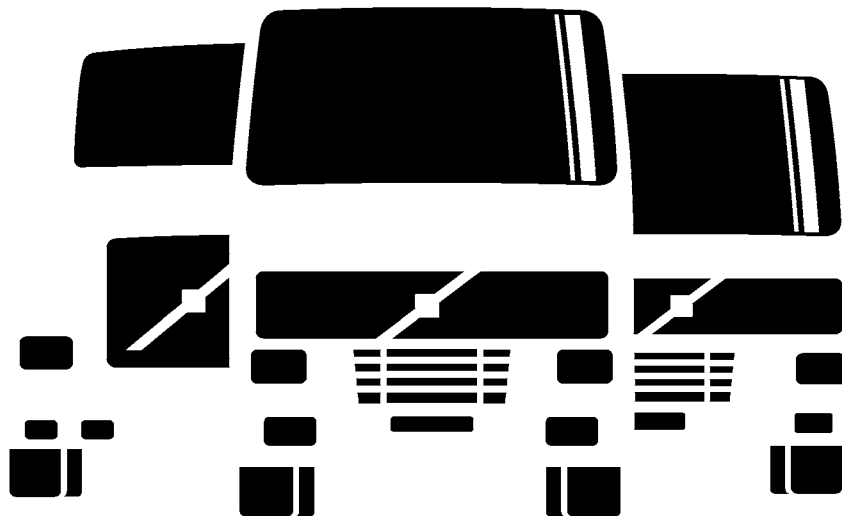


Service Manual Trucks

Group **710–500**

Frame Rails and Crossmembers
VN/VHD



Foreword

The descriptions and service procedures contained in this manual are based on designs and methods studies carried out up to August 2000.

The products are under continuous development. Vehicles and components produced after the above date may therefore have different specifications and repair methods. When this is believed to have a significant bearing on this manual, supplementary service bulletins will be issued to cover the changes.

The new edition of this manual will update the changes.

In service procedures where the title incorporates an operation number, this is a reference to an S.R.T. (Standard Repair Time).

Service procedures which do not include an operation number in the title are for general information and no reference is made to an S.R.T.

The following levels of observations, cautions and warnings are used in this Service Documentation:

Note: Indicates a procedure, practice, or condition that must be followed in order to have the vehicle or component function in the manner intended.

Caution: Indicates an unsafe practice where damage to the product could occur.

Warning: Indicates an unsafe practice where personal injury or severe damage to the product could occur.

Danger: Indicates an unsafe practice where serious personal injury or death could occur.

Volvo Trucks North America, Inc.
Greensboro, NC USA

Order number: PV776-TSP143123

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Contents

General	3
Frame Rails and Crossmembers	3
Specifications	5
Frame Rails	5
Tools	9
Standard Tools and Equipment	9
Special Tools	10
Special Equipment	11
Design and Function	13
Frame Rails and Crossmembers	13
Troubleshooting	35
HUCK-FIT® Fastener Troubleshooting	35
Service Procedures	37
Frame Rail, Replacement	37
Frame Alignment, Checking	43
Frame Alignment, Adjustment	44
Intermediate Crossmember, Replacement (Rivets Under the Flame Flange)	45
Intermediate Crossmember, Replacement (Bolted and Exposed Rivets)	46
Closing Crossmember, Replacement	47
Engine Crossmember, Replacement	47
Rear Suspension Crossmember (Bogie), Replacement	49
Frame Length, Adjustment	51
Body Bound Bolt, Installation	56
HUCK-FIT® Fastener, Removal	56
HUCK-FIT® Fastener, Installation	57
Feedback	
Operation Numbers	

General

Frame Rails and Crossmembers

The information in this manual covers specifications, tools, designs, function and service procedures for VN/VHD Frame Rails and Crossmembers. This information is essential for maintenance and proper serviceability of the Frame Rails and Crossmembers.

Specifications

Frame Rails

Material 758.4 MPa (110,000 psi) yield heat treated steel

Distance between rails

Front 1080 ± 2 mm (outside)

Rear 836 $\begin{smallmatrix} +2.7 \\ -4.6 \end{smallmatrix}$ mm

Frame rail end taper 27°

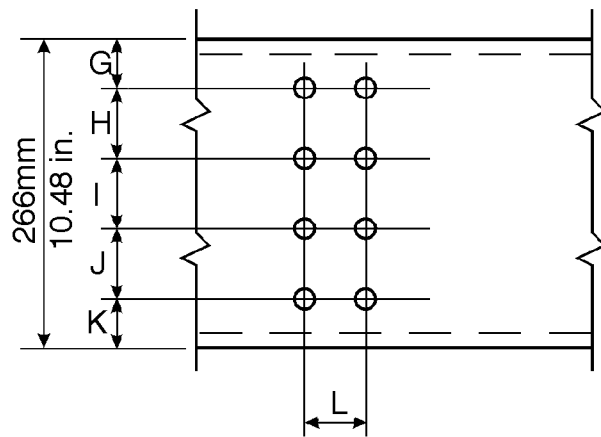
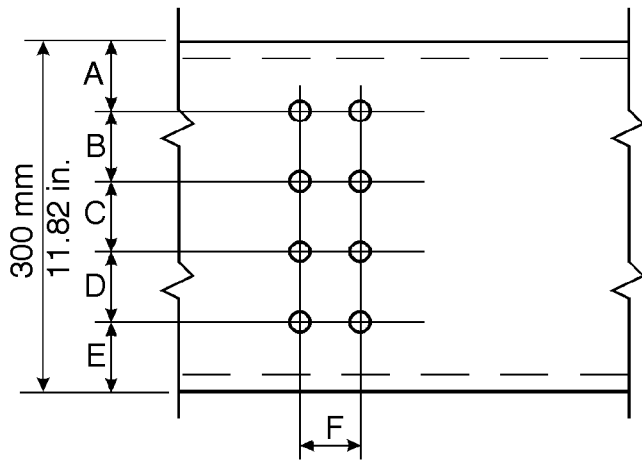
Available Frame Heights and Thicknesses

Frame height	Frame thickness
266 mm (VN)	6 mm, 7 mm, 8 mm
300 mm (VN)	7 mm, 8 mm
300 mm (VHD)	7 mm, 8 mm, 11.1 mm

Bolt Hole Patterns

Hole spacing with Volvo T-Ride suspension 60 mm (2.26 in.) (vert) x 50 mm (1.97 in.) (horiz)
 (applicable only from 1685 mm (65.2 in.) from front edge of the rail and rearward)

Note: Hole size for this spacing must be 15.5 mm (0.61 in.) long.



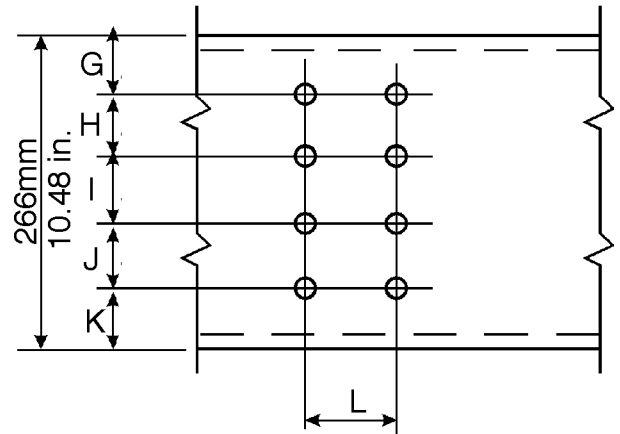
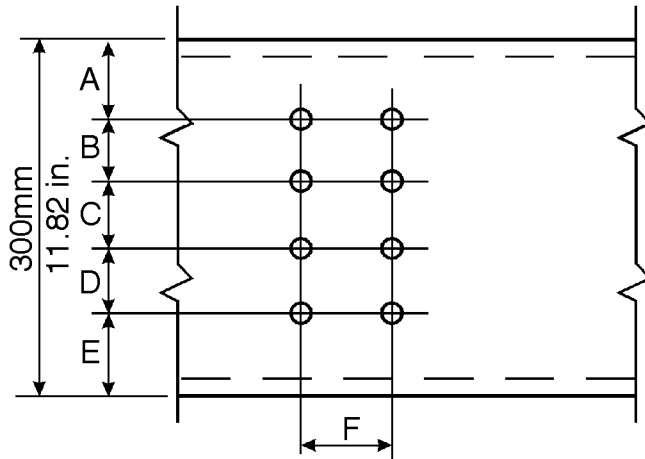
- A 60 mm (2.36 in.)
- B 60 mm (2.36 in.)
- C 60 mm (2.36 in.)
- D 60 mm (2.36 in.)
- E 60 mm (2.36 in.)
- F 50 mm (1.97 in.)
- G 43 mm (1.69 in.)
- H 60 mm (2.36 in.)
- I 60 mm (2.36 in.)
- J 60 mm (2.36 in.)
- K 43 mm (1.69 in.)
- L 50 mm (1.97 in.)

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Hole Spacing With All Suspensions Except Volvo T-Ride

Front axle crossmember and forward 60 mm (2.26 in.) (vert) x 50 mm (horiz)
 Rear of front axle crossmember 76.3 mm (3 in.) (vert) x 50.8mm (2 in.) (horiz)

Note: Hole size for this spacing must be 17 mm (0.66 in.) long.



- A 74.1 mm (2.92 in.)
- B 50.8 mm (2.00 in.)
- C 50.8 mm (2.00 in.)
- D 50.8 mm (2.00 in.)
- E 74.1 mm (2.92 in.)
- F 76.0 mm (3.00 in.)
- G 56.8 mm (2.24 in.)
- H 50.8 mm (2.00 in.)
- I 50.8 mm (2.00 in.)
- J 50.8 mm (2.00 in.)
- K 56.8 mm (2.24 in.)
- L 76.0 mm (3.00 in.)

W7001188

Tightening Torques, Frame Rail Bolts

(for property class 10.9 bolts and property class 10 nuts)

Bolt Size	Torque
M6	12 ± 2 Nm (9 ± 1.5 ft-lb)
M7	22 ± 3 Nm (16 ± 3 ft-lb)
M8	30 ± 5 Nm (22 ± 4 ft-lb)
M10	60 ± 10 Nm (44 ± 7 ft-lb)
M12 (bolts crossmembers together)	105 ± 20 Nm (78 ± 13 ft-lb)
M14 (bolts crossmembers to frame)	200 ± 33 Nm (148 ± 24 ft-lb)
M16 (bolts crossmembers to frame)	275 ± 45 Nm (204 ± 34 ft-lb)
M18	360 ± 55 Nm (267 ± 44 ft-lb)
M20 (bolts cab mounts to frame)	540 ± 90 Nm (400 ± 67 ft-lb)
M22	730 ± 120 Nm (541 ± 90 ft-lb)
M24	900 ± 140 Nm (667 ± 111 ft-lb)

Proper frame bolt thread engagement Max. 13 mm past nut, min. two (2) threads

Tools

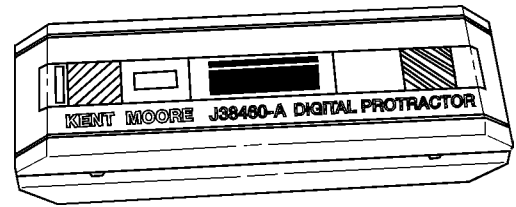
Standard Tools and Equipment

All listed tools and equipment are not required for each service procedure. Review the service procedure to be performed to determine which tools and equipment will be required.

- Torque wrench
- Tape measure
- C-clamps
- Drift pins
- Hammer
- Metal saw
- Gas cutting torch
- Metal grinder
- Welding machine
- Reamer (0.652 inch)

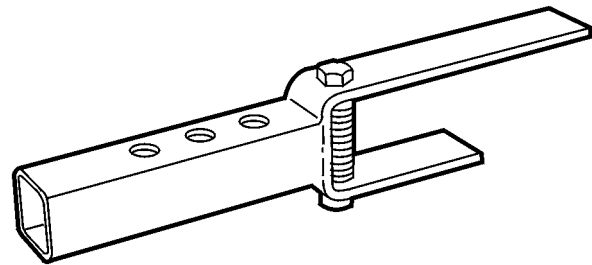
Special Tools

The J-38460-A is a digital protractor, available from Kent-Moore (telephone: 800-328-6657.)



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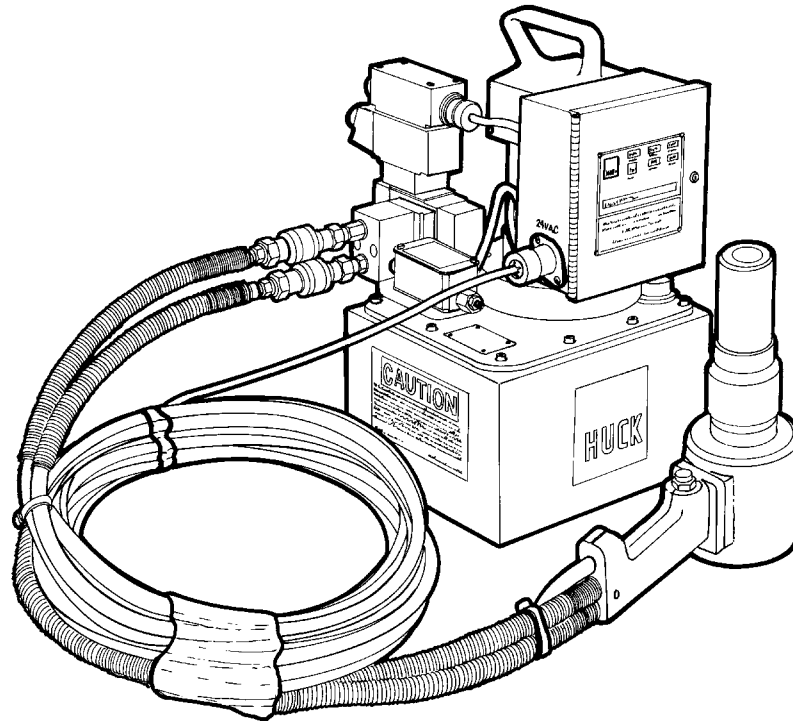
The J-44771 Frame Rail Guide Support is available from Kent Moore (telephone: 800-328-6657.)



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Special Equipment

The following special equipment may be required for work on the frame rails and crossmembers. This equipment can be ordered from your manufacturer.

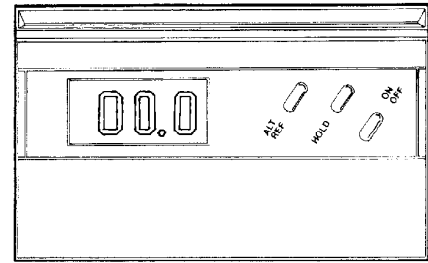


The HUCK® Manufacturing 940INTRKTV tool kit is available from your local HUCK® distributor and consists of:

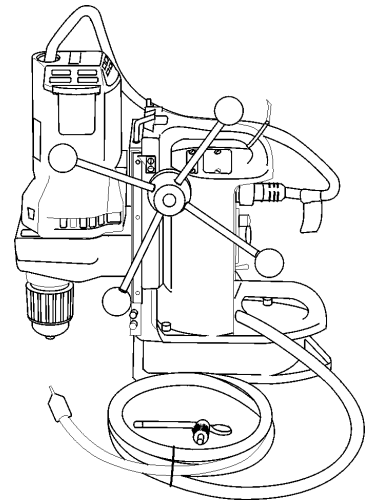
- 1 Nose assembly 99-1481 – This nose assembly is designed for use with the 16 mm (5/8") fastener and attaches to the model 585 hydraulic installation tool.
- 2 Model 585 hydraulic installation tool – This hand-held tool has a 3.5 m (12 ft.) hose assembly that is

- W0000397
- 3 Model 940 POWERIG® hydraulic unit – This portable 110V electric power unit provides hydraulic fluid under pressure to the model 585 hydraulic installation tool. (This tool is also available in 220V.)

The Digital Angle Gauge. The Anglemaster is a digital inclinometer, available from Dana-Spicer (telephone: 419-535-4300.)

