TOWNLEY
FORGING AUSTRALIAN QUALITY

Celebrating 100 YEARS

Collared Eyebolts – AS2317

Introduction

Eyebolts are used in lifting, tensioning and staying systems for connection to a tapped hole. In any lifting, tensioning or staying systems, the safe working load of each component shall take account of the conditions and shall be compatible with any loads inherent in and applied to the system, and each component should readily connect with each adjacent component. Therefore, it is important that components of lifting, tensioning or staying systems be quickly and positively identified in service for size, lifting capacity and quality grade.

Material

Eyebolts are manufactured from raw material complying with the relevant requirements of Table 1 and either AS 1442 or AS 1444, or be of another material that meets the intent of AS 2317 – 1998.
Townley Manufacture exclusively from Australian made steel.

Table 1 - Material

Steel Type	Product analysis of elements, Maximum allowable %			Indicative Minimum tensile Strength, Mpa
	Carbon	Phosphorus	Sulphur	
Fully killed Fine-grained	0.45	0.045	0.045	500

Design and Manufacture

Townley Eyebolts are drop forged cleanly in one piece, using the closed die method of forging
As per the Standard, screw threads are coarse pitch metric threads complying with AS 1721. BS 4278 also complies with AS 2317
Townley also manufacture imperial eyebolts in BSW or UNC, as well as Fine thread and other special thread forms.
Surface finish is optional; the following comply with the Standard

a) Self Coloured
b) Hot Dip Galvanized coating complying with AS 1650.
c) Class A1, Class A2 or Class B phosphate coating complying with AS 1627.6.
d) Fe/Zn 12c electroplated zinc coating complying with AS 1789.
e) Fe/Cd 12c electroplated cadmium coating complying with AS 1790.
f) Painted.

Mechanical Properties

Axial Strength – Eyebolts need to be capable of supporting the relevant strength test force specified in Table 2.
Transverse Strength – Eyebolts need to be capable of supporting a force of **25%** of that specified for axial strength in Table 2.

Table 2 – Working Load Limits and Test Forces

Nominal Size	WLL .t	Test Forces KN		
		Strength test, minimum		Proof Test
		Axial	Transverse	
M10	0.25	14.8	3.7	5.0
M12	0.40	23.6	5.9	7.9
M16	0.80	47.1	11.8	15.7
M20	1.60	94.2	23.6	31.4
M22	2.00	118.0	29.5	39.3
M24	2.50	148.0	36.8	49.1
M30	4.00	236.0	58.9	78.5
M33	5.00	295.0	73.6	98.1
M36	6.30	371.0	92.8	124.0
M39	7.00	413.0	104.0	138.0
M42	8.00	471.0	118.0	157.0
M48	10.00	589.0	148.0	197.0
M56	15.00	883.0	221.0	295.0
M64	20.00	1180.0	295.0	393.0
M72	25.00	1480.0	368.0	491.0
M76	30.00	1770.0	442.0	589.0

NOTES:
1. Minimum axial destructive test force, in kilonewtons = 6 x 9.81 x (WLL in tonnes), rounded up to three significant figures.
2. Minimum transverse destructive test force = 25% of that for axial loading.
3. Production proof test force, in kilonewtons = 2 x 9.81 x (WLL in tones), rounded up to three significant figures, or to one decimal place where less than 10 kN

Marking

Collared Eyebolts to AS 2317 need to have the following markings:

a) Manufacturer's Identification
b) 'M' to denote ISO metric thread, coarse series; 'B' for BSW; or 'U' for UNC.
c) Nominal size, e.g. M16.
d) Identification Marking to correlate the eyebolt to the test certificate

Townley Drop Forge Pty Ltd
96 John Street, P.O. Box 12, Brunswick East, Victoria, 3057
Tel: +61 3 9387 4155 Fax: +61 3 9387 3685
Email: sales@townleydropforge.com.au Web: www.townleydropforge.com.au

Testing of Mechanical Properties

Townley conducts Type tests for every batch. Type tests are also conducted where there is a change in manufacturing process, grade of material, design and size.

