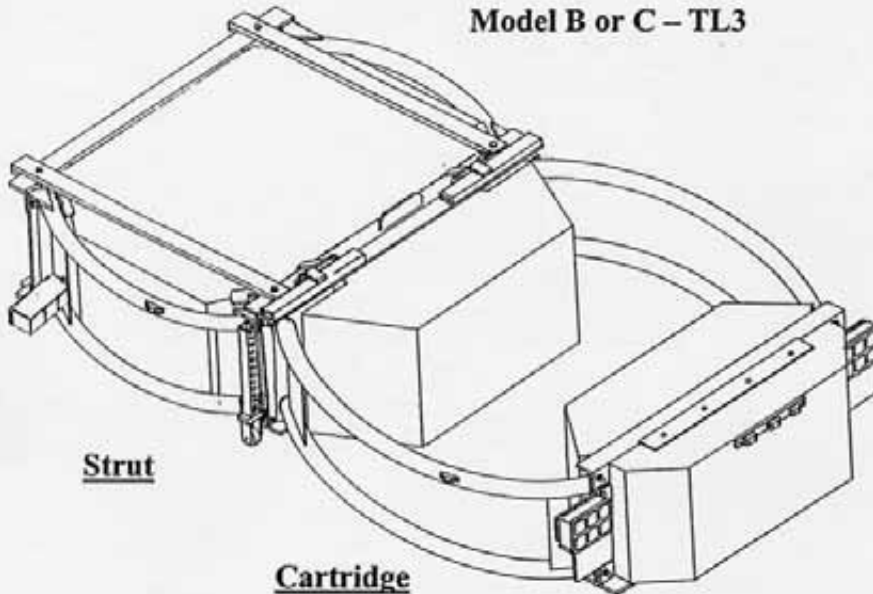


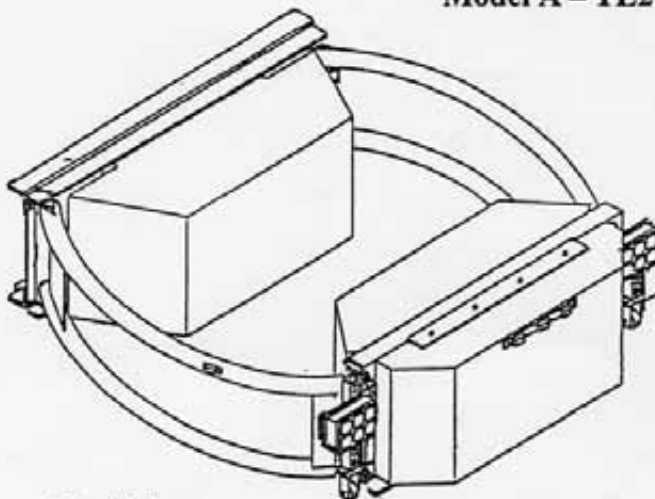
Installation, Maintenance, and Repair Manual

For Scorpion 10,000 TMA

Model B or C – TL3



Model A – TL2



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Revision C (Dated 11/5/03)

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Safety Instructions

- A. Before attempting to install or operate the Scorpion 10,000 TMA this manual should be read and understood. Those areas with warnings or cautions should be carefully followed.
- B. Before raising or lowering the TMA the operator should check that the area around the TMA is clear and that personnel are not in or near the area.
- C. Before operation on the roadway, check all 1" diameter pins and bolts at the back-up and hinge areas for tightness and excessive wear. Also, check that all cotter pins are in place.
- D. Check that the two drop jacks (27) are fully retracted and that the safety pins are in place. Also, check that the crank jacks are fully retracted and rotated to the up and locked position.
- E. For correct operation of the TMA in the use mode (fully extended in the horizontal position), the entire TMA should be 12" \pm 1" above the ground and horizontal to the roadway.
- F. The responsible agency for the truck should check that the following specifications are met. The truck should be ballasted to an actual weight of around 20,000 lbs. to provide correct performance. The ballast should be properly anchored to the truck frame to prevent movement during an impact. The truck should be equipped with proper operator safety equipment such as seat belts and headrest, etc.
- G. Before disconnecting the TMA from the truck, make sure the TMA is in the horizontal position.

Special Warnings

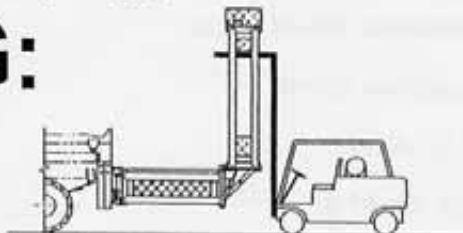
- 1. After a vehicle impact with the TMA, do not drive the truck with the damaged TMA. Remove the TMA at the backup and have the TMA transported back to the maintenance yard.
- 2. Check the TMA model to make sure that the posted speed matches the TMA capacity.

Model A = TL2 = 70 km. (45 mph)

Model B or C = TL3 = 100 km. (62 mph)

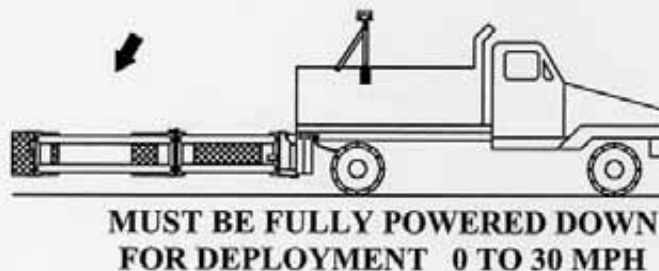
- 3. **WARNING:**

DO NOT WORK ON TMA
WITHOUT A FORKLIFT
SUPPORTING THE TMA



OPERATOR'S DEPLOYMENT INSTRUCTIONS

1. For operation, truck driver/operator will plug in hand held operating control located at right side rear of the truck and raise or lower the TMA.
2. Before travel to or from work zones, TMA must be hydraulically powered to the full stop position on the support post. **(Continue to push the up button for two seconds after stopping point is reached to ensure a full power lock.)**
3. For deployment of TMA (0-30 mph), truck driver/operator must ensure the TMA is locked into the horizontal position by action of the hydraulic system. When fully deployed, the hydraulic pressure cut-off system will ensure the TMA is set and locked into position. **(Continue to push the down button for two seconds after stopping point is reached to ensure a full power lock.)**
4. For deployment of TMA in stationary applications, truck driver/operator must ensure truck is parked with the emergency brake on and is engaged in gear or park.
5. For night operation, truck driver/operator must check and ensure that the side and rear light markers are switched on via the truck light switches.
6. On completion of the deployment, truck driver/operator must check for clearance before retracting the TMA to its fully folded position.
7. Truck driver/operator must ensure that the TMA is hydraulically powered to the full stop position on the support post before travel. **(Continue to push the up button for two seconds after stopping point is reached to ensure a full power lock.)** Disconnect the hand held operation control unit from the truck.
8. Check that TMA sets down correctly on the two side saddles. If correction is needed, loosen the U-bolt clamps, move the clamps forward or backward to find the correct position and re-tighten the U-bolts.



Attachment or Removal of TMA From Truck

1. TRUCK ATTACHMENT, REFER TO THE FOLLOWING FIGURES 1 & 2: To attach the TMA to the truck, roll the TMA up to the truck and connect the red battery wire to the red battery wire and connect the black battery wire to the black battery wire. Connect the 4-pin electrical controller. Lower the TMA to the horizontal position by pushing the down button on the controller.
 - A. Always insert the 1" diameter bolts (T-pins with safety clips are optional) (2 ea.) into the main hinges reference "A" at the truck support first.
 - B. Insert the 1" diameter bolts (T-pins with safety clips) (2 ea.) into the hydraulic cylinder clevis reference "B" supports. Use the up/down buttons on the controller to help position the pins.
 - C. Plug the 7 pin electrical light connector into the socket.
 - D. Crank the crank jacks to the full up position and unlock and rotate with the wheels inboard. Make sure the wheels are relocked in the up horizontal travel position.
 - E. Raise the cartridge just above the horizontal position and raise the drop jacks to the up (travel) position and pin in place.
 - F. Raise and lower the system with the up and down controller. Check that the hydraulic system is functioning correctly. Also, check the pins to verify that all safety pins are in place.
 - G. Check all bolts for tightness.
 - H. Raise TMA to the full Scorpion travel position stopped down on the support post.
2. TRUCK REMOVAL, REFER TO THE FOLLOWING FIGURES 1 & 2: To remove the TMA from the truck lower the TMA until the strut moves from 90° to 10°.
 - A. Lower the drop jacks by removing the pins and position the jacks at the 16" length.
 - B. Lower the TMA until the drop jack wheels just touch the ground.
 - C. Unlock the crank jacks and rotate the crank jacks to the down position and lock them in place. Lower the wheels till they are carrying the weight.
 - D. **WARNING: Do not unpin TMA while the cartridge is in the vertical position. Lower the cartridge to the 0° position. The cartridge will try to lower and extend the vertical hydraulic cylinders if it is not in the horizontal position.**
 - E. Always remove the 1" bolts (T-pins are optional) on the backup hinges reference "A" first before removing the hydraulic cylinder clevis bolts.
 - F. Remove the hydraulic clevis 1" bolts (T-pins) reference "B". Use the up/down buttons on the controller to unload the force on the pins to help remove the pins.
 - G. If the TMA is to be stored in the 90° position, now that it is disconnected from the truck, push the up button to raise the TMA cartridge to the 90° position.
 - H. Disconnect the battery cables; disconnect the 7-pin electrical light connector and the 4-pin controller.
 - I. Pull the TMA away from the truck and push to the storage area.

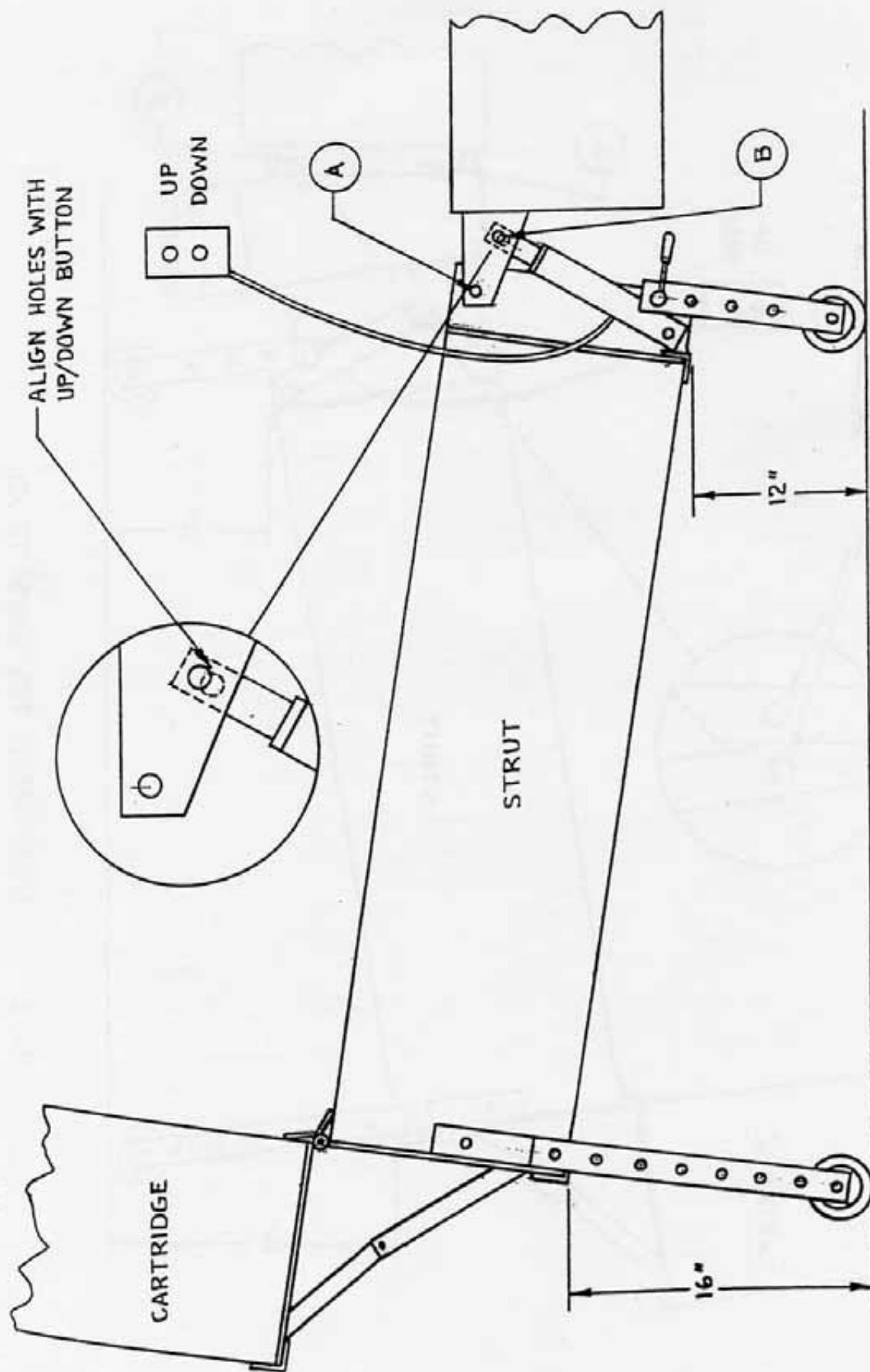


FIG. 1 STANDARD TRUCK MOUNT

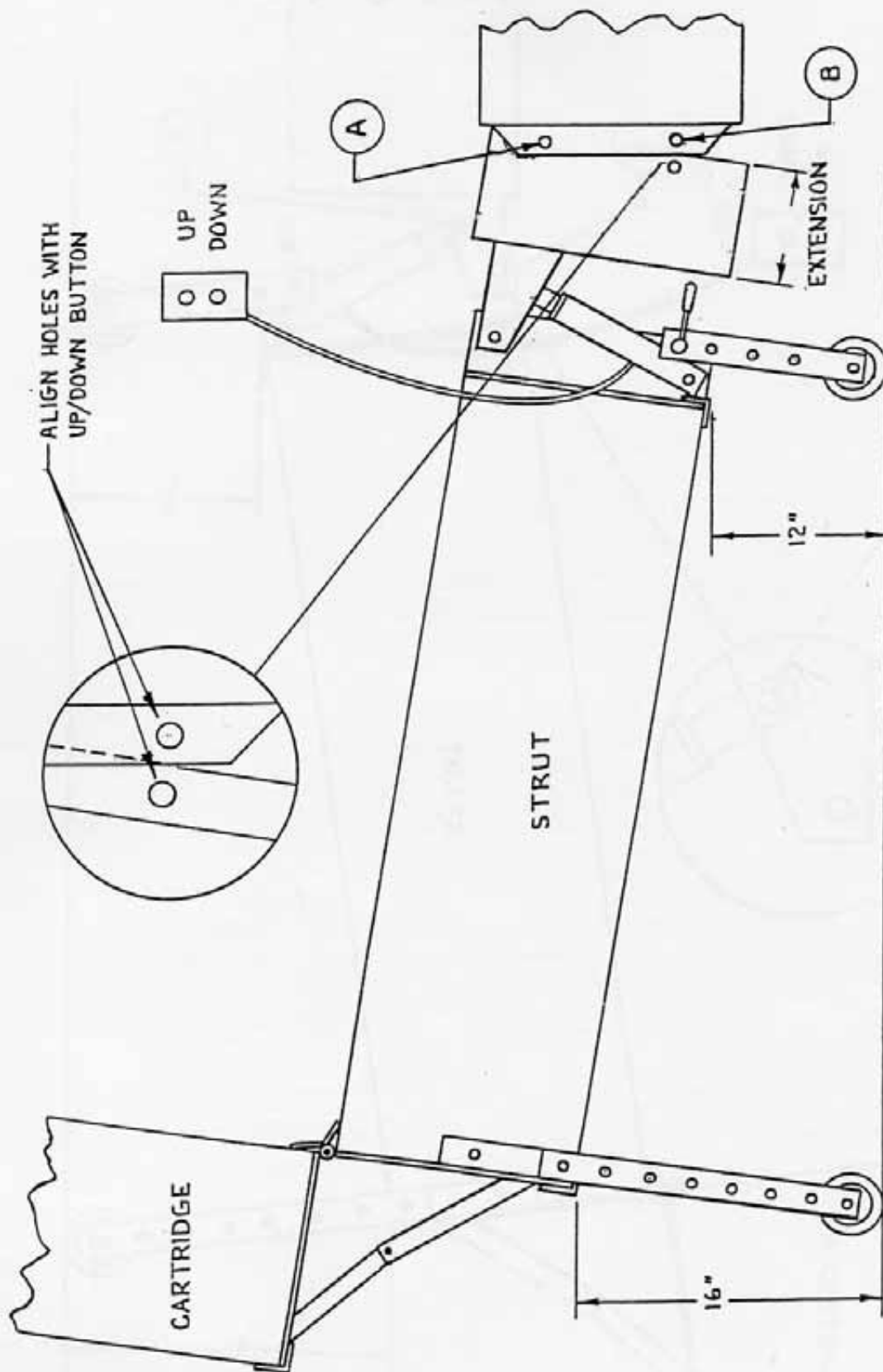


FIG. 2 EXTENSION FOR DUMP TRUCK

General Maintenance

<u>Item to Service</u>	<u>Frequency</u>
1. Check 1" bolts and nuts (4 ea.) Securing TMA to backup for tightness	Check before driving
2. Check 1" pins in hydraulic cylinders and safety pins (7 ea.) for wear and missing pins	Check before driving
3. Check hydraulic hoses for leaks and wear and secure tie-downs	Check before driving
4. Check for levelness and height in down position 12" \pm 1" clearance with the truck ballasted to 20k.	Check before driving
5. Check 1/4" bolts that attach all four modular energy absorbers for tightness	Check before driving
6. Grease zerk fittings on hinges and apply grease to lockout arm hinges and pivot.	As required
7. Clean hydraulic pump, hydraulic rams and jacks to remove dirt and salt	As required
8. Grease jacks, casters, 90° hinges, and cylinder clevises	As required
9. Add hydraulic fluid if needed	As required
10. Replace light bulbs	As required
11. Check 90° lockout mechanism	As required
12. Change hydraulic fluid annually	Annually

After Impact Removal & Repairs

1. Have an insurance inspector inspect the damage prior to performing any work.
2. Disassemble system and mark for replacement all bent and damaged parts.
3. Write down document part numbers for those items that need replacement – only Traffix replacement parts can be used for warranty validity.
4. After receiving replacement parts verify that the new sections fit against the older section and proceed to assemble per the installation manual.
5. Raise and lower the system and road test the system for proper assembly.

