NATO STANDARDIZATION AGENCY
AGENCE OTAN DE NORMALISATION

MILITARY COMMITTEE LAND STANDARDIZATION BOARD (MCLSB)

28 February 2011 NSA(ARMY)0141(2011)HIS/3542

MCLSB

STANAG 3542 HIS (EDITION 6) - TECHNICAL CRITERIA FOR THE TRANSPORT OF CARGO BY HELICOPTER

Reference: NSA(ARMY)0473-HIS/3542 dated 18 May 2005 (Edition 5)

1. The enclosed NATO Standardization Agreement, which has been ratified by nations as reflected in the NATO Standardization Documentation Database (NSDD), is promulgated herewith.

2. The reference listed above is to be destroyed in accordance with local document destruction procedures.

3. The MCLSB considers this an editorial edition of the STANAG; previous ratifying references and implementation details are deemed to be valid.

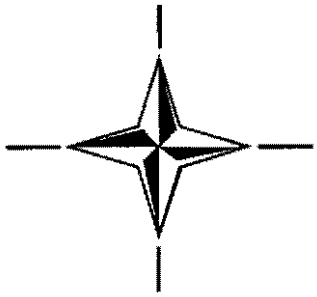
Cihangir AKSIT, TUR Civ
Director, NATO Standardization Agency

Enclosure:
STANAG 3542 (Edition 6)

STANAG 3542
(Edition 6)

NORTH ATLANTIC TREATY ORGANIZATION

(NATO)



NATO STANDARDIZATION AGENCY
(NSA)

STANDARDIZATION AGREEMENT
(STANAG)

SUBJECT: TECHNICAL CRITERIA FOR THE TRANSPORT OF CARGO BY HELICOPTER

Promulgated on 28 February 2011

Cihangir AKSIT, TUR Civ
Director, NATO Standardization Agency

RECORD OF AMENDMENTS

No.	Reference/date of amendment	Date entered	Signature

EXPLANATORY NOTES

AGREEMENT

1. This STANAG is promulgated by the Director NATO Standardization Agency under the authority vested in him by the NATO Standardization Organisation Charter.

2. No departure may be made from the agreement without informing the tasking authority in the form of a reservation. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

4. Ratification, implementation and reservation details are available on request or through the NSA websites (internet http://nsa.nato.int; NATO Secure WAN http://nsa.hq.nato.int).

FEEDBACK

5. Any comments concerning this publication should be directed to NATO/NSA – Bvd Leopold III - 1110 Brussels - Belgium.

STANAG 3542
(Edition 6)

NATO STANDARDIZATION AGREEMENT (STANAG)

TECHNICAL CRITERIA FOR THE TRANSPORT OF CARGO BY HELICOPTER

Annexes
- A. Interface Dimensions of Cargo Hooks and Relationship to Attachment Rings or Shackles
- B. Lateral and Forward Deformation Characteristics
- C. Size, Openings and Clearance Dimensions for Suspension Points on Cargo

Related Documents:
- STANAG 2286 HIS - Technical criteria for external cargo carrying slings, nets and strops/pendants
- STANAG 2445 HIS - Criteria for the Clearance of Underslung Loads and Helicopter Underslung Load Equipment (HUSLE)

AIM

1. The aim of this document is to provide standardized technical criteria for the design of future equipment used in the transport of cargo by helicopter.

AGREEMENT

2. Participating nations agree that the criteria established by the following paragraphs will apply for the carriage of cargo by helicopter.

DETAILS OF THE AGREEMENT

3. Carriage of Internal Loads

a. In-Flight Cargo Restraint. The following criteria are applicable to the restraint of cargo carried internally whether or not on pallets.

(1) Cargo Lashings. Will be as light as possible; require minimum storage space when not in use; be easy to install and remove; be easily and reliably adjustable for different sizes and shapes of cargo; be clearly marked with the strength to which they may be used; provide sufficient restraint of cargo in all directions so as to prevent shifting in flight during turbulent weather and under hard landing conditions and shall not be capable of inadvertent disconnection due to forces experienced in flight.

(2) Minimum Restraint Factors

Against	forward movement	3.0

Against	side movement	1.5
Against	aft movement	1.5
Against	upward movement	2.0
Against	downward movement	4.0

(a) The above factors should be assumed to act uni-directionally (i.e. not in combination) and refer to the ultimate strength of restraint equipment in a controlled crash situation.

