Doc: MED 14 (27920)WC
April 2025

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

भारतीय मानक **मसौदा**

गैर-अंशशोधित गोल इस्पात लिंक उत्थापन जंजीरें और जंजीर स्लिंग पर सुरक्षित उपयोग और रखरखाव — रीति संहिता

(आई एस 8324 का *दूसरा पुनरीक्षण*)

Draft *Indian Standard*

Safe Use and Maintenance on Non — Calibrated Round Steel Link Lifting Chains and Chain Slings — Code of Practice

(*Second Revision* of IS 8324)

ICS 61.080

Cranes, Lifting Chains and Related Equipment Sectional Committee, MED 14	Last date for receipt of comments is **24 May 2025**

FOREWORD
(*Formal clause will be added later*)

This standard was first published in 1976 and revised in 1988. The second revision has been brought out for incorporating the modifications found necessary as a result of experience gained with the use of this standard. Also, in this revision, the standard has been brought into the latest style and format of Indian Standards, and references wherever applicable have been updated. The following major changes have been incorporated revision:

a) The international classification for standards (ICS) number has been added; and
b) The reference standards have been updated.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Draft *Indian Standard*

SAFE USE AND MAINTENANCE ON NON — CALIBRATED ROUND STEEL LINK LIFTING CHAINS AND CHAIN SLINGS — CODE OF PRACTICE

(Second Revision)

1 SCOPE

Gives guidance for the selection, use, inspection, testing, maintenance and repair of non-calibrated round steel short link chains and chain slings.

2 REFERENCES

The Indian Standard listed in below contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below:

IS No	*Title*
IS 3109 (Part 1) : 2024	Short Link Chain, Grade M (4) — Specification Part 1 Non-Calibrated Load Chain For Lifting Purposes (*Third Revision*)
IS 6217 :1982	Specification for short link chain, grade S (6), non - Calibrated for lifting purposes (*first revision*)
IS/ISO 3076:1984	Round steel short link chains for general lifting purposes - Medium tolerance sling chains for chain slings - Grade 8 (First Revision)

3 DEFINITIONS

3.1 Working load Limit (WLL) — The maximum mass which a sling is designed to support in general service.

3.2 Working Load (W_L) — The maximum mass which a sling should be used to support in a particular stated service.

3.3 Competent Person — The person who is approved and declared as such under the relevant statutory provisions.

4 CHAIN SLING SELECTION

4.0 The principles outlined below relate to the selection of slings for general purpose use, that is, slings having branches of equal nominal reach.

4.1 The working load of the sling selected shall be at least equal to the maximum load to be lifted. This working load will be the same as the working load limit in normal circumstances or less than the working load limit under certain conditions.

4.2 The working load limit is marked on the sling and is determined by:

a) the size and grade of chain selected;
b) the geometry of the sling; and
c) the method of rating.

4.2.1 *Size and grade of chain selected* (*see* Table 1)

It will be noted that as the grade of chain selected increases from M to S to T, chain slings of progressively smaller nominal size can be used to achieve equivalent strength, for example, Grade T sling will have twice the working load limit of Grade M sling of the same size.

4.2.2 *Geometry of the sling*

It means the number of chain branches and, in the case of multi branch slings, the included angle between, them or the angle to the vertical. Included angles or angles to the vertical should be assessed as illustrated in Table 2. The greater the included angle between the branches, the lower the load a particular sling can carry without exceeding the permissible loading in the branches (*see* Fig. 1). Each situation should be checked to ensure that the permissible loading in any branch is not exceeded. The use of the sling branches at angles greater than 60° to the vertical (included angles of greater than 120 °C for two or four-branch slings) is not recommended.

