VALTIR

Alpha 70K TMA®

MODEL 7190 90° TILT-MECHANICAL LOCK

PRODUCT DESCRIPTION ASSEMBLY MANUAL

PN 115287B
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Alpha 70K TMA®
(Model 7190)
90° TILT-MECHANICAL LOCK

Product Description
Assembly Manual

15601 Dallas Parkway
Suite 525
Addison, Texas 75001

Important: These instructions are to be used only in conjunction with the assembly, maintenance, and repair of the Alpha 70K TMA® system. These instructions are for standard assembly 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. Valtir 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 Valtir at (888) 323-6374 or download from websites listed 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 Alpha 70K TMA® system information available to Valtir at the time of printing. We reserve the right to make changes at any time. Please contact Valtir to confirm that you are referring to the most current instructions.

Part No. 115287B

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Customer Service Contacts

Valtir is committed to the highest level of customer service. Feedback regarding the Alpha 70K TMA® system, its assembly procedures, supporting documentation, and performance is always welcome. Additional information can be obtained from the contact information below:

Valtir:

Telephone:	(888) 323-6374 (USA Only) (214) 589-8140 (USA or International)
E-mail:	Valtir.com/Contact
Website:	Valtir.com

Important Introductory Notes

Proper assembly of the Alpha 70K TMA® is essential to achieve performance of the system under appropriate federal and state criteria. These instructions should be read in their entirety and understood before assembling the Alpha 70K TMA® These instructions are to be used only in conjunction with the assembly of the Alpha 70K TMA® and are for standard assemblies only as specified by the applicable highway authority. In the event your system assembly requires or involves deviation from standard parameters or, during the assembly process a question arises, please contact the appropriate highway authority that specified this system at this particular location for guidance. Valtir is available for consultation with that agency. These instructions are intended for an individual who is qualified to both read and accurately interpret them as written. They are intended for the individual who is experienced and skilled in the assembly of highway products which are specified and selected by the highway authority.

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

Important: Read safety instructions thoroughly and follow the assembly directions and suggested safe practices before assembling, maintaining, or repairing the Alpha 70K 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.

Warning: Ensure that all of the Alpha 70K TMA® system Warnings, Cautions, and Important Statements within the Alpha 70K 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 assemble, maintain, or repair the Alpha 70K TMA® system. Additional copies of this Manual are immediately available from Valtir by calling (888) 323-6374. Please contact Valtir if you have any questions concerning the information in this Manual or about the Alpha 70K TMA® system. This Manual may also be downloaded directly from the websites indicated below.

Always use appropriate safety precautions when operating power equipment, mixing chemicals, and when moving heavy equipment or the Alpha 70K TMA® components. Gloves, safety goggles, steel toe boots, and back protection shall be used.

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

Safety Symbols

This section describes the safety symbols that appear in this Alpha 70K TMA® Manual. Read the Manual for complete safety, assembly, operating, maintenance, repair, and service information.

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

Warnings and Cautions

Read all instructions before assembling, maintaining, or repairing the Alpha 70K TMA® system.

Warning: Do not assemble, maintain, or repair the Alpha 70K 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 Valtir 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 Valtir parts that are specified herein for the TMA for assembling, maintaining, or repairing the TMA. Do not utilize or otherwise comingle parts from other systems even if those systems are other Valtir or Valtir 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 Alpha 70K 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 Alpha 70K 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

The Alpha 70K TMA® (Truck Mounted Attenuator) has been tested and evaluated per the recommendations of the National Cooperative Highway Research Program Report 350 (NCHRP 350). The Alpha 70K TMA®, as currently designed, is capable of decelerating and stopping light and heavy weight vehicles (816 and 2041 kg [1800 and 4500 lbs]) when the rear of the cartridge is impacted head-on, within NCHRP 350 criteria, at 70 km/h [40 mph] within this criteria.

To achieve intended impact performance, the Alpha 70K TMA must be mounted to a truck with a 5000 to 12,000 kg [11,025 to 26,460 lbs] gross vehicle weight rating (actual weight should range from 5000 to 9000 kg [11,025 to 19,845 lbs]). The TMA cartridge must be level and the bottom of the cartridge must be 305 mm ± 25 mm [12” ± 1”] above the ground.

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

Follow all applicable DOT and or applicable highway authority plans, specifications, and other regulations regarding placement and use of TMA.

Definition-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 IS INTENDED TO:

- Gradually decelerate the impacting vehicle, if such vehicle impacts within NCHRP 350 criteria
- Protect the occupants of the impacting vehicle
- Protect the barrier/shadow vehicle occupants
- Reduce damage to the barrier/shadow vehicle

If these impacts occur within NCHRP 350 criteria the TMA

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 lighter shadow/barrier vehicles
- Skid distance is reduced and is more consistent when heavier shadow/barrier vehicles are used
- Required Truck G.V.W.: 12,000 kg [26,460 lbs.] to 11350 kg [25,000 lbs.]
- Recommended Curb Weight: 9000 kg [19,845 lbs.]

Operation Instructions

The Alpha Truck Mounted Attenuator (TMA) Model TMA 7190 has been equipped with a hydraulic pump which can be used to tilt the energy absorbing Cartridge from its horizontal position. The “tilting” feature may be used to prevent possible scraping of the rear end of the Cartridge as the truck travels in and out of sloped driveways. The driver simply activates the “UP” button from inside the cab to momentarily tilt the Cartridge up. When he removes his finger from the button, it will slowly bleed back down to its horizontal position.

The hydraulic system can also be used to tilt the Cartridge to a full 90 degree “UP” position where it will be automatically locked. This feature allows the TMA equipped truck to be easily driven and parked in congested areas. It should be remembered that for the Alpha 70K TMA® to function properly during a crash, the Cartridge must be in the horizontal, “DOWN” position. To lower the Cartridge from the 90 degree “UP” position, the driver must exit the cab and check behind the Cartridge to make sure everything is clear before manually disengaging the locking braces.

A full set of procedures to operate the system follows:

Attachment and Removal of TMA 7190

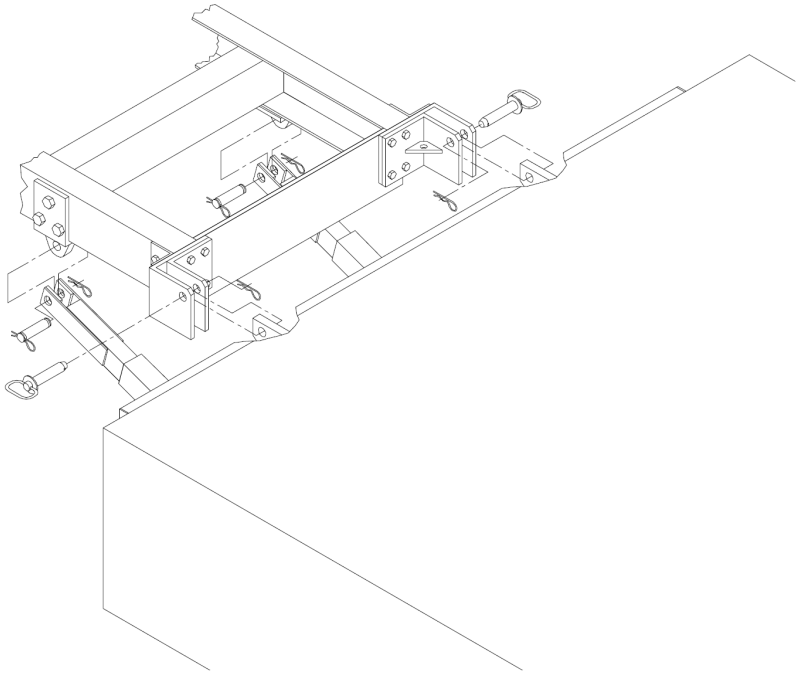
1. Attaching TMA to Truck

To attach the Model TMA 7190 to the truck:

A. Roll the system squarely toward the rear attachment points.

B. Insert the two 1” diameter attachment Pins and Retaining Pins which connect the Backup to the Truck Brackets.

C. Attach the Upper Arms of the Diagonal Struts to their Attachment Brackets. Make sure the 1” diameter Pins are properly applied.



D. Plug in the light harness and verify all turn/stop/tail/clearance lights are working properly.

E. Secure the rear Cartridge Jack and two Backup Jacks into their storage positions.

F. Verify electrical harness is clear of moving parts.

G. Verify all fasteners are tight and Cartridge is 12” ± 1” [305 ± 25mm] from the level ground at all points.

Caution: Missing or damaged Pins or Retaining Pins should be replaced before putting the TMA into service. Retainer Pins should be affixed correctly.

2. TMA Removal

To Remove TMA from rear of truck:

A. Lower the rear Jack to the “down” position.

B. Swing the two Backup Jacks into position and extend them until the weight of the TMA is off the 1 inch diameter attachment Pins.

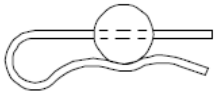
C. Remove the two Backup attachment Pins and the two upper attachment Pins in the Diagonal Struts. (The Struts should remain attached to the Backup.) Make sure the Struts are properly supported. Return the Pins and Retainer Pins to their positions in the TMA so they won’t be lost.

D. Unplug the light harness.

E. Roll the TMA away from the truck.

Note: The Jacks have been designed to roll over smooth surfaces. Rolling the TMA over rough surfaces may result in damage to Jacks and/or Cartridge.

*Make sure all Retainer Pins are attached correctly and cannot fall out:



Raise and Lower the 90 Degree Tilt System

1. RAISE the Cartridge:
   A. Make sure the top of the Cartridge is clear of all objects before proceeding.
   B. Activate the hydraulic system to raise the Cartridge using the switch in the cab or the switch located on the side of the Support Frame.
   C. The Cartridge may be tilted a full 90 degrees where it will be locked in the up position, or it may be tilted approximately 30 degrees to travel up sloped driveways, after which it will bleed back down to the horizontal position.
   D. To lock the Cartridge in the full up position, keep the activation switch "ON" until it reaches the full up position. (Be sure latching mechanism is secure before transporting TMA or allowing anyone behind an elevated Cartridge).

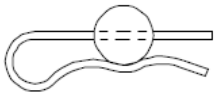
Caution: Under no circumstances should anyone be allowed behind an elevated Cartridge when the latch is not fully seated in its locked position.

2. LOWER the Cartridge from full 90 degree position:
   A. Activate the hydraulic system and manually disengage the latch (this is to be accomplished from the rear corner of the truck so that the operator can check to make sure everyone is clear). Release the switch to lower the Cartridge (See Hydraulic Assembly drawing).

Caution: As Cartridge starts to lower, stand clear of moving parts.

   B. Cartridge will then "bleed-down" in 15 – 30 seconds, regulated by the flow control valve attached to the cylinder (See Hydraulic Assembly drawing).
   C. The external switch and cord should be properly stored before moving the truck.

*Make sure all Retainer Pins are attached correctly and cannot fall out:

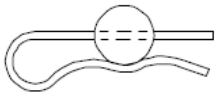


General Maintenance

	DESCRIPTION	INTERVAL
1.	Check tightness of fasteners.	1 month or 1,000 miles
2.	Oil swivel Jacks.	6 months
3.	Change hydraulic fluid (Use Dexron® III fluid only).	2 years or 30,000 miles
4.	Add hydraulic fluid (Use Dexron® III fluid only).	As required.
5.	Clean hydraulic pump.	As required.
6.	Clean hydraulic ram.	As required.
7.	Replace light bulbs.	As required.
8.	Clean Backup, Cartridge, and Support Frame. (dirt and salt)	As required.
9.	Check levelness and height of Cartridge in "DOWN" position (See sheet 1, instruction "A".)	As required. (correct immediately)*
10.	Grease friction points (moving steel parts).	6 months
11	Check the latch mechanism to make sure it moves smoothly into its locking position.	As required. (correct immediately)
12.	Check all 1" diameter pins to make sure they are held in position by a retaining pin.	As required. (correct immediately)*
13.	Check condition of wheels on Jacks.	As required.
14.	Check for damage or corrosion.	As required.*

Note: As required maintenance shall be checked monthly.

Note: For items marked with "*" check prior to each use.



Recommended Tools

- Welding equipment (for 13mm [1/2”] plate)
- Cutting torch
- Hammer
- Drift pin or alignment pin
- Tape measure
- 1/2" drive socket wrench
- 1/2" drive sockets (9/16”, 3/4", 1-1/8”, 1-1/2”)
- Open end wrenches (9/16”, 1-1/8”, 1-1/2”)
- 12” crescent wrench – 2
- Carpenter’s 600mm [24”] bubble level
- Marking implement (pencil, soap stone)
- Floor jack
- Center punch
- Torque wrench
- Hydraulic fluid (Use Dexron® III fluid only)
- Drill motor for 13/16” diameter drill
- 13/16” diameter drill and pilot drill
- 9/16” Allen wrench

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.

Assembly

1. Check shipping list against actual parts to make sure all items were received. Review drawing package and familiarize yourself with the assembly and part numbers. Read the entire Manual before proceeding.
2. Park truck on a level surface (use bubble level). The truck should be as close to the final driving weight as possible. If ballast must be added to achieve the 4540 kg [10,000 lbs.] minimum weight, add it at this time. The 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.
3. Before assembling the Alpha TMA, the truck must first be equipped with a rigid underride frame attached to the rear of the truck frame. Refer to Underride Assembly drawing for minimum requirements. The existing underride frame must be capable of withstanding an impact load of 200 k-N [45,000 lbs.] along the lower member.

   Parts and materials are supplied with the TMA for installing an underride that meets the requirements specified (See Underride Assembly drawing) if the truck is not equipped with and underride, or if the existing underride cannot withstand the load.

   A. All welding shall be performed by a welder certifiable to AWS D14.3-82 or AWS D1.1 and in accordance to Underride Assembly drawing.

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

4. After attaching the truck underride (or making sure the existing one can withstand the 200 k-N [45,000 lbs.] load), check for interference problems as described below.

   A. Temporarily position “Upper Frame Support” (P.N. 2501651-0000) against the rear of the truck frame (refer to Figures 1 and 2) and check for interference problems. Interference problems with tail lights, dump bodies (in up position), etc. should be corrected before proceeding. (The cross member on the Upper Frame Support may be removed after attachment to underride.)

