

SS180 TMA[®] **(Model 9182)**

Product Description **Assembly Manual**

Part No. 115359B

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TRINITY
HIGHWAY PRODUCTS
ENERGY ABSORPTION SYSTEMS

SS180 TMA[®] **(Model 9182)**

Product Description Assembly Manual



Important: These instructions are to be used only in conjunction with the assembly, maintenance, and repair of SS180 TMA[®] systems. 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 assembly parameters, contact the appropriate highway authority engineer. This system has been accepted 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 SS180 TMA[®] system information available to Energy Absorption Systems at the time of printing. We reserve the right to make changes at any time. Please contact Energy Absorption Systems to confirm that you are referring to the most current instructions.

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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 SS180 TMA[®] system, its assembly procedures, supporting documentation, and performance is always welcome. Additional information can be obtained from the contact information below:

Energy Absorption Systems:

Telephone:	(888) 323-6374 (USA Only) (214) 589-8140 (USA or International)
E-mail:	customerservice@energyabsorption.com
Internet: Energy Absorption Systems Trinity Highway Products, LLC	http://www.energyabsorption.com http://www.highwayguardrail.com

Important Introductory Notes

Proper assembly of the SS180 TMA[®] system 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 SS180 TMA[®] system. These instructions are to be used only in conjunction with the assembly of the SS180 TMA[®] system 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. If there are deviations, alterations, or departures from the assembly protocol specified in this Manual, the device may not perform as it was tested and accepted.

A set of product drawings will be supplied by Energy Absorption Systems, when requested. The 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 SS180 TMA[®] system is a Truck Mounted Attenuator (TMA) shown 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 system is impacted within the applicable NCHRP 350 criteria. The system mounts on the rear of a truck and may be used in stationary applications (e.g. as a truck block in a work zone) and mobile operations (e.g. striping, sweeping, plowing, etc.).



Important: Read safety instructions thoroughly and follow the assembly directions and suggested safe practices before assembling, maintaining, or repairing the SS180 TMA[®] system. Failure to follow this warning can result in serious injury or death to the worker and/or bystanders. It further compromises the acceptance of this system by the FHWA. Please keep these instructions for later use and reference by anyone involved in the assembly of the product. Use the traffic control plan set for the by the highway authority in charge of this work area.



Warning: Ensure that all of the SS180 TMA[®] system Warnings, Cautions, and Important Statements within the SS180 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 SS180 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 SS180 TMA[®] system.

Always use appropriate safety precautions when operating power equipment, mixing chemicals, and when moving heavy equipment or the SS180 TMA[®] system components. Gloves, safety goggles, safety toe shoes, 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 the safety symbols that appear in this SS180 TMA® Manual. Read the Manual for complete safety, assembly, operating, maintenance, repair, and service information.

Symbol

Meaning



Safety Alert Symbol: Indicates Danger, Warning, Important, or Caution. Failure to read and follow the Danger, Warning, Safety, or Caution indicators could result in serious injury or death to worker(s) and/or bystanders.

Warnings and Cautions

Read all instructions before assembling, maintaining, or repairing the SS180 TMA® system.



Warning: Do not assemble, maintain, or repair the SS180 TMA® system 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: Safety measures incorporating appropriate traffic control devices specified by the highway authority must be used to protect all personnel while at the assembly, maintenance, or repair site. 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 SS180 TMA® system for assembling, maintaining, or repairing the SS180 TMA® system. **Do not utilize or otherwise combine parts from other systems even if those systems are other Energy Absorption Systems or Trinity Highway Products 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 SS180 TMA® system 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 SS180 TMA® system 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 assembly 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 SS180 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. The SS180 TMA[®] is certified to the Test Level as shown below:

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

These FHWA directed 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.

Energy Absorption Systems does not represent nor warrant that the results of these controlled tests show that vehicle impacts with the products 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, 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 installed by or under the direction of Energy Absorption Systems or by third parties.

SS180 TMA[®] system is intended to be assembled, delineated, and maintained in accordance with specific State and Federal guidelines. Energy Absorption Systems offers a reflective delineator panel for its TMA line of products. However, the material is only intended to supplement delineation required by the Department of Transportation’s “Manual on Uniform Traffic Control Devices” (MUTCD). The appropriate highway authority approved engineer should be careful to properly select, assemble, and maintain the product. Careful evaluation of the 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 as soon as possible. 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 SS180 TMA[®] System

For the safety of the operator, the operator shall stand at the rear of the truck, on the curb side, (See Figure 2). When tilting the TMA, care shall be taken to stay clear of all moving parts.

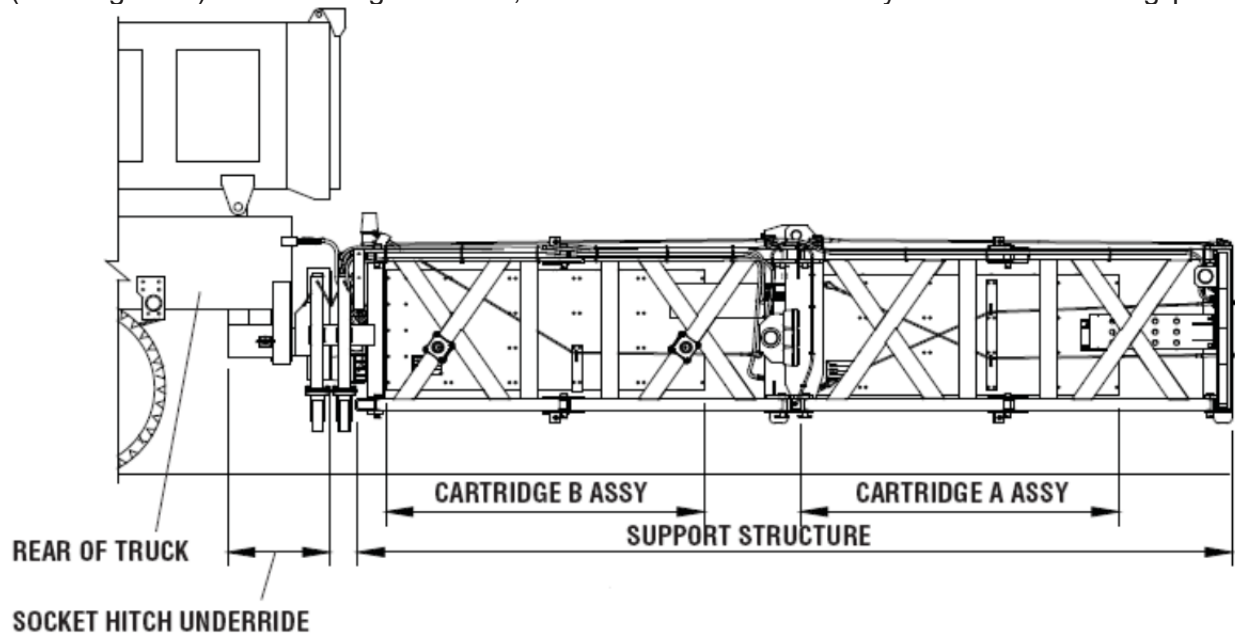


Figure 1

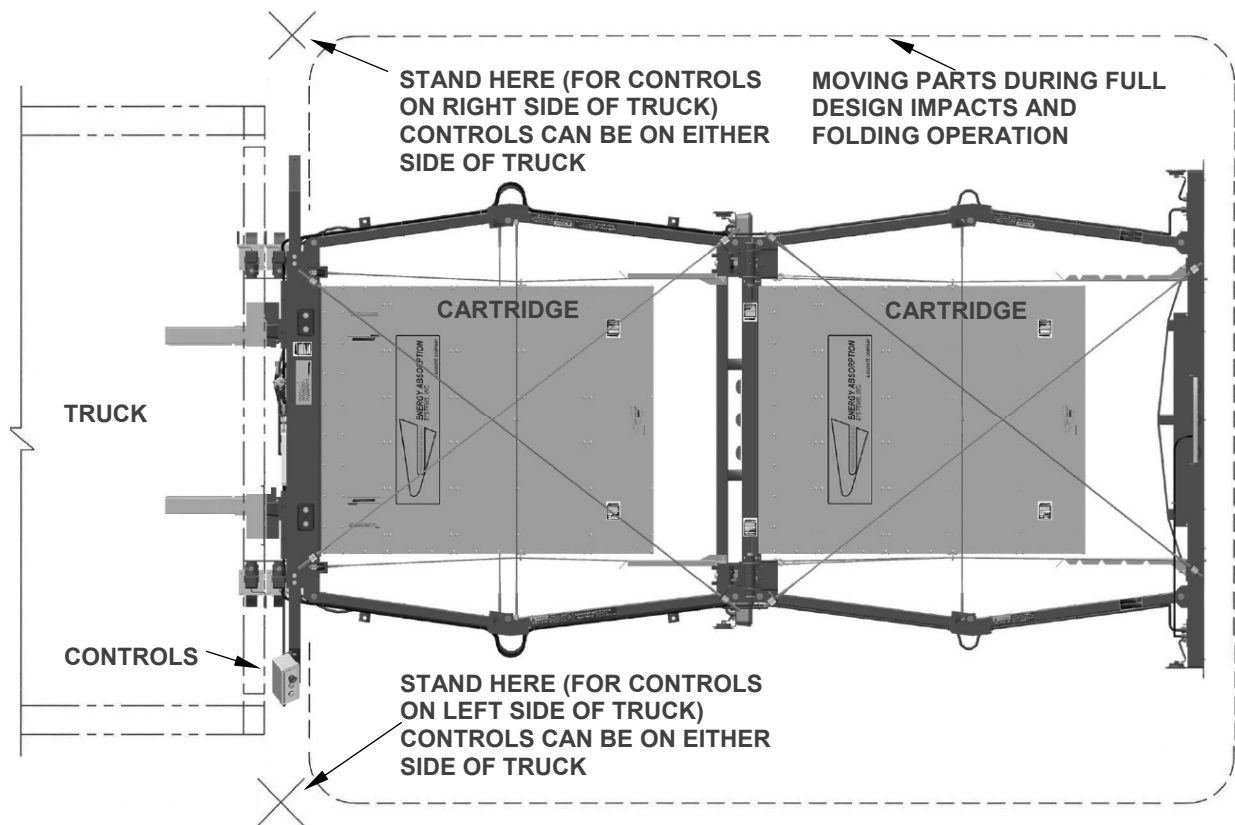


Figure 2

1. The TMA shall be rigidly fastened to the truck. In the horizontal position, the bottom of the TMA shall be 280 to 330 mm [11" to 13"] from the ground and level (See Figure 3). The TMA must be left in the unfolded position whenever possible. The TMA can only absorb the energy of an impacting vehicle when in the unfolded position.

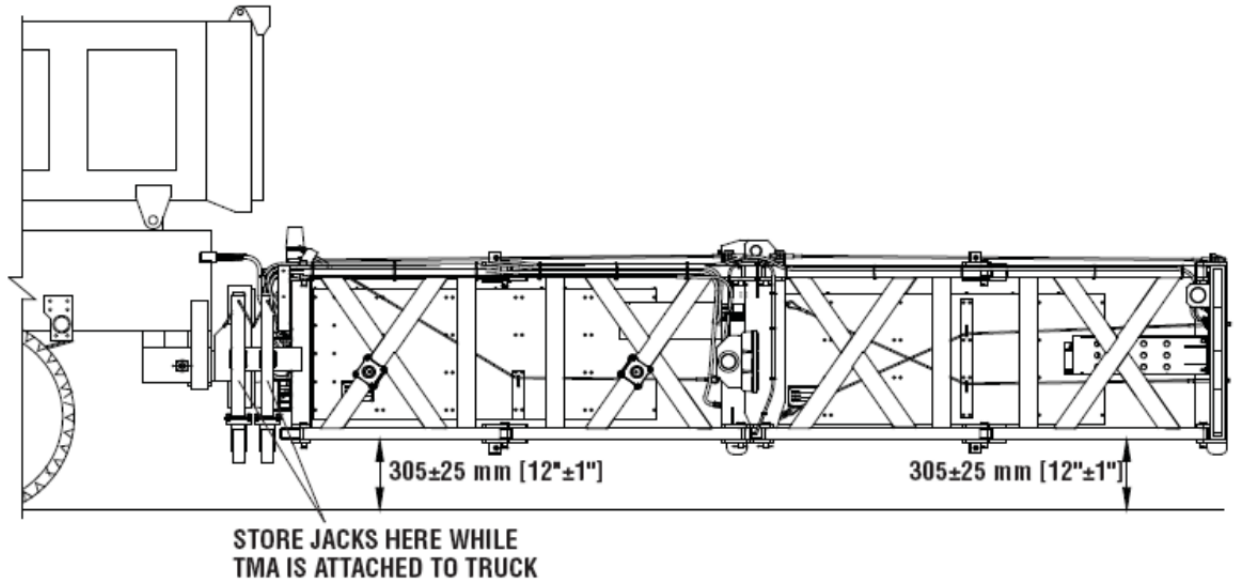


Figure 3

2. Jacks shall be used to support the TMA when it is detached from the truck. The Jacks must be stored while the TMA is attached to the truck. The Jacks can be stored on the brackets provided on the support frame (See Figure 3).
3. Make sure all pivot pins are in position and that all retaining pins are assembled correctly (See Figure 4).

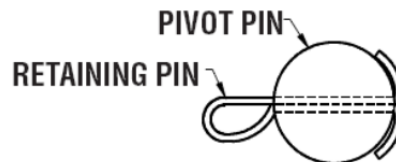


Figure 4

The SS180 TMA® shall be deployed in the unfolded position: At **all times** while operating as either a **Barrier Vehicle** or **Shadow Vehicle**.

The SS180 TMA® shall be in the **"unfolded"** position when: transporting short distances at a low speed, transporting at a speed much lower than adjacent traffic, and transporting in areas where vehicle ride characteristics and maneuverability are maintainable.

The SS180 TMA® shall be in the **"folded"** position when: transporting long distances at a high speed, transporting at a speed near the speed of adjacent traffic, and transporting under conditions of compromised maneuverability typically when the large turning radius clearance needed for the extended TMA is not safe.

4. The SS180 TMA[®] is intended to support its own weight and dissipate the kinetic energy of errant vehicles per NCHRP 350 criteria. Do not drag the TMA or place anything on its top or damage will result. Do not sit, stand or lean on any part of the TMA (See Figures 5 & 6).

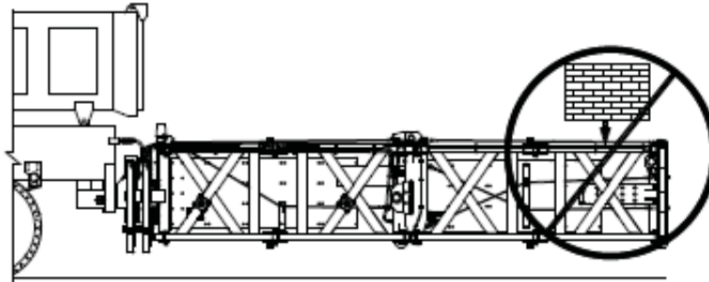


Figure 5

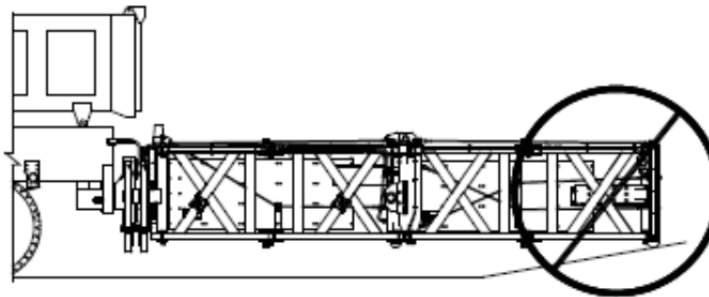


Figure 6

5. Before raising or lowering the TMA, the operator shall be fully trained as to its proper operation. All operators shall fully understand the contents of this Manual prior to operating the system. The operator should never stand under the TMA when it is raised, or attempting to lower it.
6. Folding the TMA provides the best maneuverability and driving characteristics. It is advisable, during restricted city driving and high-speed travel, to have the TMA folded to its storage position. Refer to local agency policies as required for additional guidance. Unfold the system either before, or as soon as possible after, entering a job site or beginning shadow vehicle operations. It is required that the support vehicle be stopped for TMA folding and unfolding.
7. Be sure all persons are standing clear before folding or unfolding the TMA. Be sure the system is stopped in full folded position before allowing anyone directly behind the folded system.

8. Ballast and other heavy objects **MUST BE ADEQUATELY ANCHORED** to the truck to prevent shifting during an impact (See Figure 7). The force exerted on the tie-down straps could be 20 times the weight of the ballast.

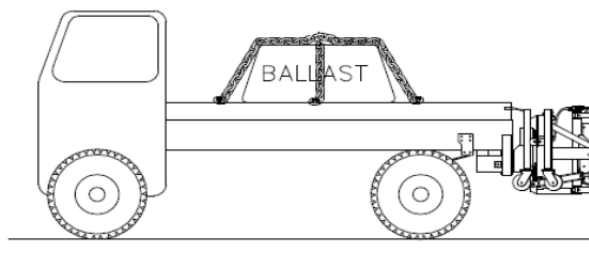


Figure 7

9. The agency responsible for the truck shall inspect it for adequate operator safety equipment (e.g., seat belts, head rests, etc.)
10. It is recommended that the SS180 TMA[®] be mounted to trucks weighing 7300 kg [16,090 lbs.] or greater.
11. Make sure that the performance and safety of the TMA is not impaired by damage or corrosion.



Warning: Failure to comply with these instructions can result in unpredictable TMA performance and possible personal injury or death. This TMA is intended to be used as an impact attenuator on the rear of trucks which meet the specifications for this system. The TMA shall not be used for any other purpose.

12. Regular maintenance of the TMA is critical for proper operation. Refer to the maintenance section of this Manual for additional information.

- Regular inspection of frame members, cartridges, and pins is necessary to ensure proper system performance.
- Regular inspection of hydraulic hoses is critical. A broken or damaged hose will cause the system to operate uncontrollably.



Warning: In the event of a hydraulic pressure loss during operation, release button and repair immediately (REPEAT whenever necessary).

- Keep electrical connections at the Pump Motor/Solenoid clean to prevent arcing. Clean any hydraulic spills or leakage to prevent bodily injury, fire, etc.
13. The driver shall be cautious while making turns with the TMA in the unfolded position. The TMA extends beyond the end of the truck and will swing wide while turning.
14. This system is an impact attenuator and is therefore used in high risk areas. Stay clear of traffic whenever possible. If the system is impacted, there may be fragments from the truck, TMA, or impacting vehicle that could cause injury.

15. The Hydraulic Assembly was designed to fold and unfold the TMA system as intended. Any other use may be hazardous to people or equipment.
- Do not use the system to push a load.
 - Do not use the raised end of the system to support any load.
 - Do not use any part of the TMA for towing or hauling a load. This could cause the lift mechanism to malfunction and permanently damage the system.
 - Do not use the TMA as a ladder.
16. The system must be in the unfolded position to perform properly during an impact. Do not leave the system raised, even slightly, when positioned at a job site.
17. Be sure the truck meets the minimum requirements for attaching a TMA (See the assembly section for further details).

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.

THE USE OF A TMA ON THE BACK OF A TRUCK

WILL:

- Gradually decelerate the impacting vehicle
- Help protect the occupants of the impacting vehicle
- Help protect the barrier/shadow vehicle occupants
- Help reduce damage to the barrier/shadow vehicle

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 + TMA weight: 8250 kg [18,190 lbs.] or greater

Assembly

Read and understand all instructions before beginning assembly.

The weight of the vehicle shall be between 7300 kg [16,090 lbs. or greater] for tested performance.

The system must be attached to the truck by welding parts to the frame. Do not weld forward of the rear leaf spring hangers to ensure structural integrity of frame. Use AWS qualified welders to ensure durable attachment of the TMA system. Disconnect the truck battery before any welding on truck or TMA.

The truck frame must be suitable and accessible for mounting a TMA system. If there are any questions regarding the suitability, contact the Customer Service Department for input as to your specific application.

1) Shipping list

Check the shipping list against the actual parts to make sure all items were received.

2) Assemble Necessary tools:

Recommended Tools

- Welding equipment (for 1/2" plate) GMAW or SMAW
- Cutting torch
- Hammer
- Drift pin or alignment pin (12" long)
- Tape measure
- 1/2" drive socket wrench w/6" extension
- 1/2" drive sockets (9/16", 1-1/8", 1-1/2", 9/16" deep well)
- Open end wrenches – (9/16", 1-1/8", 1-1/2")
- 12" crescent wrenches – (2)
- Marking implement (pencil, soap stone)
- Floor jack
- Drill for 13/16" diameter bit
- 13/16" diameter bit and pilot drill bit for same
- Center punch
- Torque wrench - 120 N-m [90 ft-lb]
- Hydraulic fluid (use Dexron® III fluid only) - Shipped with system
- Forklift
- Work gloves and other personal protection equipment as required
- Bubble level

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.

Preparation

3A) Assembly Must Be Performed On A Level Surface

The system's framework is very heavy and pivots in several areas. Until the framework is secured with the cables and trigger bolts, it can swing out in an approximate 4 m [13'] radius from either side of the truck. A level surface is required to maintain control of the framework when it is being extended to its full length.

3B) Truck ballast

Use a bubble level to verify that the truck is parked on a level surface. The truck shall be as close to the final driving weight as possible. If ballast must be added to achieve the 7300 kg [16,090 lbs.] minimum weight, add it at this time. Ballast must be properly anchored to the truck to keep it in place during an impact. Ideally, an adequately sized truck, that requires no ballast, should be used. Because the 943 kg [2080 lbs.] weight of the rearward protruding TMA is supported by the back of the shadow vehicle, care must be taken not to exceed the manufacturer's published maximum axle loads. To ensure that the driving characteristics of the vehicle are maintained, the manufacturer's recommended center-of-gravity zone shall be followed completely.

4) Check for interference

Before attempting to assemble the Underride, check for interference concerns.

The System folds such that the Impact Face is very close to the mounting location (See Figure 30 Page 33). If you are using something other than a standard Socket Receiver Hitch Underride refer to special instructions supplied with your assembly then skip to Step 8.

Temporarily position the Underride Socket Receiver under truck frame as shown (See Figure 12) and check for interference concerns. Interference concerns with tail lights, springs, dump bodies (in the folded or unfolded positions), etc., shall be corrected before proceeding.