4.2.3 *Method of rating*

4.2.3.1 *Rating with a symmetrically distributed load*

There are two methods of rating to determine WLL, the uniform load method and the trigonometric method. Details of both methods are given in Indian Standard

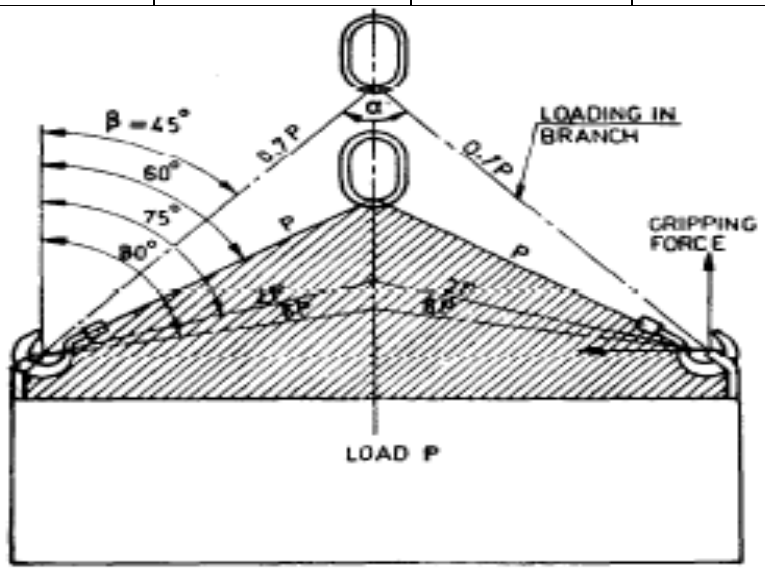
NOTE — It is strongly recommended that only one of these methods be adopted in any given premises where slings are in use.

TABLE 1 GRADE OF SHORT LINK CHAIN DESIGNED FOR USE IN CHAIN SLINGS

(*Clause* 4.2.1)

Sl No.	Grade	Indian Standard	Mean Stress at Working Load Limit (WLL) MPa (N/mm^2)	Mean Stress at Proof Force MPa (N/mm^2 (Fe)	Mean Stress at Minimum Breaking Force (Fm) MPa (N/mm^2)	Ratio of Fm/WLL
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	M(4)	IS 3109 (Part 1)	100	200	400	4:1
ii)	S(6)	IS 6217	157.5	315	630	4:1

iii)	Grade 8	IS/ISO 3076	200	400	800	4:1



NOTE — Shaded portion indicates included angles between branches of greater than 120° (66° to the vertical) at which angles, slings should not be used.

FIG. 1 VARIATION OF SLING BRANCH LOADING WITH BRANCH ANGLE FOR A GIVEN LOAD P

4.2.3.1.1 Table 2 shows the factors to be applied for calculating the WLL of multi-branch slings by the uniform load method.

For the trigonometric method, the WLL is calculated from the following formulae:

Double branch sling: WLL = 2 × WLL of single branch × cos β

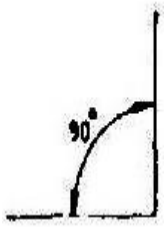
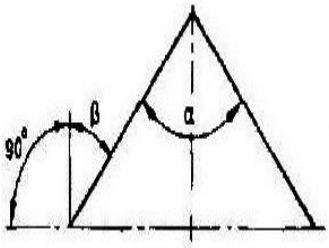
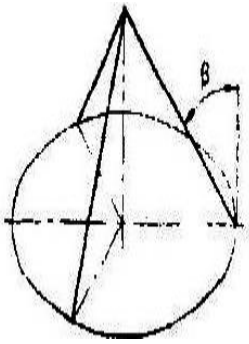
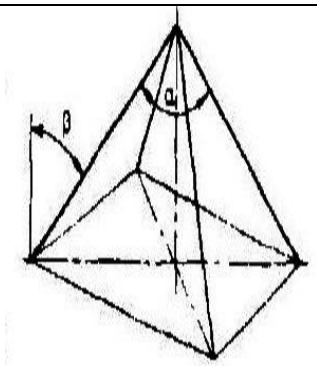
3 × 4 branch sling: WLL = 3 × WLL of single branch × cos β

NOTE — In the case of a four branch sling, if proper measures are taken to achieve the equal distribution of load between each branch, all four branches may be considered as supporting the load. This rating of a four branch sling may, in such circumstances, be based on the formulae:

4 × WLL of a single branch x cos β

TABLE 2 FACTORS FOR WLL BY UNIFORM LOAD METHOD

(*Clauses* 4.2.2 and 4.2.3.1.1)

Sl No.	**Slings**							
(1)	(2)	(3)	(4)		(5)		(6)	
i)	Number of branches	1	2		3		4	
ii)	Angle of Inclination	–	90°	120°	–	–	90°	120°
iii)	Angle to the vertical	–	45°	60°	45°	60°	45°	60°
iv)	Factor for WLL	1	1.4	1	2.1	1.5	2.1	1.5

4.2.3.2 *Rating with an asymmetrically distributed load*

If it is known that the load is likely to tilt when lifted, there will be a higher tension in the branch nearest to the centre of gravity of the load, that is, the branch where the angle to the vertical (β) is the smallest (*see* Fig. 2).