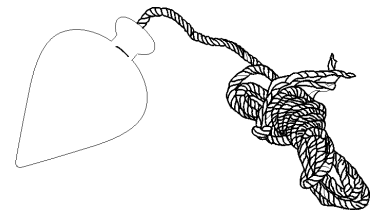


Drill with Magnetic base.



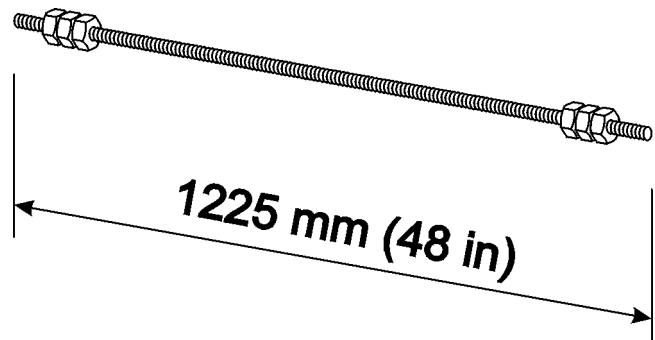
W0001876

Plumb Bob.



W0001877

Threaded rods, 1/2 in. diameter, 1200 mm (48 in.) long (2 required) with 12 nut.



W0001878

Design and Function

Frame Rails and Crossmembers

The frame for the VN/VHD series has frame sidemember designs for vehicles produced by Volvo Trucks North America. The designs include two sidemember heights, three sidemember thicknesses, and a flared shape.

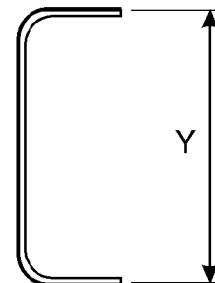
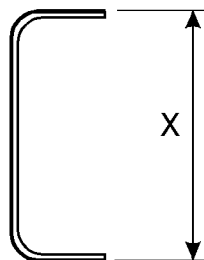
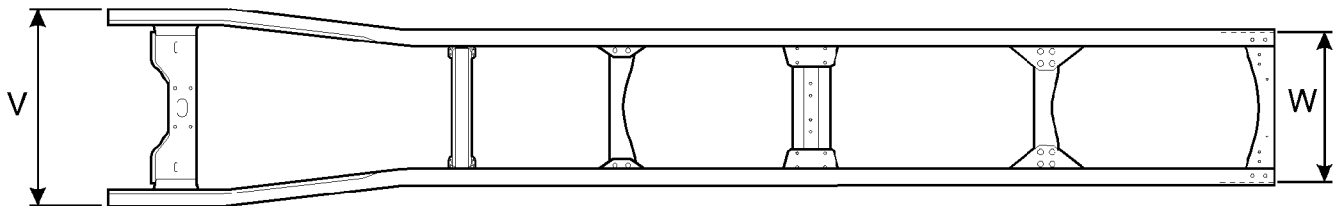
The frame height is constant for the entire length of the rail. The rail height is either 266 mm, called the Low Profile frame, or 300 mm, called the High Profile frame. The low profile frame may have a thickness of either 6 mm, 7 mm, 8 mm or 11.1 mm. The high profile height frame may have a thickness of 7 mm, 8 mm or 11.1 mm (VHD). The rails of the frame are separated at the front edge a distance of 1080 mm (outside edges). From a position just rearward of the front engine crossmember to a position just forward of the rear engine crossmember the rails are tapered closer together. From that point

to the rear edge, the distance is 836 mm (inside edges).

Note: Frame dimensions are specified in millimeters due to design. To obtain the approximate dimension in inches, multiply mm by 0.03937.

Because the frame rails are made of a high strength heat-treated steel, only the frame modifications detailed in this information are permitted, in order to ensure that the structural integrity of the rails is maintained.

In conjunction with the new frame design, the allowable bolt hole patterns in the frame web are specified and must be strictly followed.



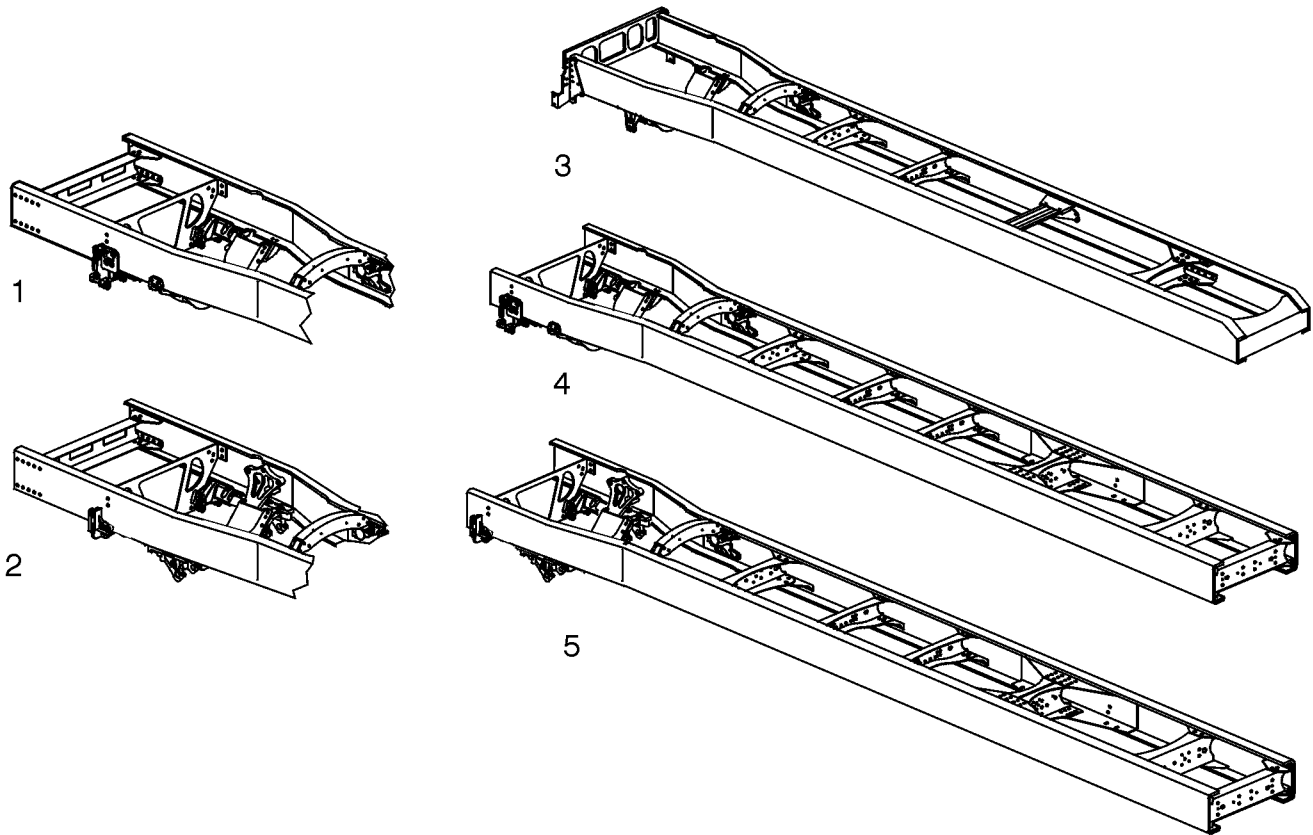
V 1080 mm (42.5 in.)

W 836 mm (32.9 in.)

X 266 mm (10.48 in.)

Y 300 mm (11.82 in.)

W7001181



W7001180

VN/VHD Frame rails with crossmembers:

- 1 Axle Forward with extension (VHD)
- 2 Axle Back with extension (VHD)
- 3 VN
- 4 Axle Forward (VHD)
- 5 Axle Back (VHD)

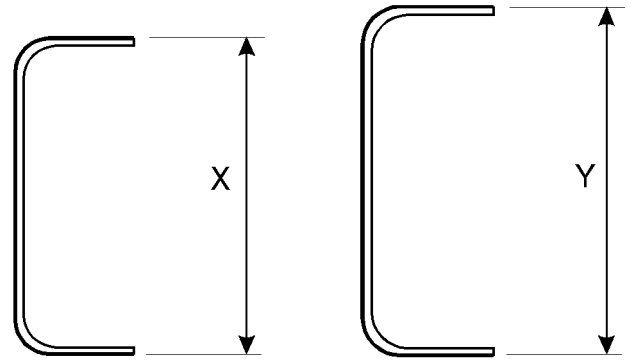
The frame consists of two steel side rails joined by several crossmembers. The frame for the VN/VHD series models is made in a variety of configurations to allow flexibility in adapting the frame for different transport requirements.

See the following design information:

- “Side Members” page 15
- “Crossmembers” page 17
- “Mountings and Brackets” page 24
- “Fasteners” page 25
- “Frame Material Behavior” page 26

Side Members

The side members, or frame rails, are constructed of 760 MPA (110,000 psi) yield heat treated steel. There are several combinations of side member height and thicknesses. The smaller height, referred to as the Low Profile frame, has a web height of 266 mm, and may be either 6 mm, 7 mm, 8 mm or 11.1 mm (VHD) thick. The larger height, referred to as the High Profile frame, has a height of 300 mm and may be either 7 mm or 8 mm thick.



X 266 mm (10.48 in.)

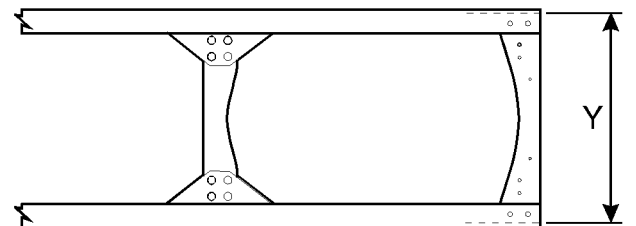
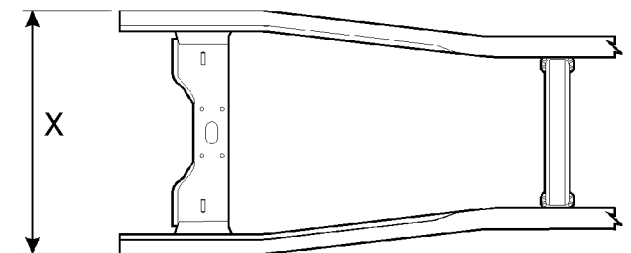
Y 300 mm (11.82 in.)

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These combinations of height and thickness provide for the variety of load and usage characteristics necessary to meet the hauling requirements of nearly any tractor. The flange width is a constant 90 mm for all combinations of web height and thickness.

Unlike previous frame designs, the side members are not an equal distance apart for their entire length. When viewed from the side, the side members appear straight. Viewed from above, the frame rails are flared outward from a point just forward of the rear engine crossmember. This design provides for increased lateral, vertical, and torsional stiffness. The result is improved vehicle integrity, handling, accident avoidance, and collision energy absorption. Widening the frame at the front also minimizes the need for cut outs in the frame flange to adapt the side members to various vendor engines.

Regardless of the frame rail height, thickness, and length, the basic frame design and dimensions are the same. The front rail separation is 1080 mm, as measured from the outside of the frame rails, because the front crossmember bolts to the outside of the rails. The separation at the rear end is 836 mm, as measured from the inside, because the closing crossmember is bolted between the rails. The separation is a constant 836 mm at a point 1635 mm from the front.



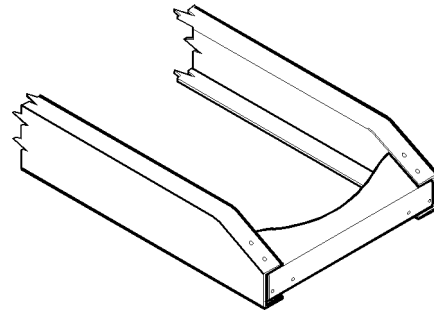
X 1080 mm (42.5 in.)

Y 836 mm (32.9 in.)

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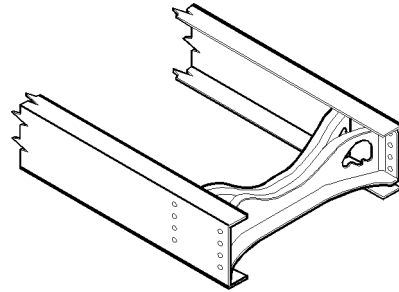
A standard hole pattern is designated for the frame rail web. For vehicles with a complete Volvo T-Ride suspension, the hole pattern is 60 mm vertically between holes and 50 mm horizontally. These dimensions apply to the web behind the rear bend and forward of the rearmost suspension component for the rear axles. For vehicles with other than Volvo T-Ride suspension, the pattern is 60 mm vertically and 50 mm horizontally from behind the forward spring hanger to the intermediate crossmember, and 3 in. vertically by 2 in. horizontally from the front axle crossmember to the rearmost suspension component for the rear axles. See "Bolt Hole Patterns" page 6.

The rear end of the frame is either cut straight or is tapered at a 27 degree angle. There are three different closing crossmembers to accompany the style of frame termination.



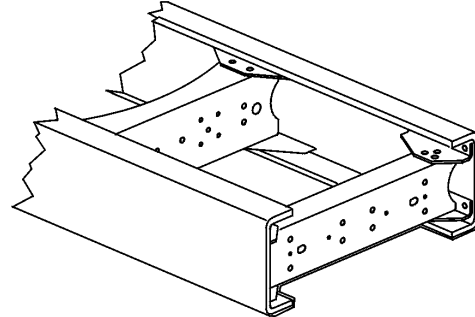
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Tapered frame end with tapered closing crossmember



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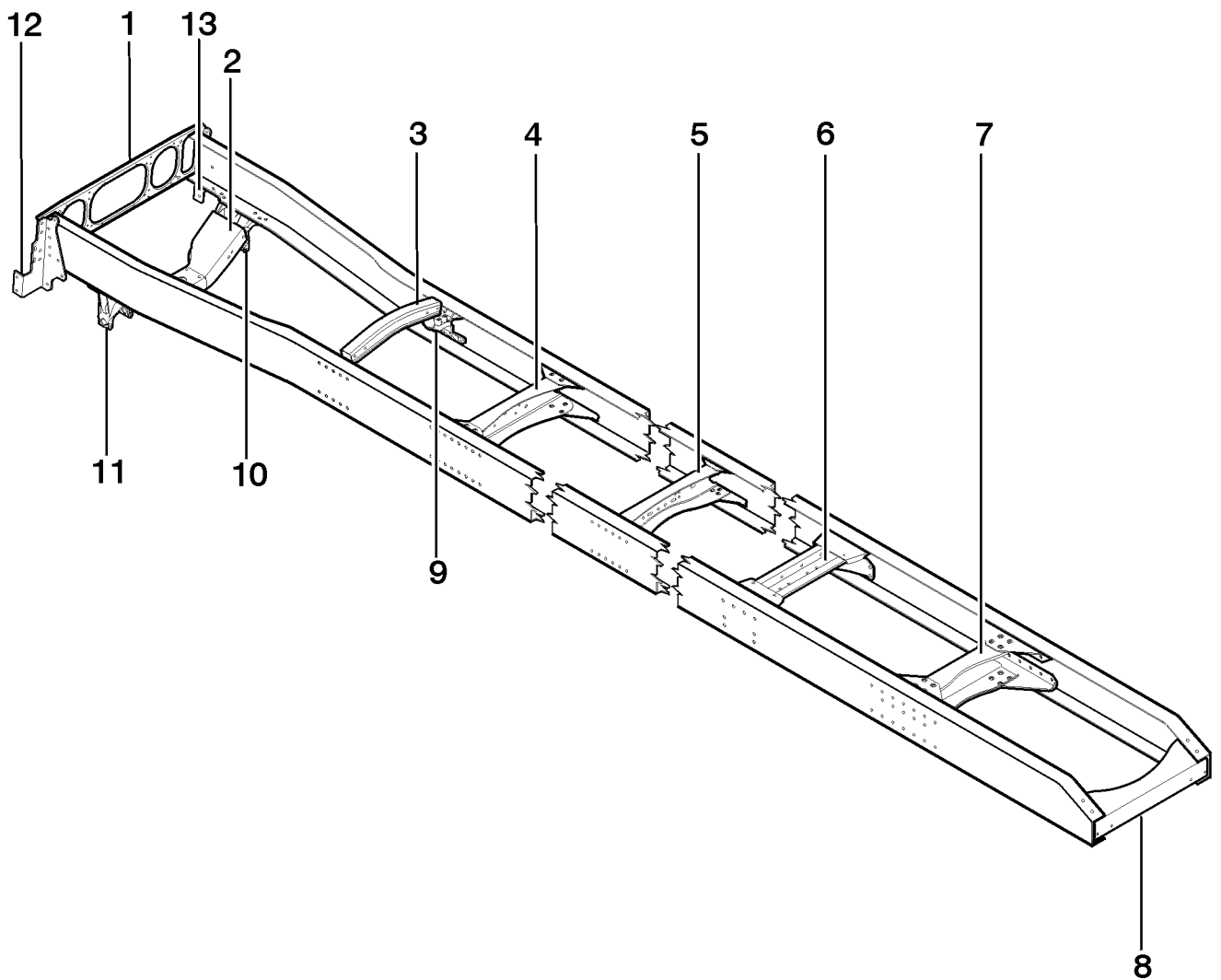
Straight frame end with splay closing crossmember



