Vorteq™ Trailer TMA

Installation/Operation

ENERGY ABSORPTION
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Saving Lives By Design

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Important Introductory Notes

This manual contains important information on the Vorteq Trailer TMA (Truck Mounted Attenuator). Proper installation and operation of the Vorteq Trailer TMA is essential to assure maximum performance. Take the time to review this entire manual thoroughly prior to installing and/or operating the Energy Absorption Systems, Inc. Vorteq TMA.

If you need additional information, or have any questions about the Vorteq TMA, please call **Energy Absorption Systems' Customer Service Department at 1-888-32-ENERG.**

RETURN GOODS POLICY

Before returning any goods for credit please contact Energy Absorption Systems Inc. Customer Service Department at 1-888-32-ENERG or your local distributor for proper instructions.

Functional Description

The Vorteq TMA is a Truck Mounted Attenuator 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. The System mounts on the rear of a truck and may be used in stationary applications, such as a truck blocking a work zone and mobile operations, such as striping, sweeping, plowing, etc.

The Vorteq TMA consists of the following basic components: frame rail assembly, an impact head, tongue, x-brace, suspension, wheels and tires (see Figures 1 and 2).

Definitions:

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

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

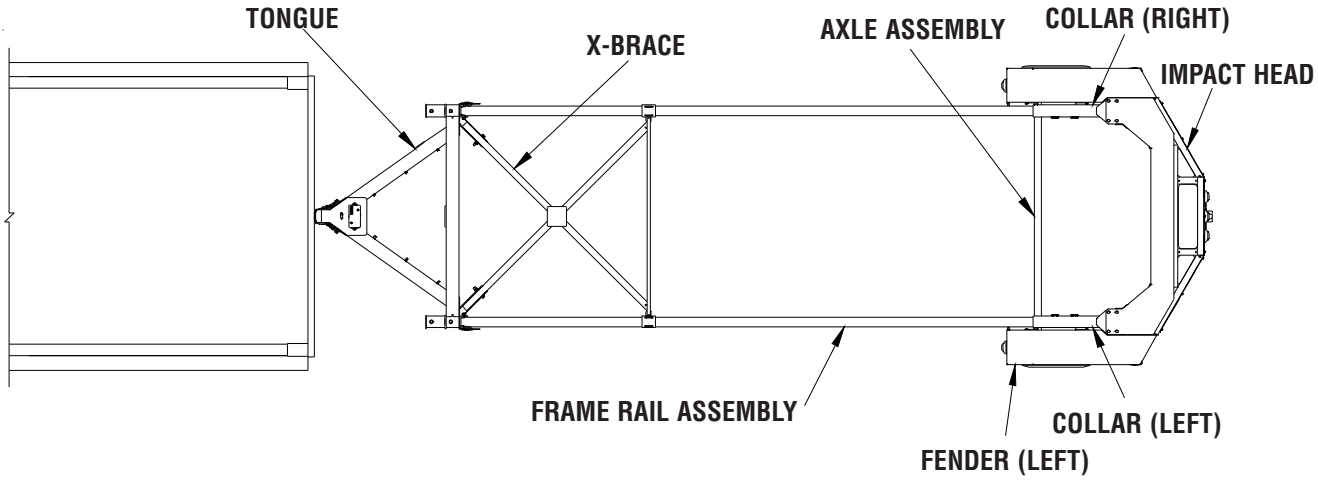


Figure 1

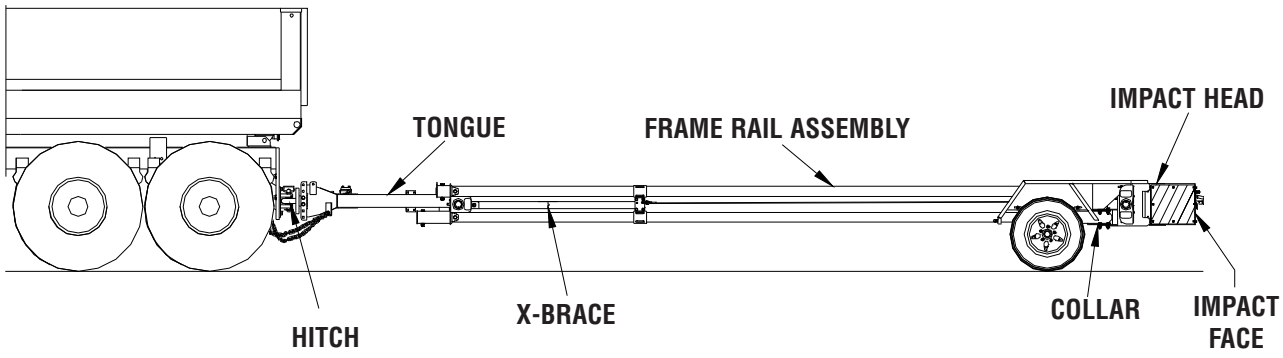
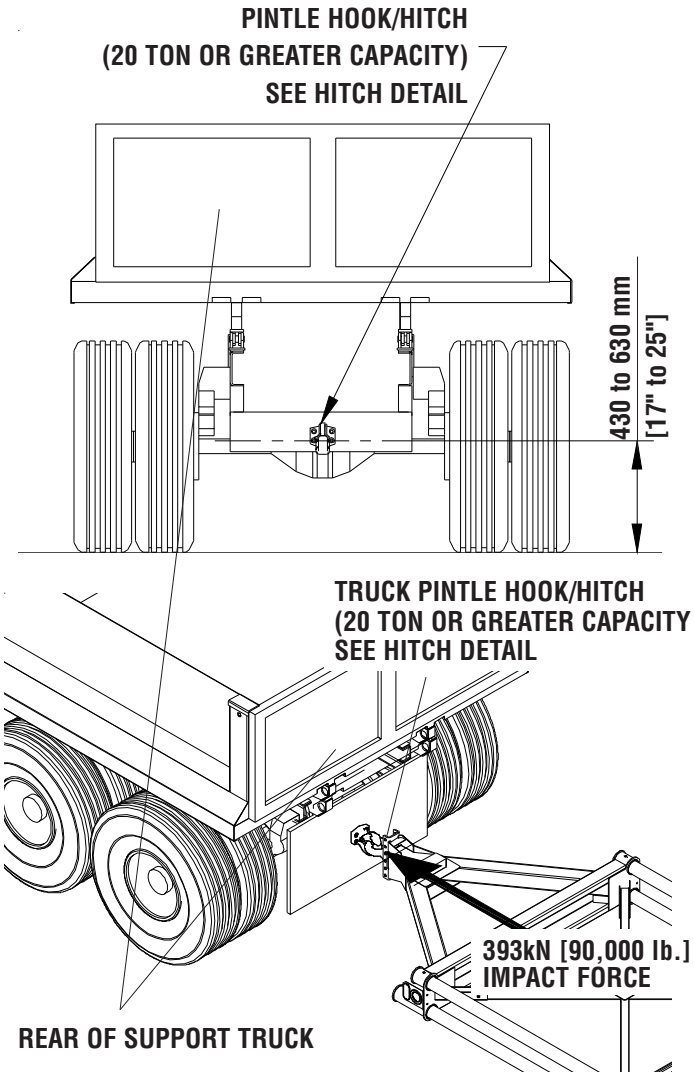


Figure 2

TMA

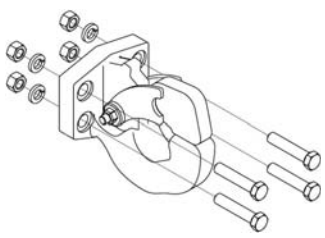
WARNING!
Strict compliance with these instructions is essential to avoid danger to life and limb.

1. For optimal performance, Energy Absorption Systems, Inc. recommends the use of a pintle hook/hitch with a rating of 20 tons or greater. (See Figure 3). We also recommend that operators using the Vorteq ensure checking 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 392 kN [90,000 lb.] impact force to the hitch.
2. The Pintle hook/hitch height above ground level must be in a range between 430 to 630 mm [17" to 25"). The preferred pintle/Euro-hitch mounting height is 530 mm [21"] (see Figure 3).
3. The TMA should be securely fastened to the truck. On level ground, the bottom of the TMA should be 350 mm +/- 50 mm [14" +/- 2"] from the ground and level (see Figure 4).
4. The Vorteq 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 TMA. **Do not drag the TMA 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 should 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 TMA is not impaired by damage or corrosion.



TRUCK BUMPER AND HITCH SUPPORT MUST BE CAPABLE OF WITHSTANDING A 392 Kn [90,000 lb.] CENTERED FORCE TO THE HITCH.

Figure 3



OPTIONAL ACCESSORY, ORDER SEPARATELY
(P/N 3526906-0000)

Hitch Detail

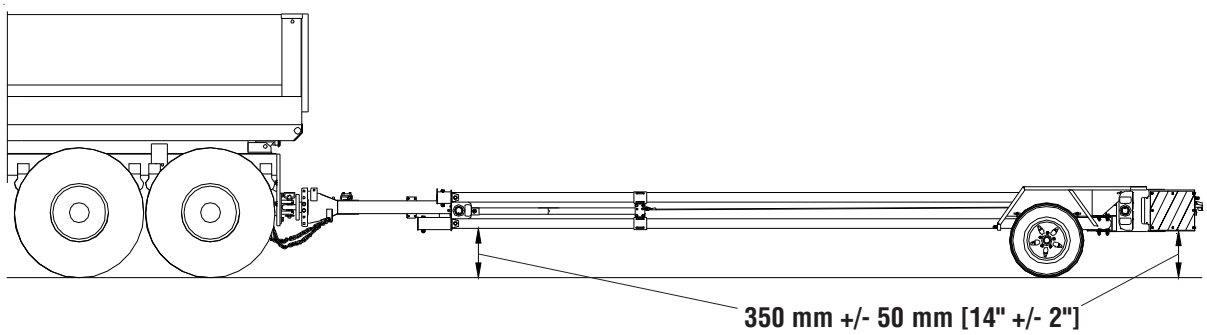


Figure 4

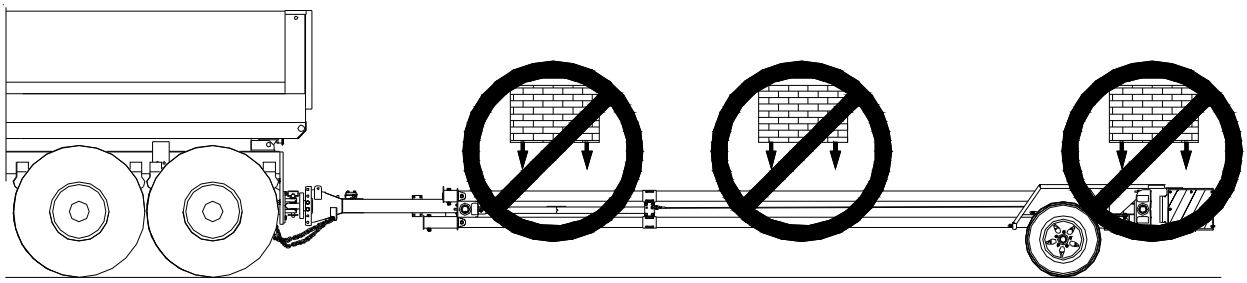


Figure 5

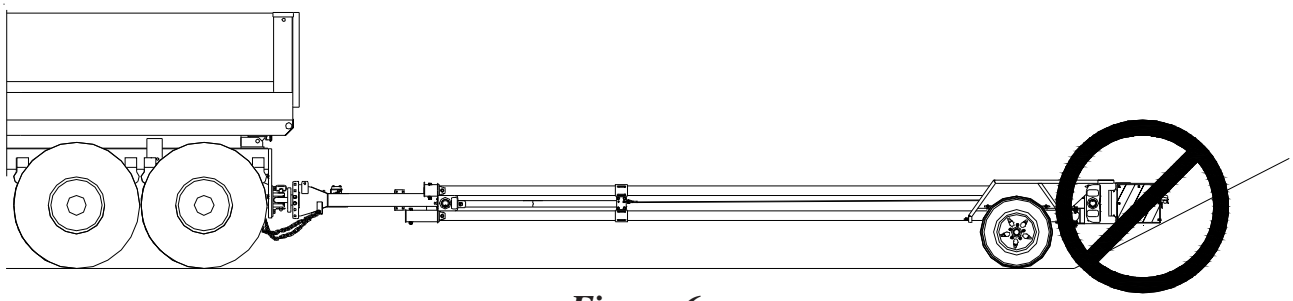


Figure 6

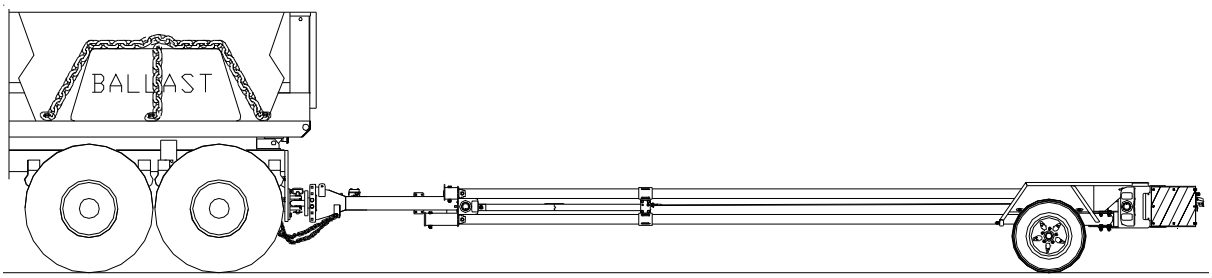


Figure 7

TMA (Cont'd.)

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

6. Regular maintenance of the Vorteq TMA is important for safe use. Refer to the maintenance section of this manual for additional information.
   - Regular inspection of frame rails, impact head and fasteners is necessary to ensure proper System performance.
   - Regular inspection of tires is important. Low tire pressure could cause a blowout.
   - Keep electrical connections clean to prevent arcing.
   - Visually inspect shear bolts at regular intervals
7. This System is a crash cushion and is therefore used in high risk areas. Stay clear of traffic whenever possible. If an accident occurs, even during a design impact, there may be fragments from the truck or impacting vehicle that could cause injury.
8. Do not use any part of the TMA for towing or hauling a load.
9. 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 components or render the Vorteq unfit for protection.

1. The jack is used to support the Vorteq TMA when it is off the truck. The jack must be fully rotated 90 degrees to the travel position while the TMA is attached to the truck.
2. The driver should be extra cautious while backing the truck with the Vorteq TMA so that injury and/or damage will not result.
3. Periodically check and correct tire pressure to recommended pressure noted on the tire side wall.
4. Make sure the wheel lug nuts/bolts on the Vorteq TMA are tightened to the correct torque as recommended in the maintenance section.
5. Use a correctly rated pintle hook/Euro-hitch (20 tons recommended). Be sure the pintle hook/Euro-hitch and pintle eye/Euro-hitch are connected and properly tightened and adjusted.
6. Make sure all lights are working correctly.
7. Avoid sudden stops and starts that can cause loss of vehicle control.
8. Avoid sudden steering maneuvers that might create sway or undue side force on the Vorteq TMA.
9. Slow down when traveling over bumpy roads, railroads crossing and ditches.
10. Ensure adequate turn radius at curves & corners. The long wheel base of the Vorteq TMA means it has a larger turning radius. Make wider turns at curves and corners.
11. When uncoupling the Vorteq 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.
12. Periodically check bearings. Maintain per maintenance schedule.

TRAILER (Cont'd.)

13. Always use safety chains when towing.
14. Cross safety chains under coupling to prevent tongue from dropping to ground in case of connection failure.
15. Allow only enough safety chain slack for tight turns.
16. Do not let safety chains drag on the ground.
17. Twist safety chains equally from hook ends to take up slack.
18. The truck operator is completely responsible for monitoring the condition of the trailer components as they relate to safe highway transit of their vehicle.
19. Check that the wiring is properly connected and not touching the road, but loose enough to make turns without disconnecting or damaging the wires.
20. Do not modify or change the trailer in any way.
21. Never weld, bolt or modify anything to the trailer. The added weight could affect impact performance.
22. The Vorteq 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 TMA.

TIRES & AXLE

1. Periodically check and correct tire pressure.
2. All trailer tires have a maximum speed rating of 105 km/h [65 m.p.h.].
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 tires.
6. Wheels and tires offset is the distance from the mounting surface to the centerline of the tire. The Vorteq axle bearing sets are designed for wheels with 0 to 13 mm [½"] inset. Modifying this offset will shorten bearing life and may lead to bearing failure.
7. Wheels and tires must be matched.
8. Make sure the wheel lug nuts are tightened to the correct torque.
9. Use the axle when jacking up the trailer. Do not jack up trailer on suspension components.
10. Never weld to the Torflex axle. The Torflex axle contains rubber cords to provide the suspension system and can 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 (see Figure 8). **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.
- Preferred truck weight is: 9,920 lbs. or greater

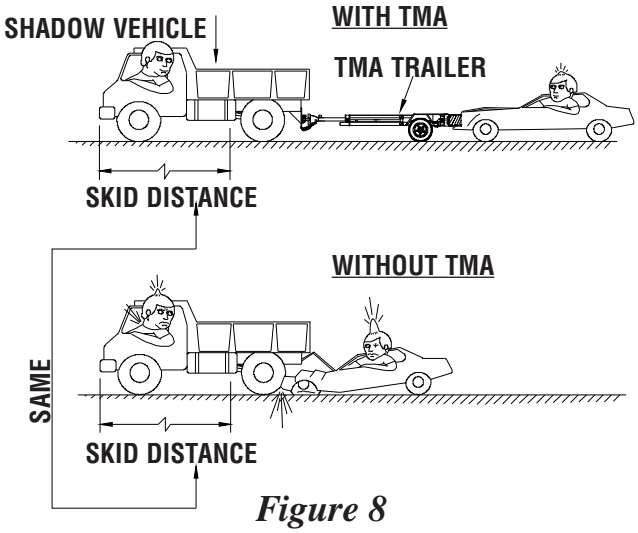


Figure 8

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]

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

Shadow or Barrier Vehicle Recommended Weight

Recommended minimum 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]

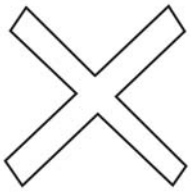
Loaded 4-yard dump truck - 11,000 kg [24,000 lbs]

SYMBOLS USED IN ASSEMBLY INSTRUCTIONS

This symbol is placed adjacent to an IMPORTANT point of the assembly process. Assemblers should take particular care at these points.