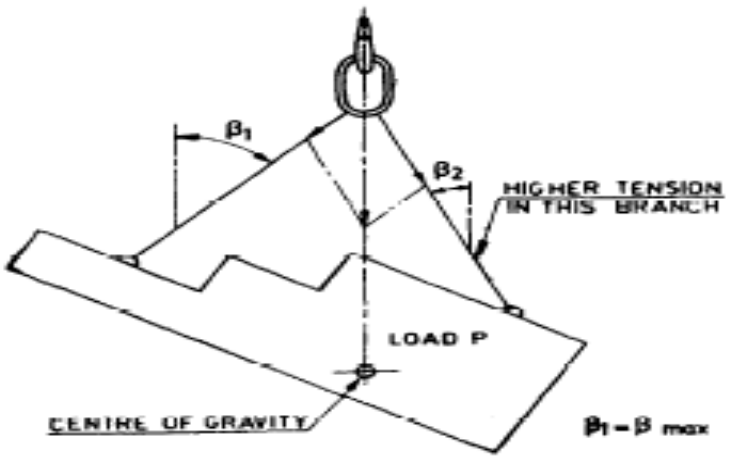


FIG. 2 ASYMMETRIC LOADING

If the sling has to be used under these circumstances (*see* **5**), the following rating factors should be applied:

Uniform load method:

Where β max is 45°
WLL for double branch = WLL of single branch
WLL for 3 and 4 branch = WLL of single branch × 1.4

Where β max is 45° to 60 °
WLL for double branch = WLL of single branch
WLL for 3 and 4 branch = WLL of single branch

Trigonometric method:

Where β max is ≤ 60 °
WLL for double branch = WLL of single branch × 2 cos β max
WLL for 3 and 4 branch = WLL of single branch × 3 cos β max

NOTE — The use of a sling where any angle β exceeds 60 ° is not recommended.

4.3 In Adverse Environments

The working load limit should be reduced to a working load in accordance with the following recommendations.

4.3.1 *High and low temperature conditions*

As the temperature which a chain sling attains in service increases, its strength decreases. Care should be taken to take account of maximum temperature which can be reached by the chain sling in service. This is difficult in practice but underestimation of the temperature involved should be avoided. The effect of increasing temperature on WL of various grades of chain sling is indicated in Table 3. Chain slings of Grade M(4), S(6) and T(8) will not be adversely affected by temperature down to - 40°C and no reduction from WLL is, therefore, necessary on this account. Where chain slings are to be used at temperatures below - 40°C the manufacturer should be consulted.

TABLE 3 WL AS A FUNCTION OF TEMPERATURE °C

(*Clause* 4.3.1)

(In percent of WLL**)***

Sl	Grade	- 40	Over 200	Over 300	Over 350	Over 400	Over 475

No.		up to + 200	up to 300	Up to 350	Up to 400	Up to 475	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	M(4)	100	100	85	75	50	Do not use
ii)	S(6)	100	90	75	75	Do not use	
iii)	T(8)	100	90	75	75	Do not use	

*The use of chain slings within these temperature ranges does not imply any permanent reduction in WLL when the chain is returned to normal temperatures. If chain slings are accidentally exposed to temperatures in excess of the maximum permissible temperature indicated above, they should be withdrawn from service and referred to the manufacturer.

4.3.2 Acidic conditions

4.3.2.1 *Grade S(6) and Grade T(8)*

Chain slings manufactured to Grade S(6) or Grade T(8) should not be used either immersed in acid solutions or exposed to acid fumes, Attention is drawn to the fact that certain production processes involve acidic solutions and fumes and the use of Grade S(6) or Grade T(8) slings for lifting in these circumstances should be avoided.