Proof Testing

When required by the customer or end user, Townley proof tests each eyebolt to the proof test force specified in Table 2. The requirements of proof testing are as follows:

a) The eyebolt shall withstand the application of the test force, without sustaining any damage that may detrimentally affect its intended function or safety
b) After proof loading, the eyebolt shall be free from deleterious permanent set or defects that can be detected by visual inspection
c) A competent person shall verify that the eyebolt complies with the above requirements

The proof testing of each production batch of eyebolts is recorded on a test certificate.

a) Nominal Size
b) Surface Finish
c) Lifting capacity WLL or SWL
d) Proof Load
e) Date of Proof Test
f) Number Tested
g) Identification marking correlating with the eyebolt.
h) A declaration that the eyebolts comply with the Standard AS 2317 – 1998
i) The name and address of the manufacturer
j) The name and address of the testing facility
k) The name of the signatory

Information that needs to be supplied with enquiries and orders

a) Nominal Size
b) Thread Type
c) Surface finish
d) Lifting capacity
e) Whether proof testing is required
f) Whether a NATA test certificate is to be supplied
g) Whether additional testing is required i.e. material analysis, ultrasonic, magnetic particle, Brinell Hardness etc

Inspection before Use

1. Ensure the WLL is clearly legible.
2. Clean eyebolt and check for any signs of deformation, cracking, nicks, gouges and excessive bruising, wear or corrosion.
3. Threads should be concentric and fit neatly into a standard nut.
4. Check that the centre line of the eye is aligned with the centre line of the thread.
5. The threaded hole in which the eyebolt is to be fitted should also be carefully checked to ensure the hole is free from dirt, grease and other contaminants that could restrict the eyebolts from seating correctly in the hole. Particular attention should be paid to the hole thread to ensure it is in good condition.
6. Check that the hole thread and the eyebolt thread are compatible.
7. It is important to also carefully check the surface area around the threaded hole (which the eyebolt collar will sit on) to ensure it is clean, free from deformation, cracking or any other problem that may restrict the eyebolt seating correctly.

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Care and Use of Eyebolts

Small Eyebolts

Normally, eyebolts of sizes smaller than 12mm should not be used for general lifting, staying or tensioning purposes, as high torsional stresses are easily induced in these smaller sizes by being screwed up too tightly. However, where they are used, care should be taken to not cause excessive torsional stresses while they are being fitted to a threaded hole.

Matching of Threads

Extreme care should be taken to ensure that eyebolts are not screwed into threaded holes of a different size or type of thread. Accidents may be caused by eyebolts with metric threads being screwed inadvertently into tapped holes having a BSW or UNC thread and vice versa. Apart from force fits, the thread sizes listed in the table below may be wrongly matched with the risk that the eyebolt may pull out of the threaded hole below the design load.
The possibility of mixing threads has always existed, but it has been accentuated by the change to metric threads.
Where an eyebolt is removed from a threaded hole, it is recommended that the surface adjacent to the threaded hole be marked with the thread type and size and a plug be inserted into the threaded hole, or that other equally effective action is taken to reduce the possibility of mismatching threads. Where an eyebolt cannot be screwed by hand, the cause of the tight fit may be mixed threads.

Common Erroneously Matched Thread Sizes

Metric Eyebolt	BSW and UNC Hole Inches
M12	½”
M20	7/8”
M24	1”
M30	1 ¼”
M36	1 ½”
M42	1 ¾”
M48	2”
M56	2 ¼”
M64	2 ¾”
M72	3”

Threaded Attachment

Where an eyebolt is used in an untapped hole, the thread should engage a nut with a thread length of at least the full thickness of a standard sized nut.
Where an eyebolt is used with a tapped hole in a plate the length of thread engagement should be at least the nominal diameter of the thread. Where the undercut is not sufficient to allow for an adequate engagement of the collar, a parallel washer beneath the collar should be used so that an adequate engagement is achieved
If the nut side of the eyebolt is on a tapered surface, such as the inside flange of an RSJ beam, then a tapered washer should be used.

Tightening of eyebolts

Eyebolts should be screwed fully down to the face of the lifted load; however, excessive tightening of the eyebolt should be avoided. It should not be possible to enter a 0.04 mm feeler gauge at any position between the collar of an eyebolt and its seating. Where this condition is not achieved, any non-axial loading may overstress the screw thread.