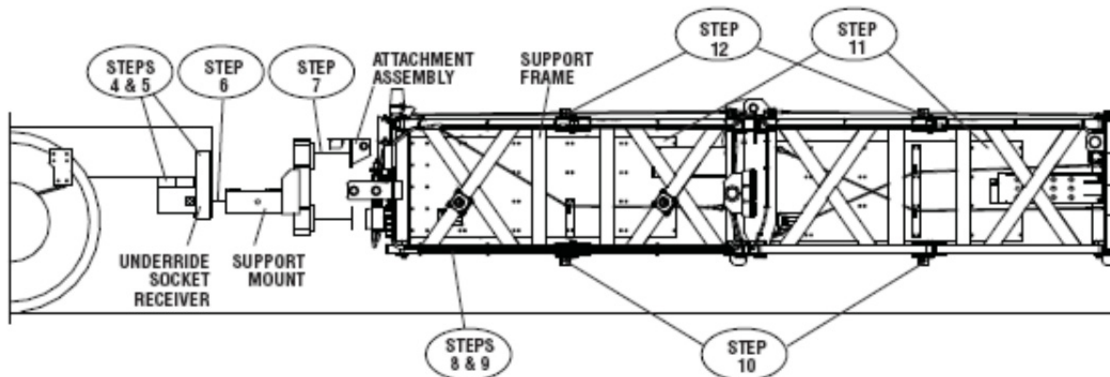


Figure 8

5) Underride Assembly

With the truck at its actual driving weight and parked on a level surface, measure the distance from the ground to the bottom of the truck frame. A distance of 711 ± 25 mm [28 ± 1 "] is required. Spacers may be added to the bottom of the frame to achieve this height (See Figure 11 Underride Assembly drawing on Page 15).

Note: The truck's springs may settle with the weight of the TMA, sometimes as much as 50 mm [2"]. Adjust the height to compensate for anticipated settling.

Measure distance from the back end of the frame forward to the rear-most leaf spring hanger. Look for any obstruction on the bottom of the frame that may interfere with the Socket Receiver. A minimum of 305 mm [12"] is required (See the Underride Assembly drawing on Page 15).

Position the Socket Receiver at the rear end of the frame so that the 76 x 387 mm [$3 \times 15\text{-}1/4$ "] flat bar is along the outside of the frame member and the Socket Receiver Assembly is flush with the end of frame. If spacers are required, weld them to the Socket Receiver and lap the Spacer Splices (pieces of 10 x 51 x 103 mm [$3/8 \times 2 \times 4$ "] flat bar) across the Socket Receiver and Spacer at the rear-most location (See Underride Assembly drawing). The top of the Socket Receiver shall be 711 ± 25 mm [28 ± 1 "] from the level ground for proper system height (See Figure 12).

Weld the Socket Receiver to the bottom of the truck frame with the 76 x 387 mm [$3 \times 15\text{-}1/4$ "] flat bar on the outer side of the frame (See Figure 11).

Note: All welding must be performed by a welder certified to AWS D14.3-82 or AWS D1.1 in accordance with the Underride drawing. Disconnect truck battery before welding.



Caution: The truck frame is high carbon steel. To avoid cracking, do not weld, or apply excessive heat, to the bottom flange, forward of rear-most leaf spring hangers.

Prime and paint all welded areas.

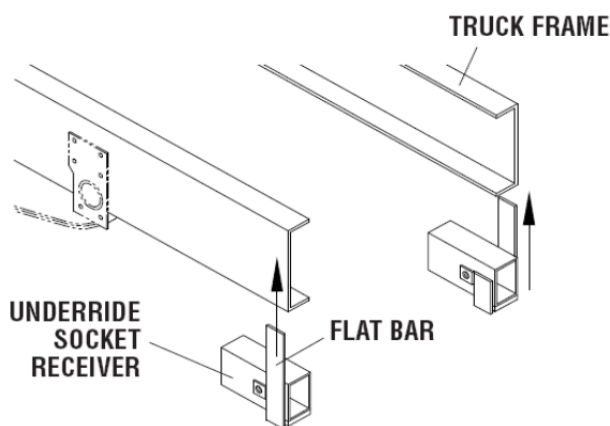


Figure 9

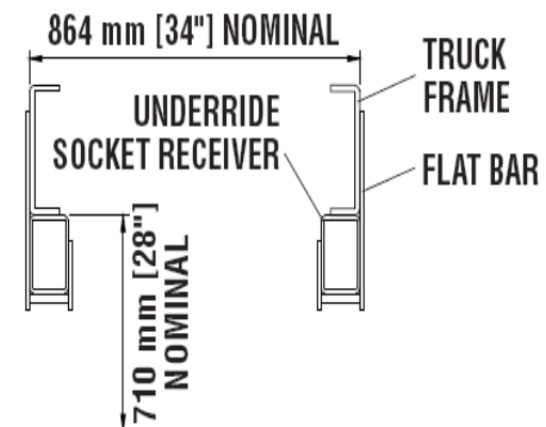
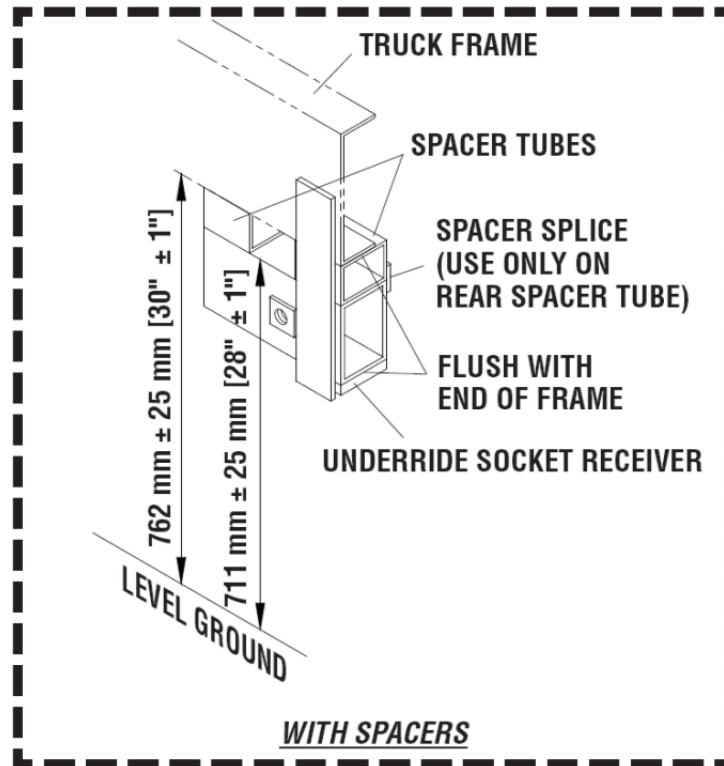


Figure 10



Note: Left and right Underride Socket Receivers must be parallel with each other and level.

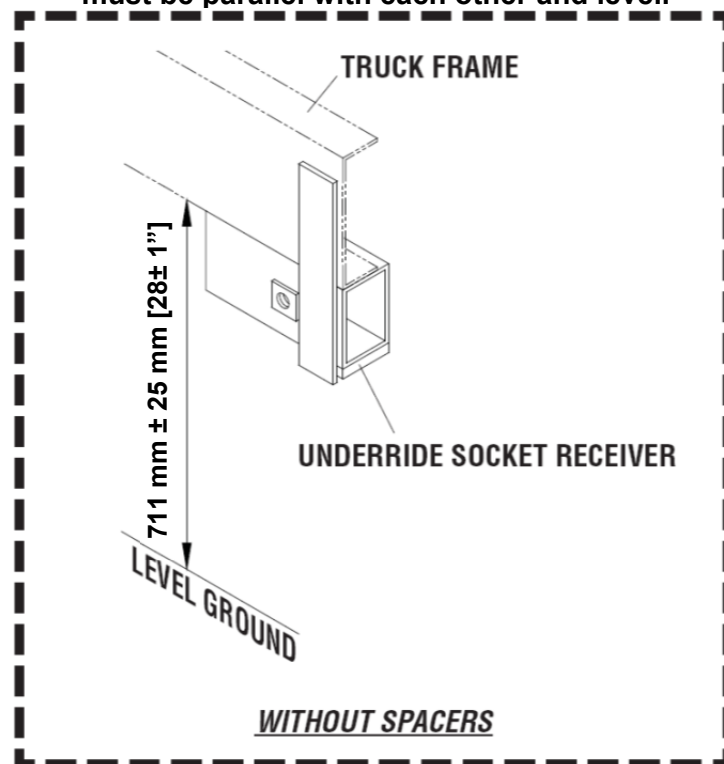


Figure 11 Socket Hitch (Left Side Shown)

6) Socket Hitch Assembly

Assemble the Socket Hitches and pin them into place using the 1" x 6-1/4" Hitch Pins and Retainer Pins shipped with the system.

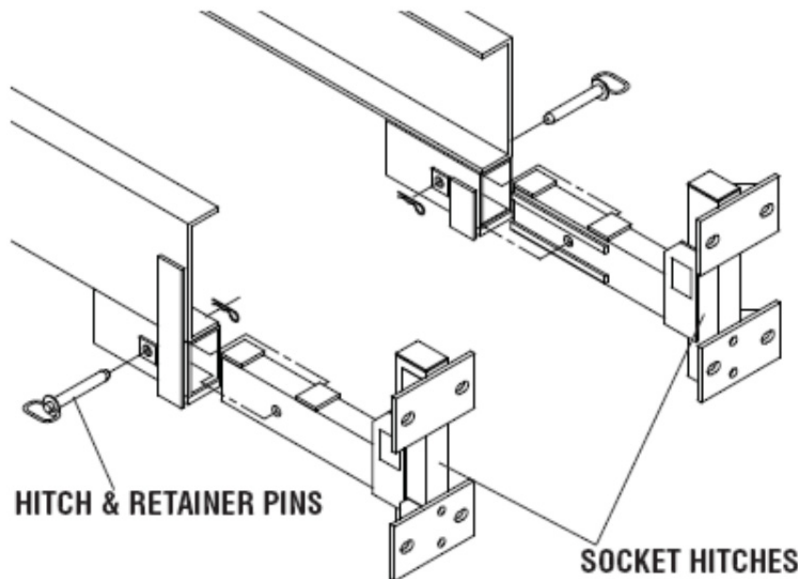


Figure 12

7) Mount the Support Brackets to Socket Receivers

Mount the Support Brackets to the Socket Hitches as shown in Figure 13. Shims are used to level the system. It is recommended that 1/2" Shims be used initially. This may be adjusted once the system is assembled.

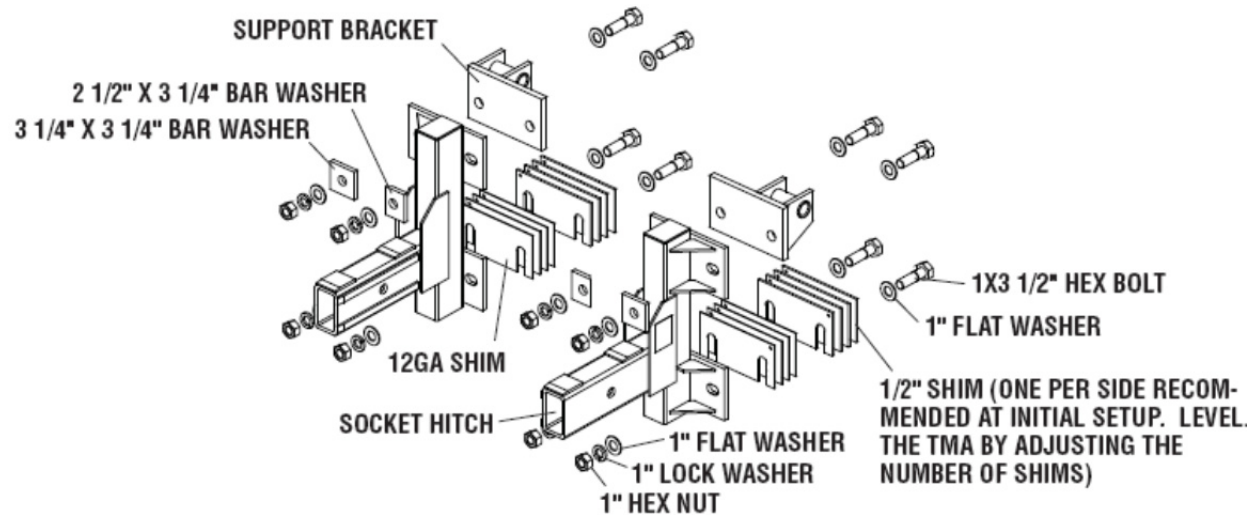


Figure 13

8) Attach the Support Frame / Backup to the Attachment Assembly

Move the system to the truck and pin the Support Frame/Backup Assembly to the Support Brackets (See Figure 14). The system is to be assembled while the Support Frame is collapsed and forklift slings are supporting the system. Use the upper set of mounting holes for the attachment.

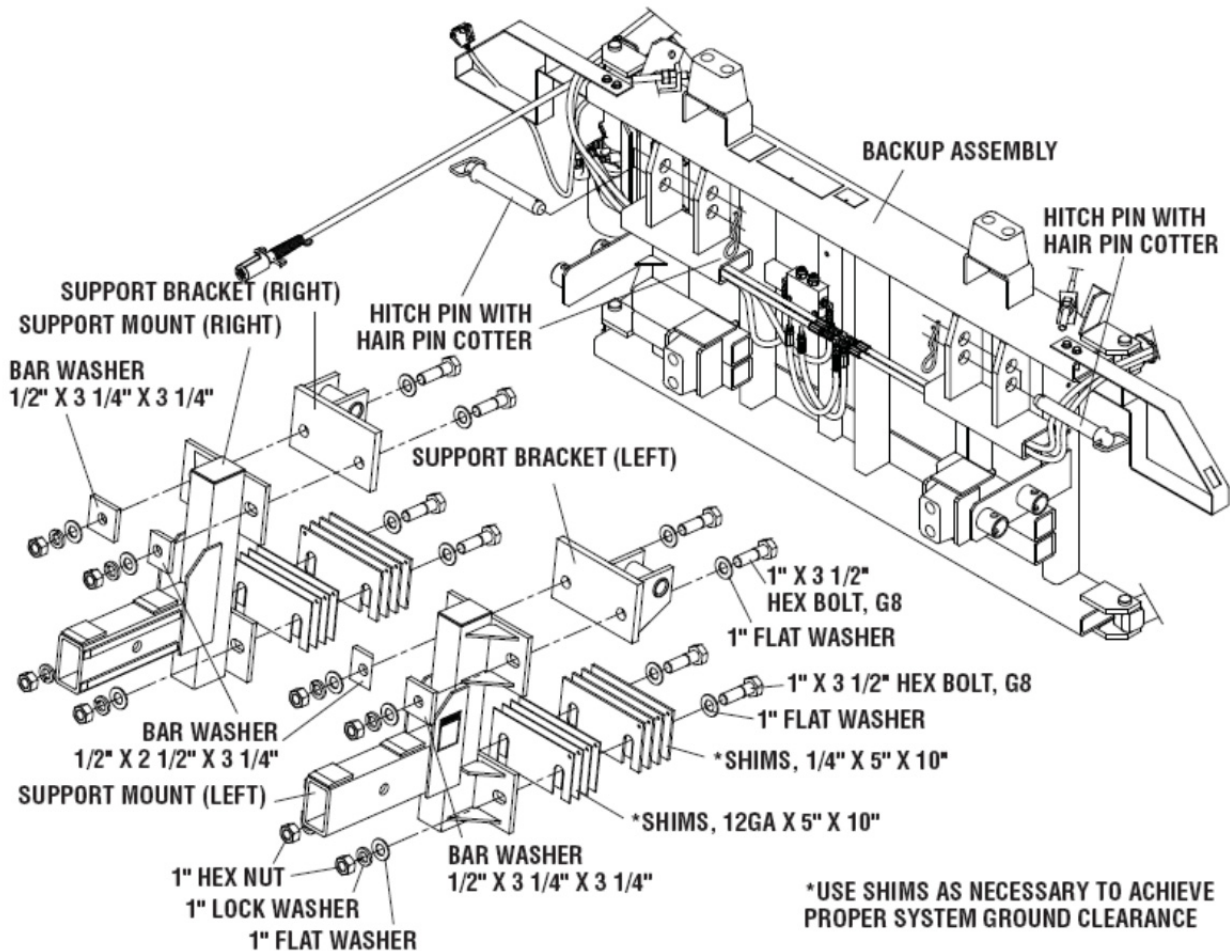


Figure 14

9) Extend the Support Frame

With the TMA pinned to Attachment Assembly, slowly and evenly pull the frame out to its full extent.



Warning: Even when supported by forklift, frame can be unwieldy. Use extreme care.



Warning: Until the cables are assembled, the system may shift to one side.

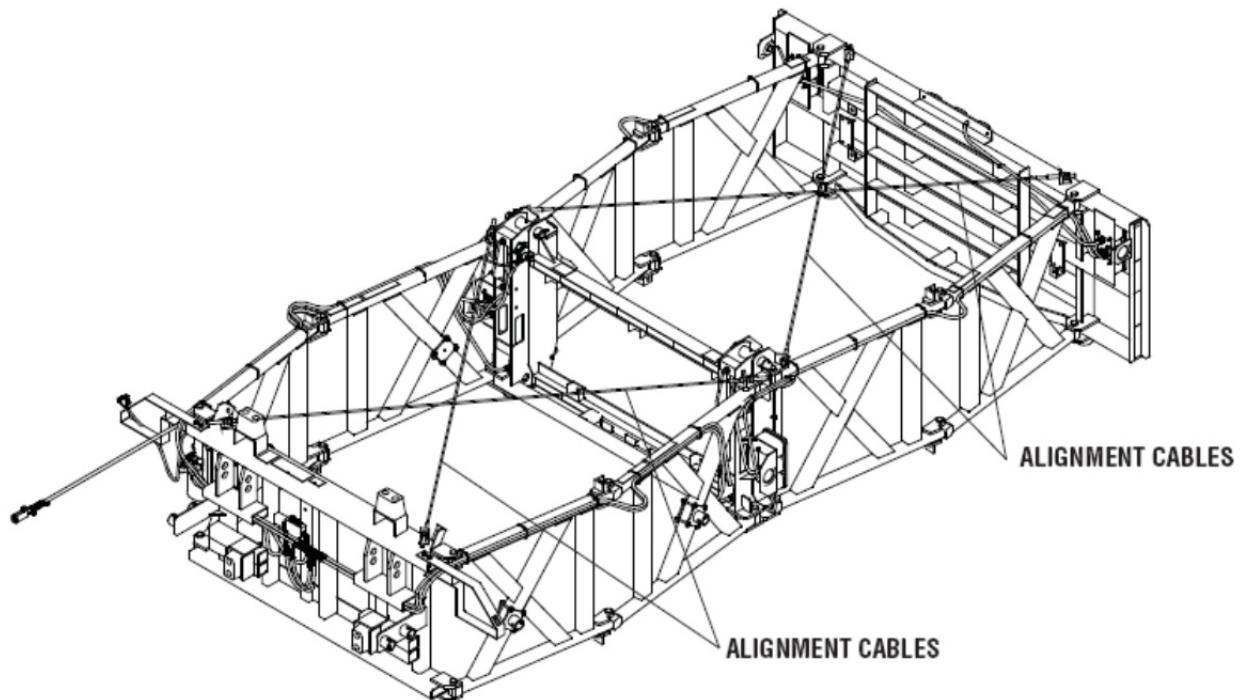


Figure 15

10) Assemble the Bottom Release Cable across the Arm Assemblies

Verify that the Support Frame is fully extended. Assemble the Bottom Release Cable across Arm Assemblies (See Figure 16). Torque the nuts to 34 ± 3 N-m (25 ± 2 ft-lb/ 300 ± 24 in-lb) making sure that roughly an equal amount of threads protrude from nuts on both ends of cable. Lock cable in place using remaining fasteners as "jam" nuts.

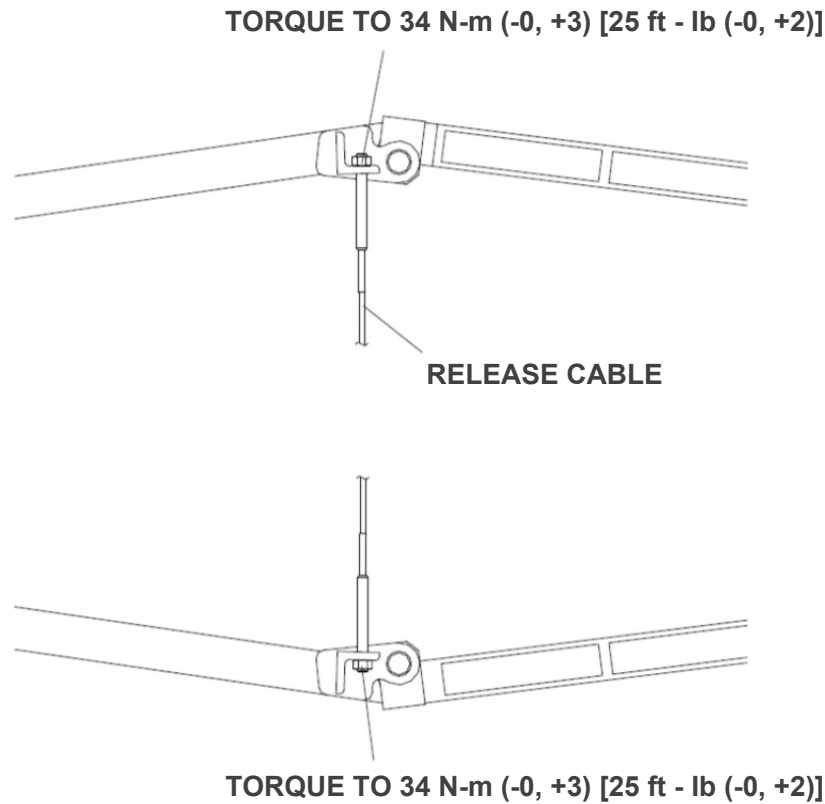


Figure 16

11) Assemble Cartridges

Remove one end of each Alignment Cable from the TMA and set aside to clear the top side of each bay. Using a forklift and sling, place Cartridge B in position and secure it using the flat washers, lock washers and nuts provided. Torque the nuts to 120 ± 7 N-m (90 ± 5 ft-lb / 1080 ± 30 in-lb). Repeat procedure for Cartridge A (See Figure 17).

12) Assemble the Top Release Cables across the Arm Assemblies

Verify that the Support Frame is extended as far as it will go. Assemble the Bottom Release Cable across Arm Assemblies (See Figure 16). Torque the nuts to 34 ± 3 N-m (25 ± 2 ft-lb / 300 ± 24 in-lb) making sure that roughly an equal amount of threads protrude from nuts on both ends of cable. Lock cable in place using remaining fasteners as “jam” nuts.

