Vorteq® Trailer TMA

Product Description Assembly Manual

Part No. 115297B

Revision F July 2012

TRINITY
HIGHWAY PRODUCTS
ENERGY ABSORPTION SYSTEMS

Vorteq® Trailer TMA

Product Description
Assembly Manual

TRINITY
HIGHWAY PRODUCTS
ENERGY ABSORPTION SYSTEMS

2525 Stemmons Freeway
Dallas, Texas 75207

Important: These instructions are to be used only in conjunction with the assembly, maintenance, and repair of the Vorteq® Trailer TMA. These instructions are for standard assemblies specified by the appropriate highway authority only. In the event the specified system assembly, maintenance, or repair would require a deviation from standard parameters, contact the appropriate highway authority engineer. This system has been accepted for use by the Federal Highway Administration for use on the national highway system under strict criteria utilized by that agency. Energy Absorption Systems representatives are available for consultation if required.

This Manual must be available to the worker overseeing and/or assembling the product at all times. For additional copies, contact Energy Absorption Systems at (888) 323-6374 or download from websites below.

The instructions contained in this Manual supersede all previous information and Manuals. All information, illustrations, and specifications in this Manual are based on the latest Vorteq® Trailer TMA information available to Energy Absorption Systems at the time of printing. We reserve the right to make changes at any time.

Part No. 115297B
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Customer Service Contacts

Energy Absorption Systems (a Trinity Highway Products company) is committed to the highest level of customer service. Feedback regarding the Vorteq® Trailer TMA, its assembly procedures, supporting documentation, and performance are always welcome. Additional information can be obtained from the contact information below:

Energy Absorption Systems:

Telephone:	(888) 323-6374 (U.S. only) (312) 467-6750 (Outside U.S.)
E-mail:	customerservice@energyabsorption.com
Internet: Energy Absorption Systems Trinity Highway Products, LLC Trinity Industries, Inc.	http://www.energyabsorption.com http://www.highwayguardrail.com http://www.trin.net

Important Introductory Notes

Proper assembly of the Vorteq® Trailer TMA is essential to achieve performance of the system under appropriate federal and state criteria. These instructions should be read in their entirety and understood before assembling the Vorteq® Trailer TMA. These instructions are to be used only in conjunction with the assembly of the Vorteq® Trailer TMA and are for standard assemblies only as specified by the applicable highway authority. In the event your system assembly requires or involves deviation from standard parameters or, during the assembly process a question arises, please contact the appropriate highway authority that specified this system at this particular location for guidance. Energy Absorption Systems is available for consultation with that agency. These instructions are intended for an individual who is qualified to both read and accurately interpret them as written. They are intended for the individual who is experienced and skilled in the assembly of highway products which are specified and selected by the highway authority.

A set of product and project shop drawings will be supplied by Energy Absorption Systems. The shop drawings will be for each section of the assembly. These drawings should be reviewed and studied thoroughly by a qualified individual who is skilled in interpreting them before the start of any assembly.

System Overview

The Vorteq® Trailer TMA is a Truck Mounted Attenuator (TMA) designed to reduce the risk of injury to passengers of an errant vehicle and to the driver of the truck to which the system is attached when the TMA is impacted within the criteria established by National Cooperative Research Highway Program 350 (NCHRP Report 350). The system mounts on the rear of a truck and may be used in stationary applications (e.g. as a truck blocking a work zone) and mobile operations (e.g. striping, sweeping, plowing, etc.).

The Vorteq® Trailer TMA consists of the following basic components: Frame Rail Assembly, an Impact Head, tongue, X-Brace, axle, wheels and tires (See Figures 1 and 2).

Definitions:

A BARRIER VEHICLE is a truck on which a TMA is mounted while positioned upstream (towards the direction that traffic is approaching) of a work zone.

A SHADOW VEHICLE is a truck on which a TMA is mounted, which is following behind a moving operation such as striping, spraying, etc.

Important: Read safety instructions thoroughly and follow the suggested safe practices before assembling, maintaining, or repairing the Vorteq® Trailer TMA. Failure to follow this warning can result in serious injury or death to the worker and/or bystanders. Please keep these instructions for later use.

Warning: Ensure that all of the Vorteq® Trailer TMA Warnings, Cautions, and Important Statements within the Vorteq® Trailer TMA manual are completely followed. Failure to follow this warning could result in serious injury or death in the event of a collision.

Recommended Safety Rules for Assembly

*** Important Safety Instructions ***

This Manual must be kept in a location where it is readily available to persons who are skilled and experienced in the assembly, maintenance, or repair of the Vorteq® Trailer TMA system. Additional copies of this Manual are immediately available from Energy Absorption Systems by calling (888) 323-6374 or by email at customerservice@energyabsorption.com. This Manual may also be downloaded directly from the websites indicated below. Please contact Energy Absorption Systems if you have any questions concerning the information in this Manual or about the Vorteq® Trailer TMA system.

Always use appropriate safety precautions when operating power equipment, mixing chemicals, and when moving heavy equipment or the Vorteq® Trailer TMA components. Gloves, safety goggles, steel toe boots, and back protection shall be used.

Safety measures incorporating traffic control devices specified by the highway authority must be used to provide safety for personnel while at the assembly, maintenance, or repair site.

Safety Symbols

This section describes safety symbols that may appear in the Vorteq® Trailer TMA Manual. Read the Manual for complete safety, assembly, operating, maintenance, repair, and service information.

Symbol	Meaning
	**Safety Alert Symbol:** Indicates Danger, Warning, or Caution. Failure to read and follow the Danger, Warning, Important, or Caution indicators could result in serious injury or death to the workers and/or bystanders.

Warnings and Cautions

Read all instructions before assembling, maintaining, or repairing the Vorteq® Trailer TMA.

Warning: Do not assemble, maintain, or repair the Vorteq® Trailer TMA until you have read this Manual thoroughly and completely understand it. Ensure that all Warnings, Cautions, and Important Statements within the Manual are completely followed. Please call Energy Absorption Systems at (888) 323-6374 if you do not understand these instructions. Failure to follow this warning could result in serious injury or death in the event of a collision.

Warning: Be sure adequate time is available for complete assembly, maintenance, or repair before beginning the assembly, maintenance, or repair process. Failure to follow this warning could result in serious injury or death in the event of a collision.

Warning: Use only Energy Absorption Systems parts that are specified herein for the Vorteq® Trailer TMA for assembling, maintaining, or repairing the Vorteq® Trailer TMA. Do not utilize or otherwise comingle parts from other systems even if those systems are other Energy Absorption Systems or Trinity systems. Such configurations have not been tested, nor have they been accepted for use. Assembly, maintenance, or repairs using unspecified parts or accessories is strictly prohibited. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact with an UNACCEPTED system.

Warning: Do NOT modify the Vorteq® Trailer TMA in any way. Failure to follow this warning could result in serious injury or death in the event of a collision.

Warning: Ensure that the Vorteq® Trailer TMA and delineation used meet all federal, state, specifying agency, and local specifications. Failure to follow this warning could result in serious injury or death in the event of a collision.

Warning: Ensure that your deployment meets all appropriate Manual on Uniform Traffic Control Devices (MUTCD) and local standards. Failure to follow this warning could result in serious injury or death in the event of a collision.

Limitations and Warnings

Energy Absorption Systems, in compliance with the National Cooperative Research Highway Program 350 (NCHRP Report 350) “Recommended Procedures for the Safety Performance of Highway Safety Features”, contracts with FHWA approved testing facilities to perform crash tests, evaluation of tests, and submittal of results to the Federal Highway Administration for review.

The Vorteq® Trailer TMA system was tested to meet the impact criteria, requirements, and guidelines of NCHRP Report 350. These tests, specifically set forth by FHWA, evaluate product performance by simulating those impacts outlined by NCHRP Report 350 involving a typical range of vehicles on our roadways, from lightweight cars (approx. 820kg [1800 lb.]) to full size pickup trucks (approx. 2000 kg [4400 lb.]) as specified by the FHWA.

A product can be certified for multiple Test Levels. Vorteq® Trailer TMA is certified to the Test Level(s) as shown in:

Test Level 3: 100 km/h [62 mph].

These specified tests are not intended to represent the performance of systems when impacted by every vehicle type or every impact condition existing on the roadway. This system is tested only to the test matrix criteria of NCHRP 350 as approved by FHWA or TD 49 as approved by the Highway Agency.

Additionally, the Vorteq® Trailer TMA was tested to meet the impact criteria, requirements, and guidelines of TD 49. These tests, specifically set forth by the Highway Agency, evaluate product performance by simulating those impacts outlined by TD 49 involving a typical range of vehicles on their roadways, from lightweight cars (approx. 900 kg [1984 lb.]) to heavier cars (approx. 1500 kg [3307 lb.]) as specified by the Highway Agency. A product can be certified for various speed levels as shown below:

TL3.UK: 110 km/h [68 mph]

Energy Absorption Systems does not represent nor warrant that the results of these controlled tests show that vehicle impacts with the products in other conditions would necessarily avoid injury to person(s) or property. Impacts that exceed the specifications of the system may not result in acceptable crash performance as outlined in NCHRP Report 350 or TD 49, relative to structural adequacy, occupant risk, and vehicle trajectory. Energy Absorption Systems expressly disclaims any warrant or liability for injury or damage to persons or property resulting from any impact, collision, or harmful contact with products, other vehicles, or nearby hazards or objects by any vehicle, object or person, whether or not the products were assembled by or under the direction of Energy Absorption Systems or by third parties.

The Vorteq® Trailer TMA is intended to be assembled and maintained in accordance with specific State and Federal guidelines. Energy Absorption Systems offers a reflective delineator panel and has reflective tape for the Vorteq®. However, the material is only intended to supplement delineation required by the Department of Transportation’s “Manual on Uniform Traffic Control Devices” (MUTCD) or local jurisdiction. The appropriate highway authority approved engineer should be careful to properly select, assemble, and maintain the product. Careful evaluation of the host vehicle, vehicle population type, speed, traffic direction, and visibility are some of the elements that require evaluation in the proper selection of a safety appurtenance by the appropriate specifying highway authority.

After an impact occurs, the product must be repaired to its original condition prior to placing back in service. When a safety product is impacted, it is mandatory that the highway authority inspect all the components for damage and repair and/or replace components as necessary. If the system is not repairable, a complete system replacement is required.

Know Your Vorteq® Trailer TMA System

For specific assembly, maintenance, or repair details; refer to the state or specifying agency's standard drawing(s) and/or Energy Absorption Systems standard layout drawings.

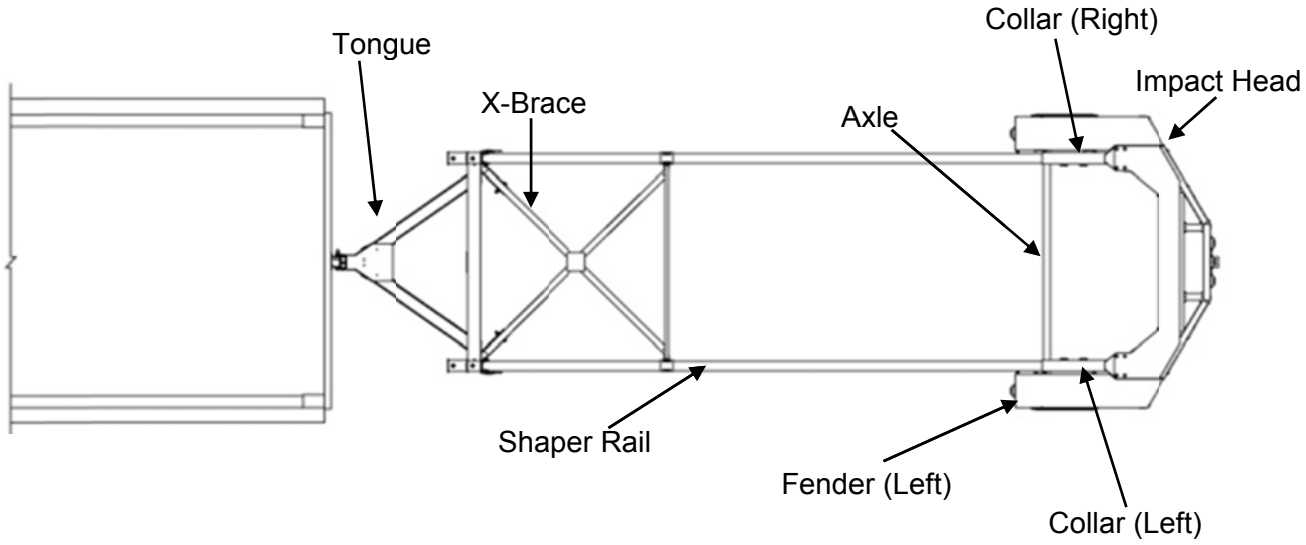


Figure 1

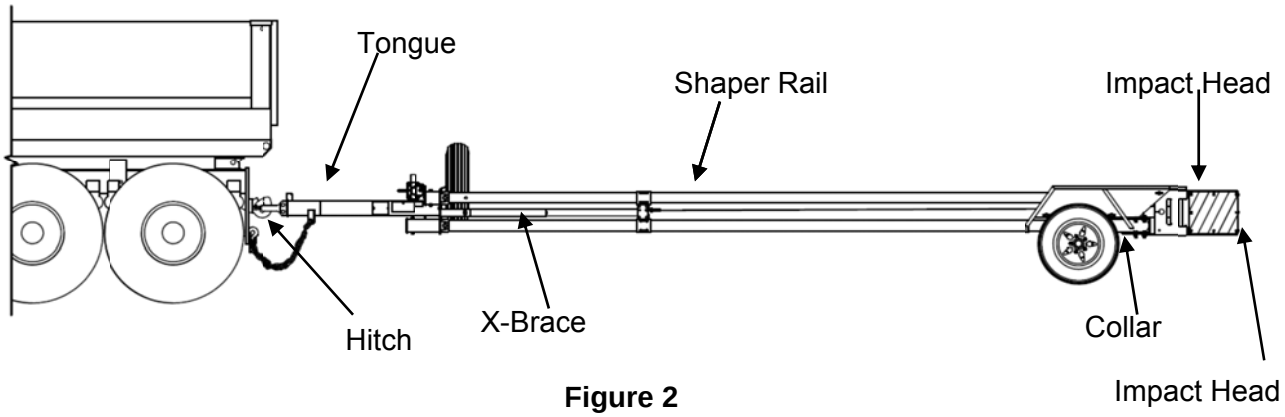
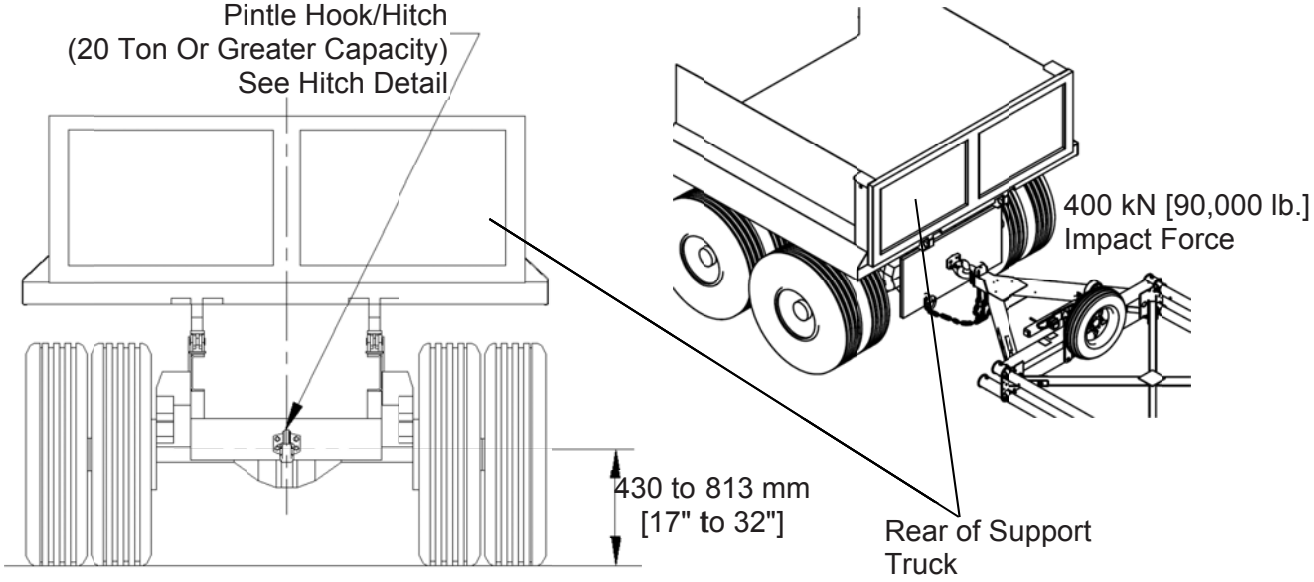


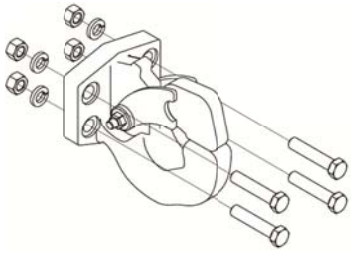
Figure 2

Warning: Strict compliance with these instructions is critical to avoid danger to workers and others.

1. To ensure system performance, Energy Absorption Systems requires the use of a pintle hook/hitch with a rating of 20 tons or greater. (See Figure 3). We also require that operators of the Vorteq® Trailer TMA check the pintle hook/hitch and receiver as part of their normal vehicle maintenance procedures. The truck's hitch and support structure must be capable of withstanding a 400 kN [90,000 lb.] impact force to the hitch.
2. The pintle hook/hitch height above ground level must be in a range between 432 to 813 mm [17" to 32"]. The pintle/Euro-hitch mounting height is 533 mm [21"] (See Figure 3).



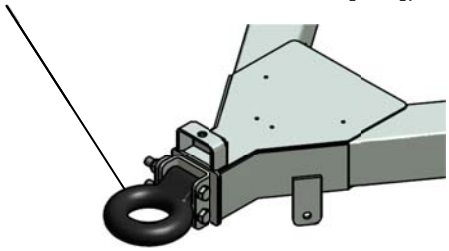
Truck Bumper and Hitch Support Must Be Capable of Withstanding a 400 kN [90,000 lb.] Centered Force To The Hitch.



Optional Accessory, Order Separately (P/N 612047B)

Hitch Detail

Pintle Ring Euro-Hitch must be attached to Pintle Hook/Hitch Heights ranging from 432 mm [17"] (But Not to Exceed 813 mm [32"])



Pintle Ring Detail

Figure 3

3. The Vorteq® Trailer TMA shall be securely fastened to the truck. On level ground, the bottom of the Impact Head shall be 350 mm +/- 50 mm [14" +/- 2"] from the ground and level (See Figure 4).
4. The Vorteq® Trailer TMA is designed to safely absorb a crash and to support its own weight. Do not sit, stand or lean on any part of the system.

Note: Do not drag the system or place anything on its top: damage may result (See Figures 5 & 6).

5. Ballast and other heavy objects MUST BE ADEQUATELY ANCHORED to the truck to prevent shifting during an impact. The tie-down straps should be strong enough to hold 20 times the weight of the ballast (See Figure 7).
6. The agency responsible for the truck shall inspect it for adequate operator safety equipment (e.g., seat belts, head rests, etc.).
7. Make sure that the performance and safety of the Vorteq® Trailer TMA is not impaired by damage or corrosion.

