THE RISERS
H = STAIR HEIGHT IN CM.
Y = QUANTITY OF THE DISTANCIAL DISCS TO INSERT BEYOND AND ABOVE THE 1ST DISTANCIAL
X = QUANTITY OF THE DISTANCIAL DISCS TO INSERT BEYOND AND ABOVE THE REMAINING RISERS
- D** In dieser tabelle kann die menge der distanzringe abgelesen werden, die auf jeder stufenhöhe angebracht werden. (SIEHE ZEICHNUNG).
- A = ANZAHL STUFENHÖHEN
H = TREPPENHÖHE IN CM.
Y = ANZAHL DISTANZRINGE UNTER ODER ÜBER DEM 1. DISTANZRING
X = ANZAHL DISTANZRINGE UNTER ODER ÜBER DENRESTLICHEN STUFENHÖHEN
- E** Esta tabla os permite averiguar la cantidad de discos separadores a colocar en cada tabicas (VER DIBUJO).
- A = NUMERO DE TABICAS
H = ALTURA ESCALERA EN CM.
Y = CANTIDAD DE DISCOS SEPARADORES A COLOCAR BAJO Y ARRIBA AL 1° SOPORTE
X = CANTIDAD DE DISCOS DISTANCIADORES A COLOCAR POR ENCIMA Y POR DEBAJO DE LAS RESTANTES TABICAS



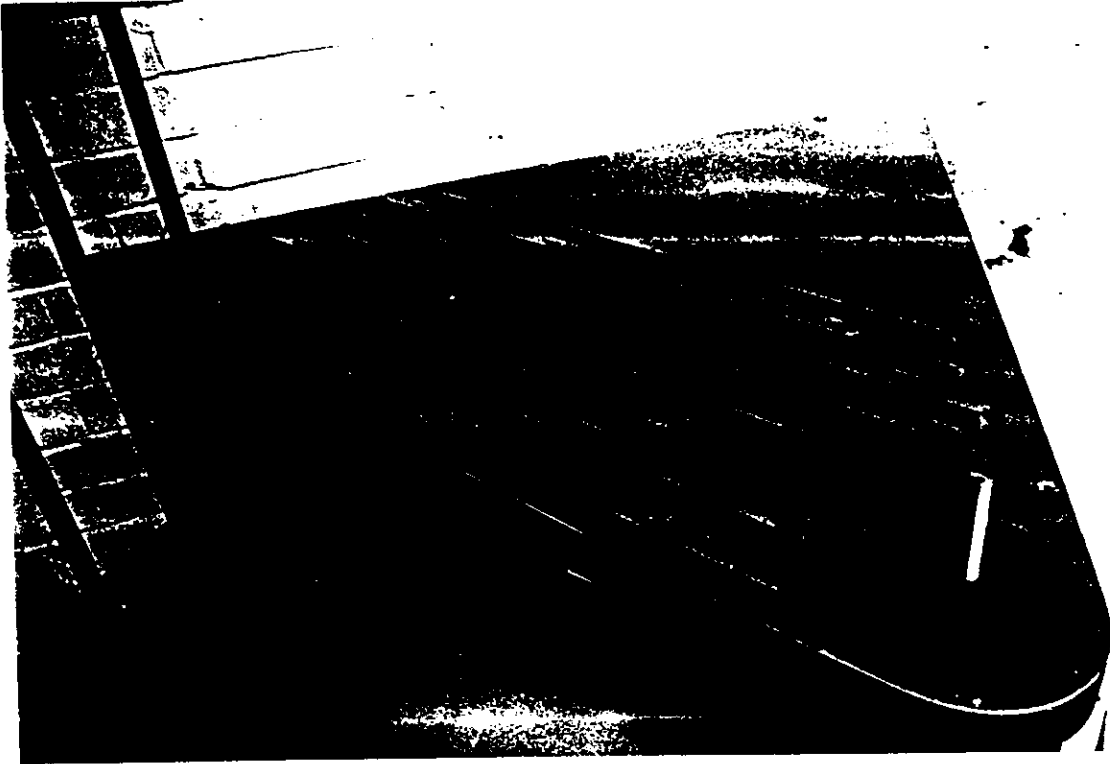
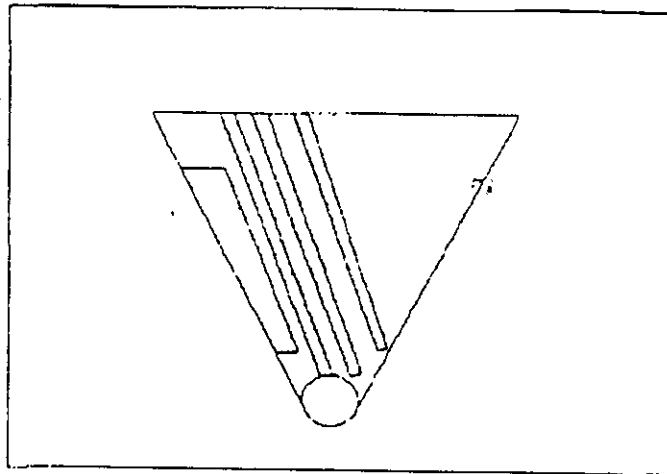