W7001005

VHD frame with closing crossmember

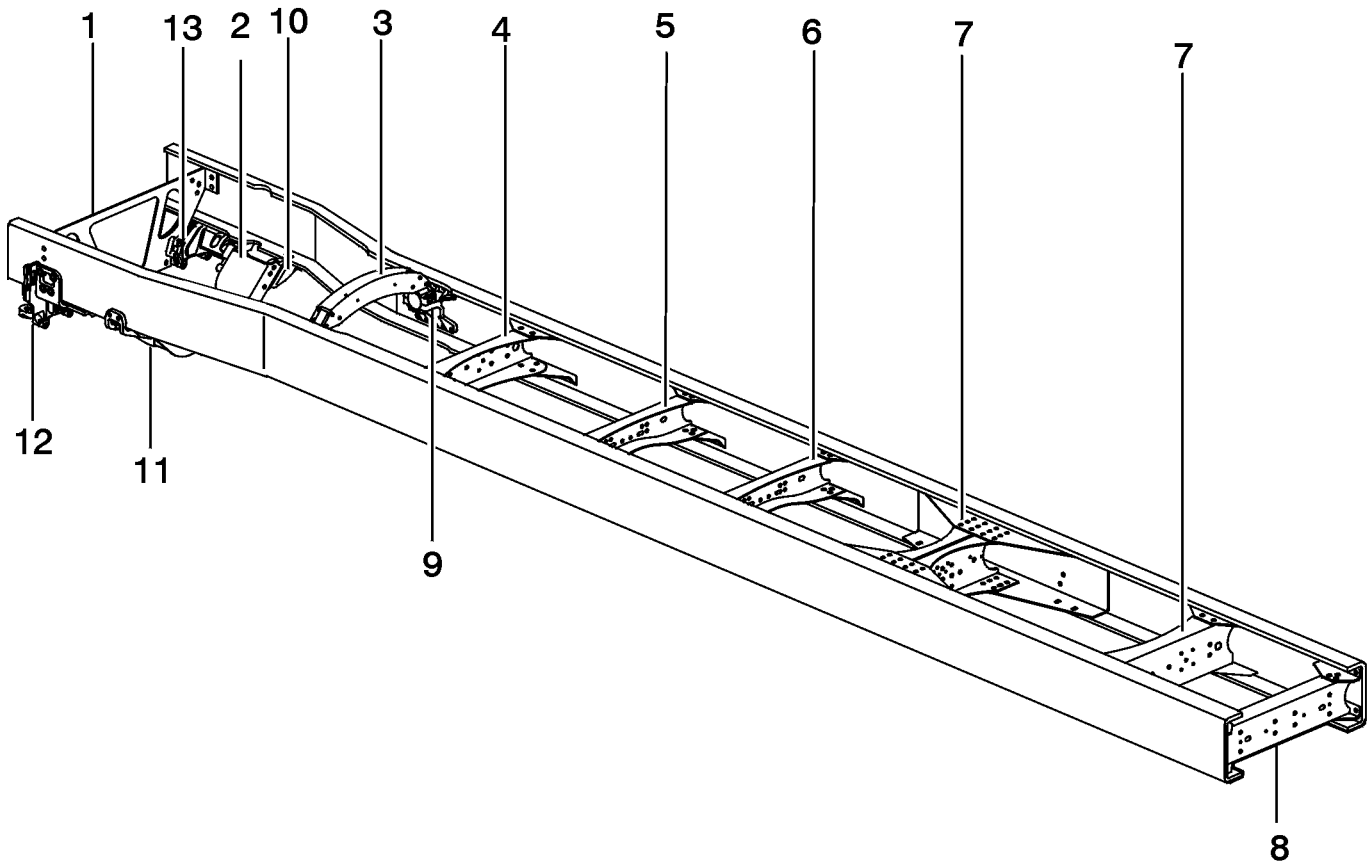
Crossmembers



W7001043

VN Frame and Crossmember

- | | |
|--------|------------------------------|
| 1 | Front Crossmember |
| 2 | Front Engine Crossmember |
| 3 | Rear Engine Crossmember |
| 4 | Transmission Crossmember |
| 5 | Intermediate Crossmember |
| 6 | Front-of-Axle Crossmember |
| 7 | Rear Suspension Crossmembers |
| 8 | Closing Crossmember |
| 9 | Rear Engine Support Brackets |
| 10, 11 | Front Spring Hanger |
| 12, 13 | Bumper Mounting Bracket |



W7001008

VHD Frame and Crossmember

- | | |
|--------|------------------------------|
| 1 | Front Crossmember |
| 2 | Front Engine Crossmember |
| 3 | Rear Engine Crossmember |
| 4 | Transmission Crossmember |
| 5 | Intermediate Crossmember |
| 6 | Front-of-Axle Crossmember |
| 7 | Rear Suspension Crossmembers |
| 8 | Closing Crossmember |
| 9 | Rear Engine Support Brackets |
| 10, 11 | Front Spring Hanger |
| 12, 13 | Bumper Mounting Bracket |

The crossmembers provide a high degree of torsional stiffness to the frame. They allow the vehicle to handle the side forces caused by turns and uneven road conditions. Improved crossmember design and positioning for the VN/VHD series models has resulted in reduced weight, enhanced frame stability, improved truck handling, and reduced noise and vibration.

The crossmember components are to be treated as a unit. Each consists of a beam and end plates. Where beams and end plates are riveted together, they must not be separated. If replacement is necessary, the replacement beams must be cut in the center and welded together after the end plates have been mounted to the frame rails. The front engine crossmember is an exception to this, in which case, the rivets are replaced by body bound bolts.

Note: The numbers in the crossmember descriptions that follow refer to the numbers on the frame and crossmember diagram at the beginning of the Crossmembers subsection.

Front Crossmember

The front crossmember connects the front ends of the side rails. It is 4 mm thick and has large holes to allow maximum air flow to the radiator and charge air cooler. It is physically bolted to the front crossmember and bumper mounting brackets, which are bolted to the side rails.

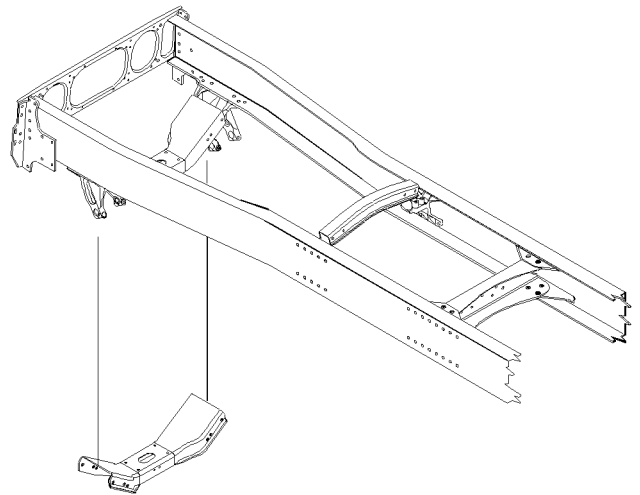


Fig. 1: VN

W7000376

Front Engine Crossmember

The second crossmember is the front engine crossmember. It is riveted to the front spring hangers, which are bolted to the side members. It is designed to support the forward end of the front suspension and the front engine mount, which is a single point suspension at the center of the crossmember. The crossmember is universal in that it can accommodate engines made by Volvo or by other manufacturers. This crossmember is simply rotated 180° from the Volvo engine position to adapt to other vendor engines.

Unique brackets have been designed for fitting each vendor engine to the VN/VHD series engine mounts. Because the second crossmember coincides with the spring hangers, it provides support against side-bending forces generated by driving in curves.

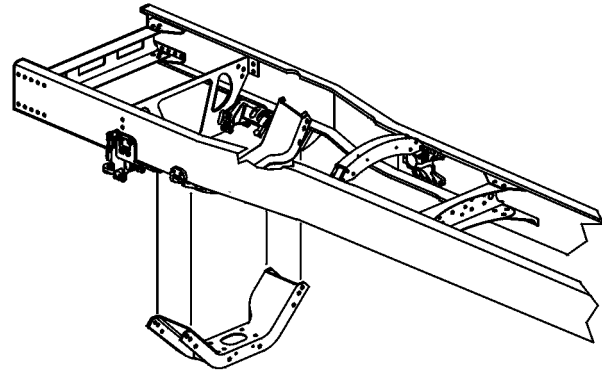


Fig. 2: VHD

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Rear Engine Crossmember

The next crossmember is the rear engine crossmember. It is supported by the rear engine support brackets and provides support against side loads that occur during vehicle turning. This crossmember is attached to the rear engine mounting brackets. If the vehicle is equipped with a Volvo transmission, the brackets are bolted to the engine flywheel housing. For vendor transmissions, the brackets are bolted to the clutch housing.

Transmission Crossmember

The transmission crossmember is the first crossmember rear of the transmission. The stiffness of this crossmember is improved over earlier models due to wider end-plate attachment flanges. Its higher placement on the frame provides greater structural strength. It is positioned so that there is sufficient prop-shaft clearance without having to bend the crossmember.

The rivets that connect the beam to the end plates on this crossmember are covered by the frame flange and are not accessible.

Intermediate Crossmember

The intermediate crossmember functions as the anchorage for the prop-shaft center bearing mounting in addition to its normal function. Longer wheelbase vehicles may have one or two additional intermediate crossmembers installed.

Note: Removal of the transmission and intermediate crossmembers requires cutting the old crossmember in half and unbolting the end plates from the frame. Installation requires cutting the new crossmember in half, bolting the halves in place, and welding them together.

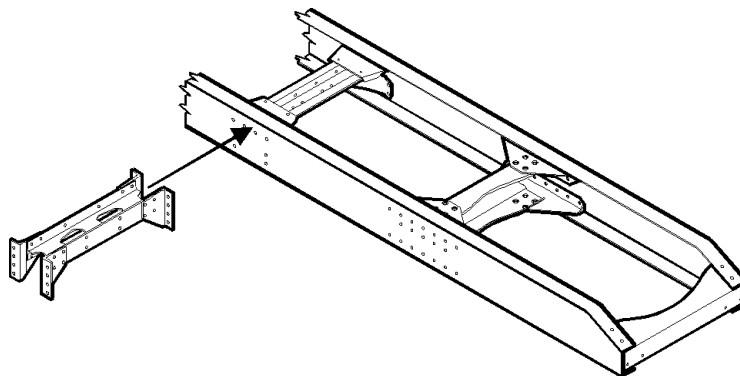


CAUTION

Possible material failure. The quality of the weld on a replacement crossmember is important to the structural strength of the crossmember. All crossmember welding must be performed by a certified welder to guarantee the integrity of the crossmember. Failure to properly perform the weld could result in failure of the crossmember.

Front-of-Axle Crossmember

The front-of-axle crossmember exists mainly to provide support for the suspension system. This particular crossmember is used on vehicles equipped with the Volvo Optimized Air Suspension (VOAS) and the four-spring leaf spring suspension. An aluminum front axle crossmember is available for reduced weight.

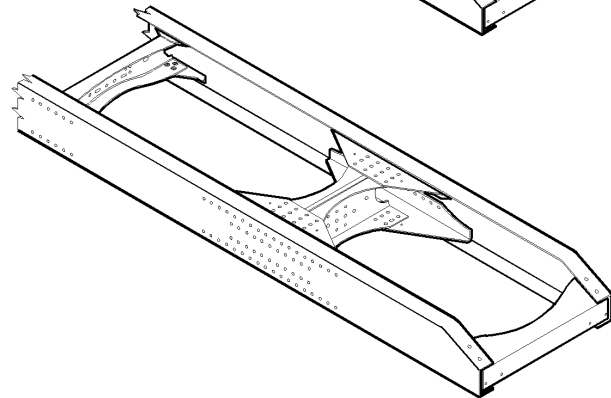
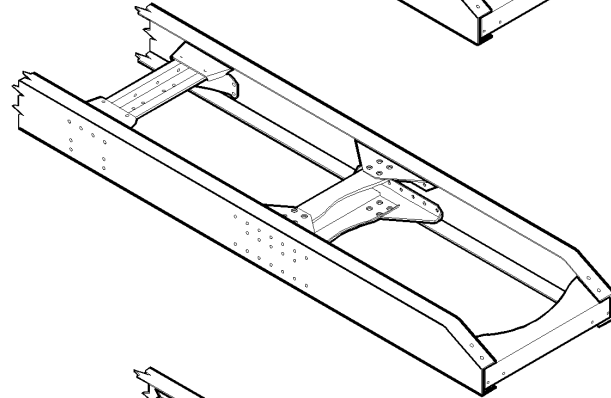
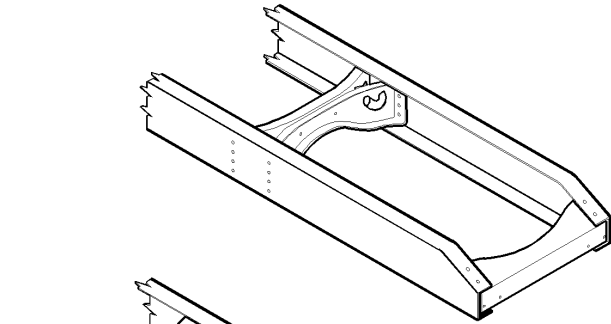


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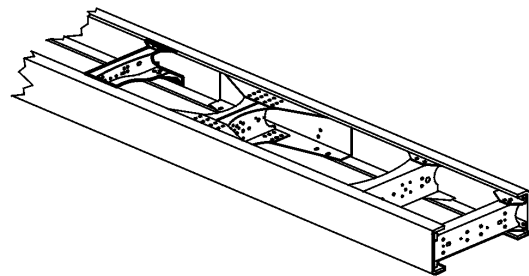
Rear Suspension Crossmember

There are a variety of rear suspension crossmembers designed to accompany the axle suspension systems they support. Because of the higher stresses and loading taken up at the rear suspension, this crossmember has larger flanges than the other crossmembers.

The rear suspension crossmembers shown at right are for 4x2 tractor with leaf springs or air ride (top), 6x4 tractor with leaf springs or Volvo Optimized Air Suspension (middle), and 6x4 tractor with T-Ride (bottom).



