International Standard 7592

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Calibrated round steel link lifting chains — Guidelines to proper use and maintenance

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

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It has been approved by the member bodies of the following countries:

Australia	Germany, F.R.	Romania
Austria	India	South Africa, Rep. of
Belgium	Ireland	Spain
Canada	Japan	Sweden
Czechoslovakia	Korea, Rep. of	United Kingdom
Egypt, Arab Rep. of	Netherlands	USSR
France	Poland	

No member body expressed disapproval of the document.

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Calibrated round steel link lifting chains — Guidelines to proper use and maintenance

1 Scope and field of application

This International Standard specifies the main principles for the use, inspection, in-service testing and maintenance of calibrated round steel link chains operating over chain wheels. The principal applications include manual and power driven hoists.

NOTE — Lifting chains may be governed by national and local laws and regulations.

2 References

ISO 1836, *Short link chain for lifting purposes — Grade M(4) calibrated, for chain hoists and other lifting appliances.*

ISO 3077, *Short link chain for lifting purposes — Grade T(8) calibrated, for chain hoists and other lifting appliances.*

ISO 4301, *Lifting appliances — Classification.*

3 Chain usage

3.1 In the interests of safety, reliable operation and satisfactory life, proper usage of chain is very important. Some of the responsibility rests with the equipment manufacturer, being dependent upon choice of relative dimensions of chain and pocket wheel, as well as the means provided for guiding, where necessary, the chain on and off the pocket wheel, and in and out of the equipment.

There are also important factors under the direct control of the user. One essential requirement is that the chain be aligned correctly with the chain wheel. If the chain forms a closed loop, aligned with the wheel and always under tension, no external guide is needed. In any installation where the chain may become slack or twisted or where it may approach the wheel at an angle to the plane of rotation, a suitable chain guide must be provided. Usage should be avoided that prevents direct entry of the chain into a hoist or lower hook block or that twists the chain upon entry.

3.2 In order to maintain the gauge length dimensions, it is necessary that the chain be under tension. Very little tension (for example the weight of a few links) is sufficient to maintain the gauge length, provided that the chain is otherwise free and not subjected to restraining side forces.

The chain should not be allowed to pick up dirt, etc. which would impair its free movement and which if carried into the equipment and deposited in the pockets of the pocket wheel could affect the proper seating of the chain in the pockets.

3.3 There are two types of pocket wheels over which chain may be required to run:

a) idler wheels, which change the direction of the chain but do not substantially affect its tension;

b) driving wheels, which change both tension in the chain and its direction. This type also includes driven wheels, such as the wheel driven by the hand chain of a manually operated hoist.

3.3.1 Idler wheels of relatively large diameter (not less than 6 X pitch of chain recommended) used with lightly loaded chain may be plain sheaves with circular grooves. Smaller wheels, or a higher chain tension, require flats or pockets to accommodate the link as chords to the wheel circumference to avoid bending and to provide sufficient bearing area.

In most installations guides are required to remove twist from the approaching chain and to align it correctly in the rotational plane of the wheel. Such guides should also prevent the chain disengaging the wheel should it become slack.

3.3.2 Driving wheels are more demanding and generally pocketed wheels are essential. In addition to the guiding requirements as for idler wheels, there are two conditions which require additional restraints, both involving the chain at the slack side.

One is stripping, or forcible removal from the wheel, of chain whose pitch appears to be too short. When the wheel is rotated to draw in chain under tension, the links at the slack side tend to remain in the wheel and must be mechanically disengaged. The condition may occur with new chain of too short pitch for the wheel or with chain of correct pitch operating over a worn wheel. The stripper usually takes the form of a finger installed between the chain strands and extending well into the centre groove of the wheel. It engages links in the plane of rotation and forces them to leave the wheel.

The other condition occurs with chain, either new or worn, whose pitch is too long for the wheel. In this case it is necessary to guide the slack chain approaching the wheel into engagement by advancing the links which are transverse to the plane of rotation. This is a difficult task at best, and in extreme conditions, may cause high rubbing forces and severe external wear.

3.4 The design of end connections to develop full chain tension becomes more difficult as chain strength increases. For example, a circular transverse pin may be used, but is limited to a diameter very little larger than that of the chain material, whereas a pin of oval cross-section may provide greater strength in bending. Two mating blocks, contoured to fit the end link, also will develop full chain strength. Strength requirements are therefore sufficiently important and demanding that only the equipment manufacturer's recommended replacement parts should be used.