Dimensions with this symbol must be accurate.

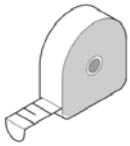
Indicates torque requirement.



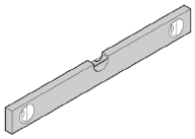
Indicates the wrong way to complete a task.

Tip to improve assembly.

Tools Required

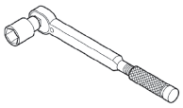


Steel Tape Measure
15 m (50 ft.)

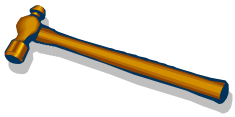


Spirit Level

Alignment Tool
16 mm (3/4")



Torque Wrench
120 Nm [90 ft-lbs]



Hammer

Wire Cutters

Circular Saw

(Cut up pallets)

Screw Gun or Drill

1/2" Drive Socket Wrench

1/2" Drive Sockets
8 mm, 10 mm, 17 mm, 19 mm,
21 mm, 13/16", 15/16"

Same size wrenches

Pipe Wrench
405 mm (16")

1/2" Drive Air Impact
Wrench

36" Crow Bar

Floor Jack

A. Crated components shown.

Figure 9

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

C. Check your order! Inventory components now.

D. Refer to Fastener Reference Chart on page 51.

E. Save pallet material for blocking system later.

Figure 10

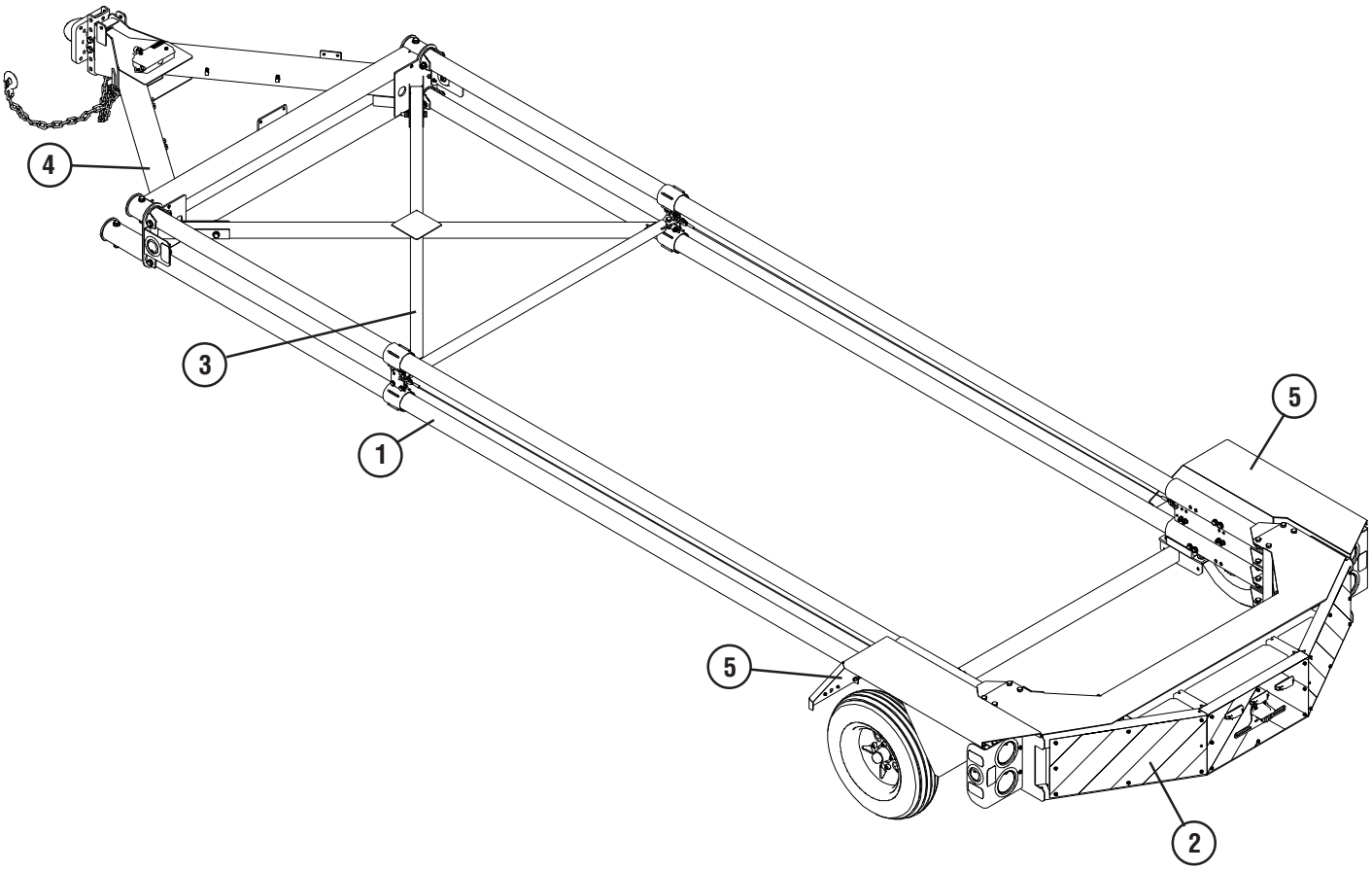


Figure 11

VORTEQ FRAME		
1	3583004-0000	FRAME RAILS
2	3583006-XXXX	IMPACT FACE
3	3583003-0000	X-BRACE ASSEMBLY
4	3583002-0000	TONGUE ASSEMBLY
5	3583005-0000	FENDER ASSEMBLY

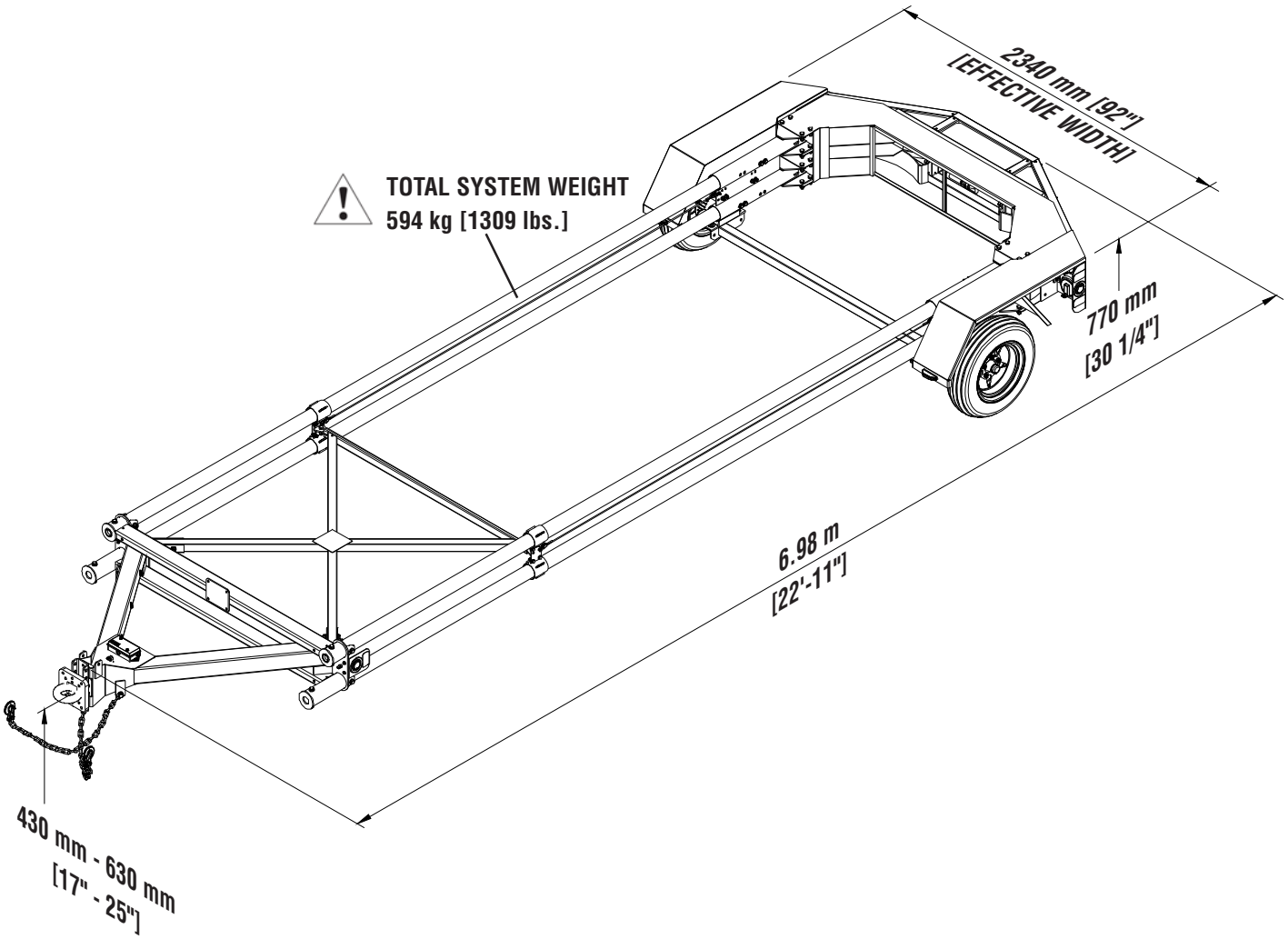
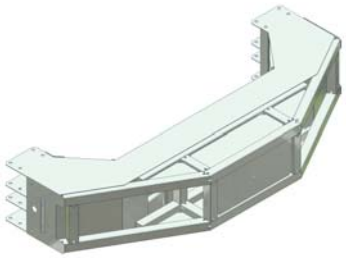

TOTAL SYSTEM WEIGHT
594 kg [1309 lbs.]
2340 mm [92"]
[EFFECTIVE WIDTH]
770 mm
[30 1/4"]
6.98 m
[22'-11"]
430 mm - 630 mm
[17" - 25"]

Figure 12

3583001-0000 Impact Head Assembly



✓

2783001-0000	x 1	

✓

2783002-0000	x 1	

✓

2783003-0000	x 1	

M14X40

✓

2698325-0000	x 32	

M14

✓

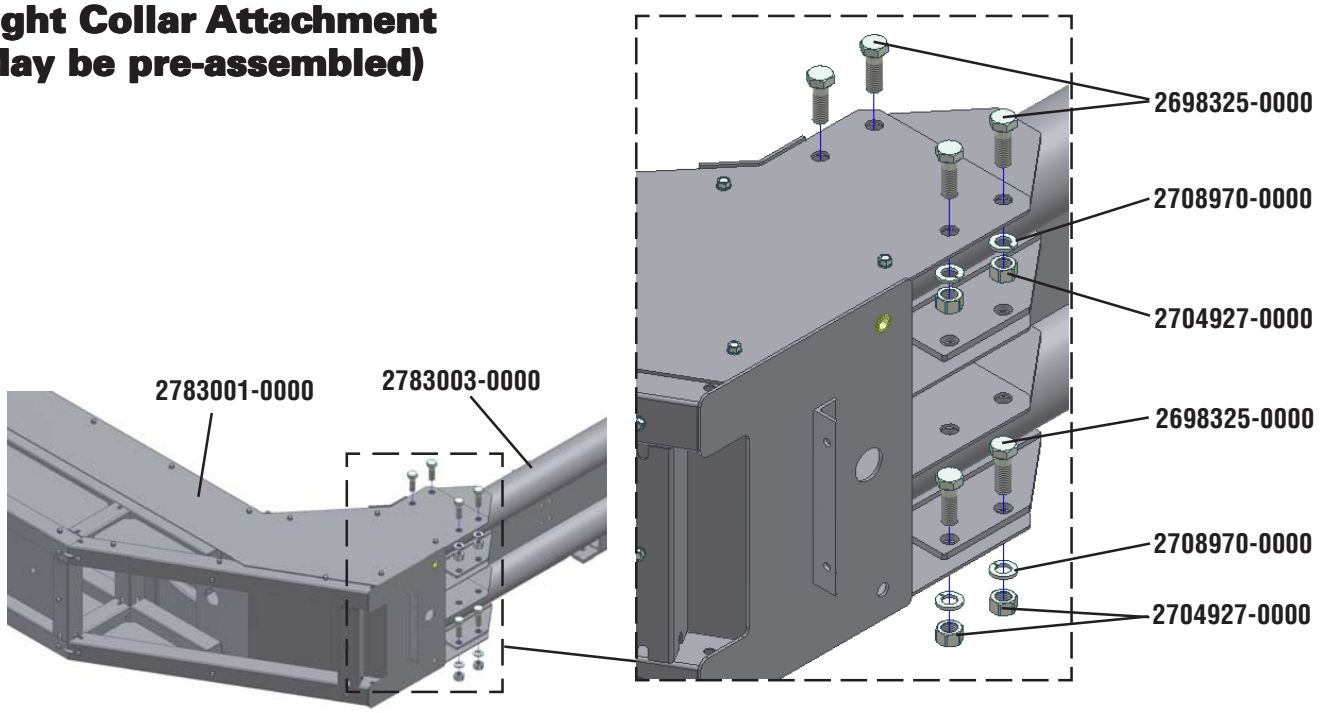
2704927-0000	x 32	

M14

✓

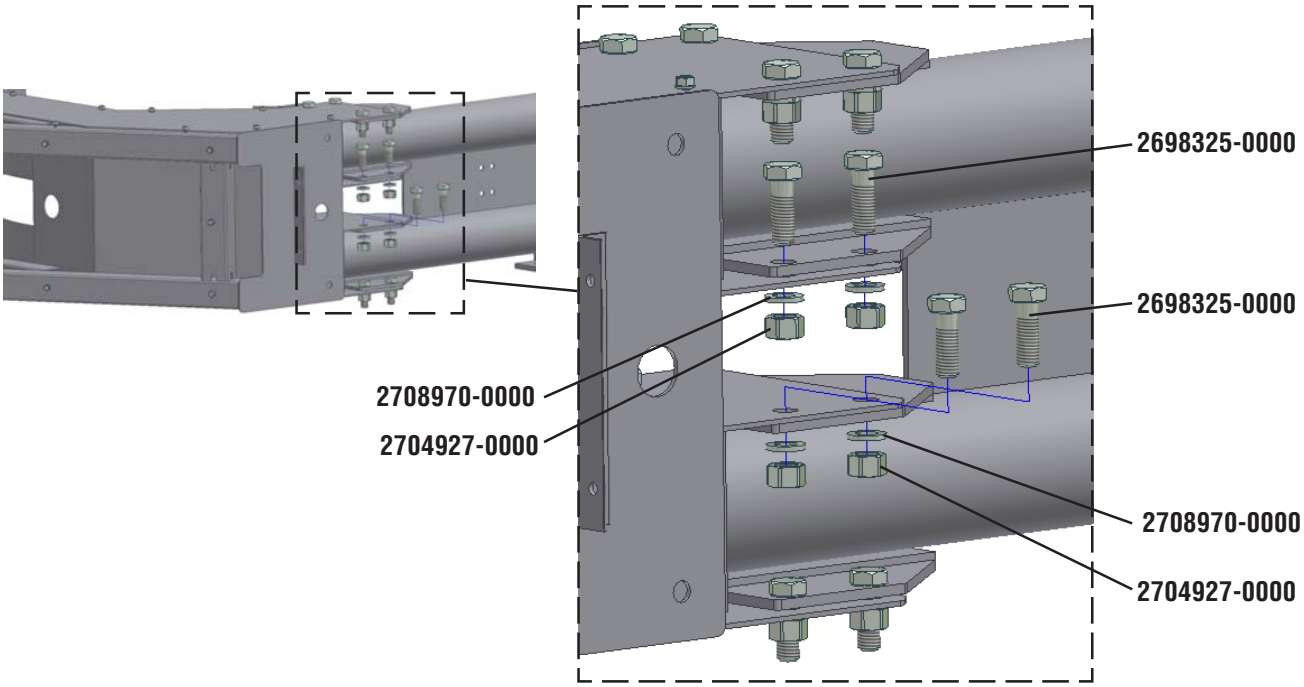
2708970-0000	x 32	

Right Collar Attachment (May be pre-assembled)



