

Chapter 26-1

Shackles – Selection, Use, and Maintenance

SECTION 26-1.0: SCOPE

This Chapter applies to shackles.

SECTION 26-1.1: TYPES AND MATERIALS

26-1.1.1 Types

(a) Body types covered are anchor, chain, and synthetic sling (see Fig. 26-1.1.1-1).

(b) Pin types covered are screw pin and bolt type (see Fig. 26-1.1.1-1).

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

NOTE: Round pin shackles are not covered by the scope of this Volume, because they have limited application in lifting. They are only restrained by a cotter pin and may present a hazard in odd angle loading conditions.

(15) 26-1.1.2 Materials

The shackle 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 26-1.2: DESIGN FACTOR

(a) The design factor for shackles up to and including a 150-ton (136-metric ton) rated load shall be a minimum of 5.

(b) The design factor for shackles over a 150-ton (136-metric ton) rated load shall be a minimum of 4.

SECTION 26-1.3: RATED LOADS

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

SECTION 26-1.4: PROOF TEST

26-1.4.1 Proof Test Requirements

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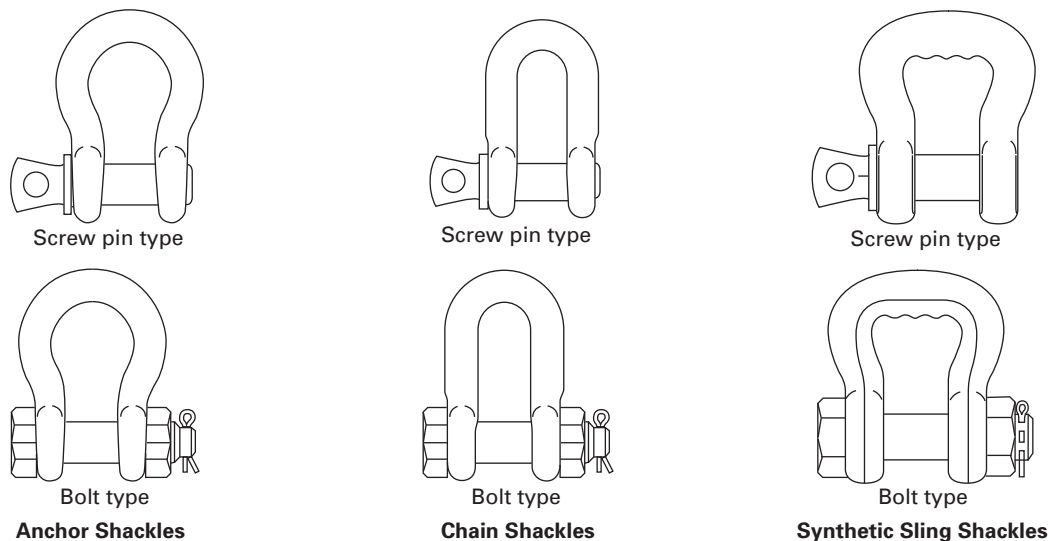
(a) Shackles are not required to be proof tested unless specified by the purchaser.

(b) Proof tested shackles shall be inspected after the test for the conditions stated in para. 26-1.8.5.

26-1.4.2 Proof Load Requirements

(a) The proof load for a shackle up to and including a 150-ton (136-metric ton) rated load shall be a minimum

Fig. 26-1.1.1-1 Shackle Types



of 2 and a maximum of 2.2 times the rated load unless approved by the manufacturer.

(b) The proof load for a shackle over a 150-ton (136-metric ton) rated load shall be a minimum of 1.33 and a maximum of 2 times the rated load unless approved by the manufacturer.