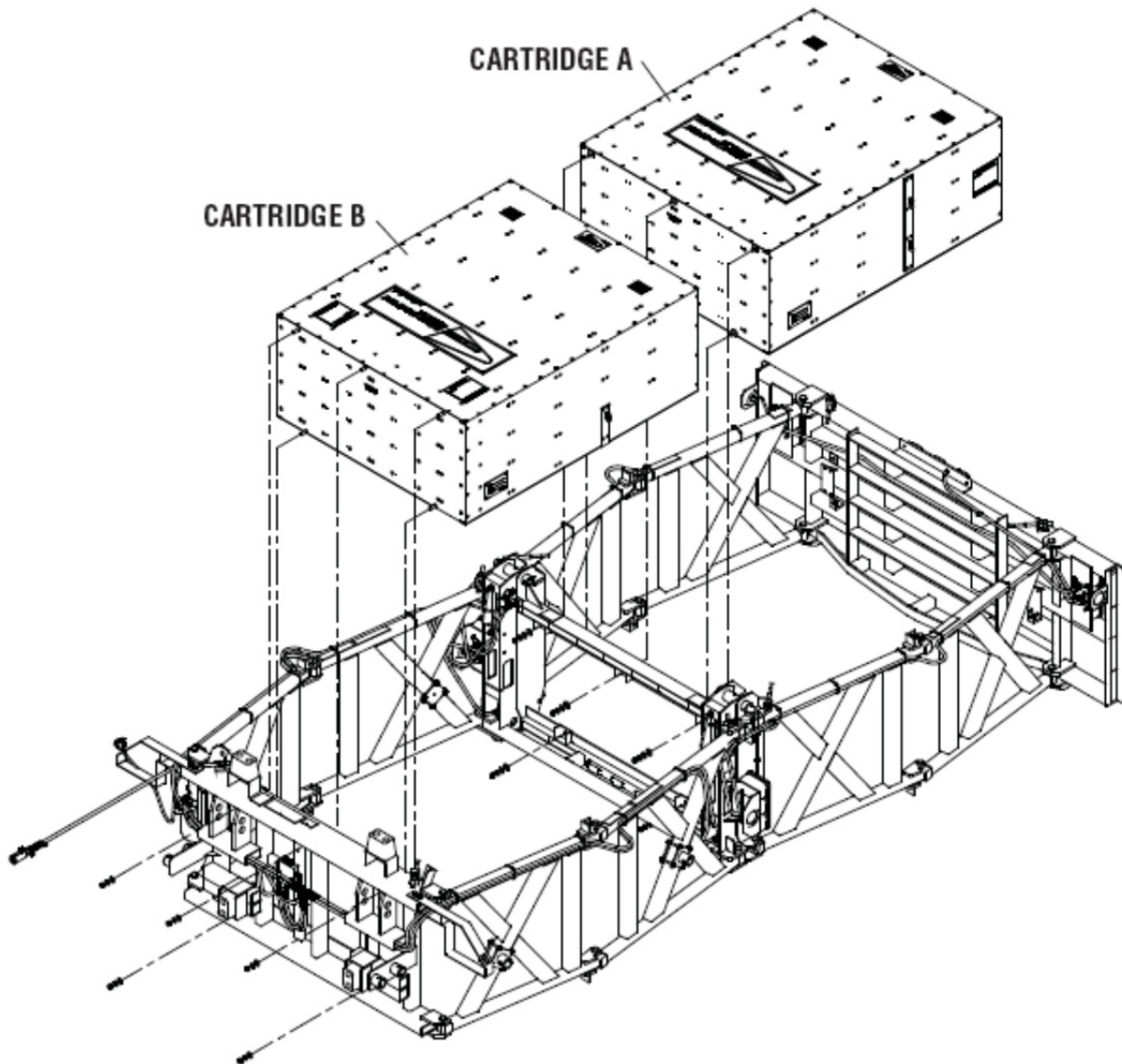


Figure 17

13) Assemble and Adjust the Alignment Cables

There are four Alignment Cables (two for each Bay). Attach the Alignment Cables as shown in Figure 18. Measure the diagonals of each bay and adjust the cables so that the diagonal measurements in each bay are the same within the given tolerance ($A = B \pm 5 \text{ mm}$ [$3/16"$], $C = D \pm 5 \text{ mm}$ [$3/16"$]) and taut. Cables are "taut" when they deflect 38 mm – 50 mm [$1 \frac{1}{2}"$ -2"] when pressed by hand at the midpoint. Lock each cable in place using the second nut as a "jam nut".

14) Assemble and Tension the Cartridge Support Cables

There are six Cartridge Support Cables. Assemble the cables as shown in Figure 19.

Attach thimble end of all Cartridge Support Cables to the intermediate frame using the provided shackles. Pass the stud end of the cable through the corresponding Cartridge Chain Loop, and attach as shown in Figure 19 using a die spring, washer and nuts.

To properly tension the Cartridge Support Cables, tighten the first nut on one cable until all slack is removed, then tighten it until the tensioning springs have been compressed to $32 \text{ mm} \pm 2 \text{ mm}$ [$1 \frac{1}{4}" \pm 1/16"$] in height. Lock this nut in place with the second "jam" nut. Repeat this procedure with the other cables.

SOCKET HITCHES NOT
SHOWN FOR CLARITY

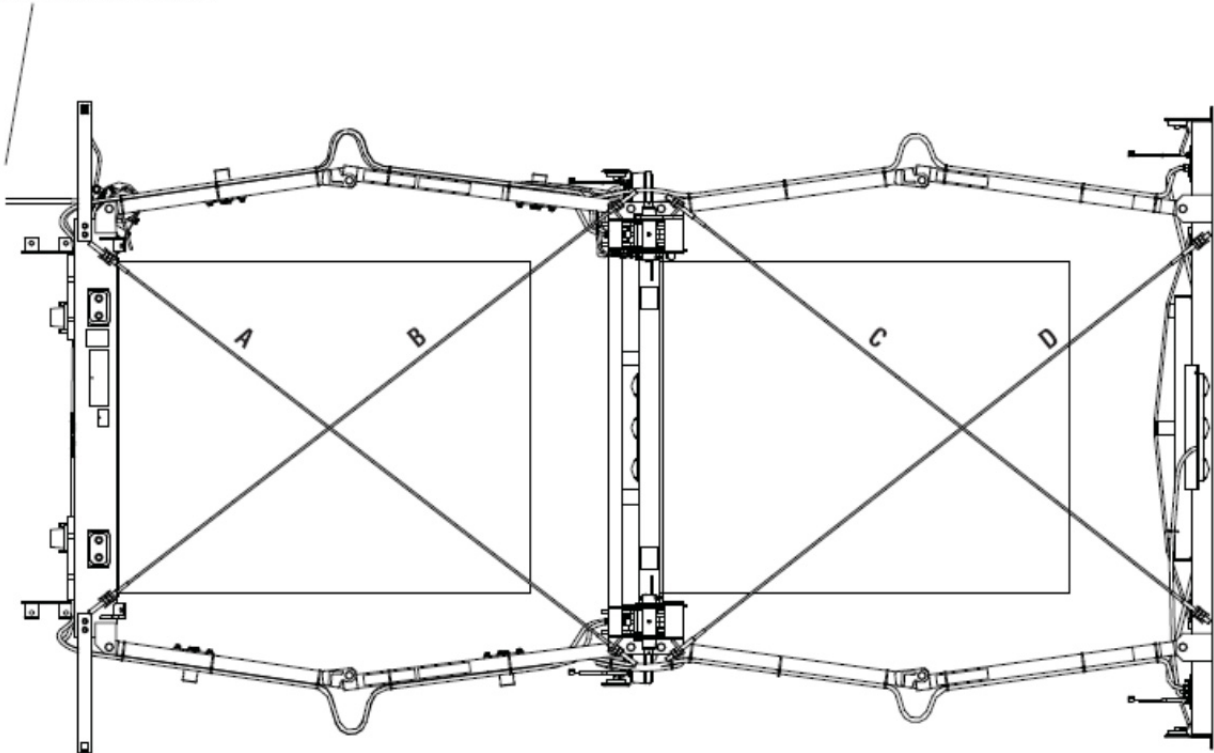


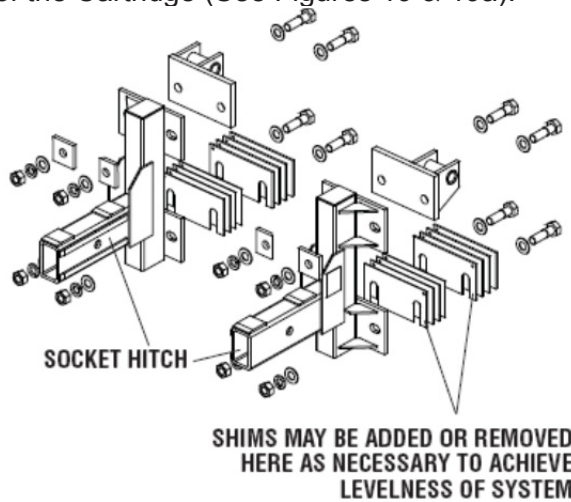
Figure 18

15) Assemble Side Guides

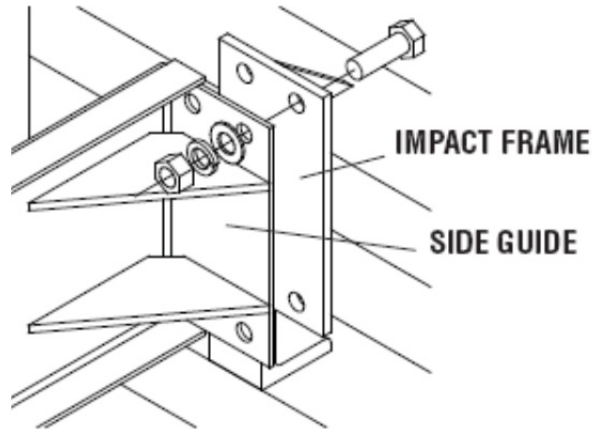
There are four Side Guides, two for Bay 1 and two for Bay 2. Attach guides as shown in Detail 19b and tighten bolts.

16) Adjust the Height and Levelness of the System Frame

Verify that the system frame is 305 ± 25 mm [$12'' \pm 1''$] from the ground at the front and rear of the system. It may be necessary to add shims to the Socket Hitch in order to adjust the levelness of the Cartridge (See Figures 19 & 19a).



Detail 19a



Detail 19b

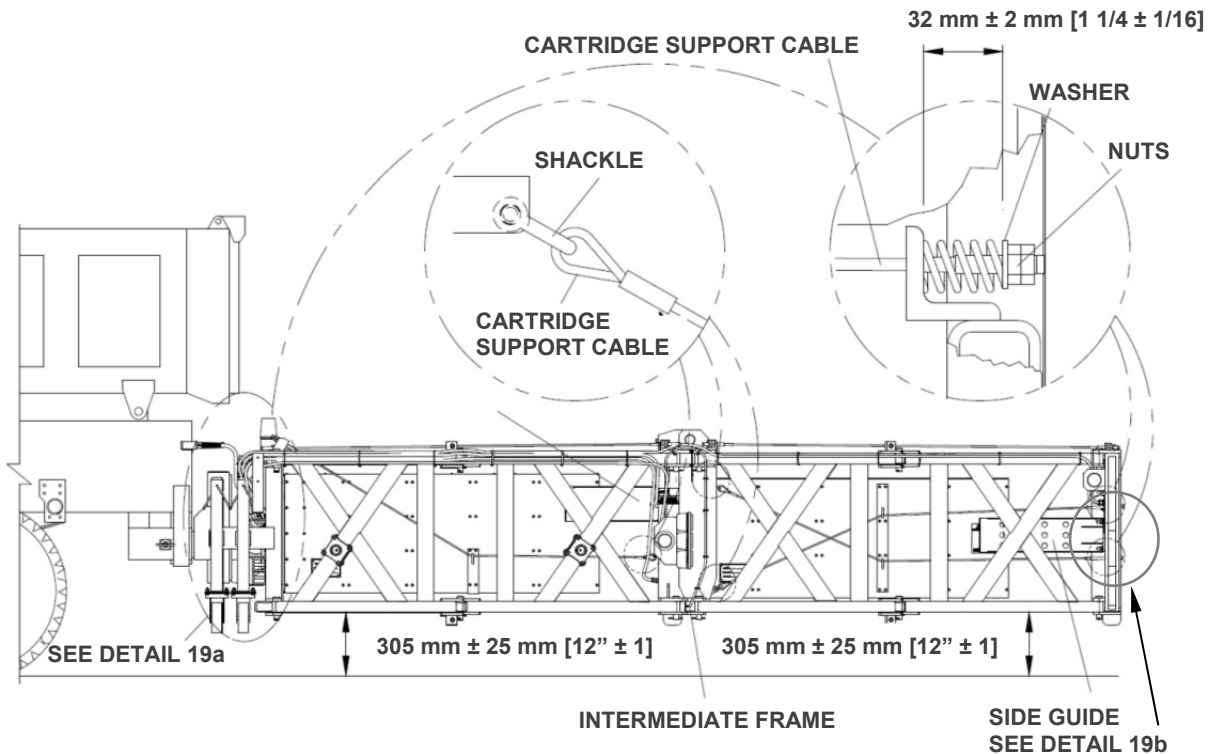


Figure 19

17) Connect the Lights and Controls

Locate the female TMA Socket Connector in a convenient location on the truck, so that lifting or lowering the TMA will not damage the electrical cable. Make sure that the electrical cord on the TMA can reach this location.

For support vehicles with combined tail and clearance lights, connect a jumper between pins 2 and 6 on the backside of the male TMA plug connector (see VIEW A-A Figure 20). Connect the 7-pin plug to the socket on the truck.

The truck battery must be of the proper voltage. The SS180 TMA[®] is available in 12 volt and 24 volt versions. Be sure the system and truck are compatible. Be sure to use standard safety practices when attaching the battery cables (e.g. do not let the ends of the cables touch, etc). Do not run the battery cables around sharp corners or metal work, or in other areas that would pinch or cut the cables. Connect the battery cable to the pump motor (see the Hydraulic Assembly in drawing package).

The controls at the rear of the truck shall be mounted to the Support Frame, on the non-traffic side (side closest to the curb). If they are not, move the rocker switch to the other side by compressing the four tabs on the back side of the switch towards the switch body. Securely fasten cable ties to secure any loose wiring to the TMA frame. Mount the cab switch box inside the cab within easy reach of the driver and plug in the cab switch box at the mating connector of the TMA.

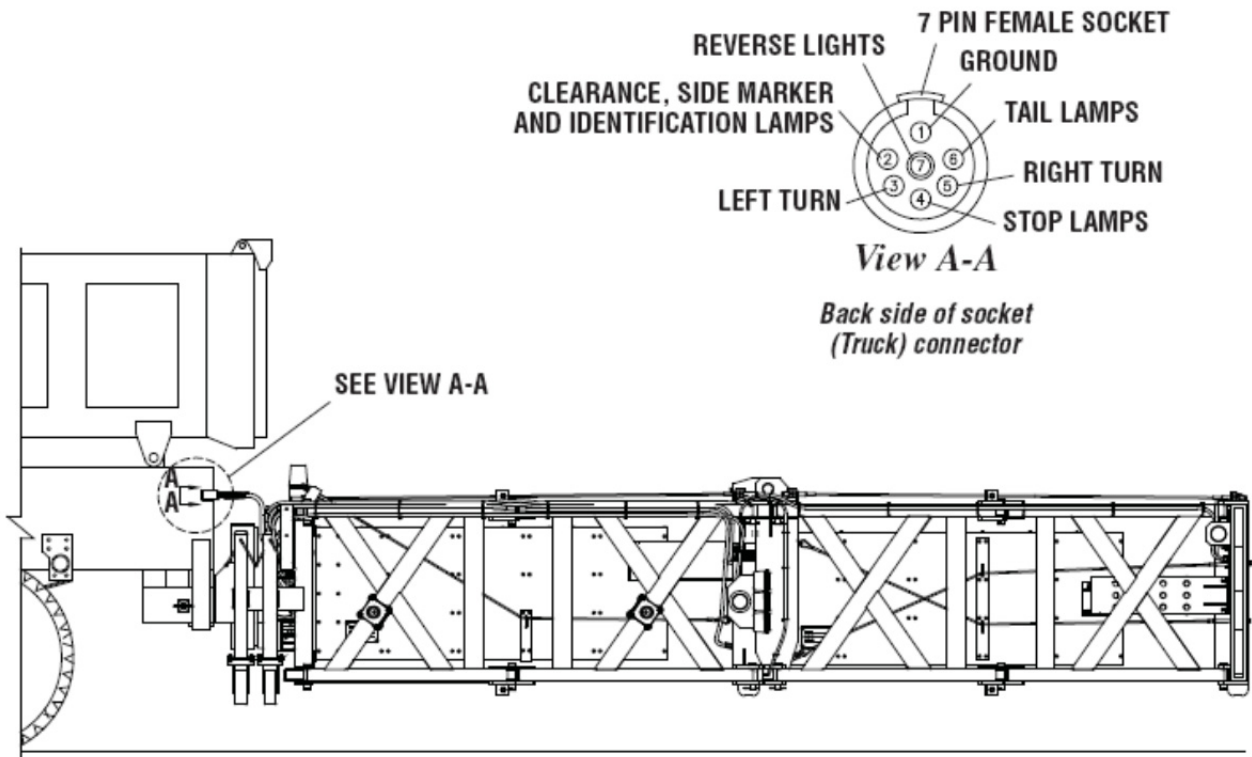


Figure 20

18) Check the Hydraulic System

The Hydraulic Assembly is pre-assembled and tested for operation and leaks before shipping. The pump is wired as shown on the Hydraulic Assembly drawing. Before operating the system, remove the vent plug from the fill port of the hydraulic pumps reservoir and check to see if the reservoir is full (the fluid should be just visible). Add only Dexron® III ATF fluid if it is not. Do not overfill. Replace the vent plug in the filler port. (Be careful not to cross thread it.)

Read Operation Instructions (See Page 27; Folding and Unfolding the System). Making sure all electrical and hydraulic lines will not be damaged, use the switch at the rear of the truck to fold and unfold the system twice. This purges air from the system and verifies operation.

Also, cycle the system using the cab switches to verify proper operation.

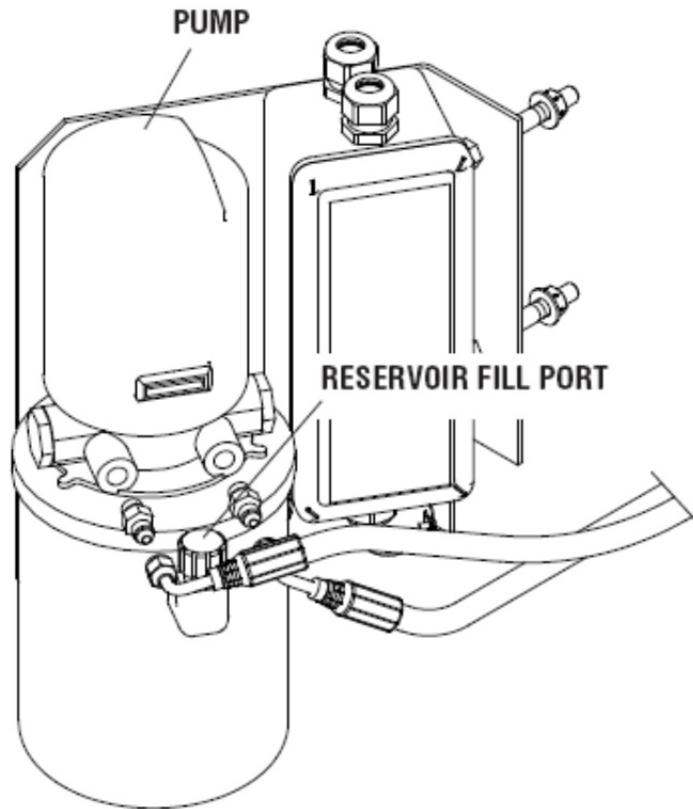


Figure 21

Note: Continuous operation may run down truck battery or damage pump.



Important: Ensure both positive and ground cables are connected directly from pump to battery. **DO NOT** rely on chassis or frame for proper grounding.

19) Store the Jacks

The Jacks are provided to facilitate the attachment and removal of a folded SS180 TMA[®] from the truck. Retrieve Jacks set aside earlier and place them in the storage positions as shown in Figure 22.

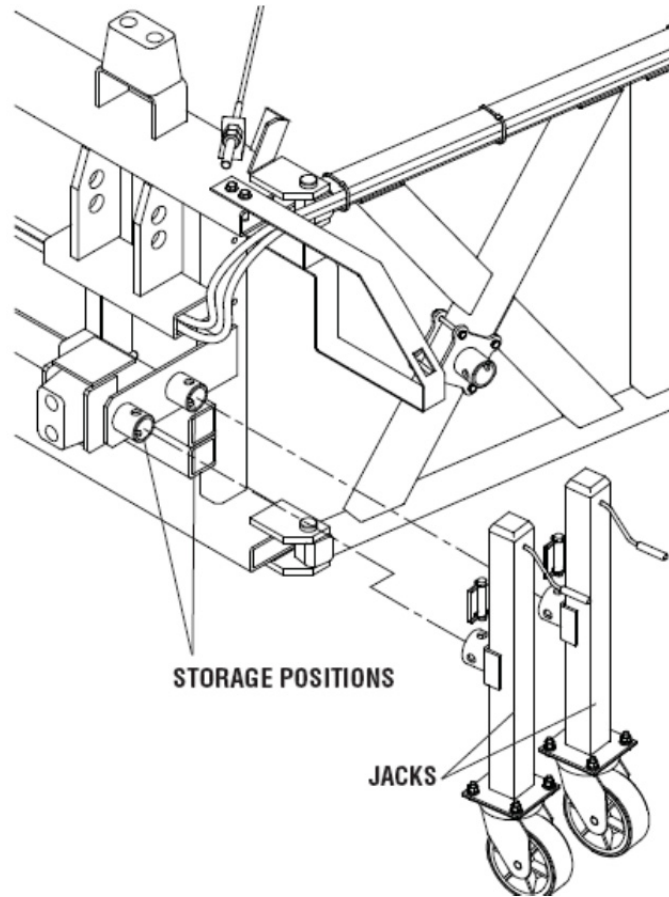


Figure 22



Warning: Jacks are to be removed from Arm Assemblies and stored when TMA is in service.

20) Check System Lights for Proper Operation

Verify that all the turn / stop / tail / reverse lights are working properly. Replace any bulbs that are out.

There are two light circuits on the SS180 TMA[®]. Verify both circuits are operational.

Raise the system to the folded position and verify secondary lights are working.

With the system unfolded, lights on the Impact Face will be on and lights on the Mid-Frame will be off.

With the system folded, the lights on the Mid-Frame will be on and the lights on the Impact Face will be off.

21) Verify the Position of the Hydraulic/Electrical Lines

Check the location of all the hydraulic and electrical lines to be sure they will not be damaged during folding and unfolding of the system.

22) Final Check of System

Check the tightness of all of the fasteners. Double check the height and levelness of the system.

23) Ready to Use

The SS180 TMA[®] system is now ready for use. To ensure proper and safe operation, all SS180 TMA[®] users shall be given operating and safety training, as given in this Manual and as specified by the owner and local regulations.

Operation Instructions

Before operating the SS180 TMA[®], thoroughly read and understand all Operation Instructions and safety sections of this Manual. Verify that the system is properly assembled and in working order. For proper impact performance, the TMA must be equipped with one SS180 TMA[®] Type A Cartridge and one SS180 TMA[®] Type B Cartridge, in their proper positions as shown in Figure 17 on Page 20.

The SS180 TMA[®] has been equipped with a Hydraulic Pump that can be used to fold the TMA from its extended position. The controls are located on one side of the Support Frame. A set of controls may also be located in the truck cab. The controls on the Support Frame shall be mounted to the non-traffic side of the system. To change the mounting, see "Connect the Lights and Controls" section in this Manual.

