

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 1082

SHACKLE TYPE CONNECTOR UNITS
FOR HIGH-TENSILE STEEL CHAIN FOR CONVEYORS

1st EDITION

May 1969

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BRIEF HISTORY

The ISO Recommendation R 1082, *Shackle type connector units for high-tensile steel chain for conveyors*, was drawn up by Technical Committee ISO/TC 82, *Mining*, the Secretariat of which is held by the Deutscher Normenausschuss (DNA).

Work on this question led to the adoption of a Draft ISO Recommendation.

In December 1967, this Draft ISO Recommendation (No. 1289) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Iran	South Africa
Belgium	Israel	Spain
Chile	Italy	Sweden
Czechoslovakia	Japan	Turkey
France	Korea, Rep. of	U.A.R.
Germany	Netherlands	United Kingdom
Greece	New Zealand	Yugoslavia
India	Poland	

No Member Body opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in May 1969, to accept it as an ISO RECOMMENDATION.

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SHACKLE TYPE CONNECTOR UNITS FOR HIGH-TENSILE STEEL CHAIN FOR CONVEYORS

1. SCOPE

This ISO Recommendation covers the requirements for a range of high grade, special purpose connector units, each consisting of the following components :

- (a) shackle type connector (part (a) in the Figure, page 9);
- (b) connector bolt (part (b) in the Figure);
- (c) connector nut (part (c) in the Figure).

The Figure illustrates the preferred ruling dimensions, set out in Table 1, and also the position of identification marking. It is not intended to indicate a complete design.

2. FIELD OF APPLICATION

The units described in this ISO Recommendation are specially manufactured for use with calibrated high-tensile steel chains (round link) in mining (see ISO Recommendation R 610, *High-tensile steel chains (round link) for chain conveyors and coal ploughs*).

This ISO Recommendation covers a size range from 14 mm to 18 mm diameter.

Three grades of quality — A, B and C — are quoted with regard to the mechanical properties of the connector units.

3. DEFINITIONS

For the purpose of this ISO Recommendation the following definitions apply.

- 3.1 *Size*. The nominal diameter of the chain for which the connector is made.
- 3.2 *Test load*. The load to which a sample of finished connector units should be subjected in order to determine the extent of permanent elongation.
- 3.3 *Ultimate breaking load*. The maximum load which the connector units withstand during the course of a test to destruction.
- 3.4 *Processing*. Any treatment of the components of the connector units subsequent to forging; for example, heat treatment, machining, polishing or other surface treatment.
- 3.5 *Inspector*. The representative of the purchaser.
- 3.6 *Lot*. An agreed number of chain connectors from which the prescribed number of samples have to be taken for the specified test(s) (see clause 5.2.2).
- 3.7 *Acceptance test*. Any test carried out by the inspector on the samples selected by him.

4. COMPONENTS OF CONNECTOR UNITS

4.1 Shackle type connectors

4.1.1 *Material.* The steel used in the manufacture of the connectors should be fully killed and of forgeable quality and such that the finished components, suitably heat treated, meet the specified requirements with regard to mechanical properties. The steel should be of a type not liable to any kind of embrittlement, including strain-age embrittlement.

Within the above limitations and unless otherwise specified, the selection of steel is the responsibility of the manufacturer of the connectors.

4.1.2 *Heat treatment.* The connectors covered by this ISO Recommendation should be heat treated in the course of manufacture; heating to a temperature between 30 and 50 °C above the upper critical point (A_{c3}) of the steel used should form part of such heat treatment.

4.1.3 *Workmanship.* All connectors should be sound and free from cracks, surface flaws, laminations and other defects. They should be finished in a workmanlike manner and should in all respects comply with appropriate forging specifications.

4.1.4 *Surface condition.* Unless otherwise agreed between the purchaser and the manufacturer, the connectors are to be supplied unpolished and free from any coating. The respective quality grades may, however, be identified by markings of different colours. Defects should not be disguised.

4.1.5 *Identification marking.* Where identification marking is applied during manufacture of the components, the marks are to be placed in either or both of the positions shown in the Figure, and these should comply with the requirements of clause 6.2.

4.1.6 *Dimensions.* The shackle type connector (part (a) in the Figure) should be produced to the preferred ruling dimensions shown in Table 1, for the appropriate size of chain. All other dimensions should be chosen in such a manner as to ensure correct mating between the connector and the associated sprocket, scraper bar and conveyor pan.