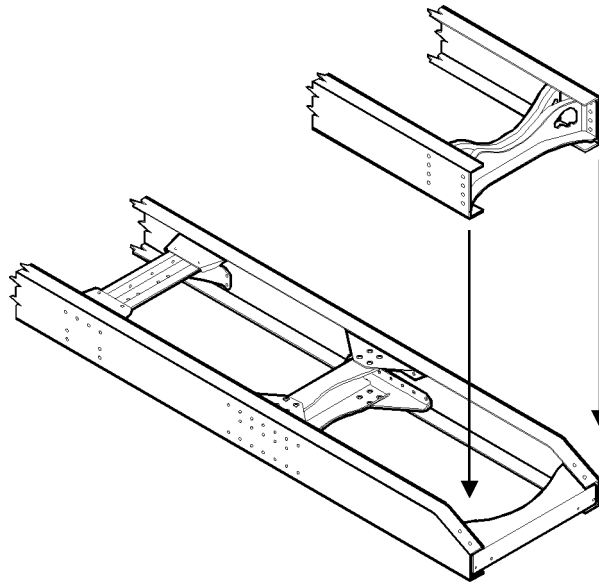
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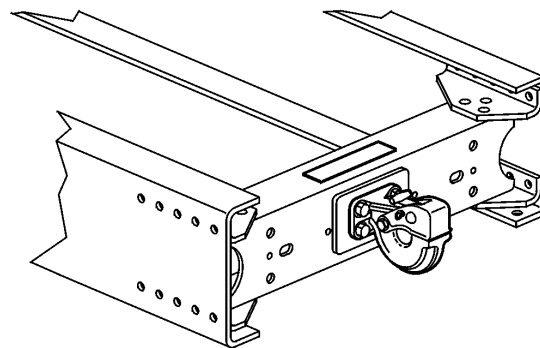
Closing Crossmember

The closing crossmember keeps the separation of the frame rail ends fixed at 836 mm. The frame rail ends are either tapered at a 27 degree angle, or are cut straight. There is a crossmember designed for each of these conditions.



W7000375

Fig. 3: Closing Crossmember



W7001010

Fig. 4: Closing Crossmember with tow hook

Mountings and Brackets

The engine mounting system consists of brackets constructed of ductile iron castings and rubber cushion isolators. With Volvo transmissions, the rear mount attaches to the engine flywheel housing. The rear mounts attach to the clutch housing on all vendor transmissions.

Various brackets have been designed to adapt the Volvo engine front isolators and cushions to vendor engines. The rubber cushions on the engine mounts are tuned to a precise vertical, longitudinal, and lateral stiffness. The fine tuning of the mount cushions enhances truck performance by isolating engine vibrations and noise from the chassis cab. These cushions have the ability to dampen forces caused by frame distortion when driving off road or on poor roads. The front and rear cushions are designed differently to allow a higher degree of movement.

The engine mounts minimize the motion of the engine. In addition, they provide for easy service to the engine. These advantages apply to all of the engines available with the VN/VHD series models.

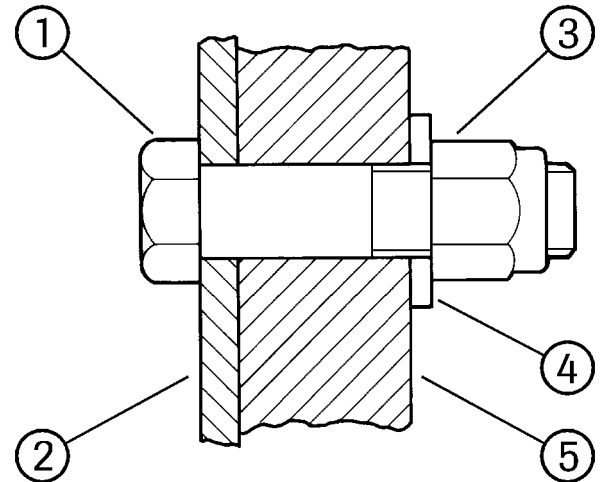
The fuel tank mountings are J-brackets that support and attach the fuel tank(s) to the chassis. Dual fuel tanks are stabilized by an additional crossover brace. They also support the steps up to the cab.

Fasteners

The crossmembers are connected to the frame rails using metric flange bolts. The beams and end plates of individual crossmembers are either bolted to one another using metric flange bolts, or are riveted. Whenever replacement of metric flange bolts is necessary, they must be replaced with identical hardware. In cases where rivets are used to connect beams and end plates, they must not be disturbed because this will affect the structural integrity of the crossmember.

Some crossmember beams are riveted to the end plates. In cases where the rivets are accessible and must be removed, they should be replaced with a 16 mm body bound bolt. These special bolts are manufactured with a shank diameter that is slightly larger than the outer diameter of the thread so that the load is not placed on the threaded portion of the bolts.

To make proper use of body bound bolts, the holes that will be used must be reamed to a diameter of 0.79 mm (0.031 in.) larger than the thread diameter. Proper joining of the crossmember and end plates or brackets is accomplished when the shank of the body bound bolt is in complete contact with the crossmember and inserts at least 2/3 of the way into the hole in the component on the nut side but does not extend out of the hole.



W7000383

- 1 Body bound bolt
- 2 Crossmember
- 3 Elastic stopnut
- 4 Hardened flat washer
- 5 End plate or spring bracket

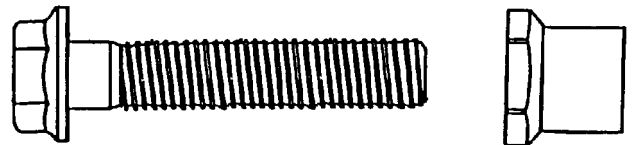
Some components are fastened to the frame using HUCK Spin® fasteners. If these fasteners must be replaced, metric flange bolts of the same size should be used.

Huck fasteners can usually be removed by using an air impact wrench.

For *Description* information see: “Huck-Fit® Fasteners” page 30.

For *Troubleshooting and Diagnostics* information see: “HUCK-FIT® Fastener Troubleshooting” page 35.

For *Service Procedure* information see: “HUCK-FIT® Fastener, Removal” page 56 and “HUCK-FIT® Fastener, Installation” page 57, “HUCK-FIT® Fastener, Installation” page 57.



HUCK® Spin bolt and collar

W7000440



CAUTION

Possible component damage. Never mix HUCK® Spin fasteners and flange fasteners within a hole pattern. Mixing fastener types could cause the flange bolts to come loose.

Frame Material Behavior

Frame Strength

The amount of stress that a frame rail can withstand is a function of several factors. The most important of these are the **Section Modulus** and the **Yield Strength**. Section Modulus is a measure of the strength of a frame member cross section. It is based on the height, thickness, and shape of the cross section, as well as the width of the flange. It does not account for the material used in that side rail. Yield Strength is a measure of the strength of the material used, and is measured in MPa (or psi). It is the maximum amount of force that can be applied to the material to stretch or twist it and still have it return to its original shape. These two factors are multiplied to produce the measure of strength known as **Resisting Bending Moment (RBM)**. Generally, when the allowable level of RBM is exceeded, the frame will likely experience failure. The degree of failure is related to how much the RBM was exceeded and the method by which it was exceeded.

The frame is designed to absorb the energy associated with stresses produced by normal operation of the vehicle, including the higher stresses involved in off road use. The frame is unlikely to experience failure as long as the conditions assumed in design are not exceeded. The failures usually occur in situations when either the maximum allowable stress levels are exceeded or the maximum levels have been reduced.

The cause of frame failures are placed into one of three classifications:

- 1 Collisions
- 2 Excessive bending moment
- 3 Localized stress concentration

Frame Failure

Frame failure resulting from collision can be in the form of cracks, bends, twists, or broken rails or crossmembers.

Excessive bending moment failures are caused by overload, improper weight distribution, or misapplication of the vehicle. Excessive bending moment failure will occur at different areas on various types of vehicles. The result will usually be twisted or cracked frame rails.

Localized stress concentration failures may be the result of exceeding allowable bending moment, however, bending moment levels encountered during normal operation would not be high enough to cause a failure. Incidental to the failure is the condition of localized stress concentration. Possible causes for exceeding allowable bending moment could be high bending loads concurrent with severe torsional loads as may be found in off road service. Points of localized stress concentration may also be the result of one or several of the following:

- Poor body or fifth wheel mounting
- Improper special equipment or accessory installation
- Improper reinforcements
- Loose bolts
- Defective material

Special equipment or accessory installation can cause high stress concentration due to the method of attachment or the weight of the equipment. Holes should never be drilled through the flanges. Rapid changes of Section Modulus, which could occur during operations such as adding a large mounting plate for supporting special equipment, should be avoided. Heavy equipment mounted across the flanges or on the web of a side rail may produce enough stress concentration to cause failure at the nearest crossmember, bracket, or other frame stiffener, or through a nearby hole in the frame flange.

Improper reinforcement or attachment of the reinforcement may cause more difficulty than the original problem. Creation of localized stress concentrations may reduce the frame's load carrying capacity below its value prior to adding reinforcements.

Frame failure may be complete failure (breakage) of the frame or partial failure (frame misalignment). The list below describes several of the possible frame misalignment conditions that could be caused by exceeding bending moment.

Sag: Refers to a frame or side rail that is bent DOWN from its proper position.

Bow: Refers to a frame or side rail that is bent UP from its proper position.

Diamond: Refers to a condition in which one entire side rail is moved forward or rearward of its correct alignment in relation to the other side rail.

Twist: Refers to a condition where the entire frame has been twisted. One rail appears to slope upward and the other appears to slope down.

Sideways: Refers to a side rail that is bent inward or outward of its proper position from the other rail.

Minimizing Frame Failure

The potential for frame failures can be reduced or eliminated by operating the vehicle within the design limits and not creating areas of local stress concentration. Observance of the following guidelines will greatly minimize the chances of frame failure.

Vehicles should only be used for the purposes for which they were designed.

- 1 Avoid overloading vehicles.
- 2 Load vehicles evenly; avoid localized overloading.
- 3 Dump trucks should never be used to spread loads.
- 4 Tank trucks should have baffles.
- 5 Avoid excessive fifth wheel positions.
- 6 Avoid vehicle operation on extremely rough terrain.

Note: Only the following repairs/modifications are permitted on the VN/VHD series frame.

- Drilling holes for the attachment of equipment in accordance with the specified hole pattern.
- Cutting the frame to shorten it (never attempt to lengthen the frame).
- Welding is only permitted on the riveted type cross-members for replacement and on the frame rail ends to shorten them.

Observe the following recommendations when altering a frame rail.

- 1 Avoid abrupt changes in section modulus.
- 2 Never drill holes in frame rail flanges.
- 3 Ensure holes drilled in the frame rail web are spaced according to the hole pattern specifications.
- 4 Use existing holes whenever possible.
- 5 Do not cut holes with a torch.
- 6 Do not cut notches in the rails.
- 7 Do not use rivets for attaching equipment through holes in the frame. Always use a proper size Class 10.9 tighten flange bolts and Class 10 nut.
- 8 Welding should only be performed by a certified welder.

Huck-Fit[®] Fasteners

The HUCK-FIT[®] fastening system, which consists of the fastener and installation tooling, was designed to meet today's high-strength industrial fastening needs.

The unique tension-tension method of the Lockbolt installation enables these fasteners to consistently retain more than 95% of their initial clamp force, providing as much as 10–20% higher clamp force and tensile strength than conventional threaded fasteners. The swaged collar design resists vibration, eliminating the back-off problem encountered with threaded nuts and bolts.

The installation tooling allows easy operation and eliminates the need for specialized welding or tighten training.

Once the fastener is installed, visual inspection of the full swage is sufficient to verify correct installation. This is in sharp contrast to traditional threaded fasteners, for which installation accuracy and inspection depend on the calibration of tighten equipment.

The fasteners are removable, which makes them both exceptional and practical. The unique swaging action of the lockbolt collar provides very high break-loose and back-off resistance. However, with enough applied force, the collar can be removed without cutting. Standard impact-type tighten tooling can be used to remove the collar.

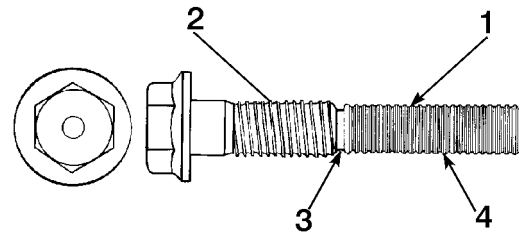


Fig. 5: Huck-Fit bolt

W7001149

- 1 Pull Grooves
- 2 Pin Helix
- 3 Breakneck Groove
- 4 Pintail

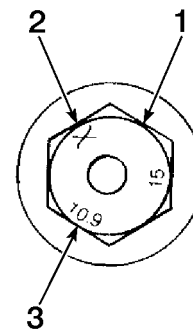


Fig. 6: Head Markings

W7001150

- 1 Grip Markings
- 2 Huck Symbol
- 3 Property class

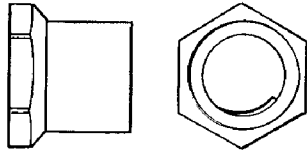


Fig. 7: Hex Base Flange Collar

W7001151

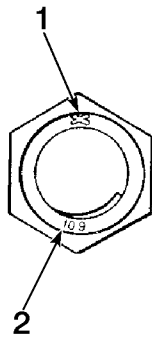


Fig. 8: Collar Markings

W7001152

- 1 Huck Symbol
- 2 Property class

Identification

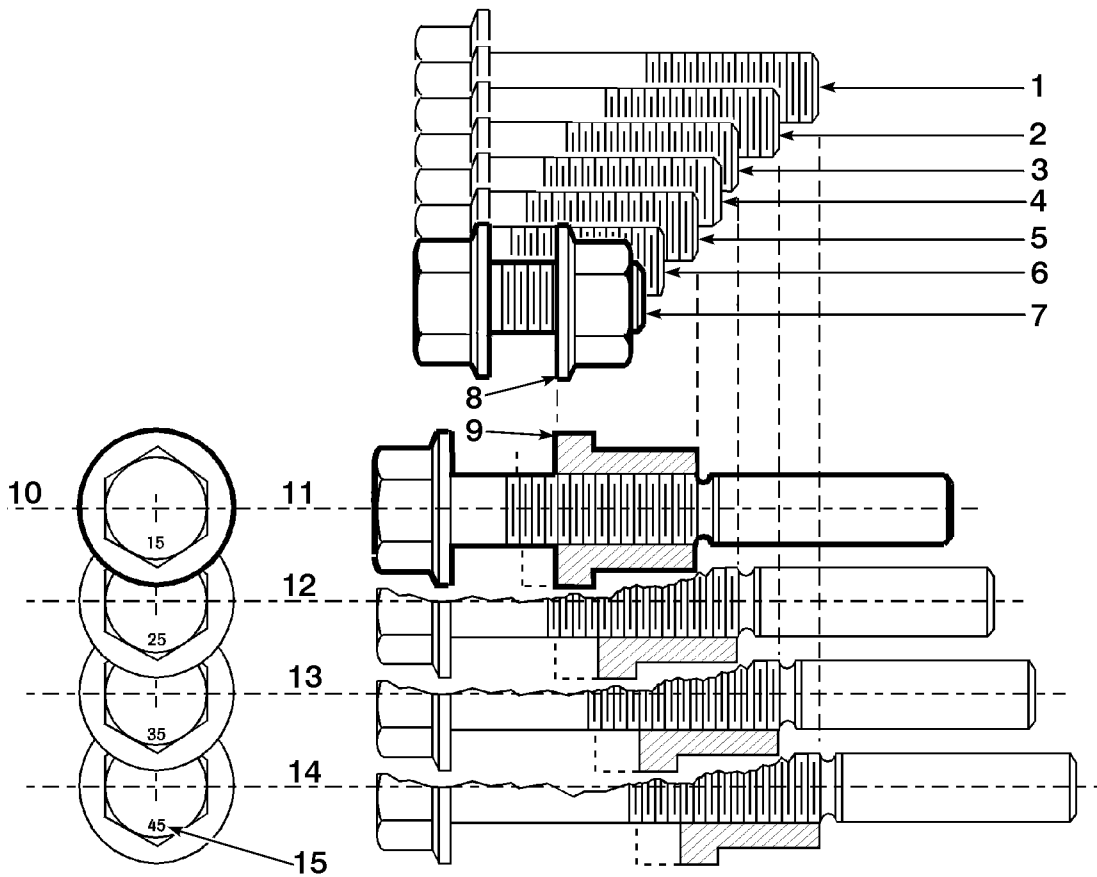


Fig. 9: Typical Flange Bolt to Huck Bolt Crossover (Reference Grade 8 Flange)

W7001147

- | | | | |
|---|--------------------------|----|-----------------------------|
| 1 | S34X6227
8397081 | 9 | MHCH-R16U
8075532 COLLAR |
| 2 | S343X6225
8397060 | 10 | HUCK P/N
VTNA P/N |
| 3 | S343X622
839709 | 11 | MHFF-DT16 -15
8075528 |
| 4 | S343X6220
8397078 | 12 | MHFF -DT16 -25
8075529 |
| 5 | S343X6217
8397077 | 13 | MHFF-DT16 -35
8075530 |
| 6 | S343X6215
839706 | 14 | MHFF-DT16 - 45
8075531 |
| 7 | S343X6212
8397075 | 15 | GRIP NO. |
| 8 | S344X6200
8397202 NUT | | |

Volvo vehicles currently use 16 mm (5/8") fasteners. Fastener selection is based on the thickness of material to be clamped. The fasteners have a "grip" number. The grip number is stamped into the head of each pin, and represents the midpoint of the grip range (expressed in millimeters) for that particular pin. The 16 mm pin is available with a grip marking of 17. This pin has a grip range of 10–24 mm. The 16 mm pin can also be identified by the raised nipple at the center of the pin head.