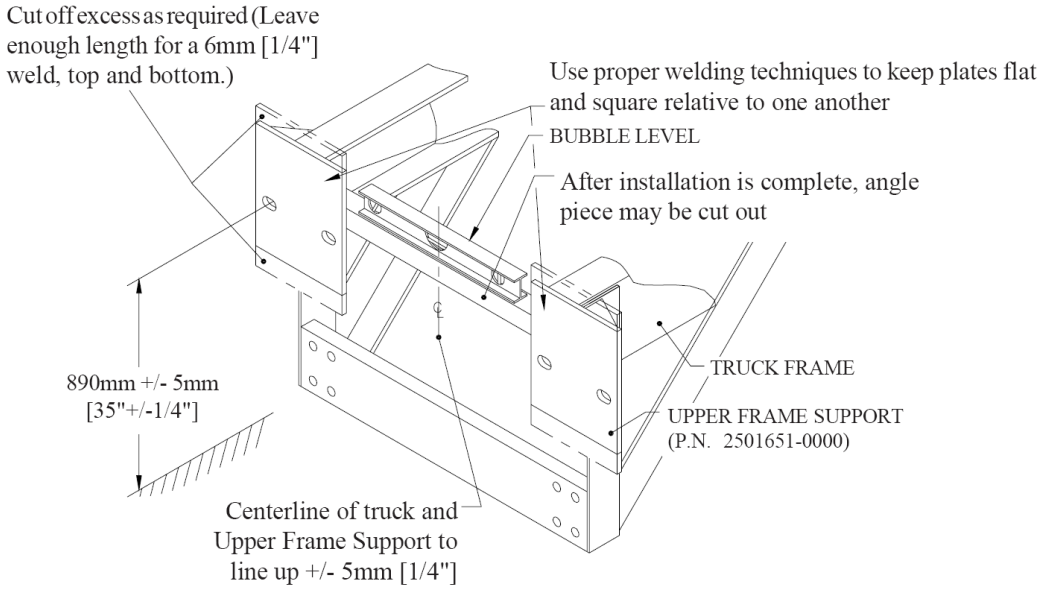


Figure 1

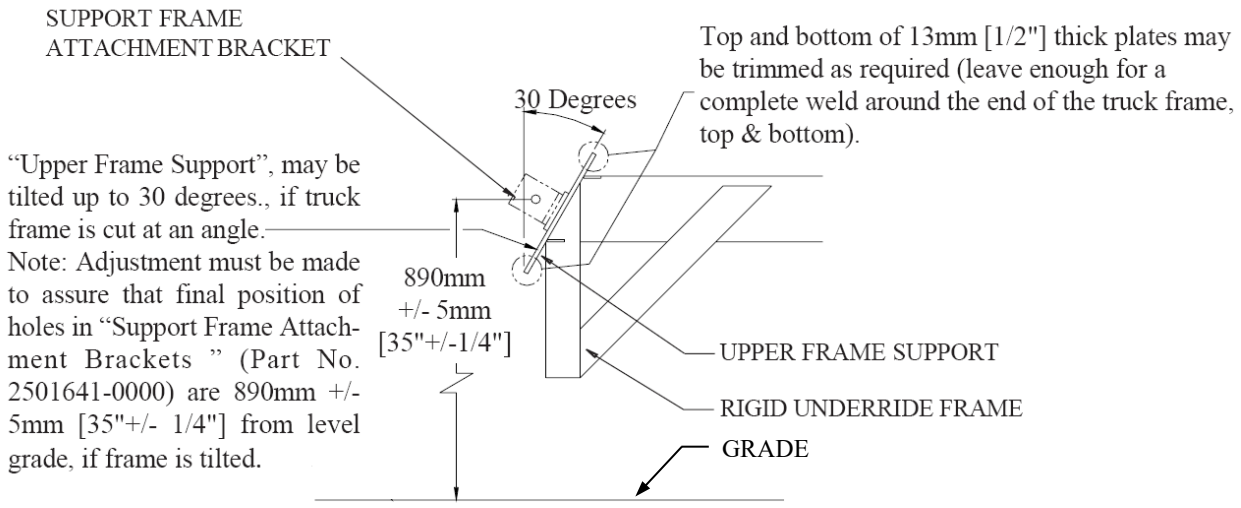


Figure 2

5. The Backup and Support Frame are pre-assembled at the manufacturing facility and therefore should arrive as a complete assembly. Attach the Cartridge to the Backup and Support Frame Assembly using the 1/2" nuts and washers attached to the Cartridge. Tighten the nuts until the lock washers are fully compressed.
6. Secure the Jacks on the Cartridge and Backup into the "DOWN" position and "elevate" the Cartridge to 305mm ± 5mm [12" ± 1/4"] at front, 330mm ± 5mm [13" ± 1/4"] at rear from the ground. The Cartridge jack may have been shipped separately from the Cartridge. See the decal on the rear of the Cartridge for assembly instructions. Torque bolts to no more than 35 N-m [25 ft. – lbs.].
7. Attach the "Support Frame Attachment Bracket" (2 ea., Part No. 2501641-0000) to the upper holes of the "TMA Support Frame" (Part No. 2728291-0000) using the 1" diameter pins. (Lower holes are for height adjustment if necessary.)

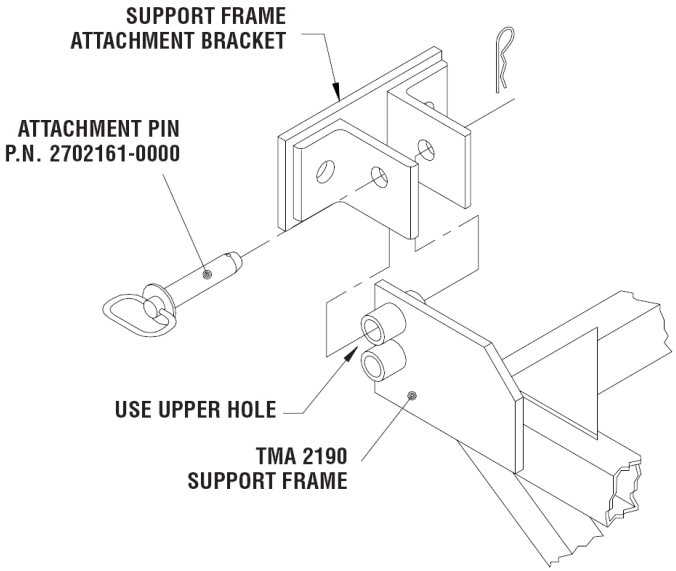


Figure 3

8. Attach the “Upper Frame Support” (P.N. 2501651-0000) to the attachment Bracket using the 1” x 3” grade 5 bolts. Center the Upper Frame support to the Attachment Brackets before tightening. Torque the nuts to 240 N-m [175 ft.-lbs.].

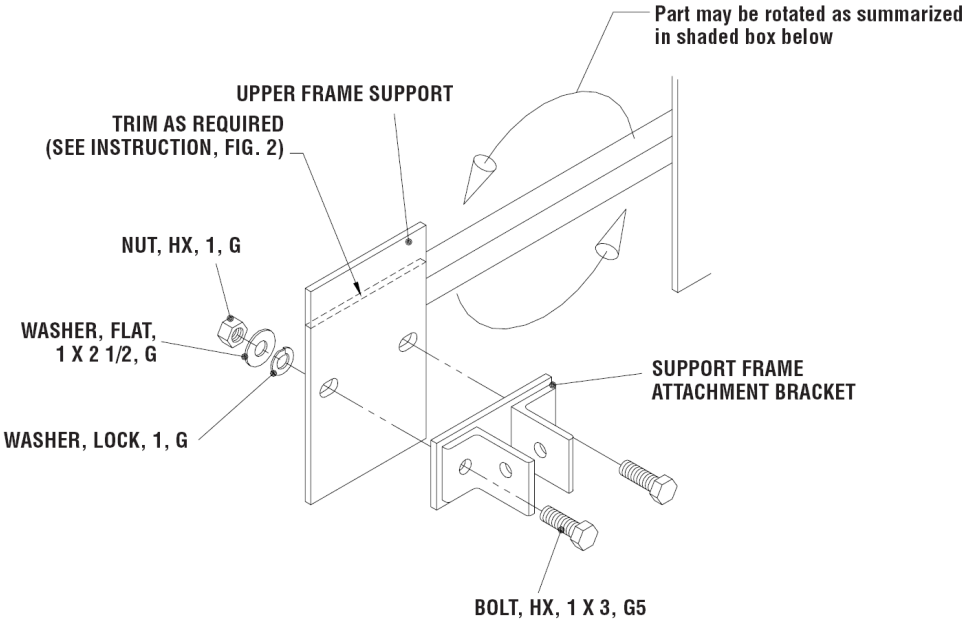


Figure 4

9. Check again to assure that the front of the Cartridge is at 305mm [12”] high and the rear of the Cartridge is set at 330 mm [13”] high. Roll the Cartridge, Backup, and Support Frame Assembly up to the truck frame. Center the “Upper Frame Support” on the truck frame (with underride) and tack weld in place. Note: The Upper Frame Support must be in intimate contact with the truck frame and centered, before welding.

Note: If there is interference with something on the truck which cannot be moved, the Upper Frame Support may be disassembled from the Support Frame Attachment Brackets and assembled to the truck frame by inverting the Upper Frame Support as shown in Figure 4 and then locating and welding it using the dimensions and cautions as shown in Figure 1 and 2. Angle cross member may need to be cut out at this time in order to proceed.

10. Remove the 1” diameter pins from the Support Frame and Support Frame Attachment Brackets and move the Cartridge, Backup, and Support Frame Assembly away from the truck.
11. Weld the “Upper Frame Support” to the truck frame per Underride Assembly drawing. Note: Minimum weld length to each frame (excluding gusset welds) is 380mm [15”]. (See note A in step #4). Weld the four Gussets (Part No. 2725051-0000) as shown making sure there is adequate bolt clearing near the holes. Paint the exposed metal parts using the primer and spray paints provided (See Figures 1 and 2).

12. Position “Lower Truck Brackets” (P.N. 2723711-0000) as shown in Figure 5. Place one 13mm [1/2”] thick “Shim” (P.N. 2723151-0000) under each “bracket, Lower Truck” (P.N. 2723711-0000). Attach with 3/4” diameter x 4” long all thread hex bolts, and torque to 200 N-m [150 ft–lbf].

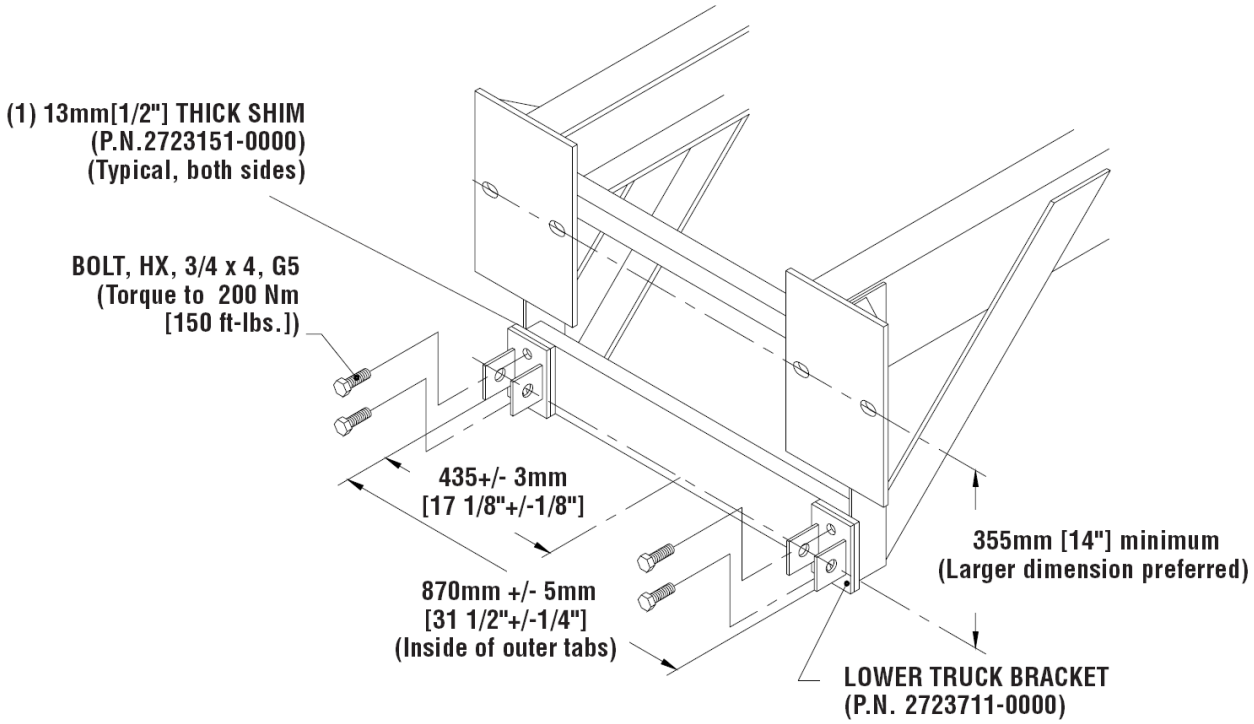


Figure 5

13. Attach electrical sockets (P.N. 2724901-0000 and P.N. 2724431-0000) to rear of truck per detail drawing, Sheet 1, provided in this booklet. Make sure that the electric cords on the Backup and Cartridge can reach this location.
14. Position and reattach TMA Support Frame (P.N. 2728291-0000) to the Support Frame Attachment Brackets (P.N. 2501641-0000) using the 1” diameter pins provided. The Retainer Pins should be on the inboard side of the frame. Refer to Detail Drawings. (Please Note: The cross member of the Upper Frame Support (P.N. 2501651-0000) may require removal at this point; refer to Figure 1.)

15. Attach Struts to the TMA Support Frame and Lower Truck Brackets as shown in Figure 6, using 1” diameter pins and Retainer Pins for the Struts and 3/4" diameter x 3 1/2" long Grade 5 Bolts. Now torque nuts to fully compress lock washers.

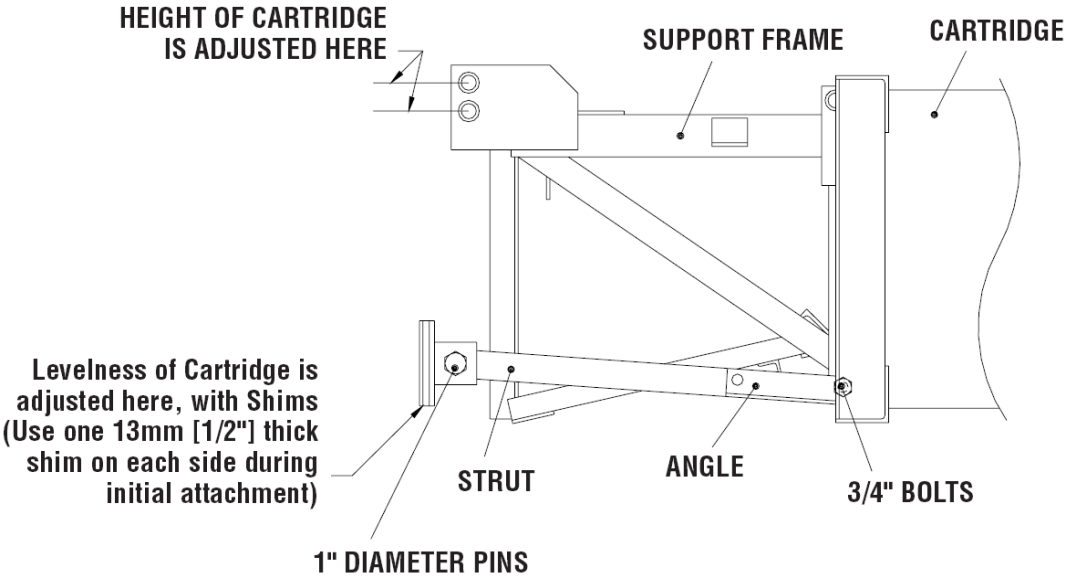


Figure 6
(Jacks not shown for clarity)

16. The hydraulic system was assembled as shown on Hydraulic Assembly drawing. The pump was wired as shown on Hydraulic Assembly drawing. Mount one switch inside the cab within easy reach of the driver. Place the “Caution” decal supplied with the push button near the switch. Mount the second switch on the passenger side of the TMA Support Frame using the support provided. Remove the metal plug and fill pump reservoir with Dexron® III fluid, supplied with unit. Fill to within 13mm [1/2”] from top. Insert the breather cap in the filler hole. Be careful not to cross thread breather cap.
17. Secure the three Jacks into the “UP” position.
18. Double check the height and levelness of the Cartridge relative to the ground (305mm ± 25mm [12 ± 1”]). If the Cartridge is not level, adjustment can be made as described under Item 13 (See Figure 6 and 7) using 13mm [1/2”] and 6mm [1/4”] thick shims provided.