Step 1

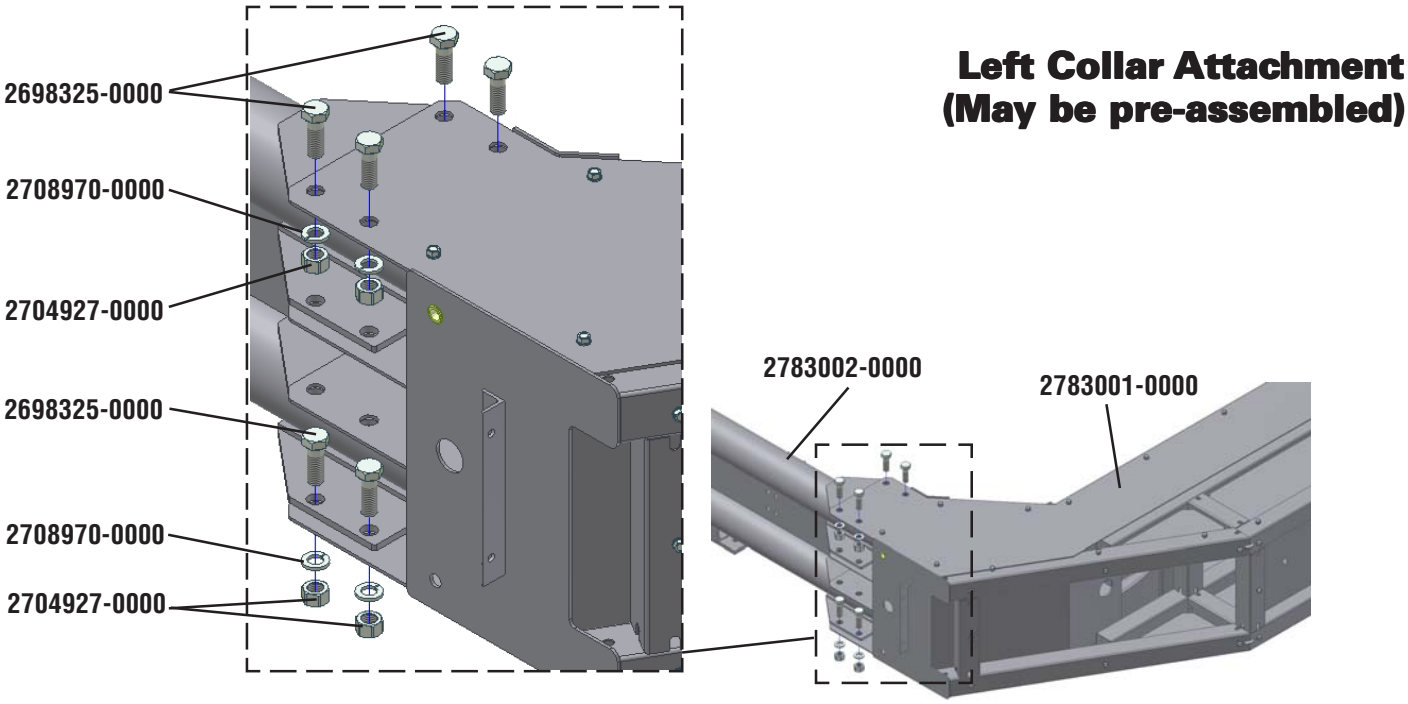
Figure 13



Step 2

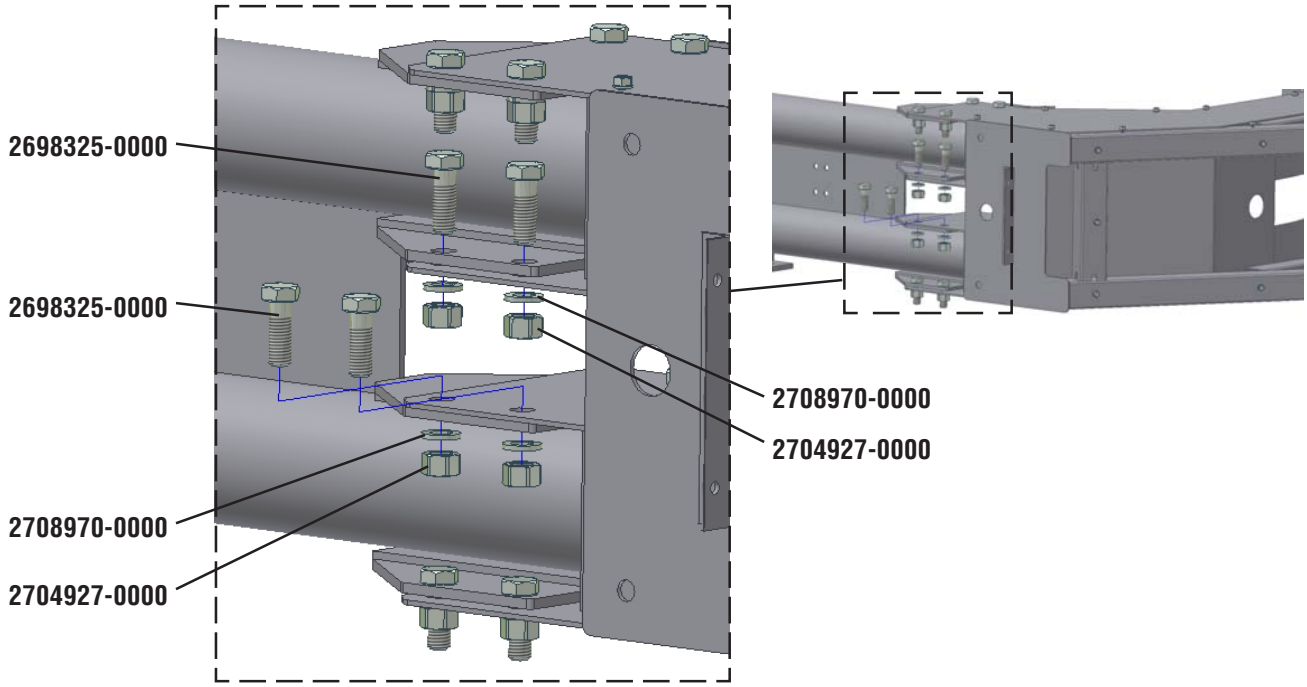
Figure 14

Left Collar Attachment (May be pre-assembled)



Step 1

Figure 15



Step 2

Figure 16

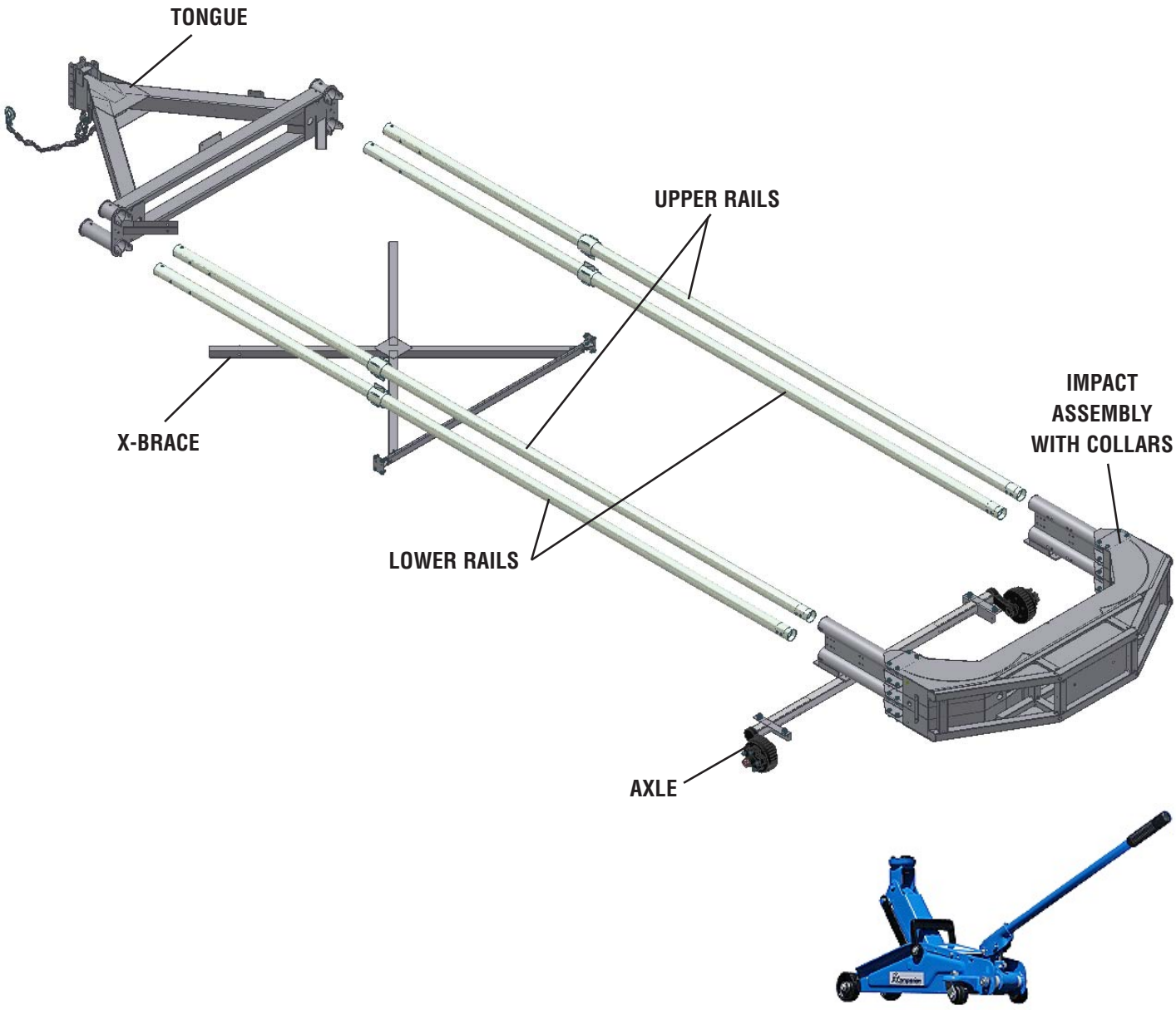

TONGUE
UPPER RAILS
X-BRACE
IMPACT
ASSEMBLY
WITH COLLARS
LOWER RAILS
AXLE

Figure 17

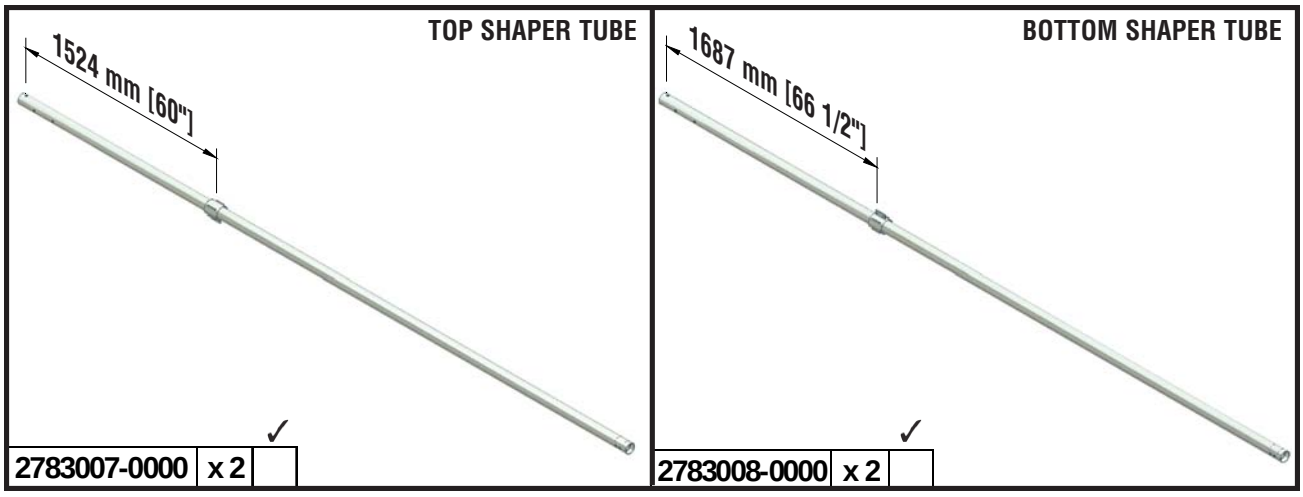
2715083-0000 Axle Assembly (May be pre-assembled)

AXLE	1/2" X 1 1/4" BOLT	1/2" LOCK NUT
		
2715083-0000 x 1 ✓	2699008-0100 x 4 ✓	2704011-0100 x 4 ✓
	1/2" FLAT WASHER  2708011-0100 x 8 ✓	

✓ *Lift Vorteq Frame with a floor jack and slide Axle underneath. Lower Frame to install bolts.*

Figure 18

3583004-0000 Shaper Rail Assembly



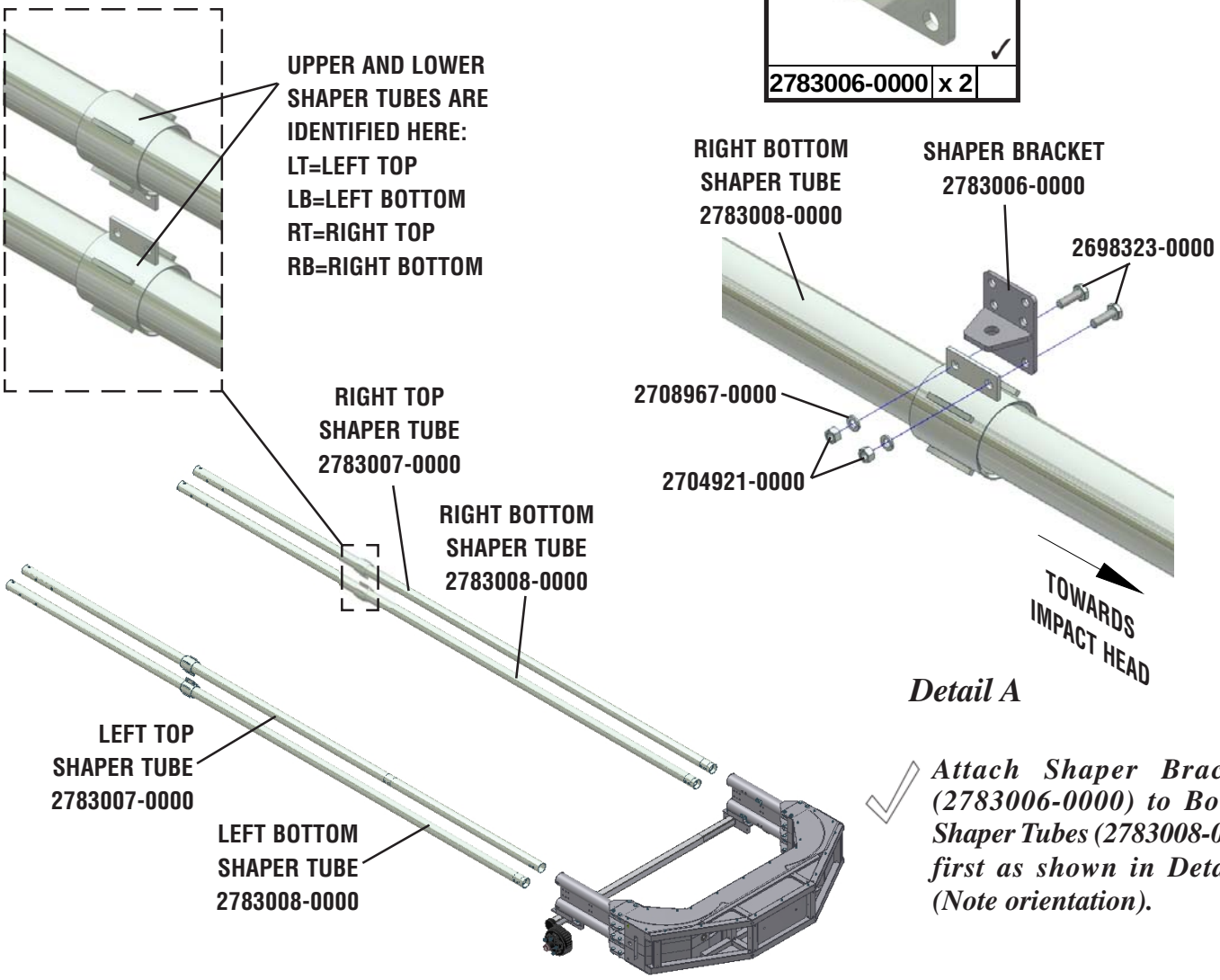
How to Determine Left/Right

To determine left from right: Face the System as shown in Figure 2. Your left is the System's left and your right is the System's right.

Figure 19

Shaper Tube Attachment

M10X30	M10	M10	SHAPER BRACKET
2698323-0000 x 8 ✓	2708967-0000 x 8 ✓	2704921-0000 x 8 ✓	2783006-0000 x 2 ✓

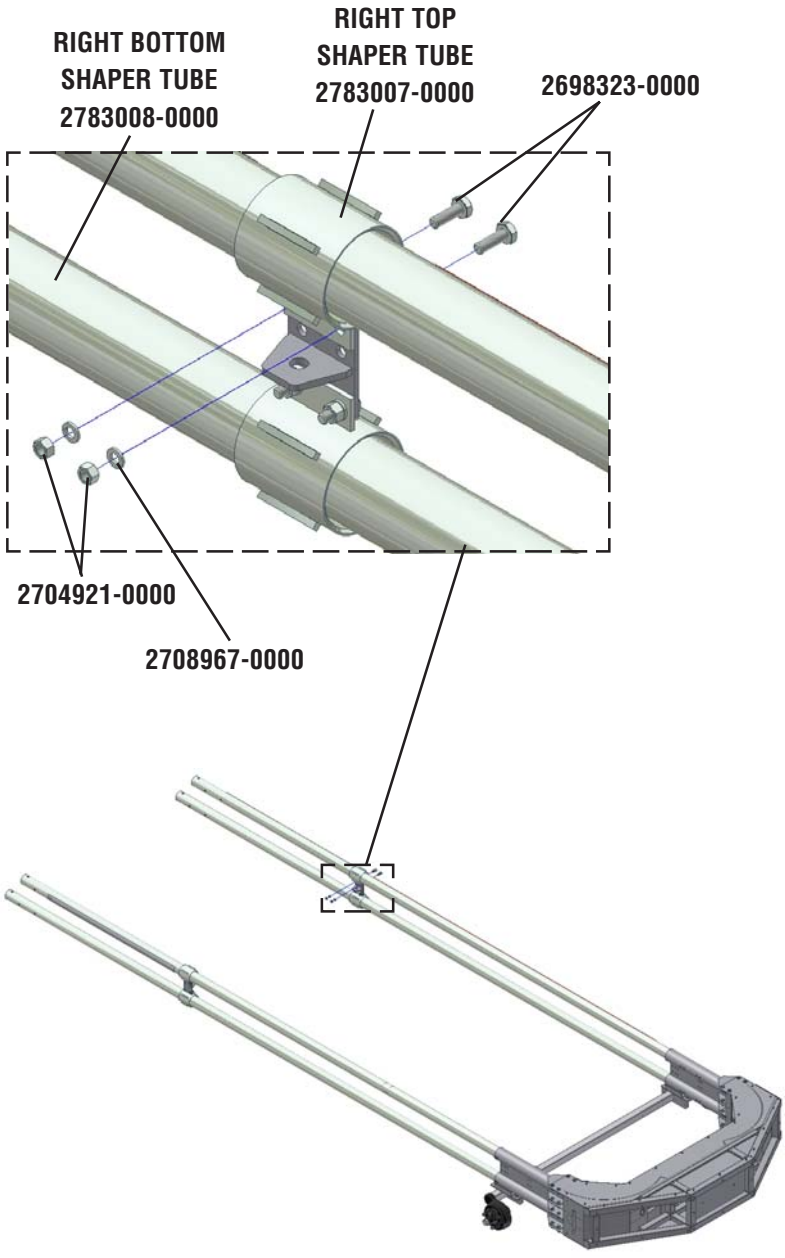


Detail A

Figure 20

✓ *Attach Shaper Brackets (2783006-0000) to Bottom Shaper Tubes (2783008-0000) first as shown in Detail A (Note orientation).*