Grip No.	mm Range (min-max)	Decimal Range (min-max)
10	5 - 15	(0.19 - 0.59)
15	10 - 20	(0.39 - 0.78)
20	15 - 25	(0.59 - 0.98)
25	20 - 30	(0.78 - 1.18)
30	25 - 35	(0.98 - 1.37)
35	30 - 40	(1.18 - 1.57)
40	35 - 45	(1.37 - 1.77)
45	40 - 50	(1.57 - 1.96)
50	45 - 55	(1.77 - 2.16)
55	50 - 60	(2.96 - 2.56)
65	60 - 70	(2.36 - 2.75)
70	65 - 75	(2.55 - 2.95)
75	70 - 80	(2.75 - 3.15)

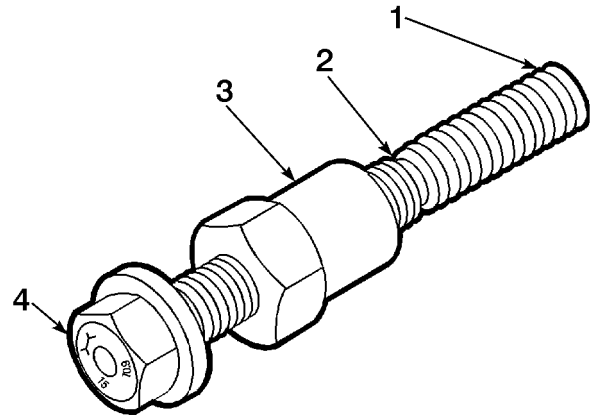


Fig. 10: VTNA Flange bolt-to-bolt crossover

W7001148

- 1 Pin-Tail
- 2 Pin-Tail
Break Area
- 3 Collar
- 4 Huck Bolt

Troubleshooting

HUCK-FIT[®] Fastener Troubleshooting

Fault	Reason	Remedy
Tool fails to operate	Inoperative POWERIG [®]	Check power source.
	Loose or disconnected control cord	Check and tighten securely.
	Loose or faulty hydraulic hose couplings	Check and tighten securely, or replace faulty couplings.
Tool operates in reverse	Reversed hose connections between POWERIG [®] and tool	Check and correct hose connections.
Tool leaks hydraulic oil	Depending on where leak occurs, defective or worn O-rings, loose hydraulic hose connection at tool	Check and replace O-rings and back-up rings, or tighten hydraulic hose.
Hydraulic oil overheats	POWERIG [®] not operating properly. Pump motor rotation reversed	See POWERIG [®] instruction manual.
	Restriction in hydraulic line	Check and tighten couplings, and replace if necessary.
Tool operates erratically and fails to install fastener properly	Low or erratic hydraulic pressure supply	See POWERIG [®] instruction manual.
	Defective or excessively worn piston O-ring in tool	Replace O-ring and back-up rings.
	Excessive wear or scoring of sliding surfaces of tool parts	Check and replace defective parts.
Pull grooves on fastener pin-tail stripped during pull stroke	Operator not sliding nose completely onto fastener pin-tail	Instruct operator in proper installation methods.
	Incorrect fastener length	Use correct length fastener.
	Worn or damaged jaw segments	Check and replace jaw set.
	Metal chips accumulated in pull grooves of jaw segments	Clean jaw segments.
	Excessive sheet gap	Eliminate excessive gap.
Collar of fastener not completely swaged	Improper tool operation	See fault "Tool operates erratically and fails to install fastener properly."
	Scored anvil in nose	Check and replace anvil.
Tool "hangs up" on swaged collar	Improper tool operation	See fault "Tool operates erratically and fails to install fastener properly."

Fault	Reason	Remedy
Pin-tail of fastener fails to break.	Pull grooves on fastener stripped	See faults "Tool operates erratically and fails to install fastener properly" and "Pull grooves on fastener pin-tail stripped during pull stroke."
Jaw segments do not maintain proper position in collet.	Improper operation of jaw follower	Check spring and install correct number of follower O-rings. Clean before re-assembling.
Hydraulic couplers leak oil.	Defective or worn O-ring in coupler body	Replace O-ring and back-up ring.
Pin-tail fails to eject from nose assembly.	Bent or broken pin-tail ejector	Replace pin-tail ejector.

Service Procedures

7113-03-02-01 Frame Rail, Replacement

DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

DANGER

Never work under or around a vehicle unless it is supported on jack stands of adequate rating. Failure to use adequate jack stands can result in the vehicle falling, which can cause serious injury or death to anyone under the vehicle.

WARNING

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire. Clean up fuel spills immediately.

WARNING

Always wear appropriate eye protection to prevent the risk of eye injury due to contact with debris or fluids.

WARNING

Use a hoist or get assistance when lifting components that weight 23 kg (50 lb) or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. Always use a spreader bar when necessary. The lifting hooks **MUST NOT** be side loaded. Failure to follow these warnings may result in personal injury.

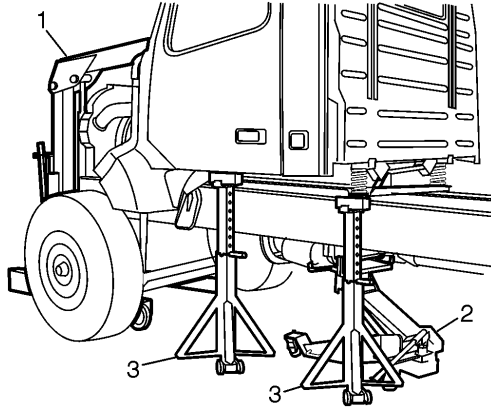
WARNING

Before beginning any service work on any part of the air system, be certain that the air pressure has been released. Failure to do so may cause a component to violently separate, which can result in serious personal injury.

Removal

- 1**
Park the vehicle on a level surface with transmission in neutral and the front wheels chocked. Raise the hood.
- 2**
Remove the mounting screws from the top and bottom of the bumper.
- 3**
Remove the support rods from the left and right sides of the bumper and remove the bumper.
- 4**
Disconnect the headlamp and foglamp connectors and remove the hood spring.
- 5**
Remove the hood splash shields on the left and right sides of the hood. Disconnect the hood restraint cylinders.
- 6**
Remove the fasteners to the hood pivot and remove the hood.

7



W7001177

- 1 Hoist
- 2 Transmission Jack
- 3 Jack stand

Support the engine and transmission jack with a hoist and transmission jack.

8

Remove the battery box cover and disconnect the batteries.

9

Remove the battery hold-down strap and remove the batteries.

10

Remove the battery cable hold-down bracket to the frame rail and disconnect the windshield wiper fluid pump.

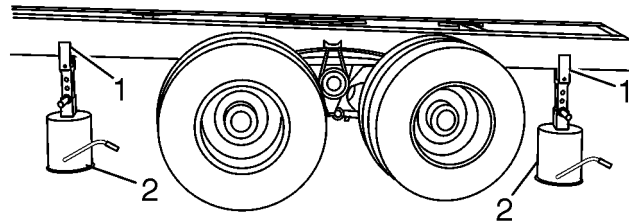
11

Disconnect the supply and return lines to the windshield washer reservoir. Remove the clamp that secures the drain valve pull cords to the air tanks.

12

Remove the air tank straps and the air tanks.

13



W7001186

- 1 Frame Rail Guide Support
- 2 Air Jack Stand

Remove the battery tray mounting bolts. Remove the battery and air tank support brackets.

Note: Some applications may require supporting the rear cab suspension.

14

Using tool J-44771, support the frame rail being removed with jack stands and frame rail guide supports, which are distributed equally throughout the length of the frame rail. J-44771

Note: A minimum of three jack stands and frame rail guide supports of adequate rating should be used for this procedure.

15

Disconnect the fuel supply and return line. Remove the fuel tank and fuel tank J- brackets.

16

Remove the inner fender splash shield and the lower bracket on the side of the vehicle being worked on.

17

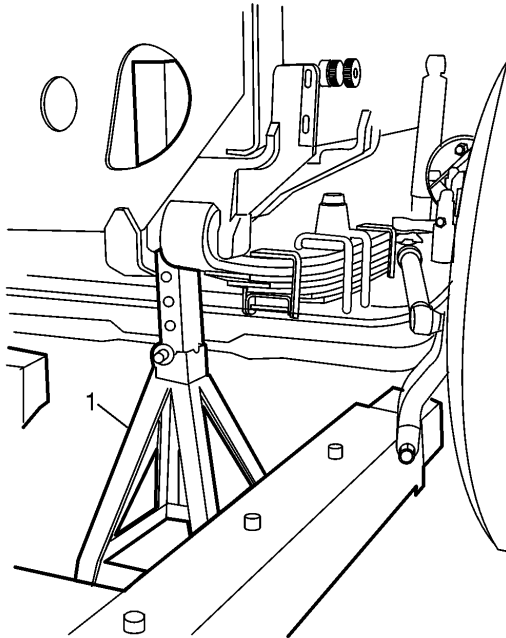
Remove the fasteners to the front closing crossmember and the fasteners to the tow hook on the side of the vehicle being worked on.

18

Remove the fasteners to the front spring hanger and remove the bumper support bracket.

Note: Support the front engine support crossmember.

19



W7001185

1 Jack Stand

Support the radiator with a jack stand. Remove the radiator support bracket and the lower radiator isolator mount on the side of the vehicle being worked on.

20

Remove the pitman arm from the steering gear.

21

Stabilize the steering gear and remove the fasteners that mount the steering gear.

22

Remove the front axle bump stop from the frame rail on the side of the vehicle being worked on.

23

Remove the Air Conditioning line support brackets inside the frame rail and remove the upper shock absorber bolt.

24

Remove the steering shaft carrier bearing bracket and/or the power steering reservoir bracket.

25

Remove the rear A/C line support bracket, the bulkhead fitting and the wheel speed sensor from the front brake.

26

Disconnect the hood release cable and remove the hood tube mount bracket.

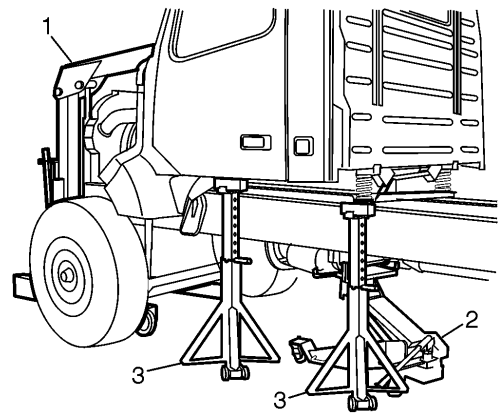
27

Remove the ground wire and the ground stud located on the frame rail forward of the front cab support.

28

Remove any air valves, wiring and/or air line brackets under the cab inside and outside of the frame rail.

29



W7001177

- 1 Hoist
- 2 Transmission Jack
- 3 Jack Stand

Support the front of the cab with a jack stand and remove the front cab support.

30

Remove the lower spring pin on the rear spring hanger to the front axle using tool 9996791.

9996791

31

Remove the rear spring hanger on the front axle.

32

Remove the transmission mount bracket and the transmission cross-member mounting bracket on the frame rail being removed.

33

Remove the fuel cooler and/or fuel water separator.

34

Remove the air dryer and/or purge tank.

35

Remove all the remaining clipping brackets from the wiring or air-line harnesses located inside and outside of the frame rail.

36

Remove any remaining air valves that are mounted inside or outside the frame rail.

37

Support the vertical exhaust pipe in place, then remove the support bracket for the exhaust.

38

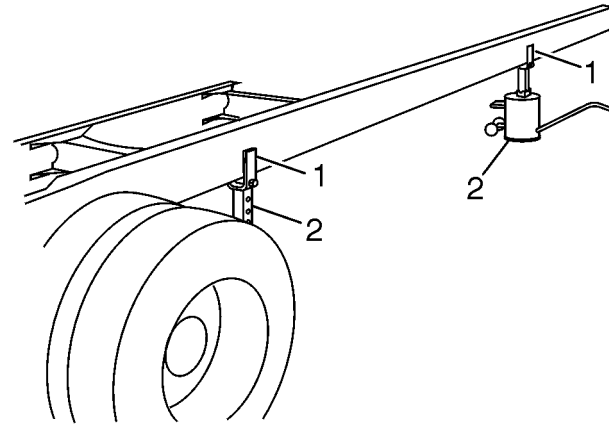
Support the rear suspension cross-member with a jackstand, then remove the upper shock brackets and the bump stops from the rear suspension.

39

Remove all existing fasteners from the rear suspension on the frame rail that is being removed.

40

Remove all existing fasteners to the crossmembers on the frame rail being removed.

41

- 1 Frame Rail Guide Support
2 Air Jack Stand

W7001179

Slide and push the frame rail backward, while simultaneously moving the jack stands, one after the other, to the rear of the frame rail. This will adequately support the frame rail while it is being removed.

Installation

Note: Do not tighten fasteners until they have been properly installed. This will help maintain proper frame alignment and will assist in obtaining proper height between the frame rails.

1

Slide and push the frame rail forward, while simultaneously moving the jack stands, one after the other, to the front of the frame rail. This will adequately support the frame rail while it is being replaced.

2

Install all fasteners and crossmembers on the frame rail being replaced.

3

Install fasteners from the rear suspension on the frame rail that is being replaced.

4

Install the upper shock brackets and the bump stops to the rear suspension.

5

Support the vertical exhaust pipe in place, then install the support bracket for the exhaust.

6

Install the air valves to the inside and outside of the frame rail.

7

Install all clipping brackets for the wiring or air-line harnesses to the inside and outside of the frame rail.

8

Once this step is complete, go back and tighten fasteners that have been installed from steps 1 through 7 as follows: M14: tighten to a torque of 200 ± 33 Nm (148 ± 24 ft-lb), M16: 275 ± 45 Nm (204 ± 34 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)
 275 ± 45 Nm
(204 ± 34 ft-lb)

9

Install the fuel cooler and/or fuel water separator.

10

Install the air dryer and/or purge tank.

11

Install the transmission mount bracket and the transmission crossmember mounting bracket on the frame rail being replaced.

12

Install the rear spring hanger on the front axle.

13

Install the lower spring pin on the rear spring hanger to the front axle using 9996791.

9996791

14

Install the front cab support.

15

Install any air valves, wiring and/or air line brackets under the cab inside and outside of the frame rail.

16

Install the ground wire and the ground stud located on the frame rail forward of the front cab support.

17

Connect the hood release cable and install the hood tube mount bracket.

18

Install the rear A/C line support bracket and remove the bulkhead fitting and wheel speed sensor from the front brake.

19

Install the steering shaft carrier bearing bracket and/or the power steering reservoir bracket.

20

Install the A/C line support bracket inside the frame rail and install the upper shock absorber bolt.

21

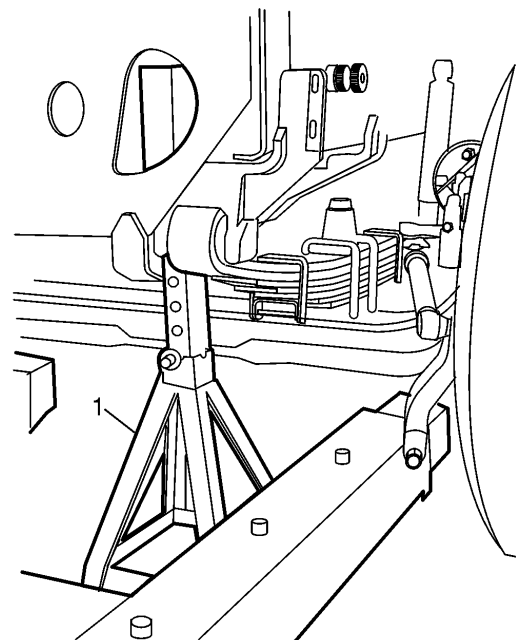
Install the front axle bump stop to the frame rail on the side of the vehicle being worked on.