Alignment of eye

Where correct alignment of the eye of an eyebolt is required but not accomplished at the first fitting, it should be achieved by the following methods:

a) Fitting a shim washer of steel under the collar. A shim washer should not be less in diameter than the diameter of the collar, and the thickness should be between 50% and 100% of the pitch of the threaded shank.
b) Machining the underside of the collar. The amount of material machined from the collar should not exceed 50% of the pitch of the thread on the shank of the eyebolts

Continuous Slings

A continuous sling should not be used with pairs of eyebolts (refer figure 3.5). Where a continuous sling is used with a pair of eyebolts, the load applied to the eyebolts is considerably increased by the tension in the horizontal portion of the sling and this may overstress the eyebolts.
Whenever lifting with eyebolts in pairs supported by slings, always use rigging assemblies with individual sling lengths.

Loading Not Aligned with Threaded End

Where the centre-line of loading is not in line with the axis of the threaded end of the eyebolt, including where a two-leg sling is connected to a pair of eyebolts to support a load, the following apply:
(a) The diameter of the boss of the tapped hole, into which the eyebolt is screwed, should be no less than the diameter of the collar of the eyebolt.
(b) The angle between the centre-line of the loading on the eye of the eyebolt and the plane containing the eye of the eyebolt should not exceed 5°, unless an adequate reduction is made to the WLL.
Where the perpendicular loading is applied (sometimes called ‘trunnion lifting’), the eye of the eyebolt should be aligned in the vertical plane.

Where two pairs of eyebolts are fitted to a single item, lifting should be effected by means of two two-leg slings and a spreader bar to ensure the load is distributed evenly across the eyebolts. This arrangement also allows the load to be readily applied to each eyebolt in the plane of the eye.

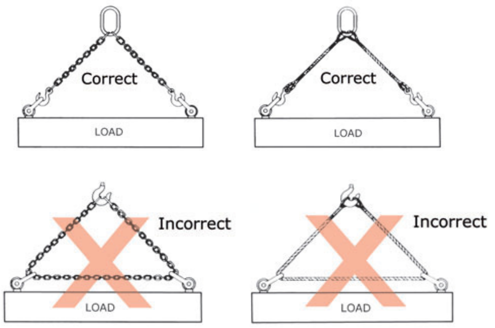
Use with a Single Eyebolt

Where a single eyebolt is used care should be taken to ensure that it remains screwed home throughout the lifting operation. If a single eyebolt is used for lifting and there is a possibility that the load will rotate or twist, a swivel should be used in the system to prevent the eyebolt unscrewing.

Service Eyebolts
Where service eyebolts are transferred from job to job, they should be examined periodically by a competent person. Should a screw thread show signs of wear or an eye show appreciable bruising, the eyebolt should be discarded

Attachment of slings
Eyebolts are not designed to have hooks attached directly to them. An approved shackle should always be fitted to the eyebolt and the slings are then attached to the shackle.

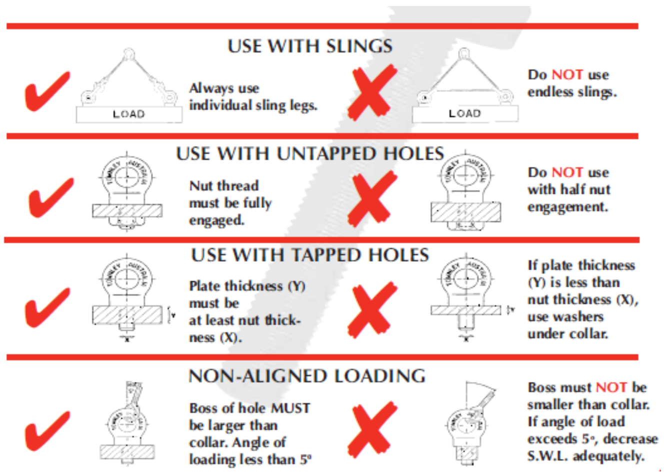
Working Load Limits On Pairs of Eyebolts
The Working Load Limits specified in the Australian Standard applies to a direct vertical loading. Where eyebolts are used in pairs and the lift is taken by means of two-legged slings, allowance must be made for the angle between the sling legs, and the Working Load Limit decreased accordingly. The table on the following page indicates Working Load Limit of two-legged slings with included angles of 30°, 60° and 90°, with the comparative value when the load is carried through a single eyebolt.
The load applied to eyebolts, when used in pairs and threaded with continuous slings, is increased considerably by the tension in the horizontal portion of the slings. It is most important, therefore, that continuous slings are not used. Correct and incorrect methods are indicated.