4.2 Connector bolt and nut

4.2.1 *Dimensions.* Apart from the dimensions specified in Table 1, the design of the bolt (part (b) in the Figure) and nut (part (c) in the Figure) is optional but, where practicable, bolts and nuts in compliance with ISO Recommendation R 272*, *Hexagon bolts and nuts – Widths across flats, heights of heads, thicknesses of nuts – Metric series*, should be used.

NOTE. – Where other than ISO bolts and nuts are used, their identifying marking should be the subject of agreement between the purchaser and manufacturer.

4.2.2 *Mechanical properties.* The mechanical properties of the connector bolt (part (b) in the Figure) and the connector nut (part (c) in the Figure) are quoted in Table 2, for guidance; properties conforming to national standards may be adopted until such time as relevant international standards are published.

5. SAMPLING AND TESTING

5.1 General

The dimensional and mechanical properties required for each of the three grades of quality are shown in Tables 1 and 2.

The manner of testing to ascertain that the connector units meet the specified properties, and the rate of testing, are as stated in the remaining clauses of section 5. The tests include an optional dynamic test.

Arrangements for the acceptance tests (see clause 3.7) should be agreed between the purchaser and the manufacturer at the time of ordering.

* 2nd edition, 1968.

5.2 Sampling

5.2.1 *Method of sampling.* Unless otherwise specified by the purchaser, the following arrangements should apply :

- (a) test samples are selected at random by the inspector and at his discretion;
- (b) test samples are to be in the same condition as the bulk of the chain connectors and free from any coating which might obscure defects.

5.2.2 *Rate of sampling.* The chain connectors to be tested should be selected as follows, noting that a lot will normally consist of 500 connectors, unless otherwise agreed between the purchaser and manufacturer :

Dimensional test	Five samples per lot
Static test	One sample per lot
Dynamic test or stress reversal test	One sample per five lots; at least one sample.

5.3 Testing

5.3.1 *Dimensional tests.* The dimensions of the finished connectors should be as shown in Table 1, particular attention being given to the requirements of clause 4.1.6.

5.3.2 *Static tensile tests*

- (a) **TEST CONDITIONS.** For the purpose of the test the finished connector should be assembled with a connector bolt and nut, and a suitable spacer. The whole assembly should be tight.
The thickness of the spacer should be such that the distance between the legs of the connector being tested is the same as that between the legs of the assembled connector in use.
During tightening, the torque applied to the nut should not exceed the relevant value listed in Table 2 and should be not less than 50 % of that value.
The type and accuracy of the testing machine should be in accordance with the relevant national standard(s). The testing machine should be used only within its appropriate range, as shown by the test certificate for the machine.
- (b) **ELONGATION UNDER TEST LOAD .** The connector unit should be subject to a pre-stressing load not greater than half of the specified test load. Thereafter the load should be decreased to a setting load equivalent to 2.5 kgf/mm² (see Table 2) and the outside length of the connector measured and recorded.
The load should then be increased at a rate of approximately 1 kgf/mm² per second to the test load specified in Table 2, and the outside length of the connector again measured.
The total elongation so determined should not exceed the value shown in Table 2.
- (c) **ULTIMATE BREAKING LOAD .** Following the application of the test load, the load should then be increased further until the sample breaks (see (d) below).
The ultimate breaking load determined by the test should be not less than the appropriate value stated in Table 2.
If, during the acceptance test, the sample does not reach the ultimate breaking load stated in Table 2, because of prior failure of the connector bolt or nut, the test is void and should be repeated on another sample.
- (d) **PERMANENT ELONGATION .** After the test break, the broken parts of the connector should be put together and the outside length (dimension *C* in Table 1) of the connector should be measured.
The permanent elongation determined by the test should be not less than the minimum value given in Table 2. Provided the minimum specified values for load and permanent elongation have clearly been exceeded the test may be terminated before fracture takes place. This procedure simplifies the necessary measurements but it should be agreed between the manufacturer and the purchaser.

5.3.3 *Dynamic tests pulsator tests*). Where dynamic tests are required and are agreed between the purchaser and the manufacturer, details should be stated on the enquiry and order. The following conditions should apply to such tests :

Samples should be selected in accordance with clause 5.2.

