

CHAPTER 10
TRAILER COUPLING DEVICES (FIFTH WHEELS)

REVISED FEBRUARY 2008

TABLE OF CONTENTS

<u>SCOPE</u>	10-3
<u>INTRODUCTION</u>	10-3
<u>DEFINITIONS</u>	10-3
Fifth Wheel.....	10-3
Automatic Fifth Wheel.....	10-3
Kingpin.....	10-3
<u>OPERATION - STANDARD FIFTH WHEEL</u>	10-4
Coupling	10-4
Automatic Coupling.....	10-4
Locking Device.....	10-4
Manual Release.....	10-4
Accidental Disconnect Prevention.....	10-4
<u>DESIGN AND CONSTRUCTION</u>	10-4
Basic Design.....	10-4
No Slack Fifth Wheels.....	10-4
Mounting Brackets	10-7
Upper Half.....	10-8
<u>COMPONENT PARTS</u>	10-9
Lower Half	10-9
Use of Nomenclature	10-9
<u>INSPECTION PROCEDURE</u>	10-9
Depth of Inspections	10-9
Preliminary Procedure	10-9
Lower Half Mounting	10-10
Upper Half Mounting.....	10-11
Structural Failures.....	10-11
Accidental Disconnect Protection.....	10-11
Coupler Jaw Engagement.....	10-15
Coupler Jaw Locking Mechanism.....	10-16
Kingpin.....	10-16
Skid Plate	10-16
Excessive Slack.....	10-16

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 10

TRAILER COUPLING DEVICES (FIFTH WHEELS)

10.1 SCOPE. This Chapter applies to the operation and inspection of -standard and automatic fifth wheels as defined in Paragraphs 10.3.1 and 10.3.2.

10.2 INTRODUCTION. The information in this Chapter is intended to provide general information describing the operation of fifth wheels and their component parts, in addition to providing a suggested inspection procedure.

10.3 DEFINITIONS.

10.3.1 Fifth Wheel. For the purpose of this Chapter, a fifth wheel is a coupling device used to connect two vehicles together which consists of an upper and lower skid plate, a kingpin, coupler jaws, or similar parts designed and arranged in such a way as to be readily separable, permit free rotation between the upper and lower halves, and provide lateral stability' to the towed vehicle. (See Figure 10-7.)

10.3.2 Automatic Fifth Wheel. An automatic fifth wheel is a device' which performs the function of, a standard fifth wheel and the additional function of raising or lowering the semitrailer landing gear automatically when the vehicles are coupled or uncoupled.

- a. The design of automatic fifth wheels is essentially the same regardless of the manufacturer.
- b. The coupler jaws, locking mechanism, and operating handle are on the towed vehicle, and the kingpin is located on the lower half of the fifth wheel on the towing vehicle.
- c. The coupler jaws and locking cam can be seen by sighting down the throat at the entry point of the mounting plate on the towed vehicle, and the operating handle is usually located in the right front rubrail of the semitrailer.

10.3.3 Kingpin. The kingpin is the pin that holds the upper and lower halves of the fifth wheel together. The pin is attached to the upper half of the standard fifth wheel and is secured by the coupler jaws to the lower half of the fifth wheel.

10.4 OPERATION - STANDARD FIFTH WHEEL.

10.4.1 Coupling. The upper and lower halves of a fifth wheel are coupled together by the use of coupler jaws in the lower half of the fifth wheel. The coupler jaws lock into a groove cut into the kingpin which is secured to the upper half.

10.4.2 Automatic Coupling. When the kingpin of the upper half of the fifth wheel is forced into the lower half of the fifth wheel, as the vehicles are coupled together, the kingpin contacts the open coupler jaws. Additional movement of the kingpin causes the coupler jaws to close around the kingpin.

10.4.3 Locking Device. The coupler jaws are held in the closed position by a mechanical locking device which is forced into position and held by spring force.

10.4.4 Manual Release. The coupler jaw locking device is released by manual operation of a releasing lever. Forward movement of the towing vehicle will then cause the coupler jaws to open and release the kingpin, permitting separation of the upper and lower halves.

10.4.5 Accidental Disconnect Prevention. The fifth wheel must be designed and maintained in such a manner that the manual release cannot be accidentally operated, or a device must be installed on the fifth wheel which will prevent accidental operation of the release lever.

10.5 DESIGN AND CONSTRUCTION.

10.5.1 Basic Design. All fifth wheels have basic design similarities in that they all have upper and lower skid plates, a king pin, and a locking mechanism to hold the kingpin in place.

- a. Variations in design and construction occur with each manufacturer.
- b. Design variations occur most frequently in the coupler jaw and release mechanisms.

