Chapter 26-2
Adjustable Hardware — Selection, Use, and Maintenance

SECTION 26-2.0: SCOPE

This Chapter applies to adjustable hardware, including turnbuckles, eyebolts, eye nuts, and swivel hoist rings.

SECTION 26-2.1: TYPES AND MATERIALS

26-2.1.1 Types

(a) Turnbuckles, including open and pipe body types with hook, eye, or jaw end fittings (see Fig. 26-2.1.1-1).

(b) Eyebolts, including shoulder nut, nonshoulder nut, nonshoulder machinery, and shoulder machinery types (see Fig. 26-2.1.1-2).

(c) Eye nuts (see Fig. 26-2.1.1-3).

(d) Swivel hoist rings (see Fig. 26-2.1.1-4).

(e) Adjustable hardware other than those detailed in this Chapter shall be used only in accordance with recommendations of the manufacturer or a qualified person.

(15) **26-2.1.2 Materials**

The hardware, excluding bushings and bearings, shall have sufficient ductility to permanently deform before losing the ability to support the load at the temperatures the manufacturer has specified for use.

SECTION 26-2.2: DESIGN FACTOR

The design factor for adjustable hardware shall be a minimum of 5.

SECTION 26-2.3: RATED LOADS

Rated load shall be in accordance with the recommendation of the hardware manufacturer. The terms *rated capacity* and *working load limit* are commonly used to describe rated load.

SECTION 26-2.4: PROOF TEST

(15) **26-2.4.1 Proof Test Requirements**

(a) New adjustable hardware is not required to be proof tested unless specified by the purchaser.

(b) All repairs to swivel hoist rings with bushings or bearings should be proof tested.

(c) Proof tested adjustable hardware shall be inspected after the test for the conditions stated in para. 26-2.8.5.

26-2.4.2 Proof Load Requirements

The proof load shall be a minimum of 2 times the rated load.

SECTION 26-2.5: IDENTIFICATION (15)

26-2.5.1 Turnbuckle, Eyebolt, and Eye Nut Identification

Each turnbuckle, eyebolt, and eye nut shall be durably marked by the manufacturer to show

(a) name or trademark of manufacturer

(b) size or rated load

(c) grade for alloy eyebolts

26-2.5.2 Swivel Hoist Ring Identification

Each swivel hoist ring shall be durably marked by the manufacturer to show

(a) name or trademark of manufacturer

(b) rated load

(c) torque value

26-2.5.3 Maintenance of Identification

Turnbuckle, eyebolt, eye nut, and swivel hoist ring identification should be maintained by the user so as to be legible throughout the life of the hardware.

SECTION 26-2.6: EFFECTS OF ENVIRONMENT

26-2.6.1 Temperature

(a) When adjustable hardware, excluding swivel hoist rings and carbon steel eyebolts, is to be used at temperatures above 400°F (204°C) or below −40°F (−40°C), the hardware manufacturer or a qualified person should be consulted.