While folding or unfolding the SS180 TMA[®] from outside the cab, the operator must stand on the non-traffic side of the truck. Always stay clear of moving parts. Never stand underneath the TMA.

Folding and Unfolding the System



Caution: Make sure the area above and behind the system is clear of all objects before proceeding. **Under no circumstances shall anyone be allowed behind the system when it is being folded or unfolded.** When operating from the cab, always be aware of objects behind and above the SS180 TMA[®].

Folding and unfolding the system: The Rocker Switch operates by pushing and holding the switch down on the end towards the desired direction of unfolded or folded.

The system will not serve its intended purpose when folded. The SS180 TMA[®] must be unfolded during shadow or barrier vehicle operations. The truck and SS180 TMA[®] combination offers the best driving characteristics when folded. Driving with the system in the folded position is permissible and recommended during restricted city driving and extended high-speed travel. Be sure to unfold the system either before, or as soon as possible after, entering into a site. The support vehicle shall be stopped for SS180 TMA[®] folding and unfolding.

The SS180 TMA[®] shall only be operated while the truck is at rest. Jarring or severe bumping of the system while folding or unfolding will cause damage to the system or injury to the operator.

The pump is not intended for continuous operation. The pumps motor has a thermal cut-out switch to protect the motor from overheating. The thermal cut-out switch will reset when the temperature of the electric motor has cooled down.

Maintenance

Before performing any maintenance on the SS180 TMA[®], thoroughly read and understand the Maintenance Section and the Safety Section of this Manual.

I. Routine Maintenance

Description

1. Height and Levelness - The height and levelness of the system is important to its impact performance. Check regularly and adjust as necessary (See Figure 23).

Interval

A/R

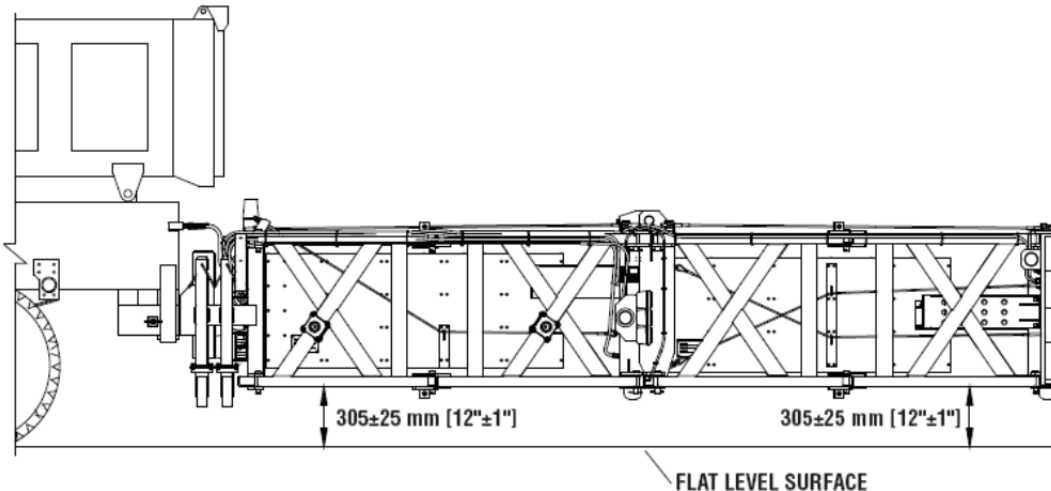


Figure 23

2. Fasteners - Check the tightness of the fasteners. See the drawings for the locations of the fasteners. Be sure to check bolts attaching the cartridges to the support structure. Lock washers shall be fully compressed.

1 month

3. Cables – (System unfolded)

A. Cartridge Support Cables - The spring length shall be $32\text{mm} \pm 2\text{mm}$ [$1\frac{1}{4}'' \pm 1/16$] (See Figure 19 on Page 22).

1st day,
1st week,
then
1 month

B. Alignment Cables - Crossing cables are of equal length $\pm 5\text{mm}$ ($3/16''$) and deflect $38\text{-}50\text{mm}$ [$1\frac{1}{2}\text{-}2''$] (See Page 21).

C. Release Cables - Torqued to $34\pm 3\text{ N}\cdot\text{m}$ ($25\text{ ft}\cdot\text{lb}$ $(-0, +2)$) (See Page 19).

4. Jacks - Check the condition of the wheels on the Jacks.

1 month

5. Lights - Replace the light bulbs.

A/R

6. Pins - Check all pins to make sure they are held in position by a retaining pin as intended.

Each use

7. Lubrication - Lubricate as described in the Lubrication Section (Maintenance Section - III) of the Manual.

Varies –
see
section

Description	Interval
8. <u>Hydraulic Pump</u> – Clean the outside of the Hydraulic Pump as required. Check fluid level and electrical connections. Remove all residue or debris on or around the pump.	1 month
9. <u>Hydraulic Rams</u> – Clean the Hydraulic Rams. Remove all residue or debris on or around the rams.	1 month
10. <u>Hydraulic Hoses</u> – Check all Hydraulic Hoses for damage, leaks or cracks. Replace damaged or leaking hoses.	Each use
11. <u>Clean System</u> - Clean the system frame, Cartridges and Impact Face from dirt and salt. Always check lubrication after cleaning.	1 month & each use when salt & / or snow are present

II. Detaching and Attaching the System to the Truck

1) Detaching the System from the Truck

Be sure the TMA and the truck are on level ground

- A. Ensure the system is in the folded position.
- B. Remove the Jacks from the storage location and assemble them on the Active Mounts as shown in Figures 24 & 25.
- C. Extend the Jacks until the weight of the system is supported.

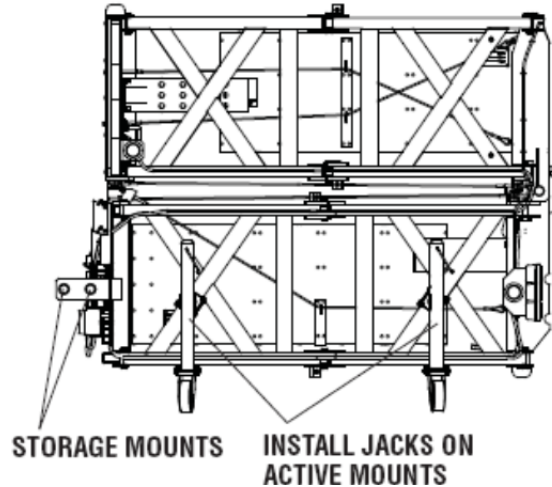


Figure 24

- D. Unplug the light harness and disconnect the positive and negative cables from the pump. Unplug the Cab Switch Box at the mating connector on the TMA.
- E. Remove the Socket Hitches from the Underride Socket Receivers by removing both 1 x 6 1/4" hitch pins and retainer pins (See Figure 26). (If the alignment is off, making removal difficult, it may be necessary to adjust Jacks or temporarily disengage the TMA from the Socket Hitches. This can be done by removing the two 1 1/4 x 7" hitch pins and retainer pins as shown in Figure 26.) Loosen the hardware to ease interference and be sure to retighten.
- F. Move the TMA away from the truck.

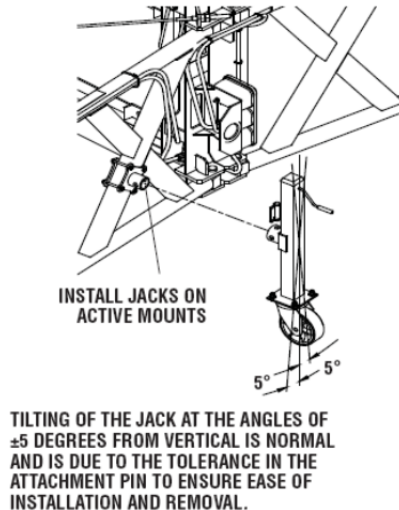


Figure 25

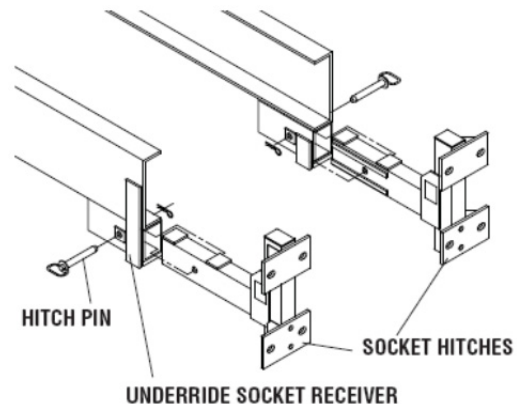


Figure 26

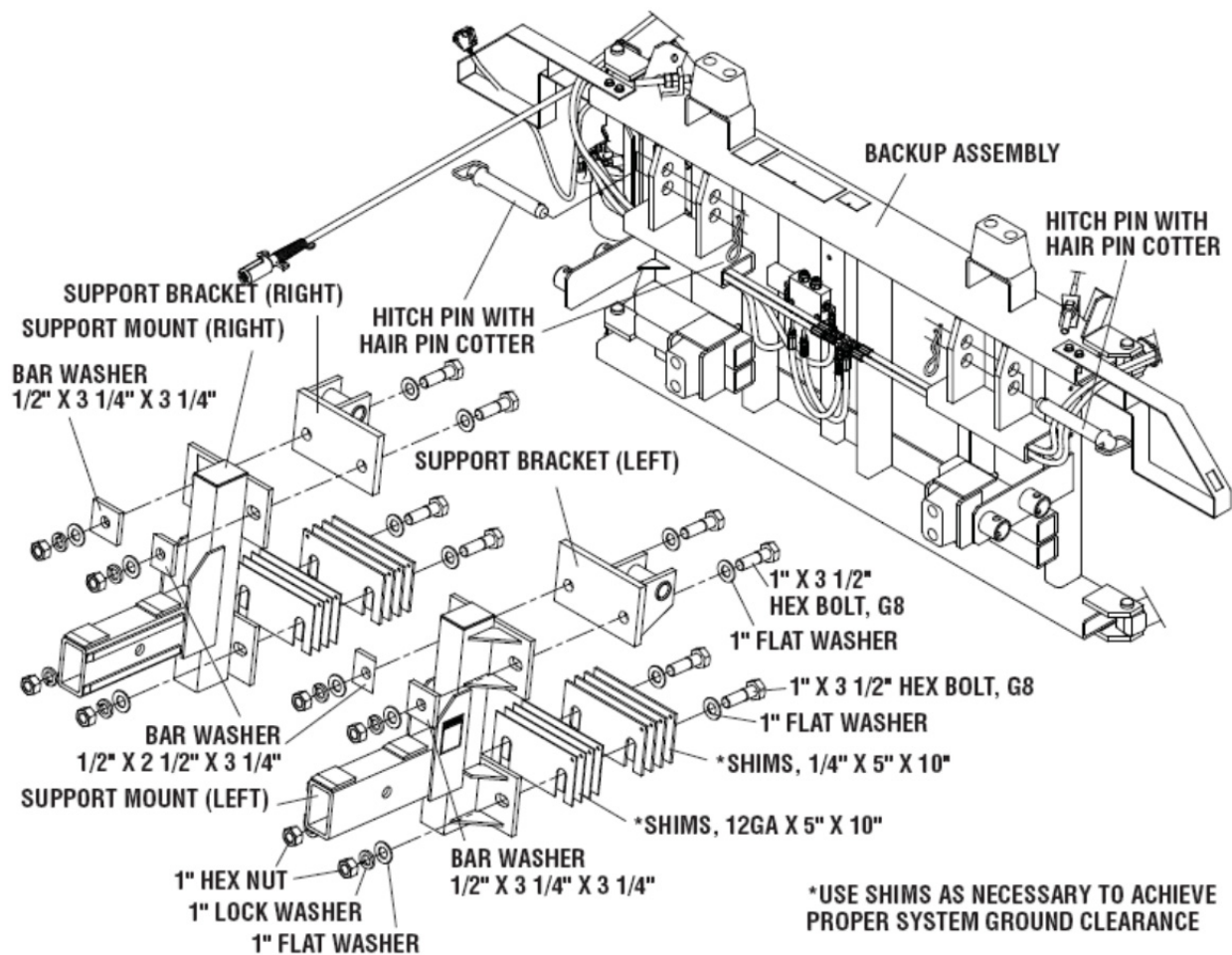


Figure 27

2) Attaching the System to the Truck

- A. Move the TMA to truck.
- B. Insert the Socket Hitches into the Underride Socket Receivers and pin them into place using 1" x 6-1/4" pin and retainer pin. If alignment is off, making the assembly difficult, it may be necessary to adjust Jacks or temporarily uncouple the Socket Hitches from the TMA. Be sure the retainer pins are inserted correctly and cannot fall out.
- C. Plug in the light harness and connect the positive and negative cables to the pump. Plug in the Cab Switch Box to the mating connector on the TMA.
- D. Retract the Jacks completely and relocate them to the storage location.
- E. Check hydraulic/electrical system for proper operation.
- F. Verify system is level and 280-330 mm [11"-13"] above level ground.

III. Lubrication

When handling hydraulic fluid, use appropriate measures to prevent spillage. Clean any spillage immediately.

1) Add Hydraulic Fluid

Add hydraulic fluid as required and check the fluid level monthly. The reservoir is full when the fluid level is visible inside the fill port. Use only Dexron® III ATF Hydraulic fluid. Figure 28 shows the location of the hydraulic fluid fill port.

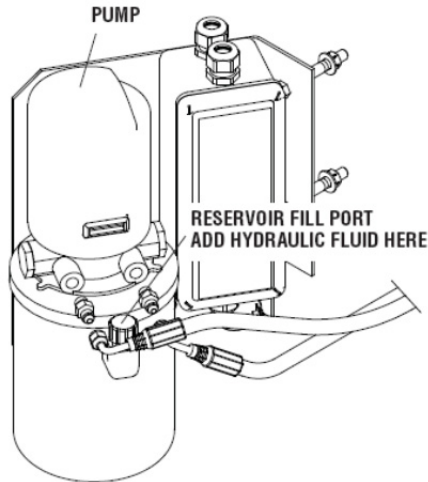


Figure 28

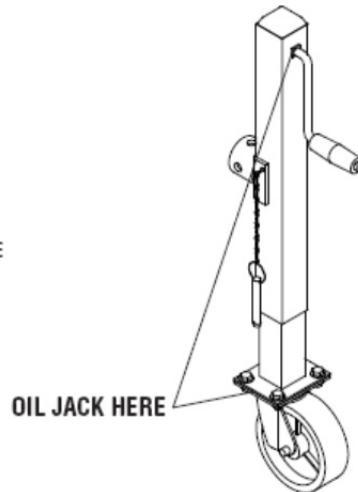


Figure 29

2) Oil Swivel jacks

Oil the Swivel Jacks every six months as shown in Figure 29.

3) Change Hydraulic Fluid

Change the hydraulic fluid every 2 years, or if you strongly suspect the oil is contaminated with water. Use only Dexron® III ATF fluid. The empty oil capacity of the reservoir, hoses, and cylinders is approximately 4 quarts (the capacity of the reservoir alone is approximately 2 1/2 quarts).

The reservoir and hydraulic system may need to be filled and cycled several times to remove air that may be in the system.



Caution: When refilling an empty system, do not attempt to fold or unfold the system more than 60 degrees until after cavitation has ceased. Always stay clear of a moving TMA.

As the TMA is folded/unfolded the pump will cavitate when the reservoir is emptied. Add fluid until system fully rises to 60 degrees without cavitation. After that, cycle the system beyond 60 degrees and add fluid as necessary. The reservoir shall be full (oil just visible at the filler port) when the TMA is fully **UNFOLDED**. If this procedure is not followed, the TMA will come down faster than expected (whether folding or unfolding).

IV. Technical Specifications

1) Weight

Cartridge A	157 lbs	71 kg
Cartridge B	185 lbs	84 kg
Frame Components	1639 lbs	758 kg
Jacks	86 lbs	39 kg
Total	2067 lbs	953 kg

2) Dimensions

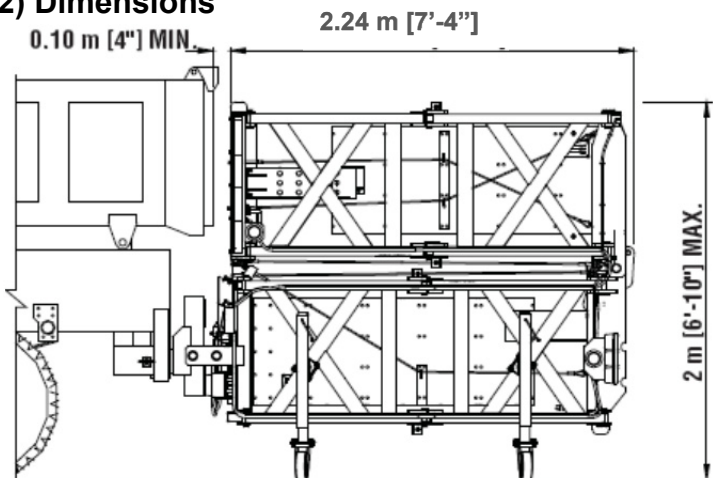


Figure 30

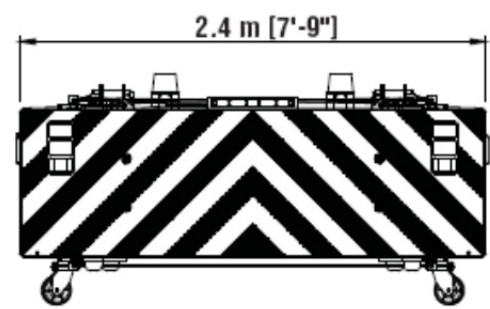


Figure 31

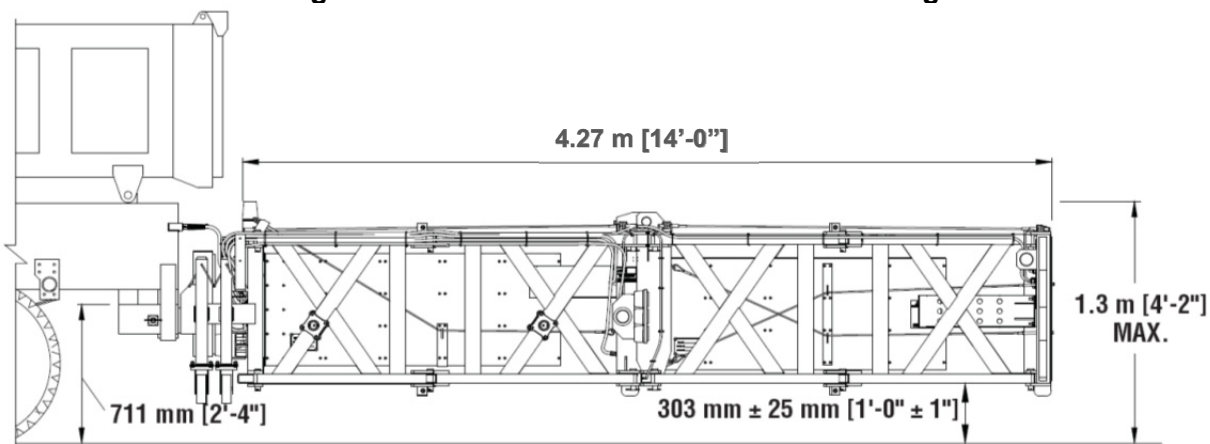


Figure 32

3) Replacement Parts

For details on replacement parts, refer to the drawing package. The drawings include the part numbers and descriptions. For replacement parts, contact customer service: (888) 323-6374.

4) Operating Rates

The system **folds** to the folded position in approximately 35 to 40 seconds (based on a fully charged battery).

The system **unfolds** to the unfolded position in approximately 35 to 40 seconds (based on a fully charged battery).

Repair Instructions

Post Impact

Note: Only parts manufactured by Energy Absorption Systems shall be used to repair a damaged system. Failure to comply will 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 pins and bolts for damage.

Replace all bolts and pins that have been damaged. Refer to the system drawings for the part numbers and descriptions of the parts.

3) Expand system and detach one end of each alignment cable.



Caution: Frames may swing side to side.

Extend the frame and detach one end of each of the four alignment cables.

4) Remove cartridges and spent release cables.

Remove the crushed Cartridges.

Do not attempt to repair a damaged Cartridge. For full impact capacity, the Cartridges will need to be replaced even if only crushed slightly.



Warning: For proper system performance, only use Release Cables supplied by Energy Absorption Systems. Failure to use the correct equipment could lead to improper system performance.

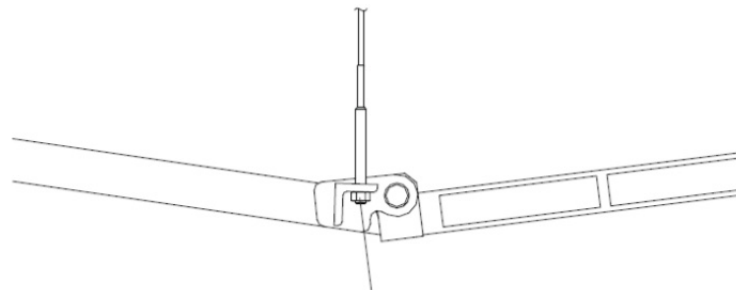
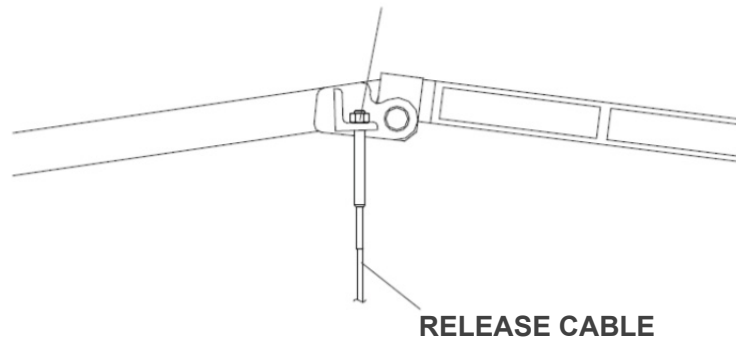
5) Assemble the Bottom Release Cable across the Arm Assemblies.

Verify that the frame is fully extended. Attach the Bottom Release Cable across Arm Assemblies (See Figure 33). Torque the nuts to 34 N-m (-0, +3) [25ft-lbf (-0, +2)] making sure that roughly an equal amount of threads protrude from nuts on both ends of cable. Lock cable in place using remaining fasteners as "jam" nuts.



Warning: Until cables are assembled, the system may shift to one side.

TORQUE TO 34 N-m (-0, +3) [25 ft - lb (-0, +2)]



TORQUE TO 34 N-m (-0, +3) [25 ft - lb (-0, +2)]

Figure 33

6) Assemble Cartridges

Remove one end of each alignment cable from the TMA and set aside to clear the top side of each bay. Using a forklift and sling, place Cartridge B in position and secure it using the flat washers, lock washers and nuts provided. Torque the nuts to 120 ± 7 N-m [90 ± 5 ft-lb]. Repeat procedure for Cartridge A (See Figure 34).