10.5.2 No Slack Fifth Wheels. One design variation is the "no slack" fifth wheel.

- a. Fifth wheels of this type are designed in such a manner that there is no slack between the kingpin and coupler jaws.
- b. Wear in the kingpin or coupler jaws can be compensated for in this type of fifth wheel by coupler jaw adjustment or design.

c. Illustrations of "no slack" fifth wheel coupler. jaws are below in Figures 10-1, 10-2, and 10-3.

(1) Slack is eliminated in the design illustrated in Figure 10-1 by the use of wedges behind the kingpin.

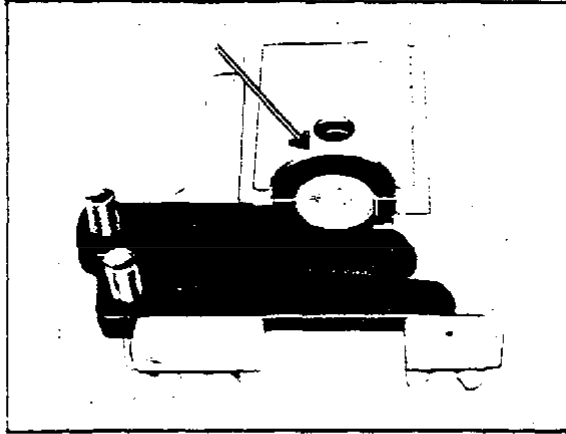


Fig. 10-1. "No Slack" Fifth Wheel Coupler

(2) Slack is eliminated in the design illustrated in Figure 10-2 by use of an offset cam in the coupler jaw pivot pin which, when rotated, varies the coupler jaw location.

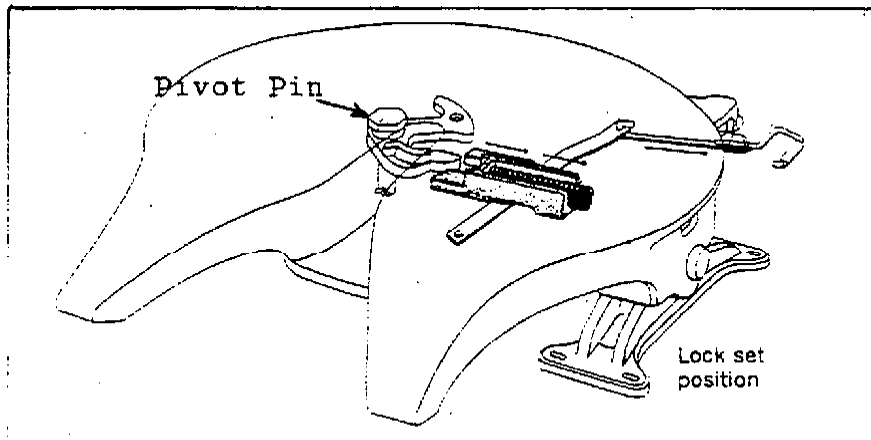


Fig. 10-2. "No Slack" Fifth Wheel Coupler

(3) Slack is eliminated in the design illustrated in Figure 10-3 by the use of a rubber buffer placed forward of and compressed by the kingpin when in the coupled position.