(b) When the national air transport regulations of the country providing the aircraft require higher factors than those above, it is the responsibility of that nation to provide the additional restraint required.

(3) All transport helicopters will be equipped with lashings for one or more of the following categories:

5000 N, 25000 N, 50000 N and 100000 N

(4) Floor Tie-Down Fittings

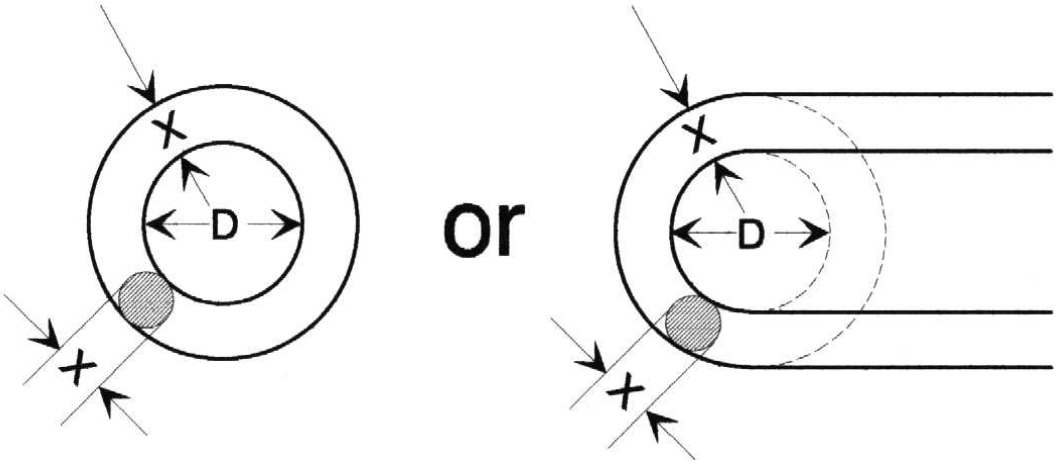
(a) Strengths: Floor tie-down fittings shall be of one or more of the following categories having minimum ultimate strengths in all directions to resist forces of:

5000 N, 25000 N, 50000 N and 100000 N

(b) Locations: A 500 mm grid pattern, for cargo tie-down fittings commencing with the floor centre line, shall be standard for all future helicopters designed to carry cargo. Variations are acceptable only where a 500 mm grid is not technically feasible.

(c) Dimensions:

Capacity	Min. Clear Opening D (mm)	Min. Diameter of Cross Section X (mm)	Max. Diameter of Cross Section X (mm)
5000 N	32	4	5
25000 N	51	11	13
50000 N	51	11	16
100000 N	76	11	22



(d) Markings. The strength category to which the tie-down fitting can be used is to be shown. This is to be done by one of the following methods:

i The strength being marked on the fitting itself or on the floor area immediately adjacent to the fitting.

ii The strength being recorded by suitable stencilling inside of the aircraft cargo compartment.

iii A metal plate with a diagram indicating strengths and locations of tie-down fittings being placed in a clearly visible position in the aircraft cargo compartment.

iv A chart showing the strength and locations of tie-down fittings being readily available in each aircraft.

b. Crashworthy Cargo Restraint. Cargo restraints should be capable of maintaining their integrity under longitudinal accelerations of 16 g peak with a change in velocity (V final - V initial) of 13m/sec (43ft/sec) and lateral accelerations of 10 g peak with a change in velocity of 9m/sec (30ft/sec) or to the structural limits of the fuselage. If the structure of the fuselage and floor is not strong enough to withstand cargo crash loads, energy absorbers may be used to limit the loads transmitted to the structure. The lateral and forward peak load by plastic deformation of cargo lashing (absorbers) to failure is shown in Annex B (Figures 1 and 2 respectively).

c. Restraint Devices. Nets used to restrain small bulk cargoes and restraint lines used to restrain large items of cargo should be constructed of material with low elongation characteristics so as to minimize dynamic overshoot.