Trouble Shooting Instructions

Problem	Solution
1. <u>Hydraulic motor lacks power</u>	The electric motor draws a high amperage current so all connections need to be clean and tight. The positive and negative wires need to be #1 gauge or larger. The battery should be fully charged. The voltage across the motor terminals will read 12 volts with motor running if the electrical connections are sufficient.
2. <u>Hydraulic motor runs but does not lift</u>	<p>The fluid level needs to be reasonably full to allow pumping.</p> <p>Occasionally, the two-button controller will fail to activate both the motor and open the hydraulic solenoid valve (Up-top red solenoid, Down-lower red solenoid). Use another controller to test if the controller is faulty. Replace the solenoid if it does not activate when powered.</p>
3. <u>Hydraulic motor barely lifts TMA</u>	Follow the instructions on page 19 to increase the pressure relief setting on the adjustable relief valve.
4. <u>Hydraulic motor does not run</u>	Touch the copper bus bar on the motor with the red battery wire. If motor runs the problem is in the controller.
5. <u>TMA is not level</u>	The TMA will settle out over time due to bolts seating. Shims should be welded to the bottom 4" x 4" Angle 16 on the truck support to level the entire TMA at 12" ± 1" above the ground.
6. <u>Lights will not work</u>	Check light bulbs and plugs. Also, check power and power supply plug.

Limitations and Warnings

The Scorpion 10,000 TMA (Truck Mounted Attenuator) has been tested and evaluated per the recommendations of the National Cooperative Highway Research Program (NCHRP) report 350. The Model A is capable of decelerating and stopping light and heavy weight vehicles (820 kg. and 2000 kg.) in accordance with the criteria of tests 2-50 and 2-51 for TL-2 certification (70 kph). Reference FHWA letter HSA-CC65 for additional information.

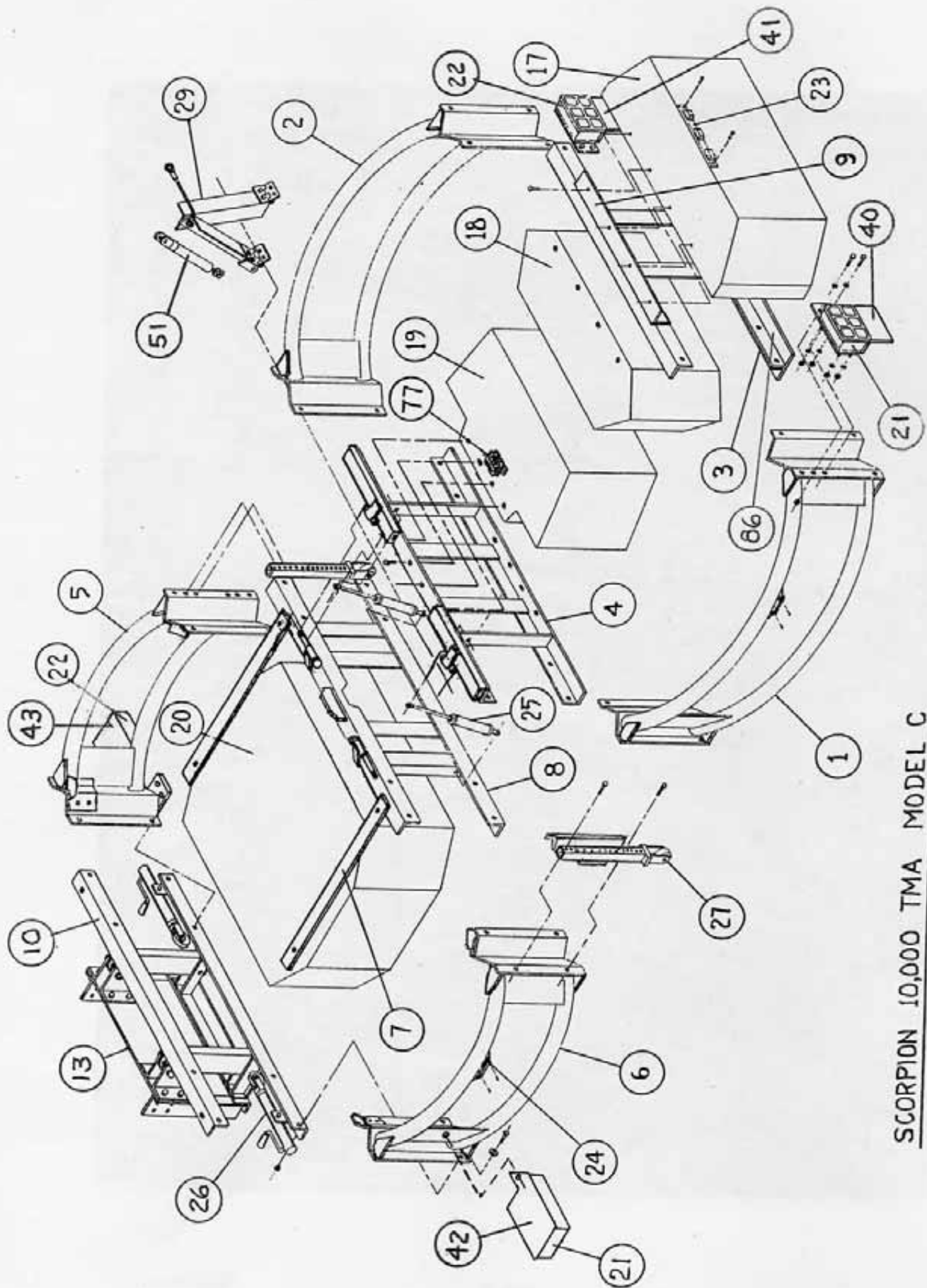
The Model B and C Scorpion TMA's are capable of decelerating and stopping light and heavy weight vehicles (820 kg. and 2000 kg.) in accordance with the criteria of tests 3-50, 3-51, and optional tests 3-52 and 3-53 for TL-3 certification (100 kph.). Reference FHWA letter HSA-CC65 for additional information.

To achieve acceptable impact performance, it is recommended that the Scorpion 10,000 TMA be mounted to a truck with a weight of approximately 20,000 lbs. The entire TMA must be mounted level with the ground and the bottom of the TMA must be $12" \pm 1"$ (305 mm. \pm 25 mm.) above the ground.

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.

Scorpion 10,000 TMA Parts List

Item #	Part #	Item Description	Qty
1	10100L	Cartridge Tube Assembly Left	1
2	10100R	Cartridge Tube Assembly Right	1
3	10100D	Cartridge Diaphragm, Rear	1
4	10100E	Cartridge Diaphragm, Front of Rear	1
5	10200TR	Strut Tube Frame Right	1
6	10200TL	Strut Tube Frame Left	1
7	10118	Strap Assy (Left & Right)	1
8	10200E	Strut Diaphragm Assembly, Rear	1
9	10465	Rear Top Angle, Cartridge	1
10	10300	Back-Up Assembly	1
11	10351	Bracket Hydraulic Right	2
12	10352	Bracket Hydraulic Left	2
13	10353	Backing Plate	1
14	10354	4" x 9" Angle Right	1
15	10355	4" x 9" Angle Left	1
16	10356	4" x 4" Bottom Angle	1
17	10400A	Module A Energy Absorber	1
18	10400B	Module B Energy Absorber	1
19	10400C	Module C Energy Absorber	1
20	10400D	Module D Energy Absorber	1
21	10508	Left Turn Light	2
22	10516	Right Turn Light	2
23	10500B	ICC Bar Light Assy	1
24	10502	Side Marking Light	4
25	10601	2 1/2" Diameter Cylinder	2
26	10701	Swivel Jack	2
27	10700A	Drop Jack Assembly	2
29	10800	Lock Out Mechanism	1
30	13000	Support Post	1
31	13025	Support Post Bottom	1
32	13050	Support Post Top	1
40	10550L	Left Tail Light Cover Assy	1
41	10550R	Right Tail Light Cover Assy	1
42	10532A-L	Left Strut Light Bracket	1
43	10532A-R	Right Strut Light Bracket	1
51	10802	2" Diameter Cylinder	1
77	10518	Junction Box	2
86	10127	Rear Bottom Angle, Cartridge	1



SCORPION 10,000 TMA MODEL C

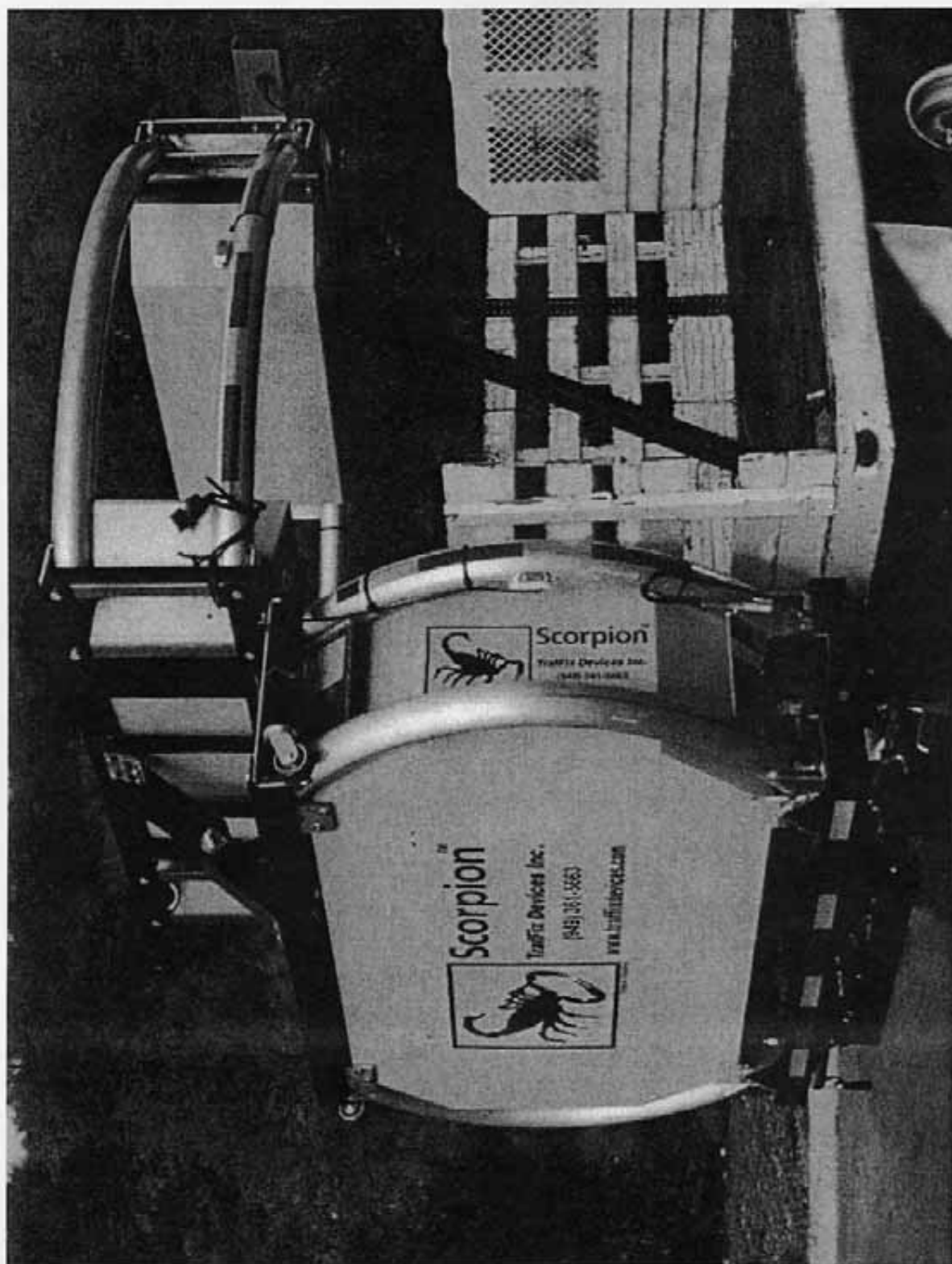


Fig. 4

Revision C

Std Back-Up For Flatbed or Dump Truck Mount Parts List			
Item #	Part #	Item Description	Qty
10	10300	Back-Up Assembly	1
11	10351	Bracket Hydraulic Right	2
12	10352	Bracket Hydraulic Left	2
26	10701	Swivel Jack	2
110	12010	1"-8 x 3" Bolt GR.5 HHCS-Z	8
111	12011	1"-8 x 7" Bolt GR.5 HHCS-Z cut to 5 1/2" chamfered	2
112	12012	1"-8 Nylon Insert Stop Nut	10
127	12028	1" I.D. x 2 1/2" O.D. Flat Washer, Zinc Plated	8