These samples, assembled as specified in clause 5.3.2 (a), should be subjected to load pulsations, between the limits of load specified in Table 3, at a frequency of 500 pulsations per minute, until breakage occurs (see Note, below).

The temperature of the connector during the test should remain between 20 and 50 °C.

The total number of pulsations withstood by the sample should be recorded on the test certificate and should be not less than the appropriate number specified in Table 2.

NOTE. — By agreement between the purchaser and the manufacturer, alternative test frequencies may be selected from the range 300 to 700 pulsations per minute. In such cases the frequency adopted should be stated on the test certificate. The minimum specified number of pulsations (see Table 2) is based on a test frequency of $500 \pm 10\%$.

With higher frequencies the sample is likely to withstand a greater number of load pulsations; with lower frequencies a smaller number of pulsations is to be expected, owing to an increase in deformation. This should be taken into account when interpreting the results.

6. INSPECTION PROCEDURE

6.1 Acceptance

When every sample from a lot of connector units fulfils all the specified test requirements, that lot of units is acceptable.

Should any of the samples fail to meet any of the specified tests, two further samples should then be selected from the same lot. If both these additional samples meet all the specified tests, the lot is acceptable; if not, the lot should be rejected.

6.2 Marking

6.2.1 *Identification marking*. During manufacture the connectors should be legibly marked so as to indicate the manufacturer, the quality grade and, by agreement between the purchaser and the manufacturer, any other information.

6.2.2 *Inspection marking*. Provided the results of all specified tests are satisfactory, the inspector should signify his acceptance of each lot. The precise extent and nature of the inspection marking to be used should be subject to agreement between the purchaser and the manufacturer.

It is recommended that the inspector's stamp be applied to a number of the actual components in each lot, or to seals or tags wired to the components.

6.3 Test certificate

The manufacturer should supply a certificate of test and examination with every consignment of connector units supplied as conforming to this ISO Recommendation; when agreed between the purchaser and the manufacturer, identification of the cast number of the steel is to be stated. This also applies in instances where connector units are supplied as part of a complete conveyor chain assembly.

The certificate should be signed by the manufacturer, and by the inspector if he witnessed the inspection tests.

6.4 General inspection

For the purpose of witnessing the specified tests and of satisfying himself as to the accuracy of the testing machines and methods of examination, the inspector should be given access to the relevant parts of the manufacturer's works at all reasonable times.