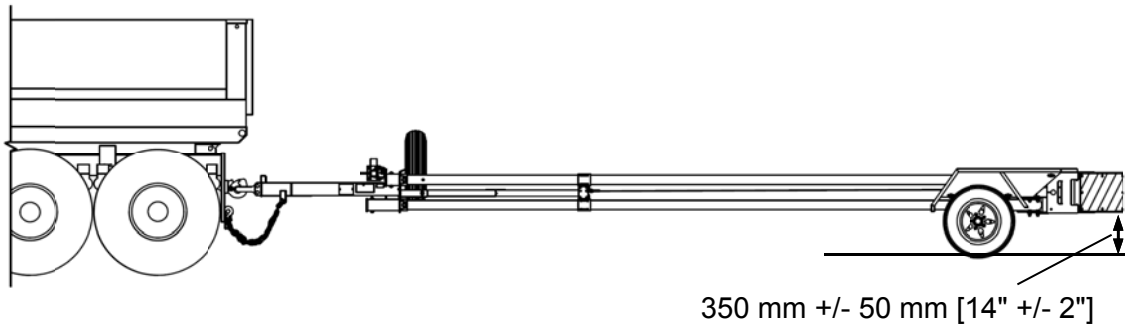


Figure 4

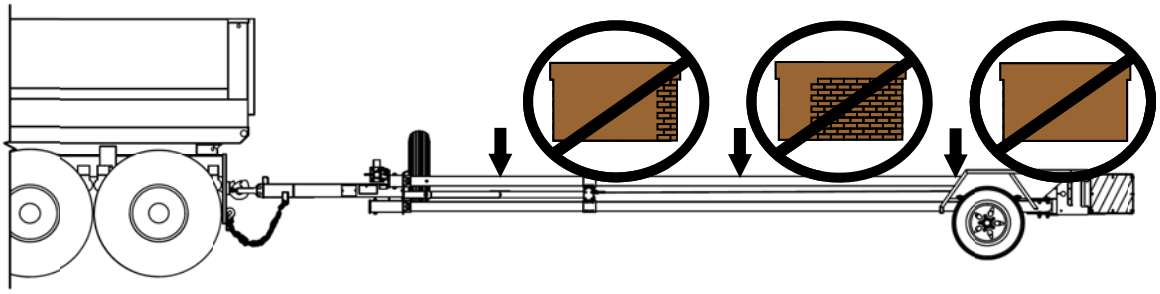


Figure 5

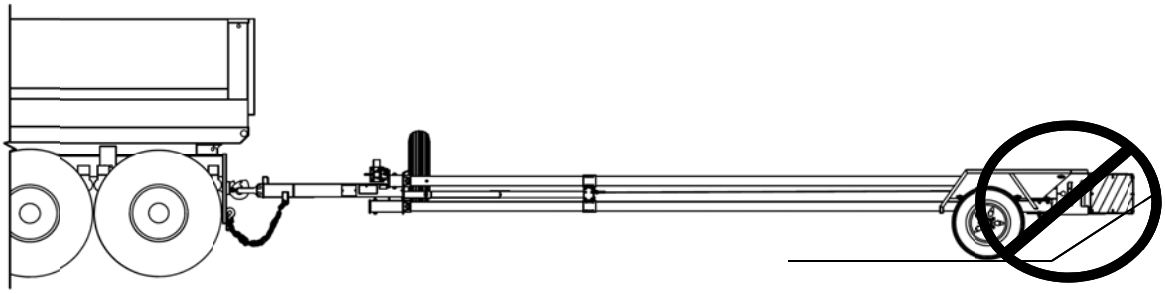


Figure 6

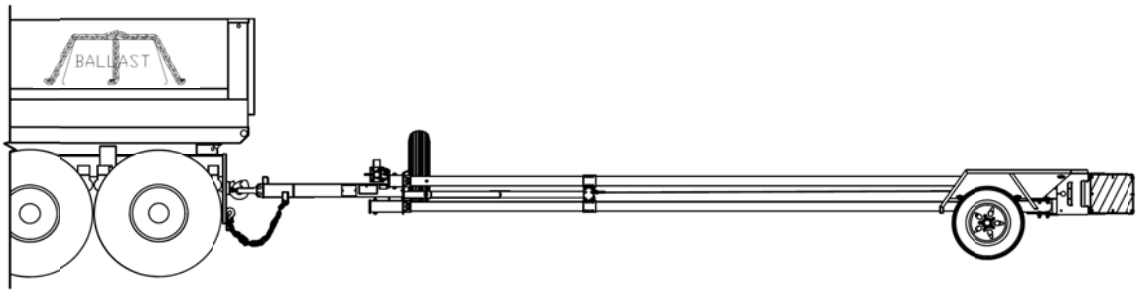


Figure 7

Warning: Failure to comply with these instructions can result in improper TMA performance and possible personal injury. This system is intended to be used as a crash attenuator on the rear of trucks which meet the design specifications for this system.

8. Regular maintenance of the Vorteq® Trailer TMA is important for safe use. Refer to the Maintenance section of this Manual for additional information.
    - Regular inspection of Shaper Rails, Impact Head, and fasteners is required to ensure proper system performance.
    - Regular inspection of tires is important. Low tire pressure could cause a blowout.
    - Visually inspect 1/2" x 1 1/4" hex bolts (Grade 2) and Lock Bar Washers at regular intervals (see Figure 21).
9. This system is a crash attenuator and is therefore used in high risk areas. Stay clear of traffic whenever possible. If an accident occurs, even under NCHRP-350 or TD 49 conditions, there may be fragments from the truck or impacting vehicle that could cause injury.
10. Do not use any part of the system for towing or hauling a load.
11. Be sure the truck is appropriate for attaching a Vorteq® TMA. See the assembly section for further details.

Trailer

Caution: Noncompliance with these instructions can lead to damage of the Vorteq® Trailer TMA components or render the Vorteq® Trailer TMA unfit for protection.

1. A jack is used to support the Vorteq® Trailer TMA when it is off the truck. The jack must be fully rotated 90 degrees to the travel position or removed while the system is attached to the truck.
2. The driver should be extra cautious while backing the truck with the Vorteq® Trailer TMA so that injury and/or damage will not result.
3. Use a correctly rated pintle hook/Euro-hitch (20 tons min. required). Confirm that the pintle hook/Euro-hitch and pintle eye/Euro-hitch are connected and properly tightened/adjusted.
4. Verify all lights are operational.
5. Avoid sudden stops and starts that can cause loss of vehicle control.
6. Avoid sudden steering maneuvers that might create sway or undue side force on the Vorteq® Trailer TMA.
7. Slow down when traveling over bumpy roads, railroad crossings, and ditches.
8. Ensure adequate turn radius at curves and corners. The long wheel base of the Vorteq® Trailer TMA means it has a larger turning radius. Make wider turns at curves and corners.
9. When uncoupling the Vorteq® Trailer TMA, place blocks or wheel chocks at the front and rear of the trailer tires to ensure that the trailer does not roll away when the coupling is released.
10. Periodically check bearings. Maintain per the axle manufacturer's schedule.
11. Always use safety chains when towing.
12. Cross safety chains under coupling to prevent tongue from dropping to ground in case of connection failure.
13. Allow only enough safety chain slack for tight turns.
14. Do not let safety chains drag on the ground.

15. Twist safety chains equally from hook ends to take up slack.
16. The truck operator is completely responsible for monitoring the condition of the system components as they relate to safe highway transit of their vehicle.
17. Check that the lighting harnesses are properly connected and not touching the road, but loose enough to make turns without disconnecting or damaging the wires.
18. Do not modify or change the Vorteq® Trailer TMA in any way.
19. Never weld, bolt or modify anything to the Vorteq® Trailer TMA. Modifications to the system are strictly prohibited.
20. The Vorteq® Trailer TMA could contact the vehicle used to tow it while making excessively sharp turns or backing up while turning. Take care to avoid contact between the tow vehicle and the Vorteq® Trailer TMA.

Tires & Axle

1. Periodically check and correct tire pressure.
2. All trailer tires have a maximum speed rating of 105 km/h [65 mph].
3. Three to five years is the projected life of a normal trailer tire.
4. The mileage expectation of a trailer tire would be 19,300 km [12,000 miles].
5. Always replace trailer tires with (ST) Special Trailer rated tires.
6. Wheel and tire offset is the distance from the mounting surface to the centerline of the tire. The Vorteq® Trailer TMA axle bearing sets are designed for wheels with 0 to 13 mm [1/2"] offset. Modifying this offset will shorten bearing life and may lead to bearing failure.
7. Wheels and tires must be matching pairs.
8. Confirm that the wheel lug nuts are tightened to the correct torque.
9. Use the frame when jacking up the trailer. Do not jack up trailer from suspension components.
10. Never weld to the Torflex® axle. The Torflex® axle contains rubber cords for the suspension system and will be damaged by heat generated from welding on the bracket or tube.

Controlling Skid Distance

The use of a TMA on the back of a truck will not:

- Affect the skid (roll ahead) distance of an impacted truck. **KEEP WORK CREWS CLEAR!**

Controlling skid distance (roll ahead):

- Skid distance is significantly increased and is less predictable for lightweight shadow vehicles.
- Skid distance is reduced and is more consistent when heavier shadow vehicles are used.
- Required truck weight: 9,920 lbs. or greater.

Roll-Ahead Distance for Shadow Vehicles

Weight of Shadow Vehicle (Moving)	Prevailing Speed km/h [mph]	Weight of Impacting Vehicle to be Contained*			
		2,040 kg [4,500 lbs]	4,536 kg [10,000 lbs]	6,804 kg [15,000 lbs]	10,886 kg [24,000 lbs]
4,536 kg [10,000 lbs]	96-105 [60-65]	30 m [100 ft]	53 m [175 ft]	69 m [225 ft]	84 m [275 ft]
	80-88 [50-55]	30 m [100 ft]	46 m [150 ft]	53 m [175 ft]	60 m [200 ft]
	72 [45]	23 m [75 ft]	30 m [100 ft]	38 m [125 ft]	46 m [150 ft]
6,804 kg [15,000 lbs]	96-105 [60-65]	23 m [75 ft]	46 m [150 ft]	53 m [175 ft]	69 m [225 ft]
	80-88 [50-55]	23 m [75 ft]	38 m [125 ft]	46 m [150 ft]	53 m [175 ft]
	72 [45]	15 m [50 ft]	30 m [100 ft]	30 m [100 ft]	30 m [100 ft]
10,886 kg [24,000 lbs]	96-105 [60-65]	23 m [75 ft]	30 m [100 ft]	46 m [150 ft]	53 m [175 ft]
	80-88 [50-55]	15 m [50 ft]	23 m [75 ft]	30 m [100 ft]	46 m [150 ft]
	72 [45]	15 m [50 ft]	23 m [75 ft]	23 m [75 ft]	30 m [100 ft]

Note: Distances are appropriate for shadow vehicle speeds up to 25 km/h [15 mph].

Roll-Ahead Distance for Barrier Vehicles

Weight of Barrier Vehicle (Stationary)	Prevailing Speed km/h [mph]	Weight of Impacting Vehicle to be Contained*			
		2,040 kg [4,500 lbs]	4,536 kg [10,000 lbs]	6,804 kg [15,000 lbs]	10,886 kg [24,000 lbs]
4,536 kg [10,000 lbs]	96-105 [60-65]	15 m [50 ft]	30 m [100 ft]	46 m [150 ft]	60 m [200 ft]
	80-88 [50-55]	8 m [25 ft]	23 m [75 ft]	30 m [100 ft]	46 m [150 ft]
	72 [45]	8 m [25 ft]	15 m [50 ft]	23 m [75 ft]	30 m [100 ft]
6,804 kg [15,000 lbs]	96-105 [60-65]	8 m [25 ft]	23 m [75 ft]	30 m [100 ft]	46 m [150 ft]
	80-88 [50-55]	8 m [25 ft]	15 m [50 ft]	23 m [75 ft]	30 m [100 ft]
	72 [45]	8 m [25 ft]	8 m [25 ft]	15 m [50 ft]	23 m [75 ft]
10,886 kg [24,000 lbs]	96-105 [60-65]	8 m [25 ft]	15 m [50 ft]	23 m [75 ft]	30 m [100 ft]
	80-88 [50-55]	8 m [25 ft]	8 m [25 ft]	15 m [50 ft]	23 m [75 ft]
	72 [45]	8 m [25 ft]	8 m [25 ft]	8 m [25 ft]	15 m [50 ft]

Shadow or Barrier Vehicle Recommended Weight

Recommended minimum Barrier/Shadow vehicle weight: 4,500 kg [9,920 lbs].

***Weights of Typical Vehicles:**

Midsize automobile - 1,020 kg [2,250 lbs]

Full-size automobile - 1,500 kg [3,500 lbs]

Loaded 3/4-ton pickup truck - 2,750 kg [6,000 lbs]

Loaded 1-ton cargo truck - 4,500 kg [10,000 lbs]

Loaded 4-yard dump truck - 11,000 kg [24,000 lbs]

Source: "Use of Truck Mounted Attenuators in Work Zones" by Jack B. Humphreys, P.E. and T. Darcy Sullivan, P.E., University of Tennessee.

Recommended Tools

- Steel Tape Measure 15 m (50 ft.)
- Spirit Level
- Alignment Tool 12 mm (1/2")
- Torque Wrench 120 N-m [90 ft-lbf]
- Hammer
- Wire Cutters
- Circular Saw (Cut up pallets)
- Screw Gun or Drill
- 1/2" Drive Socket Wrench
- 1/2" Drive Sockets 1/4" thru 1”
- Same size open end wrenches as above
- Pipe Wrench 405 mm (16")
- 1/2" Drive Air Impact Wrench with Air Compressor
- 36" Crow Bar
- Floor Jack

Note: The above list of tools is a general recommendation. Depending on specific site conditions and the complexity of the assembly specified by the appropriate highway authority, additional or fewer tools may be required. Decisions as to what tools are needed to perform the job are entirely within the discretion of the specifying highway authority and the authority’s selected contractor performing the assembly of the system at the authority’s specified assembly site.

Uncrating Instructions

A. Crated components shown.

Figure 9

B. Carefully uncrate system and stage components (2-3 personnel may be required).

C. Check your order! Compare items received with packing list now.

D. Refer to Fastener Reference Chart on Page 55.

E. Save Pallet material for blocking system later.

Figure 10

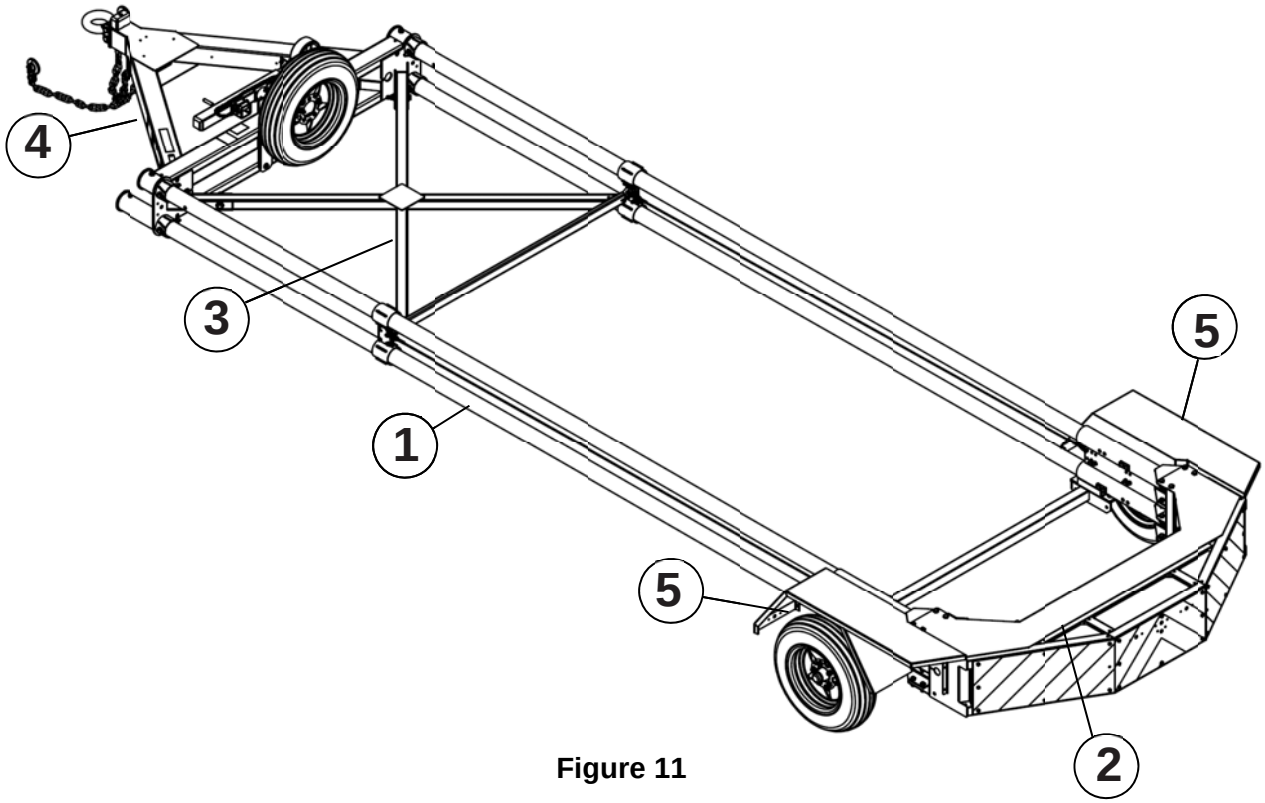
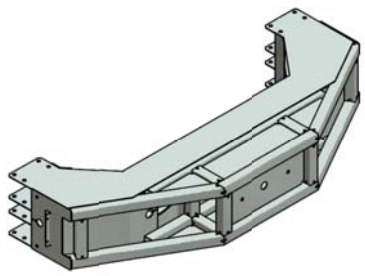
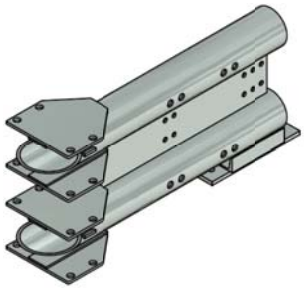
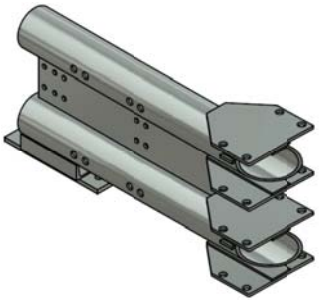
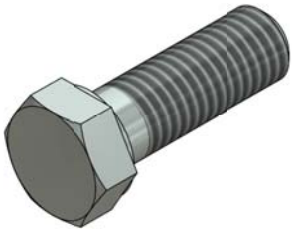


Figure 11

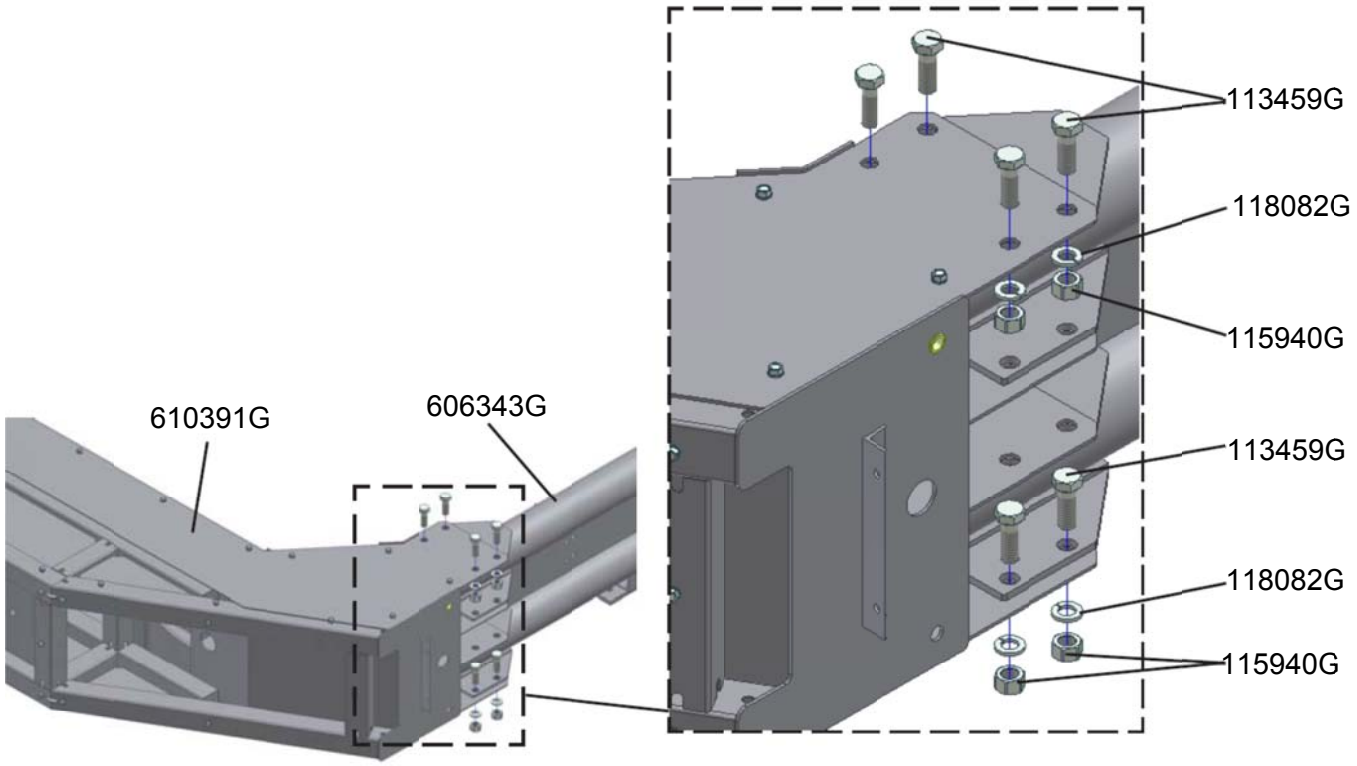
Vorteq® Trailer TMA Frame
1 609047B Shaper Rail Assembly
2 618747B Impact Head Assembly
3 618749B X-Brace Assembly
4 618748B Tongue Assembly
5 618770B Fender Assembly