✓ *Finger tighten Fasteners at this Step.*

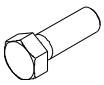


✓ *Insert Bottom Shaper Tubes (2783008-0000) in Collars first.*

✓ *Add Top Shaper Tubes (2783007-0000) and finger tighten all fasteners.*

Figure 21

Lock Bar Washer Attachment

1/2" -1 1/4			LOCK BAR WASHER		
 ✓			 ✓		
2701611-0100	x 8		2783019-0000	x 4	

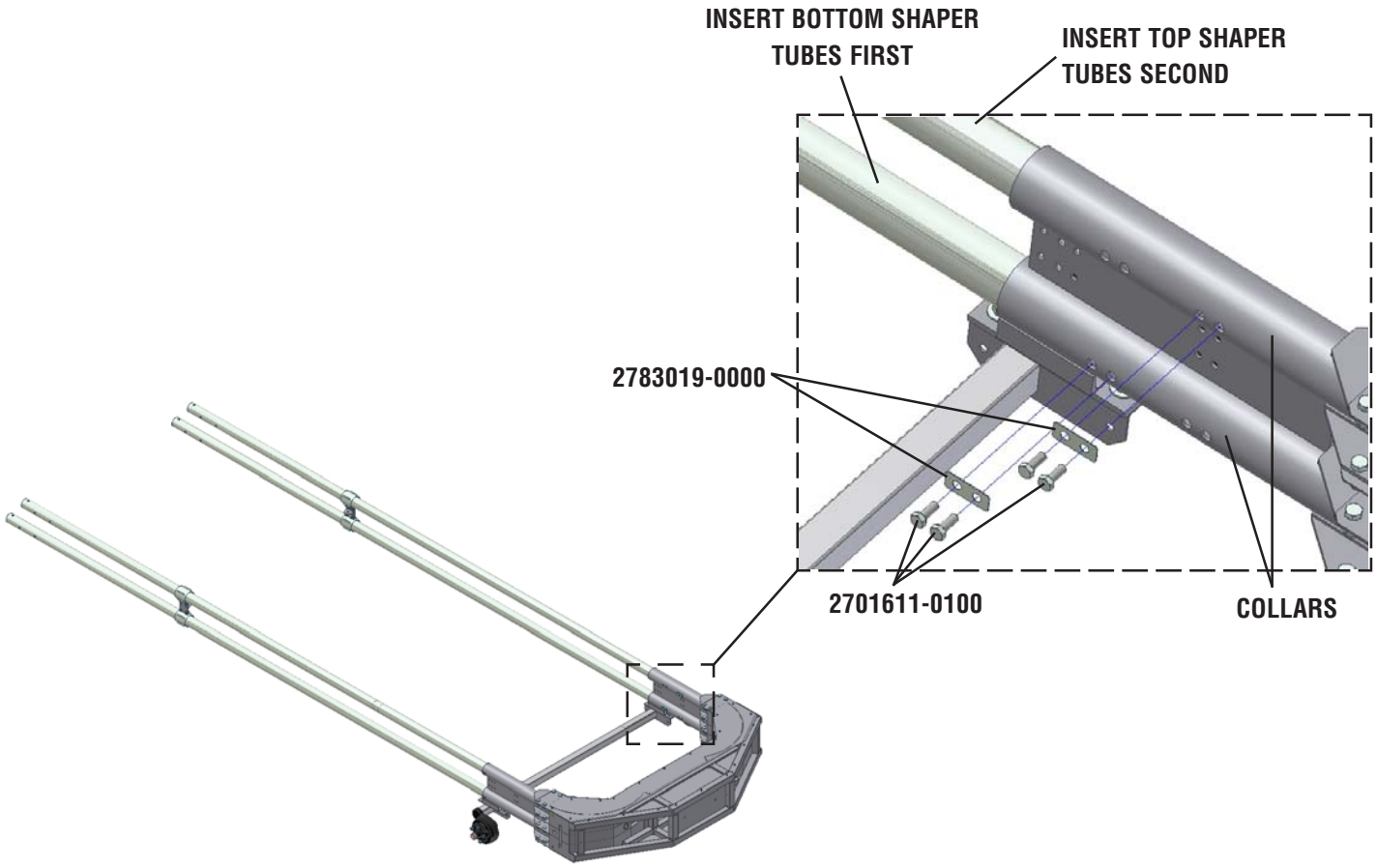
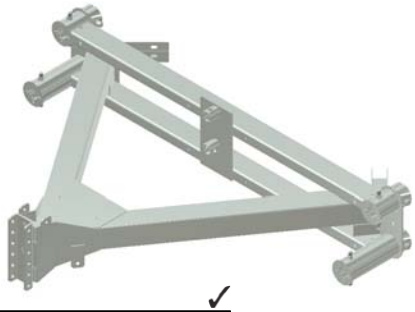
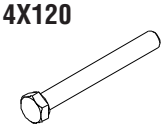
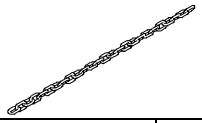
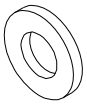


Figure 22

3583002-0000 Tongue Assembly

 ✓	M14 (LOCK NUT)  ✓	M14X120  ✓	M14 (STANDARD NUT)  ✓
2783004-0000 x 1	2704049-0000 x 8	2698329-0000 x 4	2704927-0000 x 6
	 ✓	 ✓	M14X40  ✓
	2708970-0000 x 6	2783009-0000 x 2	2698325-0000 x 10
			M14  ✓
			2708057-0000 x 18

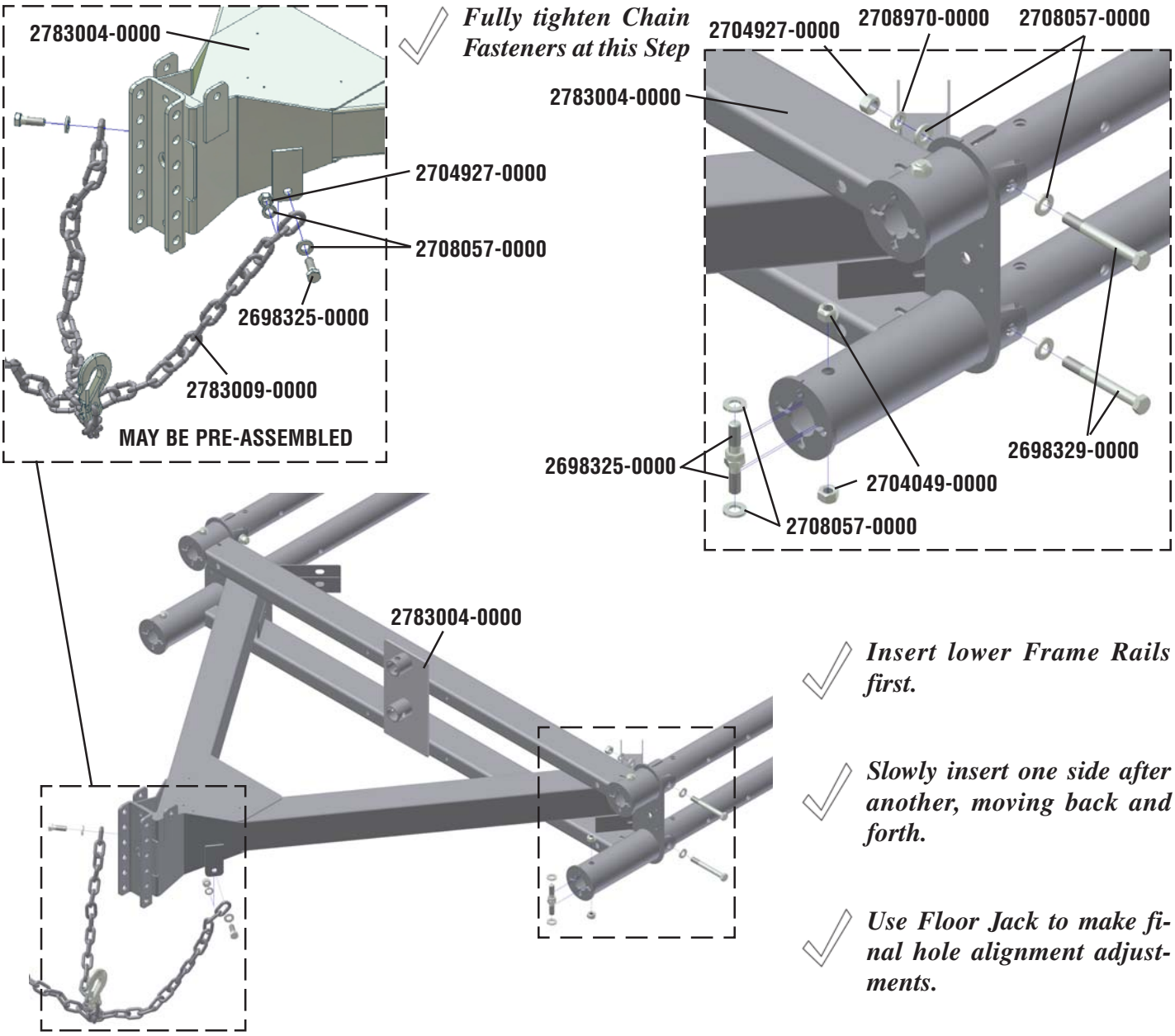
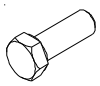
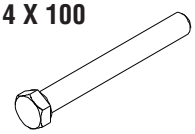


Figure 23

3583003-0000 X-Brace Assembly

 2783005-0000 x 1 ✓	M14X40  2698325-0000 x 2 ✓	M14 NUT  2704927-0000 x 4 ✓	M14 FLAT WASHER  2708057-0000 x 4 ✓
	M14 LOCK WASHER  2708970-0000 x 4 ✓	M14 X 100  2698328-0000 x 2 ✓	

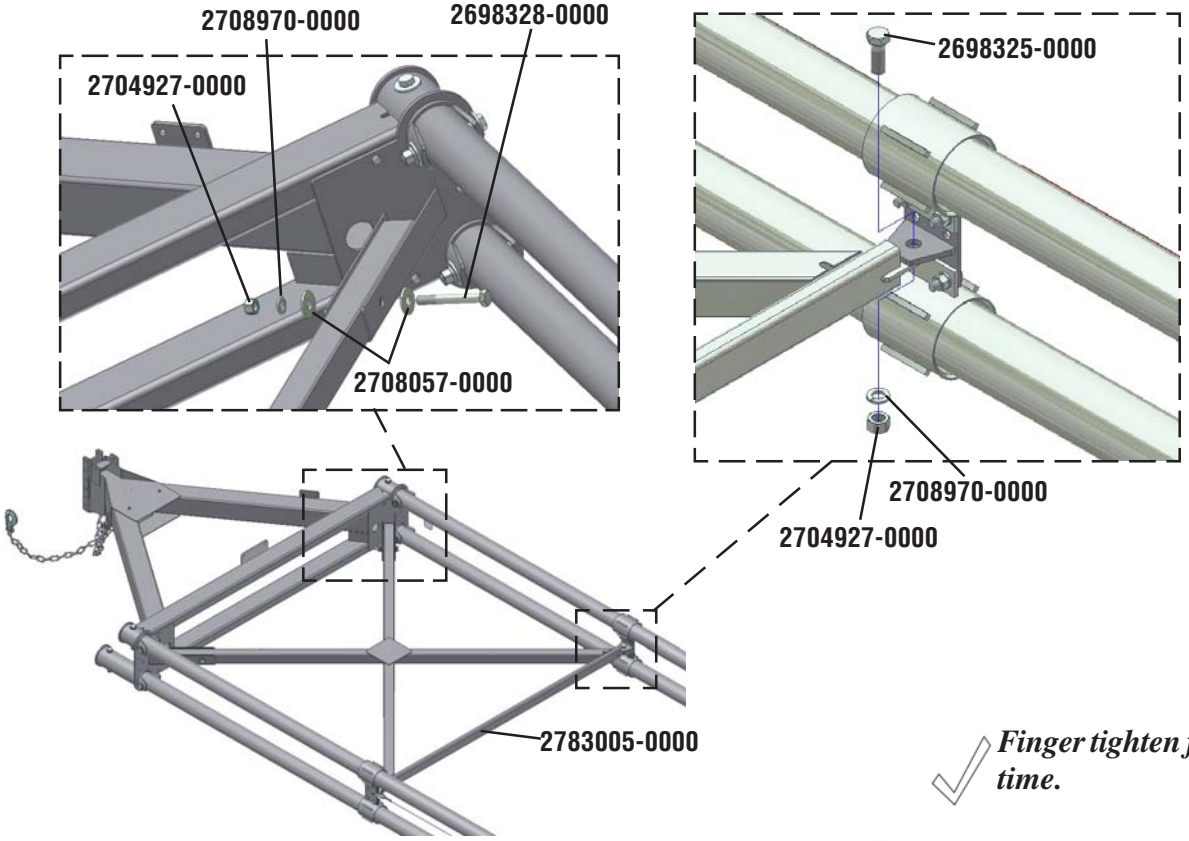


Figure 24

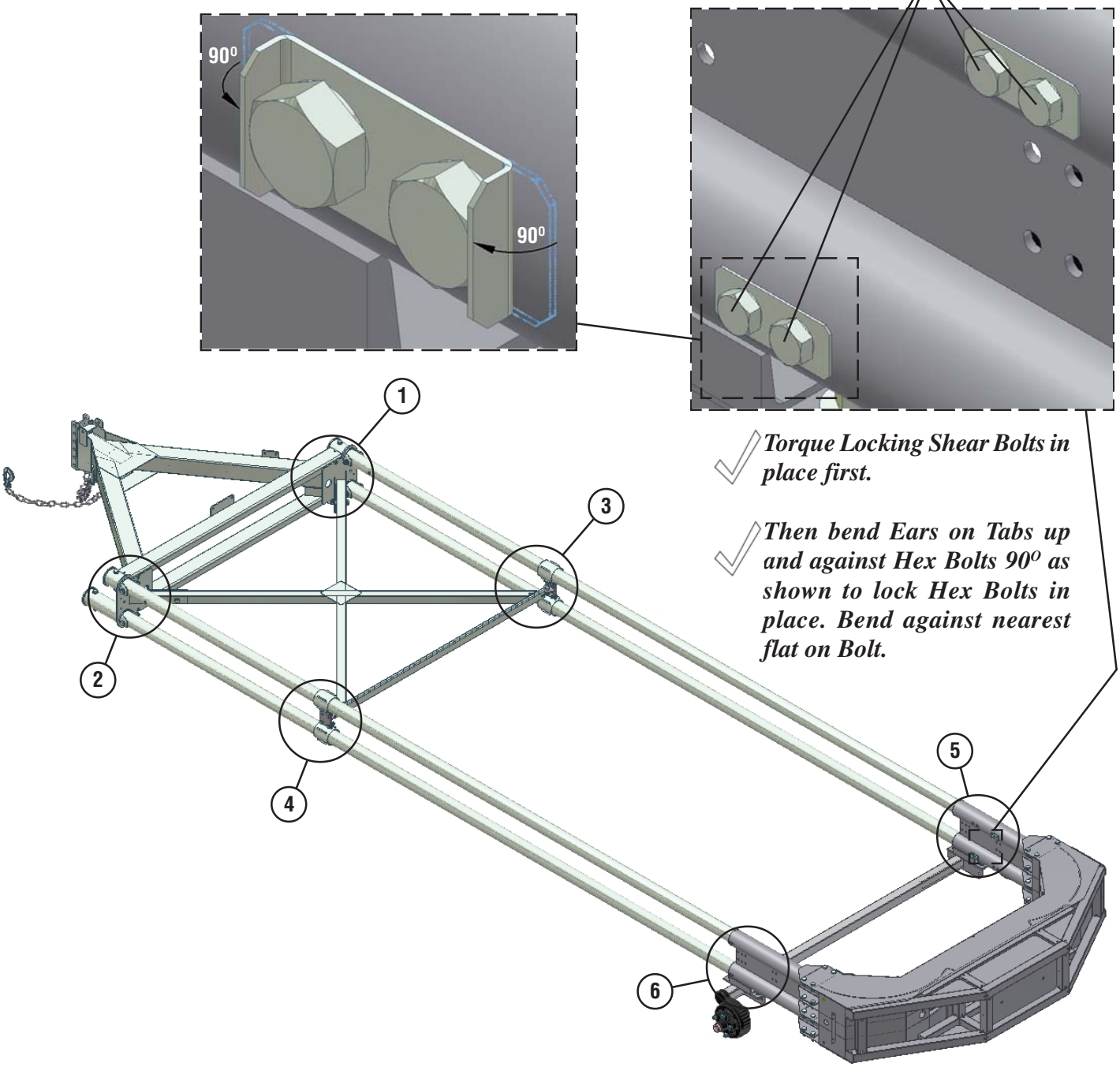
✓ *Finger tighten fasteners at this time.*

✓ *Use Floor Jack on Tongue to help adjust & align.*

Vorteq™ Trailer TMA
Bolt tightening order

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

Torque to 68 Nm $^{+7\ Nm}_{-0\ Nm}$ *(50 ft-lbs* $^{+5\ ft\text{-}lbs}_{-0\ ft\text{-}lbs}$ *)*



Torque Locking Shear Bolts in place first.

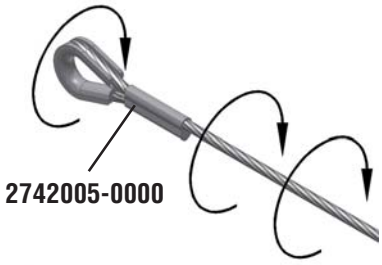
Then bend Ears on Tabs up and against Hex Bolts 90° as shown to lock Hex Bolts in place. Bend against nearest flat on Bolt.