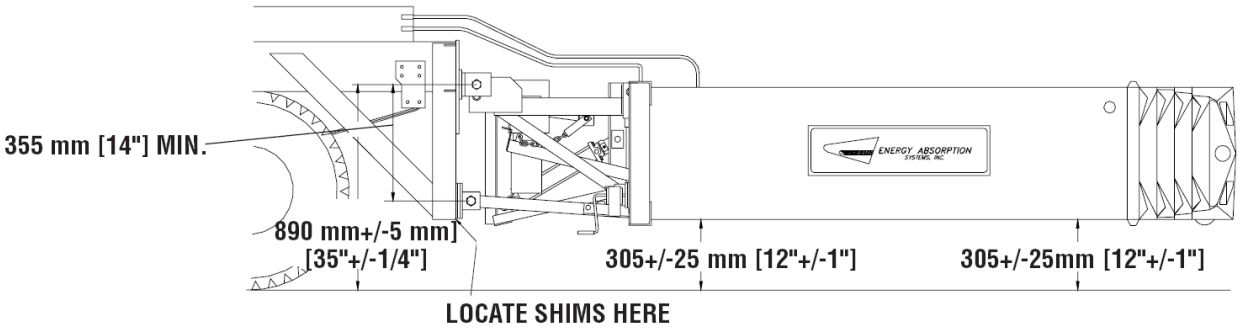


Figure 7

19. Plug in the Cartridge and Backup Plugs as well as the pump's battery cable (to the + [positive] terminal) and verify that all turn/stop/tail lights are working properly.
20. Check location of all hydraulic and electrical lines to make sure they will not be damaged during raising and lowering of unit.
21. Read the Operating Instructions then cycle the system up and down several times to relieve air from the system. If necessary, adjust the bleed-down rate using the flow control valve. Cartridge should bleed down from 90 degrees to horizontal in 15 – 30 seconds. (Refer to Hydraulic Assembly drawing).

NOTE: Do not run down truck battery.

22. Make sure the latch mechanism smoothly locks the Cartridge in the 90 degree "UP" position.

NOTE: Problems here often can be corrected by varying the length of the large 76mm [3"] bore hydraulic cylinder by turning the clevis one or two revolutions.

CAUTION: Each time the operator elevates the Cartridge, they should verify latch is fully locked before allowing anyone behind the Cartridge.

23. Check tightness of all fasteners. Double check height and levelness of Cartridge.
24. The TMA system is now ready for use. To achieve intended operation, all TMA users should be given operating and safety instructional training as given in this Manual and as required by the specifying highway authority.

Repair Instructions

The following Repair Instructions are given by first presenting a problem and then giving a possible solution.

I. Cartridge cannot be elevated

Consult hydraulic schematic in this manual. Clogged filters or improperly adjusted “internal pump relief valve” could be the problem. There may not be enough hydraulic fluid in the pump reservoir. Use only Dexron® III fluid.

II. Cartridge will not bleed down

A. Refer to I. above. The flow control valve for adjusting the bleed down rate may be too tight or clogged with dirt.

B. Check and make sure the support braces are clearing the seats on the Support Frame, when handle is turned.

III. Latch does not work properly

A. Check for areas where it might be binding and correct the problem.

B. Refer to I. above.

IV. Lights will not work

A. Replace affected light bulb(s).

B. Check wires for damage.

C. Using a volt/ohmmeter, troubleshoot and locate the problem.

V. Cartridge is not level

A. Check for cause of problem.

1. Temporary extra load in truck.
2. Support Frame improperly assembled.
3. Weakening truck springs.

B. Adjust Cartridge

1. Shims can be added or subtracted under the Lower Truck Brackets to adjust the levelness of the Cartridge. Each 13mm [1/2”] thick shim will raise or lower the rear end of the Cartridge approximately 50mm [2”]. 6mm [1/4”] thick shims are also supplied. Height is adjusted up or down by using the attachment holes in the Support Frame. The correct final position the Cartridge should be 305mm ± 25mm [12” ± 1”] above the ground at all points.

Minor damage to aluminum Cartridge

A. Damage to the rear 2,134mm [7’] of the Cartridge top and bottom outer skin or to the rear 914mm [3’] of the side cover with an affected area smaller than 610mm [24”] wide x 571mm [22 1/2”] high x 152mm [6”] deep may be repaired by applying appropriately sized aluminum reinforcement to cover the damaged area. Use .032” [0.8mm] thick aluminum on damaged top and bottom skins and .063” [1.6mm] thick aluminum on damaged side covers. Pop riveting is the recommended fastening method for attaching new parts.

B. Damage to the front of the Cartridge, because this is the area that supports the cantilevered weight of the system, cannot be replaced. If this area of the Cartridge has not been crushed, extra rivets can be added as needed.

Major damage to aluminum Cartridge

Damage to areas larger or deeper than 610mm [24”] wide x 571mm [22 ½”] high x 152mm [6”] deep in the rear 2134mm [7’] of the Cartridge or any crushed area in the front 305mm [12”] of the Cartridge is considered “major” damage. Damage to the front 1219mm [4’] of the side covers or length ripples along any covers is also considered “major” damage. Such damage could significantly affect the total energy absorbing ability of the Cartridge. Repairs for “major” damage are not recommended.

See General Information if an evaluation is desired.

General Information

Valtir personnel are available to assist in evaluating damaged TMA Cartridges. Several photos of the damaged area, taken at different angles, should be submitted for evaluation. (Send to: Customer Service Manager (See Page 3)).

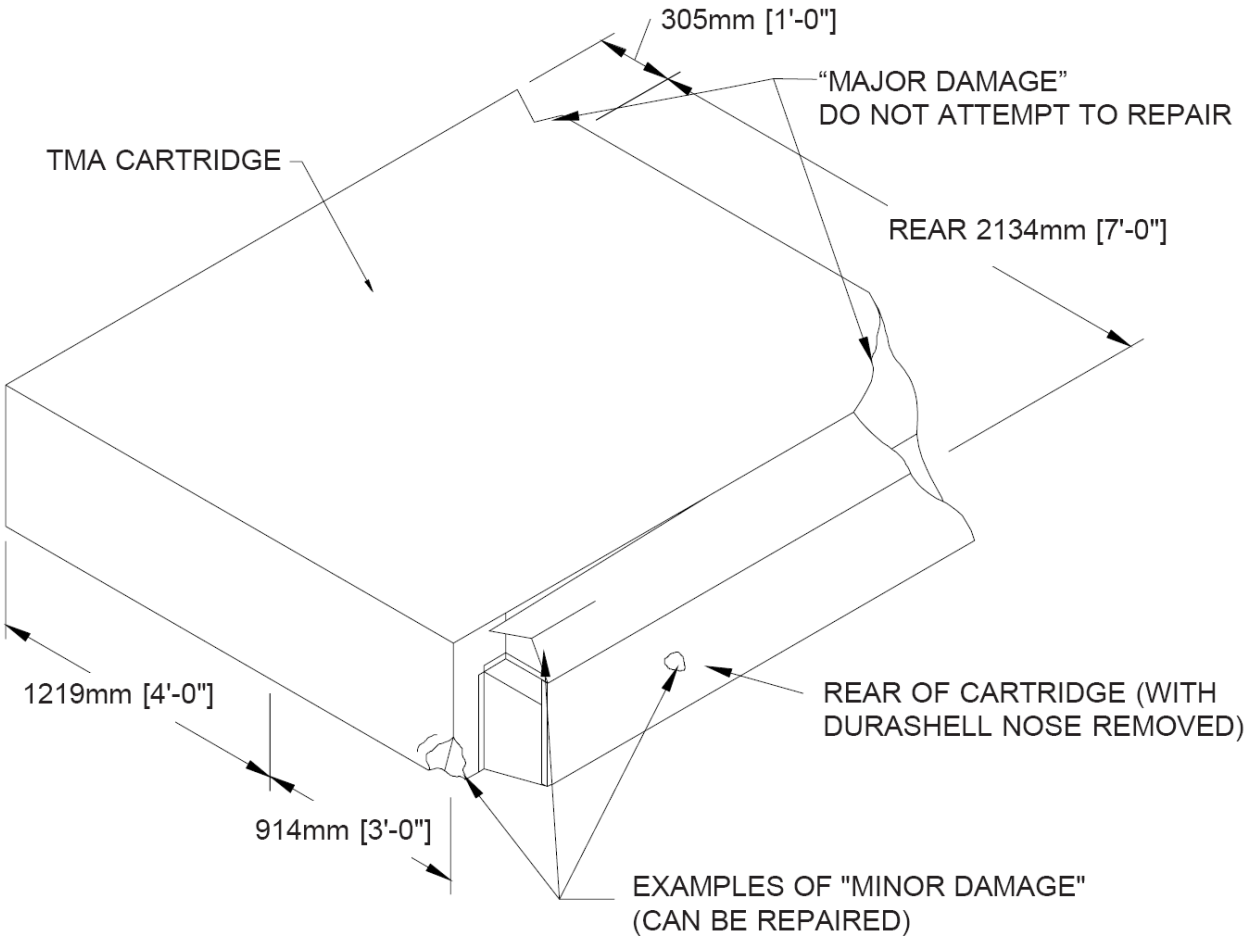
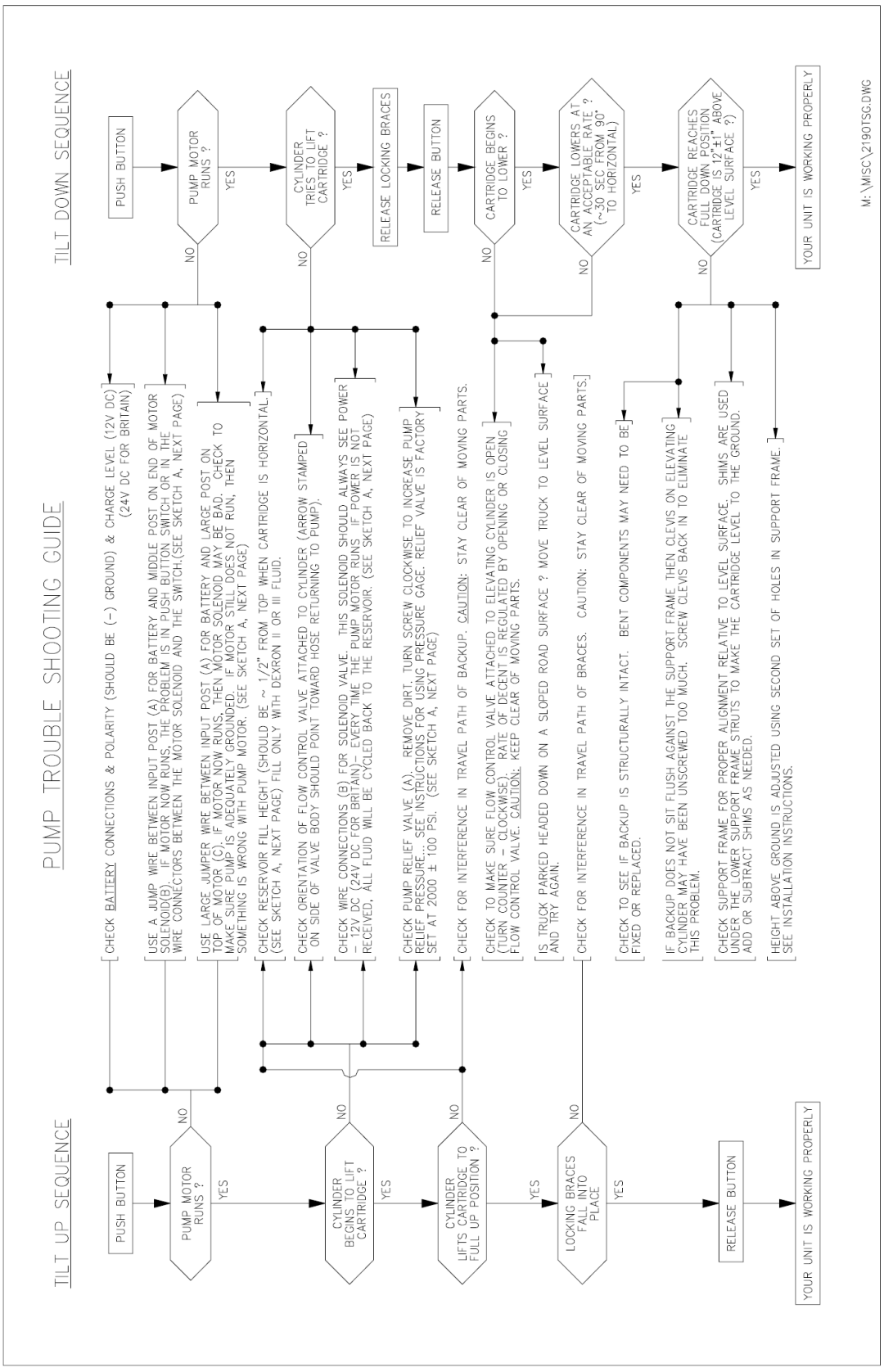