4. Carriage of External Cargo

a. Sling System Load Factors. When carrying the maximum permitted load, the slinging system must have an ultimate strength in vertical direction based on a total factor of 4.3, (which is obtained by multiplying a 2.5 flight loadfactor by a 1.5 safety factor and by a 1.15 aerodynamic factor).

b. Helicopter External Cargo Hook

(1) Lift Capacity: To ensure that helicopter cargo hooks can support loads in designed weight ranges, hook capacity is categorized as follows:

"Light"	up to and including 2500 kg
"Medium"	over 2500 kg to 5000 kg
"Heavy"	over 5000 kg to 10000 kg
"Extra Heavy"	over 10000 kg

NOTE: Under normal operating conditions and not related to the maximum lift capacity of the helicopter.

(2) Dimensions. The specific dimensions of the cargo hooks for the above categories are at Annex A. In reaching these dimensions consideration has been given to the types and sizes of attachment devices to be utilized to connect slings to the hook.

(3) Operation. Operation of the hook release may be mechanical, automatic, electric or a combination of all, but an overriding emergency release must be provided. Emergency releases should be operable by the helicopter crew from inside the helicopter and by the loading team outside the helicopter.

c. Attachment Rings or Shackles. Sling, net or strop attachment rings or shackles are to be designed to be compatible with the range of hooks at paragraph 4.b. above. The maximum cross-section dimensions of attachment devices to be fitted to the helicopter cargo hook are at Annex A

d. Slings. A safety factor of 4.3 must be achieved for any sling when used at its maximum lift capacity with a corresponding maximum leg angle. Accordingly use of a sling beyond the published maximum angle attracts a lower load capacity. Furthermore, sling capacities may be further reduced when lifting asymmetric loads with a displaced centre of gravity in the horizontal plane and when slings (of certain materials) have been subject to actinic or temperature degradation.

e. Strops/Pendants

(1) Strops/pendants must comply with factor 4.3 shown at paragraph 4.a.

(2) Secondary Hooks. These should be capable of accepting the same attachment rings or shackles as the helicopter external cargo hook (see paragraph 4.b above). If it is not capable of doing this, the nation providing the hook must also supply suitable adaptors.

(3) Swivels. Strops used with single hook operations are to incorporate a swivel connection at either the top or lower end, to enable the load to spin about a vertical axis. This point is not valid for helicopters equipped with swivel-hooks.

f. Nets. All helicopter nets used for the carriage of external underslung cargo must be capable of withstanding 4.3 g throughout their entire service life.

g. Suspension Points on Cargo. Future design of cargo to be transported externally should be capable of meeting the following criteria:

(1) Suspension points should be spaced as far from the centre of gravity (C of G) with a distribution as symmetrical as possible. If exact weight symmetry cannot be achieved, limited asymmetry is permissible provided the ratio of the largest vertical force to the smallest vertical forces does not exceed the factor 1.2.

(2) Suspension points should, if possible, be on a horizontal plane above that of the C of G, and placed so that the lifting sling will not damage or be obstructed by any part of the equipment.

(3) Each suspension point must be stressed to withstand its proportionate share of the ultimate load factor of 4.3 or greater.

(4) The dimension of suspension points on cargo must meet the criteria defined in Annex C.

(5) Suspension points should be clearly marked.

5. Helicopter Cross Operations

a. All equipment used in helicopter cross operations will be duly licensed/certified according to national regulations of the nation providing the equipment and operated in accordance with the operating instructions.

b. Clearance of other nations equipment as used in this context is completely described in para 7. of STANAG 2445.

IMPLEMENTATION OF THE AGREEMENT

6. This STANAG is considered implemented when a nation has issued instructions that all future equipment procured for its forces will be manufactured in accordance with the specifications detailed in this agreement.

ANNEX A TO
STANAG 3542
(Edition 6)