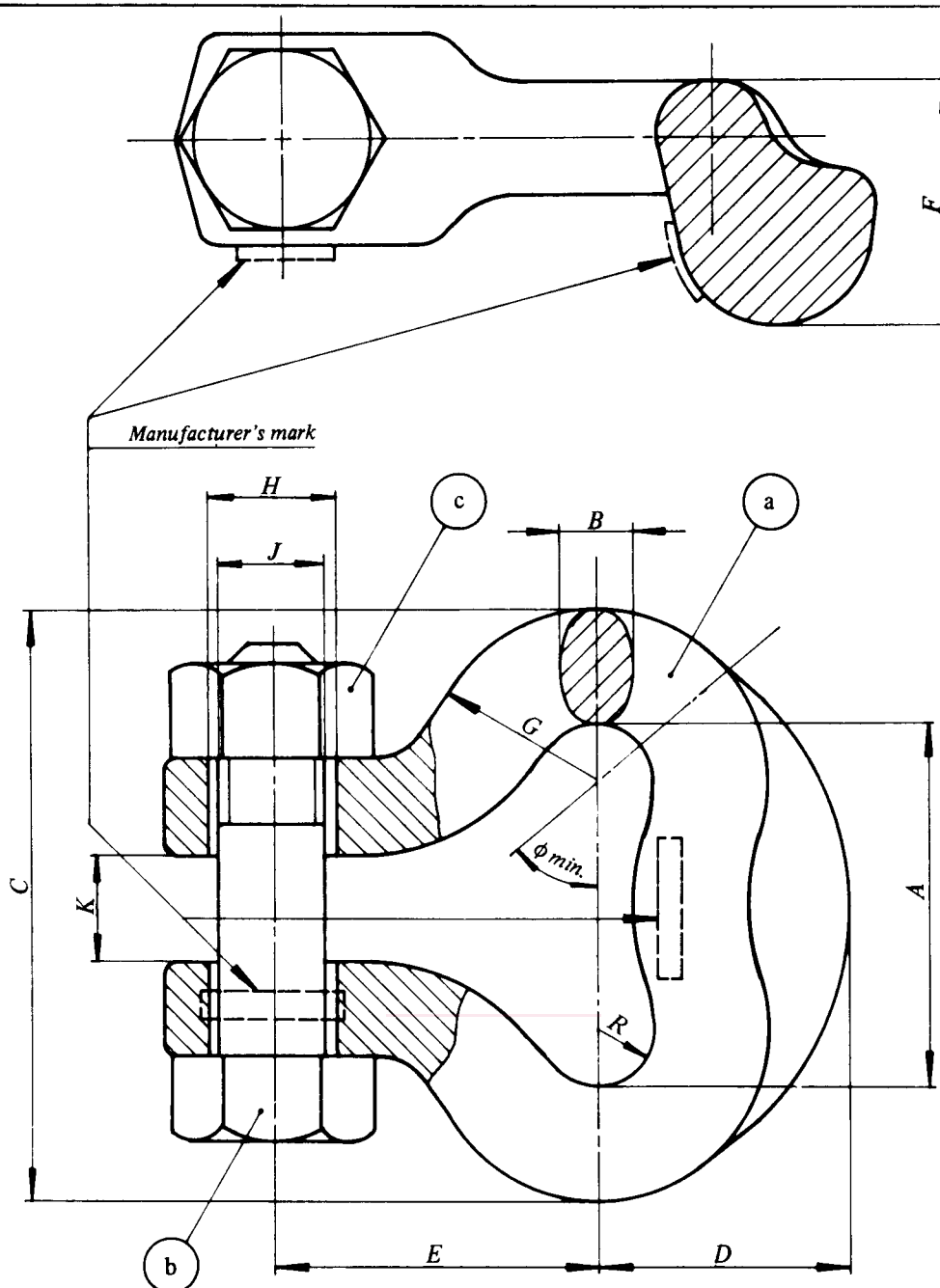


FIGURE – Shackle type connector unit

TABLE 1 – Dimensions of shackle type connector units

Size of chain (wire dia. x pitch)	A		B		C	D	E	F	G	H	J	K*	R	φ
	max.	min.	max.	min.	max.	max.		max.	max.	nom.		min.	min.	min.
14 X 50	50	48	16	14	81	32	51 ± 1	35	25	18	M.16**	16	8	45°
16 X 64	64	62	18	16	99	45	55 ± 1	40	28	22	M.20**	18	9	45°
18 X 64	64	62	20	18	103	45	55 ± 1	42	32	22	M.20**	20	10	45°

* In assembled condition.

** As agreed between purchaser and supplier, but generally in accordance with ISO Recommendation R 272, Hexagon bolts and nuts – Widths across flats, heights of heads, thicknesses of nuts – Metric series (2nd edition, 1968).

TABLE 2 – Mechanical properties

Connector unit								Bolt	Nut	Torque on spanner
Grade	Size of chain (wire dia. x pitch)	Setting load (equivalent to 2.5 kgf/mm ²)	Test load	Total elongation at test load (max.)	Breaking load (min.)	Permanent elongation at break (min.)	Pulsations for dynamic test (min.)	Property class*		
	mm	tf	tf	%	tf	%			kgf·m	
A	14 X 50	0.8	11	2	15	8	20 000	4.6	4.8	9.5
	16 X 64	1.0	14		20					18
	18 X 64	1.3	18		25					18
B	14 X 50	0.8	15	2	19	6	40 000	8.8	6.8	18
	16 X 64	1.0	20		25					30
	18 X 64	1.3	25		32					30
C**	14 X 50	0.8	20	2	25	6	40 000	8.8	6.8	18
	16 X 64	1.0	26		32					30
	18 X 64	1.3	33		41					30

* See ISO Recommendation R 871, *Mechanical properties of fasteners – Part 1 : Bolts, screws and studs*.

** All the values given for grade C are provisional, as grade C components are at present in the stage of development. They will be subject to later consideration, as more experience is gained.

TABLE 3 – Dynamic (pulsator) test of connector unit

Size of chain (wire dia. x pitch)	Limiting load	
	Lower (equivalent to 5 kgf/mm ²)	Upper (equivalent to 5 kgf/mm ²)
mm	tf	tf
14 X 50	1.5	7.7
16 X 64	2.0	10.1
18 X 64	2.5	12.7