

© British Standards Institution. No part of this publication may be photocopied or otherwise reproduced without the prior permission in writing of BSI.

Draft for Development
Methods for testing and assessing
the performance of prefabricated
heavy duty support towers

Projet à développer

Méthodes d'essai et d'évaluation des tours de support préfabriquées, modèle lourd

Entwurf zur weiteren Ausarbeitung

Verfahren zur Prüfung und Bewertung des Verhaltens von vorgefertigten Traggerüsten für schwere Lasten

Contents

	Page		Page
Foreword	Inside front cover	Appendices	
Committees responsible	Back cover	A. Basic considerations	10
Methods		B. Methods of applying load to towers	11
		C. Variation of details of test set-up	12
Section one. General		Table	
0. Introduction	2	1. Test schedule for test 1	4
1. Scope	2	Figures	
2. Definitions	3	1. Assembly of tower for test 1	13
Section two. Methods of test		2. Assembly of tower for test 2A	14
3. Apparatus	3	3. Assembly of tower for test 2B	15
4. General test requirements	4	4. Assembly of system for test 3	16
5. Test procedures	4	5. Assembly of tower for test 5	17
6. Recording of data	8	6. Assembly of tower for test 6A	18
Section three. Assessment and reporting		7. Examples of modes of buckling of a tower	19
7. Assessment of results	9		
8. Test report	9		

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature because further experience of the use of the methods described is needed to establish satisfactory repeatability and reproducibility. It should be applied on this provisional basis, so that information and experience of its practical application may be obtained.

A review of this Draft for Development will be carried out not later than two years after its publication. Notification

of the start of the review period, with a request for the submission of comments from users of this Draft for Development will be made in an announcement in the appropriate issue of BSI News. Observations which it is felt should receive attention before the official call for comments will be welcomed.

According to the replies received, the responsible BSI Committee will judge whether the Draft for Development can be converted into a British Standard or what other action should be taken.

Foreword

This Draft for Development was prepared under the direction of the Civil Engineering and Building Structures Standards Committee. It is the third BSI publication describing methods of test for falsework equipment, the other two being BS 5507 : Parts 1 and 3.

The need to establish accurately the structural properties of equipment has become more important, and so in consequence has the need to have satisfactory test methods. These should relate as closely to practice as possible and be completely reproducible.

When this publication was prepared it was clear that prefabricated heavy duty support towers would be expected to be used in accordance with BS 5975. The recommendations of BS 5975 were therefore analysed and a series of tests prepared to yield data that could be applied as directly as possible to the recommendations therein.

One consequence of this is that the test on assembled towers considers only vertical loads as in practice horizontal loads should be distributed laterally through bracing and lacing to be resisted elsewhere, with a number of linked towers thus acting together as a larger assembly. Where there is formwork at the top of the tower that is relatively stiff this may also provide a load path for horizontal loads. A large number of reports of tests already carried out were examined and several testing facilities were visited, but the opportunity was taken to consider the requirements for testing from first principles, and no one existing method or procedure has been adopted in full. It is as a result of this that these methods are being published in a Draft for Development. It is hoped that experience will show that they can be confirmed and subsequently incorporated as a further Part of BS 5507.

Draft for Development

Methods for testing and assessing the performance of prefabricated heavy duty support towers

Section one. General

0. Introduction

This Draft for Development describes methods of test for the evaluation of the performance of prefabricated heavy duty support systems when used in the form of towers. Seven groups of tests are detailed, with the required number of each test, and they can be combined together to provide a very comprehensive test programme. Each method can also be used alone when a full evaluation in accordance with this Draft for Development is not required. In this case, the testing programme should be subject to agreement between the parties concerned.

Prefabricated heavy duty support systems within the scope of this Draft for Development are of three basic types as follows.

(a) *Frame systems*

(1) *Frame and brace systems.* These comprise a range of prefabricated frames that fit one above another, together with braces or ledgers (or both) that attach to the frames to form them into towers or lines of braced towers.

(2) *Frame-only systems.* These comprise rectangular or triangular frames that can be assembled at 90° on plan or spirally without braces or ledgers to form towers.

(b) *Tube component modular systems* (otherwise known as 'system scaffolding', 'universal scaffolding', etc.). These comprise a range of standards with connecting attachments fixed to them and ledgers and braces that attach to the standards to form towers or birdcage assemblies.