3.5 Chain is a mechanism in which high bearing pressures are developed. In order to attain maximum life it is therefore necessary to ensure that lubrication is maintained, particularly in the interlink contact areas where pressures are highest. Suitable lubricants are those that cling and are capable of withstanding high pressures, but in all cases where equipment manufacturer's recommendations are available they should be strictly followed. In those special applications where chain lubricant cannot be used because of possible contamination of the material being handled or the lubricant itself, the life of the chain and pocket wheel may be drastically reduced.

3.6 A protective coating for steel chain will reduce corrosion. Whatever process is chosen, the following points should be taken into consideration:

a) the possibilites of reduction in pitch due to thickness of the coating applied, for example hot galvanizing is generally unsuitable;

b) the possible effects on the mechanical properties of the chain.

Users shall not apply any coating unless approved by the chain manufacturer.

3.7 If the slack chain descending from an overhead hoist is undesirable, a chain container may be installed. It is essential that the container be of adequate size, properly aligned and provided with a means of drainage. If a few links of chain overflow the edge of the container (whether caused by improper alignment or inadequate capacity) all of the chain may be caused to run out of the container. The top of the chain pile is a cone, which must not build up so high as to remove all tension from the slack side chain, as otherwise the chain may not re-enter the wheel properly.

3.8 Chains fitted to lifting appliances are usually provided with free swivelling hooks to ensure that any twists in the chain will be removed automatically before the load is moved. Such chains used in choke hitch (i.e. by back hooking after passing the chain round the object to be moved) renders the safety swivelling ineffective and is therefore an unsafe procedure. Also using the load chain and hook in a choking hitch configuration may damage the load chain and shorten the driving wheel life.

Slinging should always be carried out using separate equipment attached to the hook.

In the case of hooks supported on two or more falls of chain, care should be taken that the chain does not become twisted by the operator inadvertently passing the hook through the loop of the chain and turning the hook block over. If such twisting has occurred, it should be rectified by passing the hook through the loops of chain in the reverse direction.

4 Inspection

4.1 Classification of service

Proper maintenance depends on an evaluation of the severity of usage to which the chain and the appliance, in which it is installed, are subjected. The duty should be evaluated to conform to one of the following classes so that inspection can then be performed as described in 4.2:

4.1.1 light service: Chains and appliances subjected very rarely to the maximum load and, normally, to light loads;

4.1.2 moderate service: Chains and appliances subjected fairly frequently to the maximum load and, normally, to moderate loads;

4.1.3 heavy service: Chains and appliances subjected frequently to the maximum load and, normally, to loads of heavy magnitude;

4.1.4 very heavy service: Chains and appliances subjected regularly to the maximum load.

NOTE — Further information on the classification of lifting appliances is given in ISO 4301, from which the above duties are extracted.

4.2 Inspection classification

Inspection procedure is divided into two general classifications based upon the intervals at which inspection should be performed for chains in regular service. The general classifications are herein designated as "frequent" and "periodic" with respective intervals between inspection as defined below. (In addition, visual observations shall be conducted during regular service for any damage or evidence of malfunction which might occur between regular inspections.)

4.2.1 Frequent inspection

This is a visual examination by the operator or other designated personnel, without requiring records to be made. Inspection should be carried out at the following intervals:

a) light service — every month;

b) moderate service — every two weeks;

c) heavy service — every week;

d) very heavy service — every day.

4.2.2 Periodic inspection

This is a thorough examination by an appointed person, making records of external conditions to provide the basis for a con-

tinuing evaluation. Inspection should be carried out at least at the following intervals:

a) light service — yearly (equipment in place);

b) moderate service — half yearly (equipment in place unless external conditions indicate that disassembly should be done to permit detailed inspection);

c) heavy service — quarterly (equipment in place unless external conditions indicate the disassembly should be done to permit detailed inspection);

d) very heavy service — six weekly (equipment in place unless external conditions indicate that disassembly should be done to permit detailed inspection).

4.3 Inspection procedure

4.3.1 Procedure for frequent inspection

First examine the chain throughout its working length to detect any evidence of wear, distortion or external damage. Next operate the equipment under no load and under a load as near as possible to the usual operating load, in both directions and observe the functioning of the chain and wheels. The chain should feed smoothly into and away from the wheels in each case.

If the chain binds, jumps or is noisy, check that it is clean and properly lubricated. If the trouble persists after lubrication, inspect the chain and mating parts for wear, distortion or other damage as outlined below.