4.3.2.2 *Grade M(4)*

Chain slings of Grade M(4) may be used in acidic conditions but in the absence of specific recommendations from the manufacturer, the following precautions should be adopted:

a) The WL of such a sling should not be greater than 50 percent of the WLL;
b) The sling should be thoroughly washed in clean water immediately after use; and
c) The sling should be given a thorough examination by a competent person each day before use (*see* **5**).

4.3.3 *Other conditions in which the sling is likely to be subjected to attach (chemical, abrasive, etc)*

The manufacturer of the sling should be consulted if such conditions apply.

5 HANDLING THE LOAD

5.1 A lifting chain is usually attached to the load and the lifting device by means of terminal fittings, such as, hooks and links. Chains should be straight, without twists, knots or kinks. The load should be seated well down in a hook, never on the point (*see* Fig. 3) or wedged in the opening; the hook should be free to incline in any direction so as to avoid bending. For the same reason, the master link should be free to incline in any direction on the lifting device hook, Egg or pear-shaped links should not be used as master links or as lower terminals in any situation

where the link could be inverted leading to a wedging action and subsequent distortion of the link.

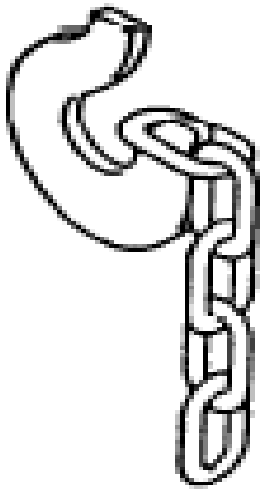


FIG. 3 HOOK

5.2 The chain may be passed under the load in a basket hitch (*see* Fig. 4) or choke hitch (*see* Fig. 5). It is necessary that in the case of a basket hitch where there.ls a danger of the load tilting, more than one chain sling be applied to the load, preferably in Conjunction with a spreader beam (*see* Fig. 6).

Fig. 4 (a) Single branch in basket hitch (back hooked into top link)

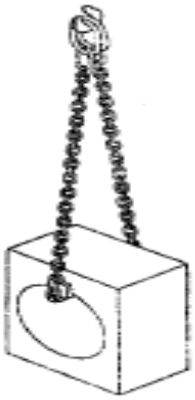


Fig. 4 (b) Reevable collar sling in basket hitch

Fig. 4 (c) Single adjustable basket sling

FIG.4 BASKET HITCH

FIG. 5 CHOKE HITCH

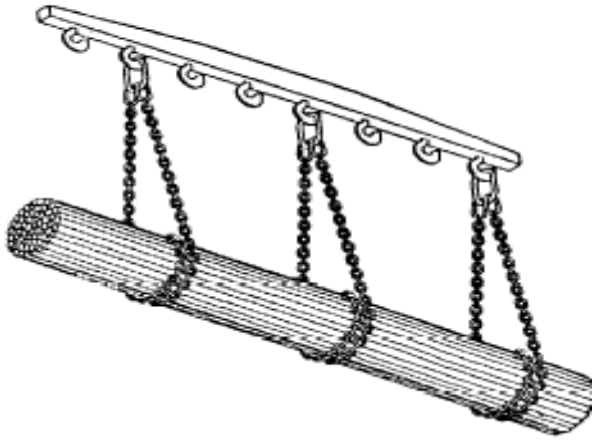


FIG. 6 USE OF SPREADER BEAM

5.3 Damage to a chain may be caused by dragging it from under the load or by rolling a load on to it; these practices should be avoided.

5.4 When a choke hitch is employed, very high tensile forces are imposed and the use of a larger chain for a given load may be necessary. Alternatively, the sling should be derated as recommended by the manufacturer, or irrational legislation or standards. In the absence of such recommendations or requirements, the WL should not exceed 80 percent of WLL. Care should also be taken to avoid repeated engagement of the terminal fitting in the same link, as this will eventually cause damage.