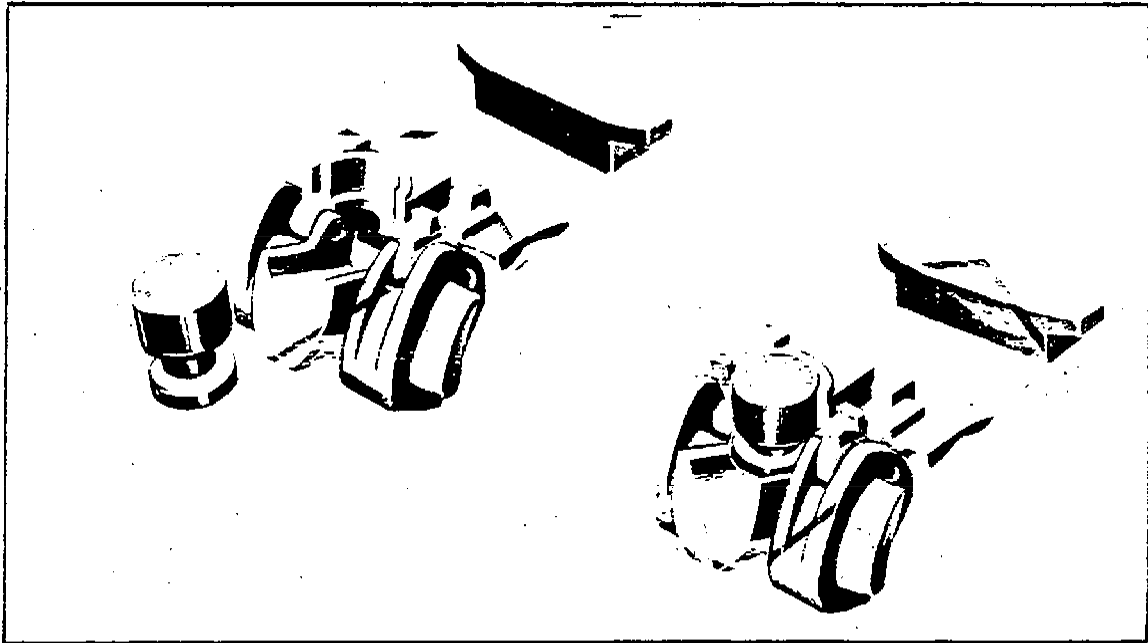


Fig. 10-3. "No Slack" Fifth Wheel Coupler

10.5.3 Mounting Brackets. The design and construction of fifth wheel mounting brackets varies considerably.

- a. In some designs a pin is used to secure the fifth wheel to the mounting bracket and sustains the pulling force exerted by the tractor.
- b. In other designs the mounting bracket and fifth wheel are machined with matching trunnion surfaces. The mounting bracket and fifth wheel are held in place by a pivot, pin; however, pulling force is exerted against the trunnion not the pin. Rubber shoes or other types of shims are often used to absorb shock and compensate for wear.
- c. Mounting brackets are illustrated in Figures 10-4 and 10-5.