Correct and incorrect methods of pairing sling legs with eye bolts

GUIDELINES FOR GENERAL USE

- **IS THE EYEBOLT TIGHT?**
  Do not excessively tighten, but have less than 0.04mm gap between the collar and the face of the load.
- **HAS THE WORKING LOAD LIMIT BEEN CHECKED?**
  Make sure the W.L.L for the eyebolt is checked against the load being lifted.
- **DO THE THREADS MATCH?**
  The threads of the eyebolt and hole must match in both size and thread type
- **HAS THE EYEBOLT BEEN INSPECTED PRIOR TO USE?**
  Check the eyebolt for cracks, corrosion, deformation or thread damage and debris. Discard if worn.



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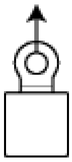
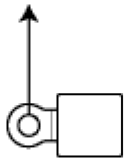
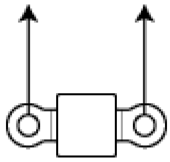
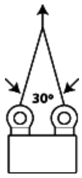
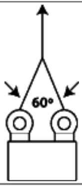
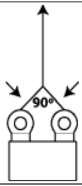
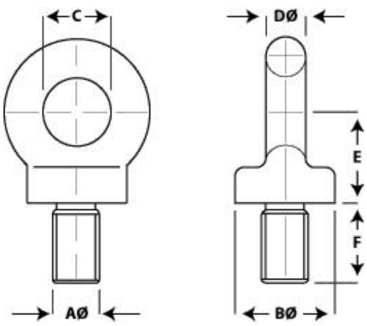
WORKING LOAD LIMIT (WLL)

Imperial Nominal	Metric Nominal	Axial WLL tonnes	Trunion Type Mounting WLL tonnes	Perpendicular Type Mounting WLL tonnes	0° - 30° WLL tonnes	31° - 60° WLL tonnes	61° - 90° WLL tonnes
							
3/8"	M10	0.25	0.06	0.12	0.31	0.20	0.12
1/2"	M12	0.40	0.10	0.20	0.50	0.32	0.20
5/8"	M14	0.40	0.10	0.20	0.50	0.32	0.20
5/8"	M16	0.80	0.20	0.40	1.00	0.64	0.40
3/4"	M18	0.80	0.20	0.40	1.00	0.64	0.40
3/4"	M20	1.60	0.40	0.80	2.00	1.28	0.80
7/8"	M22	2.00	0.50	1.00	2.50	1.60	1.00
1"	M24	2.50	0.62	1.25	3.10	2.00	1.25
1.1/8"	M30	4.00	1.00	2.00	5.00	3.20	2.00
1.1/4"	M33	5.00	1.25	2.50	6.30	4.00	2.50
1.1/2	M36	6.30	1.57	3.10	7.90	5.00	3.10
1.1/2"	M39	7.00	1.75	3.50	8.80	5.60	3.50
1.3/4"	M42	8.00	2.00	4.00	10.00	6.40	4.00
2"	M48	10.00	2.50	5.00	12.60	8.00	5.00
2.1/2"	M56	15.00	3.70	7.50	18.90	12.00	7.50
2.1/2"	M64	20.00	5.00	10.00	25.00	16.00	10.00
3"	M72	25.00	6.20	12.50	31.00	20.00	12.50
3"	M76	30.00	7.50	15.00	37.00	24.00	15.00

DIMENSIONS



Imperial AØ	Metric AØ	BØ	C	DØ	E	F	Net Weight (kg)
3/8”	M10	21	14	9	19	18	0.06
1/2”	M12	28	18	11	24	22	0.15
1/2”	M14	35	24	15	31	27	0.28
5/8”	M16	35	24	15	31	27	0.28
5/8”	M18	42	29	16	35	40	0.46
3/4”	M20	42	29	16	35	40	0.46
7/8”	M22	50	33	20	41	41	0.85
1”	M24	57	38	22	48	42	0.85
1 1/4”	M27	71	48	28	65	52	2.10
1 1/4”	M30	71	48	28	65	52	2.10
1 1/4”	M33	71	48	28	65	52	2.20
1 1/2”	M36	86	55	33	73	63	3.70
1 1/2”	M39	86	55	33	73	64	3.70
1 3/4”	M42	102	68	40	90	79	6.30
2”	M48	115	76	49	99	89	9.50
2 1/2”	M56	143	97	56	124	116	19.50
2 1/2”	M64	143	97	56	124	116	19.50
3”	M76	163	98	66	140	125	29.00

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