TM-5-5420-279-10

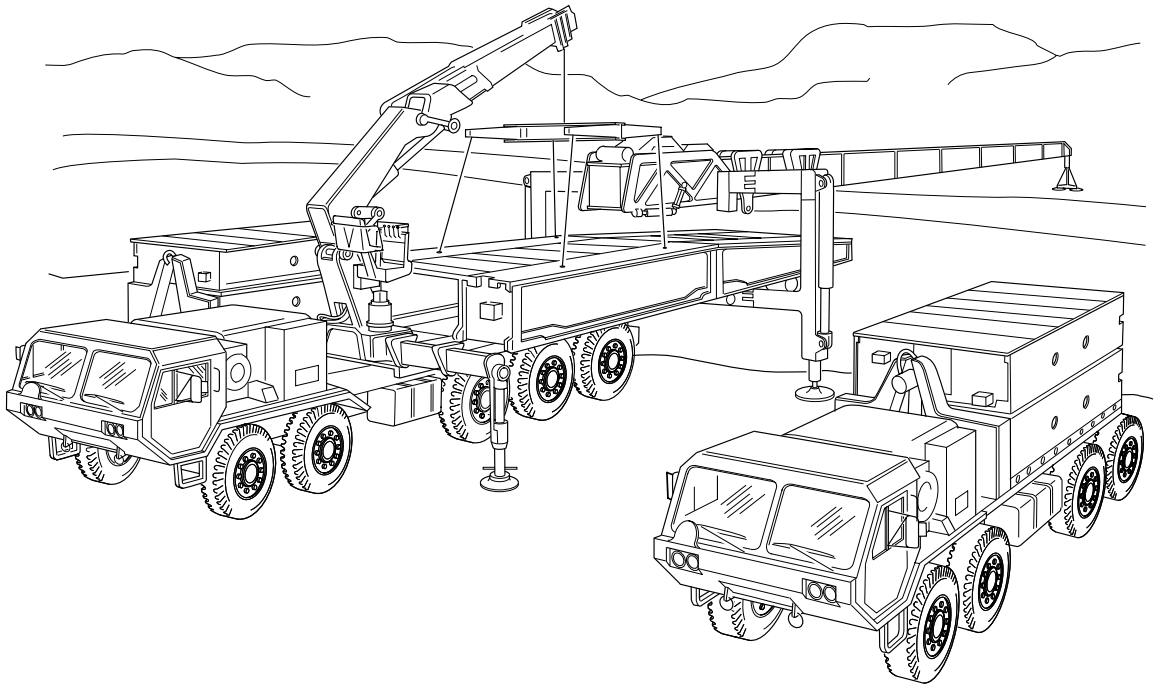
Supersedes copy dated 8 April 2003. See page i for details

OPERATOR MANUAL

FOR

DRY SUPPORT BRIDGE (DSB)

(NSN 5420-01-469-7479)



Approved for public release: distribution is unlimited

May 2004 **HEADQUARTERS, DEPARTMENT OF THE ARMY**

WARNING SUMMARY

ACID BURN. BATTERY ACID (ELECTROLYTE) IS EXTREMELY HARMFUL. ALWAYS WEAR SAFETY GOGGLES AND RUBBER GLOVES, AND DO NOT SMOKE WHEN PERFORMING MAINTENANCE ON BATTERIES. INJURY WILL RESULT IF ACID CONTACTS SKIN OR EYES. WEAR RUBBER APRON TO PREVENT CLOTHING FROM BEING DAMAGED.

BURN HAZARD. ITEMS MAY BE HOT WEAR PROTECTIVE GLOVES WHEN HANDLING EXHAUST COMPONENTS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY.

BURN HAZARD. WEAR SUITABLE GLOVES WHEN HANDLING HOT EXHAUST PARTS TO AVOID BURNS. FAILURE TO OBSERVE THIS INSTRUCTION WILL RESULT IN SEVERE PERSONAL INJURY.

CHEST PACK E-STOP OPERATION. IF THE CHEST PACK IS FITTED TO THE LAUNCH VEHICLE WHEN THE FOUR POSITION SWITCH, IN THE VEHICLE CAB, IS SET TO POSITION 2 THE CHEST PACK E-STOP BUTTON IS DISABLED. SHOULD IT THEN BE OPERATED IN AN EMERGENCY, ELECTRICAL POWER AND THUS HYDRAULIC POWER WILL NOT BE REMOVED FROM THE LAUNCHER. FAILURE TO HEED THIS INFORMATION COULD LEAD TO DEATH OR SEVERE INJURY TO PERSONNEL.

CRANE OPERATION. THE CRANE OPERATOR MUST BE AWARE OF PERSONNEL AND OBSTACLES IN THE DANGER AREA. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SERIOUS INJURY OR DEATH TO PERSONNEL.

CRANE OPERATION. WHEN OPERATING THE CRANE HEED THE SYMBOLS ON THE CONTROL LEVERS. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO DEATH OR SEVERE INJURY TO SURROUNDING PERSONNEL.

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

CRUSH HAZARD. NEVER LEAN ON THE BRIDGE STOP EMERGENCY HANDLE. THE HANDLE SHOULD ALWAYS BE IN THE UP POSITION UNLESS THE BRIDGE STOP EMERGENCY IS BEING OPERATED TO ALLOW THE PASSAGE OF THE BRIDGE JAWS. FAILURE TO OBSERVE THIS WARNING CAN RESULT IN THE BRIDGE FALLING OFF THE LAUNCH VEHICLE AND CAUSING DEATH OR SEVERE INJURY TO PERSONNEL.

CRUSH HAZARD. A SUSPENDED BRIDGE WILL MOVE IF SV10 IS MANUALLY OPERATED AND THE CHEST PACK RIGHT-HAND JOYSTICK IS MOVED FROM THE CENTRAL POSITION CAUSING ACTIVATION OF OTHER SOLENOID VALVES. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE DEATH OR SEVERE INJURY TO PERSONNEL.

CRUSH HAZARD. BEFORE CARRYING OUT TROUBLESHOOTING INVOLVING SV10, A SUSPENDED OR PART BUILT BRIDGE MUST BE MADE SAFE EITHER BY COMPLETING THE BUILD OPERATIONS IN BACK-UP MODE OR BY RETRIEVING THE BRIDGE. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE DEATH OR SEVERE INJURY TO PERSONNEL.

CRUSH HAZARD. BEFORE LOWERING CRANE STABILIZER LEGS ENSURE PERSONNEL ARE STANDING CLEAR OF THE STABILIZER FEET. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. CONTINUING TO RAISE THE BRIDGE MODULE ONCE ANY OR ALL THE SHOOTBOLTS HAVE BEEN INSERTED CAN RESULT IN FAILURE OF THE BRIDGE DOWELS. FAILURE TO OBSERVE THIS INSTRUCTION COULD RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL.

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

CRUSH HAZARD. DEATH OR SEVERE INJURY COULD OCCUR IF THE BRIDGE STOP EMERGENCY (BSE) ARE NOT FULLY LOCKED DURING THE DISCONNECTION OF THE HOME BANK CARRIAGE. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO UNEXPECTED MOVEMENT OF THE BRIDGE.

CRUSH HAZARD. DO NOT EXCEED 6 INCHES WHEN BOOMING THE BRIDGE. THE BRIDGE MAY TIP INJURING PERSONNEL.

CRUSH HAZARD. DO NOT INSERT FINGERS IN PIN HOLES, WHEN CLEANING OUT ACCUMULATED DIRT USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

CRUSH HAZARD. DO NOT RELEASE BRIDGE STOPS EMERGENCY UNTIL BRIDGE IS CONNECTED TO THE CARRIAGE AND IT STARTS TO MOVE REARWARD. FAILURE TO HEED THIS INSTRUCTION COULD RESULT IN THE BRIDGE FALLING OFF THE LAUNCHER WITH CONSEQUENT DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. DO NOT REMAIN IN DANGER AREA WHILE THE CRANE IS DOCKING. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SERIOUS PERSONAL INJURY OR DEATH.

CRUSH HAZARD. ENSURE THAT THE AREA WITHIN THE CRANE WORKING AREA IS CLEAR OF PERSONNEL. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO DEATH OR SEVERE INJURY TO PERSONNEL.

CRUSH HAZARD. FAILURE TO INSTALL THE FINAL LOCKING PIN AND ITS R CLIPS WILL CAUSE THE LAUNCH BEAM TO FLEX AND CREEP BACKWARDS. FAILURE TO HEED THIS INSTRUCTION COULD RESULT IN SEVERE PERSONAL INJURY.

CRUSH HAZARD. GREAT CARE MUST BE EXERCISED WHEN OPERATING THE TAIL LIFT IN BACK UP MODE, ESPECIALLY WHEN PERSONNEL ARE STANDING ON THE TAIL LIFT PLATFORM. UNEXPECTED MOVEMENT MAY OCCUR IF THE SEQUENCE OF OPERATION IS INCORRECT. SERIOUS INJURY CAN OCCUR TO PERSONNEL IF THIS INSTRUCTION IS NOT COMPLIED WITH.

CRUSH HAZARD. KEEP CLEAR DURING MOVEMENT OF THE TILT ROLLERS. THE TILT ROLLERS WEIGH 114 LB (52 KG) AND COULD CAUSE INJURY TO PERSONNEL.

CRUSH HAZARD. KEEP HANDS CLEAR OF THE TWO MODULES AS THE UPPER MODULE IS LOWERED INTO PLACE. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY TO PERSONNEL.

CRUSH HAZARD. NEVER REMOVE THE CRANE STABILIZER LEG PIN UNTIL THE CABLE IS TAUT. FAILURE TO OBSERVE THIS INSTRUCTION COULD RESULT IN SERIOUS INJURY OR DEATH.

CRUSH HAZARD. ONCE THE TRANSPORT STRAPS ARE RELEASED FROM THE APPROACH RAMP TRANSPORT FRAME, THE APPROACH RAMPS MAY FLIP UPWARDS SHOULD PERSONNEL WALK ON THE TAPERED END OF THE RAMP.

CRUSH HAZARD. OPERATION OF THE ARTICULATOR CYLINDERS BEFORE THEY ARE ROTATED TO THE VERTICAL MAY CAUSE SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. PERSONAL INJURY CAN RESULT IF EXTREME CAUTION IS NOT USED WHEN INSTALLING THE BEAM CONNECTING PINS. KEEP HANDS AND FINGERS CLEAR OF PIN HOLES AND COMPONENTS BEING MOVED OR CONNECTED.

CRUSH HAZARD. SEVERE INJURY CAN RESULT IF HANDS ARE NOT KEPT CLEAR OF MATING PARTS DURING RAISING AND LOWERING OF THE CARRIAGE LIFTING BEAMS.

CRUSH HAZARD. SEVERE PERSONAL INJURY CAN RESULT IF HANDS ARE NOT KEPT CLEAR OF MATING SURFACES DURING END BEAM CONNECTION.

CRUSH HAZARD. TAKE CARE DURING DEPLOYMENT OF THE TILT ROLLERS, THE TILT ROLLERS WEIGH 114 LB (52 KG) AND COULD CAUSE INJURY TO PERSONNEL.

CRUSH HAZARD. THE BRIDGE STOP EMERGENCY MUST BE RAISED TO ALLOW THE JAW SYSTEM TO PASS THROUGH THE A-FRAME. THE BRIDGE STOP EMERGENCY MUST BE RE-ENGAGED AS SOON AS THE JAW SYSTEM HAS PASSED. FAILURE TO HEED INSTRUCTION CAN RESULT IN THE BRIDGE FALLING FROM THE LAUNCHER CAUSING DEATH OR SEVERE INJURY TO SURROUNDING PERSONNEL.

CRUSH HAZARD. THE CRANE DOES NOT LIFT VERTICALLY. DURING THE DISCONNECTION PROCESS, ENSURE THAT A PERSON IS PLACED AT THE SIDE OF THE LAUNCHER TO DIRECT THE CRANE OPERATOR SHOULD THE LIFTING SLING MOVE FROM THE VERTICAL. IF THE SLING IS NOT MAINTAINED IN THE VERTICAL, THE RAMP WILL SWING WHEN SEPARATED FROM THE END BEAM CAUSING SEVERE INJURY TO SURROUNDING PERSONNEL.

CRUSH HAZARD. THE LOAD MAY FALL FROM THE CRANE, IF A LOAD IS LIFTED WITHOUT FIRST ENSURING THAT THE LIFTING SLINGS ARE CENTERED OVER THE LOAD IN BOTH DIRECTIONS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. WHEN JOINING THE END BEAM AND RAMP MODULE, THE PERSONNEL OPERATING THE END BEAM WRENCHES MUST ENSURE THAT BOTH OF THEIR HANDS ARE KEPT CLEAR OF THE RAMP MODULE AND END BEAM INTERFACE. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY.

CRUSH HAZARD. WHEN PREPARING TO RETRIEVE A BRIDGE, ALWAYS MAKE SURE THAT THE BRIDGE SURFACE HAS BEEN SWEPT AND IS FREE OF MUD, ICE AND SNOW, IN SEVERE CASES IF A BUILD UP IS ALLOWED THE EXTRA WEIGHT COULD OVERLOAD THE CRANE. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY OR DEATH TO PERSONNEL.

CRUSH HAZARD. PERSONAL INJURY CAN RESULT IF EXTREME CAUTION IS NOT USED WHEN INSTALLING THE BEAM CONNECTING PINS. KEEP HANDS AND FINGERS CLEAR OF PIN HOLES AND COMPONENTS BEING MOVED OR CONNECTED.

CRUSH INJURY. PERSONNEL STANDING ON THE TAIL LIFT REAR CROSS MEMBER MUST BE AWARE OF OVERHEAD EQUIPMENT. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO DEATH OR SEVERE INJURY.

CRUSH INJURY. RAISING THE TAIL LIFT WITH THE GUARD RAILS ERECTED MAY CAUSE A TRAPPING HAZARD. KEEP ALL LIMBS CLEAR DURING TAIL LIFT MOVEMENT.

CRUSH INJURY. REMOVAL OF THE STABILIZER ROTATE PIN PRIOR TO STABILIZER EXTENSION MAY CAUSE THE STABILIZER TO ROTATE UNEXPECTEDLY CAUSING SEVERE INJURY TO PERSONNEL.

DANGER OF INJURY TO PERSONNEL WHEN WORKING NEAR ENGINE COOLING FAN, ENGINE MUST BE TURNED OFF AND THE BATTERY ISOLATION SWITCH TURNED TO OFF.

DEATH OR SEVERE INJURY. WHEN ELECTRICAL POWER IS NOT PRESENT ON THE LAUNCH VEHICLE, THE EMERGENCY STOP SYSTEM IS INOPERATIVE. EXERCISE GREAT CARE WHEN OPERATING THE SYSTEM AS THERE IS NO QUICK WAY OF STOPPING THE OPERATION ONCE IT IS STARTED. ALL PERSONNEL MUST BE AWARE OF THE POTENTIAL DANGER OF MOVING COMPONENTS AND MODULES.

DEEP WATER FORDING. DO NOT FORD WATER UNLESS ITS DEPTH IS KNOWN. WATER DEEPER THAN 4FT (1.2 M) MAY ENTER THE LAUNCH VEHICLE. FAILURE TO OBSERVE THIS INSTRUCTION COULD RESULT IN PERSONNEL INJURY.

EQUIPMENT FAILURE. STAND WELL CLEAR OF EQUIPMENT WHEN FIRST UNFOLDING A-FRAME. SERIOUS PERSONAL INJURY OR DEATH COULD RESULT IF EQUIPMENT FAILS.

EYE INJURY. WHEN DRIVING ROADFORM SPIKES INTO THE GROUND THERE IS A POSSIBILITY THAT SMALL METAL FRAGMENTS MAY BE CREATED, PERSONNEL MUST WEAR EYE PROTECTION. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO INJURY TO THE EYES.

FALL HAZARD. ATTEMPTS TO DEPLOY THE CURBS WITH TWO HANDS MAY CAUSE PERSONNEL TO FALL OFF THE BRIDGE RESULTING IN DEATH OR SERIOUS INJURY.

FALL HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE APPROACH RAMPS ARE NOT PULLED TOWARDS THE CENTER OF THE BRIDGE BEFORE DEPLOYMENT. PERSONNEL SHOULD NOT ATTEMPT TO DEPLOY APPROACH RAMPS WHILE POSITIONED AT THE EDGE OF THE BRIDGE. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO PERSONNEL FALLING INTO THE GAP AND SUFFERING SEVERE INJURY OR DEATH.

FALL HAZARD. PERSONNEL ON TOP OF THE BRIDGE MUST WEAR THE SAFETY HARNESS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY.

FALL HAZARD. SEVERE INJURY COULD RESULT IF THE LADDER IS PLACED TOO FAR AWAY FROM THE SLING CAUSING OPERATORS TO LEAN TO THE SIDE EXCESSIVELY TO CONNECT THE SLINGS.

FROST BURN. DO NOT TOUCH EXTREMELY COLD METAL (BELOW -26 DEGREES F [-32 DEGREES C]). BARE SKIN MAY FREEZE TO COLD METAL AND CAUSE INJURY TO PERSONNEL.

HEAVY OBJECT. TIRE ASSEMBLY IS VERY HEAVY 500 LB. (227 KG). DO NOT TRY TO LIFT OR CATCH TIRE ASSEMBLY. INJURY TO PERSONNEL COULD RESULT.

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC FLUIDS SPILLAGE. PERSONNEL MAY SLIP ON SPILT HYDRAULIC FLUID. SUITABLE CONTAINER AND ABSORBENT MATERIAL ARE TO BE USED TO CONTAIN SPILLAGE.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

HYDRAULIC PRESSURE. THE HYDRAULIC FLUID IS UNDER GREAT PRESSURE. ENGINES ON BOTH TRUCKS MUST BE SHUT OFF WHILE DISCONNECTING HYDRAULIC LINES. FAILURE TO DO SO COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL.

INJURY TO PERSONNEL. WHEN OPERATED THE EMERGENCY STOP OVERRIDE SWITCH DISABLES THE EMERGENCY STOP SYSTEM. GREAT CARE MUST BE EXERCISED WHILE BUILDING BRIDGES WITH THE EMERGENCY STOP OVERRIDE SWITCH OPERATED, AS THERE IS NO WAY TO REMOVE HYDRAULIC POWER QUICKLY IN AN EMERGENCY.

INJURY TO PERSONNEL. WHEN OPERATED THE EMERGENCY STOP OVERRIDE SWITCH DISABLES THE EMERGENCY STOP SYSTEM. GREAT CARE MUST BE EXERCISED WHILE BUILDING BRIDGES WITH THE EMERGENCY STOP OVERRIDE SWITCH OPERATED, AS THERE IS NO WAY TO REMOVE HYDRAULIC POWER QUICKLY IN AN EMERGENCY.

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

MANUAL OPERATION OF CRANE. WITH THE CRANE IN THE MANUAL OVERRIDE CONDITION THE OVERLOAD SAFETY SYSTEM IS INOPERATIVE, SHOULD THE CRANE BE INADVERTENTLY OVERLOADED CATASTROPHIC FAILURE OF THE CRANE MAY OCCUR. DEATH OR SEVERE INJURY COULD RESULT IF THIS INSTRUCTION IS NOT HEEDED.

PERSONAL INJURY OR DEATH. ALWAYS USE THE SEAT BELT WHEN OPERATING THE CRANE CONTROLS.

PERSONAL INJURY OR DEATH. BRIDGING SITES ARE DANGEROUS PLACES. PERSONNEL MUST WEAR HARD HATS, PROTECTIVE GLOVES AND SAFETY FOOTWEAR.

PERSONAL INJURY. EVERY TIME THE CRANE IS USED, THE VEHICLE MUST BE STABILIZED AND SECURED SO THAT IT DOES NOT ROLL AWAY. NEVER DRIVE THE VEHICLE WITH A SUSPENDED LOAD.

PERSONAL INJURY. WHEN HANDLING WINCH CABLE, USE THICK LEATHER GLOVES TO PREVENT INJURY TO HANDS FROM BROKEN STRANDS.

POWER SUPPLY CONNECTION OR DISCONNECTION. ENSURE HYDRAULIC AND ELECTRICAL SYSTEMS ARE SWITCHED OFF WHEN CONNECTING OR DISCONNECTING HYDRAULIC COUPLINGS AND ELECTRICAL CONNECTORS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY TO PERSONNEL.

PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

RISK OF ELECTRIC SHOCK. REMOVE ALL JEWELRY SUCH AS RINGS, DOG TAGS, BRACELETS, ETC. IF JEWELRY OR TOOLS CONTACT POSITIVE ELECTRICAL CIRCUITS A DIRECT SHORT MAY RESULT. DAMAGE TO EQUIPMENT, INJURY OR DEATH TO PERSONNEL MAY OCCUR.

RISK OF ELECTROCUTION. CHECK FOR OVERHEAD POWER LINES OR OTHER OBSTRUCTIONS BEFORE ATTEMPTING CRANE OPERATION. SERIOUS INJURY OR DEATH TO PERSONNEL COULD RESULT FROM CONTACT WITH ELECTRICAL POWER LINES.

RISK OF SKIDDING. APPLY ENGINE BRAKE ONLY WHEN THE LAUNCH VEHICLE TIRES HAVE GOOD TRACTION. USE OF ENGINE BRAKE ON SLICK SURFACES CAN CAUSE LAUNCH VEHICLE TO SKID AND CAUSE INJURY OR DEATH.

TAIL LIFT OPERATION. ENSURE PERSONNEL ARE CLEAR FROM UNDER THE TAIL LIFT PLATFORM BEFORE LOWERING THE TAIL LIFT. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE SEVERE INJURY TO PERSONNEL.

TAIL LIFT OPERATION. THE TAIL LIFT IS DESIGNED TO CARRY A MAXIMUM OF FOUR PERSONS (500KG (1102.31LBS)). DO NOT OVERLOAD THE TAIL LIFT OR PERSONS COULD BE KILLED OR INJURED AND THE TAIL LIFT DAMAGED IN THE EVENT OF A FAILURE.

TAIL LIFT OPERATION. THE TILT UP OR TILT DOWN BUTTON MUST NEVER BE USED WHEN PERSONNEL ARE ON THE PLATFORM AS THERE IS A DANGER OF TIPPING THEM OFF. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE SEVERE INJURY TO PERSONNEL.

DEATH OR PERSONAL INJURY. THESE LUBRICATION PROCEDURES MUST BE PERFORMED WITH GREAT CARE OR DEATH OR SERIOUS PERSONAL INJURY COULD RESULT.

TIPPING HAZARD. THE DISABLED LAUNCH VEHICLE BEING TOWED MUST WEIGH LESS THAN THE TOWING VEHICLE. THE LAUNCH VEHICLE MUST BE FULLY STOWED AND IN TRANSIT CONDITION. FAILURE TO FOLLOW PROPER PROCEDURES MAY CAUSE SERIOUS INJURY OR DEATH.

TO ENSURE THE SAFETY OF PERSONNEL, ALL TOOLS AND EQUIPMENT MUST BE KEPT CLEAN AND DRY TO PREVENT THE OPERATOR FROM SLIPPING AND CAUSING PERSONAL INJURY.

TRIP HAZARD. BEWARE OF OBSTACLES IN THE CRANE OPERATING AREA.

UNEXPECTED MOVEMENT OF EQUIPMENT. ENSURE ALL SHOOTBOLTS ON THE FAR BANK SUPPORT ARE FULLY INSERTED AND LOCKED BEFORE LIFTING OPERATIONS COMMENCE.

UNEXPECTED MOVEMENT OF EQUIPMENT. KEEP WEIGHT ON FAR BANK SUPPORT WHEN RELEASING STRAPS TO CONTROL SWINGING. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO INJURY OF PERSONNEL.

UNEXPECTED VEHICLE MOVEMENT. IF BRAKES ON DISABLED LAUNCH VEHICLE MUST BE MANUALLY RELEASED, ENSURE THAT THE WHEELS OF THE DISABLED LAUNCH VEHICLE ARE CHOCKED PRIOR TO MANUALLY RELEASING THE BRAKES. FAILURE TO CHOCK WHEELS COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL.

UNEXPECTED VEHICLE MOVEMENT. WHEELS ON DISABLED LAUNCH VEHICLE MUST BE CHOCKED PRIOR TO DISCONNECTING FROM TOWING VEHICLE. FAILURE TO CHOCK WHEELS ON DISABLED LAUNCH VEHICLE COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL.

WHEN INSTALLING THE BEAM CONNECTING PINS. KEEP HANDS AND FINGERS CLEAR OF PIN HOLES AND COMPONENTS BEING MOVED OR CONNECTED.

CAUTION SUMMARY

Equipment damage. The values given on the load diagram are definitive and must not be exceeded. They apply when the crane is operated with the boom horizontal, with the jib horizontal, and with the stabilizers and slides extended on both sides. When the crane is on an incline, the maximum load is reduced.

Equipment damage. All snow and ice should be removed from launch vehicle as soon as possible. Snow and ice may slow or stop movement of critical parts if allowed to pile up. All ladders and walkways should always be cleared of snow and ice before use.

Equipment damage. All snow and ice should be removed from the launch vehicle as soon as possible. Snow and ice may slow or stop the movement of critical parts if allowed to pile up.

Equipment damage. Before backing the launch vehicle in mud, sand or snow, the mud flaps must be pinned on the stowage hook located on mud flap bracket. If the mud flap is not pinned, damage may result.

Equipment damage. Before operating, cheek equipment for signs of damage or hydraulic leaks due to handling or transportation.

Equipment damage. Blowing sand may scratch glass/plastic surfaces. Glass/plastic surfaces should remain covered as much as possible in these conditions to prevent scratching.

Equipment damage. Check connection to donor vehicle and particularly that the tank hose is fitted correctly.

Equipment damage. Check interface panel for any warning lights when in launch conditions.

Equipment damage. Check oil levels often and keep operating temperatures as low as possible. Truck cooling and lubrication systems support each other. Failure of one system may rapidly cause failure of other system.

Equipment damage. Clouds of dust can scratch glass and plastic surfaces. Keep glass and plastic surfaces covered as much as possible in dusty conditions to prevent scratching and ensure that both the interface and launch vehicle cabinet doors are closed.

Equipment damage. Crane column bearings should be lubricated with the vehicle engine and the PTO engaged. Failure to observe this instruction could lead to damage to the equipment

Equipment damage. CTIS of disabled launch vehicle must be set to highway position or damage to axles may result.

Equipment damage. Damage to pins and pin holes can result if undue force is used to insert the connecting pins. DO NOT hammer the pins into position in the upper jaws.

Equipment damage. Damage to pins and pinholes can result if undue force is used to remove the connecting pins. Do not hammer the pins out of the lower jaws.

Equipment damage. Discontinue the launch vehicle reverse if the tail lift will not pass between the top of the home bank ramp module and the underside of the lower transverse beam of the A-frame. Damage to the tail lift will result if this instruction is not observed.

Equipment damage. Do not adjust the flow control as over-speeding the motors could cause damage.

Equipment damage. Do not allow spare tire to swing back and forth while raising tire. Raise tire slowly during lifting operation. Failure to comply could cause serious damage to equipment.

Equipment damage. Do not allow the carriage beam to rest on the bridge or the winch wire ropes may become entangled.

Equipment damage. Do not attempt to start engine if there is obvious engine damage or damage to equipment may result.

Equipment damage. Do not change the CTIS setting when cornering or when wheels are slipping. Damage to drive line may result.

Equipment damage. Do not engage the launch vehicle transmission and drive it backwards, in excess of 2 mph (3.2 kph), the A-frame could be damaged.

Equipment damage. Do not engage the launch vehicle transmission and drive it forwards or backwards, in excess of 2 mph (3.2 kph), the A-frame could be damaged.

Equipment damage. Do not extend the jib sufficient to cause damage to the launch beam pin storage rack.

Equipment damage. Do not level the A-frame at this stage or the slide frame could be damaged.

Equipment damage. Do not overshoot the reverse drive such that the launch beam contacts the launch beam safety stop. The control of the launch beam by the operation of the right hand joystick on the chest pack is such that the beam can be decelerated before the launch beam contacts the emergency stop. Failure to heed this instruction will lead to equipment damage.

Equipment damage. Do not rotate the crane or extend the extension piece of the jib until the boom and the jib are in working position.

Equipment damage. Do not use low (LO) position on transfer case to move launch vehicle, if tires are frozen to the ground or brakes are frozen to the drums. Damage to driveline may result.

Equipment damage. Do not wind cable too tight on winch. Cable should be wound snug. Winding cable too tight could cause damage to equipment.

Equipment damage. Electrical panel doors should always be fastened when not in use. Keep dust caps on all unused electrical and hydraulic connection points.

Equipment damage. Engine speed on the donor PLS truck must be at idle before using hydraulic selector switch, or damage to equipment may result.

Equipment damage. Ensure both the cab floor drain caps are securely in place before attempting to ford water. Failure to comply may result in damage to equipment.

Equipment damage. Ensure connectors and receptacles are free of dirt, sand and debris.

Equipment damage. Ensure that the A-frame ladders are lifted clear of the ground and held while the A-frame is lowered. Failure to observe this instruction will result in damage to the A-frame ladders.

Equipment damage. Ensure that the A-frame ladders have been deployed before raising the A-frame. Failure to observe this instruction will result in damage to the A-frame ladders.

Equipment damage. Ensure the CTIS ON/OFF switch is in the OFF position and the LHS selector switch is in the OFF position on both slave truck and launch vehicle while performing the slave starting procedure. Failure to comply may result in damage to equipment.

Equipment damage. Ensure the tail lift does not rest on the ground at any time operations are being carried out. Damage to the equipment will occur due to loads being transmitted from the launch vehicle to the tail lift through the sub frame.

Equipment damage. Every time the crane is used, the vehicle must be stabilized and secured so that it does not roll away. Never drive the vehicle with a suspended load.

Equipment damage. Extreme care should be taken when building or retrieving the bridge in poor visibility.

Equipment damage. Extreme care should be taken when building or retrieving the bridge in poor visibility. Stand well clear of opening bridge modules in case of falling dirt that may have built up in panel recesses.

Equipment damage. Failure to adhere to the procedure below will allow the rope to double wrap (nest) on the winch drum.

Equipment damage. Failure to adhere to this procedure will allow the rope to double wrap on the winch drum.

Equipment damage. Ice and snow should be removed from launch beams and bridge modules before starting to build.

Equipment damage. If engine fails to start after four tries, refer to troubleshooting, TM 9-2320-364-10 Chapter 3. Do not turn engine switch to START position while engine is still running or engine damage may result.

Equipment damage. If hydraulic functions are not being operated for any length of time, the donor truck should be turned off to avoid the hydraulic system overheating.

Equipment damage. If launch vehicle is being towed because of a steering hydraulic failure resulting in fluid loss, both output propeller shafts from transfer case must be disconnected or damage to emergency steering pump may result. Contact Unit Maintenance to remove propeller shafts.

Equipment damage. If the A-frame is not horizontal, the bridge modules will run at an angle making further module connection difficult and will accelerate the wear of the bridge wear pads when the bridge is boomed.

Equipment damage. If there is any possibility of the A-frame feet slipping when deploying or stowing the launch vehicle on ice or snow, ground stakes should be driven in to avoid movement.

Equipment damage. If unusual sounds or vibrations are produced by the crane, discontinue its use, investigate the cause and repair the fault.

Equipment damage. In severe cold, engine coolant, fluid in windshield washer can freeze, batteries can freeze and crack, oil and grease may get thick and stiff and rubber may crack or break easily.

Equipment damage. In severe cold, the engine coolant and fluid in the windshield washer can freeze, batteries can freeze and crack, oil and grease may become thick and stiff and rubber may crack or break easily.

Equipment damage. Keep a constant watch on the hydraulic oil temperature on the donor vehicle, to ensure that it does not overheat. If overheating occurs stop build in a safe condition and allow the donor vehicle hydraulic oil to return to normal temperature.

Equipment damage. Keep dust caps on all unused electrical and hydraulic connection points.

Equipment damage. Never bridge or repair defective fuses as damage to equipment can occur.

Equipment damage. Only one function at a time should be operated when using the cross connection pump unit.

Equipment damage. Operate the control levers in a smooth and considered manner. The speed of the working movements is determined by the degree to which the control lever is moved.

Equipment damage. Operation of hydraulic systems that contain insufficient fluid will cause damage to the system and slow response. Make sure the level of hydraulic fluid in the reservoir is correct before commencement of operations.

Equipment damage. Park in shelter when possible, if shelter is not available; park so the front of the launch vehicle does not face wind. Place planks or brush under wheels so the launch vehicle will not freeze in place.

Equipment damage. Protect couplings and plugs against entry the of dirt during transport, contamination or damage to plugs and systems may result.

Equipment damage. Protect open coupling and plugs against the entry of dirt during transport, contamination or damage to plugs and systems may result.

Equipment damage. Retraction of the crane jib may be required during the lowering of the ramp module onto the end beam. Failure to lower the home bank ramp vertically may cause the end beam to be pulled from its guides.

Equipment damage. Stop the reverse and adjust the height of the tail lift if the tail lift will not pass under the energy chain or between the top of the home bank ramp module and the underside of the A-frame lower cross member of the A-frame. Failure to observe this instruction will result in equipment damage.

Equipment damage. System damage can occur if steps 4.15.1.16 to 4.15.1.19 are not carried out.

Equipment damage. Take care not to overshoot the beam maximum forward position or damage may occur. The travel stop provided is for emergency use only.

Equipment damage. Take care not to overshoot the maximum forward movement or damage may occur. The travel stop provided is for emergency use only.

Equipment damage. Take care not to push the far bank ramp module beyond the far bank carriage attachment position and ensure that the crane jib does not hit the launch beam storage rack.

Equipment damage. The 4 position rotary selector switch in the cab must be in position 1 before driving the vehicle.

Equipment damage. The CARRIAGE EMPTY function is only to be selected when both carriages are supporting no load. It is to be used for carriage retrieval or deployment only. It MUST NOT be used while the bridge is suspended.

Equipment damage. The engine speed must be at idle before using the 4 position rotary selector switch, or damage to equipment may result.

Equipment damage. The fuel/water separator should be drained before topping off the fuel tank. Keep the fuel tank as full as possible during cold operations. Water forms in empty fuel tank as it cools. Water in the fuel system could freeze and block the system.

Equipment damage. The pinch roller ball valve must never be opened unless the launch beam transport pin is in place.

Equipment damage. The tail-lift should be in raised position to avoid damage if sinking occurs. Suitable ground conditions should always be established prior to bridge build or retrieval.

Equipment damage. Tires should be inflated to highway pressure or damage to tires may result.

Equipment damage. To prevent hydraulic contamination, keep the hydraulic quick disconnects clean, and replace all plastic covers after use, or damage to hydraulic system may result.

Equipment damage. To prevent hydraulic contamination, keep the hydraulic quick disconnects clean, or damage to hydraulic system may result.

Equipment damage. TOP WINCH this selection is a maintenance function and should not be selected at any time during a bridge build sequence.

Equipment damage. Transfer case lock-up switch of disabled launch vehicle must be in the OFF position or damage to equipment may result.

Equipment damage. Transfer case of disabled launch vehicle must be in Neutral (N) and in the UNLOCKED position or damage to transfer case may result.

Equipment damage. Transmission of disabled launch vehicle must be set in Neutral (N) position or damage to transmission may result.

Equipment damage. Watch the instrument panels closely. If there are any unusual readings, stop the launch vehicle or stop the build in safe condition and shut off the engine. Check immediately.

Equipment damage. When operating launch vehicle in very hot temperatures of above 100 degrees F (38 degrees C), extra care must be taken to prevent overheating engine (temperatures over 230 degrees F (110 degrees C)) and transmission (temperatures over 250 degrees F (121 degrees C)). Watch water and transmission temperature gauges closely.

Equipment damage. When operating the crane, heed the symbols on the control levers.

Equipment damage. When retracting the slide frame, it is essential that the vehicle chassis and the slide frame are both in line longitudinally. If the vehicle chassis is at a different angle to the slide frame the energy chains that run down the inside of the slide frame beams will be damaged, and the launcher will not sit on the twist lock blocks when lowered.

Equipment damage. When towing another vehicle do not go over GCWR given by the data plate on driver's side door. Going over GCWR may cause damage to disabled and towing launch vehicle.

Equipment damage. When towing disabled launch vehicle, speed must not exceed 35 mph (56 km/h) and towing distance must not exceed 100 miles (161 km). Failure to comply may result in damage to equipment.

Equipment damage. When warming up exercise is complete, the pinch roller ball valve must be closed. The valve should not be operated if the launch beam is being built or retrieved.

Equipment operation is allowable with minor leak (Class I or II). Consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify the supervisor. When operating with Class I or II leaks, continue to check fluid levels as required in the PMCS. Class III leaks should be repaired using tools available, if possible. If not, use "Not Fully Mission Capable" column criteria.

TECHNICAL MANUAL
TM 5-5420-279-10
Change No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 22 May 2006

OPERATOR'S MANUAL

FOR

DRY SUPPORT BRIDGE (DSB)
(NSN 5420-01-469-7479)

TM 5-5420-279-10, dated 10 May 2004, is updated as follows:

1. File this change sheet in front of the publication for reference purposes.
2. New or changed material is indicated by a vertical bar adjacent to the material and/or change designations at the bottom of the affected page.
3. Remove old pages and insert new pages:

Remove Pages	Insert Pages
A /(B Blank)	*A and B*
i and ii	*i and ii*
1-11 and 1-12	*1-11 and 1-12*
2-27 and 2-28	*2-27 and 2-28*
3-37 and 3-38	*3-37 and 3-38*
3-117 thru 3-122	*3-117 thru 3-122*
3-131 thru 3-136	*3-131 thru 3-136*
4-3 and 4-4	*4-3 and 4-4*
4-37 thru 4-40	*4-37 thru 4-40*
5-3 and 5-4	*5-3 and 5-4*
7-3 and 7-4	*7-3 and 7-4*
7-5 and 7-6	*7-5 and 7-6*
7-19 and 7-20	*7-19 and 7-20*
7-37 and 7-38	*7-37 and 7-38*
8-1 and 8-2	*8-1 and 8-2*
8-11 and 8-12	*8-11 and 8-12*
8-15 and 8-16	*8-15 and 8-16*
8-21 and 8-22	*8-21 and 8-22*
8-25 and 8-26	*8-25 and 8-26*
8-31 and 8-32	*8-31 thru 8-32.2*
8-37 and 8-38	*8-37 thru 8-38.2*
8-65 and 8-66	*8-65 thru 8-66.2*
8-69 thru 8-72	*8-69 thru 8-72*
8-75 and 8-76	*8-75 and 8-76*
8-81 and 8-82	*8-81 and 8-82*
9-1 and 9-2	*9-1 and 9-2*
None	*9-10.1/(9-10.2 Blank)*
10-75 and 10-76	*10-75 and 10-76*
11-19 and 11-20	*11-19 and 11-20*
11-23 and 11-24	*11-23 and 11-24*
11-29 and 11-30	*11-29 and 11-30*
11-33 thru 11-36	*11-33 thru 11-36*
11-103 thru 11-108	*11-103 thru 11-108*

Remove Pages	Insert Pages
11-111 and 11-112	*11-111 and 11-112*
11-115 thru 11-128	*11-115 thru 11-128*
12-15 and 12-16	*12-15 and 12-16*
C-3 and C-4	*C-3 and C-4*
D-9 and D-10	*D-9 and D-10*
G-1 and G-2	*G-1 and G-2*
None	*H-1/(H-2 Blank)*
None	*I-1 and I-2*
Index 1 and Index 2	*Index 1 and Index 2*
Index 15 and Index 16	*Index 15 and Index 16*

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0612402

Distribution:

To be distributed in accordance with the initial distribution number IDN: 256764, requirements for TM 5-5420-279-10.

LIST OF EFFECTIVE PAGES

Insert latest changed pages.
Destroy superseded pages.

NOTE

The portion of the text or illustration changes is indicated by a vertical line in the outer margins of the page.

Dates of issue for original and changed pages are:

Original 0 10 May 2004
Change 1 22 May 2006

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 946, CONSISTING OF THE FOLLOWING:

Page No.	*Change No	Page No.	*Change No	Page No.	*Change No
Title	0	4-3	1	8-21	1
Blank	0	4-4 – 4-36	0	8-25	0
a - n	0	4-37 – 4-39	1	8-26	1
i	1	4-40 – 4-114	0	8-27 – 8-30	0
ii – iv	0	5-1 – 5-2	0	8-31 – 8-31.0/(8-31.1 Blank)	1
1-1 – 1-10	0	5-3	1	8-32 – 8-36	0
1-11 – 1-12	1	5-4 – 5-36	0	8-37 – 8-37.0/(8-37.1 Blank)	1
1-13 – 1-26	0	6-1 – 6-8	0	8-38 – 8-64	0
2-1 –2-26	0	7-1 – 7-2	0	8-65 – 8-65.0/(8-65.1 Blank)	1
2-27	0	7-3	1	8-66 – 8-68	0
2-28	1	7-4	0	8-69 – 8-72	1
2-29 – 2-60	0	7-5	1	8-73 – 8-75	0
3-1 – 3-36	0	7-6 – 7-19	0	8-76	1
3-37	0	7-20	1	8-77 – 8-80	0
3-38	1	7-21 – 7-37	0	8-81 – 8-82	1
3-9 – 3-117	0	7-38	1	8-83 – 8-88	0
3-118 – 3-121	1	7-39 – 7-44	0	9-1	0
3-122 – 3-131	0	8-1	1	9-2	1
3-132	1	8-2 – 8-11	0	9-3 – 9-10	0
3-133	0	8-12	1	9-10.1/(9-10.2 Blank)	1
3-134 – 3-135	1	8-13 – 8-15	0	9-11 – 9-54	0
3-136 – 3-144	0	8-16	1	10-1 – 10-75	0
4-1 – 4-2	0	8-17 – 8-20	0	10-76	1

* Zero In This Column Indicates An Original Page

Page No.	*Change No	Page No.	*Change No	Page No.	*Change No
10-77 – 10-80	0	11-119 – 11-123	1	E-1 – E-4	0
11-1 – 11-18	0	11-124	0	F-1 – F-2	0
11-19	1	11-125 – 11-128	1	G-1	0
11-20 – 11-22	0	12-1 – 12-15	0	G-2	1
11-23	1	12-16	1	G-3/(G-4 Blank)	0
11-24 – 11-28	0	12-17 – 12-44	0	H-1/(H-2 Blank)	1
11-29	1	13-1 – 13-5/(13-6 Blank)	0	I-1 – I-2	1
11-30 – 11-33	0	A-1 – A-10	0	Index-1	0
11-34 – 11-36	1	B-1 – B-30	0	Index-2	1
11-37 – 11-103	0	C-1 – C-3	0	Index-3 – Index-14	0
11-104 – 11-107	1	C-4	1	Index-15	1
11-108 – 11-111	0	D-1 – D-8	0	Index-16 – Index-20 Blank	0
11-112	1	D-9	1	DA Form 2028	0
11-113 – 11-114	0	D-10	0	Metric Conversion Chart	0
11-115 – 11-117	1	E-1 – E-4	0	Back cover	0
11-118	0				

* Zero In This Column Indicates An Original Page

TECHNICAL MANUAL
***TM 5-5420-279-10**

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC., 10 MAY 2004

OPERATOR'S MANUAL

FOR

DRY SUPPORT BRIDGE (DSB)
(NSN 5420-01-469-7479)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DAForm2028 (*Recommended Changes to Publications and Blank Forms*), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is https://aeps.ria.army.mil/. The DA Form 2028 is located under the Public Applications section in the AEPS Public Home Page. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or e-mail your letter or DA Form 2028 direct to: AMSTA-LC-LPIT/TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is: TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

Approved for public release: distribution is unlimited

TABLE OF CONTENTS

*This manual supersedes TM 5-5420-279-10, dated 8 April 2003.

HOW TO USE THIS MANUAL

This manual is designed to help you operate the Dry Support Bridge and its launch vehicle.

It should be noted by the reader, that this manual is in a commercial format.

FEATURES OF THIS MANUAL

- A table of contents is provided at the beginning of this manual**.**
- WARNINGs, CAUTIONs NOTEs, subject headings, and other important information are highlighted in **BOLD** print as a visual aid.

WARNING

A WARNING indicates a hazard, which can result in death or serious injury.

CAUTION

A CAUTION is a reminder of safety practices or directs attention to usage practices that may result in damage to the equipment.

NOTE

A NOTE is a statement containing information that will make procedures easier to perform.

- Technical instructions include metric units as well as standard units; metric units are shown in brackets.

FOLLOW THESE GUIDELINES WHEN YOU USE THIS MANUAL

- Read this manual and become familiar with its contents before attempting to operate the DSB system.
- A Warnings and Cautions summary is provided at the front of this manual, it should be read before attempting to operate the DSB system.

DESCRIPTION OF CHAPTERS

This manual is divided into 13 chapters and 7 Appendices, each of which covers a broad topic. It is recommended that each member of the DSB operating crew becomes familiar with the chapters related to his or her tasks, before moving to the bridge site. In particular, all users must be completely familiar with the warnings and cautions associated with the various stages of deployment and retrieval. For Unit Level Maintenance Procedures at site and depot level, refer to the Maintenance Manual for the DSB TM-5-5420-279-23.

Chapter 1, **INTRODUCTION**, contains a high level overview of the features of the DSB system, guidance on the selection of, and preparation of, the bridging site. It also contains information on transportation of the DSB system to and from the bridging site.

Chapter 2, **TECHNICAL DESCRIPTION AND DATA**, contains descriptions of all the assemblies and components of the DSB. It also contains tables of technical data about DSB equipment and components.

Chapter 3, **GENERAL DRILLS**, contains operating procedures and practices for various facilities of the DSB, e.g. tail-lift, crane, launcher, bridge modules, etc. These detailed procedures should be practiced and understood by appropriate members of the crew, so that they have become second nature by the time that an actual bridge is being built.

Chapter 4, **BRIDGE BUILDING**, contains all the procedures necessary to build a DSB bridge. Procedures covered include: the positioning of launch vehicle and trailers at the bridge site, setting up the launch vehicle, building the launch beam, building the bridge roadway and retrieving the launch beam. It also covers post-build activities, such as bridge inspection and equipment stowage.

Chapter 5, **BRIDGE RETRIEVAL**, contains all the procedures necessary to retrieve a bridge after use.

Chapter 6, **BUILD SEQUENCE FOR 40 METER BRIDGE**, is a tabulated sequence of instructions for all the critical tasks necessary for constructing a DSB bridge, 40 meters long.

Chapter 7, **OPERATION IN BACK-UP MODE**, provides an overview of the facilities available to the bridge crew in the event of loss of electrical power. It also includes procedures for manual operation of hydraulic controls.

Chapter 8, **PREVENTIVE MAINTENANCE CHECKS (PMCS)**, contains illustrated tables detailing the sequences of checks to be carried out before, during and after DSB operation. It also contains general procedures for lubrication and fluid top-up operations.

Chapter 9, **FAULT-FINDING & OPERATOR TROUBLE-SHOOTING**, Introduces the Built-in-Test Equipment (BITE) facilities on the launch vehicle and contains other miscellaneous procedures, which can be used by the crew to isolate and diagnose faults.

Chapter 10, **OPERATOR MAINTENANCE**, contains procedures for replacing simple electrical or mechanical components and adjustments.

Chapter 11, **DSB TRANSPORTATION AND LOADING PLANS**, contains procedures for loading and securing the DSB components on the launch vehicle and trailers.

Chapter 12, **OPERATION IN UNUSUAL CONDITIONS**, contains procedures for operating the launch vehicle and bridge in severe conditions.

Chapter 13, **SUPPORT INFORMATION** contains reference material and acronym list etc.

Appendix A **FRACTURE CONTROL PLAN**, details procedures for monitoring fatigue and cracks in the bridge modules.

Appendix B **MAC**, contains the maintenance allocation chart and the tools and test equipment chart.

Appendix C **OVERBRIDGING**, gives details on building an overbridge.

Appendix D **BASIC ISSUE ITEMS (BII)**, lists the contents of the BII.

Appendix E **COMPONENT OF END ITEM (COEI)**, lists the contents of the COEI.

Appendix F **ADDITIONAL AUTHORIZATION LIST (AAL)**, lists the contents of the AAL.

Appendix G **EXPENDABLE AND DURABLE ITEMS LIST**, lists the expendable and durable items.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

Sect/ Para **Contents** **Page**

CHAPTER 1

INTRODUCTION

Section I. OVERVIEW OF DSB SYSTEM

1.1 INTRODUCTION

This manual describes the components, the operations and operational sequences required to load, transport, deploy and recover the 131.23 ft (40 m) Dry Support Bridge (DSB). It also includes field repairs, field maintenance procedures and trouble shooting sections.

1.1.1 Scope

The manual is primarily intended for the 8-man crew who carry out the bridge building tasks. The loading, transport and maintenance sections will be relevant to other personnel who carry out those operations.

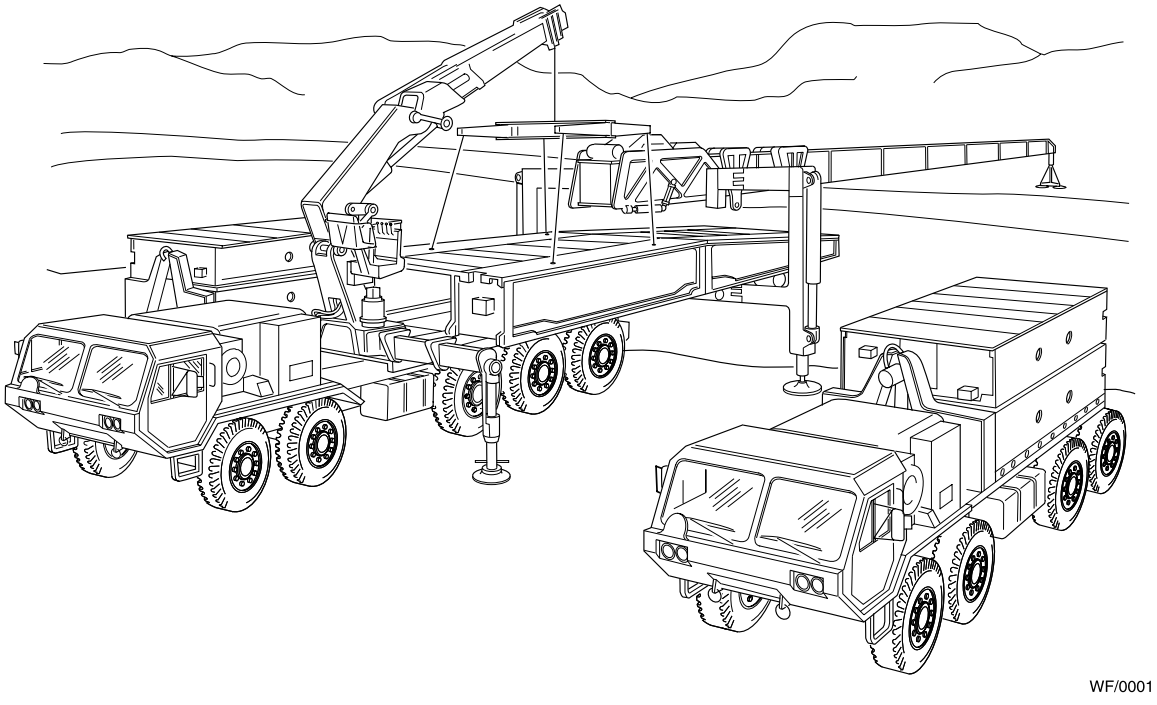


Figure 1. 1 Dry Support Bridge

1.1.2 Corrosion Prevention and Control (CPC).

1.1.2.1 The DSB System has a total service life of twenty years, which allows for extended periods of operation in a corrosive environment. A corrosive environment includes exposure to high humidity, salt spray, road-deicing chemicals, gravel, and atmospheric contamination. No action beyond normal washing and repair of damaged areas is necessary to control corrosion. However, it is recommended that to prevent moisture accumulation during periods of low use, the launcher should be periodically exercised to allow water to drain and hinge joints and cylinders to be exercised.

1.1.2.2 Strong detergents should not be used on the bridge or the launch beam modules, as these can be corrosive to aluminum. Particular care should be taken to ensure that all traces of salt spray and deicing chemicals are removed from exposed areas of aluminum, particularly in the jaw bores of the launch beam modules.

1.1.3 General Description

NOTE

When an item on the vehicle or launcher is referred to as front or rear, left or right, the cab is taken as the front of the launcher vehicle, all references are taken as if personnel are looking forward towards the cab. Therefore if the left hand side A-frame leg is being discussed, the A-frame leg on the launcher vehicle's left hand side is the item being described, i.e. the driver's side.

When talking about the launch beam, the front of the beam is to be taken as the far bank and the rear is taken as the home bank. Similarly the far bank carriage is the one nearest the far bank and the home bank carriage is the one nearest the home bank.

1.1.3.1 The DSB system consists of a launch vehicle and launcher, launch beam and bridging modules including end beams and approach ramps. It is compatible with the pallet loading system (PLS) and is transported on a total of seven PLS flatracks. It is lightweight in construction and easy to construct by a crew of eight personnel. It is capable of bridging spans of up to 131.23 ft (40 m) and the deck is 14 ft 1 in (4.3 m) wide. Table 1. 1 lists the capacity of the bridge and Table 1. 2 lists the vehicle crossing speeds.

Table 1. 1 Bridge Capacity

	NORMAL CROSSING	CAUTIOUS CROSSING
BRIDGE CAPACITY	MLC96W (wheeled)	MLC100W (wheeled)
	MLC70T (tracked)	MLC80T (tracked)
Approach ramp angle 1:9		

Table 1. 2 Vehicle Crossing Speeds

VEHICLE WEIGHT	CROSSING SPEED
Up to MLC 30	25 mph (40 kph)
Above MLC 30	15 mph (25 kph)
Exceptions: Vehicles with low ground clearance such as the Abrams mine plow must be limited to a crossing speed of 10 mph (16 kph).	
Vehicles with large front or rear overhangs must approach and exit the bridge with caution and at a slow speed to prevent contact with, and subsequent damage to the bridge.	

1.1.3.2 The complete system is capable of constructing two 20 m bridges.

1.1.3.3 A launcher attached to the transport vehicle consists of a crane, a slide frame, a launch frame and a fold out A-frame for leveling and stabilization. The crane is operated separately while the launcher is operated via hydraulic circuits controlled from a chest pack. The chest pack includes two joysticks and illuminated panels to indicate the current action being or about to be executed. Leads, from a control cabinet on the vehicle, terminate at either end of the vehicle to facilitate connection of the chest pack lead.

1.1.3.4 The launch frame also carries the first section of the launch beam upon which the far bank and home bank carriages, used to support the bridge sections during assembly and placement, are already in place. The launch frame features a launch beam drive unit to move the launch beam forward or rearward as required. Winches attached to the launch frame, control the movement of the carriages and the raising or lowering of the bridge during deployment and recovery.

1.1.3.5 The A-frame consists of foldout support legs that allow the vehicle to be leveled and stabilized for bridge deployment and an upper beam that supports the launch frame. This upper beam is used in its lower position for launch beam deployment and is raised to provide clearance for the modular bridge sections during bridge deployment.

1.1.3.6 The operation of the drive mechanism, winches and hydraulic cylinders is controlled via the chest pack. The operator of the chest pack controls the whole bridge deployment operation, which relies on coordinated actions of the 8-man crew in order to achieve minimum deployment times.

1.1.4 Basic Operational Sequence (Deployment)

1.1.4.1 Upon arrival at the crossing, the build site is marked out in accordance with Figure 1. 12.

1.1.4.2 All vehicles are driven to the staging area and a number of palletized loads ground loaded.

1.1.4.3 The launch vehicle is then partially prepared for use. The tail-lift is opened, the crane partially deployed and the A-frame unfolded and pinned. The launch vehicle is then guided to the predetermined set back distance from the bank edge using the tire alignment marks. This provides clearance and support for the bridge when it is lowered into position. The A-frame stabilizer legs are extended to raise the launcher clear of the rear of the vehicle. The launch vehicle is then driven forward to extend the slide frame. With the slide frame fully extended the crane can be fully deployed.

1.1.4.4 The palletized loads are then positioned at both sides of the launch vehicle in readiness for bridge building.

1.1.4.5 The vehicle must be leveled by the A-frame and crane stabilizers and pinned in position before the crane operator retrieves a section of launch beam. The beam section is then connected to the forward launch beam section by inserting pins through the jaws at the top and then bottom of launch beam sections. A guide system on the launch beam aids in the alignment of the jaws to facilitate pin insertion.

1.1.4.6 As the launch beam is boomed out across the gap, the crane operator retrieves and places in position the next section of the launch beam. The sequence continues until the launch beam assembly is complete, with eight sections being required for the full span. The launch frame articulator cylinders then lower the launch beam far end until the far bank support contacts the ground to support the assembled beam. The far bank support is self-leveling and does not require any manual intervention.

1.1.4.7 During bridge deployment, the location of the palletized loads, and thus the modular bridge sections, is critical to the speed of the operation. This sequence is given in detail later in this manual.

1.1.4.8 The articulator cylinders are detached from the slide frame cross member and stowed under the launch frame by the articulator stow cylinders. The upper A-frame beam is then raised and pinned in the bridge deployment position, and the A-frame support struts are lowered. This provides clearance for the modular bridge sections to be launched through the A-frame.

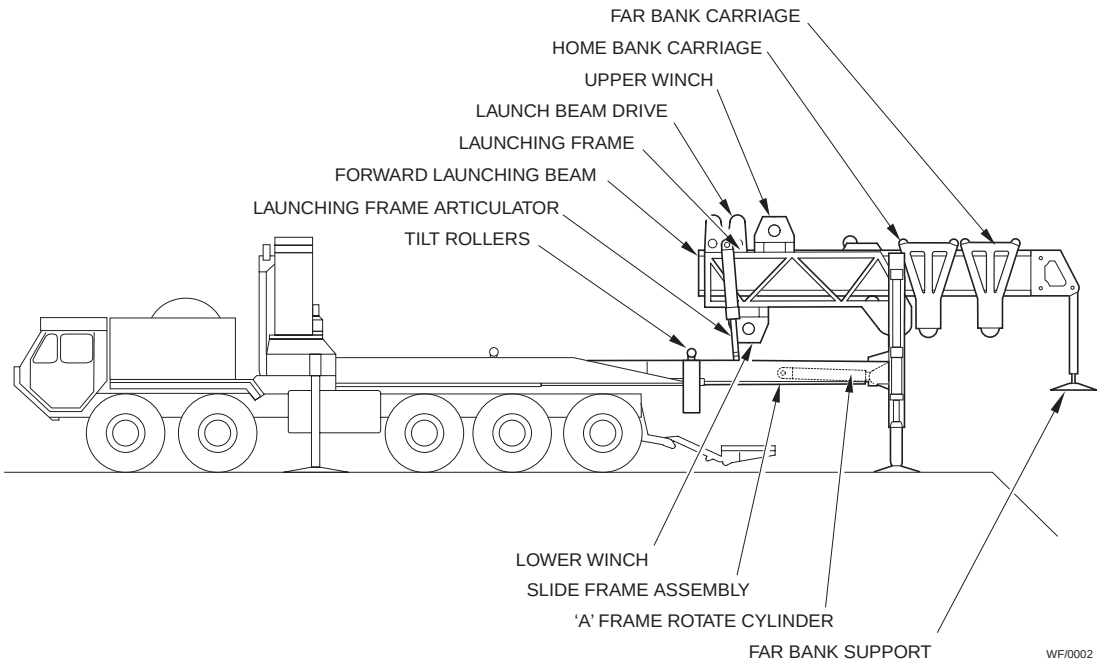
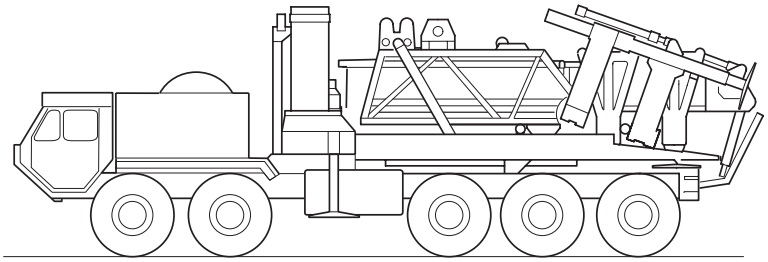
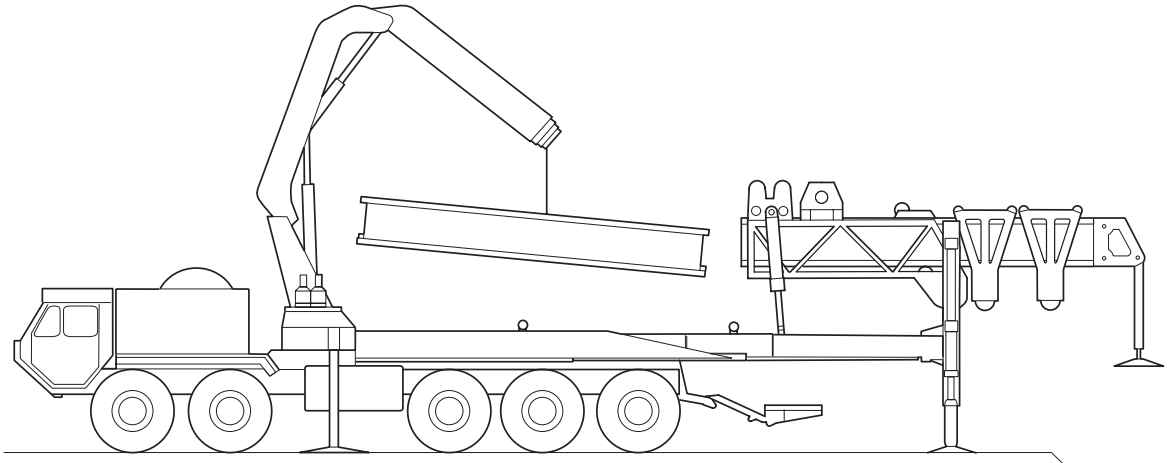


Figure 1.2 Launcher Vehicle Extended

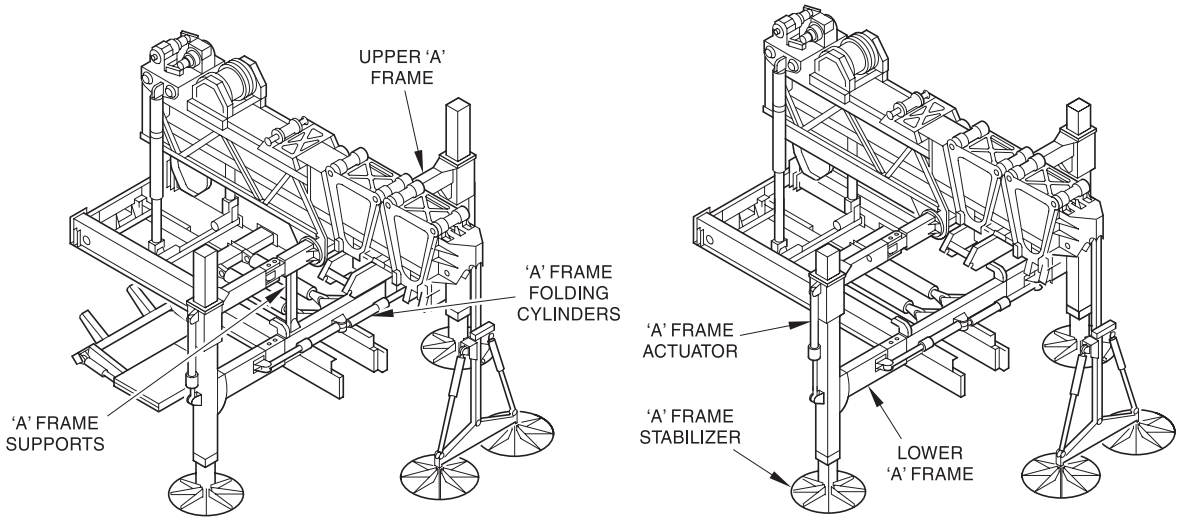


BOTH CRANE AND LAUNCHING MECHANISM ARE STOWED FOR TRANSPORTATION



BEAM ASSEMBLY AND SUBSEQUENT BRIDGE ASSEMBLY IS ACHIEVED
BY A CRANE MOUNTED ON THE HOST VEHICLE

WF/0003



'A' FRAME IN LOW POSITION

'A' FRAME IN RAISED POSITION

686A575

Figure 1. 3 Beam Module Deployment

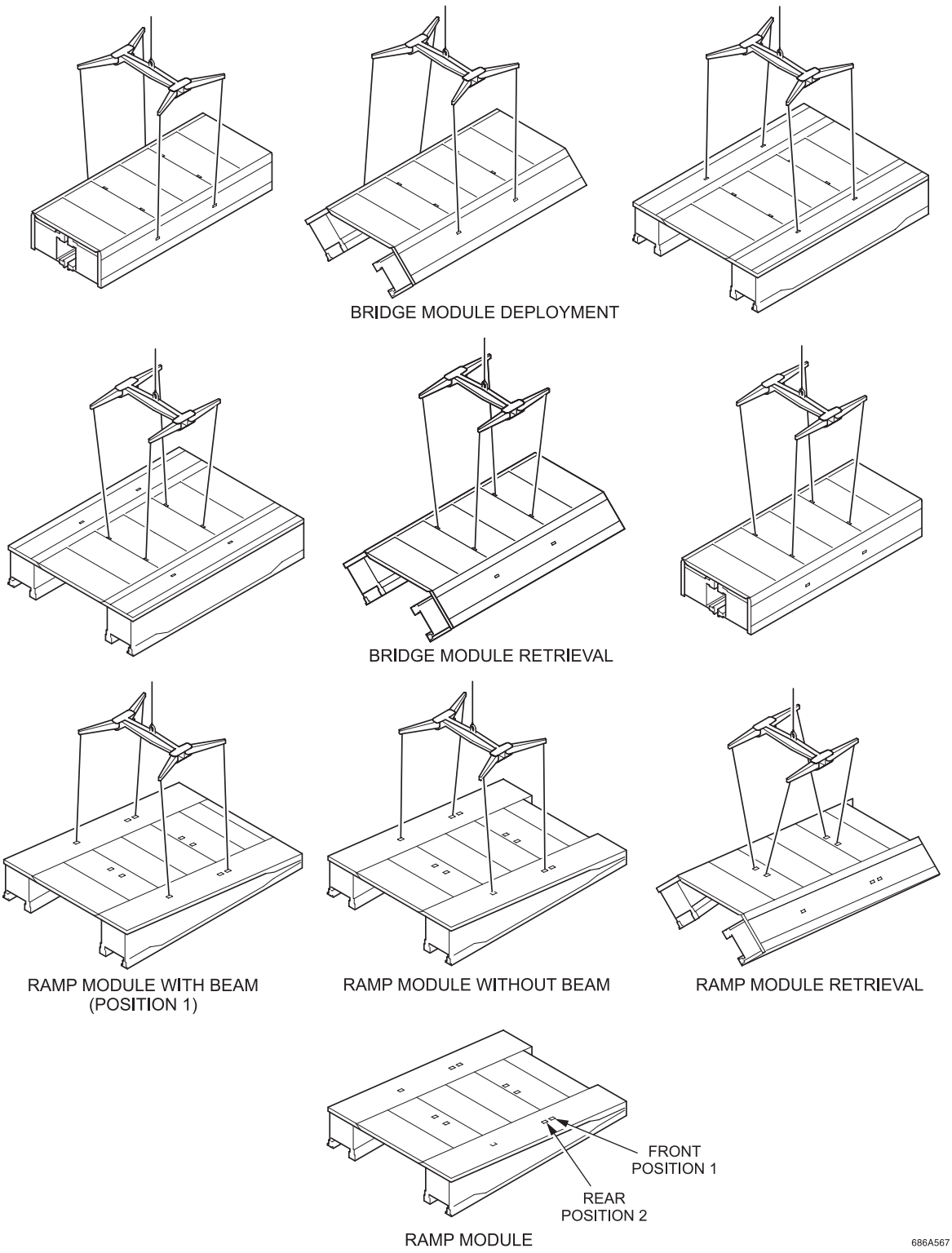


Figure 1. 4 Bridge Modules

1.1.4.9 As with the launch beam, the bridge module sections are placed in position by the crane operator. The end beam is craned onto its end beam guides, which have been pre-positioned on either side of the slide frame. The far bank ramp module is raised from the flatrack, which due to the positioning of the module lifting slings, folds out the ramp panel on each side of the center decking panels.

1.1.4.10 The ramp module is connected and then pinned to the end beam. The approach ramps are placed on top of the ramp module and transported across the gap as the bridge is assembled.

1.1.4.11 The ramp module is pushed through the A-frame by the crane and is then attached to the far bank carriage. This is then used to support the bridge modules, suspended from the launch beam, until the bridge is finally completed and lowered into position. The home bank end of the bridge is supported by rollers on the A-frame during bridge construction.

1.1.4.12 When the far bank ramp module is located on the A-frame and supported by the far bank carriage, the next bridge module is positioned and secured with pins and shootbolts to the far bank ramp.