7) Assemble the Top Release Cables across the Arm Assemblies

Assemble the Top Release Cable across the Arm Assemblies (See Figure 36). Torque the nuts to 34 N-m [25 ft-lb], making sure that roughly an equal amount of threads protrude from nuts on both ends of cable. Lock cable in place using remaining fasteners as "jam" nuts.

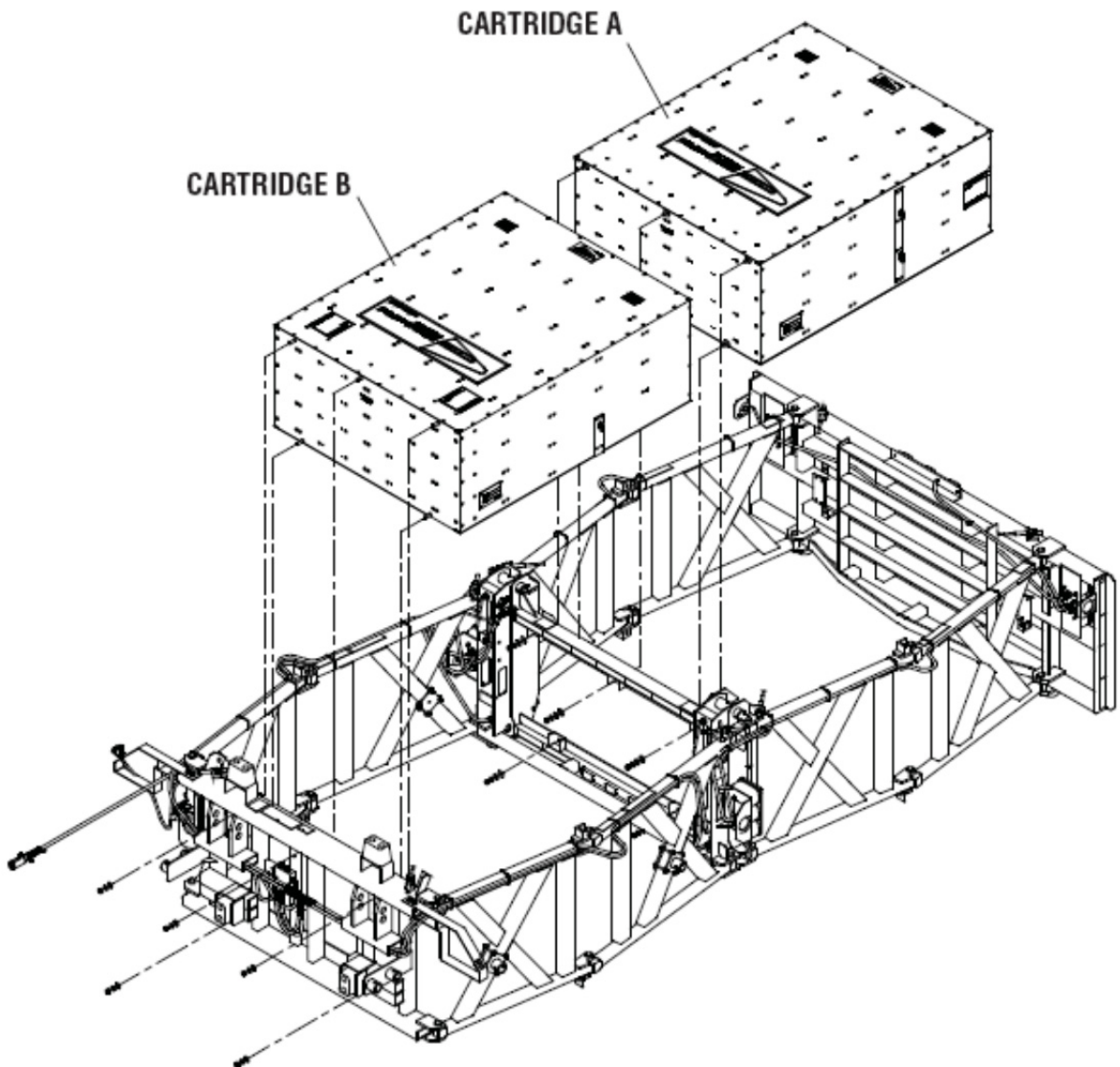


Figure 34

8) Reassemble and Adjust the Alignment Cables

There are four Top Cables (two for each bay). Reattach the Alignment Cables as shown in Figure 35. Measure the diagonals of each bay and adjust the cables so that the diagonal measurements in each bay are the same ($A = B \pm 5 \text{ mm}$ [$3/16"$], $C = D \pm 5 \text{ mm}$ [$3/16"$]). Lock each cable in place using the second nut as a "jam nut".

9) Replace Side-Guides

The Side-Guides must be inspected and replaced if damaged. The Side-Guides are sacrificial and can be easily attached to their respective mounts. Side-Guides are necessary for proper system alignment during an impact and must be in place to ensure proper performance characteristics during system operation in an impact (See Figure 35).

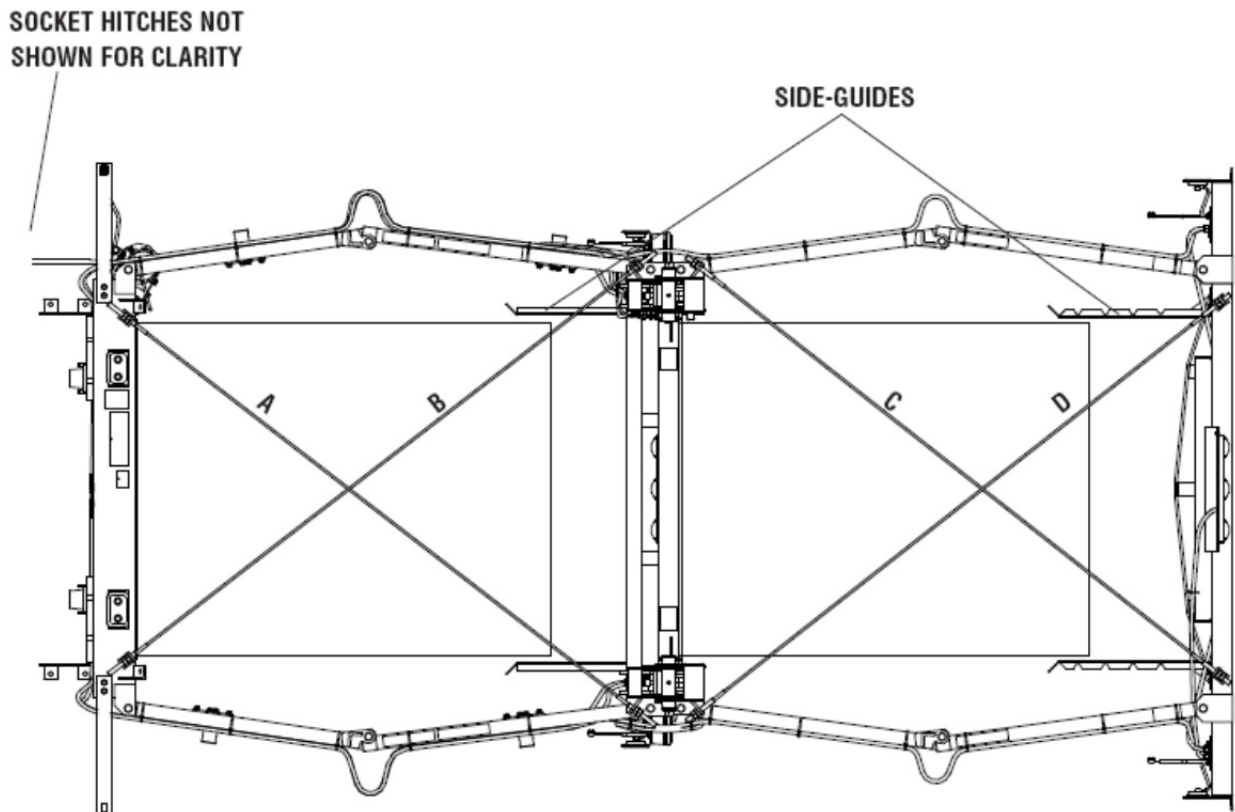


Figure 35

10) Assemble and Tension the Cartridge Support Cables

There are six Cartridge Support Cables. Pass the stud end of the cable through the corresponding cartridge chain loop and attach as shown in Figure 36 using a die spring, washer, and nuts.

To properly tension the Cartridge Support Cables, tighten the first nut on one cable until all slack is removed then tighten it until the tensioning springs have been compressed to 32 mm [1 1/4"] in height. Lock this nut in place with the second "jam" nut. Repeat this procedure with the other cables.

11) Adjust the Height and Levelness of the System Frame

Verify that the System Frame is 305 ± 25 mm [$12'' \pm 1''$] from the ground at the front and rear of the system. It may be necessary to add shims to the Socket Hitches in order to adjust the levelness of the Cartridge (See Figure 36a).

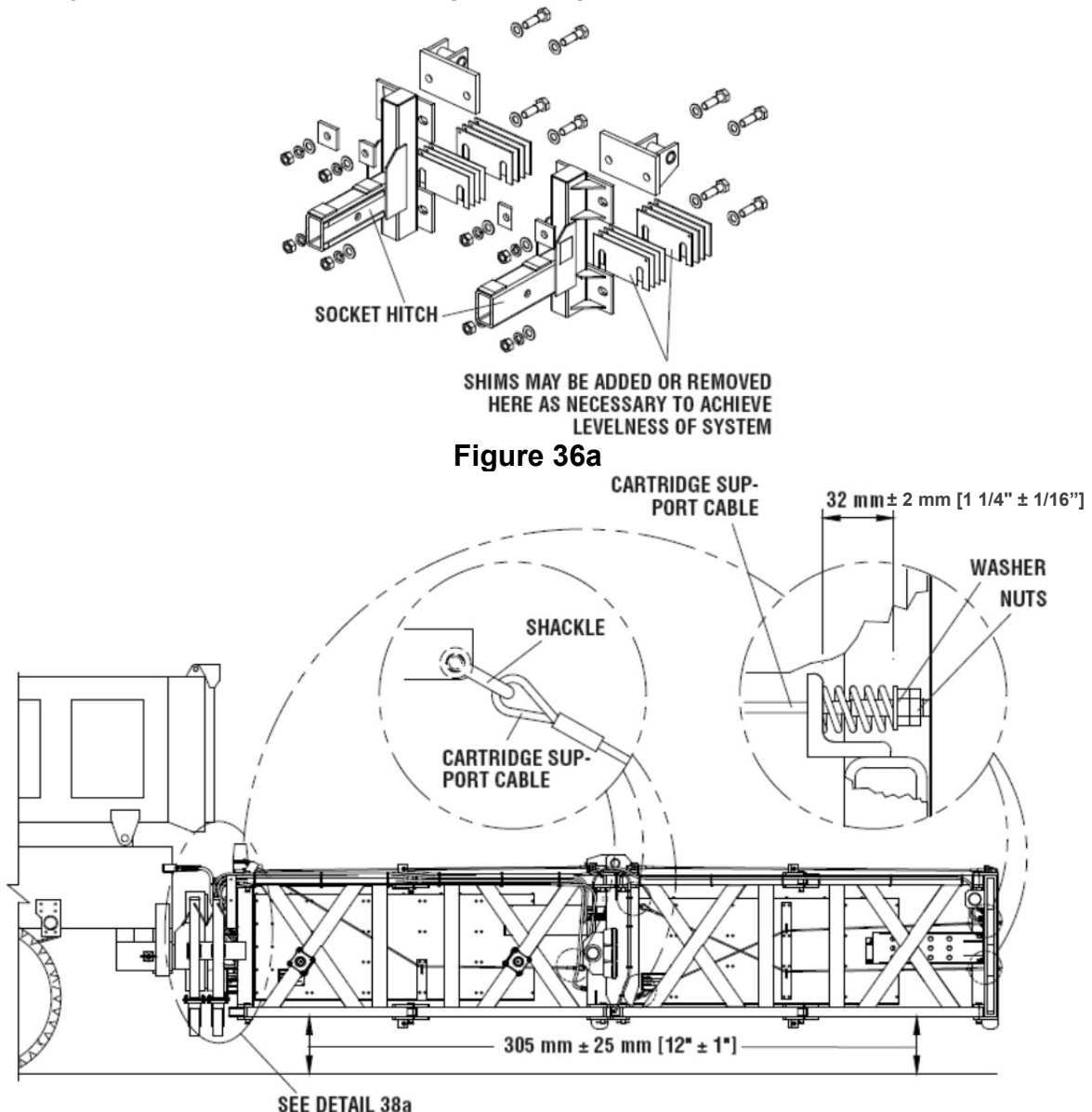


Figure 36

12) Verify Position of Hydraulic / Electrical Lines

Check the location of all the hydraulic and electrical lines to make sure they will not be damaged during the folding and unfolding of the system.

13) Check System Lights for Proper Operation

Verify that all the turn / stop / tail / reverse lights are working properly. Replace any bulbs that are out.

There are two light circuits on the TMA. Verify both circuits are operational.

Raise the system to folded position and verify secondary lights are working.

With the system unfolded, lights on the Impact Face will be on and lights on the Mid Frame will be off.

With the system folded, the lights on the Mid Frame will be on and the lights on the Impact Face will be off.

14) Final check

Check the tightness of all the fasteners. Check all steel cables to verify that they are properly attached and tightened.

15) Ready to Use

The system is now ready for use.

Troubleshooting Guide

Safety Notes – See Troubleshooting Decision Trees on Page 50.

- 1) Always wear eye protection when working on or around machinery or power tools, and while working with hydraulics.
- 2) Do not attempt to control a hydraulic leak with your hand. High-pressure hydraulic fluid can puncture the skin and cause severe injury or death. Use extreme caution when working on hydraulic systems.

In general, consult Energy Absorption Systems Customer Service Department 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 the test equipment required to troubleshoot DC powered hydraulic systems.

1. Pressure Gage

A 34.5 MPa [5000 psi] pressure gage, preferably glycerin filled, is a valuable and relatively inexpensive tool for checking fluid pressure in the various sections of the circuit.

2. DC 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.

3. Continuity Light

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

4. Volt Meter

A DC 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.

5. Ohmmeter

Note: All tests conducted with an ohmmeter must be done with the power source disconnected from the system.

An ohm meter is used to measure resistance and is useful when working with solenoid coils. On some coils the wire resistance is large enough that a DC test light might not illuminate, falsely indicating an open circuit (infinite resistance). A successful coil test, however, shall always show some non-infinite value of resistance.

6. Assorted Hoses, Pressure Fittings

These can be used to connect and/or isolate certain parts of a hydraulic circuit for diagnosing hydraulic problems.

If you suspect problems, do not operate the system. Diagnose and repair, or contact Energy Absorption Systems Customer Service Department for input as to your specific application.

Hydraulic Fluid

1. Purpose

The main purpose of hydraulic fluid is to transfer power from the pump to the actuators. Secondary tasks include reducing metal on metal friction and preventing the formation of rust and sludge. These traits are achieved when the oil has a good lubricity (slipperiness), and with additives that inhibit oxidation and the entrainment of air and water in the oil, respectively. The viscosity (thickness) of the oil must be appropriate for the operating temperature to minimize unwanted leakage and to lubricate the close fitting parts in the system.

Additionally, the oil must be compatible with the seals used in the system. Finally, the oil must be able to pour or flow at the lowest expected operating temperature so that it can enter the reservoir and pump for use. For all of these reasons, automatic transmission fluid (ATF, Dexron® III) has been found to be the best readily available fluid for the job in most climate conditions.

2. Selecting Fluids for Applications Outside ATF'S Temperature Range

When looking for fluids that can be used in place of ATF or for applications where the operating temperature is outside the range of ATF, the following specs should be discussed with your local oil distributor:

- A. Fluid must be compatible with Buna-N sealing compounds.
- B. The Pour Point must be below the lowest anticipated temperature that will be encountered.
- C. It should contain Rust or Oxidation inhibitors as well as other detergent type inhibitors.
- D. The viscosity (SUS) shall lie between 80 and 375 in the operating range, with the ideal viscosity near 200 SUS.
- E. The viscosity index should be as high as possible. As an example, ATF has the following specs as listed by most oil manufacturers:

[1] Viscosity	(SUS)
37 deg. C [99 deg. F]	185 to 205
99 deg. C [210 deg. F]	45 to 55
Pour Point	-44 deg. C [-47 deg. F] to -37 deg. C [-35 deg. F]
Viscosity Index	145 to 165

Note: In an emergency, for cold weather applications, SAE 10 W non-detergent oil mixed by volume with no more than 30% #1 fuel oil or kerosene can be used.

Hydraulic System

Finding & Solving Problems

Caution: Repair of hydraulic components shall only be performed by fully qualified individuals or hydraulic shops. In most cases, contact Energy Absorption Systems Customer Service Department for advice on repair or replacement of TMA parts. All replacement components must be approved for use or provided by Energy Absorption Systems to guarantee quality and correctness.

Hydraulic system failures can occur in several ways: A gradual or sudden loss of pressure or flow, a loss of power at the pump, or other difficulties. Any of the system's components could be the cause. Start with the checklist below that most applies to the symptom at hand.

Note: Avoid the use of Teflon[®] tape on hydraulic fittings as it can easily jam valves and cause failures in the hydraulic system.

1. Motor does not Start

- Improper ground. Check ground conditions.
- Improper or low voltage supply. Check voltage supply from truck battery and at pump.
- Electrical system inoperative: Verify that cable from battery is correctly attached.
- Failed motor solenoid: Replace, taking note of correct wire locations for reassembly.

2. System Operates Rough or Erratic

- Insufficient or no oil system, pump losing prime: Fill system, check for leaks.
- Ground fault: Check for loose wire leads, verify that pump is securely mounted to TMA frame and that the truck lighting plug is correctly attached. Ensure ground wire from pump is directly routed to the truck battery.
- Wrong oil in system (should be ATF Dexron[®] III): Change Oil.
- Clogged or dirty cylinder check valve: Remove the load on cylinders, disassemble cylinder check valve and clean (See section on Cylinder Check Valves).
- Oil line is restricted, dirty, or collapsed: Clean or replace oil line.
- Dirty pump: Clean exterior and check for contaminated oil. If necessary, drain, flush, and refill system with ATF Dexron[®] III.
- Worn components (valves, cylinders, etc.): Check for cause of wear. Replace worn parts with correct components.
- Leakage: Check all components, verify tightness of fittings, and inspect hoses for wear while system is idle. Replace damaged hoses or fittings.
- Excessive loading (especially any features not originally installed by Energy Absorption Systems): Remove excessive load.

3. System Operates Slowly or Cavitates

- Low voltage: Verify voltages with DC voltmeter and check truck charging system.
- Oil viscosity too high or cold oil: Allow oil to warm up before operating or replace with oil as necessary.
- Air in system: Check for leaks and tighten as necessary. Cycle the system several times to relieve air from system.
- Oil leaks: Tighten fittings, replace seals or damaged lines.
- Worn components (valves, cylinders, etc.): Check for cause of wear. Replace worn parts with correct components.
- Restriction in lines or cylinder check valves: Remove the load on cylinders, clean lines or valves, replace hoses if necessary.

4. System Operates too Fast

- Internal fixed flow controls reversed: Contact Energy Absorption Systems

5. Pump Overheats

- Low voltage at pump: Check battery and wiring
- Incorrect, low volume, or dirty oil: Add or change oil as necessary
- Excessive internal leakage (pump): Replace the pump (contact Energy Absorption Systems).
- Restriction in lines or cylinder check valves: Remove the load on cylinders, clean lines or valves, replace hoses if necessary.
- Insufficient heat radiation: Clean dirt and mud from reservoir and components.

6. Noisy Pump

- Low oil level, incorrect or foamy oil: Replace or add oil as necessary.
- Suction line or inlet screen plugged: Consult Energy Absorption Systems.
- Worn or damaged pump: Replace the pump (contact Energy Absorption Systems).

7. Load Drops When System is Locked

- Leaking cylinder seals or fittings: Remove the load on cylinders, inspect for damaged hoses or fittings, tighten fittings or replace hoses if necessary.
- Faulty counterbalance valve: Remove the load on cylinders. Clean or replace the appropriate counterbalance valve components.

8. Leaky Cylinder(s)

- Seals worn or damaged: Replace the cylinder.
- Rod damaged: Replace the cylinder.

Pressure Relief Valve

1. Purpose

- A. Limit the maximum pressure in the hydraulic system to a safe level.
- B. Keep the motor amperage (and battery drain) at a minimum when the cylinders dead head (reach full stroke).

2. Adjusting Relief Valve (on the pump)

Note: In general, do not adjust the relief valve. It is set to the correct operating pressure at the factory.

- A. Symptoms of incorrect pressure relief adjustment.
 - 1) Relief pressure too high
 - a. Battery current draw is excessive
 - b. Motor RPM is slow
 - 2) Relief pressure too low.
 - a. Motor RPM is fast
 - b. System will not fold (cylinders will not extend).
 - c. Excessive turbulence in reservoir.

Note: On applications where a hydraulic component is being replaced, contact Energy Absorption Systems Customer Service Department to purchase replacement parts.

Warning: Do not exceed pressure rating for hydraulic system components! System pressure is set to 2400 psi at the factory.

Counterbalance Valve

1. Purpose

The counterbalance valve allows free flow of hydraulic oil into and out of the cylinders but blocks the flow when there is no pump pressure. The counterbalance valve locks the system when the pump is not running.

Warning: When the system is stopped at an intermediate angle, there will be pressure on the oil in the hoses between the counterbalance valve and cylinders! This pressure is supporting the load of the folding bay! **ALWAYS** make sure the TMA is completely folded or completely unfolded before loosening a hose fitting or servicing any check valve! This will minimize the chance of injury from an uncontrolled falling load or spray of high-pressure oil. Never stand underneath the TMA when performing any sort of service or checking any component of the system.

2. Repairing Counterbalance Valve

A. Symptoms

If the TMA exhibits a slow drifting of the folding bay when the pump is not running, one of the following may be true:

- 1) The counterbalance valve has become blocked by foreign debris in the oil line.
- 2) The piston ring seals inside the cylinders have been compromised.

B. Repair procedure

1) Blocked Cartridge

- a. Again, make sure the system is completely folded or completely unfolded.
- b. Remove the Cartridge from the valve body, being cautious of oil spray from residual pressure in the system.
- c. Clean the Cartridge using compressed air, making sure to direct the air away from anyone's face. Avoid breathing the oil mist that this process may create.
- d. Reinsert the Cartridge as they were before disassembly.

2) Piston ring seal

- a. Refer to the following section on Hydraulic Cylinders.

Note: If the counterbalance valve has failed in some other way, do not attempt to repair it. Replace it with a new valve by contacting Energy Absorption Systems Customer Service Department.

Hydraulic Cylinders

Caution: Never allow anyone underneath the moving portion of the SS180 TMA®. Block out all loads and disconnect electrical contact prior to performing any service on hydraulic equipment.

1. Troubleshooting

If you suspect problems with the hydraulic cylinders on the TMA, you may need to remove the cylinders from the TMA for repair or replacement. The cylinders can only be removed when the TMA is completely folded. Double check all electrical contacts between the TMA and support vehicle have been disconnected prior to performing any work on the hydraulic system.