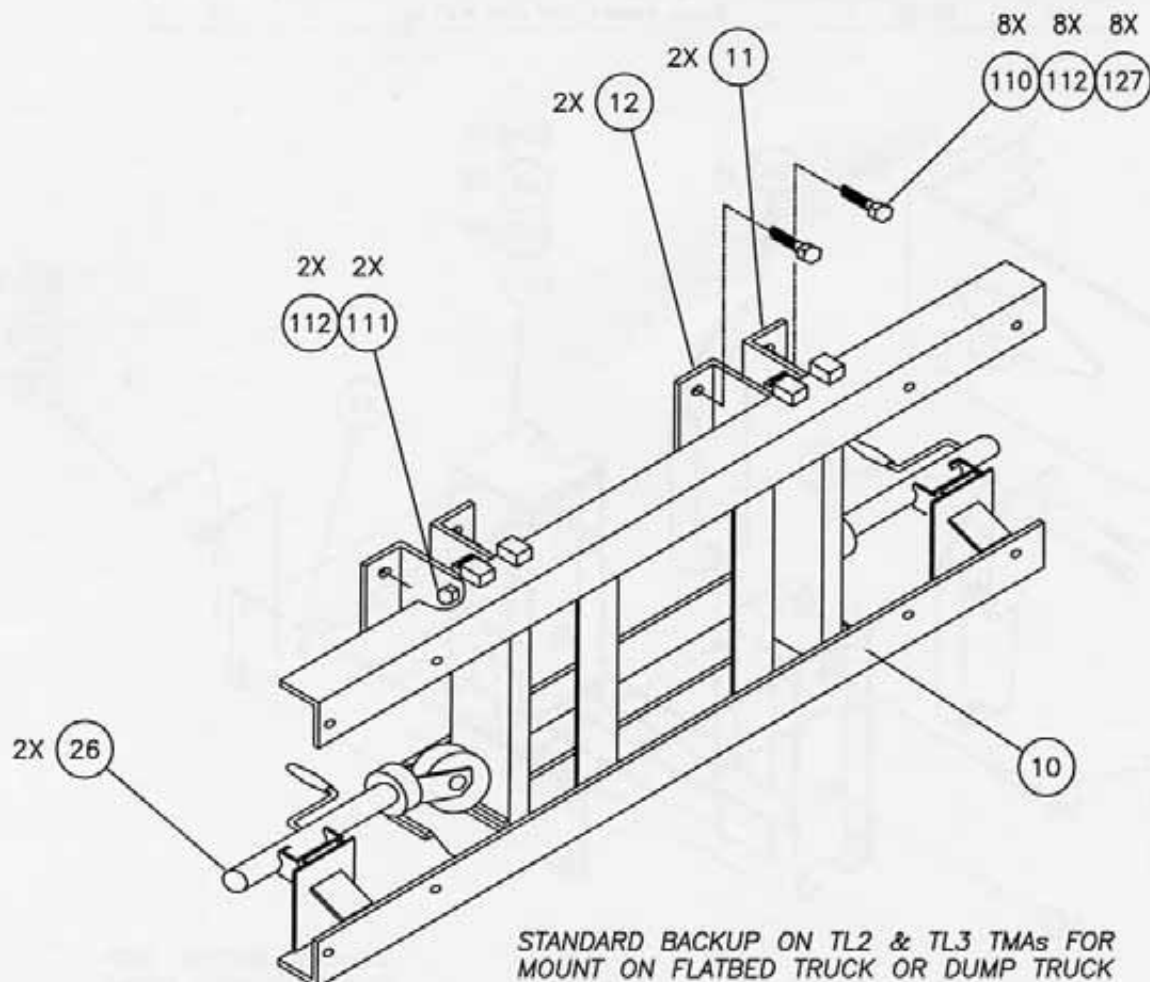
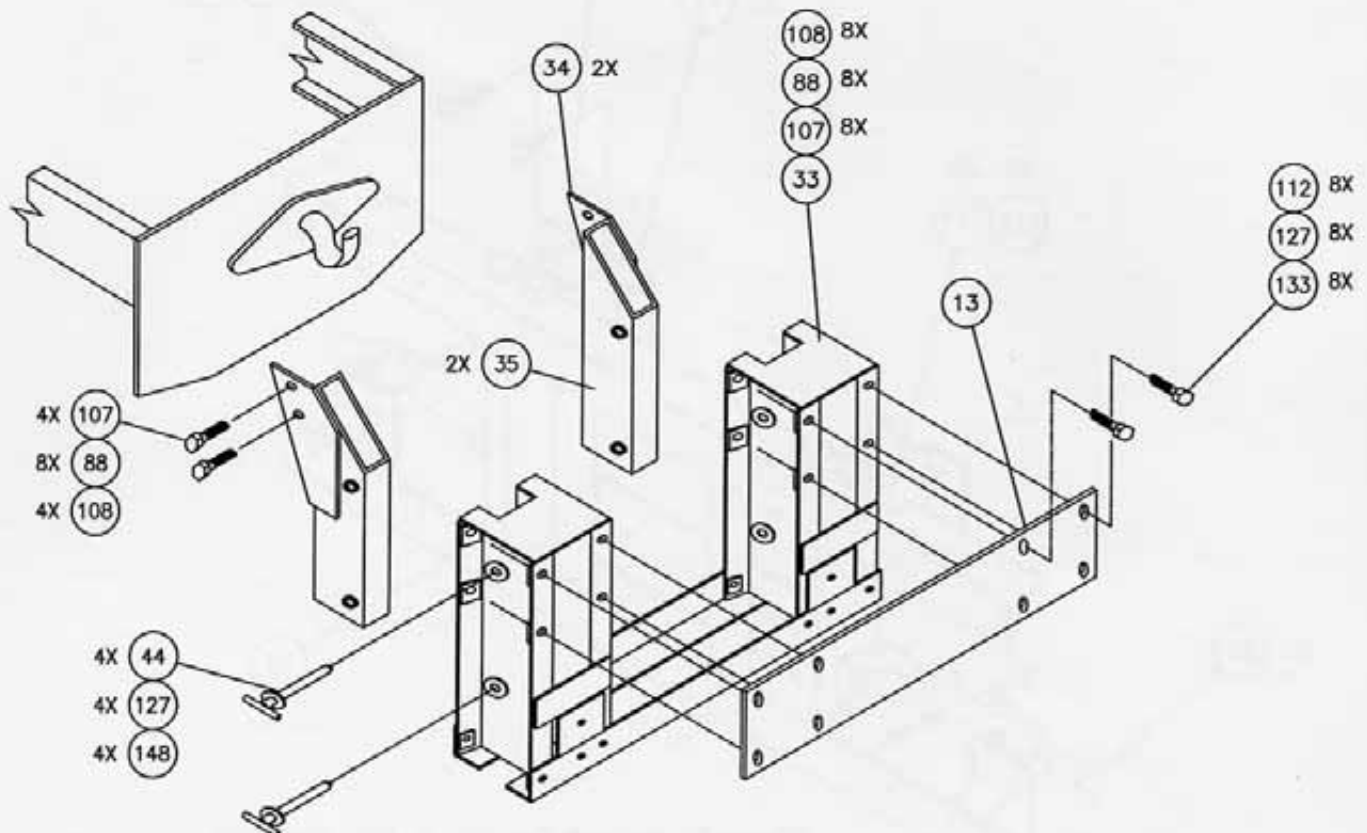


Fig. 5

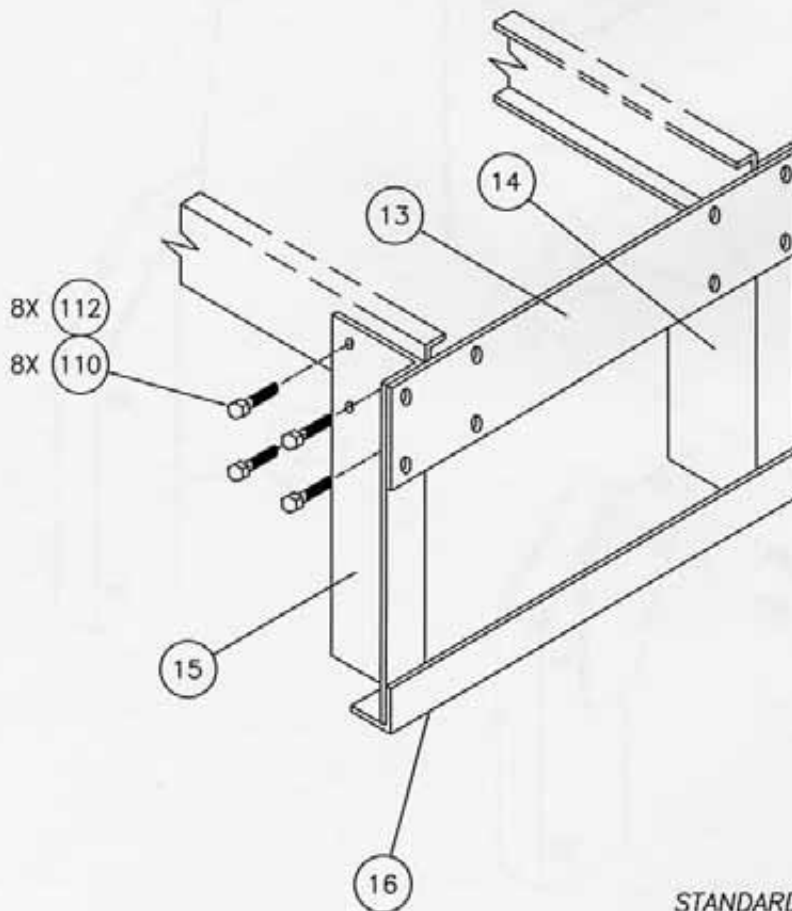
Revision C

Standard Support Assy For Dump Truck Mount Parts List			
Item #	Part #	Item Description	Qty
	11093	Complete Support Assy	1
		consisting of:	
13	10353	Backing Plate	1
33	11095	Standard Extension Frame	1
34	11098	Splice Plate, Dump Truck Mounting	2
35	11096	Tube Weldment, Dump Truck Mounting	2
44	10922	Hitch T-Pin, 1" Dia. x 6 3/4" Lg. Quick Disconnect	4
87	12083	Shim, Steel, 1" I.D. x 1 1/2" O.D.	8
88	12088	Washer, Flat, 13/16" I.D. x 1 1/2" O.D. x .14 Thk.	16
107	12007	3/4"-10 X 2 1/2" Bolt GR.5 HHCS-Z	12
108	12008	3/4"-10 Nylon Insert Stop Nut	12
112	12012	1"-8 Nylon Insert Stop Nut	8
127	12028	Washer, Flat, 1" I.D. x 2 1/2" O.D., Zinc Plated	12
133	12000	1"-8 x 3 1/2" Hex Bolt, Zinc Plated	8
148	12058	Snap, Safety, 1/4" Dia. x 2" Lg	4



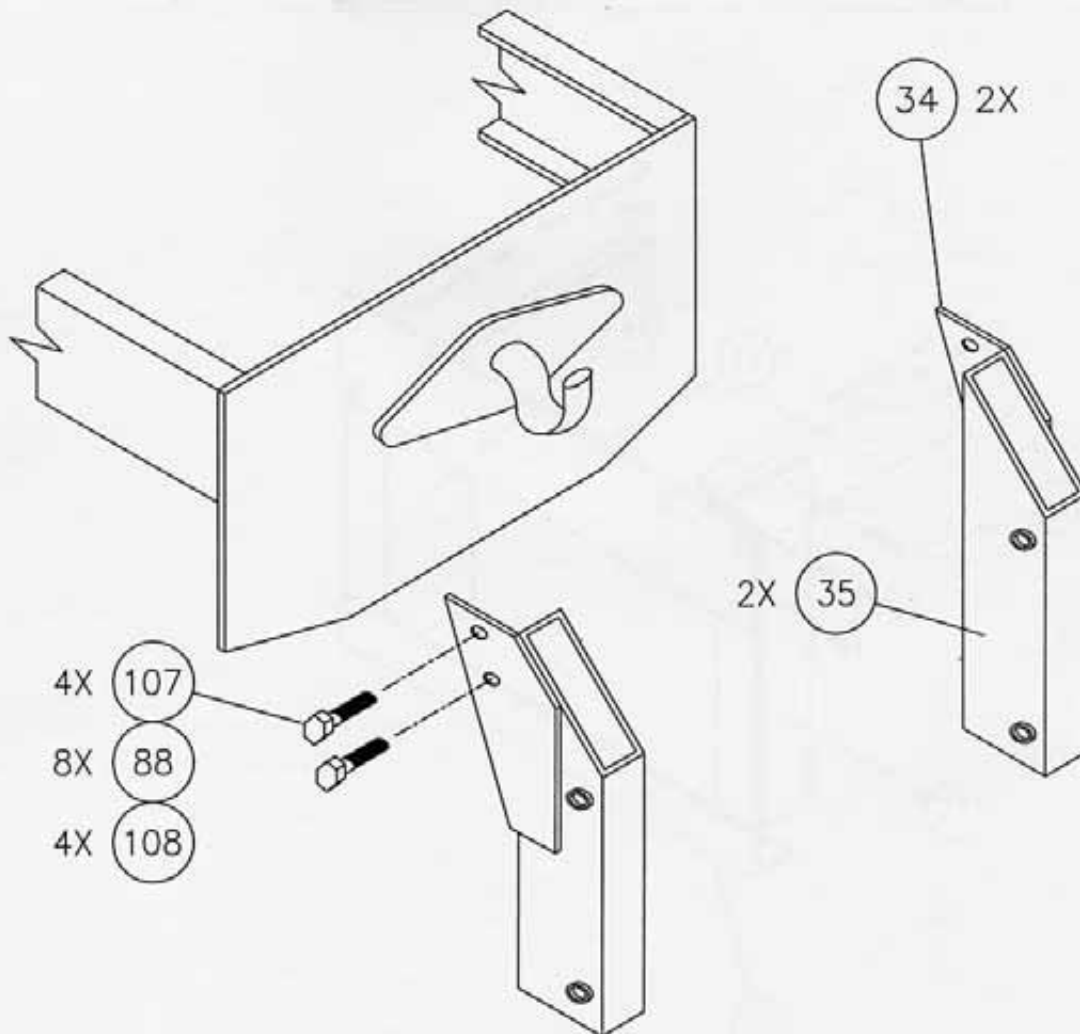
STANDARD SUPPORT ASSY
FOR DUMP TRUCK MOUNT

Std Support Assy For Flatbed Truck Mount Parts List			
Item #	Part #	Item Description	Qty
	10350 OPTION	Complete Support Assy	1
		consisting of:	
13	10353	Backing Plate	1
14	10354	4" x 9" Angle Right	1
15	10355	4" x 9" Angle Left	1
16	10356	4" x 4" Bottom Angle	1
110	12010	1"-8 x 3" Bolt GR.5 HHCS-Z	8
112	12012	1"-8 Nylon Insert Stop Nut	8



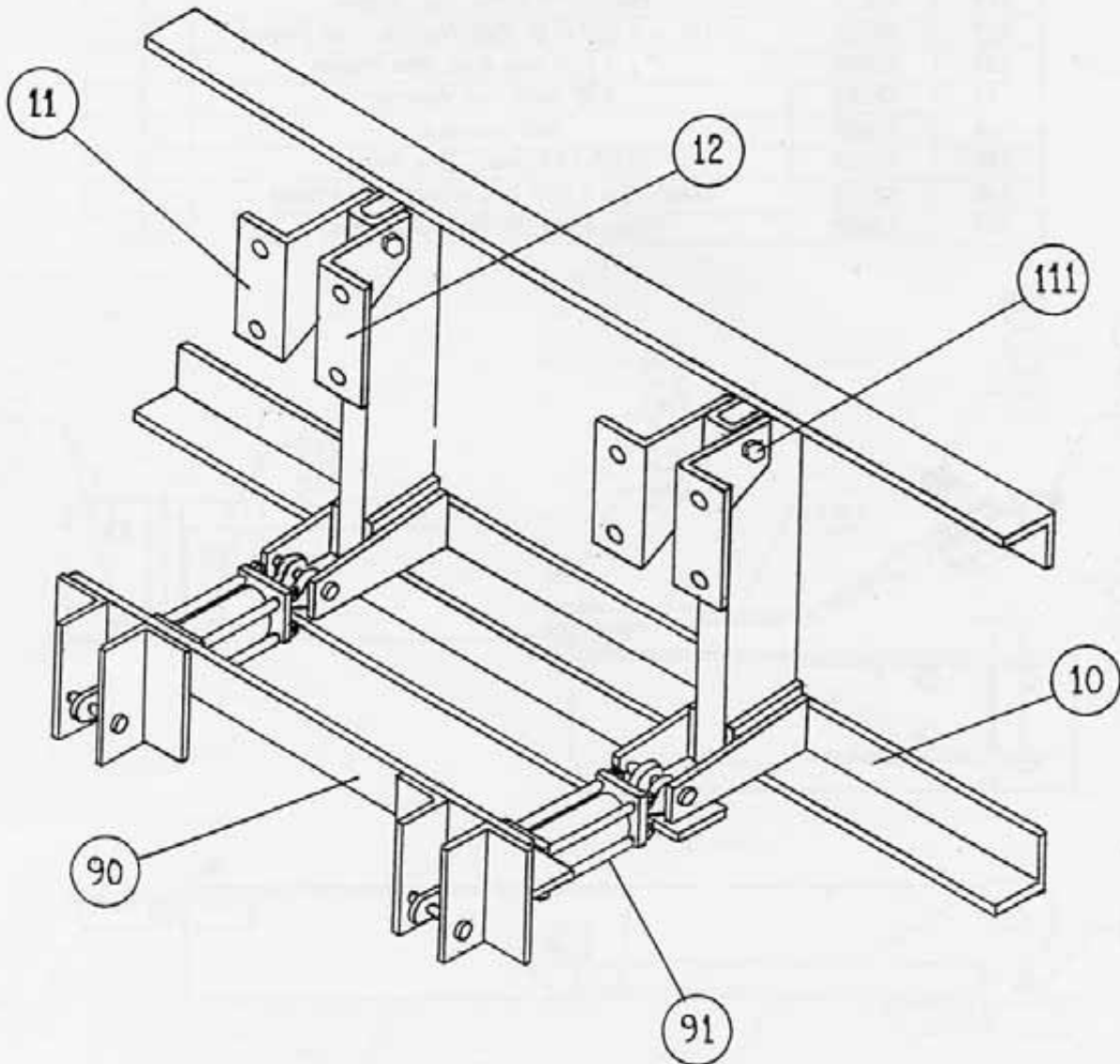
STANDARD SUPPORT ASSEMBLY
FOR FLATBED TRUCK MOUNT