Figure 8


PUMP TROUBLE SHOOTING GUIDE
TILT UP SEQUENCE
PUSH BUTTON
PUMP MOTOR RUNS ?
NO
YES
CHECK BATTERY CONNECTIONS & POLARITY (SHOULD BE (-) GROUND) & CHARGE LEVEL (12V DC) (24V DC FOR BRITAIN)
USE A JUMP WIRE BETWEEN INPUT POST (A) FOR BATTERY AND MIDDLE POST ON END OF MOTOR SOLENOID(B). IF MOTOR NOW RUNS, THE PROBLEM IS IN PUSH BUTTON SWITCH OR IN THE WIRE CONNECTORS BETWEEN THE MOTOR SOLENOID AND THE SWITCH.(SEE SKETCH A, NEXT PAGE)
USE LARGE JUMPER WIRE BETWEEN INPUT POST (A) FOR BATTERY AND LARGE POST ON TOP OF MOTOR (C). IF MOTOR NOW RUNS, THEN MOTOR SOLENOID MAY BE BAD. CHECK TO MAKE SURE PUMP IS ADEQUATELY GROUNDED. IF MOTOR STILL DOES NOT RUN, THEN SOMETHING IS WRONG WITH PUMP MOTOR. (SEE SKETCH A, NEXT PAGE)
CYLINDER BEGINS TO LIFT CARTRIDGE ?
NO
YES
CHECK RESERVOIR FILL HEIGHT (SHOULD BE ~ 1/2" FROM TOP WHEN CARTRIDGE IS HORIZONTAL (SEE SKETCH A, NEXT PAGE) FILL ONLY WITH DEXRON II OR III FLUID.
CHECK ORIENTATION OF FLOW CONTROL VALVE ATTACHED TO CYLINDER (ARROW STAMPED ON SIDE OF VALVE BODY SHOULD POINT TOWARD HOSE RETURNING TO PUMP).
CHECK WIRE CONNECTIONS (B) FOR SOLENOID VALVE. THIS SOLENOID SHOULD ALWAYS SEE POWER - 12V DC (24V DC FOR BRITAIN)- EVERY TIME THE PUMP MOTOR RUNS. IF POWER IS NOT RECEIVED, ALL FLUID WILL BE CYCLED BACK TO THE RESERVOIR. (SEE SKETCH A, NEXT PAGE)
CYLINDER LIFTS CARTRIDGE TO FULL UP POSITION ?
NO
YES
CHECK PUMP RELIEF VALVE (A). REMOVE DIRT. TURN SCREW CLOCKWISE TO INCREASE PUMP RELIEF PRESSURE... SEE INSTRUCTIONS FOR USING PRESSURE GAGE. RELIEF VALVE IS FACTORY SET AT 2000 ± 100 PSI. (SEE SKETCH A, NEXT PAGE)
CHECK FOR INTERFERENCE IN TRAVEL PATH OF BACKUP. CAUTION: STAY CLEAR OF MOVING PARTS.
LOCKING BRACES FALL INTO PLACE
NO
YES
CHECK TO MAKE SURE FLOW CONTROL VALVE ATTACHED TO ELEVATING CYLINDER IS OPEN (TURN COUNTER - CLOCKWISE). RATE OF DECENT IS REGULATED BY OPENING OR CLOSING FLOW CONTROL VALVE. CAUTION: KEEP CLEAR OF MOVING PARTS.
IS TRUCK PARKED HEADED DOWN ON A SLOPED ROAD SURFACE ? MOVE TRUCK TO LEVEL SURFACE AND TRY AGAIN.
CHECK FOR INTERFERENCE IN TRAVEL PATH OF BRACES. CAUTION: STAY CLEAR OF MOVING PARTS.
RELEASE BUTTON
CHECK TO SEE IF BACKUP IS STRUCTURALLY INTACT. BENT COMPONENTS MAY NEED TO BE FIXED OR REPLACED.
IF BACKUP DOES NOT SIT FLUSH AGAINST THE SUPPORT FRAME THEN CLEVIS ON ELEVATING CYLINDER MAY HAVE BEEN UNSCREWED TOO MUCH. SCREW CLEVIS BACK IN TO ELIMINATE THIS PROBLEM.
CHECK SUPPORT FRAME FOR PROPER ALIGNMENT RELATIVE TO LEVEL SURFACE. SHIMS ARE USED UNDER THE LOWER SUPPORT FRAME STRUTS TO MAKE THE CARTRIDGE LEVEL TO THE GROUND. ADD OR SUBTRACT SHIMS AS NEEDED.
HEIGHT ABOVE GROUND IS ADJUSTED USING SECOND SET OF HOLES IN SUPPORT FRAME. SEE INSTALLATION INSTRUCTIONS.
YOUR UNIT IS WORKING PROPERLY
TILT DOWN SEQUENCE
PUSH BUTTON
PUMP MOTOR RUNS ?
NO
YES
CYLINDER TRIES TO LIFT CARTRIDGE ?
NO
YES
RELEASE LOCKING BRACES
RELEASE BUTTON
CARTRIDGE BEGINS TO LOWER ?
NO
YES
CARTRIDGE LOWERS AT AN ACCEPTABLE RATE ? (~30 SEC FROM 90° TO HORIZONTAL)
NO
YES
CARTRIDGE REACHES FULL DOWN POSITION (CARTRIDGE IS 12"±1" ABOVE LEVEL SURFACE ?)
NO
YES
YOUR UNIT IS WORKING PROPERLY
M:\MISC\2190TSG.DWG

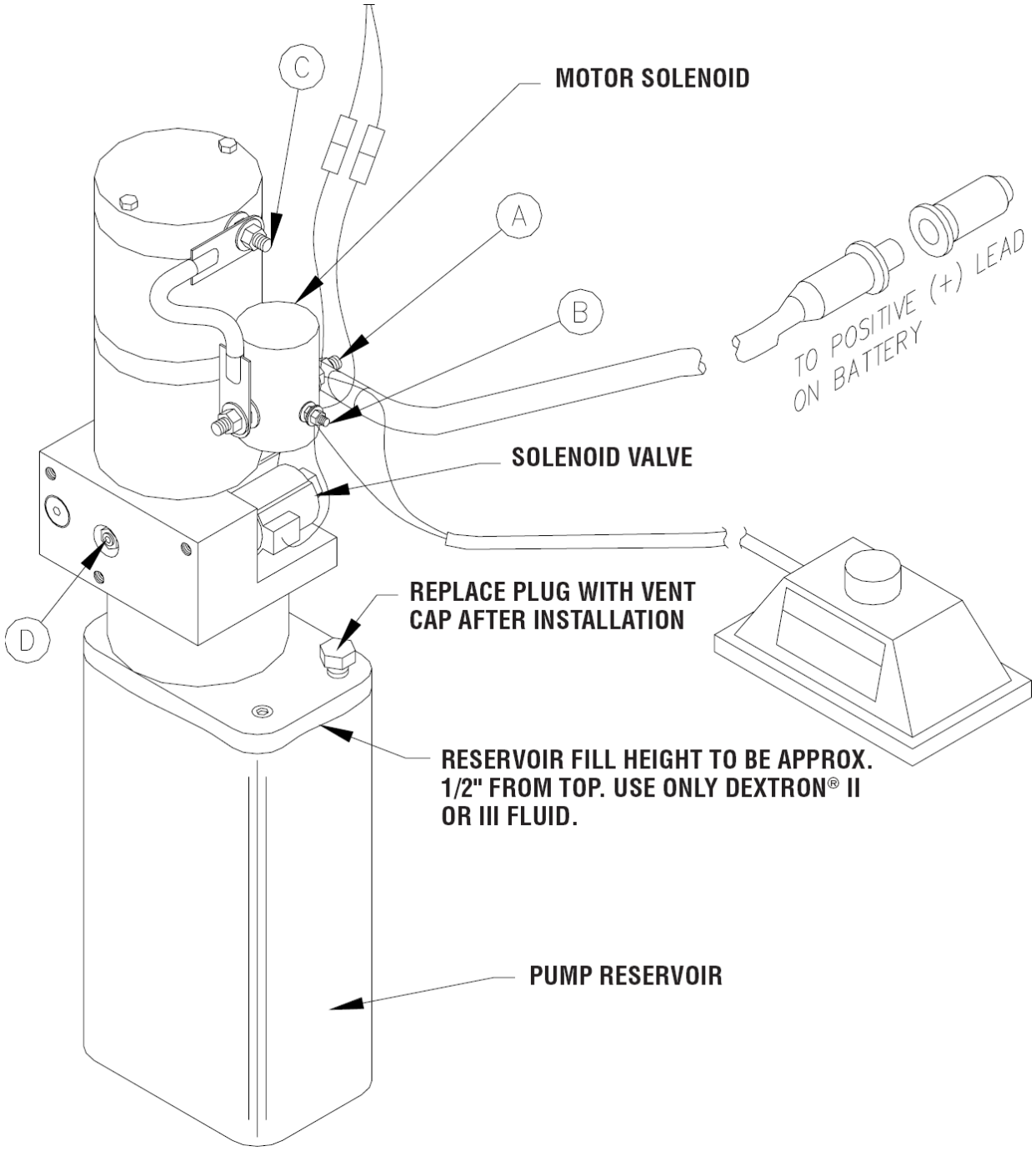

C
MOTOR SOLENOID
A
B
TO POSITIVE (+) LEAD
ON BATTERY
SOLENOID VALVE
D
REPLACE PLUG WITH VENT
CAP AFTER INSTALLATION
RESERVOIR FILL HEIGHT TO BE APPROX.
1/2" FROM TOP. USE ONLY DEXTRON® II
OR III FLUID.
PUMP RESERVOIR

Figure 9

Quick Troubleshooting Guide

(Williams/Monarch Pumps)

NEVER STAND BENEATH THE TMA WHEN IT IS BEING REPAIRED, LOWERED, OR SOMEONE IS AT THE CONTROLS

Finding and Solving Problems:

Hydraulic system failures usually follow a similar pattern: A gradual or sudden loss of pressure or flow, followed by a loss of cylinder or motor power. Any of the systems components could be the cause. The problem may be solved by following a step by step procedure.

1. Motor Fails to Start:

- ☐ Failed Motor Starter Solenoid: Replace if necessary.
- ☐ Electrical switch inoperative: Repair or replace.
- ☐ "Open" circuit/insufficient grounding: Check and correct.
- ☐ Motor inoperative: Repair or replace.

2. System is Inoperative

- ☐ No oil in system; insufficient oil in system; pump losing prime: Fill system. - Check for leaks.
- ☐ Wrong oil in system (Should be Dexron® III): - Change oil.
- ☐ Clogged or dirty filter: Drain oil and replace filter or element.
- ☐ Oil line restricted: Line dirty or collapsed - Clean or replace oil line.
- ☐ Air leaks in pump suction line: Repair or replace as needed.
- ☐ Worn or dirty pump: Clean, repair or replace; check alignment; check for contaminated oil - drain, flush, and refill system with approved oil.
- ☐ Badly worn components (valves, cylinders, etc.): Examine and test for internal or external leakage. Replace faulty components. Check for cause of wear.
- ☐ Leakage: Check all components, especially the relief valve, for proper settings.
- ☐ Excessive load.
- ☐ Broken or slipping pump drive: Repair or replace belt couplings, etc. Check for proper alignment or tension.
- ☐ "Ground" fault.

3. System Operates Erratically

- ☐ Air in system. Check suction side for leaks. Repair.
- ☐ Cold oil. Allow system to warm up.
- ☐ Damaged or dirty components. Clean or repair as needed.
- ☐ Restricted lines or filters: Clean and/or replace lines or elements as necessary.

4. System Operates Slowly

- ☐ Oil viscosity to high; cold oil: Allow oil to warm up before operating or replace oil with proper specified oil.
- ☐ Low oil level: Check reservoir & add oil as necessary.
- ☐ Air in system: Check suction side for leaks – repair; cycle system several times to relieve air from system.
- ☐ Worn pump valves, cylinders, etc. Replace or repair as necessary.
- ☐ Restriction in lines or filters: Clean or replace elements or lines.
- ☐ Improperly adjusted flow control valve: Replace or adjust a necessary.
- ☐ Oil leaks: Tighten fittings; replace seals or damaged lines. Low Voltage.

5. System Operates too Fast

- ☐ Incorrectly adjusted flow control valve: Replace or adjust as necessary.

6. Oil in System Overheats

- ☐ Incorrect, low or dirty oil: Add or change oil as necessary.
- ☐ Excessive component internal leakage: Repair or replace as necessary.
- ☐ Restriction in lines or filters: Clean or replace as needed.
- ☐ Insufficient heat radiation: Clean dirt and mud from reservoir and components.
- ☐ Malfunction component: Replace or repair.

7. Foaming of Oil

- ☐ Incorrect, low or dirty oil. Replace or add oil as needed.
- ☐ Air leaks. Check suction lines & component seals for leaks. Replace.

8. Noisy Pump

- ☐ Low oil level, incorrect or foamy oil: Replace or add oil as necessary.
- ☐ Suction line or inlet screen plugged: Clean or replace.
- ☐ Worn or damaged pump: Repair or replace.

9. Leaky Pump or Motor

- ☐ Damaged or worn shaft seal: Replace. Check for misalignment.
- ☐ Loose or broken parts: Tighten or replace.
- ☐ Incorrectly adjusted relief valve.

10. Load Drops When System “Locked”

- ☐ Leaking cylinder seals or fittings: Replace worn parts.

11. Leaky Cylinder(s)

- ☐ Seals worn or damaged: Replace.
- ☐ Rod damaged: Replace

Troubleshooting Guide

Safety Notes

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

Warning: 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 Valtir 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 Valtir.

Test Equipment for DC Powered Hydraulic Systems

The following is a recommended list of the test equipment required to troubleshoot DC powered hydraulic systems.

1. Pressure Gage

A small 34,450 KPa [0-5000 psi] pressure gage, preferably glycerin filled, is a valuable and relatively inexpensive tool for checking 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

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

4. Voltmeter

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 ohmmeter 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, should 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 Valtir Customer Service Department for assistance.

7. High Pressure Shut Off Valve

The shut off valve can be used to choke off oil flow so that a "false" load can be put on the pump and other components. With the valve assembled, it can be slowly shut off while the equipment listed above records the data for making a proper diagnosis.

Hydraulic Fluid

1. The Purpose of Oil

The main purpose of hydraulic fluid is to transfer power from the pump to the actuators but it must also perform many other tasks which are critical to a properly designed system. First, the oil must have good lubricity or be “slippery” so that the friction will be as low as possible to keep metal to metal wearing at a minimum. Second, the viscosity or “thickness” must be in the proper range at the operating temperature so that unwanted leakage will be at a minimum but will still allow the oil to lubricate the close fitting parts in the system. (Oil that is too thin will leak past seals, valve spools, and the gears; oil that is too thick will not flow properly and cause the pump to cavitate or starve.) Third, the oil must be compatible with the seals used in the system. Fourth, there should also be additives in the oil to slow down the effects of rust, oxidation (oxygen in the air combining with the oil to form sludge) foaming, and water settling to the bottom of the reservoir. Fifth, the oil must be able to pour or flow at the lowest expected temperature so that the oil can reach or get into the pump.

2. Selecting Fluids for Applications Outside Dexron® III ATF’s Temperature Range

When looking for fluids that can be used in place of Dexron® III ATF or for applications where the operating temperature is outside the range of Dexron® III ATF the following specifications 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. Fluid shall 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 shall be as high as possible. As an example, Dexron® III ATF has the following specs as listed by most oil manufacturers:

[1] Viscosity (SUS)

37 deg. C [100 deg. F] 185 to 205

99 deg. C [210 deg. F] 45 to 55

[2] Pour Point -44 deg. C [-45 deg. F] to

-37 deg. C [-35 deg. F]

[3] 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.