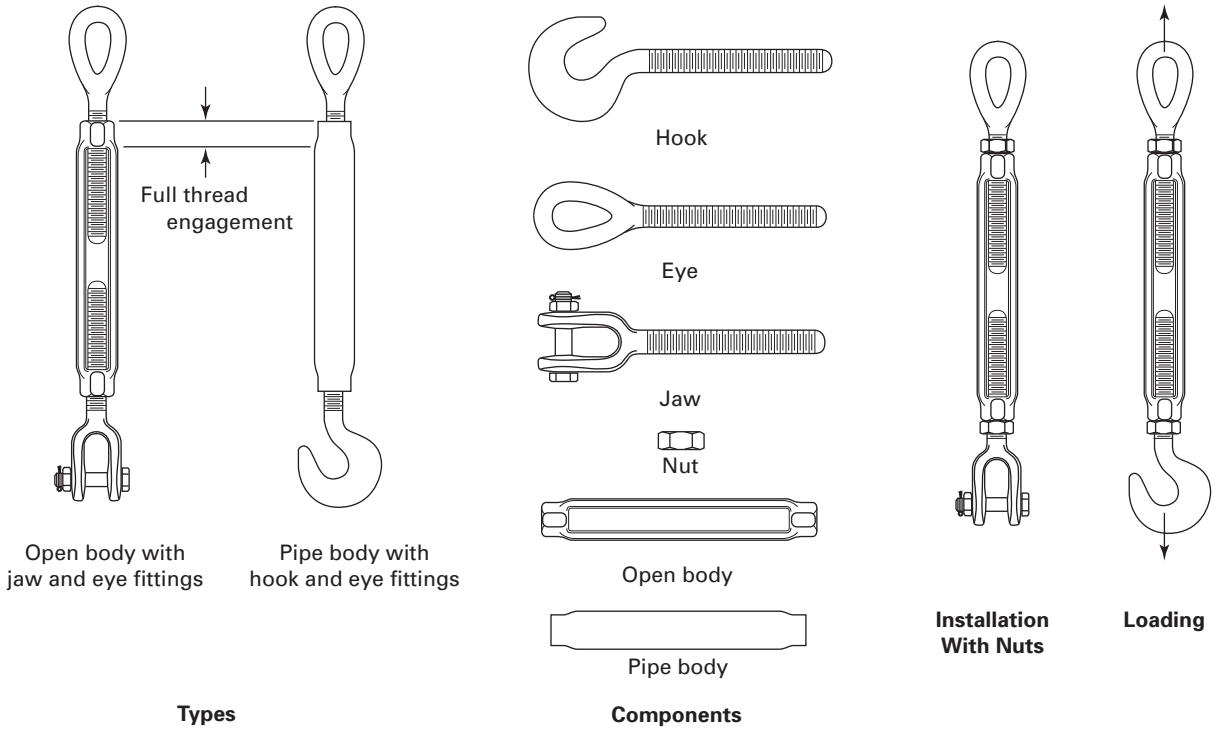
(b) When swivel hoist rings are to be used at temperatures above 400°F (204°C) or below −20°F (−29°C), the hardware manufacturer or a qualified person should be consulted.

(c) When carbon steel eyebolts are to be used at temperatures above 275°F (135°C) or below 30°F (−1°C), the hardware manufacturer or a qualified person should be consulted.

26-2.6.2 Chemically Active Environments (15)

The strength of adjustable hardware can be affected by chemically active environments such as caustic or acidic substances or fumes. The adjustable hardware

Fig. 26-2.1.1-1 Turnbuckles



(15)