Impact Head Assembly

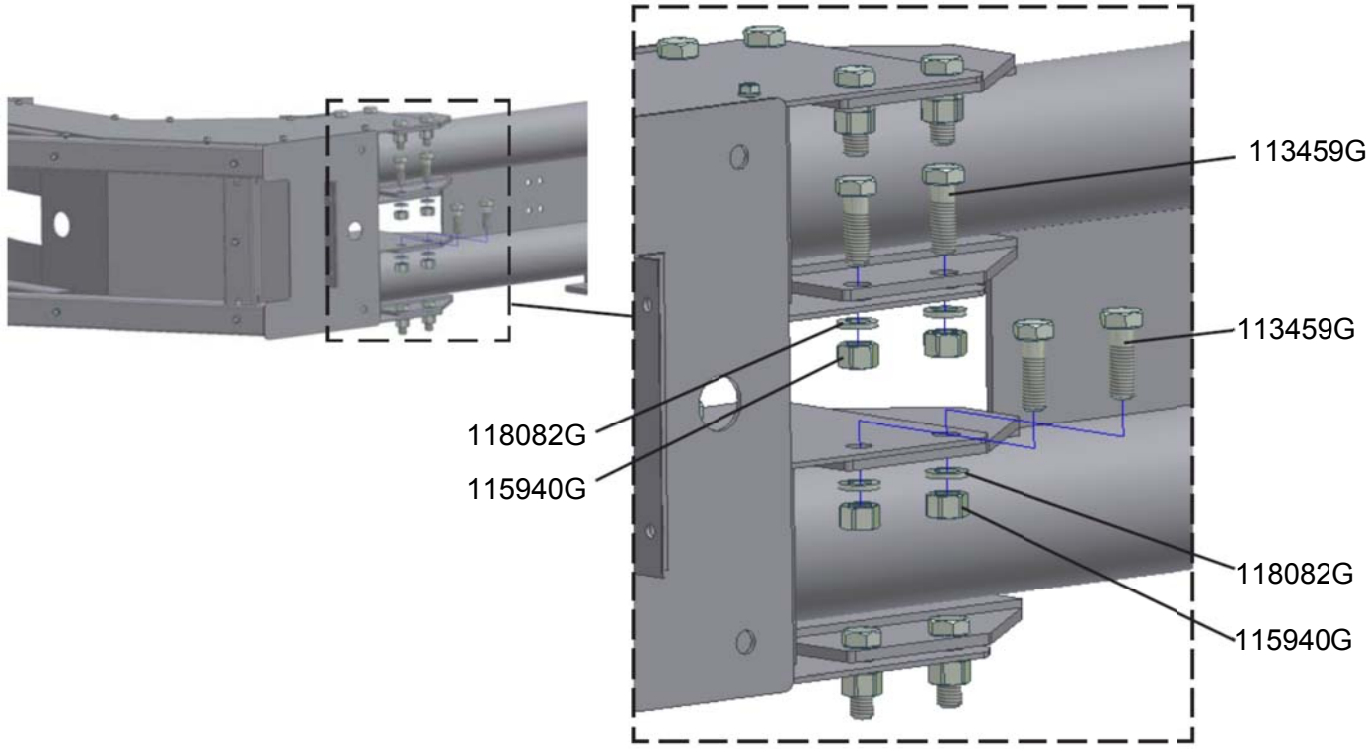
618747B

Impact Head 	610391G	x 1	**Left Collar** 	606341G	x 1
Right Collar 	606343	x 1			
1/2” x 1 1/2" Hex Bolt 	113459G	x 32	**1/2" Nut** 	115940G	x 32
1/2” Lock Washer 	118082G	x 32			

Right Collar Attachment (May be Pre-Assembled)

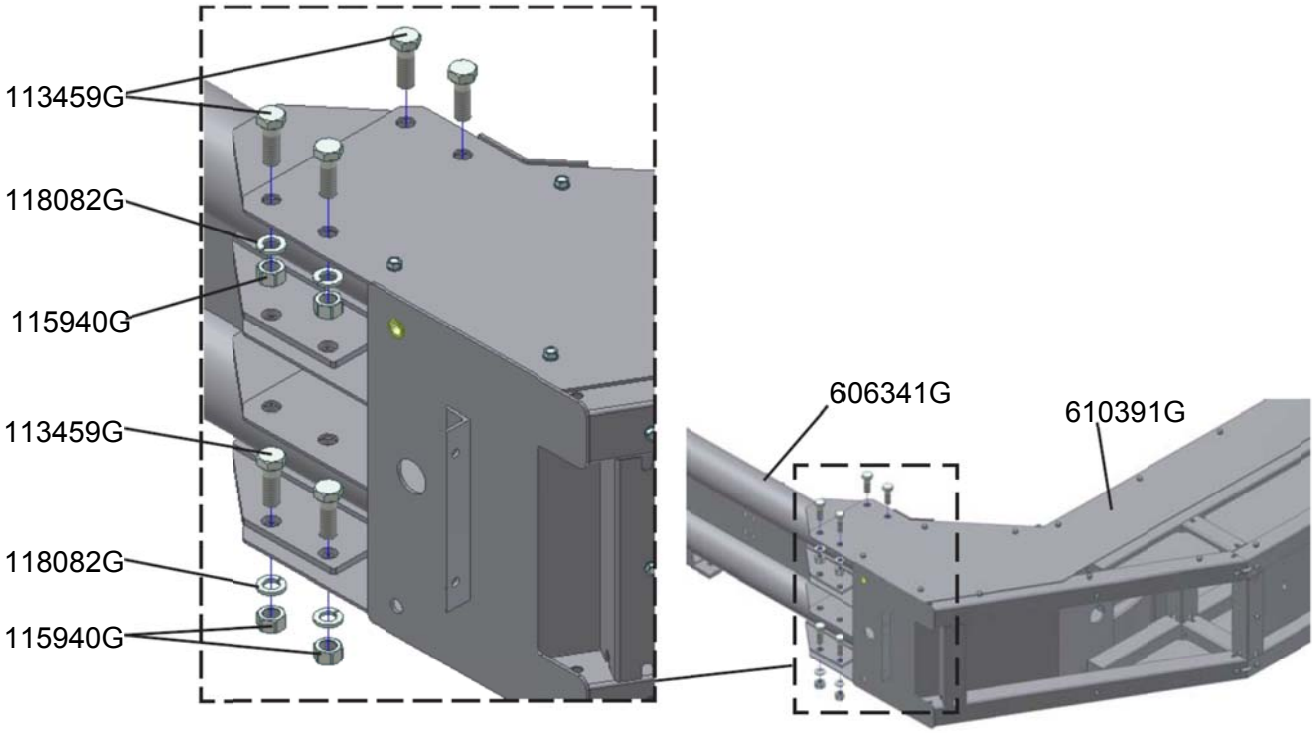


Step 1
Figure 12

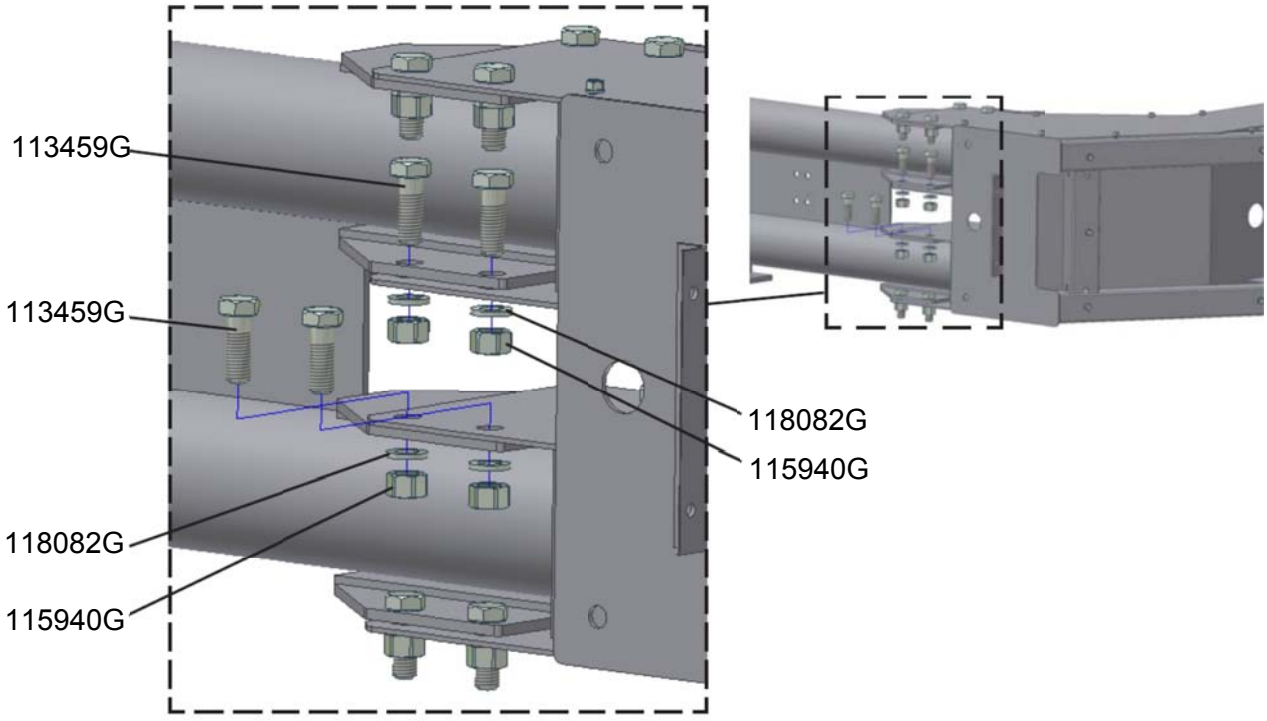


Step 2
Figure 13

Left Collar Attachment (May be Pre-Assembled)



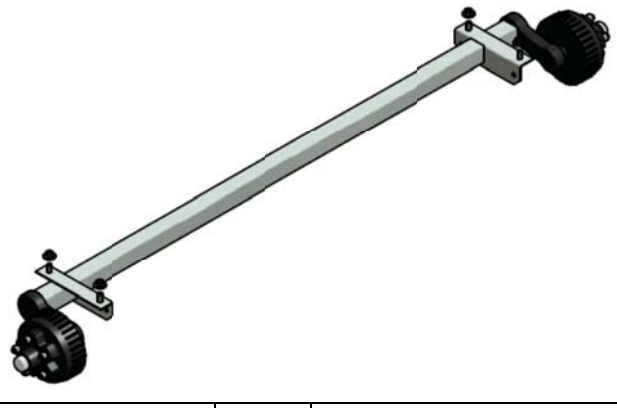
Step 1
Figure 14

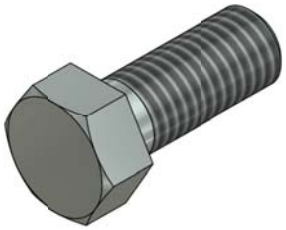


Step 2
Figure 15

Axle Assembly (May be Pre-Assembled)

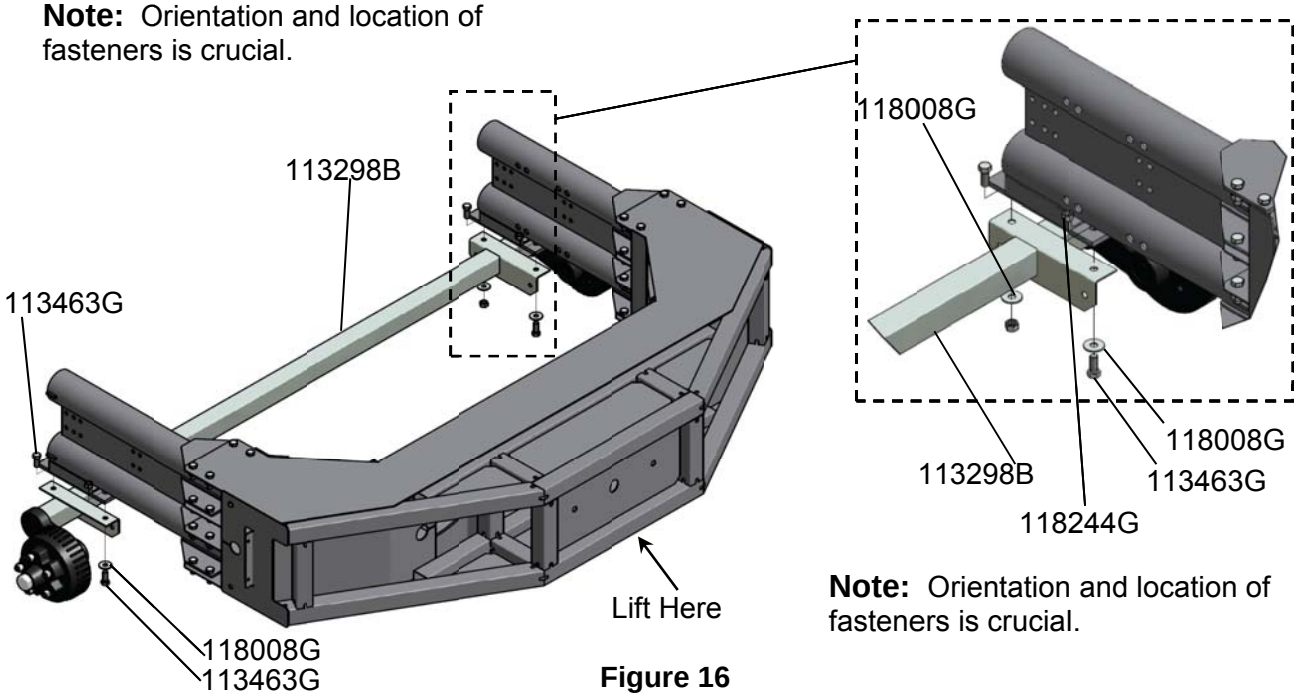
113298B

Axle		
		
113298G	**x 1**	

1/2" x 1 1/4" Bolt*			1/2" Lock Nut*			1/2" Flat Washer*		
								
113463G	**x 4**		**118244G**	**x 4**		**118008G**	**x 4**	

***Fasteners supplied with Axle from Manufacturer.**

Note: Orientation and location of fasteners is crucial.



Note: Orientation and location of fasteners is crucial.

Figure 16

Shaper Rail Assembly

609047B

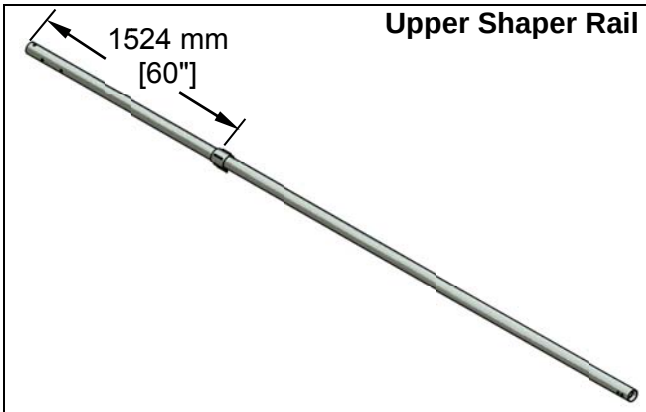
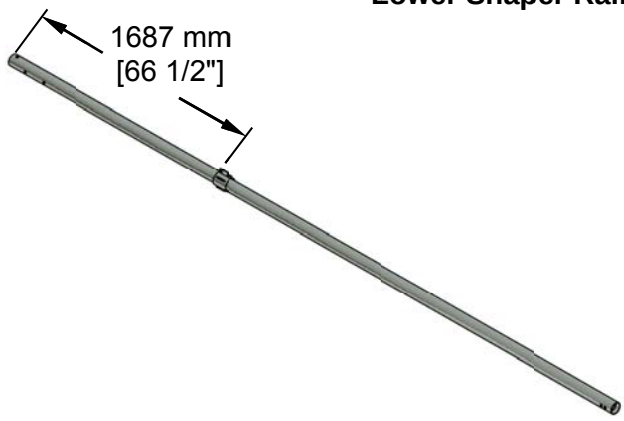
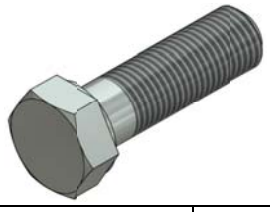
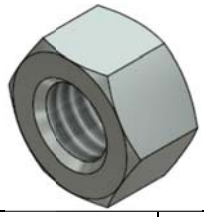
Upper Shaper Rail			Lower Shaper Rail		
					
614038G	x 2		614037G	x 2	

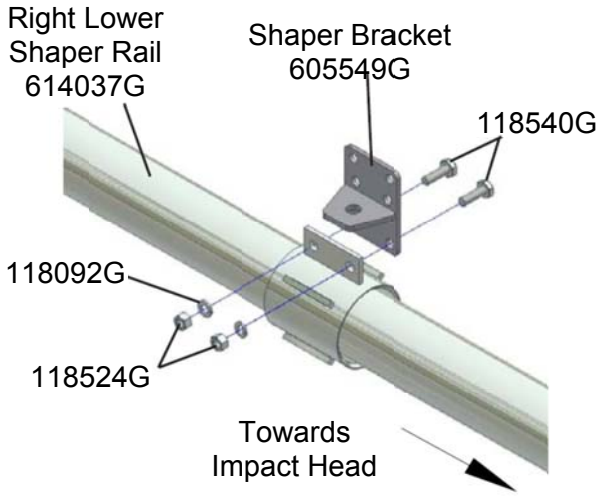
Figure 17

How to Determine Left/Right

To determine left from right: Face the system as shown in Figure 17. Your left is the system's left and your right is the system's right.

Shaper Rail Attachment

3/8” x 1/4" Hex Bolt		3/8” Lock Washer		3/8” Nut		Shaper Bracket	
							
118540G	**x 8**	**118092G**	**x 8**	**118524G**	**x 8**	**605549G**	**x 2**



Detail A

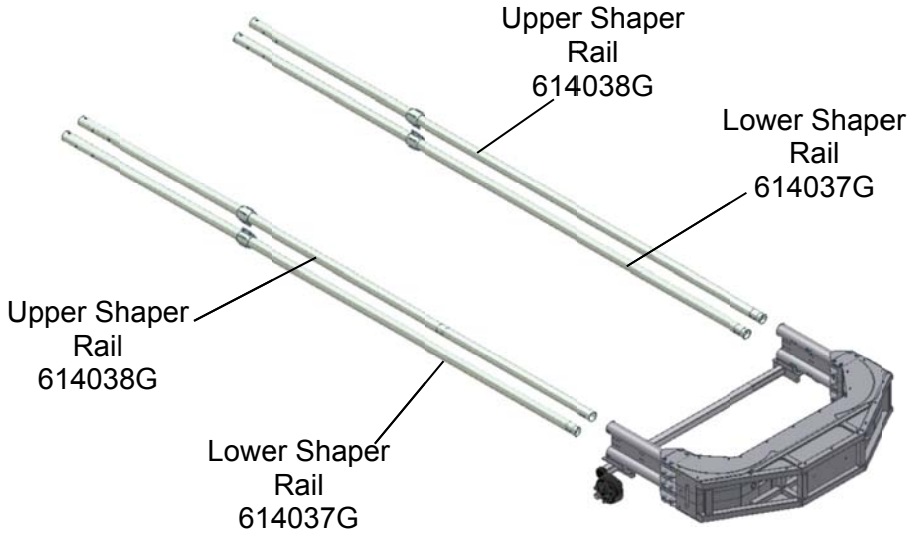


Figure 18

A. Attach Shaper Brackets (605549G) to Lower Shaper Rails (614038G) first as shown in Detail A (Note orientation).
B. Finger tighten fasteners at this step.