1.1.4.13 The chest pack operator then moves the bridge modules forward with appropriate movements of the joystick. The control system coordinates the movement of the upper and lower winches to draw the bridge modules along the launch beam.

1.1.4.14 This sequence continues until all the required bridge modules have been assembled and the home bank ramp module is then attached and secured to the home bank carriage. The bridge is then boomed forward to the required position. Locking pins in the carriages are then removed and the bridge lowered into position.

1.1.4.15 With the bridge in position and the carriages are disconnected, the A-frame support struts are raised and the upper A-frame beam and launch beam are lowered. Once lowered the articulator cylinders are deployed and attached to the slide frame cross member with shootbolts. The carriages are then withdrawn along the launch beam. The launch beam is then raised from the far bank by retracting the articulator cylinders. A section of launch beam is withdrawn, disconnected from the launch beam and stowed by the crane operator on to the appropriate flatrack.

1.1.4.16 The next launch beam sections are withdrawn and removed until only the forward launch beam section remains in the launch frame.

1.1.4.17 The crane stabilizers are raised and the slide frame closed and secured. The A-frame stabilizer legs are then raised and the launch vehicle is driven to the staging area and the launcher is then stowed. During this sequence, the curbs, bridge markers, approach ramps and bridge defile markers are deployed in preparation for bridge trafficking.

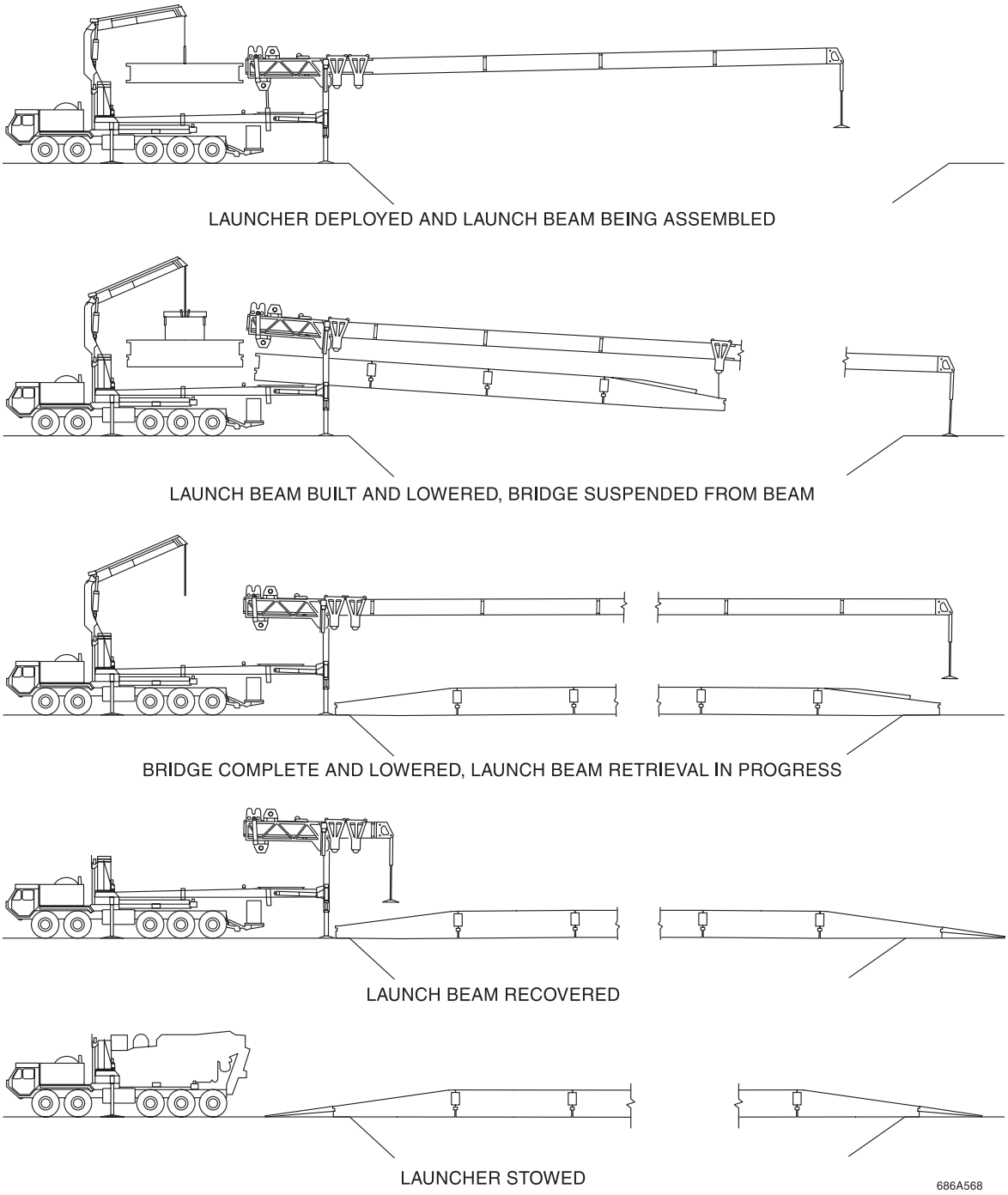


Figure 1. 5 Bridge Build Sequence

1.1.5 Basic Operational Sequence (Retrieval)

1.1.5.1 The retrieval operation is essentially a reversal of the deployment procedure. However, because of the passage of vehicles across the bridge, the modules must be cleaned prior to bridge retrieval. This important procedure ensures any debris is removed which may otherwise damage bridge parallel panels during stowing operations or cause injury to personnel as the modules close.

1.1.5.2 The launch vehicle is positioned on the centerline of the bridge. The A-frame stabilizer legs are then extended and the launcher deployed in readiness for construction of the launch beam.

1.1.5.3 The flatracks are positioned, to reload retrieved bridge modules. The home bank approach ramp frames are placed on the right-hand side flatrack “pallet” (V1) near to the bridge. The home bank approach ramps are stowed and strapped into their frames.

1.1.5.4 The approach ramp frames are placed on the far bank ramp module and the approach ramps are stowed and strapped into the frames.

1.1.5.5 With the launch beam deployed, the bridge is connected to the carriages, and then raised from the ground until the carriages can be locked by the insertion of shootbolt pins. The bridge stops emergency are raised so that the bridge can be drawn onto the A-frame by the operation of the carriages from the launch chest pack. The home bank end of the bridge is then lowered until it is supported on the A-frame rollers. The bridge stops emergency are then lowered to retain the bridge on the A-frame prior to the home bank carriage being disconnected.

1.1.5.6 The home bank carriage is disconnected from the bridge and the bridge drawn rearwards to the correct position for the removal of the home bank ramp module. The crane operator positions the module lifting beam, which is then attached to the opening sling positions on the ramp module. The bridge connecting pins are then removed and the weight of the module taken by the crane. Once the shootbolts have been retracted the module can be placed on the end beam guides and removable rollers attached to the slide frame for end beam removal.

1.1.5.7 To remove the end beam the ramp module has to be re-slung to account for the change in center of gravity. The end beam pins are removed, the module lifted and then lowered across flatrack T1 at 90 degrees. Once on the flatrack the module lifting beam is reconfigured for closing and attached to the closing cables located between the deck units. As the module is raised, it will fold to its transportation configuration for re-loading onto the flatrack. The end beam may now be craned from the end beam guides. The end beam guides and removable rollers are removed from the slide frame and stowed alongside the vehicle.

1.1.5.8 A similar sequence is repeated for all modules until the bridge is fully recovered from the gap. The launch beam retrieval and vehicle stowage sequences being direct reversals of the build procedure.

Section II. BRIDGING SITE PREPARATION

1.2 BRIDGING SITE PREPARATION

Where tactically and strategically possible, perform a preliminary study and site selection checks to determine the proposed location of the bridge prior to marking out the site.

1.2.1 Preliminary Study

Carry out intelligence gathering and reconnaissance of the proposed bridge location.

1.2.2 Intelligence Gathering

Refer to intelligence studies and reports, maps, aerial photographs and personal aerial reconnaissance. If possible, seek the advice of friendly local civilians.

1.2.3 Site Reconnaissance

NOTE

For additional information on site reconnaissance, refer to Appendix H.

1.2.3.1 Reconnaissance is required to:

(1) select a suitable site,

(2) select the bridge center line,

(3) measure the gap, bank heights and bank transverse and longitudinal slopes.

1.2.3.2 The following considerations apply to the selection of a suitable site:

(1) For normal build sites, a minimum size of 49.2ft (15m) wide (perpendicular to the gap) by 134.5ft (41m) long is required (see Figure 1. 12).

(2) For restricted build sites, a minimum size of 35.8ft (10.9 meters) wide (perpendicular to the gap) by 73.65ft (22.45m) long is required (see Figure 1. 13).

(3) The maximum bridge gap (**'AR' span**) is not to exceed 131.2ft (40m) (see Figure 1. 11).

(4) The maximum longitudinal slope on the home bank should not be steeper than 1 in 20 in either direction (see Figure 1. 9).

(5) The maximum lateral slope on the home bank should not exceed 1 in 20 (see Figure 1. 9).

(6) Bank height difference '**H**' to comply with either:

40 meter bridge. The far bank is not to be more than 9.8ft (3m) higher or 9.8ft (3m) lower than that of the home bank when measured from the horizontal projection of the home bank.

or

20 meter bridge. The far bank is not to be more than 6.5ft (2m) higher or 6.5ft (2m) lower than that of the home bank when measured from the horizontal projection of the home bank (refer to Figure 1. 10).

(7) The ground bearing capacity should be greater than 4177lb/in^2 (200 kN/sq.m). (Additional grillage (foundations) will be required if softer banks are to be used.) (Refer to Table 1. 12.)

(8) Bridge load capacity is for normal crossings MLC 96W and MLC 70T. For cautious crossings, the load capacity is MLC 100W and MLC 80T.

1.2.4 Hasty Reconnaissance

This is carried out where it is not possible to take measurements with instruments and where access to the far bank is not possible. Make best estimates of span and bank heights.

1.2.5 Deliberate Reconnaissance

1.2.5.1 Deliberate reconnaissance should always be carried out where possible following standard practice. Measure the gap by triangulation using an instrument or by a tape. Determine the relative bank heights by means of a suitable instrument.

1.2.5.2 Refer to Figure 1. 11 and re-check the bridge gap (‘AR' span) to make sure the bridge is of sufficient length.

1.2.6 Bridge Design

NOTE

For additional information on Bridge Design, refer to Appendix I.

1.2.6.1 Determine the gap ('AR' span) to be spanned.

1.2.6.2 Determine the position of the launcher, dimension ‘A’, from Table 1. 3 for build and Table 1. 4 for retrieval.

1.2.6.3 Determine the setting of the upper A-frame from Table 1. 5.

1.2.6.4 The bridge and launch beam configuration can be found from Table 1. 6.

1.2.6.5 Bridge length and configuration can be found from Table 1. 7.

1.2.6.6 Stabilizer leg pin positions can be found in Table 1. 8 for normal conditions and Table 1. 9 and Table 1. 10 for extreme conditions.

Table 1. 3 Dimension ‘A’ – Bridge Build

Bridge Build		
'AR' Span	**Bridge Configuration**	**Dimension ‘A’**
65.6 to 72.17 ft (20m to 22m)	2 parallel + 2 ramp modules	5.57 ft (1.7m) + (72.17 ft (22m) – 'AR' span))
72.17 to 91.86 ft (22m to 28m)	3 parallel + 2 ramp modules	5.57 ft (1.7m) + (91.86 ft (28m) – 'AR' span))
91.86 to 111.54 ft (28m to 34m)	4 parallel + 2 ramp modules	5.57 ft (1.7m) + (111.54 ft (34m) – 'AR' span))
111.54 to 131.23 ft (34m to 40m)	5 parallel + 2 ramp modules	5.57 ft (1.7m) + (131.23 ft (40m) – 'AR' span))

e.g. If the 'AR' span = 124.67 ft (38m) - then ‘A’ = 5.57 ft (1.7m) + (131.23 ft-124.67 ft)(40-38m) = 12.13 ft (3.7m)

Table 1. 4 Dimension ‘A’ – Bridge Retrieval

Bridge Retrieval		
'AR' Span	**Bridge Configuration**	**Dimension ‘A’**
All spans	All bridge configurations	31.49 in (800mm) from edge of bridge

Table 1. 5 Upper A-frame Setting

Far Bank Height	Upper A-frame Setting
Lower than home bank	Top pin
Level with home bank	Top pin
Higher than home bank	Bottom pin

Table 1. 6 Bridge and Launch Beam Configuration

'AR' Span	Launch Beam Configuration	Bridge Configuration
65.6 to 72.17 ft (20m to 22m)	Forward launch beam + 4	2 parallel + 2 ramp modules
72.17 to 91.86 ft (22m to 28m)	Forward launch beam + 5	3 parallel + 2 ramp modules
91.86 to 111.54 ft (28m to 34m)	Forward launch beam + 6	4 parallel + 2 ramp modules
111.54 to 131.23 ft (34m to 40m)	Forward launch beam + 7	5 parallel + 2 ramp modules

Table 1. 7 Bridge Length

'AR' Span	Bridge Length	Nominal Home Bank Bearing	Nominal Far Bank Bearing
65.6 to 72.17 ft (20m to22 m)	78.41ft (23.9m)	Bridge length – 'AR' span – 2.78ft (0.85m)	2.78 ft (0.85m)
72.17 to 91.86 ft (22m to28 m)	97.76ft (29.8m)	Bridge length – 'AR' span – 2.78ft (0.85m)	2.78 ft (0.85m)
91.86 to 111.54 ft (28m to 34m)	117.45ft (35.8m)	Bridge length – 'AR' span – 2.78ft (0.85m)	2.78 ft (0.85m)
111.54 to 131.23 ft (34m to 40 m)	136.81ft (41.7m)	Bridge length – 'AR' span – 2.78ft (0.85m)	2.78 ft (0.85m)

e.g. The 'AR' span = 124.67 ft (38 m).

Therefore nominal home bank bearing = 136.81ft - 124.67ft -2.78ft = 9.36 (41.7 – 38 - 0.85 = 2.85m)

NOTE

If the home bank slope is less than level and the home bank bearing is greater than 0.85m then site preparation is required.

1.2.7 Setting of Stabilizer Leg Height Prior to Build

1.2.7.1 These pin hole positions are irrespective of bridge configuration or ground conditions.

Table 1. 8 A-frame Stabilizer Hole Position (Bank Slopes ±1:20)

Far Bank Height 'H'		Stabilizer Hole Position
Feet	Meters	
+3.28 to +9.84	+1 m to +3 m	Hole 14 ½ or above
+3.28 to -3.28	+1 m to –1 m	Hole 10
+3.28 to -9.84	-1 m to –3 m	Hole 6 or below

Table 1. 9 A-frame Stabilizer Hole Position Home bank slope +1:20 to +1:10

Far Bank Height 'H'		Stabilizer Hole Position
Feet	Meters	
+2.3 to –2.3	+0.7 to –0.7	Hole 6 or below

Table 1. 10 A-frame Stabilizer Hole Position Home bank slope -1:20 to -1:10

Far Bank Height 'H'		Stabilizer Hole Position
Feet	Meters	
+2.3 to –2.3	+0.7 to –0.7	Hole $14^{1}/_{2}$ or above

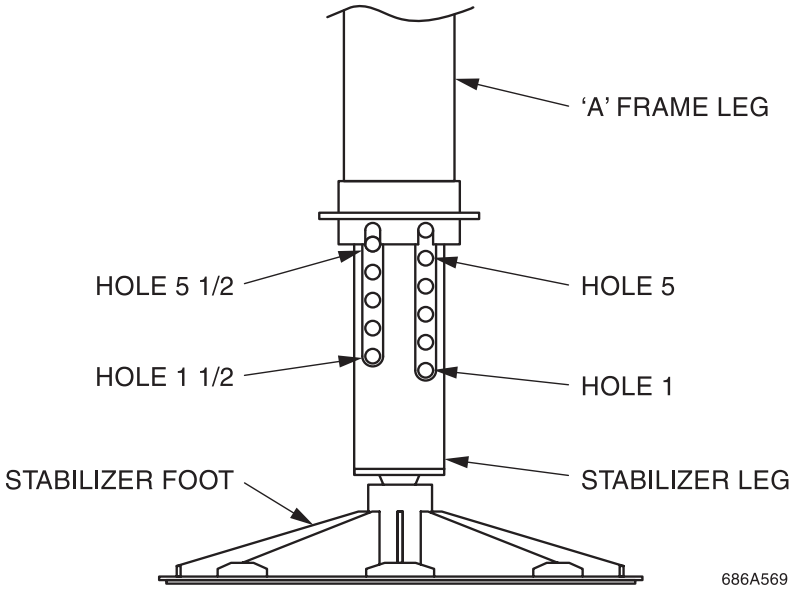


Figure 1. 6 A-frame Stabilizer Leg Pin Hole Numbering

1.2.8 Bridge Bearing

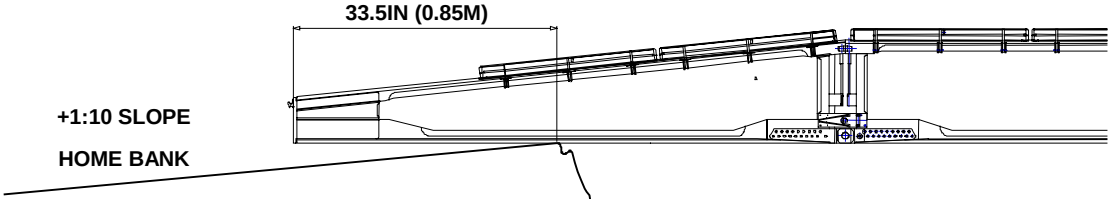
1.2.8.1 The minimum allowable bearing length (i.e. length of bridge at each end resting on the bank) of an emplaced bridge must not be less than 19.6in (500 mm). There is no maximum bearing length, the bridge is capable of accepting bearing support over its entire length.

NOTE

If the home bank slope is less than level, AND the home bank bearing is greater than 33.5in (0.85m) then site preparation is required prior to bridge deployment.

1.2.8.2 An example is shown below: -

'AR' Span	= 124.6ft (38m)
Bridge Length	= 136.8ft (41.7m)
Home Bank Bearing (from calculation)	= 9.3ft (2.85m)
Home Bank Slope	= + 1:10



TRAFFICKING THE BRIDGE IN THIS CONDITION WILL SEVERELY DAMAGE THE BRIDGE

Figure 1. 7 Home Bank Without Preparation

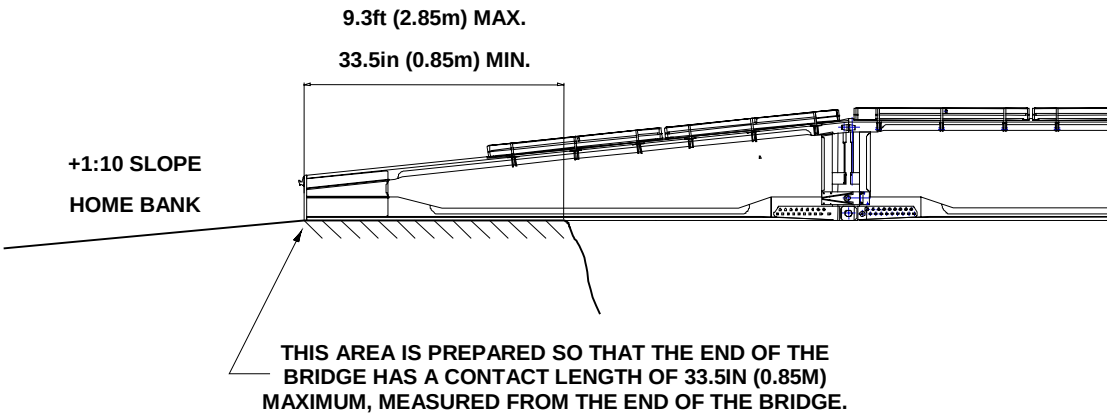


Figure 1. 8 Home Bank After Preparation

1.2.9 Site Marking for Bridge Build

1.2.9.1 After determining dimension 'A' (see Table 1. 3), refer to Figure 1. 12 and mark out the site using pegs and suitable tape.

1.2.10 Bridge Retrieval

1.2.10.1 Remove the home bank approach ramps.

1.2.10.2 Determine the bridge centerline and project it on to the site.

1.2.10.3 Refer to Table 1. 4 and mark out the site using pegs and suitable tape.

NOTE

Under certain extreme site conditions, it may not be possible to retrieve the bridge from the far bank side and the same site that was used for building must be used for retrieval.

Unless the bridge is being retrieved from its known build site, always confirm the site parameters for the proposed retrieval site.

1.2.10.4 When a preliminary study has not been undertaken for any reason, use the bridging crew to carry out a reconnaissance of the proposed bridging site (including where possible the far bank) before bridge deployment commences. Refer to Figure 1. 9 and determine the longitudinal and transverse slopes of the bridge approaches.

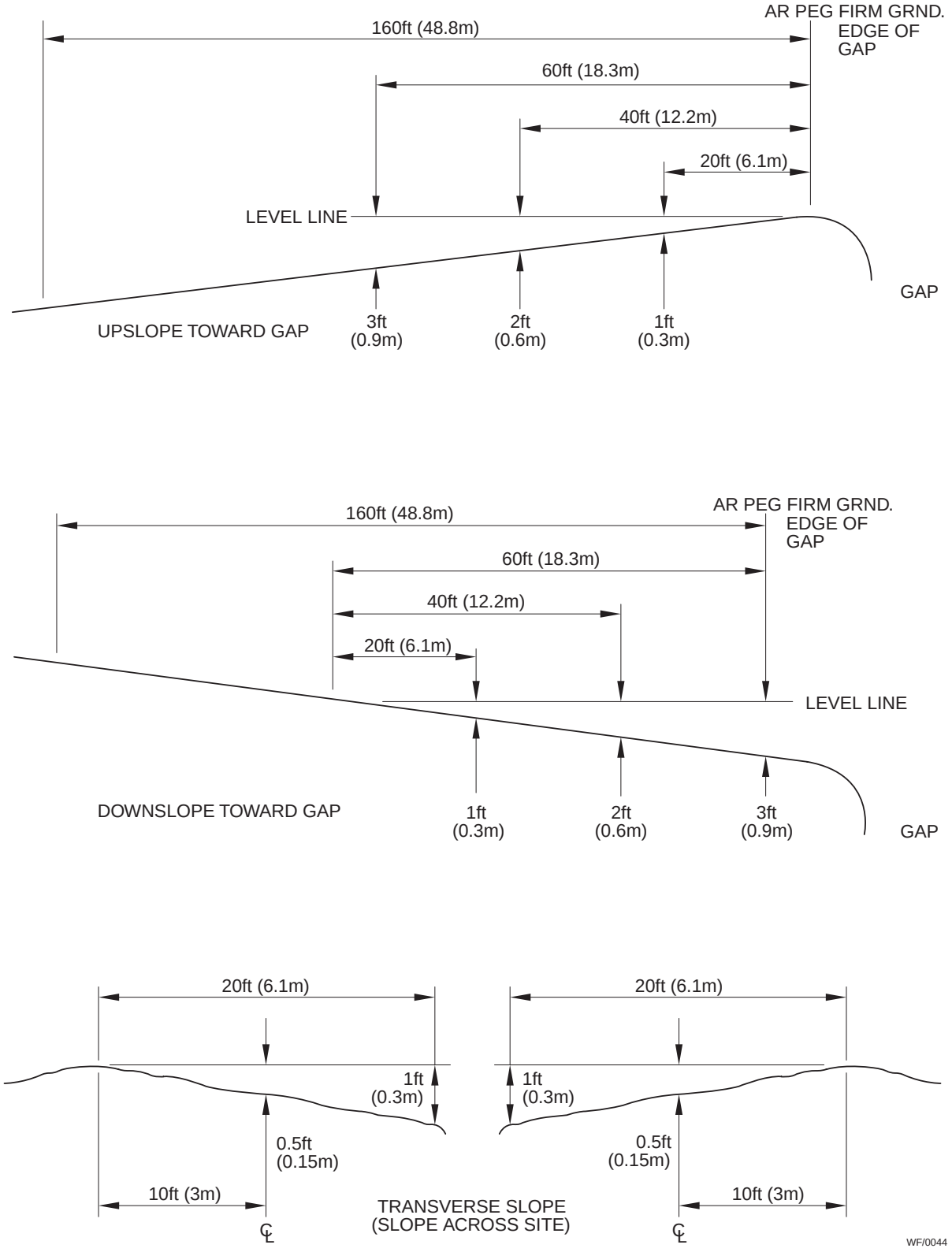


Figure 1. 9 Slope Measurement

1.2.11 Site Parameters

1.2.11.1 Carry out further checks on arrival at the proposed location to ascertain the site suitability for bridge deployment. Although not exhaustive, consider the following factors:

1.2.11.2 **Access routes:** - Tie in the access routes at both ends of the bridge where possible to the existing main road network to reduce preparation and maintenance.

1.2.11.3 **Banks:** - Make sure both banks are of approximately equal height. Operations are possible provided the difference in bank height does not exceed 9 ft 10 in (3 m) – see site reconnaissance. Refer to Figure 1. 9 to determine the difference in home and far bank heights. The banks at the bearing areas of the bridge are to have a minimum soil bearing capacity (SBC) of 1.86 ton/ft^2 (200 kn/m^2). Refer to Table 1. 12 for the SBC of various soil types.

1.2.11.4 **Chest Pack Bank Selection Matrix: -** During bridge building operations, a bank condition has to be selected via the chest pack. The matrices below give the appropriate selections for deployment and final deployment.

Table 1. 11 Initial Deployment

Bridge Configuration	Far Bank Height 'H'	Chest Pack selection		
		High	Level	Low
2 Parallel + 2 Ramp Modules	+1.5m to +2.0m		YES	
	+1.5m to –2.0m			YES
3 Parallel + 2 Ramp Modules	+2.0m to +2.5m		YES	
	+2.0m to –2.5m			YES
4 Parallel + 2 Ramp Modules	+2.5m to +3.0m	YES		
	+2.0m to +2.5m		YES	
	+2.0m to –3.0m			YES
5 Parallel + 2 Ramp Modules	+2.5m to +3.0m	YES		
	+2.0m to +2.5m		YES	
	+2.0m to –3.0m			YES

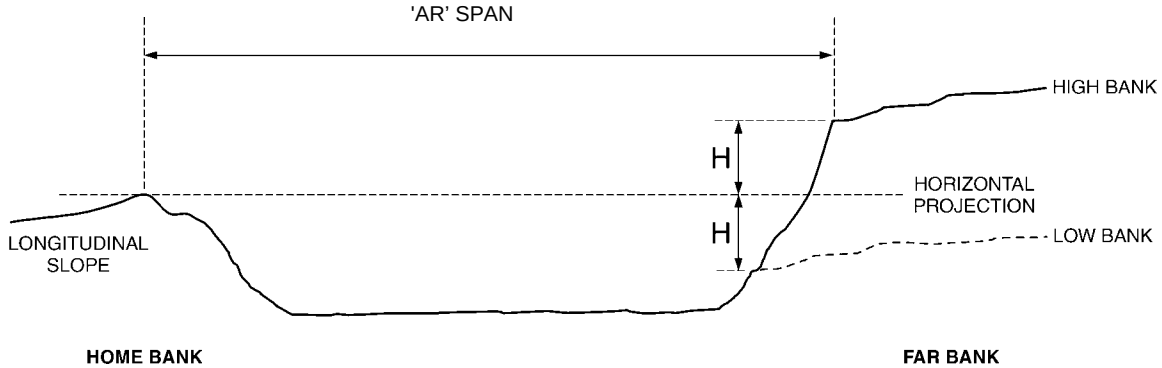


Figure 1. 10 Bank Height Measurement

Table 1. 12 Examples of Soil Bearing Capacities (SBC)

Soil Description	SBC-ton/ft^2 (kN/m^2)
Hardpan overlaying rock	12 (1290)
Very compact sandy gravel	10 (1075)
Loose gravel and sandy gravel, compact sand and gravelly sand, very compact sand-inorganic silt soils	6 (645)
Hard, dry, consolidated clay	5 (537)
Loose coarse to medium sand, medium compact fine sand	4 (430)
Compact sand clay	3 (322)
Loose, fine sand, medium compact sand-inorganic silt soils	2 (215)
Firm or stiff clay	1.5 (161)
Loose, saturated sand-clay soils, medium soft clay	1 (107)

1.2.11.5 **Construction Site: -** Make sure the area can accommodate a normal construction site of 134 ft 6 in (41 m) by 49 ft 3 in (15 m) symmetrical about the bridge centerline. Deployment is possible on sites that are more restricted but construction times are increased due to the necessity for an increased number of positional changes to the flatrack carrier vehicles to off-load the launch beam and bridge modules.

1.2.11.6 **Local Weather Conditions:** - Make sure the strength and direction of prevailing winds will not hamper deployment or usage of the bridge. The deployment shall not commence in wind speeds in excess of 35 mph (56 kph). Also make sure heavy rainfall will not cause problems on the launch site or cause a rise in the water levels when crossing rivers, streams etc.

1.2.12 Bridge Gap ('AR' Span)

1.2.12.1 Stand at a point on the home bank (point A) of the proposed bridge centerline and select an object (point B) on the far bank (also positioned on the centerline). Point B is subject to the restrictions set out in 1.2.11.3.

1.2.12.2 Use a compass and record the bearing of the selected object (point B) along the proposed bridge centerline (the azimuth). Move up or down the home bank on a line at a right angle (90 degrees) to the azimuth until point C is reached where the bearing of the selected object (point B) equals the azimuth bearing plus or minus 45 degrees.

1.2.12.3 Use a tape to measure the distance between points A and C along the home bank (which equals the distance between points A and B - the gap) to determine the gap dimension.

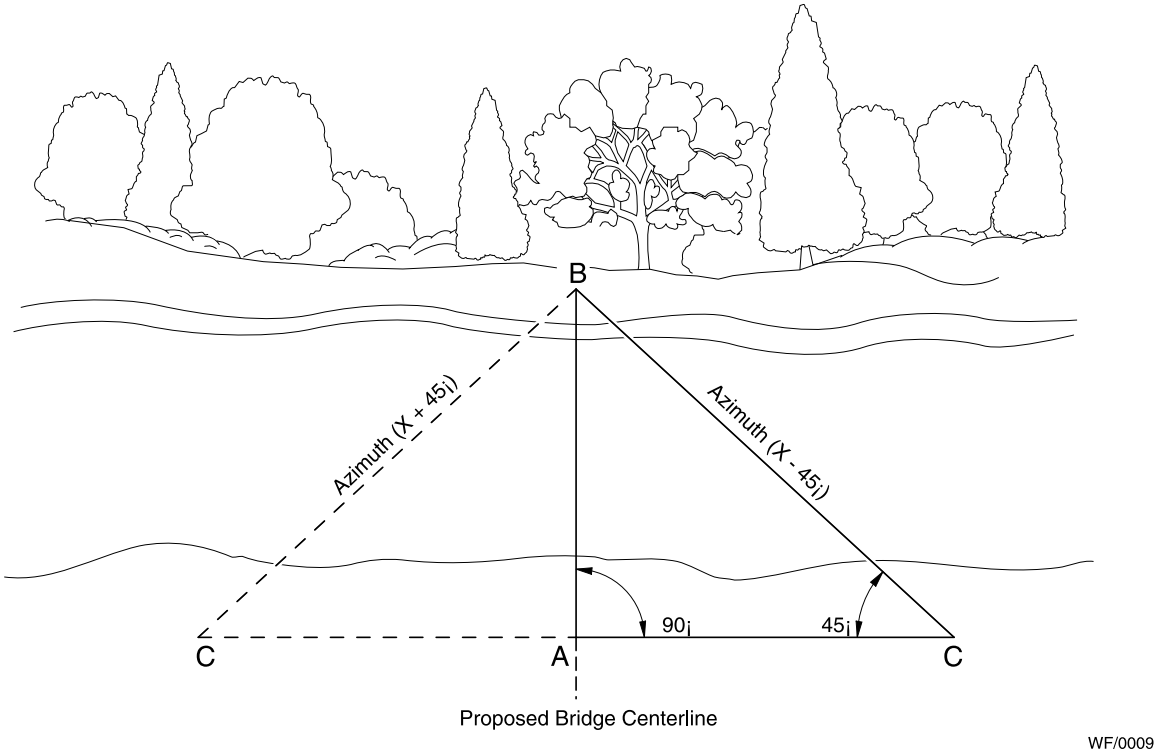


Figure 1. 11 Span Measurement

1.2.13 Site Marking Out

1.2.13.1 On arrival at the bridge site the area designated for construction/recovery should be marked out as shown in Figure 1. 12 for a normal site. Use Figure 1. 13 if the site is restricted for space.

1.2.13.2 At night, conditional to the local military situation, a system of marker lights, chemical light sticks and reflective tape may be used to mark out the site for construction/recovery.

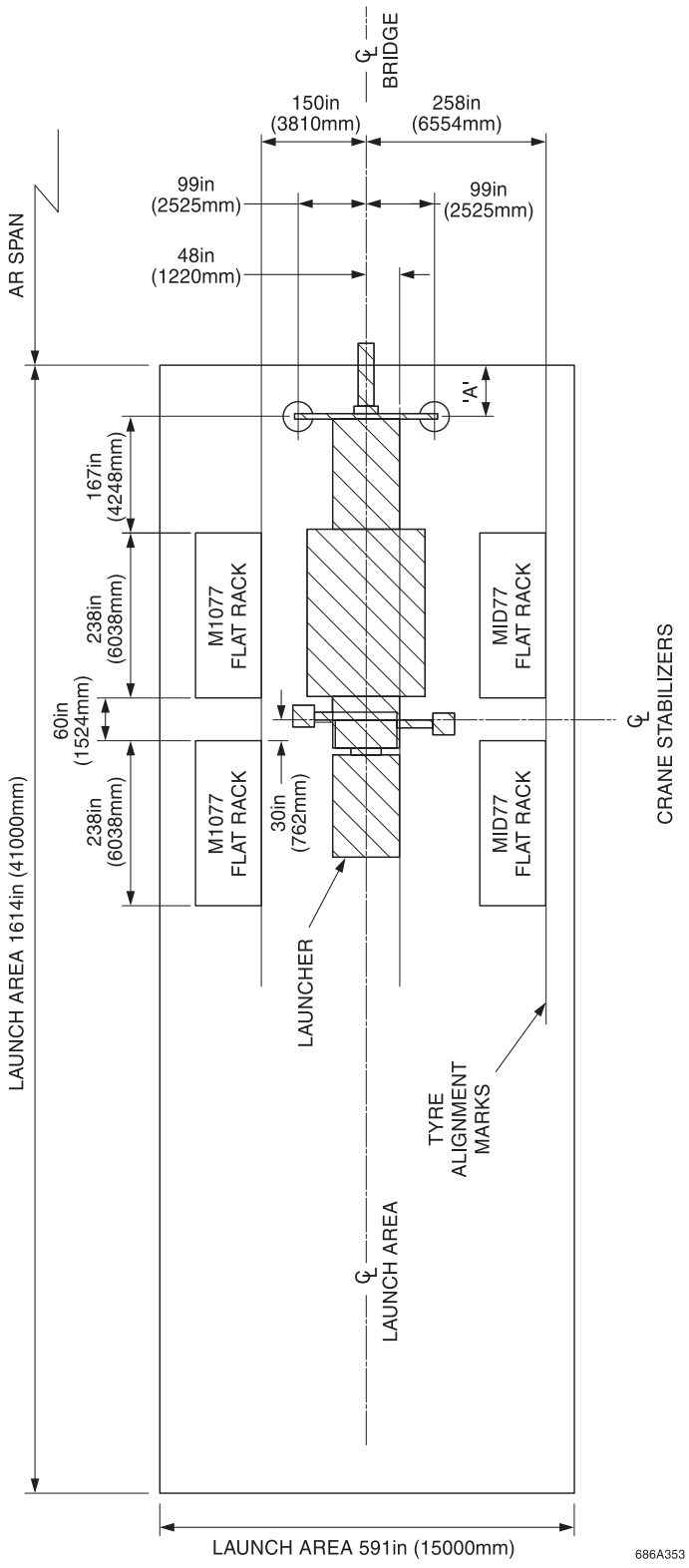


Figure 1. 12 Build Site Marking Out

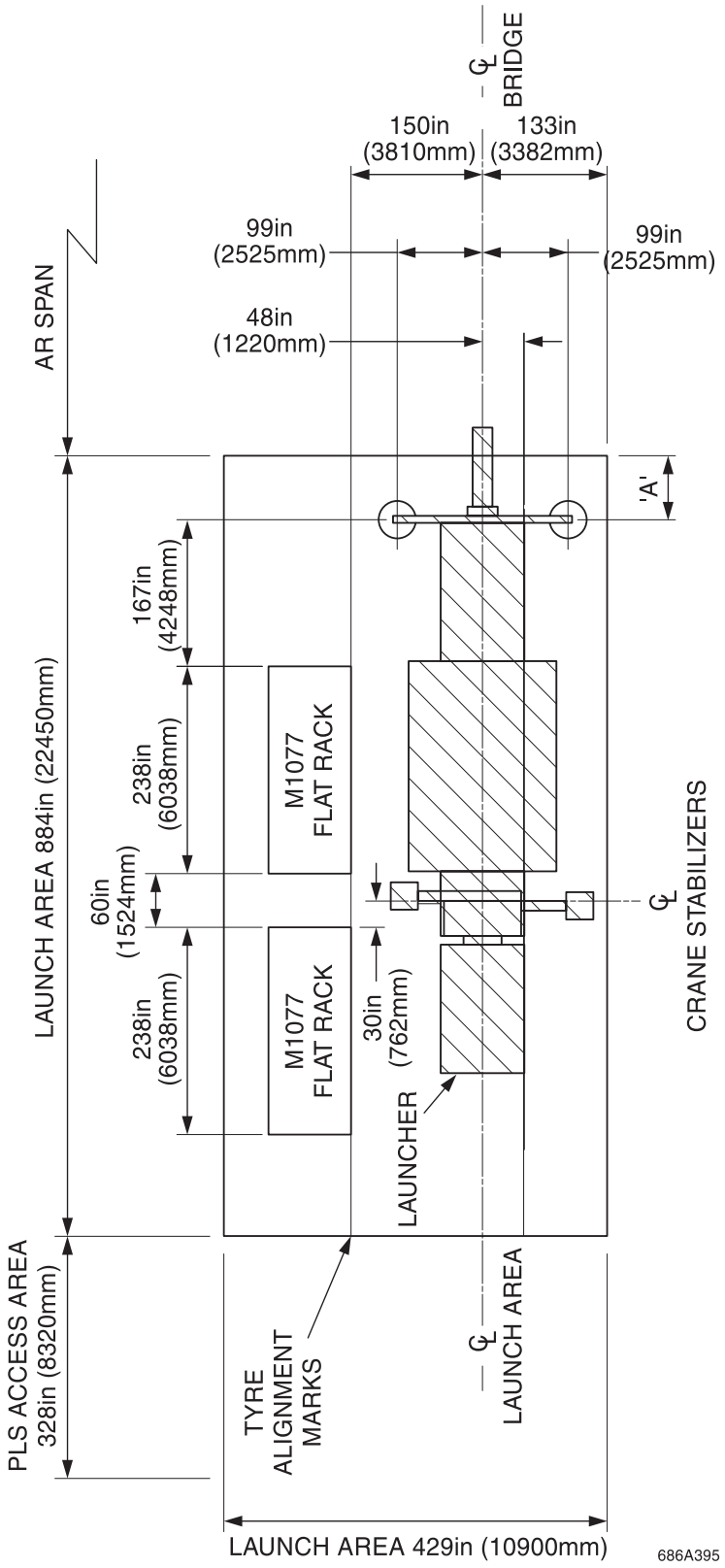


Figure 1. 13 Restricted Site Marking Out

Section III. DSB TRANSPORTATION

1.3 LOADING AND SECURING

1.3.1 General

1.3.1.1 The equipment to launch and deploy the DSB is carried on flatracks by four vehicles including the launcher and their associated trailers. Each vehicle and trailer is configured for the carriage of specific launch beam, bridge module, ramp modules and associated items of equipment as shown in Figure 1. 14 and Figure 1. 15. The configuration of the flatracks on each vehicle and trailer allows delivery of the items to the necessary location on the bridge site in the order they will be required for use.

1.3.1.2 On flatracks where two modules are transported, both upper and lower tiers of items are individually secured to the flatracks by ratchet straps, each having a safe working load of 2.5 tons (2267.9 kg). The vertical straps are hooked over the top chord of the bridging modules at one end and connected to the flatrack tie-down points mounted along each side edge of the flatracks at the other. To prevent longitudinal travel, each tier is secured at its forward and rear ends by a ratchet operated strap which also has a safe working load of 2.5 tons (2267.9 kg). For detailed strapping of each load, refer to Chapter 11.

1.3.2 Transporting

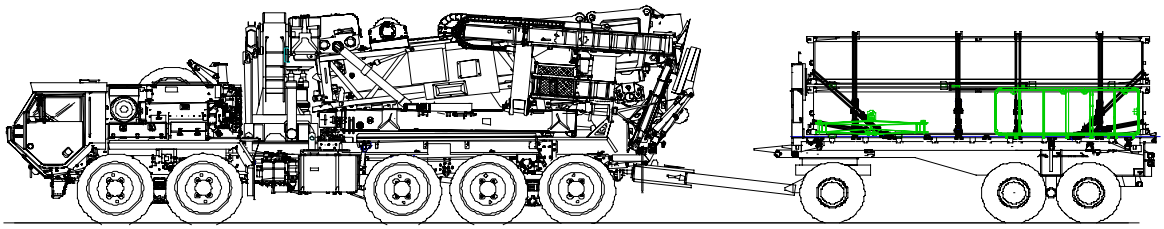
The DSB can be transported by highway, air, external air transport, marine or rail. The components can be transported as fully loaded vehicles if the transport mode allows or, the palletized loading system (PLS) enables the components to be easily and quickly transferred from one vehicle type to another where space is limited. For detailed information on all modes of transport, refer to Chapter 11.

1.3.3 Highway Transport

The bridge and launching equipment is transported on three CBT or PLS vehicles and four trailers. See Chapter 11.

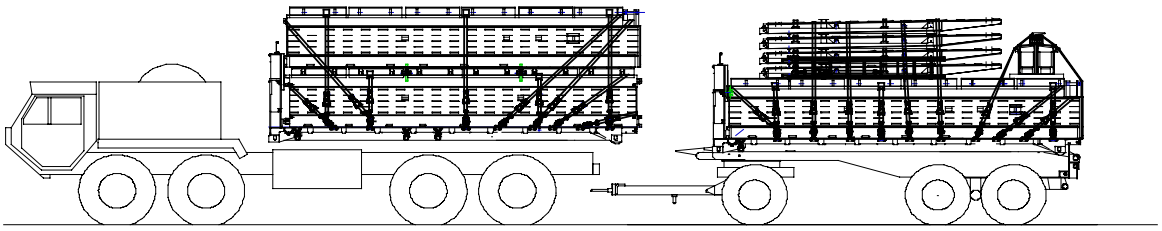
1.3.4 Air Transport

The launching system, and loaded transporters (CBT or PLS and M1076 PLS trailers) can be transported by C5 and C-17 aircraft. The bridge and the launcher vehicle can also be transported by C-130 aircraft however, the crane and launcher have to be removed. The tail-lift may be either reconfigured to remain within the space envelope or removed. Dependent on the type and internal space of the aircraft employed, components such as mirrors, spare tires and other attachments may require removal and stowage within the vehicles to enable the DSB to meet the criteria for air transportation. Similarly, the necessity to download the DSB pallet loads and the bridging modules from the flatracks may be required. If this proves necessary, the equipment will require installation on the launch vehicle and the bridging modules re-loading onto suitable transport at their destination.



LAUNCH VEHICLE (LV)
A-frame and forward Launch Beam

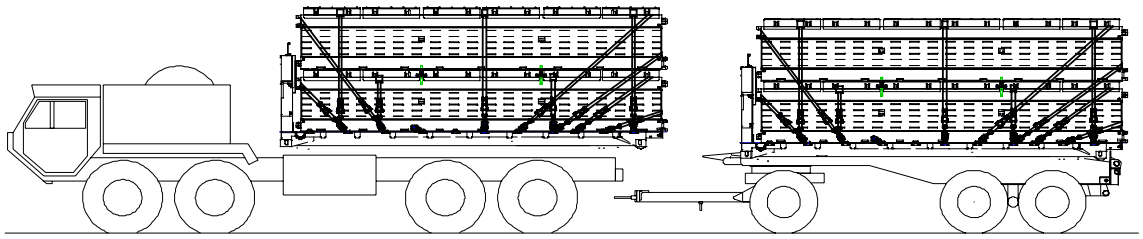
LAUNCH VEHICLE TRAILER
Consists of: 1 Module Lifting Beam
1 Launch Equipment Storage Box
7 Launch beams
2 Crane Transport Foot



VEHICLE LOAD 1 (V1)
Consists of : Far Bank Ramp Module
1 Parallel Bridging Module

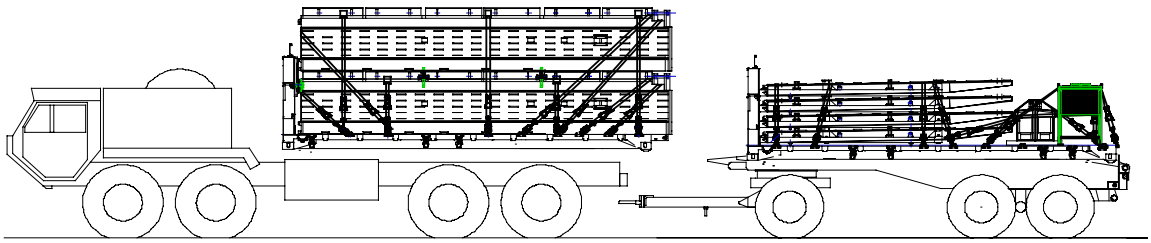
TRAILER LOAD 1 (T1)
Consists of: 1 Home bank Ramp Module
20 Approach ramps
2 End Beams
2 Module Access Ladders
12 Defile Markers
2 Packing Timber Bridge
9"Wx36"LGx3"THK

Figure 1. 14 V1, T1, V2 and T2 Loads



VEHICLE LOAD 2 (V2)
Consists of:2 Parallel Bridge Modules

TRAILER LOAD 2 (T2)
Consists of:2 Parallel Bridge Modules



VEHICLE LOAD 3 (V3)
Consists of:2 Ramp Modules

TRAILER LOAD 3 (T3)
Consists of : 20 Approach Ramps
2 End Beams
12 Defile Markers
2 Anchorage storage Boxes
2 Packing Timber Bridge
9"Wx36"LGx3"THK

Figure 1. 15 V2, T2, V3 and T3 Loads

1.3.5 External Air Transport (E.A.T.) - Helicopter Lift

The DSB flatrack loads, including the trailer load LVT, are transportable by CH-47 as underslung loads. (For detailed slinging information refer to Chapter 11).

1.3.6 Marine Transport

The DSB launcher vehicle and loaded transporters are transportable by landing craft utility (LCU) 2000 or larger vessels and ships. Normal loading and strapping procedures for marine cargo apply.

1.3.7 Rail Transport

1.3.7.1 The DSB launch vehicle and loaded transporters can be transported by railway flatcar, although downloading of the DSB pallet loads may prove necessary. Rail clearance specifications are governed in the USA by the AAR and in Europe by the Gabarit International de Chargement clearance diagram.

1.3.7.2 The crane and launcher require removal from the launcher vehicle chassis for unrestricted rail transport and re-installation on arrival at their destination. The launch vehicle has however, also been designed to be transportable as a complete vehicle where bridge clearances allow. For detailed rail transport information, refer to Chapter 11.

1.3.8 Shipping Data Plate

1.3.8.1 Each shipping unit is provided with a shipping unit data plate for each transportation mode (where different criteria are employed according to the mode utilized). The data plate(s) is attached in a prominent but protected position, the plate shows the silhouette of the unit in its transport configuration and indications of its center of gravity and the location of the lifting and tie-down points.

TABLE OF CONTENTS

CHAPTER 2

TECHNICAL DESCRIPTION AND DATA

CHAPTER 2

TECHNICAL DESCRIPTION AND DATA

Section I. LAUNCHER VEHICLE

2.1 DETAILED DESCRIPTIONS

NOTE

When an item on the vehicle or launcher is referred to as front or rear, left or right, the cab is taken as the front of the launcher vehicle, all references are taken as if personnel are looking forward towards the cab. Therefore if the left hand side A-frame leg is being discussed, the A-frame leg on the launcher vehicle's left hand side is the item being described, i.e. the driver's side.

When referring to the launch beam the front of the beam is to be taken as the far bank and the rear is taken as the home bank. Similarly the far bank carriage is the one nearest the far bank and the home bank carriage is the one nearest the home bank.

2.1.1 Power Take Off (PTO) and Hydraulic Pump

2.1.1.1 The variable displacement pump provides the hydraulic power to operate the equipment services. The pump powers the launcher and crane hydraulic circuits and is driven itself via a power take-off on the vehicle transmission.

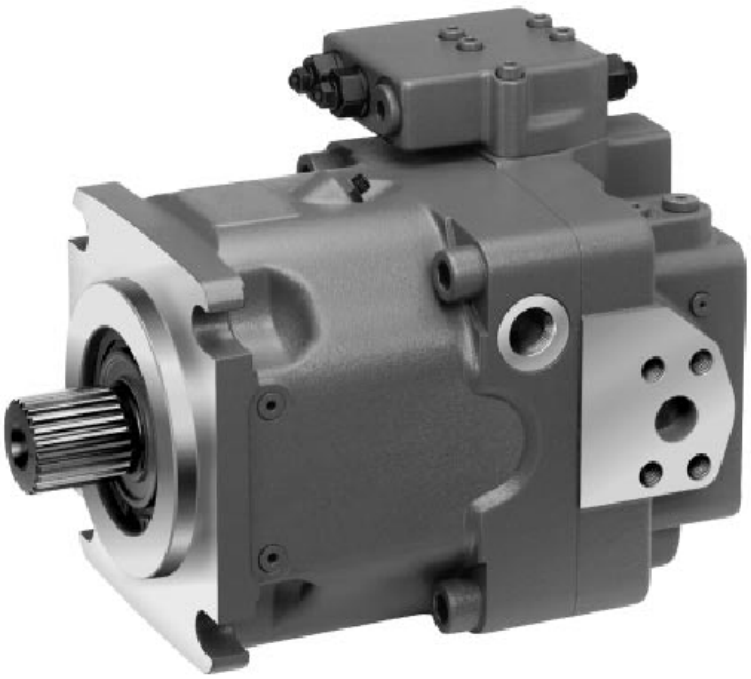


Figure 2. 1 Hydraulic Pump

2.1.1.2 A cross connection facility (Figure 2. 2. (1)) is provided on the launcher to allow another suitable hydraulic system to be connected to the DSB launch vehicle in the event of the hydraulic pump or engine failing. This allows the launcher to complete its mission at a lower speed.

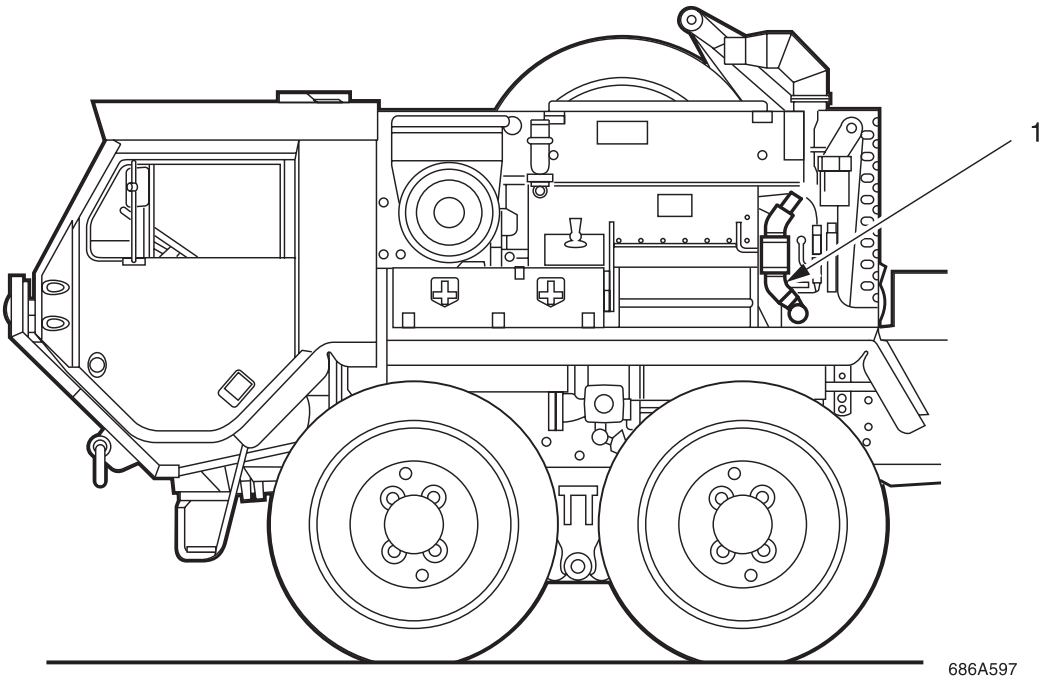


Figure 2. 2 Cross Connection Facility

2.1.2 Launch Beam Lifter and Module Lifting Beam

2.1.2.1 The lifting equipment is dedicated to its particular function (either launch beam or parallel/ramp module transfer) and is not interchangeable. The smaller launch beam lifter, used for the launch beam modules, is of fixed geometry and is suspended from the crane hook via a 6 ft 6 in (2 m) extension sling during operation.

2.1.2.2 The larger module lifting beam, used for the parallel modules, also attaches to the crane hook via a 6 ft 6 in (2 m) extension sling and has a three-position configuration. Two arms at each end of a central beam are held in one of three positions by quick-release shootbolts. The positions of the arms are dependent on use, module deployment, module folding or stowage of the lifting beam itself.

2.1.3 Tail lift

2.1.3.1 When deployed, the tail lift provides a work platform for the crew members designated as parallel module pinners during bridging operations. It comprises a foldout platform and extending walkway sections. The tail lift is attached to mounting brackets on the vehicle chassis. It is deployed by hydraulic cylinders, controlled by a tail lift handset.

2.1.4 Tail lift Platform

2.1.4.1 The tail lift platform (Figure 2. 4) is located at the rear of the launch vehicle and consists of both folding and extending sections.

2.1.4.2 The platform unfolds and extends to form a platform 19 ft 4 in (5.9 m) long (across the rear of the vehicle) and 2 ft 11 in (0.9 m) wide. Safety handrails 3 ft 6 in (1.07 m) high are inserted around the perimeter of the platform.

2.1.5 Tail lift Hydraulic Cylinders and Controls

2.1.5.1 Hydraulic swing, lift and tilt cylinders are operated remotely from the tail lift handset. The height of the tail lift may be adjusted to position it at the most convenient level for the height of the crewmembers. In the event of loss of electrical power, direct manual operation is possible from the selector valve. An emergency stop button is located below the selector switches on the tail lift pendant Figure 2. 3.

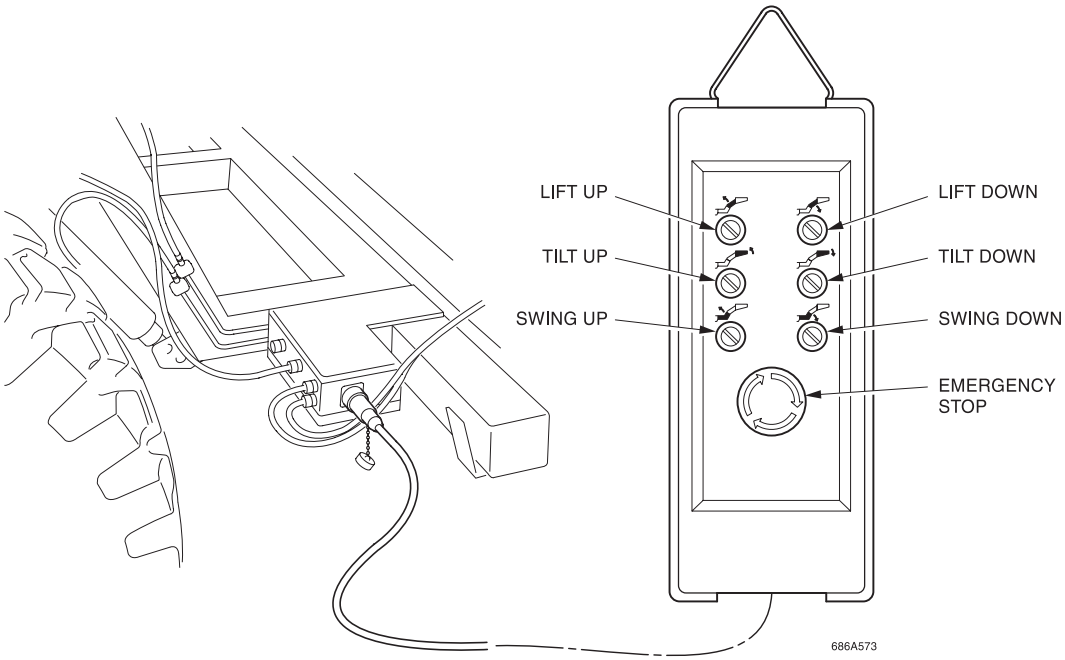


Figure 2. 3 Tail lift Pendant

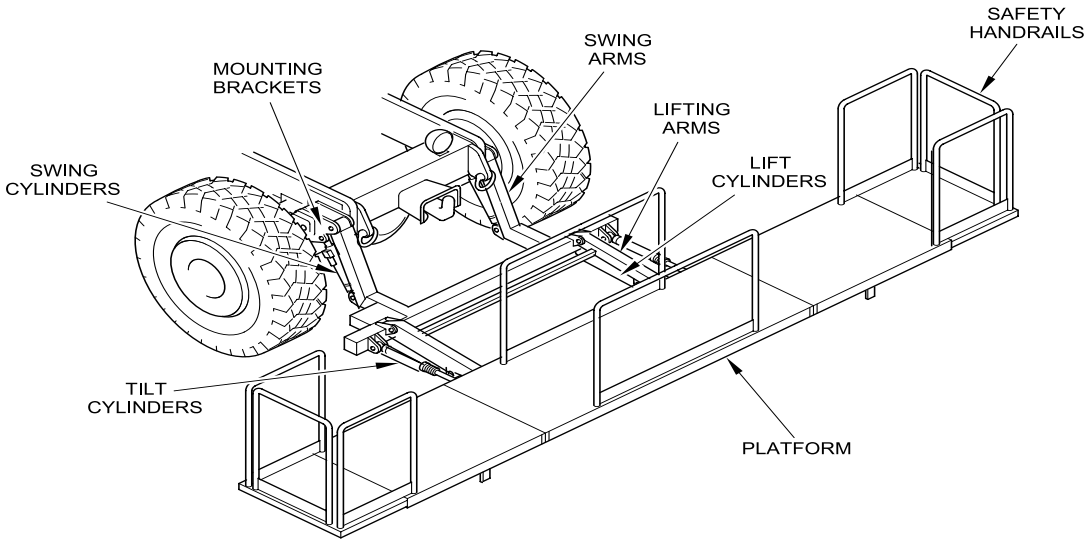


Figure 2. 4 Tail lift

2.1.6 A-Frame

The A-frame is of steel construction and when deployed it, stabilizes the rear of the launch vehicle. The A-frame provides a level home bank platform for the launch frame, launch beam and parallel modules. It comprises upper and lower transverse beams, stabilizer legs, hydraulic cylinders and control valves.

2.1.7 Upper A-Frame Transverse Beam

2.1.7.1 The upper A-frame transverse beam spans the rear of the vehicle and consists of a central beam connected to the launch frame. The upper A-frame central beam incorporates a pivot to which the launch frame attaches.

2.1.7.2 The launch frame is moved vertically on the A-frame legs by the operation of hydraulic cylinders. The transverse beam is pinned in its upper position for deployment of the parallel modules.

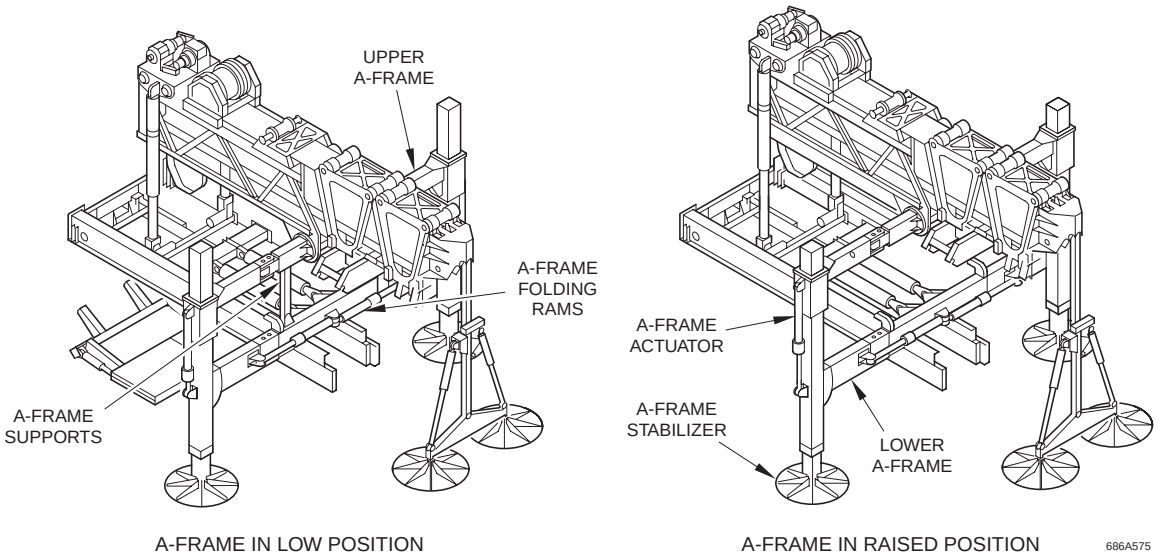


Figure 2. 5 A-Frame

2.1.8 Lower A-Frame Transverse Beam

The lower A-frame transverse beam spans the rear of the vehicle and attaches to the rear of the slide frame by a hinged arrangement, and to the A-frame legs at their hinge points. The beam provides mounting for the A-frame to fold and rotate. A spirit level installed on the beam accurately positions the horizontal axis of the A-frame by adjustment of the stabilizer legs.

2.1.9 A-Frame Legs

2.1.9.1 The A-frame legs consist of the leg itself and an internal sliding stabilizer leg to which is attached a circular baseplate. The stabilizer leg is extended or retracted by the stabilizer cylinder to vary the height of the A-frame. The control valve for manual operation of the A-frame stabilizer leg is mounted on the outer face of the lower center beam.

2.1.10 Hydraulic Cylinders

2.1.10.1 The A-frame rotate hydraulic cylinders rotate the A-frame assembly from its stowed to its working position.

2.1.10.2 The A-frame folding hydraulic cylinders fold the A-frame legs from the stowed to the working position.

2.1.10.3 The A-frame stabilizer leg cylinders are extended and or retracted to allow the launching equipment to be leveled ready for bridge building.

2.1.10.4 The A-frame raise hydraulic cylinders elevate the upper A-frame transverse beam ready for bridge deployment.

2.1.10.5 Two articulator cylinders are connected to the launch frame and the slide frame cross member. They are used to articulate the launch beam to accommodate varying bank heights. To allow bridge build the articulator cylinders are detached from the slide frame cross member and stowed. To facilitate stowing, stow cylinders are used to rotate the articulator cylinders clear of the bridge surface during building.

2.1.11 Hydraulic Controls

2.1.11.1 The hydraulic operation of the A-frame is controlled from two locations on the vehicle. The A-frame fold and rotate functions are operated from the operators cabinet located above the tool chest on the right hand side of the launch vehicle. Limit switches are incorporated into the circuit to guard against incorrect sequencing of operations.

2.1.11.2 The A-frame stabilizer legs are operated by two manual levers mounted on the center rear face of the lower A-frame transverse beam.

2.1.11.3 With the launcher deployed, hydraulic control is carried out via the chest pack. Should electrical failure occur all cylinders and motors can be operated manually.

2.1.12 Launch Frame

2.1.12.1 The launch frame is a steel framework through which the launch beam passes during launch beam deployment. It is attached at its forward end to the A-frame and at the rear end to the slide frame via the articulator cylinders. Once beam deployment is complete, the articulator cylinders are stowed. The forward launch beam is retained in the launch frame after beam retrieval. Mounted on the launch frame are various roller assemblies, hydraulic valves, winches and the launch beam drive unit.

2.1.12.2 At the back of the launch frame (by the articulating cylinders) is the launch beam stop. This prevents over deployment of a launch beam if no following beam is attached.

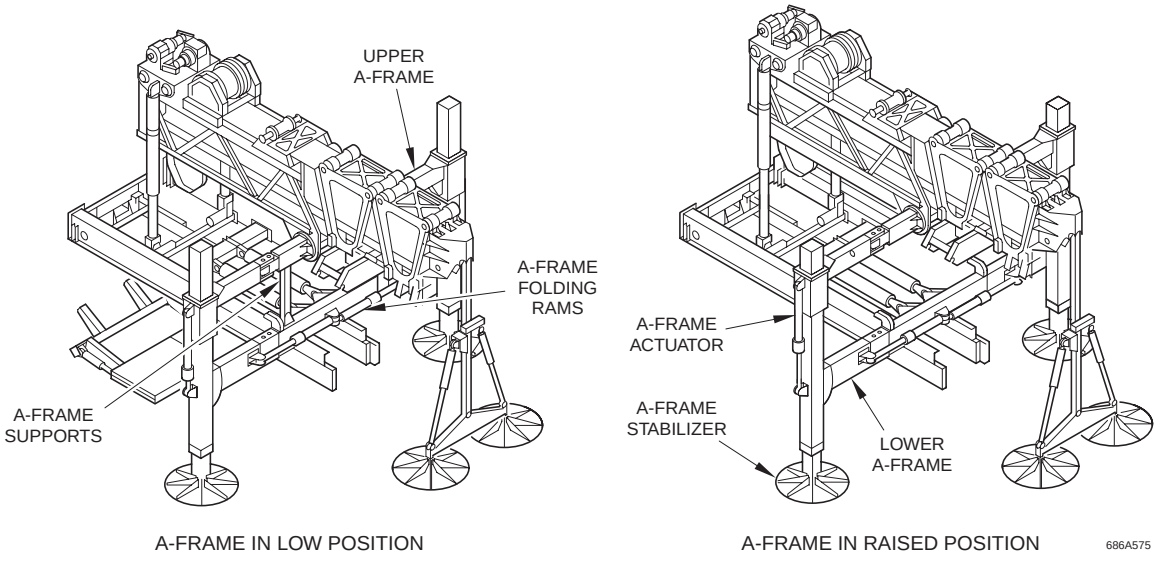


Figure 2. 6 A-Frame and Launch Frame

2.1.13 Roller Assemblies

2.1.13.1 At the bottom rear of the launch frame is a pinch roller, which ensures that the launch beam maintains contact with the launch beam drive.

2.1.13.2 At the bottom front of the launch frame is a twin set of rollers, which support the launch beam during deployment.

2.1.13.3 Four vertical side rollers mounted on either side of the launch frame ensure that the beam is guided centrally through the launch frame.

2.1.13.4 A roller assembly mounted on the top of the launch frame ensures that the correct winch cable fleet angle is maintained.

2.1.14 Drum Winches

2.1.14.1 A drum winch is installed on the upper and lower surfaces of the launch frame. Attached to the winches are the wire cables used to control and operate the home and far bank carriages.

2.1.15 Winch Tensioners

Lower Winch

2.1.15.1 The lower winch tensioner (Figure 2. 7) is the simpler of the two tensioners fitted to the launch frame. It is of a purely mechanical design. It consists of a spring loaded roller which spans the full width of the winch drum and maintains a positive force on to the cable to reduce the possibility of the rope becoming slack on the drum when too much cable is paid off, a primary cause of winch cable nesting.

2.1.15.2 The tensioner does however have its limits and will not stop the cable from nesting; it only allows more cable to be paid off before the cable starts to nest. The tensioner is only a backstop; it should not be used to compensate for poor control of the winch by the chest pack operator.

2.1.15.3 The lower tensioner is primarily used when the bridge is being lowered or picked up. During this process slack cable is paid off the winch to allow the carriages to be lowered, allowing the slings to be attached to the bridge.