Fig. 26-2.1.1-2 Eyebolts

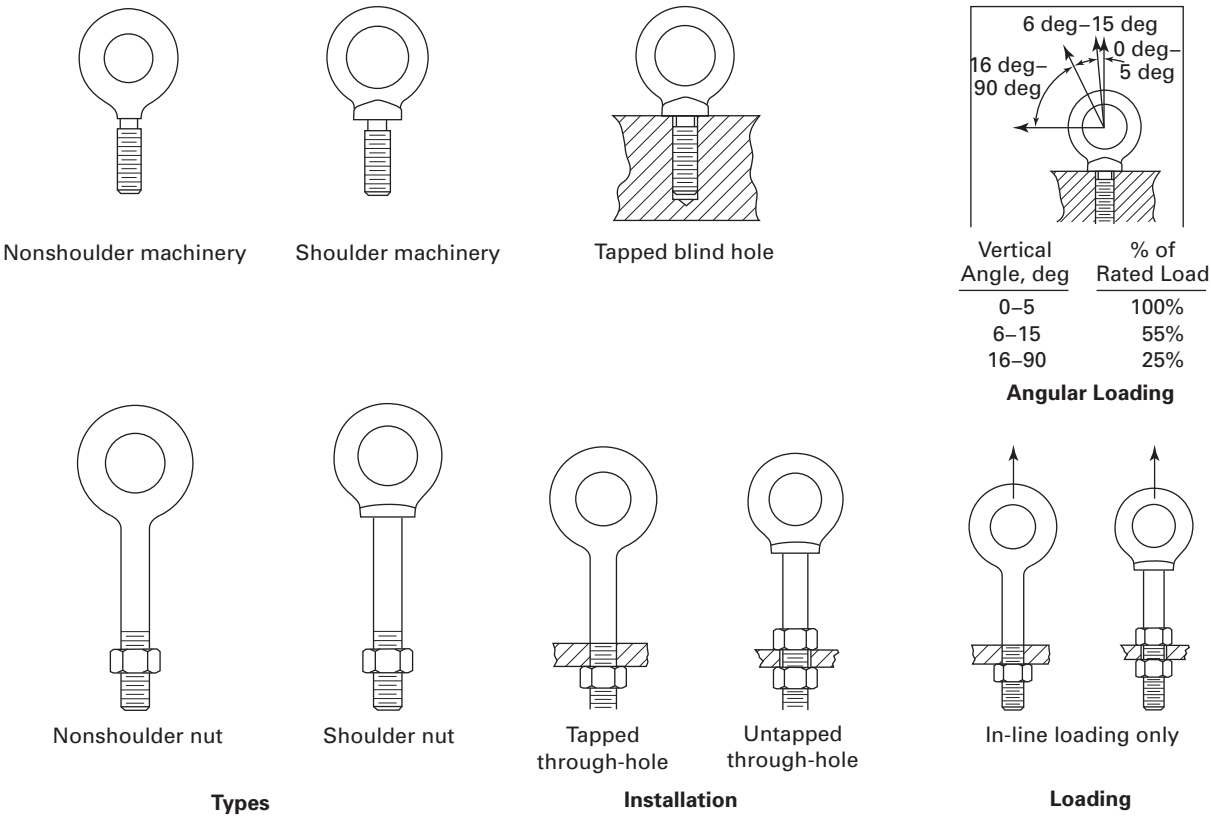
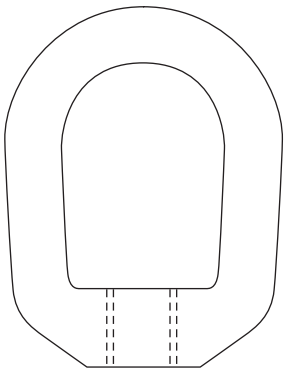
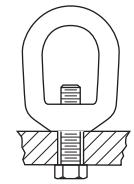