A cracked, bent, or leaky cylinder may need repair but will almost always be replaced to ensure reliable performance.

2. Cylinder Replacement

- A. Completely fold the TMA.
- B. Unplug all electrical connections between the TMA and the support vehicle.
- C. See Hydraulic Cylinder Assembly drawing 610306. Loosen (but do not disconnect) the “Follower Link Pivot” and the “Push Link Pivot” where they are bolted to the “Weldment, Front Intermediate Frame” and the “Weldment, Rear Intermediate Frame”, respectively.
- D. At the top end of the cylinder rod, loosen the set screw and push out the short 1” diameter pin, making note of the alignment and location of all linkage components for later reassembly.
- E. Disconnect the hoses leading into the cylinder at two convenient locations and place temporary caps on the hoses or cylinder ports to prevent spillage or contamination.
- F. At the bottom end of the Cylinder body, remove the Cotter Pin from the Clevis Pin and push out the long 1” diameter pin, making note of the alignment and location of all components for later reassembly.
- G. The cylinder should now be free. Reinstall a new cylinder in the reverse order of these removal steps, making sure to properly align and (where necessary) tighten all components. Use blue thread locker (medium strength) on all fasteners.

Note: See the section on Hydraulic System Priming. You will likely need to prime the system if you are installing a new or “dry” cylinder.

3. Repairing Cylinders

Replace any faulty or damaged cylinders with a new cylinder.

Hydraulic System Priming

SS180 TMA[®] hydraulic systems come direct from the factory primed and ready to operate. Priming should only be necessary after changing the oil or if you have recently repaired a leak.

1. Priming Process

Systems that have been disassembled for repair require priming for proper performance. The hydraulic system is said to be primed when all hoses and cylinders are full of oil and the air has been expelled. The reservoir shall be full of oil (oil just visible at the filler port) when the TMA is UNFOLDED. Prime the pump as follows:

- A. Detach the long hoses where they connect to the cylinder. Note which hoses connect to the top and bottom of the cylinder.
- B. Jog and pump by briefly depressing the “FOLD” button until clean oil flows from two of the hoses.
- C. Repeat this process for the other two hoses by briefly depressing the “UNFOLD” button.
- D. Replace and retighten all four hoses.

Caution: Do not completely fold or unfold the TMA until it has been jogged a few times to work out any air in the system. Add oil at the filler port any time that the pump begins to cavitate.

- E. Jog the system a few times by depressing “FOLD” or “UNFOLD” (depending on the current state of the TMA).

2. Check for These Problems When a System Fails to Prime

- Correct pump mounting, with the motor on top and reservoir at the bottom. All SS180 TMA[®]s shall have vertically mounted pumps. Mounting a pump in some other orientation would prevent the suction line from picking up oil, causing cavitation.

Note: Vertical mount pumps have a label stating such designation.

- A solid plug in the reservoir filler port instead of a vent plug (See Reservoir section).

Reservoir

Note: Do not use a solid plug or fill cap without a filter/breather element, or damage will be caused to the pump and/or reservoir.

1 Use Recommended Fluid:

Fill reservoir with Dexron[®] III only (See Hydraulic Fluid section).

2 Proper Filling:

- A. With the TMA UNFOLDED (cylinders fully retracted), fill the reservoir so that oil can just be seen in the filler port.
- B. Operate the unit several times starting with short cylinder strokes, increasing the length of each successive stroke.
- C. Recheck oil level often and add as necessary to keep the pump from picking up air.
- D. Reinstall the filter/breather plug provided.

3 Reservoir Problems

- A. Clear oil flowing out of the filler port usually means the reservoir was completely filled before the cylinders were fully collapsed (TMA unfolded).
- B. Foamy oil flowing out of the filler port points to one of the following:
 - 1) Air present in the system; the response is usually spongy or the cylinders may move with a jerking motion.
 - 2) There is no drop tube or “down spout” on the return line so that the oil is not returning to the bottom of the reservoir.
- C. Water in the oil:

Water can enter the reservoir through the filler port if the unit is left outdoors or washed with a high-pressure washer. Protect the unit, whenever possible, and change the oil if you suspect contamination. In cold weather the water could freeze, preventing the pump from working until the ice melts.

Warning: Remove all rings, watches, jewelry, etc. prior to doing any electrical work!

Electrical Problems

1 Low Voltage

Operating DC (direct current) power units efficiently requires proper voltage. Any attempt to operate below the minimum required voltage could cause system failure.

- A. Signs that point to low voltage are:
 - 1) Motor won't run because solenoid won't shift.
 - 2) Motor running at reduced speed.
- B. Minimum voltage requirements:
 - 1) Between the motor stud and ground: 9.0 volts at maximum load.
- C. Causes for low voltages are:
 - 1) Improper ground. Check grounds.
 - 2) Battery capacity too small.
 - 3) Cable ends not electrically secure to battery cable.
 - 4) Battery cable size too small for load and length of run. Copper #4 automotive is the recommended minimum size battery cable. Larger copper battery cable (#2, #1, #0, or #00) may be required for cable lengths over 25 feet to keep performance from deteriorating.
 - 5) The pump ground is established through the battery ground cable. Clean any dirt or rust from cable to achieve proper ground.
 - 6) Burnt contacts on motor solenoid.
- D. Check for low voltage as follows (requires a voltmeter):
 - 1) On alternator equipped vehicles, verify that the battery voltage is approximately 13.5 volts with no electrical accessories operating and the engine running.
 - 2) Operate the TMA while an assistant uses the voltmeter to probe each connection, cable end, and cable from the battery all the way back to the motor stud. Note the voltage losses. Make necessary repairs. Increase the voltage above the minimum as required.

Note: Check the ground connections as well: remove any paint, rust, and dirt that may be acting as insulators.

2 DC Motors

Before concluding that the hydraulic pump is malfunctioning:

- Verify that all connections are secure and that the problem does not lie somewhere else.
- Check ground.
- Check brushes for wear, and replace if necessary.

Note: A motor that does not turn in freezing weather could be caused by frozen water in the oil.

If it has been verified that the pump is defective; contact Energy Absorption Systems Customer Service Department for input as to your specific application (See Page 3).

3 Electrical Switches

A. If you suspect that the switch is defective, use one of these three methods to test the operation of the switch:

- 1) First check grounds.
- 2) Use continuity light to test the switch (See Test Equipment section).
- 3) Use a circuit test light to test the switch (See Test Equipment section).

B. Motor solenoid switches:

The solenoid switches found on the hydraulic pump are four post style solenoid. They shall be constructed and wired such that:

- 1) The large posts with the connecting bar must be attached to the cable from the battery.
- 2) The same post (shared hot lead) provides power to the control circuit.
- 3) The remaining large posts attach to the motor wires.
- 4) The small post on each solenoid connects to the control circuit on the side and the other small post connects to the ground. This circuit activates the solenoid (and hence the pump) when energized.

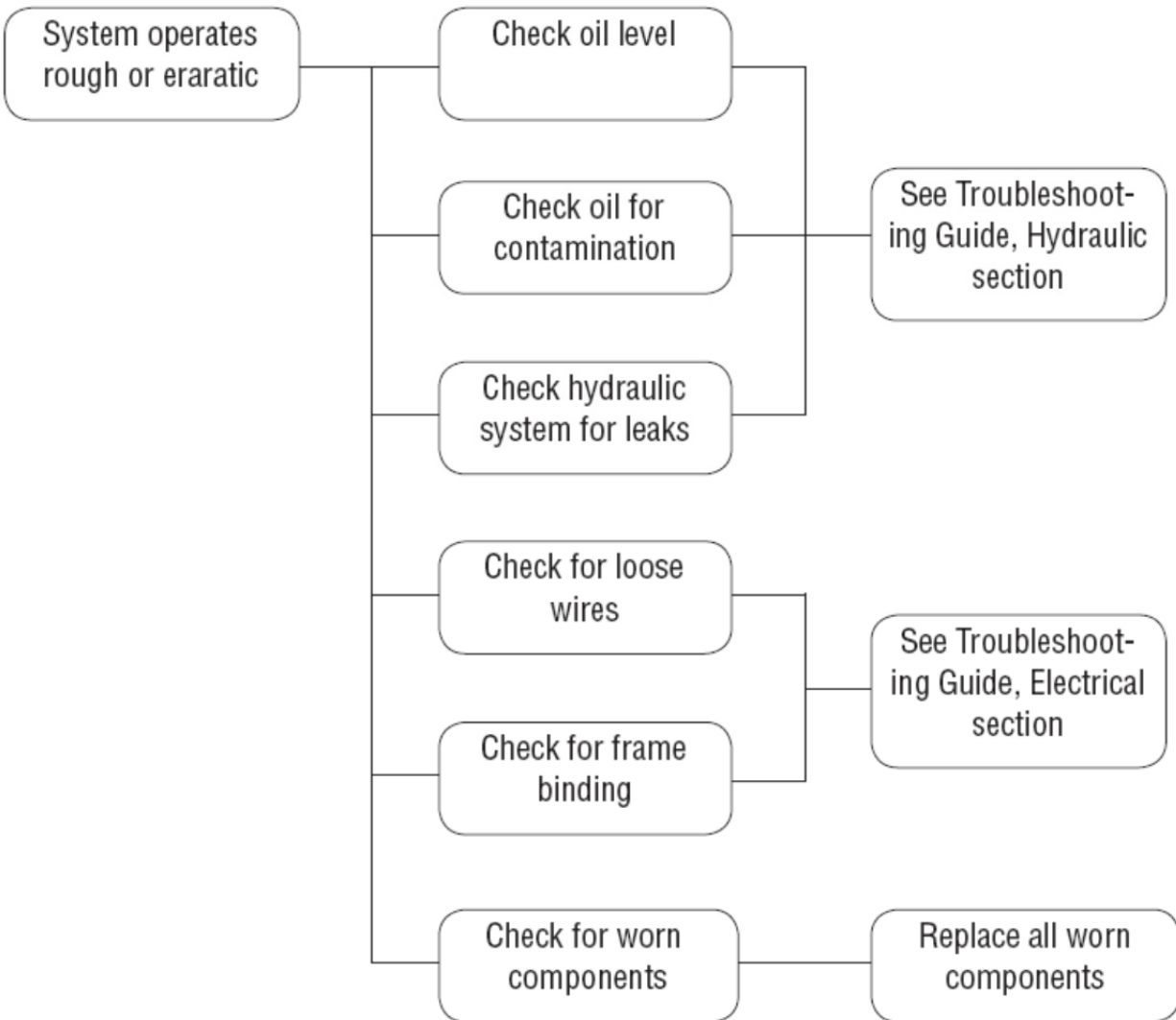
4 Electrical Polarity

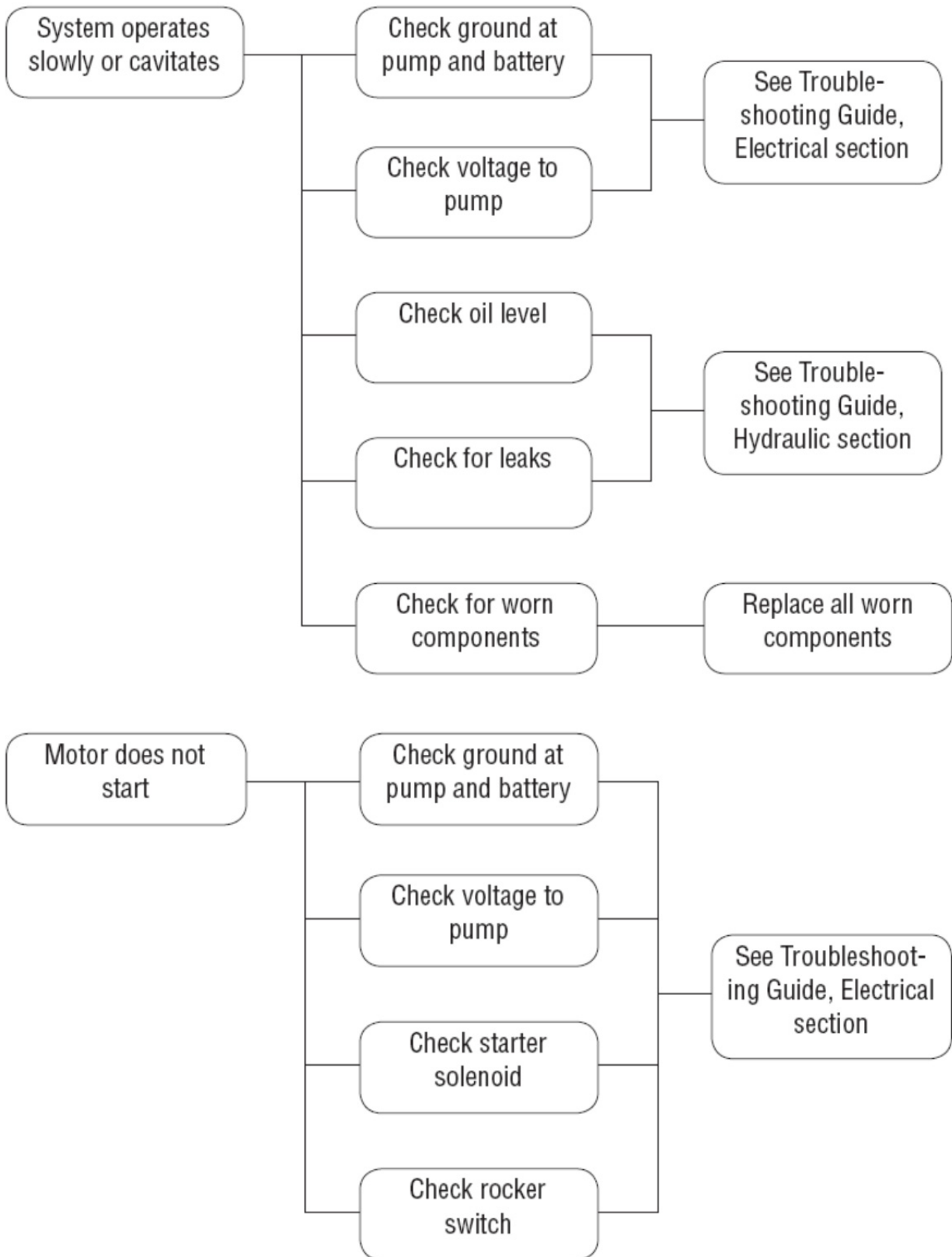
The pump motor and all controls have a negative ground.

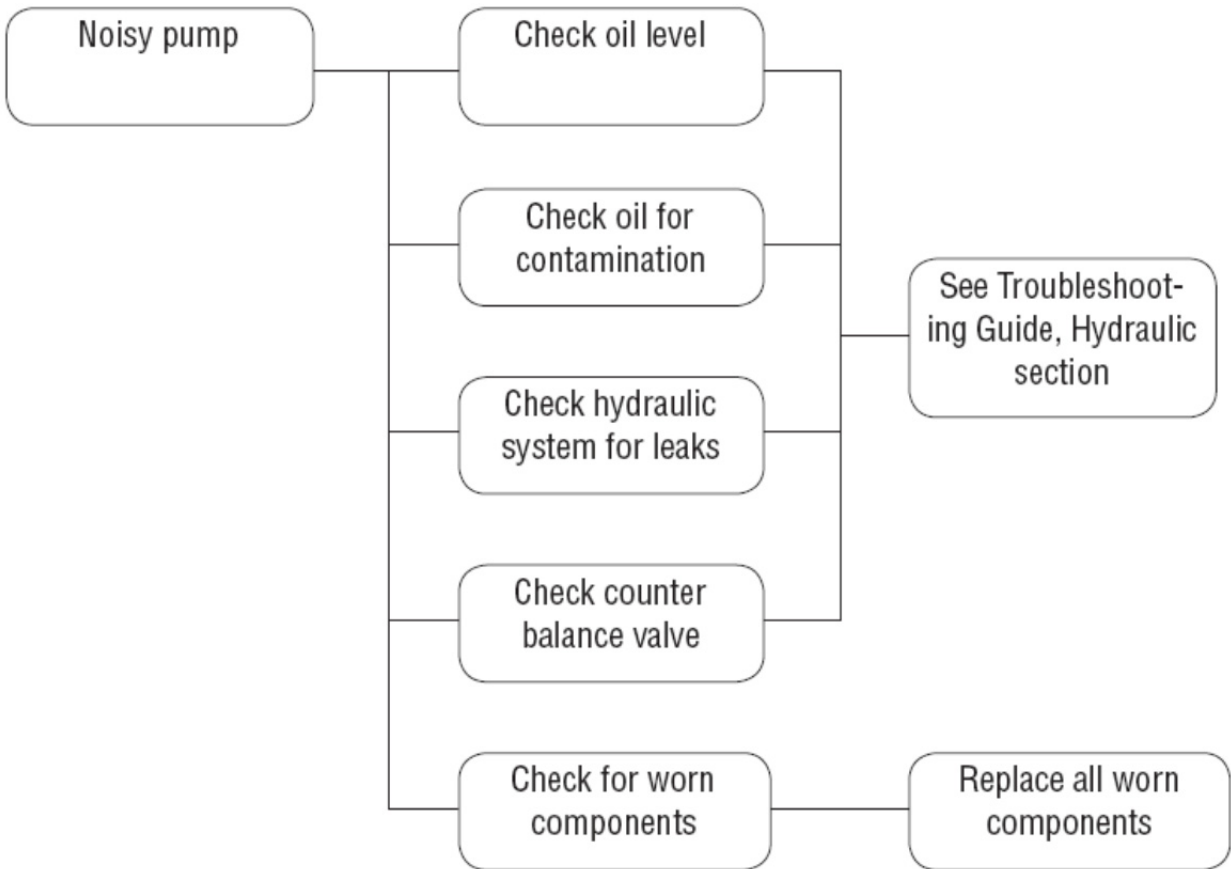
5 Electrical Shorts or Open Circuits

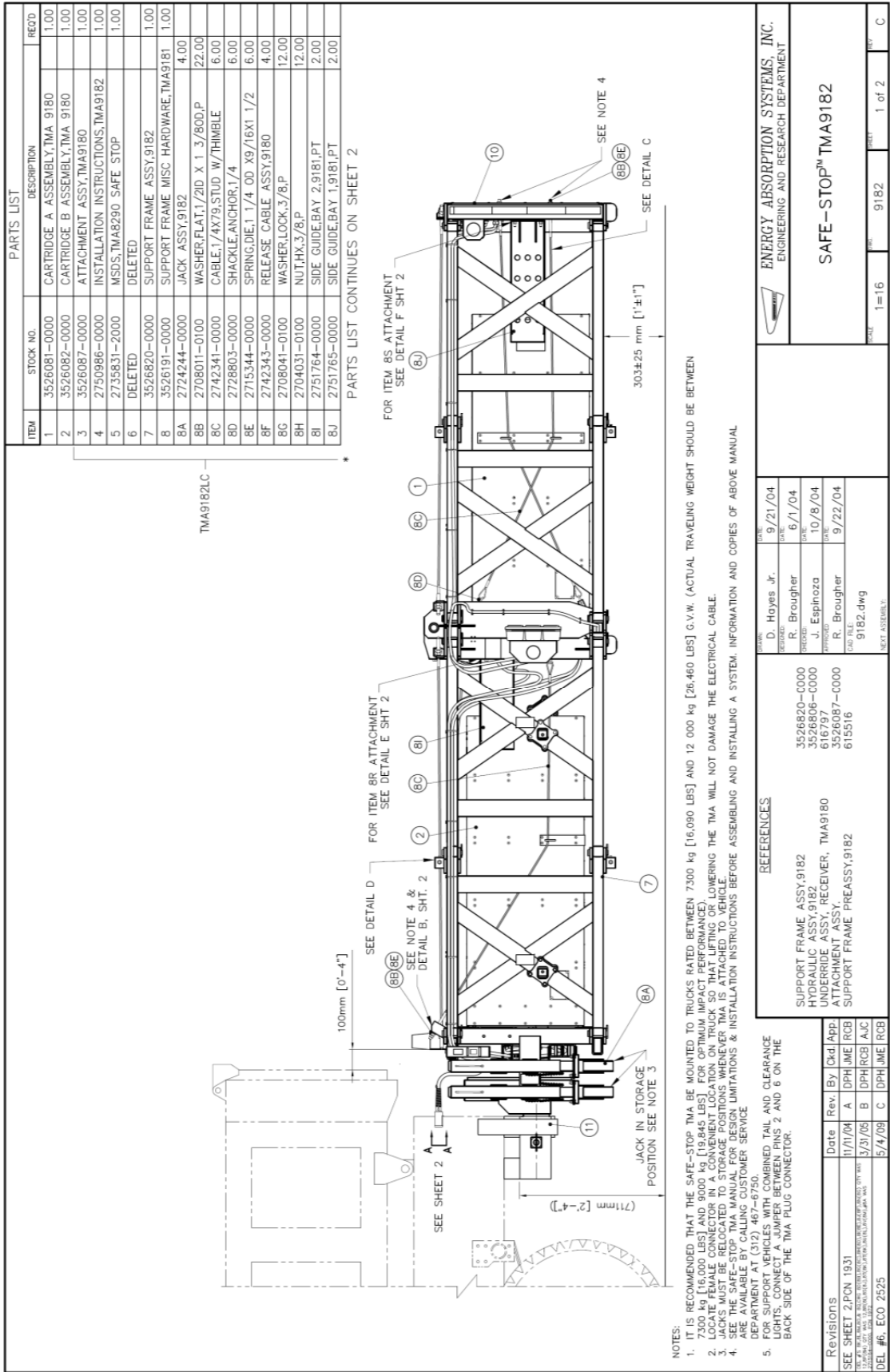
- A. Shorts occur when wires with power come in contact with a ground. A short will cause a fuse to blow or a wire to burn. Look for pinched or cut wires.
- B. An open circuit is simply a break which prohibits current flow. Look for pinched or cut wires.