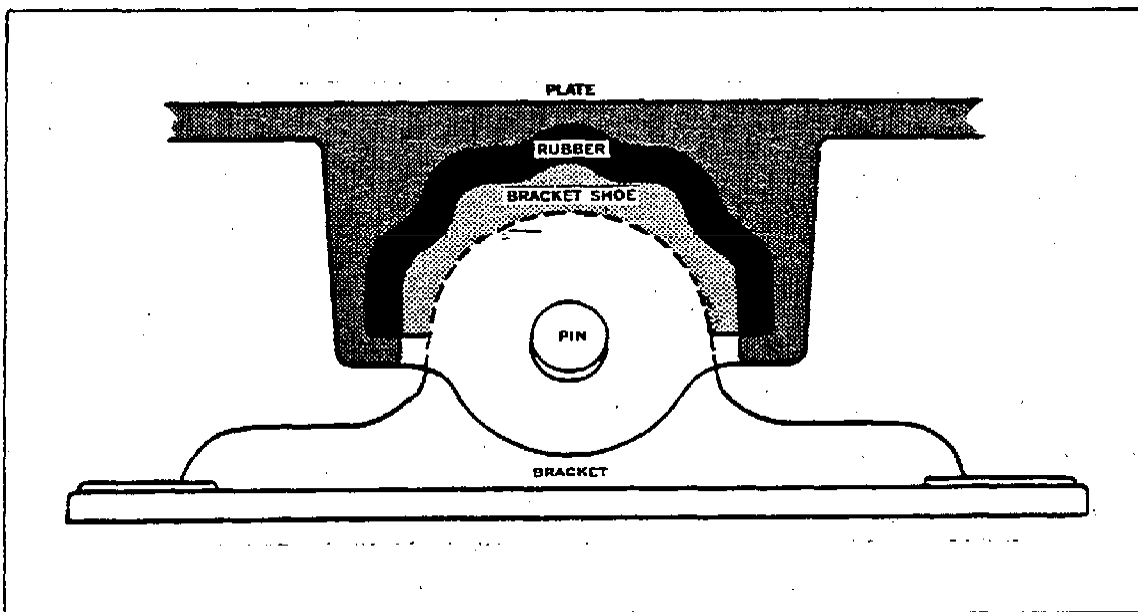


Fig. 10-4. Mounting Bracket

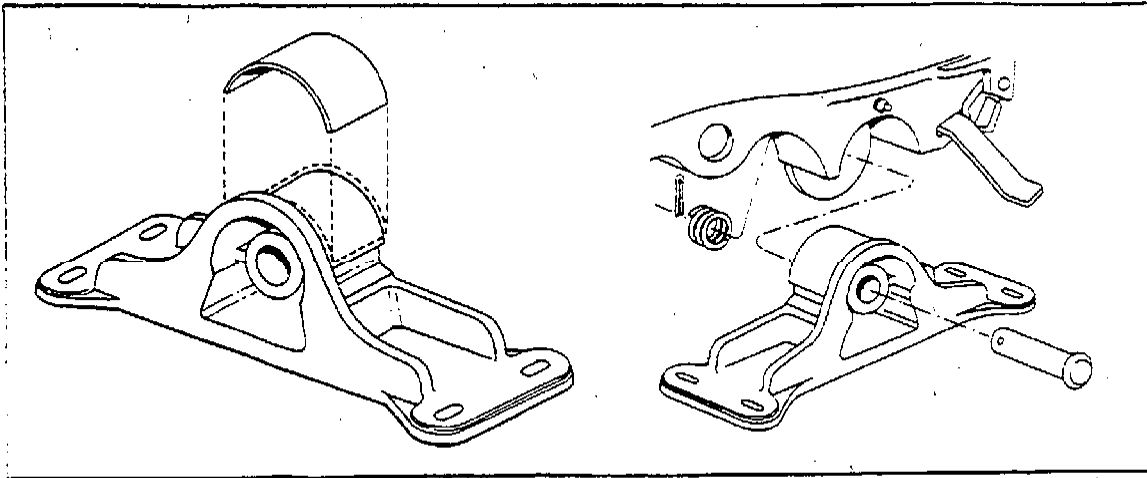


Fig. 10-5. Mounting Bracket

10.5.4 Upper Half. The upper half of the fifth wheel consists of a skid plate and kingpin. The upper half of the fifth wheel is normally attached to the towed vehicle; however, when automatic fifth wheels are used the upper half is attached to the towing vehicle. Figure 10-6 illustrates a standard kingpin.

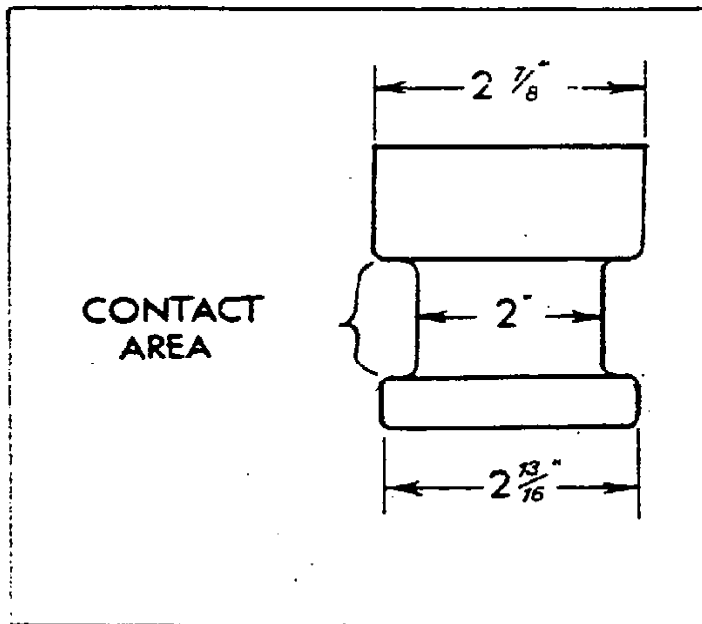


Fig. 10-6. Standard Kingpin

10.6 COMPONENT PARTS.

10.6.1 Lower Half. The component parts of the lower half of a fifth wheel are labeled in Figure 10-7 below.

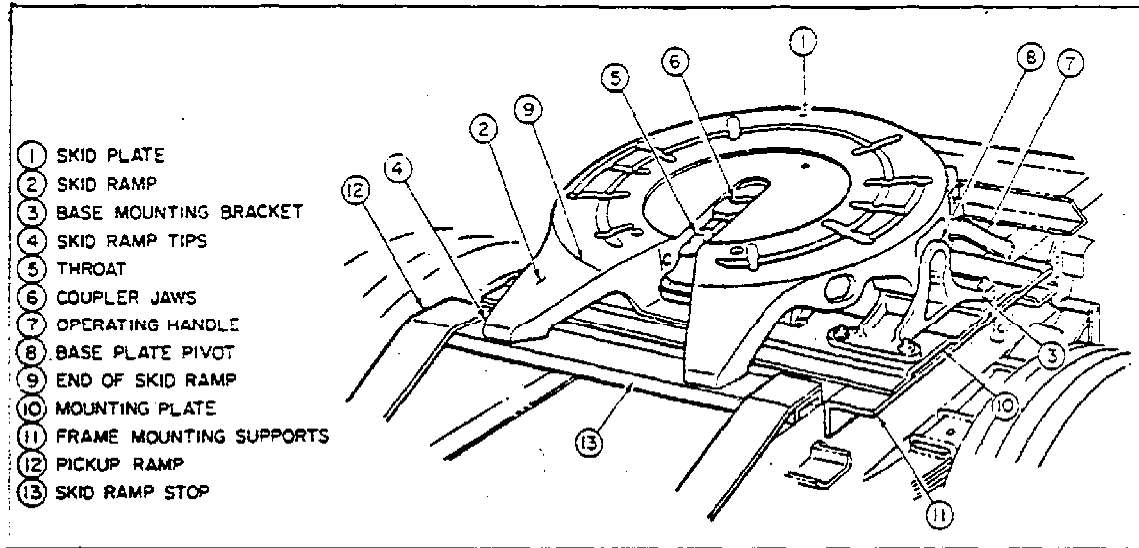


Fig. 10-7. Component Parts of a Fifth Wheel

10.6.2 Use of Nomenclature. The terms used to identify the component parts have been adopted by the SAE Fifth Wheel Committee and should be used in any written reports describing fifth wheel parts.