22

Stabilize the steering gear and install the fasteners that mount the steering gear.

23

Install the pitman arm to the steering gear.

24

W7001185

1 Jack Stand

Install the radiator support bracket and the lower radiator isolator mount.

25

Install the fasteners to the front spring hanger and reinstall the bumper support bracket.

26

Install the fasteners to the front closing crossmember and the fasteners to the tow hook on the side of the vehicle being worked on.

27

Install the inner fender splash shield and the lower splash shield support bracket to the frame rail.

28

Install the battery tray mounting fasteners and install the battery and air tank support brackets.

29

Once this step is complete, go back and tighten fasteners that have been installed from steps 8 through 26, as follows: M14: tighten to a torque of 200 ± 33 Nm (148 ± 24 ft-lb), M16: 275 ± 45 Nm (204 ± 34 ft-lb) and M20: 540 ± 90 Nm (400 ± 67 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)
 275 ± 45 Nm
(204 ± 34 ft-lb)
 540 ± 90 Nm
(400 ± 67 ft-lb)

30

Install the air tank straps and the air tanks.

31

Reconnect the supply and return lines to the wind shield washer reservoir. Reinstall the clamp that secures the drain valve pull cords to the air tanks.

32

Install the battery cable hold down bracket to the frame rail and reconnect the windshield wiper fluid pump.

33

Install the battery hold down strap and remove the batteries.

34

Install the battery box cover and reconnect the batteries.

35

Reconnect the fuel supply and return line. Install the fuel tank and the fuel tank J- brackets.

36

Reinstall the engine and transmission jack. Reinstall the hoist and transmission jack.

37

Check the frame alignment and make sure everything is installed and properly tightened to specifications.

38

Install the fasteners to the hood pivot blocks and install the hood.

39

Install the hood splash shields on the left and right sides of the hood. Connect the hood restraint cylinders.

40

Connect the headlamp and foglamp connectors and install the hood spring.

41

Install the support rods from the left and right sides of the bumper and install the bumper.

42

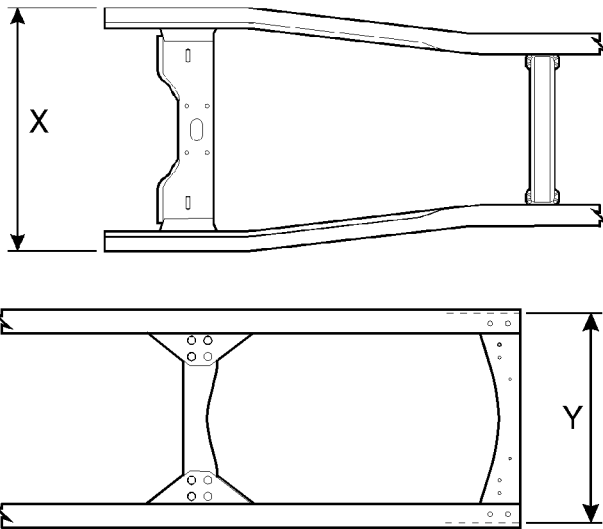
Install the mounting screws from the top and bottom of the bumper.

7113-06-02-01 Frame Alignment, Checking



Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

1



W7001183

X 1080 mm (42.5 in.)

Y 836 mm (32.9 in.)

Measure the distance between the outside edges of the front edge of the frame rails. The dimension must be 1080 ± 2 mm.

2

Measure the distance between the inside edges of the rear end of the frame rails. The dimension must be $836 \begin{smallmatrix} +2.7 \\ -4.6 \end{smallmatrix}$.

3

Ensure the vehicle is on a level area of the shop floor.

4

Make a mark on the floor directly beneath the front lower edge of each frame rail, and one directly beneath the rear lower edge of each rail.

5

Move the vehicle away from the marks.

6

Refer to "Frame Alignment, Adjustment" page 44. Measure from the mark for the front of the right frame rail to the rear of the left frame rail (this is dimension A).

7

Measure from the mark for the front of the left frame rail to the rear of the right frame rail (this is dimension B). This dimension must be the same as dimension A.

8

If any of the dimensions noted are not within tolerance, align the vehicle frame.

7113-05-02-03 Frame Alignment, Adjustment



Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Total wheel vehicle alignment may be necessary. For proper specifications for wheel vehicle alignment, refer to:

Service Bulletin 601-06
Wheel Alignment Steer and Drive Axles VN/VHD

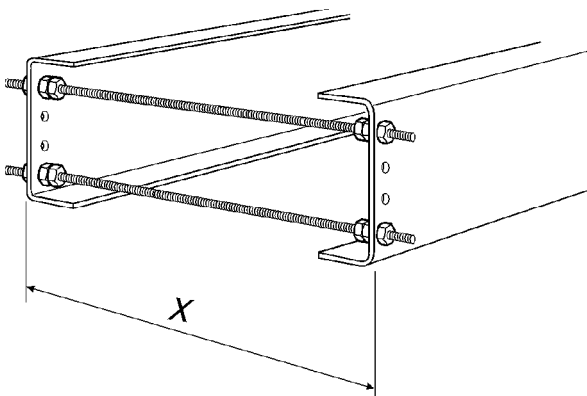
IMPACT Function Group 601
Information Type: Bulletin
"Alignment Specifications and Procedures".

1
Ensure all crossmember mounting bolts are loose.

2
Remove the front bumper and any other obstructions to the front crossmember.

3
Remove the front crossmember and the bumper mounting brackets.

4



X 1080 mm (42.5 in.)

W7001184

Insert a 1/2 in. (12 mm) threaded rod, approximately 48 in. (1200 mm) long, through the uppermost front crossmember mounting bracket hole in one frame rail.

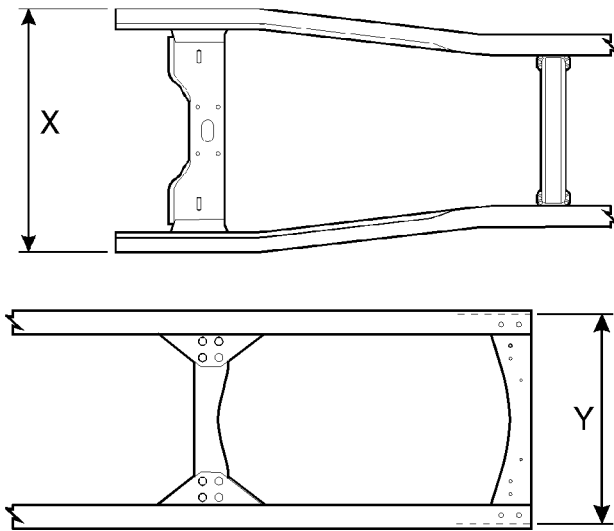
5
Run four nuts onto the rod so that they are between the frame rails.

6
Insert the rod through the uppermost hole in the other frame rail.

7
Run a single nut onto the rod on the outside of both rails.

8
Repeat the steps for inserting a threaded rod in the lowest front crossmember mounting bracket hole.

9



W7001183

X 1080 mm (42.5 in.)

Y 836 mm (32.9 in.)

Adjust the position of the inner and outer nuts to set the distance between the front outer edges of the frame rails to 1080 ± 2 mm.

10

Tighten the nuts while ensuring the distance between the rails remains at 1080 ± 2 mm.

11

Refer to "Frame Alignment, Adjustment" page 44. Adjust the position of one of the rails until the crosswise dimension is the same both ways ($A = B$).

12

Adjust the distance between the rear end of the rails until the distance between the inside edges is

$$836 \begin{matrix} +2.7 \text{ mm} \\ -4.6 \text{ mm} \end{matrix}$$

13

Re-verify all dimensions. Readjust if necessary.

14

Tighten the mounting fasteners on all crossmembers. See "Tightening Torques, Frame Rail Bolts" page 8.

7112-03-02-02

Intermediate Crossmember, Replacement (Rivets Under the Flame Flange)



Before working on a vehicle, set the parking brakes, place the transmission in neutral and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Removal

1

Park the vehicle on a level surface with the transmission in neutral and the front wheels chocked.

2

Remove the closing crossmember.

3

Remove the harness supports between the closing and the intermediate crossmembers.

4

Remove the rear light bar.

5

Remove the intermediate crossmember from the vehicle by sliding it out of the frame rail.

Note: For intermediate crossmembers with riveted beams, located forward of the rear suspension crossmembers must be removed. See "Rear Suspension Crossmember (Bogie), Replacement" page 49.

Installation

- 1**
Install the intermediate crossmember. Tighten fasteners to a torque of 200 ± 33 Nm (148 ± 24 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)
- 2**
Install the harness supports between the intermediate and the closing crossmember. Tighten fasteners to a torque of 200 ± 33 Nm (148 ± 24 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)
- 3**
Install the closing crossmember. Tighten fasteners to a torque of 200 ± 33 Nm (148 ± 24 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)
- 4**
Install the light bar. Tighten fasteners to a torque of 200 ± 33 Nm (148 ± 24 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)

7112-03-02-03

Intermediate Crossmember, Replacement (Bolted and Exposed Rivets)



DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Removal

- 1**
Remove any equipment which obstructs crossmember replacement.
- 2**
Remove fasteners or rivets from the installed crossmember beam. Remove the beam from the end plates.
- 3**
If required, unbolt and remove the end plates from the frame rails.

Installation

- 1**
If required, bolt the new end plates to the frame rails. Do NOT tighten.
- 2**
For bolted beams, bolt the new beam to the end plates.
For riveted beams, bolt the beam to the end plates using body bound bolts. Perform body bound bolt installation in accordance with the procedure in this manual.
- 3**
Tighten the end plate-to-the frame rail fasteners. Tighten the beam-to-end plate fasteners. Tighten both fasteners as follows: M14 tighten to a torque of 200 ± 33 Nm (148 ± 24 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)

7112-03-02-04 Closing Crossmember, Re- placement



Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Removal

1
Remove taillight assemblies and wiring harness clamps.

2
Remove closing crossmember fasteners.

3



Before beginning any service work on any part of the air system, be certain that the air pressure has been released. Failure to do so may cause a component to violently separate, which can result in serious personal injury.

For air suspension, disconnect and remove air line for left side rear air bag and remove left side upper shock absorber bracket. Also remove leveling valve assembly on 4x2 tractor.

4
Remove closing crossmember.

Installation

1
Place new closing crossmember between the frame rails.

2
Install and tighten the crossmember fasteners. Tighten fasteners to a torque of 200 ± 33 Nm (148 ± 24 ft-lb).

3

For air suspension, install upper shock absorber bracket and air line for left side rear air bag. On 4x2 tractor, install leveling valve assembly.

4

Install taillight assemblies and wiring harness clamps.

7112-03-02-05 Engine Crossmember, Replace- ment



Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.



Do not remove the coolant fill cap (or cap on the expansion tank) if the coolant is hot; wait until coolant temperature is less than 50° C (120° F). Otherwise, scalding steam or fluid may escape under pressure, which can cause serious injury.



Coolant may be combustible. Coolant leaked or spilled onto hot surfaces or electrical components can cause a fire. Clean up coolant spills immediately.



Use a hoist or get assistance when lifting components that weight 23 kg (50 lb) or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. Always use a spreader bar when necessary. The lifting hooks **MUST NOT** be side loaded. Failure to follow these warnings may result in personal injury.

Removal

- 1**
Park the vehicle on a level surface with the transmission in neutral and the front wheels chocked.
- 2**
Remove the ABS modulator valves from the front engine crossmember and/or the frame rails on both sides of the front engine crossmember.
- 3**
Support the frame rail on both sides of the front engine crossmember and remove the front spring pins. This step is for VNM and VNL models only.
- 4**
Support the front of the engine with a hoist.
- 5**
Drain the coolant into a suitable container. Disconnect the lower radiator hose and air cooler hose. This step is for VNM and VNL models only.
- 6**
Remove the fasteners that hold the front engine isolator mount to the front engine crossmember.
- 7**
Slowly raise the engine with the hoist to separate the isolator from the crossmember.
- 8**
Remove the fasteners that mount the front engine crossmember to the spring hangers on the VHD. For the VNM and VNL models, remove the fasteners that mount the spring hangers to the frame rail. For the VHD axle forward, remove the frame bracket on one side to assist in the removal of the front engine crossmember. For the VHD axle back, remove the front engine mount isolator from the engine to assist with the removal of the front engine crossmember.
- 9**
Remove the front engine crossmember.

Installation

- 1**
Install the front engine crossmember.
- 2**
Install the front engine mount isolator on the VHD axle back. Tighten fasteners to a torque of 105 ± 20 Nm (78 ± 13 ft-lb). Install the frame bracket on the VHD axle forward, or install the spring hanger fasteners to the frame rail on the VNM and VNL models. Tighten fasteners to a torque of 200 ± 33 Nm (148 ± 24 ft-lb).
- 3**
Lower the engine and install the front engine mount isolator to the front engine crossmember.
- 4**
Connect the lower radiator hose and the air cooler hose on the VNM and VNL models. Fill the radiator with coolant.
- 5**
Install the front spring pins on the VNM and VNL models. Tighten fasteners to a torque of 851 ± 15 Nm (63 ± 11 ft-lb).
- 6**
Install the front ABS modulator valves. Tighten fasteners as follows: M10: tighten to a torque of 60 ± 10 Nm (44 ± 7 ft-lb).

7112-03-02-06 Rear Suspension Crossmember (Bogie), Replacement



Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Removal

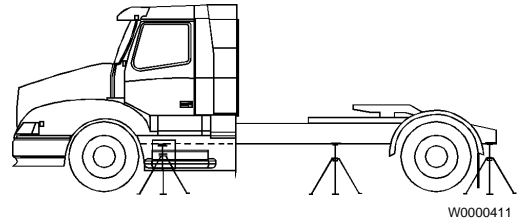
- 1**
Park the vehicle on a level surface with the transmission in neutral and the front wheels chocked.
- 2**
Remove the rear light bar and mud flaps.
- 3**
Remove the closing crossmember. See "Closing Crossmember, Replacement" page 47.
- 4**
Remove the harness support brackets that are located between the rear suspension crossmember and the closing crossmembers.
- 5**
Remove the airline support brackets located under the rear suspension crossmember.
- 6**



Before beginning any service work on any part of the air system, be certain that the air pressure has been released. Failure to do so may cause a component to violently separate, which can result in serious personal injury.

Remove the brake valves and brake hoses that are mounted to, or located at, the rear suspension. Also remove the Traction Control Valve (TCS) mounted to the frame rail if the vehicle is equipped with TCS.

7



Using jack stands, support the nose of the first and second drive axles and the rear section of the frame rails.

- 8**
Remove the bump stops and the upper shock brackets for the rear drive axle.

- 9**
Remove the intermediate crossmember. See "Intermediate Crossmember, Replacement (Bolted and Exposed Rivets)" page 46.

- 10**
This step only applies to trucks with the Volvo Optimized Air Suspension. For proper information on removing fasteners for the spring hangers refer to:

Service Manual 710-500
Volvo Optimized Air Suspension from 5/99.

IMPACT Function Group 7114
Information Type: Repair
"Spring Hanger, Replacement"

Remove the fasteners for the spring hangers on the rear drive axle on trucks equipped with the Volvo Optimized Air Suspension.

- 11**
Remove the V-torque rod on trucks equipped with the Volvo T-Ride.

12

Remove the leaf spring assembly on each side of the suspension on trucks equipped with the Volvo T-Ride.

13

Support the saddle bracket on each side of the suspension on trucks equipped with the Volvo T-Ride.

14

Remove the fasteners to the saddle bracket on each side of the rear suspension on trucks equipped with the Volvo T-Ride.

15

Remove the fasteners to the V-torque rod on the first drive axle at the frame bracket if the truck is equipped with the Volvo T-Ride.