Pump Priming

1. New Assemblies

New system assemblies, as well as those that are disassembled for repair, require proper priming to avoid possible pump failure. A pump is said to be “primed” when the internal cavity is full of oil and all air has been expelled.

A. Prime a pump as follows:

1. “Crack” or remove the high pressure line at or near the cylinder.
2. “Jog” the unit until oil flow is clear.
3. Retighten or replace hose.

2. When Systems Fail to Prime or Lose Their Prime, Check for the Following:

A. Correct unit mounting position in the case of a pump-motor-reservoir combination. It is either horizontal or vertical and failure to mount in the proper manner could mean pump could not prime (pick up oil) because the suction is not submerged in the oil at all times.

Note: Pumps designed for vertical mounting will have a label stating such.

B. Partially clogged suction filter (see Filter section).

C. A loose or improperly assembled suction hose or pickup tube.

D. A bad front pump seal (see Pump section).

E. A solid fill plug in reservoir with no vent (see Reservoir section).

F. Oil that is too thick (see Hydraulic fluid section) or contaminated with water (see Reservoir section).

G. Occasionally a pump will not prime itself because a check valve spring in the high pressure port is too “stiff” or the Spring Retainer is turned down too far. If this condition is expected, loosen the Spring Retainer (found in the high pressure outlet port), energize the pump to prime it, and then turn the retainer back to the correct depth (see section on Check Valves).

Reservoirs

1. Use Recommend Fluid

Fill reservoir with Dexron® III ATF. (See Hydraulic Fluid section).

2. Filling & Operating

A. Fill reservoir to within 12.5 mm [1/2”] with all the cylinders in the fully retracted position.

B. Operate unit several times starting with short cylinder strokes and increasing length of each successive stroke.

C. Recheck oil level often and add as necessary to keep pump from pulling in air.

D. After system is purged of air, collapse all cylinders, check oil level in reservoir, and assemble the filter/breather plug provided.

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.

3. Reservoir Problems

A. Clear oil flowing out of fill hole usually means cylinders were not fully collapsed when reservoir was filled.

B. Foamy oil flowing out of the fill hole points to the following:

1. Air is present in the system; that is, cylinders and fluid lines. The response usually is “spongy” and the cylinder moves 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.
3. The return oil velocity is excessive; to correct: add a flow control valve to decrease velocity, increase size of “down spout” or add a diffuser.
4. The reservoir is too small to supply the volume of oil required by the cylinders, and the pump picks up air when the oil level drops below the suction pickup tube.
5. Damage to pump seal (See Pump Section).

C. Water in the oil.

Water can enter the reservoir through the fill hole if the unit is left outdoors or washed with high pressure washers. Protect the unit, whenever possible, and change oil regularly to minimize problems. In cold weather, the water will freeze and the pump will not work until the ice melts.

4. Tips and Comments

A. In most cases the reservoir is made to be mounted either vertically or horizontally and improper mounting will not allow it to be filled to capacity (See Pump Priming section).

B. On units with a remote reservoir, try to mount it above the pump whenever possible to “flood” the inlet.

C. One of the functions of the reservoir is to keep the reservoir in the proper temperature range. If the reservoir cannot dissipate enough heat, increase the size in order to bring the oil temperature down to the proper level (See Hydraulic Fluid section).

Filters

Most pump systems have filters which must be cleaned periodically or whenever flow is slow or sluggish. Some filters may be washed in cleaning solvent and blown dry with compressed air. Those which cannot be cleaned properly should be replaced. External high pressure filters may be added to the system for added protection and ease of cleaning.

Relief Valves

1. The Purpose of a Relief Valve is to:

A. Limit the maximum pressure in the system to a safe level.

B. Keep the current draw and battery drain at a minimum when the cylinder “deadheads” (reaches full stroke).

2. The Pump relief Valves on TMA’s are Basically the Same Except:

An internal cavity is drilled into the pump base on Monarch pumps for the relief valve. The following parts are inserted to make up the relief valve assembly.

A. Ball or Cone

B. Heavy Spring

C. Adjusting Screw

3. Diagnosing and Repairing Relief Valves

Note: When testing or making adjustments on the relief valve the system must be “deadheaded” (cylinder at full stroke or in a position where cylinder movement is zero).

A. Relief valve pressure to high.

1. Symptoms:

a. Current draw and battery drain excessive when system is “deadheaded.”

b. Motor RPM is slow in comparison to full load system operation.

2. Repair procedure:

Turn relief valve adjusting screw counterclockwise using a pressure gauge teed into a high pressure line to record the proper pressure setting.

Note: On the Monarch relief valve the jam nut will need to be loosened before adjusting. The Monarch relief valve is adjusted with an Allen wrench. Retighten the jam nut.

B. Relief valve pressure too low.

1. Symptoms

a. Motor RPM is “faster” than normal.

b. Cylinder will not extend.

c. Excessive turbulence in the reservoir.

Recommended Pressure:

Monarch: 1800 psi

2. Repair procedure

a. There are two possible causes for lack of pressure.

[1] The adjusting screw has backed up.

[2] Debris or “dirt” is trapped between the seat and the ball or cone.

b. Repair as follows:

[1] Using a pressure gauge teed into the pressure line turn the adjusting screw clockwise a turn or two and watch the gauge; if it goes up, continue to turn the screw until the required setting is reached. If the screw does not remain in the correct position replace it with one that has a locking pin. (In an emergency the screw threads may be deformed slightly with a small prick punch and hammer to hold the setting.)

[2] If the pressure does not climb when the adjusting screw is tightened: Turn the adjusting screw counterclockwise all the way out; energize the pump to “flush” the dirt past the seat.

Caution: Use hand or a piece of hose to divert oil into a container. Do not look into the port.

Inspect the cone or ball for nicks and replace if necessary; re-seat the ball or cone using a small drift punch and hammer with a light tap; reassemble spring and screw and reset the pressure.

Note: In an emergency, if a pressure gauge is not available, turn the relief valve screw in until the cylinder moves under worst conditions and then tighten 1/2 to 3/4 additional turn.

[3] If the above mentioned procedure fails to increase the relief valve setting, check for a worn pump or leaking cylinder. (See Pump and Cylinder sections)

Note: Avoid the use of Teflon® tape on hydraulic fittings as it can easily clog valves and filters in the system.

Check Valves

1. The Purpose of a Check Valve is to Allow Free Flow in one Direction but Block Reverse Flow.

2. Two Types of Check Valves are Used:

A. Ball type
B. Poppet type

3. Styles of Check valves Used:

A. Internal style
In an “internal” style, a cavity is drilled in the pump base into which the parts are assembled (inside pipe port cavity).

B. External style
A check valve mounted “outside” the pump base in a housing of some type is called an external check valve (in line). The housing is usually hex-shaped.

Note: Both styles of check valves use either types of construction depending on application and model.

4. Troubleshooting and Repairing Check Valve Failures.

A. Load drift failure.

1 Symptom: in most cases a check valve will fail such that a load will drift down when the unit is in the “hold” position.

Note: Check cylinder for leakage past piston seals (See cylinder section). A bad piston seal will give the same symptom.

2. Repair procedure.

a. Remove the Spring Retainer.

Note: Measure the depth to the Spring Retainer so it can be reassembled to the same depth after repair.

b. Remove spring.
c. Remove ball or poppet.
d. Start pump to “flush” dirt from the seat area. (Caution: use hand or a piece of hose to divert oil into a container - do not look into the port).
e. Inspect ball or poppet for damage and replace if necessary.
f. Reassemble ball or poppet.
g. “Seat” the ball or poppet using a small drift punch and hammer with a light tap.
h. Reassemble the spring.
i. Replace the Spring Retainer to the correct depth.

B. Blocked flow failure.

1. Symptom
Once in a while a ball type check valve will restrict flow to the point where the spring will collapse and the flow will be greatly reduced (even blocked) causing flow over the relief.

2. Repair procedure
a. Remove the check valve components and replace the spring.
b. If the problem persists, replace the ball type with a poppet type as they cannot completely block flow.

Note: Do not use Teflon® tape on hydraulic fittings as it can easily clog valves and plug the filters in the system.

Hydraulic Cylinders

1. Diagnosing and Troubleshooting Hydraulic Cylinders

A. Single acting (Ram type)
   1. Most ram type failures are caused by one of the following reasons:
      a. Excessive side load
      b. Stroking the rod to full extension
   2. Excessive side load can be diagnosed by observing the following:
      a. Cracked gland nut
      b. Gouged rod
      c. A cracked or bent rod that will not retract back into the tube
   3. Overstroking can be diagnosed by the following:
      a. Premature leakage past the V-rings
      b. System filters that become prematurely clogged with pieces of rubber due to v-ring crushing (See section on Filters.)

B. Double acting
   1. In addition to the same types of failures as found in single acting ram type cylinders (above), it is also possible to have a piston seat failure. This feature will show up as a cylinder drift in the hold position. Troubleshoot in the following manner:
      a. Put the cylinder in the hold position.
      b. Place a jack under the load.
      c. Remove the high pressure hose from the cylinder port on the side opposite the holding end.
      d. Let the jack down slowly: If the position seal is bad, oil will escape from the port.

Caution: Do not get near the load! USE CAUTION!!

2. Repairing Hydraulic Cylinders

A. Single Acting cylinder
   1. Remove cylinder from the assembly, disconnect hose line(s), and drain oil.
   2. Remove gland nut, rod, spreader, and packing assembly from the tube assembly.
   3. Clean internal tube and inspect chrome rod for gouges, scratches, or wear. Replace if necessary.
   4. Replace chrome rod back into tube assembly.
   5. Insert steel spreader.
   6. Grease the V-ring set on the inside and outside diameters.
   7. Reassemble one V-ring at a time making sure each V-ring lies flat on the ring prior to it.
   8. Replace the gland nut complete with a new wiper ring if worn. Thread it down until it makes contact with the V-rings, then tighten an additional 1 to 1 1/2 turns. The distance between the top of the threaded collar and the bottom of the large section on gland nut should be 1/4" to 6.35 to 7.94 mm [5/16"]. Do not over tighten.

Note: If it is possible to stroke the cylinder after repairing, turn gland nut until it contacts the V-rings and stroke the cylinder to allow the rings to seat and align, then retighten as described above.

B. Double-acting cylinder
   1. Follow the exact same procedures 1, 2, & 3 above.

Note: On 50.8 & 63.5 mm [2" and 2-1/2"] bore cylinders there is a retaining ring assembled just below the threaded area of the tube assembly. This ring must be removed in order to remove the rod assembly.

2. Double acting cylinders have two piston cups on the internal threaded end of the chrome rod. If these cups are worn, they must be replaced to ensure a proper seal. It is also advisable to check the piston "O" ring and the stuffing box "O" ring and replace if signs of wear exist.

Note: When replacing pistons on the rod, have the "O" ring well-greased and screw the piston past the threads to prevent damage to the new "O" ring.

3. Replace the V-rings, spreader, and gland nut as described in 5, 6, 7, & 8 above.

Electrical Problems

Caution!!! Remove all Rings, Watches, Etc. Prior to Doing Any Electrical Work!!!

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

A. Signals which point to low voltages are:
   1. Motor running at reduced speed.
   2. Solenoid valves not shifting.

B. Minimum voltage readings are as follows:
   1. The minimum voltage between the motor stud and ground is 9.0 volts at maximum load conditions.
   2. The minimum voltage between the valve solenoid power wire ("hot wire") and ground is 9.5 volts at maximum load conditions.

C. Causes for low voltage are:
   1. Battery capacity too small.
   2. Cable ends not electrically secured to battery cable. (Solder them if necessary)
   3. Battery cable size too small for load and length of run. Copper #2 automotive battery cable is the recommended minimum size. Larger copper battery cable (#1, #0 or #00) may be required for cable lengths over 30 feet to keep performance from deteriorating.
   4. Grounding is established through the pump mounting bolts. Clean any dirt, or rust from mounting holes and bolts to achieve proper ground.
   5. Bad joints where cable ends are bolted to battery, motor solenoid, start switch, ground, etc.
   6. Burnt contacts on motor solenoid or start switch.

D. Check for low voltage as follows: (A DC voltmeter will be required.)
    1. On vehicles equipped with an alternator, the voltage should be approximately 13.5 volts with no electrical accessories operating and the engine running - Check it
    2. Operate pump under maximum conditions. Use the volt meter to probe each connection, cable end, and cable from the battery all the way back to the motor stud and note the voltage losses. Make necessary repairs. Increase the voltage above the minimum required.

Note: Check the ground side as well: paint, rust, and dirt are insulators - remove them.

2. DC Motors

Motors should be serviced periodically to ensure good performance. Service as follows:

A. Remove head assembly from motor.
B. Check sleeve bearing in head assembly for wear.
C. Place a few drops of oil on felt liner in head assembly.
D. Check brushes for wear, and replace if necessary.
E. Blow dirt and dust out of motor housing and check for shorts, burnt wires, or open circuits in the field coil assembly.
F. Check armature and commutator for shorts or open circuits.
G. Check ball bearing on motor shaft: A growling motor can be caused by bad bearings.
H. Check for excessive “end play” of armature and add thrust washers as necessary.
I. If there is an excessive amount of water, condensation, or rust in the motor, a small drain hole may be drilled in the motor case on the low side of the motor depending on the mounting – consult with pump manufacturer for additional information.

Note: A motor which does not turn in freezing weather could be caused by water that has frozen inside the housing.

J. Be sure to check orientation of motor before replacing.
K. If motor fails to turn the pump, check the pump by turning drive shaft by hand – it may be “set-up.”

3. Electrical Switches

A. Push button, toggle, rocker or manual motor start switches: Defective switches are a common cause of electrical malfunction. What SEEMS to be a serious system defect can often be caused simply by a faulty switch, especially where the switch controls two functions (e.g. start the motor, and shift a valve) in those cases, one half the switch might be defective, while the other half operates correctly and the fault appears to be with some other component. Trouble shooting can be done by any one of three methods.
    1. Use a continuity light to test switch. (See Test Equipment section.)
    2. Use a circuit test light to test switch. (See Test Equipment section)
    3. Remove the wires from the switch and touch them together in the proper order to operate them.

Note: Even though external switch is “waterproof”, any switch controls subject to the weather should be mounted so that the cord exits from the bottom to prevent water from entering the box.

B. Motor start solenoid switches: Although there may be exceptions, most solenoid switches found on TMA pumps are the following type.

Three Post Solenoid Switch (See Figure below)

a. This three post solenoid switch is wired and constructed as follows:

[1] The large post marked “Bat” must be attached to the cable leading from the battery.

[2] The small post connects to the control circuit. (Push button, rocker, or toggle, etc.)

[3] The shared “hot” lead from the control circuit must also be attached to the large post marked “Bat”.

[4] The remaining large post attaches to the cable leading to the motor.

4. Shorts, Grounding Faults, and Open Circuits

In control wiring, shorts can only occur when “hot” lines (lines connected directly to the battery) come in contact with a ground. A short will either cause a fuse to blow, if there is a fuse, or burn the wire off at its weakest point. Likely spots for shorts are switches, electrical strain reliefs, electrical junction boxes, and a control cord which has been pinched or cut.