Troubleshooting Decision Trees

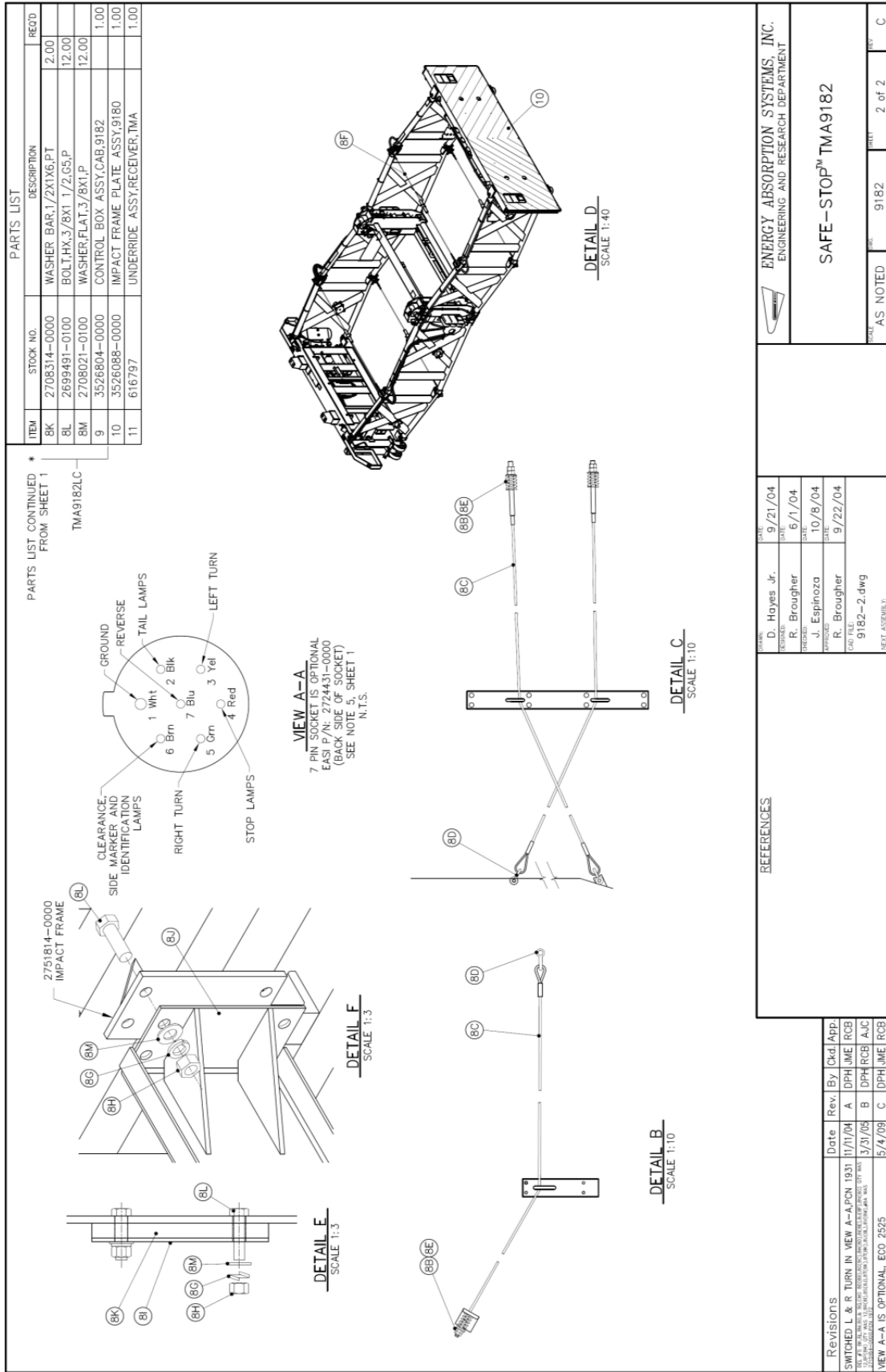








DWG 9182 Sheet 2 of 2



ITEM	STOCK NO.	DESCRIPTION	QTY.
1	352682A-0000	SUPPORT FRAME PRE-ASSY 9182	1
2	3526800-0000	LIGHTING/WIRING ASSY TMA 9182	1
3	2756281-0000	TIE NYLON 3/16X8	22
4	2756101-0000	RIVET STD SDR128S 3/16X3/4 DH	4
5	2756223-0000	SWITCH ASSY CONTROL 9182	1

TMA9182LC

TOL. LINEAR: ± 1/16"

TOL. ANGULAR: ± 1°

UNLESS OTHERWISE SPECIFIED

SEE PARTS LIST

PARTS LIST

ITEM

STOCK NO.

DESCRIPTION

QTY.

1

352682A-0000

SUPPORT FRAME PRE-ASSY 9182

1

2

3526800-0000

LIGHTING/WIRING ASSY TMA 9182

22

3

2756281-0000

TIE NYLON 3/16X8

4

2756101-0000

RIVET STD SDR128S 3/16X3/4 DH

4

5

2756223-0000

SWITCH ASSY CONTROL 9182

1

1

352682A-0000

SUPPORT FRAME PRE-ASSY 9182

1

2

3526800-0000

LIGHTING/WIRING ASSY TMA 9182

22

3

2756281-0000

TIE NYLON 3/16X8

4

2756101-0000

RIVET STD SDR128S 3/16X3/4 DH

4

5

2756223-0000

SWITCH ASSY CONTROL 9182

1

1

352682A-0000

SUPPORT FRAME PRE-ASSY 9182

1

2

3526800-0000

LIGHTING/WIRING ASSY TMA 9182

22

3

2756281-0000

TIE NYLON 3/16X8

4

2756101-0000

RIVET STD SDR128S 3/16X3/4 DH

4

5

2756223-0000

SWITCH ASSY CONTROL 9182

1

1

352682A-0000

SUPPORT FRAME PRE-ASSY 9182

1

2

3526800-0000

LIGHTING/WIRING ASSY TMA 9182

22

3

2756281-0000

TIE NYLON 3/16X8

4

2756101-0000

RIVET STD SDR128S 3/16X3/4 DH

4

5

2756223-0000

SWITCH ASSY CONTROL 9182

1

1

352682A-0000

SUPPORT FRAME PRE-ASSY 9182

1

2

3526800-0000

LIGHTING/WIRING ASSY TMA 9182

22

3

2756281-0000

TIE NYLON 3/16X8

4

2756101-0000

RIVET STD SDR128S 3/16X3/4 DH

4

5

2756223-0000

SWITCH ASSY CONTROL 9182

1

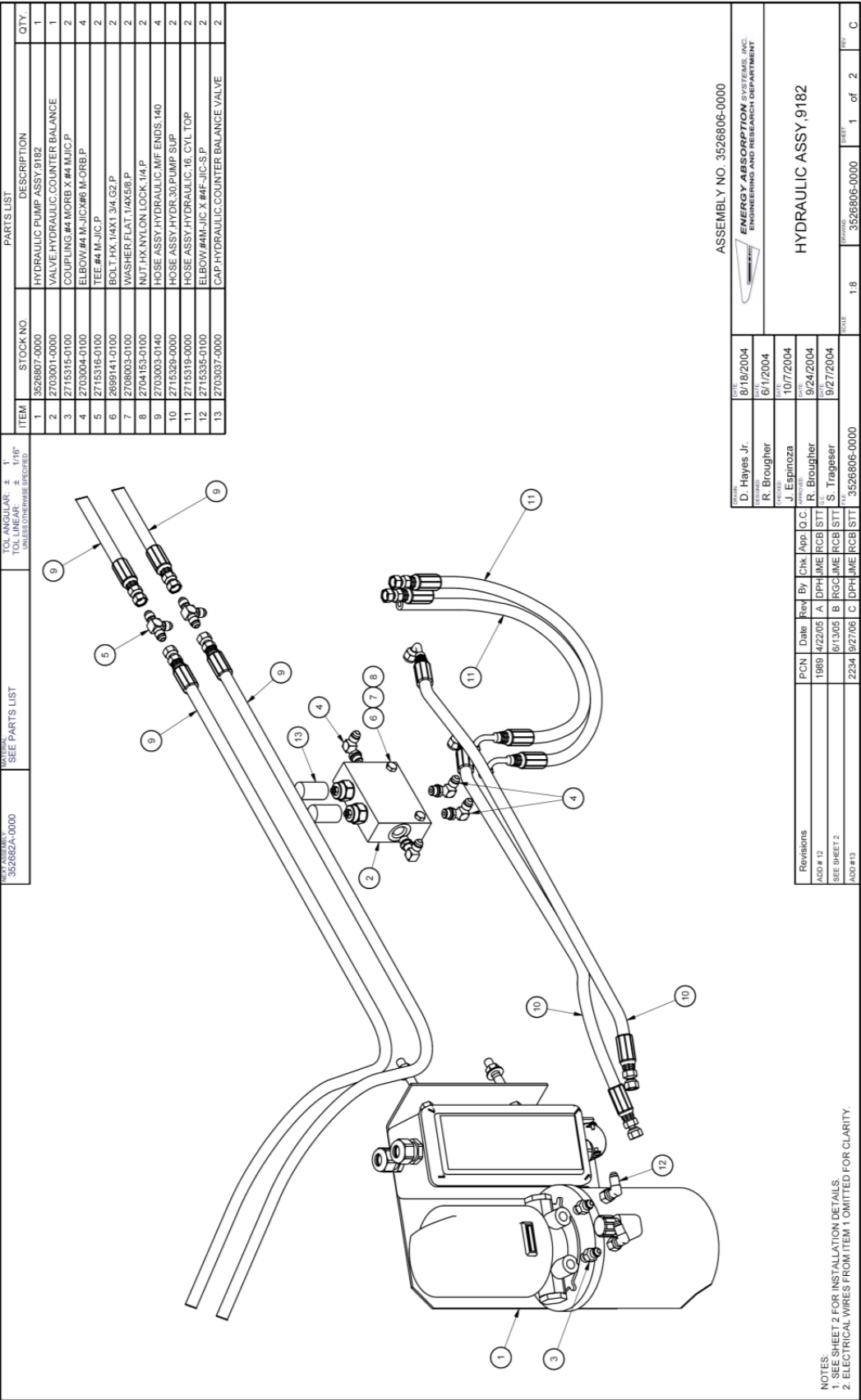
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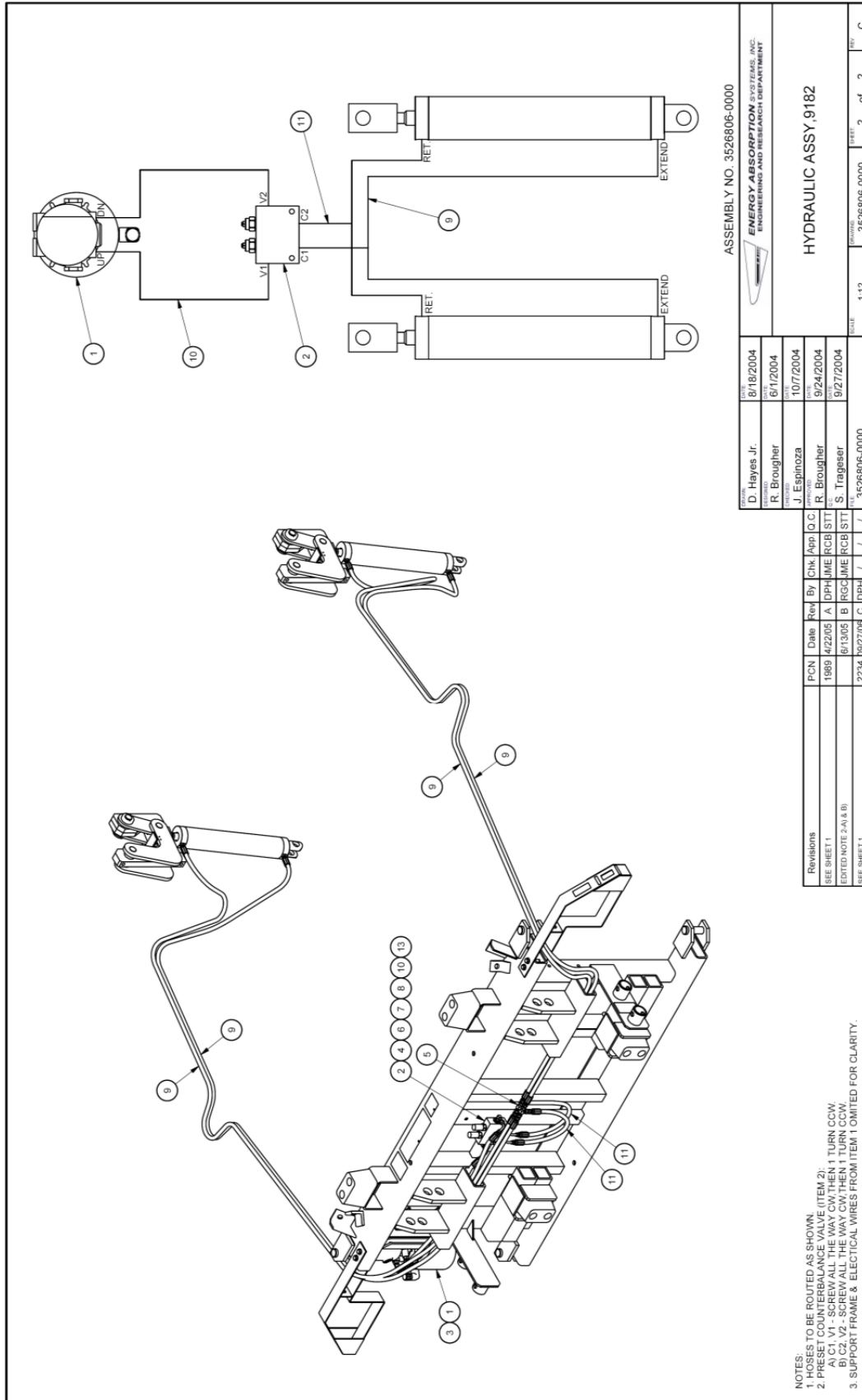
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SUPPORT FRAME PRE-ASSY 9182

1

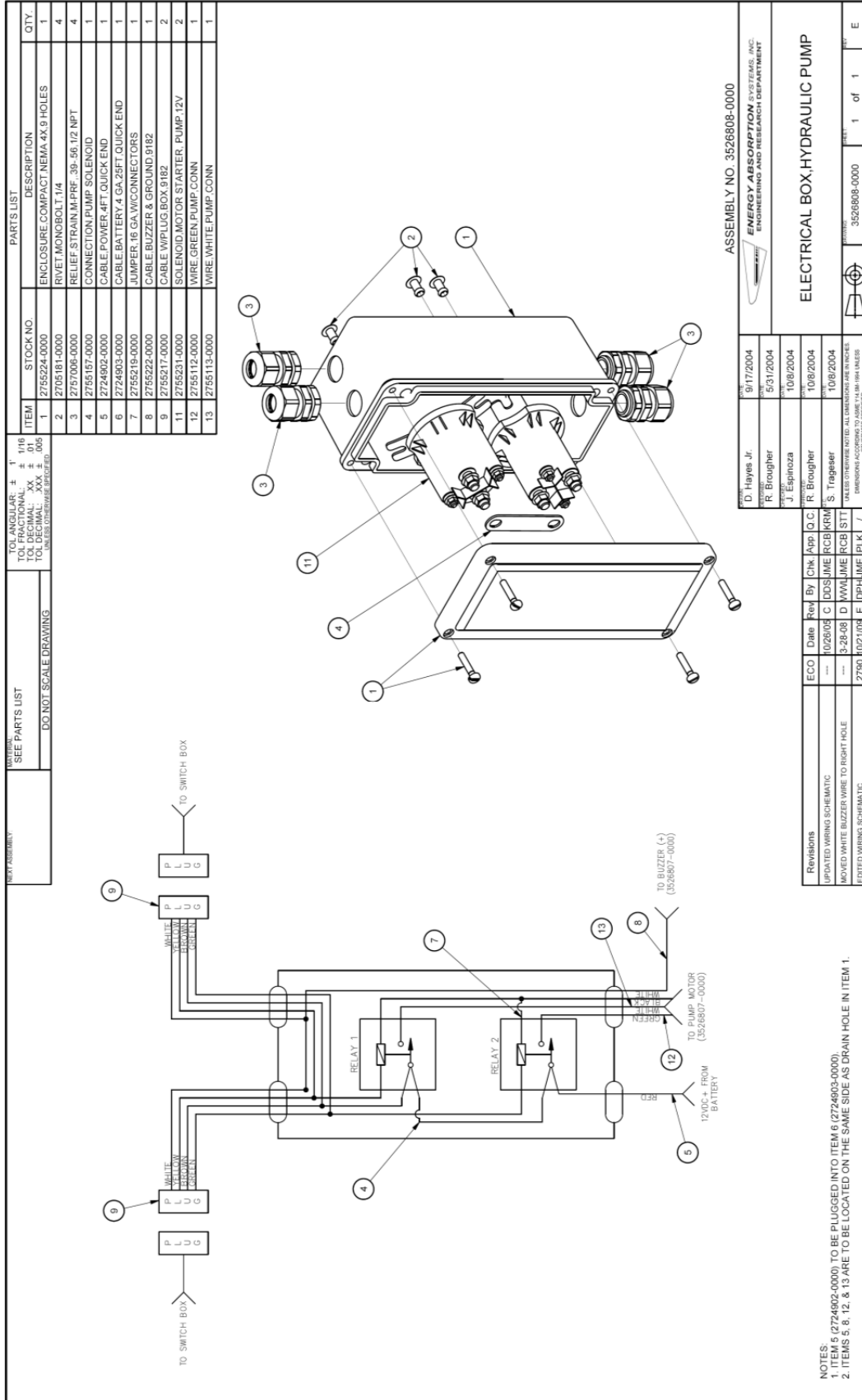
Support Frame Assembly, 9182



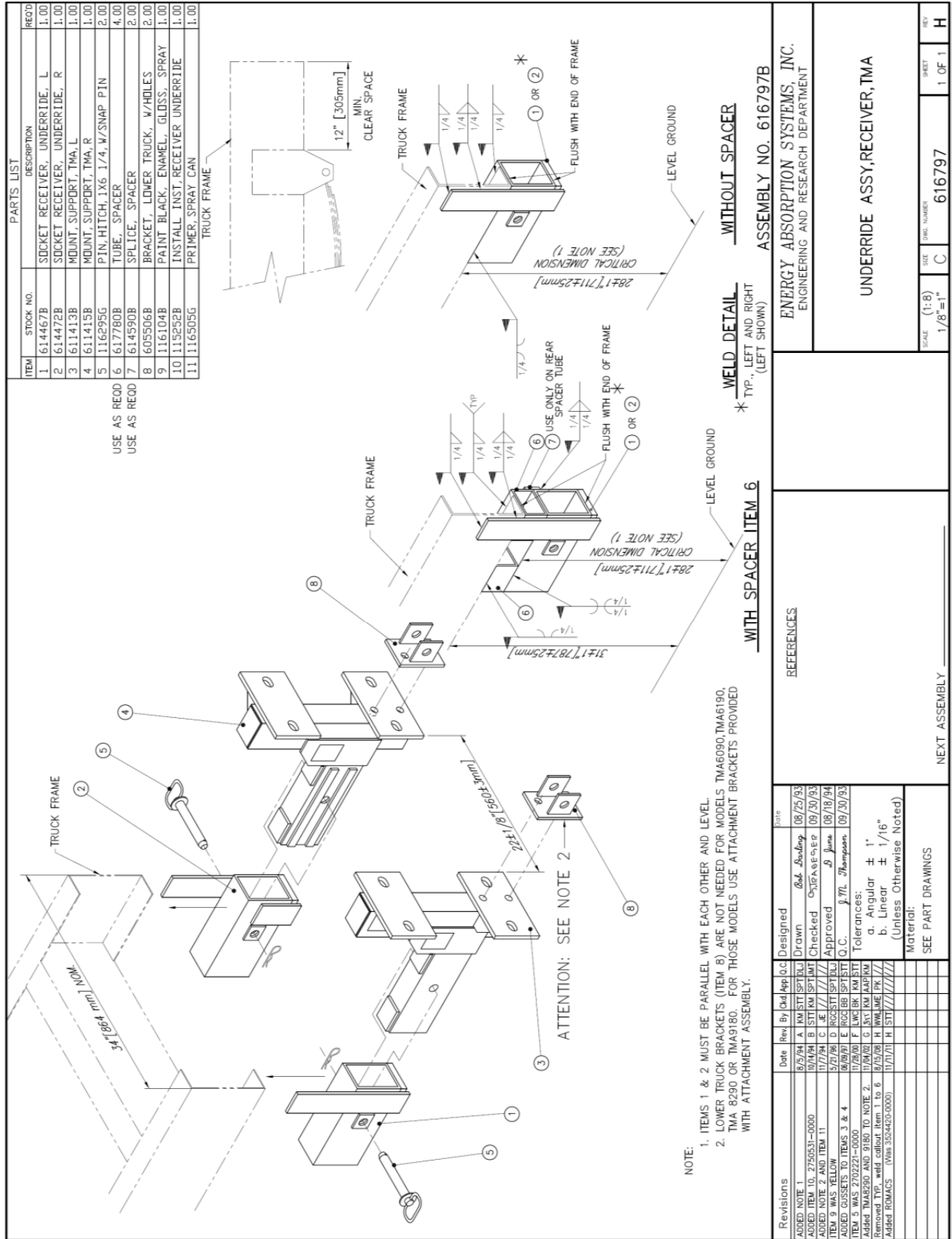


ITEM	STOCK NO.	DESCRIPTION	QTY.
1	3526808-0000	ELECTRICAL BOX, HYDRAULIC PUMP	1
2	2757657-0000	BUZZER 6-28V 80-95DB	1
3	2715401-0000	BRACKET, PUMP TMA 9182 PT	1
4	2701020-0000	BOLT, HX, 3/8X3/4, G	2
5	2708021-0100	WASHER, FLAT, 3/8X1/4 P	2
6	2708041-0100	WASHER, LOCK, 3/8 P	2
7	2701311-0100	BOLT, HX, 3/8X3/4, G2 P	2
8	2708601-0300	WASHER, LOCK, #10 S	4
9	2704861-0300	NUT, HX, #10-32 S	4
10	2700971-0100	BOLT, HX, 5/16X3/4, G2 P	1
11	2708131-0100	WASHER, FLAT, 5/16 X 11/16 P	2
12	2708171-0100	WASHER, LOCK, 5/16 P	2
13	2704081-0100	NUT, HX, 5/16 P	1
14	2723671-0000	PUMP, MARINE QD, VERT, 12V	1
15	2704243-0100	NUT, HX, LOCK, 3/8 GC P	2
16	2708612-5300	SCREW, SOCKET, HD, 10-32X1 S	4
19	2020961-0000	WRAP, SHRINK, 1/4	6
20	2755036-0000	CONNECTOR, BUTT, 12-10 TO 16-14 GA	1
21	2755937-0000	WIRE, 10 GA, BLACK	.75