Variations within these descriptions are possible, but are nevertheless likely to fall within the scope of this Draft for Development. Equipment often known as 'heavy duty props' or 'shores' does not come within the scope of this Draft for Development. When testing such equipment BS 5507 : Part 3 may offer useful guidance.

Most systems are fabricated from steel, but the tests described in this Draft for Development can also be applied to towers constructed from other materials, for instance aluminium. While the scope of this Draft for Development is limited to single towers of three or four legs it is likely that the data can be applied to larger assemblies, although this should not be assumed to be the case in all instances.

This Draft for Development has been prepared to be suitable for heavy duty towers, the description 'heavy duty'

applying to systems capable of giving an ultimate capacity per leg greater than 60 kN. However, the same procedures may be used for equipment with a lower capacity.

For the purposes of illustration only, most of the figures illustrating the tests have been shown as applied to frame and brace systems; nevertheless these tests can normally be applied to the other systems described above equally well.

There are many practical difficulties in assessing the strength and other related properties of these towers by analysis alone and it has become customary for users to rely on information largely based on test results, including that published in suppliers' literature.

Hitherto in the UK there has been no generally recognized method of conducting these tests or interpreting their results. The tests described here should now provide a common and verifiable basis for the determination of structural properties. Using appropriate analytical techniques and factors of safety, design tables can be prepared. These methods can also be used as a design tool when developing a new or modified type of tower.

Guidance on which tests to use in particular circumstances is obtainable from appendix A, which sets down the basis on which the tests were formulated. It also suggests how the test data may most usefully be interpreted for the user.

The material of which the samples tested are made will sometimes have significantly better properties than the minimum required by its specification. However, in test 1 the failure will be dominated by the buckling of the vertical legs which is not sensitive to material properties, and in tests 2 to 6 the rather larger number of tests specified should go some way towards overcoming this problem.

Successful use of these methods will produce more meaningful data from fewer tests.

NOTE. This Draft for Development makes reference to the International System of units (SI). For further information reference should be made to BS 3763 and PD 5686.

1. Scope

This Draft for Development describes methods of test for establishing the structural properties of prefabricated heavy duty support towers having three or four legs and their component parts when acted on by vertical loading only or combinations of vertical and horizontal load. These tests can be used for initial assessment of novel designs, for reassessment of existing designs, and for guidance on production standards. The mechanical testing of materials is described but metallurgical examination is not considered.

NOTE. The titles of the publications referred to in this Draft for Development are listed on the inside back cover.

2. Definitions

For the purposes of this Draft for Development the following definitions apply.

2.1 base. The underlying platform or floor on which the tower is tested.

2.2 baseplate. A metal plate with a spigot or socket for distributing the load from a standard or other load-bearing member, and which may incorporate a means of adjustment.

2.3 brace. A member placed diagonally with respect to the vertical or horizontal members of a tower and fixed to them to afford stability.

2.4 falsework. A temporary structure used to support a permanent structure while it is not self-supporting.

2.5 forkhead. A U-shaped housing with a spigot or socket for carrying joists or the like, and which may incorporate a means of adjustment.

2.6 factor of safety. The ratio of ultimate load to the safe working load.

2.7 frame. A prefabricated two-dimensional unit usually, but not necessarily, comprising two legs connected with integral braces and ledgers.

2.8 jack brace. A brace used to restrain a forkhead or baseplate.

2.9 jack extension. The extension of the jack of an adjustable forkhead or baseplate measured from the same point when the jack is fully closed.

2.10 lacing. Essentially horizontal tubular members that connect together and reduce the unsupported lengths of columns.

2.11 ledger. A component of a system or other member compatible with the system placed horizontally between legs.

NOTE. This definition includes members referred to as 'transoms' in scaffolding usage (see also lacing).

2.12 leg. A standard, or vertical member of a frame, forming a vertical member of a tower.

2.13 lift. The assembly of members forming each horizontal level of a tower.

2.14 loading beam. A beam supporting the applied test loads and transmitting them to the primary beams.

2.15 load point. The point of application of the load.

2.16 plan brace. A brace orientated in a horizontal plane.

2.17 primary beam. A beam placed directly into the forkheads.

2.18 puncheon. A frame or standard incorporating a facility for vertical adjustment.