INTERFACE DIMENSIONS OF CARGO HOOKS AND RELATIONSHIP TO ATTACHMENT RINGS OR SHACKLES

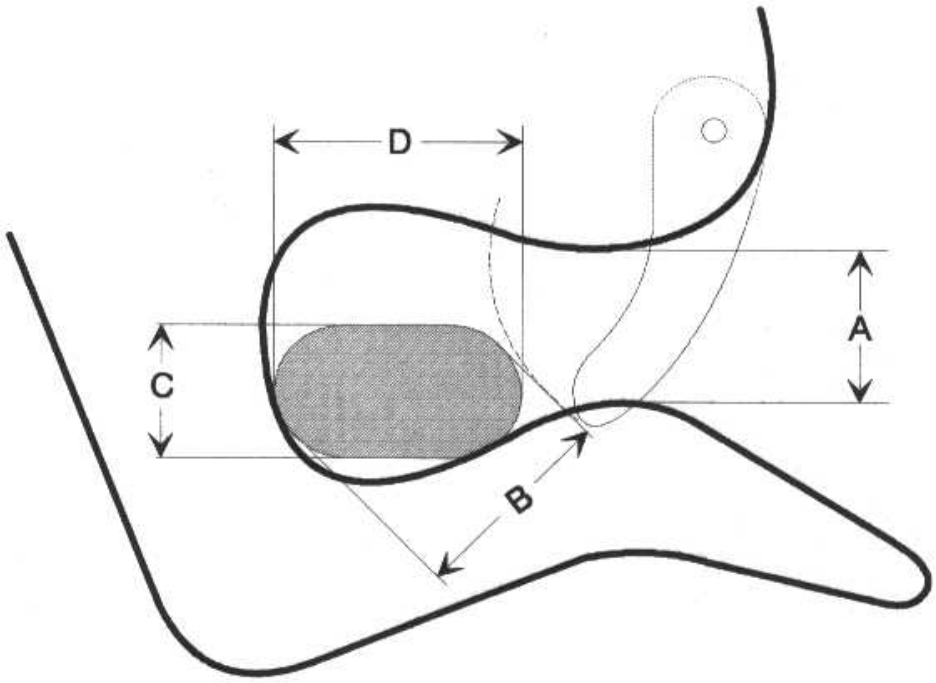
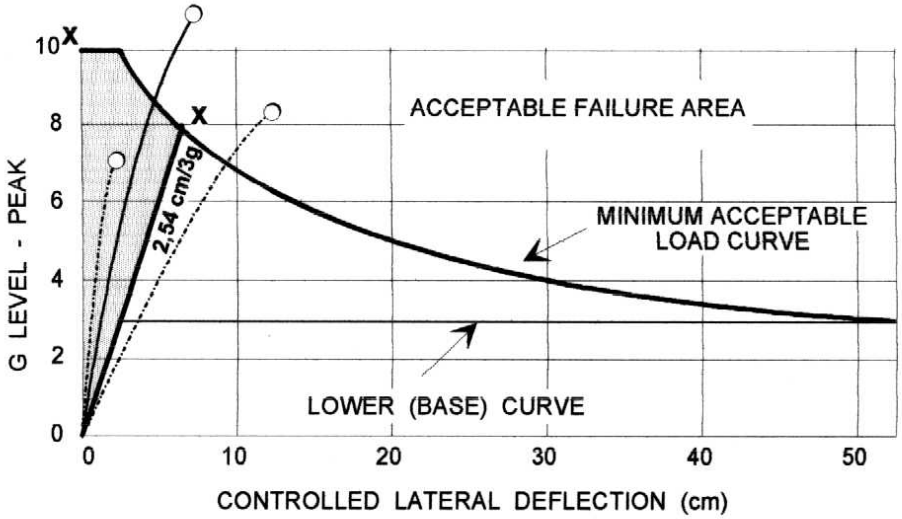


FIGURE A 1. INTERFACE DIMENSIONS OF CARGO HOOKS

CARGO HOOK DIMENSION	MINIMUM CLEARANCE (mm)		MAX. CROSS-SECTION RINGS / SHACKLES (mm)	
	A	B	C	D
LIGHT	38	50	36	48
MEDIUM	48	62	46	60
HEAVY	60	73	58	71
EXTRA HEAVY	52	76	50	74

ANNEX B TO
STANAG 3542
(Edition 6)