10.7 INSPECTION PROCEDURE.

10.6.3 Depth of Inspections. Inspections of fifth wheels are to be conducted to the depth necessary to determine whether the device complies with statutory requirements and is maintained in a safe operating condition.

- a. The inspection procedure is designed to be conducted visually without the use of tools and is neither restrictive nor all inclusive.
- b. Separation of vehicles for this inspection is not recommended or necessary unless some condition is observed which requires separation of the vehicles to determine if further operation would be unsafe.

10.6.4 Preliminary Procedure. It is essential for inspecting personnel to ensure that no accidental disconnection can occur which may result in dropping the semitrailer. If the

vehicles are to be separated, semitrailer landing gear must be properly positioned and of adequate strength to support the vehicle.

10.6.5 Lower Half Mounting. Check the mounting and securement of the lower half to the vehicle frame to ensure that it is securely mounted to the vehicle and that proper methods and materials have been used in its installation.

a. Fifth wheels mounted on vehicles subject to the Motor Carrier regulations contained in Title 13, CAC, must comply with (1) and (2) below.

(1) If "U" bolts are used to attach the fifth wheel to the frame, they must be of one piece construction (not welded), of adequate size, and securely tightened (Title 13, CAC, Section 1213(e)).

(2) If capscrews and bolts are used to secure the fifth wheel to the frame, they must meet SAE Standard J429 f or grade 5 threaded fasteners in the 1965 or later edition of the SAE Handbook and must be installed so that the frame will not crack, warp, or become deformed (Section 34506 VC and Title 13, CAC, Section 1213(e)). A table of SAE grades and head marking for threaded fasteners is shown in Figure 10-8 below.

Grade Designation	Products	Nominal Size Dia. in	Full Size Bolts, Screws, Studs, Caps		Machine Test Specimens of Bolts, Screws, and Studs				Surface Hardness		Core Hardness		Grade Identification Marking
			Proof Load, psi	Tensile Strength Min, psi	Yield Strength Min, psi	Tensile Strength Min, psi	Elongation Min, %	Reduction of Area Min, %	Rockwell 30M Max	Rockwell			
										Min	Max		
1	Bolts, Screws, Studs	1/4 thru 1-1/2	33,000	60,000	36,000 ^b	60,000	18	35	—	870	8100	None	
2	Bolts, Screws, Studs	1/4 thru 3/4 ^c	55,000	74,000	57,000	74,000	18	35	—	880	8100	None	
		Over 3/4 to 1-1/2	33,000	60,000	36,000 ^b	60,000	18	35	—	870	8100		
4	Studs	1/4 thru 1-1/2	—	115,000	100,000 ^d	115,000	10	35	—	C22	C32	None	
5	Bolts, Screws, Studs	1/4 thru 1	85,000	120,000	92,000	120,000	14	35	54	C25	C34	Bolts and screws only	
		Over 1 to 1-1/2	74,000	105,000	81,000	105,000	14	35	50	C19	C30		
5.14	Bolts, Screws, Washers	No. 6 thru 3/8	85,000	120,000	—	—	—	—	59.5 ^g	C23	C40 ^h	Hex head screws only	
5.2	Bolts, Screws	1/4 thru 1	85,000	120,000	92,000	120,000	14	35	56	C26	C36	Bolts and screws only	
7 ^e	Bolts, Screws	1/4 thru 1-1/2	105,000	133,000	115,000	133,000	12	35	54	C28	C34	Bolts and screws only	
8	Bolts, Screws, Studs	1/4 thru 1-1/2	120,000	150,000	130,000	150,000	12	35	57.5	C32	C38	Bolts and screws only	
8.1	Studs	1/4 thru 1-1/2	120,000	130,000	130,000	130,000	10	35	—	C22	C36	None	
8.2	Bolts, Screws	1/4 thru 1-1/2										None	

See Appendix

^a Yield strength is stress at which a permanent set of 0.2% of gage length occurs.
^b Yield point shall apply instead of yield strength at 0.2% offset.
^c Grade 2 requirements for sizes 1/4 through 3/4 in apply only to bolts and screws 6 in and shorter in length, and to studs of all lengths. For bolts and screws longer than 6 in, Grade 1 requirements shall apply.
^d Grade 5 material heat treated before assembly with a hardened washer in acceptable situations.
^e Grade 7 bolts and screws are roll threaded after heat treatment.
^f See Table d for gage length.
^g Hex washer head and hex flange products without assembled washers shall have a core hardness not exceeding Rockwell C38 and a surface hardness not exceeding Rockwell 30M 57.5.
^h Semi-screw and washer assemblies.