Figure 25

✓ *Attach Safety Cables*

1/4" SHACKLE			SAFETY CABLE		
2728803-0000	x 4		2742005-0000	x 2	

✓ *Twist/rotate ends of Cables in direction of Cable weave to tighten & remove slack.*



Detail A

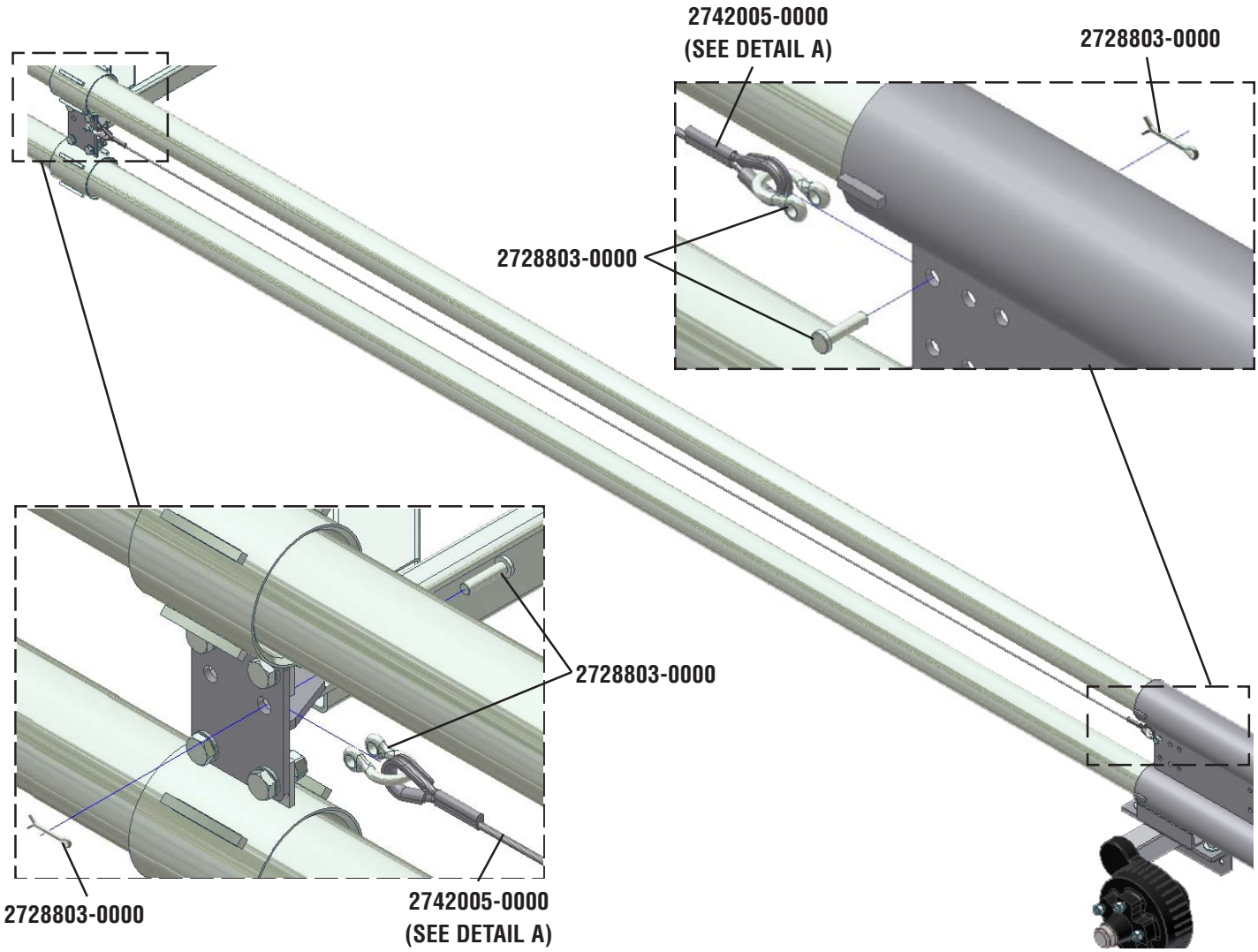
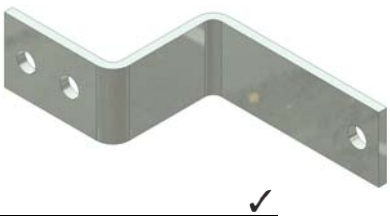
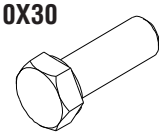
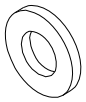


Figure 26

3583005-0000 Fender Assembly

RIGHT SQUARE FENDER	LEFT SQUARE FENDER	BRACKET
		
✓	✓	✓
2783011-0000 x 1	2783012-0000 x 1	2715816-0000 x 4

M10X30	M10 FLAT WASHER	M10 LOCK WASHER	M10 NUT
			
✓	✓	✓	✓
2698323-0000 x 14	2708047-0000 x 20	2708967-0000 x 14	2704921-0000 x 12

Attach Brackets to Collars

(May be pre-assembled)

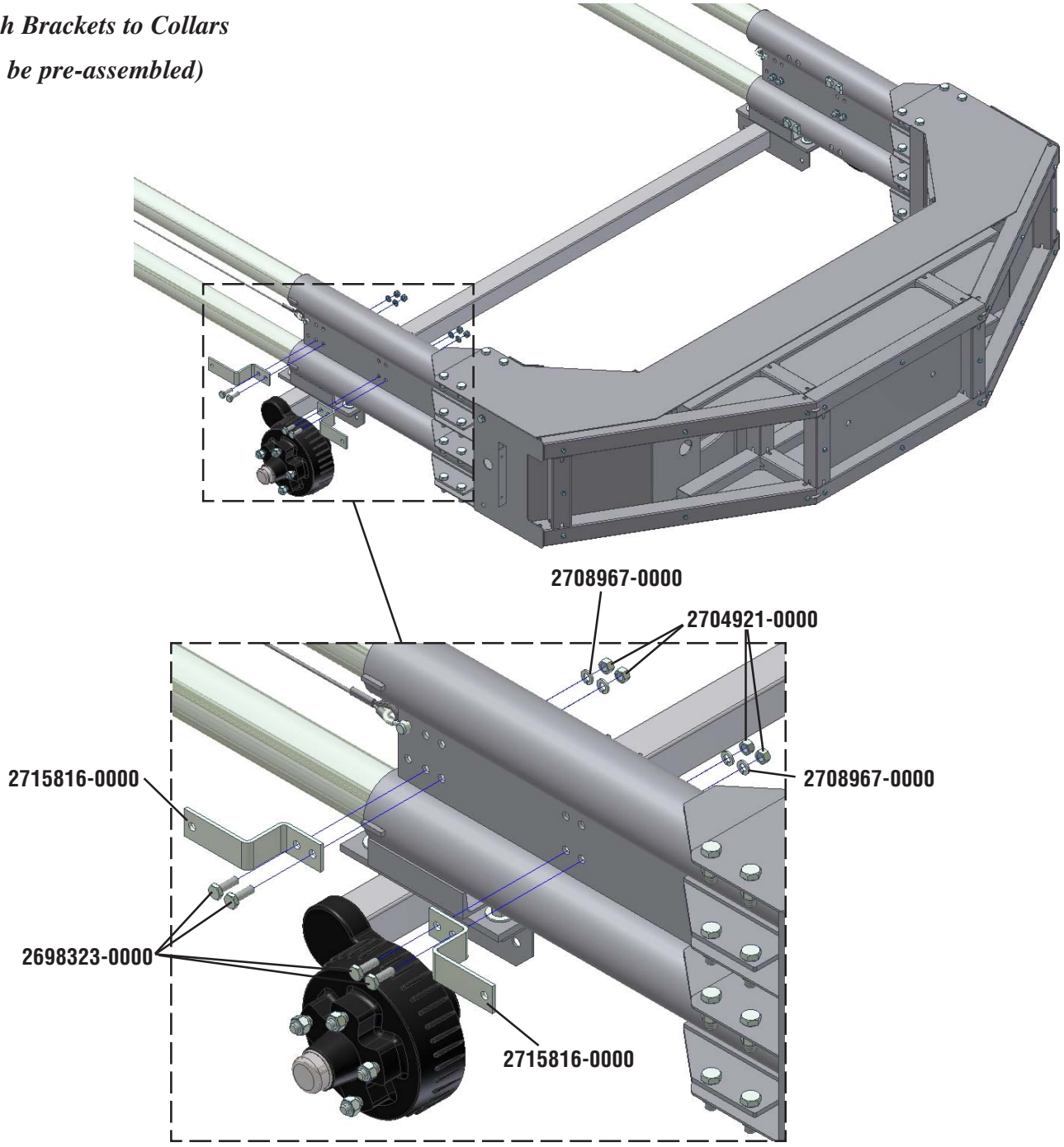


Figure 27

✓ *Attach Fenders to Brackets*

(May be pre-assembled)

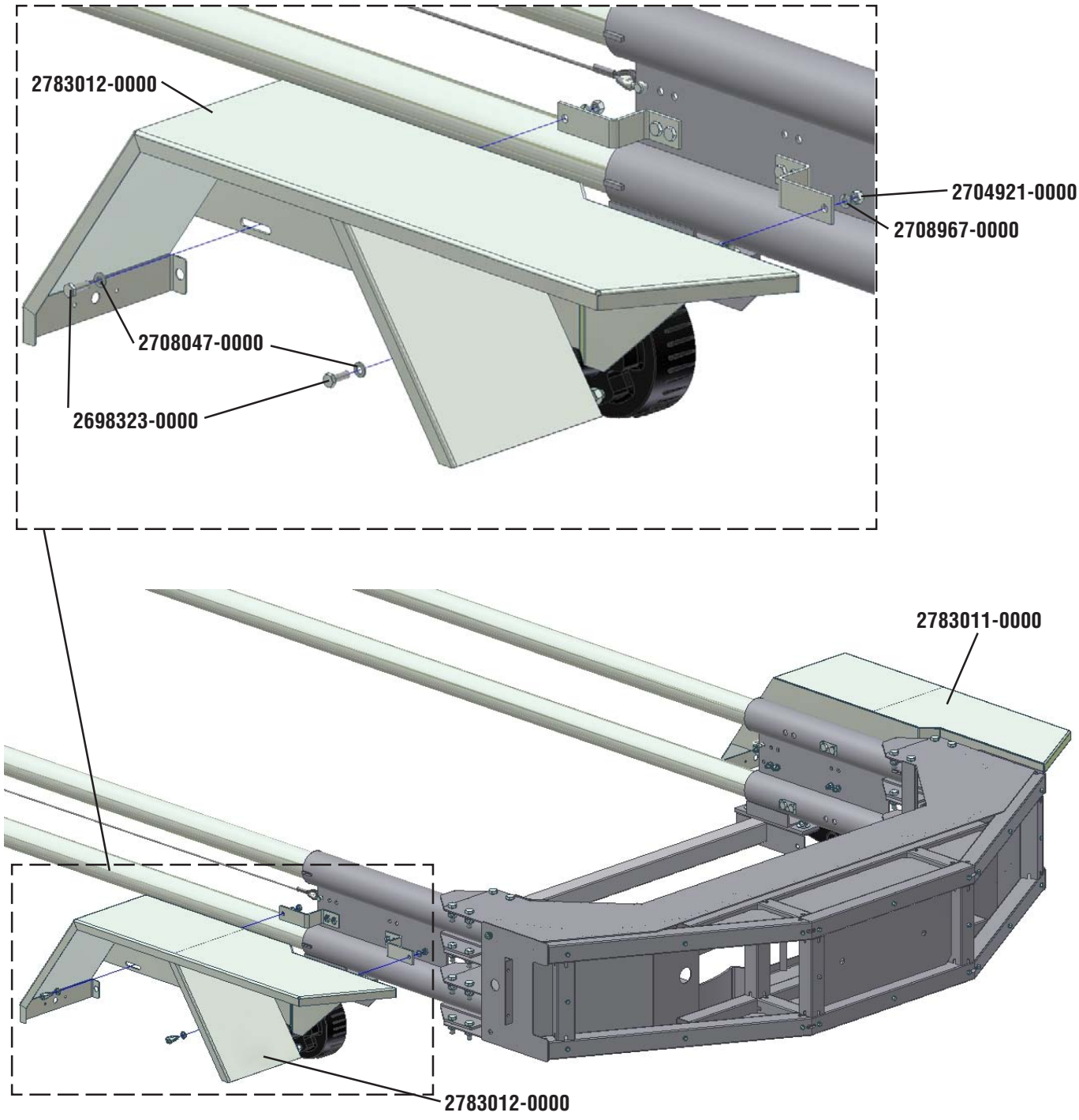
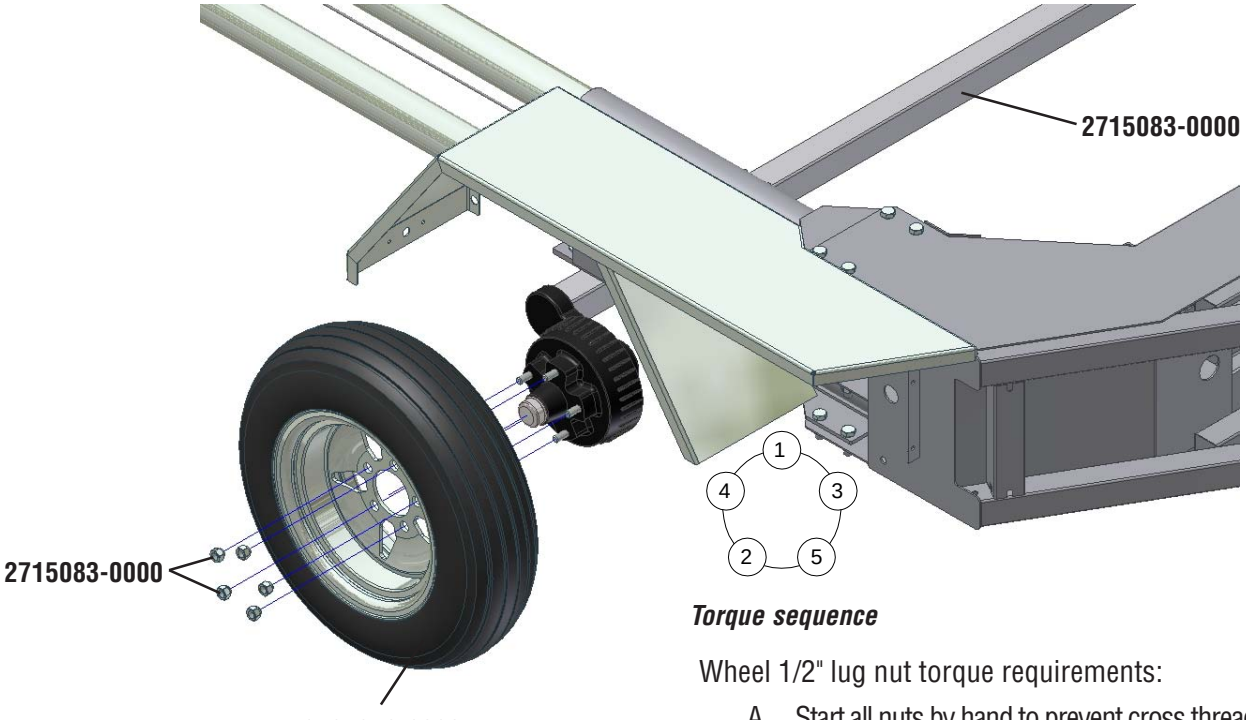


Figure 28

Wheels & Tires

WHEEL	LUG NUT
	
2724246-0000 x 2 ✓	2715083-0000 x 10 ✓



Torque sequence

Wheel 1/2" lug nut torque requirements:

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

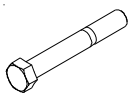
B. Torque nuts in stages as follows:

1st stage	2nd stage	3rd stage
20-25 ft-lbs.	35-40 ft-lbs.	70 ± 5 ft-lbs.

C. Follow torque sequence above.

Figure 29

3583008-0000 US Hitch

HITCH	5/8" X 4 1/2"	5/8" LOCK NUT	5/8" LOCK WASHER
 ✓	 ✓	 ✓	 ✓
2751106-1000 x 1	2701114-0100 x 2	2704510-0100 x 2	2708231-0100 x 2

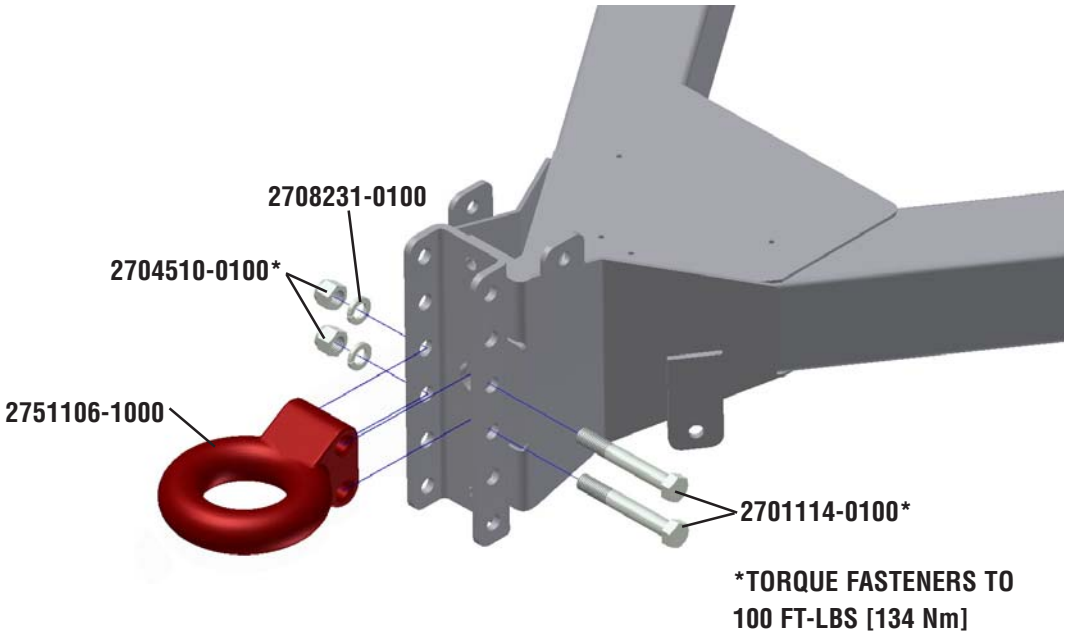
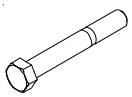


Figure 30

3583007-0000 European Hitch Adapter

HITCH	5/8" X 4 1/2"	5/8" LOCK NUT	5/8" LOCK WASHER
 ✓	 ✓	 ✓	 ✓
2783016-0000 x 1	2701114-0100 x 2	2704510-0100 x 2	2708231-0100 x 2