LATERAL AND FORWARD DEFORMATION CHARACTERISTICS



CODE FOR SAMPLE CURVES

○ FAILURE LOAD

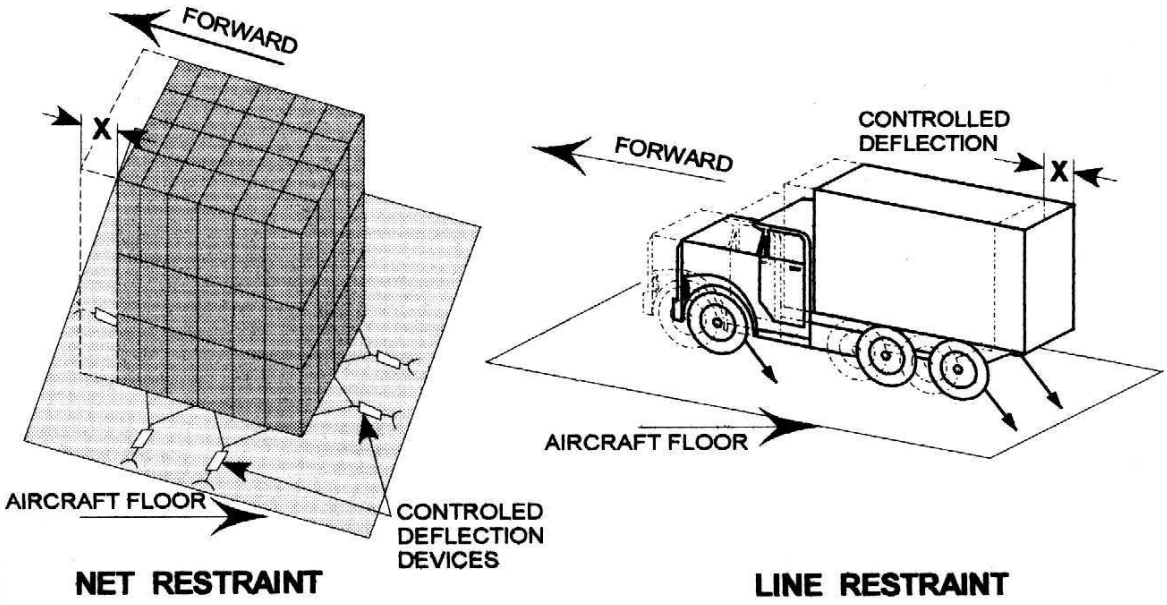
..... UNACCEPTABLE PERFORMANCE

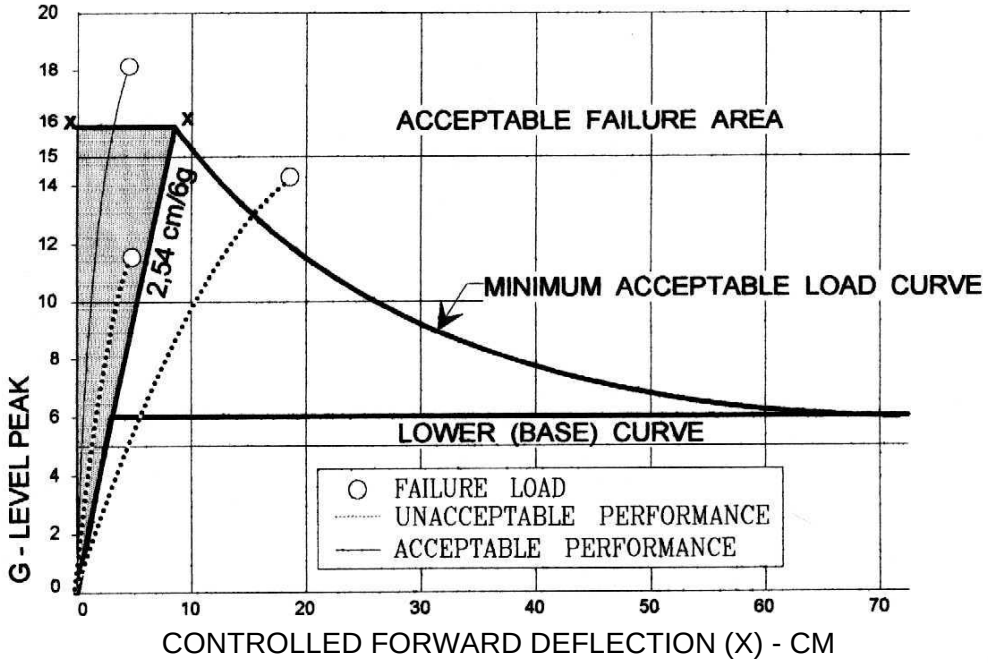
——— ACCEPTABLE

NOTE:

All acceptable "G" Level Peak vs Controlled Lateral Deflection Curves must remain within the shaded area until crossing the line X – X. Breakage of cargo restraint material may only occur above the minimum acceptable load curve.