Fig. 10-8. Fastener Grades and Identification

b. A positive means must be provided to prevent fifth wheels, including sliding fifth wheels, from shifting on the frame of the vehicle (Section 29001 VC).

1) A securely mounted fifth wheel with no evidence of shifting shall be deemed to meet requirements f or a "positive means to prevent shifting."

(2) The number and type of locking devices in good mechanical condition, normally supplied by a manufacturer of a sliding fifth wheel, shall be deemed to provide the ultimate strength sufficient to control the gross weight of the towed vehicle or combinations of vehicles.

10.6.6 Upper Half Mounting. Check the mounting and securement of the upper half of the fifth wheel. The upper half of the fifth wheel must be securely affixed to the vehicle, structurally adequate, and installed so that the frame will not crack, warp, or become deformed (Sections 29001 VC and 29003 VC).

10.6.7 Structural Failures. Inspect for cracked welds or breaks in the vehicle frame at the mounting area, the mounting plate, or fifth wheel components. Cracks indicating impending structural failure are considered an unsafe condition (Sections 29003 VC and 24002 VC).

10.6.8 Accidental Disconnect Protection. Check the operating handle to ensure that it is designed, installed, and maintained so that it cannot be accidentally operated (Section 29002 VC).

a. The handle is not required to have a separate safety latch to prevent its accidental operation, unless by reason of its design or location it is susceptible to accidental operation.. The examples illustrated in Figures 10-9 through 10-18 will assist in appropriate application of this requirement.

(1) The design illustrated in Figure 10-9 complies. The handle design and springload feature of this operating handle protects it against accidental operation and the springload holds the handle in the closed position.

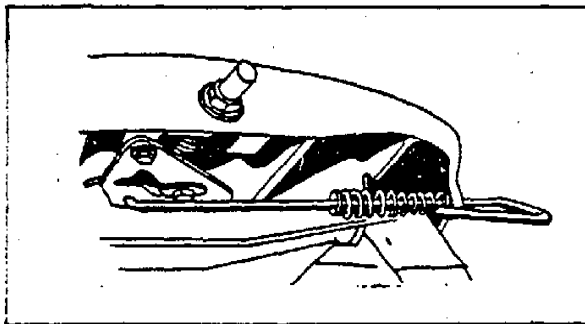


Fig. 10-9. Safety Latch Which Complies

(2) The design illustrated in Figure 10-10 complies. This operating handle must be pulled out to unlock the coupler jaws. It is shielded by the skid plate and is springloaded to hold it in the closed position.

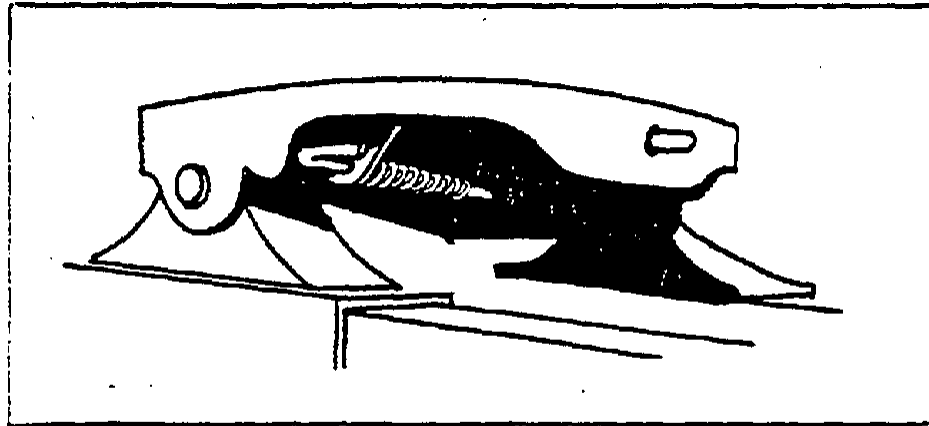


Fig. 10-10. Safety Latch Which Complies

(3) The design illustrated in Figure 10-11 complies. This operating handle is protected against accidental operation by its design and a manually operated safety latch that permits automatic closure of the coupler jaws and holds the handle in the closed position.

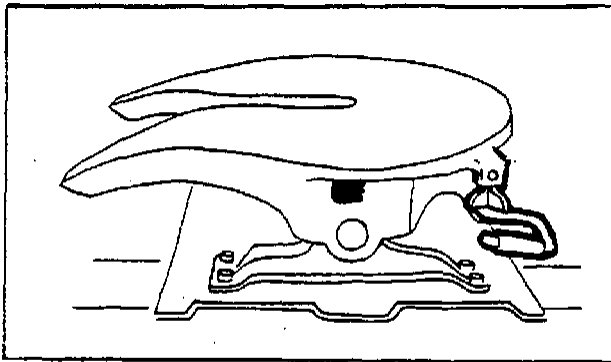


Fig. 10-11. Safety Latch Which Complies

(4) The design illustrated in Figure 10-12 complies. This operating handle is protected against accidental operation by a manually operated safety latch that permits automatic closure of the coupler jaws and holds the handle in the closed position.