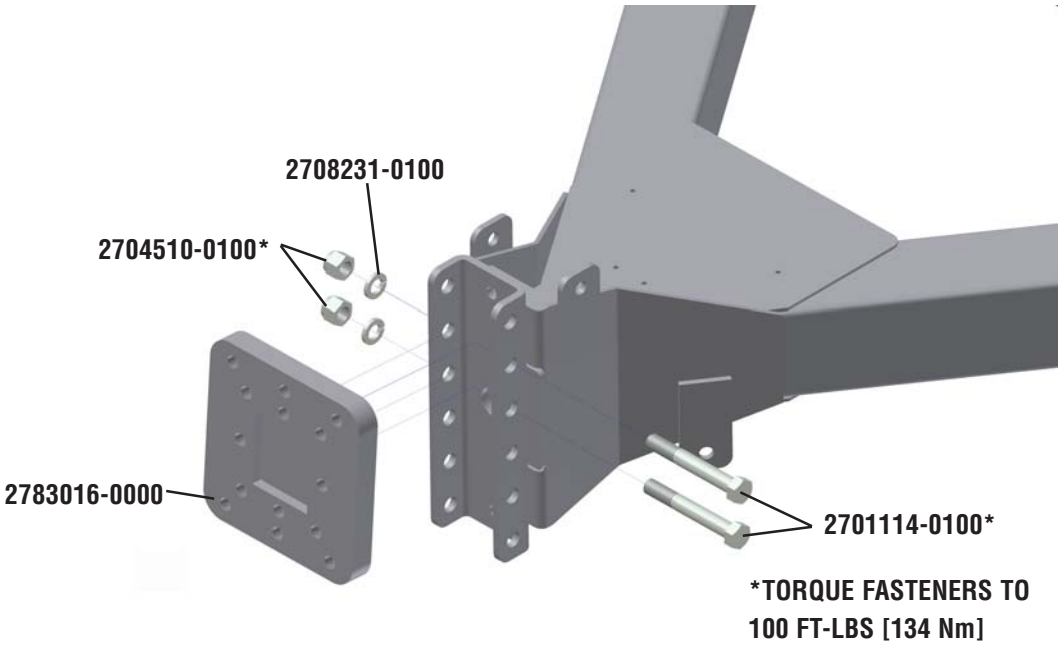


Figure 31

3583026-0000 Jack Assembly

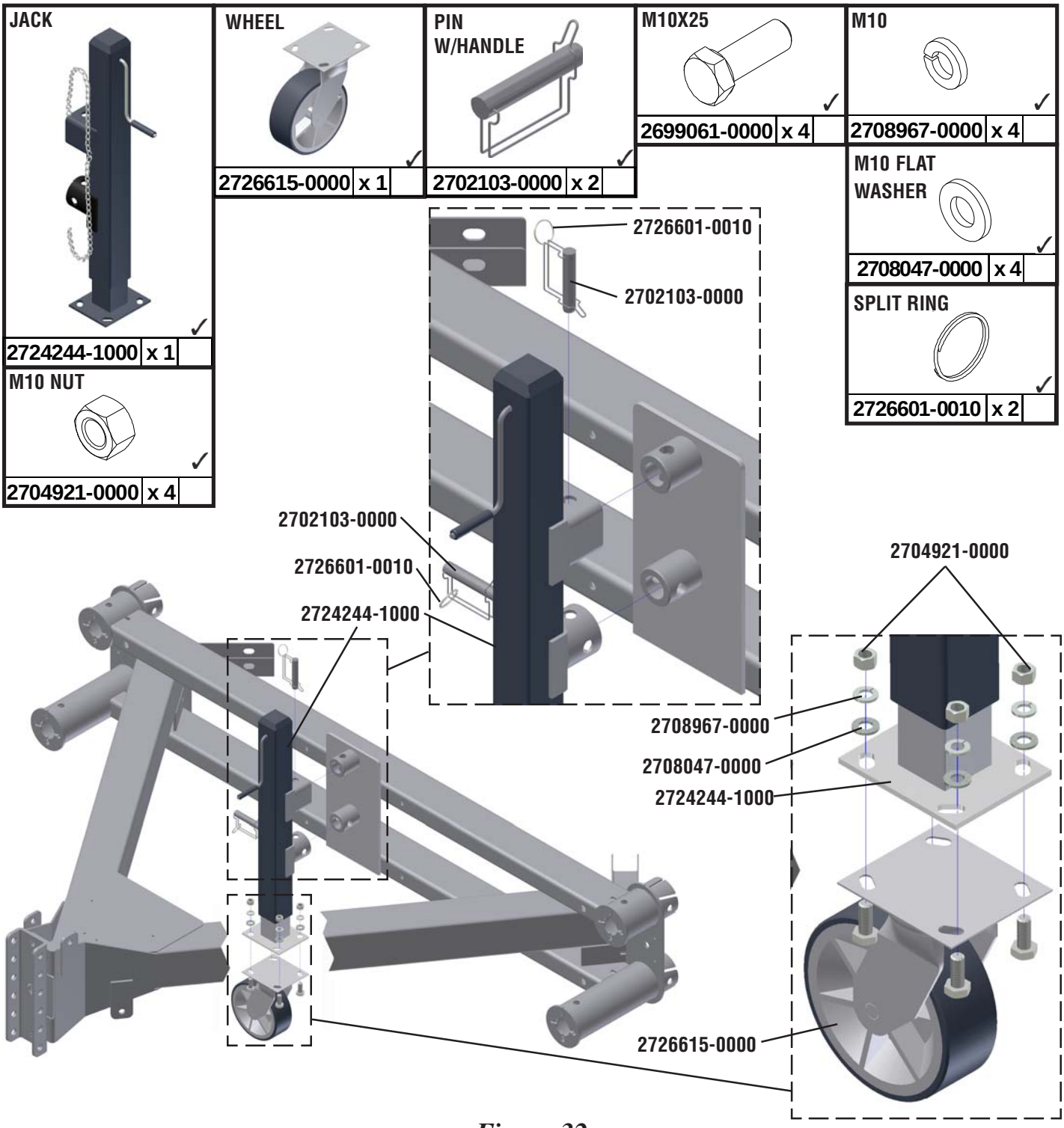


Figure 32

3583006-0000 Impact Face

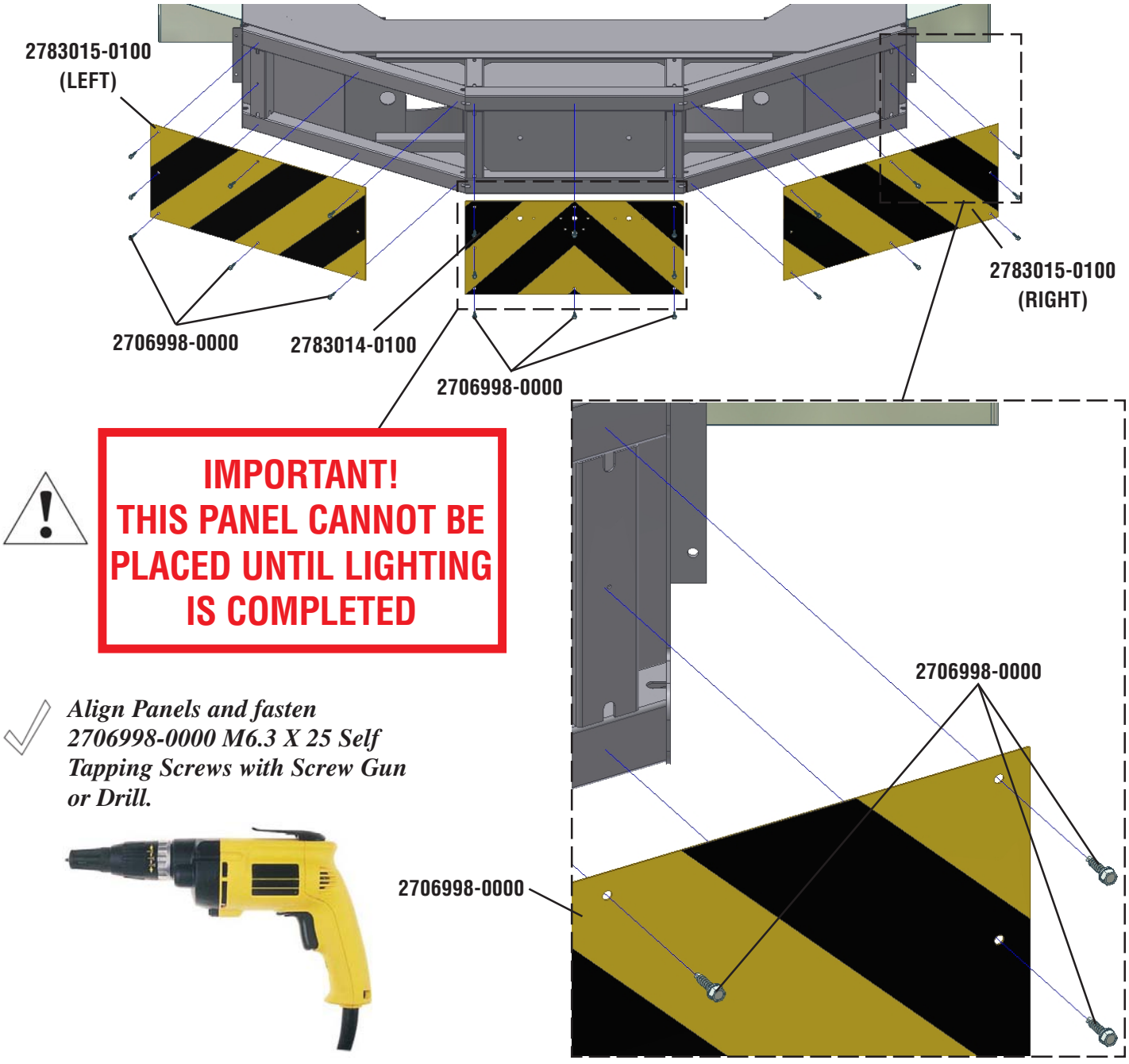
LEFT	CENTER	RIGHT
 ✓	 ✓	 ✓
2783015-0100 x 1 ☐	2783014-0100 x 1 ☐	2783015-0100 x 1 ☐

M6.3X25
 ✓
2706998-0000 x 22 ☐

IMPORTANT!
SEE LIGHTING PACKAGE BEFORE COMPLETING THIS STEP

Impact Face Attachment

Ensure the striping patterns line up with center panel prior to final installation.



Align Panels and fasten 2706998-0000 M6.3 X 25 Self Tapping Screws with Screw Gun or Drill.

Figure 33

3583022-0000 Oversized Impact Face (Optional)

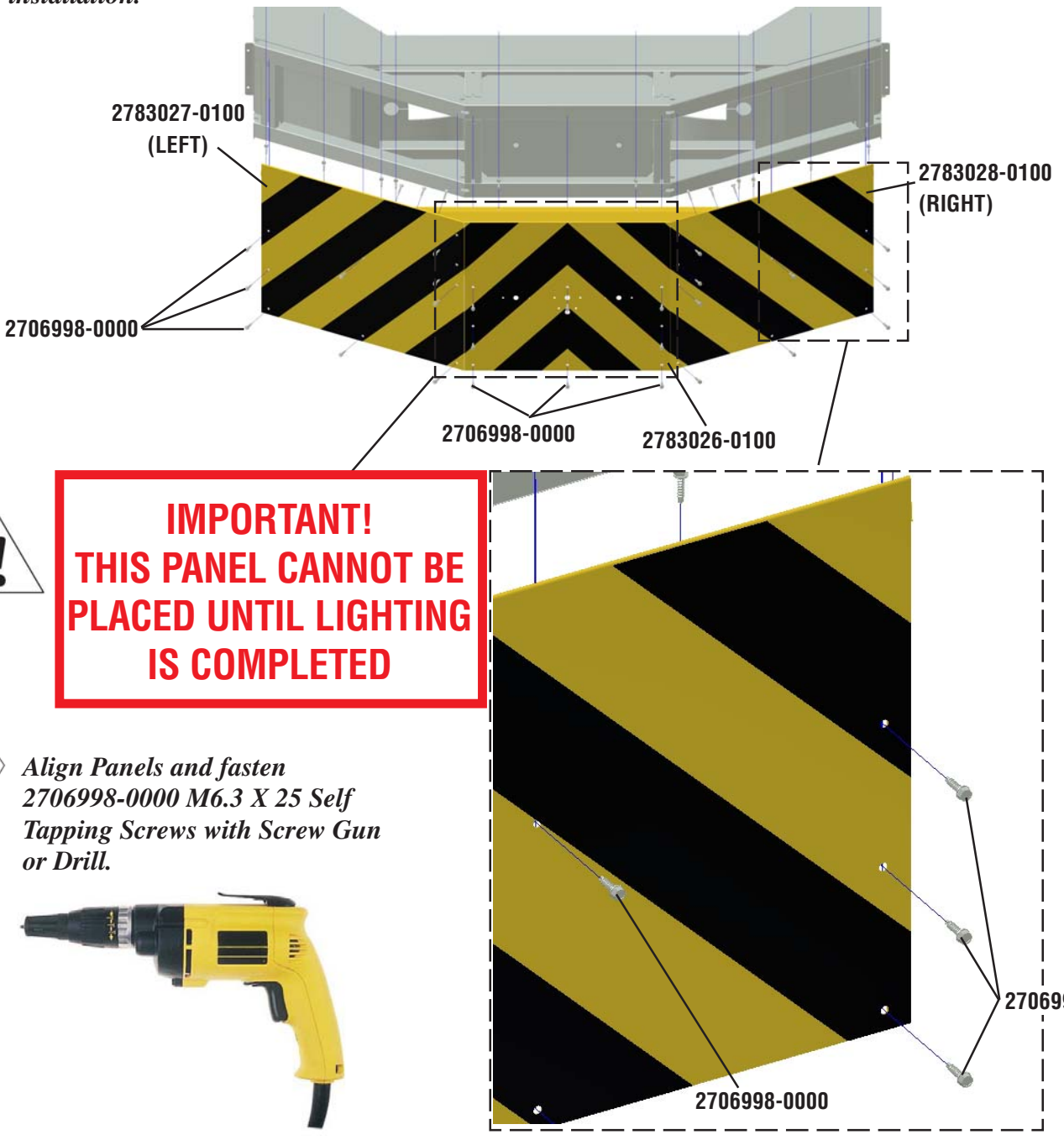
LEFT	CENTER	RIGHT
 ✓	 ✓	 ✓
2783027-0100 x 1 ☐	2783026-0100 x 1 ☐	2783028-0100 x 1 ☐

M6.3X25
 ✓
2706998-0000 x 42 ☐

IMPORTANT!
SEE LIGHTING PACKAGE BEFORE COMPLETING THIS STEP

Oversized Impact Face Attachment (Optional)

Ensure the striping patterns line up with center panel prior to final installation.

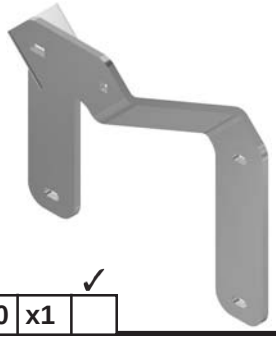
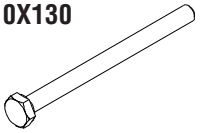


Align Panels and fasten 2706998-0000 M6.3 X 25 Self Tapping Screws with Screw Gun or Drill.

Figure 34

*** Optional (purchased separately)**

3583009-0000 Spare Tire Carrier

SPARE TIRE CARRIER	M10X130	M10 FLAT WASHER
 ✓	 ✓	 ✓
2783024-0000 x1	2698335-0000 x 4	2708047-0000 x 4
	M10 NUT	**M10**
	 ✓	 ✓
	2704921-0000 x 4	2708967-0000 x 4