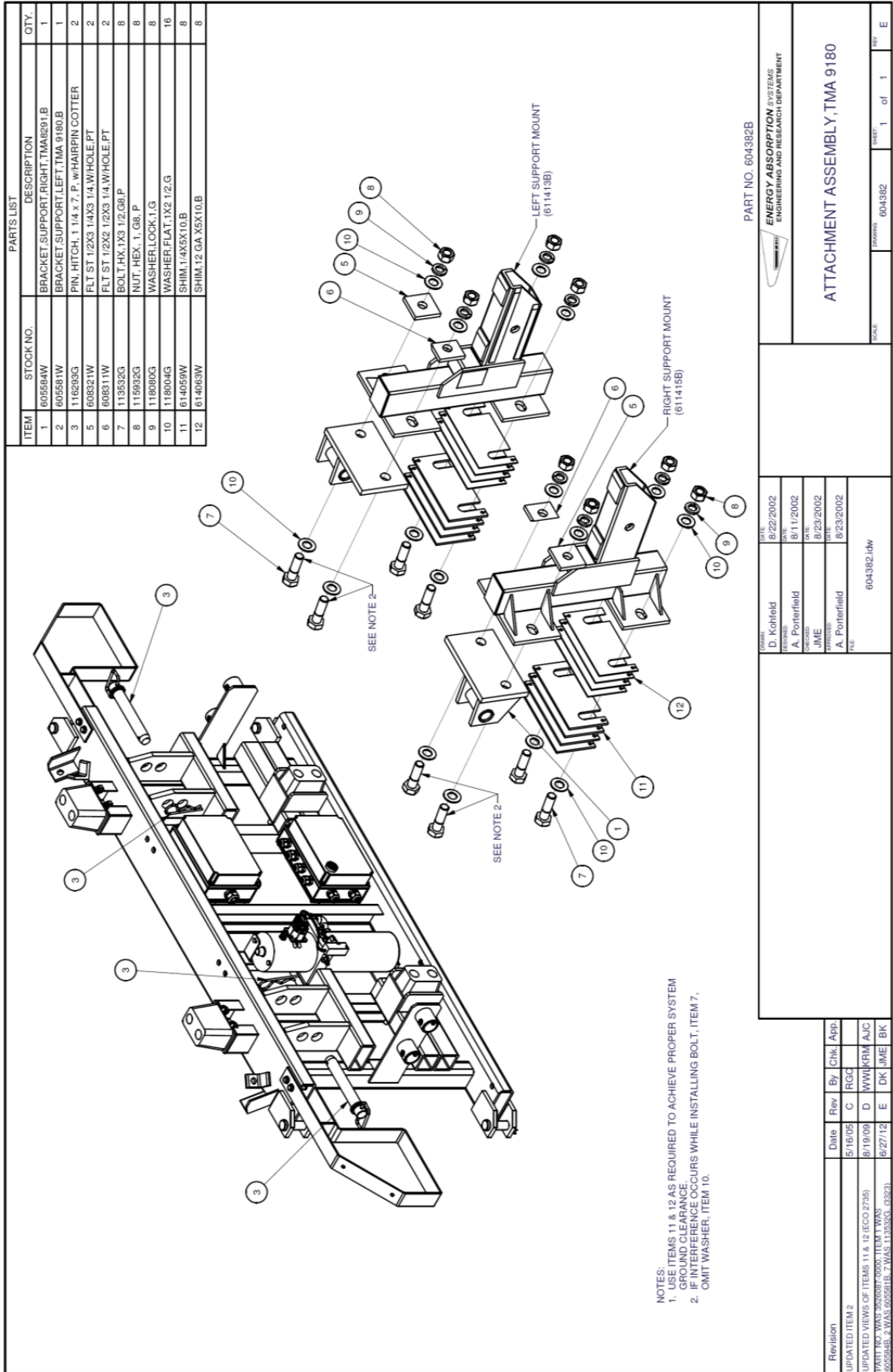
DWG 3526808



Electrical Box Hydraulic Pump

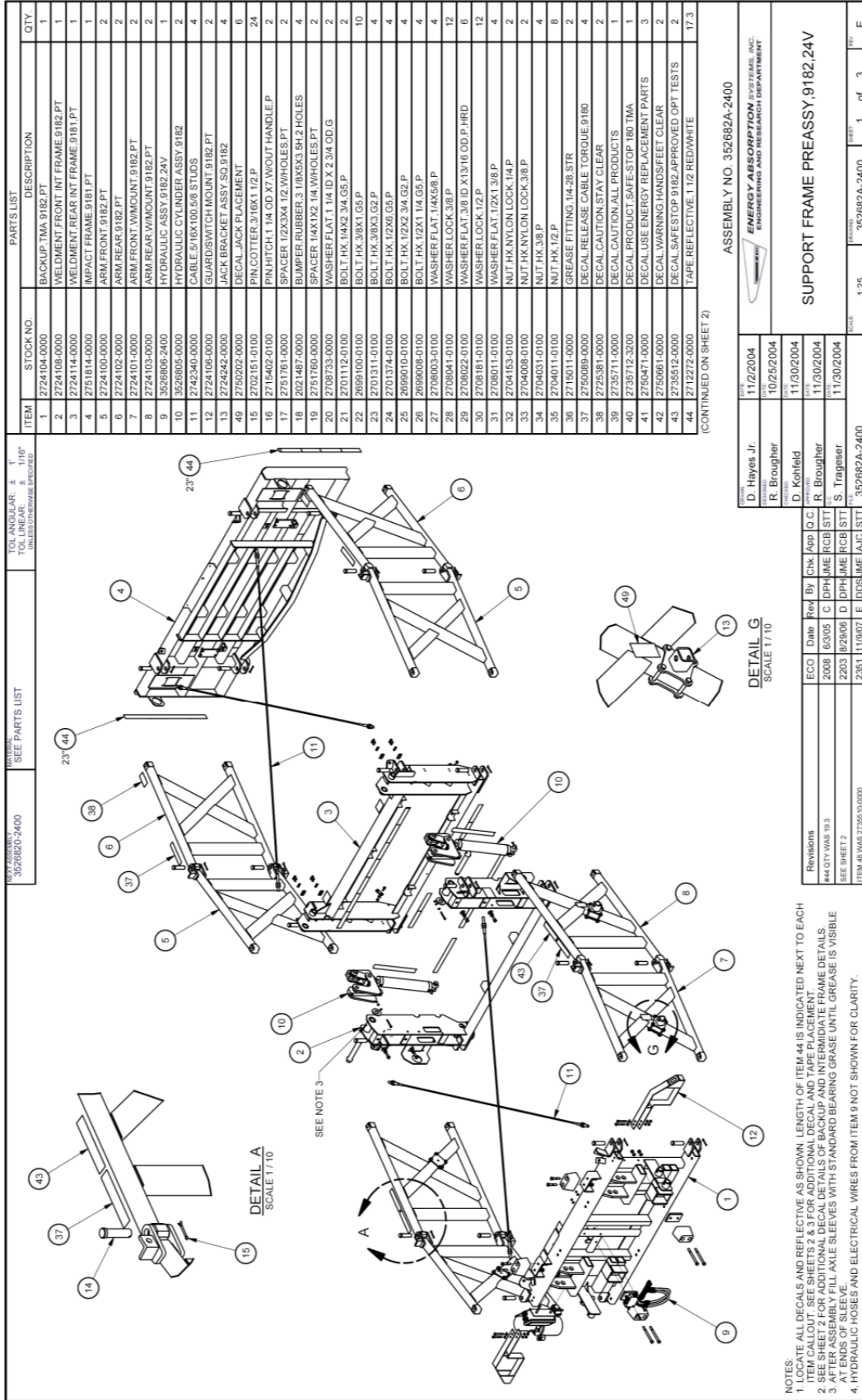


DWG 604382

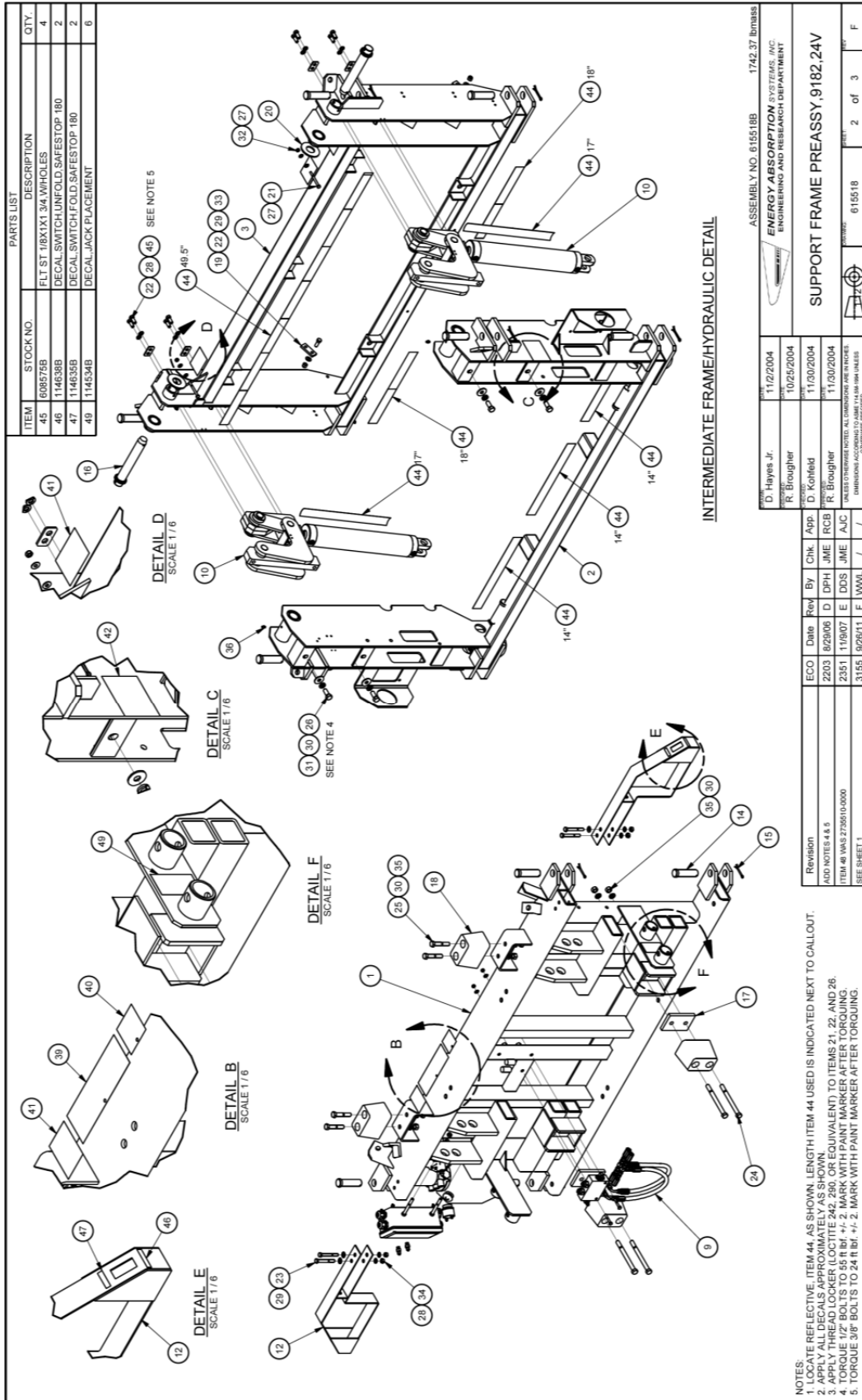


Attachment Assembly, 9180

DWG 352682A Sheet 1 of 3



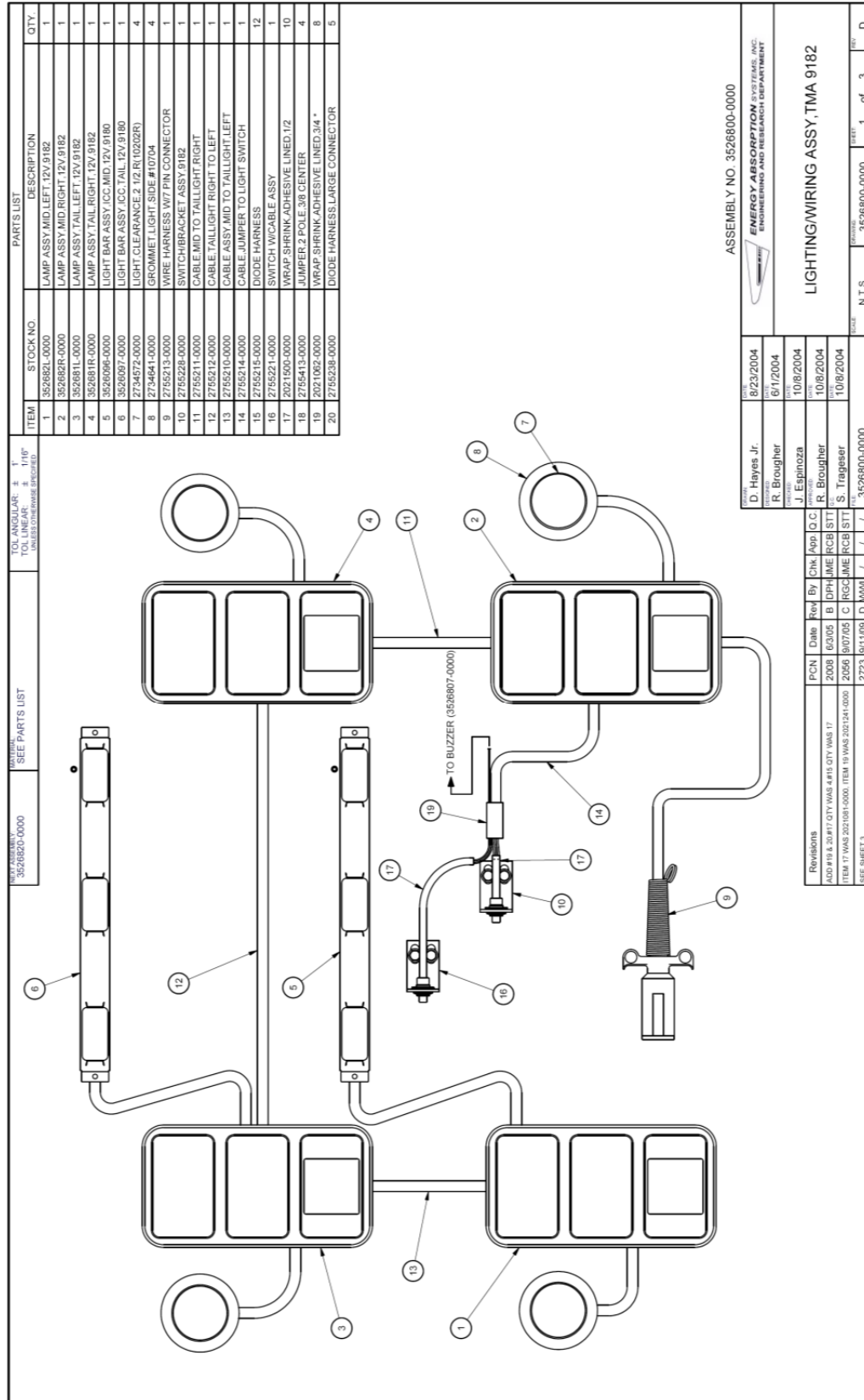
Support Frame Preassembly, 9182, 24V





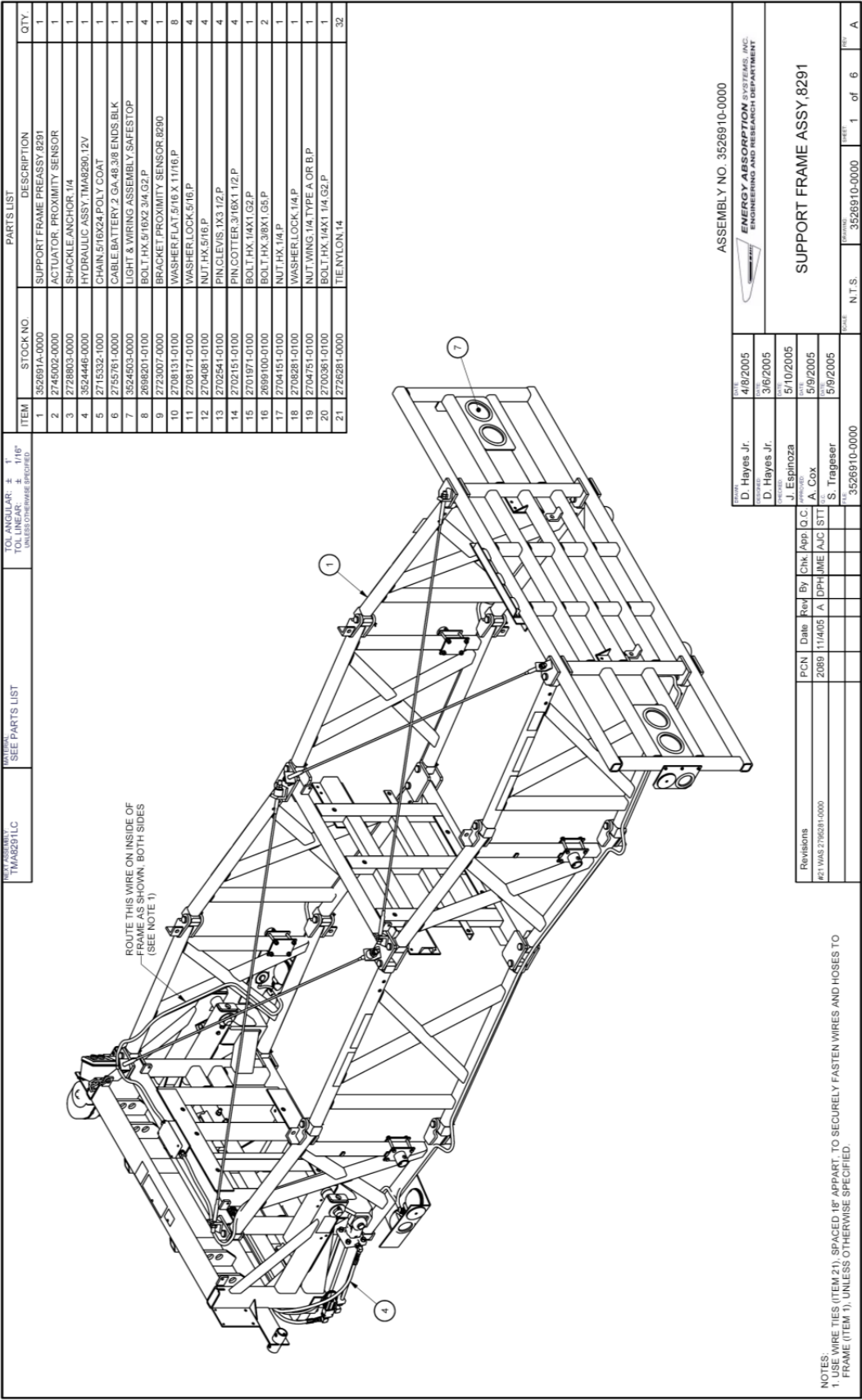
NOTES:
1. APPLY ALL DECALS APPROXIMATELY AS SHOWN.

DWG 3526800 Sheet 1 of 3



Lighting/Wiring Assembly, 9182

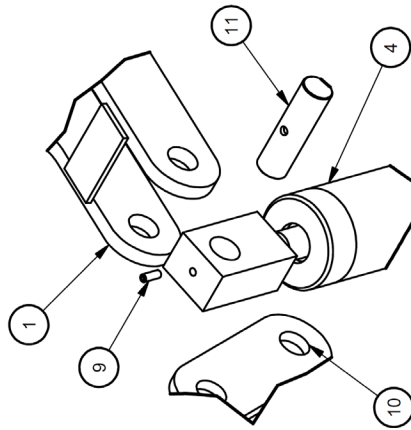
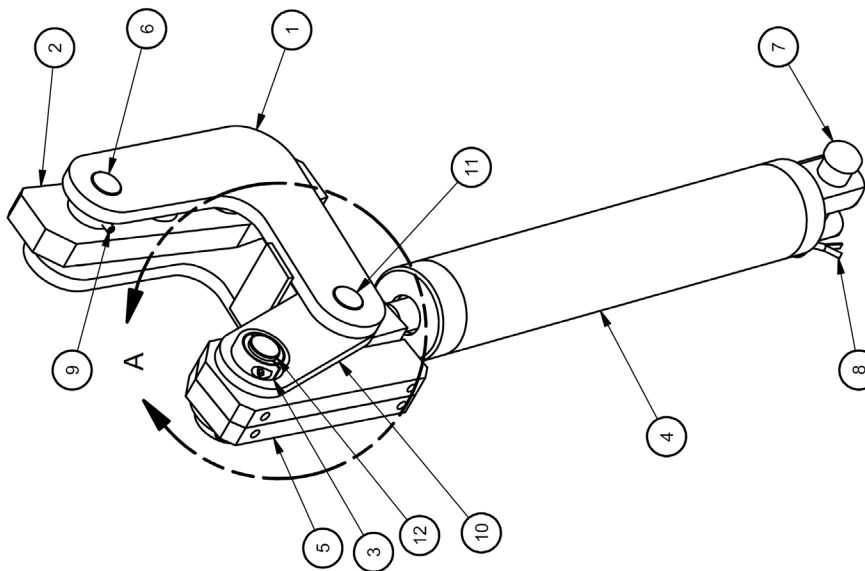
DWG 3526820-0000



Support Frame Assembly, 8291

DWG 610306

NEXT ASSEMBLY:	MATERIAL SEE PARTS LIST	TOL ANGULAR: \pm 1° TOL LINEAR: \pm 1/16" UNLESS OTHERWISE SPECIFIED	PARTS LIST			
			ITEM	STOCK NO.	DESCRIPTION	QTY.
			1	608973W	FOLLOWER LINK, 9182, PT	1
			2	608972W	FOLLOWER LINK PIVOT, 9182, PT	1
			3	117075B	SHAFT, COLLAR, 1 3/4 ODX 1 IDX 1/2 WD	2
			4	114409B	CYLINDER, 2 1/2 B, 12S, CRIMPED	1
			5	612857B	PUSH LINK PIVOT, TMA 9180, PT	2
			6	613784G	RRD ST 1 ODX 3 1/2 W/SET HOLE	1
			7	118386G	PIN, CLEVIS, 1X3 3/4, P	1
			8	116276G	PIN, COTTER, 3/16X1 1/2, P	1
			9	116979G	SCREW, SET, 1/4-20X3/4 B	2
			10	608782W	FLT ST 3/8X2 1/2X7 3/16, PT	2
			11	613785G	RRD ST 1 ODX 3 1/2 W/HOLE	1
			12	613783G	RRD ST 1 OD X 3 1/2	1



DETAIL A

NOTES:
1. USE BLUE LOCK-TITE ON ITEMS 3 & 9. TIGHTEN AND MARK WITH PAINT MARKER.
2. PUT ALL PURPOSE GREASE ON PINS DURING THIS ASSEMBLY.

Revision	ECO	Date	Rev	By	Chk.	App.
ITEM 7 WAS 116253G	3199	5/15/12	B	WWL	JME	RCB
ADDED NOTE 2	3588	3/11/13	C	WWL	JME	RCB
CHG. #12 WAS 613786G	3701	8/30/13	D	DPH	JME	RCB

DRAWN: D. Hayes Jr.		DATE: 9/24/2004	PART NO. 610306B		54.57 lbmass
DESIGNED: A. Cox	CHECKED: J. Espinoza	DATE: 6/1/2004	ENERGY ABSORPTION SYSTEMS ENGINEERING AND RESEARCH DEPARTMENT		
APPROVED: A. Cox	DATE: 10/7/2004	DATE: 9/29/2004	HYDRAULIC CYLINDER ASSY, 9182		
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE IN INCHES. DIMENSIONS ACCORDING TO ASME Y14.5M-1994, UNLESS OTHERWISE SPECIFIED.			DRAWINGS	SHEET	REV
			610306	1 of 1	D

Hydraulic Cylinder Assembly, 9182

Notes:



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Dallas, Texas 75207

888-323-6374 (USA only)

214-589-8140 (Outside USA)

www.energyabsorption.com

www.highwayguardrail.com