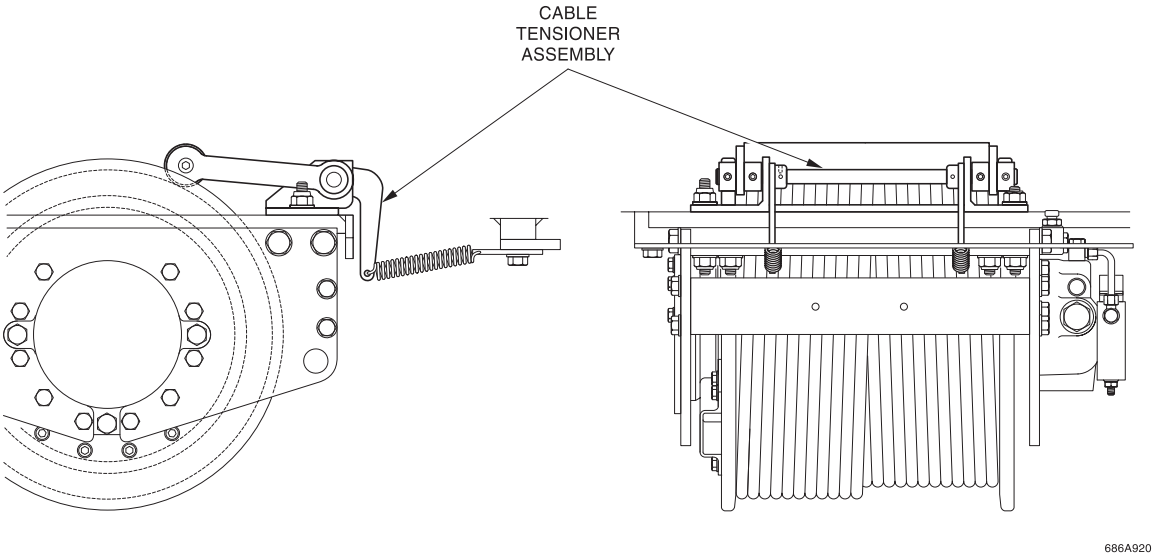


Figure 2. 7 Lower Winch Tensioner

Upper Winch Tensioner and Winch Tension Indicator

2.1.15.4 The Upper winch tensioner consists of two assemblies. The winch tensioner (Figure 2. 8) is a spring-loaded roller of a similar design to that used on the lower winch. Again, the tensioner maintains a positive pressure on the cable to help prevent the cable from becoming slack on the drum.

2.1.15.5 The upper winch cable tension indicator assembly (Figure 2. 9) consists of a roller, pivot arm and limit switch which are used to stop excessive cable being paid out. The roller sits on top of the upper winch cable, when the cable goes slack such that it sits on top of the launch beam the roller is lowered and trips the limit switch. Once the limit switch has tripped, the winch is prevented from paying out any more cable. It can only pay in cable so that tension is re-established.

2.1.15.6 The limit switch is monitored via the firmware in the launcher main control enclosure, and is only functional in a HIGH BANK build. It is only in HIGH BANK that the top winch is driven proportionally via the chest pack joystick. In all other instances, the upper winch is either applying back tension, which is trying to pull in cable or the cable, is being pulled off the upper winch.

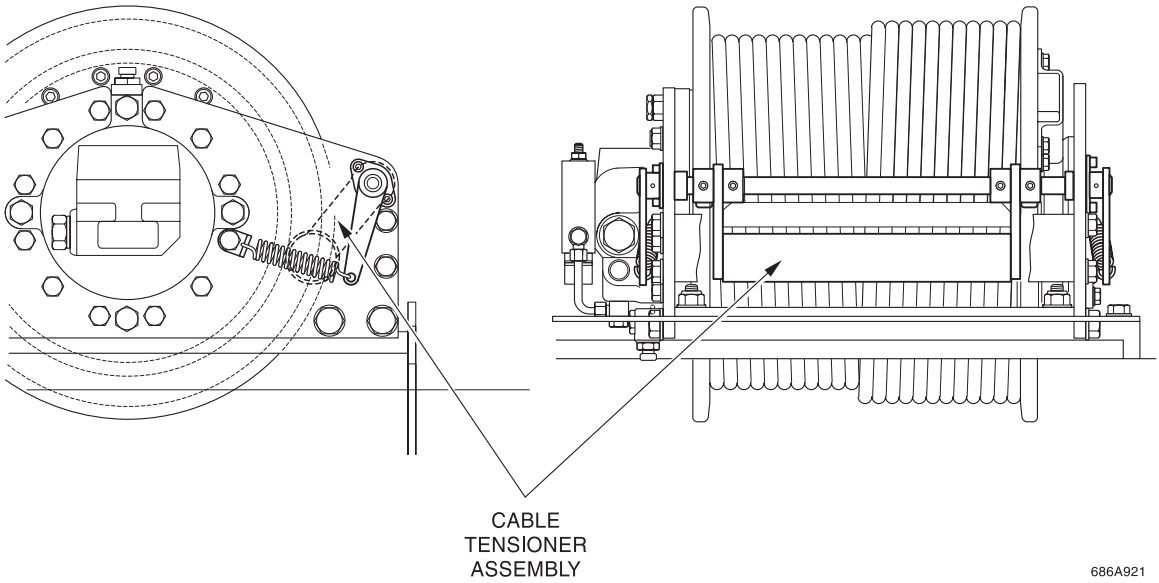


Figure 2. 8 Upper winch Tensioner

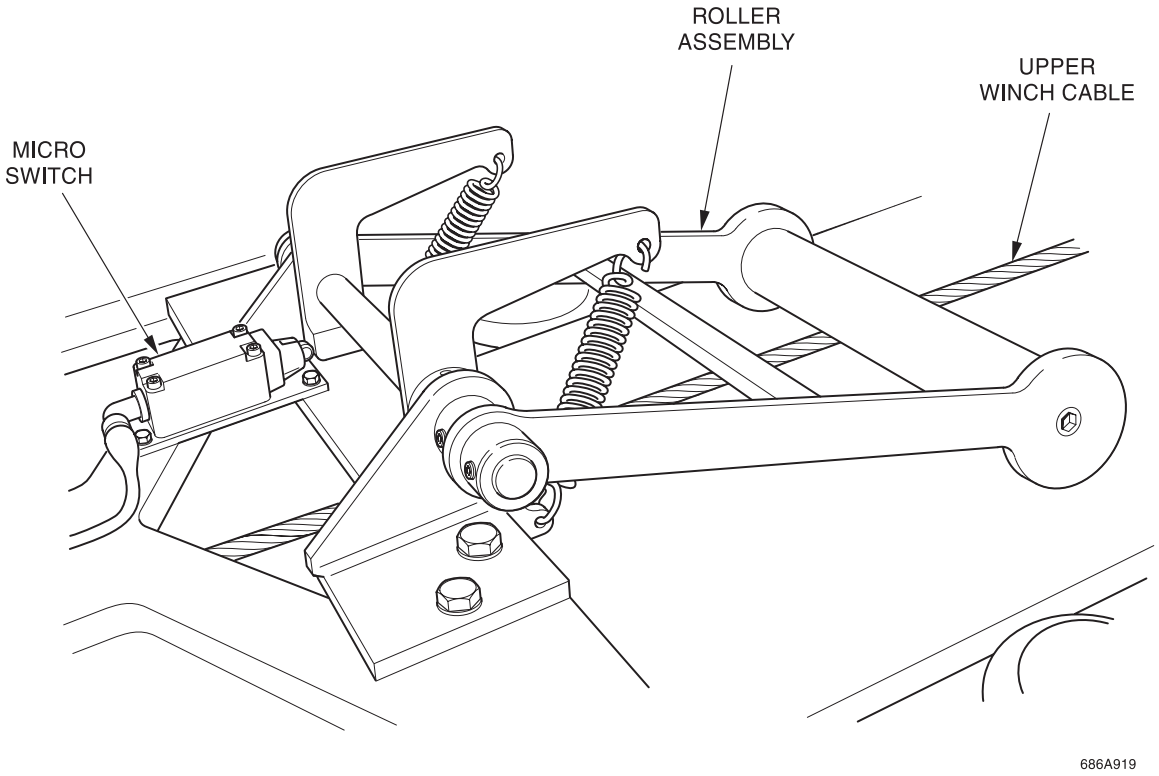


Figure 2. 9 Upper Winch Cable Tension Indicator

2.1.16 Launch Beam Drive

2.1.16.1 The launch beam drive is mounted on top of the launch frame and is controlled from the chest pack. The unit propels the launch beams in the required direction during build/retrieval. In the event of chest pack failure, the manual control valve mounted on the A-frame frame stabilizer leg allows manual operation.

2.1.17 Slide Frame Assembly

2.1.17.1 After deployment of the tail lift, A-frame and launch frame, the slide frame is used to create the work area required (between the crane and the A-frame) to position the launch beam and bridging modules for loading. It comprises a telescopic frame, relax mechanism and tilt rollers.

2.1.18 Slide Frame

2.1.18.1 The frame comprises of three pairs of telescopic steel box sections. The inner (forward) box sections (Section 1) attach to the launch vehicle chassis via the relax mechanism and the outer (rear) box sections (Section 3) connect to the A-frame by a hinged arrangement on the lower transverse beam of the A-frame. The center box sections (Section 2) attach the inner and outer sub-frames.

2.1.18.2 Removable rollers are positioned on Section 2 of the slide frame prior to bridge deployment and removed prior to slide frame retraction. Section 3 of the slide frame has adjustable height tilt rollers attached which are used to orientate the bridge to the same angle as the launch beam, so that varying bank heights can be accommodated during bridge construction.

2.1.18.3 The left and right hand sections of the slide frame are connected by two cross members. Twist-lock blocks mounted on a bracket at either side of Section 3 retain the slide frame in the transportation position, until released for deployment. Release of the twist-lock fasteners allows the deployment of the slide frame by driving the launch vehicle forwards.

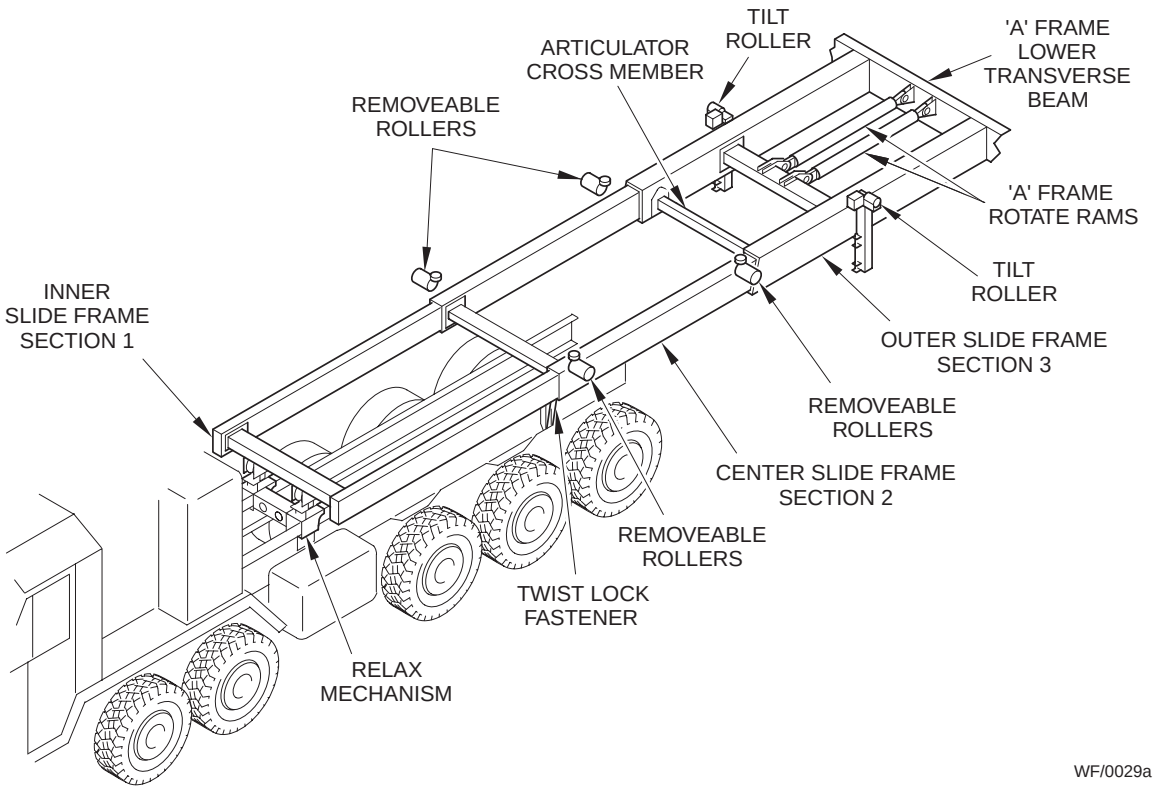


Figure 2. 10 Slide Frame

2.1.19 Relax Mechanism

2.1.19.1 The relax mechanism attaches Section 1 of the slide frame to the vehicle chassis. The mechanism is unlocked by manual operation of shootbolts, the relax mechanism allows a controlled sliding movement of -25 mm to +80 mm during bridge build.

2.1.19.2 Four hydraulic cylinders are used to re-set the relax mechanism to its neutral position on completion of bridging operations. Movement of the cylinders re-aligns the holes to permit re-installation of the shootbolts, locking the relax mechanism in its neutral setting. Limit switches, operated by the shootbolts, prevent operation of the chest pack controls until the relax mechanism is unlocked for operation.

2.1.20 Tilt Rollers

2.1.20.1 Two tilt rollers are used to orientate the bridge so that it is parallel to the launch beam during bridging operations. They are extended/retracted by hydraulic cylinders fitted inside the main body of the tilt roller. This operation is controlled via the chestpack.

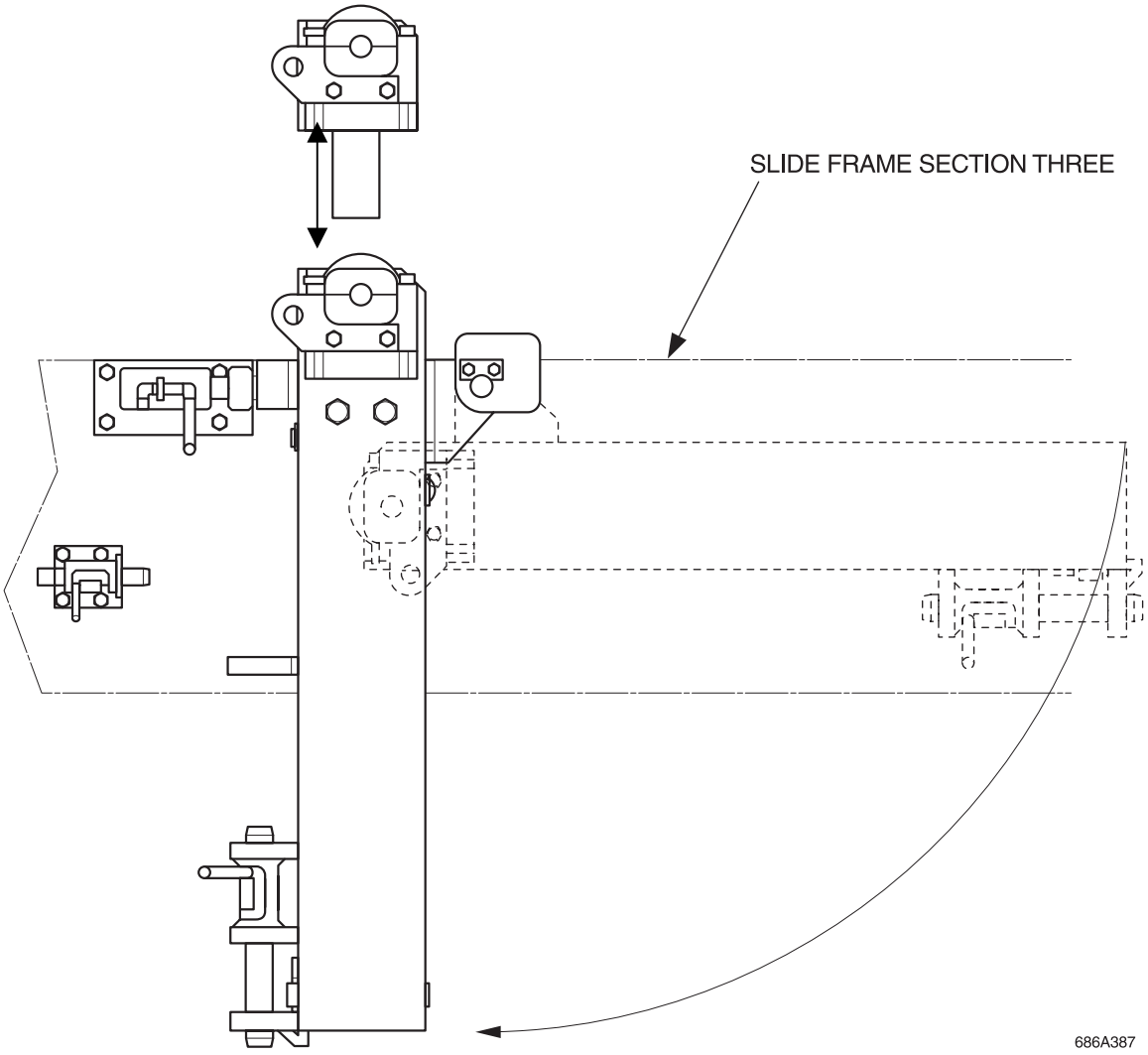


Figure 2. 11 Tilt Roller Deployed

2.1.21 Launch beam

2.1.21.1 The launch beam, when deployed, provides support for the home and far bank carriages from which the bridge is suspended during bridge construction. It comprises eight launch beam modules, which connect together to form the launch beam. Seven identical beams are transported to the bridging site on a PLS flatrack carried on an M1076 PLS trailer. The forward launch beam is permanently carried in the launch frame of the launch vehicle.

2.1.21.2 The connection systems at either end of the beams are identical and consist of an upper and lower six lug jaw system.

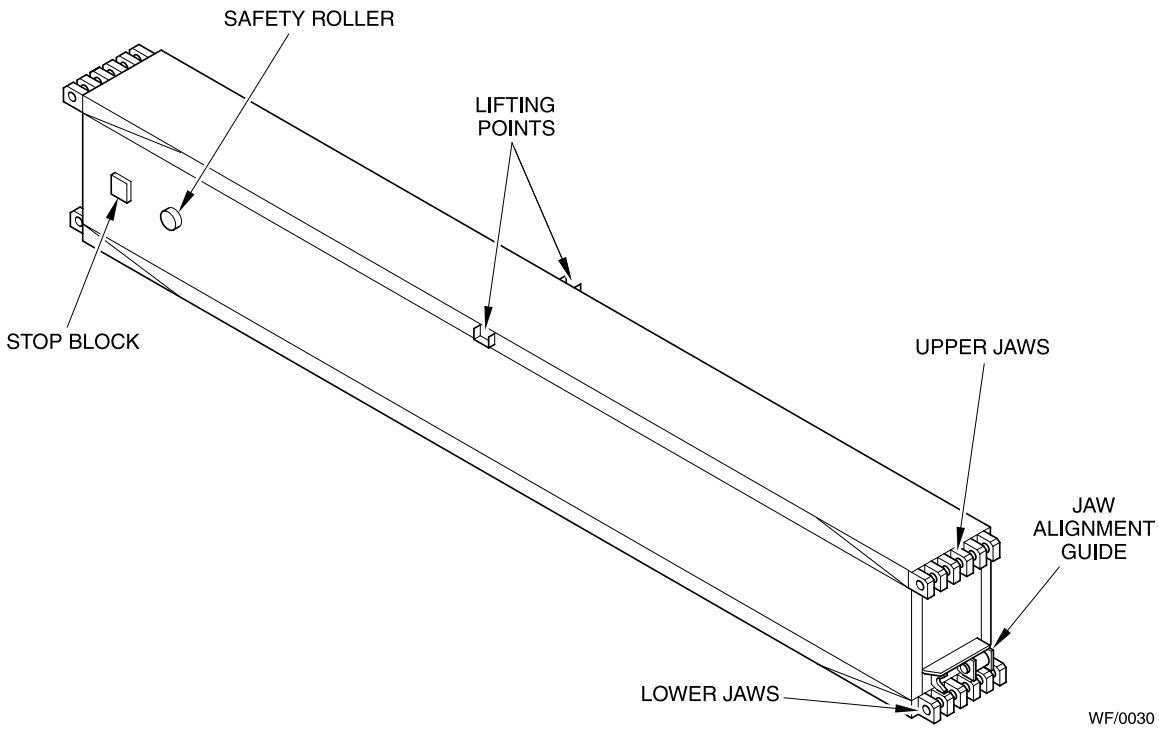


Figure 2. 12 Launch Beam

2.1.21.3 The jaws of each beam are aligned to contact the jaw lugs of the beam already positioned in the launch frame and then pinned in position. The upper jaws first and then the lower jaws.

2.1.21.4 The launch beam connecting pins incorporate a flat on the head of the pin, which allows insertion into the lugs in one position only. The forward launch beam is permanently retained in the launch frame. It has a jaw connection system identical to that of the standard launch beam on one end. The opposite end having the mounting point for the far bank support along with winch cable pulleys.

2.1.21.5 The launch beams incorporate safety rollers and stop blocks to prevent over deployment of a launch beam if no following beam is attached.

2.1.22 Home and Far Bank Carriages

2.1.22.1 The home and far bank carriages are similar assemblies manufactured from aluminum alloy. They consist of upper frames and lower bridge lifting beam assemblies pinned together by shootbolts. They are operated and moved by the drum winches on the launch frame.

2.1.22.2 Two roller assemblies mounted on the top of each upper frame assembly support the carriages on the launch beam. Grooved pulleys are installed on both the upper assembly and on the lower bridge lifting beams to allow separation of the two halves to lower the bridge.

2.1.22.3 The lower bridge lifting beams also incorporate attachment points for the bridge lifting slings. The upper and lower assemblies are fitted with a guide system and attachment lugs to enable the assemblies to be manually pinned together.

2.1.22.4 Steel wire ropes from the drum winches, on the launch frame, are routed around the launch beam to the home and far bank carriages see Figure 2. 13. The upper winch cable being routed along the top of the launch beam around the end of the forward launch beam and connecting to the front of the far bank carriage. The lower winch cable passing underneath the launch beam around both carriages grooved pulleys and connecting to the rear of the far bank carriage.

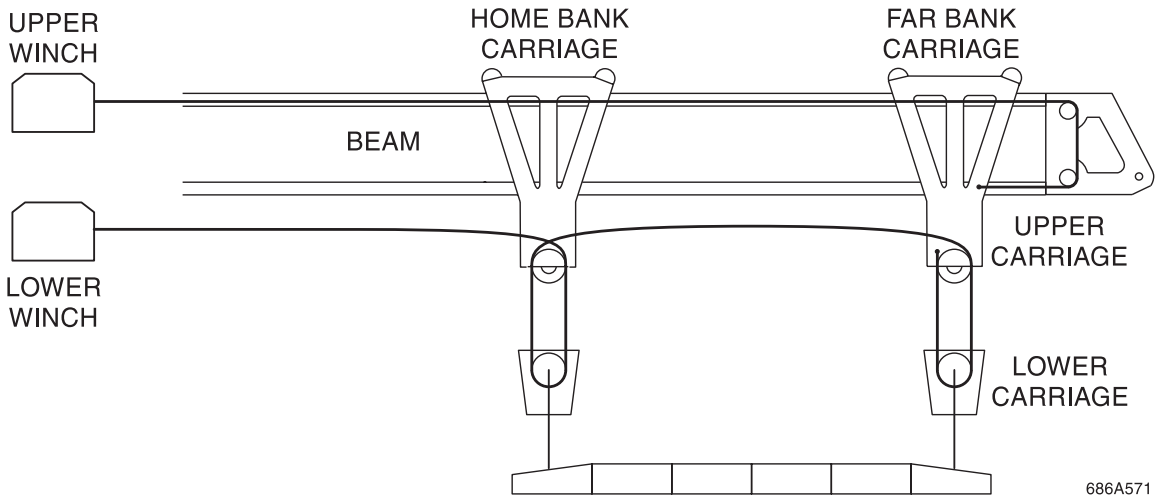


Figure 2. 13 Winch Cable Routing

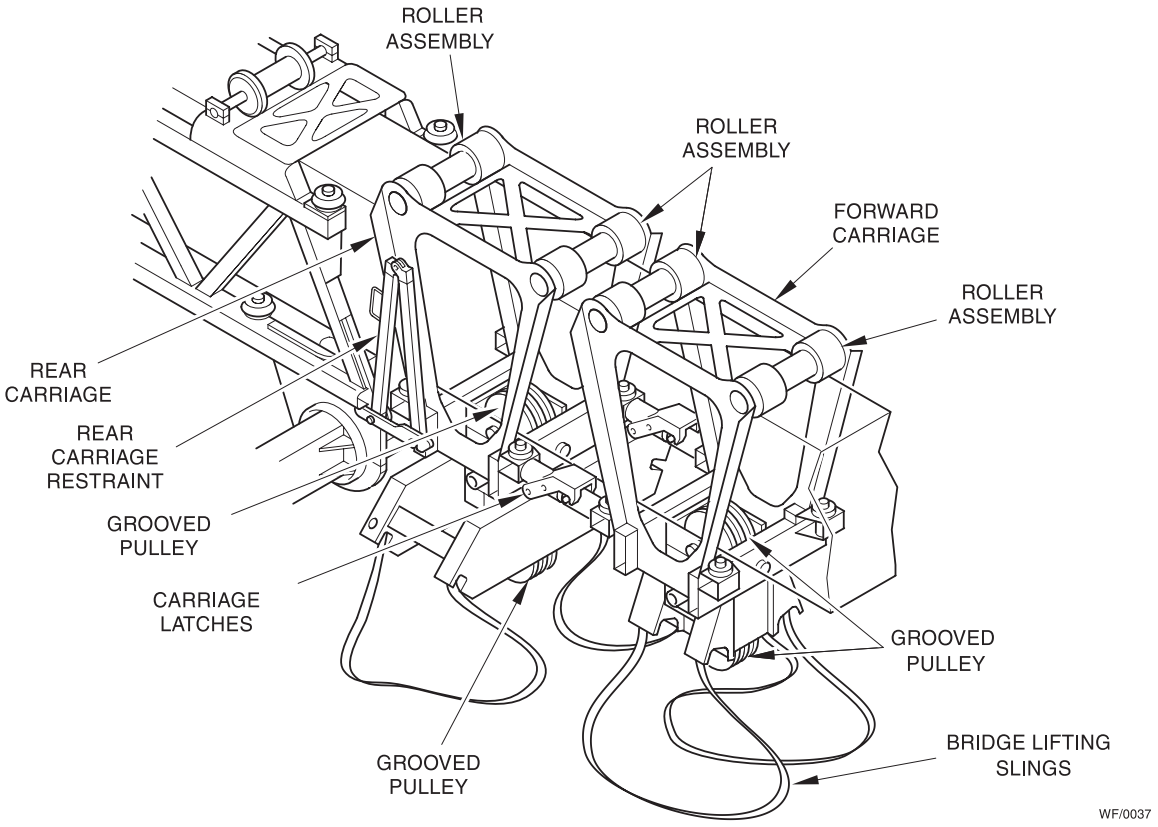


Figure 2. 14 Home Bank and Far Bank Carriages

2.1.24 Walkways

2.1.24.1 Fixed and removable walkways are positioned on the launch vehicle to allow safe and easy access for tasks to be carried out.

2.1.24.2 The fixed walkways are attached to section three of the slide frame.

2.1.24.3 Fixed walkways are also attached to the crane sub frame. This allows access down the center of the vehicle.

2.1.24.4 Removable walkways are stored between the launch vehicle chassis rails and on top of the fixed walkways beneath the launch frame. These walkways are arranged on the launcher once it has been fully deployed.

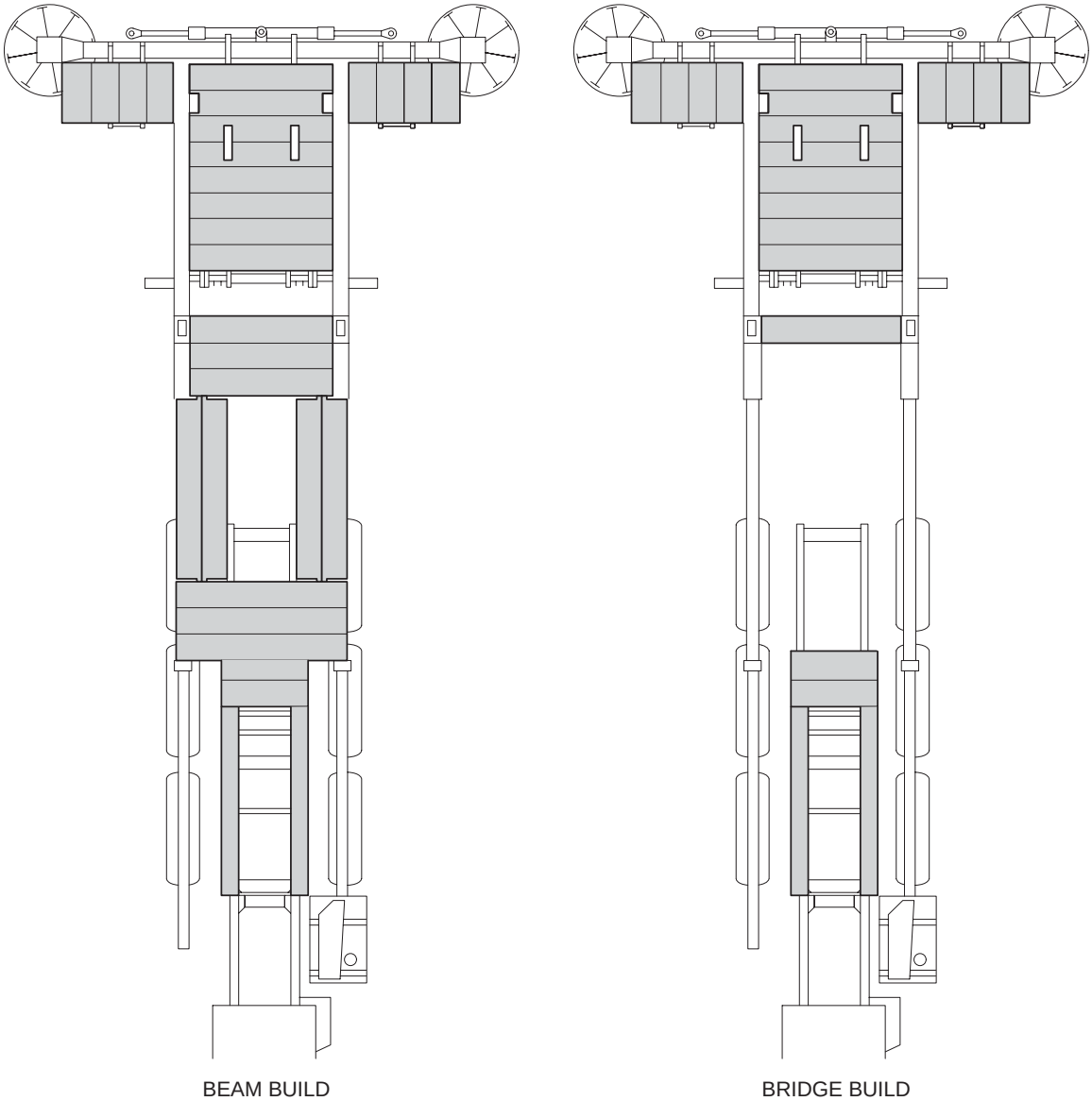


Figure 2. 16 Walkway Positions for Beam and Bridge Build

2.2 CRANE SYSTEM

2.2.1 Crane

2.2.1.1 The crane system is used to transfer the launch beams and parallel modules from their flatracks to the launcher during bridging operations. The system comprises a Atlas 390.1 LM Plus crane, a launch beam lifter for the launch beams and a bridge module lifting beam for use with the bridge modules.

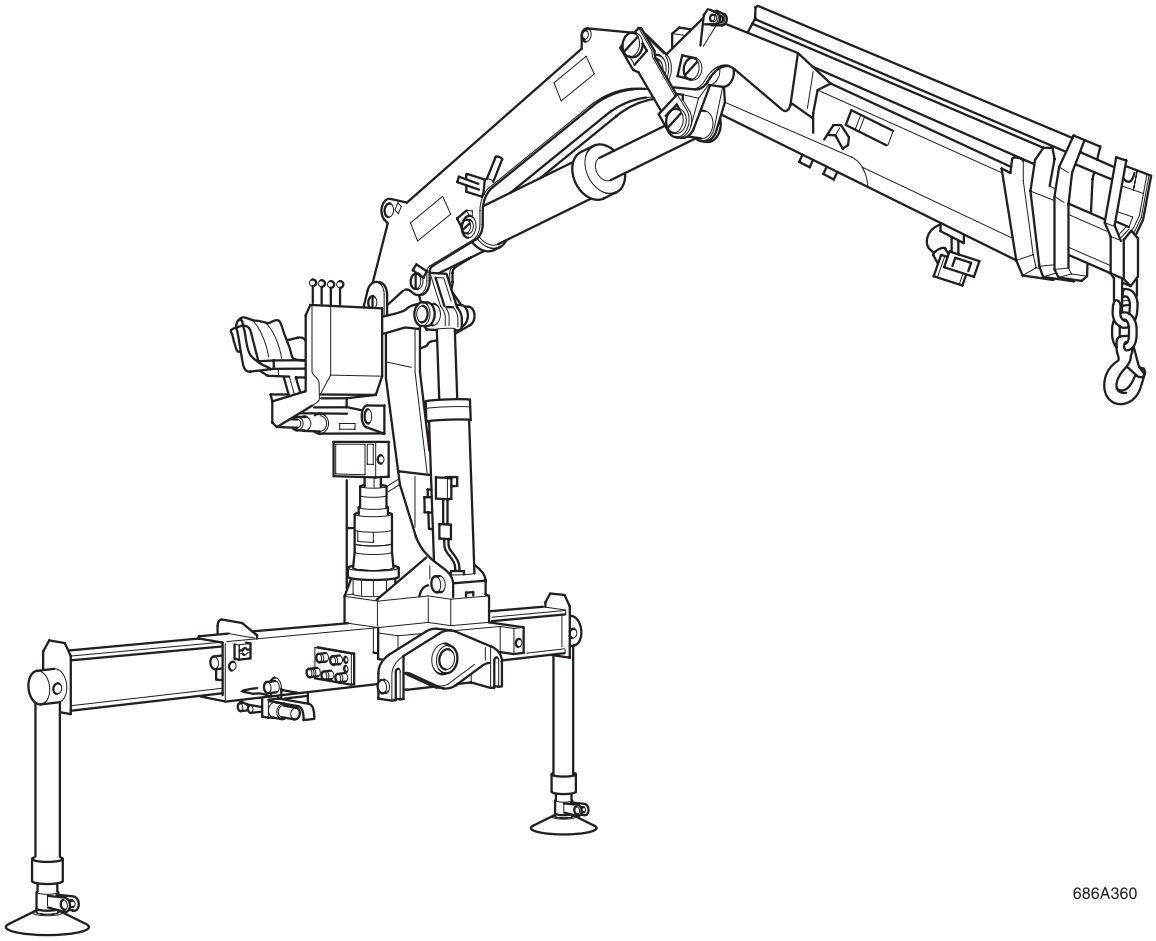


Figure 2. 17 Launch Vehicle Crane

2.2.1.2 The crane is hydraulically powered and is of the knuckle boom type. This enables the boom of the crane to be folded hydraulically.

2.2.1.3 The crane is attached to a sub-frame, which is located on top of the launch vehicle chassis. The connection of the crane to the sub-frame is achieved via four pins which when extracted allow the crane to be removed.

2.2.1.4 Incorporated into each side of the crane base is a stabilizer leg, deployed and operated by stabilizer hydraulic cylinders. The crane cannot be operated unless both its stabilizer legs are deployed and down.

2.2.1.5 The crane can rotate on its column a full 360 degrees.

2.2.1.6 The knuckle boom system consists of a main boom and a three-part telescopic jib. Mounted on the jib is a rotatable load hook with a safety catch. The boom and jib are actuated by the lift, the jib and the three telescopic extension hydraulic cylinders.

2.2.1.7 The crane incorporates an overload protection shut-off system. In the event of any overload situation, however caused, the system prevents any further movement of the crane boom, which will increase the load moment. This system only allows movements that reduce the load moment and continued operation within the rated capacity of the crane.

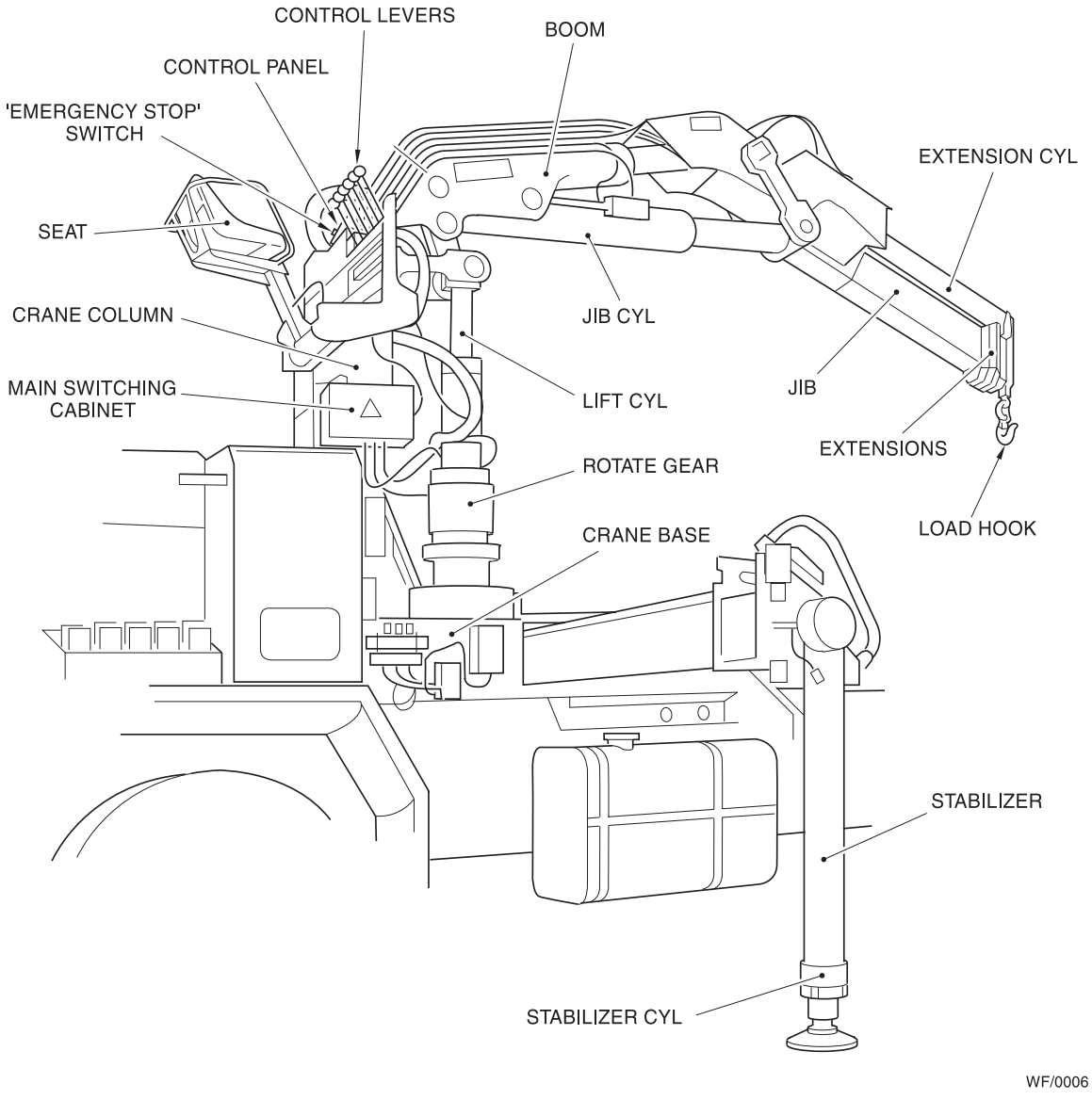


Figure 2. 18 Crane Nomenclature

2.1.23 Far Bank Support

2.1.23.1 When the launch beam is fully deployed, and reaches the far bank, it is lowered to accommodate the height difference between the two banks. The launch beam is supported on the far bank by the far bank support.

2.1.23.2 The far bank support comprises a central telescopic column, a bottom pivot beam and two ground bearing pads. The ground bearing pads are fitted to the ends of the beam prior to deployment of the launch beam.

2.1.23.3 The bottom beam pivots to accommodate far bank cross slopes of up to 1 in 20.

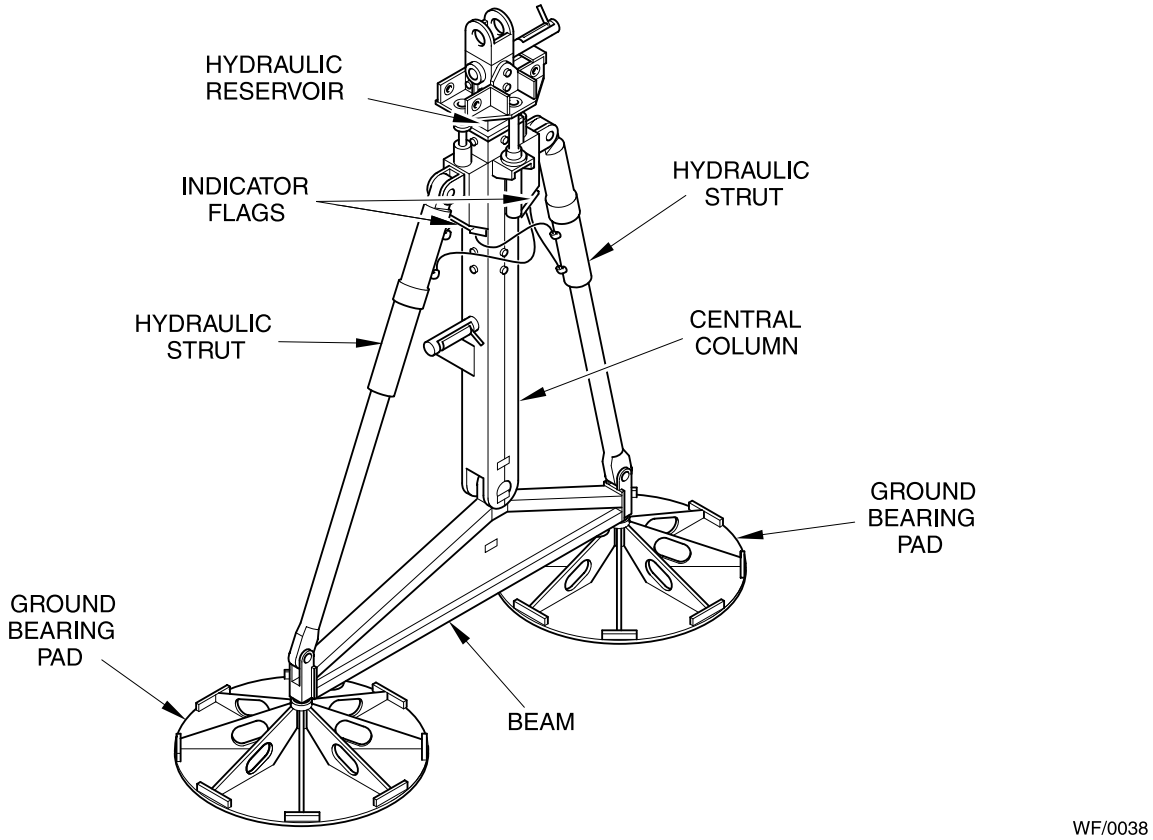


Figure 2. 15 Far Bank Support

2.1.23.4 The far bank support is stabilized by telescopic hydraulic struts, which lock the far bank support assembly laterally, creating a stable support for the launch beam (and bridge during construction).

2.1.23.5 Yellow Indicator flags confirm that the far bank support is locked in position. There is no need for an operator to cross the launch beam to manually adjust the far bank support prior to commencement of the bridging module deployment.

2.1.23.6 The far bank support is permanently connected to the forward launch beam.

2.3.1.5 When in the folded condition, the modules are 8 ft (2.447 m) wide (over the nibs) and 14 ft (4.302 m) wide when deployed. One end of the ramp module incorporates a dowel and shootbolt arrangement along with a jaw configuration. This connection system is common with the parallel modules.

2.3.1.6 The toe end of the ramp incorporates an aperture in which the end beam locates, it is held by an upper fixed and a lower removable pin, which is locked by a twisting action. Guide pads located within the aperture are used to align the lower holes of the end beam and the ramp module.

2.3.1.7 With the end beam inserted, a continuous gutter is created onto which the approach ramps are ‘hooked’ to complete the end of bridge.

2.3.2 Ramp End Beam

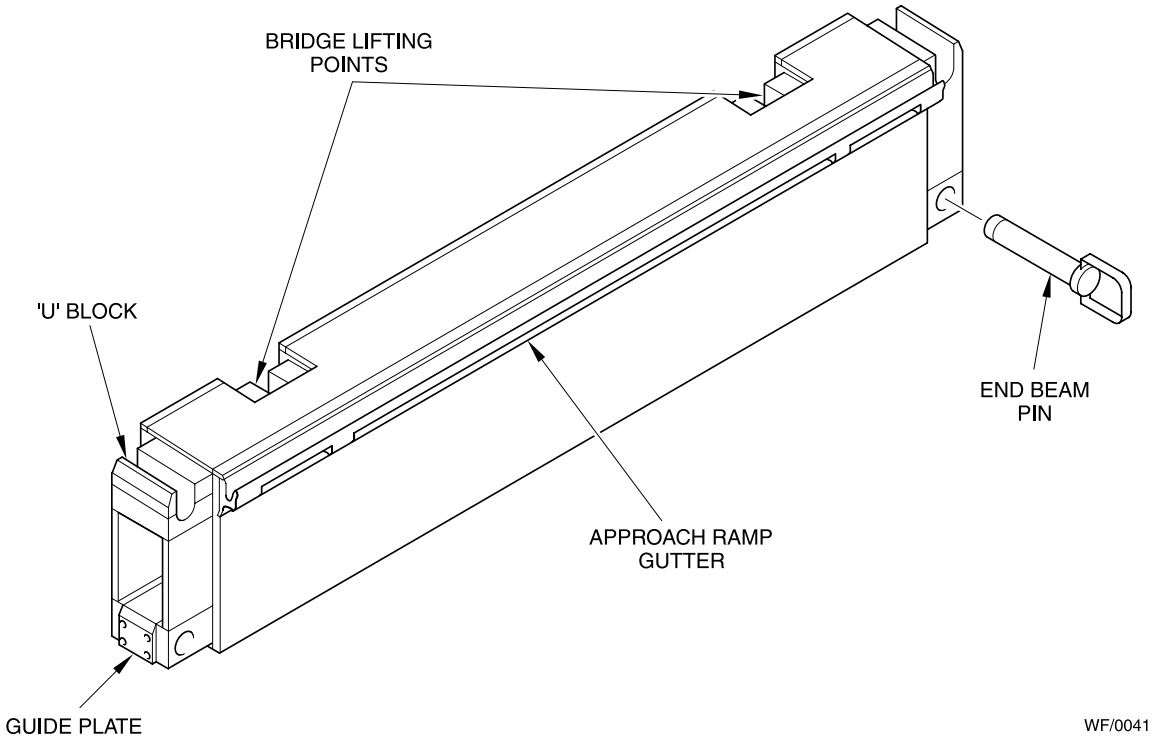


Figure 2. 20 End Beam

2.3.2.1 The end beam is a rectangular welded box section, which is positioned in an aperture at the toe end of each ramp module. It includes bridge lifting points through which the forward carriage straps are routed and also provides mounting for the bridge approach ramps. Fixed pins within the aperture of the ramp module locate on the end beam as the ramp module is lowered down onto it and side guide pads aid alignment of the lower holes. The end beam is secured to the ramp module at its lower edge by insertion of twist-to-lock pins.

2.3.3 Parallel Modules

NOTE

It should be noted that the parallel modules are interchangeable and reversible when connecting to each other and ramp modules.

2.3.3.1 The parallel modules have an overall length of 19.54 ft (5.955 m) and each consists of six transverse deck units attached at 24 hinge points to two longitudinal parallel panels.

2.3.3.2 For transportation, the two parallel panels are rotated about the hinge points and stored underneath the deck units to form a compact transportation package. The modules are deployed by attaching the module lifting beam to the opening slings and lifting vertically upwards. Similarly, the modules are folded by lifting with the closing slings. Three curbs are hinged on each side of the module and are lifted and dropped into position during bridge deployment. Each center curb houses a bridge marker flag, which is raised into the vertical position for traffic guidance after bridge deployment.

2.3.3.3 When in the folded condition, the modules are 8 ft (2.447 m) wide (over the nibs) and 14 ft (4.302 m) wide when deployed, but without the three curbs deployed. The compression faces of the parallel panels incorporate a dowel and shootbolt arrangement along with a jaw configuration, which is common to both ends of the module. The jaws are fixed to the module with friction grip bolts, which include torque caps, these are used to indicate that the bolts are correctly fastened.

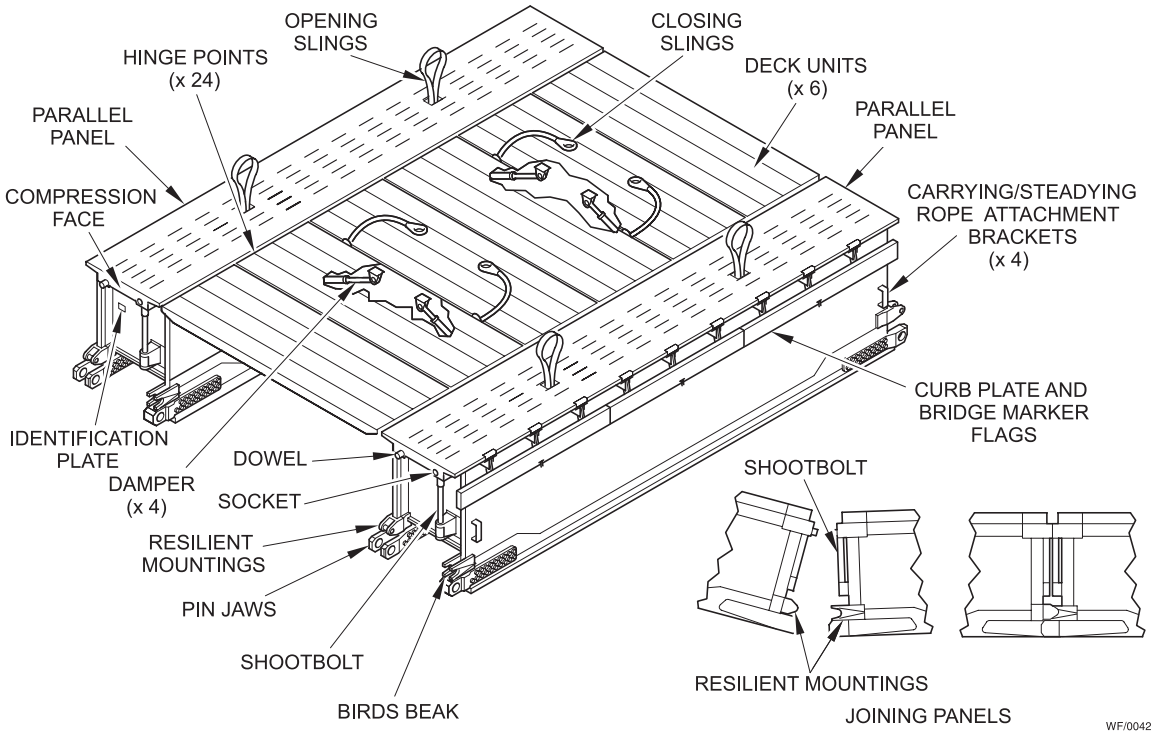


Figure 2. 21 Parallel Module

Section II. BRIDGING MODULES

2.3 BRIDGING MODULES

2.3.1 Ramp Modules

2.3.1.1 Two ramp modules and end beams, five parallel modules and 20 approach ramps are pinned and shootbolted together to form a 40m bridge span. Two extra ramp modules, two end beams and 20 approach ramps are located on additional flatracks to deploy two 20 m bridges instead of one 40 m bridge if required.

2.3.1.2 The ramp modules have an overall length of 19.58 ft (5968 m) and each consists of six transverse deck units attached at 24 hinge points to two longitudinal ramp panels.

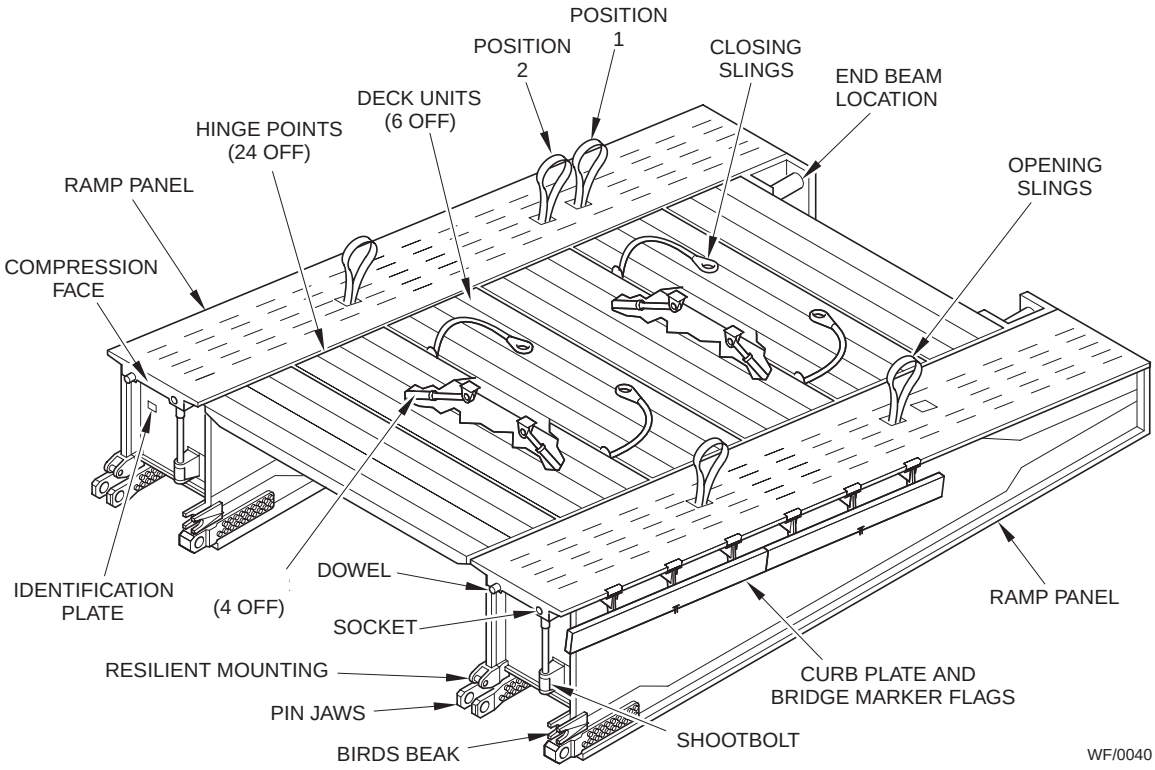


Figure 2. 19 Ramp Module

2.3.1.3 For transportation, the two ramp panels are rotated about the hinge points and stored underneath the deck units to form a compact transportation package. The ramp modules are deployed by attaching the module lifting beam to the opening slings and lifting vertically upwards. Similarly, the modules are folded by lifting with the closing slings. A further set of lifting points are incorporated in the ramp module, these are used to attach the home bank carriage lifting slings to the completed bridge structure.

2.3.1.4 Two curbs are hinged on each side of the module and are lifted and dropped into position during bridge deployment. One curb houses a bridge marker flag, which is raised into the vertical position for traffic guidance after bridge deployment.

2.3.3.4 A fatigue monitoring device is fitted to each module to monitor the accumulative stresses and strains incurred in the module during bridge crossings. The monitor will fail in two stages. The first failure is an indicator that the parallel module to which it is attached is within 1000 full load crossings of its design life. Once the monitor has cracked across its whole length, the module *must* be taken out of service.

2.3.4 Approach Ramps

2.3.4.1 Ten approach ramps; each 15.5 in (0.394 m) wide and 13 ft 5 in (4.089 m) long are positioned at each end of the bridge to complete the bridge approach angle. Anti-lift brackets are incorporated on the ramp connection end to stop lifting of the ramps during trafficking.

2.3.5 Bridge Markers, Defile Markers and Road Signs

2.3.5.1 To allow vehicular traffic to correctly position itself on the bridge and while approaching the bridge, bridge edge markers and defile markers are employed.

2.3.5.2 The bridge edge markers are fixed to the central curb on either side of each parallel module. They are integral with the bridge curbs and are rotated to the vertical once the curbs have been deployed.

2.3.5.3 Defile markers are placed into the ground on either side of the bridge approach and exit, they form a tapered lead in onto and off the bridge. Tape is wrapped around and between each defile marker to clearly define the approach to the bridge.

2.3.5.4 Road signs displaying the weight carrying capacity of the bridge are displayed on posts driven into the ground at each end of the bridge.

2.3.6 Tag Ropes

2.3.6.1 Tag ropes are used with the DSB system to control crane loads during craning operations. The tag ropes consist of a steel hook, which can be attached to a bridge or launch beam module handle and 9 m of rope to allow control of any slung load. A minimum of two tag ropes should be used with any slung load at a time.

Section III ELECTRICAL SYSTEM

2.4 ELECTRICAL SYSTEM

2.4.1 General

2.4.1.1 The electrical supply is provided from the launch vehicle and regulated to 24Vdc by a voltage regulator installed in the electrical control cabinet.

2.4.1.2 The system is fail safe with controls spring-loaded to the 'OFF' position.

2.4.2 Emergency Stop System

2.4.2.1 Emergency stop buttons are fitted at strategic locations where crewmembers are working, their operation will stop all operating functions and disconnect the power take off (PTO) in the event of an emergency.

2.4.2.2 Eight emergency stop buttons are provided. They are located at:

1 - Crane	2 - Launch Frame
1 - Tail lift	1 - Launch Chest Pack
1 - Operator Panel	2 - A-Frame Legs.

2.4.2.3 Pressing any of the emergency stop buttons will cause operation to cease and the PTO to disengage. The operator panel of the interface cabinet will identify which button has been activated. The reason for emergency shut down should be ascertained and that it is safe to proceed before resetting the emergency stop system. The activated button must be reset by pulling out the button (or twisting) and then pressing the 'Emergency Stop Reset' button on the operator panel.

WARNING

INJURY TO PERSONNEL. WHEN OPERATED THE EMERGENCY STOP OVERRIDE SWITCH DISABLES THE EMERGENCY STOP SYSTEM. GREAT CARE MUST BE EXERCISED WHILE BUILDING BRIDGES WITH THE EMERGENCY STOP OVERRIDE SWITCH OPERATED, AS THERE IS NO WAY TO REMOVE HYDRAULIC POWER QUICKLY IN AN EMERGENCY.

2.4.2.4 Fitted in the vehicle cab is the emergency stop override switch, which overrides the emergency stop system in the event of a cable loom being damaged. The emergency stop override will deactivate in the event of the four position selector switch, in the vehicle cab, being moved between positions causing hydraulic power to be removed from the launcher. The switch will have to be reset for operations to be continued.

Figure 2. 22 Example Emergency Stop

2.4.3 Four Position Deployment Selector Switch

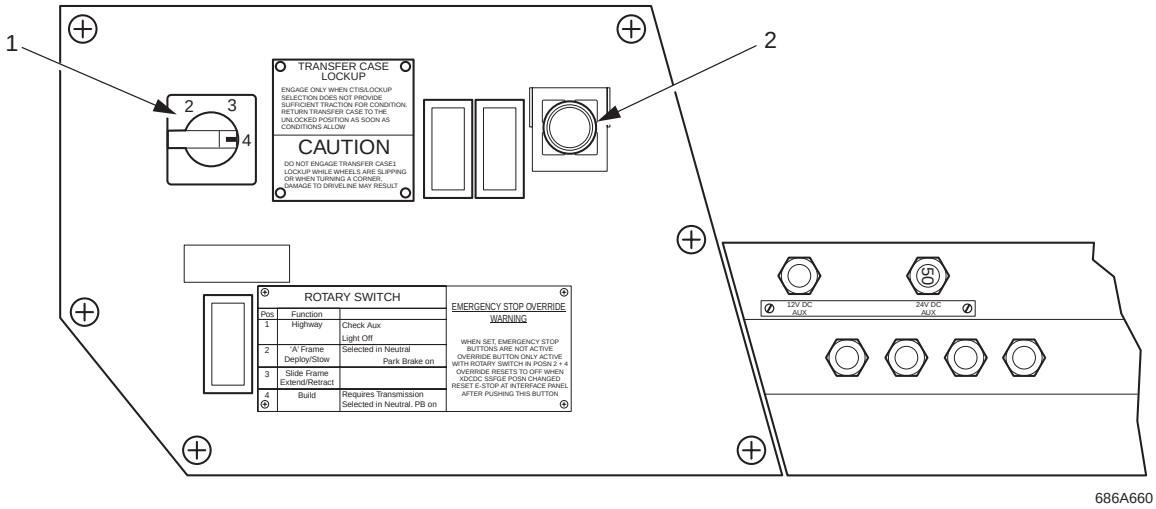


Figure 2. 23 Four Position Deployment Selector Switch

2.4.3.1 Within the cab of the vehicle is the four position deployment selector switch (1), in positions 2 and 4 the engine should be heard to go to high idle and the PTO will engage. Position 2 being used for launcher deployment and position 4 being used for bridge build. In positions 1 and 3 no signal is supplied.

2.4.3.2 The emergency stop override switch (2), is used to bypass the emergency stop circuit should it become damaged. The override function is self-canceling when the ignition is switched off or the four position switch (1) is rotated to another position.

2.4.4 Built-in Test Equipment (BITE)

2.4.4.1 The launch vehicle is equipped with various items of built-in test equipment to monitor, test and fault find on the electrical and hydraulic systems. The BITE system is split into two sections, one being found on the launch frame electrical control enclosure and is explained in 2.4.6. The other is integrated into the operators interface control enclosure, and shows potential primary faults such as filter blockage and low oil level etc. and is referred to in paragraph 2.4.5.4.

2.4.5 Operators Interface Control Enclosure

2.4.5.1 The operators interface control enclosure is mounted on the right side of the launch vehicle and interfaces between the vehicle, the launcher deployment hydraulics and the launch frame electrical control enclosure.

2.4.5.2 The enclosure contains all the switches and push buttons required to deploy and retrieve the A-Frame (1). It contains:

- Circuit breakers, which protect the internal circuits of the cabinet (2).
- A lamp test button (3).
- Panel illumination switch (4) to allow the illumination to be changed from bright, dim or off.
- The Tail lift controller illumination switch (5).
- The E-STOP reset button (6) and an E-STOP button.
- The PTO override controls (7) and an hours run meter (8) to record the PTO pump running.

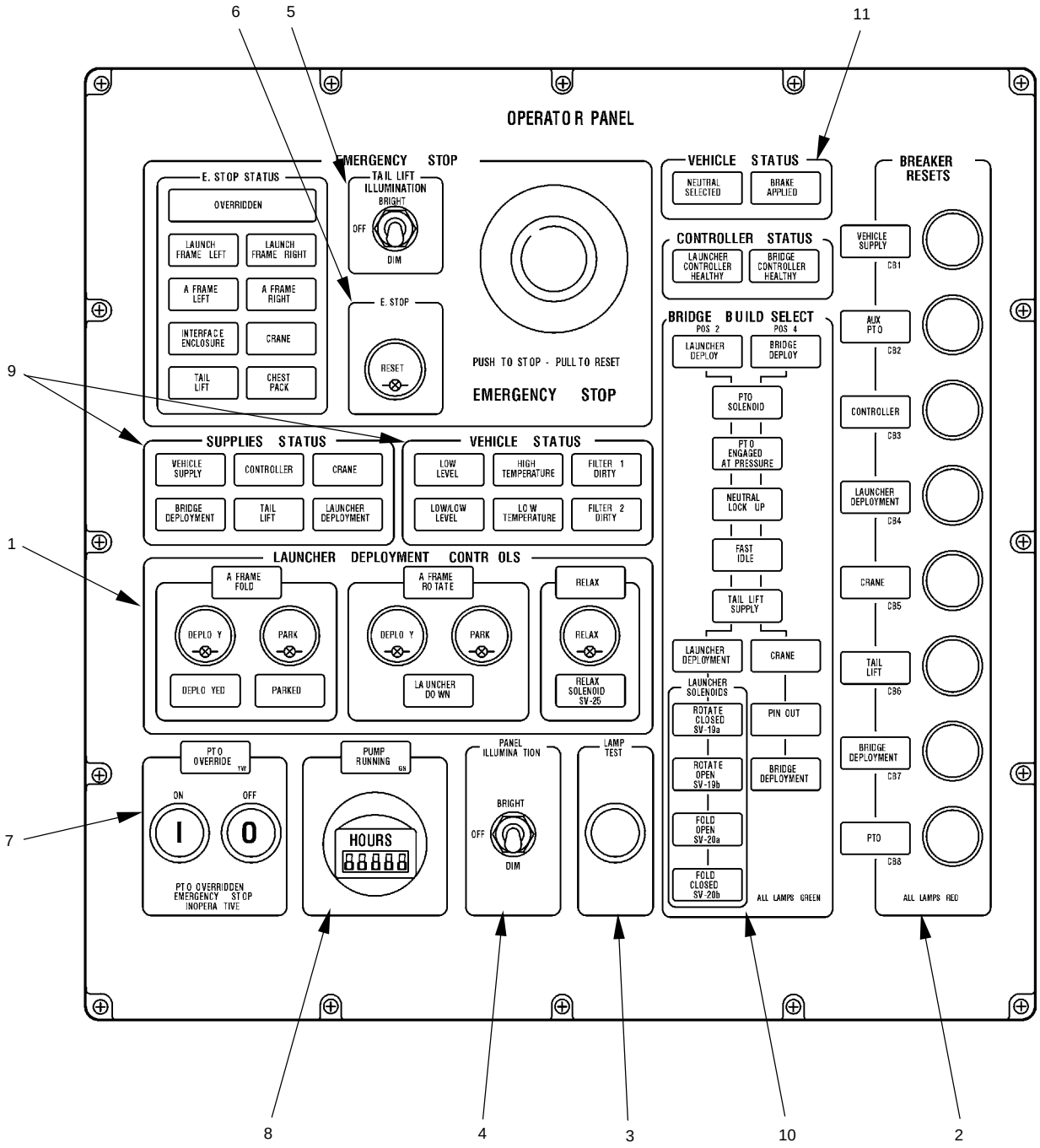


Figure 2. 24 Operators Interface Control Enclosure

2.4.5.3 Mounted externally on the control enclosure are eight multi-pin bayonet connectors, which are routed via electrical cables to the valves, manifolds and the launch frame electrical control enclosure.

2.4.5.4 Monitoring and fault finding of the electrical system is provided within the enclosure from a mimic front panel. The panel is only visible with the enclosure door open and displays the state of the electrical supplies (9).

2.4.5.5 When the rotary switch located in the vehicle cab is placed in position 2 or 4 the operators panel runs through a check sequence of operations required for the launcher to be fully powered. Should a failure occur this will be indicated by the sequence of lights not fully illuminating with the error occurring at the first none illuminated light on the Bridge Build Select sub-panel (10).

2.4.5.6 The status of the parking brake and the gearbox being selected to neutral are indicated by annunciators on the Vehicle Status sub-panel (11).

2.4.6 Launch Frame Electrical Control Enclosure

2.4.6.1 The launch frame electrical control enclosure is mounted on the left side of the launch frame and interfaces between the chest pack and the launcher hydraulic solenoids.