Necessary Components For Extra Dump Truck Mount			
Item #	Part #	Item Description	Qty
	11108	Complete Assy	1
		consisting of:	
34	11098	Splice Plate, Dump Truck Mounting	2
35	11096	Tube Weldment, Dump Truck Mounting	2
88	12088	Washer, Flat, 13/16" I.D. x 1 1/2" O.D. x .14 Thk.	8
107	12007	3/4"-10 X 2 1/2" Bolt GR.5 HHCS-Z	4
108	12008	3/4"-10 Nylon Insert Stop Nut	4



COMPONENTS NECESSARY TO MOUNT
TMA TO ANOTHER DUMP TRUCK

Model B Back-Up & Support Assy Parts List			
Item #	Part #	Item Description	Qty
10	10300B	Back-Up Assembly	1
11	10351	Bracket Hydraulic Right	2
12	10352	Bracket Hydraulic Left	2
90	10375	Bottom Support Bracket Model B	1
91	11066B	3" Diameter Cylinder 4" Stroke	2
111	12011	1"-8 x 7" Bolt GR.5 HHCS-Z cut to 5 1/2" chamfered	2



BACK-UP AND SUPPORT ASSEMBLY
MODEL B

Lock Out Arm Mechanism Assy Parts List			
Item #	Part #	Item Description	Qty
36	10860	Rear Arm	1
37	10850	Front Arm	1
38	10807	Wire Rope, 3/8" Diameter w/Eyelets	1
39	10810	Bushing, 1 7/16" O.D., 3/16" Wall	1
101	12001	2" O.D. x 1" I.D. Washer, Zinc Plated	3
112	12012	1"-8 Nylon Insert Stop Nut	2
113	12013	5/8" Shoulder Lifting Eye Bolt	1
115	12015	1" x 5" Clevis, Zinc Plated	1
117	12017	Hairpin, 1" Shaft, Zinc Plated	1
127	12028	1" I.D. x 2 1/2" O.D. Flat Washer, Zinc Plated	2
133	12000	1" x 3 1/2" Hex Bolt, Zinc Plated	2
143	12043	5/8" SAE Flat Washer	2
144	12062	5/8" Locknut	1
145	12066	9/16"-12 Nylock, Zinc Plated	8
146	12069	9/16"-12 x 1 1/4" Grd 8 Bolt, Zinc Plated	8
147	12093	Hinge Assy, 5" Wide x 7" Open	2

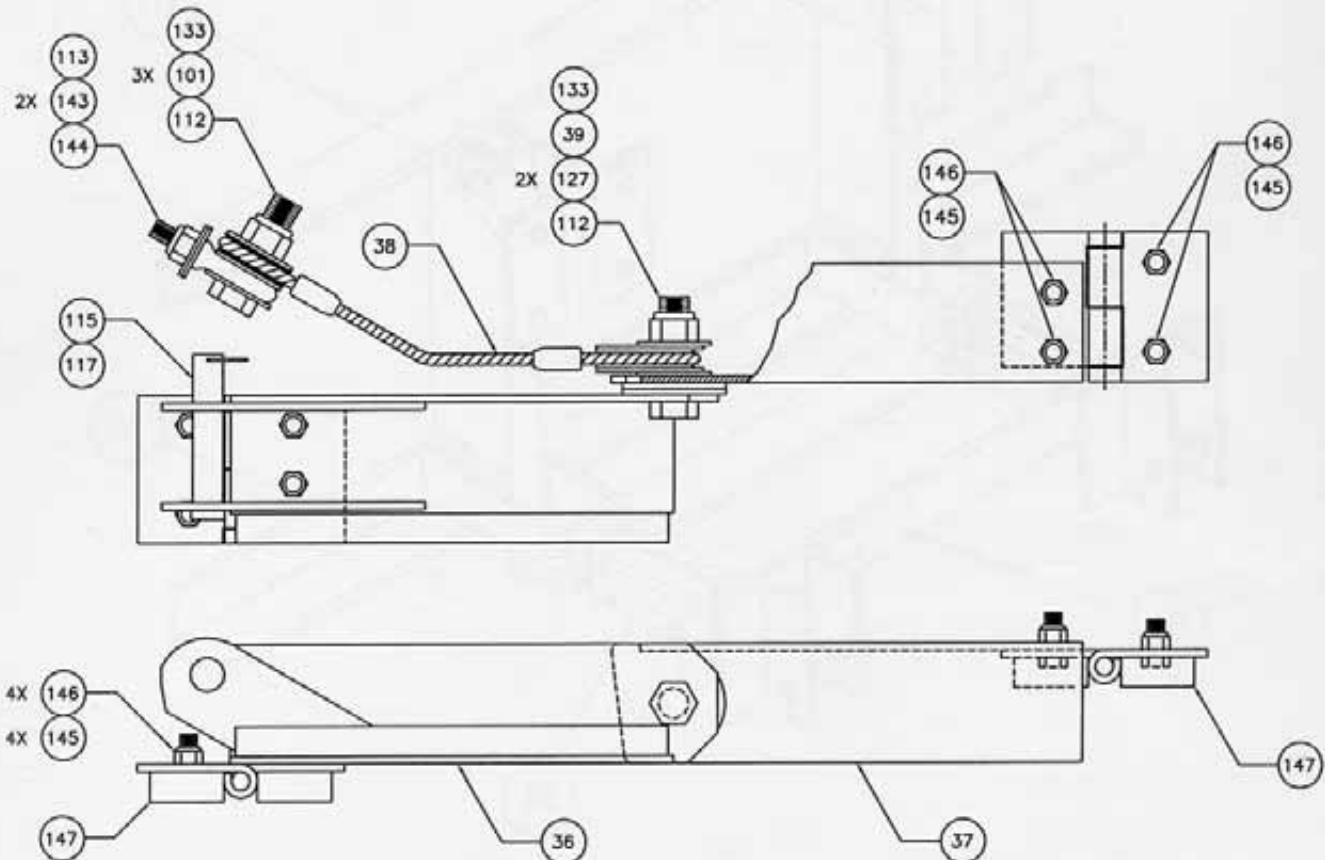


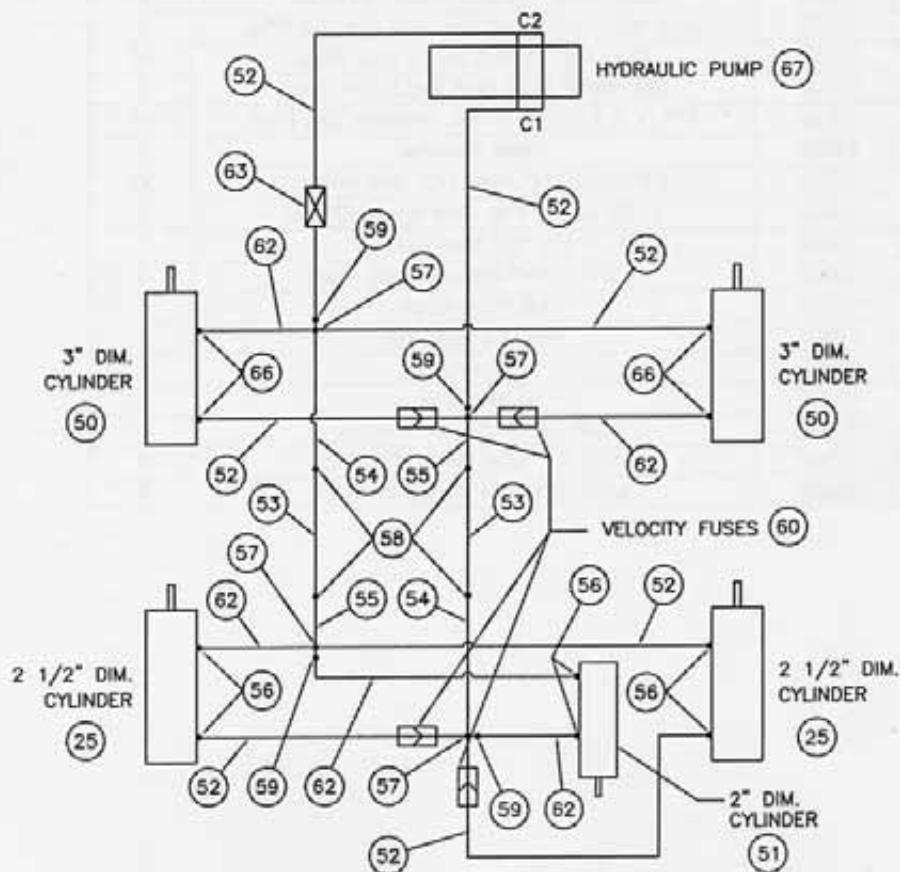
Fig. 10

Revision C

Nuts & Bolts Parts List			
Item #	Part #	Item Description	Qty
100	12038	Binding Nut	50
101	12001	2" OD X 1" ID washer Zinc Pltd.	5
102	12002	3/8" - 16 X 1 1/2L Grd.5 (HHCS-Z) Tap Bolt	8
103	12003	3/8" Sae Flt Washer Steel/Zinc	20
104	12004	1/2"-13x2 1/2" Bolt ZP HHCS	4
105	12005	1/4"X1 1/4"O.D. Fender Washer	32
106	12006	3/4"-10 X 2" Bolt GR.5 HHCS-Z	16
107	12007	3/4"- 10 X 2 1/2" GR.5 HHCS-Z Bolt	16
108	12008	3/4"-10 Nylon Insert Stop Nut-Z	32
109	12009	3/4"X.82 ID X 1.46 OD X .02 TH. WasherYZ 43-49C	12
110	12010	1"-8X3" Bolt GR.5 HHCS-Z	16
111	12011	1"-8X7" Bolt GR.5 HHCS-Z cut to 5 1/2" chamfered	4
112	12012	1"-8 Nylon Insert Stop Nut	22
113	12013	5/8" Shoulder Lifting Eye Bolt	1
115	12015	1" X 5" Clevis Zinc Pltd.	8
116	12016	1" X 6" Tapered Clevis, Zinc Pltd.	2
117	12017	Hairpin, 1" Shaft, Zinc Pltd.	8
118	12018	Safety Snap, 3/8" X 2 1/2", Zinc Pltd.	2
119	12019	3/16"X1/4" Grip Pop Rivet, Alum./Steel	740
121	12021	Bolt, 5/16 - 18 x 3/4" Grd. 5 HHCS	3
123	12023	Bolt, 1/2" 13 X 1 1/2" Grade 5 HHCS Z Pltd.	2
124	12024	Nut, 1/2"-13 Std. Nylok Zinc Pltd.	10
126	12027	3/8"-16X1" H.H. Bolt Grd.5 Zinc Pltd.	2
127	12028	1" I.D. X 2 1/2" O.D. Flt. Washer Zinc Pltd.	12
129	12030	Black Washer	2
131	12032	1/4"-20X1 1/4" Allen HD. Bolt w/Patch	30
132	12033	1 1/2" Cotter Pin - Sttl Alum. Coated	2
133	12000	1" x 3 1/2" Hex Bolt, ZP	1
134	10803	1 3/4" x 1/4" Round Alum. Tube	1
135	10807	14" Wire Rope	1
137	10825	Hinge 4 Gussets	2
138	10850	Front Arm	1
139	10860	Rear Arm	1
141	12060	3/4" I.D. x 2" Flat Washer	12
142	12097	1"-8 X 7" Bolt GR.5 HHCS-Z	4
146	12069	9/16"-12X1 1/4" Grd 8 Bolt ZP	8

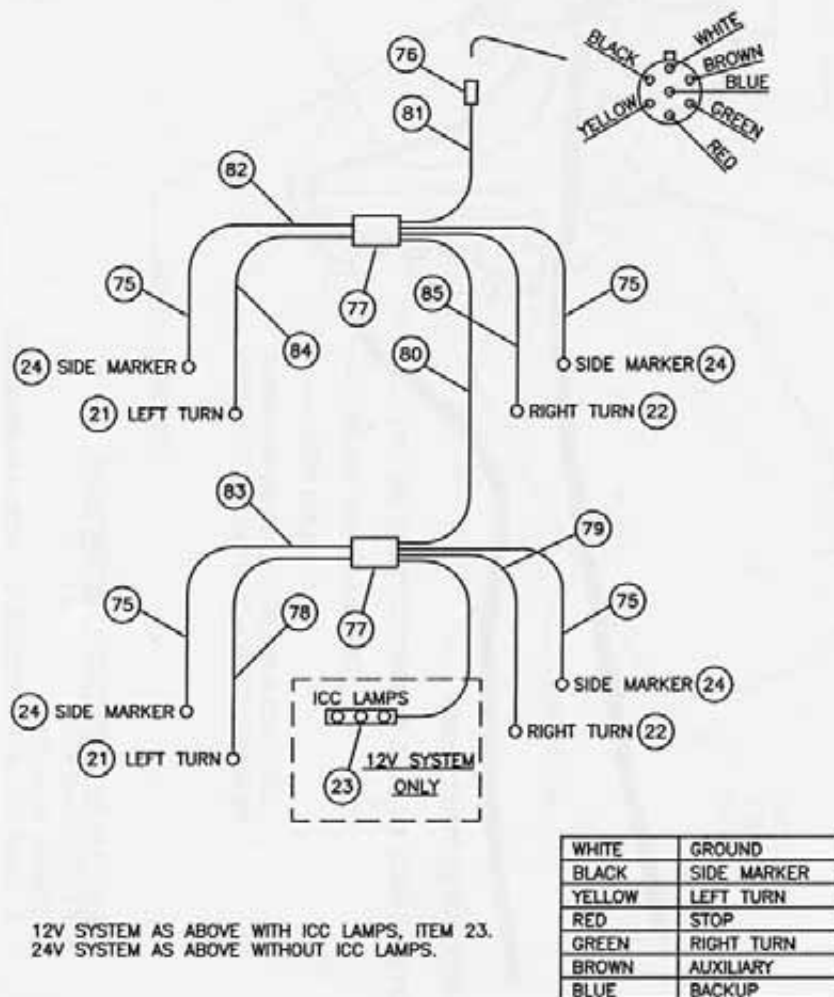
Hydraulic Parts			
Item #	Part #	Item Description	Qty
25	10601	2 1/2" Diameter Cylinder	2
50	11001	3" Diameter Cylinder	2
51	10802	2" Diameter Cylinder	1
67	11012	12V Motor	1
68	11026	2 Button Controller	1
	10600G	Complete Hydraulic Hose Assy	1
		consisting of:	
52	10603	36" Hydraulic Hose	7
53	10604	48" Hydraulic Hose	2
54	10605	8" Hydraulic Hose	2
55	10606	14" Hydraulic Hose	2
56	10607	90 Degree Angle M/F	5
57	10608	Tee Connection F/F/F	4
58	10609	90 Degree Angle F/F	4
59	10610	Tee Connection M/F/F	4
60	10611	Velocity Fuse	4
61	10612	Hose Clamps	11
62	11003	28" Hydraulic Hose	5