Photo 3. Showing how anti slip tape is to be applied to landing



Photo 4. Showing how anti slip tape is to be applied to treads

Application of Anti slip Tape to Stair Landing



1. Apply nosing anti slip mat to approaching side of Landing
2. Apply strips of anti slip tape starting 25mm from end of mat
3. Apply subsequent strips parallel to the previous one at intervals equivalent to the width of the tape i.e. at 25mm (see drawing)



APPENDIX 2

Independent slip resistance test report



Gaw House
Alperton Lane
Wembley
Middlesex
HA0 1WU
Telephone: 0181 998 2171
Fax: 0181 997 9723

**SLIP TESTING TO BS5395
REPORT No. DC51549/GLB/98**

Prepared for: Building Investigation and Testing Services Ltd
Trowers Way
Redhill
Surrey
RH1 2LH

For the attention of: Mr. I. Collins

Date: 21 July 1998



We have been requested to carry out slip resistance tests on sample steps from spiral staircases by your order No. 566 dated 15 July 1998.

Samples of two staircase steps and a landing cover were received on 9 July 1998. One sample of spiral stairway step comprised of laminated wood with a clear slightly textured coating finish. The other sample comprised of black plastic covers which would be placed over the step and landing section of a metal spiral staircase, the step cover had strips of rough textured plastic nosings on both edges.

Tests were made to BS5395 using a TRRL pendulum slip tester and a rubber test foot of specified hardness of IRHD 55 ± 5.

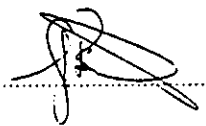
Test were made on both dry and wet surfaces and the machine reading converted to coefficient of friction (COF) and compared to those requirements in BS5395. Part 1.

Results

Sample	Coefficient of Friction for	
	Dry	Wet
Wood step tested across the step	>1.00	0.24
Black plastic step cover		
Centre step	>1.00	0.35
Nosing strip	>1.00	0.39
Black plastic landing cover	0.94	0.30

Notes

1. We have been told that the COF should be 0.4 minimum.
2. The wood step COF when wet was 0.24 i.e. below minimum requirement.
3. The plastic cover for the metal staircase had a COF for the nosing marginally below 0.4 and in low use conditions would probably be suitable especially as the nosing was slightly raised. In this test the full test area could not be used due to the dimensions of the nosing.
4. The texture on the plastic landing cover was finer than that on the nosing for the step and was below requirement for these structures. It is suggested that samples of the black plastic nosing material is prepared so that at full area test may be made in two directions.

Prepared by 
 G. L. Birch
 Principal Consultant



Gaw House
Aiperton Lane
Wembley
Middlesex
HA0 1WU
Telephone: 0181 998 2171
Fax: 0181 997 9723

SLIP TEST TO BS5395
Report No. 51549.2/GLB/98

Prepared for: Building Investigations and Testing Services Ltd
Trowers Way
Redhill
Surrey
RH1 2LH

For the attention of: Mr. I. Collins

Date: 02 September 1998



Our report No. DC51549 dated 21 July 1998 showed slip resistance tests on samples of spiral staircases to be satisfactory when tested dry but marginally below specification when tested in a wet condition.

We have been requested to test the same samples which have modified surfaces as per your order No. 581 dated 18 August 1998 and your fax dated 19 August 1998.

The sample received in August 1998 comprised of those samples as tested in our first report but which had anti slip tape 25 mm wide bonded to the test surface at 25 mm intervals.

Tests were made to BS5395 using a TRRL pendulum tester in the wet condition only.

The test was carried out in two directions, parallel with the tape and at right angles to it. In the parallel direction the test was made with the test foot covering two strips and one strip of abrasive tape respectively.