SECTION 26-1.5: IDENTIFICATION

(15) 26-1.5.1 Shackle Body Identification

Each shackle body shall have durable markings by the manufacturer to show

- (a) name or trademark of manufacturer
- (b) rated load
- (c) size

(15) 26-1.5.2 Shackle Pin Identification

Each shackle pin shall have durable markings by the manufacturer to show

- (a) name or trademark of manufacturer
- (b) grade, material type, or load rating

26-1.5.3 Maintenance of Identification

Shackle identification should be maintained by the user so as to be legible throughout the life of the shackle.

SECTION 26-1.6: EFFECTS OF ENVIRONMENT

26-1.6.1 Temperature

When shackles are to be used at temperatures above 400°F (204°C) or below -40°F (-40°C), the shackle manufacturer or a qualified person should be consulted.

26-1.6.2 Chemically Active Environments

The strength of shackles can be affected by chemically active environments, such as caustic or acidic substances or fumes. The shackle manufacturer or a qualified person should be consulted before shackles are used in chemically active environments.

SECTION 26-1.7: TRAINING

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

(15) SECTION 26-1.8: INSPECTION, REPAIR, AND REMOVAL

26-1.8.1 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.

26-1.8.2 Initial Inspection

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

26-1.8.3 Frequent Inspection

(a) A visual inspection shall be performed each shift before the shackle 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. 26-1.8.5 or any other condition that may result in a hazard shall cause the shackle to be removed from service. Shackles shall not be returned to service until approved by a qualified person.

(c) Written records are not required.

26-1.8.4 Periodic Inspection

(a) A complete inspection of the shackle shall be performed. The shackle shall be examined for conditions such as those listed in para. 26-1.8.5 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 shackles 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.

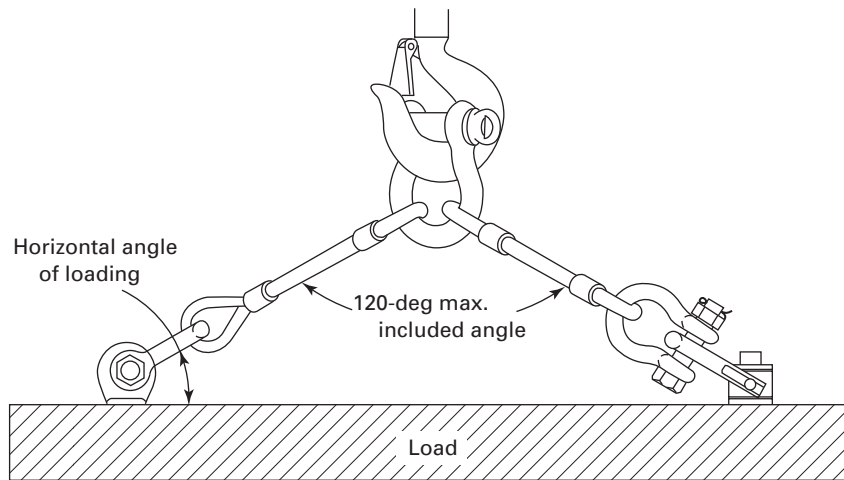
26-1.8.5 Removal Criteria

Shackles 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 around the body or pin
- (g) incomplete pin engagement

Fig. 26-1.9.1-1 Angle of Loading (Shackles)

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

- (h) excessive thread damage
- (i) evidence of unauthorized welding or modification
- (j) other conditions, including visible damage, that cause doubt as to the continued use of the shackle

26-1.8.6 Repairs and Modifications

- (a) Repairs, alterations, or modifications shall be as specified by the shackle manufacturer or a qualified person.
- (b) Replacement parts, such as pins, shall meet or exceed the original equipment manufacturer's specifications.

SECTION 26-1.9: OPERATING PRACTICES

(15) 26-1.9.1 Shackle Selection

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

NOTE: The angle of loading affects the stress in the shackle. As the horizontal angle decreases, the stress increases in the shackle (see Fig. 26-1.9.1-1).

- (b) The rated load of the shackle shall not be exceeded.
- (c) Shackles that appear to be damaged shall not be used until inspected and accepted as usable under Section 26-1.8.