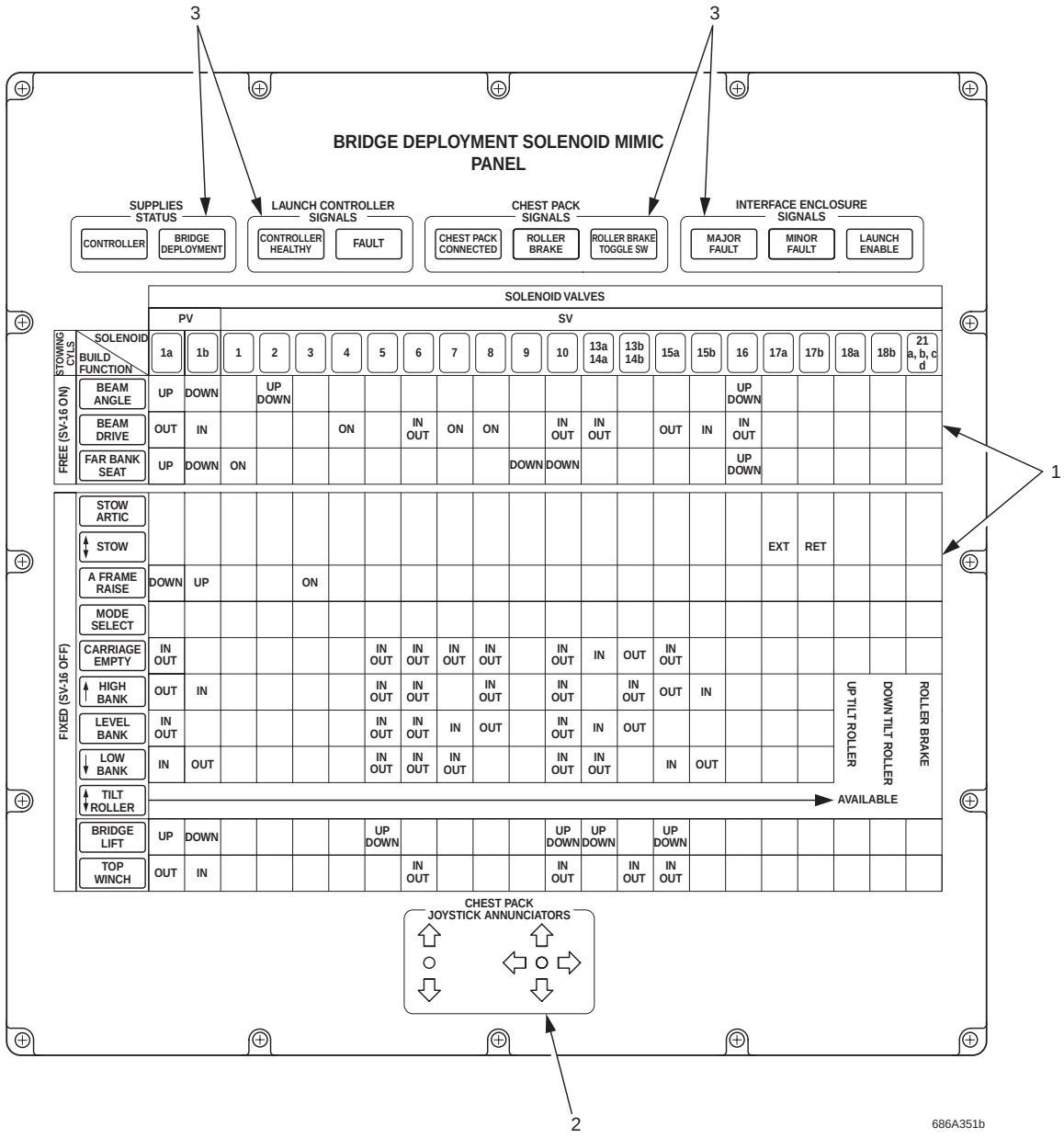


Figure 2. 25 Launch Frame Electrical Control Enclosure

2.4.6.2 With the enclosure door open the action/solenoid matrix (1) the chest pack joystick annunciation panel (2) and status caption lights (3) are visible. The matrix enables fault finding to be carried out. The chest pack joystick annunciation panel shows the position of both the chest pack joysticks. This enables confirmation of movement of a joystick and that the signal from the chest pack has arrived at the launch frame electrical control enclosure.

2.4.7 Launch Chest Pack Umbilical Cable

2.4.7.1 The umbilical multi-core cable is 33 ft (10 m) long with a multipin MIL plug on each end. One end is plugged into the launch chest pack the other into the emergency stop boxes located on the left and right A-frame stabilizer legs.

2.4.8 Chest Pack

2.4.8.1 The chest pack controls the hydraulic system during launch beam and bridge deployment and recovery. It is attached to a harness worn by the chest pack operator. The chest pack is linked to the electrical control cabinet via an umbilical cable.

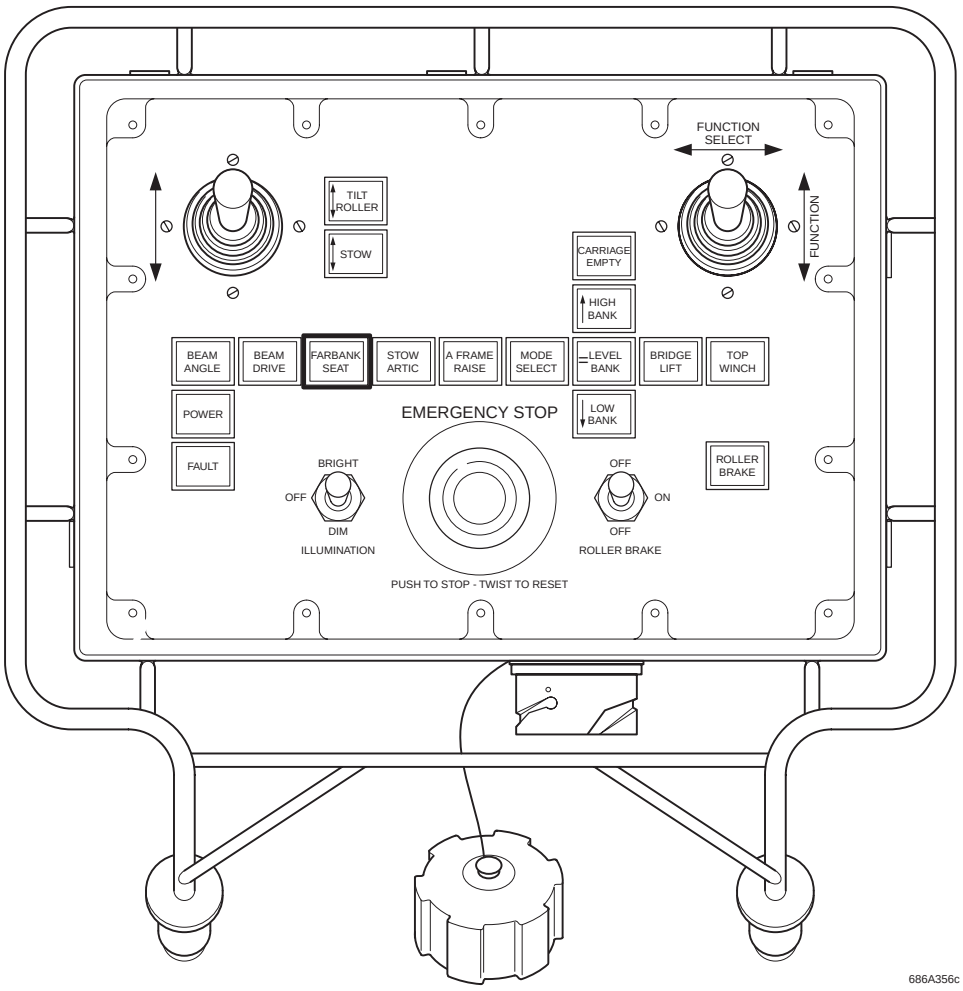


Figure 2. 26 Chest Pack

2.4.8.2 The chest pack contains a proportional control joystick, a tilt roller/stow articulator joystick, a lights bright/dim switch, a roller brake switch, a display screen, and an emergency stop button. The joystick, switch and display screen are protected from inadvertent operation and damage by a guard.

2.4.8.3 The display screen shows a series of illuminated captions with text legends to indicate which function is in operation at the time.

2.4.8.4 A warning light shows critical and non-critical faults via a single legend which flashes for non-critical failures such as filter blockages and remains permanently illuminated for critical failures.

Section IV. HYDRAULIC SYSTEM

2.5 HYDRAULIC SYSTEM

2.5.1 General

2.5.1.1 The hydraulic system is separated into three circuits which are used to operate the services of the chassis, the A-frame and the launching equipment. Hydraulic fluid is drawn from the PLS reservoir to the transmission-driven pump and directed through a pressure filter to the control valves which operate the various hydraulic functions of the circuits.

2.5.2 Hydraulic Reservoir

2.5.2.1 The hydraulic reservoir provides bulk storage of hydraulic fluid for operation of the hydraulic circuits and is a modified version of the standard PLS reservoir.

2.5.2.2 A low-level warning switch is fitted to coincide with the minimum fluid level (operational). A further low-level warning switch, coinciding with the minimum fluid level (pump damage), stops the equipment functions should this level be reached. These switches produce warning signals to the launch chest pack and the operators interface control cabinet.

2.5.2.3 The temperature of the hydraulic fluid in the center of the reservoir is sensed by a gauge thermometer probe device.

2.5.3 Hydraulic Test Points

2.5.3.1 Test points are fitted at strategic locations to assist monitoring and fault finding of the hydraulic system. All test points can be used for hydraulic fluid sampling.

2.5.4 Filter Indicators

2.5.4.1 All hydraulic filters are equipped with an electrical indicator which signals filter restrictions to the chest pack and operators interface control enclosure.

2.5.5 Hydraulic Reservoir Sampling Point

2.5.5.1 At the top of the hydraulic reservoir, a valved port is provided to permit hydraulic fluid sampling.

2.5.6 Manifolds

2.5.6.1 There are several manifolds used throughout the launcher, all of a similar construction, these being:

Chassis

- Interface manifold
- Tail lift manifold

Slide Frame

- A-frame rotate manifold/tilt roller manifold

A-Frame

- A-frame fold and stabilizer manifold

Launch Frame

- Winch manifold
- Articulator manifold
- Pinch roller manifold
- Launch beam drive manifold

2.5.6.2 Each manifold consists of a manifold block and several valve stacks. Each of the valve stacks is terminated with a solenoid valve, which allows for both electrical and manual operation. Operation of all the solenoids is normally controlled via the chest pack and the Programmable Logic Controller (PLC) logic with the exception of the A-frame stabilizer cylinders, which are manually controlled.

Section V. CRANE

2.6 CRANE

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

2.6.1 Safety Instructions

2.6.1.1 Make sure you are familiar with all the information necessary for the safe operation of the crane.

2.6.1.2 Read the operating instructions.

2.6.1.3 The relevant health and safety regulations for the country of operation must be adhered to.

2.6.1.4 In addition, make sure you adhere to the relevant national regulations and road traffic laws.

2.6.1.5 Only use the crane if it is in a serviceable condition.

2.6.1.6 Carry out a visual inspection. Make a note of damage or leaks.

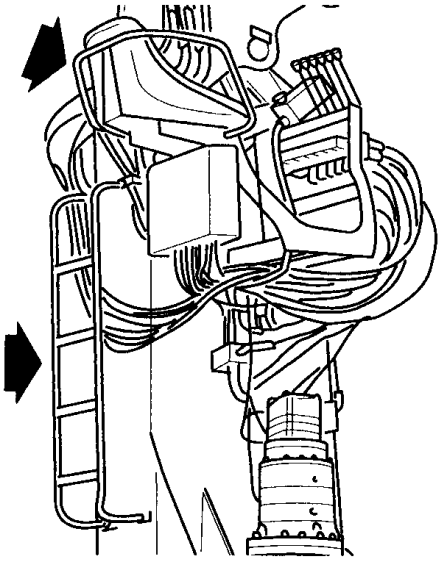
2.6.1.7 Make sure the necessary maintenance is carried out in accordance with the maintenance schedule.

2.6.1.8 The crane is only to be used for its designated purpose.

2.6.1.9 The values given on the maximum load diagram must not be exceeded.

2.6.1.10 Every time the crane is in use, the vehicle must be stabilized and secured so that it cannot roll away.

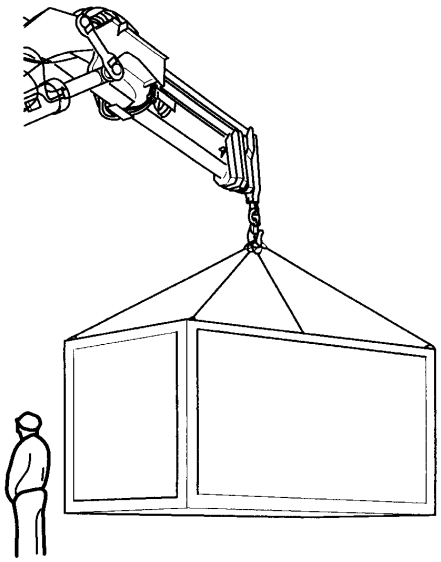
2.6.1.11 Make sure the ground is capable of bearing the load. If necessary, earth pressure can be reduced by the use of suitable load spreaders.



2.6.1.12 Only use the ladder and grip handles to get on and off the seat.

2.6.1.13 Damage *must* be repaired or reported immediately. Only resume work with the crane when the damage has been repaired.

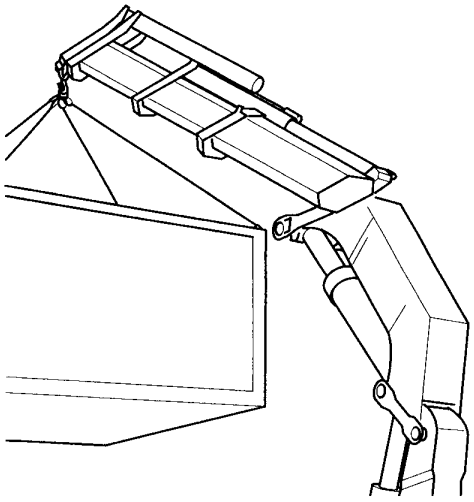
2.6.1.14 Only lift loads when the vehicle has been adequately stabilized.



2.6.1.15 No person may enter the working or rotating range.

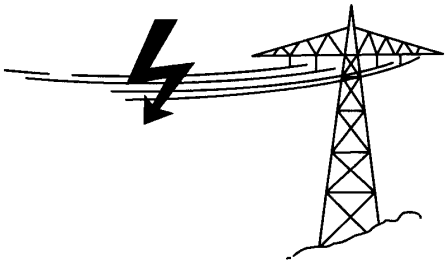
(1) Seal off the working area.

(2) Heed obstacles in the working area of the crane.



2.6.1.16 Do not rotate until the load is suspended.

2.6.1.17 Do not park the crane with a suspended load.



2.6.1.18 Keep away from overhead electrical cables.

2.6.1.19 Keep a distance of at least 5 meters from overhead cables.

2.6.1.20 In the event of a flashover:

(1) Bring the crane out of the danger area. If this is not possible:

(2) Request outsiders to keep their distance.

(3) Have the current switched off.

2.6.1.21 Never drive the vehicle with a freely suspended load.

2.6.1.22 Increasing the hydraulic operating pressure is not permitted.

2.6.1.23 Observe all safety instructions when working.

2.6.1.24 All working movements (especially rotating) must be operated with precision.

2.6.1.25 Observe maximum load capacity.

2.6.1.26 Never drive the vehicle with the hydraulic pump drive switched on.

2.6.2 Crane Loading

CAUTION

The values given on the load diagram are definitive and must not be exceeded. They apply when the crane is operated with the boom horizontal, with the jib horizontal, and with the stabilizers and slides extended on both sides. When the crane is on an incline, the maximum load is reduced.

2.6.2.1 Refer to the crane loading diagram for definitive extended loading.

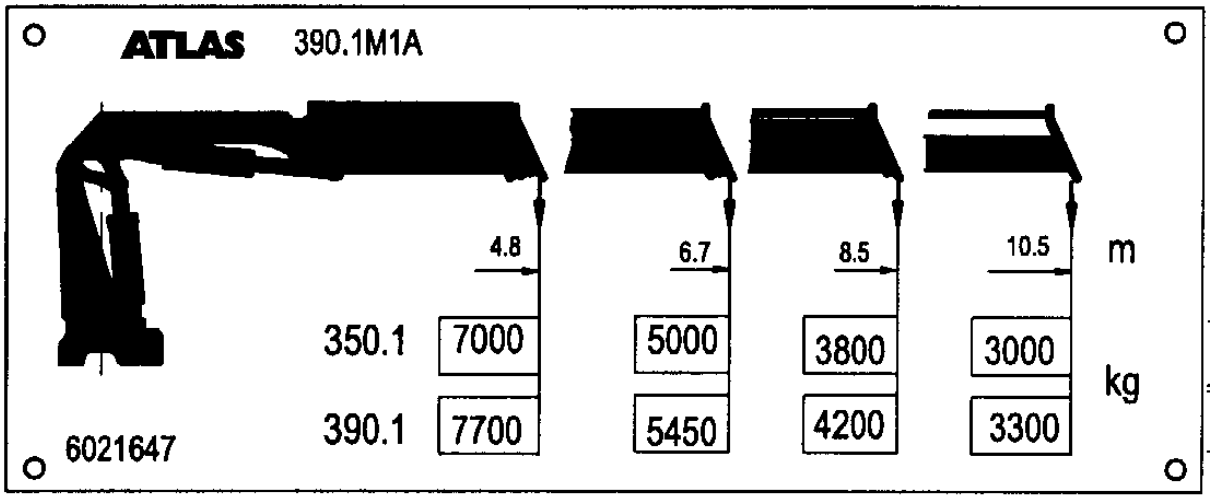


Figure 2. 27 Crane Load Diagram

2.6.3 Crane Controls and Indicators

WARNING

PERSONAL INJURY. EVERY TIME THE CRANE IS USED, THE VEHICLE MUST BE STABILIZED AND SECURED SO THAT IT DOES NOT ROLL AWAY. NEVER DRIVE THE VEHICLE WITH A SUSPENDED LOAD.

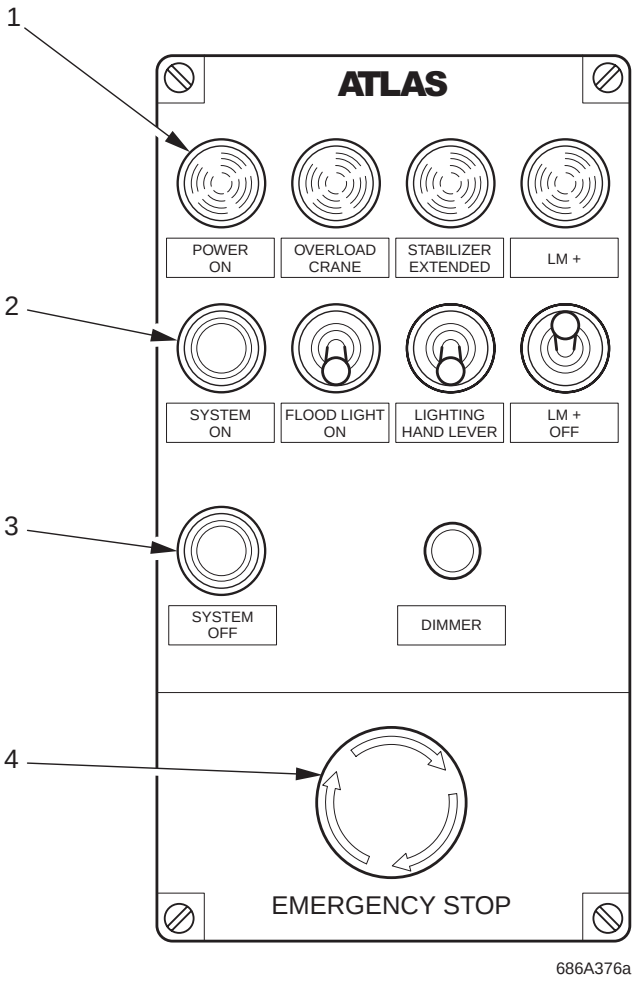
CAUTION

Equipment damage. Every time the crane is used, the vehicle must be stabilized and secured so that it does not roll away. Never drive the vehicle with a suspended load.

2.6.4 Safety regulations

2.6.4.1 The accident prevention regulations concerning crane operation that are in force in the country of operation constitute an integral part of these instructions.

2.6.4.2 Read the regulations and operating instructions carefully. It is important that the safety rules the instructions contain are observed.



2.6.4.3 In emergencies, stop the crane by pressing an EMERGENCY STOP switch (4).

2.6.4.4 Release the EMERGENCY STOP switch (4) to re-start.

2.6.5 Avoiding Damage

CAUTION

Equipment damage. Operate the control levers in a smooth and considered manner. The speed of the working movements is determined by the degree to which the control lever is moved.

Equipment damage. When operating the crane, heed the symbols on the control levers.

Equipment damage. If unusual sounds or vibrations are produced by the crane, discontinue its use, investigate the cause and repair the fault.

2.6.6 Crane Seat Deployment

WARNING

PERSONAL INJURY OR DEATH. ALWAYS USE THE SEAT BELT WHEN OPERATING THE CRANE CONTROLS.

2.6.6.1 Release the lock (2).

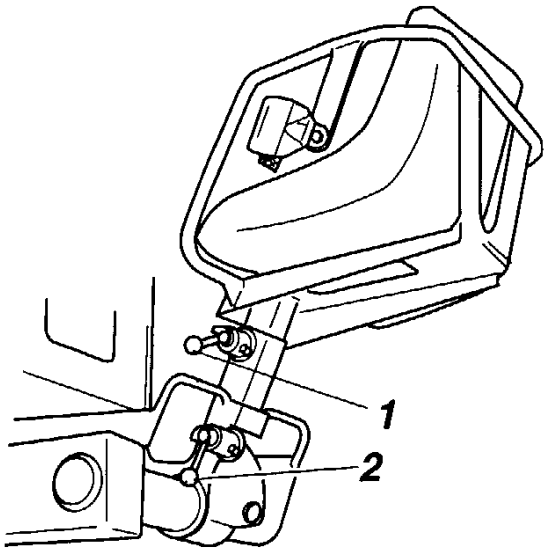


Figure 2. 28 Crane Seat Release

2.6.6.2 Fold the seat in to the working position and engage the lock (2).

2.6.6.3 Release lock (1).

2.6.6.4 Adjust the seat height and engage the lock (1).

2.6.7 Manual Controls and Control Panel on Crane Column

2.6.7.1 The control panel located at the crane base contains a switch, which when operated illuminates the manual control area.

2.6.8 Crane Control Panel and Lever Function

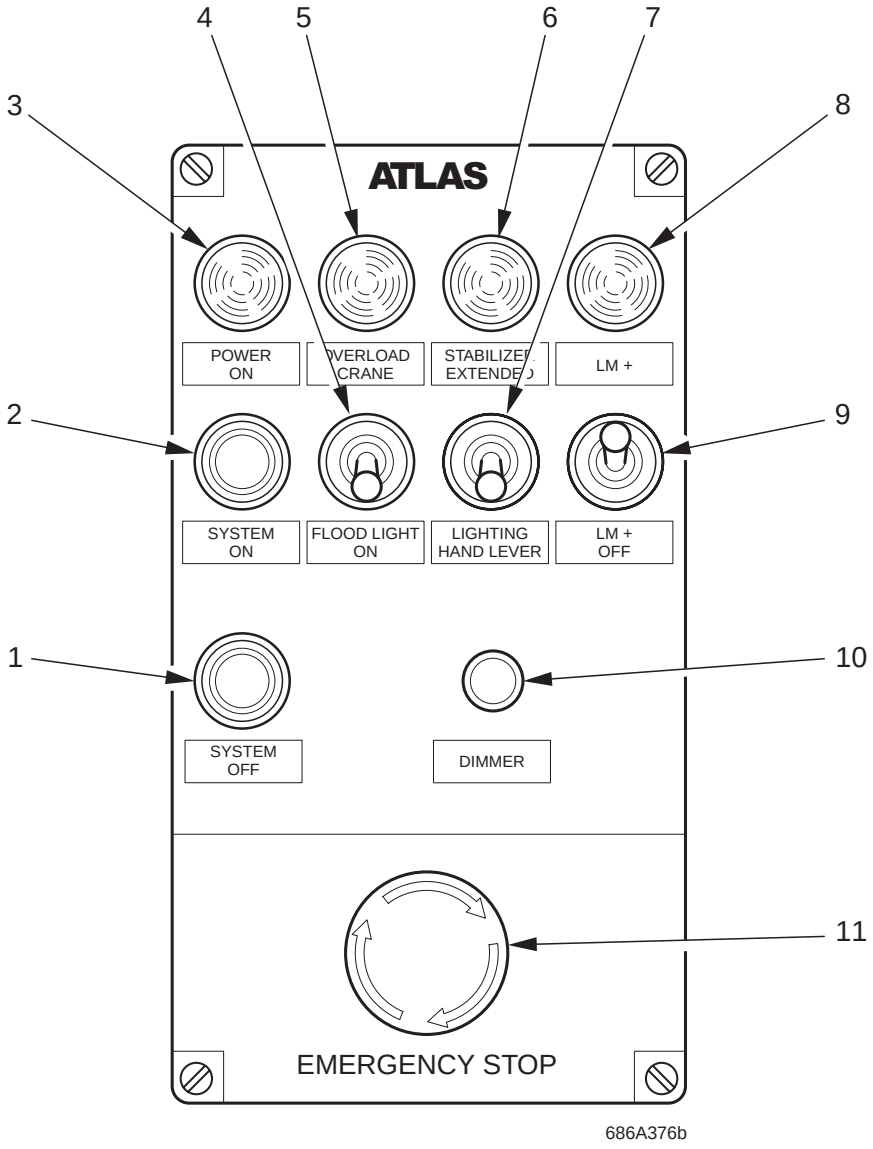


Figure 2. 29 Crane Control Panel

2.6.8.1 The control panel has the following functions

(1) Switch system off.

(2) Switch system on.

(3) Power On indicator light.

(4) Switch floodlights on/off.

(5) Crane overload warning light.

(6) Indicator light, green when stabilizer legs are fully deployed.

(7) Switch hand control lever lights on/off.

(8) LM+ on indicator light.

(9) Switch LM+ on/off.

(10) Lights Dimmer.

(11) EMERGENCY STOP switch.

2.6.8.2 The crane control levers have the following functions:

Change over from crane to stabilizers (1).

Extend and retract stabilizer slides (2).

Stabilizer legs raise or lower (3).

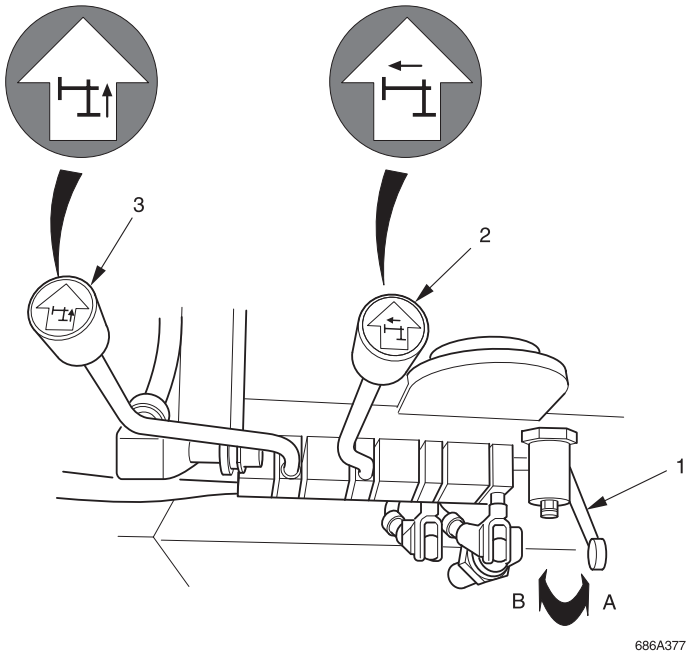


Figure 2. 30 Stabilizer Leg Levers

2.6.8.3 At the base of the crane just above the stabilizer leg controls is mounted a small control box (3) which is for switching the hand lever lighting (1) on and off and also monitors the stabilizer legs extension (2).

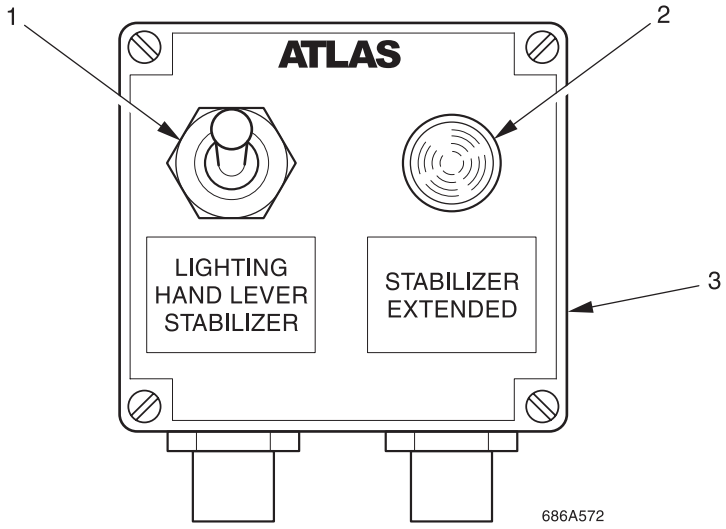


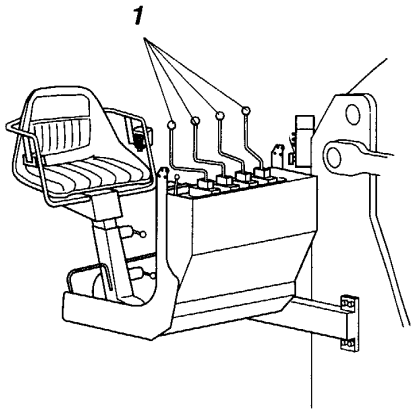
Figure 2. 31 Stabilizer Leg Extension Monitor Control

CAUTION

Equipment damage. Operate the control levers in a smooth and considered manner. The speed of the working movements is determined by the degree to which the control lever is moved.

Equipment damage. When operating the crane heed the symbols on the control levers.

2.6.8.4 The crane operating levers (1) mounted adjacent to the operator seat have the following functions:



2.6.8.5 The working movements for the control levers are as follows:

Control lever (1) – Rotate crane column left/right.

Control lever (2) – Boom raise – lower.

Control lever (3) – Jib fold/unfold.

Control lever (4) – Jib extension extend/retract.

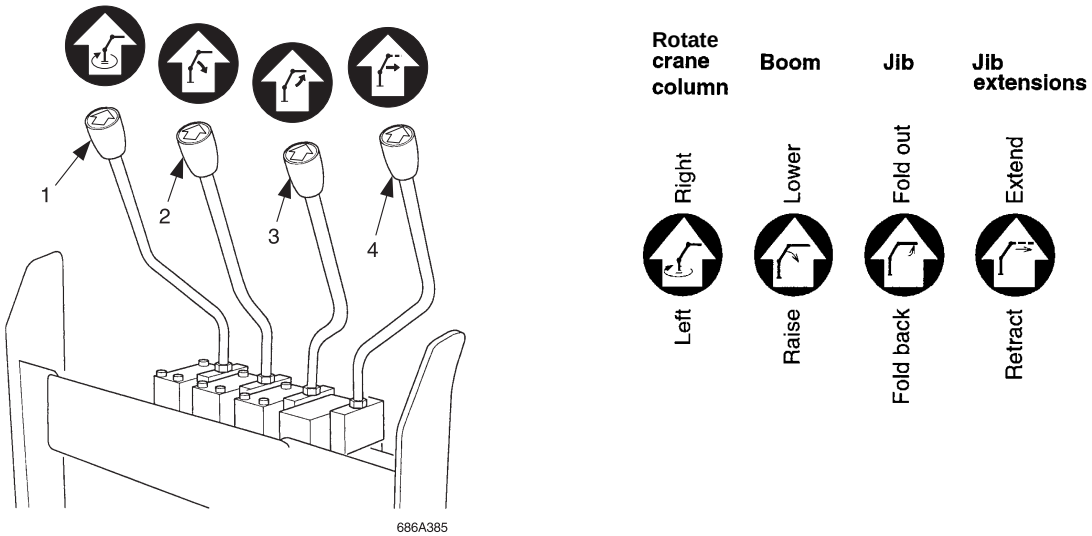


Figure 2. 32 Operator Control Levers

2.6.9 Overload Safety Feature

2.6.9.1 If the maximum load capacity is exceeded, all working movements that increase the load moment and ‘lower boom’ are switched off.

2.6.9.2 Shortly before the maximum load is reached, the crane overload warning lamp (1) on the crane column illuminates.

NOTE

The crane overload warning lamp (1) will flash once when the crane is switched on, this indicates that the crane overload safety circuits are operating correctly.

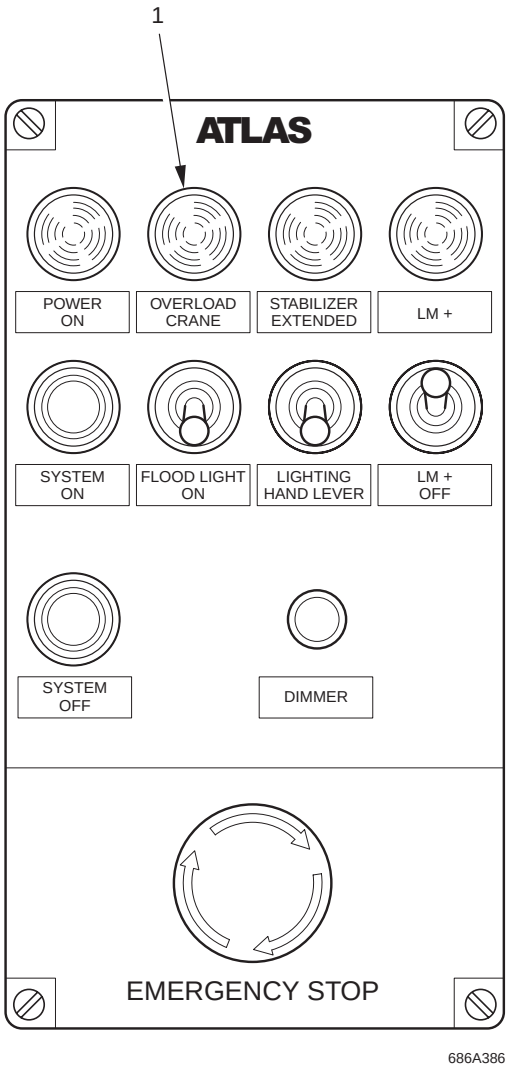


Figure 2. 33 Crane Overload Warning Light

2.6.9.3 The crane load is reduced by working movements that decrease the load moment, once this is done the full working functions are restored.

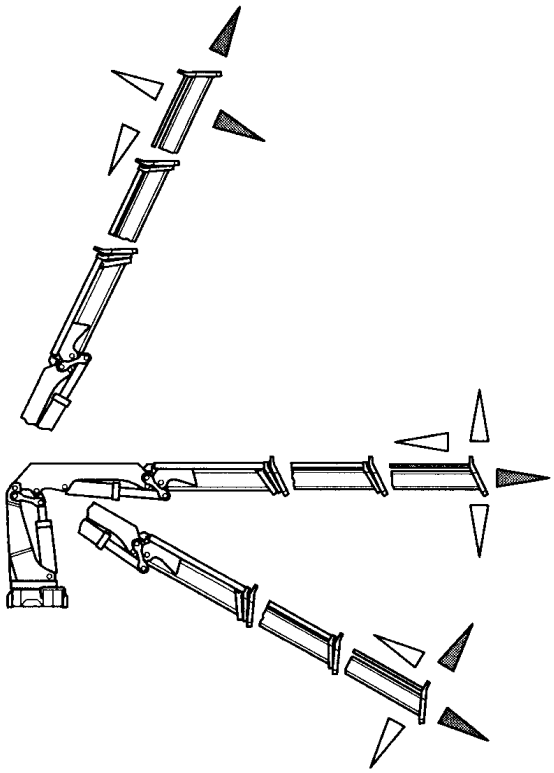


Figure 2. 34 Crane Load Moments

2.6.9.4 The clear triangles show decreasing load moments. The filled triangles show the increasing load moments.

2.6.10 Emergency Boom Lowering Switch

2.6.10.1 The crane is equipped with an emergency boom lowering switch for the boom. If the lift cylinder is extended as far as it will go, the overload protection device switches off operations that will increase the load moment. The boom can be lowered should this occur by means of the boom emergency lowering switch.

2.6.10.2 To enable emergency lowering of the boom pull the boom emergency lowering switch (1).

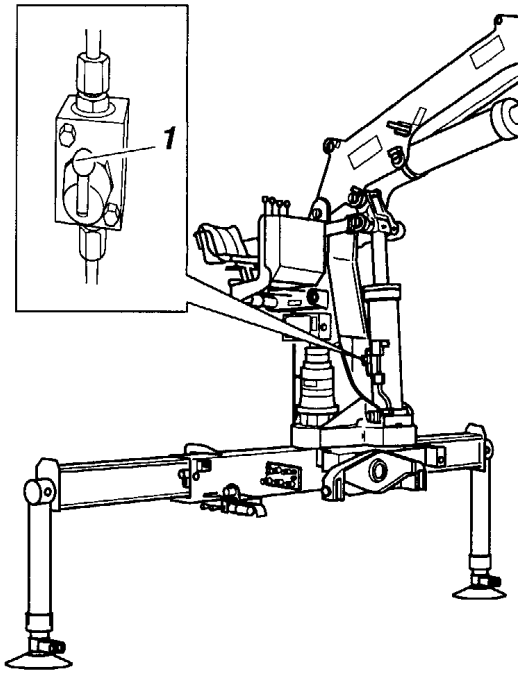


Figure 2. 35 Emergency Boom Lower Switch

Section VI. EQUIPMENT DATA

2.7 LAUNCH VEHICLE

2.7.1 Launch Vehicle and Launcher

Length	475 in (12065 mm)
Width	117.5 in (2985 mm)
Height	157.5 in (4000 mm)
Weight	87857 lb (39844 kg)

2.7.2 Launch Vehicle

Length	420.1 in (10671 mm)
Width	96.1 in (2440 mm)
Height	120.7 in (3066 mm)
Weight	42826 lb (19422.3 kg)*

* = 2.7.1 weight - 2.7.3 weight

2.7.3 Sectionalized Launcher with Stabilizer Leg Feet Removed

Length	256.8in (6522 mm)
Width	109.9in (2792 mm)
Height	95.6in (2429 mm)
Weight	45031lb (20422 kg)

2.7.4 Tail Lift

Length	104.3 in (2650 mm)
Width	88.2 in (2240 mm)
Height	34.2 in (867 mm)
Weight	1213 lb. (550 kg)

2.8 CRANE

Manufacturer	Atlas
Model	390.1 LM+
Max. Operating Pressure	4556 lb/in^2 (31412.5 kPa)
Length (folded)	100.4in (2550mm)
Width (folded)	53.7in (1365mm)
Height (folded)	97.6in (2480mm)
Weight (inc. stabilizers)	10780 lb (4890 kg)

2.9 BRIDGING EQUIPMENT

2.9.1 Ramp Module

Overall Length	241.4 in (6131 mm)
Effective Length	235 in (5968 mm)
Roadway Width	169.4 in (4302 mm)
Max. Depth	47.4 in (1205 mm)
Min. Depth	20.8 in (529 mm)
Folded Depth	44.6 in (1132 mm)
Top Chord Slope	1:9
Estimated Weight	8996 lb (4080 kg)

2.9.2 Parallel Module

Overall Length	241.4in (6131 mm)
Effective Length	234.4 in (5955 mm)
Roadway Width	169.4 (4302 mm)
Girder Depth	47.4 in (1205 mm)
Folded Depth	44.6 in (1132 mm)
Weight	9740 lb (4417 kg)

2.9.3 End Beam

Length	98.4in (2500 mm)
Width	14.8in (375 mm)
Height	22.2in (563 mm)
Weight	788 lb. (357 kg)

2.9.4 Launch Beam

Overall Length	234 in (5944 mm)
Width	22in (560mm)
Depth	34.5in (875mm)
Weight	1246 lb (565 kg)

2.9.5 Approach Ramp

Overall Length	161in (4089 mm)
Width	16.6 in (421 mm)
Depth	7.5 in (191 mm)
Estimated Weight	190 lb (86 kg)

2.9.6 Approach Ramps loaded onto transport frames and stacked

Length	163.1 in (4143 mm)
Width	87.8 in (2229 mm)
Height	22.2 in (564 mm)
Weight	2220 lb (1007 kg)

2.9.7 Far Bank Support

Length	91.9in (2335 mm)
Width	62.2 in (1580 mm)
Depth	29.9 in (760 mm)
Weight	436 lb (198 kg)

2.9.8 Stabilizer Leg Foot

Length	42.3 in (1075 mm)
Width	42.3 in (1075 mm)
Depth	7.5 in (191 mm)
Weight	82 lb (37 kg)

2.10 HYDRAULIC ITEMS

2.10.1 Hydraulic Pump

Manufacturer	Rexroth
Model	Standard A11V075
Type	Variable displacement, swash plate piston
Weight	132 lb (60 kg)
Flow at 3674 lb/in^2 (250 bar)	26.4 to 31.68 US galls (100 to 120 liters)

2.10.2 Drum Winch

Rated Line Pull	12569 lb (5700 kg)
Weight (no cable)	904 lb (410 kg)

2.10.3 Launch Beam Drive Unit

Motor Drive Unit	143 lb (65 kg)

2.10.4 Launching Valve

Weight	110 lb (50 kg)

2.10.5 Carriage Manifold

Valve Block Weight	110 lb (50 kg)

2.11 LOOSE ITEM DETAILS

2.11.1 Launch Equipment Storage Box

Length	98.4 in (2500 mm)
Width	22 in (560 mm)
Depth	34.5 in (875 mm)
Weight	180.3 lb (81.8 kg)

2.11.2 Tail lift Hand Rail (Large)

Length	44.7 in (1135 mm)
Width	30.7 in (780 mm)
Depth	1.2 in (30 mm)
Weight	11.4 lb (5.18 kg)

2.11.3 Tail lift Hand Rail (Small)

Length	44.7 in (1135 mm)
Width	26.8 in (680 mm)
Depth	1.2 in (30 mm)
Weight	10.6 lb (4.82 kg)

2.11.4 End Beam Guide (Left Hand)

Length	23.6 in (600 mm)
Width	12.7 in (322 mm)
Depth	12.2 in (310 mm)
Weight	33.8 lb (15.3 kg)

2.11.5 End Beam Guide (Right Hand)

Length	23.6 in (600 mm)
Width	12.7 in (322 mm)
Depth	12.2 in (310 mm)
Weight	33.8 lb (15.3 kg)

2.11.6 Removable Roller

Length	23.1 in (587 mm)
Width	12.7 in (322 mm)
Depth	13.2 in (336 mm)
Weight	37.2 lb (16.9 kg)

2.11.7 Crane Sling With Hook

Length	60 in (1524 mm)
Weight	25.9 lb (11.75 kg)

2.11.8 Launch Beam Lifter

Length	25.6 in (650 mm)
Width	3 in (76 mm)
Depth	11.1 in (283 mm)
Weight	19.2 lb (8.7 kg)

2.11.9 Tag Line (Guide Rope)

Length	354 in (9000 mm)
Weight	4 lb (1.8 kg)

2.11.10 Bridge Mans Harness & Safety Line

Weight	6 lb (2.7 kg)

2.11.11 End Beam Lifting Sling

Length	100 in (2540 mm)
Weight	1 lb (0.5 kg)

2.11.12 End Beam Wrench

Length	15.8 in (400 mm)
Width	0.8 in (20 mm)
Depth	4.2 in (106 mm)
Weight	3.8 lb (1.7 kg)

2.11.13 Approach Ramp Handle

Length	12.7 in (323 mm)
Width	5.24 in (133 mm)
Depth	6.4 in (162 mm)
Weight	2.8 lb (1.3 kg)

2.11.14 Ramp Lead in Bracket (Left Hand)

Length	9.84 in (250 mm)
Width	6.7 in (170 mm)
Depth	7.9in (200 mm)
Weight	9.6 lb (4.35 kg)

2.11.15 Ramp Lead in Bracket (Right Hand)

Length	9.84 in (250 mm)
Width	6.7 in (170 mm)
Depth	7.9in (200 mm)
Weight	9.6 lb (4.35 kg)

2.11.16 Bridge Module Connecting Pin

Length	9.6 in (245 mm)
Diameter	3 in (76 mm)
Weight	19 lb (8.62 kg)

2.11.17 Launch Beam Pin

Length	23 in (583 mm)
Diameter	1.8 in (45 mm)
Weight	14.6 lb (6.62 kg)

2.11.18 Slide Frame Locking Pin

Length	15.8 in (401 mm)
Diameter	0.9 in (24 mm)
Weight	3.3 lb (1.5 kg)

2.11.19 Road Sign

Length	31.9 in (810 mm)
Width	23.6 in (600 mm)
Depth	3.1 in (79 mm)
Weight	12.6 lb (5.71 kg)

2.11.20 Road Sign Pole

Length	79.3 in (2015 mm)
Width	9.9 in (251 mm)
Depth	2 in (51 mm)
Weight	13.6 lb (6.17 kg)

2.11.21 Roll of Marker Tape

Weight	0.5 lb (0.23 kg)

2.11.22 Bag of Spare ‘R’-Clips

Weight	2.35 lb (1.07 kg)

2.11.23 Launcher Special Tools

Includes: Slide frame locking pin, peg wrench and peg socket.

Weight	5.5 lb (2.5 kg)

2.11.24 Wrench, Allen Key, & Pin Punch Set

Weight	3.6 lb (1.63 kg)

2.11.25 Crane Pin Extractor

Length	6.1 in (156 mm)
Diameter	3.2 in (80 mm)
Weight	3.8 lb (2.5 kg)

2.11.26 Anchorage Equipment Storage Box

Length	42.6 in (1083 mm)
Width	27.6 in (700 mm)
Depth	41.5 in (1054 mm)
Weight	316 lb (143.3 kg)

2.11.27 Holdfast Spike

Length	38 in (965 mm m)
Width	2 5 in (0.064 m)
Depth	7/8 in (0.022 m)
Weight	7.1 lb (3.2 kg)

2.11.28 Earth Anchor Bar

Length	36.8 in (934 mm)
Width	5.5 in (140 mm)
Depth	1.9 in (47 mm)
Weight	29.8 lb (13.51 kg)

2.11.29 Anchorage Beam C/W Shackle

Length	39.3 in (997 mm m)
Width	3.5 in (89 mm)
Depth	12.8 in (324 mm)
Weight	68.4 lb (31 kg)

2.11.30 T532 Tirfor Winch

Length	24.8 in (631 mm)
Width	5.8 in (148 mm)
Depth	14.1 in (35.7 mm)
Weight	52.9 lb (24 kg)

2.11.31 Tirfor Winch Handle

Length	2 ft 1 19/32 in (0.650 m)
Weight	4.8 lb (2.2 kg)

2.11.32 Wire Rope C/W Connecting Pins & 'R'-Clips

Length	40 ft (12.192 m)
Weight	33.3 lb (15.14 kg)

2.11.33 Folding Steps

Length	32.3 in (820 mm)
Width	19 in (485 mm)
Depth	3 in (75 mm)
Weight	9.9 lb (4.5kg)

2.11.34 LH Removable Mudguard

Length	568.4 in (14438 mm)
Width	16.5 in (421 mm)
Depth	26 in (663 mm)
Weight	26 lb (11.8 kg)

2.11.35 RH Removable Mudguard

Length	56.8 in (1443 mm)
Width	16.6 in (421 mm)
Depth	24.6 in (633 mm)
Weight	26 lb (11.8 kg)

2.11.36 Vehicle Exhaust Elbow Assy

Length	19 in (485 mm)
Width	6.7 in (171 mm)
Depth	13 in (331 mm)
Weight	12.3 lb (5.6 kg)

2.11.37 Far Bank Support Pads

Length	37.4 in (950 mm)
Width	37.4 in (950 mm)
Depth	23 in (285 mm)
Weight	56 lb (25.4 kg)

2.11.38 Crane Pads

Length	33 in (840 mm)
Width	33 in (840 mm)
Depth	2.3 in (60 mm)
Weight	80 lb (36.3 kg)

2.11.39 Buffer Assy

Length	30.3 in (770 mm)
Width	25.7 in (655 mm)
Depth	3.2 in (82 mm)
Weight	39.2 lb (17.8 kg)

2.11.40 Module Lifting Beam

Length	76.6 in (1948 mm)
Width	22.4 in (569 mm)
Depth	21.6 in (550 mm)
Weight	529.1 lb (240.4 kg)

2.11.41 Bottom Spacer Beam Assembly

Length	95.6 in (2430 mm)
Width	4.7 in (120 mm)
Depth	4.4 in (114 mm)
Weight	24 lb (10.9 kg)

2.11.42 Intermediate Spacer Beam Assy

Length	95.6 in (2430 mm)
Width	4.7 in (120 mm)
Depth	5.1 in (130 mm)
Weight	27.9 lb (12.7 kg)

2.11.43 Top Spacer Beam Assembly

Length	95.6 in (2430 mm)
Width	4.7 in (120 mm)
Depth	5.1 in (130 mm)
Weight	24 lb (10.9 kg)

2.11.44 Ramp Buffer Assy

Length	30.3 in (770 mm)
Width	8 in (203 mm)
Depth	1.8 in (47 mm)
Weight	12.5 lb (5.7 kg)

2.11.45 Ladder Assy-Modular Access

Length	109.8 in (2790 mm)
Width	17.7 in (450 mm)
Depth	9.2 in (236 mm)
Weight	31.5 lb (14.5 kg)

2.11.46 3"x9"x36" Packing Timber

Length	36 in (914 mm)
Width	9 in (229 mm)
Depth	3 in (76 mm)
Weight	19.8 lb (9 kg)

2.11.47 Defile Marker Tube

Length	59 in (1500 mm)
Width	1.2 in (32 mm)
Depth	1.2 in (32 mm)
Weight	3.3 lb (1.5 kg)

2.11.48 Roadform Spike

Length	17.7 in (450 mm)
Width	0.7 in (19 mm)
Depth	0.7 in (19 mm)
Weight	2.2 lb (1 kg)

TABLE OF CONTENTS

CHAPTER 3

GENERAL DRILLS

CHAPTER 3

GENERAL DRILLS

Section I. TAIL LIFT

3.1 TAIL LIFT

3.1.1 Safety Instructions

3.1.1.1 It is very important that each operator is instructed and fully familiar with the operation of the tail lift. Each one should be advised of the dangers resulting from overloading the platform.

3.1.1.2 Improper operation of this lift can result in serious personal injury.

3.1.1.3 The tail lift operator is responsible for working area safety.

3.1.1.4 When two or more people are in attendance, the operator must ensure he knows the whereabouts of everybody concerned before commencing operations.

3.1.1.5 Do not overload - **max load** capacity is **1102 lbs (500 kg)** or four persons. Remember that this limit applies to both lifting and lowering operations.

3.1.1.6 The launch vehicle must always be in neutral with the parking brake applied before using the tail lift. Make certain that the area behind the platform is clear before operating the platform and at all times during operation. Never stand in, move through, or allow anyone else to stand in or move through the area in which the tail lift may operate or into which an unsecured load may fall.

3.1.1.7 Take particular care not to position any part of your body between the platform inner edge and rear body of vehicle or handrails and outer edges of bridge.

3.1.1.8 When in transit, the tail lift must be secured in the stowage position with transport straps.

3.1.1.9 Always inspect the tail lift for damage before using it. If there are signs of damage to a vital part or platform or the surface is slippery, do not use the tail lift until the damage has been repaired or the platform surface has been cleaned.

3.1.1.10 In case of hose failure stop using the platform immediately.

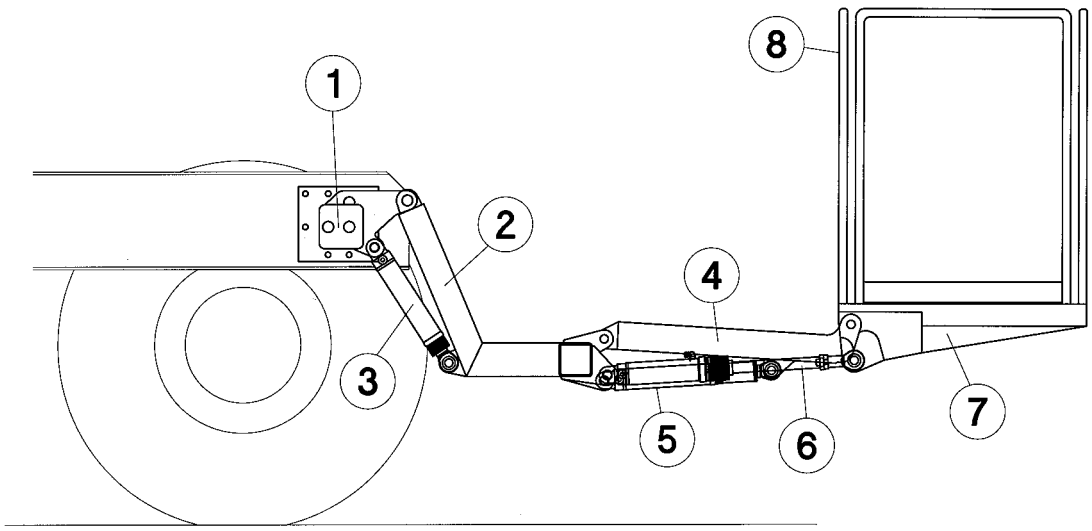
3.1.1.11 Leaked oil is a hazardous waste. Ensure care is taken to dispose of oil and any oil absorption material in accordance with local orders and environmental regulations.

3.1.1.12 Always keep the surface of the platform clean and clear of foreign objects to minimize the risk of slipping and falling from the platform while working.

3.1.1.13 While operating the tail lift, pay special attention to how the tail lift pendant is located in your hand. If you have to change the tail lift pendant from one hand to another, ensure that the orientation of the tail lift pendant does not change, ensure that the umbilical cable always points away from you, otherwise the operating switches of the tail lift pendant will be transposed and incorrect operation could result.

3.1.1.14 When not in use always place the tail lift pendant in a position where it will not become damaged or cause one of the operation buttons to be accidentally depressed. Ensure that the umbilical cable is secure and not on the ground in the event that the vehicle is moved.

3.1.2 Tail lift Main Components



1. Mounting brackets
2. Swing arms
3. Swing cylinder
4. Lifting arms
5. Lift cylinder
6. Tilt cylinder
7. Platform
8. Handrails

3.1.3 The Tail Lift Pendant

3.1.3.1 The tail lift pendant has a single push button for each operation as shown. The buttons are the self-centering type, stopping the tail lift operation as soon as they are released.

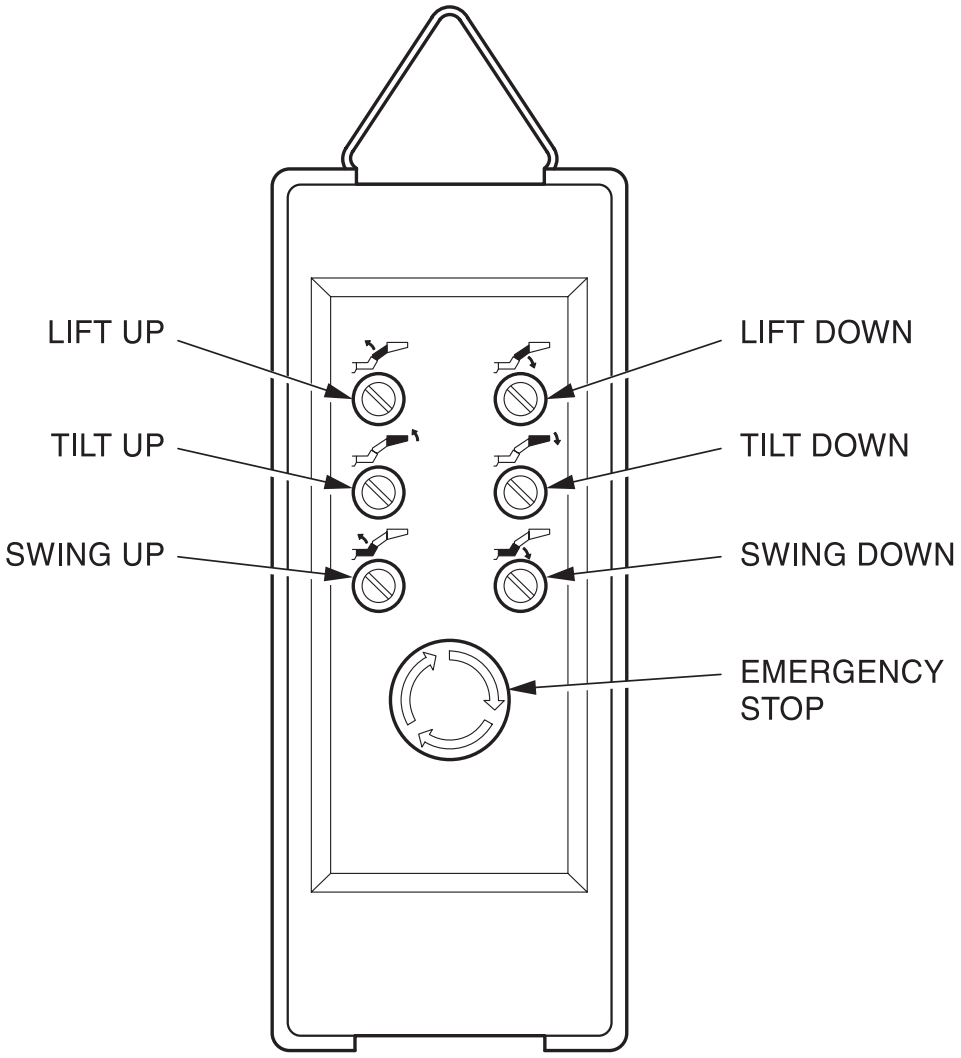
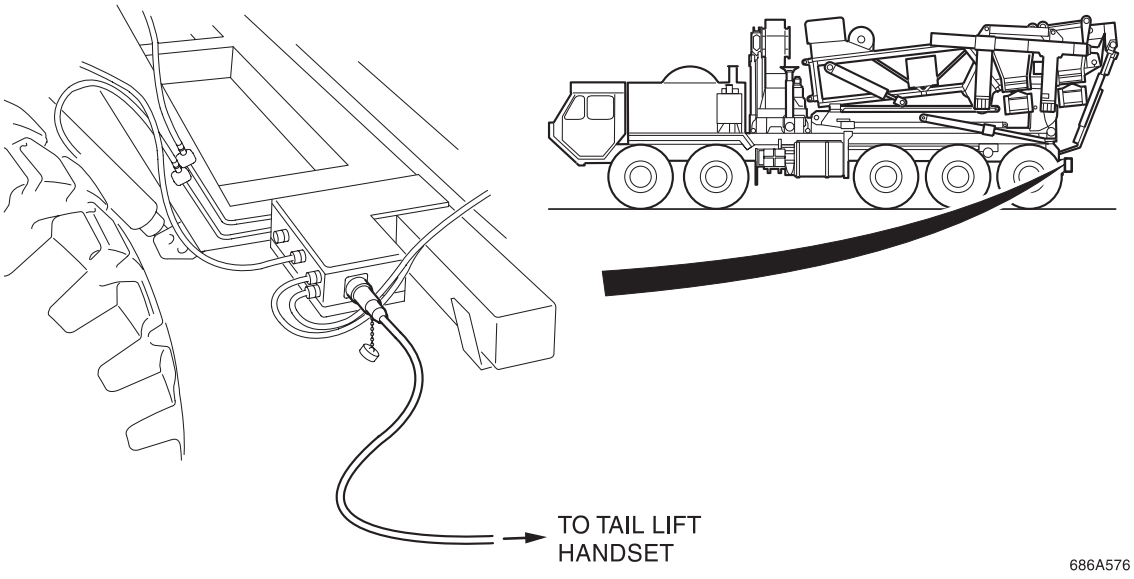


Figure 3. 1 Tail Lift Pendant

3.1.4 Preparing the Tail lift for Operation

3.1.4.1 Remove the tail lift pendant from its stowage position and attach it to the tail lift control box, which is located on the left hand side of the swing arms.



Tail lift pendant Connection Point

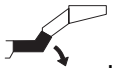
3.1.4.2 Release and remove the two transportation straps retaining the tail lift in its stowed position.

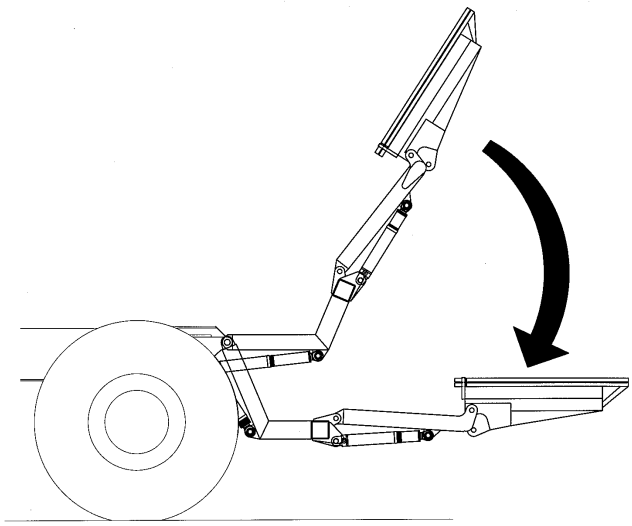
3.1.5 Swing Down the Tail lift

NOTE

NEVER use the SWING operation when the platform is in the working position. The SWING operation is only for moving the platform from transport position to the working position.

On very rough terrain, it may be necessary to raise the platform to prevent it hitting the ground at the end of the swing down operation. This can be achieved by pressing the LIFT UP  **button.**

3.1.5.1 Lower the tail lift to its working position by pressing the **SWING DOWN** button  . The swing cylinders must be fully retracted and the swing arms fully down before using the tail lift as a working platform.

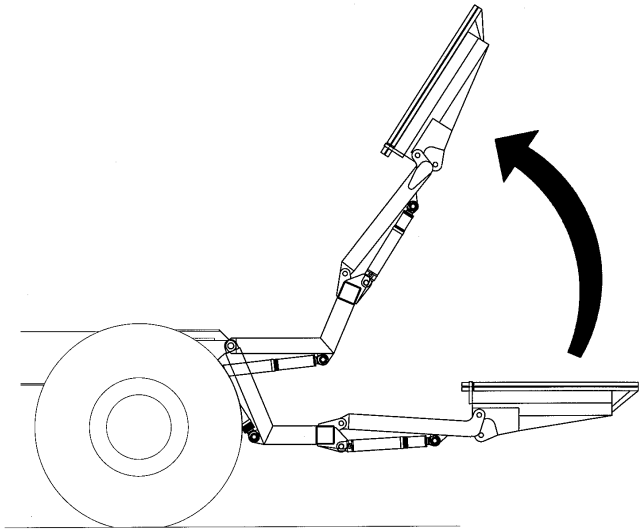


Swinging the Tail lift Down

3.1.6 Swing up The Tail lift

3.1.6.1 Pressing the **SWING UP** button  will swing up the platform ready for transport.

3.1.6.2 The swing cylinders must be fully extended and the swing arms fully up.



Swinging Up the Platform

3.1.7 Tilting of the Platform

WARNING

TAIL LIFT OPERATION. THE TILT UP OR TILT DOWN BUTTON MUST NEVER BE USED WHEN PERSONNEL ARE ON THE PLATFORM AS THERE IS A DANGER OF TIPPING THEM OFF. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE SEVERE INJURY TO PERSONNEL.

NOTE

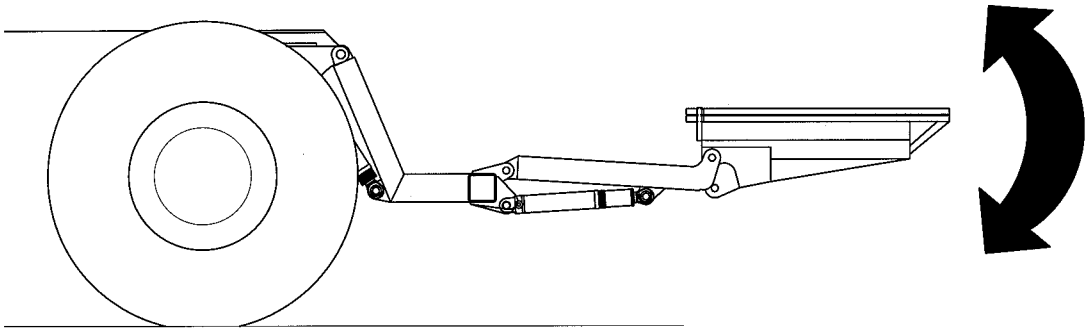
This button is used to level the platform ready for operation.

It is recommended that the platform is leveled to the horizontal position and kept at that position. The platform stays horizontal while using up and down movement button.

3.1.7.1 The platform can be tilted up or down by pressing the **TILT UP** button  or **TILT DOWN** button  .

3.1.8 Leveling the Platform

Level the platform to a horizontal working position. By pressing either the **TILT DOWN**  or **TILT UP**  buttons.



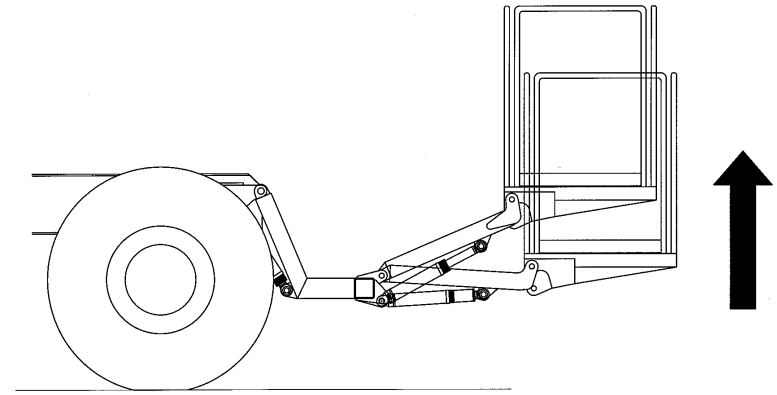
Tilting of the Platform

3.1.9 Lifting the Platform

Platform moves up by pressing the **LIFT UP** button  .

NOTE

This button is always used to move the platform when personnel are on the platform.



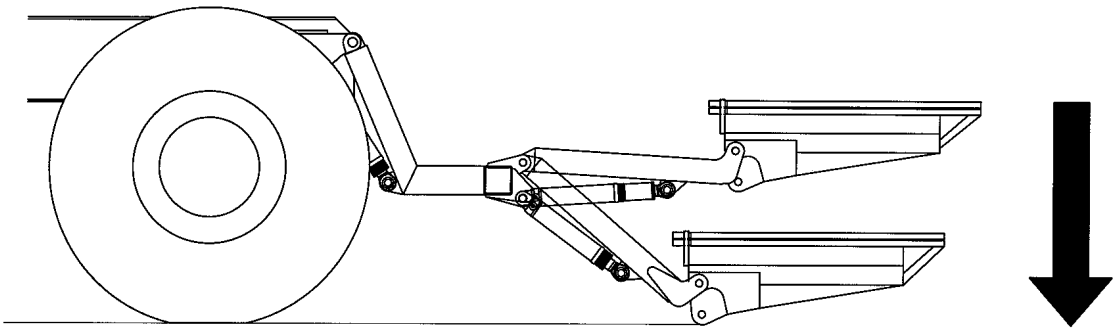
Moving the Platform Up

3.1.10 Lowering the Platform

The platform moves down by pressing the **LIFT DOWN** button  .

NOTE

This button is always used to move the platform when personnel are on the platform.



Lowering the Platform

3.1.11 Opening The Working Platform

3.1.11.1 Remove the folding steps and two crane stabilizer spreader pads from the top of the platform by undoing the transportation straps and lift them to a safe position away from the tail lift working area where they won't be damaged, or in somebody else's working area.

3.1.11.2 Release the two flexible draw latches securing the hinged platforms.

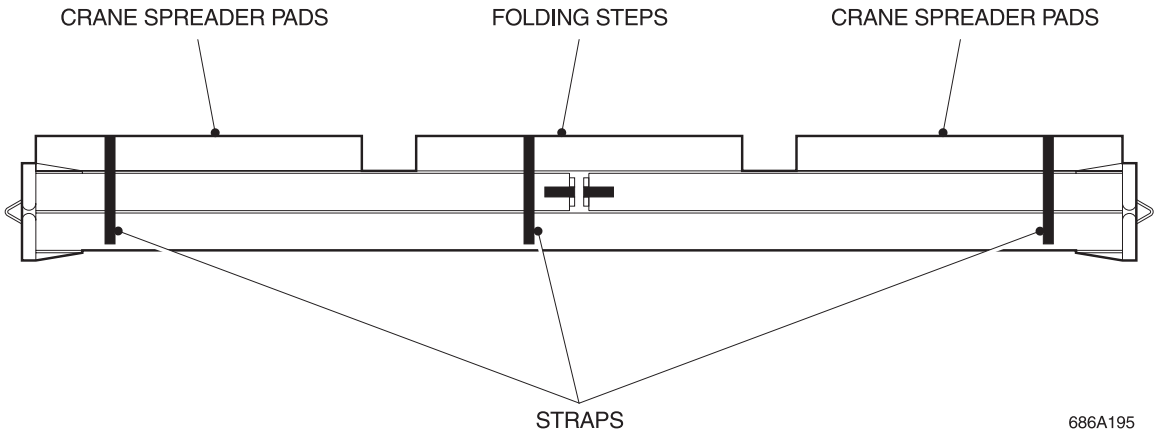


Figure 3. 2 Tail lift Stowage Straps

3.1.11.3 Open both sides of the platform by using the lifting straps, being careful not to let the platform sides drop, lower them gently to a horizontal position.