2.19 safe working load. The maximum allowable working load on the equipment during use.

2.20 standard. A vertical or near vertical tubular member.

2.21 supplier. The designer, manufacturer, importer, supplier or other person giving design data on the use of the system.

2.22 system. A series of components designed or normally used together to form towers or other supports in falsework.

2.23 tendon. A high-tensile rod, wire, strand or rope, with low bending stiffness compared to its axial stiffness, either as an innate property or by the introduction of flexible couplings.

2.24 tower. An assembly of components forming a structure used principally to carry vertical loading.

2.25 ultimate load. A measure of the maximum load-bearing capacity of a member (see 8.2).

2.26 wedge. A piece of strong timber or metal that tapers in its length and is used to adjust elevation or line or to tighten falsework. Folding wedges comprise a pair of wedges laid together so that their outer faces are parallel.

Section two. Methods of test

3. Apparatus

3.1 General. The apparatus listed in 3.2 to 3.6 is required in the test procedures described in clause 5.

NOTE. The exact details of type, size and number of pieces of apparatus will vary according to the test being carried out and the equipment being tested.

3.2 Steel primary beams and loading beams to transmit the test load evenly into the equipment under test. They need to be strong enough and stiff enough to withstand forces applied during the test safely and without appreciable deformation. The bearing points of such beams need to be of a sufficient size to provide adequate support to baseplates and forkheads.

NOTE. See 5.2 and 5.3 for dimensions of bearings.

3.3 Measuring equipment to measure the dimensions of components and to measure deflections and movement during the test.

NOTE. Although it is preferable to measure movements with dial gauges or transducers, the relatively large and unpredictable movements of falsework towers may make this impracticable. As an alternative, measurements may be made with a surveyor's level or theodolite reading on to graduated scales mounted vertically and horizontally at the appropriate points. For some movements the location of a plumb bob may be recorded on squared paper fixed immediately below. The accuracy requirements of 6.4 should be taken into account.

Suitable* equipment is also required for the measurement of the load input during the test. This equipment should comply with the requirements of grade B of BS 1610 as regards repeatability and accuracy (see 6.4).

3.4 A means of applying load at the rate specified in 5.1 up to the failure load.

NOTE. The test procedures in 5.2 and 5.3 refer to the use of kentledge, tendons in tension, or a purpose built reaction frame incorporating a means of applying either tension or compression. These methods are considered in further detail in appendix B.

3.5 Steel cones having a conical included angle of 60° and a means of attachment to the legs of a tower.

NOTE. See 5.3 for alternative end details.

3.6 Plywood pads of 19 mm exterior grade Douglas Fir plywood having plan dimensions to suit the requirements of the test in question.

* The capacity of a testing machine is suitable when the expected failure load of the test sample lies in the upper four-fifths of the selected range of the machine being used.

4. General test requirements

4.1 Sampling. The components to be tested shall be representative of components of the system in general use, so far as this is possible to ascertain; components shall not be specially selected or prepared for the test unless they are prototypes.

4.2 Base arrangements. A rigid and horizontal base for the tower under test that is either a smooth concrete slab, or a smooth concrete floor, or a rigid framework of steel beams shall be provided.

NOTE. A rigid framework of steel beams permits the jacks and other equipment to be located below the tower where they are more readily accessible.

4.3 Assembly of towers. The sequence of assembly, means of attachment of components, tightening torques, etc. shall be in accordance with the supplier's published guidance or, if this is not yet available, his specification. On completion of assembly, the load point shall be brought vertically above the centroid of the reactions at base level, subject to a tolerance of 5 mm, by use of the screw adjustment of the appropriate baseplate spigots; if necessary, after this alignment the forkheads shall be adjusted to the same horizontal level.

4.4 Variation of detail. Various details of arrangement of the components or assembled towers are possible (see appendix C). The configuration to be tested shall be determined before testing commences.

5. Test procedures

5.1 General

5.1.1 Initial loads. Before commencing the tests, estimate the expected value of the failure load, for example by approximate calculation or by interpretation of the known results of similar tests.

Determine the mass of all test apparatus, including primary beams, loading beams, tendons, etc., for example by weighing or by calculation from known dimensions and densities. Take this mass into account when calculating the additional vertical load required to provide the required test load on the tower or component. Do not include the self weight of the tower or component under test in this calculation.