Fig. 26-2.1.1-3 Eye Nuts

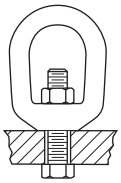


Typical

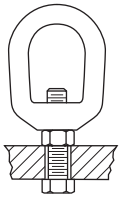
Types



Through-hole no nut

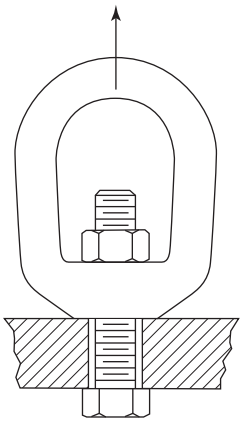


Through-hole top nut



Through-hole bottom nut

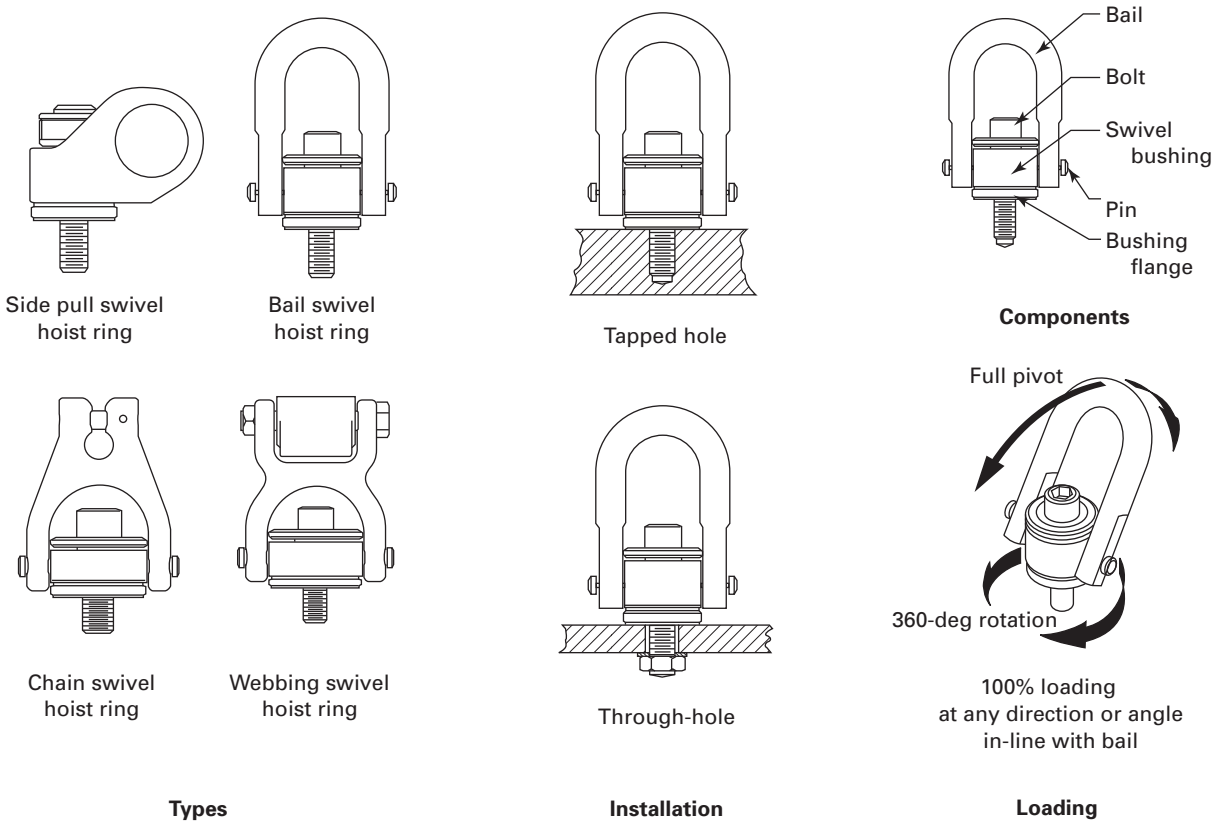
Installation



In-line loading only

Loading

Fig. 26-2.1.1-4 Swivel Hoist Rings



manufacturer or a qualified person should be consulted before use in chemically active environments.

SECTION 26-2.7: TRAINING

Adjustable hardware users shall be trained in the selection, inspection, cautions to personnel, effects of environment, and rigging practices as covered by this Chapter.

(15) SECTION 26-2.8: INSPECTION, REPAIR, AND REMOVAL

26-2.8.1 General

All inspections shall be performed by a designated person. Any deficiencies identified shall be examined and a determination made by a qualified person as to whether they constitute a hazard.

26-2.8.2 Initial Inspection

Prior to use, all new, altered, modified, or repaired adjustable hardware shall be inspected to verify compliance with the applicable provisions of this Chapter. Written records are not required.

26-2.8.3 Frequent Inspection

(a) A visual inspection shall be performed each shift before the adjustable hardware is used. Rigging hardware in semi-permanent and inaccessible locations where frequent inspections are not feasible shall have periodic inspections performed.

(b) Conditions such as those listed in para. 26-2.8.5 or any other condition that may result in a hazard shall cause the adjustable hardware to be removed from service. Adjustable hardware shall not be returned to service until approved by a qualified person.

(c) Written records are not required.

26-2.8.4 Periodic Inspection

(a) A complete inspection of the adjustable hardware shall be performed. The adjustable hardware shall be examined for conditions such as those listed in para. 26-2.8.5 and a determination made as to whether they constitute a hazard.

(b) Periodic Inspection Frequency

(1) Periodic inspection intervals shall not exceed 1 yr. The frequency of periodic inspections should be based on

(-a) frequency of use

(-b) severity of service conditions

(-c) nature of lifting or load handling activities

(-d) experience gained on the service life of adjustable hardware used in similar circumstances

(2) Guidelines for the time intervals are

(-a) normal service — yearly

(-b) severe service — monthly to quarterly

(-c) special service — as recommended by a qualified person

(c) Written records are not required.