FIGURE B 1. LATERAL LOAD DEFLECTION REQUIREMENTS FOR CARGO RESTRAINT SYSTEMS





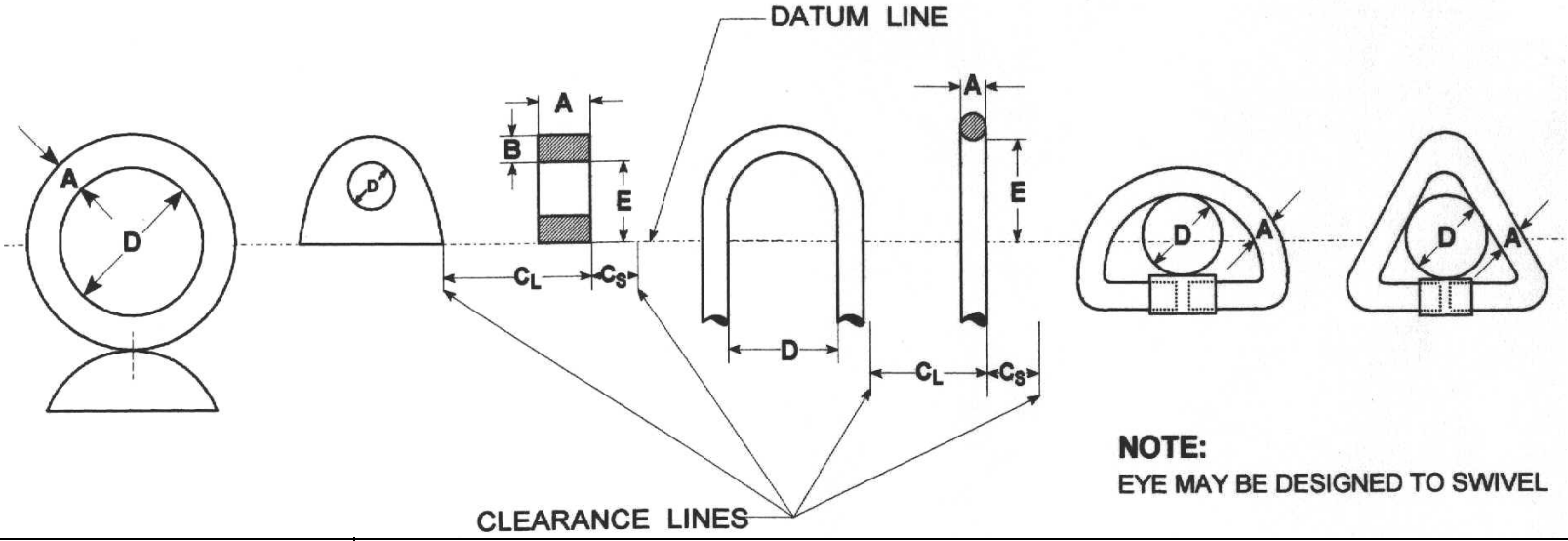
NOTE:

All acceptable "G" Level Peak vs Controlled Forward Deflection Curves must remain within the shaded area until crossing the line X – X. Breakage of cargo restraint material may only occur above the minimum acceptable load curve.

FIGURE B 2. FORWARD LOAD - DEFLECTION REQUIREMENTS FOR ENERGY-ABSORBING CARGO RESTRAINT SYSTEMS

ANNEX C TO
STANAG 3542
(Edition 6)

SIZE, OPENINGS AND CLEARANCE DIMENSIONS FOR SUSPENSION POINTS ON CARGO



MASS RANGE OF EQUIPMENT		DIMENSIONS IN MILLIMETRES					
		A MAX	B MAX	CL MIN*	CS MIN	D MIN	E MIN
KILOGRAMS		MM	MM	MM	MM	MM	MM
up to	5000	25.4	25.4	178	76	76	76
over	5000 up to 10000	38.1	28.6	229	102	76	76
over	10000 up to 20000	50.8	38.1	305	127	76	89

* There shall be no interference of obstruction within the dimensions CL and CS that could interfere with engaging a shackle and pin in the eye. Either side of the eye may be used as the datum from which to measure CL and CS.

FIGURE C 1.