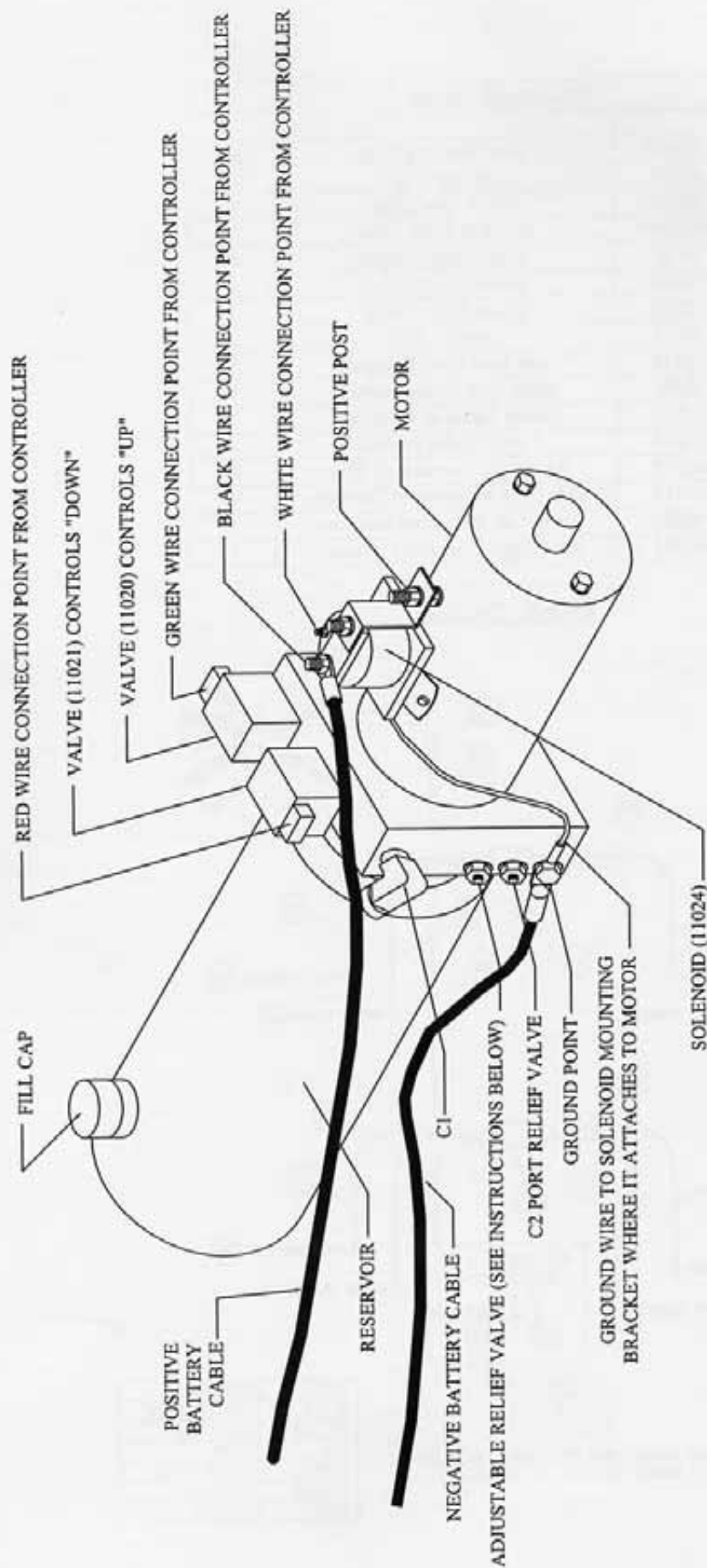
HYDRAULIC HOSE DIAGRAM – STANDARD



Electrical Parts			
Item #	Part #	Item Description	Qty
21	10508	Left Turn Light	2
22	10516	Right Turn Light	2
23	10500B	ICC Bar Light Assy	1
24	10502	Side Marking Light	4
75	10520	Side Light Bracket	4
76	10506	Cable Plug 7-Way	1
77	10518	Junction Box	2
78	10519	Left Turn Wire Harness	1
79	10509	Right Turn Wire Harness	1
80	10510	Power Cable to Cartridge	1
81	10511	Power Cable to Strut	1
82	10512	Side Light Harness to Strut	2
83	10513	Side Light Harness to Cartridge	2
84	10533	Strut Left Turn Wire Harness	1
85	10534	Strut Right Turn Wire Harness	1

WIRING DIAGRAM





RELIEF VALVE ADJUSTMENT INSTRUCTIONS:

A. LOOSEN JAM NUT.

B. ADJUST PRESSURE.

1. TURN SCREW CLOCKWISE TO INCREASE PRESSURE.
2. TURN SCREW COUNTER CLOCKWISE TO DECREASE PRESSURE.

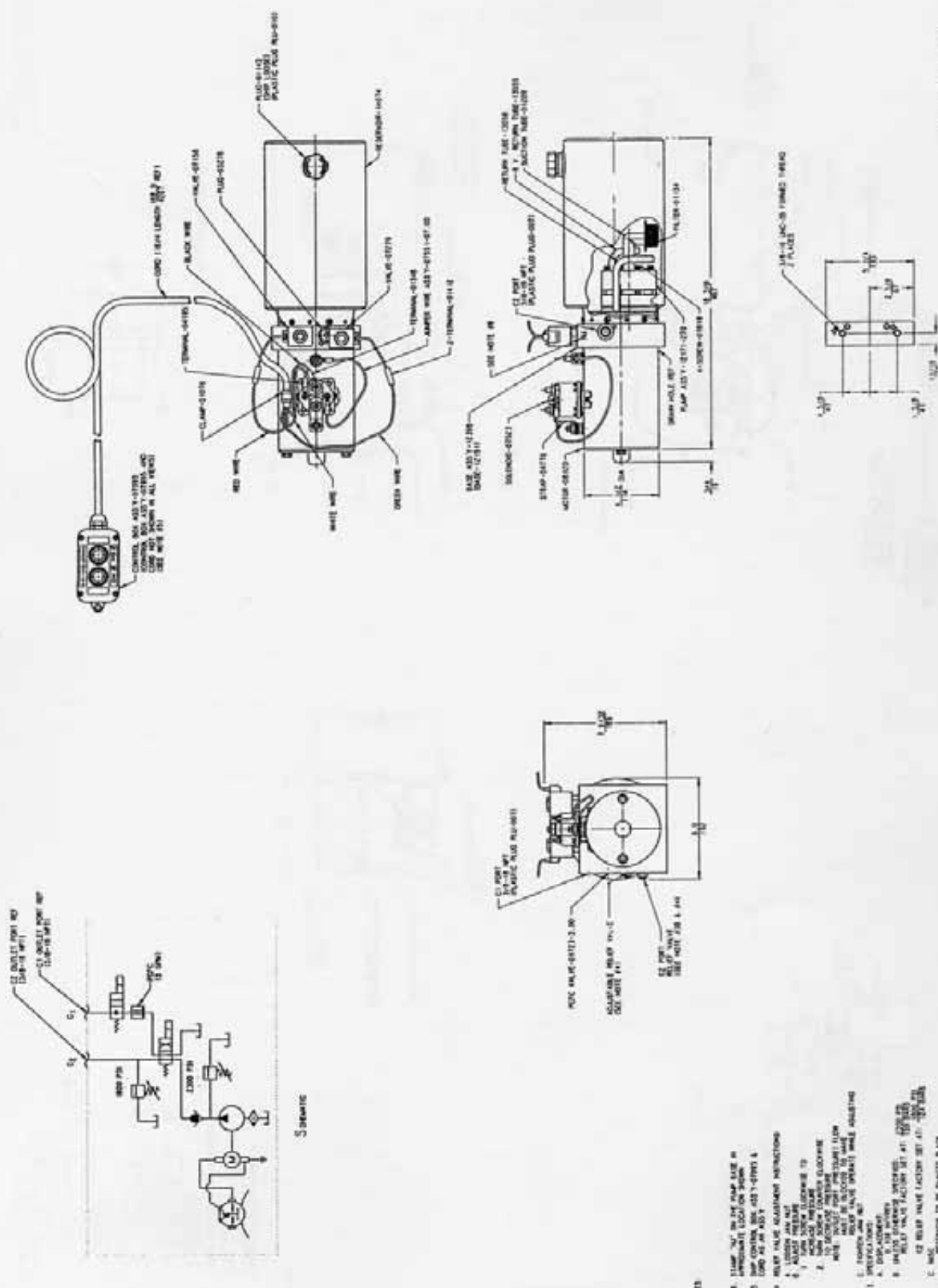
NOTE: OUTLET PORT (PRESSURE) FLOW MUST BE BLOCKED TO MAKE RELIEF VALVE OPERATE WHILE ADJUSTING.

C. TIGHTEN JAM NUT.

STANDARD 12 VDC PUMP UNIT WIRING CONFIGURATION
11012NJ

Fig. 13

Revision C



500

[illegible]

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Fig. 15, 24 VDC Pump Unit

Revision C

Installation Tools

1. Welding equipment (for ½" plate)
2. Cutting torch
3. Hammer
4. Tapered pry bar
5. C-clamps – 2 ea.
6. Level-carpenters 24" bubble
7. Tape measure
8. Marking pencil for steel – silver or white
9. 12" Crescent wrench
10. ½" Drive socket wrench
11. ½" Drive socket (1 7/16")
12. Open end wrenches (1 7/16", ¾", 7/16")
13. ¼" Drive socket wrench
14. ¼" Drive socket (3/4")
15. 1/8" Drive socket wrench
16. 1/8" Drive socket (7/16")
17. Allen wrench (3/16")
18. Wire cutter/crimper
19. Hydraulic fluid (use Dextron ® II, III or standard transmission fluid)
20. Long nose funnel
21. Floor jacks or stands (2 ea.)
22. Disk grinder
23. Forklift

Pre-installation Options & Check List

1. MAKE SURE THAT THE TRUCK IS BALLASTED TO AROUND 20,000 LBS. TMA height (12" ± 1") will change if ballast is added after TMA is installed.	X
2. CHECK IF THE TRUCK IS A DUMP OR FLATBED. THIS WILL AFFECT THE TYPE OF SUPPORT POST USED. Order the appropriate support post.	X
3. DETERMINE WHETHER THE BED OF THE TRUCK OVERHANGS MORE THAN 4" FROM THE REAR OF THE FRAME. THIS WILL AFFECT WHAT TYPE OF EXTENSION IS USED. Refer to the following four primary methods that can be used for attachment of the TMA. The Model A and Model C are positioned vertically in the travel position and only have 4" of available space between the rear of the frame and the front vertical surface of the TMA (fig. 16). If 4" is not available, vertical support tubes can be welded into position to secure the 11" extension frame as shown in fig. 17. When a dump truck is used that already has a flat plate welded to the back of the frame and there is further interference from a salt spreader, a 24" extension frame is used as in fig. 18.	X X X X
4. DETERMINE IF THE TMA HAS TO BE QUICKLY DISCONNECTED FROM THE TRUCK (5-10 MIN.). T-pins (p/n 10922) are used rather than bolts for a quick disconnect.	X
5. Battery cables are available with quick disconnects and 20' of cable (p/n 10928).	X
6. For controlling the TMA from the truck cap a second up/down controller is available (p/n 11026).	X
7. To sequence the 90° fold so that the TMA fits over a 3' x 6' arrow board order the sequence option (p/n 10600A & B).	X
8. For TMA's that are rolled frequently in gravel storage yards heavy duty jacks are available (p/n 10700NJ).	X
9. For TL-2 TMA's (70 km/hr) a Gordon Stanley hitch is available with an electric power unit (p/n 10330) or with manual hydraulic controls (p/n 14000) for trucks with PTO's.	X
10. A cone cage (p/n 11040A) is available for placing cones from the TMA truck.	X

Fig. 16

Standard Brackets

Used on flatbed trucks with less than 4" of overhang on the bed.

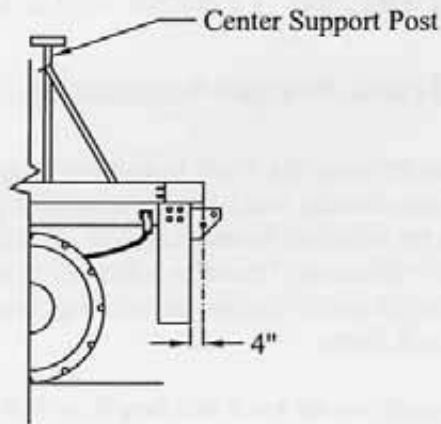


Fig. 17

Standard Dump Truck Mount

Used on dump trucks with less than 15" of overhang on the bed.

Extension frame is removable from truck with quick pins.

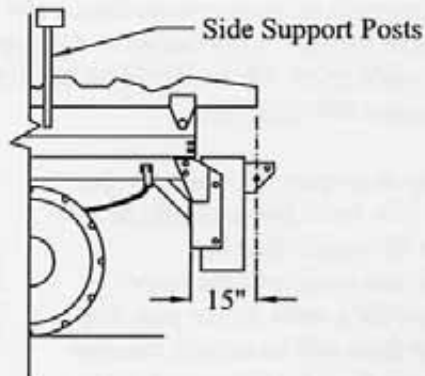


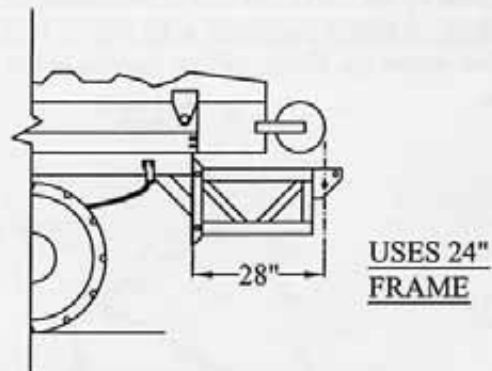
Fig. 18

24" Extension Frame

Used on trucks with less than 28" of overhang on the bed.

Support angles are easily bolted onto flat plate on rear of dump truck.

Extension frame is removable from truck with quick pins.



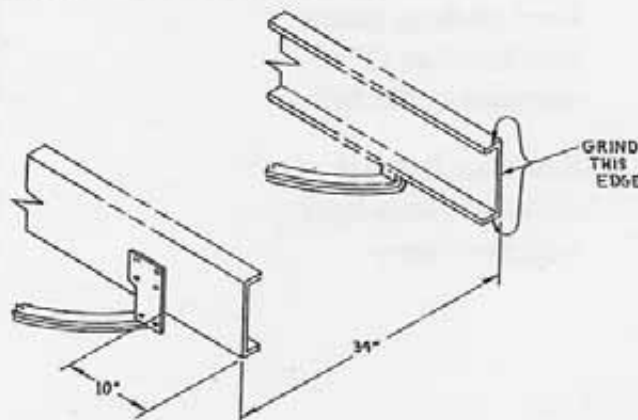
For Flatbed Trucks with Center Supports

Truck Bracket Installation Models A and C

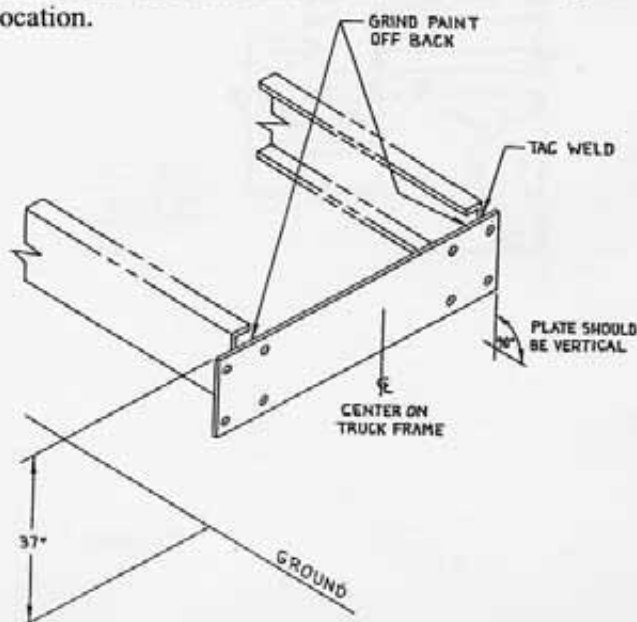
Before attempting to install the TMA to a shadow vehicle truck make sure that the truck meets the following criteria. Truck weight specifications vary from state to state; however, it is always best to try to ballast the truck as near to 20,000 lbs. as possible, which is truck weight used for certification. Typically, a flat bed truck will require the addition of about 5,000 lbs. The weight is easily added by securing two 6' lengths of (Concrete Median Barrier) to the truck bed and frame.