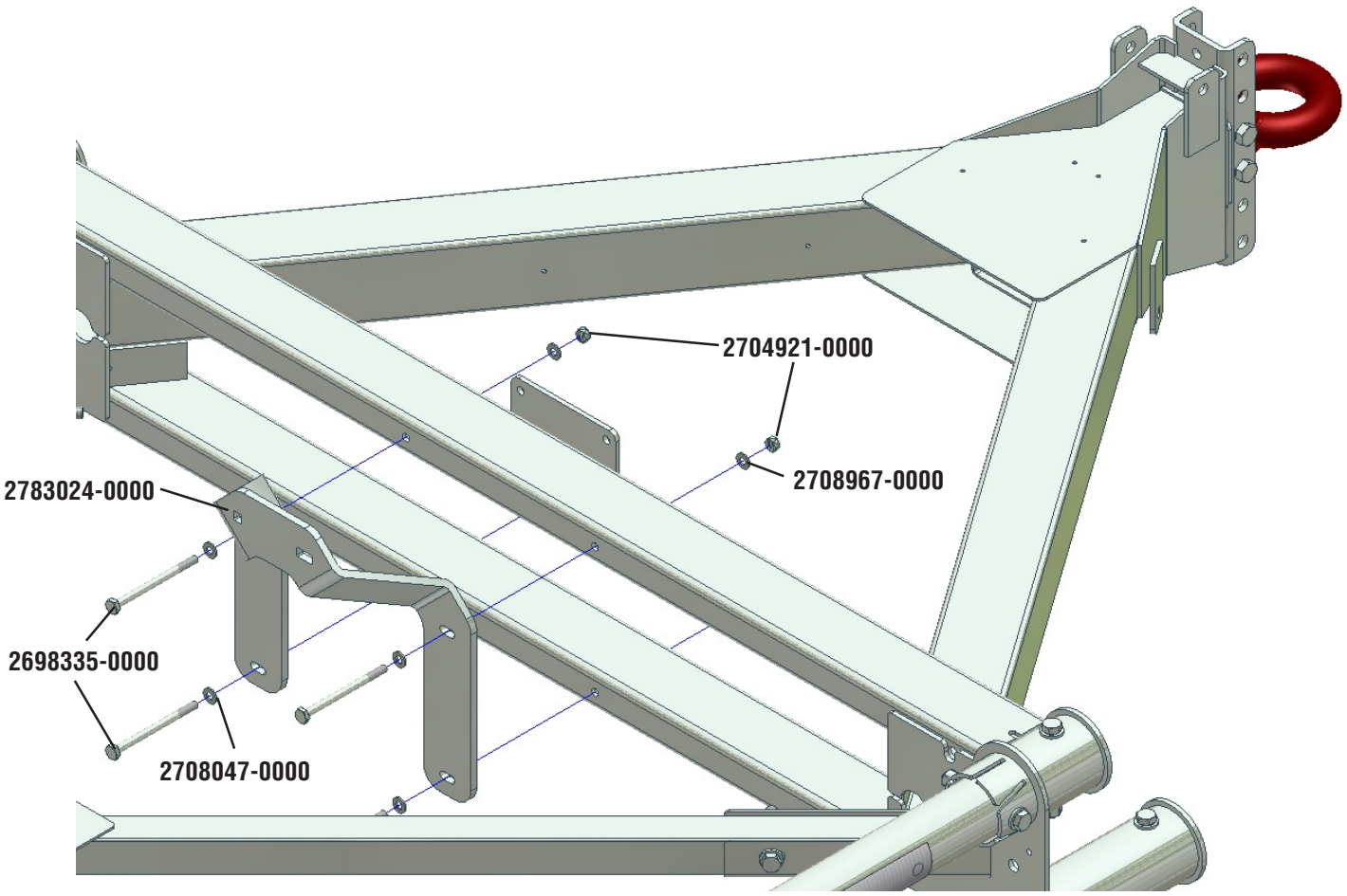


Figure 35

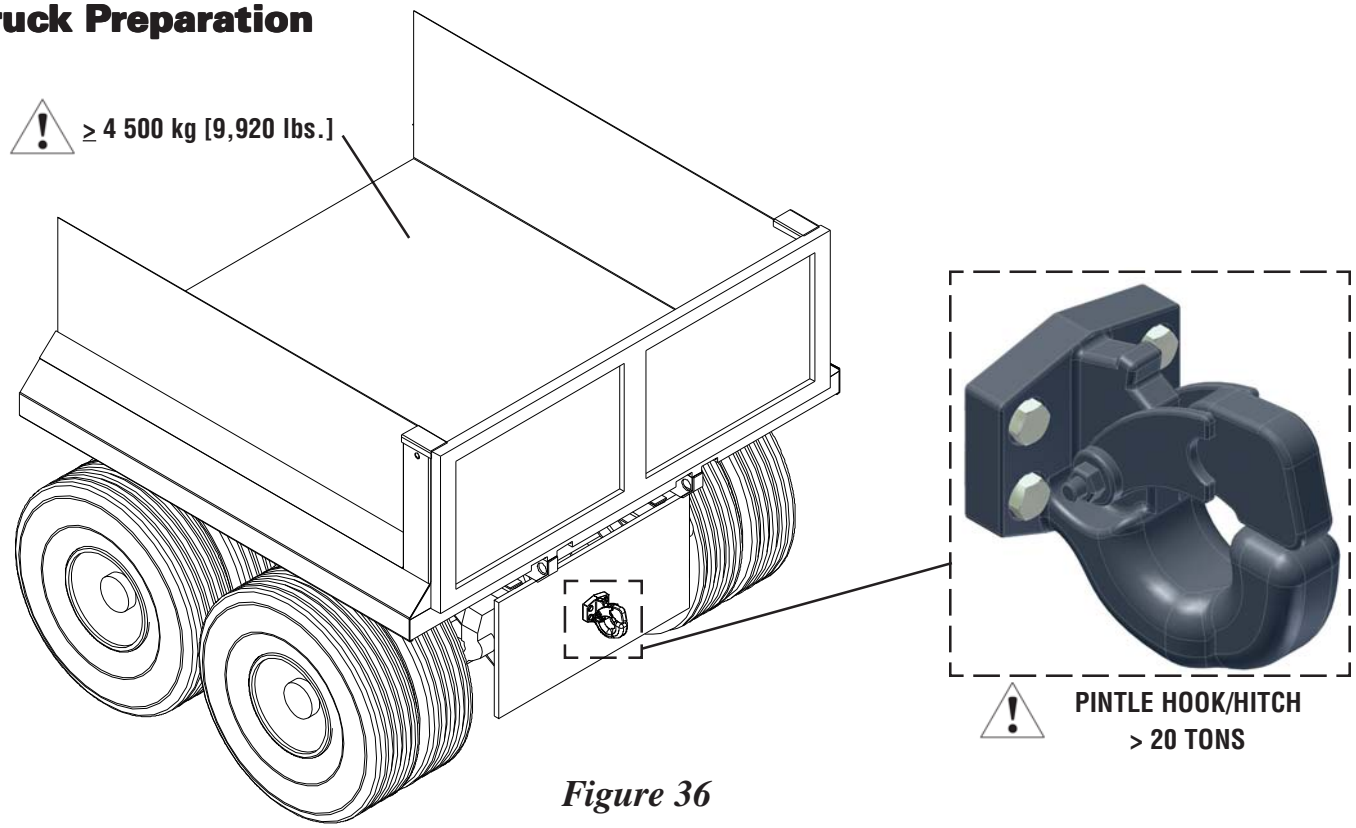


Figure 36

✓ ***Truck frame must be suitable 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 assistance (see phone numbers on back cover).***

✓ ***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 ℄ height above ground level must be in a range between 430 to 630 mm [17" to 25"]. The preferred pintle/Euro-hitch mounting height is 530 mm [21"] (see Figure 36a)***

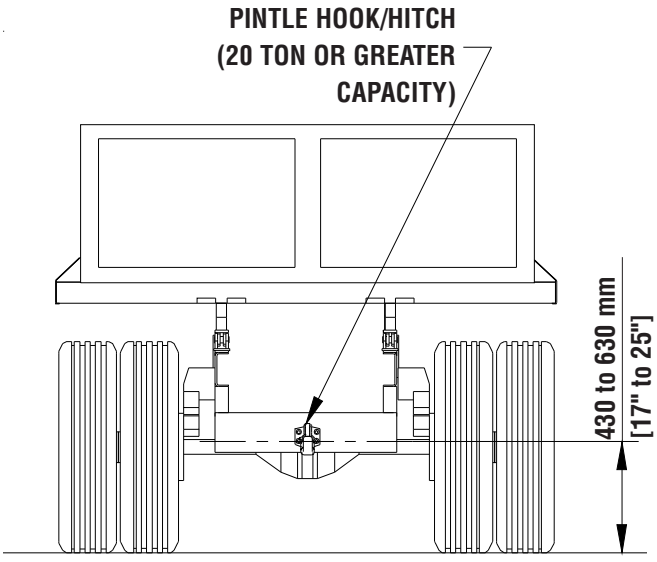


Figure 36a

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.

Welding Procedures:

1. Start by grinding the inside and outside of the frame ends to prepare for the weld. See Figure 37.

2. The plate needs to be a minimum of 1/2" thick and wider than 36". See Figure 38.

3. Grind the plate in the locations where the frame is to be welded.

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" 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 truck frame, add

4" X 4" X 1/2" angle gussets(See Figure 38)

8. Weld the 3/4" X 5" Reinforcement Bar in a horizontal position as shown in Figure 38 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.

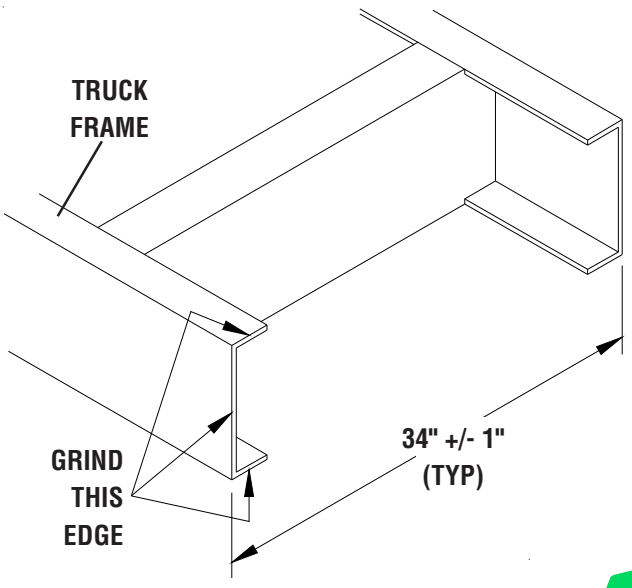


Figure 37

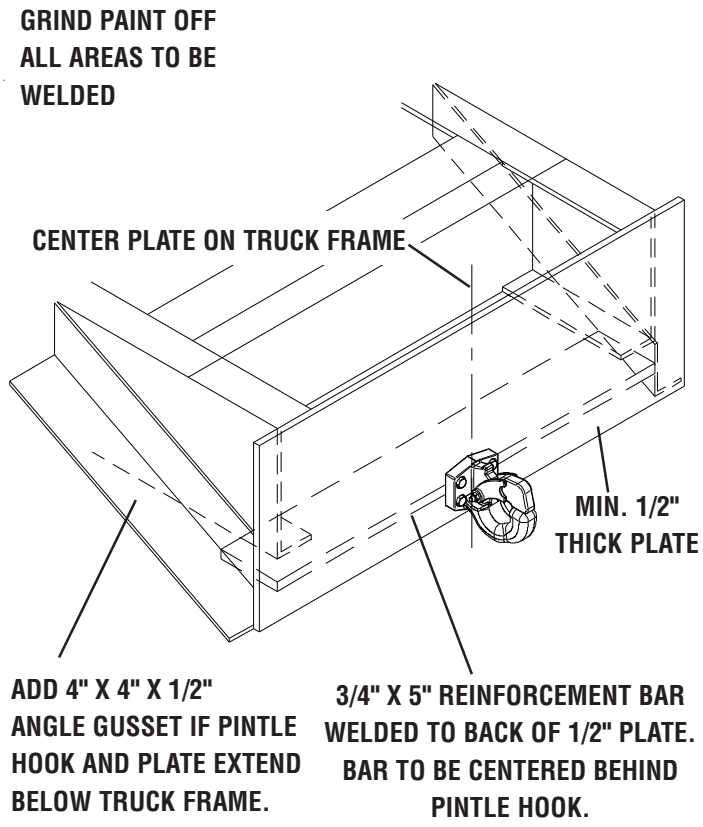


Figure 38

Vorteq™ Trailer TMA

Bolt-on Procedures:

1. Start by cutting two 4" x 4" x 1/2" angles to the height of the rear plate. See Figure 39.
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 40.
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 41.
7. Drill two matching holes in each end of the plate.
8. Install 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 install 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. 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 install two more 1" bolts to attach angle gusset to truck frame, as well as another 1" bolt to attach the angle gusset to each verticle angle.
10. If 1/2" plate extends below truck frame, incorporate a 4" X 4" X 1/2 " 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 40
11. Bolt or weld pintle hook to rear palte, centering it vertically on the 4" X 4" X 1/2" horizontal reinforcement angle.

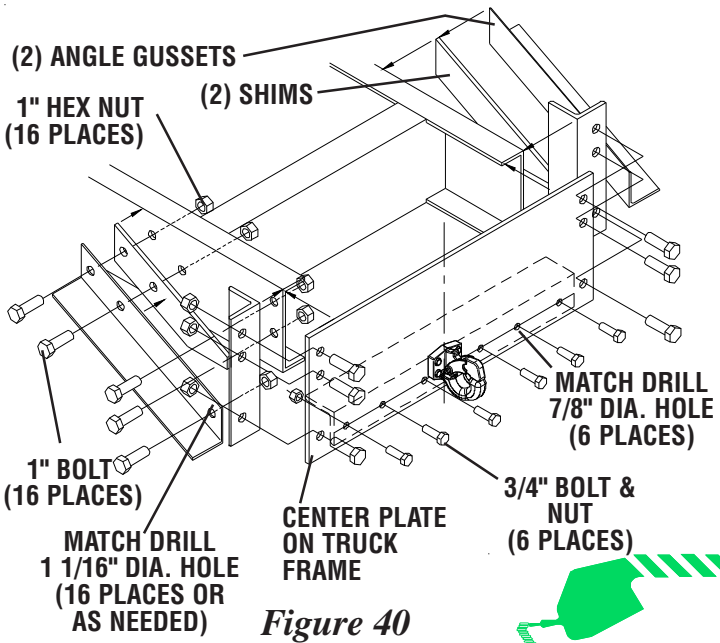


Figure 40

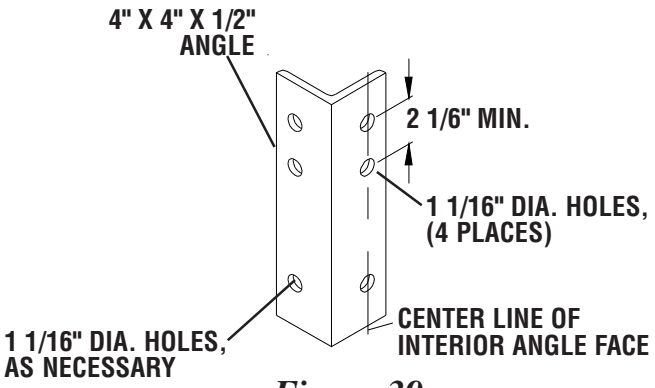


Figure 39

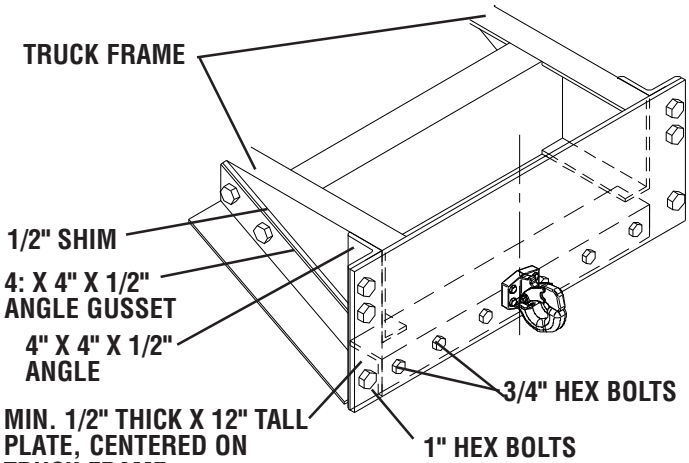


Figure 41

Underride Assembly

With the truck at its actual driving weight, parked on a level surface, measure the distance from the ground to the pintle hook/Euro-hitch. Attach the pintle eye/Euro-hitch to the trailer at the same height knowing that the trailer frame is 350 ± 50 mm [14" ± 2"] above the ground.

Note: The truck's springs may settle with the weight of the Trailer TMA. Adjust the height to compensate for anticipated settling.

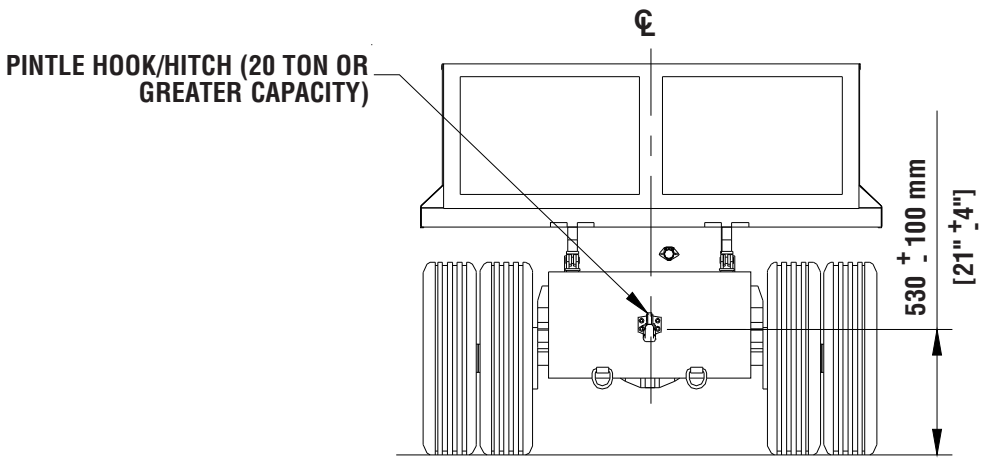


Figure 42
Rear of Support Truck (typical)

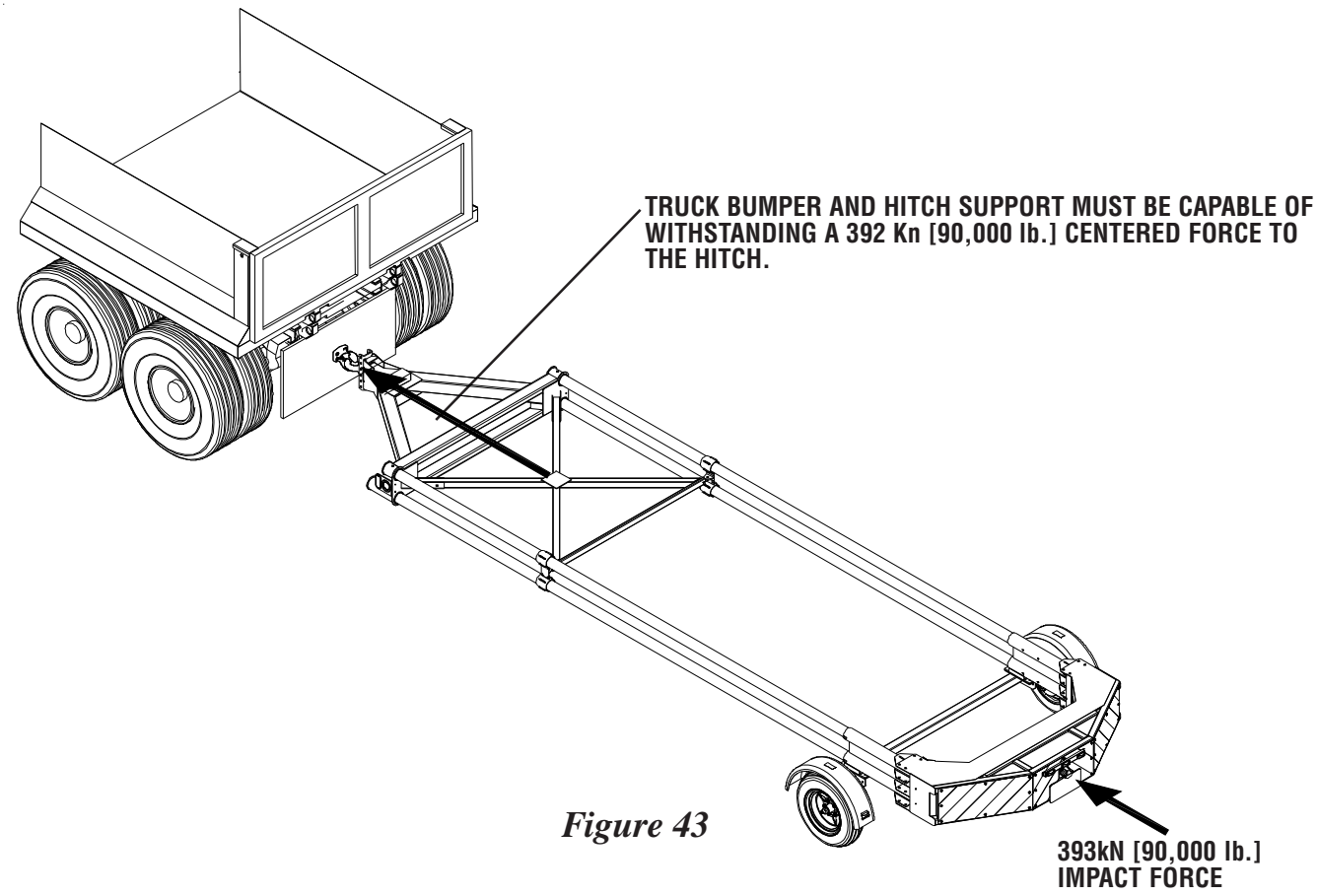


Figure 43

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: 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 44).
6. Backing up the Vorteq 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.