Grounding faults are much like shorts except they occur on the opposite side of the electrical component. A “ground fault” will cause the coil in the motor solenoid switch to remain energized. This type of failure can happen because switching is done in the ground wire due to the construction of the motor solenoid switch (See 3 – Electrical Switches above). Likely spots for “faults” are the same as the shorts – See above.

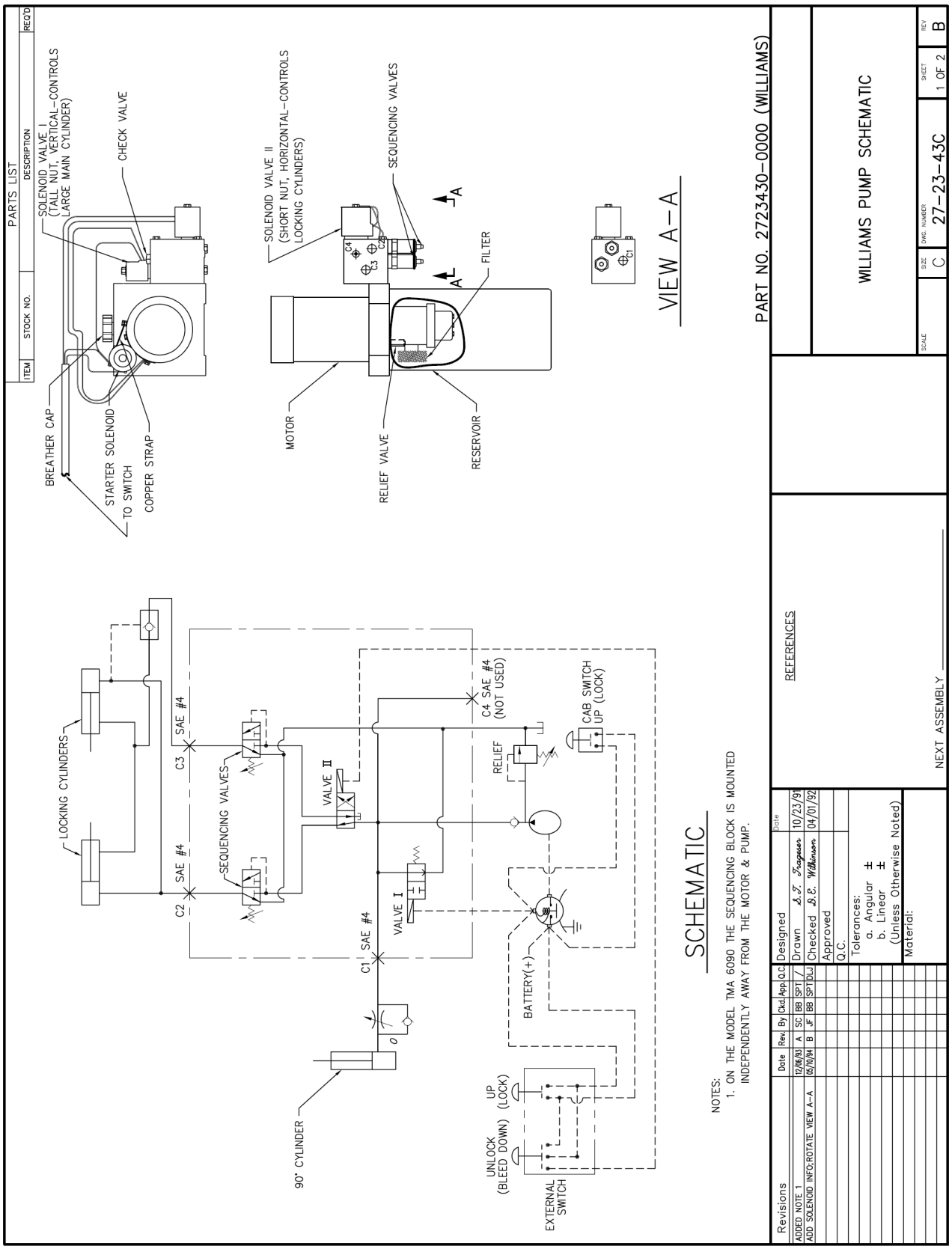
An “open” circuit is simply a break which prohibits current flow. Likely spots for “open” circuits are the same as shorts- See Above.

5. Solenoid Coils

Coils are used in solenoid operated valves and start switches. Failures can be caused by vibration, water, improper voltage, or corrosion. The best way to test a coil is with an ohmmeter. The meter should read some value of ohms. An infinite reading means that the coil has an open circuit. The reading between any lead on the coil and the “can” should be infinite unless there is only one lead wire and the coil is grounded to the “can”.

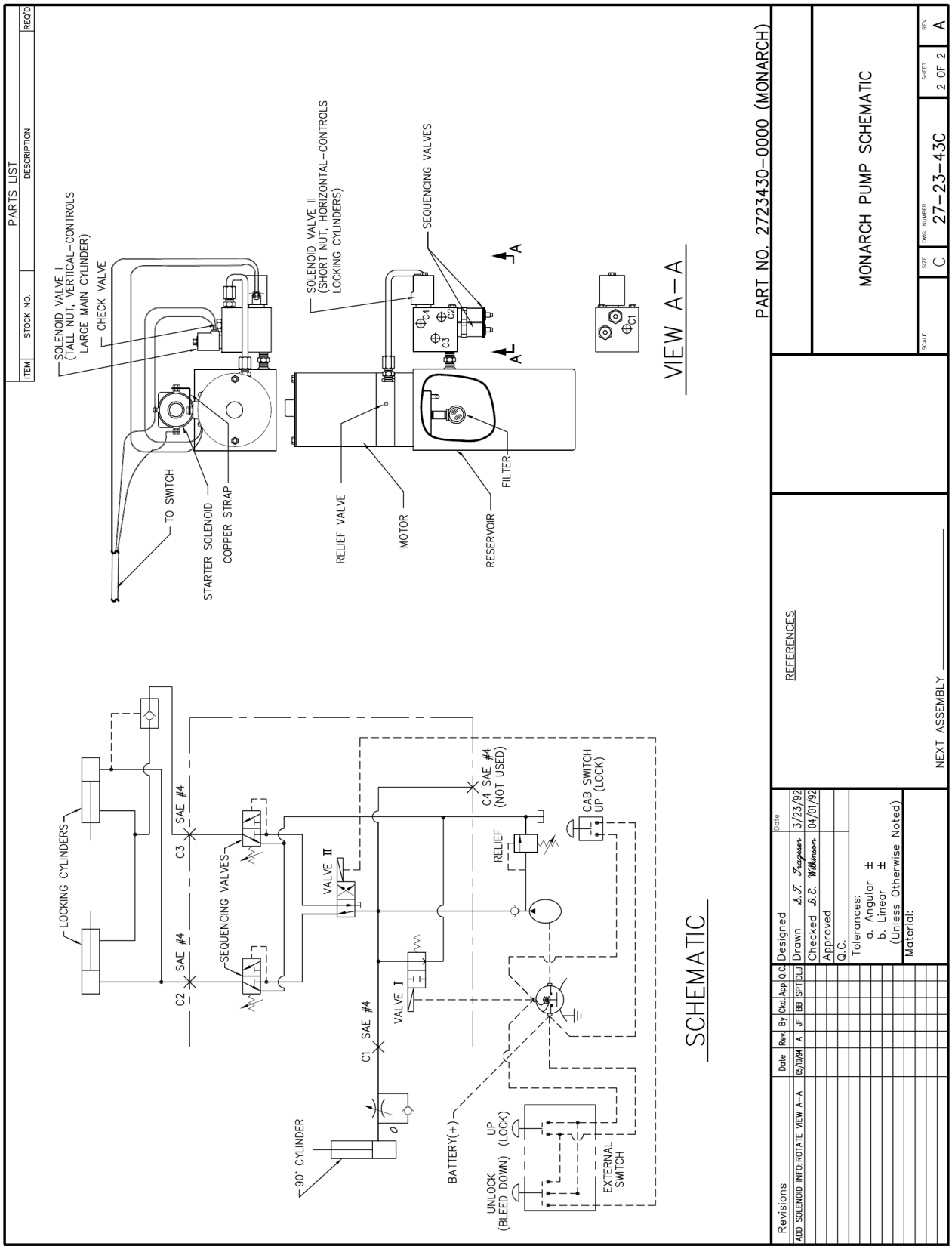
6. Electrical Polarity

Pump motors supplied with TMA’s can be used on either positive or negative ground systems.