Adding ballast can affect the truck bed height, so it is advisable to ballast the truck before attaching the TMA. Check the truck frame to make sure that it is structurally sound and not rusted. Also check the amount of frame extension in back of the spring brackets – a minimum of 10" is needed. Check that the bed of the truck does not extend beyond the back of the frame more than 4" (see Fig. 16). This is necessary for vertical clearance of the TMA if in the double 90° position is used. Check the frame for a cross tie plate connecting one side to the other if the frame extends to the rear more than a few feet. It is preferred to keep the frame from extending more than 24" from the back of the spring support bracket. Also check the height of the truck side gates. These should be less than 8' 6" from the ground to allow clearance if the double 90° tilt is used.

1. You are now ready to prepare the truck for the TMA installation. The truck frame should be two c-channels spaced 34" apart. Start by grinding the inside and outside of the end of the frame to prepare for a weld. Make sure that the frame is square from side to side by measuring the same distance from the frame ends to the back of the spring shackles.

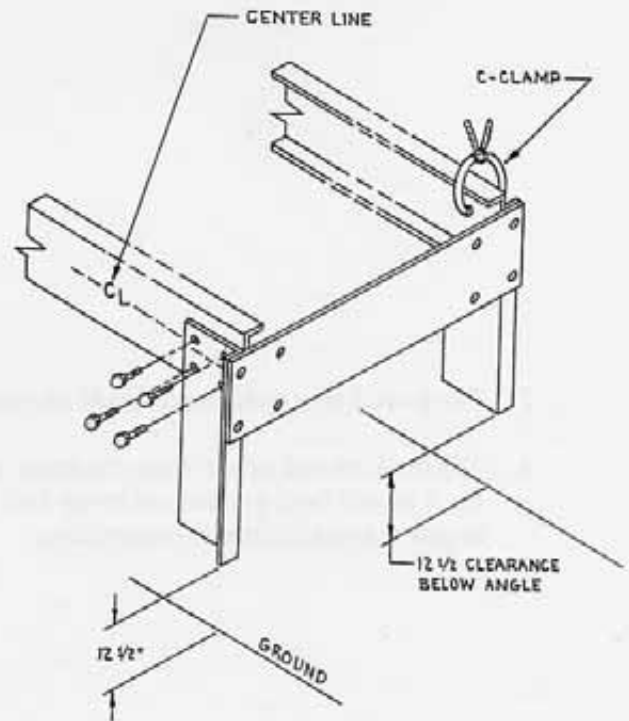


2. The rear plate (42" x 9") 13 (shipped with the strut) will be centered on the back of the truck frame and the top of the plate will be 37" above the ground. The truck will settle about 1/2" after installation of the TMA and this is accounted for. REMEMBER THAT THE TRUCK MUST BE BALLASTED BEFORE WELDING THE REAR PLATE ON THE TRUCK FRAME. Note where the frame will be welded to the plate and grind the paint off the plate in this location.

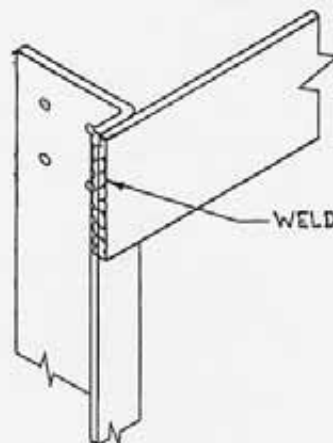


3. Tac weld the rear plate 13 into position and make sure that the rear plate is at 37" high, is level across the top, and positioned vertically at 90° to horizontal. Continue by welding the inside and outside frame end to the plate.

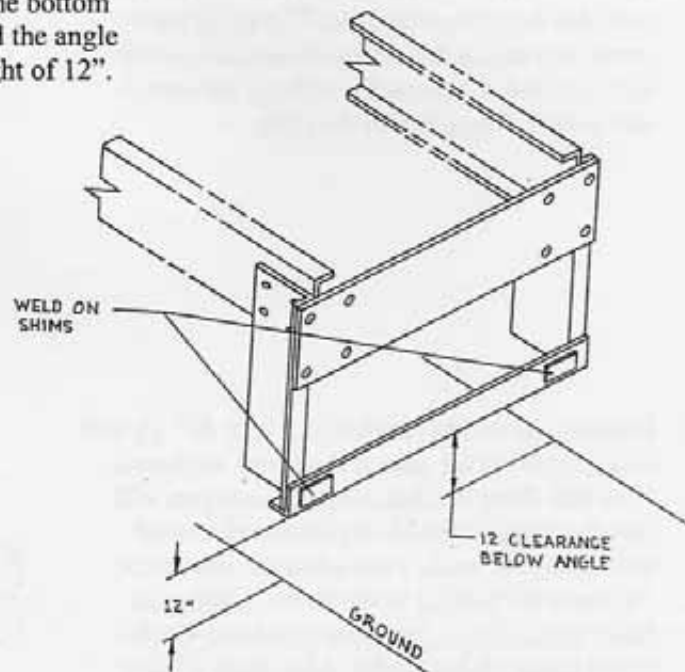
4. Position the vertical angles 9" x 4" x 40" 15 with c-clamps on to the side of the frame as shown. Note that there is a left and right side part and that the flanges should be positioned toward the rear of the truck. Four holes are located in the angle for bolting to the frame. Center the holes vertically on the frame and burn 4 holes in the frame on both sides. Also, burn 2 holes on the angle to match the rear holes in the rear plate. The angle is supplied longer than needed because truck frame height varies. Cut-off the bottom of the angles at 12 1/2" high.



5. Bolt the vertical angles onto the frame with the 1" bolts 110. Weld the angle in place with a vertical weld at the rear of the angle.



6. Position the 4" x 4" x 42" angle on the bottom of the vertical angles as shown. Weld the angle in place as shown with a bottom height of 12".



7. The truck frame weld areas should be spray painted to prevent rust.
8. The truck should have a 7 pin electrical connector attached for the TMA lighting system. The truck should have a minimum gauge size of #1 battery cable for both the positive and negative hydraulic motor connections.

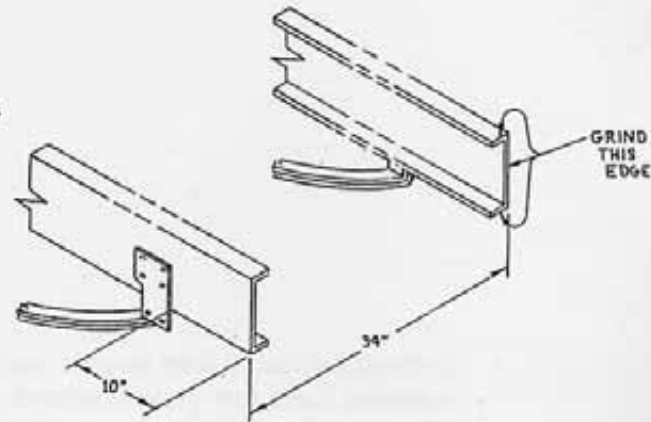
For Dump Trucks with Side Supports

Installation of Extension Frame

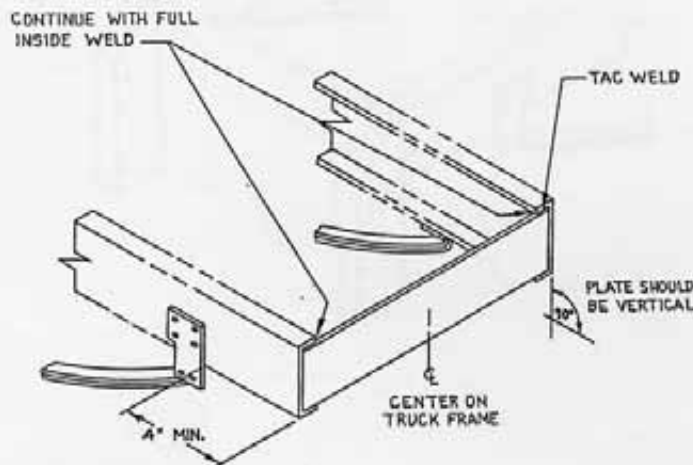
Before attempting to install the TMA to a shadow vehicle truck make sure that the truck meets the following criteria. Truck weight specifications vary from state to state; however, it is always best to try to ballast the truck as near to 20,000 lbs. as possible, which is truck weight used for certification. Typically, a dump truck will require the addition of about 5,000 lbs. The weight is easily added by securing two 6' lengths of (Concrete Median Barrier) to the truck bed.

Adding ballast can affect the truck bed height, so it is advisable to ballast the truck before attaching the TMA. Check the truck frame to make sure that it is structurally sound and not rusted. Also check the amount of frame extension in back of the spring brackets – a minimum of 4" is needed. Check that the bed of the truck does not extend beyond the back of the frame more than 15" (see Fig. 17). This is necessary for vertical clearance of the TMA if the double 90° position is used. Also check the height of the truck side gates. These should be less than 8' 6" from the ground to allow clearance if the double 90° tilt is used.

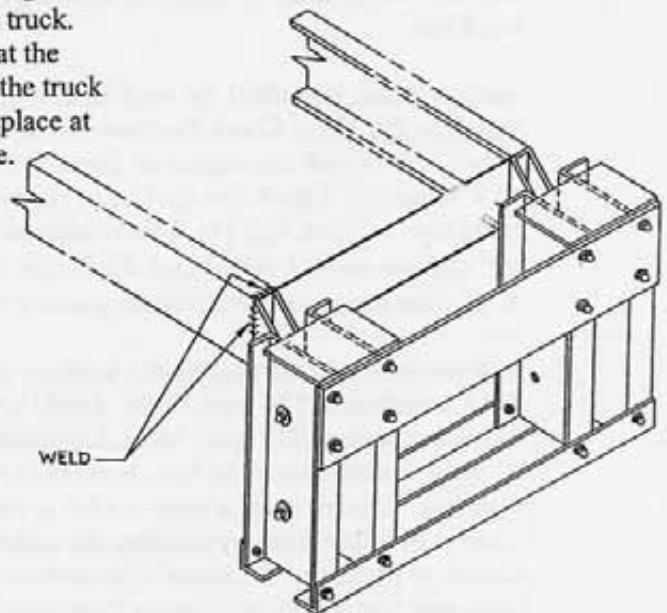
1. You are now ready to prepare the truck for the TMA installation. The truck frame should be two c-channels spaced 34" apart. Most dump trucks have a ½" plate welded across the back between the frame members. If there is not a plate welded to the back do so at this time. Start by grinding the inside and outside of the end of the frame to prepare for a weld. Make sure that the frame is square from side to side by measuring the same distance from the frame ends to the back of the spring shackles.



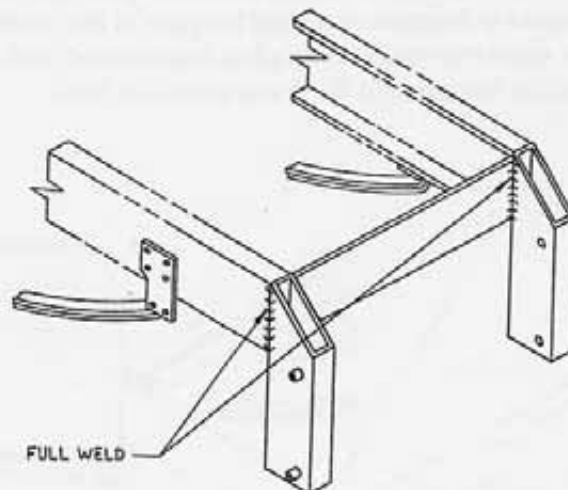
2. A rear plate (33" x 10") should be centered on the back of the truck frame. Note where the frame will be welded to the plate and grind the plate in this location. Tac weld the rear plate into position and make sure that the rear plate is positioned vertically at 90° to horizontal. Continue by welding the inside of the frame end to the plate.



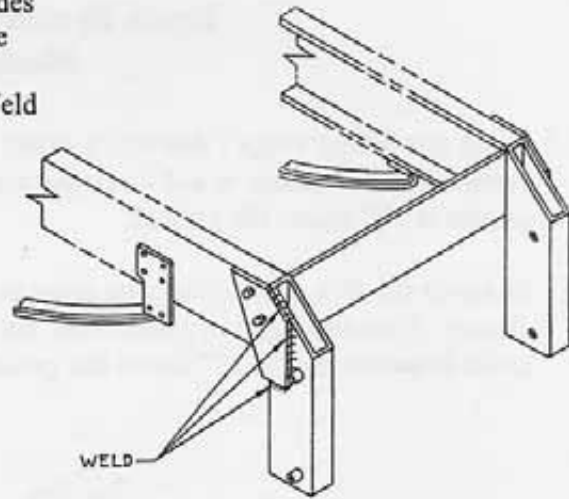
3. The extension frame comes with the right and left vertical tubes bolted in place in the right and left frame sections. Bolt the complete frame assembly together with the eight $\frac{3}{4}$ " bolts as shown noting the right and left sides. It is quite easy to position the frame on the truck by first attaching the frame to the TMA and rolling the TMA with extension frame up to the back of the truck. Make sure the TMA is at 12 $\frac{1}{2}$ " in height and that the TMA is horizontal and parallel with the back of the truck (both the frame and the bed). Weld the tubes in place at the four corners where the tubes touch the frame.



4. Remove the four 1" bolts from the vertical tubes and roll the TMA rearward to pull the extension frame free from the vertical tubes. Fully weld the tubes in place on all four sides where the tubes touch the frame and the back plate.



5. Position the side plates as shown against the sides of the frame and the vertical tubes. Mark on the plate the position of two holes for $\frac{3}{4}$ " bolts. Drill these holes in the plates and the frame. Weld the edge of the plate to the vertical tube.



6. The truck frame weld areas should be spray painted to prevent rust. Install the four $\frac{3}{4}$ " bolts.
7. To reattach the TMA to the truck either use the 1" bolts supplied or the T-pins if these were purchased as an option.

Optional

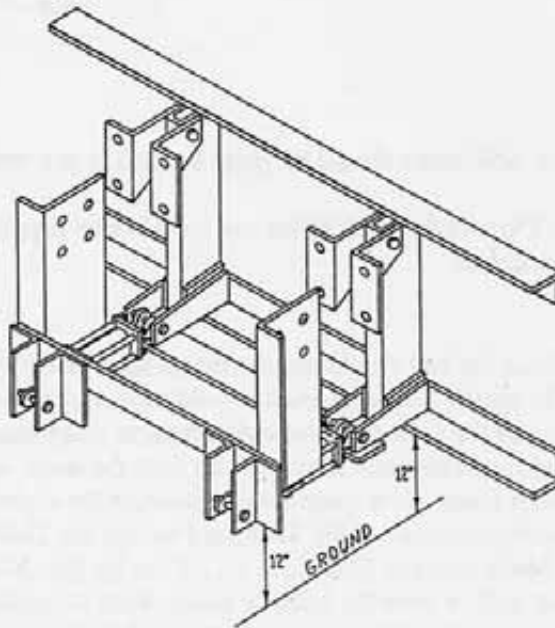
For some dump trucks, the bed overhangs the frame such that an optional 24" extension frame will be needed. The rear of the dump truck should have a plate welded to the back of its frame. Check the weld area on the plate to frame connection to make sure that there is a full strength connection. The optional extension frame comes with the truck mounting brackets bolted in place on the extension frame. It is quite easy to position the eight 1" holes on the truck rear plate by mounting the extension frame to the TMA and rolling the TMA extension frame up to the back of the truck. Make sure the TMA is at 12 1/2" in height. Mark the position of the 8 holes on the rear plate and drill or burn the holes in place. Bolt the extension frame brackets in place with the eight bolts supplied. Now remove the four 1" bolts securing the extension frame to the brackets. Use the four T-pins to hold the extension frame to the brackets.

For Trucks with No Support Posts

Truck Bracket Installation Model B



- 1-5. Read and follow steps 1 through 5 which are previously listed for the truck bracket installation of Models A and C. However, for Model B, cut-off the bottom of the angles at 17" above the ground.
6. Position the 4" x 4" x 42" angled cross brace on the bottom of the vertical angles as shown. Weld the angle in place. Note that the bottom of the cylinder brackets on the cross brace should be 12" above the ground.