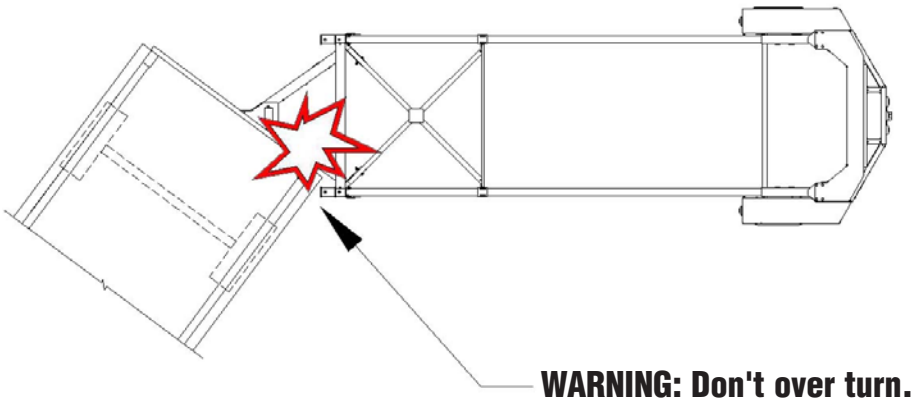


Figure 44

Limitations and Warnings

The Vorteq TMA (Truck Mounted Attenuator) has been tested and evaluated per the recommendations of the National Cooperative Highway Research Program (NCHRP) Report 350*. The Vorteq TMA is capable of decelerating and stopping small cars and light trucks of 820 and 2000 kg [1808 and 4410 lbs.] when the rear of the System is impacted at 100 km/h [62 m.p.h.]. The Vorteq has passed test #50, 51, 52 and 53 at Test Level 3 (100 km/h). Tests 50 (small car) and 51 (light truck) are straight-on impacts, test 52 (light truck) is an offset impact and test 53 (light truck) is an angle offset impact.

The Vorteq TMA was tested on an infinite weight truck for the NCHRP 350 tests. The System must be level and the bottom of the System must be 350 ± 50 mm [14" ± 2"] above the ground.

The truck's hitch and support structure must be capable of withstanding a 392 kN [90,000 lb.] centered impact force.

Impacts that exceed the design capabilities described in this manual (vehicle weight, speed and impact angle) may not result in acceptable crash performance as described in NCHRP 350, relative to structural adequacy, occupant risk and vehicle trajectory factors.

* Copy may be obtained from:

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

It is also available at:
http://safety.fhwa.dot.gov/programs roadside_hardware.htm

The Vorteq TMA has also been tested and evaluated per the United Kingdom TD49/07 test recommendations at the 110 km/h velocity class. In addition to NCHRP 350 performance the Vorteq is capable of decelerating and stopping a mid-weight 1500 kg [682 kg] vehicle when the rear of the system is impacted at 110 km/h [68 m.p.h.] according to Test 3-51.UK.

Maintenance

Before performing any Maintenance on the Vorteq 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 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 TMA integrity by their choice of methods, tools, or parts.

I. General

a. Always replace any fastener with one of equal size, grade, and type.

b. Be sure the grade marks on the replacement fastener match the original bolt.

c. 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 fasteners for tightness			•		
Tires	Check tire pressure (Tire pressure to be 120 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	•	•			

III. Lubrication

Oil Swivel jack

Oil the swivel jack every six months as shown in Figure 45.

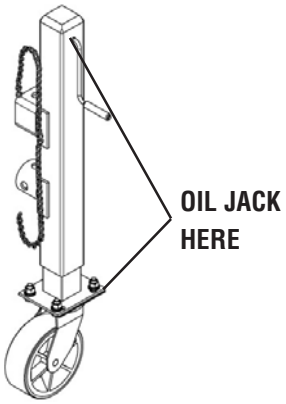


Figure 45

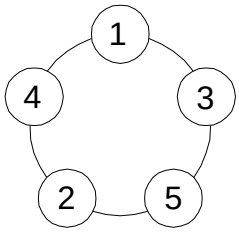


Figure 46

IV. Tires & Wheels

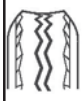
1. Always replace trailer tires with ST (Special Trailer) tires.
2. Tire pressure should be checked cold before operation.
3. Inspect tires for damage.
4. Check inflation pressure before each use to insure the maximum tire life and tread wear.

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.

1. Wheel attachment:
   a. The proper procedure for attaching wheels is as follows:
   b. Start all bolts or nuts by hand to prevent cross threading.
   c. Tighten bolts or nuts in the sequence as shown in Figure 46.
   d. Torque the nuts in the following stages:
   e. 1st stage: 27 to 34 Nm [20 to 25 ft.-lbs].
   f. 2nd stage: 47 to 54 Nm [35 to 40 ft.-lbs].
   g. 3rd stage: 95 ± 7 Nm [70 ± 5 ft.-lbs].
2. Maintain proper lug nut torque.
3. 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.
4. The Vorteq TMA tire size is ST20575D14. The bias ply tire provides stiffer side walls and more resistance to sway.
5. 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.
6. Be sure that necessary adjustments are made and any damaged or worn parts are replaced.

Tire Wear Diagnostic Chart

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.

IV. Electrical

1. Make sure connector-plug prongs and receptacles, light bulb sockets, and ground connections are clean and shielded from moisture.

VI. Axle

WARNING!
Never weld to the Torflex axle. The Torflex axle contains rubber cords to provide the suspension system and can be damaged by heat generated from welding on the bracket or tube.

1. Recommended wheel bearing lubrication specifications:

Grease

- Thickener Type: Lithium Complex
- Dropping Point:
  215 Degree C (419 Degree F) Minimum
- Consistency: NLGI No.2
- Additives:
  EP, Corrosion & Oxidation Inhibitors
- Viscosity Index: 80 Minimum

Approved Sources:

- Mobil Oil
  Mobilgrease HP, Mobilith AW2
- Exxon/Standard
  Ronex MP
- Kendall Refining Co.
  Kendall L-427
- Ashland Oil Co.
  Valvoline Multipurpose GM
- 76 Lubricants
  76 Multiplex EP
- Citgo Petroleum
  Lithoplex MP#2
- Mystik
  Mystik JT-6 Hi Temp Grease
- Pennzoil Product Co.
  Premium Wheel Bearing Grease 707L

WARNING!
It is important to NOT mix different types of grease thickeners. The grease that Torflex Axle uses has a Lithium Complex thickener. Mixing grease with a Barium, Calcium, Clay, or Polyurea soap based thickener agent will cause adverse affects. This may include causing the two greases to harden, separate, become acidic, or pose other hazards and damage to the bearings.

2. Grease hub bearings:
   a. Remove the rubber plug from the grease cap.
   b. Place a standard grease fitting on the fitting.
   c. Rotate the hub while adding grease.
   d. As new grease is pumped into the bearings, the old grease will flow out around the fitting.
   e. When the new grease is observed, remove the grease gun.
   f. Wipe off excess grease and replace rubber plug.
3. Whenever the hub is removed, inspect the seal to assure that it is not nicked or torn and is still capable of properly sealing the bearing cavity.
   a. To replace the seal:
   b. Pry the seal out of the hub with a screwdriver. Never drive the seal out with the inner bearing as you may damage the bearing.
   c. Tap the new seal into place using a clean wood block.
4. When adding grease, always use a hand grease gun. An automatic grease gun will destroy the hub's inner seal.
5. Hub removal
   a. Elevate and support the trailer by the frame.

CAUTION: You must follow the maintenance procedures to prevent damage to important structural components. Damage to certain structural components such as wheel bearings may lead to axle failure.

CAUTION: Be sure to wear safety glasses when removing or installing force fitted parts. Failure to comply may result in serious injury.

b. Remove the wheel.

c. Remove the cotter pin.

d. Unscrew the spindle nut (counterclockwise) and remove the spindle washer.

e. Remove the hub from the spindle, being careful not to allow the outer bearing cone to fall out. The inner bearing cone will be retained by the seal.

6. Bearing adjustment:

a. If the hub has been removed or bearing adjustment is required, the following procedure must be followed:

b. After placing the hub, bearing, washers, and spindle nut back on the axle spindle in reverse order, rotate the hub assembly slowly while tightening the spindle nut to approximately 68 Nm [50 lbs-ft.] (12" wrench or pliers with full hand force.).

c. Then loosen the spindle nut to remove the torque. Do not rotate the hub.

d. Finger tighten the spindle nut until just snug.

e. Back the spindle nut out slightly until the first castellation lines up with the cotter key hole and insert the cotter pin.

f. Bend over the cotter pin legs to secure the nut.

VII. Storage

1. Storage

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. Storage Preparation:

a. If the trailer is to be stored for an extended period of time or over the winter, it is important that the trailer be prepared properly.

b. Jack the trailer and place jack stands under the trailer frame so that the weight will be off the tires.

3. After Prolonged Storage

a. Remove wheels.

b. Inspect hubs.

c. Reinstall wheels.

d. Remove the jack stands.

VIII. Technical Specifications

1) Weight

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

3) Replacement Parts

For details on replacement parts, refer to the drawing package. The drawings include the part numbers and descriptions. See next page for most likely replacement items. For replacement parts, call customer service: 1-(888)-323-6374.

2) Dimensions

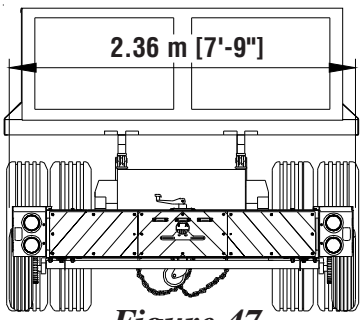


Figure 47

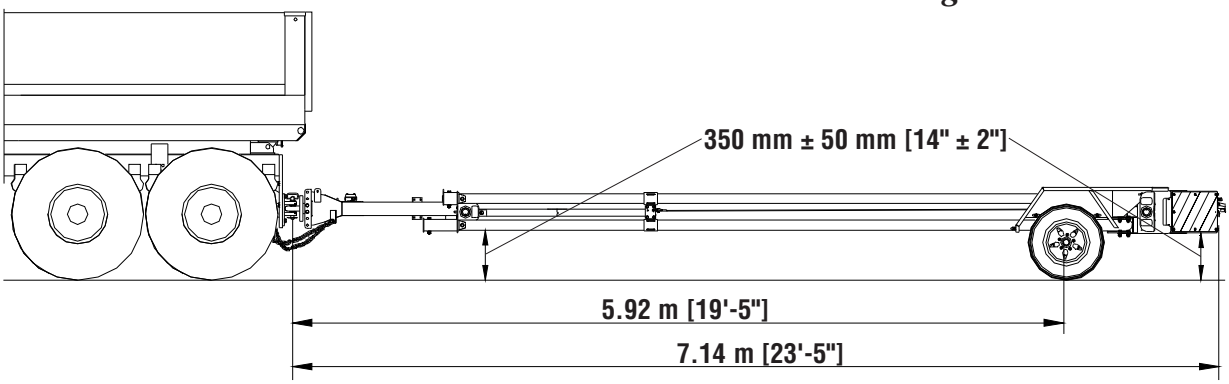


Figure 48

Repair Instructions

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

- Frame Rail Assy Part #3583004-0000
- Impact Head Assy (W/Collars) Part #3583001-0000
- X-Brace Assy Part #3583003-0000
- Galvanized Fender, Right Part #2783011-0000
- Galvanized Fender, Left Part #2783012-0000
- Axle Part #2715083-0000
- Wheel & Tire Part #2724246-0000

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

- Safety Chain Assy Part #2783009-0000
- Pintle Eye Part #2751106-1000
- Euro-hitch Part #2783016-0000
- Jack (W/Wheel) Part #3583026-0000
- LED Taillight Part #2757659-0000
- LED Round Amber Clearance light,10-30V Part #2757659-1000
- LED Round Red Clearance light,10-30V Part #2757440-1000
- LED Rectangular Red Marker light,10-30V Part #2757654-0000
- LED Rectangular Amber Marker light,10-30V Part #2757653-0000
- LED License Plate light, 12V Part #2757627-1000

I. Post Impact

Note: Only the correct parts manufactured by Energy Absorption Systems, Inc. should 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) Remove damaged components

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

> ***WARNING!***
> For proper System performance, only use frame rails supplied by Energy Absorption Systems, Inc. Failure to use the correct equipment could lead to fatigue or result in poor System performance.

Vorteq™ Trailer TMA Troubleshooting Guide

Safety Notes

1) Always wear eye protection when working on or around machinery or power tools, and while working with hydraulics.

2) In general, consult Energy Absorption Systems' Customer Service Department (see phone numbers on back cover) if problems associated with operating or repairing the TMA should arise. This guide is meant to be an aide for performing minor repairs, not a detailed repair manual.

Note: For any problems not listed here, contact Energy Absorption Systems.

Test Equipment

The following is a recommended list of test equipment required to troubleshoot electrical systems.

1. D.C. TEST LIGHT

A test light is a light bulb with one lead wired to an alligator clip and the other lead connected to a metal probe. It is used to check for the presence of a voltage in the electrical circuit. With the alligator clip grounded, the light glows when the probe comes into contact with a hot electrical component.

2. CONTINUITY LIGHT

A continuity light is like a test light but contains its own battery. It is used for testing electrical continuity when the components are not connected to a power source.

3. VOLT METER

A D.C. voltmeter can be used to troubleshoot voltage problems. Two common uses are: 1) Ground one probe while using the other to probe hot leads in search of the available voltage at the point where the second probe is connected. 2) Measure a voltage drop in a wire or component by connecting one probe to one end and the remaining probe to the other end of the item in question.

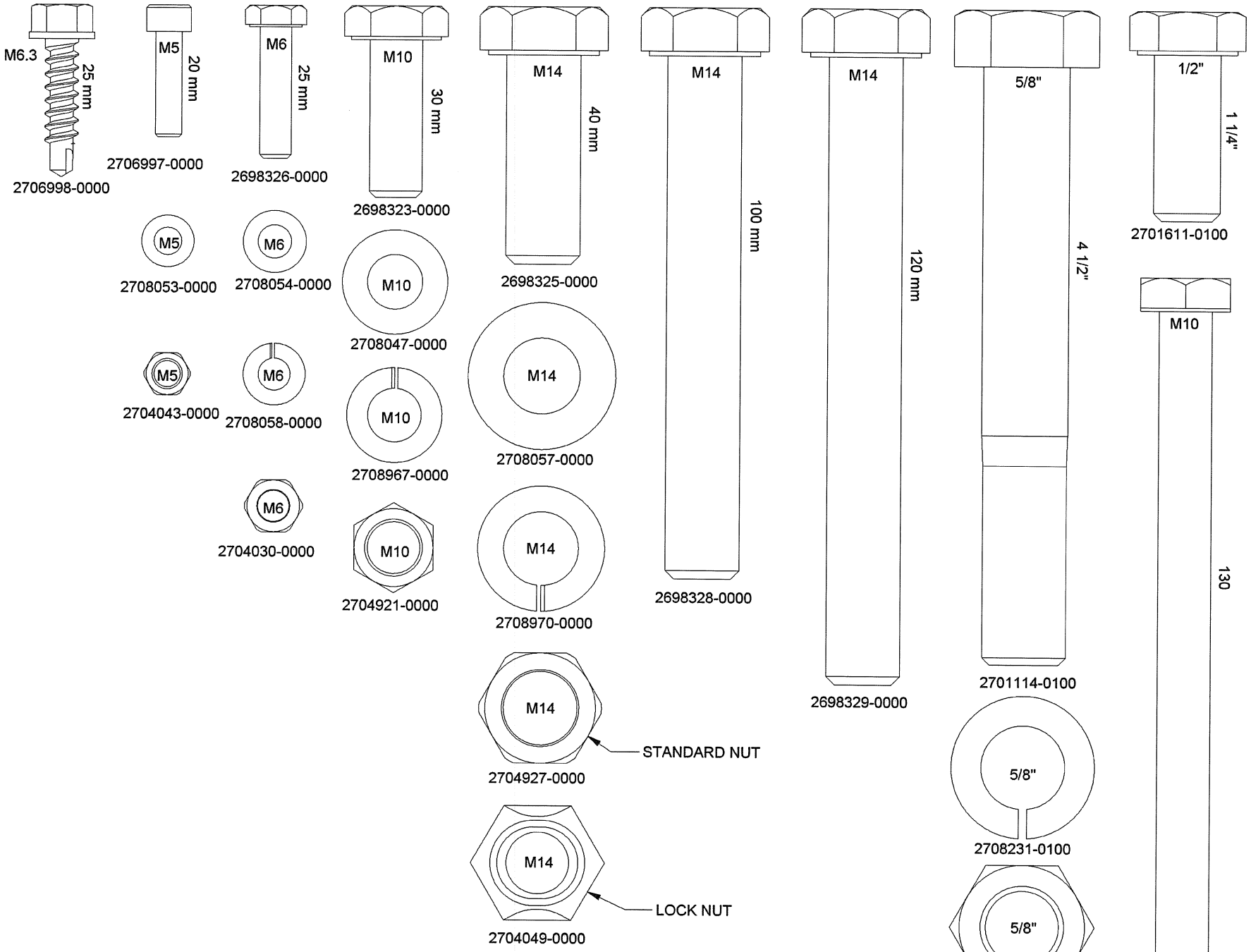
Electrical Problems

WARNING!
REMOVE ALL RINGS, WATCHES, JEWELRY, ETC. PRIOR TO DOING ANY ELECTRICAL WORK!

5. ELECTRICAL SHORTS OR OPEN CIRCUITS

A. Shorts occur when wires with power come in contact with a ground. A short will cause a fuse to blow or a wire to burn. Look for pinched, chafed or bare wires.

B. An open circuit is simply a break which prohibits current flow. Look for pinched or cut wires.



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