5.1.2 Test loads. Apply a single sequence of loading to failure.

To eliminate secondary effects such as slackness at joints and uneven bearings at supports, apply an initial load, vertical, horizontal or inclined, as appropriate, not exceeding 5 % of the expected failure load. Record the magnitude of this load. Take the point reached after any settlement under this initial load as being the datum point for subsequent measurements of movement.

Progressively increase the load until the maximum attainable load is reached, or until the deformation of the component or tower is such that in practical conditions failure would be said to have occurred. The rate of loading shall be such that the expected failure load is not reached until at least 5 min has elapsed since the commencement of applying load.

When the load is increased incrementally, sustain each test load at a constant value until movement ceases and take movement readings at the end of this period.

NOTE. The first test load increments, after the initial load, should normally be about 10 % of the estimated failure load. However, towards the end of the test when failure appears to be imminent, smaller increments may be more appropriate.

When the load is applied continuously take readings of load and movement simultaneously.

5.2 Measurement of the load capacity of assembled towers

5.2.1 Test 1: vertical load only (see figure 1)

5.2.1.1 Principle. A vertical load is applied to a tower in which both the top and the bottom are fixed against horizontal movement in order to evaluate the behaviour under vertical load only. (See foreword.)

5.2.1.2 Number of tests. For any one system, carry out three tests on the basic configuration of the system. Thereafter one test of any different configuration of the same system is sufficient, provided that at least three tests on different configurations are carried out and that the results of all the tests fit a reasonable engineering analysis of the structural behaviour.

NOTE. Not all alternative configurations need to be tested; in cases where the change in configuration is not great, reasonable interpolation (but not extrapolation) between other configurations tested may be used. Table 1 indicates the recommended test schedule for systems with more than one arrangement.

Table 1. Test schedule for test 1

Configuration	Number of tests
Basic (B)	3
B plus one variant	3 + 3
B plus two variants	3 + 2 + 1
B plus three variants	3 + 1 + 1 + 1
B plus four variants	3 + 1 + 1 + 0 + 1
B plus five or more variants	As for B plus four variants, i.e. six tests

5.2.1.3 Test arrangement. Assemble three lifts of the system vertically one above the another and orientated such that they are the right way up as intended in the system. The tower shall have the minimum number of legs normally used in the system.

NOTE 1. The minimum number of legs normally used is four, as illustrated in figure 1, but may be three.

The plan dimensions of the tower shall be equal to the largest used in normal applications of the system. The height of the lifts shall be not less than the largest used in normal applications of the system.

NOTE 2. The lifts need not be of equal height; where the maximum height is governed by the use of forkheads or baseplates, the top or bottom lift (or both) may be shorter than the centre lift.

Incorporate forkheads and baseplates at the top and bottom of the tower respectively. Extend adjustable forkheads and baseplates to the maximum permissible without requiring jack braces (see also 4.3 and A.4). Mount each baseplate on a single plywood pad having plan dimensions such that they extend 25 mm beyond the baseplate on all sides.

Place the primary beams across pairs of forkheads, mounted on single plywood pads with plan dimensions on adjacent sides equal to the width of the primary beams and to the width of the forkheads, as appropriate. Position and wedge the beams so that their centroids are 25 mm

eccentric to the spigots of the forkheads, all eccentricities being in the same direction relative to the spigots, sockets or jacks of the forkheads. Locate the primary beams parallel to the vertical plane in which the system is stiffest. If this is not obvious, or in cases of doubt, repeat the test with the primary beams in the orthogonal plane.

NOTE 3. The stiffest vertical plane should be determined by inspection and will usually be the plane of the frames in frame and brace systems or the plane of the smaller plan dimension between legs in other arrangements. A different arrangement may be necessary in the case of towers of other than four legs.

Restrain the primary beams from moving horizontally or rotating on plan.

Place a loading beam to span, at right angles, between centres of the primary beams. Make a positive connection to each primary beam to fix the beams together and to prevent relative rotation on plan.

Establish a load point at such a position on the loading beam that the test load is distributed equally to all legs.

NOTE 4. More than one load point may be used provided that equality of loading is assured.

5.2.1.4 Instrumentation. Make provision for observing and recording the following:

- (a) the vertical load applied to the loading beam at each point;
- (b) the vertical movements of the load point and horizontal movements of the forkheads relative to the baseplates.