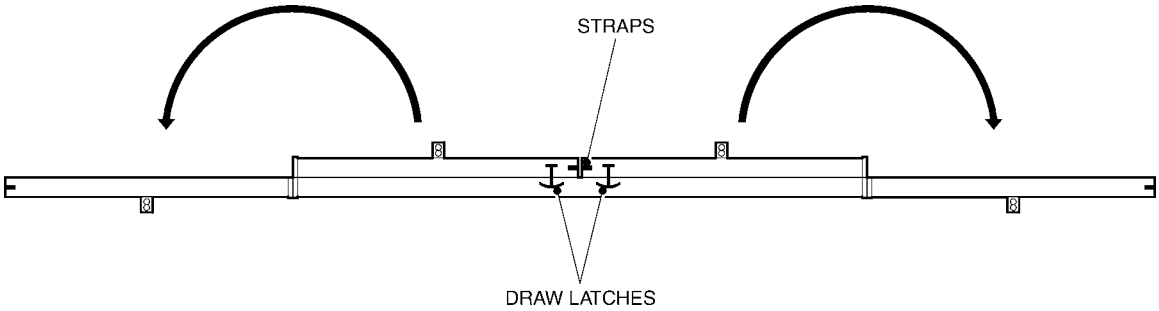


Figure 3. 3 Opening the Tail lift Platform

3.1.11.4 Open the telescopic parts from both sides, by pulling the straps, ensuring they are completely out.

3.1.12 Installing The Handrails

3.1.12.1 Remove the tail lift handrails, which are stored in basket BII on flatrack LVT.

3.1.12.2 Fit the tail lift handrails to the platform. Ensure the handrails lock the telescopic parts open.

NOTE

All handrails must be installed correctly for safe use of platform.

3.1.12.3 There are a total of 8 handrails:

Four Large - 27.5 inches (750mm) for both sides and the center of the platform.

Four small - 25.5 inches (650mm) 2 each for front and back of platform ends. Ensure these are fitted the correct way with the sloping edge facing inwards. White painted alignment marks are provided to assist.

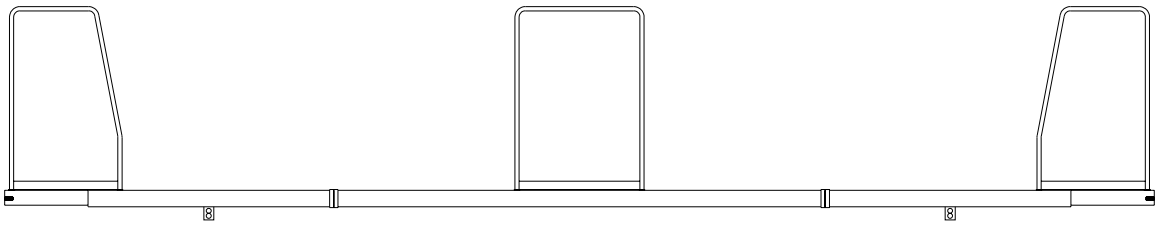


Figure 3. 4 Tail lift Platform

3.2 TAIL LIFT DEPLOYMENT AND RECOVERY

WARNING

TAIL LIFT OPERATION. ENSURE PERSONNEL ARE CLEAR FROM UNDER THE TAIL LIFT PLATFORM BEFORE LOWERING THE TAIL LIFT. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE SEVERE INJURY TO PERSONNEL.

3.2.1 Releasing the Tail lift and Far Bank Support

3.2.1.1 Remove the two transportation securing straps restraining the tail lift.

3.2.1.2 Remove the tail lift pendant with the attached umbilical cable from its stowage box located on the left of the vehicle next to the battery box.

3.2.1.3 Remove the dust cover from the tail lift umbilical connection mounted at the left side of the launch vehicle, aft of the fifth wheel axle.

3.2.1.4 Check the emergency stop button on the tail lift pendant is released by turning the knob clockwise in the direction of the arrows.

3.2.1.5 Connect the tail lift umbilical cable to the tail lift vehicle connection point (see Figure 3. 6). Make sure the switch lights on the tail lift pendant are illuminated.

3.2.1.6 In the launch vehicle cab (Figure 3. 5), to the right of the driving position, on the left side of the center console, set the 4-position mode selector rotary switch from position 1 to position 2 (A-frame **DEPLOY**). Make sure the PTO engages and the engine rpm goes to high idle.

3.2.1.7 On the interface cabinet press the E STOP RESET button to enable the system to go through the steps for HIGH IDLE and the production of hydraulic pressure.

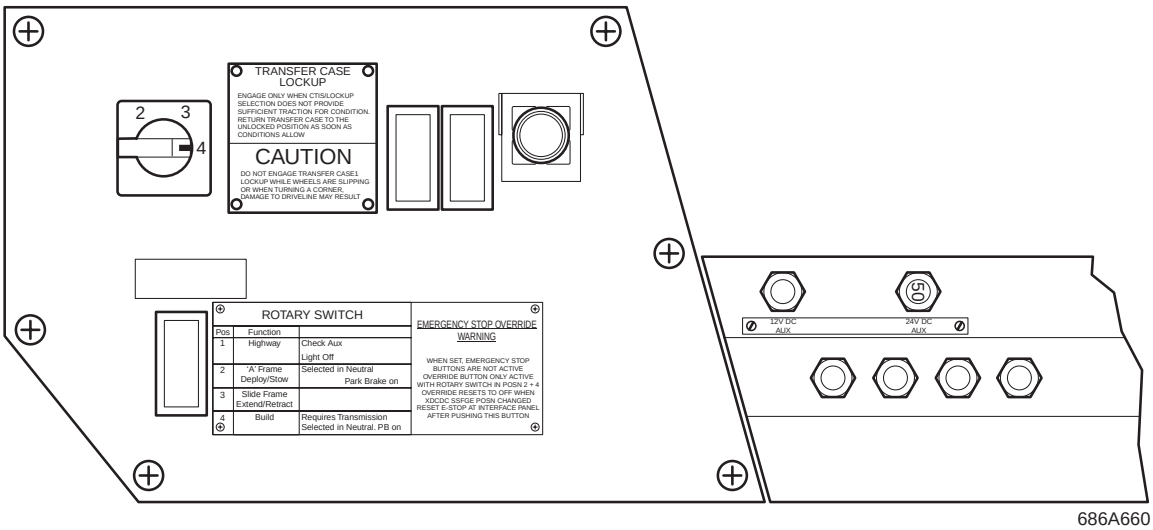


Figure 3. 5 Four Position Switch in Cab

3.2.1.8 Make sure the area at the rear of the launch vehicle is clear of personnel.

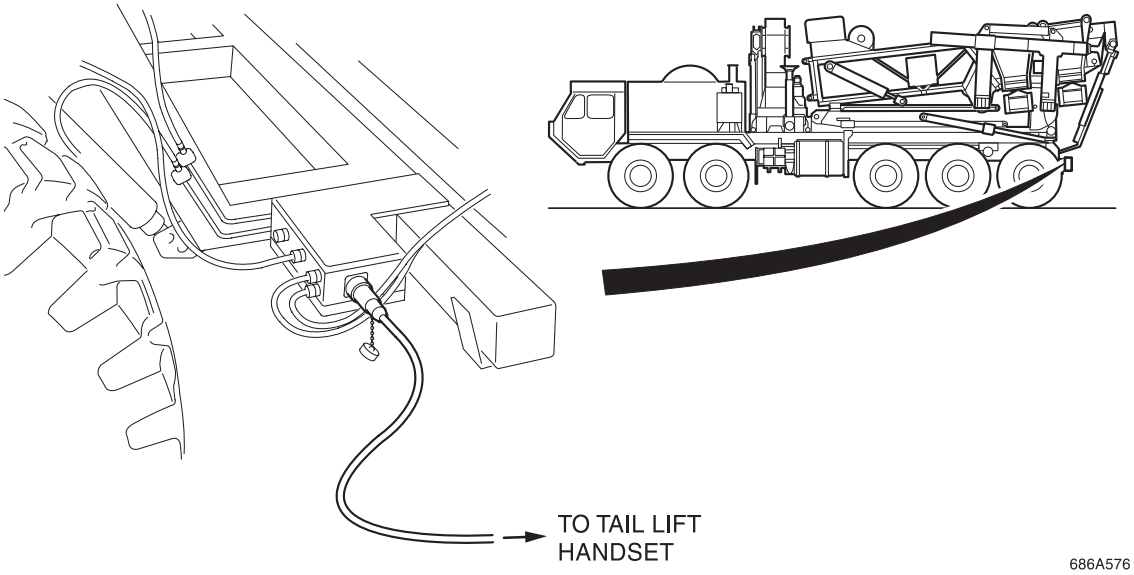


Figure 3. 6 Tail Lift Pendant Connection Point

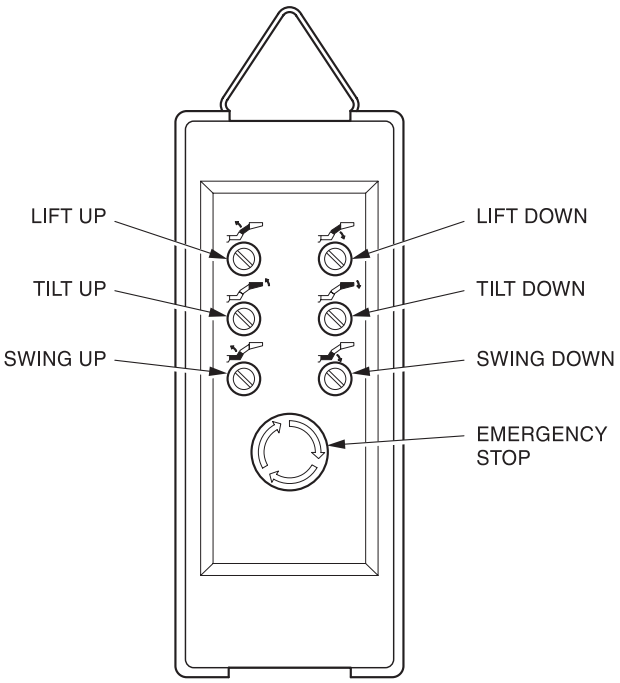
WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

TAIL LIFT OPERATION. ENSURE PERSONNEL ARE CLEAR FROM UNDER THE TAIL LIFT PLATFORM BEFORE LOWERING THE TAIL LIFT. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE SEVERE INJURY TO PERSONNEL.

3.2.1.9 On the tail lift pendant, operate the **SWING DOWN** switch to pivot the tail lift platform downwards.



Tail Lift Pendant

NOTE

The swing hydraulic cylinders must be fully retracted before using the tail lift as a working platform.

When traversing rough terrain, operate the LIFT UP switch on the tail lift pendant as necessary to prevent the platform striking the ground.

3.2.1.10 On the tail lift pendant, operate the tail lift **TILT UP** or **TILT DOWN** switches to level the tail lift platform.

3.2.1.11 Release the straps and remove the two crane stabilizer spreader pads and folding steps from the tail lift platform. Position these items clear of the launch vehicle and any other possible vehicle/trailer traffic.

3.2.1.12 On the tail lift pendant, operate the **LIFT DOWN** switch to lower the tail lift platform.

NOTE

This is a two-man job; one man holds the far bank support while the other man removes the restraining strap.

3.2.1.13 Carefully remove the transportation securing straps from the far bank support. Take care as the far bank support pivots about its attachment to the forward launch beam to a vertical position as the securing strap is released.

WARNING

CRUSH INJURY. PERSONNEL STANDING ON THE TAIL LIFT REAR CROSS MEMBER MUST BE AWARE OF OVERHEAD EQUIPMENT. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO DEATH OR SEVERE INJURY.

NOTE

It may be necessary to manually swing the far bank support to engage the stirrups on the tail lift platform.

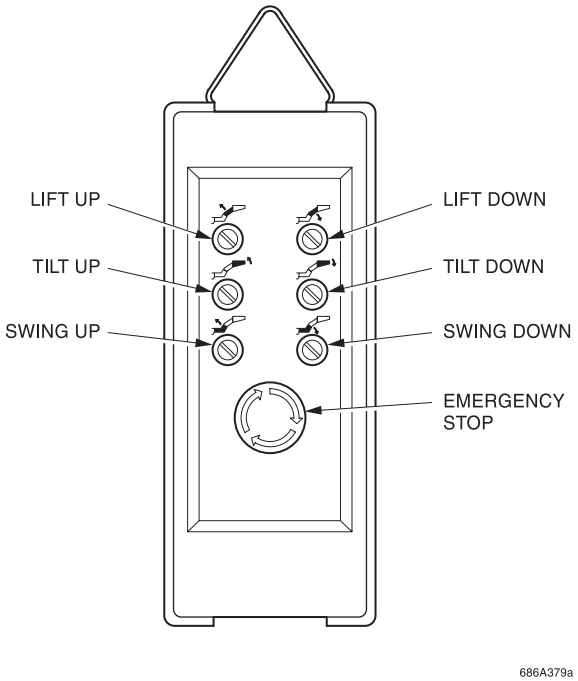
3.2.1.14 Remove the pin clip from the latch retaining the far bank support pads and support the weight of the pads. Using two personnel rotate the retaining latch clear, lift the far bank support bearing pads from their stowage brackets, and stow them in a safe position.

3.2.1.15 Place one person on the tail lift rear cross member.

3.2.1.16 On the tail lift pendant, operate the **SWING UP** switch to raise the tail lift platform. Make sure the lift hydraulic cylinders extend and raise the tail lift platform until the bottom beam of the far bank support engages with the “U” shaped stirrups attached to the tail lift.

3.2.1.17 Release the **SWING UP** switch when the tail lift structure supports and lightly compresses the far bank support. This is noticeable when the shootbolt holding the far bank support central column in the closed transportation position becomes loose and can be retracted.

3.2.1.18 Remove the pin clip and retract the lower shootbolt from the far bank support and, on the tail lift pendant operate the **SWING DOWN** switch to lower the tail lift platform. Make sure the tail lift hydraulic cylinders operate and lower the tail lift platform, supporting the far bank support until its fully extended position is reached.



Tail Lift Pendant

3.2.1.19 Step onto the tail lift and re-insert the shootbolt to secure it in the extended position, locking it in place with the pin clip. If necessary, adjust the position of the tail lift platform to move the far bank support to align the holes and facilitate installation of the shootbolt.

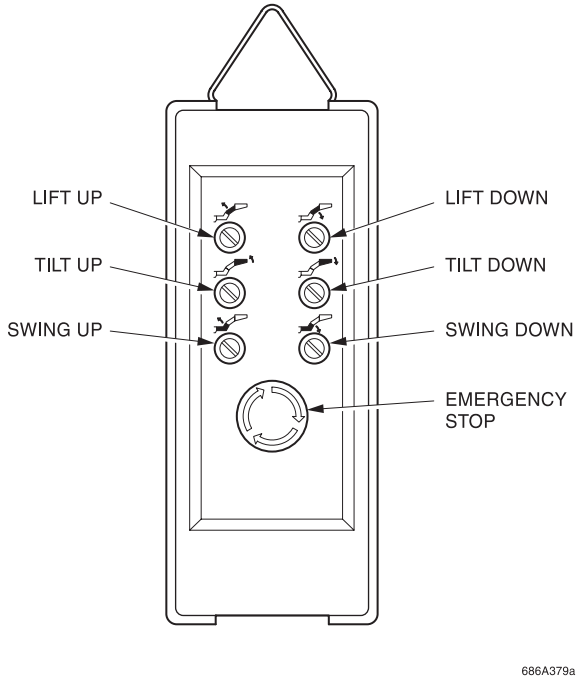
3.2.1.20 Release the **SWING DOWN** switch when the far bank support is fully extended.

3.2.1.21 Insert the upper shootbolt and lock in place with a retaining clip. If necessary, adjust the position of the tail lift platform to move the far bank support to align the holes and facilitate installation of the shootbolt.

3.2.1.22 On the tail lift pendant, operate the **SWING DOWN** switch to lower the tail lift away from the far bank support.

3.2.1.23 Put the far bank support bearing pads in position on the tail lift platform.

3.2.1.24 On the tail lift pendant, operate the **LIFT UP** switch to raise the tail lift platform.



Tail Lift Pendant

3.2.1.25 Release the **LIFT UP** switch when the attachment holes in the bearing pads and the far bank support are aligned.

3.2.1.26 Connect the bearing pads to the far bank support by retracting the spring-loaded pin, inserting the ball joint and re-inserting the pin. Make sure the spring-loaded pin is fully engaged.

3.2.2 Stowing the Far Bank Support and Tail lift

WARNING

TAIL LIFT OPERATION. THE TAIL LIFT IS DESIGNED TO CARRY A MAXIMUM OF FOUR PERSONS (500KG (1102.31LBS)). DO NOT OVERLOAD THE TAIL LIFT OR PERSONS COULD BE KILLED OR INJURED AND THE TAIL LIFT DAMAGED IN THE EVENT OF A FAILURE.

CRUSH INJURY. RAISING THE TAIL LIFT WITH THE GUARD RAILS ERECTED MAY CAUSE A TRAPPING HAZARD. KEEP ALL LIMBS CLEAR DURING TAIL LIFT MOVEMENT.

CAUTION

The tail lift is designed to carry a maximum of four persons (500kg (1102.31lbs)). Do not overload the tail lift. The tail lift will be damaged in the event of a failure.

3.2.2.1 Remove the stepladder and crane spreader pads (if fitted) and temporarily stow next to the vehicle. Slide the two extension pieces on either side of the platform into the folding sections of the tail lift.

3.2.2.2 Fold the two sections of the tail lift platform using the straps provided and lock in position.

3.2.2.3 On the tail lift pendant, operate the **LIFT DOWN** switch to lower the tail lift platform. Position the tail lift platform conveniently to support the weight of the far bank support bearing pads.

3.2.2.4 Pull back the spring-loaded retaining clips and disconnect the bearing pads from the far bank support. Place bearing pads close by, and out of the way of personnel.

3.2.2.5 Operate the **LIFT UP** switch until the tail lift structure supports the far bank support ensuring that the far bank support locates in the stirrups on the tail lift.

3.2.2.6 Step onto the tail lift, remove the pin clip and retract the shootbolt securing it in the extended position.

3.2.2.7 Operate the **LIFT UP** switch until the tail lift platform compresses the far bank support and the retracted position locking holes are aligned.

3.2.2.8 Insert the shootbolt in the far bank support at its retracted position and lock in place with the pin clip.

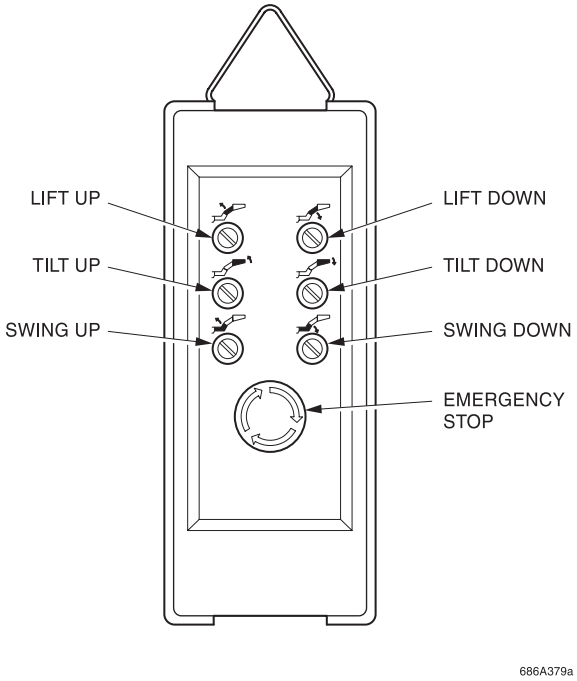
3.2.2.9 On the tail lift pendant, operate the **LIFT DOWN** switch until the tail lift platform is at ground level and its support of the far bank support is removed.

3.2.2.10 Stow the far bank support bearing pads to the far bank support, one at the back and one at the front stowage positions.

3.2.2.11 Using two personnel push the far bank support into its stowed position and install the transportation straps on the far bank support and secure it in its stowed position on the launch vehicle (LV).

3.2.2.12 Recover the tail lift guardrails and locate them in their stowed position in basket LVT and on flatrack LVT.

3.2.2.13 Secure the crane spreader pads and the stepladder with the over center buckle straps on the tail lift. Ensure that the buckle on the strap is located on the side of the load to prevent contact with the far bank support hydraulic pipes.



Tail lift pendant

3.2.2.14 On the tail lift pendant, operate the **SWING UP/DOWN** switches to move the tail lift hydraulic cylinders until they are fully extended and the far bank support is supported by the tail lift.

NOTE

It may be necessary to adjust the tail lift to the transport position by further operation of the TILT UP, TILT DOWN, LIFT UP or LIFT DOWN switches.

3.2.2.15 Disconnect the tail lift umbilical cable from the launch vehicle connection point. Fit dust covers to the electrical connections at the umbilical cable end and the launch vehicle.

3.2.2.16 Coil the tail lift umbilical cable and return the cable and the tail lift pendant to their stowage.

3.2.2.17 Install the two transportation-securing straps from the launch vehicle to the tail lift and tighten. Ensure that the anti chafe sliding covers (1) are positioned where the strap passes through the bracket (2) on the A-frame lower cross member.

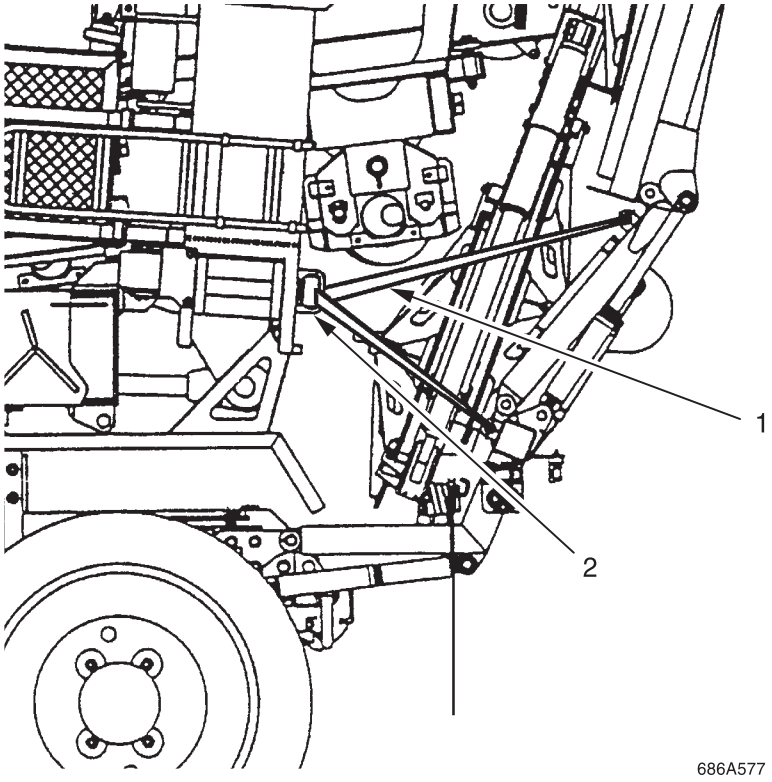


Figure 3. 7 Tail lift Transport Straps

3.3 LADDERS

NOTE

When climbing bridge loads, in particular, loads placed on trailers or PLS vehicles; strict safety procedures should be followed.

3.3.1 Use of Ladders When Module Opening

3.3.1.1 Position the module access ladder to the side of the parallel module where the sling is to be attached to the module lifting beam.

3.3.1.2 Ensure that the hooked ladder off stands have securely engaged over the chord of the bridge module and are laterally restrained by the deck unit hinge brackets.

3.3.1.3 Extend the ladder to a suitable working length and angle.

3.3.1.4 Ascend the ladder and once at a height suitable for connecting the sling, lean against the ladder and using two hands connect the sling to the module lifting beam hook.

WARNING

FALL HAZARD. SEVERE INJURY COULD RESULT IF THE LADDER IS PLACED TOO FAR AWAY FROM THE SLING CAUSING OPERATORS TO LEAN TO THE SIDE EXCESSIVELY TO CONNECT THE SLINGS.

3.3.1.5 Descend the ladder and reposition it alongside the next module sling ensuring that it is correctly attached.

3.3.1.6 Ascend the ladder and once at a height suitable for connecting the sling, lean against the ladder and using two hands connect the sling to the module lifting beam hook

3.3.1.7 Descend the ladder and stow the ladder for later use.

Section II. LAUNCHER

3.4 CHEST PACK

3.4.1 Chest pack Harness Fitting/Adjustment

3.4.1.1 The concept of the chest pack webbing harness (Figure 3. 8) is to allow the operator to remove the chest pack easily, when not needed, without having to take the harness off. The harness should be correctly adjusted for the user. As there is usually only one normal user for the chest pack in a team, the harness should be adjusted to correctly suit that user. Once this is achieved, it should not need to be adjusted again.

3.4.1.2 The correct adjustment is achieved when the two rear straps are adjusted to insure that the cross over of the straps are approximately in the middle of the back level with the lower part of the shoulder blades. This should mean that there is no direct load onto the back of the neck, but the load is transmitted to the back and down to the plastic anchor plate.

3.4.1.3 The front straps should be adjusted so that the plastic anchor plate is approximately on the waist line this will ensure that the top of the chest pack frame is below the level of the elbow and fore arm.

3.4.1.4 The chest pack should be fitted and the shoulder straps should be connected to the lug or vertical part of the frame on the front of the chest pack. The straps are then adjusted to place the joysticks at a comfortable position for the hands to rest on the front corners of the frame and the joysticks operated with the thumb and forefinger.

3.4.1.5 The chest pack can now be removed and refitted easily when not in use. If the webbing is adjusted correctly, the loads will not be applied to the back of the neck.

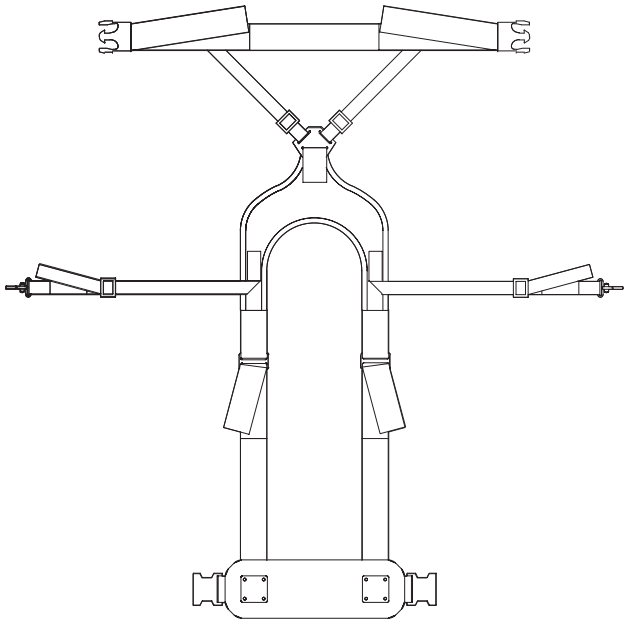


Figure 3. 8 Chest Pack Harness

3.4.2 Connecting the Chest Pack to Launcher

NOTE

If the four position deployment selector switch in the vehicle cab is placed to position 4 with the chest pack disconnected, the emergency stop system will be automatically operated.

3.4.2.1 Remove the chest pack and its umbilical cable, if disconnected, from its stowage and uncoil it along the ground adjacent to the launch vehicle.

3.4.2.2 Remove the chest pack harness from its stowed position and secure it to the operator with the shoulder harness straps. Attach the chest pack to the harness.

3.4.2.3 Check the emergency stop button is released by pulling the knob.

3.4.2.4 Remove the dust caps from the ends of the umbilical cable and, if required, the chest pack and connect the end of the launch umbilical cable to the chest pack.

3.4.2.5 Remove the dust caps (Figure 3. 9) from either of the remote connectors on the outer A-frame legs. Connect the umbilical cable to the connector selected for use.

3.4.2.6 Set the chest pack power switch to DIM or BRIGHT as necessary. Make sure the indications on the chest pack display screen are correct and that the 'Power' light is only illuminated.

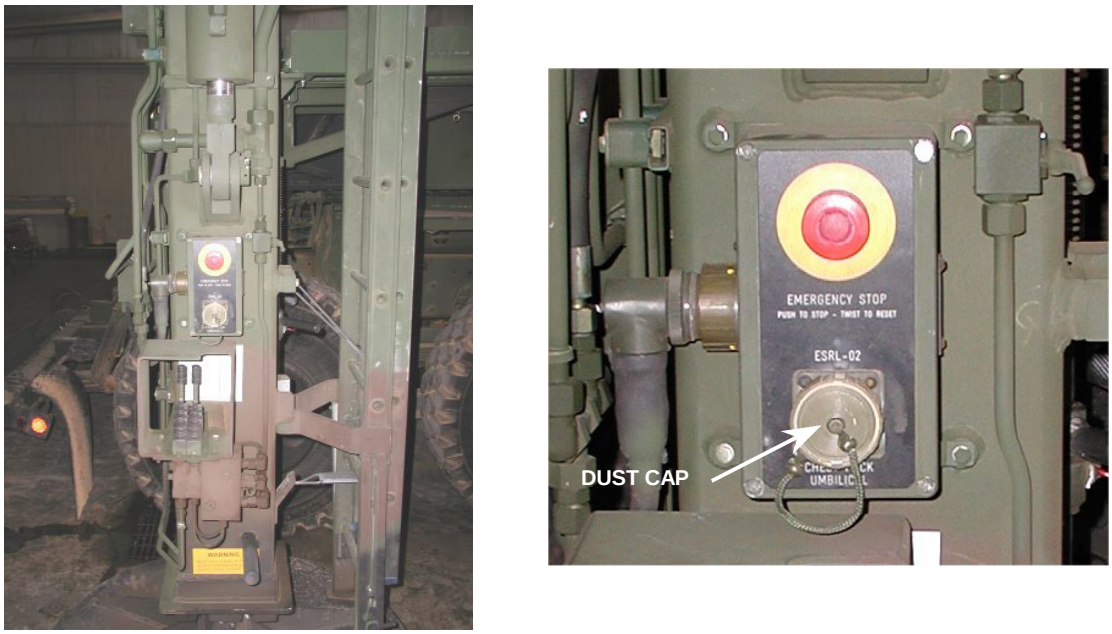


Figure 3. 9 Chest Pack Connection Point (typical)

3.4.3 Operation of the Chest Pack

WARNING

CHEST PACK E-STOP OPERATION. IF THE CHEST PACK IS FITTED TO THE LAUNCH VEHICLE WHEN THE FOUR POSITION SWITCH, IN THE VEHICLE CAB, IS SET TO POSITION 2 THE CHEST PACK E-STOP BUTTON IS DISABLED. SHOULD IT THEN BE OPERATED IN AN EMERGENCY, ELECTRICAL POWER AND THUS HYDRAULIC POWER WILL NOT BE REMOVED FROM THE LAUNCHER. FAILURE TO HEED THIS INFORMATION COULD LEAD TO DEATH OR SEVERE INJURY TO PERSONNEL.

3.4.3.1 Movement through the chest packs menu system is achieved by moving the joystick on the right-hand side of the chest pack either left or right. Each movement to the left or right selecting the next function to the left or right of the current selection within the menu.

3.4.3.2 When MODE SELECT is chosen the MODE SELECT light will flash and movement of the joystick forward or rearward will move up and down the choice of bank conditions. When the appropriate bank condition is selected one further movement of the joystick to the right will select this bank condition and the MODE SELECT light will stop flashing.

3.4.3.3 Once a function has been selected movement of the joystick forward or rearward will cause a motion to occur dependent on the current function selected. In general, movement of the joystick forward causes an outwards or upward movement with movement of the joystick rearward causing a downward or inwards movement.

3.4.3.4 The joystick is proportional; therefore, an increase in the speed of operation of a function is increased the further the joystick is moved from its center position.

3.4.3.5 The following are the indications and their associated function displayed on the chest pack.

3.4.3.6 **FAULT**: When continuously illuminated this indicates that a malfunction has occurred within the system. An investigation to identify and rectify the malfunction must be carried out before continued operation of the chest pack. When flashing, a fault has occurred which does not stop further use of the system but an investigation to identify and rectify the malfunction must be carried out at the earliest practicable time.

3.4.3.7 **POWER**: When illuminated this indicates the chest pack is switched on and power is available.

3.4.3.8 **BEAM ANGLE**: Refer to Figure 3. 10. When illuminated this indicates the function is active. Movement of the joystick forward will raise the end of the beam thus increasing the beam angle and rearward will lower the end of the beam decreasing the beam angle. The angle at which the beam is set is dependent upon whether the far bank is higher, level or lower than the home bank and may also be used to position the rear of the launch beam at a suitable height for pinning operations.

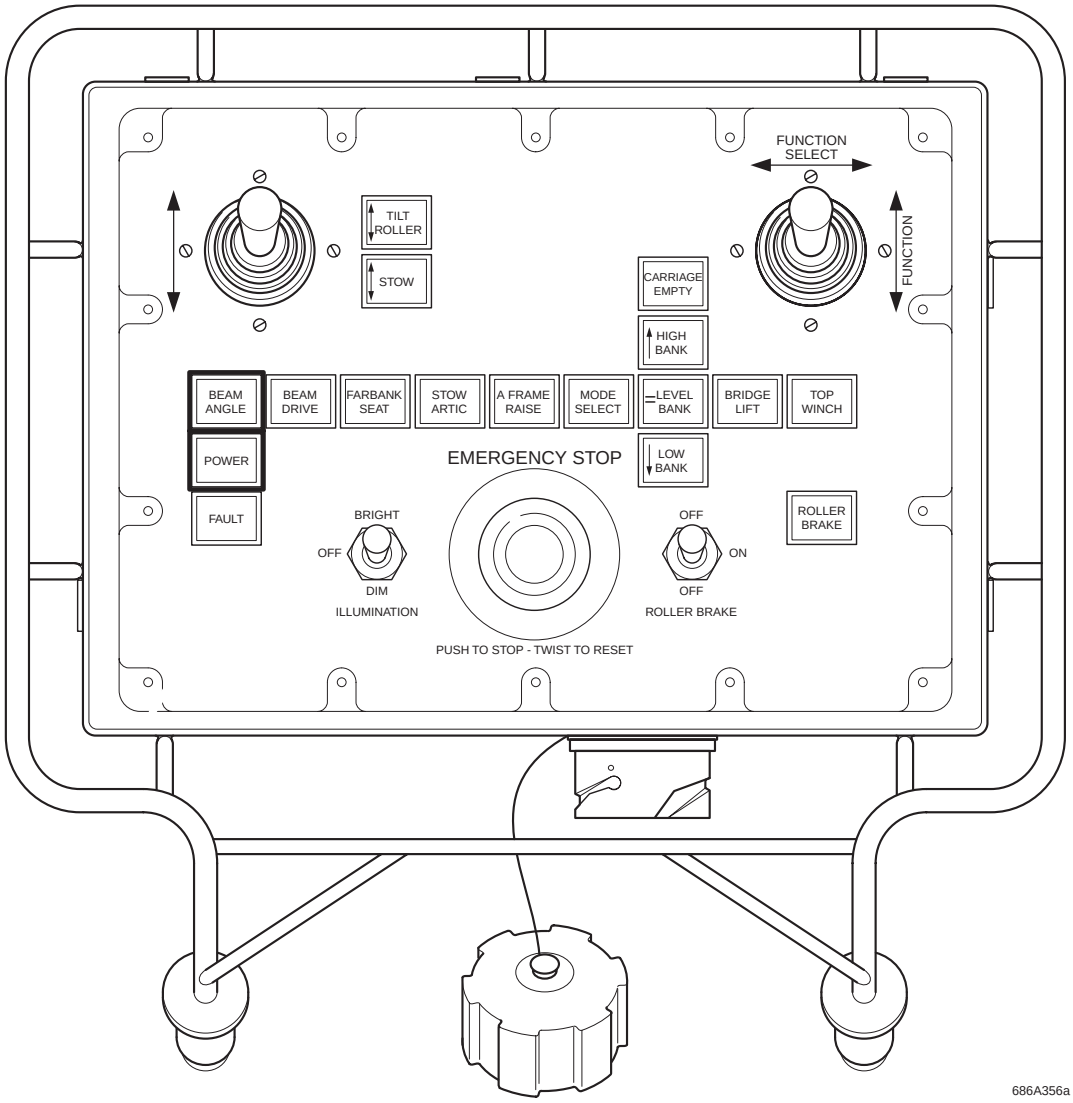


Figure 3. 10 Beam Angle Caption

3.4.3.9 **BEAM DRIVE**: Refer to Figure 3. 11. When illuminated this indicates the function is active and movement of the joystick forward will cause the beam drive to drive the launch beam out across the gap and rearward will drive the launch beam back.

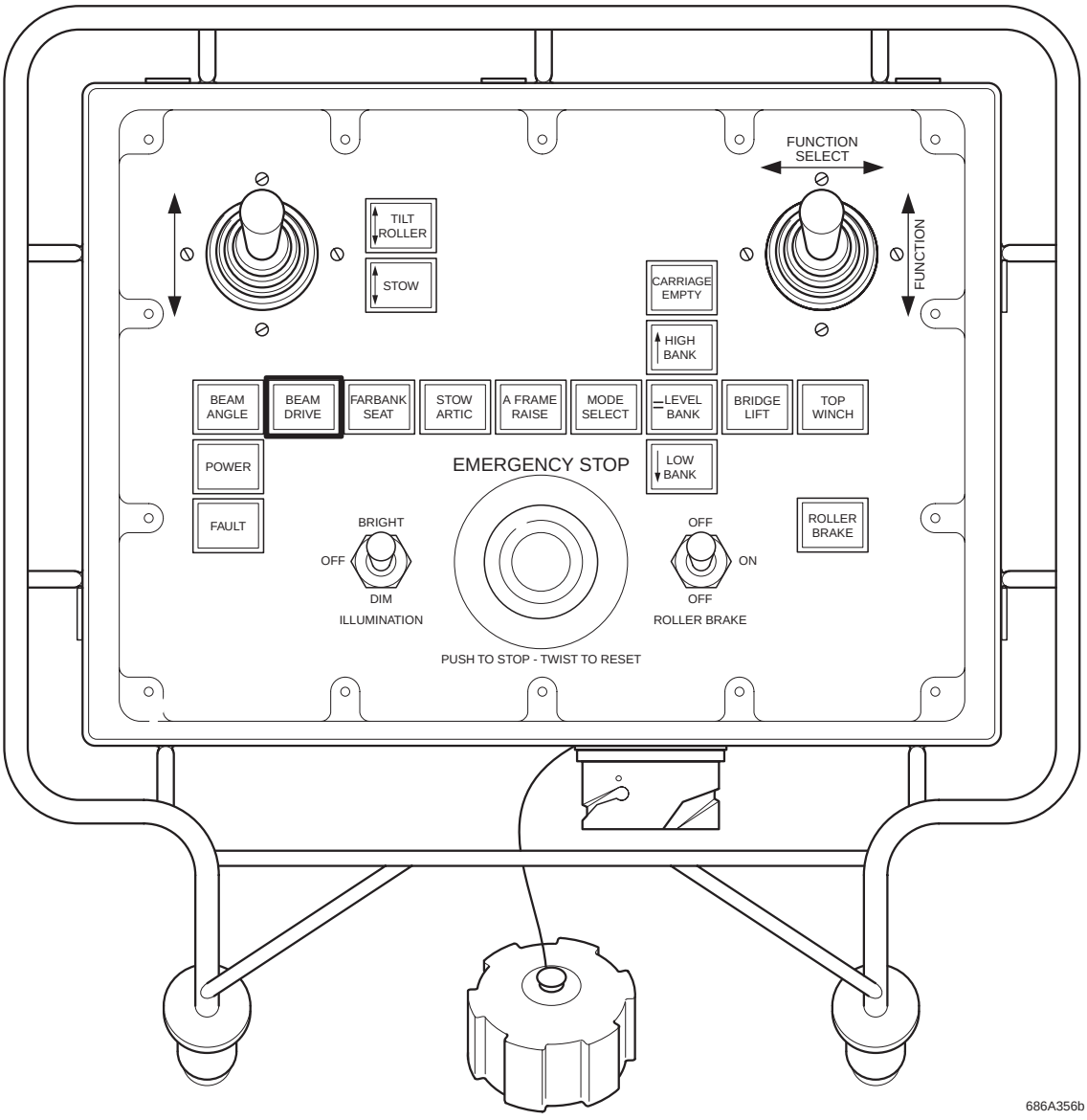


Figure 3. 11 Beam Drive Caption

3.4.3.10 **FAR BANK SEAT**: Refer to Figure 3. 12. When illuminated this indicates the function is active and movement of the joystick rearward extends the articulator cylinders and lowers the far bank support. Movement of the joystick forward retracts the articulator cylinders and raises the far bank support.

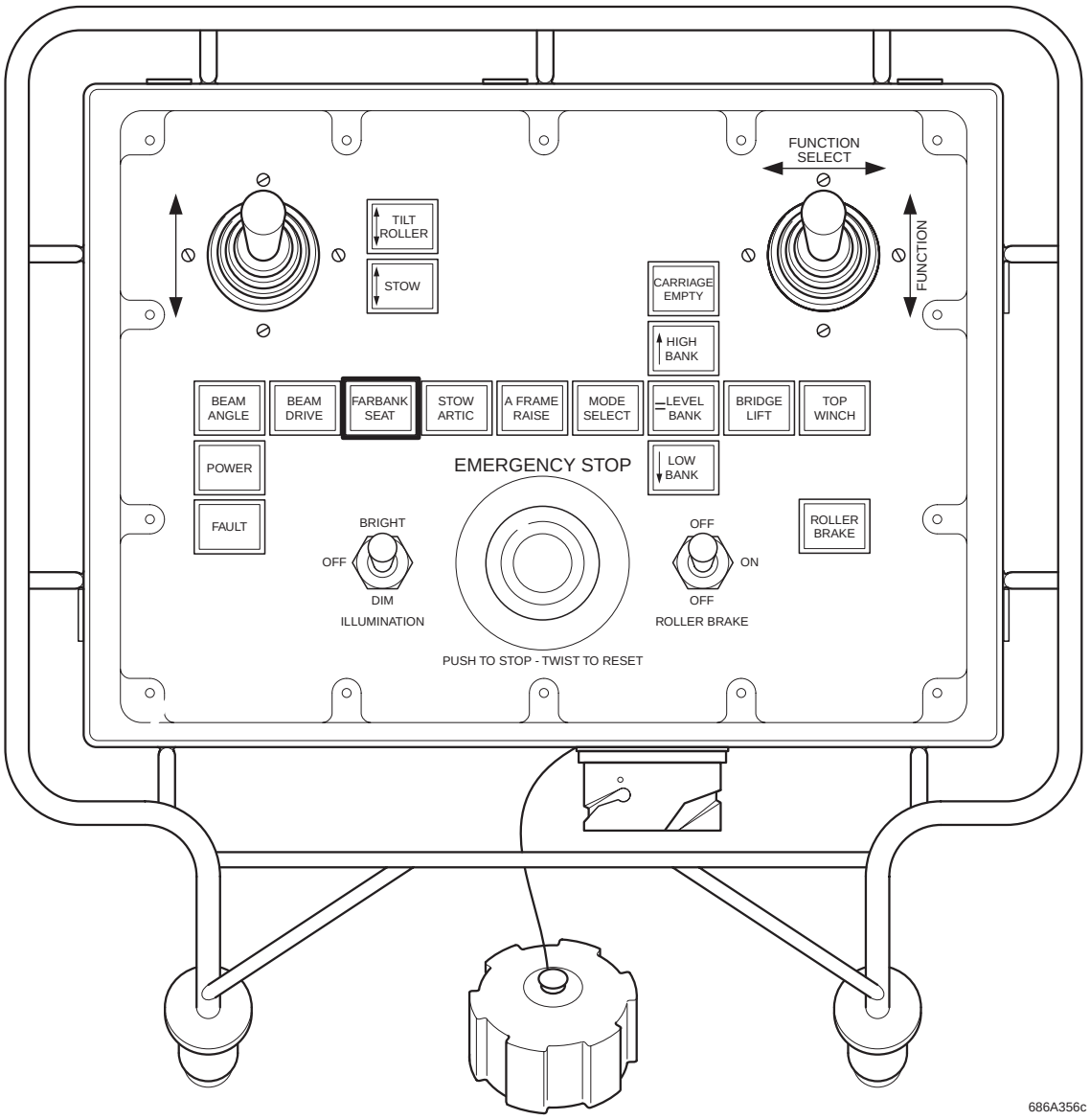


Figure 3. 12 Far Bank Seat Caption

3.4.3.11 **STOW ARTIC**: Refer to Figure 3. 13. When illuminated this indicates the function is active. When this function is selected the **STOW** function light, which is located to the right of the left hand joystick, also illuminates. This indicates that the left hand joystick is now functional and is set for stowing the articulator cylinders.

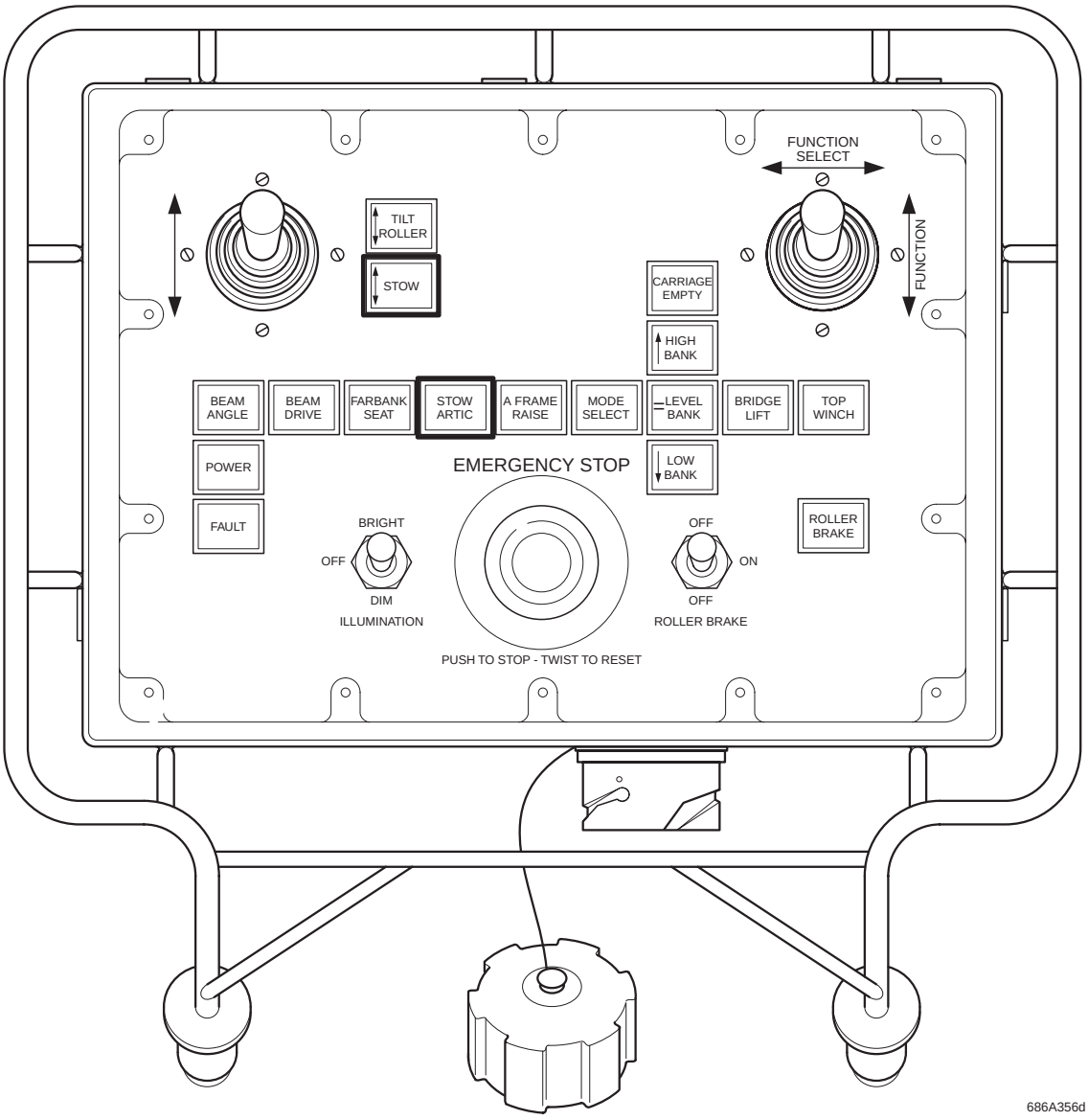


Figure 3. 13 Stow Articulator Caption

3.4.3.12 When the left hand joystick is moved forward, the articulator stowing cylinders retract pulling the articulator cylinders to the stowed position.

3.4.3.13 Movement of the left hand joystick forward causes the articulator stowing cylinders to extend pushing the articulator cylinders to the deployed position. Operation of the right hand joystick rearward then extends the articulator cylinders towards their positions for securing with the shootbolts. If necessary final alignment by hand may be required.

3.4.3.14 **A-FRAME RAISE** Bridge Build: Refer to Figure 3. 14. When illuminated this indicates the function is active. For this function to operate correctly the A-frame pins need to be removed. Movement of the joystick forward causes the A-frame raise cylinders to extend raising the A-frame to the upper position. The A-frame should be raised to a point where the A-frame pins can be re-inserted and then the A-frame is lowered onto the pins. With the pins removed, movement of the joystick rearward causes the A-frame raise cylinders to retract and lower the A-frame. The A-frame should be lowered until it sits on the lower captive pins at which point the A-frame pins can be reinserted.

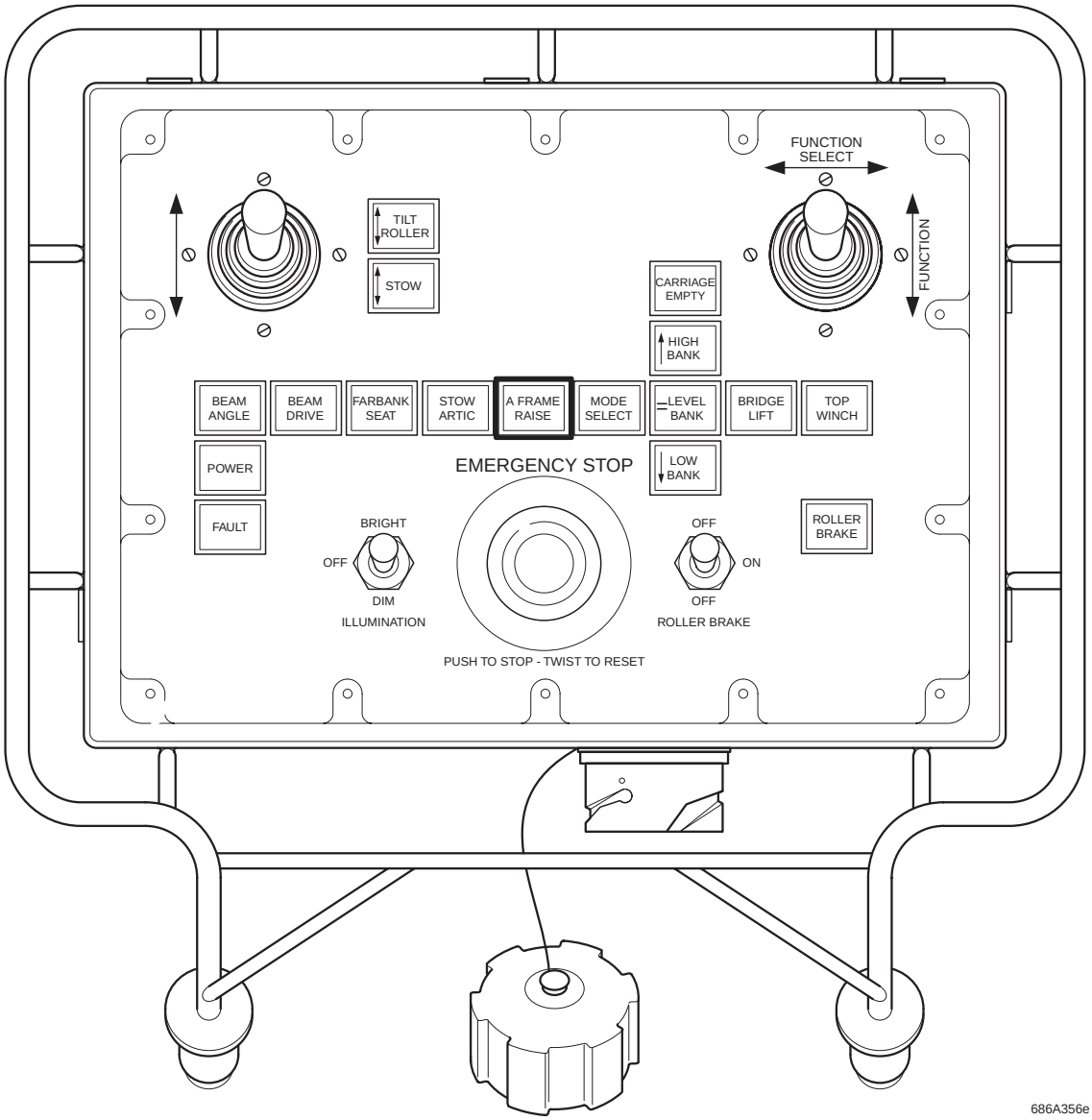


Figure 3. 14 A-Frame Raise Caption

NOTE

In this mode, forward or rearward movement of the joystick on the chest pack results in no physical effect on the hydraulic system.

3.4.3.15 **MODE SELECT**: Refer to Figure 3. 15. When illuminated this indicates the function is active. On initial selection, the **MODE SELECT** light caption flashes and **LOW** illuminates. Movement of the joystick forward will select the high bridge drive logic and the **HIGH** caption illuminates. Movement of the joystick rearward selects the low bridge drive logic and the LOW caption illuminates.

3.4.3.16 The bridge drive logic setting is determined by the height of the far bank and reference should be made to Chapter 1 Section II Table 1.11 for the correct setting.

3.4.3.17 This mode selection alters the tension in the upper and lower winches. In HIGH mode the upper winch becomes the primary driving winch as the bridge tends to run back towards the launch vehicle. In **LOW** and **LEVEL** mode the lower winch becomes the primary driving winch as the bridge tends to run towards the far bank.

3.4.3.18 Once the bank condition is selected i.e. **HIGH**, **LOW** or **LEVEL** a further movement of the joystick to the right selects that condition for all further operations. The **MODE SELECT** caption goes off, the bank condition chosen stays illuminated and the **TILT ROLLER** caption located next to the left hand joystick illuminates as does the roller brake function. This indicates that the left hand joystick is now functional and is set for extending or retracting the tilt roller cylinder. Operation of the tilt roller joystick will now move the tilt roller, forward to raise, rearward to lower.

3.4.3.19 Intermittent flashing of the **TILT ROLLER** and **ROLLER BRAKE** lights indicates that the roller brakes have not been applied and that the tilt rollers are currently non functional.

3.4.3.20 The upper and lower winches are fitted with winch tensioners, in addition the upper winch cable is monitored by a winch cable tension indicator. The winch cable tension indicator operates a micro switch. The limit switch is monitored via the firmware and is *only* functional in a **HIGH BANK** build, as it is only in **HIGH BANK** that the top winch is driven proportionally via the joystick. In all other instances, the upper winch is either applying back tension, which is trying to pull in cable or the cable, is being pulled off the upper winch.

3.4.3.21 If the cable does go slack and the limit switch trips then the winch can no longer be driven so that more cable is paid off. The operator is made aware of this by the **FAULT** light on the chest pack flashing along with the **TOP WINCH** light, which is located to the far right of the chest pack menu. This method of identifying the fault gives a clear indication that the fault is top winch related.

3.4.3.22 Should the top winch cable become slack and set off the micro switch, the joystick should be moved rearwards to pay in cable and hence re-tension the cable. It should be confirmed that the correct selection has been made for the conditions for the bridge build. i.e. is HIGH bank being used in a **LEVEL** bank situation.

3.4.3.23 As stated, the cable tension sensor is only used in the **HIGH** bank mode. It is disabled for **TOP WINCH** (Para. 3.4.3.25) as this mode is used for replacing cables on to the drum during which slack is likely to occur.

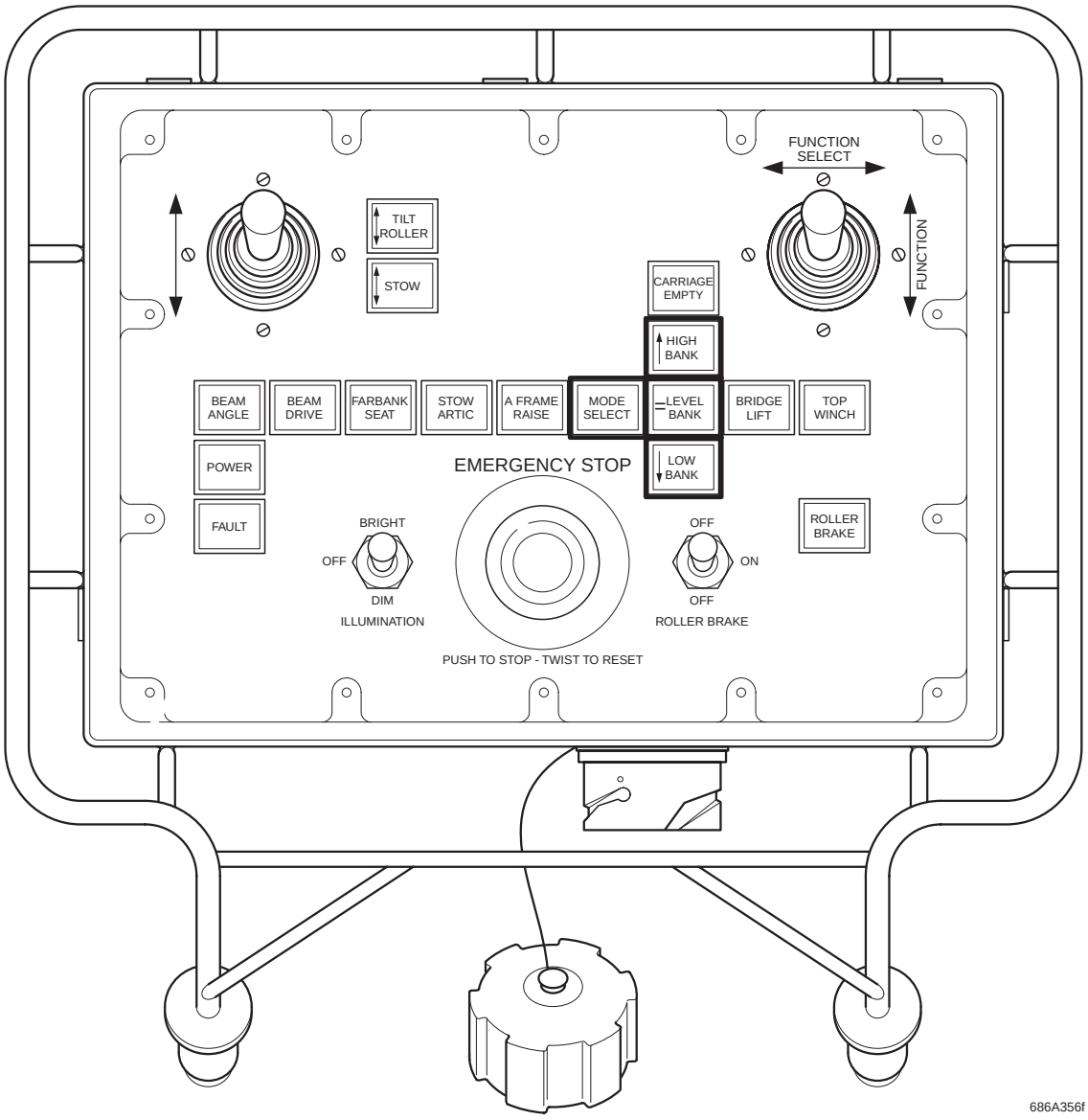


Figure 3. 15 Mode Select Captions

3.4.3.24 **BRIDGE LIFT**: Refer to Figure 3. 16. When illuminated this indicates the function is active. For this function to operate correctly either or both of the carriage shootbolts (these shootbolts are on the launch beam home and far bank carriages) need to be retracted. Movement of the joystick forward causes the carriage beams to be lifted and rearward causes the carriage beams to be lowered.

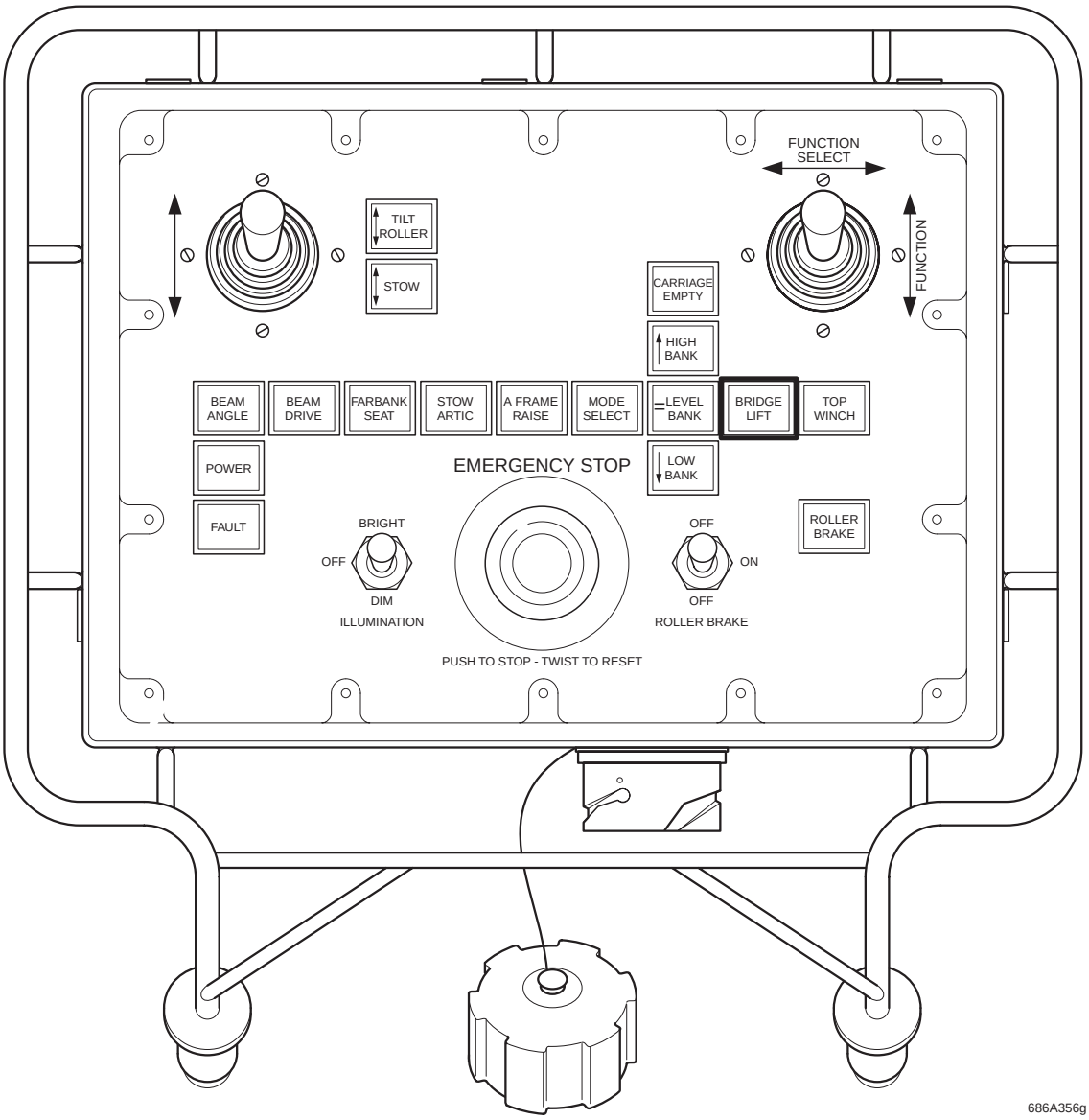


Figure 3. 16 Bridge Lift Caption

CAUTION

Equipment damage. TOP WINCH this selection is a maintenance function and should not be selected at any time during a bridge build sequence.

3.4.3.25 **TOP WINCH**: Refer to Figure 3. 17. When illuminated this indicates the function is active. This allows the winch cable to be spooled off the winch drum for maintenance procedures.

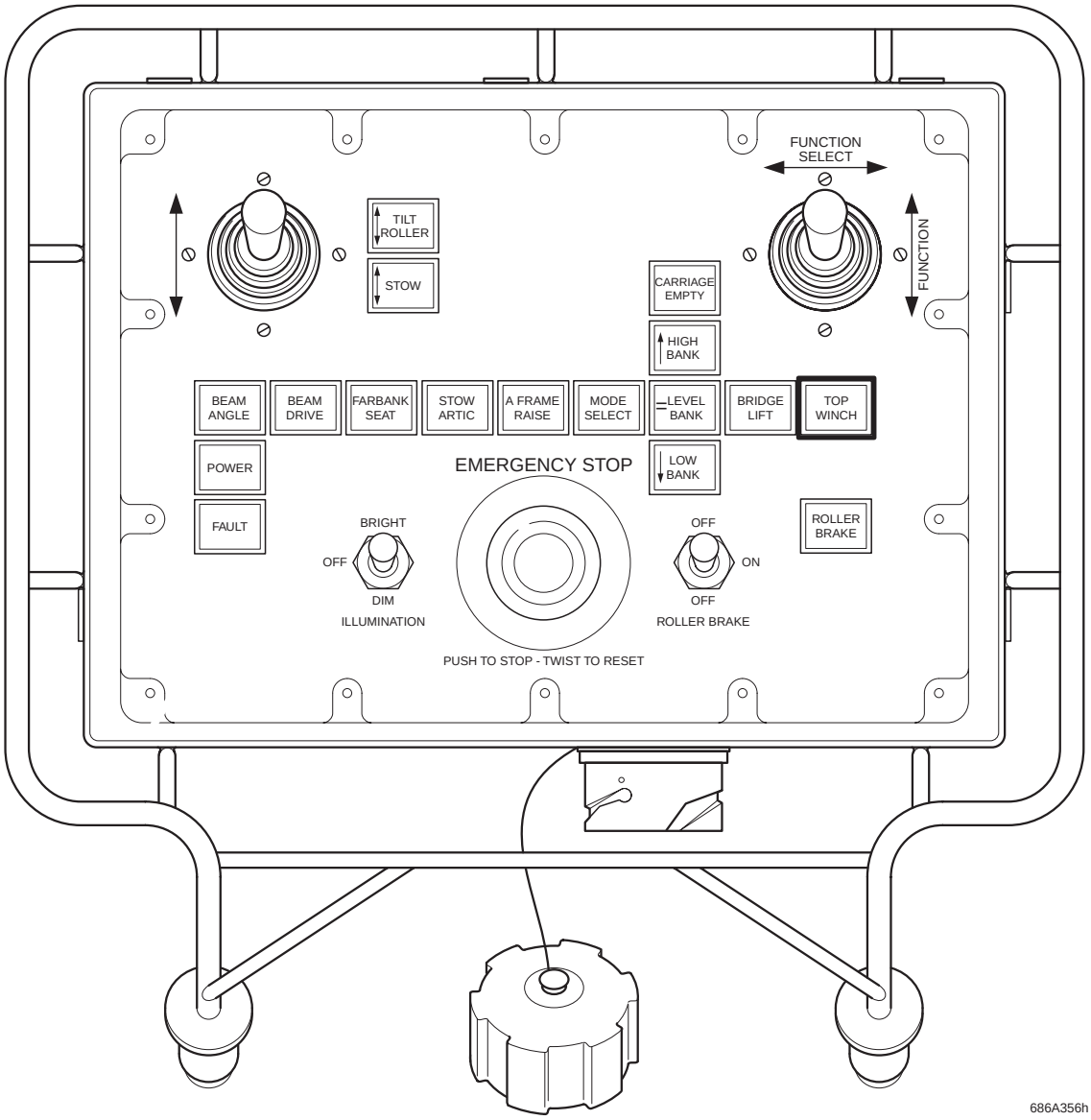


Figure 3. 17 Top Winch Caption

3.4.4 A-frame Roller Brake Operation

The hydraulically operated A-frame roller brakes are controlled by a switch on the chest pack. The roller brake can be used whenever the operator deems it necessary to slow, or stop, bridging module movement. The switch (Figure 3.18 (1)) that controls the roller brake is a three-position switch with a central ON position and two OFF positions, one position a normal latched OFF, the other a spring loaded momentary OFF position.

3.4.4.1 During much of the bridge build procedure, the roller brakes are not required, therefore, they will be deactivated by placing the switch into the forward latched OFF position.

3.4.5 Roller Brake Operation (General)

3.4.5.1 Refer to Figure 3.18.

3.4.5.2 To apply the roller brakes, set the switch (1) to the central **ROLLER BRAKE ON** position.

3.4.5.3 To release the roller brakes during bridge build, the operator should set the roller brake three-position switch (1) from the central ON position to the rear spring-loaded OFF position. With the switch in this position, should it be required, all the operator has to do is remove his hand from the switch and the roller brake will be immediately applied.