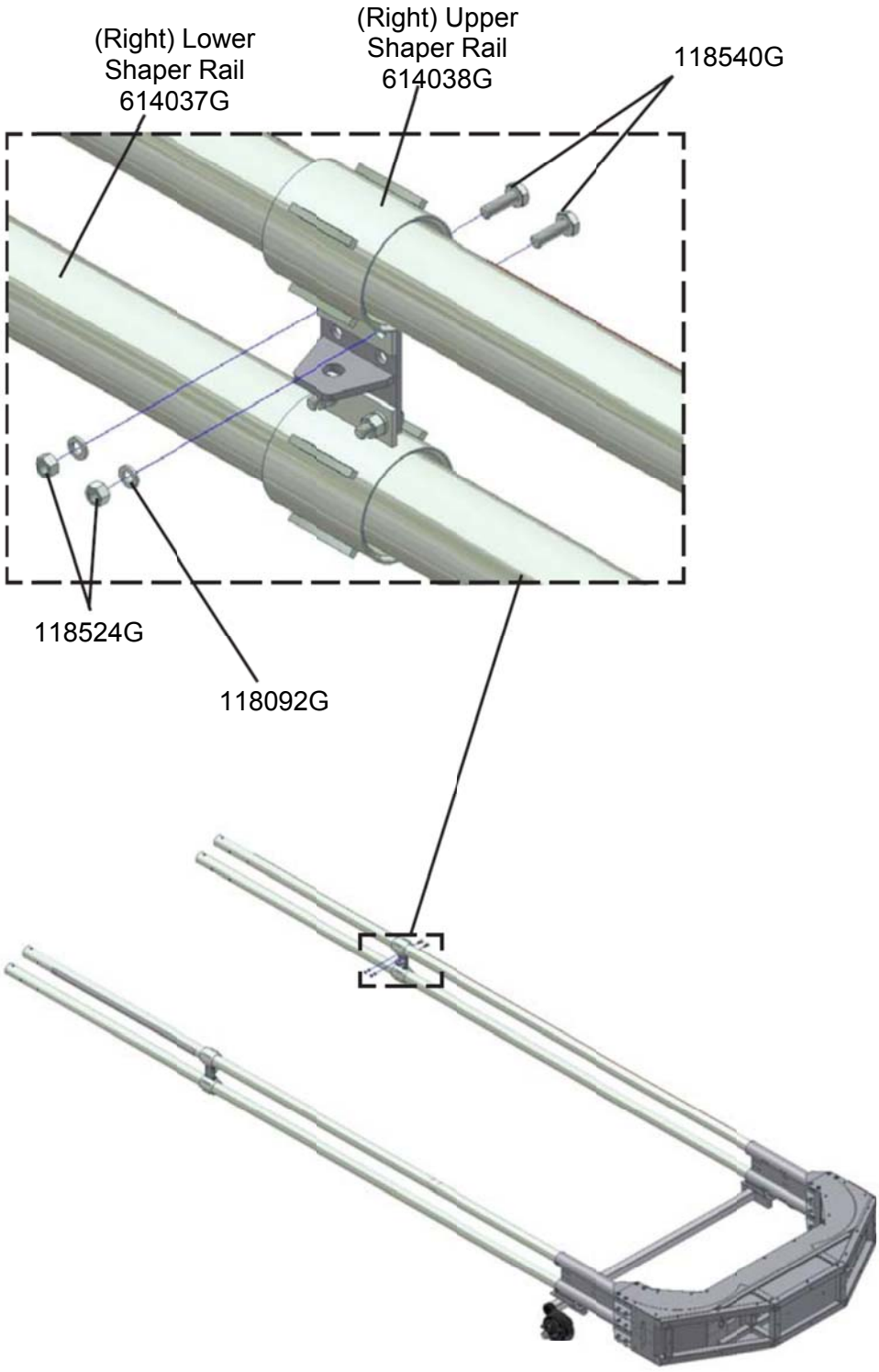
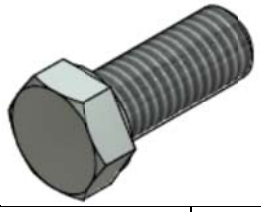
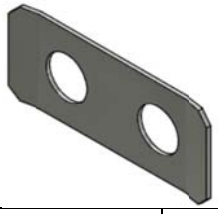


Figure 19

A. Insert Lower Shaper Rails (614037G) in Collars first.
B. Add Upper Shaper Rails (614038G) and finger tighten all fasteners.

Lock Bar Washer Attachment

1/2" x 1 1/4" Hex Bolt*		Lock Bar Washer	
			
113462G*	**x 8**	**617037G**	**x 4**

***Grade 2 only**

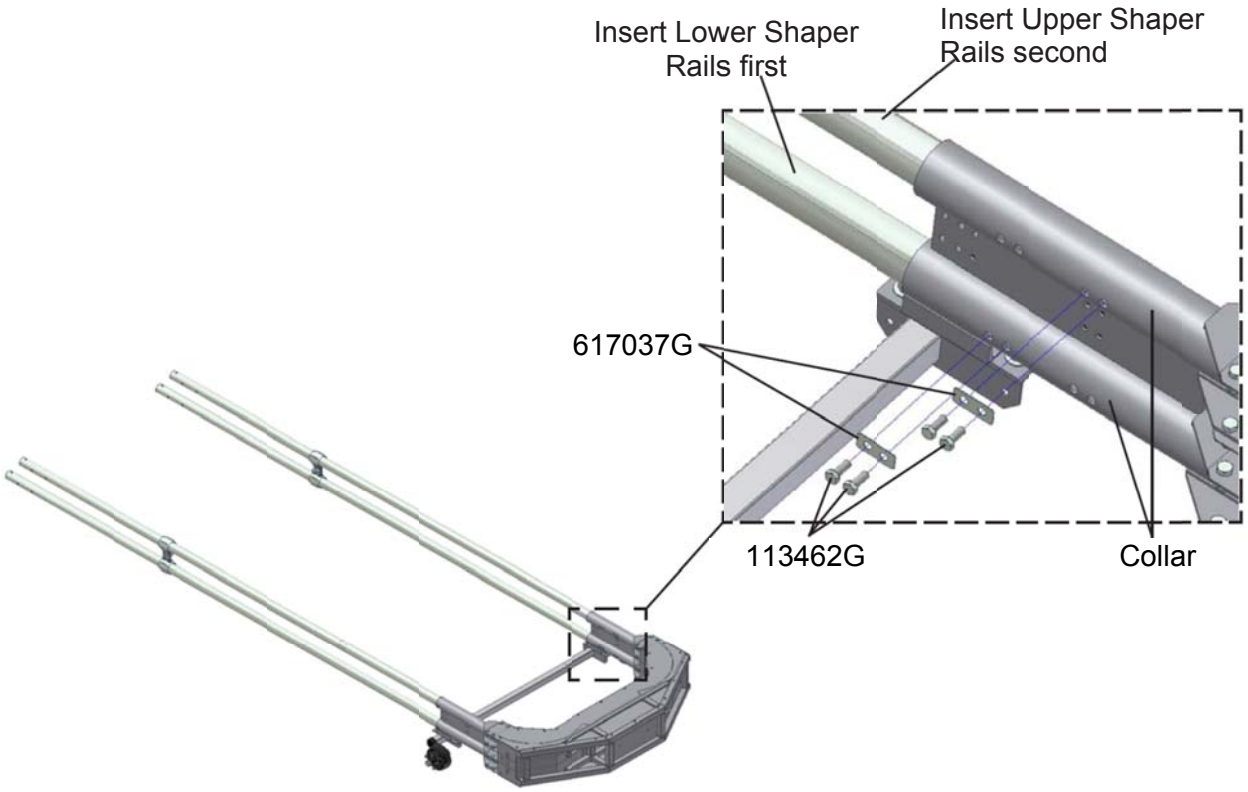
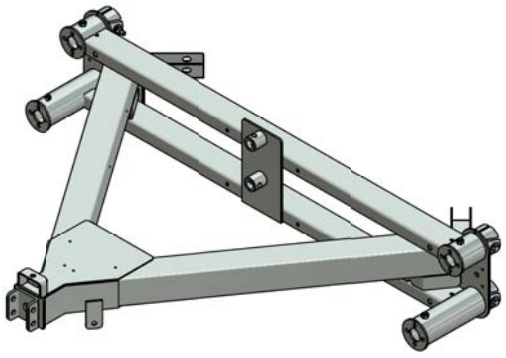
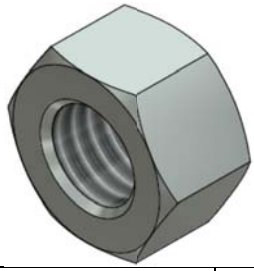
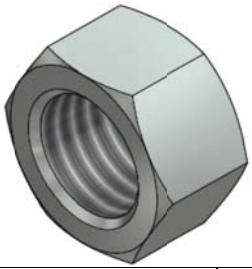


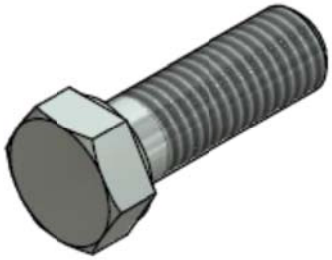
Figure 20

Tongue Assembly

618748B

Tongue	
	
618895G	x 1

1/2" Lock Nut		1/2" x 5” Hex Bolt		1/2" Hex Nut	
					
118521G	x 8	118520G	x 4	115940G	x 4

1/2” Lock Washer		Safety Chains Assy.		1/2" x 1 1/2" Hex Bolt	
					
118082G	x 4	613956B	x 1	113459G	x 8

1/2” x 1 3/8” Flat Washer	
	
118009G	x 1

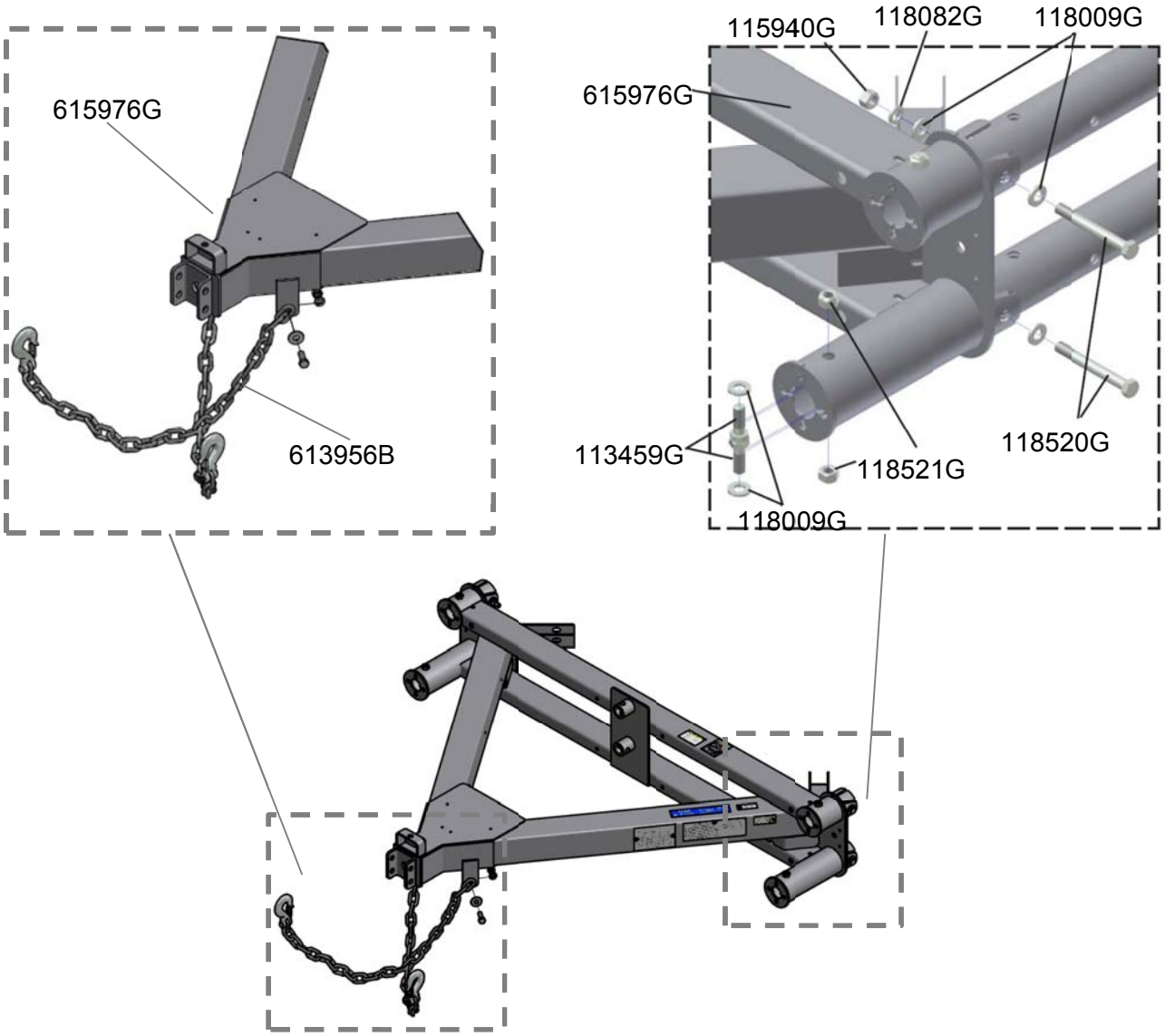


Figure 21

A. Insert Lower Shaper Rails first.

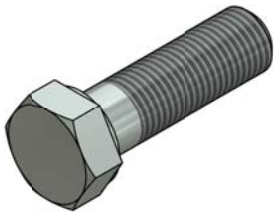
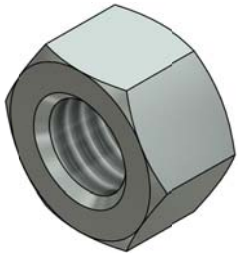
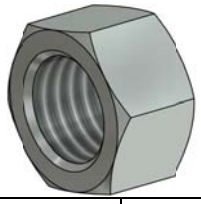
B. Slowly insert one side after another, moving back and forth.

C. Use floor jack to make final hole alignment adjustments.

D. Finger tighten fasteners at this time.

X-Brace Assembly

618749B

X Brace		3/8” x 1 1/4" Hex Bolt		3/8” Hex Nut		3/8” Lock Washer	
							
617302G	**x 1**	**118540G**	**x 2**	**118524G**	**x 2**	**118092G**	**x 2**
1/2" Lock Washer		**1/2" x 4” Hex Bolt**		**1/2" x 1 3/8” Flat Washer**		**1/2” Hex Nut**	
							
118521G	**x 8**	**118520G**	**x 2**	**118009G**	**x 4**	**115940G**	**x 2**

A. Finger-tighten fasteners at this time.

B. Use floor jack to make final hole alignment adjustments.

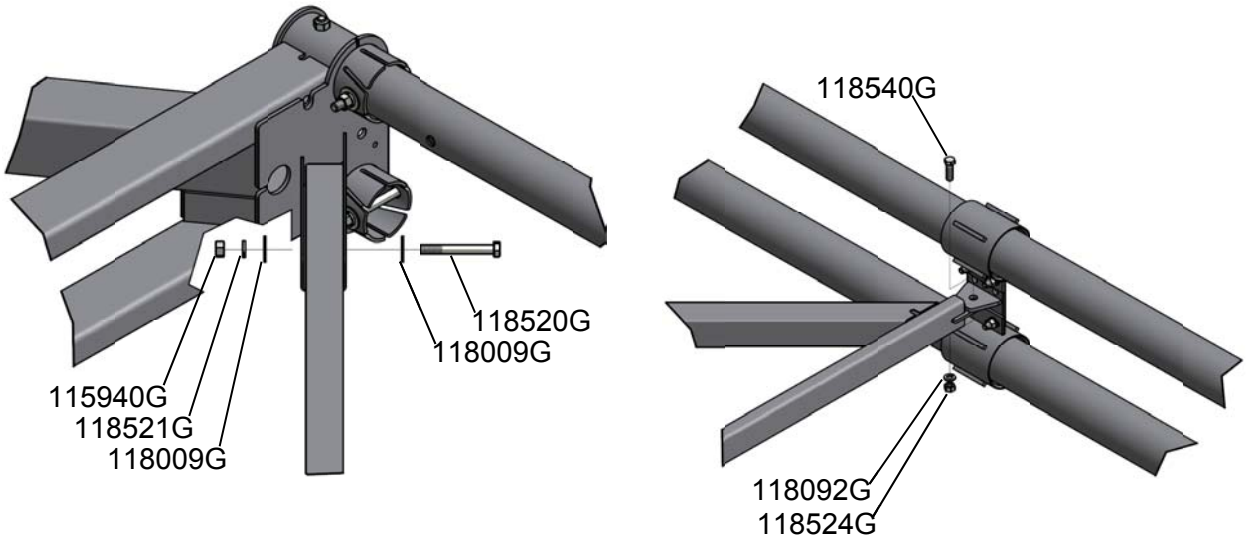


Figure 22

Bolt Tightening Sequence

A. Tighten all fasteners at this time. Follow sequence 1 – 6 as shown below.

B. Torque 1/2" x 1 1/4" hex bolts (Grade 2) in place first.

C. Bend Ears on Lock Bar Washers up and against Hex Bolts 90° as shown to lock 1/2" x 1 1/4" hex bolts (Grade 2) in place. Bend against nearest flat on Bolt using a punch and hammer.

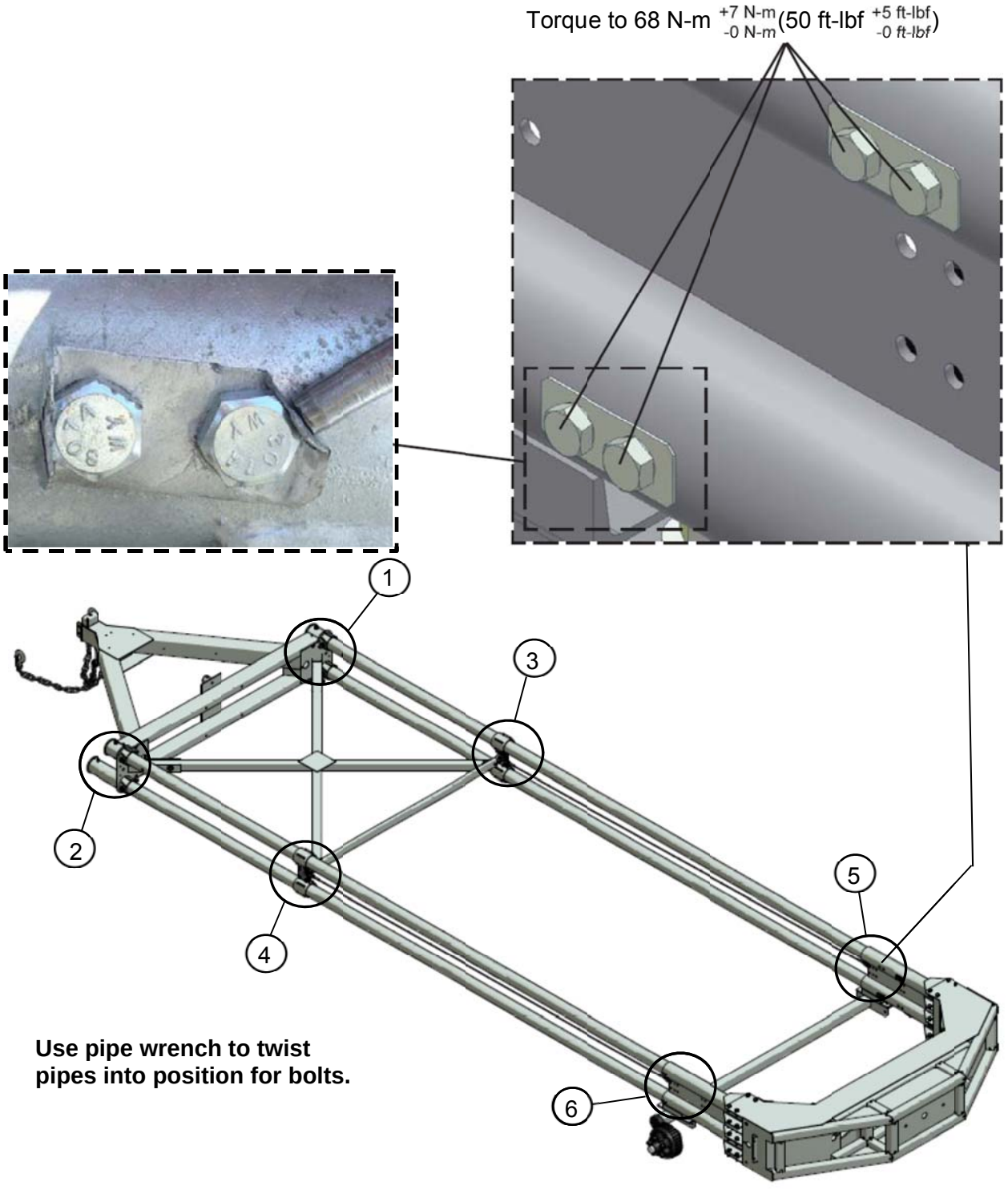
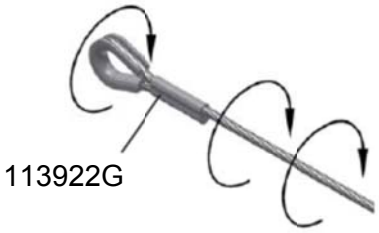


Figure 23

1/4" Shackle		Safety Cable	
			
117069G	**x 4**	**113922G**	**x 2**

Twist/rotate ends of Cables in direction of Cable weave to shorten and remove slack.