5.2.1.5 Application of load. Apply an axial vertical load to the load point or points in the manner described in 5.1 using one of the following methods:

- (a) by applying tension to a suitable tendon or tendons anchored in the base vertically below the load point;
- (b) by loading with kentledge;
- (c) by applying compression through a large reaction frame.

5.3 Measurement of load capacity of individual components

5.3.1 Test 2A : behaviour of adjustable forkheads (see figure 2)

5.3.1.1 Principle. Combinations of horizontal and vertical loads are applied to a single lift of a frame system in order to evaluate the behaviour of adjustable forkheads used without jack braces.

NOTE. Test 3A will usually be more appropriate for tube component modular systems.

5.3.1.2 Number of tests. In each test, failure will be initiated by two or more forkheads acting simultaneously, which imposes a degree of averaging. Consequently, one test of any one configuration of the system is sufficient, provided that at least five tests are carried out and that the results of all tests fit a reasonable engineering analysis of the structural behaviour.

NOTE. Not all of the different configurations need to be tested; in cases where the change in configuration is not great, reasonable interpolation (but not extrapolation) between other configurations tested may be used.

5.3.1.3 Test arrangement. Erect a single lift of the tower, orientated the right way up as intended in the system. At the bottom of each leg of the tower incorporate a steel 60° cone or such other arrangement as will ensure minimal fixity without translation. The tower shall comprise the minimum number of legs normally used in the system.

NOTE 1. The minimum number of legs normally used is four, as illustrated in figure 2, but may be three.

The plan dimensions of the tower shall be the maximum normally used in the system.

Incorporate forkheads at the top of each of the legs of the tower. Extend the forkheads to the specified length.

NOTE 2. Tests will usually be required at a number of different extensions.

Locate the primary beams as described in 5.2.1.3.

Place two loading beams to span between primary beams so that they are centred over the forkheads and are at right angles to the primary beams.

Establish a load point on each loading beam so that an inclined load or horizontal and vertical loads can be applied at the level of the top of the primary beams and in such a manner that the vertical load is equally distributed to each leg.

Orientate the tower so that the horizontal load is applied in the direction in which the tower is least stiff. If this is not obvious, or in cases of doubt, repeat the test with the primary beams in the orthogonal plane.

NOTE 3. The direction in which the tower is least stiff should be determined by inspection and will usually be the direction of the larger plan dimension between legs.

If the specified ratio of horizontal load to vertical load indicates that overturning of the tower arrangement is likely, anchor the legs in tension to the base. This anchorage shall be devised to introduce as little rotational restraint as possible.

5.3.1.4 Instrumentation. Make provision for observing and recording the following:

- (a) the vertical and horizontal loads, or their combination, applied to each loading beam;
- (b) the vertical and horizontal movements of the point of application of the load;
- (c) the vertical and horizontal movements of the forkheads;
- (d) the horizontal movement of the point at which the topmost brace or ledger intersects the leg.

5.3.1.5 Application of load. Apply the loads in the manner described in 5.1. Increase the horizontal and vertical loads by the same percentage. Apply a horizontal load with a value of 2.5 % of the vertical load.

NOTE 1. Tests may also be required over a range of ratios of horizontal load to vertical load.

Apply vertical load to the load point: either

- (a) by applying tension to a suitable tendon anchored in the base;

or

- (b) by loading with kentledge.

NOTE 2. Loading in a reaction frame is not suitable for this test owing to the difficulty of assessing the horizontal restraint.

Apply horizontal load to the load point: either

- (c) by applying tension or compression to a suitable member anchored to a rigid point external to the tower;

or

- (d) by anchoring the tendon specified in (a) so that it is inclined to the vertical. Calculate the horizontal load at all times from the horizontal separation between the load

point and the base anchorage point, and select the initial eccentricity to allow for the expected horizontal movement of the tower.

5.3.2 Test 2B: behaviour of adjustable baseplates (see figure 3)

5.3.2.1 Principle. Combinations of horizontal and vertical loads are applied to a single lift of a frame system in order to evaluate the behaviour of adjustable baseplates used without jack braces.

NOTE. Test 3B will usually be more appropriate for tube component modular systems.