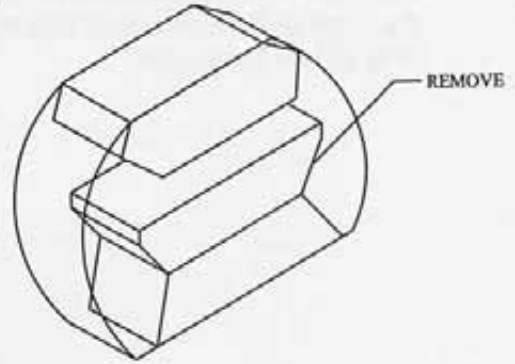


7. The truck frame weld areas should be spray painted to prevent rust.
8. The truck should have a 7 pin electrical connector attached for the TMA lighting system. The truck should have a minimum gauge size of #1 battery cable for both the positive and negative hydraulic motor connections.

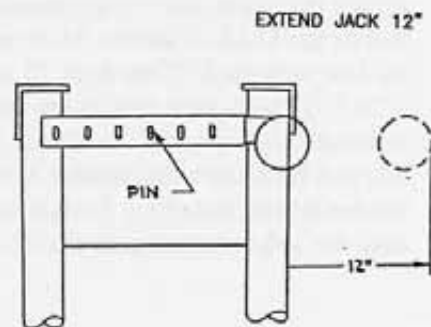
Assembly of TMA Model A (TL-2)



1. Inspect the pallet containing the cartridge for completeness against the packing list.
2. Note that the Warning Top Heavy means that caution should be used in moving the pallet. Use fork extenders and keep all personnel away while moving.
3. Unwrap the shrink-wrap from the pallet. Remove the box of accessories from the cartridge pallet. Also, remove the energy-absorbing container 17, positioned in the cartridge as shown.



4. The drop jacks 27 should be extended at this time to allow the cartridge to be placed 12" above the ground. Slip the retainer off the back of the pin and pull the pin out to reposition the leg. With the pin out, pull the leg out 12" (measured from the bottom of the TMA) and repin the leg.

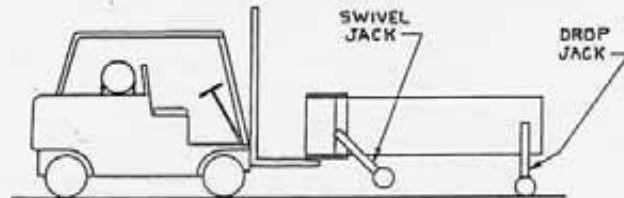


5. Use the forklift and several people to lower the pallet to the horizontal position as shown. Make sure that the pallet is tipped in the correct orientation with the hinges up as shown.

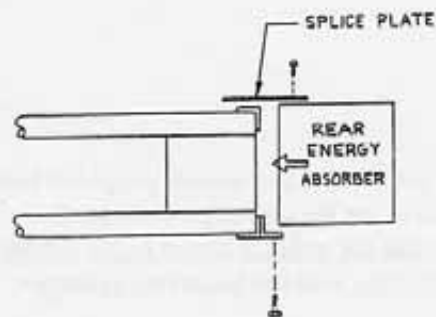
Caution – Do not rotate crank jacks until after the pallet is lowered to horizontal position.



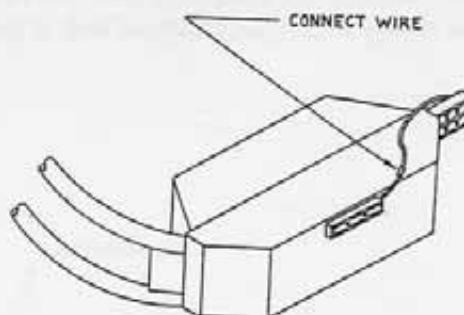
6. Caution – when the steel banding is cut the TMA cartridge may fall a few inches. Keep personnel away from the TMA when the steel bands are cut. Keep feet away from pallet when pallet is pulled free of the cartridge because it will drop a few inches.
Caution- Do not rotate crank jacks until after the pallet is lowered to horizontal position.
7. Use the forklift to lift the backup end of the cartridge 12". Unlock the crank jacks 26 and rotate the wheels to the down position. Rotate the crank on both jacks until they support the strut 12" off the ground.



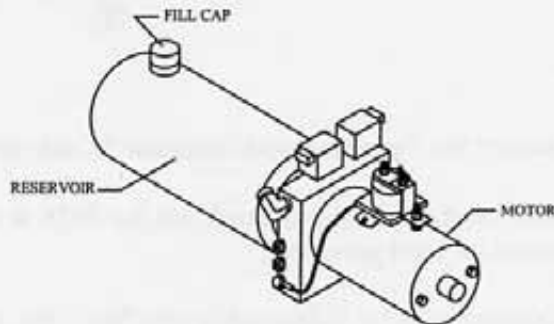
8. Attach the black rear energy absorber 17 to the rear of the TMA as shown. Make sure to position the box with the ICC bar light 23 on top. Use eight $\frac{1}{4}$ " x $1 \frac{1}{4}$ " bolts with washers to attach the energy absorber. Use one small washer at the head of the bolt and back the small washer with one larger washer before installing. Torque the allen head bolts until the large washers just start to dish inward.



9. The rear ICC bar light 23 (on top of the black box) has two wires extending from it with plugs, connect the plugs into the electrical wire plugs at the light.

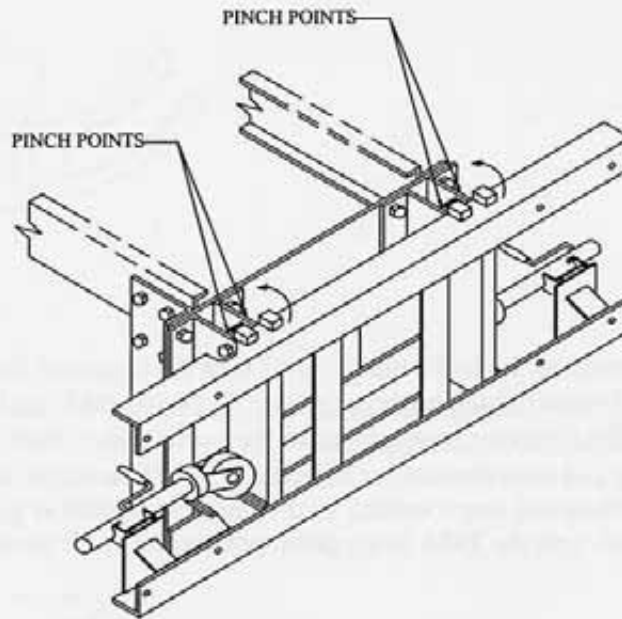


10. Fill the reservoir on the hydraulic pump 67 with the hydraulic fluid (three quarts) and attach the electrical wires (minimum gauge size of #1 battery cable for both the positive and negative hydraulic motor connections) to the motor cables. Push the up button on the yellow controller 68 and raise the rear backup plate 90°. Fill the reservoir a final time (2 quarts). Cycle the system two times waiting 15 min. between cycles to get the air bubbles out of the system. Finish with the TMA in the down position to attach the truck:



11. The TMA is now ready to attach to the truck. Roll the TMA back to the truck and bolt the four angle brackets 11 to the rear plate (eight 1" bolts) 110. Use full manual torque with a breaker bar and a wrench.
12. Crank the jacks 26 on the sides of the backup to the full up position. Pull the pins and rotate the jacks 90° with the wheels facing inward. The pin should spring lock the jacks in place.
13. Push the up button and raise the cartridge to 10°. Release the lock pins on the drop jacks 27 and push the jacks up to the full up position. Re-pin the jacks in the up position.

14. Warning the two hinges on the backup (the 90° tilt mechanism at the rear of the truck) have a pinch point 11 when the cartridge is raised to the vertical position. Make sure personnel do not have their hands in this area while raising the TMA. Also, check that the control cable is brought out below the hinge area. Push the button and raise to the 90° position. Attach the chain as shown to provide a manual lock in the 90° position.

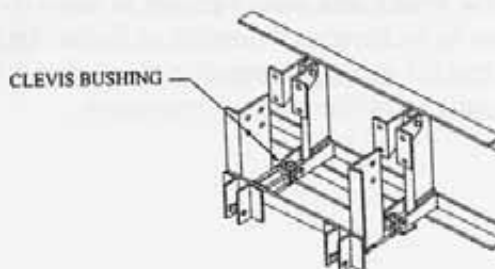


15. Connect the 7-pin electrical connector 76 and verify that all the lights function correctly.
16. Road test the system and check that the TMA in the horizontal position is $12'' \pm 1''$ above the ground on level pavement.
17. Check all bolts for tightness after the first 3 hrs. of running time and refer to the maintenance section of the manual to set up regular maintenance.

Assembly of TMA Model B (TL-3)



- 1-16. Read and follow steps 1 through 16 which are listed for the TMA assembly Model C.
17. Fill the reservoir with hydraulic fluid (three quarts) and attach the battery wires (minimum gauge size of #1 battery cable for both the positive and negative hydraulic motor connections) to the motor battery cables. Push the up button on the yellow controller and extend the lower hydraulic cylinders on the backup. Continue to push the up button and raise the cartridge to 90°. Fill the reservoir a final time (three quarts). Cycle the system several times waiting 3 min. between cycles to get the air bubbles out of the system. Top the reservoir off with (2 quarts). Finish with the TMA in the down position to attach to the truck.
18. The TMA is now ready to attach to the truck. Roll the TMA back to the truck and bolt the four angle brackets to the rear plate (eight 1" bolts). Use full manual torque with a breaker bar and a wrench.
19. Bolt the two lower hydraulic cylinder clevises in place using the two 1" diameter bolts. Tighten the nuts on the two 1" bolts.
20. Crank the jacks on the sides of the backup to the full up position. Pull the pins and rotate the jacks 90°, with the wheels facing inward lock the jacks in place.
21. Push the up button and raise the cartridge to 90°. Continue to push the up button and raise the strut to the full up 10° position. Release the lock pins on the drop jacks and push the jacks up to the full up position. Re-pin the jacks in the up position.
22. Connect the 7-pin electrical connector and verify that all the lights function correctly.
23. Road test the system and check that the TMA in the horizontal position is 12" \pm 1" above the ground on level pavement in the down position. If the TMA is not 12" \pm 1" at the rear of the TMA push the up bottom and raise the TMA a few inches. Drop the drop jacks to support the TMA. Unbolt the clevis on the horizontal cylinders and adjust the clevis bushing length using the washers supplied to lengthen or shorten the clevis bushing distance.

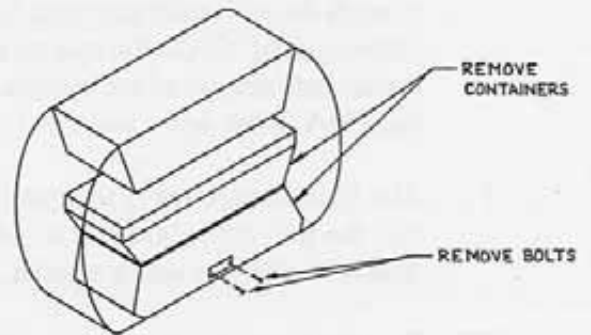


24. Check all bolts for tightness after the first 3 hrs. of running time and refer to the maintenance section of the manual to set up regular maintenance.

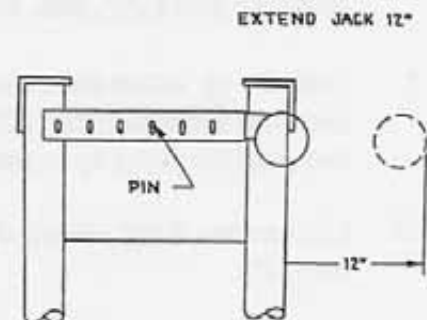
Assembly of TMA Model C (TL-3)



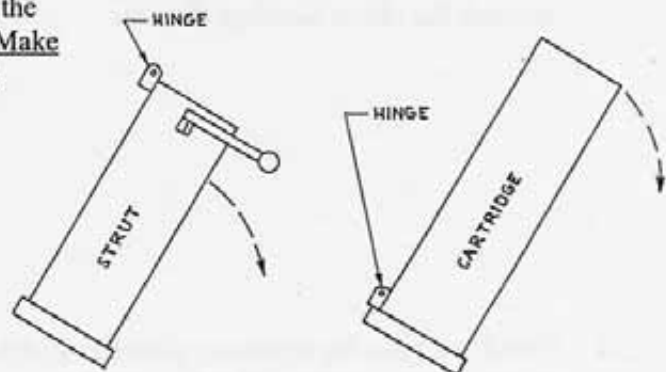
1. Inspect the two pallets containing the cartridge (tallest) and the strut for shipping damage and for completeness against the packing list.
2. Note that the Warning Top Heavy means that caution should be used in moving the pallets. Use fork extenders and keep all personnel away while moving.
3. Unwrap the shrink-wrap from the pallets. Caution: When the steel banding is cut, the steel bracket on top of the two containers will fall. Remove the box of accessories from the cartridge pallet. Also, remove the two energy-absorbing containers 17, 19 positioned in the cartridge as shown. Note: two bolts are used to temporarily hold the electrical connector box 77 – remove both bolts.



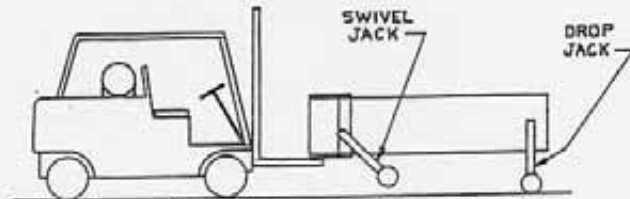
4. The drop jacks 27 should be extended at this time to allow the strut (shortest) to be placed 12" above the ground. Slip the retainer off the back of the pin and pull the pin out to reposition the leg. With the pin out, pull the leg out 12" (measured from the bottom of the TMA) and repin the leg.



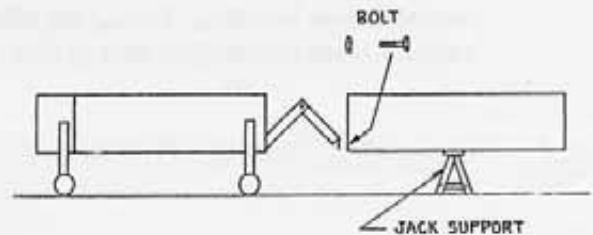
5. Use the forklift and several people to lower the pallets to the horizontal position as shown. Make sure that the pallets are tipped in the correct orientation with the hinges up as shown.



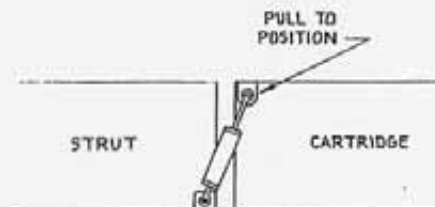
6. Caution – when the steel banding is cut the TMA cartridge and strut may fall a few inches. Keep personnel away from the TMA when the steel bands are cut. Keep feet away from pallet when pallet is pulled free of the cartridge because it will drop a few inches.
7. Use the forklift to lift the backup end of the strut 12". Unlock the crank jacks 26 and rotate the wheels to the down position. Rotate the crank on both jacks until they support the strut 12" off the ground.



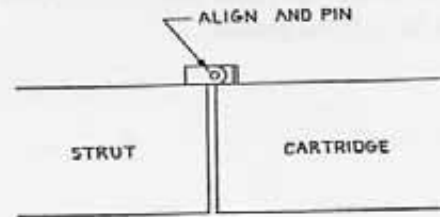
8. Position automotive roller jacks or other supports under both sides of the cartridge. The supports should be about midway between front and back and about 12" high.
9. Roll the strut into position next to the cartridge. With the strut about 12" away from the cartridge extend the folded arm 29 positioned on the strut such that the arm extends and touches the cartridge. Use the two 1/2" bolts to bolt the lower hinge part of the arm to the holes located on the bottom cross brace of the strut. Make sure the bolts heads are placed on the cartridge side and the nuts placed on the hinge side. Tighten the nuts and bolts.