16

Remove the remaining fasteners to the rear suspension (Bogie) crossmember and remove the rear suspension (Bogie) crossmember.

Installation

1

Once this step is complete, go back and tighten fasteners that have been installed from steps 1 through 7 as follows:

2

Install the rear suspension (Bogie) crossmember. Install and tighten fasteners as follows: M14: tighten to a torque of 200 ± 33 Nm (148 ± 24 ft-lb), M16: 275 ± 45 Nm (204 ± 34 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)
275 ± 45 Nm
(204 ± 34 ft-lb)

3

Install the fasteners between the V-torque rod and the frame bracket and apply the proper torque to trucks equipped with the Volvo T-Ride. M14: tighten to a torque of 200 ± 33 Nm (148 ± 24 ft-lb), M16: 275 ± 45 Nm (204 ± 34 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)
275 ± 45 Nm
(204 ± 34 ft-lb)

4

Install the fasteners to the saddle brackets and apply the proper torque on trucks equipped with the Volvo T-Ride. M14: tighten to a torque of 200 ± 33 Nm (148 ± 24 ft-lb), M16: 275 ± 45 Nm (204 ± 34 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)
275 ± 45 Nm
(204 ± 34 ft-lb)

5

Install the leaf spring assembly on each side and tighten the U-bolts to the saddle caps on trucks equipped with the Volvo T-Ride. Tighten the U-bolts to a torque of 500 ± 75 Nm (369 ± 55 ft-lb).

500 ± 75 Nm
(369 ± 55 ft-lb)

6

Install the fasteners to the spring hangers on the rear drive axle and apply proper tighten on trucks equipped with the Volvo Optimized Air Suspension.

7

Install the intermediate crossmember and tighten the fasteners to a torque of 200 ± 33 Nm (148 ± 24 ft-lb).

200 ± 33 Nm
(148 ± 24 ft-lb)

8

Install the upper shock brackets and the bump stops and the tighten fasteners.

9

Install the brake valves and hoses located near the rear suspension crossmember.

10

Install and properly tighten the V-torque rod, on trucks equipped with the Volvo T-Ride. Tighten the V-torque rod nuts (axle housing) to a torque of 310 ± 50 Nm (228 ± 37 ft-lb). Tighten the V-torque rod bolts (chassis bracket) to a torque of 320 ± 50 Nm (236 ± 37 ft-lb).

310 ± 50 Nm
(228 ± 37 ft-lb)
320 ± 50 Nm
(236 ± 37 ft-lb)

11

Install all the harness and airlines mounting brackets.

12

Install the light bar and mud flaps.

13

Install the closing crossmember. See "Closing Crossmember, Replacement" page 47.

14

Remove any supports for the frame rails and the drive axle.

7113-05-02-04 Frame Length, Adjustment

DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

WARNING

Always wear appropriate eye protection to prevent the risk of eye injury due to contact with debris or fluids.

Note: Total wheel vehicle alignment may be necessary after completing this procedure. Refer to the appropriate service information.

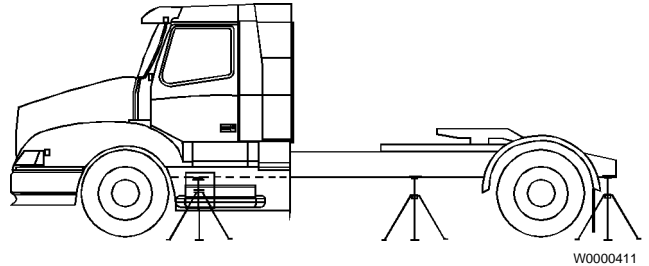
Note: The only approved alteration to the frame is shortening of the vehicle wheelbase by moving the rear axle(s) forward and cutting the excess frame from the end. Frame rails are not to be spliced or extended.

WARNING

Before beginning any service work on any part of the air system, be certain that the air pressure has been released. Failure to do so may cause a component to violently separate, which can result in serious personal injury.

WARNING

Use a hoist or get assistance when lifting components that weight 23 kg (50 lb) or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. Always use a spreader bar when necessary. The lifting hooks **MUST NOT** be side loaded. Failure to follow these warnings may result in personal injury.

1

Place the vehicle on jack stands at the normal ride height. Do not jack the vehicle up.

2

Remove the driveshaft.

3

Unbolt the fifth wheel angle irons from the frame and remove the fifth wheel and the angle irons as an assembly.

4

Mark the frame at the existing wheelbase (centerline of the rear axle for single axle and center between axles for a tandem axle).

5

Unbolt the existing suspension brackets, hardware, and crossmembers.

6

Unbolt and remove any other brackets, hoses, or electrical wiring that obstruct the area of the frame to be altered.

7

Remove any intermediate crossmember that will no longer be needed.

8

Make a template of the hole pattern for the rear suspension using the existing wheelbase and hole pattern as reference points.

9

Determine the new wheelbase for the vehicle and mark on the frame rails.

10

Mark and drill the new holes necessary to accommodate the rear axle crossmember at its new position. Holes must be placed in accordance with the specifications given in "Bolt Hole Patterns" page 6.

11

Unbolt the rear axle crossmember end plates from the frame and move the crossmember to its new position.

12

Bolt up the suspension and crossmembers. Tighten the fasteners as follows:
 M14: 200 ± 33 Nm (148 ± 24 ft-lb).
 M16: 275 ± 45 Nm (204 ± 34 ft-lb).

13

Remove the jack stands from under the frame.

14

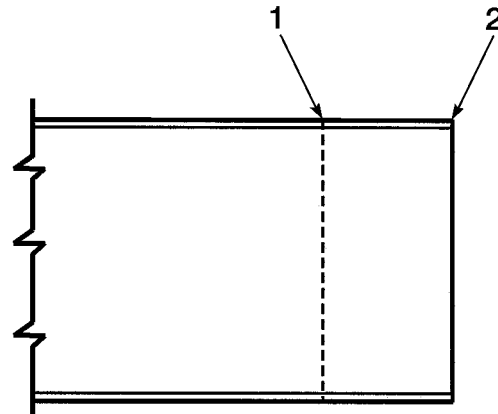
Determine the appropriate overhang from the table below.

Axle Type	Overhang		
	Straight End	Tapered end*	Tapered end**
4x2	838 mm	813 mm	889 mm
6x4	1371 mm	1346 mm	1422 mm

* for bar type mud flap brackets

** for spring type mud flap brackets

15



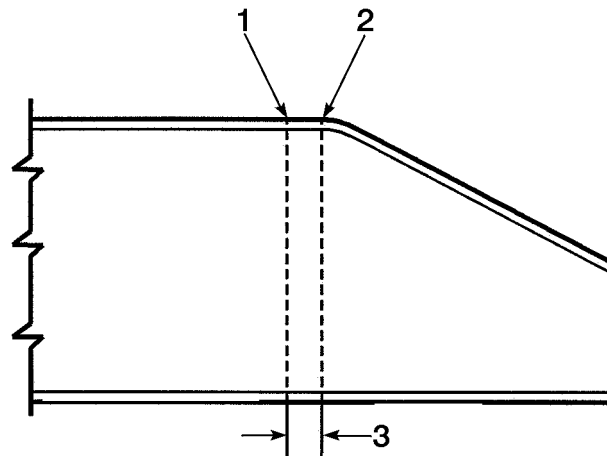
- 1 Desired end of frame
- 2 Current end of frame

W7001167

Measure rearward from the new centerline of the rear axle (4x2) or from the new centerline of the bogie (6x4) the overhang amount. Mark that point on the frame rails as the **desired end of frame**.

DO NOT CUT THE FRAME.

16

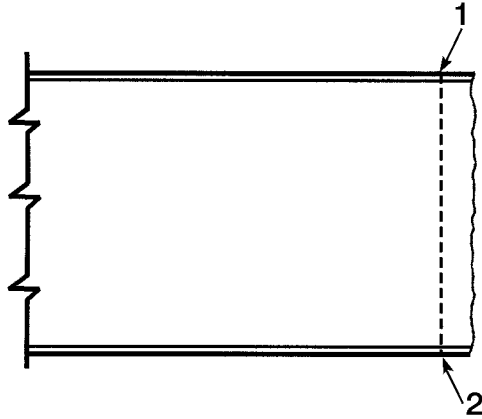


- 1 Desired end of frame
- 2 Rough cut
- 3 28.5 mm (266 mm frame)
36.0 mm (300 mm frame)

W7001168

For tapered rail ends only, mark the frame rail at a point 28.5 mm (266 mm frame height) or 36 mm (300 mm frame height) past the mark for desired end of frame. This is the **rough cut** mark.

17



W7001169

- 1 Desired end of frame
- 2 Rough cut

For straight rails, cut the excess frame off at the mark for **desired end of frame**. For tapered rails, cut the excess frame off at the mark for **rough cut**.

18

If the frame ends will be straight, bolt two splay crossmembers back to back using M12 bolts and nuts. tighten the bolt to 105 ± 20 Nm (142 ± 27 ft-lb).

105 ± 20 Nm
(142 ± 27 ft-lb)

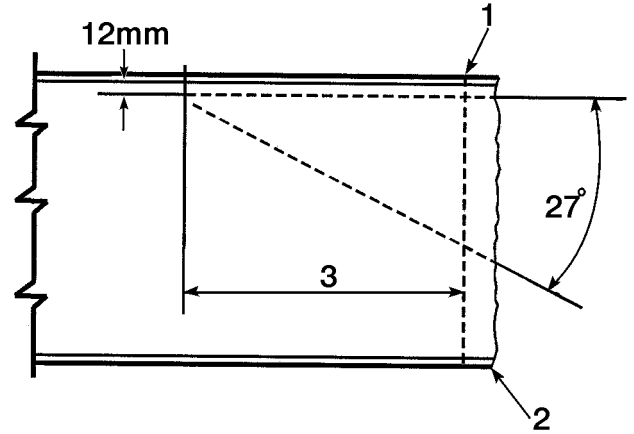
Note: Splay crossmembers must be painted prior to installation.

19

Insert the closing crossmember between the frame rails and slide it as far forward as possible.

Note: Steps 20 through 29 for cutting, beveling, and welding the frame web apply only to vehicles that require a tapered closing crossmember.

20



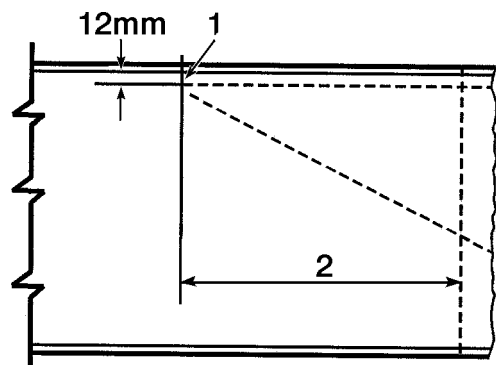
W7001170

- 1 Desired end of frame
- 2 Rough cut
- 3 See table for dimensions

Mark a wedge shape on the frame web for cutting. Refer to the table below for dimensions.

Frame Height	Frame Thickness		
	6 mm	7 mm	8 mm
266 mm	236.4 ± 2 mm	232.6 ± 2 mm	228.7 ± 2 mm
300 mm	N/A	299.3 ± 2 mm	295.4 ± 2 mm

21



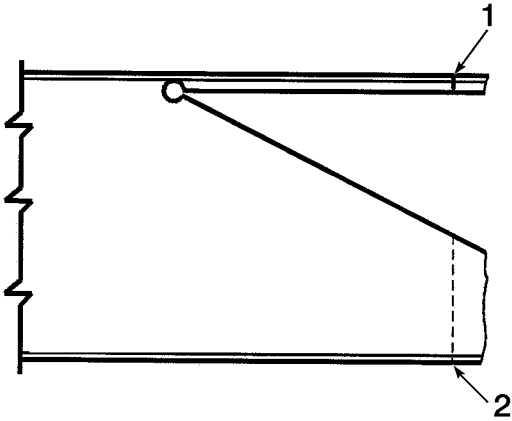
W7001171

- 1 Drill hole here
- 2 See table for dimensions

Drill a 24 mm diameter hole with center at the upper corner of the wedge (12 mm below the bottom of the upper flange).

22
Verify the angle of the wedge is $27 \pm 0.25^\circ$.

23

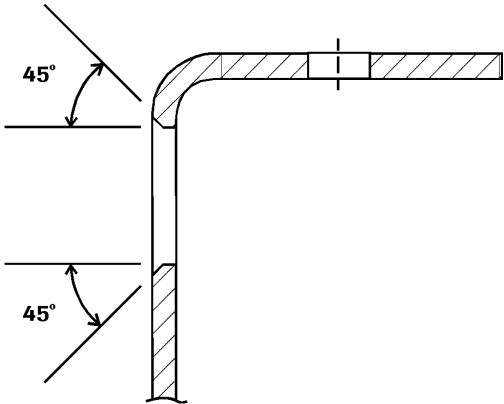


W7001172

- 1 Desired end of frame
- 2 Rough cut

Cut out the wedge.

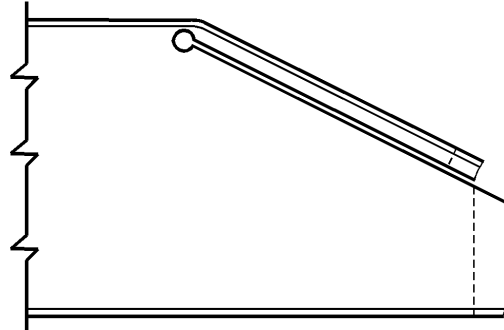
24



W7000390

Bevel the outer edges of the cuts to 45° .

25



W7000408

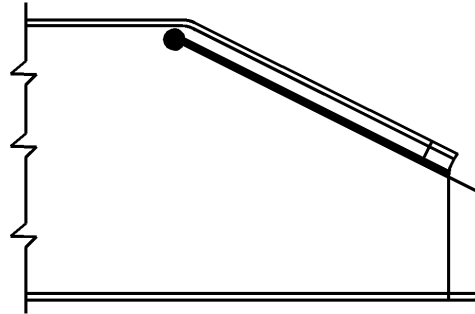
Bend the upper flange down until it makes contact with the web.

Note: It may be necessary to heat the flange in order to bend it.

26

Verify the proper fit up of the tapered crossmember before welding.

27



W7000413

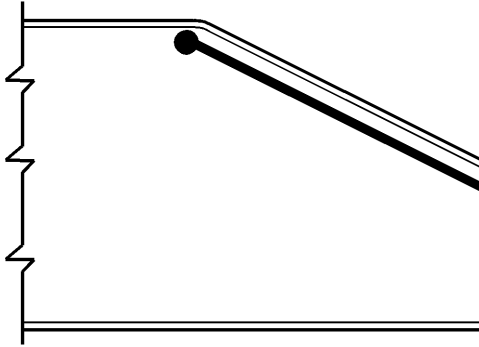


WARNING

Eye injury hazard. Wear eye protection during welding. Failure to wear eye protection could result in severe eye injury and blindness.

Weld the cut edges of the web together.

28



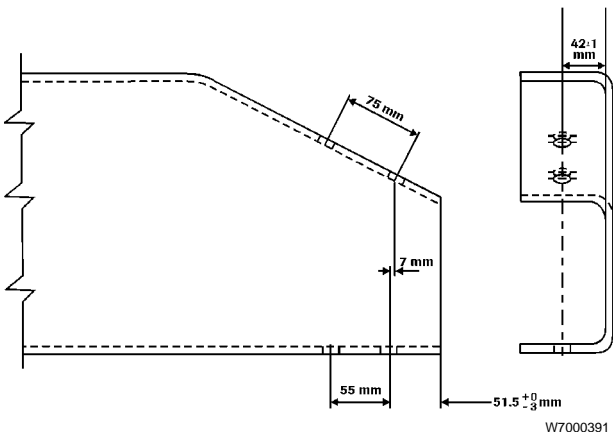
W7000414

Cut off the end of the frame rail at the desired end frame mark.

29

Repeat the cutting and welding process for the other frame rail.