26-2.8.5 Removal Criteria

Adjustable hardware shall be removed from service if conditions such as the following are present and shall only be returned to service when approved by a qualified person:

(a) missing or illegible identification

(b) indications of heat damage, including weld spatter or arc strikes

(c) excessive pitting or corrosion

(d) bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components

(e) excessive nicks or gouges

(f) a 10% reduction of the original or catalog dimension at any point

(g) excessive thread damage or wear

(h) evidence of unauthorized welding or modification

(i) for swivel hoist rings, lack of the ability to freely rotate or pivot

(j) other conditions, including visible damage, that cause doubt as to continued use

26-2.8.6 Repairs and Modifications

(a) Repairs, alterations, or modifications shall be as specified by the adjustable hardware manufacturer or a qualified person.

(b) Replacement parts, including nuts, pins, and bolts, shall meet or exceed the original equipment manufacturer's specifications.

SECTION 26-2.9: OPERATING PRACTICES

26-2.9.1 Adjustable Hardware Selection (15)

(a) Adjustable hardware having suitable characteristics for the type of load, hitch, angle of loading, and environment shall be selected in accordance with the recommendations of the adjustable hardware manufacturer or a qualified person.

NOTES:

(1) The angle of loading affects the stress in the hardware. As the horizontal angle decreases, the stress increases (see Fig. 26-2.9.1-1).

(2) The integrity of the load where the adjustable hardware attaches is the responsibility of the end user.

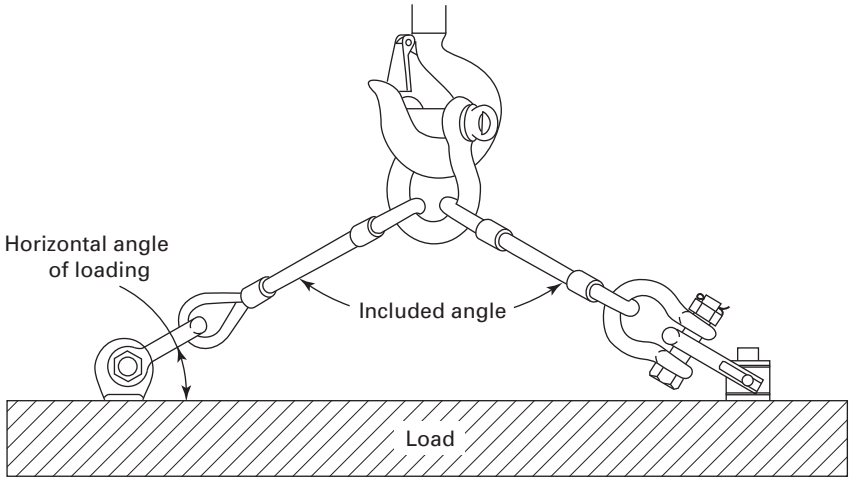
(b) The rated load of the adjustable hardware shall not be exceeded.

(c) Adjustable hardware that appears to be damaged shall not be used until inspected and accepted as usable per Section 26-2.8.

26-2.9.2 Cautions to Personnel

(a) All portions of the human body shall be kept from between the rigging hardware, the load, and any other rigging during lifting or load handling activities.

(15) **Fig. 26-2.9.1-1 Angle of Loading (Adjustable Hardware)**



Horizontal Angle, deg	Stress Multiplier
90	1.000
60	1.155
45	1.414
30	2.000

(b) Personnel should stand clear of the suspended load.

(c) Personnel should stand clear of rigging when it is under tension.

(d) Personnel shall not ride rigging hardware.

26-2.9.3 Storage and Work Environments

(a) Adjustable hardware should be stored in an area where it will not be subjected to damage, corrosive action, or extreme heat.

(b) If extreme temperatures or chemically active environments are involved, the guidance provided in para. 26-2.6.1 or 26-2.6.2 shall be followed.

(15) ### 26-2.9.4 Rigging Practices

26-2.9.4.1 Turnbuckles

(a) Turnbuckle end-fitting threads shall be fully engaged in the body threads.

NOTE: Pipe bodies conceal the length of thread engagement. Verify full engagement before loading (see Fig. 26-2.1.1-1).