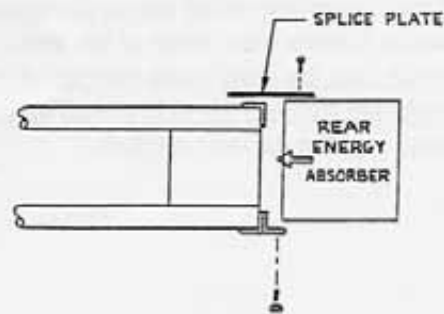
10. Now push the strut up against the cartridge with the top hinges 9 positioned close to good pin alignment. Do not pin the hinge yet. Pull on each of the large hydraulic cylinder clevises until they match the hole positions on the aluminum upper hinges. Pin the cylinders in place with the 1" pins supplied and insert the safety pins.



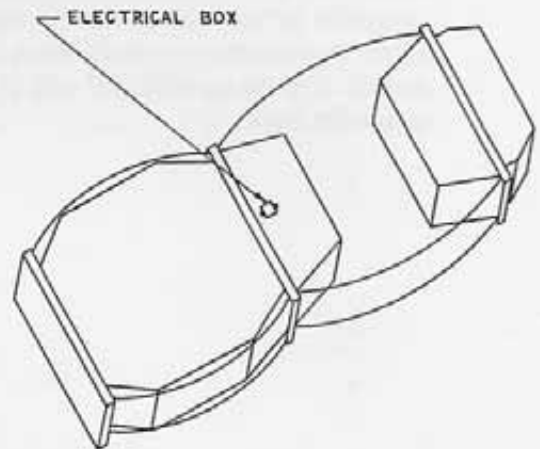
11. It is now time to put the 1" pins 116 into the aluminum upper hinges. This will be difficult unless a tapered pry bar is used. Align the holes using the pry bar and hammer the pins into position. Place the 1" ID washer on each pin and insert the cotter pins 132. Bend one leg of the cotter pin.



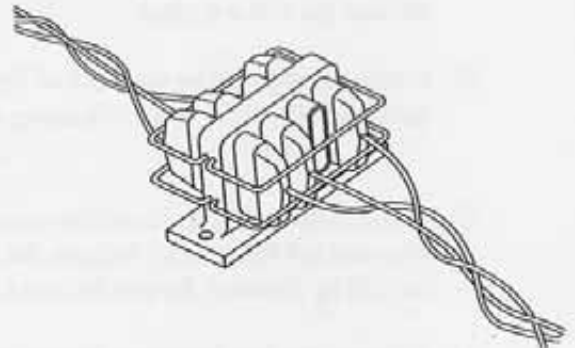
12. Remove the automotive roller jacks or supports from under both sides of the cartridge.
13. Attach the black rear energy absorber 17 to the rear of the TMA as shown. Make sure to position the box with the ICC bar light 23 on top. Use eight $\frac{1}{4}$ " x $1 \frac{1}{4}$ " bolts with washers to attach the energy absorber. Use one small washer at the head of the bolt and back the small washer with one larger washer before installing. Torque the allen head bolts until the large washers just start to dish inward.



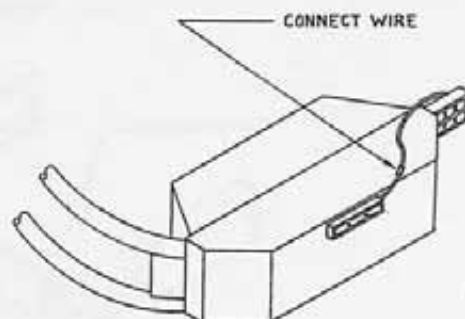
14. Attach the yellow energy-absorbing cartridge 19 as shown (cartridge that was removed in step #3). Use two of the bolts to reattach the electrical connector box. Use eight $\frac{1}{4}$ " x $1\frac{1}{4}$ " bolts with washers to attach the energy absorber. Use one small washer at the head of the bolt and back the small washer with one larger washer before installing. Torque the allen head bolts until the large washers just start to dish inward.



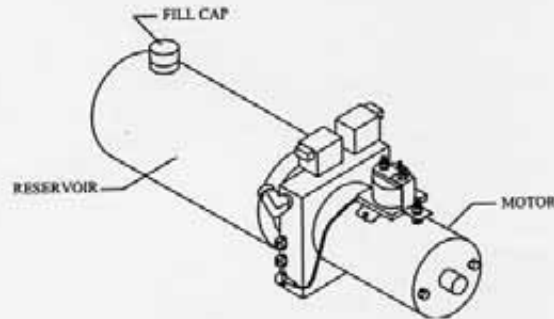
15. Plug the main power cable 80 from the strut (left side) into the electrical connector box on the cartridge. Snap the wire retainers in place on the electrical connector box 77 and wire tie the retainers together.



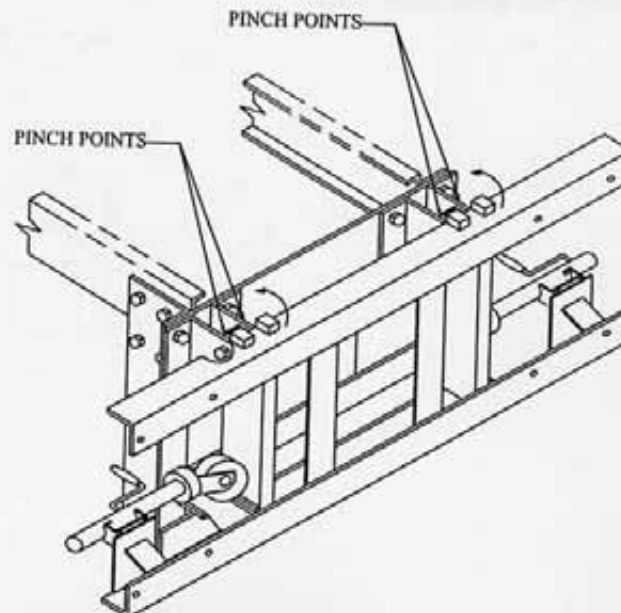
16. The rear ICC bar light 23 (on top of the black box) has two wires extending from it with plugs, connect the plugs into the electrical wire plugs at the light.



17. Fill the reservoir on the hydraulic pump 67 with the hydraulic fluid (three quarts) and attach the electrical wires (minimum gauge size of #1 battery cable for both the positive and negative hydraulic motor connections) to the motor cables. Push the up button on the yellow controller 68 and raise the rear backup plate 90° . Fill the reservoir a second time (2 quarts). Cycle the system two times waiting 3 min. between cycles to get the air bubbles out of the system. Top the reservoir off with (2 quarts). Finish with the TMA in the down position to attach the truck:

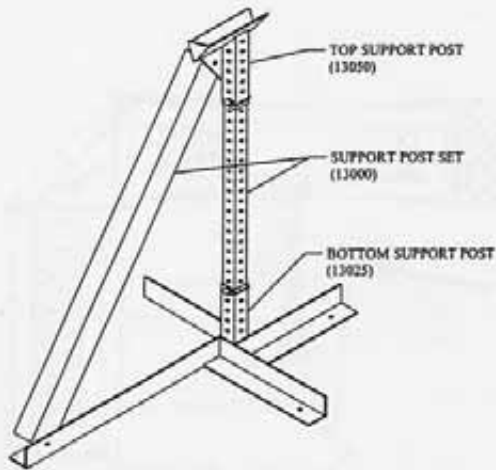


18. The TMA is now ready to attach to the truck. Roll the TMA back to the truck and bolts the four angle brackets 11 to the rear plate (eight 1" bolts) 110. Use full manual torque with a breaker bar and a wrench.
19. Crank the jacks 26 on the sides of the backup to the full up position. Pull the pins and rotate the jacks 90° with the wheels facing inward.
20. Push the up button and raise the cartridge to 90° . Continue to push the up button and raise the strut just off the ground. Release the lock pins on the drop jacks 27 and push the jacks up to the full up position. Re-pin the jacks in the up position.
21. Warning the two hinges on the backup (the 90° tilt mechanism at the rear of the truck) have a pinch point 11 when the strut is raised to the vertical position. Make sure personnel do not have their hands in this area while raising the TMA. Also, check that the control cable is brought out below the hinge area. Push the button and raise to the double 90° position. The cartridge will stop at greater than 90° so push the down button until the cartridge is horizontal.

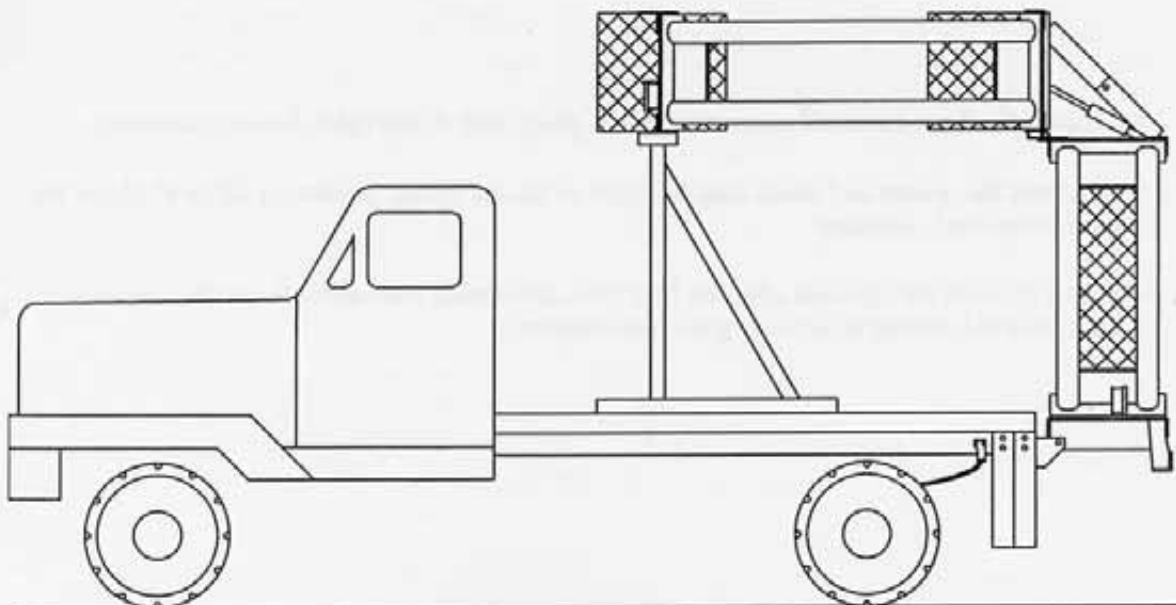
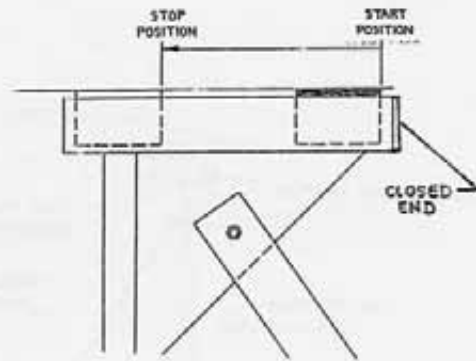


Flat Bed Trucks

22. To assemble the support post 30-32 that the cartridge will be supported on, first measure the height from the cartridge to the truck bed and pin the support post together at this height. Position the support post under the cartridge with the rear of the top support even with the rear of the V on the cartridge. Cut diagonal angle iron brace to length, drill the hole at the end, and bolt the brace in place. Use the four 1/2" bolts 123 supplied to bolt the bottom of the stand to the truck. Push the up bottom to bring the cartridge down and forward (usually 4") on the support post. The TMA is now locked in position for driving.

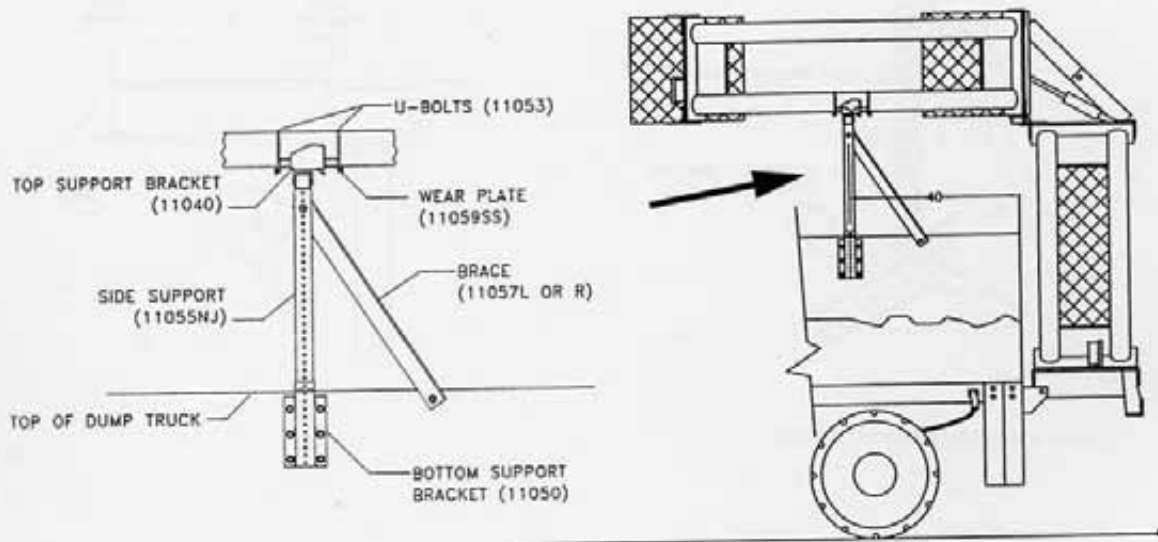


CENTER MOUNT SUPPORT ASSEMBLY



Dump Trucks

23. For dump trucks the cartridge is supported on side supports. To properly position the side supports: First raise the cartridge section until it is level and parallel with the top of the truck. Position the bottom support bracket directly below the side light which is on the cartridge tube. Mark the position on each side of the truck the same distance and drill the four 9/16" holes needed to mount the brackets as shown. Place the side post in the bottom support brackets and pin to the correct support height. The aluminum bracket at the top should have the sloped end facing the front of the truck. Use the U-bolts to hold the wear plates in place on the cartridge tubes. The wear plates should rest in the saddle of the top support bracket. Now place the left and right braces for the support posts as shown. They are notched to provide bolting to the unistrut tubing.



24. Connect the 7-pin electrical connector 76 and verify that all the lights function correctly.
25. Road test the system and check that the TMA in the horizontal position is $12" \pm 1"$ above the ground on level pavement.
26. Check all bolts for tightness after the first 3 hrs. of running time and refer to the maintenance section of the manual to set up regular maintenance.

TMA Limited Warranty

TraFFix Devices warrants to the purchaser that the Scorpion Truck Mounted Attenuator (TMA) is free from any defects in materials and workmanship. If this product proves to be defective in material or workmanship during the period of this warranty, TraFFix Devices will repair or replace, at its option, the defective product free of charge (except for transportation charges). The period of this warranty is the one year period beginning from the date the purchaser puts the unit into service or one year from the date of purchase.

To obtain warranty service, the purchaser or distributor must first fill out a warranty authorization form and fax same to TraFFix Devices to have our technical services department evaluate the problem and recommend repair procedures. **TraFFix Devices will then issue a signed warranty work approval form** to authorize the distributor or customer to repair or replace any items, which TraFFix deems to have been defective. All replacement parts claimed to be defective will be invoiced at the time of shipment, and upon receipt and evaluation a credit memo will be issued.

This warranty does not extend to any failure of the Scorpion TMA caused by misuse, abuse or material alteration of this product, or any negligence in connection with the installation, service, or use of this product. For the correct installation, service, or use of this product refer to the installation manual, the operator's deployment instructions, and the operator's checklist.

Warranty Authorization Form

1. Company Name _____
2. Address _____
3. Phone, Fax Number, and E-Mail _____
4. Name of Customer _____
5. Date _____
6. Serial number of TMA near controller outlet: _____
7. Repair parts are listed in which section of the installation manual listed below?

A. Main Parts	page 9	E. Nuts & Bolts	page 18
B. Back-up Parts	page 12	F. Hydraulic Parts	page 19
C. Support Assy Parts	pages 13-16	G. Electrical Parts	page 20
D. Lock Out Parts	page 17	H. Pump Unit Parts	page 21
8. List part numbers of replacement or repair items:

9. Describe the problem and reason for failure: _____

10. Fax this form and e-mail any pictures. Then phone TraFFix Devices technical services.
Phone: (949) 361-5663 Fax: (949) 361-9205 E-mail: info@traffixdevices.com