3.4.5.4 If bridge build mode has been selected with the brake in the OFF position, the tilt roller will be inoperative, as indicated by a flashing **ROLLER BRAKE** light (2) and the flashing **TILT ROLLER** light (3) on the chest pack. To enable the tilt rollers, set the toggle switch (1) to the central ON position to enable the tilt rollers.

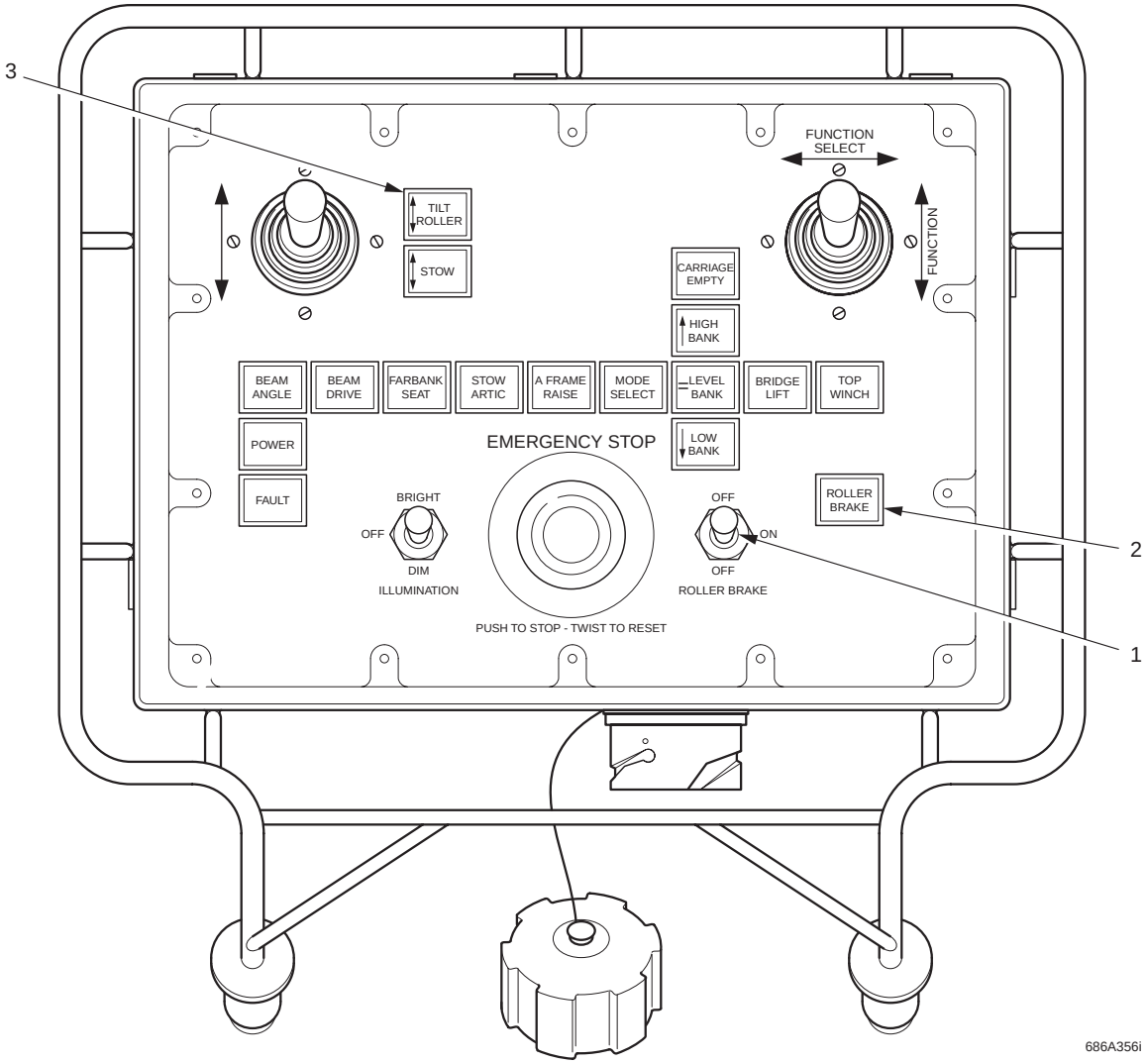


Figure 3.18 A-Frame Roller Brake Switch and Roller Brake Caption

3.4.6 Disconnecting the Chest pack

3.4.6.1 Set the chest pack to OFF.

3.4.6.2 Disconnect the launch umbilical cable from the chest pack and the launch vehicle connection point. Alternatively, disconnect the umbilical cable from the launch vehicle only.

3.4.6.3 Fit dust covers to the electrical connections at the umbilical cable ends, the chest pack and the launch vehicle.

3.4.6.4 Coil the chest pack umbilical cable around the chest pack or by itself and return the cable and the chest pack to their stowage position.

3.5 LAUNCHER DEPLOYMENT

3.5.1 A-Frame Deployment

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

CHEST PACK E-STOP OPERATION. IF THE CHEST PACK IS FITTED TO THE LAUNCH VEHICLE WHEN THE FOUR POSITION SWITCH, IN THE VEHICLE CAB, IS SET TO POSITION 2 THE CHEST PACK E-STOP BUTTON IS DISABLED. SHOULD IT THEN BE OPERATED IN AN EMERGENCY, ELECTRICAL POWER AND THUS HYDRAULIC POWER WILL NOT BE REMOVED FROM THE LAUNCHER. FAILURE TO HEED THIS INFORMATION COULD LEAD TO DEATH OR SEVERE INJURY TO PERSONNEL.

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

NOTE

Procedures 3.5.1.1 to 3.5.1.34 are carried out at the staging area.

3.5.1.1 Park the launch vehicle at the staging area in preparation for launcher deployment.

3.5.1.2 Apply the parking brake.

3.5.1.3 Ensure that neutral is selected on the gear box.

NOTE

When the four position switch is turned to position 2 an automatic procedure is initiated by the Programmable Logic Controller (PLC) which sets up the launch vehicle in preparation for deploying the A-frame. There is approximately two seconds delay between each automatic action carried out by the PLC, therefore, the lights indicating the actions will also have a delay in their sequence of lighting.

3.5.1.4 Turn the rotary switch in the vehicle cab to position 2.

3.5.1.5 On operation of the rotary switch, the engine should go to high idle and the PTO engage. Should this not occur then carry out procedures 3.5.1.6 to 3.5.1.9 otherwise proceed to 3.5.1.10.

3.5.1.6 Open the interface enclosure on the right hand side of the launch vehicle.

3.5.1.7 Ensure that the panel illumination is set to either bright or dim as required by ambient light conditions.

NOTE

The PANEL ILLUMINATION switch must be in either the bright or dim position for the panel lights to be illuminated during operation.

3.5.1.8 Carry out a lamp test by pushing the LAMP TEST button ensure that all lights illuminate. Release LAMP TEST button.

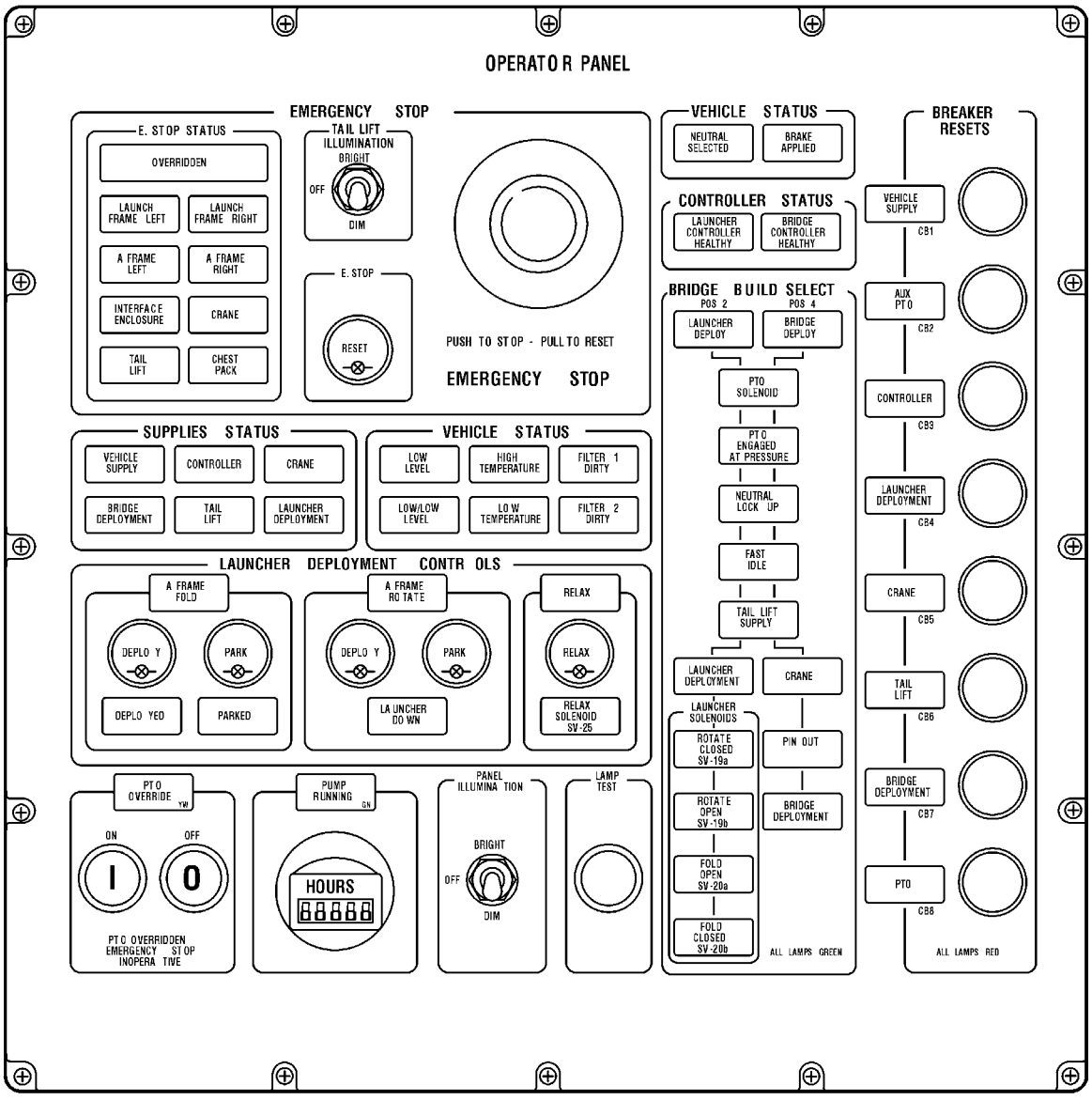


Figure 3. 19 Interface Enclosure

3.5.1.9 Check that the following lamps are lit:

E Stop Reset

Reset

On Supplies Status

Vehicle Supply

Controller

Crane

Bridge Deployment

Tail lift

Launcher Deployment

On Controller Status

Launcher Control Healthy

On Launcher Deployment Controls

A-frame Fold

Parked

A-Frame Rotate

Launcher Down

On Vehicle Status (at the top of panel)

Neutral Selected

Brake Applied

3.5.1.10 Press the EMERGENCY STOP RESET button. Ensure that none of the lights on the E-Stop status panel, at the top left of the main panel are illuminated, or, if illuminated that they go out. If any of the emergency status light do not extinguish check the E-Stop status panel for their location and release any emergency stop buttons that are engaged.

3.5.1.11 Ensure the following lights come on after pushing the E-STOP RESET button:

On Launcher Deployment Controls

A-Frame Fold

Parked

A-Frame Rotate

Launcher Down

Pump running along with the hours meter running

On Bridge Build Select

Launcher Deploy

PTO Solenoid

PTO Engaged at Pressure

5 second delay after PTO Solenoid comes on	Neutral Lock Up
2 second delay after Neutral Lock Up comes on	Fast Idle
2 second delay after Fast Idle comes on	Tail lift Supply

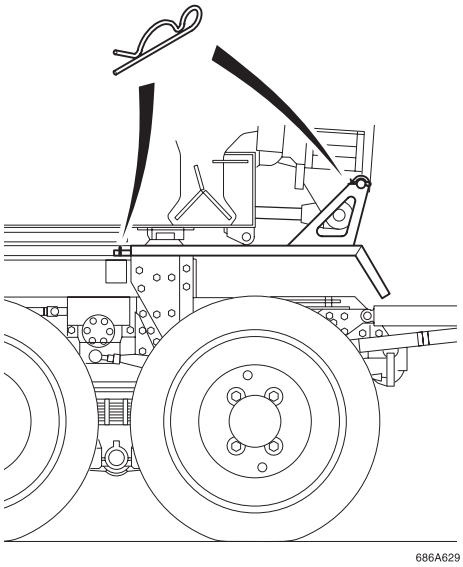
Launcher Deployment

3.5.1.12 Remove left and right hand mudguard extensions by removing the R clips from the front securing peg and from the rear shootbolt, retract the shootbolt.

3.5.1.13 Remove the mudguards and stow clear of the vehicle.

3.5.1.14 Replace the R clips from the front mudguard-securing peg back into the mudguard ready for use on mudguard refit.

3.5.1.15 Replace the R clips from the rear mudguard shootbolt on the vehicle, back into the shootbolt ready for use on mudguard refit.



Position of Mudguard R clips

3.5.1.16 Deploy the tail lift and the far bank support as described in Section 3.2.1, Paragraphs 3.2.1.1 through 3.2.1.18.

3.5.1.17 Remove A-frame leg hinge pins and clips, 2 on the left hand side and 2 on the right hand side.

3.5.1.18 Press the A-frame fold – **DEPLOY** button only when the A-frame hinge pins have been removed.

3.5.1.19 Make sure the outer-leg-folding hydraulic cylinders extend and pivot both outer A-frame legs outwards about the upper and lower A-frame transverse beams to their deployed positions.

3.5.1.20 Ensure that the A-frame **deployed** lamp illuminates and that the A-frame **parked** lamp extinguishes.

3.5.1.21 Release the **DEPLOY** pushbutton when the outer A-frame legs are fully spread.

3.5.1.22 Install the locking pins and their R clips in the outer A-frame legs at the upper and lower transverse beam hinge points to lock the legs in the spread position. Long pins are inserted into the lower beam from the front to rear. The short pins are inserted in the upper beam from the front to rear.

NOTE

The A-frame cannot be rotated to the vertical position unless the outer legs are in the spread position.

3.5.1.23 Refer to Figure 3. 19, on the A-frame rotate panel of the interface cabinet, operate and hold the A-frame rotate - **DEPLOY** pushbutton, to rotate the A-frame to the vertical position. Make sure the **DEPLOYED** caption illuminates.

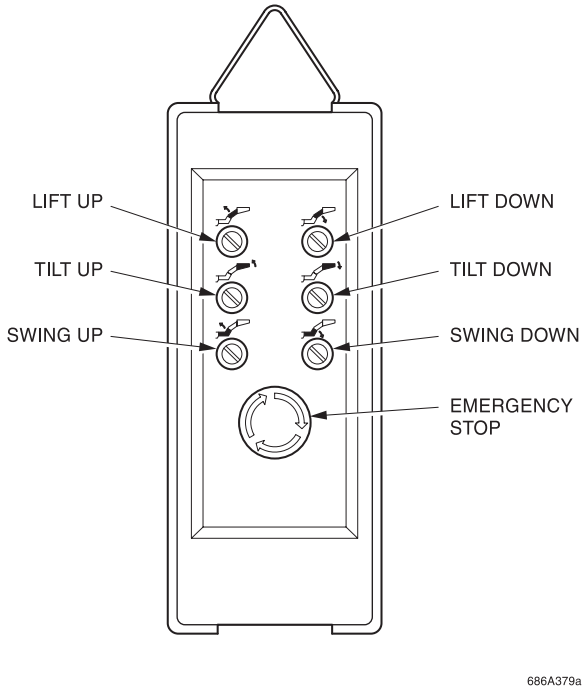
3.5.1.24 Make sure the hydraulic cylinders retract and pivot the A-frame out from its stowed condition to its deployed vertical position.

3.5.1.25 Release the **DEPLOY** pushbutton when the A-frame is deployed vertically and the shootbolts can be inserted.

3.5.1.26 Install the shootbolts and pin clips at the slide frame hinge point and the lower transverse beam to lock the A-frame vertical.

3.5.1.27 Support the far bank support with the tail lift.

3.5.1.28 On the tail lift pendant, operate the **LIFT UP** switch to raise the tail lift platform. Make sure the lift hydraulic cylinders extend and raise the tail lift platform until the far bank support spreader pads are supported by the tail lift.



Tail lift pendant

3.5.1.29 Ensure all pins are fitted to A-frame hinge points in preparation for moving launcher to bridging site.

3.5.1.30 Ensure that the launch vehicle is secured for movement to the bridging site.

3.5.1.31 If required close the operators panel cabinet door.

3.5.1.32 In vehicle cab switch four position switch to position 1.

3.5.1.33 Ensure PTO disengages.

3.5.1.34 Select gear and release handbrake.

3.5.1.35 Move vehicle to bridging site.

NOTE

The following procedures are carried out at the bridging site.

3.5.1.36 Make sure the area at the rear of the launch vehicle is clear of personnel.

3.5.1.37 Reverse the launch vehicle towards the gap and its marked out position. Use guiding personnel to make sure the area is clear and the launch vehicle correctly positioned.

3.5.1.38 Stop the launch vehicle movement and apply the handbrake.

3.5.1.39 Release the slide frame twist-to-lock fasteners, which are located at the rear of the vehicle at the end of the crane sub-frame. The twist-to-lock fasteners are released when the handles are 90 degrees to the chassis.

3.5.1.40 Set the 4-position mode selector rotary switch 2. Make sure the PTO engages and the engine rpm goes to high idle.

3.5.1.41 Remove the R clips and the pins securing the A-frame stabilizer legs in the retracted position. Slight extension or retraction of the stabilizer cylinders may be required to remove the pins.

WARNING

CRUSH HAZARD. BEFORE LOWERING A-FRAME STABILIZER LEGS ENSURE PERSONNEL ARE STANDING CLEAR OF THE STABILIZER FEET. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SERIOUS INJURY TO PERSONNEL.

3.5.1.42 At the A-frame controls on the centerline of the rear face of the A-frame, lower the stabilizer legs simultaneously by operating both levers together.

3.5.1.43 Make sure the stabilizer leg hydraulic cylinders extend and lower both A-frame stabilizer feet towards the ground.

3.5.1.44 Once the stabilizer leg feet are touching the ground, continue to extend the stabilizer leg hydraulic cylinders, lifting the slide frame above the chassis until the twist lock block is aligned with or above the slide frame/chassis clearance indicator on the chassis (see Figure 3. 20).

Figure 3. 20 Slide Frame/Chassis Clearance Indicator

3.5.1.45 Insert the pins in the highest pin hole position available, from the inside to the outside and lock in place by fitting the R clip into the outermost hole in the pin.

NOTE

The bank slope will determine the position of the stabilizer leg pins (refer to Chapter 1 Para 1.2.7). Ensure that both pins are at the same height.

3.5.1.46 Lower the A-frame onto the pins.

CAUTION

Equipment damage. Do not level the A-frame at this stage or the slide frame could be damaged.

3.5.1.47 Remove the chest pack from its stowage location and connect the chest pack (see 3.4.2) to its A-frame connection point, using its umbilical cable at either the left hand or right hand connection point.

3.5.2 Slide Frame Deployment

3.5.2.1 Select position 3 on the rotary switch in the cab. Make sure the PTO disengages and the engine rpm reduces to idle. Ensure case lock is engaged (all wheel drive).

CAUTION

Do not engage the launch vehicle transmission, and drive it forward or backward, in excess of 2 mph (3.2 kph), the A-frame could be damaged.

3.5.2.2 Select a forward gear and slowly (not exceeding 2 mph (3.2 kph)) drive the vehicle forward to fully extend the slide frame.

3.5.2.3 When in position select neutral on the transmission and ensure that the handbrake is properly applied.

3.5.2.4 Set the 4-position mode selector rotary switch to position 2. Make sure the PTO engages and the engine rpm goes to high idle.

3.5.2.5 If the engine does not go to high idle or the PTO pump does not engage then check that all appropriate lights are as described in paragraph 3.5.2.6. Otherwise, proceed to paragraph 3.5.2.7.

3.5.2.6 The following lights should be illuminated:

E Stop Reset

Reset

On Supplies Status

Vehicle Supply

Controller

Crane

Bridge Deployment

Tail lift

Launcher Deployment

On Vehicle Status (at the top of panel)

Neutral Selected

Brake Applied

On Vehicle Status

Neutral Applied

Brake Applied

On Controller Status

Launcher Control Healthy

On Bridge Build Select

Launcher Deploy

PTO Solenoid

PTO Engaged at Pressure

5 second delay after PTO Solenoid comes on — Neutral Lock Up

PTO Engaged at pressure

2 second delay after Neutral Lock Up comes on — Fast Idle

2 second delay after Fast Idle comes on — Tail lift Supply

Launcher Deployment

On Launcher Deployment Controls

A-frame Fold

Parked

A-Frame Rotate

Launcher Down

3.5.2.7 Press the '**RELAX**' button on the interface enclosure. The **RELAX SOLENOID SV-25** caption will illuminate.

3.5.2.8 Ensure that the relax mechanism centers.

3.5.2.9 Withdraw the relax shootbolts.

3.5.2.10 Ensure that the **PIN OUT** light on the interface enclosure illuminates.

3.5.2.11 Close the interface enclosure door.

3.5.2.12 Place chocks under the front axle wheels.

3.5.2.13 Deploy the tilt rollers as described in Section 3.5.3.

3.5.3 Deploying the Tilt Rollers

WARNING

CRUSH HAZARD. KEEP CLEAR DURING MOVEMENT OF THE TILT ROLLERS. THE TILT ROLLERS WEIGH 114 LB (52 KG) AND COULD CAUSE INJURY TO PERSONNEL.

NOTE

When building or recovering a bridge, the tilt rollers are deployed only after the launch beam has beam constructed.

3.5.3.1 While supporting the weight of the tilt roller, remove the lower shootbolt (2) securing the tilt roller head (4) in position.

3.5.3.2 Rotate the tilt roller head (4) outwards.

3.5.3.3 Remove tilt roller leg shootbolt (3) whilst supporting the weight of the tilt roller assembly.

3.5.3.4 Rotate the tilt roller assembly to the vertical position.

3.5.3.5 Secure in the vertical position with upper shootbolt (1).

3.5.3.6 On the chest pack move the joystick to the right until **LEVEL BANK** is selected and the **TILT ROLLER** light has illuminated. Using the left joystick ensure that the tilt rollers are fully retracted.

NOTE

The tilt rollers adjust the module approach angle required to compensate for the launch beam angle created by the up/down slope of gap banks and ensure the correct tension is maintained on the home bank carriage and far bank carriage slings.

3.5.3.7 Using the tilt roller joystick on the left of the chest pack raise the tilt rollers to contact the underside of the bridge.

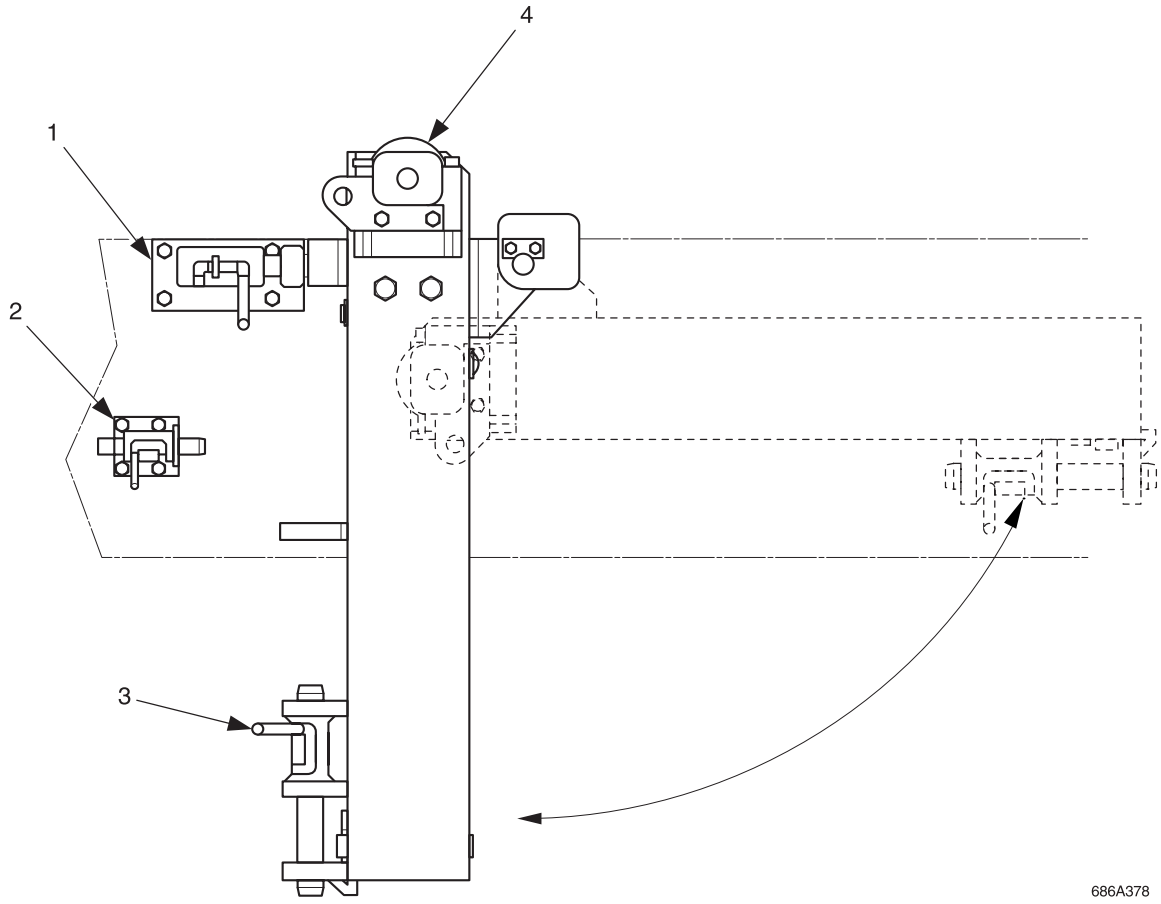


Figure 3. 21 Tilt Roller

3.5.4 Leveling the A-Frame

3.5.4.1 If not already selected, set the 4-position mode selector rotary switch to position 4. Make sure the PTO engages and the engine rpm goes to high idle.

NOTE

If the A-frame is not horizontal, difficulty could be experienced when launch beam or bridging modules are being connected together during assembly.

3.5.4.2 Check the spirit level gauge on the lower A-frame transverse beam to confirm the A-frame is level. If necessary, adjust the A-frame horizontal position by carrying out step 3.5.4.4. Confirm that the A-Frame stabilizer legs are within the correct pin hole range (Chapter 1 Section II Table 1.8, Table 1.9 or Table 1.10).

3.5.4.3 Check the longitudinal slope of the slide frame to ensure that the slide frame is slightly angled either positively or negatively. If the slide frame is horizontal raise or lower the A-frame dependent on the ground slope to create a positive or negative slope on the slide frame.

3.5.4.4 If necessary, at the A-frame stabilizer controls, extend the stabilizer on the low side of the A-frame until the spirit level on the lower A-frame transverse beam indicates the A-frame is horizontally level. The A-frame being level when the bubble is between the two lines.

3.5.4.5 Remove the already inserted pin in the adjusted stabilizer leg and re-install it and the retaining clip to secure the stabilizer leg in position and retain the A-frame horizontal. Make sure the slide frame remains clear of the launch vehicle chassis.

3.5.4.6 At the A-frame stabilizer controls, lower the A-frame stabilizer leg until it sits on the locking pin.

Figure 3. 22 A-frame Stabilizer Controls

3.5.5 Slide Frame Decking Panel Deployment

3.5.5.1 Release the retaining straps and clips from both the outer A-frame legs and using the ladder, lower the outer A-frame platforms so that they rest on their location brackets. Remove the platform safety rails from their stowage locations. Extend the access ladders and adjust the stile extensions on the ends of the ladders to account for any ground variations. Unfold the two walkway extension pieces and position and pin the safety rails in the two location holes in the folding walkways.

3.5.5.2 Remove the slide frame decking panels from the chassis well at the rear of the crane and un-strap the three walkways stowed underneath the launch frame.

3.5.5.3 Refer to Figure 3. 23 and install the decking panels on the slide frame between the crane and the A-frame. Make sure the decking panels are in their correct locations.

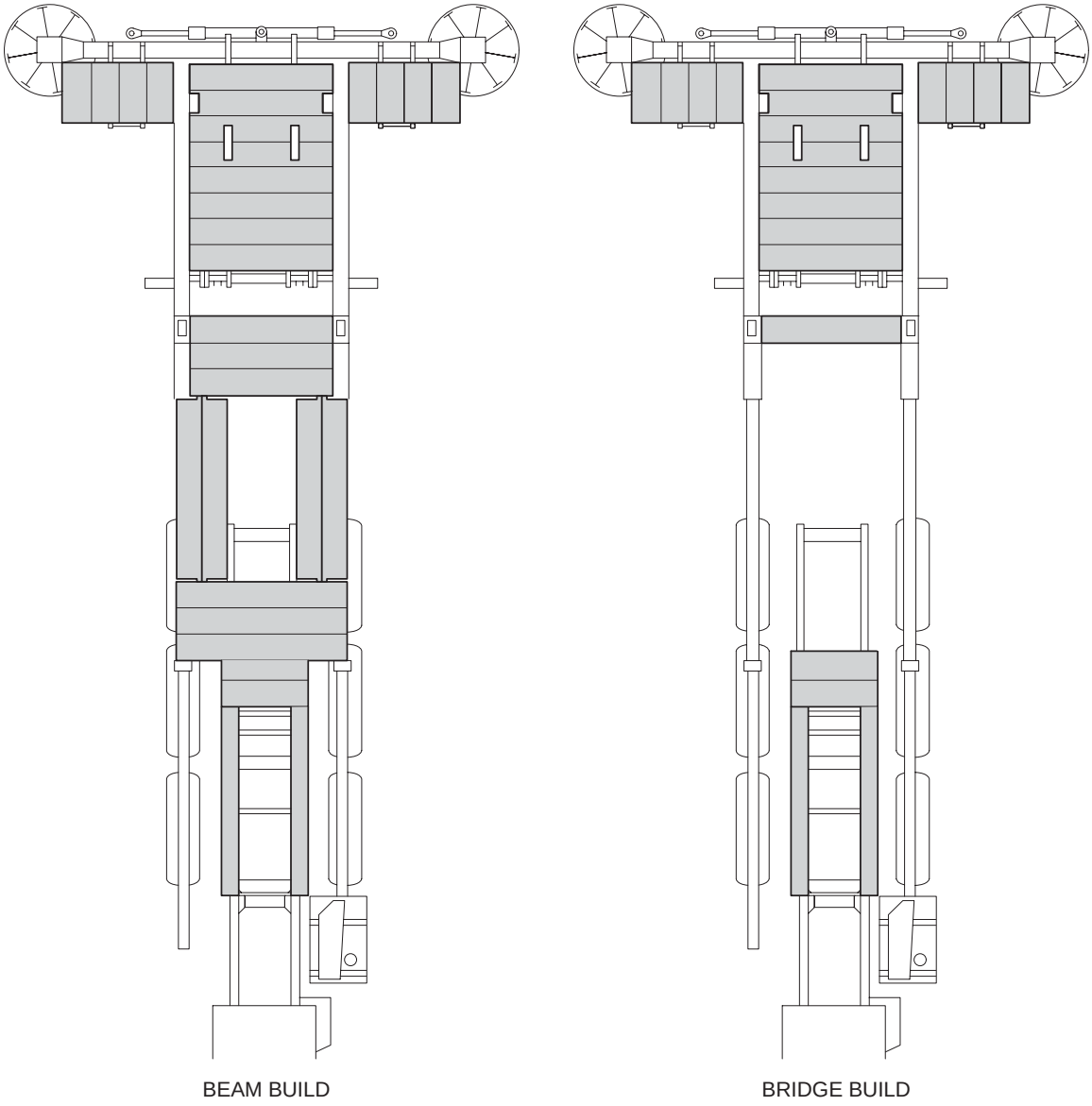


Figure 3. 23 Slide Frame Decking Panels (Beam Build)

3.5.6 Slide Frame Decking Panel Stowage

3.5.6.1 Refer to Figure 3. 24 and stow the walkway decking panels as described below:

(i) Lift the walkways fitted at the rear of the launching frame (Nos. 4, 5 and 6) and stow under the launching frame. Ensure that they are stowed to the rear of the launching frame (the end by the articulator cylinders), as, if stowed in the wrong place they will be crushed as the A-frame is rotated down.

(ii) Unpin and remove the safety rails from the two location holes in the folding walkways.

(iii) Place the walkway safety rails in their stowage locations on the previously stowed walkways below the rear of the launching frame.

(iv) Remove the removable slide frame decking panels (Nos. 1, 2, 3, and the two double panels) from their deployed positions and stow in the chassis well at the rear of the crane.

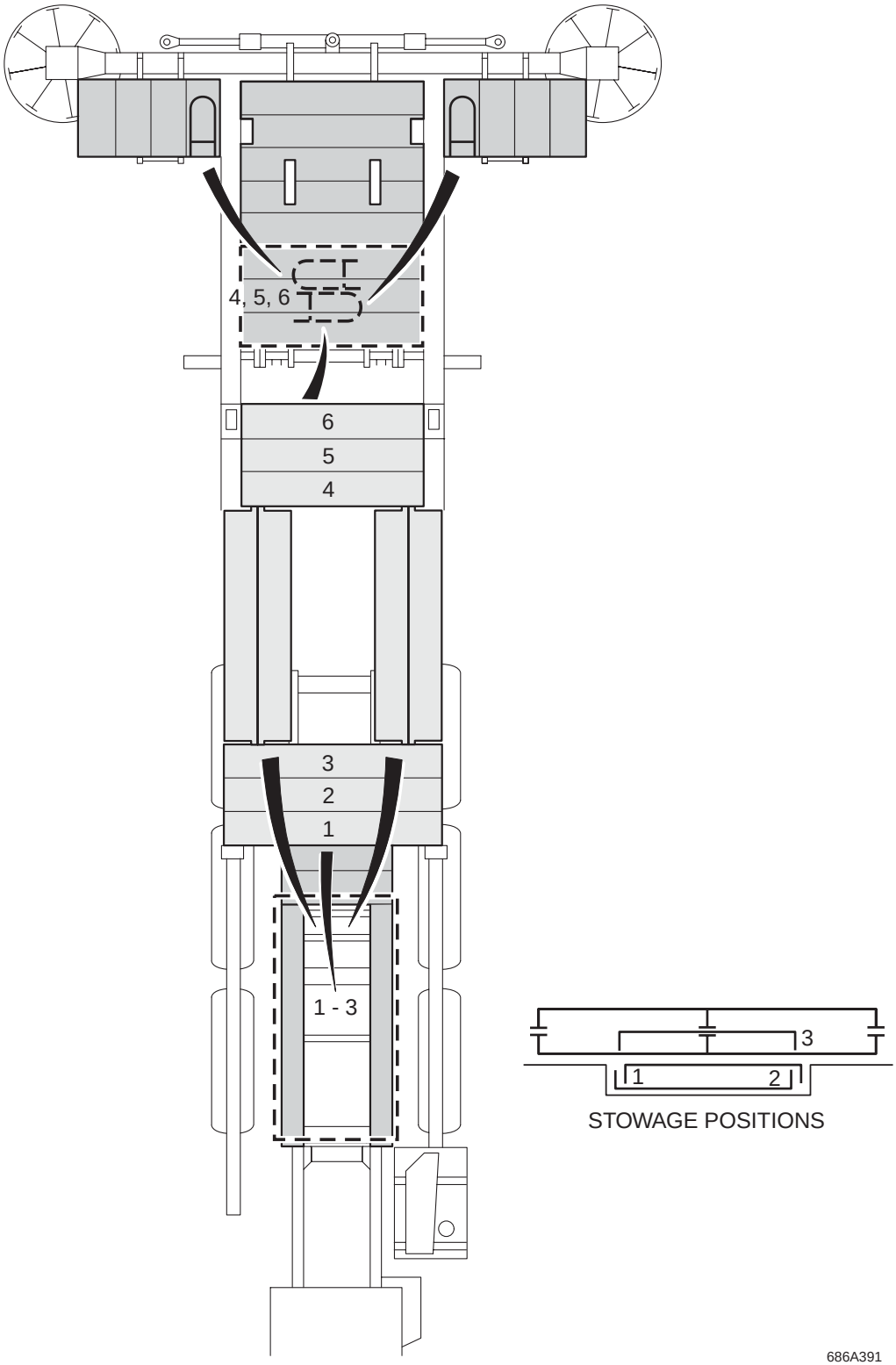


Figure 3. 24 Walkway Stowage

3.6 LAUNCHER STOWING

3.6.1 Stowing the Tilt Rollers

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

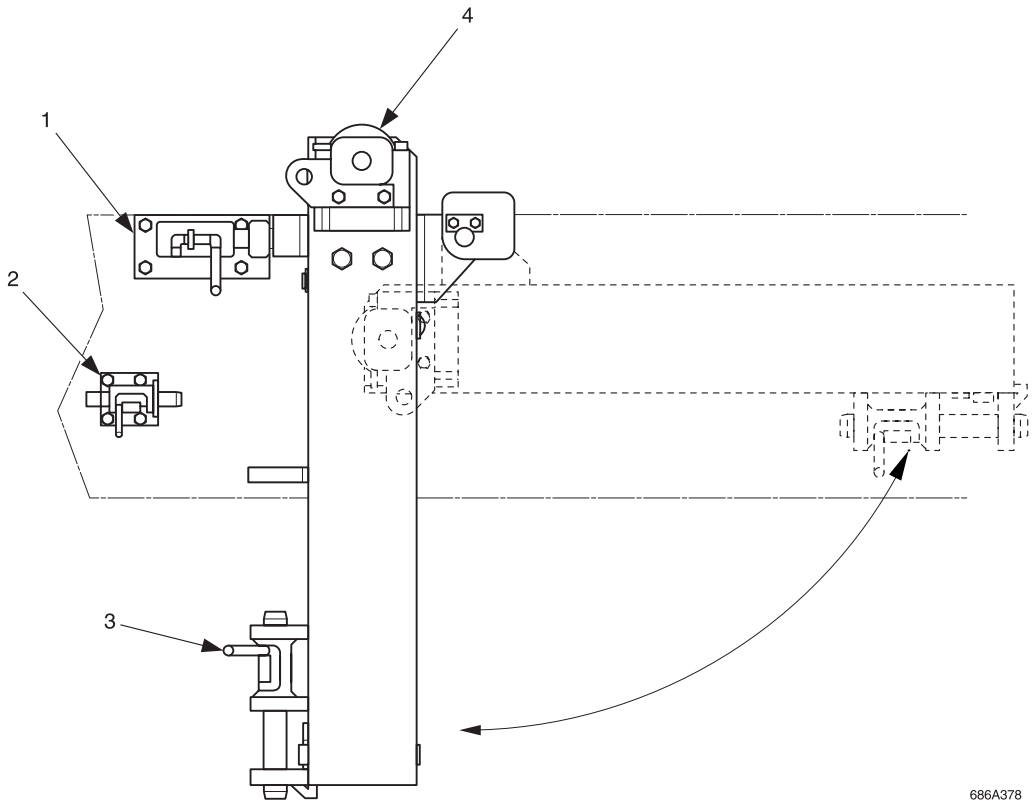
CRUSH HAZARD. KEEP CLEAR DURING MOVEMENT OF THE TILT ROLLERS. THE TILT ROLLERS WEIGH 114 LB (52 KG) AND COULD CAUSE INJURY TO PERSONNEL.

3.6.1.1 On the chest pack move the joystick to the right until **LEVEL BANK** is selected and the **TILT ROLLER** light has illuminated. Using the left joystick ensure that the tilt rollers are fully retracted.

3.6.1.2 While supporting the weight of the tilt roller, withdraw the upper shootbolt (1).

3.6.1.3 Rotate the tilt roller assembly to the horizontal stowed position. Secure in position with the tilt roller leg shootbolt (3)

3.6.1.4 Rotate the tilt roller head (4) inwards and secure with the lower shootbolt (2).



Tilt Roller

3.6.2 Retracting the Slide Frame

3.6.2.1 Refer to Figure 3. 19. At the interface cabinet, press and hold the **RELAX** button. Release the **RELAX** button when the shootbolt holes in the relax mechanism are aligned.

3.6.2.2 Engage the relax mechanism shootbolts. Make sure the **PIN OUT** caption on the interface cabinet extinguishes.

3.6.2.3 Dismantle the tail lift guard rails and store them in basket BII on flatrack LVT. Push in the tail lift extension pieces and fold the tail lift platform extensions to their stowed configuration.

3.6.2.4 Stow the tilt rollers as described in Section 3.6.1.

3.6.2.5 Refer to Para 3.5.6 and stow the walkway decking panels in the center of the chassis well and under the launch frame, securing as necessary.

3.6.2.6 Retract the A-frame access ladders, remove the safety rail and fold the A-frame platform extension pieces. Place the safety rails in their stowage place on the removable walkway decking panels located under the launch frame, secure with transport straps. Rotate the A-frame extension walkways vertically and lock in position with pin clips. Secure the ladders with webbing straps.

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

3.6.2.7 On the tail lift pendant, operate the **LIFT UP** switch to raise the tail lift until the tail lift platform height is sufficient to pass through the space between the top of the home bank ramp module and the underside of the lower transverse beam of the A-frame.

3.6.2.8 Operate both A-frame stabilizer leg extend controls together. Make sure the stabilizer leg hydraulic cylinders operate to extend the legs. Release the controls when the stabilizer cylinders extend the legs to position the slide frame at its maximum height.

3.6.2.9 Remove the stabilizer locking pins from their current position and re-insert in the maximum achievable hole of each leg.

3.6.2.10 Lower the A-frame until it locates on the two locking pins.

3.6.2.11 Stow the tail lift controller on the tail lift and ensure the umbilical cable is secured so that it will not drag along the ground during vehicle movement.

3.6.2.12 Set the 4-position mode selector rotary switch to position 3. Make sure the PTO disengages and the engine rpm reduces to idle.

3.6.2.13 Remove the chocks (and ladder if fitted) from the launch vehicle front axle wheels.

CAUTION

Equipment damage. Do not engage the launch vehicle transmission, and drive, it forward or backward, in excess of 2 mph (3.2 kph), the A-frame could be damaged.

3.6.2.14 Set the launch vehicle transmission to reverse and release the parking brake.

CAUTION

Equipment damage. Discontinue the launch vehicle reverse if the tail lift will not pass between the top of the home bank ramp module and the underside of the lower transverse beam of the A-frame. Damage to the tail lift will result if this instruction is not observed.

3.6.2.15 Reverse the launch vehicle and retract the slide frame.

NOTE

Stop the reverse and carry out steps 3.6.2.16 through 3.6.2.19 if the tail lift will not pass between the top of the home bank ramp module and the underside of the lower transverse beam of the A-frame.

3.6.2.16 Stop the launch vehicle, set the transmission to neutral, apply the parking brake.

3.6.2.17 Set the 4-position mode selector rotary switch to position 2, A-frame DEPLOY. Make sure the PTO engages and the engine rpm goes to high idle.

3.6.2.18 Repeat step 3.6.2.7 to set the tail lift to the correct clearance height.

3.6.2.19 Repeat steps 3.6.2.12, 3.6.2.14 and 3.6.2.15, fully retract the slide frame.

3.6.2.20 Operate both A-frame stabilizer leg control levers together to slightly extend the stabilizer legs.

3.6.2.21 Remove the locking pins from the A-frame stabilizer legs.

CAUTION

Equipment damage. As the weight of the launcher is lowered onto the vehicle, the compression of the suspension may cause the tail lift to contact the bridge causing damage to the tail lift. Check and adjust the height of the tail lift as necessary during retraction of the A-frame stabilizer legs.

3.6.2.22 Operate both A-frame stabilizer leg retract controls together to lower the slide frame onto the chassis twist-to-lock fasteners. Make sure the stabilizer leg hydraulic cylinders operate and retract the legs.

3.6.2.23 Make sure the twist-to-lock fasteners on the slide frame are correctly located. Continue to retract the stabilizer legs until they are fully retracted and the feet are clear of the ground. Install the locking pins in the fully retracted A-frame stabilizer legs from the outside in.

3.6.2.24 Engage the twist-to-lock fasteners on the slide frame.

Figure 3. 25 A-Frame Stabilizer Controls

3.6.3 Stowing the A-Frame

3.6.3.1 Disengage the shootbolts securing the A-frame in the vertical position.

3.6.3.2 Disconnect the chest pack and umbilical cable from the connection point on the A-frame stabilizer leg; replace all electrical connector dust covers.

3.6.3.3 Stow the chest pack and umbilical cable in the toolbox located above the front wheels on the left hand side of the vehicle.

NOTE

If the shootbolts are difficult to disengage, press and hold momentarily the DEPLOY pushbutton on the A-frame rotate panel of the interface cabinet.

3.6.3.4 Make sure personnel are clear from the area around the A-frame.

3.6.3.5 On the A-frame rotate panel of the interface cabinet, press and hold the **PARK** pushbutton. Make sure the hydraulic cylinders extend and rotate the A-frame to the stowed position. Ensure that the A-frame is sitting on the rubber supporting pads.

3.6.3.6 Release the **PARK** pushbutton when the A-frame is fully rotated to the stowed position. Make sure the **LAUNCHER DOWN** caption illuminates.

3.6.3.7 Remove the R clips and the locking pins in the A-frame upper and lower transverse beams which lock the outer A-frame legs in the spread position.

NOTE

If the locking pins are difficult to disengage, press and hold momentarily the DEPLOY pushbutton on the A-frame fold panel of the interface cabinet.

3.6.3.8 Make sure personnel are clear from the area around the A-frame.

3.6.3.9 On the A-frame fold panel of the interface cabinet, press and hold the **PARK** pushbutton. Make sure the hydraulic cylinders retract and fold the outer A-frame legs to the stowed position.

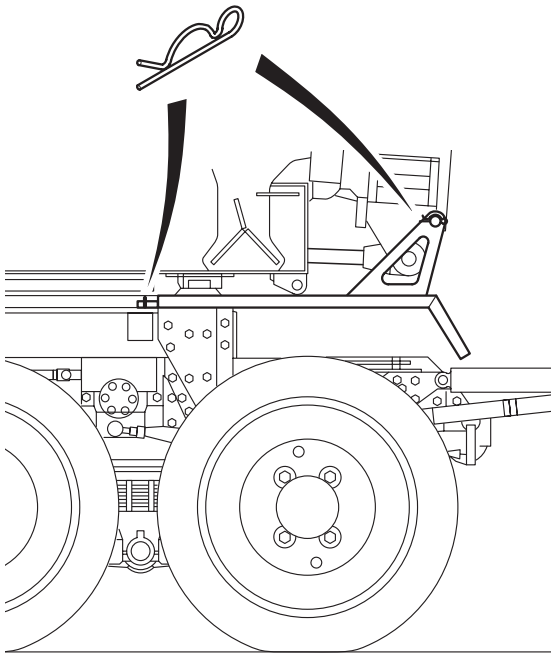
3.6.3.10 Release the **PARK** pushbutton when the outer A-frame legs are in the folded position. On the A-frame fold panel of the interface cabinet, make sure the **DEPLOYED** caption goes off.

3.6.3.11 Install the locking pins and their R clips at the hinge point of the upper transverse beam to lock the outer A-frame legs in the folded position.

NOTE

The long pin is inserted from the REAR to the FRONT in the top hole and the short pin is inserted from the FRONT to the REAR in the bottom hole.

3.6.3.12 Refit the mudguards to the launch vehicle ensuring shootbolts and front peg are fully engaged and R clipped.



Position of Mudguard R clips

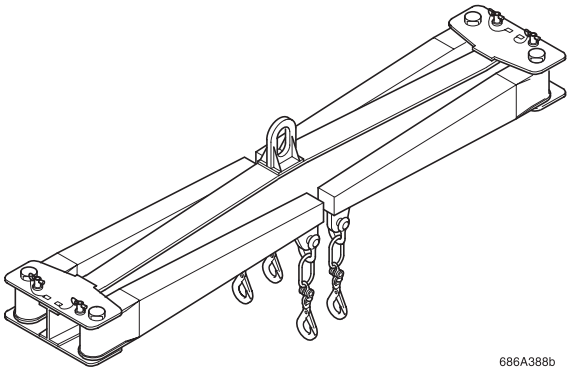
Section III SLINGING AND LIFTING

3.7 LIFTING BEAMS

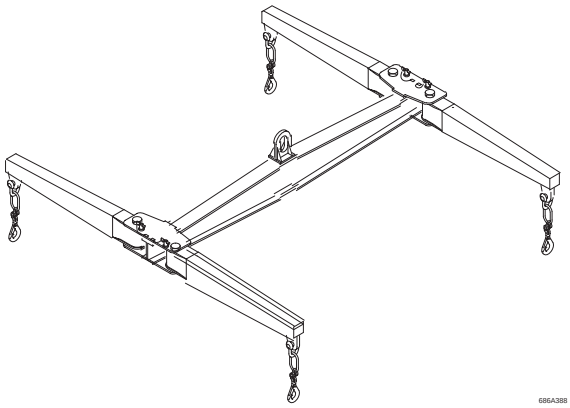
3.7.1 Module Lifting Beam - Operation and Configuration

3.7.1.1 For parallel/ramp module opening, withdraw the shootbolts. Move the two arms at each end of the central beam to the widest positions and insert the shootbolts.

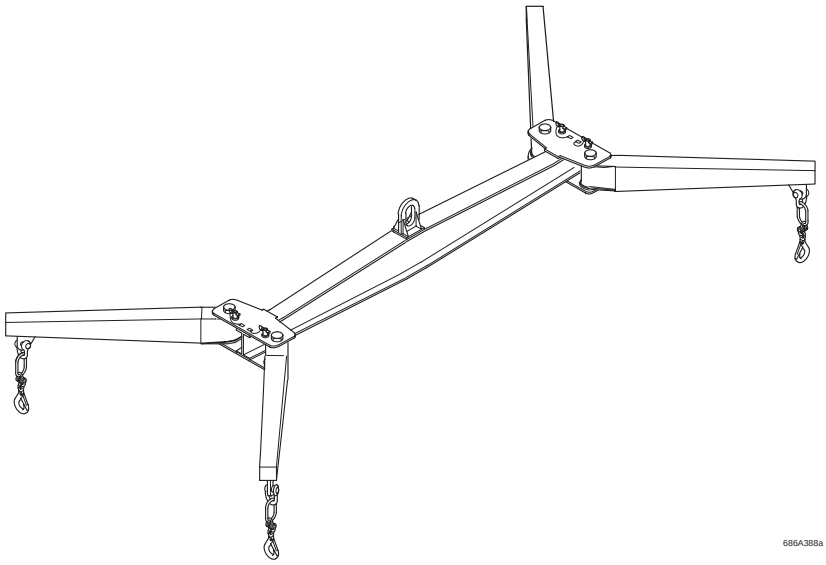
3.7.1.2 For parallel /ramp module closing, withdraw the shootbolts. Move the two arms at each end of the central beam to the center position and insert the shootbolts.



Module Lifting Beam Closed (Stowage Position)



Module Lifting Beam In Center Position (Module Folding)



Module Lifting Beam In Widest Position (Opening Modules)

Figure 3. 26 Parallel /Ramp Module Lifting Beam

3.7.2 Launch Beam Lifter - Operation and Configuration

3.7.2.1 To engage the launch beam lifter into its location lugs on the launch beam, first retract the locking lever towards the lifting lug. Then rotate the locating hook towards the top of the lifter assembly.

3.7.2.2 Locate the fixed locator hook into the central locator on the launch beam and then lower the launch beam lifter to allow location of the rotated locator hook into the opposite side locator on the launch beam.

3.7.2.3 Rotate the locator hook so it engages into the central locator on the launch beam and lock it in place by lowering the locking lever into place behind the locator hook.

3.7.2.4 The launch beam lifter is of fixed geometry and its configuration cannot be altered.

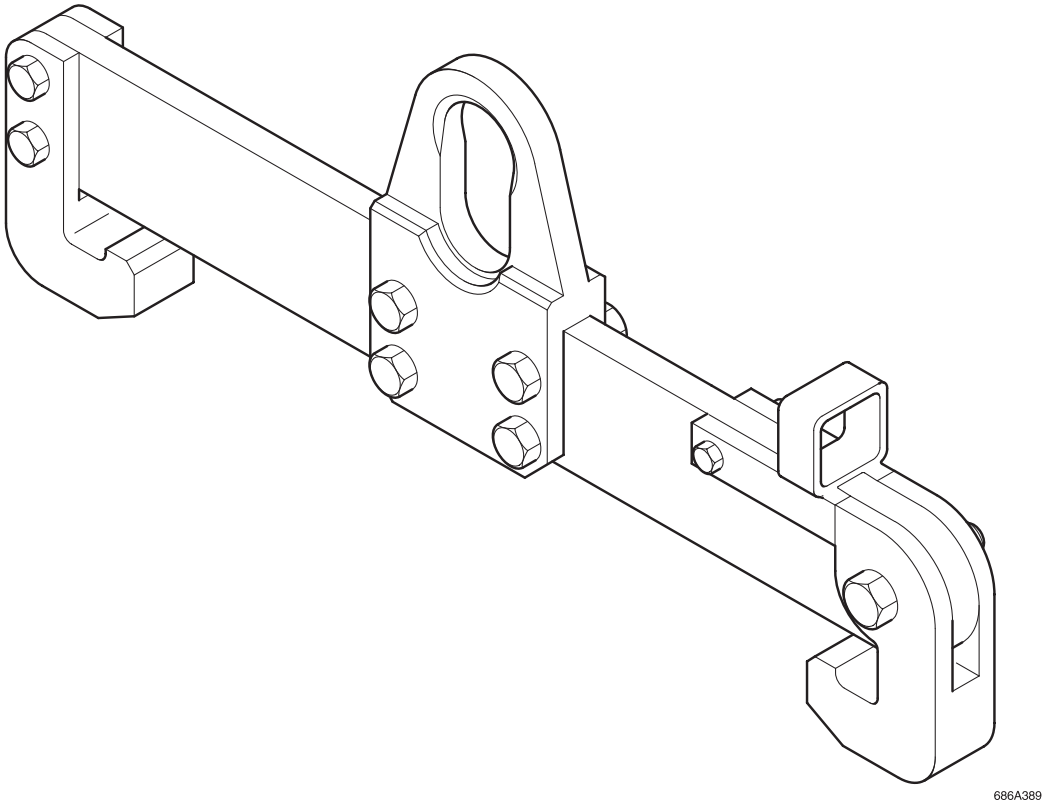


Figure 3. 27 Launch Beam Lifter

3.8 WEBBING LIFTING SLINGS

3.8.1 Limitations as to use due to Environmental Conditions

3.8.1.1 The material from which the slings are manufactured is polyester (PES). Polyester is resistant to chemical attack from mineral acids but can be attacked by strong alkalis. Take contaminated slings out of service at once, thoroughly soak in water, and allow to dry naturally. **In case of any doubt about the security of any sling following contamination remove from service and destroy**.

3.8.1.2 Beware of formation of ice at low temperatures, which can have an abrasive or cutting effect on the slings.

3.8.1.3 When bridge modules are stowed, water can pool in the inside of the panels. As the opening slings hang down inside the panels, they can become frozen to the panel in cold weather.

3.8.1.4 During non-operational periods when the system is stored at temperatures below 32 degrees Fahrenheit (0 degrees Centigrade) or when freezing is expected to occur, to prevent the slings freezing to the insides of the bridge sections, all the module opening slings should be pulled out from the modules so that they hang externally.

CAUTION

Transportation of bridge modules with incorrectly stowed slings may cause system damage.

3.8.1.5 Prior to transportation, all straps must be re-inserted, using the module sling tool if necessary.

3.8.1.6 Slings should be protected from prolonged exposure to direct sunlight or sources of ultra-violet radiation.

3.8.2 Checks Prior to Each Use/Period of Use for Webbing Slings

3.8.2.1 Prior to each use, the sling should be inspected for:

a) any defects

b) correct identification and specification.

3.8.2.2 In addition to the statutory examination by a competent person, the responsible person should make regular in-service inspections. The interval between inspections will depend on the conditions of service but as slings can be damaged in use, the operative should visually check them on each occasion prior to slinging the load. If any of the following defects are found the sling should be withdrawn from service and referred to a competent person:

a) **Surface chafe**. In normal use some chafing will occur and is unavoidable. If this is confined to the surface fibers as opposed to the yarns it has no effect on the safe use however in extreme cases the faces of the webbing can become so worn that the outer yarns are severed.

b) **Local abrasion**. If the webbing shows signs of local abrasion, as opposed to general wear, serious loss of strength may occur.

c) **Cuts**. Both longitudinal and cross cuts into the surface of the webbing result in loss of strength.

d) **Chemical attack**. While polyester fibers have a good resistance to selected chemicals, chemical attack to the webbing results in local weakening and softening of the material. This is indicated by flaking of the surface fibers which can be plucked or rubbed off.

e) **Heat damage**. The surface fibers take on a glazed appearance and in extreme cases fusion of the fibers occurs.

f) **Damaged stitching**. Any damage to the stitching or noticeable loosening of the threads must be treated seriously.

g) **Loose webbing**. The webbing becomes loose and soft to the touch so that the weft can be moved or split with the fingers.

h) **Missing or illegible marking**. The sling should **NOT** be used if the identifying markings are missing or illegible.

i) **Soiling**. Heavy soiling can obscure damage making detection during inspection difficult. It can also make identification difficult by obscuring any marking or color-coding. Grit and dirt will collect on the face of soiled webbing and can cause rapid wear and abrasion. Clean the sling in an approved manner but if the soiling is such that cleaning has little or no effect withdraw from service and refer to a Competent Person.

NOTE

Only use clean water and mild detergent to clean lifting slings.

3.8.3 Use of Webbing Slings

3.8.3.1 Good slinging practices should be followed; the slinging, lifting and lowering operations should be planned before commencing the lift.

3.8.3.2 Slings should be correctly positioned and attached to the load in a safe manner. Slings should be placed on the load such that the loading is uniform across their width. They should never be knotted or twisted.

3.8.3.3 Stitching should never be placed over hooks or other lifting devices: the stitching should always be placed in the standing part of the sling. Damage to the labels should be prevented by keeping them away from the load, the hook and the angle of choke.

3.8.3.4 In the case of multi-leg slings, ensure that the loading of the sling assembly is symmetrical. This means that when a load is lifted the sling legs are symmetrically in plan and are at the same angle to the vertical.

3.8.3.5 Slings should be protected from sharp edges, friction and abrasion, whether from the load or the lifting appliance. Where reinforcement and protection against damage from sharp edges and/or abrasion, such as a sleeve, is supplied as part of the sling, this should be correctly positioned to protect the sling from sharp edges.

3.8.3.6 The load should be secured by the sling(s) in such a manner that it cannot topple or fall out of the sling(s) during the lift. The sling(s) should be arranged so that the point of lift is directly above the center of gravity and the load is balanced and stable. Movement of the sling over the lifting point is possible if the center of gravity of the load is not below the lifting point.

3.8.3.7 When a sling is used in choked hitch, as in the case of lifting the ramp module end beams it should be positioned so as to allow the natural 120 degrees angle to form and avoid heat being generated by friction. A sling should never be forced into position nor an attempt made to tighten the bite.

3.8.3.8 Care should be taken to ensure the safety of personnel during the lift. Persons in the danger area should be warned that the operation is to take place and, if necessary, evacuated from the immediate area.

3.8.3.9 Hands and other parts of the body should be kept away from the sling to prevent injury as the slack is taken up.

3.8.3.10 A trial lift should be made. The slack should be taken up until the sling is taut. The load should be raised slightly and a check made that it is secure and assumes the position intended.

3.8.3.11 If the load tends to tilt, it should be lowered and attachments repositioned. The trial lift should be repeated until the stability of the load is ensured.

3.8.3.12 Care should be taken when making the lift to ensure that the load is controlled, e.g. to prevent accidental rotation or collision with other objects.

3.8.3.13 Snatch or shock loading should be avoided, as this will increase the forces acting on the sling.

3.8.3.14 A load in the sling or the sling itself should not be dragged over the ground or rough surfaces.

3.8.3.15 The load should be lowered in an equally controlled manner as when lifted.

3.8.3.16 Trapping the sling when lowering the load should be avoided. The load should not rest on the sling, as this could cause damage. Pulling the sling from beneath the load when the load is resting on it should not be attempted.

3.8.3.17 On completion of the lifting operation, the sling should be returned to proper storage.

3.8.3.18 When not in use, slings should be stored in clean, dry and well ventilated conditions, at ambient temperature and on a rack, away from any heat sources, contact with chemicals, fumes, corrosive surfaces, direct sunlight or other sources of ultraviolet radiation.

3.8.3.19 Prior to placing in storage, slings should be inspected for any damage, which may have occurred during use. Slings should never be returned damaged to storage.

3.8.3.20 Where lifting slings have been exposed to acids and/or alkalis, dilution with water or neutralization with suitable media is recommended prior to storage.

3.8.3.21 Slings, which have become wet in use, or as the result of cleaning, should be hung up and allowed to dry naturally.

3.9 SLINGING, LIFTING AND TAG LINES

3.9.1 Launch beams

3.9.1.1 Connect the single leg sling to the crane hook and the other end to the launch beam lifter.

3.9.1.2 Ensure that the safety clip on the crane hook is correctly positioned so that the sling cannot become disconnected from the crane. Also, ensure that the safety clip on the hook at the end of the single leg sling is similarly correctly positioned so that the launch beam lifter will not become accidentally disconnected.

3.9.1.3 Connect the launch beam lifter to the launch beam to be lifted by rotating the safety catch upwards and then rotating the hook at the end of the launch beam lifter.

3.9.1.4 Hook the fixed end of launch beam lifter into the lifting point in the center of the beam so that it is positioned between the locating lug.

3.9.1.5 Lower the launch beam lifter so that the rotatable hook (which is raised up) will locate in the other locating lug, lower the hook on the launch beam lifter. Ensure that it is located between the lugs.

3.9.1.6 Rotate the safety catch so that it locks the rotatable hook in the down position.

3.9.1.7 Connect tag lines to the handles either end of the beam to assist in controlling the launch beam during lifting and connection to the launch beam.

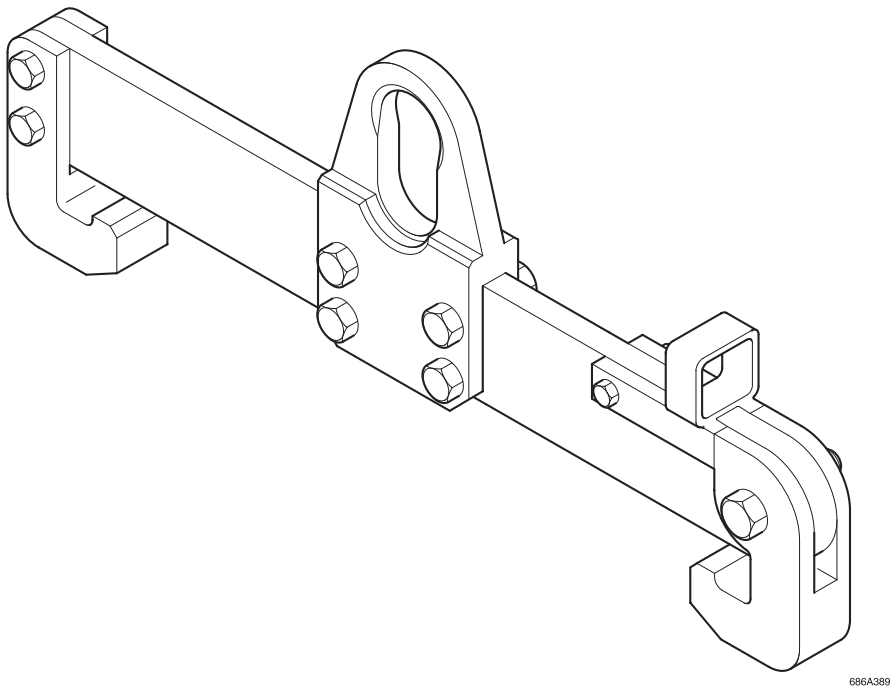


Figure 3. 28 Launch Beam Lifter

3.9.2 End Beam Slinging

3.9.2.1 Wrap two slings around the ramp module passing one sling through each lifting point at each end of the end beam and looping the sling through its self so that it is secure. (See Figure 3. 29 (A)).

3.9.2.2 Ensure that the slings are tight and not twisted.

3.9.2.3 Connect each sling to the crane hook and ensure that the slings are not entangled with the safety clip on the hook. Make sure that the safety clip on the crane hook is in the up position.

A

B

Figure 3. 29 Method and Position of Slinging the End Beam

3.9.2.4 Attach tag lines by looping the rope through the end beam pinhole and hooking the loop through the karabiner to secure it in place Figure 3. 29 (B).

3.9.3 Sling Extraction Tool

3.9.3.1 The webbing slings fitted to the ramp and bridge modules are susceptible to submersion when the bridging modules are stored on their flatracks. Under normal temperatures, this is not a problem, but when freezing weather is expected or experienced they can freeze. If this happens it can be very difficult to extract/insert the webbing lifting slings.

3.9.3.2 To aid in extraction/insertion a special tool is supplied and is illustrated in Figure 3. 30.

Figure 3. 30 Bridge Module Lifting Sling Extraction Tool

3.9.3.3 To extract the webbing lifting slings from the bridge/ramp module girder section insert the small hooked end of the tool into the hole in the track way decking of the bridge/ramp module. Hook the loop of the webbing sling and gently pull the sling through the hole.

NOTE

Should the strap be frozen in pooled water it may be necessary to break the ice first.

3.9.3.4 To insert the sling into the bridge/ramp module girder section push as much as possible of the webbing lifting sling back through the track way decking and use the extraction tool to push the remainder inside the girder section.

3.9.4 Slinging and Opening Ramp Modules

3.9.4.1 Open the bridge module lifter to its widest position (OPENING) and secure the arms with the locking shootbolts.

3.9.4.2 Connect the bridge module lifter to the single leg sling and the sling to the hook on the crane. Ensure that the safety clip on the crane hook is correctly positioned so that the sling cannot become disconnected from the crane. Also, ensure that the safety clip on the hook at the end of the single leg sling is similarly correctly positioned so that the bridge module lifter will not become accidentally disconnected.

3.9.4.3 Connect the hooks on each leg of the bridge module lifter to the opening lifting sling fitted to the beams of the ramp module.

NOTE

The module lifting beam must be positioned so that the main beam runs across the panel.

The front lifting sling of the bridge module lifter MUST be fitted to the rear position (POSITION 2) of the two front end lifting slings on the ramp module (see Figure 3. 31), this is to enable the ramp module to be balanced as the end beam is not fitted at this stage.

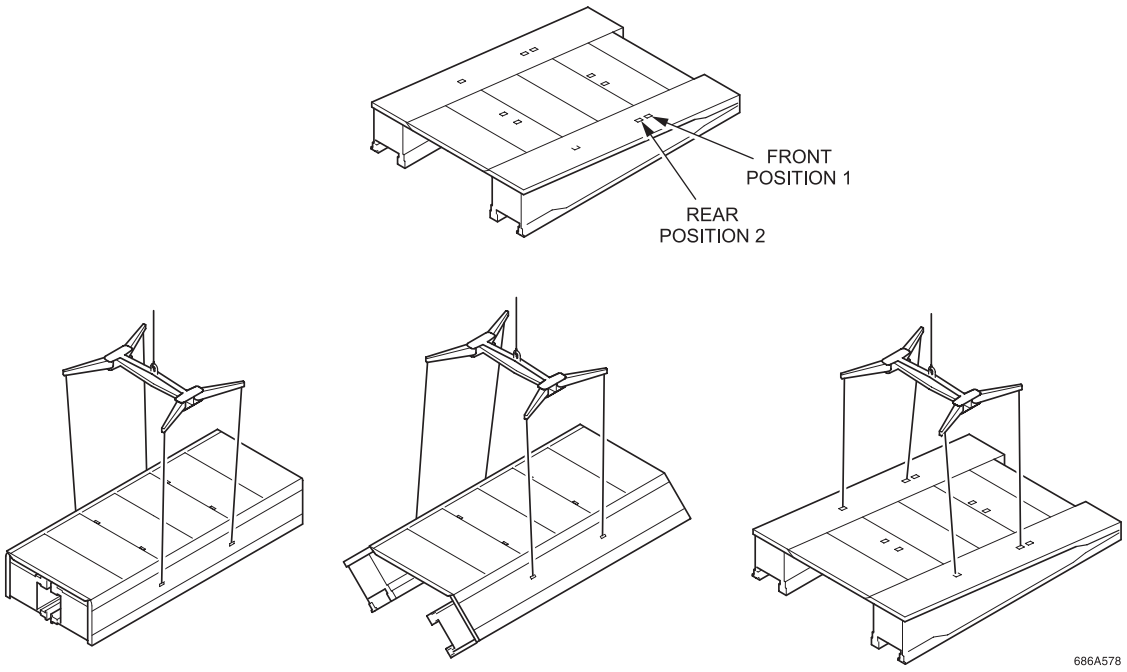


Figure 3. 31 Bridge Module Lifter Fitted to POSITION 2 and Opening Ramp Module

3.9.4.4 Attach tag lines to one front handle and through the end beam pin hole to assist in controlling the ramp module when lifting operations commence. If building from the right attach both tag lines to the right-hand side, if building from the left attach tag lines to left-hand side.