Detail A

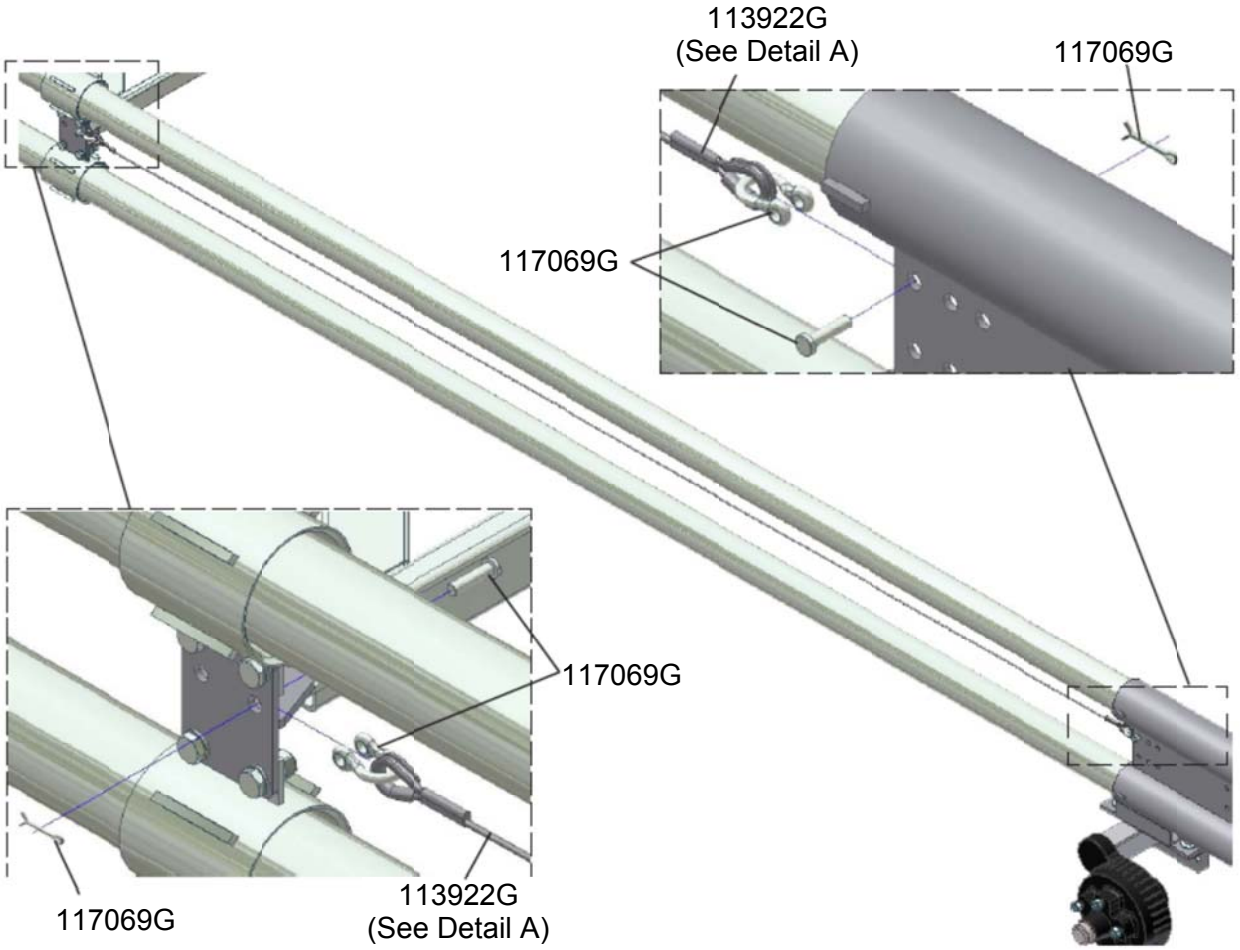
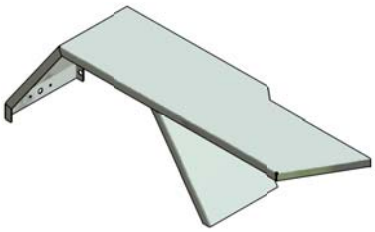
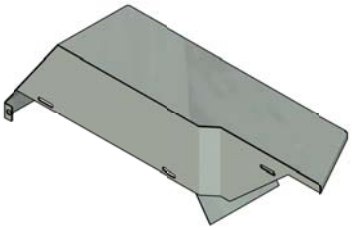


Figure 24

Fender Assembly

618770B

Left Square Fender		Right Square Fender		Bracket	
					
608252G	x 1	608256G	x 1	605377G	x 4

3/8” x 1 1/4" Hex Bolt		3/8” x 1” Flat Washer		3/8” Lock Washer		3/8” Nut	
							
118540G	x 12	118036G	x 4	118092G	x 12	118524G	x 12

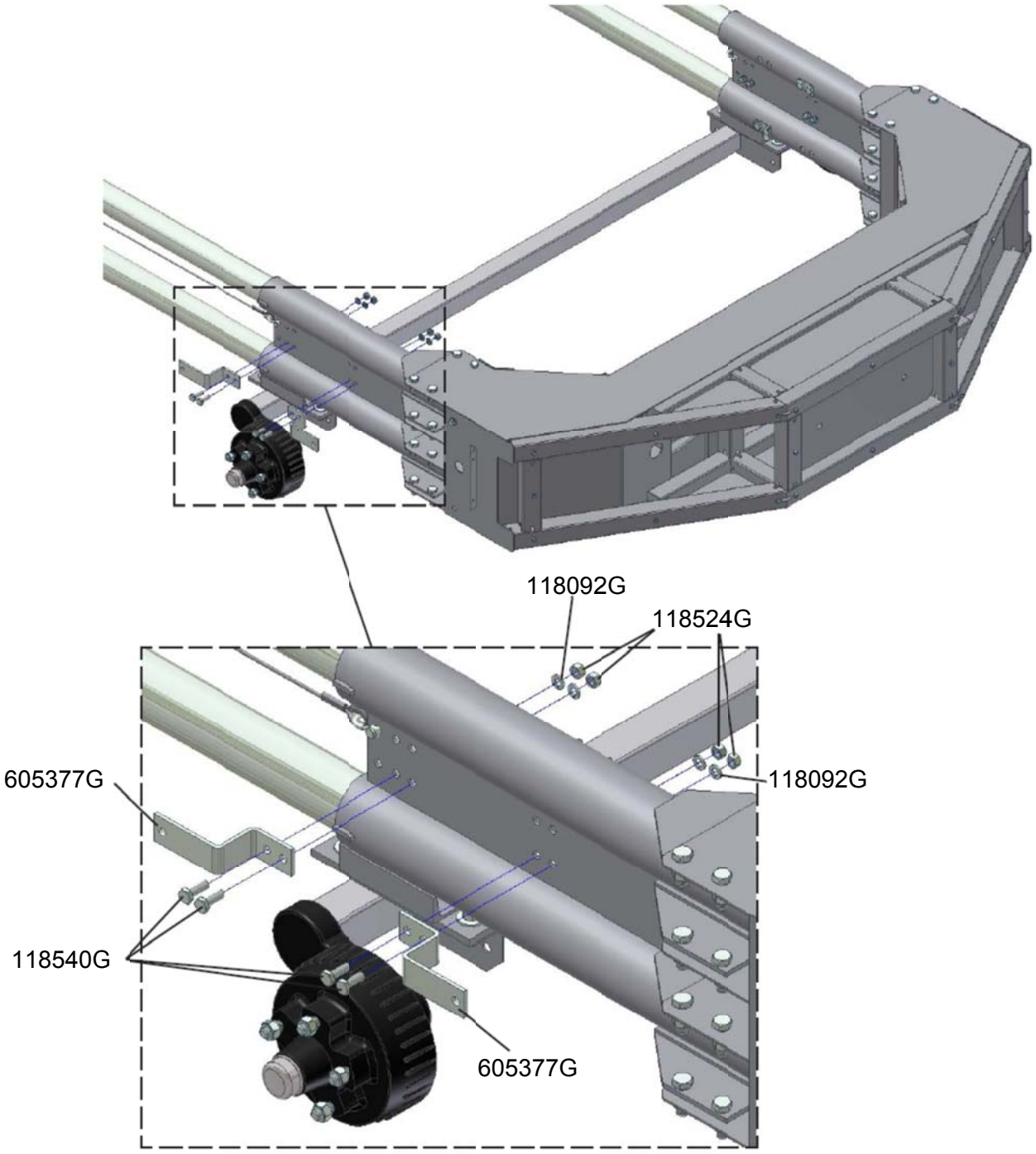


Figure 25

Attach Brackets to Collars (May be pre-assembled).

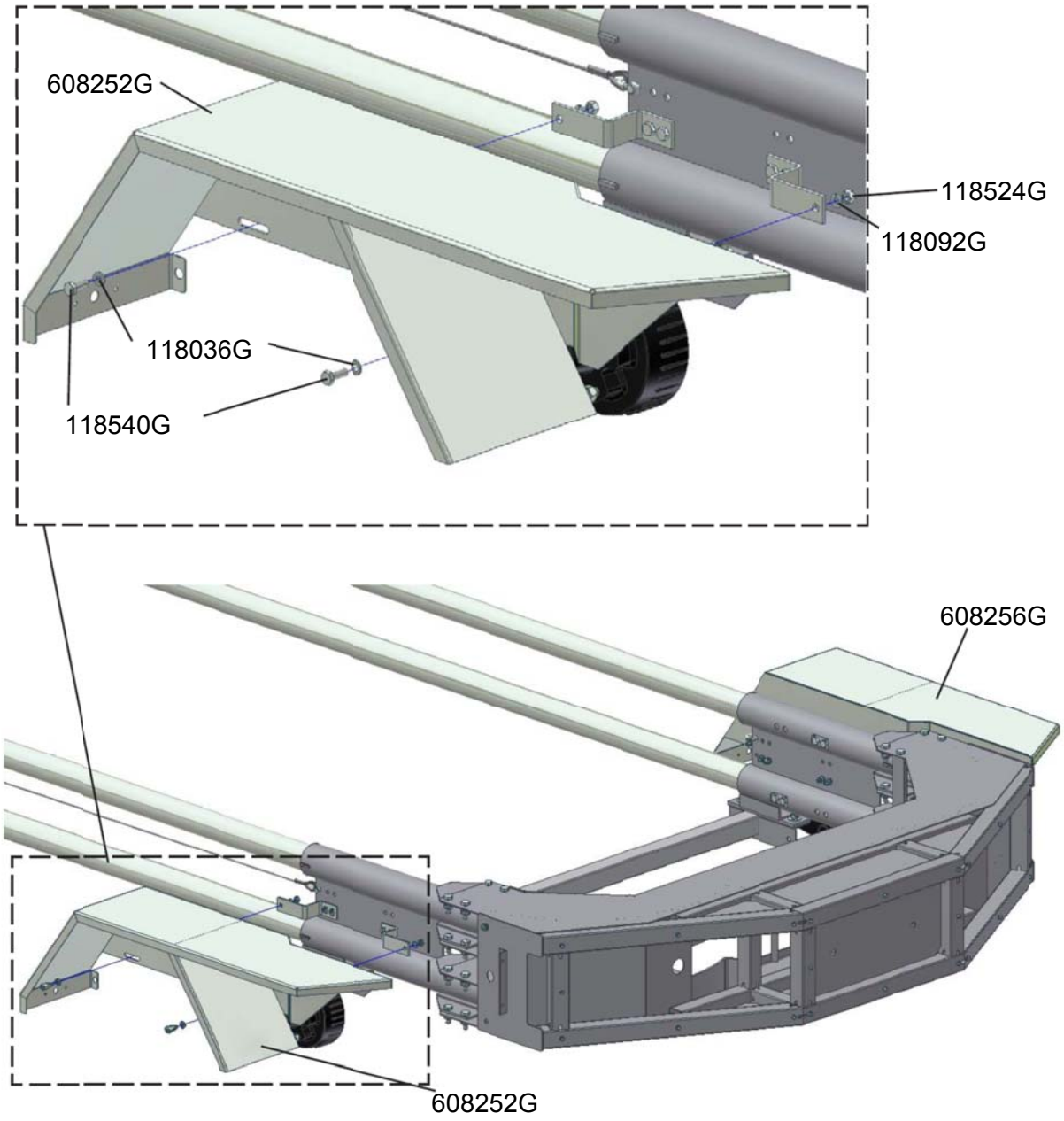


Figure 26

Attach Fenders to Brackets (May be pre-assembled).

Wheels & Tires

Wheel with Tire		Lug Nut*	
			
118151B	**x 2**	**116044G**	**x 10**

* Lug nut included with Axle Assembly. Part number provided for spare part orders.

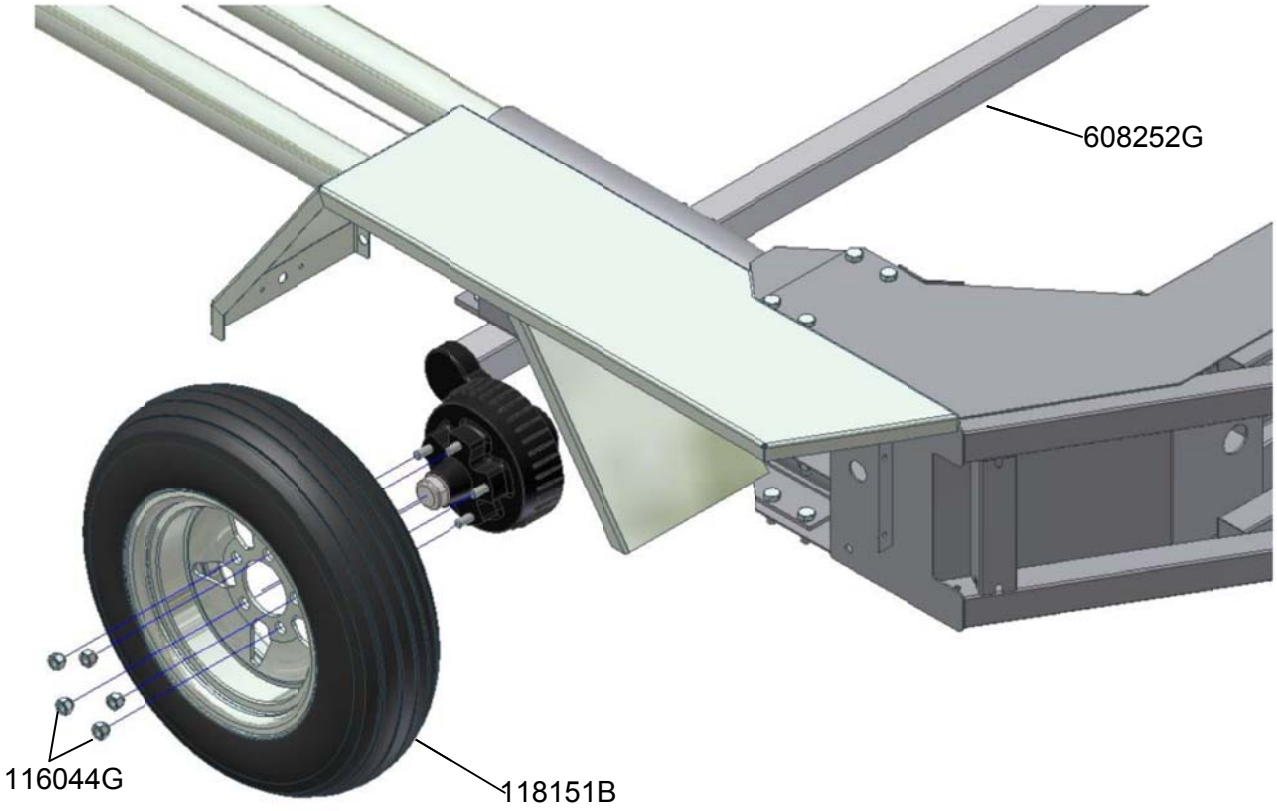


Figure 27

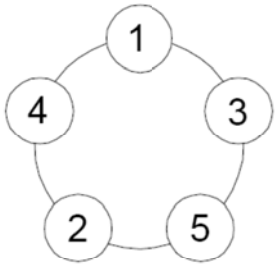
Wheel 1/2" Lug Nut torque requirements:

A. Start all nuts by hand to prevent cross threading.

B. Torque nuts in stages as follows:

   1. 1st stage: 27 to 34 N-m [20 - 25 ft-lbf].
   2. 2nd stage: 47 to 54 N-m [35 - 40 ft-lbf].
   3. 3rd stage: 95 ± 7 N-m [70 ± 5 ft-lbf].

C. Follow illustrated torque sequence.



Torque Sequence

Pintle Ring

610244B

Pintle Ring		5/8” x 5 1/2”Hex Bolt		5/8” Lock Nut		Bar Washer	
							
610243W	**x 1**	**118572G**	**x 2**	**116023G**	**x 2**	**618920G**	**x 1**

*Torque fasteners to 100 ft-lbf [134 N-m].

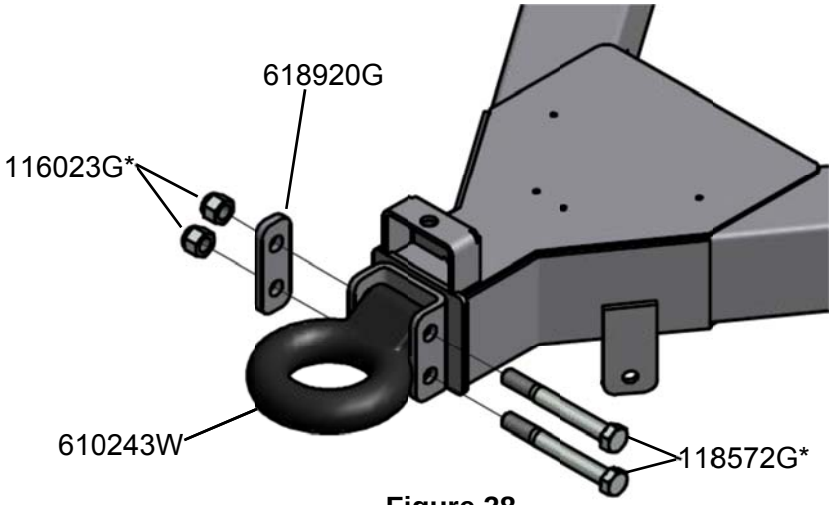
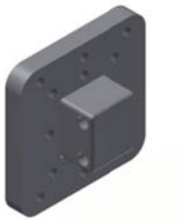


Figure 28

European Hitch Adapter

610240B

Hitch		5/8” x 5 1/2”Hex Bolt		5/8” Lock Nut		Bar Washer	
							
603523W	**x 1**	**118572G**	**x 2**	**116023G**	**x 2**	**618920G**	**x 1**

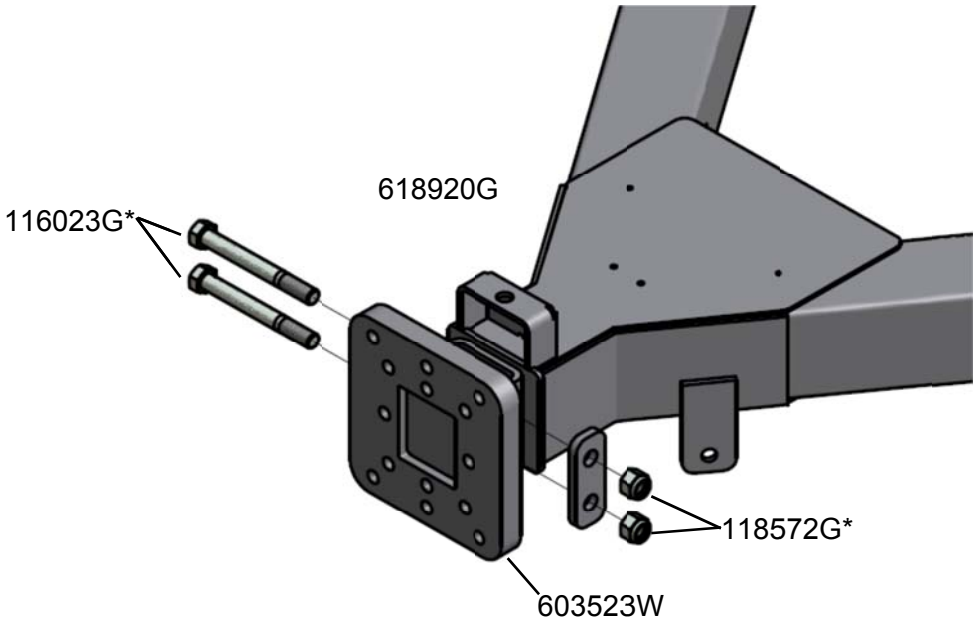
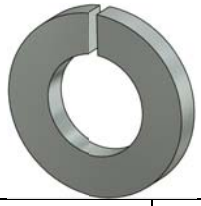


Figure 29

*Torque fasteners to 100 ft-lbf [134 N-m].