At right angles to the tape the two test areas included three strips and two strips respectively.

Results

Sample	Coefficient of Friction
Wood step	
Parallel direction	
A. two strips	>1.00
B. one strip	>1.00
at right angles	
A. three strips	0.82
B. two strips	0.67
Metal Step	
Parallel direction	
A. two strips	>1.00
B. one strips	1.00
at right angles	
A. three strips	0.92
B. two strips	0.82

Reported by 

G L BIRCH
Principal Consultant

APPENDIX 3

Detailed BS 6180 handrail and balustrade test results

These include: 1) Tests on baluster kit
2) Tests on stair handrail

Results taken from report BS 2383/1/IC/98
(All components from this report would be identical to that used on the Klan product)

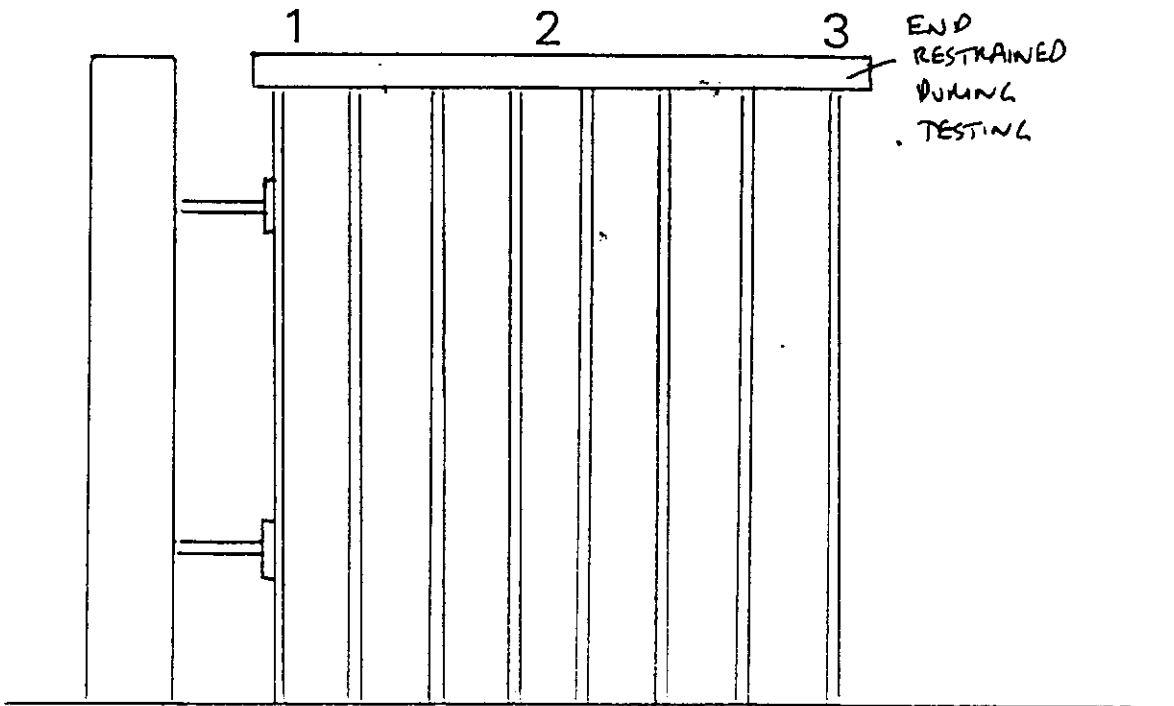


Figure 1. Location of dial gauges

6.3.4 Infill panels and balustersStair baluster

Load kN	Actual deflection
0.125	2.70
0.125 (after 5 mins)	2.58
0	0.17
0 (after 5 mins)	0.00

Note

Some relaxation of the handrail occurred under load due to the compressible nature of the material used.

Baluster kit

Load kN	Actual deflection
0.125	4.51
0.125 (after 5 mins)	4.51
0	0.25
0 (after 5 mins)	0.18

6.5 DeflectionBaluster kit handrail

Load kN (0.36kN/m length = 1.17m x 0.36 = 0.42)	Actual deflection		
	1	2	3
0.42	9.18	12.01	10.20
0.42 (after 5 mins)	9.50	12.23	10.15
0	2.06	2.37	1.44
0 (after 5 mins)	1.38	1.67	0.86

Note - See figure 1 for dial gauge locations.