5.3.2.2 Number of tests. In each test, failure will be initiated by two or more baseplates acting simultaneously, which imposes a degree of averaging. Consequently, one test of any one configuration of the system is sufficient, provided that at least five tests are carried out and that the results of all tests fit a reasonable engineering analysis of the structural behaviour.

NOTE. Not all of the different configurations need to be tested; in cases where the change in configuration is not great, reasonable interpolation (but not extrapolation) between other configurations tested may be used.

5.3.2.3 Test arrangement. Erect a single lift of the system, orientated upside down to the normal way intended in the system. At the bottom (as assembled) of each leg of the tower incorporate a steel 60° cone or such other arrangement that will ensure minimal fixity without translation.

The number of legs, the plan dimensions, and the orientation of the tower shall be as specified in 5.3.1.3. Incorporate baseplates at the top (as assembled) of each of the legs of the tower. Extend the baseplates to the specified length.

NOTE. Tests will usually be required at a number of different extensions.

Place the primary beams across pairs of baseplates and locate them in planes parallel to the direction of the horizontal load. Ensure that the primary beams have a bearing width at least equal to the plan dimensions of the baseplate. Mount each primary beam on single plywood pads with plan dimensions such that they extend 25 mm beyond the baseplates on all sides.

Attach two steel beams transversely between the primary beams in such a way as to restrain the primary beams in vertical planes. Alternatively use the loading beam arrangement specified in 5.3.1.3.

Establish a load point or load points at such a position on each primary beam (or loading beam, if appropriate) that the load applied to each beam is distributed equally to the two supporting legs under each primary beam.

If necessary anchor the legs in tension as specified in 5.3.1.3.

5.3.2.4 Instrumentation. Make provision for observing and recording loads and movements of the baseplates as specified in 5.3.1.4 for adjustable forkheads.

5.3.2.5 Application of load. Apply the load as described in 5.3.1.5.

5.3.3 Test 3: behaviour of adjustable forkheads (test 3A) or adjustable baseplates (test 3B) (alternatives to tests 2A and 2B) (see figure 4)

5.3.3.1 Principle. Combinations of horizontal and vertical loads are applied to a single leg of a tube component modular system in a 'mirror image' assembly in order to evaluate the behaviour of forkheads (test 3A) or baseplates (test 3B) used without jack braces.

NOTE. Test 2A or test 2B will usually be more appropriate for frame systems.

5.3.3.2 Number of tests. Tests 3A and 3B are alternative to tests 2A and 2B respectively. The number of tests shall be the same as required for tests 2A and 2B.

5.3.3.3 Test arrangement. Arrange two lifts of the system, one above the other and with the lower the right way up and the upper upside down, and in such a manner that a single leg of each assembly is loaded. Tie the leg units at the positions normally specified for the load with the appropriate ledger so that the leg is restrained in two directions. Fix the other end of the ledger with the proprietary fixing used in the system to a similar leg held in the test rig. Ensure that this leg is effectively held in position at its ends. Other legs shall be removed if practical or, where this is not the case, arranged so that no significant load can be transferred to them.

NOTE. If it is impossible to reproduce the layout characteristic of the system without transferring load in this way, test 2A should be used for forkheads and test 2B for baseplates.

Incorporate the adjustable forkheads or baseplates, as appropriate, at the mid-height. When testing forkheads insert and wedge lengths of steel beam in each forkhead so that the centroids of these forkhead beams are 25 mm eccentric to the spigots of the forkhead in the direction of the horizontal load.

Incorporate the loading beam between the forkhead beams or baseplates, as appropriate. When testing baseplates the bearing of the loading beam shall have an area at least equal to the plan area of the baseplate.

Insert single plywood pads between each point of contact between beams and between beams and forkheads or baseplates. The plan dimensions of these plywood pads shall be at least equal to the plan dimensions of the forkhead or baseplate, as appropriate. At the two outer ends of the leg assembly attach 60° cones or such other arrangements as will ensure minimal fixity without translation.

5.3.3.4 Instrumentation. Make provision for observing and recording the following:

- (a) the vertical and horizontal loads applied;
- (b) the relative vertical movement of the two forkheads or baseplates;
- (c) the horizontal movements of the forkheads or baseplates and of the points at which the innermost braces or ledgers intersect the legs.

5.3.3.5 Application of load. Apply the loads in the manner described in 5.1. Apply a compressive vertical load to the extreme ends of the assembly.