4.3.2 Procedure for periodic inspection

Chains should be cleaned for inspection, using any cleaning method that will not cause damage. Methods to avoid are those that may cause hydrogen embrittlement (such as immersion in caustic or acid bath), overheating, removal of metal or movement of metal which may cover cracks or other surface defects.

Adequate lighting should be provided for the inspector. The chain should be examined link by link for cracks, gouges or nicks, distortion, corrosion, deposits of foreign material and for interlink wear. To inspect for wear at the interlink contact points, slacken the chain and rotate adjacent links to expose the inner ends of the link. If wear is observed or if elongation is suspected, measure the chain according to the equipment maker's instructions. If instructions are not available, proceed as follows:

a) select an unworn, unstretched length of chain (for example at the slack end);

b) suspend the chain vertically under tension. Use a caliper type gauge to measure the accumulated pitch of between 5 and 11 links;

c) measure the same number of links throughout the used chain and calculate the percentage increase in length.

4.4 Rejection criteria

The chain should be rejected if any of the following conditions are observed:

a) cracks;

b) severe nicks or gouges;

c) visible distortion;

d) severe corrosion;

e) deposits which cannot be removed;

f) increase in gauge length which exceeds the manufacturer's recommendations. In the absence of manufacturer's recommendations the chain should be replaced if the gauge length measured over any 5, 7, 9 or 11 links as appropriate exceeds that of the unused chain by:

1) 2 % if power driven;

2) 3 % if manually operated.

g) if interlink wear leaves a rough surface, this indicates that rapid wear is occurring and the chain should be rejected immediately.

A chain with superficial smooth wear or minor gouges may remain in use provided that the gauge length is within the limits given above, and provided that the chain works smoothly in the load wheel pockets.

The chain should be relubricated before it is returned to service.

5 Chain replacement

5.1 Calibrated chain is chain which, during manufacture has had its pitch carefully adjusted and regularised, so as to be compatible with a specific design of pocket wheel. It follows therefore that when replacing chain in any appliance, it will not function correctly in the pocket wheel unless it is to the original dimensional specification. Furthermore as chains are available in a variety of material grades and hardnesses, an incorrect chain could result in failure.

For these reasons, only those calibrated chains which fully comply with the appliance manufacturer's specification and recommendations should be used as replacements.

When replacing a worm chain with a new chain it is generally advisable to install a new pocket wheel and to verify correct chain guide action.

A partly worn chain from one appliance should not be transferred to another similar appliance.

Care should be taken to re-install chain without any twist between the chain wheels or between a wheel and an anchored end. Proper orientation of the entering link should be established since a twist cannot be corrected except by removing and re-installing the chain.

Where the appliance manufacturer's instructions are available they should be followed strictly, particularly with respect to the relationship of the chain link weld to the pocket wheel groove so as to ensure best operating conditions.

5.2 In addition to the problems associated with proper fit are those involving transfer of load from link to link and from chain to pocket wheel. This process involves wear as well as the possibility of fatigue failure in the chain – both of which determine the expected useful life of the chain/pocket wheel combination. Because the life expectancy of a hoist involves its type of duty, for example hand operated or power driven, slow or fast speed, industrial or home duty, the hoist manufacturer will have selected a suitable grade of calibrated load chain from national standards, from relevant International Standards i.e. ISO 1836, ISO 3077, or from the chain manufacturer's recommendations.

6 In-service testing of chain

6.1 A specified in-service test may be required by the Regulating Authority. In no case should test values and test intervals be more severe than the following recommendations, bearing in mind that severe overload tests, repeated too frequently, may cause damage where none previously existed:

6.1.1 Routine tests should not be made more often than at annual intervals, additional tests being made only on replacement of load bearing parts of the appliance itself.

6.1.2 The test force should not exceed either 1,5 times the working load limit of the chain or 1,5 times the rated capacity of the appliance.

6.1.3 The test force should be applied gradually to the length of chain in its normal assembly in the appliance.

6.1.4 A link by link inspection should be made following the test, using the procedure given under periodic inspection (see 4.2.2).

6.2 A chain which passes the test and inspection may continue in service.

7 Repair of chain

Highly specialized equipment and technology are required to produce calibrated lifting chains. Repair of these chains is not recommended.

8 Record keeping

8.1 Adequate records as a part of periodic inspection are essential for the proper use of calibrated chains.

8.2 The chain record should include a complete description and identification of the new chain, the date and results of each inspection, the date and results of each test and the date and description of any maintenance.

8.3 The record is a continuous history of the chain and shows that it has been regularly inspected and maintained in good operating condition.

8.4 When the chain is removed from service, a new record should be prepared for the replacement chain.