Stair handrail

Load kN (0.36kN/m length. Tested over 1m length)	Actual deflection		
	1	2	3
0.36	13.39	24.06	16.69
0.36 (after 5 mins)	12.74	23.06	16.06
0	0.25	0.87	0.90
0 (after 5 mins)	0.09	0.63	0.75

Note

Some relaxation of the handrail occurred under load due to the compressible nature of the material used.

Landing rigid handrail

Load kN (0.36kN/m length = 0.83m x 0.36 = 0.30)	Actual deflection		
	1	2	3
0.30	17.33	20.80	8.37
0.30 (after 5 mins)	17.40	20.49	8.34
0	1.75	1.79	0.87
0 (after 5 mins)	1.58	1.36	0.62

Note

See figure 2 for dial gauge locations.

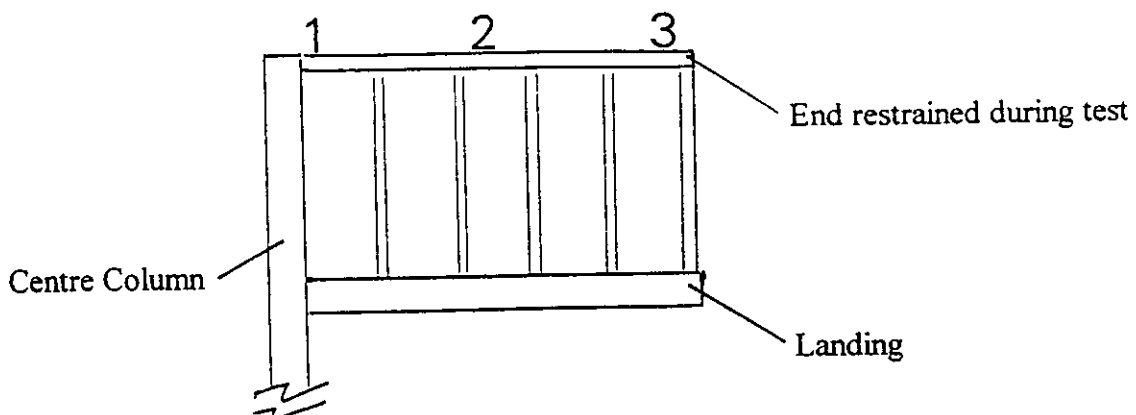


Figure 2. Location of dial gauges

APPENDIX 3

Independent fire assessors report

RPL 1050.2
Page 1 of 4

Roger Perryman Limited
Fire and Chemical Engineering Consultancy

REPORT No. RPL 1050.2
Date 24th July 1998

ASSESSMENT OF SPIRAL STAIRS TO BS 5395
AND
ASSOCIATED REGULATIONS FOR FIRE REQUIREMENTS

Report prepared for

Building Investigation & Testing Services (Redhill) Limited
Trowers Way
Holmethorpe Industrial Estate
Redhill
Surrey
RH1 2LH

ASSESSMENT OF SPIRAL STAIRS TO BS 5395 AND ASSOCIATED REGULATIONS FOR FIRE REQUIREMENTS

1.0 Introduction

- 1.1.1 It is required to determine the fire requirements for a spiral staircase, known as 'Klan' fabricated from predominantly steel with plywood treads. The staircase is intended for the domestic market.
- 1.1.2 For the purpose of this investigation two main documents apply to the staircase with respect to the fire requirements.
- a) British Standard 5395: Part 2: 1984
 - b) The Building Regulations 1991 and 1992 & 1998 Editions

2 Assessment

2.1 British Standard 5395: Part 2: 1984

- 2.1.1 This Standard clearly state that, for 'Category A - Small Private Stairs'. This category of stair may be used as a fire escape for a small number of people who are familiar with the stair. To comply with the Standard, the stair must have specific dimensions for Rise, Going, Clear Width, etc.
- 2.1.2 Therefore, for the stairs to be in accordance with the Standard for Category A, the clear width must not be less than 600mm.
- 2.1.3 For 'Category B - Private stair'. This category is for a stair to the upper floor used as a main access of a dwelling. In other words to a main habitable area in regular use. The dimensional limits change and the Clear Width must not be less than 800mm.
- 2.1.4 Under Clause 6 of BS5395 Fire Protection and Means of Escape recommendations are made to BS 5588 Part 1. Section 2 Single Family Dwellings would be the only section under which this type of stair would be acceptable as a means of escape and for properties not exceeding 4.4 m in height without being a protected stair. The stair should not be in an inner room unless it is provided with a door or window providing a suitable means of escape.
- 2.1.5 The stair may be used for properties of greater than 4.5m height but it must be either protected or the room served above must itself be fire protected and with a separate means of escape.