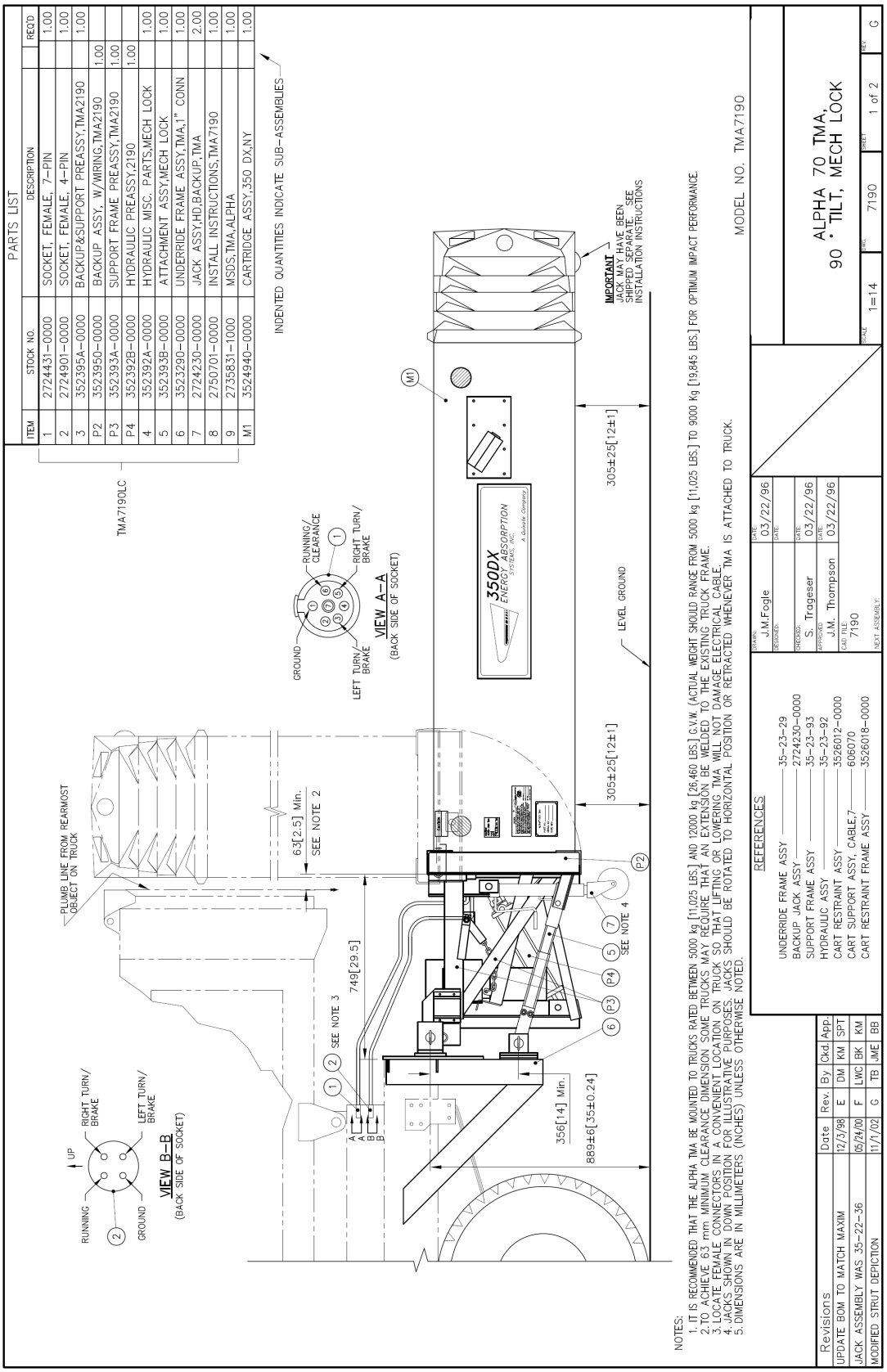
Williams Pump Schematic

DWG 272343C Sheet 1 of 2



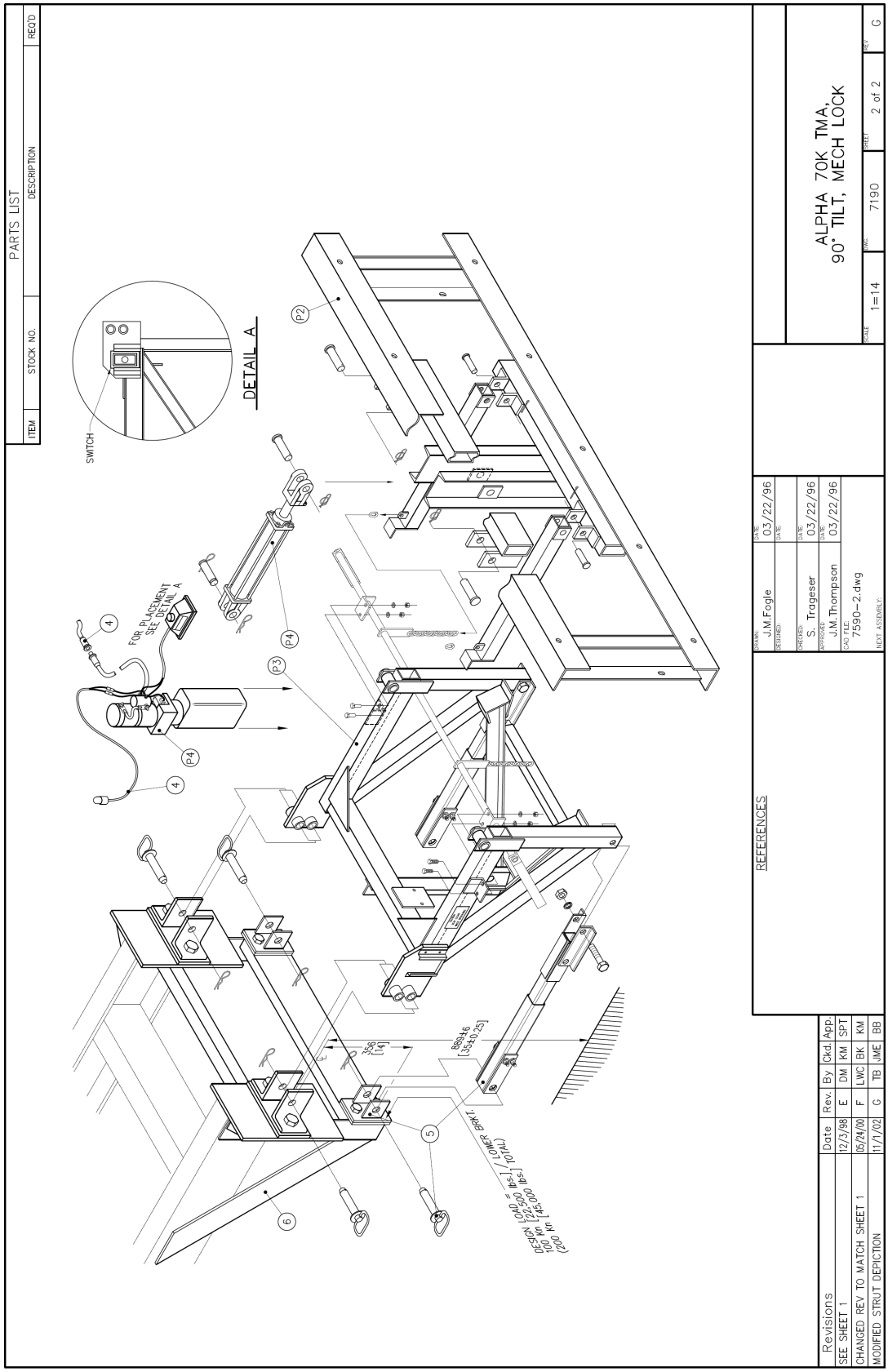
Monarch Pump Schematic

DWG 272343C Sheet 2 of 2

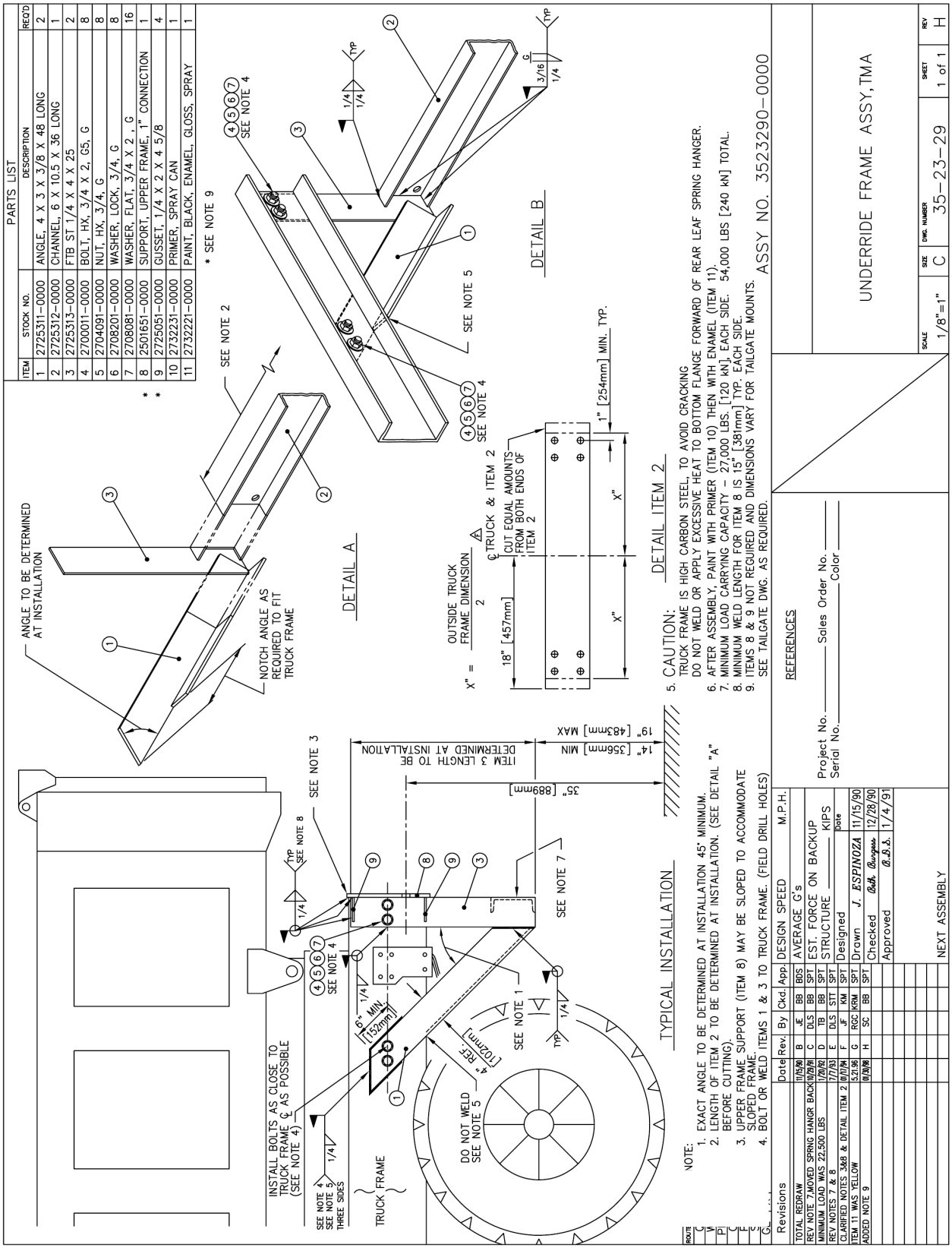


Alpha 70 TMA 90° Tilt, Mechanical Lock

DWG 7190 Sheet 1 of 2

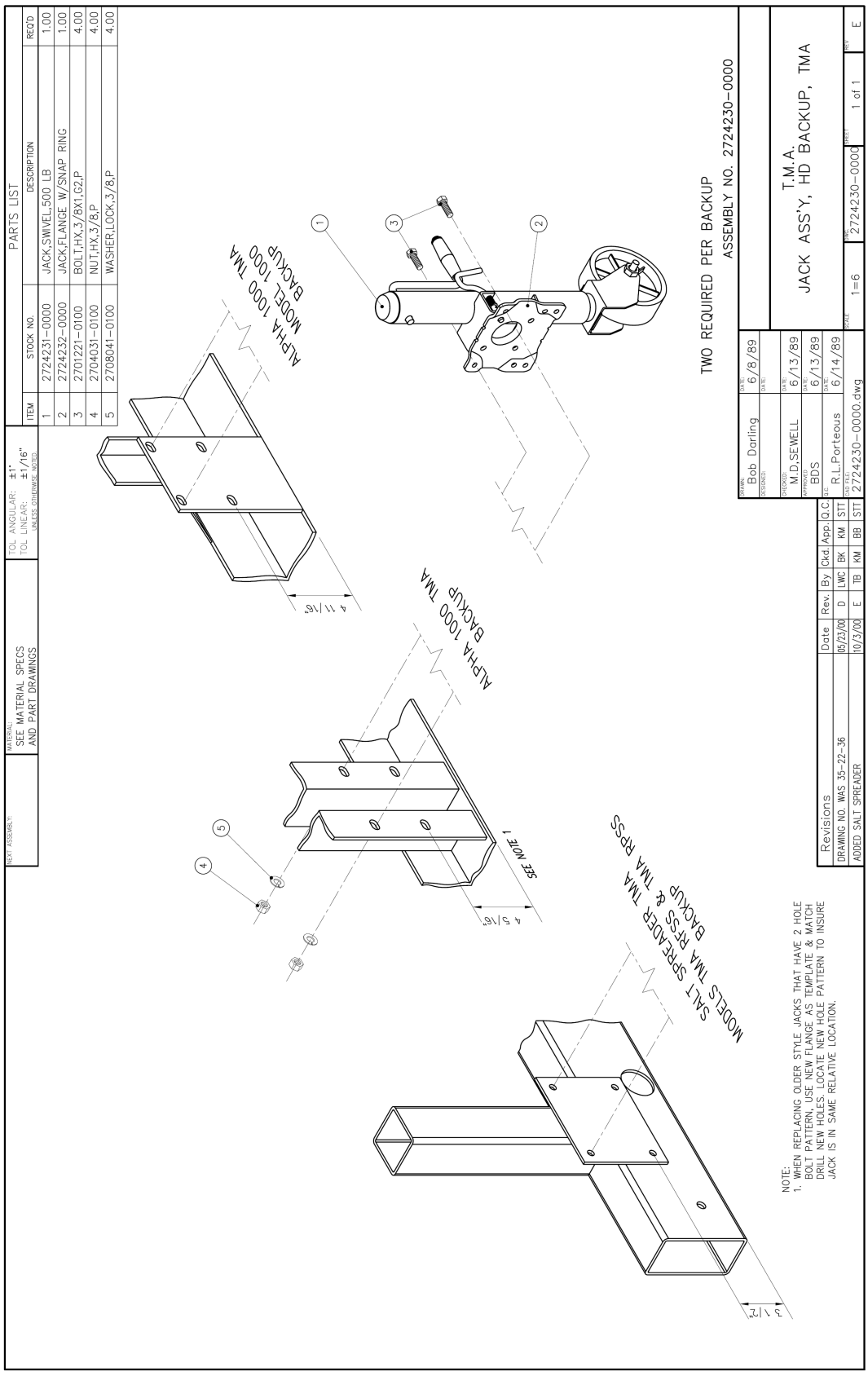


DWG 7190 Sheet 2 of 2



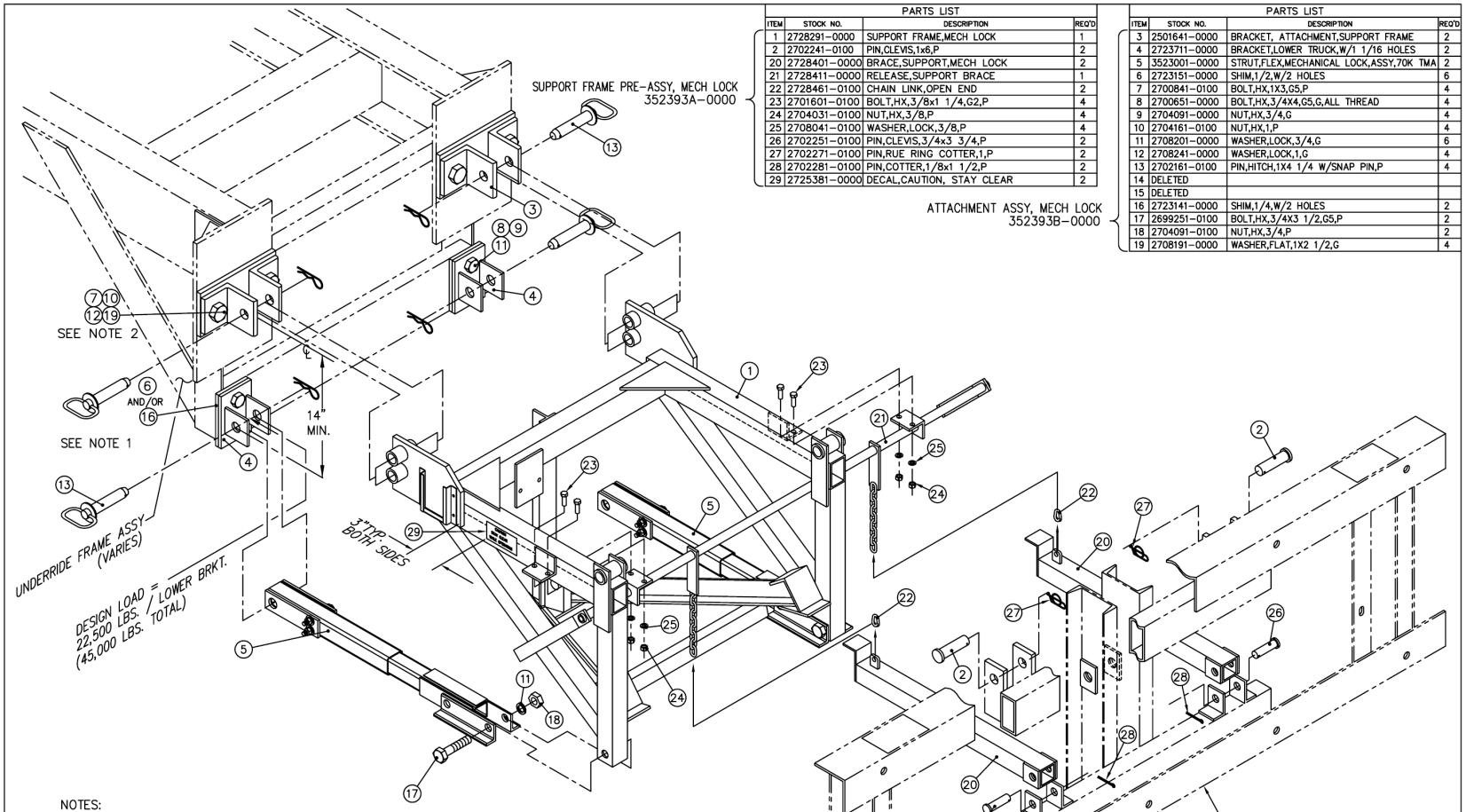
DWG 3523290-0000

Underride Frame Assembly, TMA



Jack Assembly, HD Backup, TMA

DWG 272430-0000



PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	REQ'D
1	2728291-0000	SUPPORT FRAME,MECH LOCK	1
2	2702241-0100	PIN,CLEVIS,1x6,P	2
20	2728401-0000	BRACE,SUPPORT,MECH LOCK	2
21	2728411-0000	RELEASE,SUPPORT BRACE	1
22	2728461-0100	CHAIN LINK,OPEN END	2
23	2701601-0100	BOLT,HX,3/8x1 1/4,G2,P	4
24	2704031-0100	NUT,HX,3/8,P	4
25	2708041-0100	WASHER,LOCK,3/8,P	4
26	2702251-0100	PIN,CLEVIS,3/4x3 3/4,P	2
27	2702271-0100	PIN,RUE RING COTTER,1,P	2
28	2702281-0100	PIN,COTTER,1/8x1 1/2,P	2
29	2725381-0000	DECAL,CAUTION, STAY CLEAR	2

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	REQ'D
3	2501641-0000	BRACKET, ATTACHMENT,SUPPORT FRAME	2
4	2723711-0000	BRACKET,LOWER TRUCK,W/1 1/16 HOLES	2
5	3523001-0000	STRUT,FLEX,MECHANICAL LOCK,ASSY,70K TMA	2
6	2723151-0000	SHIM,1/2,W/2 HOLES	6
7	2700841-0100	BOLT,HX,1X3,G5,P	4
8	2700651-0000	BOLT,HX,3/4X4,G5,G,ALL THREAD	4
9	2704091-0000	NUT,HX,3/4,G	4
10	2704161-0100	NUT,HX,1,P	4
11	2708201-0000	WASHER,LOCK,3/4,G	6
12	2708241-0000	WASHER,LOCK,1,G	4
13	2702161-0100	PIN,HITCH,1X4 1/4 W/SNAP PIN,P	4
14	DELETED		
15	DELETED		
16	2723141-0000	SHIM,1/4,W/2 HOLES	2
17	2699251-0100	BOLT,HX,3/4X3 1/2,G5,P	2
18	2704091-0100	NUT,HX,3/4,P	2
19	2708191-0000	WASHER,FLAT,1X2 1/2,G	4

NOTES:

1. THE DISTANCE BETWEEN THE UPPER & LOWER MOUNTING BRACKETS WILL GOVERN THE NUMBER OF SHIMS REQUIRED TO LEVEL THE SYSTEM. SEE INSTALLATION INSTRUCTIONS.
2. IF INTERFERENCE OCCURS WITH THE INSTALLATION OF BOLT, ITEM 10, OMIT WASHER, ITEM 20.