Jack Assembly
610989B

Jack		3/8” Nut		Wheel		Pin with Handle	
							
611008B	x 1	115963G	x 4	114060B	x 1	116248B	x 2
3/8" x 1” Hex Bolt		**3/8” Lock Washer**		**3/8” x 1” Flat Washer**		**1/8” x 1”Split Ring**	
							
113597G	x 4	118093G	x 4	118037G	x 4	116739G	x 2

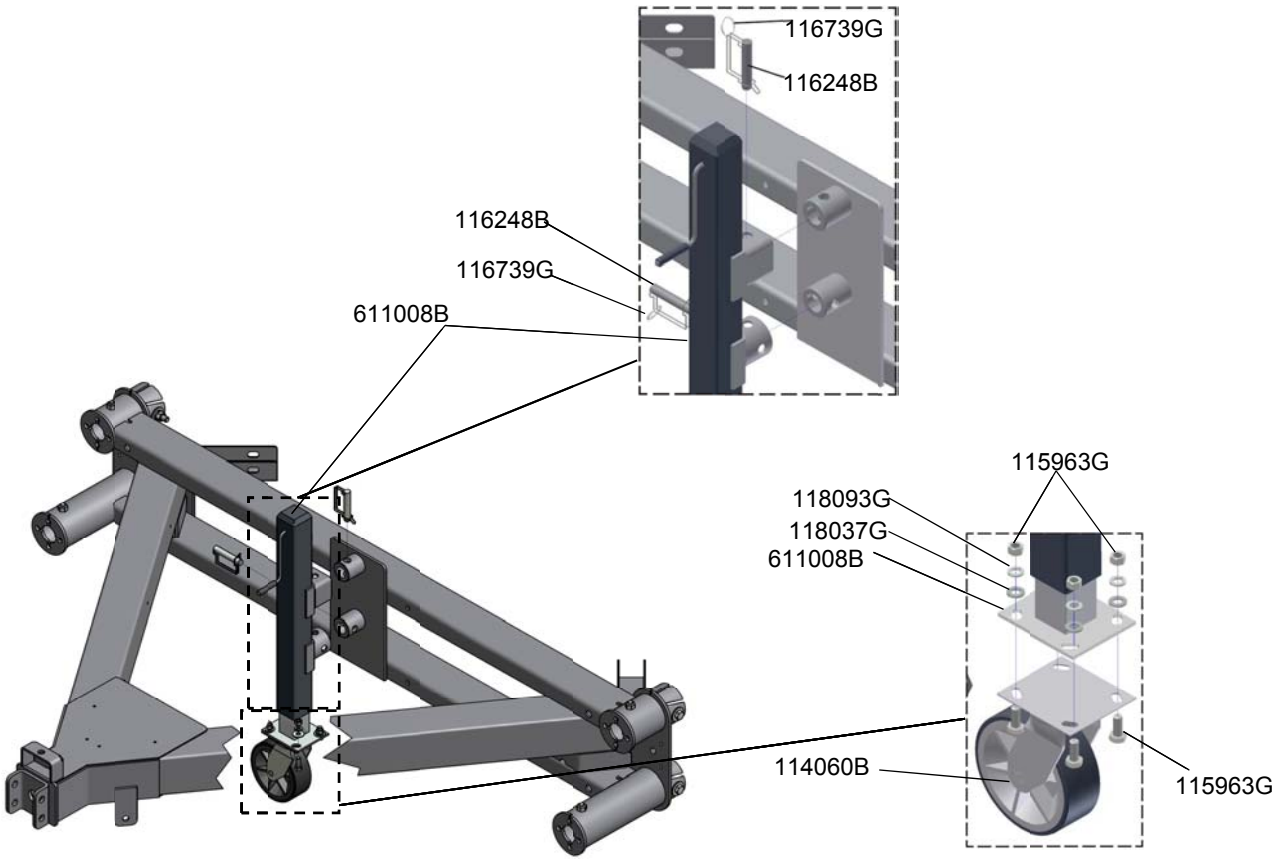
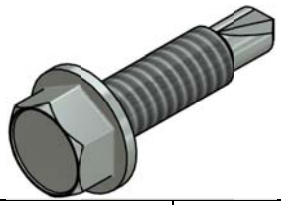


Figure 30

Impact Face

618750B

Left	Center		Right
			
	614760B	x 1	

1/4" x 1” Screw	
	
116891G	x 22

Impact Face Attachment

A. Ensure the striping patterns line up with center pane prior to final assembly.
B. Align Panels and fasten 116891G 1/4” x 1” self-tapping screws with screw gun or drill.

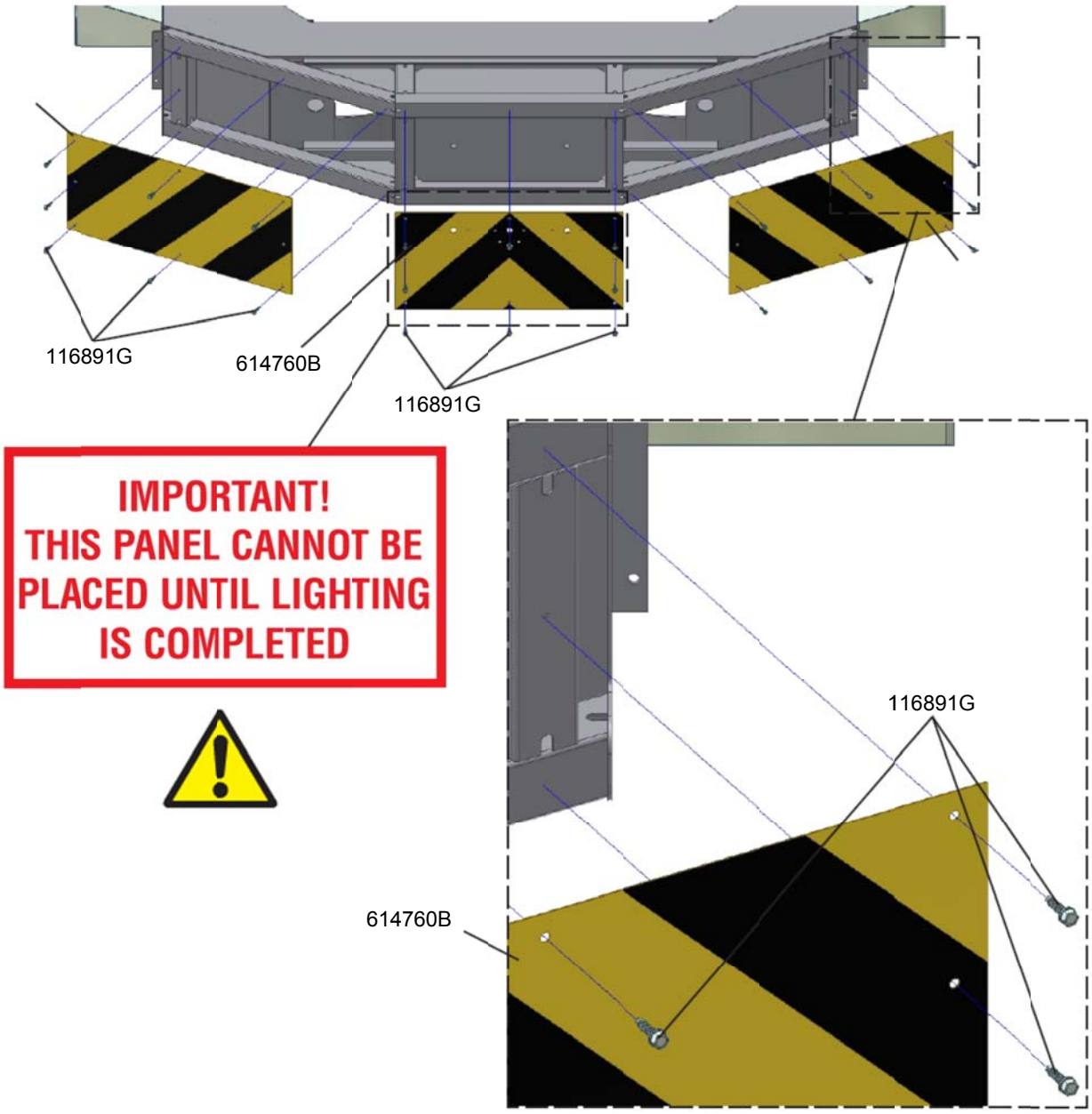
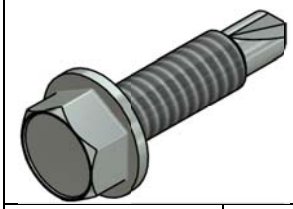


Figure 31

Oversized Impact Face (Optional)

618734B

Left		Center		Right	
					
		610761B	x 1		

1/4" x 1” Screw	
	
116891G	x 42

Oversized Impact Face Attachment (Optional)

A. Ensure the striping patterns line up with center panel prior to final assembly.
B. Align Panels and fasten 116891G 1/4” x 1” self-tapping screws with screw gun or drill.

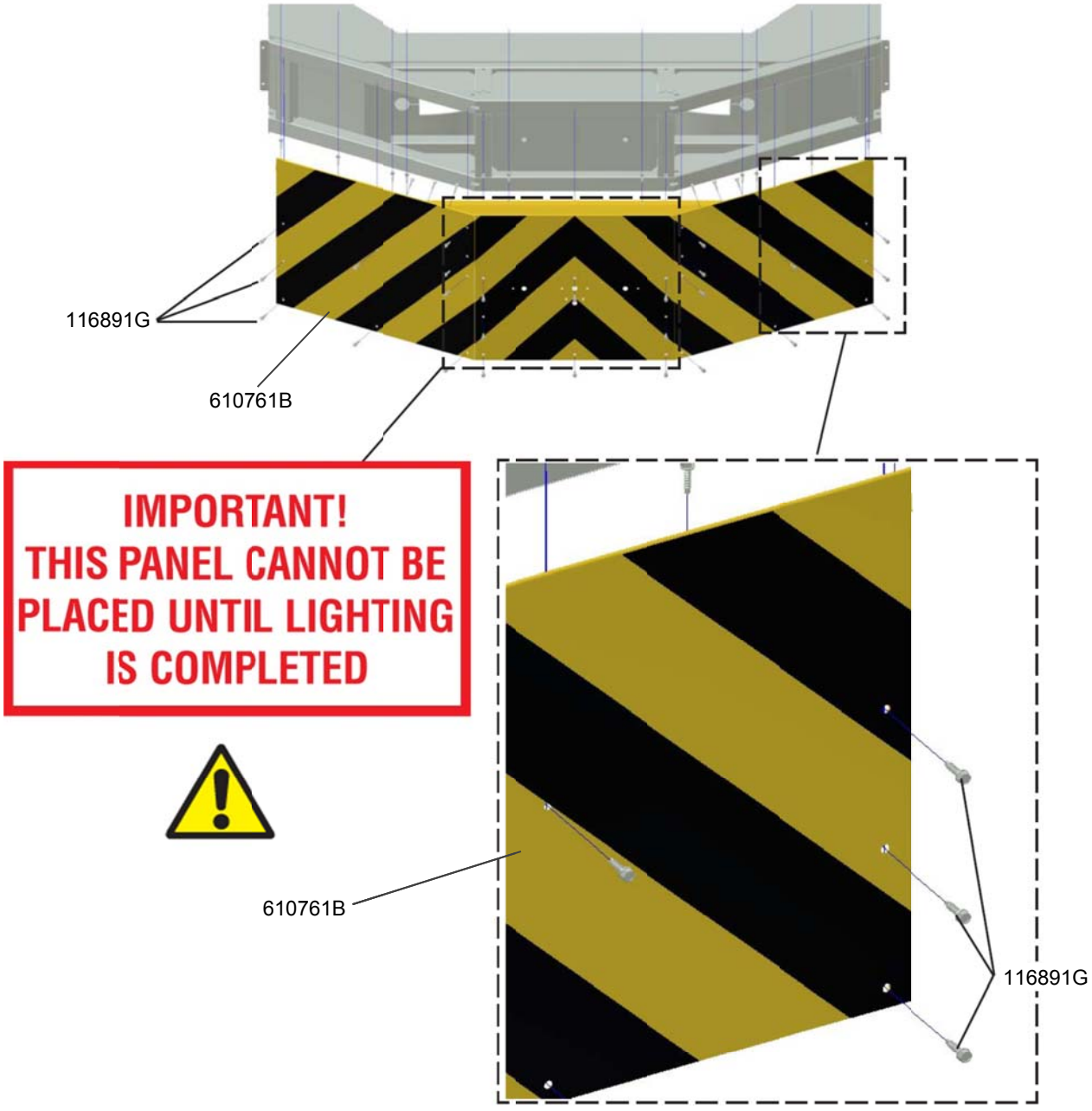


Figure 32

Spare Tire Carrier Assembly

618724B

Spare Tire Carrier	
	
614574G	**x 1**

3/8" x 5 Hex Bolt		3/8” x 1” Flat Washer		3/8” Nut		3/8” Lock Washer	
							
118523G	**x 4**	**118036G**	**x 4**	**118524G**	**x 4**	**118092G**	**x 4**

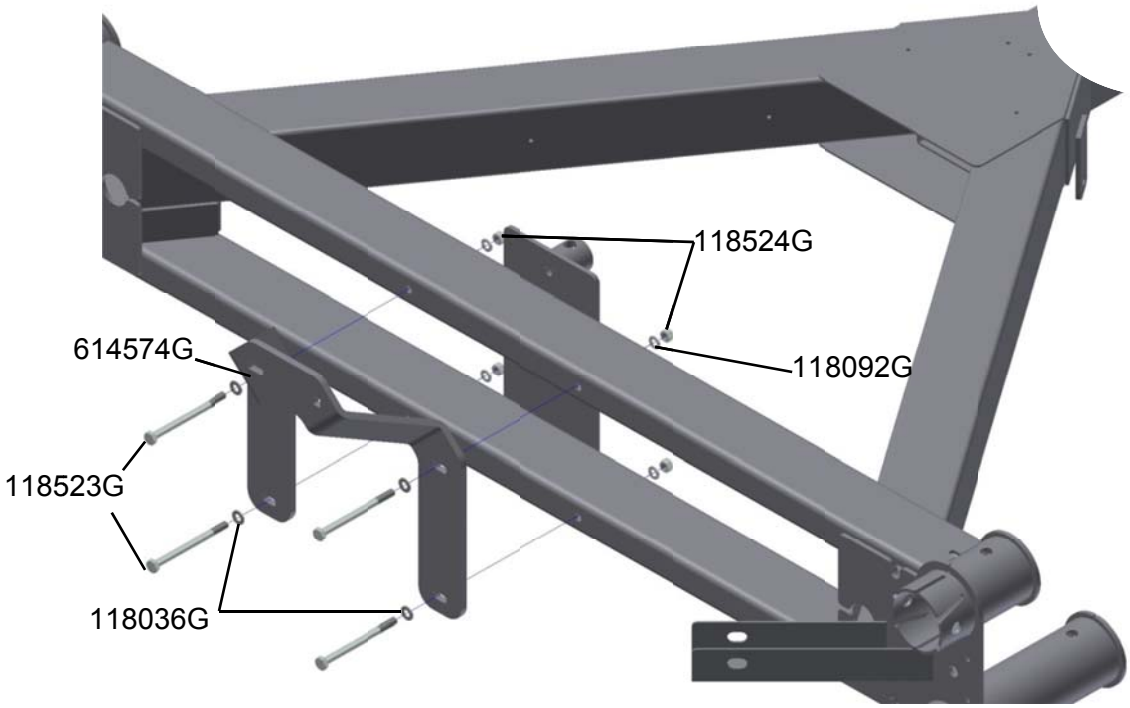


Figure 33

Truck Preparation

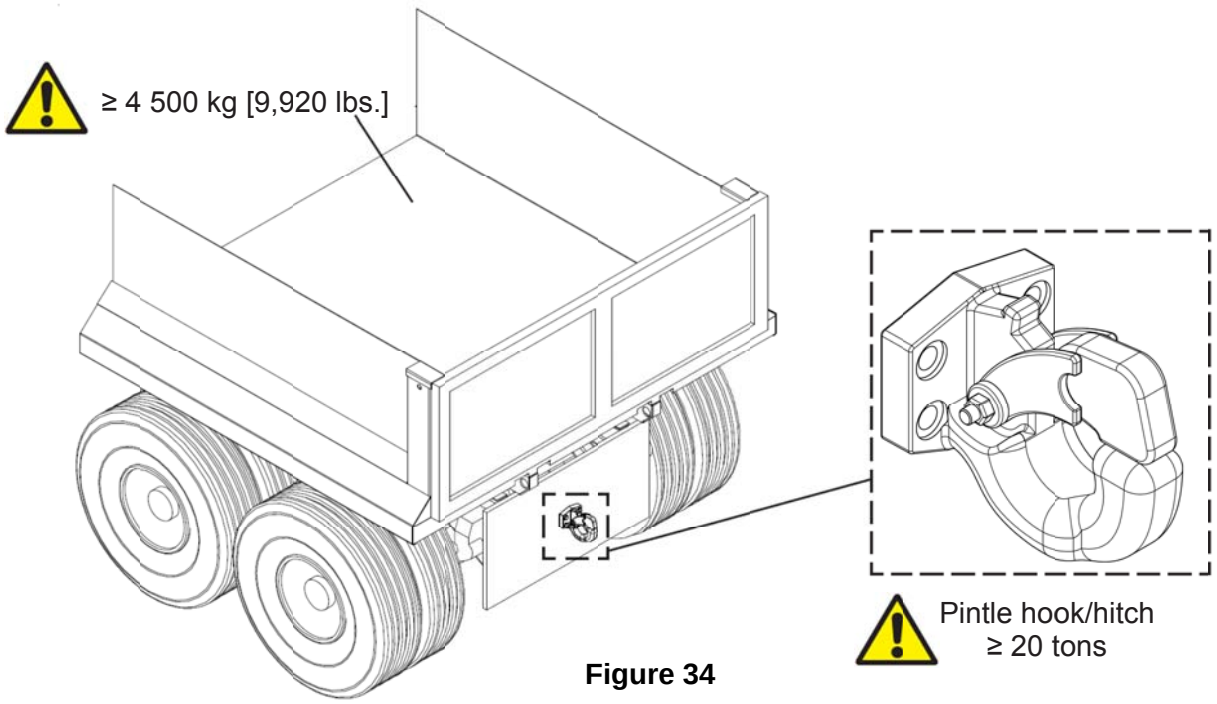


Figure 34

Truck frame must be structurally adequate for towing a trailer TMA system. Truck hitch and support structure must be capable of withstanding a 392 kN [90,000 lb.] impact force to the hitch. If there are any questions regarding the suitability, contact the Customer Service Department for input (see contact information on page 3 of this manual).

The truck should be as close to the final driving weight as possible. Ideally, ballast should not be used; but if it is, it must be anchored in a way to hold 20 times the ballast weight in order to keep it in place during an impact. The manufacturer's recommended center-of-gravity zone should be adhered to as well.

The Pintle/Euro-Hitch centerline height above ground level must be in a range between 432 to 813 mm [17" to 32"]. The preferred pintle/Eurohitch mounting height is 533 mm [21"] (see Figure 34a).

Prepare the truck for the pintle hook/hitch. The truck frame should be two C-channels spread 34"+/- 1" apart. Most trucks have a 1/2" plate welded across the back frame members and a pintle hook/hitch. If not, start by making sure the frame is square by measuring back from the spring shackles. Cut the frame square first if needed. Once the frame is squared, the plate can be welded or bolted on.

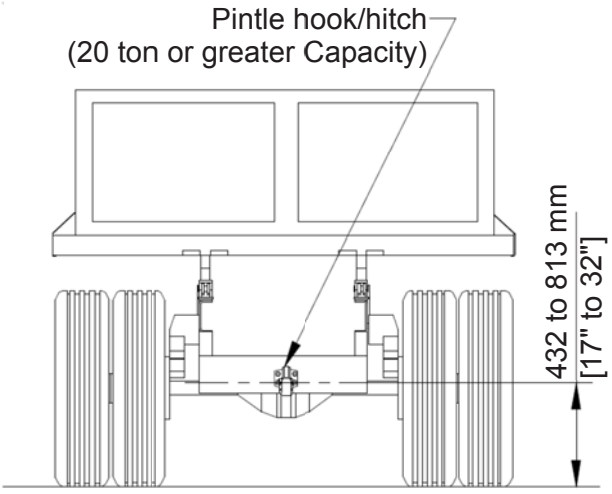


Figure 34a

Welding Procedures:

1. Start by grinding chamfers on the inside and outside of the frame ends to prepare for the weld (See Figure 35).
2. The plate needs to be a minimum of 1/2" thick and wider than 36" (See Figure 36).
3. Grind the plate in the locations where the frame is to be welded to remove any paint or rust.
4. Tack the plate into position and make sure that the rear plate is positioned correctly.
5. Continue welding the inside and outside frame to the plate.
6. Incorporate a 3/4" x 5" or larger reinforcement bar to make the 1/2" plate capable of withstanding a 392 kN [90,000 lb.] centered impact force.
7. If the pintle hook and plate extend below the truck frame, add 4" x 4" x 1/2" or larger angle gussets (See Figure 36).
8. Weld the 3/4" x 5" reinforcement bar in a horizontal position as shown in Figure 36 to the Rear Plate using 3/8" fillet with 3" skip welds, 6" on center, top and bottom.
9. Weld the 4" x 4" x 1/2" angle gussets to truck frame with 3/8", 3-6 skip-welds, followed by welding to the ends of the 3/4" x 5" reinforcement bar and the back of the 1/2" plate.
10. Bolt or weld pintle hook to rear plate, centering it vertically on the 3/4" x 5" reinforcement bar.

Grind paint off all areas to be welded.