(b) Components, including pins, bolts, nuts, or cotter pins used with jaw ends, shall be in good working condition prior to use.

(c) If locking nuts (see Fig. 26-2.1.1-1) are used, they shall be compatible with the threads of the turnbuckle end.

(d) Contact with obstructions that could damage or bend the turnbuckle should be avoided.

(e) Shock loading should be avoided.

(f) The load applied to the turnbuckle should be in line and in tension.

(g) Turnbuckles should not be side loaded.

(h) Turnbuckles should be rigged or secured to prevent unscrewing during lifting or load handling activities.

(i) For long-term installations, turnbuckles shall be secured to prevent unscrewing.

(j) Turnbuckles should not be dragged on an abrasive surface.

(k) Turnbuckles should be adjusted with a properly sized wrench, used on the wrench flats of the turnbuckle body.

26-2.9.4.2 Eyebolts

(a) Eyebolts should be tightened or otherwise secured against rotation during lifting or load handling activities.

(b) When used in a tapped blind hole, the effective thread length shall be at least 1½ times the diameter of the bolt for engagement in steel (see Fig. 26-2.1.1-2). For other thread engagements or engagement in other materials, contact the eyebolt manufacturer or a qualified person.

(c) When used in a tapped through-hole of less than one diameter thickness, a nut shall be used under the load and fully engaged and tightened securely against the load (see Fig. 26-2.1.1-2).

(d) When used in an untapped through-hole, the nut under the load shall be fully engaged. If the eyebolt is not shouldered to the load, a second nut on top of the load should be used where possible (see Fig. 26-2.1.1-2).

(e) Eyebolts not shouldered to the load shall only be used for in-line loads (see Fig. 26-2.1.1-2).

(f) Only shoulder eyebolts shall be used for angular loading. When used for angular loading, the shoulder shall be flush and securely tightened against the load. The working load limit (WLL) must be reduced as shown in Fig. 26-2.1.1-2.

(g) When using eyebolts for angular load handling, the plane of the eyebolts shall be aligned with the direction of pull. Steel flat washers may be used under the shoulder to position the plane of the eye.

(h) Eyebolts shall be in good working condition prior to use.

(i) Shock loading should be avoided.

26-2.9.4.3 Eye Nuts

(a) Eye nuts should have full thread engagement and should be secured against rotation during lifting or load handling activities.

(b) The threads of the eye nut shall be fully engaged (see Fig. 26-2.1.1-3).

(c) Eye nuts shall only be used for in-line loads (see Fig. 26-2.1.1-3).

(d) The plane of the eye may be positioned with a flat washer(s) or locknut.

(e) Components shall be in good working condition prior to use.

(f) Shock loading should be avoided.

26-2.9.4.4 Swivel Hoist Rings

(a) When used in a threaded hole, the effective thread length shall be $1\frac{1}{2}$ times the diameter of the bolt for steel (see Fig. 26-2.1.1-4). For other thread engagements or engagement in other materials, contact the swivel hoist ring manufacturer or a qualified person.

(b) When used in a through-hole application, a nut and washer shall be used. The washer and nut shall be in accordance with the swivel hoist ring manufacturer's recommendations. The nut shall be fully engaged (see Fig. 26-2.1.1-4).

(c) The bushing flange (see Fig. 26-2.1.1-4) shall fully contact the load surface.

(d) Spacers or washers shall not be used between the bushing flange and mounting surface of the load.

(e) The swivel hoist ring shall be tightened to the torque specifications of the manufacturer.

(f) The swivel hoist ring shall be free to rotate and pivot without interference during load handling activities (see Fig. 26-2.1.1-4).

(g) The load applied to the swivel hoist ring shall be centered in the bail to prevent side loading.

(h) Any attached load handling component shall be narrower than the inside width of the bail to avoid spreading (see Fig. 26-2.1.1-4).

(i) Components shall be in good working condition prior to use.

(j) Ensure that the swivel hoist ring WLL meets or exceeds the anticipated angular rigging tension (see Fig. 26-2.9.1-1).

(k) Shock loading should be avoided.