RPL 1050.2
Page 3 of 4

2.2 The Building Regulations 1992. Document B

- 2.2.1 These Regulations are a revision of the 1991 Regulations to correct certain errors when the document was reprinted. There are no modifications as far as the staircase is concerned.
- 2.2.2 Under these regulations it is required to provide a means of escape from the upper floor to the area below in the event of fire. The regulations consider that any staircase is a means of escape unless there is the facility for escape from the upper room to the outside through a door or a window.
- 2.2.3 It is preferred that the staircase is installed from a hallway or other area requiring the opening of only one door to escape to the outside.
- 2.2.4 If the staircase has to be installed such that the lower end of it is in a room with no direct exit to the outside then it is required that that room should be protected from the rest of the property by a fire resistant doorset.

2.3 The Building Regulations 1991. Document K

- 2.3.1 These Regulations were revised in the 1998 Edition. They were simplified under the Requirement K1 Spiral and Helical stairs 1.21 to refer only BS 5395 Stairs, ladders and walkways. Part 2: 1984 Code of practice for the design of helical and spiral stairs.
- 2.3.2 It would be wise when intending to install a new stair to consult the Building Control Officer of the specific Local Authority.
- 2.3.3 It may be necessary to apply under Building Regulation for agreement to the proposed installation. The officer will advise on this matter and the suitability of a proposed stair under the regulations.
- 2.3.4 Building Control Officers may, and some do, on the basis of the requirements of The Building Regulations, ignore the requirements of BS 5395: Part 2: 1984 with regard to the 'Clear Width' given in Table 2, Sizes of Stairs for Category A. Small private stair. They consider that as the Building Regulation are more up to date. Therefore under these circumstances they will accept that the clear width may be less than that given by the Standard of 600mm minimum.
- 2.3.5 Where only a small number of people are likely to use the stair they may only require that the clear width is enough for a person to reasonably pass up and down the stair.
- 2.3.6 The Building Control Officer will require that the stair comply with the requirement for gaps between treads and balustrade rails to be not more than 100mm. This is a safety aspect to prevent entrapment of parts of the body especially children.

RPL 1050.2
Page 4 of 4

3 Other Requirements

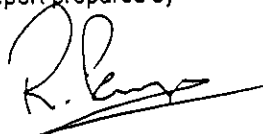
3.1 Surface Spread of Flame

- 3.1.1 There does not appear to be a requirement under the Building Regulation for the stair to comply with a Class of Surface Spread of Flame, as it does not form either a wall or ceiling lining.
- 3.1.2 While there does not appear to be a requirement for a classification on surface spread of flame, it might be thought that the landing form a type of ceiling. Therefore, the client might be wise to ascertain the performance of the plywood for Surface Spread of Flame in accordance with BS 476: Part 7: 1987. It is unlikely a performance of better than Class 3 would ever be required as the area of the landing is less than 4 square metres.

4 Conclusions

- 4.1 In our opinion the spiral stair complies with the requirements of BS 5395: Part 2 1984 Clause 6 Fire Protection and Means of Escape. However, there are conditions applicable to the height of the property and its installation in that property. It is recommended that reference be made to the potential purchaser that they check on the requirements for the installation of the stair with respect to the Standard.
- 4.2 In our opinion the spiral stair complies with the requirements of BS 5395: Part 2 1984 Clause 6 Fire Protection and Means of Escape. However, there are conditions applicable to the height of the property and its installation in that property. It is recommended that reference be made to the potential purchaser that they check on the requirements for the installation of the stair with respect to the Standard.
- 4.3 However, there appears to be a strong case to support the installation of spiral stair of narrower clear width. The indications are that Building Control Officers consider that the Building Regulations are more up to date and that there is no mention of clear width limitations in these Regulations. Therefore, they are willing to accept spiral stairs with a clear width of less than 600mm for installation in domestic properties, or small offices, where there are a small number of people who would use and are likely to be familiar the stair.
- 4.4 It is recommended that the client submit a sample of the plywood used for the landing for at least an indicative test for Surface Spread of Flame in accordance with BS 476: Part 7: 1987. For this test the thickness of the plywood cannot exceed 50mm. If the sample is thicker it must be reduced for the test and it must be ensured that the side having the original surface is subjected to the test conditions.