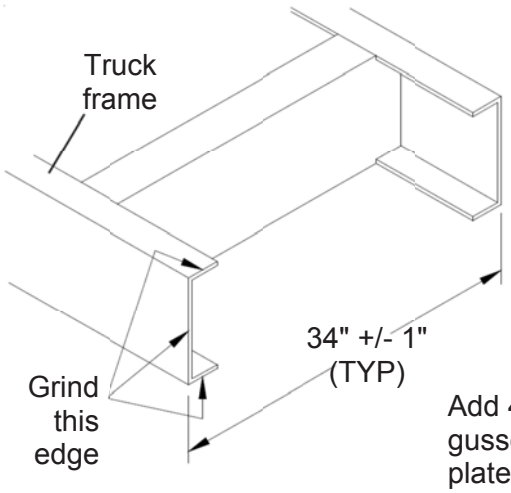


Figure 35

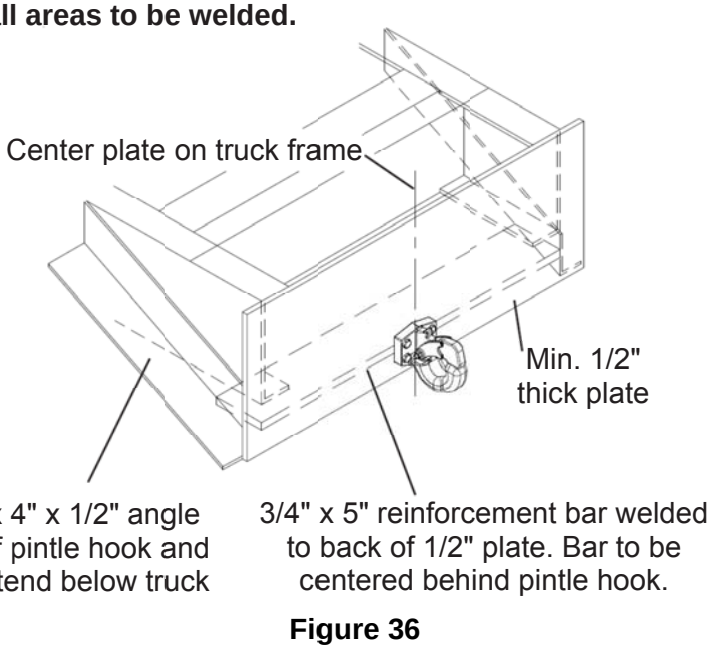


Figure 36

Bolt-on Procedures:

1. Start by cutting two 4" x 4" x 1/2" angles to the height of the rear plate (See Figure 37).
2. Measure and mark the angles for six 1-1/16" holes, as shown (three on each side). Space top holes at least 2-1/16" apart.
3. Drill holes in the angle sections.
4. Use the angles as a template for marking and drilling holes in the truck frame (See Figure 38).
5. Bolt the angle sections in place using two 1” grade 5 bolts on each side.
6. The plate needs to be a minimum of 1/2” thick and match the width of the truck frame plus the width of the angles (See Figure 40 on Page 46).
7. Drill two matching holes in each end of the plate.
8. Fasten plate using four 1” grade 5 bolts.
9. If the plate needs to extend below the truck frame, because of the height requirement of the pintle hook, drill and fasten one more 1” bolt in each angle, as shown. An angle gusset will be needed for strength if the pintle hook needs to be below the height of the truck frame.

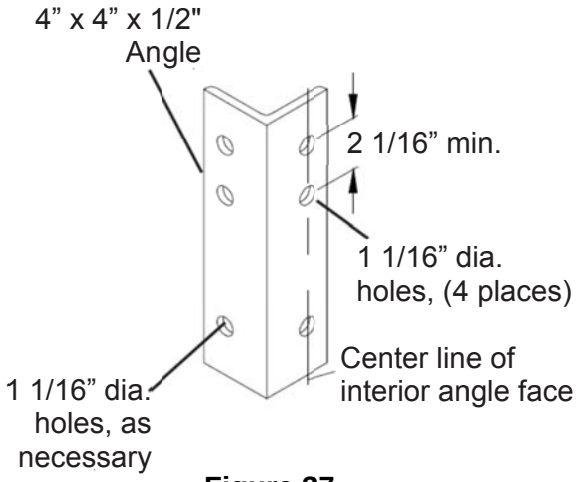


Figure 37

10. This angle gusset will overlap the vertical angle and a shim will be required between the angle gusset and the truck frame, as shown. Drill and fasten two more 1" bolts to attach angle gusset to truck frame, as well as another 1" bolt to attach the angle gusset to each vertical angle.
11. If 1/2" plate extends below truck frame, incorporate a 4” x 4” x 1/2” or larger reinforcement angle behind existing hitch plate capable of withstanding a 392 kN [90,000 lb.] centered impact force. Attach with 3/4” x 3” Grade 5 bolts as shown in Figure 38. Bolt or weld pintle hook to rear plate, centering it vertically on the 4” x 4” x 1/2” horizontal reinforcement angle.

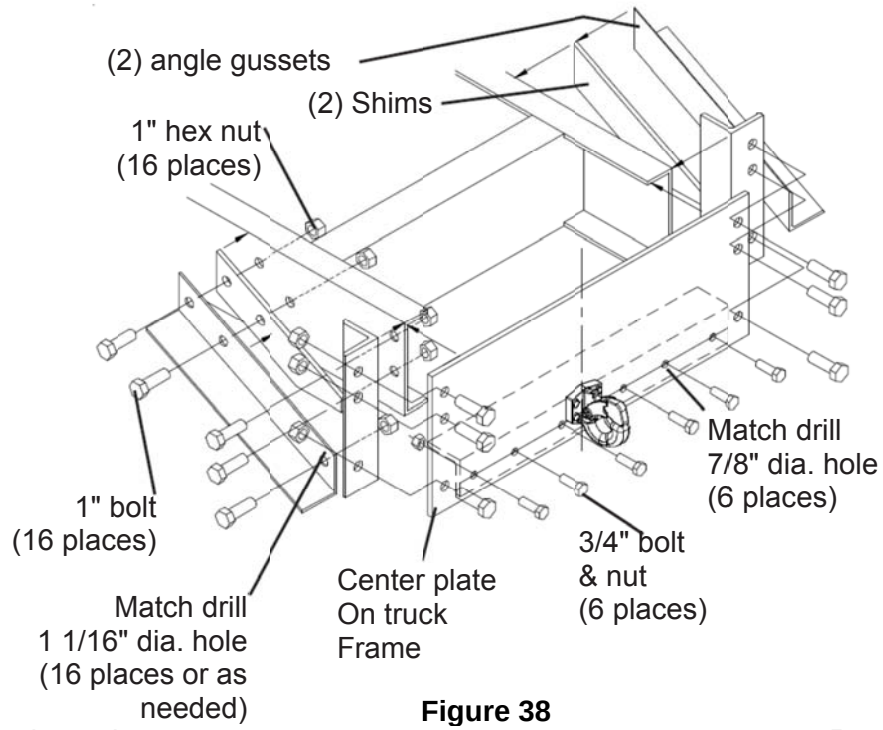


Figure 38

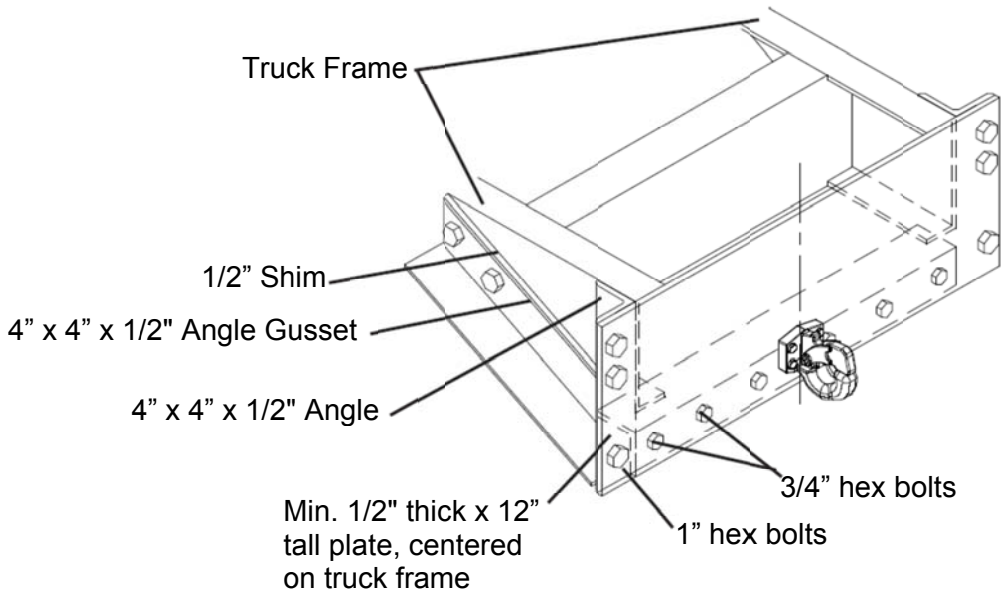


Figure 39

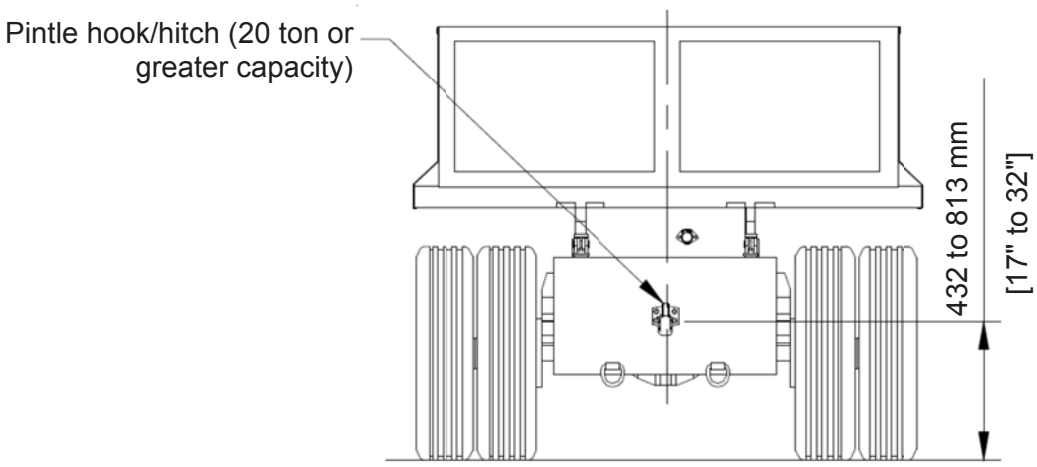


Figure 40
Rear of Support Truck (typical)

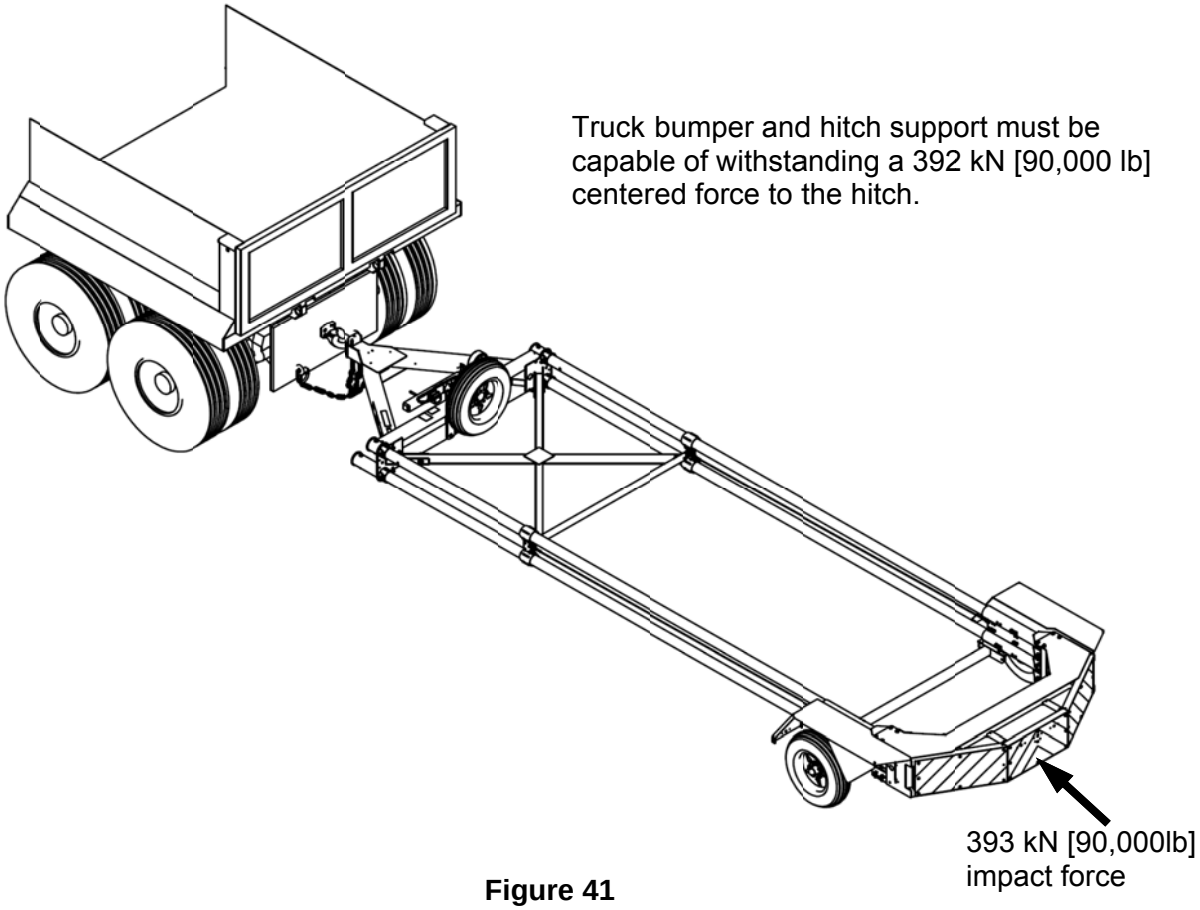


Figure 41

Operation Instructions

Trip preparation checklist:

1. Check pintle hook/hitch and trailer eye.
2. Check tire pressure.
3. Check operation of all lights.
4. Check trailer height (measured from bottom of Impact Head to ground when system is level): 350 mm ± 50 mm [14" ± 2"].
5. Be careful of trailer corner-cutting when turning corners or next to objects such as guardrails (see Figure 42).
6. Backing up the Vorteq® Trailer TMA:

Caution: Make sure the area behind the system is clear of all objects before proceeding. Under No circumstances should anyone be allowed behind the system during backing maneuvers.

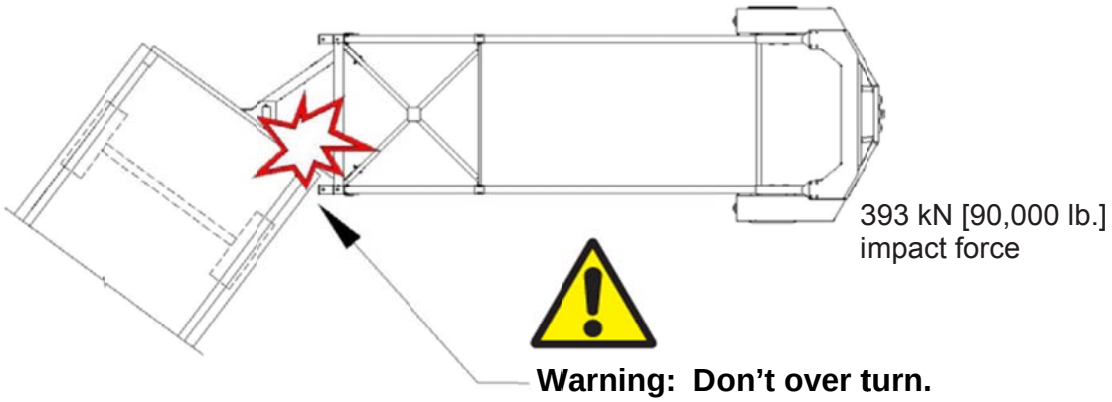


Figure 42

Maintenance

Before performing any maintenance on the Vorteq® Trailer TMA, thoroughly read and understand the Maintenance Section and the Safety Section of this manual.
Appropriate service methods and proper repair procedures are essential for the safe and reliable operation of the Vorteq® Trailer TMA. This manual provides general directions for performing service and repair work. Following these guidelines will help assure reliability.

There are numerous variations in procedures, techniques, tools, parts for servicing, as well as in skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Anyone who departs from the instructions provided in this manual must first establish that they neither compromise their personal safety nor the Vorteq® Trailer TMA integrity by their choice of methods, tools, or parts.

I. General

a. Always replace any fastener with one specified by Energy Absorption Systems.

b. Check the nuts, bolts, and other fasteners to ensure that the hitch remains secured to the truck and the coupler remains secured to the trailer.

II. Routine Maintenance

Maintenance Schedule

Item	Inspection Intervals	First use	Each use	1 Month	3 Months	1 Year
TMA	Check frame rails for damage	•	•			
	System height and levelness 350 mm ± 50 mm [14" ± 2"]	•	•			
	Check shear bolts for damage	•	•			
	Check all 1/2" x 1 1/4" hex bolts for torque and grade			•		
Tires	Check all tire pressure (Tire pressure to be 50 psi, max. inflation indicated on tire side wall) (Include spare tire)	•	•			
	Check tires for wear				•	
	Check tires for tread and sidewall damage		•			
	Replace tires					•
Wheels	Check and repack wheel bearings					•
	Check seals for damage					•
	Inspect hub for damage					•
	Check lug nut torque	•			•	
Trailer	Check pintle eye/Euro-hitch for wear	•	•			
	Check pintle hook/Euro-hitch for wear	•	•			
	Check condition of Jack and wheel	•		•		
	Lubrication (grease fittings for bearings)	•		•		
	Inspect suspension parts for damage		•			
Electrical	Check and replace lights as required	•	•			

Maintenance Chart

III. Lubrication

Oil Swivel jack

Oil the swivel jack every six months as shown in Figure 43.

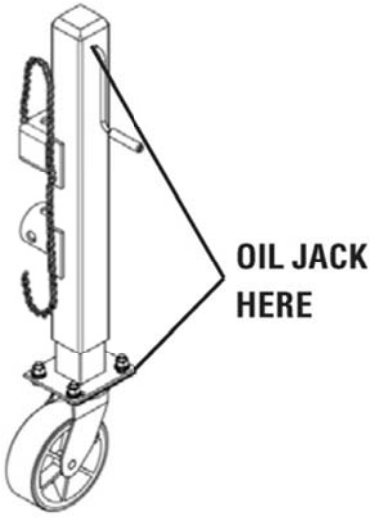


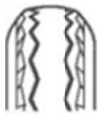
Figure 43

IV. Tires & Wheels

1. Always replace trailer tires with ST (Special Trailer) tires.
2. Tire pressure [50 psi] should be checked cold before operation.
3. Inspect tires for damage.
4. Check inflation pressure before each use to insure the maximum tire life and tread wear.

Caution: Tire wear should be checked frequently because once a wear pattern becomes firmly established in a tire; it is difficult to stop, even if the underlying cause is corrected.

Caution: Wheel nuts or bolts must be tightened and maintained at the proper torque levels.

Wear Pattern		Cause	Action
	Center Wear	Over inflation	Adjust pressure to particular load per tire catalog.
	Edge Wear	Under inflation	Adjust pressure to particular load per tire catalog.
	Side Wear	Loss of camber or overloading	Align at alignment shop.
	Toe Wear	Incorrect toe-in	Align at alignment shop.
	Cupping	Out of balance	Check bearing adjustment and balance tires.
	Flat Spots	Wheel lockup and tire skidding	Avoid sudden stops when possible and adjust brakes.

5. Wheel attachment:
   A. Start all bolts or nuts by hand to prevent cross threading.
   B. Tighten lug nuts in the sequence as shown in Figure 44.
   C. Torque the nuts in the following stages:
      1) 1st stage: 27 to 34 Nm [20 - 25 ft-lbs].
      2) 2nd stage: 47 to 54 Nm [35 - 40 ft-lbs].
      3) 3rd stage: 95 ± 7 Nm [70 ± 5 ft-lbs].

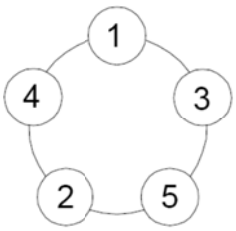


Figure 44

6. Maintain proper lug nut torque.

7. Wheel nuts should be torqued after each wheel removal, re-torque after 80 km [50 miles] and approximately 4830 km [3,000 miles] frequently thereafter.
8. The standard Vorteq® Trailer TMA tire size is ST20575D14*. The bias ply tire provides stiffer side walls and more resistance to sway.

Note: *Tire size may vary.

9. Replace tires every three to five years, whether they look like they are worn out or not. Trailer tires lose about 1/3 of their strength in 3 to 5 years.
10. Be sure that necessary adjustments are made and any damaged or worn parts are replaced.

V. Storage

1. Storage Instructions
   a. The ideal storage is in a cool, dark garage.
   b. Put trailer on jack stands to take the weight off the tires, lower the air pressure, and cover tires to protect from the direct sunlight.
2. After Prolonged Storage
   a. Remove wheels.
   b. Inspect hubs.
   c. Reinstall wheels.
   d. Remove the jack stands.