NOTE

Make sure the opening slings are in the correct position when lifting the ramp module with or without the ramp end beam installed. When the ramp module DOES NOT have the end beam fitted, then the REAR (position 2) attachment position MUST be used. When the ramp module has an end beam fitted, due to the extra weight the center of gravity moves forward, the FRONT (position 1) attachment position MUST be used.

3.9.4.5 Operate the lift controls on the crane and lift the ramp module.

3.9.4.6 As the ramp is lifted, it will open to its working position.

3.9.4.7 Disconnect the bridge module lifting beam from the POSITION 2 lifting points on the outboard sides of the far bank ramp module ramp panels.

3.9.5 Slinging and Closing Ramp Modules

3.9.5.1 Adjust the bridge module lifting beam to its narrowest setting and secure it in position with the shootbolts.

3.9.5.2 Connect the bridge module lifting beam to the retrieval lifting points on the inboard sides of the far bank ramp module ramp panels.

3.9.5.3 Remove any debris or stones from the hinge lines of the far bank ramp module.

3.9.5.4 Operate the lift and traverse controls on the crane. Make sure the far bank ramp module closes slowly and progressively as it is lifted by the crane. Do not operate the traverse controls of the crane until the module has fully closed.

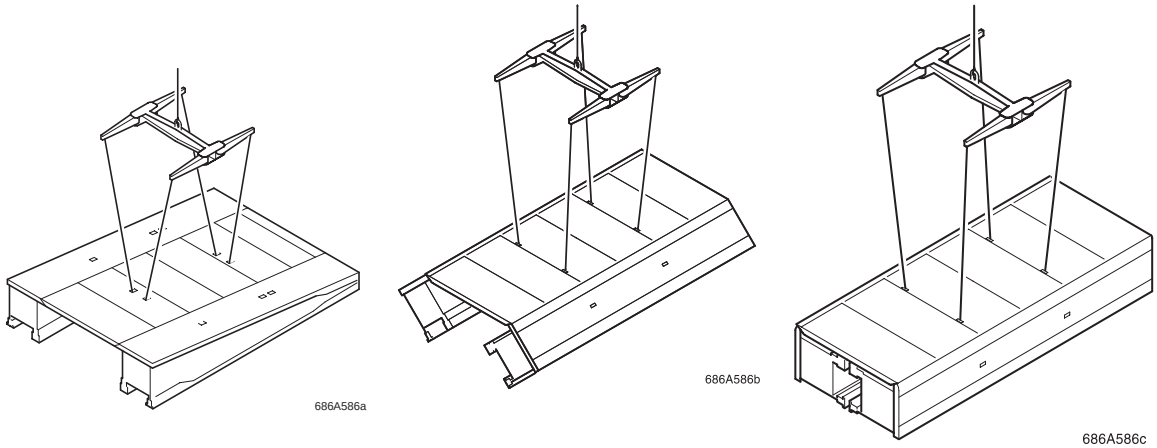


Figure 3. 32 Ramp Module Closing

3.9.5.5 Disconnect the bridge module lifting beam and the steadying rope lines from the ramp module.

NOTE

Flatracks T1 and V3 are modified with a wooden spacer fitted to prevent the ramp jaws damaging the flatrack storage box. The wooden spacer is fitted to the flatrack when a ramp module is stored on top of another bridge module.

3.9.6 Slinging and Opening Bridge Modules

3.9.6.1 Open the bridge module lifter to its widest position (OPENING) and secure the arms with the locking shootbolts.

3.9.6.2 Connect the bridge module lifter to the single leg sling and the sling to the hook on the crane. Ensure that the safety clip on the crane hook is correctly positioned so that the sling cannot become disconnected from the crane. Also, ensure that the safety clip on the hook at the end of the single leg sling is similarly correctly positioned so that the bridge module lifter will not become accidentally disconnected.

3.9.6.3 Connect the hooks on each leg of the bridge module lifter to the opening lifting sling fitted to the beams of the bridge module.

3.9.6.4 Connect tag lines to the handles at each end of the bridge module above the jaws to assist in controlling the module when lifting operations begin. If building from the right attach both tag lines to the right-hand side handles, if building from the left attach tag lines to left-hand side.

3.9.6.5 Operate the lift controls on the crane and lift the parallel module.

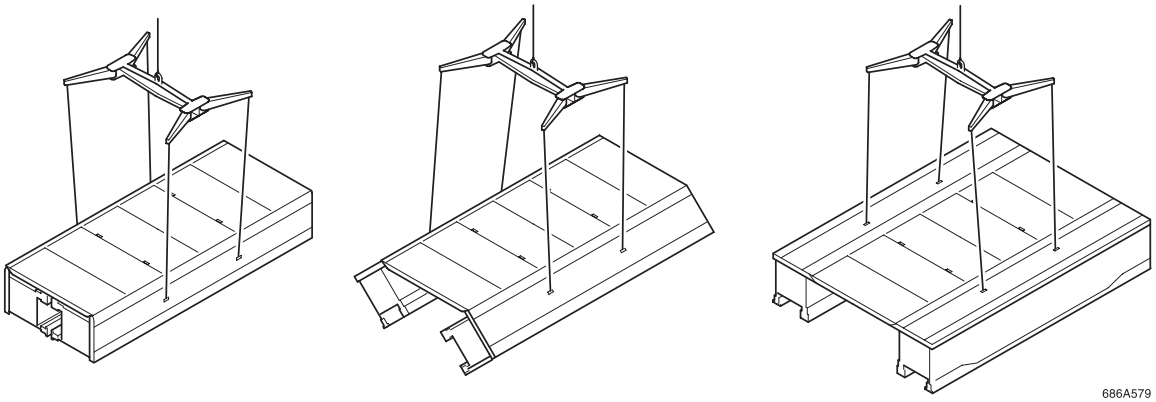


Figure 3. 33 Bridge Module Opening

3.9.7 Slinging and Closing Bridging Modules

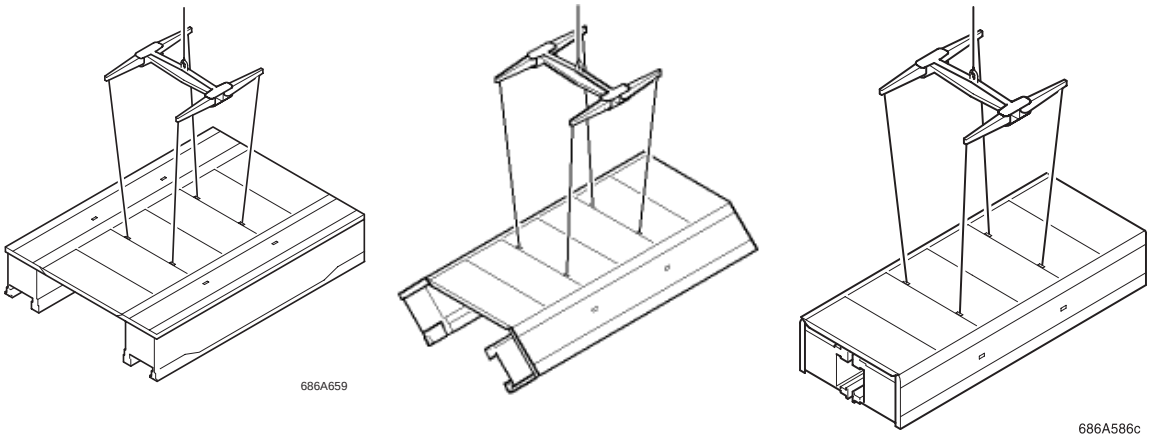


Figure 3. 34 Bridge Module Closing

3.9.7.1 Configure the module lifting beam to the center position for module closing.

3.9.7.2 Operate the controls on the crane to position the bridge module lifting beam in position to attach it to the bridge module.

3.9.7.3 Connect the bridge module lifting beam to the closing sling located between the decking panels of the bridge module, ensure that the lifting beam runs across the module.

3.9.7.4 Operate the lift controls on the crane and slowly lift the bridge module.

3.9.7.5 The parallel module will slowly close as the module is lifted.

3.9.8 Attaching the Far Bank Carriage

3.9.8.1 The far bank carriage is connected to the far bank ramp unit at the end beam lifting position (see Figure 3. 35).

3.9.8.2 Remove the R clip from the sling retractable pin on the far bank carriage and retract the captive pin.

3.9.8.3 Route the carriage slings through the end beam bridge lifting points and re-connect the sling to the carriage. Ensure the sling straps do not cross and have not twisted. Ensure that the carriage is level horizontally and vertically prior to lifting, with respect to the upper part of the carriage.

NOTE

It is extremely important that the two carriage parts are in line vertically and horizontally, failure to ensure correct alignment will result in the bottom half of the carriage becoming jammed in the top half of the carriage when it is raised.

3.9.8.4 Make sure the retractable pin is fully located and secured with the R clip.

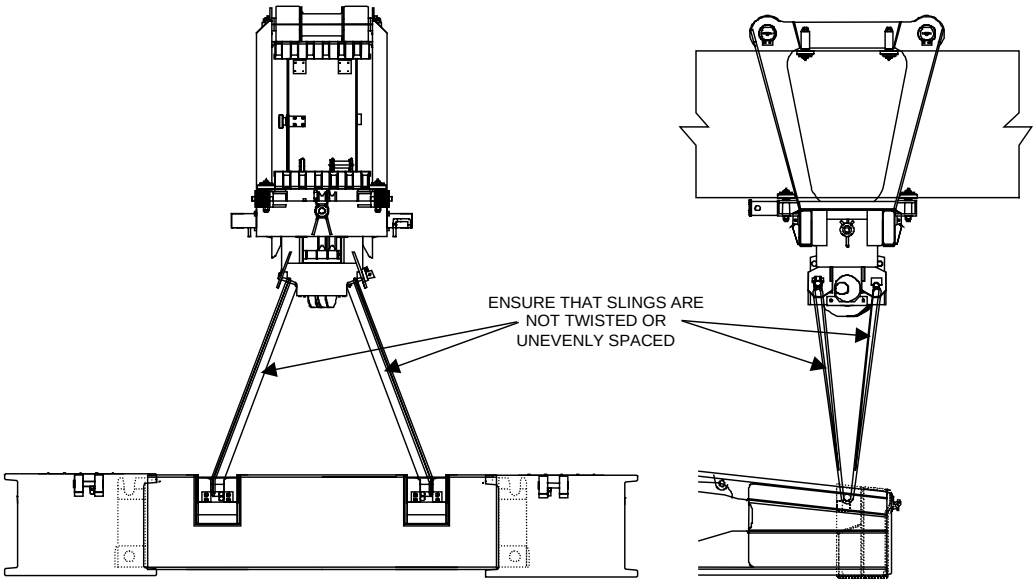


Figure 3. 35 Method and Location of Slinging Far Bank Ramp Module

3.9.9 Attaching the Home Bank Carriage

3.9.9.1 The far bank carriage is connected to the ramp module beams (see Figure 3. 36).

3.9.9.2 Remove the R clips from the sling retractable pins and retract the pins.

3.9.9.3 Route the slings of the far bank carriage through the bridge lifting points on the home bank ramp module and reconnect the sling to the carriage. Make sure the retractable pin is fully located and secured with the retaining clip.

3.9.9.4 Prior to lifting, ensure that the carriage is level horizontally and vertically with respect to the upper part of the carriage.

NOTE

It is extremely important that the two carriage parts are in line vertically and horizontally. Failure to ensure correct alignment will result in the bottom half of the carriage becoming jammed in the top half of the carriage when it is raised.

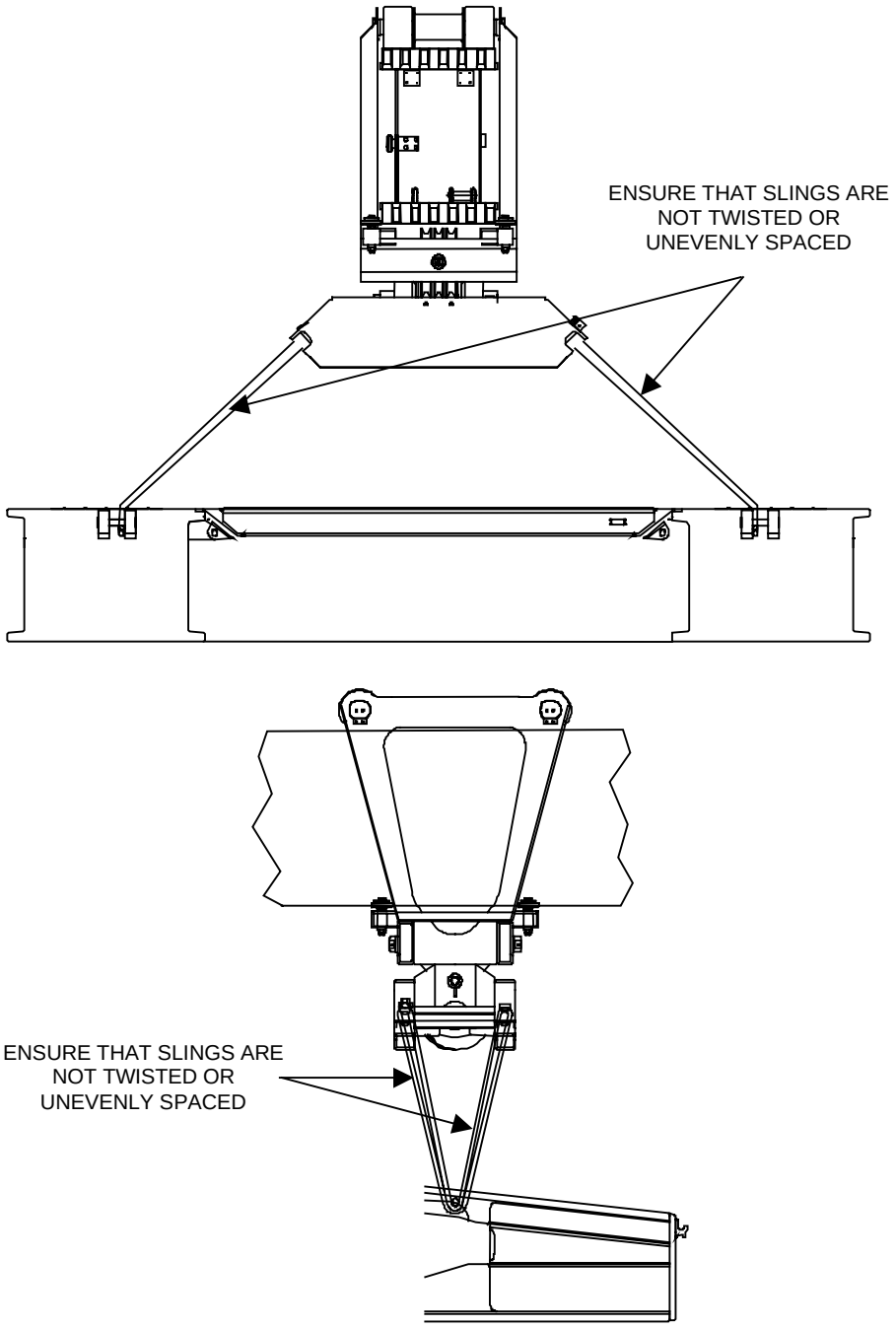


Figure 3. 36 Method and Location of Slinging Home Bank Carriage

3.9.10 Raising the Bridge

NOTE

When an item on the launch vehicle or launcher is referred to as front or rear, left or right, the cab is taken as the front of the launch vehicle, all references are taken as if personnel are looking forward towards the cab. Therefore, if the left hand side A-frame leg is being discussed, the A-frame leg on the launch vehicle's left hand side is the item being described (i.e. the driver's side).

When referring to the launch beam the front of the beam is to be taken as the far bank and the rear is taken as the near bank, it follows therefore, that the front carriage is the far bank carriage and the rear carriage is the home bank carriage.

Before bridge retrieval is commenced, the appropriate bridge drive setting must be selected to take account of the site conditions. The bridge drive setting is determined by the bank heights, refer to Chapter 1 Section II Table 1.11 for correct settings.

3.9.10.1 On the chest pack, make progressive movements to the right on the joystick until the required bridge drive mode is selected. Make sure the **POWER** and **MODE SELECT** captions on the chest pack display flashes and the **LEVEL** caption illuminates.

CAUTION

Equipment damage. The CARRIAGE EMPTY function is only to be selected when both carriages are supporting no load. It is to be used for carriage retrieval or deployment only. It MUST NOT be used while the bridge is suspended.

NOTE

The CARRIAGE EMPTY function light will continuously flash and is green in color. This is to act as a warning for the conditions of its use.

While in MODE SELECT, forward or rearward movement of the joystick on the chest pack results in no physical effect on the hydraulic system.

3.9.10.2 On the chest pack, move the joystick forwards until the **CARRIAGE EMPTY** function is selected. Move the joystick once to the right and make sure the **POWER** caption remains illuminated and the **CARRIAGE EMPTY** caption is illuminated. Make sure the **MODE SELECT** caption goes off.

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

3.9.10.3 Release the restraint holding the home bank carriage to the launch frame. Move carriages rearward if necessary.

Figure 3. 37 Home Bank Carriage to Launch Frame Restraint

3.9.10.4 On the chest pack, make progressive movements to the right on the joystick until the required bridge drive mode is selected. Make sure the **POWER** and **MODE SELECT** captions on the chest pack display flashes and the **LEVEL** caption illuminates.

CAUTION

Equipment Damage. The CARRIAGE EMPTY function is only to be selected when both carriages are supporting no load. It is to be used for carriage retrieval or deployment only. It MUST NOT be used while the bridge is suspended.

NOTE

The CARRIAGE EMPTY function light will continuously flash. This is to act as a warning for the conditions of its use.

In this mode, forward or rearward movement of the joystick on the chest pack results in no physical effect on the hydraulic system.

3.9.10.5 On the chest pack, move the joystick forward to drive the home bank and far bank carriages away from the launch vehicle until the home bank carriage restraint is fully extended, and the far bank carriage is touching the stops on the beam approximately 12 inches beyond the end beam lifting points at the far bank.

3.9.10.6 On the chest pack, select the **BRIDGE LIFT** function. Make sure the **POWER** and **BRIDGE LIFT** captions on the chest pack display illuminate, and the bridge drive selected caption (**LEVEL**, **HIGH** or **LOW**) extinguishes.

3.9.10.7 Send two personnel to the far bank to assist the far bank carriage in lowering.

3.9.10.8 Position one man by the far bank carriage ready to pull on the lower half of the carriage.

3.9.10.9 Position one man at the mid way point of the bridge ready to pull on the wire winch rope.

3.9.10.10 On the chest pack, move the joystick forward to raise the far bank carriage so that the shootbolts can be retracted.

NOTE

Continuing to operate bridge lift will create a build up of tension in the lower winch cable, which could cause the cable to nest on the winch drum.

3.9.10.11 Retract the shootbolts on the far bank carriage.

WARNING

PERSONAL INJURY. WHEN HANDLING WINCH CABLE, USE THICK LEATHER GLOVES TO PREVENT INJURY TO HANDS FROM BROKEN STRANDS.

CAUTION

Equipment damage. Failure to adhere to the procedure below will allow the rope to double wrap (nest) on the winch drum.

3.9.10.12 To allow the far bank carriage slings to go slack, perform the following:

3.9.10.13 One of the two far bank operatives stands at the center of the bridge.

3.9.10.14 Operate the lower winch to pay out the rope.

3.9.10.15 Just prior to the slack rope touching the center of the bridge, the first operative grabs hold of the rope and pulls it towards the far bank. This allows the second operative to pull down on the far bank carriage and thus slacken the slings.

3.9.10.16 It is important to pull on the rope in a continuous motion as the winch is operated, to prevent the rope from double wrapping on the winch drum.

3.9.10.17 On the chest pack, move the joystick rearward to lower the far bank carriage. Do not allow the far bank carriage beam to rest on the bridge as this may cause the cables to become entangled.

3.9.10.18 Route the far bank carriage slings through the far bank ramp end beam lifting points (Figure 3. 38) and reconnect to the carriage beam. Ensure that the sling straps do not cross and are not twisted. Ensure that the carriage is level horizontally and vertically prior to lifting, with respect to the upper part of the carriage.

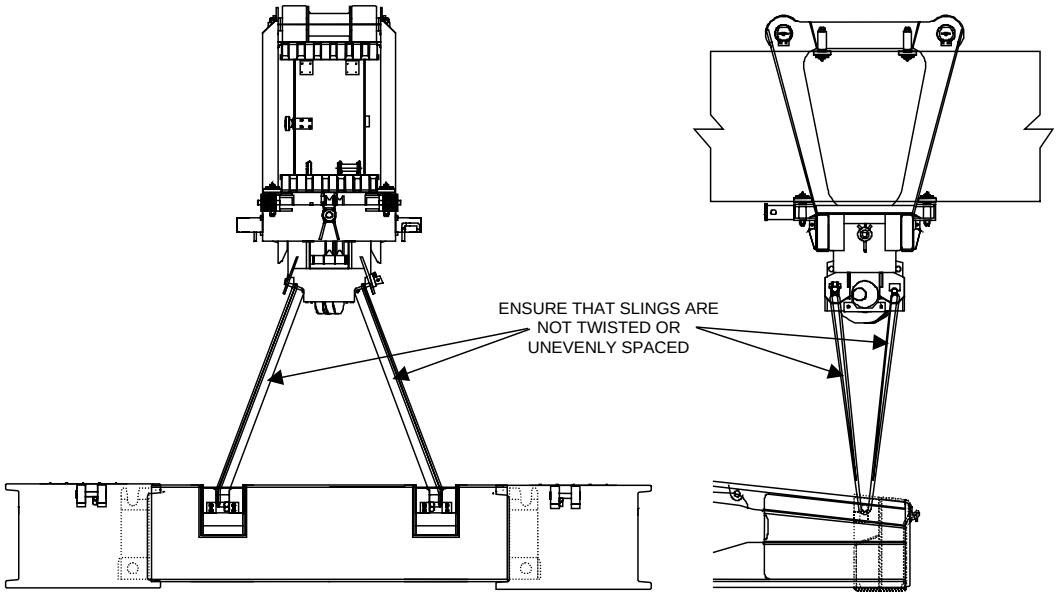


Figure 3. 38 Method and Location of Slinging Far Bank Ramp Module

NOTE

It is extremely important that the two carriage parts are in line vertically and horizontally. Failure to ensure correct alignment will result in the bottom half of the carriage becoming jammed in the top half of the carriage when it is raised.

3.9.10.19 Make sure personnel are clear of the area. On the chest pack, move the joystick forward to partially raise the far bank carriage beam and the bridge until slings are lightly tensioned.

3.9.10.20 Adjust far bank carriage slings to ensure evenly distributed loads through both left and right slings. Ensure that the carriage lifting slings are pushed to the outside of the carriage to assist in a balanced lift. Ensure that lifting slings are not twisted.

NOTE

The bridge may lift out of balance, due to mud or personnel on the bridge. To overcome this situation lower the bridge and re-sling or ensure that personnel on the bridge are as close to the centerline as possible. If the bridge still lifts out of balance, it is permissible to have personnel on the bridge to one side or other of the centerline to assist in balancing the bridge.

3.9.10.21 Continue to slowly raise the far bank carriage and the bridge, until the shootbolts in the far bank carriage beam can be inserted to reconnect the two halves.

NOTE

Ensure that the lower section of the far bank carriage is correctly aligned with the upper section of the far bank carriage. Personnel should use the lifting slings to assist in aligning the two halves of the far bank carriage.

3.9.10.22 Move the joystick on the chest pack rearwards to release the tension in the lower winch cable. Tension is sufficiently released when the cable starts to move away from the underside of the launch beam.

3.9.10.23 On the chest pack, move the joystick rearward to lower home bank carriage.

NOTE

Do not allow the beam to rest on the bridge as this may cause the cables to become entangled.

3.9.10.24 Route the carriage slings through the front ramp module bridge lifting points (Figure 3. 39) and re-connect the sling to the carriage. Ensure the sling straps do not cross or become twisted. Ensure that the carriage is level horizontally and vertically prior to lifting, with respect to the upper part of the carriage.

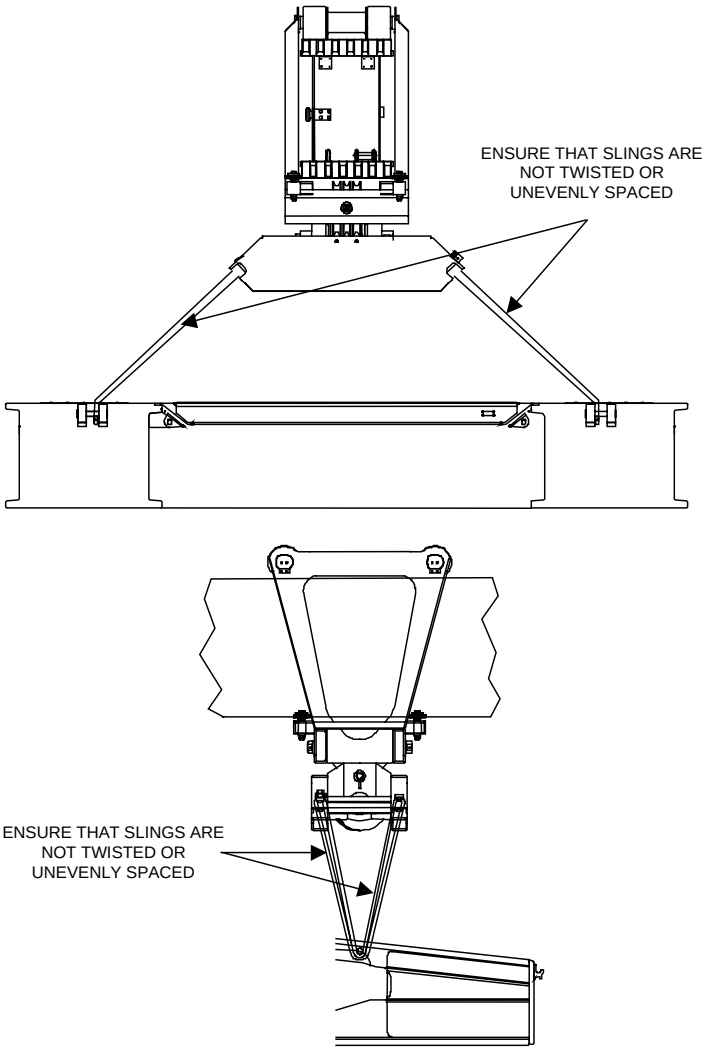


Figure 3. 39 Method and Location of Slinging Home Bank Carriage

NOTE

It is extremely important that the two carriage parts are in line vertically and horizontally. Failure to ensure correct alignment will result in the bottom half of the carriage becoming jammed in the top half of the carriage when it is raised.

3.9.10.25 Make sure personnel are clear of the area. On the chest pack, move the joystick forward to partially raise the home bank carriage beam and the bridge until slings are lightly tensioned.

3.9.10.26 Adjust home bank carriage slings to ensure evenly distributed loads through both left and right slings.

NOTE

The bridge may lift out of balance, due to mud or personnel on the bridge. To overcome this situation lower the bridge and re-sling or ensure that personnel on the bridge are as close to the centerline as possible. If the bridge still lifts out of balance, it is permissible to have personnel on the bridge to one side or other of the centerline to assist in balancing the bridge.

3.9.10.27 Continue to slowly raise the home bank carriage and the bridge, until the shootbolts in the far bank carriage beam can be inserted to reconnect the two halves.

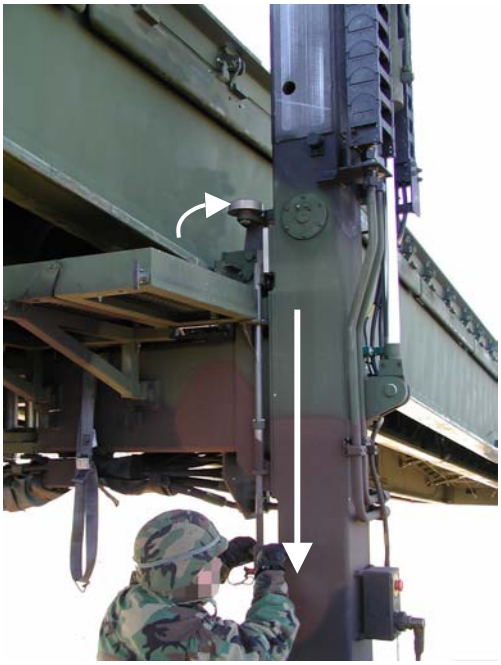
NOTE

Ensure that the lower section of the home bank carriage is correctly aligned with the upper section of the home bank carriage. Personnel should use the lifting slings to assist in aligning the two halves of the far bank carriage.

3.9.10.28 On the chest pack, move the joystick to the left to select the **BRIDGE DRIVE** function.

3.9.10.29 Make sure the **POWER** and the **BRIDGE DRIVE** mode previously selected captions (**LEVEL**, **HIGH** or **LOW**) on the chest pack display, illuminate. **DO NOT OPERATE IN EMPTY CARRIAGE MODE**.

Bridge stop emergency in down position



Bridge stop emergency in raised position

3.9.10.30 On the chest pack, move the joystick rearward to reverse the bridge towards the launch vehicle. Release the joystick when the home bank carriage is fully retracted and the restraints engage locking the home bank carriage to the launch frame.

3.9.10.31 Place two removable rollers onto the second section of the slide frame at the marks located nearest the A-frame.

3.9.10.32 Remove the retaining pin and deploy the end beam guide adapters located at the end of section one of the slide frame, nearest the crane.

3.9.10.33 Locate two end beam guides onto the end beam adapters ensuring that they are properly seated and that the locking arms are in the up position.

3.9.10.34 On the chest pack, select the **LIFT BRIDGE** function. Make sure the **POWER** and **BRIDGE LIFT** captions on the chest pack display illuminate.

3.9.10.35 On the chest pack, move the joystick forward to take the weight of the bridge and allow the retraction of both home bank carriage beam shootbolts.

3.9.10.36 Pull down on the bridge stop emergency.

3.9.10.37 On the chest pack, move the joystick rearward to lower the home bank carriage and the home bank end of the bridge onto the A-frame rollers. As the bridge is lowered onto the A-frame rollers, ensure that the bridge stop emergency lowers and fully locks in position.

3.9.10.38 Continue the lowering function until the slings of the home bank carriage are slack. Disconnect the slings of the home bank carriage from the ramp module and reconnect to the home bank carriage.

WARNING

CRUSH HAZARD. DEATH OR SEVERE INJURY COULD OCCUR IF THE BRIDGE STOP EMERGENCY (BSE) ARE NOT FULLY LOCKED DURING THE DISCONNECTION OF THE HOME BANK CARRIAGE. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO UNEXPECTED MOVEMENT OF THE BRIDGE.

3.9.10.39 On the chest pack, move the joystick forward to raise the home bank carriage beam. Make sure the drum winches operate to raise the home bank carriage beam and insert the shootbolts to connect the two carriage halves.

3.9.10.40 Place the carriage slings over the shootbolts to prevent them dragging on the bridge.

3.9.10.41 On the chest pack, move the joystick to the left to select the **BRIDGE DRIVE** function.

3.9.10.42 Make sure the **POWER** and the bridge drive mode previously selected captions (**LEVEL**, **HIGH** or **LOW**) on the chest pack display illuminate. Make sure the **BRIDGE LIFT** caption on the chest pack display goes off.

3.9.10.43 On the chest pack, move the joystick rearward to reverse the bridge towards the launch vehicle.

WARNING

CRUSH HAZARD. DEATH OR SEVERE INJURY COULD OCCUR IF THE BRIDGE STOP EMERGENCY (BSE) ARE NOT FULLY LOCKED DURING THE DISCONNECTION OF THE HOME BANK CARRIAGE. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO UNEXPECTED MOVEMENT OF THE BRIDGE.

CRUSH HAZARD. NEVER LEAN ON THE BRIDGE STOP EMERGENCY HANDLE. THE HANDLE SHOULD ALWAYS BE IN THE UP POSITION UNLESS THE BRIDGE STOP EMERGENCY IS BEING OPERATED TO ALLOW THE PASSAGE OF THE BRIDGE JAWS. FAILURE TO OBSERVE THIS WARNING CAN RESULT IN THE BRIDGE FALLING OFF THE LAUNCH VEHICLE AND CAUSING DEATH OR SEVERE INJURY TO PERSONNEL.

3.9.10.44 Pull down on the bridge stop emergency once the jaws of the ramp module are within 12 inches of the bridge stop emergency rollers. Release the bridge stop emergency as soon as the ramp jaws are clear of the bridge stop emergency rollers.

3.9.10.45 Continue to reverse the bridge. Release the joystick when the pins connecting the home bank ramp module to the parallel module, are in line with the center of the Tail lift.

3.9.11 Approach Ramp Transport Frame

3.9.11.1 The approach ramp transport frames are lifted using the bridge module lifter in its widest position and with the main lifting beam positioned across the approach ramps.

3.9.11.2 The bridge module lifter is connected to the four wire lifting slings two on each side of the approach ramp transport frame. All the slings are connected to the hooks on the bridge module lifter.

3.9.11.3 The two frames are lifted as one initially (Figure 3. 40 (A)). Once one frame is fitted to the required ramp module, either left or right of the centerline, the top frame is lifted from the bottom transport frame (Figure 3. 40 (B)), by disconnecting the lower frame's wire slings (1 & 2) and lifting the top frame into its required position on the other side of the ramp module centerline.

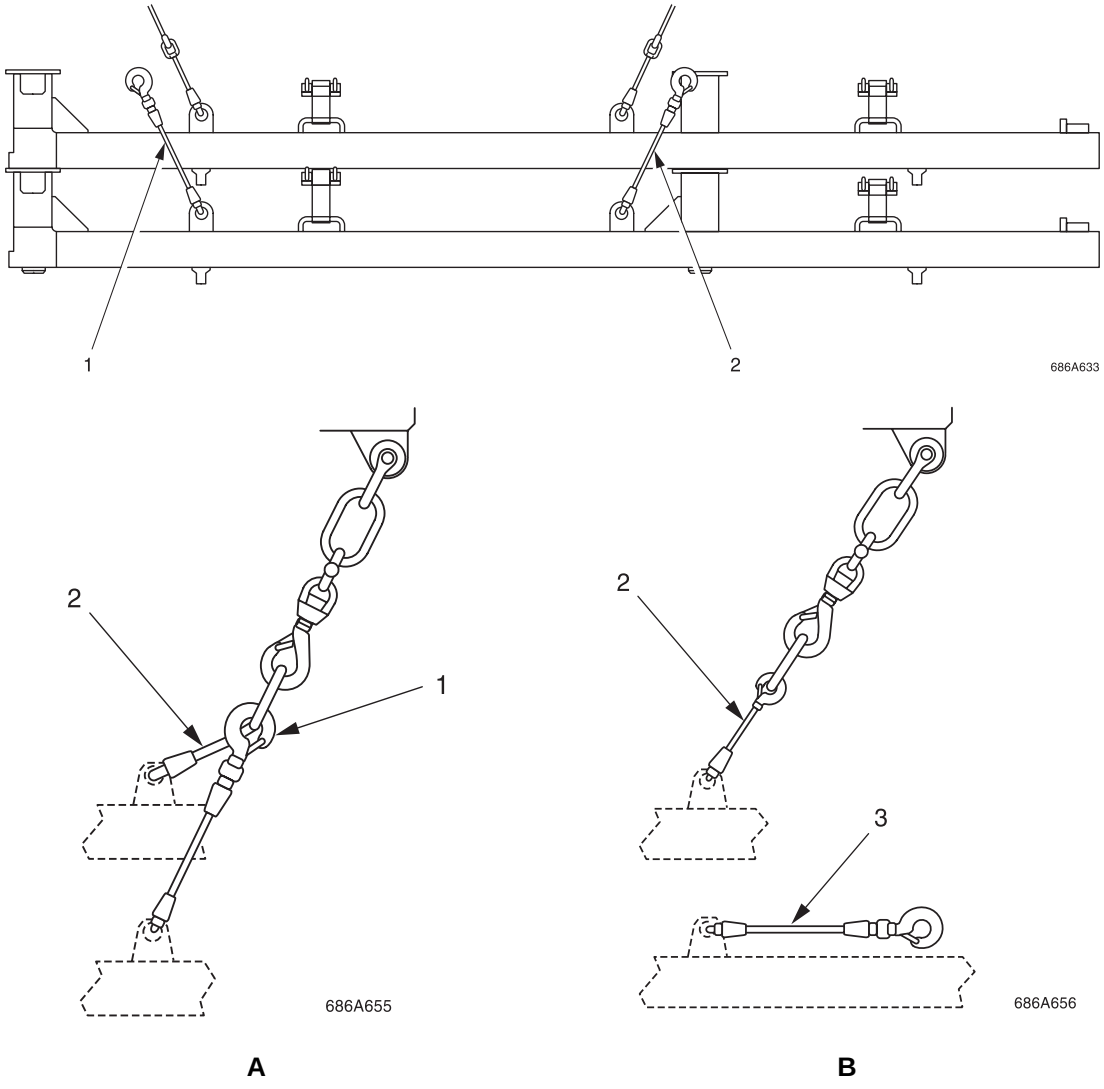


Figure 3. 40 Slinging of Approach Ramp Transport Frame

Section VI. MODULE CONNECTION

3.10 LAUNCH BEAM AND MODULE CONNECTIONS

3.10.1 Connecting Launch Beams

3.10.1.1 Operate the lift and traverse controls on the crane and, using the steadying guide ropes, locate the next launch beam into position at the launch frame.

3.10.1.2 Rock the suspended launch beam to align its upper jaws with those of the launch beam held in the launch frame.

WARNING

CRUSH HAZARD. PERSONAL INJURY CAN RESULT IF EXTREME CAUTION IS NOT USED WHEN INSTALLING THE BEAM CONNECTING PINS. KEEP HANDS AND FINGERS CLEAR OF PIN HOLES AND COMPONENTS BEING MOVED OR CONNECTED.

CAUTION

Equipment damage. Damage to pins and pin holes can result if undue force is used to insert the connecting pins. DO NOT hammer the pins into position in the upper jaws.

3.10.1.3 Insert the launch beam pin into the upper jaws and secure it with an R clip.

NOTE

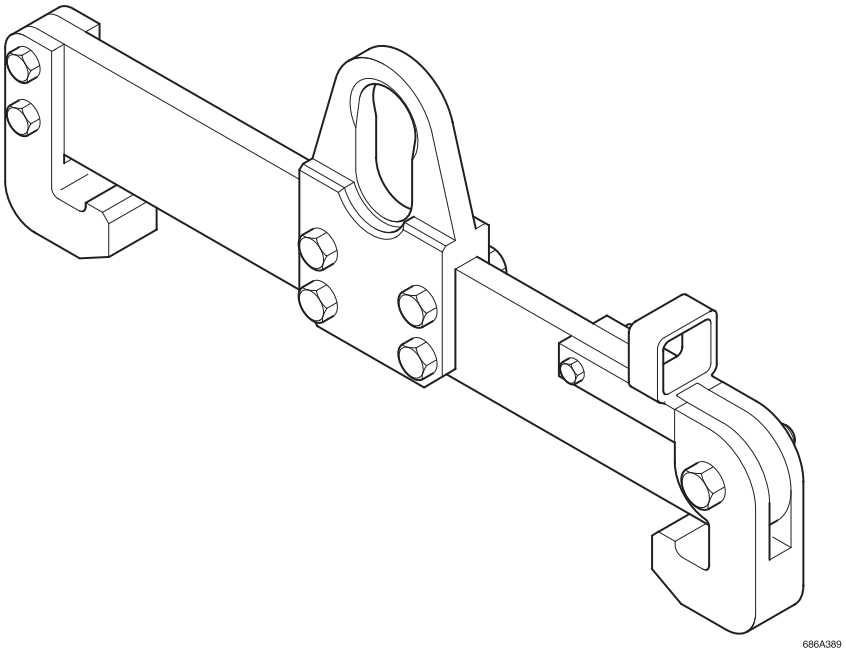
The head of the launch beam pin must be orientated so that the flat locates under the tab on the side of the launch beam jaws.

3.10.1.4 Operate the lower controls from the crane and align the lower jaws with those of the launch beam held in the launch frame. Continue lowering until the single leg sling just goes slack.

3.10.1.5 Insert the launch beam pin into the lower jaws and secure it with an R clip.

NOTE

Providing the single leg sling is slack, the guide system on the launch beam will ensure correct alignment for pin insertion.



Launch Beam Lifter

3.10.1.6 Disconnect the launch beam lifter and the steadying ropes from the connected launch beam.

3.10.1.7 Position the pinning operatives in the shelter of the launch frame during slinging operations.

3.10.1.8 Operate the traverse and raise/lower controls on the crane and reposition the launch beam lifter to attach the next launch beam.

3.10.1.9 Connect the launch beam lifter and steadying rope lines to the next launch beam.

3.10.1.10 On the chest pack, use the joystick to select the **BEAM DRIVE** function.

3.10.1.11 On the chest pack, move the joystick forward to advance the connected launch beams.

CAUTION

Equipment damage. Take care not to overshoot the maximum forward movement or damage may occur. The travel stop provided is for emergency use only.

3.10.1.12 Release the joystick when the rear jaws of the last launch beam connected still protrude 5 to 6 in (127 to 152.4 mm) from the rear of the launch frame and the lever arm has dropped into position. Make sure the launch beam slows and then stops in this position.

NOTE

The launch beam is now correctly positioned to receive the next launch beam.

3.10.1.13 Repeat steps 3.10.1.1 through 3.10.1.12 until the required launch beams are connected and the launch beam spans the gap.

3.10.1.14 On the chest pack, move the joystick forward and rearward as necessary to align the holes for the launch beam final stop locking pin.

WARNING

CRUSH HAZARD. FAILURE TO INSTALL THE LOCKING PINS AND THEIR R CLIPS WILL CAUSE THE LAUNCH BEAM TO FLEX AND CREEP BACKWARDS. FAILURE TO HEED THIS INSTRUCTION COULD RESULT IN SEVERE PERSONAL INJURY.

3.10.1.15 Install the locking pin and R clip to secure the launch beam final stop.

3.10.2 Connecting a Ramp Module to an End Beam

3.10.2.1 Operate the lift and traverse controls on the crane and position the crane to lift the end beam.

3.10.2.2 Connect the two slings and tag lines to the end beam (Para 3.9.2).

3.10.2.3 Operate the lift and traverse controls on the crane, and lift the end beam into position on the end beam adapters positioned on the launch vehicle slide frame.

3.10.2.4 Disconnect the two slings and tag lines from the end beam.

3.10.2.5 Connect the bridge module lifting beam and single leg sling to the crane.

3.10.2.6 Operate the lift and traverse controls on the crane and position the crane to lift the ramp module.

3.10.2.7 Connect the bridge module lifting beam at POSITION 2 and tag lines to the ramp module (see Figure 3. 41).

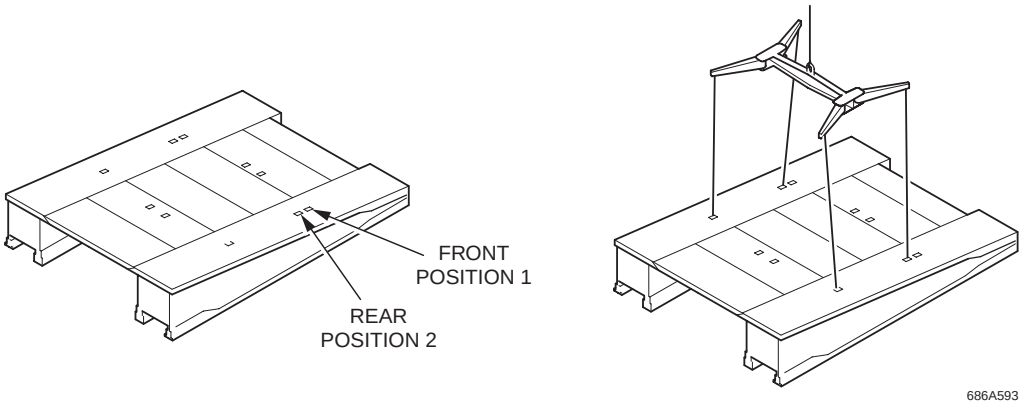


Figure 3. 41 Bridge Module Lifter Connected to Ramp Module in POSITION 2

3.10.2.8 Operate the lift controls on the crane, and lift the ramp module. Make sure the module opens slowly and progressively as it is lifted by the crane. Do not operate the traverse controls of the crane until the ramp module has fully opened.

3.10.2.9 Operate the lift and traverse controls on the crane and, using the tag lines, guide the ramp module into position over the end beam.

3.10.2.10 If necessary connect the ramp module wrench to the approach ramp gutter on the end beam and rock the end beam to align the tapered guide.

Figure 3. 42 End Beam Wrench and Method of Use

3.10.2.11 Recover the end beam locking pins from the LVT basket and place them safely on the slide frame platform.

3.10.2.12 Align the ramp module with the tapered guide on the end beam and slowly lower the ramp module until the two are fully engaged and the ramp module is sat on the removable rollers.

3.10.2.13 Insert the lower locking pins and secure them by twisting the pin so that they locate within the locking bracket.

3.10.2.14 Disconnect the bridge module lifting beam and steadying rope lines from the lifting points on the ramp module.

3.10.3 Connecting Modules Where the Upper Dowels Contact First

NOTE

It should be noted that the parallel modules are interchangeable and reversible when connecting to each other and ramp modules.

3.10.3.1 In order to connect the bridging modules together to form a stable and secure structural unit it is necessary to carry out the following procedure:

3.10.3.2 Once the bridge module is slung, it has to be aligned with the module fitted in place on the sliding frame.

3.10.3.3 To connect the ramp module with the bridging module, the bridge module is slung into position so that the top dowels on the two modules are aligned.

3.10.3.4 Sling the bridge module so that the dowels are inserted into their receptacles on the connecting modules.

3.10.3.5 Insert all four shootbolts.

3.10.3.6 Lower the boom of the crane until the lifting sling goes slack allowing the resilient mounting to align the pin holes.

3.10.3.7 Insert the bridge pins (the outside pins are fitted from the outside in and the two inside pins are fitted from the inside out, so that the R clips are fitted inside the bridge) and clip.

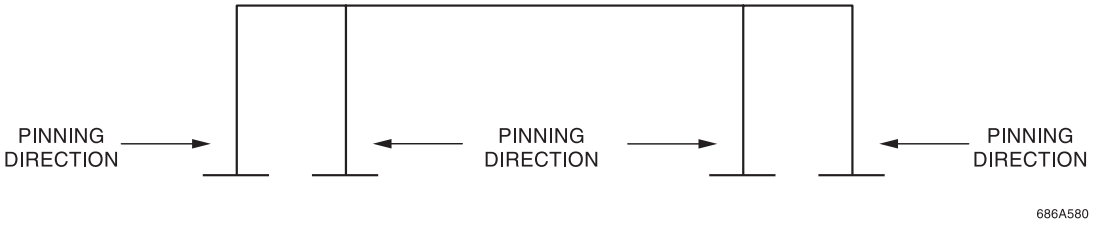


Figure 3. 43 Method of Pinning Ramp and Bridging Modules Together

3.10.4 Connecting Modules Where the Jaws Contact First

NOTE

It should be noted that the parallel modules are interchangeable and reversible when connecting to each other and ramp modules.

3.10.4.1 To connect a bridge module to another bridge module follow the procedure below:

3.10.4.2 When connecting bridge modules together they will invariably be orientated away from the level due to the angle of the launch beam.

3.10.4.3 Sling the bridge module towards the bridge module installed on the launcher, align the birds beaks. Use the tag lines to control the position of the bridge module.

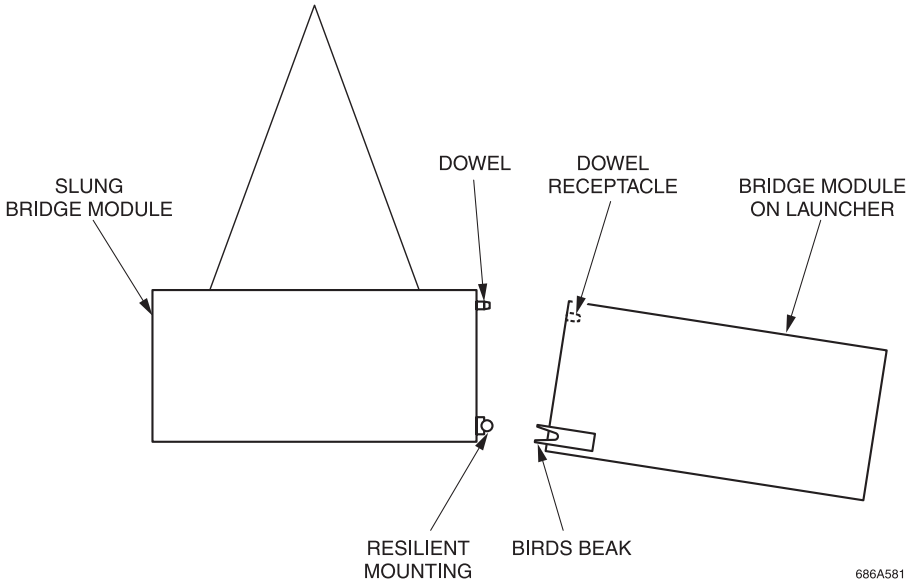


Figure 3. 44 Sling Bridge Module and Align the Birds Beaks

3.10.4.4 Rotate the bridge module by extending the jib on the crane so that the dowels and their respective location holes engage.

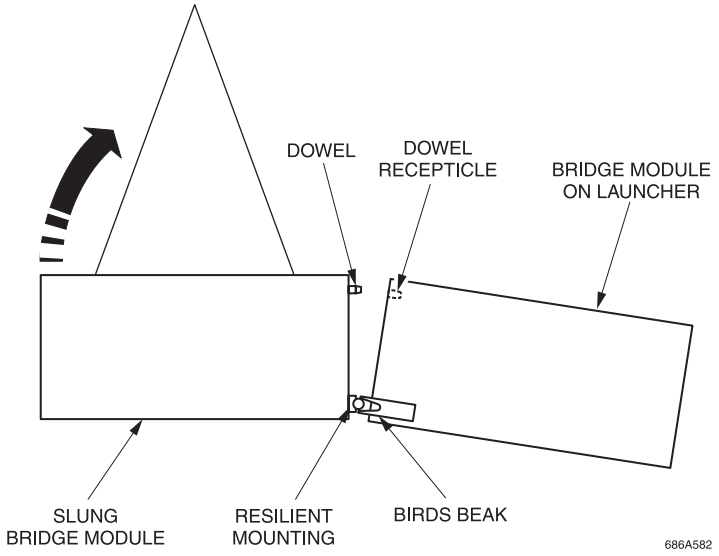


Figure 3. 45 Engage the Birds Beaks and Rotate Bridge Module to Engage the Shootbolts

WARNING

CRUSH HAZARD. CONTINUING TO RAISE THE BRIDGE MODULE ONCE ANY OR ALL THE SHOOTBOLTS HAVE BEEN INSERTED CAN RESULT IN FAILURE OF THE BRIDGE DOWELS. FAILURE TO OBSERVE THIS INSTRUCTION COULD RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL.

3.10.4.5 Insert their shootbolts to secure the top chords together.

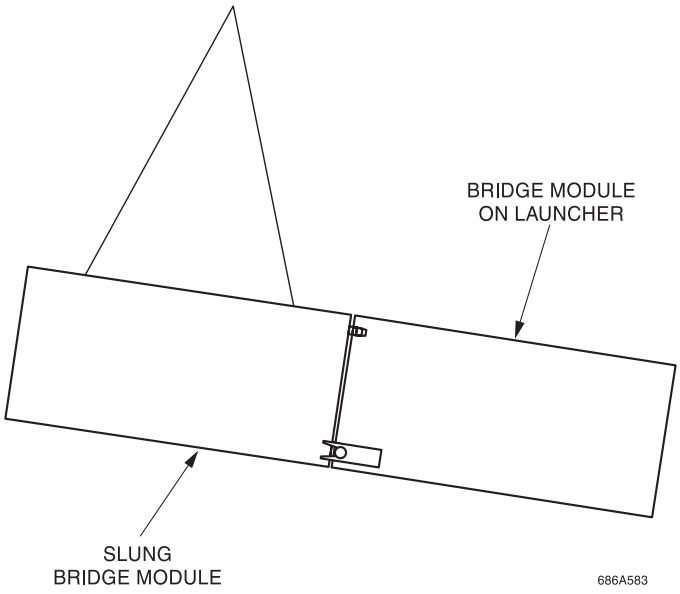


Figure 3. 46 Engage the Shootbolts Pin the Bridge Modules Together and Clip

3.10.4.6 Lower the module to allow the sling to go slack and the pinning holes to align, pin the modules together (the outside pins are fitted from the outside in and the two inside pins are fitted from the inside out, so that the R clips are fitted inside the bridge) and clip.

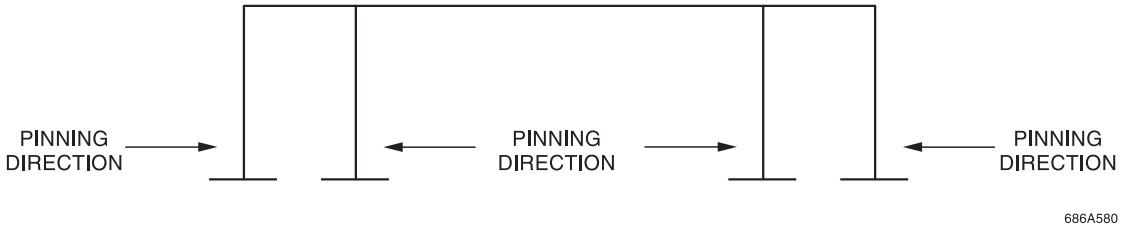


Figure 3. 47 Method of Pinning Bridging Modules Together

3.10.5 Disconnecting a Ramp and End Beam

3.10.5.1 Make sure the bridge module lifting beam is adjusted to its widest setting and secured in this position with the shootbolts.

3.10.5.2 Attach the bridge module lifting beam to the crane hook.

3.10.5.3 Operate the lift and traverse controls on the crane and position the bridge module lifting beam at the ramp module.

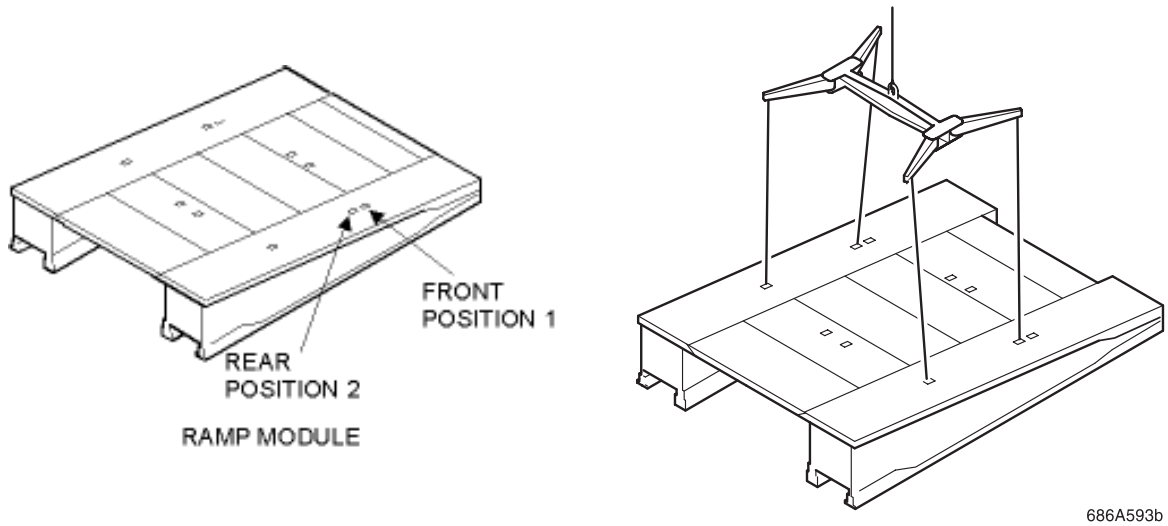


Figure 3. 48 Bridge Lifting Beam connected to POSITION 2

3.10.5.4 Connect the bridge module lifting beam to POSITION 2 lifting points on the outboard sides of the ramp module. Attach steadying rope lines to the ramp module.

3.10.5.5 Remove the connecting pins securing the ramp module to its end beam, by twisting the pins so that they disengage with the locking bracket.

WARNING

CRUSH HAZARD. THE CRANE DOES NOT LIFT VERTICALLY. DURING THE DISCONNECTION PROCESS, ENSURE THAT A PERSON IS PLACED AT THE SIDE OF THE LAUNCHER TO DIRECT THE CRANE OPERATOR SHOULD THE LIFTING SLING MOVE FROM THE VERTICAL. IF THE SLING IS NOT MAINTAINED IN THE VERTICAL, THE RAMP WILL SWING WHEN SEPARATED FROM THE END BEAM CAUSING SEVERE INJURY TO SURROUNDING PERSONNEL.

CAUTION

If end beam does not release from ramp module stop the lift and lower ramp module onto the slide frame. Investigate the reason for the non-release of the end beam.

3.10.5.6 Operate the lift and traverse controls on the crane to lift ramp module away from end beam, leaving the end beam on the end beam adapters fitted to slide frame.

3.10.5.7 Continue to operate the lift and traverse controls on the crane and position the far bank ramp module at 90 degrees across flatrack V1.

Section IV VEHICLE LASHING AND TRANSPORT AIDS

3.11 TRANSPORTATION AIDS

3.11.1 Module Transportation Aids

3.11.1.1 The transportation guides are used wherever one module is stowed on top of another. There are four guides per load. The guides are used on the lower of the two modules and are positioned in between the deck units.

3.11.1.2 The four transportation aids are fitted, two per side, in between the deck units. The brackets being place between the deck units through which the closing slings are accessed (see Figure 3. 49).

3.11.1.3 The transportation aids are fitted so that the white painted faces are orientated upwards and outwards.

3.11.1.4 The transportation aids are removed once the top module has been removed during bridge build; they are then stored in the flatrack storage box.

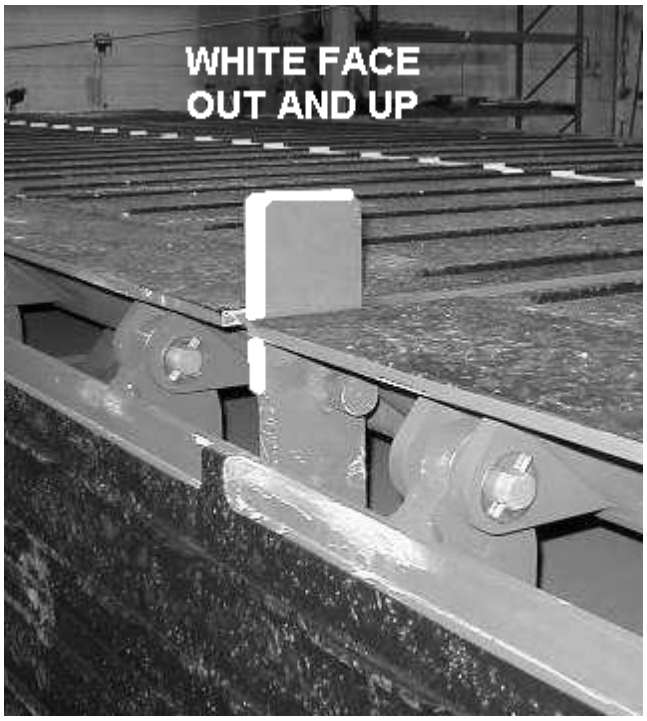


Figure 3. 49 Transportation Aid Fitted to Module

3.11.2 Fitting Bridge Module Transport Aids

3.11.2.1 Four transportation aides, two per side, are fitted between the deck units as shown in Figure 3. 50 through Figure 3. 54. The transportation aides being placed between the deck units through which the closing slings are accessed.

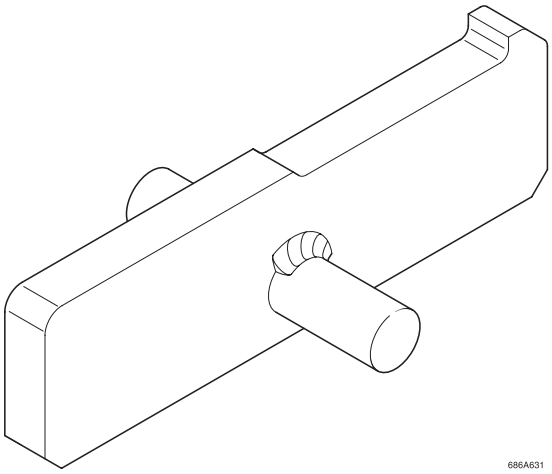


Figure 3. 50 Transportation Bracket

Figure 3. 51 Transport Aid Insertion

Figure 3. 52 Transport Aid inserted Under Deck Unit

Figure 3. 53 Final Position

Figure 3. 54 Lower Top Module Onto Aid

3.11.3 Approach Ramp Transportation Aids

3.11.3.1 The spacer below is used in a similar manner to the transportation aid in that it is placed between the deck units on the lower module but then has the approach ramps placed on top. The spacers are fitted on either side of the ramp module at the first and third deck unit space from the end of the flatrack.

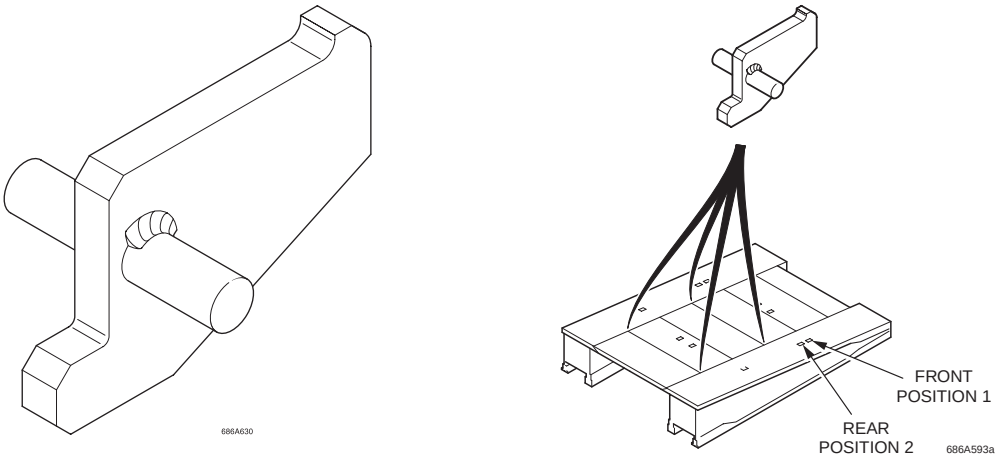


Figure 3. 55 Approach Ramp Transport Frame Transport Aid

3.12 SECURING FLATRACK LOADS FOR TRANSPORT

3.12.1 Lashing Loads

3.12.1.1 When transporting DSB loads it is important that they are secure. To achieve this all loads are secured to the flatrack with transport straps.

3.12.1.2 The transport strap consists of a webbing strap with hooks on each end and a ratchet mechanism to tighten the strap. Positioned over the webbing strap are two wear sleeves (see Figure 3. 56), which are moved along the webbing straps and positioned at corners of the load, these protect the webbing from sharp edges.

3.12.1.3 The following figures show the lashing arrangements for the flatrack loads, they also show the positioning of the wear sleeves.