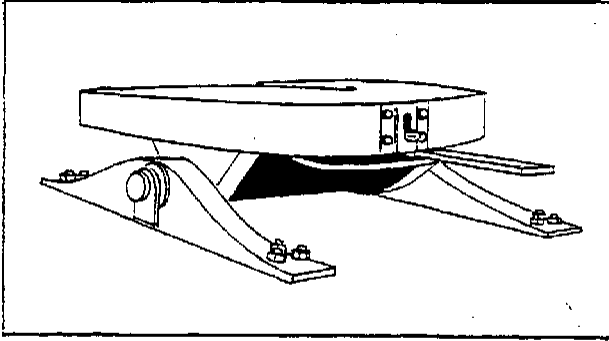


Fig. 10-12. Safety Latch Which Complies

5) The design illustrated in Figure 10-13 complies. This operating handle is protected against accidental operation by a manually operated safety latch that permits automatic closure of the coupler jaws and holds the handle in the closed position.

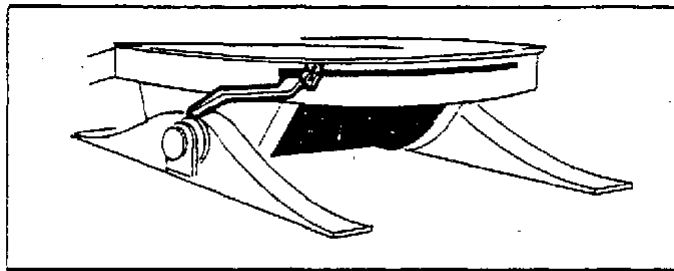


Fig. 10-13. Safety Latch Which Complies

(6) The modification kit installation illustrated in Figure 10-14 complies. This modification has been performed on several fifth wheels presently in use to bring them into compliance, including the types illustrated in Figures 10-17 and 10-18. The safety latch provides protection against accidental operation, holds the handle in the closed position, and permits automatic operation of the locking device.

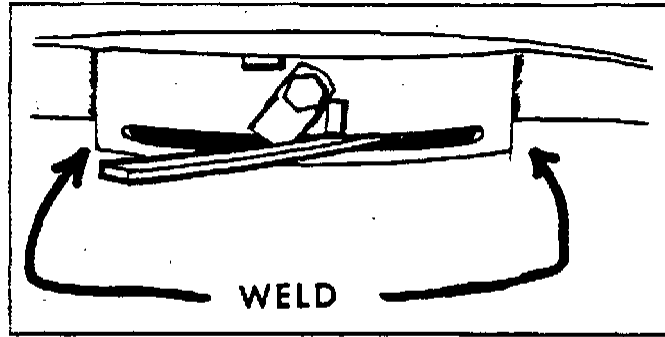


Fig. 10-14. Safety Latch Which Complies

(7) 10-13 The design illustrated in Figure 10-15, "automatic" fifth wheel operating handle, complies. This operating handle is protected against accidental operation by a gravity latch that must be manually raised to move the operating handle to the open position.

(8) The design illustrated in Figure 10-16 does not comply. This operating handle must be lifted upward and pulled outward to release the coupler jaw locking device. It is not adequately protected against accidental operation. The location and design of the handle leaves it vulnerable, to release by loose tire treads and objects set in motion by the wheel rotation. No means is provided to hold it in the closed position,.

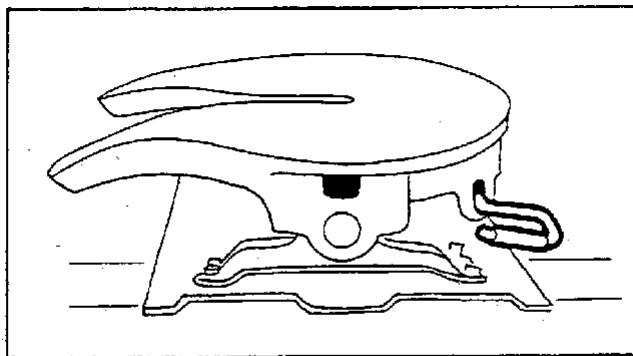


Fig. 10-16. Operating Handle Not in Compliance

(9) The design illustrated in Figure 10-17 does not comply. This operating handle is not adequately protected against accidental operation. It is dependent solely upon a notch in the lever slot to hold it in the closed position.