26-1.9.2 Cautions to Personnel

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

26-1.9.3 Storage and Work Environments

- (a) Shackles should be stored in an area where they 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. 26-1.6.1 or 26-1.6.2 shall be followed.

26-1.9.4 Rigging Practices

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- (a) The screw pin threads shall be fully engaged and tight, and the shoulder should be in contact with the shackle body (see Fig. 26-1.9.4-1).
- (b) If a shackle is designed for a cotter pin, the cotter pin shall be used and maintained in good working condition.
- (c) Contact with sharp edges that could damage the shackle should be avoided.
- (d) Shock loading should be avoided.
- (e) The load applied to the shackle should be centered in the bow of the shackle to prevent side loading of the shackle.

(f) Multiple sling legs should not be applied to the shackle pin.

(g) If the shackle is to be side loaded, the rated load shall be reduced according to Fig. 26-1.9.4-2 or the recommendations of the manufacturer or a qualified person.

(h) Screw pin shackles shall not be rigged in a manner that would cause the pin to unscrew.

(i) For long-term installations, bolt-type shackles should be used; if screw pin-type shackles are used, the pin shall be secured from rotation or loosening.

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

(k) Multiple slings in the body of a shackle shall not exceed 120-deg included angle (see Fig. 26-1.9.1-1).

(l) When a shackle is used in a choker hitch, the pin shall be connected to the choking eye of the sling.

Fig. 26-1.9.4-1 Typical Shackle Components

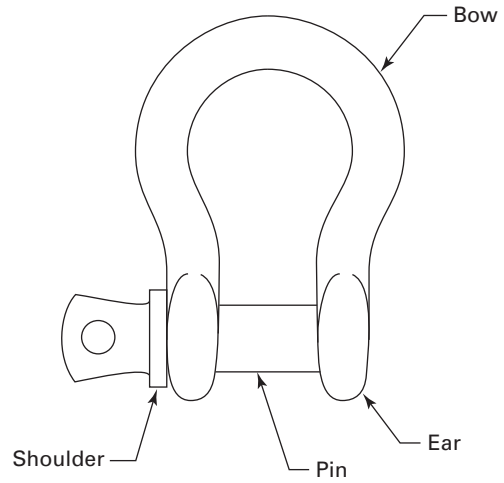
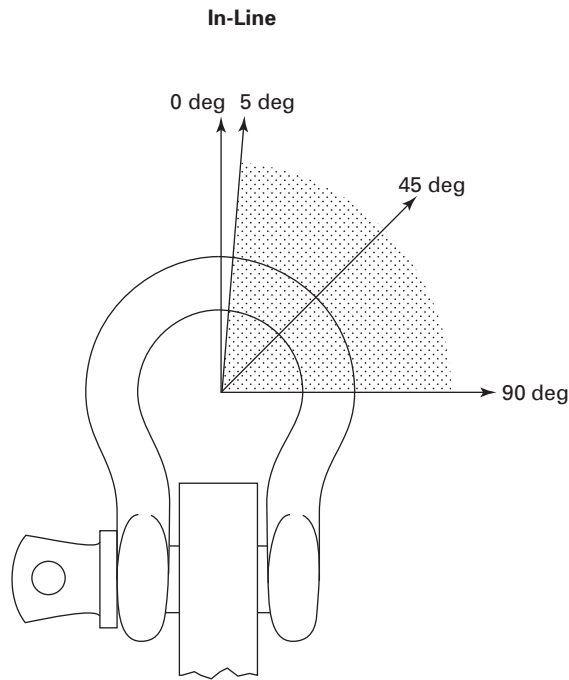


Fig. 26-1.9.4-2 Side Loading



| Side Loading Angle, deg | % Rate Load Reduction |
|----------------------------|--|
| In-line (0) to 5 | None |
| 6 to 45 | 30% |
| 46 to 90 | 50% |
| Over 90 | Not recommended to load in this condition. Consult manufacturer or qualified person. |