VI. Technical Specifications

1. Weight

Frame Components	594 kg [1309 lbs]
Jack	11.2 kg [24.6 lbs]
Total	605 kg [1334 lbs]

2. Dimensions

Width	2.36 m [7'-9"]
Length (Tongue to Wheel)	5.84 m [19'-2 1/4"]
Length (System)	7.00 m [22'-11 3/4"]

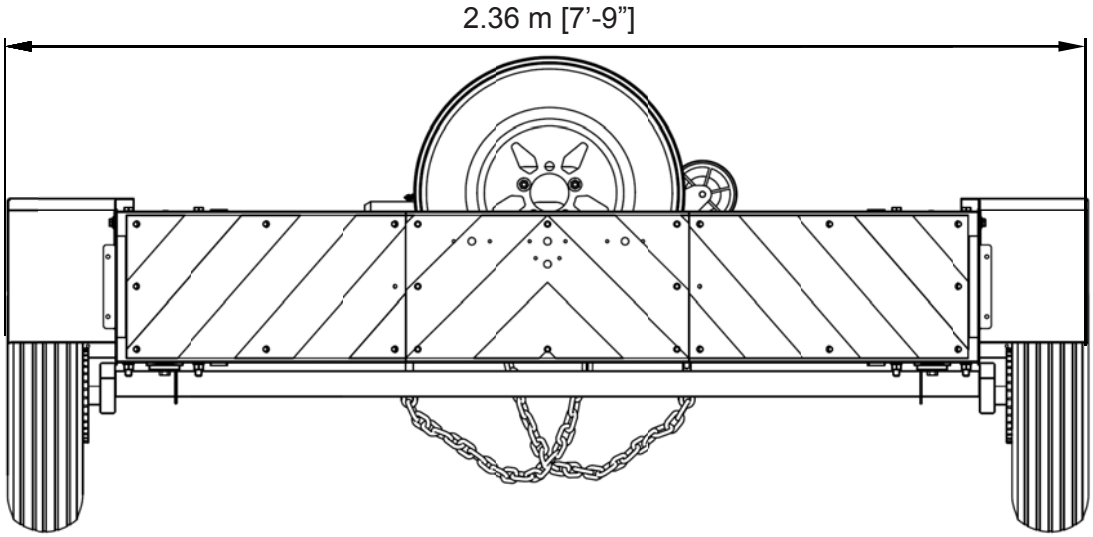


Figure 45

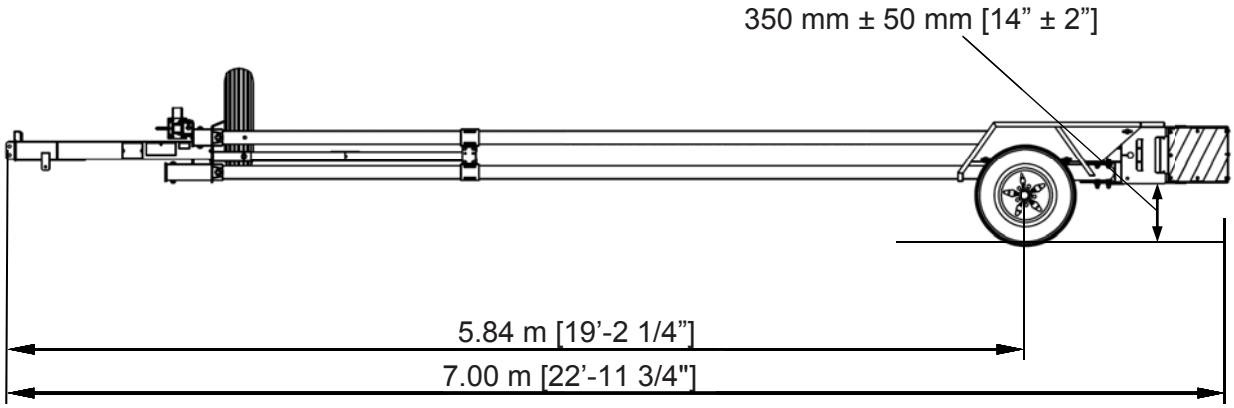


Figure 46

Repair Instructions

Items that most likely need replacement after an impact are as follows:

• Shaper Rail Assembly	Part #609047B
• Impact Head Assembly (w/Collars)	Part #618747B
• X-Brace Assembly	Part #618749B
• Fender, Right	Part #608256G
• Fender, Left	Part #608252G
• Axle	Part #113298B
• Wheel (w/Tire)	Part #118151B

Other items that could become damaged, wear out or become lost over time are as follows:

• Safety Chain Assembly	Part #613956B
• Pintle Ring Assembly	Part #610244B
• Euro-hitch Assembly	Part #610240B
• Jack (w/Wheel)	Part #610989B

I. Post Impact

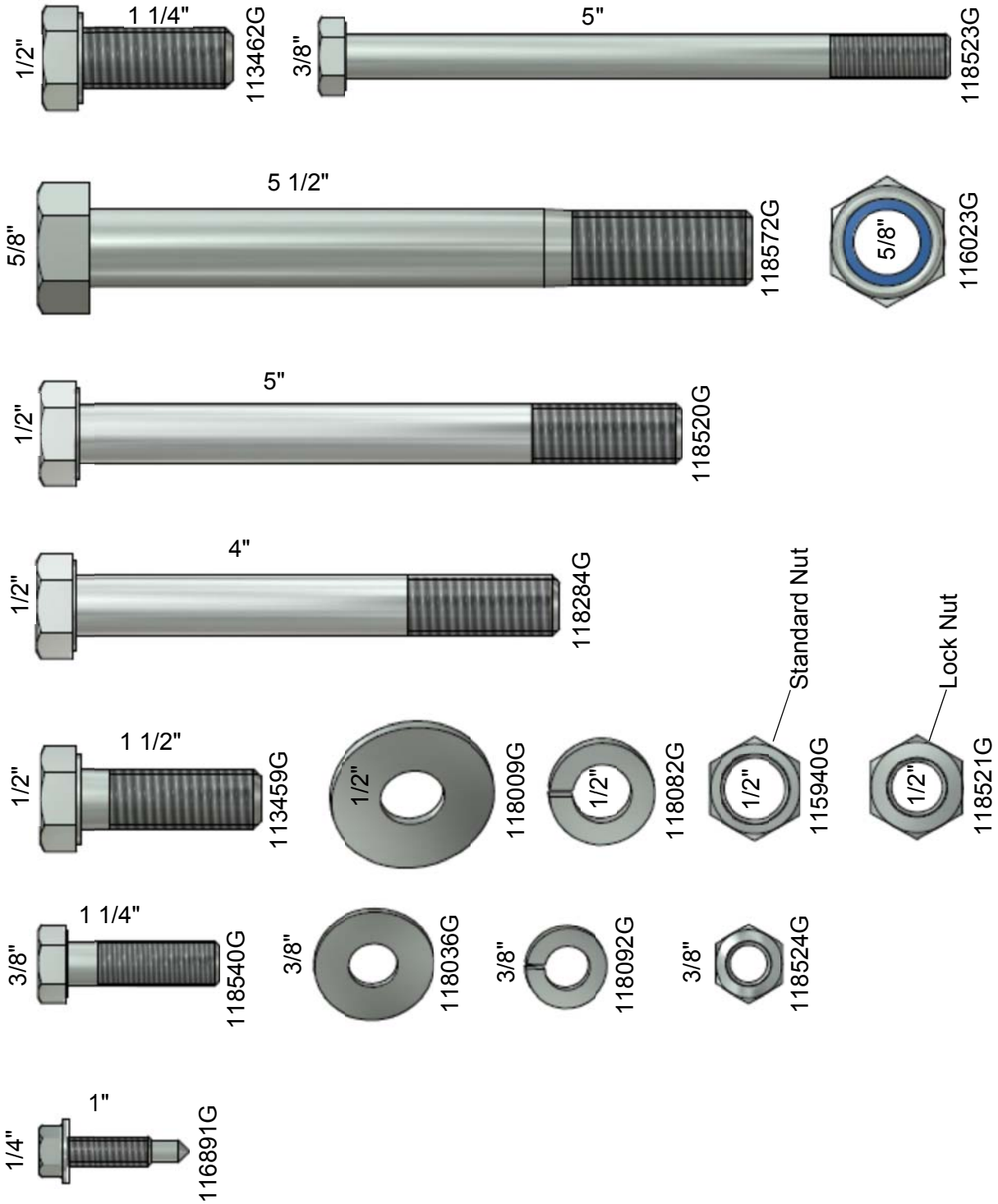
Note: Only the specified parts manufactured by Energy Absorption Systems shall be used to repair a damaged system. Failure to comply could result in reduced safety or damage to the system.

1. Inspect the frame for bent parts. Replace any frame members that have been damaged. Do not attempt to weld or straighten parts. Replace the arms in pairs to ensure that the system collapses properly. Refer to the system drawings for the part numbers and descriptions of the parts.
2. Inspect bolts for damage.

   Replace all bolts that have been damaged. Refer to the system drawings for the part numbers and descriptions of the parts.
3. Replace damaged components.
4. Replace all eight 1/2" x 1 1/4" hex bolts (Grade 2).

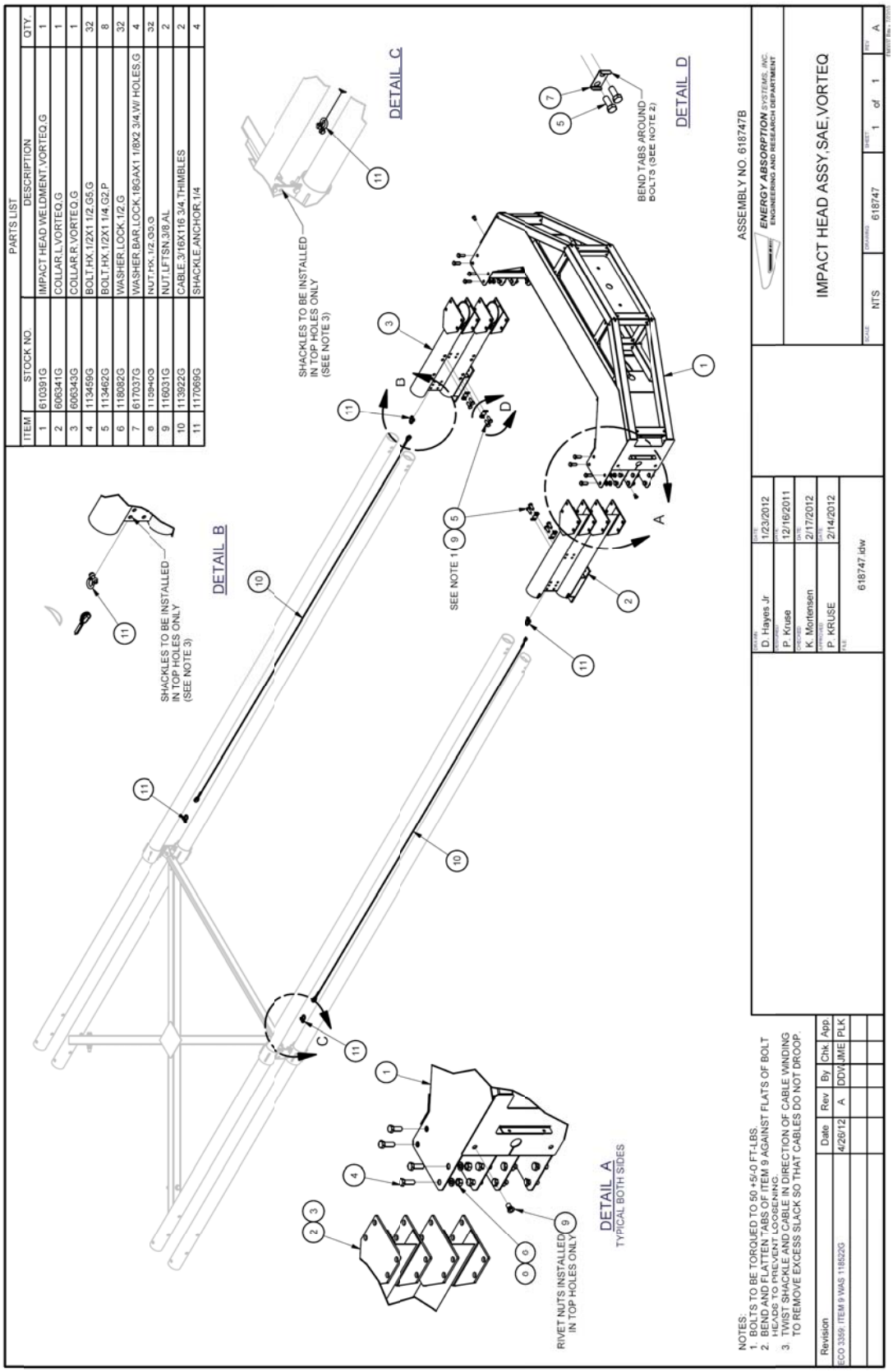
Do not attempt to repair a damaged Shaper Rail. For full impact capacity the Shaper Rail will need to be replaced even if they were only bent slightly.

Warning: For proper system performance, only use Shaper Rails supplied by Energy Absorption Systems. Failure to use the specified hardware could lead to fatigue or result in poor system performance.



Vorteq® Fastener Reference Chart

Reference Drawings



Impact Head Assembly, Vorteq®, G

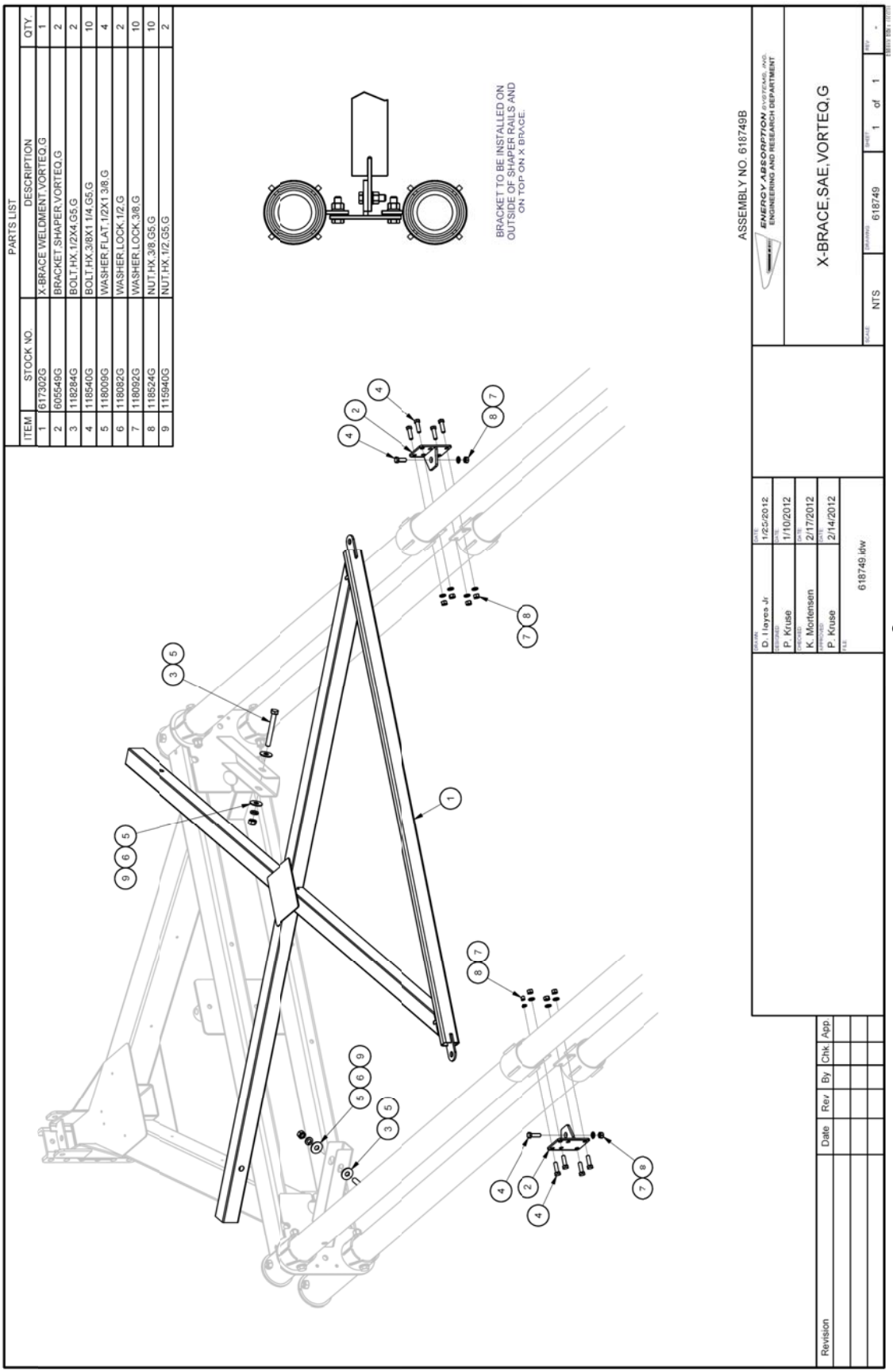
DWG 618747

DWG 609047

Shaper Rails, Vorteq®, G

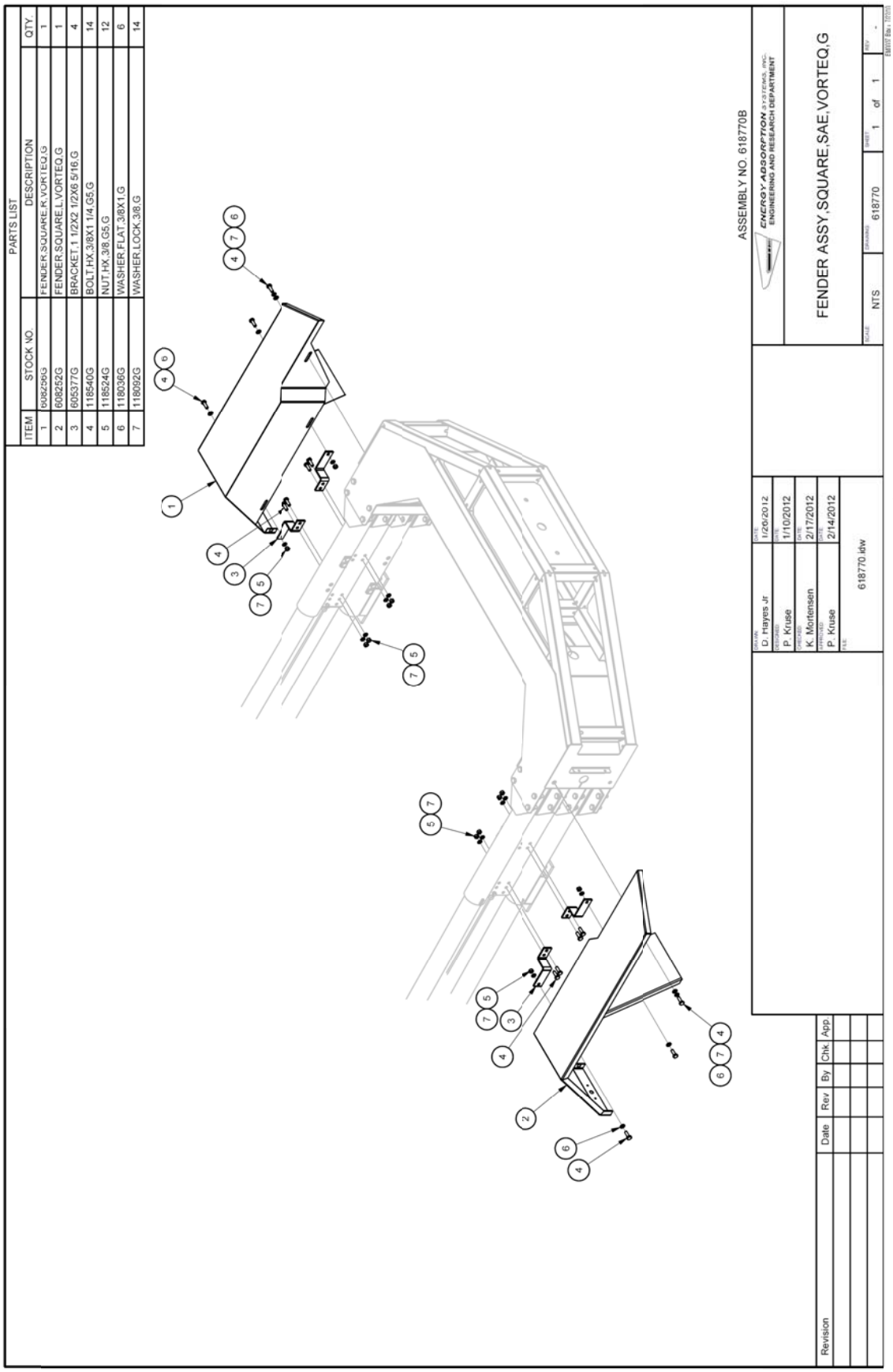
X-Brace, Vorteq®, G

DWG 618748



DWG 618749

X-Brace, Vorteq®, G



DWG 618770

Fender Assembly, Square, Vorteq®, G

Hitch, US, Vorteq®

DWG 610244

DWG 610240

Hitch Adapter, Euro, Vorteq®

DWG 618750

Impact Face, Vorteq®

Spare Tire Mount, Vorteq®

DWG 618724

Notes

Notes

2525 Stemmons Freeway
Dallas, Texas 75207
888-323-6374 (USA only)
312-467-6750 (Outside USA)
www.energyabsorption.com
www.highwayguardrail.com