5.5 All multi-branch slings exert a gripping force (*see* Fig. 1) on the load which increases as the angle between the sling branches is increased. Where hooks or other fittings are threaded on a loop of chain, for example, case slings and drum slings, the gripping force is much greater and consequently, the angle between such branches should not exceed 60^{o} (30^{o} to the vertical). Care should always be taken to ensure that the load to be moved is able to resist the gripping force without being damaged.

5.6 Packing may be required where a chain contacts a load, to protect either the chain or the load or both. A sharp corner of the hard material may bend or damage the chain links, conversely, the chain may damage the load because of high contact pressure. Packing, such as wooden blocks, may be used to prevent such damage. Hands and other parts of the body should be kept away from the chain to prevent injury as the slack is taken up.

5.7 A tag line is recommended to prevent swaying or rotation of a load and to position it for landing.

5.8 When ready to lift, the slack should be carefully taken up until the chain is taut, the load raised slightly and a check made that the load is secure and remains level; this is specially important with basket or other loose hitches where friction retains the load. If the load tilts, it should be lowered and the lifting device hook re-postioned towards the low end. This can be accomplished by repositioning the lifting points or by the use of shortening devices in one or more legs. When all is in order, the lift can proceed.

5.9 The load should be landed carefully. Before slackening the chain, a check should be made that the load is properly supported; this is specially important when several loose objects are in basket hitch and choke hitch.

5.10 When loads are accelerated or decelerated quickly, high dynamic forces occur which increase the stresses in the chain. Such situations which should be avoided, arise from snatch or shock loading, for example, from not taking up the slack chain before starting to lift or by the impact of arresting falling loads.

5.11 Common Malpractices to be avoided

5.11.1 The following shall be particularly avoided:

a) Overloading slings and continuing to use chain after it has been stretched by overloading;
b) Using long link chain (that is, pitch >3d) for lifting;
c) Using hoist chains as sling chains;
d) Using components of lower grade than the chain;
e) Using a sling with any broken or deformed links;
f) Connecting chain links with bolts or wires (*see* Fig. 7);
g) point loading of hooks (*see* Fig. 3);
h) Wrapping the chain several times around a hook (*see* Fig. 8); and
j) Using a worn out chain beyond the limits stated in **7.3**.

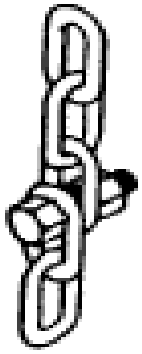


FIG. 7 CONNECTING CHAIN LINKS WITH BOLTS OR WIRES

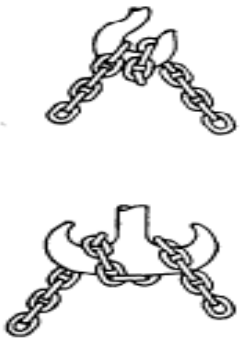


Fig. 8 Wrapping chain around hook

6 INSPECTION

6.1 Frequent Inspection

This is a regular visual inspection by the operator or other designated personnel. No records need be kept of such inspections. The chain sling should be examined throughout its working length including all attachments to detect any evidence of wear, distortion or external damage. The frequency of these inspections should be related to severity of the service.

If faults are found during this inspection, the procedure given in **6.2** should be followed.

6.2 Periodic inspection

This is a thorough examination by a competent person of which records should be made to provide the basis for a continuing evaluation.

Chain slings should be thoroughly cleaned so as to be free from oil and dust prior to inspection. Any cleaning method which does not damage the parent metal is acceptable. Methods to avoid are those that may cause hydrogen embrittlement, overheating, removal of metal or movement of metal which may cover cracks or surface defects.

Adequate lighting, free from shadows, should be provided and the sling examined throughout its length to detect any evidence of wear, distortion or external damage.