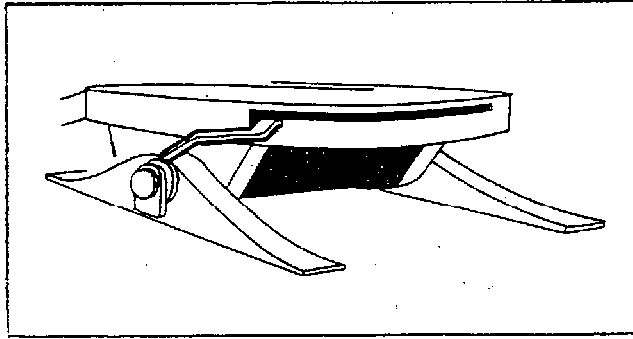


Fig. 10-17. Operating Handle Not in Compliance

(10) The design illustrated in Figure 10-18 does not comply. This operating handle is protected against accidental operation by the pin device, but the pin will prevent automatic closure of the coupler jaws if returned to its keeper when the operating handle is moved to the open position.

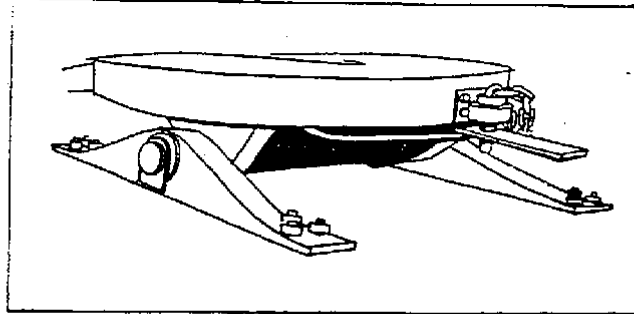


Figure 10-18. Operating Handle Not in Compliance.

b. The foregoing examples of acceptable means of compliance are not exclusive of alternate methods offering equal protection. The examples are provided as a guide to aid in evaluating compliance with the requirements.

10.6.9 Coupler Jaw Engagement. Check the coupler jaws to ensure full closure around the kingpin in the following manner: (Malfunctions or defects which are immediate safety hazards may constitute violations of Section 24002(a) VC.)

- a. Ensure that the operating handle is secured in the locked position.
- b. Sight down the throat of the skid plate and determine that the coupler jaw(s) is fully engaged. The kingpin will not be visible if the coupler jaws are fully engaged.
- c. Examine operating handle for damage, deformation, or excessive wear which will prevent its returning to fully closed position automatically.

10.6.10 Coupler Jaw Locking Mechanism. Check the coupler jaw locking mechanism to ensure it is in position to prevent opening of the coupler jaws (Malfunctions or defects which are immediate safety hazards may constitute a violation of Section 24002(a) VC).

- a. Inspect the operating handle and spring to ensure that there are no broken or missing parts and that the operating handle does not bind.
- b. Check the lubricants to ensure that through aging or absorption of dirt and residue, the lubricant has not become so thickened it interferes with free operation.

10.6.11 Kingpin. This inspection can be made only when the vehicles are separated. (Malfunctions or defects which are immediate safety hazards may constitute a violation of Section 24002(a) VC).

- a. Check the kingpin mounting in the upper skid plate to ensure that it is properly secured and free of cracks, sharp edges, or grooves and is not unduly worn.
- b. Check for cracks in any welds securing the kingpin to the skid plate.
- c. Measure the diameter of the kingpin at the groove for out-of-round and excessive wear. Kingpins should be replaced when the wear exceeds 3/16-inch.

10.6.12 Skid Plate. Inspect the skid plates as follows: (Malfunctions or defects which are immediate safety hazards may constitute a violation of Section 24002(a) VC)

- a. Check bearing surfaces to ensure that the upper half rests evenly and smoothly on the lower half.
- b. Check contact surfaces to ensure that there is lubrication present to minimize frictional resistance. Fifth wheels equipped with plastic low coefficient friction liners need not be lubricated.
- c. Check bearing surfaces for cracks, warps or severe scoring.
- d. Check underplate for cracked webs, deformation, and condition of fulcrum mounting.

10.6.13 Excessive Slack. Check for excessive slack in the coupler jaws and kingpin as follows: (Malfunctions or defects which are immediate safety hazards may constitute a violation of Section 24002(a) VC)

- a. With the towed vehicle brakes locked or with its wheels blocked fore and aft, request the driver to slowly move the towing vehicle forward and reverse enough to take up any fifth wheel coupling slack.

- b. Observe any movement between the upper and lower halves.
- c. If appreciable slack is noted, apply match (index) marks to the upper and lower halves and repeat the towing vehicle movements.
- d. Change in alignment of the marks exceeding 1/2-inch is excessive, except that not more than 1 inch of slack is permitted for automatic fifth wheels.

THIS PAGE INTENTIONALLY LEFT BLANK