PART NO. 3523930-0000

Revisions	Date	Rev.	By	Ckd.	App.
CHANGED ITEM 5, ADDED ITEM 14, ITEM 29, AND NOTE 1	2/18/92	A	SC	BB	SPT
NEW STRUT,ITEM 14 AND ADD NOTE 2	3/7/92	B	TB	ST	SPT
MATCHED PARTS LIST TO DBASE	4/17/92	C	TB	BB	SPT
CHGD FROM 2190 TO MECH LOCK	9/16/92	D	DLS	ST	SPT
PIN ATTACHMENT OPTION IS NOW STD.	8/23/93	E	JE	KM	SPT
UNDERRIDE FRAME REF. WAS 35-23-94	12/16/93	F	JF	STT	SPT
14" DIM WAS 12"	05/25/94	G	TB	BB	SPT
ITEM 4 ANGLE WAS 5X3 1/2X1/2	02/27/96	H	JF	STT	SPT
REV TO SHOW LEFT & RIGHT RELEASE	7/21/98	I	DLS	KM	//
ADDED NOTE 2	12/20/99	J	DK	STT	DO
ITEM 13 WAS 2702161-0000	11/29/00	K	RSG	BB	KM
ITEM 5 WAS 2728471-0000;QTY ITEM 6 WAS 4;DELETED 14 & CHGD NOTE 1	10/25/02	L	TB	JME	BB

DESIGN SPEED	M.P.H.
AVERAGE G's	
EST. FORCE ON BACKUP STRUCTURE _____	KIPS
Designed	Date
Drawn D L Staus	12/2/91
Checked S.T. Trageser	12/10/91
Approved D June	12/9/91
NEXT ASSEMBLY	

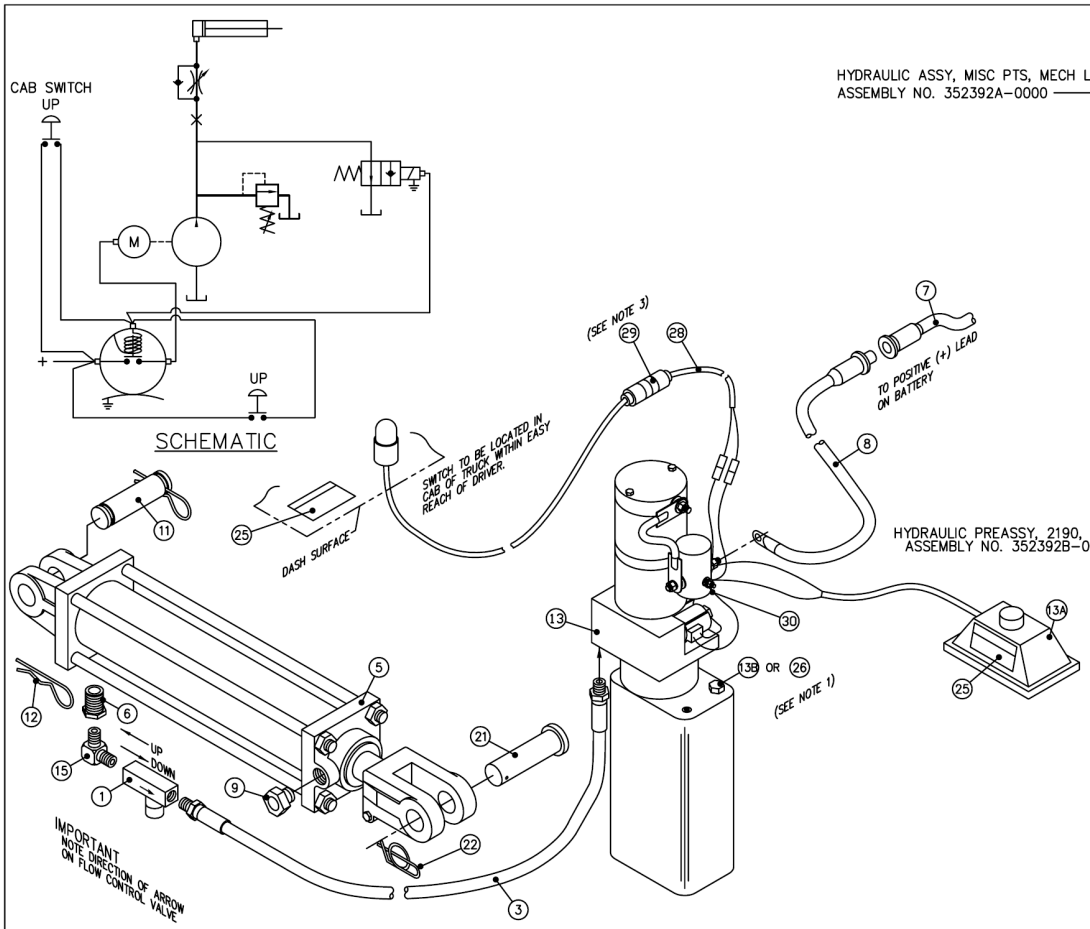
REFERENCES

Project No. _____ Sales Order No. _____
Serial No. _____ Color _____

SUPPORT FRAME ASSY, MECH LOCK
TMA 2190/4190/7190

SCALE	SIZE	DWG. NUMBER	SHEET	REV
(1:8) 1/8"=1"	C	35-23-93		L

Support Frame Assembly, Mechanical Lock



PARTS LIST

	ITEM	STOCK NO.	DESCRIPTION	REQ'D
*	13B	2728501-0000	VENT CAP, PLASTIC RESERVOIR, M-259	1.00
	23	2726821-0000	FLUID, TRANSMISSION, DEXRON	2.00
	25	2725871-0000	DECAL, CAUTION, SWITCH	1.00
	29	2734731-0000	CONNECTOR, 2-WAY	1.00
	1	2724251-0200	VALVE, FLOW CONTROL, 1/4NPT,	1.00
	2	2755761-0000	CABLE, BATT, 2 GA, 48, 3/8 ENDS	1.00
	3	2724674-0000	HOSE, HYD, 36	1.00
	5	2724661-0000	CYLINDER, 3B, 12S	1.00
	6	2724771-0100	REDUCER, BUSHING, 1/2X1/4 NPT, P	1.00
	7	272342B-0000	CABLE, BATTERY, 25 FT, QUICK END, F	1.00
	8	272342A-0000	CABLE, BATTERY, 2 FT, QUIK END, M	1.00
	9	2726571-0000	BREATHER, CYLINDER, 1/2(#9833K11)	1.00
	10	2728452-0000	SHROUD, PUMP, 100K	1.00
	11	2702191-0100	PIN, GROOVED, HEADLESS, 1X3 3/8 EFF LG	1.00
	12	2702511-0100	PIN, HAIR, COTTER, 7/8X1, SHAFT, P	2.00
	13	2728431-0000	PUMP, M-259	1.00
*	13A	2726581-0000	SWITCH, PUMP, 1 BUT, w/6' CORD, M-259	1.00
	15	2728441-0100	ELBOW, 1/4 M X1/4 M, NPT, P	1.00
	16	2700971-0100	BOLT, HX, 5/16X3/4, G2, P	5.00
	17	DELETED		
	18	2708221-0000	WASHER, FLAT, 5/16 X 7/8, G	3.00
	19	DELETED		
	20	2700361-0100	BOLT, HX, 1/4X1 1/4, G2, P	1.00
	21	2702261-0100	PIN, CLEVIS, 1X4 1/2, P	1.00
	22	2702271-0100	PIN, RUE RING COTTER, 1, P	1.00
	24	2708171-0000	WASHER, LOCK, 5/16, G	2.00
	25	2725871-0000	DECAL, CAUTION, SWITCH	1.00
	26	2725971-0000	PLUG, 3/8 NPT	1.00
	27	2704751-0100	NUT, WING, 1/4, TYPE A OR B, P	1.00
	28	3524651-0000	SWITCH ASSY, PUSH BUTTON, CAB, 30	1.00
	30	2734231-0000	CONNECTOR, CRIMP, 16-14GA, 3/16 STUD	1.00

* SEE NOTE 2

NOTES:
1. REPLACE PLUG (ITEM 26) WITH VENT CAP (ITEM 13B) AFTER FILLING.
*2. ITEMS 13A & 13B ARE PURCHASED AS PART OF THE PUMP (ITEM 13).
3. ITEM 29 SHIPPED LOOSE. INSTALL IN A CONVENIENT LOCATION AS DESIRED.
4. USE LOCTITE 545 (PURPLE) HYDRAULIC SEALANT OR EQUAL ON ALL HYDRAULIC FITTINGS.

Revisions	Date	Rev.	By	Ckd.	App.
ADDED NOTE 4,ITEM 2 WAS RED	08/03/89	P	LWC	BB	SPT
MATCHED PARTS LIST TO DATABASE; ADDED ITEM 25	04/20/92	C	TB	BB	SPT
DEL ITEM 20; ADD 3D; 23 WAS 2728501	07/09/92	D	TB	ST	SPT
CHGD FROM 2190 TO MECH LOCK	09/16/92	E	DLS	ST	SPT
MULTIPLE REVS: SEE CK PRINT	09/16/93	F	STT	BB	SPT
CHG'D PART LIST, SEE DWG	11/09/93	G	SC	BB	SPT
ADDED ITEMS 28 & 29;DELETED ITEMS 11, 12, & 13c. ADDED NOTE 3. ADDED LNOTE7. ITEM 25	11/11/94	H	STT	BB	SPT
ITEM 16 WAS 2699521-0100	01/23/95	I	BK	BB	SPT
DEL ITEMS 11&12(SEE #28); ADD #30	05/02/95	J	JF	STT	SPT
ITEM 7 WAS IN MISC PARTS ASSY	02/16/96	K	JF	STT	SPT
ADDED #11 & 12	11/7/96	L	DLS	SML	SPT
#12 WAS 2502511-0000; #30 IN ASSY B	07/21/97	M	JF	SML	SPT
ITEM 10 WAS 2728451-0000, ITEM 16 QTY WAS 2.00, DELETED ITEMS 17 & 19	08/12/97	N	RGC	KRM	BB
ADDED SWITCH BRACKET SHEET 2	9/24/98	O	DM	KM	SPT

		Date
DESIGN SPEED	M.P.H.	
AVERAGE G's		
EST. FORCE ON BACKUP STRUCTURE	KIPS	
Designed		
Drawn	D L Staus	11/25/91
Checked	S.T. Tragesser	12/10/91
Approved	B June	12/9/91

NEXT ASSEMBLY

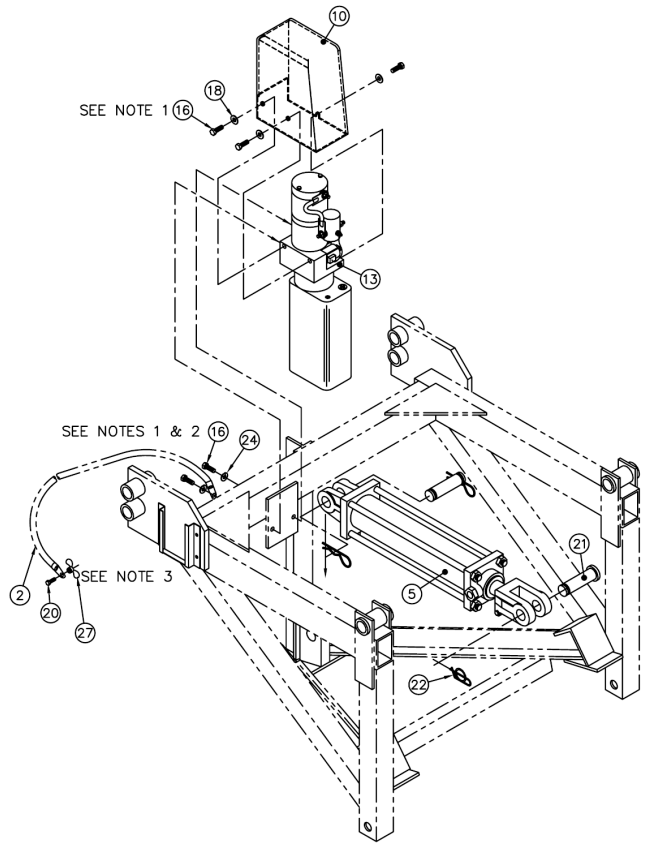
REFERENCES

Project No. _____ Sales Order No. _____
Serial No. _____ Color _____

TMA MECH LOCK
HYDRAULIC ASSEMBLY

SCALE	SIZE	DWG. NUMBER	SHEET	REV
(1:4) 3" = 1'-0"	C	35-23-92	1 of 2	P

TMA Mechanical Lock Hydraulic Assembly



NOTE:
1. APPLY LOCTITE #242 (BLUE) TO THREADS BEFORE INSTALLING.
2. BEFORE MOUNTING PUMP, CLEAN PAINT OR PRIMER FROM PUMP MOUNTING HOLES TO ACHIEVE PROPER GROUND.
3. IMPORTANT: PUMP MUST BE GROUNDED. ATTACH ITEMS 2, 20, & 27 THROUGH GROUNDED HOLE IN TRUCK FRAME.

Revisions	Date	Rev.	By	Ckd.	App.
ADD ITEM 24 & NOTE 2	07/13/92	A	TB	BB	SPT
CHGD FROM 2190 TO MECK LOCK	08/16/92	B	DLS	ST	SPT
ADDED GROUND CABLE & NOTE 3	10/15/93	C	STT	BB	SPT
CHGD REV TO MATCH SHEET 1	11/07/96	L	DLS	SML	/
SEE SHEET 1	08/05/97	M	JF	/	/
ITEMS 10 & 16 CHANGED PER SHEET 1	08/15/97	N	RGC	KRM	BB
ADDED SWITCH BRACKET	9/24/98	O	DM	KM	SPT
CHGD REV TO MATCH SHEET 1	08/03/99	P	LWC	BB	SPT

DESIGN SPEED	M.P.H.	
AVERAGE G's		
EST. FORCE ON BACKUP STRUCTURE _____ KIPS		
Designed	Date	
Drawn *D L Starus*	11/27/91	
Checked *S.T. Fragesser*	12/10/91	
Approved *D June*	12/9/91	

NEXT ASSEMBLY

REFERENCES

Project No. _____ Sales Order No. _____
Serial No. _____ Color _____

TMA MECH LOCK
HYDRAULIC ASSEMBLY

SCALE	SIZE	DWG. NUMBER	SHEET	REV
1/8"=1"	C	35-23-92	2 OF 2	P

Notes:

Notes:

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