Report prepared by

Roger Perryman, C.Eng. F I Chem E. A I Fire E. MIFS.
For and on behalf of Roger Perryman Limited

APPENDIX 5

Detailed loading results to Appendix A of BS 5395

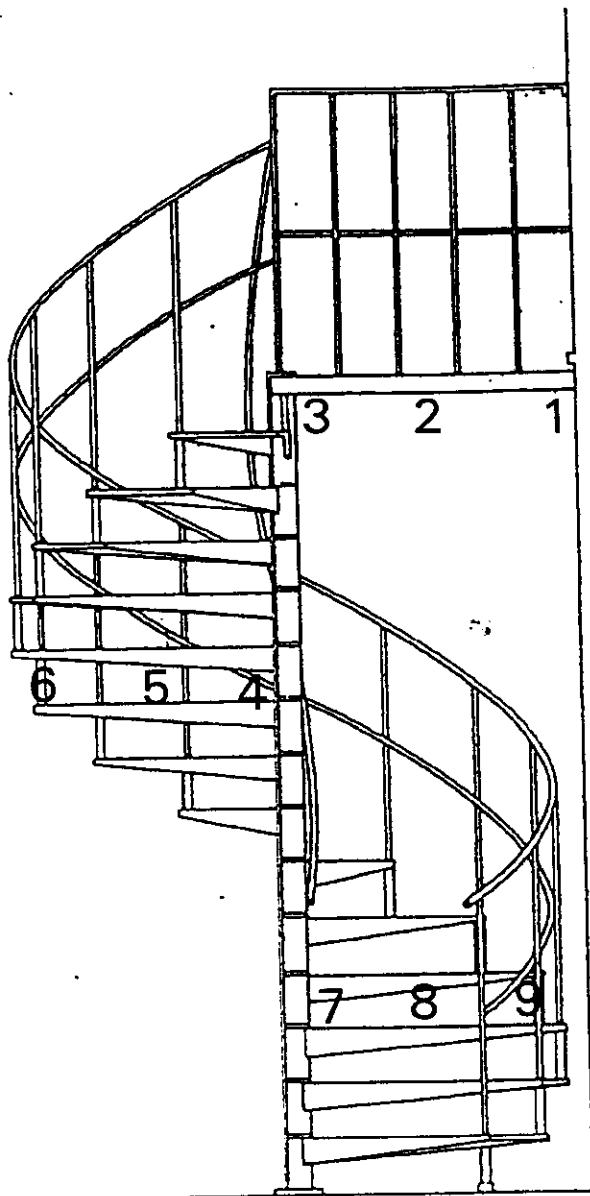


Figure 3. Dial gauge locations used .
(figure from BS 5395 for reference only)

Load	Actual deflection mm								
	Landing			Tread 7			Tread 3		
	1	2	3	4	5	6	7	8	9
Landing only	0.25	0.33	0.12	0.02	0.05	0.06	0.01	0.00	0.01
Full load	0.33	0.51	0.29	0.34	1.12	1.88	0.06	2.17	3.94
Full load(+ 5 mins)	0.34	0.52	0.29	0.35	1.14	1.92	0.06	2.21	4.01
Full load(+15 mins)	0.34	0.52	0.29	0.35	1.15	1.93	0.06	2.23	4.07
180° off	0.34	0.50	0.25	0.28	0.95	1.58	0.02	0.67	1.06
Centre only (x2)	0.06	0.08	0.04	0.17	0.14	0.98	0.00	0.22	0.39
0 load	0.05	0.05	0.02	0.02	0.12	0.23	0.00	0.14	0.26

Note

Figure 3 is a diagrammatic sketch from BS 5395 and has been included to show the general location of dial gauges 1 to 9.

Test DLanding

Load	Actual deflection mm		
	1	2	3
Two x 0.9kN	0.53	0.55	0.17
Two x 0.9kN (after 5 mins)	0.54	0.56	0.17
0	0.10	0.06	0.06
0 (after 5 mins)	0.10	0.06	0.06

Tread 7

Load	Actual deflection mm		
	4	5	6
Two x 0.9kN	0.16	0.94	1.19
Two x 0.9kN (after 5 mins)	0.16	0.96	1.21
0	0.00	0.06	0.07
0 (after 5 mins)	0.00	0.03	0.04

Tread 4

Load	Actual deflection mm		
	7	8	9
Two x 0.9kN	0.36	1.94	3.14
Two x 0.9kN (after 5 mins)	0.37	2.02	3.27
0	0.04	0.15	0.25
0 (after 5 mins)	0.02	0.08	0.13