30



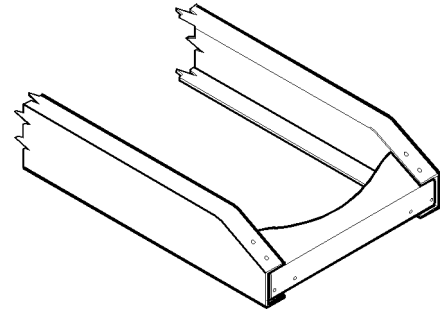
W7000391

Measure, mark and drill holes in the frame to accommodate the closing crossmember.

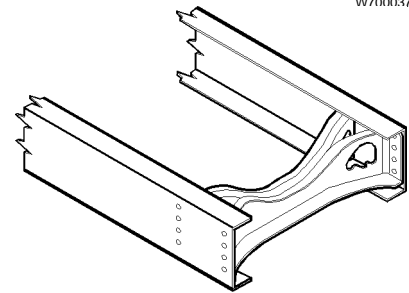
31

Grind the end of the frame and the welded areas smooth and paint all bare metal frame surfaces.

32



W7000378



W7000379

Slide the closing crossmember into place. Tighten tapered crossmember bolts to 275 ± 45 Nm (203 ± 33 ft-lb).

33

Mark and drill holes for the fifth wheel angle irons. Bolt the fifth wheel assembly to the frame and tighten bolts to 275 ± 45 Nm (203 ± 33 ft-lb).

34

Install and tighten an appropriate size metric flange bolt into each frame rail web hole that is not used.

35

Measure distance from transmission pinion to axle pinion, and record the distance. Have a certified driveline shop alter the drive shaft for this distance.

36

Install the drive shaft.

37

Check the pinion angles and ride height, and make corrections if necessary.

7119-02-02-01 Body Bound Bolt, Installation

1

WARNING

Always wear appropriate eye protection to prevent the risk of any eye injury due to the contact with debris or fluids.

CAUTION

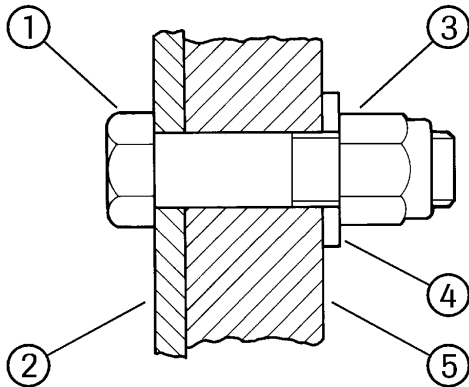
Only use a reamer with clockwise rotation. Do not reverse rotation to remove the reamer. Use a drill with a maximum 350 rpm no-load speed. Always use cutting oil. Failure to follow these precautions will result in damage to the reamer.

Ream the holes in the crossmember and end plates or bracket to 16.56 mm (0.652 in.).

2

Clean out any metal chips that remain in the holes.

3



W7000383

- 1 Body bound bolt
- 2 Crossmember
- 3 Elastic stopnut
- 4 Hardened flat washer
- 5 End plate or spring bracket

Measure the thickness of the end plate or spring bracket.

4

Multiply the thickness from Step 3 by 66%.

5

Measure the thickness of the cross-member.

6

Add the thickness values from Steps 3 and 5. This is maximum bolt shank length.

7

Add the thickness values from Steps 4 and 5. This is minimum bolt shank length.

8

Select a body bound bolt with a shank length between the minimum and maximum shank length.

9

Install the body bound bolts in each hole that was reamed. Place a hardened steel washer and a stop nut on each bolt.

10

Tighten the nuts to 225 ± 37.5 Nm (166 ± 28 ft-lb). Hit the bolt with a brass hammer several times during torquing to insure proper seating.

225 ± 37.5
Nm
(166 ± 28 ft-lb)

7113-01-02-01 HUCK-FIT[®] Fastener, Removal

1

An air impact wrench can generally be used to remove the fasteners. Always try to remove the collar with an air impact wrench first. If you encounter difficulty, increase air pressure to the maximum for your equipment to obtain best results. If the air impact wrench fails to remove a fastener, the collar must be split or cut.

2

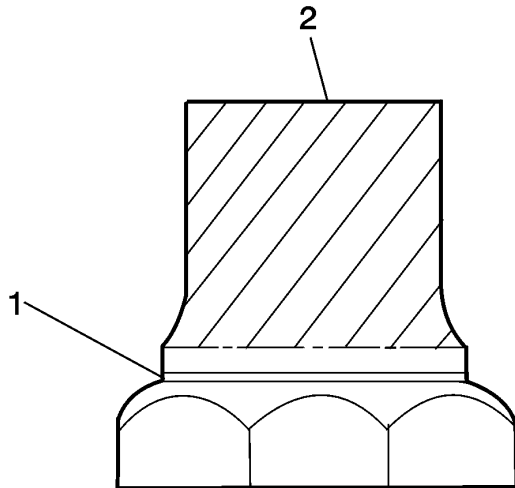


Fig. 11: Huck-Fit Fastener

W7001135

- 1 Cut through collar and pin at this location.
- 2 Swaged area.

Note: Use this method of removal only if the fastener cannot be removed with an air impact wrench or hydraulic splitter.

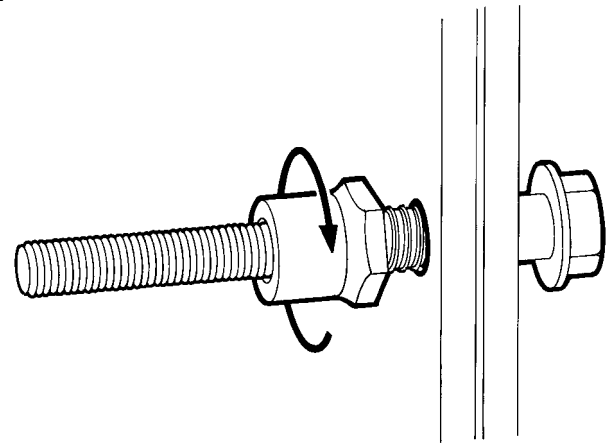
A hydraulic collar splitter is available from HUCK®. If the splitter is available to you, it should be used. Make the cut just above the collar's hex flange. To help avoid damage to other components, use an 1/8" metal shield with a hole that fits around the hex portion of the collar.

7113-02-02-01 HUCK-FIT® Fastener, Installation

To install the fasteners, select the correct grip range pin. To ensure flush pin seating, the hole size for 16 mm (5/8") pins must be 17.1–17.5 mm (use an 11/16" drill bit). Holes as small as 16 mm can be used, but the holes have to be chamfered on the head side to ensure proper head pin seating.

Note: Never reuse fasteners. Huck-Fit fasteners are not serviceable or reusable.

1



W7000306

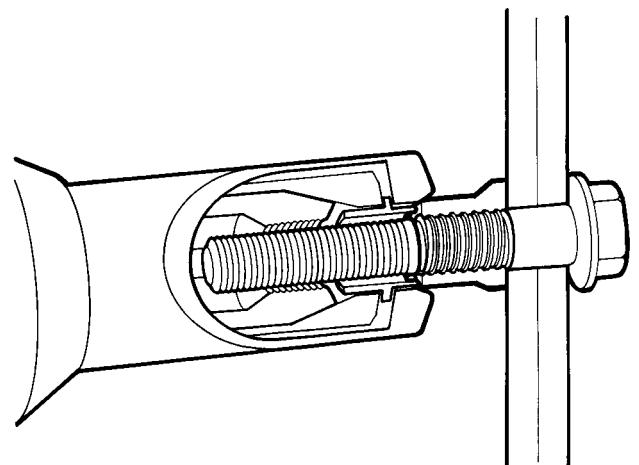
Fig. 12: Threading the collar onto the bolt

Insert pin (bolt) through prepared hole.

2

Slide the collar over the pin-tail and hand tighten.

3



W7000307

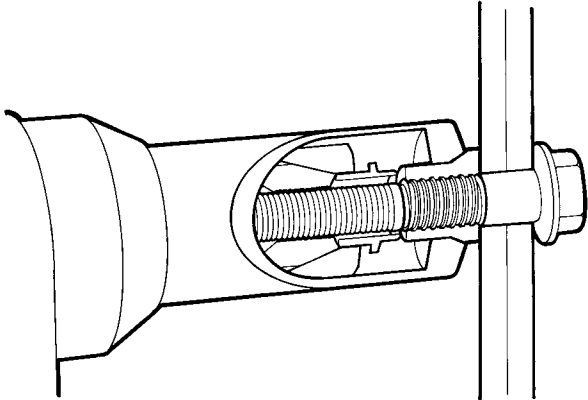
Fig. 13: Swaging of the collar

Place hydraulic tool nose assembly over pin-tail and squeeze the trigger.

4

The nose assembly pulls on the pin-tail, drawing the work pieces together. The anvil pushes on the collar.

5

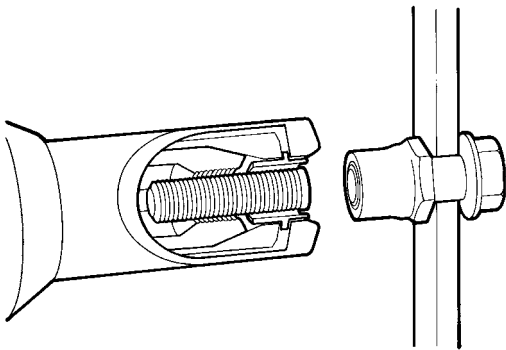


W7000308

Fig. 14: Completing the swage of the collar

The tool continues pulling on the pin-tail, moving the anvil forward and swaging the collar into the locking grooves of the pin (bolt) thereby achieving clamp.

6



W7000309

Fig. 15: Pin-tail breaking off

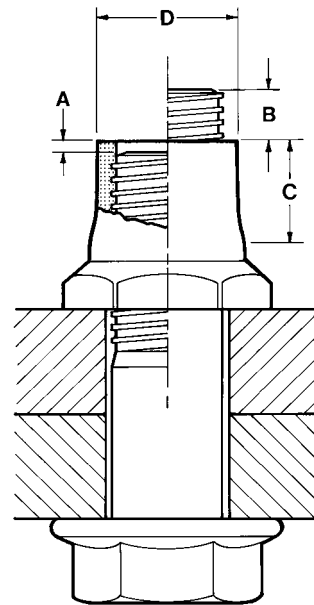
When the tool completes the swage, the pin-tail breaks off the bolt.

7

The tool automatically ejects itself off the collar.

Inspection

1



W7000310

Fig. 16: Dimensional limitations

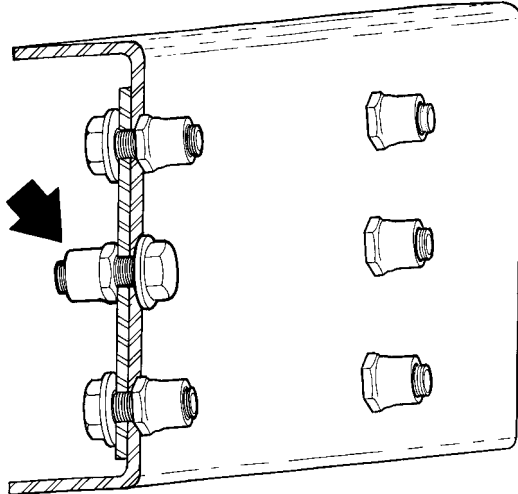
Visually inspect the installed fastener as follows:

- Check for a complete swage ("D" dimension)
- Check for proper pin protrusion ("B" dimension)

Diameter	16mm (5/8")
A max.	0.6mm (.023")
B max.	10.6mm (.417")
C max.	17.7mm (.696")
D max.	24.1mm (.948")

Should "A" or "B" dimensions exceed the given values, the fastener is out-of-grip. A "C" dimension less than the given value indicates an incomplete swage. A "D" dimension greater than the given values indicates an incorrect or worn anvil on the installation tool. **If any of these conditions are present, the fastener is installed incorrectly and must be replaced.**

2

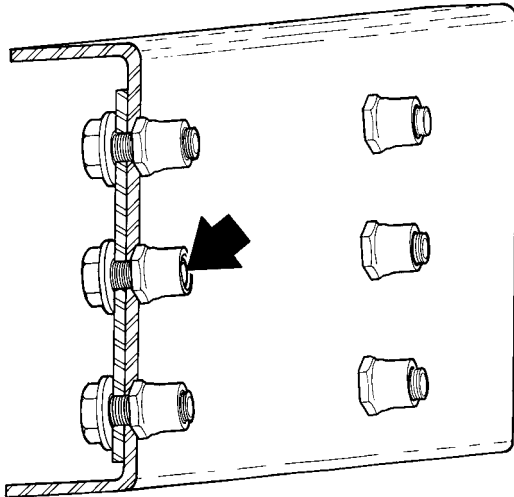


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Fig. 17: Bolt turned inboard

HUCK® bolts **can** be turned in or outward as tool limitations may require.

3

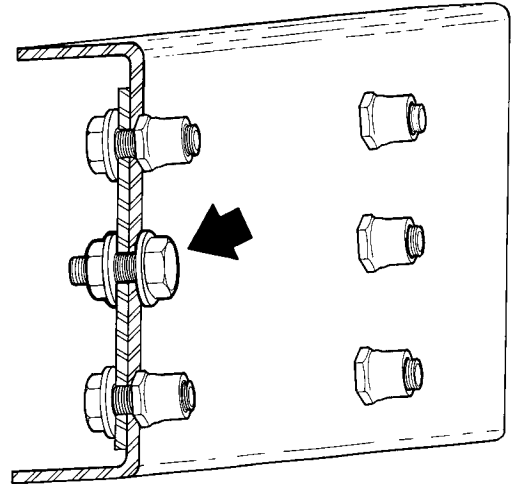


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Fig. 18: Less than a flush break

Bolt pin-break to be flush or greater than the collar length. A recessed pin-break less than flush with the collar is **unacceptable**.

4

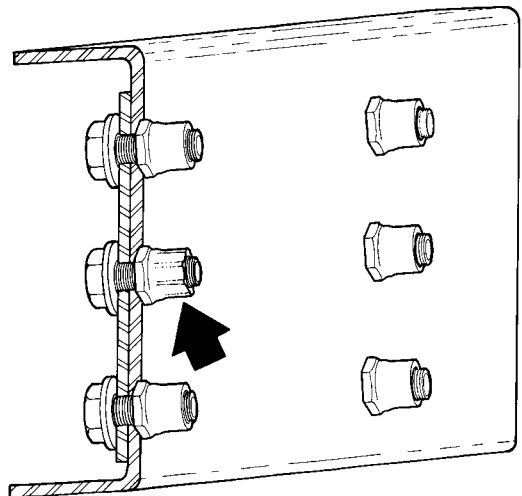


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Fig. 19: Flange bolts and bolts

Do not mix bolts and flange bolts within a hole pattern unless a specific exception is documented.

5



W7000304

Fig. 20: Scored collar

If the collar is scored, the tool anvil is worn and should be replaced.

Feedback

One of our objectives is that workshop personnel should have access to correct and appropriate service manuals where it concerns fault tracing, repairs and maintenance of Volvo trucks.
In order to maintain the high standards of our literature, your opinions and experience when using this manual would be greatly appreciated.
If you have any comments or suggestions, make a copy of this page, write down your comments and send them to us, either via telefax or mailing directly to the address listed below.

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From

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Comments/proposals

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Concerns Service Manual:

Operation Numbers

7112-03-02-02	Intermediate Crossmember, Replacement (Rivets Under the Flame Flange)	45
7112-03-02-03	Intermediate Crossmember, Replacement (Bolted and Exposed Rivets)	46
7112-03-02-04	Closing Crossmember, Replacement	47
7112-03-02-05	Engine Crossmember, Replacement	47
7112-03-02-06	Rear Suspension Crossmember (Bogie), Replacement	49
7113-01-02-01	HUCK-FIT® Fastener, Removal	56
7113-02-02-01	HUCK-FIT® Fastener, Installation	57
7113-03-02-01	Frame Rail, Replacement	37
7113-05-02-03	Frame Alignment, Adjustment	44
7113-05-02-04	Frame Length, Adjustment	51
7113-06-02-01	Frame Alignment, Checking	43
7119-02-02-01	Body Bound Bolt, Installation	56

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