The sling should be withdrawn from service for maintenance and repair if any of the following faults are observed:

a) The sling markings are illegible, that is, information on the sling identification and/or the working load limit.
b) Distortion of the upper or lower terminal fittings;
c) *Chain stretch* — If the chain links are elongated or if there is any lack of free articulation between the links or noticeable difference in the branch length of multi-branched slings, the chain may have been stretched. Where possible, as an initial inspection procedure, it is recommended that the actual reach of the sling be measured and recorded. This procedure allows a rapid indication of major deviation from the original product;
d) *Wear* — Wear by contact with other objects usually occurs on the outside of the straight portions of the links where it is easily seen and measured. Wear between adjoining links is hidden (*see* **6** and Fig. 9). The chain must be slack and the adjoining links rotated to expose the inner end of each link;
e) Cuts, nicks, gouges, cracks, excessive corrosion, heat discoloration, bent or distorted links or any other defects in chain or fittings. Shallow and rounded indentations in areas of low tensile stress may not be significant but deep nicks in high tension areas and sharp transverse nicks are unacceptable;

f) Signs of opening out of hooks, that is, any noticeable increase in throat openings or any other form of distortion in the lower terminal fitting. The increases in throat opening should not exceed 10 percent of the nominal, or be such as to allow the safety catch, if fitted, to become disengaged; and
g) In correct assembly of the mechanical joining devices in slings of non-welded construction (refer to manufacturer's instructions).

7 MAINTENANCE AND REPAIR

7.1 The repair or replacement of individual links, fittings or lengths of chain should only be' carried out by the manufacturer or by those organizations which have the necessary knowledge and equipment (such as welding, heat-treatment, proof testing and crack detection facilities).

7.2 Links that are cracked, visibly bent or twisted, severely corroded or have deposits which cannot be removed should be discarded and replaced, as should visibly distorted components,

7.3 Inter-link wear may be tolerated until the thickness of the material at the point of contact (Fig. 9) has been reduced to 80 percent of the nominal diameter (0.8 d_n). In those cases where wear occurs at more than one point on the same cross-section, the mean diameter should be measured and such wear may be tolerated until the mean diameter has been reduced to 90 percent of the nominal diameter (0.9 d_n).

7.4 Where appropriate, for example, in the case of large hooks and sling fittings, minor defects, such as nicks and gouges, may be removed by careful grinding or filing. Following repair, the surface should blend smoothly into the adjacent material without abrupt change of section. The complete removal of the defect should not reduce the thickness of the section at that point by more than 10 percent.

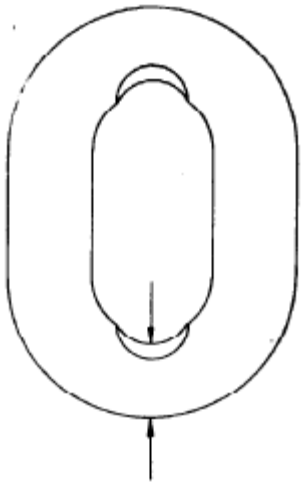


FIG. 9 INTER-LINK WEAR ON LINKS

7.5 In the case of slings whose repair has involved welding, each repaired sling shall be proof tested and inspected before it is returned to use. However, where repair is accomplished by the

insertion of a mechanically assembled component, proof testing is not required provider that the component has already been proof tested by the manufacturer.

A proof force has been established for each size and grade of chain sling. These are given in the relevant Indian Standards which should be consulted.

7.6 If the tag or label identifying the sling and its WLL becomes detached and the necessary information is not marked on the master link itself, or by some other means, the sling should he withdrawn from service.

8 STORAGE AND CARE OF CHAIN SLINGS

8.1 Chain slings should normally be kept on a properly designed rack. They should not be left lying on the ground after use where they may be, damaged.

8.2 If the chain slings are to be left suspended from a crane hook, the sling hooks should be engaged in an upper link.

8.3 If chain slings are expected to be out of use for some time they should be cleaned (*see* **6.2**), dried and protected from corrosion for example, lightly oiled.

NOTE — Chain slings should not be galvanized or subjected to any plating processes without the approval of the manufacturer.

9 RECORD KEEPING

9.1 Adequate records are essential for the proper use and maintenance of lifting equipment. The record is a continuous history of the chain sling and should show dates of inspection, testing and maintenance.

9.2 The initial record is a description of the chain sling and its identification markings. Inspection periods and test intervals should be determined and entered in the record.

9.3 After each periodic inspection, the condition of the chain sling should be noted in the record, the results of each proof test should be recorded.

9.4 Each time the sling is repaired the reasons for, and the details of the repairs should be entered in the record.