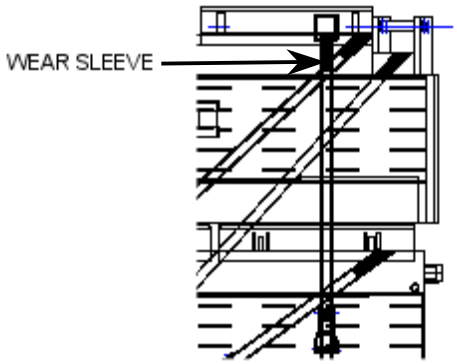


Figure 3. 56 Wear Sleeve Positioned at Corner of Load

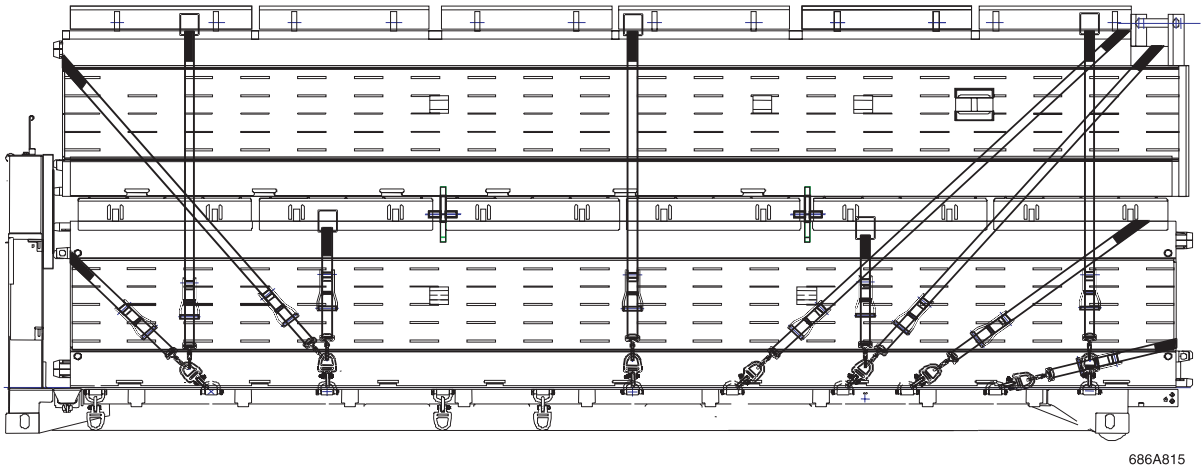


Figure 3. 57 Flatrack Load V1 Lashing Arrangements

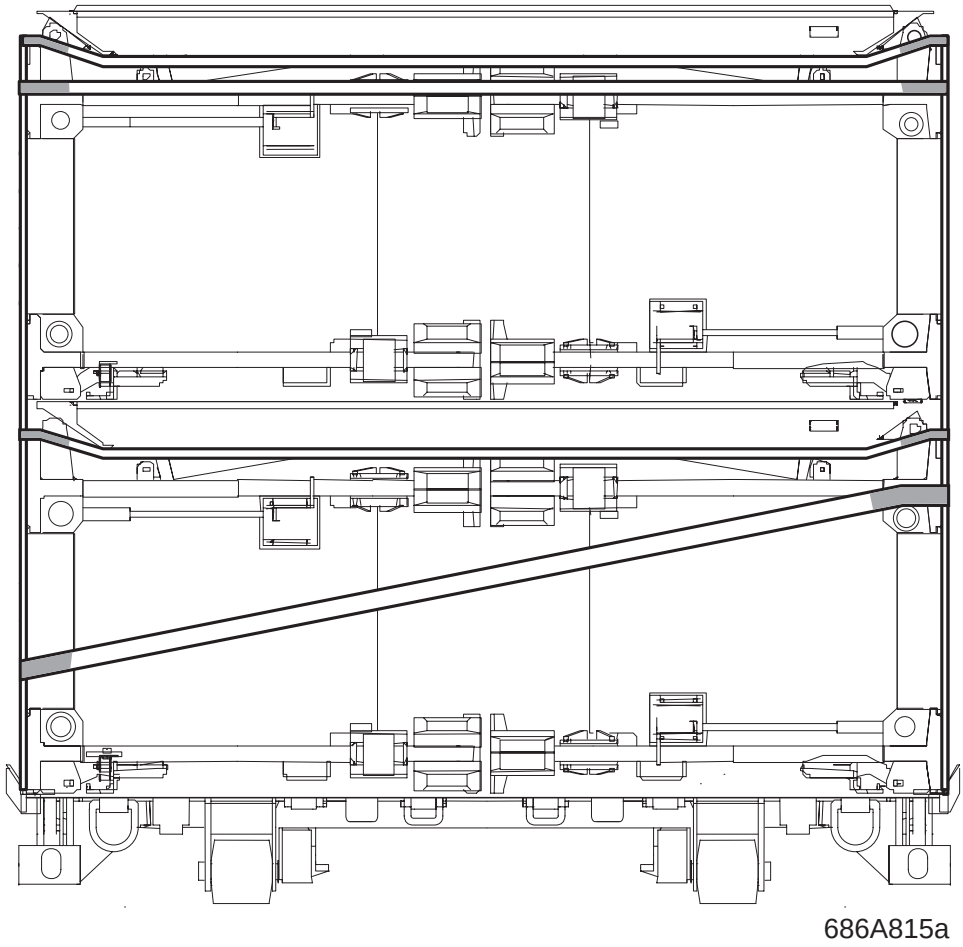


Figure 3. 58 Flatrack Load V1 End Lashing Arrangements

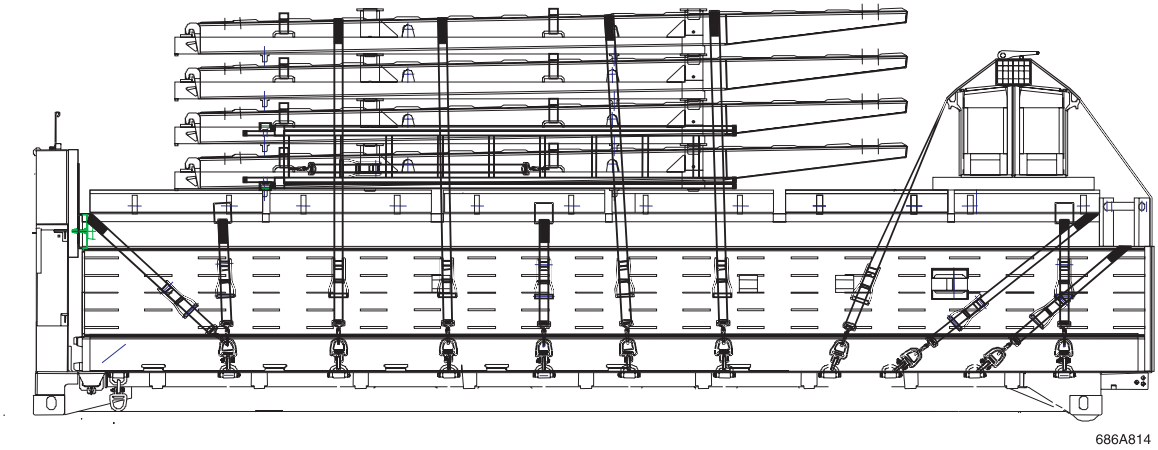


Figure 3. 59 Flatrack Load T1 Lashing Arrangements

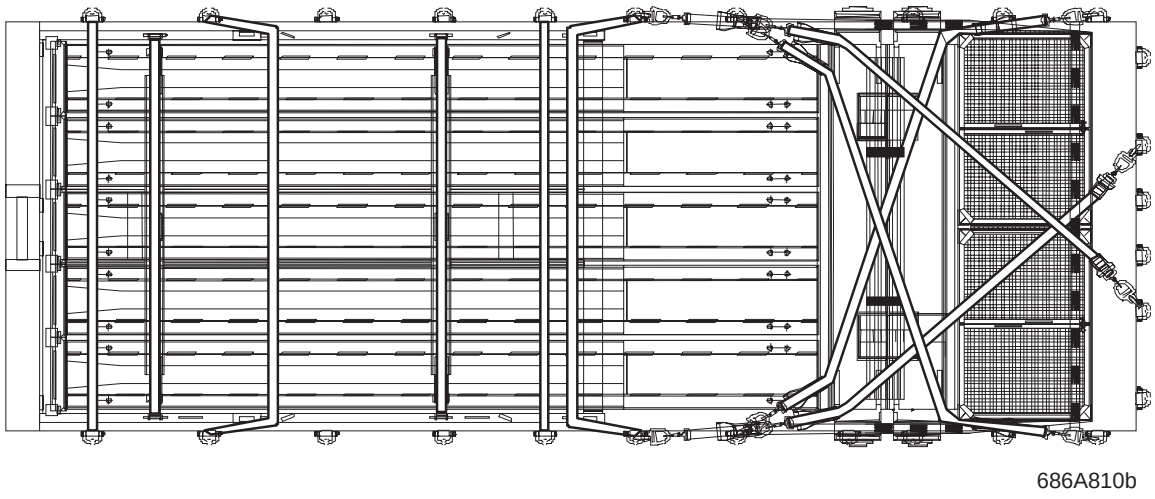


Figure 3. 60 Flatrack Load T1 Top Lashing Arrangements

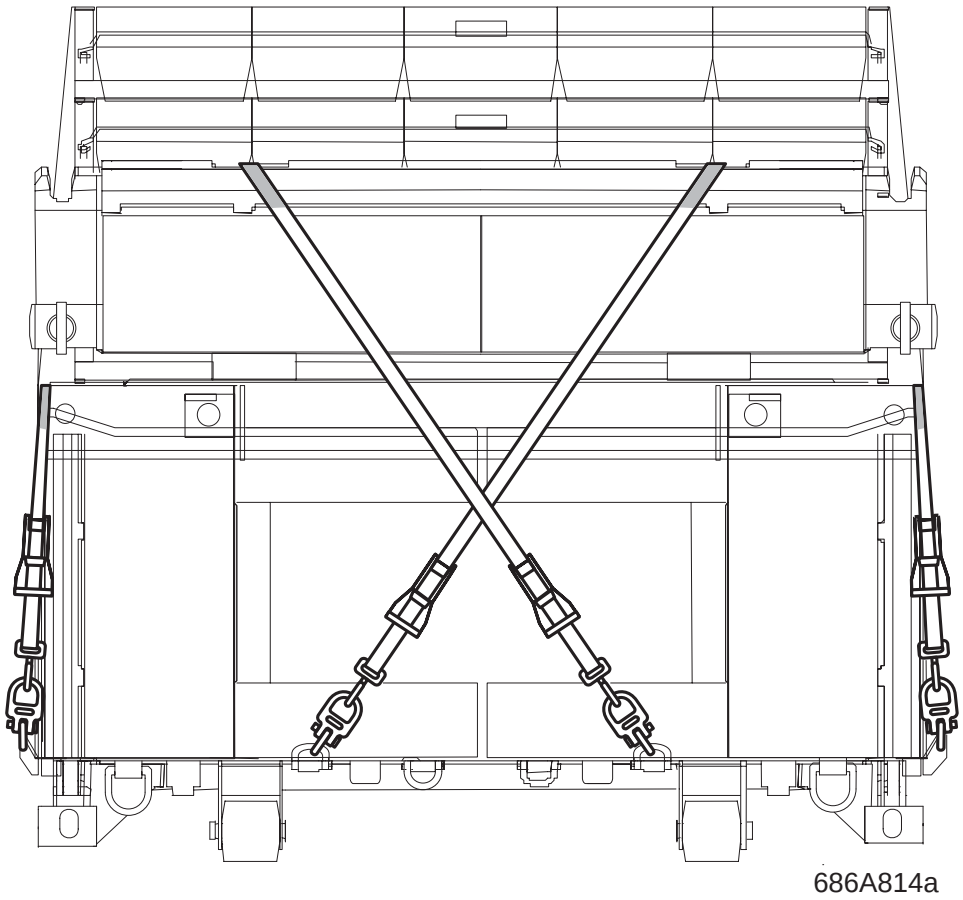


Figure 3. 61 Flatrack Load T1 End Lashing Arrangements

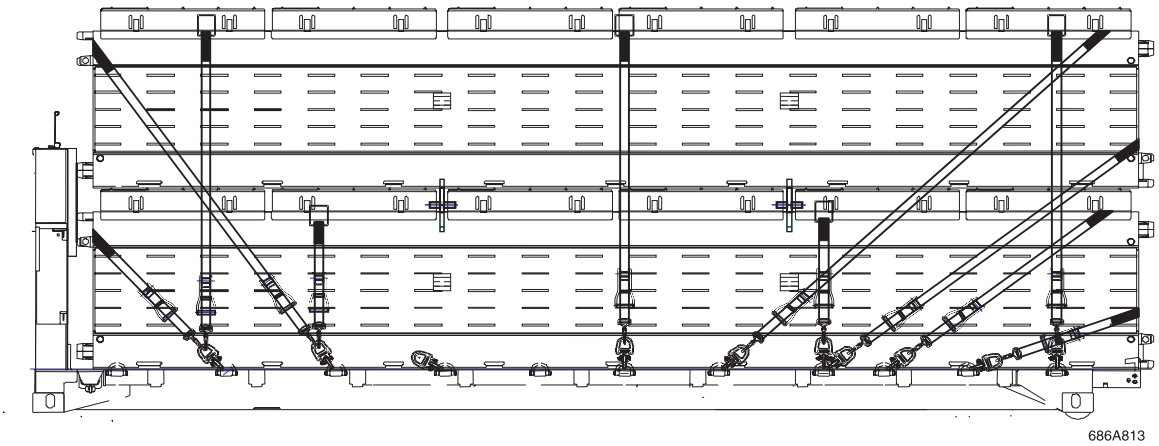


Figure 3. 62 Flatrack Load V2 Lashing Arrangements

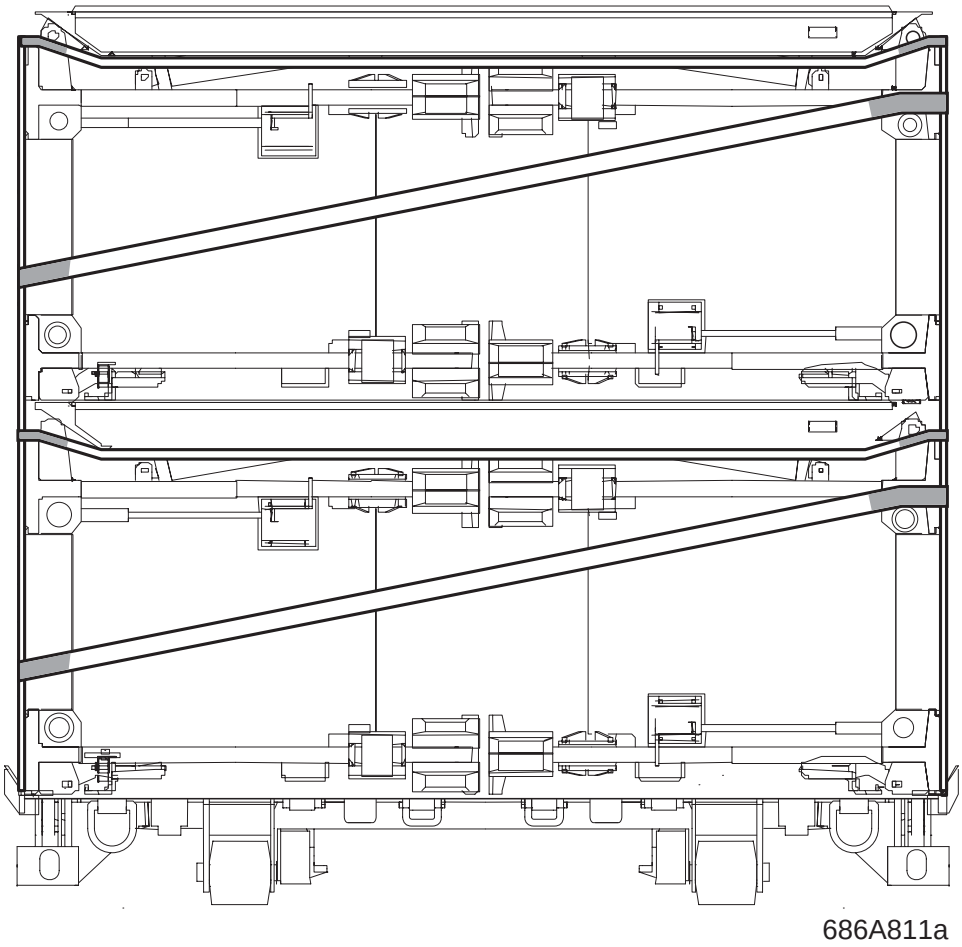


Figure 3. 63 Flatrack Load V2 End Lashing Arrangements

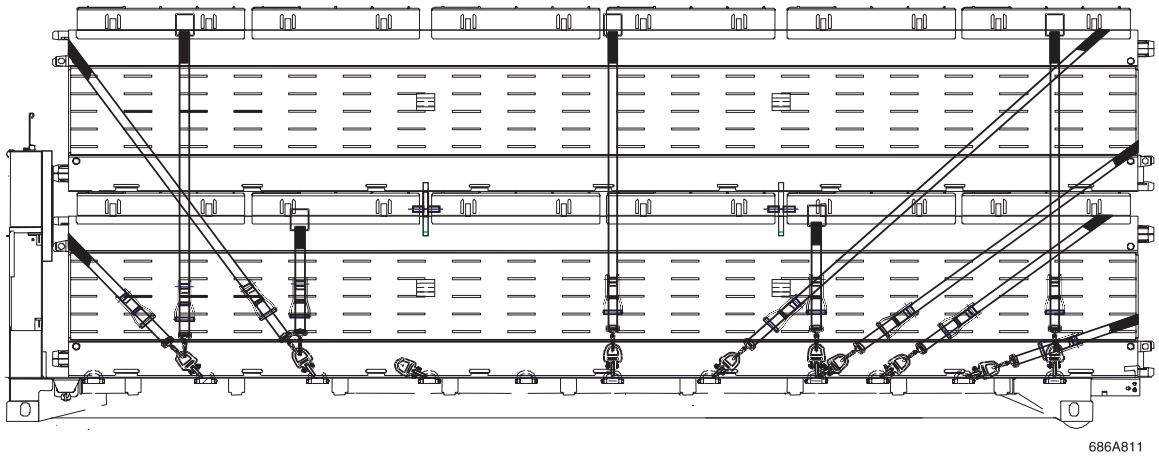


Figure 3. 64 Flatrack Load T2 Lashing Arrangements

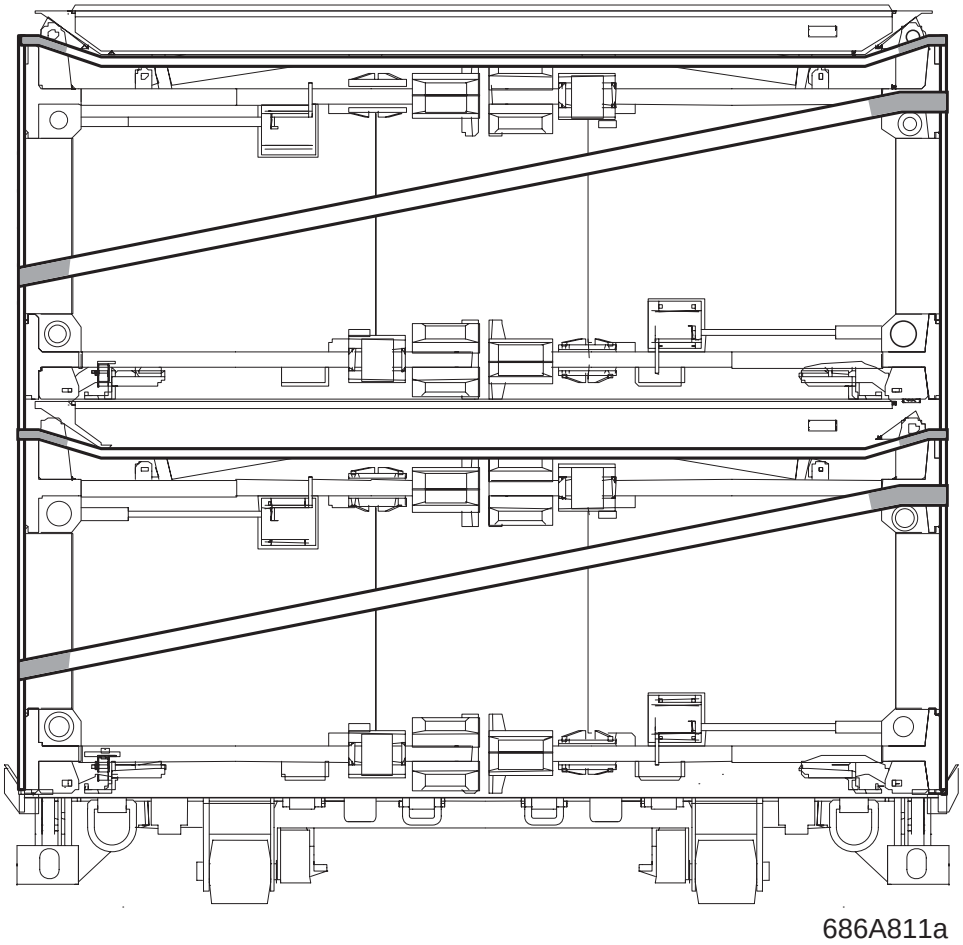


Figure 3. 65 Flatrack Load T2 End Lashing Arrangements

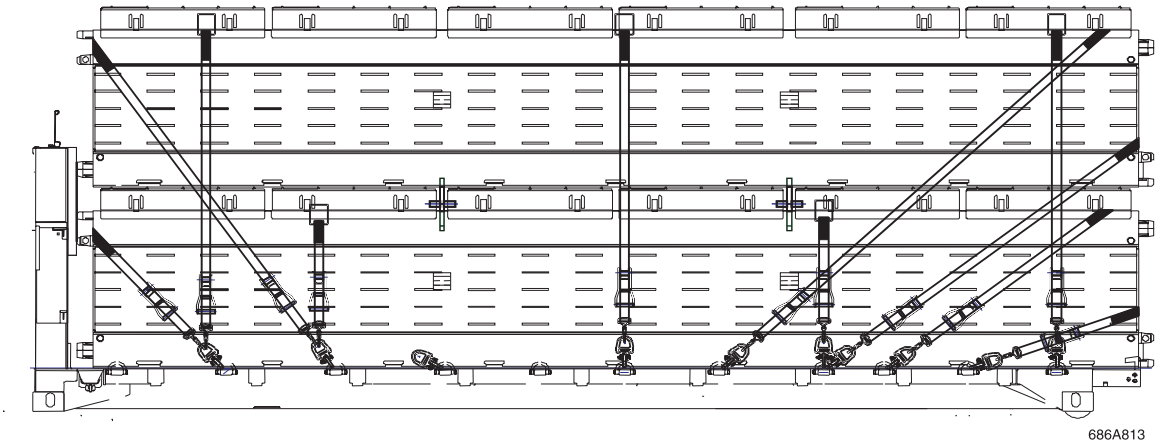


Figure 3. 66 Flatrack Load V3 Lashing Arrangements

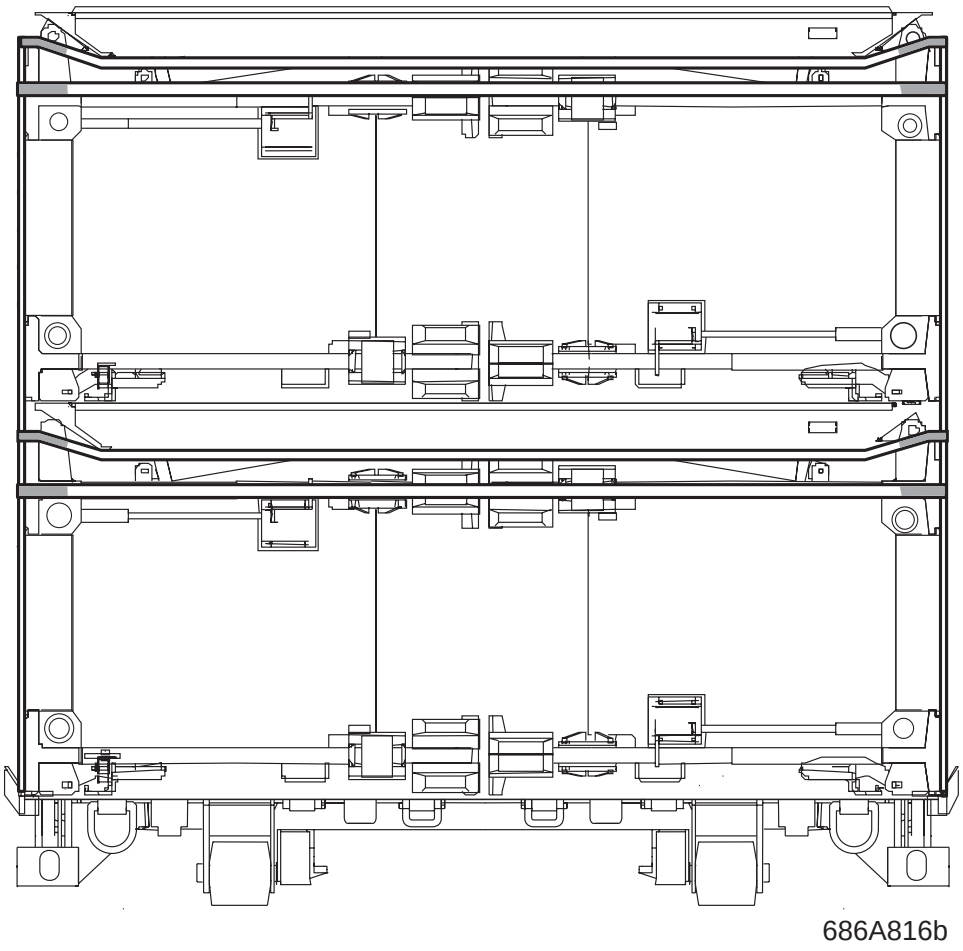


Figure 3. 67 Flatrack Load V3 Lashing Arrangements

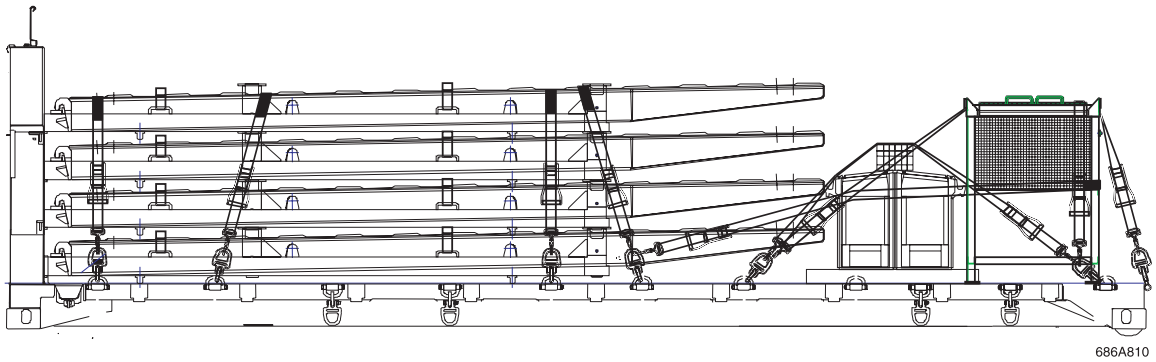


Figure 3. 68 Flatrack Load T3 Lashing Arrangements

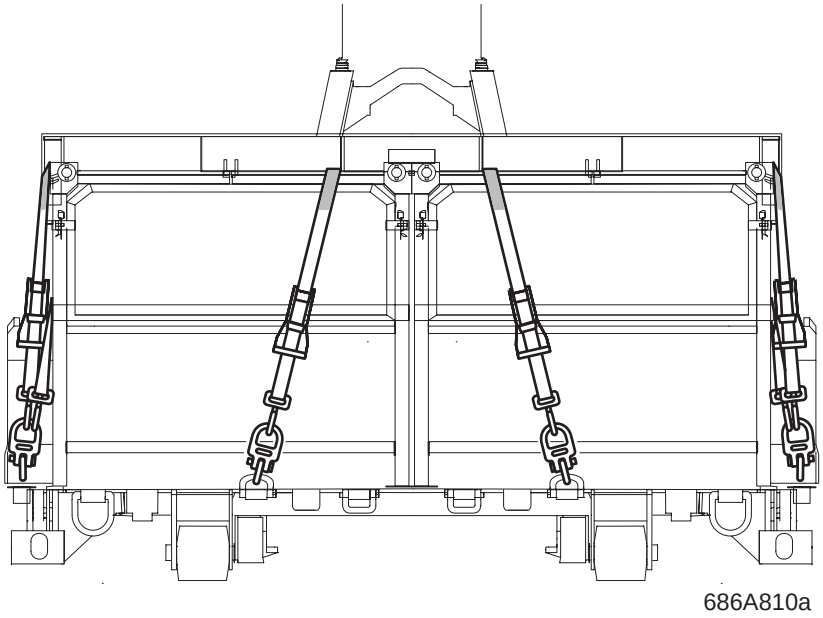


Figure 3. 69 Flatrack Load T3 End Lashing Arrangements

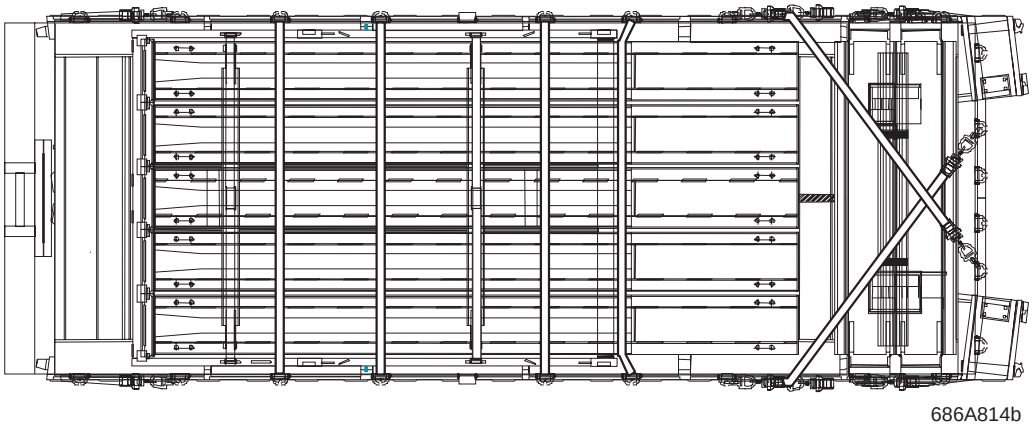


Figure 3. 70 Flatrack Load T3 Top Lashing Arrangements

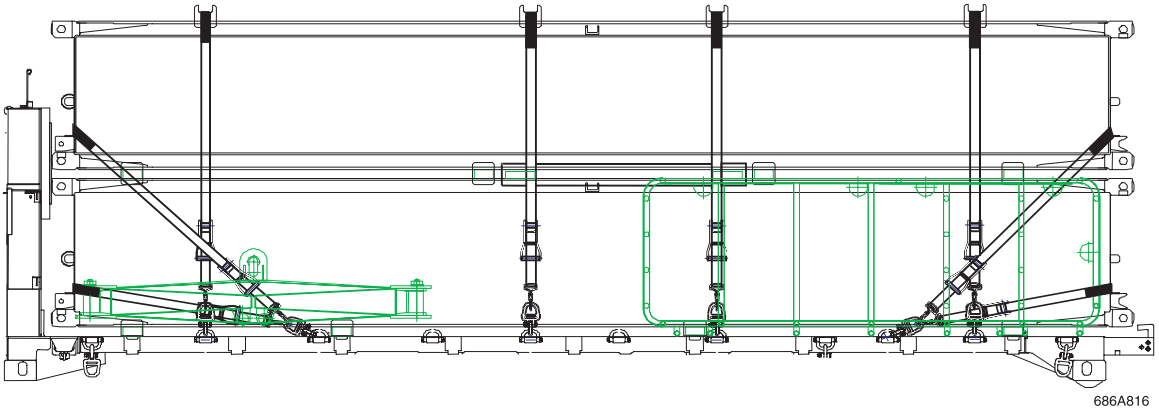


Figure 3. 71 Flatrack Load LVT Lashing Arrangements

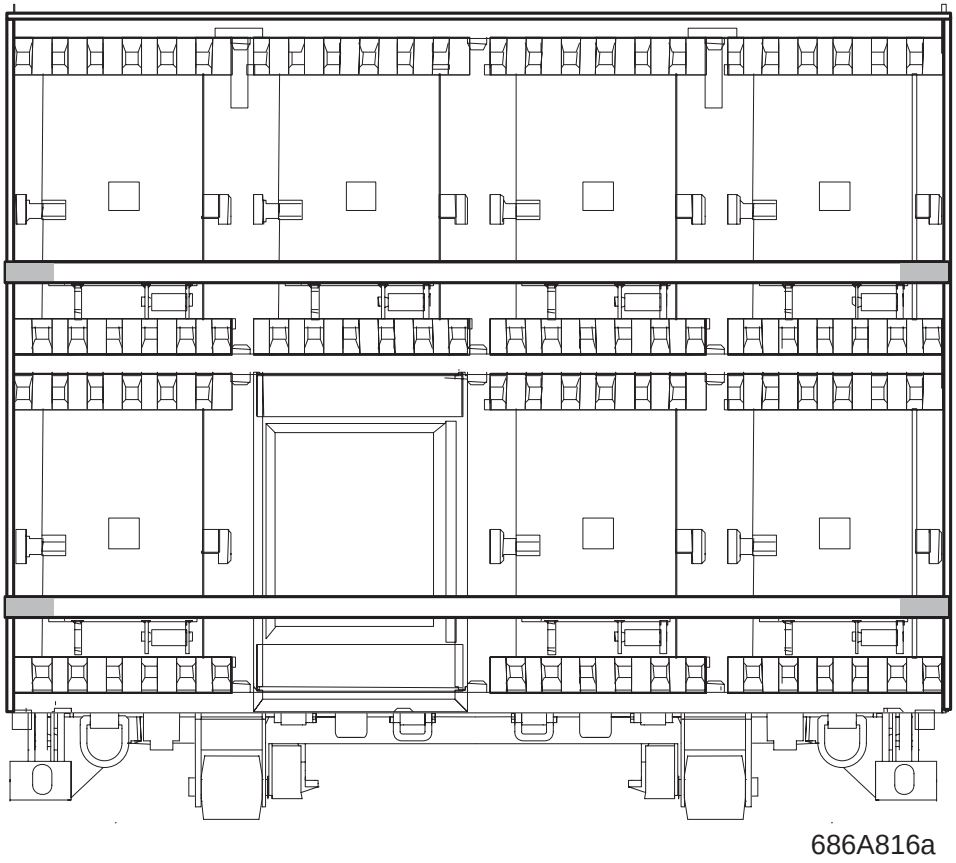


Figure 3. 72 Flatrack Load LVT End Lashing Arrangements

3.13 APPROACH RAMP DEPLOYMENT

3.13.1 Far Bank Approach Ramps

WARNING

CRUSH HAZARD. ONCE THE TRANSPORT STRAPS ARE RELEASED FROM THE APPROACH RAMP TRANSPORT FRAME, THE APPROACH RAMPS MAY FLIP UPWARDS SHOULD PERSONNEL WALK ON THE TAPERED END OF THE RAMP.

NOTE

This operation MUST ONLY be carried out once the launch beam has been retracted and the far bank support is clear of the far bank ramp module.

3.13.1.1 Un-strap the far bank approach ramps from their frames and remove the four retaining bars.

3.13.1.2 Place the straps and the bars at the side of the bridge.

3.13.1.3 Using the approach ramp carrying handle lift the rear end of the central ramp of one of the two approach ramp frames clear of its location blocks and push forward.

3.13.1.4 Place a carrying handle in each location on the front of the approach ramp and lift it ready for deployment.

3.13.1.5 With the end of the approach ramp on the deck, drag the approach ramp forward until the approach ramp approaches the gutter.

3.13.1.6 Remove the two handles and locate them in the gutter end of the approach ramp.

WARNING

FALL HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE APPROACH RAMPS ARE NOT PULLED TOWARDS THE CENTER OF THE BRIDGE BEFORE DEPLOYMENT. PERSONNEL SHOULD NOT ATTEMPT TO DEPLOY APPROACH RAMPS WHILE POSITIONED AT THE EDGE OF THE BRIDGE. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO PERSONNEL FALLING INTO THE GAP AND SUFFERING SEVERE INJURY OR DEATH.

NOTE

The gutter has cut outs along its bottom edge to allow the approach ramps to be inserted. Sliding the approach ramps sideways locks them in position.

The approach ramps located toward the center of the bridge may be deployed without sliding inboard.

3.13.1.7 Lift the approach ramp and locate with the gutter in the ramp module. Place the lifting handles on the same side at either end of the approach ramp and position the ramp to the outside edge of bridge.

3.13.1.8 Slide the next approach ramp into the central location on the approach ramp frame and repeat the procedure, working from the center outwards.

3.13.1.9 Once all the approach ramps have been put in place from one transport frame repeat the procedure for the other transport frame.

3.13.1.10 Using two personnel lift the approach ramp frames and store them on the empty flatrack.

3.13.1.11 Position 3 defile marker posts on either side of the bridge to form a lead onto the bridge for traffic.

NOTE

Defile marker guide posts are driven into the ground by foot. The dogleg on the post being used to push the post into the ground.

3.13.1.12 Wrap marker tape between the posts securing it in the defile marker post clip and tie back to the ramp module.

3.13.2 Home Bank Approach Ramp Deployment

WARNING

FALL HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE APPROACH RAMPS ARE NOT PULLED TOWARDS THE CENTER OF THE BRIDGE BEFORE DEPLOYMENT. PERSONNEL SHOULD NOT ATTEMPT TO DEPLOY APPROACH RAMPS WHILE POSITIONED AT THE EDGE OF THE BRIDGE. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO PERSONNEL FALLING INTO THE GAP AND SUFFERING SEVERE INJURY OR DEATH.

CRUSH HAZARD. ONCE THE TRANSPORT STRAPS ARE RELEASED FROM THE APPROACH RAMP TRANSPORT FRAME, THE APPROACH RAMPS MAY FLIP UPWARDS SHOULD PERSONNEL WALK ON THE TAPERED END OF THE RAMP.

3.13.2.1 Unstrap the home bank approach ramps stored on flatrack V1 from their frames and remove the four retaining bars.

3.13.2.2 Place the straps and the bars at the side of flatrack V1.

3.13.2.3 Using four personnel with carrying handles lift the approach ramp from the approach ramp frame and offer up approach ramp to the home bank ramp module.

NOTE

The gutter has cut outs along its bottom edge to allow the approach ramps to be inserted. Sliding the approach ramps sideways locks them in position.

3.13.2.4 Lift the approach ramp and locate with the gutter in the center of the ramp module, slide sideways to the edge of the bridge. Repeat procedure to fully ramp bridge.

3.13.2.5 Lift the two approach ramp frames and store on an empty flatrack.

3.13.2.6 Position 3 defile marker posts on either side of the bridge to form a lead onto the bridge for traffic.

NOTE

Defile marker posts are driven into the ground by foot. The dog leg on the post is to be used to push the post into the ground.

3.13.2.7 Wrap marker tape between the posts securing it in the defile marker post clip and tie back to the ramp module.

Section V. CRANE

3.14 OPERATION

3.14.1 Operating the Crane

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

CRANE OPERATION. WHEN OPERATING THE CRANE HEED THE SYMBOLS ON THE CONTROL LEVERS. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO DEATH OR SEVERE INJURY TO SURROUNDING PERSONNEL.

CAUTION

Operate the control levers in a smooth and considered manner. The speed of the working movements is determined by the degree to which the control lever is moved. Failure to carry out his instruction could lead to equipment damage.

3.14.1.1 The function of the control panel, adjacent to the seat, is to switch the system on and off and to switch to special functions.

3.14.1.2 Switch on the system, push button (2).

3.14.1.3 The green indicator lamp (3) lights up.

3.14.1.4 The red indicator lamp (5) should flash once to indicate that the overload/safety circuit is operating. If the indicator lamp fails to light up, check whether the EMERGENCY STOP switch (8) is still engaged. If the switch is engaged, release it by turning it to the right. Press button (2) again.

3.14.1.5 The red indicator lamp (5) should flash once to indicate that the overload/safety circuit is operational. If the red indicator lamp (5) remains illuminated, this indicates an overload. Press EMERGENCY STOP switch (8) to switch off the launch vehicle and crane's electrical and hydraulic systems and investigate cause of overload.

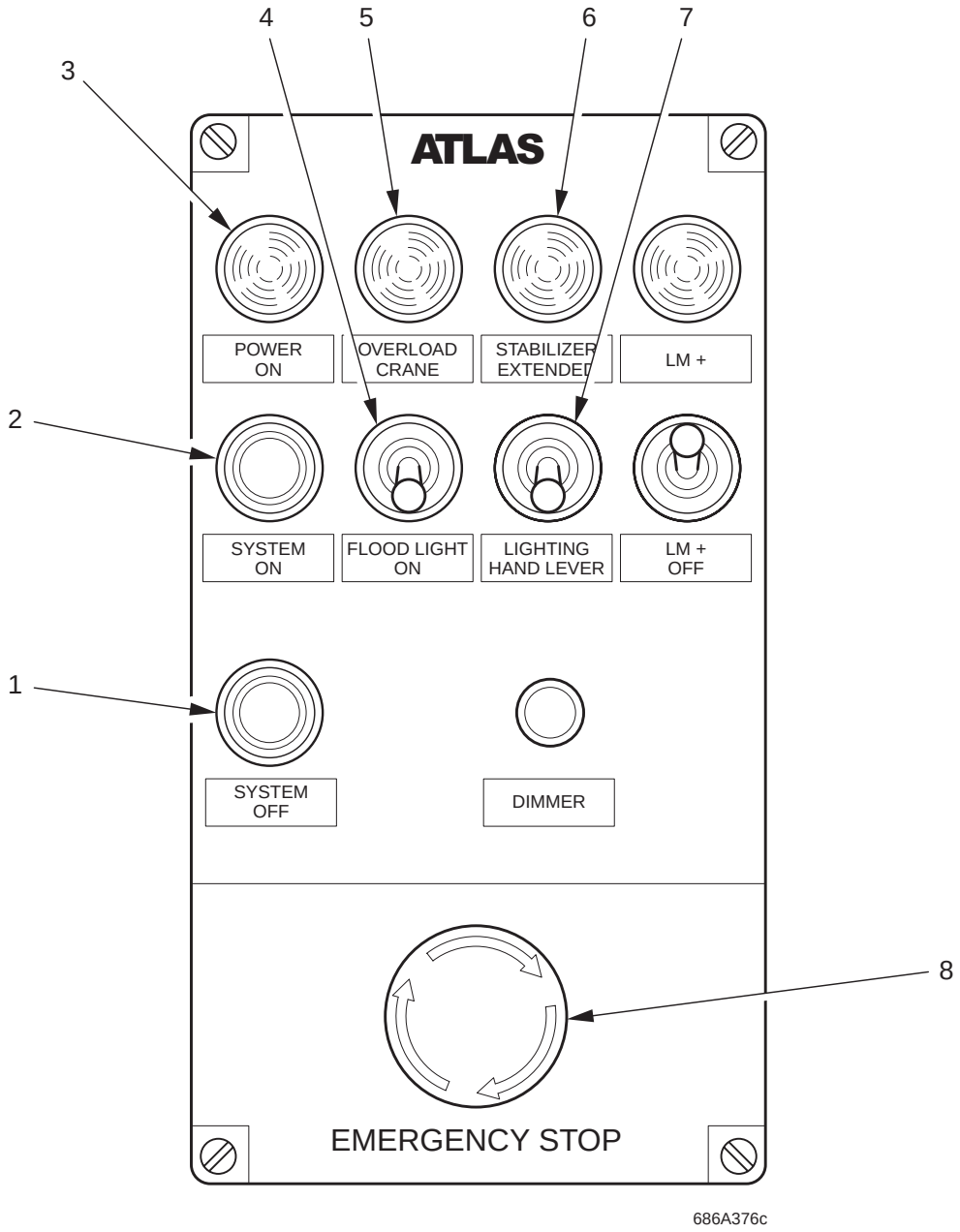
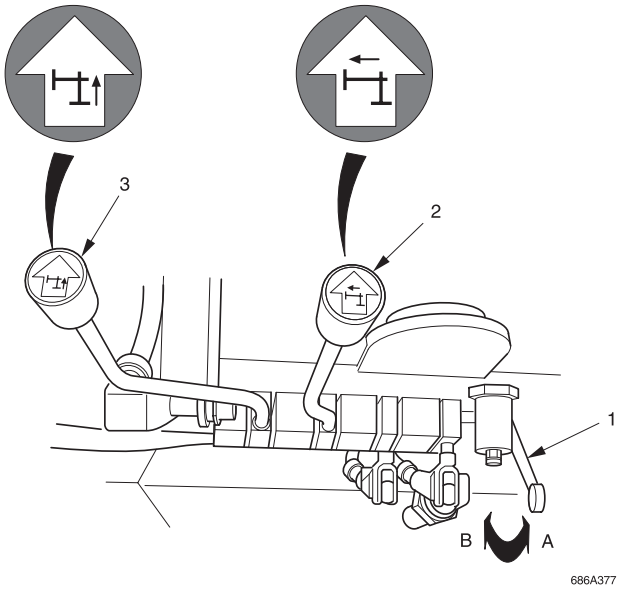


Figure 3. 73 Crane Switch Panel

3.14.2 Deploying the Crane Stabilizer Legs

3.14.2.1 Remove the retaining clips and the locking pins securing the crane stabilizer slide frame in the stowed position on both sides of the crane.



3.14.2.2 Move the control lever (1), which operates the changeover valve, to stabilizer (A).

WARNING

CRUSH HAZARD. BEFORE LOWERING CRANE STABILIZER LEGS ENSURE PERSONNEL ARE STANDING CLEAR OF THE STABILIZER FEET. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SERIOUS INJURY TO PERSONNEL.

3.14.2.3 Operate the stabilizer control (2) adjacent to the stabilizers and extend the crane stabilizer legs outwards from the stowed position.

3.14.2.4 Release the appropriate controls when the stabilizers are fully extended (2).

3.14.2.5 Extend the stabilizer leg cylinder until the steel wire rope is taut. Movement (A).

WARNING

CRUSH HAZARD. NEVER REMOVE THE CRANE STABILIZER LEG PIN UNTIL THE CABLE IS TAUT. FAILURE TO OBSERVE THIS INSTRUCTION COULD RESULT IN SERIOUS INJURY OR DEATH.

3.14.2.6 Remove safety pin (1) and retaining pin (2).

3.14.2.7 Remove locking pin (3).

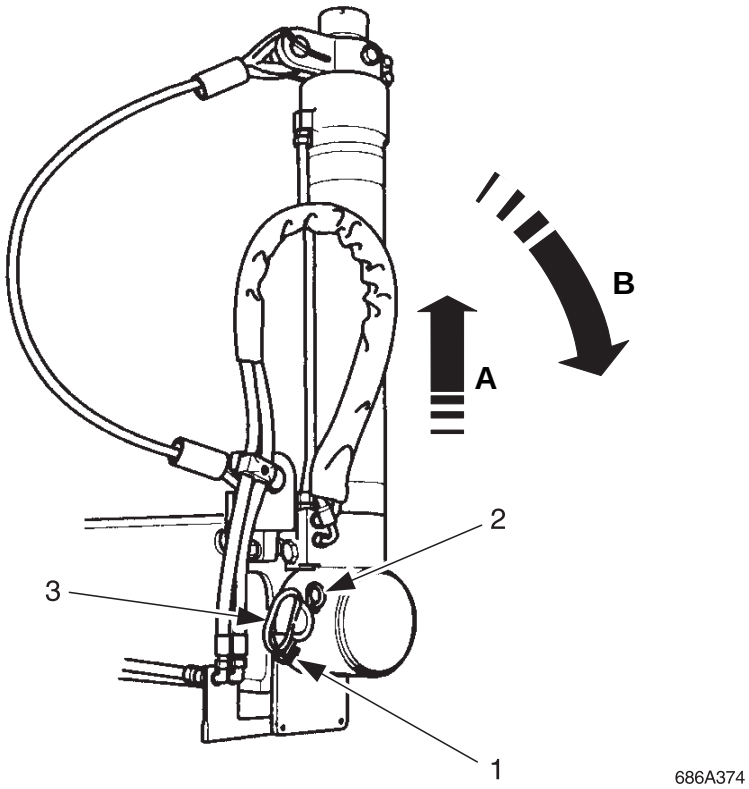


Figure 3. 74 Crane Stabilizer Leg

WARNING

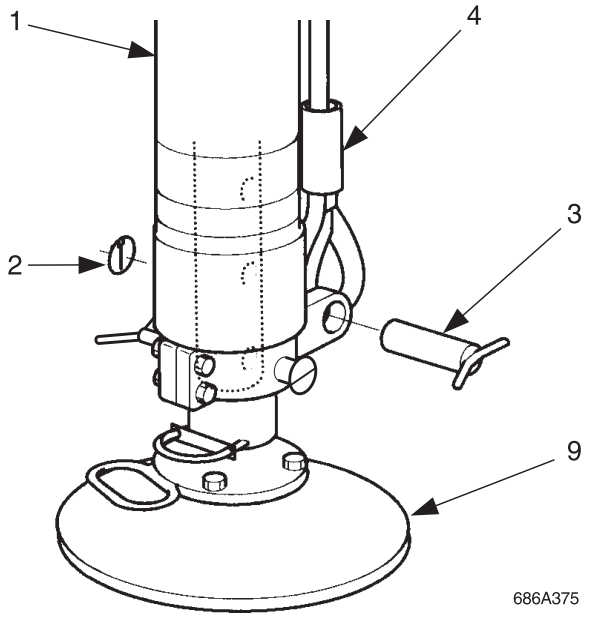
CRUSH HAZARD. BEFORE LOWERING CRANE STABILIZER LEGS ENSURE PERSONNEL ARE STANDING CLEAR OF THE STABILIZER FEET. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SERIOUS INJURY TO PERSONNEL.

3.14.2.8 Operate the stabilizer controls adjacent to the stabilizers to retract the stabilizer leg and thus rotate the crane stabilizer legs downwards to the down position. Movement (B)

3.14.2.9 Release the appropriate controls when the stabilizers are fully vertically down, insert the locking pins (3), retaining pin (2) and safety pins (1) to secure the stabilizers fully rotated downwards.

NOTE

The left hand side locking pin (Figure 3. 74. item3) MUST be inserted from the front of the stabilizer leg. The right hand side locking pin MUST be inserted from the rear of the stabilizer leg.



3.14.2.10 Remove the retaining clips (2) and the pins (3) and disconnect the wire retention cable (4) from the bottom of the crane stabilizer legs (1). Refit the pins and retaining clips.

3.14.2.11 Put the crane stabilizer spreader pads in position centrally below each crane stabilizer leg and make sure the area around the crane stabilizer legs is clear of personnel.

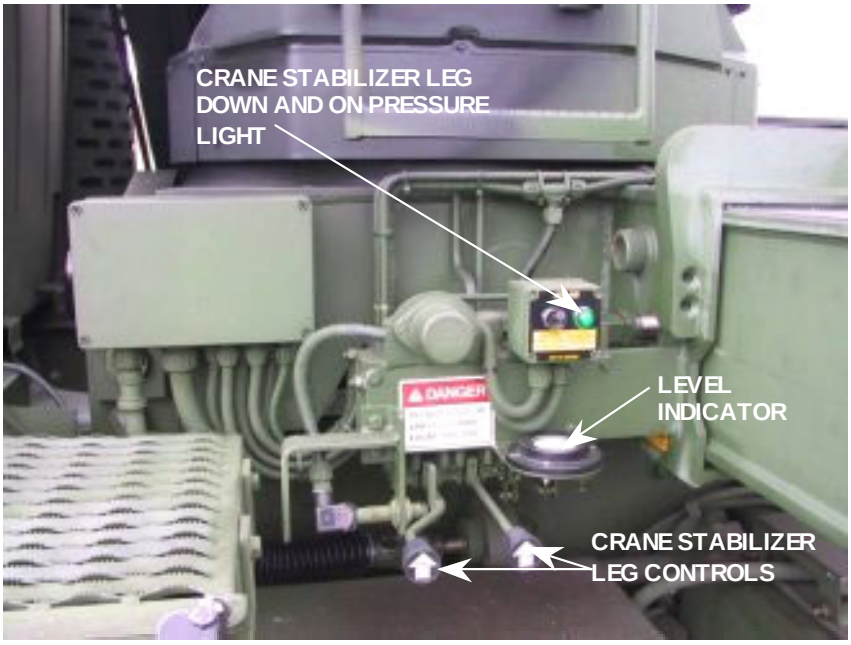
3.14.2.12 Operate the crane controls on the crane to lower the crane stabilizer legs to the ground.

3.14.2.13 Make sure the hydraulic cylinders extend and position the feet of the crane stabilizer legs centrally on the crane stabilizers spreader pads.

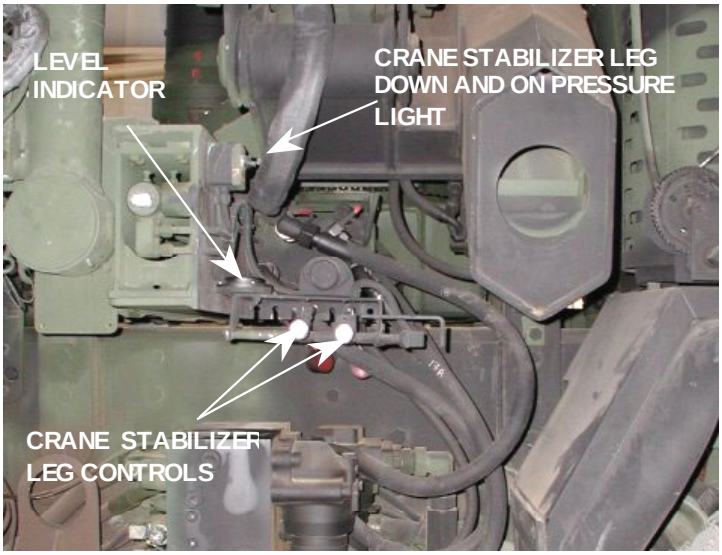
3.14.2.14 Continue to independently operate the controls of the stabilizer leg on the low side of the vehicle and raise the leg until the level on the crane legs indicates the crane is horizontally level and the on pressure green light comes on (see Figure 3. 75).

NOTE

The last operation must be to extend the stabilizer leg, this operation electrically locks the hydraulic pressure in the stabilizer leg.



Left Hand Side



Right Hand Side

Figure 3. 75 Location of Crane Stabilizer Leg Down and on Pressure Lights

3.14.3 Crane Stabilizer Leg Extension

3.14.3.1 On extremes of cross slope, it may be necessary to use the crane stabilizer leg extension (3) to increase the length of the stabilizer leg. With the stabilizer foot just above the ground support the weight of item (9) with the handle and remove pin (4) and clip (5).

3.14.3.2 Manually lower the crane spreader plate and leg extension (9) to the ground, using the crane stabilizer controls retract the stabilizer cylinder to a suitable height.

3.14.3.3 Reinsert pin (4) and clip (5) to secure stabilizer extension.

3.14.3.4 Extend stabilizer leg as normal to complete setup of crane carry out Paras 3.14.2.12 to 3.14.2.14.

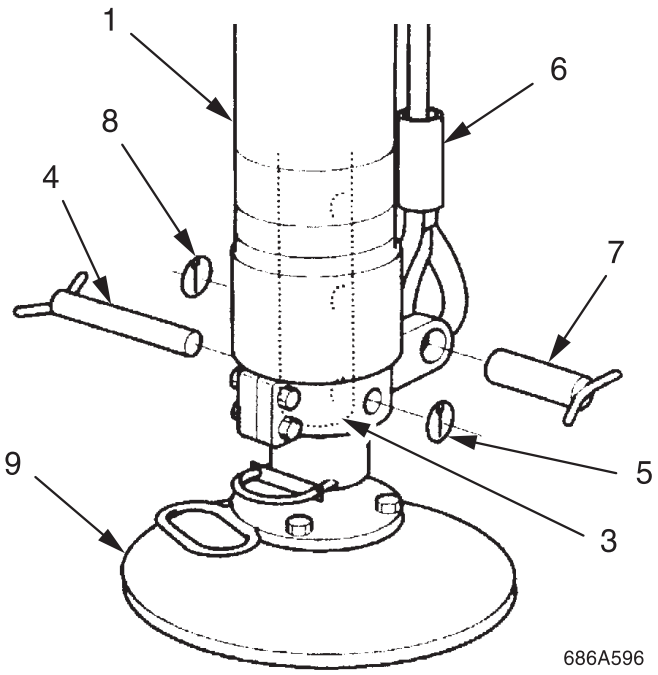


Figure 3. 76 Crane Stabilizer Leg Extension

3.14.4 Bringing the Crane into the Working Position

WARNING

CRUSH HAZARD. DO NOT REMAIN IN DANGER AREA WHILE THE CRANE IS UNFOLDING. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO DEATH OR SEVERE INJURY.

CRANE OPERATION. WHEN OPERATING THE CRANE HEED THE SYMBOLS ON THE CONTROL LEVERS. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO DEATH OR SEVERE INJURY TO SURROUNDING PERSONNEL.

CAUTION

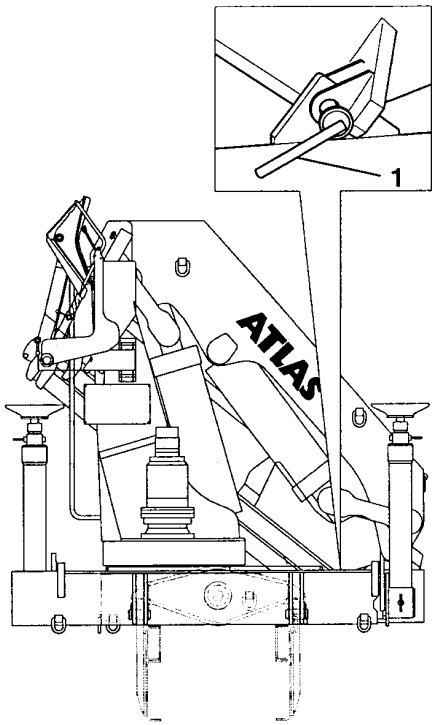
Operate the control levers in a smooth and considered manner. The speed of the working movements is determined by the degree to which the control lever is moved.

Beware of obstacles in the danger area. Failure to heed this instruction can lead to equipment damage.

Do not rotate the crane or extend the extension piece of the jib, until the boom and the jib are in working position. Failure to heed this instruction can lead to equipment damage.

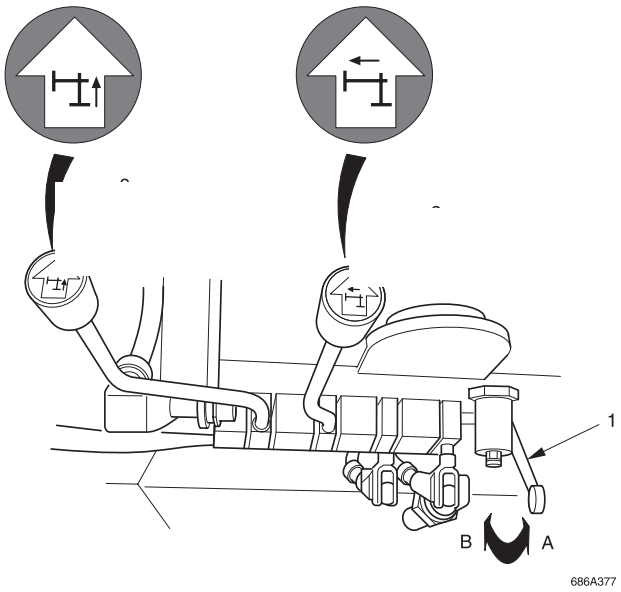
3.14.4.1 Ensure that procedures in 3.14.1 and 3.14.2 have been carried out.

3.14.4.2 Remove the locking pin (1).



Crane Boom Transport Pin

3.14.4.3 Move the crane to stabilizer control lever (1) from stabilizer (A) to crane (B).

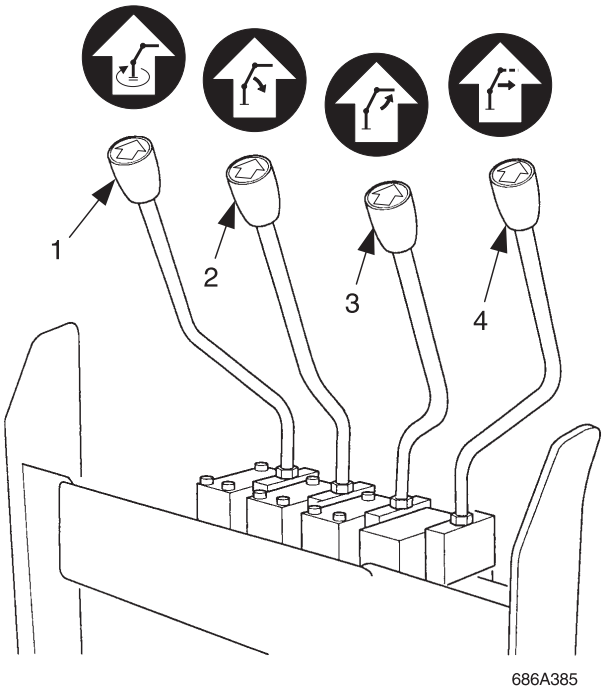


Crane Stabilizer Leg Controls

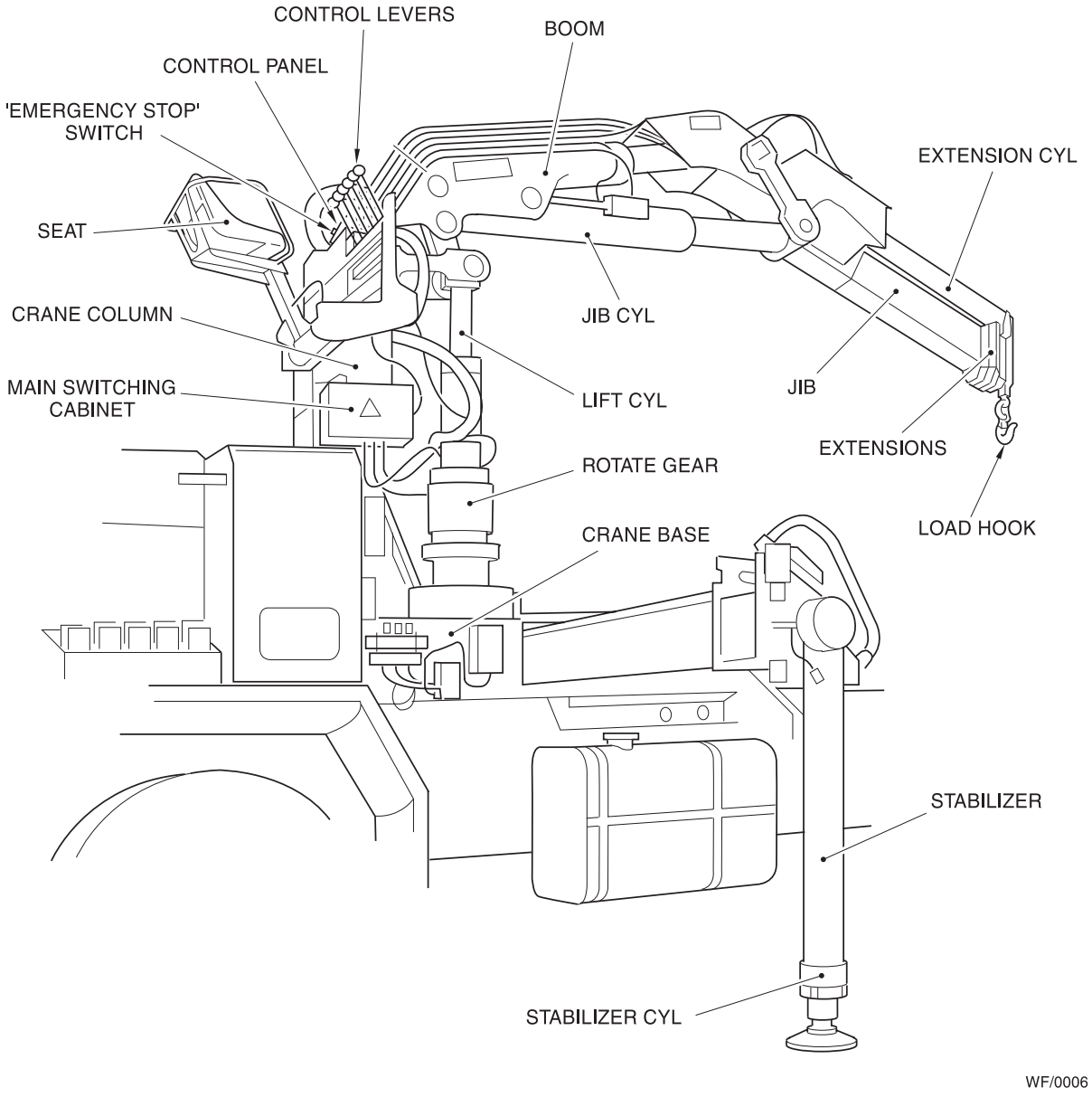
3.14.4.4 Using the boom raise - lower controls (2) lift the boom from the docking bracket until the jib can be folded out with no risk of accident.

3.14.4.5 Use the jib fold/unfold control to unfold the crane jib (3).

3.14.4.6 Using the jib extension extend/retract control extend the crane arm (4).



Crane Boom and Jib Controls



Crane Component Location

3.14.5 Stowing the Crane

WARNING

CRUSH HAZARD. DO NOT REMAIN IN DANGER AREA WHILE THE CRANE IS UNFOLDING. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO DEATH OR SEVERE INJURY.

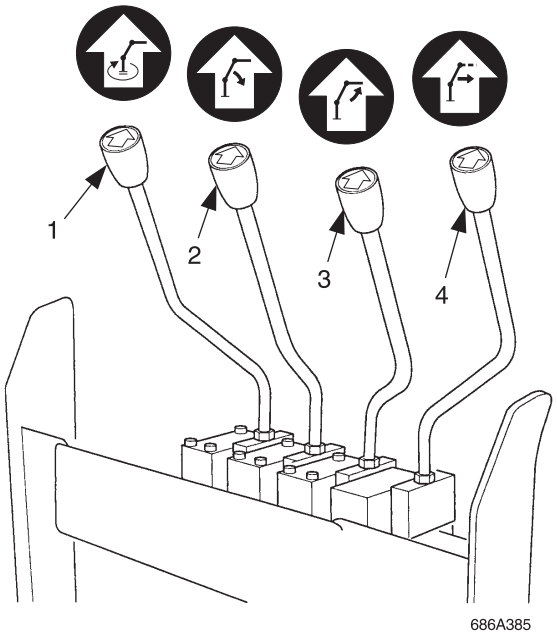
CRANE OPERATION. WHEN OPERATING THE CRANE HEED THE SYMBOLS ON THE CONTROL LEVERS. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO DEATH OR SEVERE INJURY TO SURROUNDING PERSONNEL.

CAUTION

Operate the control levers in a smooth and considered manner. The speed of the working movements is determined by the degree to which the control lever is moved.

Beware of obstacles in the danger area. Failure to heed this instruction can lead to equipment damage.

Do not rotate the crane or extend the extension piece of the jib, until the boom and the jib are in working position. Failure to heed this instruction can lead to equipment damage.



Crane Boom and Jib controls

WARNING

CRUSH HAZARD. ENSURE THAT THE AREA WITHIN THE CRANE WORKING AREA IS CLEAR OF PERSONNEL. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO DEATH OR SEVERE INJURY TO PERSONNEL.

3.14.5.1 Operate the controls on the crane to retract the crane jib, and then fold and stow the crane to the transportation position.

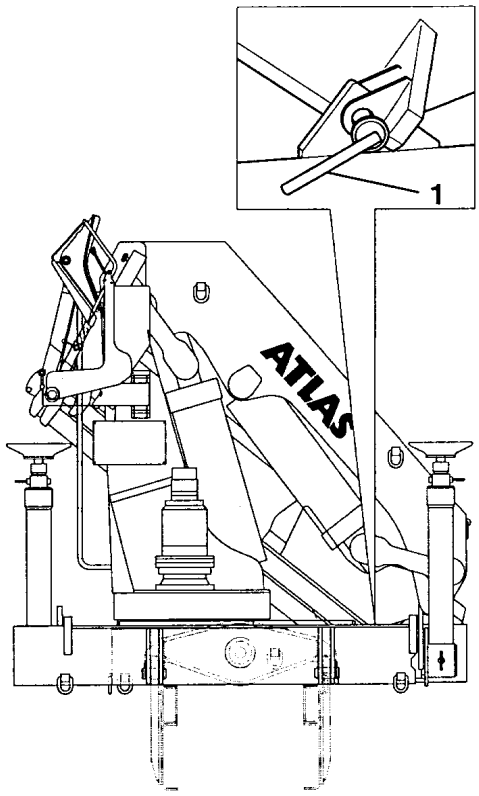
3.14.5.2 Use lever (4) to fully retract the jib.

3.14.5.3 Use lever (3) to fully stow the jib.

3.14.5.4 Use lever (2) to stow the boom aligning it with the transport bracket.

3.14.5.5 Fold the crane operator's seat to the stowed position and secure it with the shootbolt.

3.14.5.6 Secure the crane boom to the crane base with the locking pin (1).



Crane Boom Transport Pin

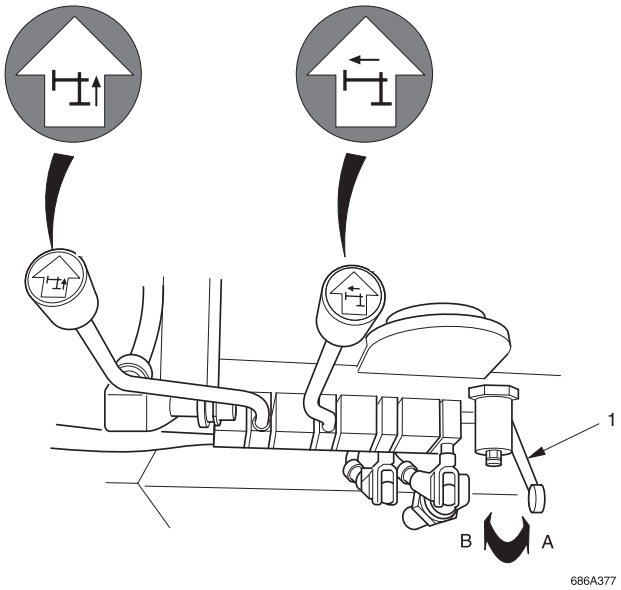
3.14.6 Stowing the Crane Stabilizer Legs

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

CRUSH HAZARD. ENSURE THAT THE AREA WITHIN THE CRANE WORKING AREA IS CLEAR OF PERSONNEL. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO DEATH OR SEVERE INJURY TO PERSONNEL.



Crane Stabilizer Leg Controls

3.14.6.1 Move the crane to stabilizer lever (1) from crane (B) to stabilizer (A).

3.14.6.2 Operate the crane stabilizer controls adjacent to both stabilizers and retract both stabilizer legs.

3.14.6.3 If the crane stabilizer leg extension has been used retract the crane stabilizer leg so that item (9) is just above the ground.

3.14.6.4 Support the weight of item (9) with handle and remove clip (4) and pin (5).

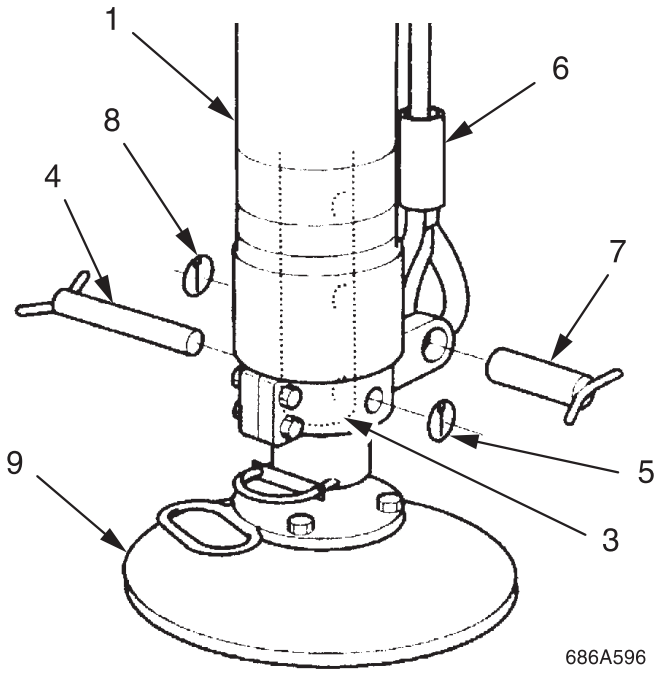
3.14.6.5 Push item (3) up into the crane stabilizer leg carefully until pin (4) can be inserted into the hole next to item (9).

3.14.6.6 Secure pin (4) with clip (5).

3.14.6.7 Continue to recover crane stabilizer leg as normal 3.14.6.8 through 3.14.6.20.

3.14.6.8 Make sure the hydraulic cylinders fully retract for convenient attachment of the wire stabilizer deployment strop.

3.14.6.9 Remove the crane stabilizer spreader pads from beneath the crane stabilizer legs.



Crane Leg Deployment, Wire Rope Pin Arrangement

3.14.6.10 Remove the retaining clip (8) and the pin (7) from the wire rope (6) attachment bracket on each crane stabilizer leg (1).

3.14.6.11 Put wire rope (6) in position and re-insert the pin (7). Secure the pin (7) with the retaining clip (4).

3.14.6.12 Remove the retaining clips (10, 11) and the locking pin (12) from the pivot of the crane stabilizer leg (1).

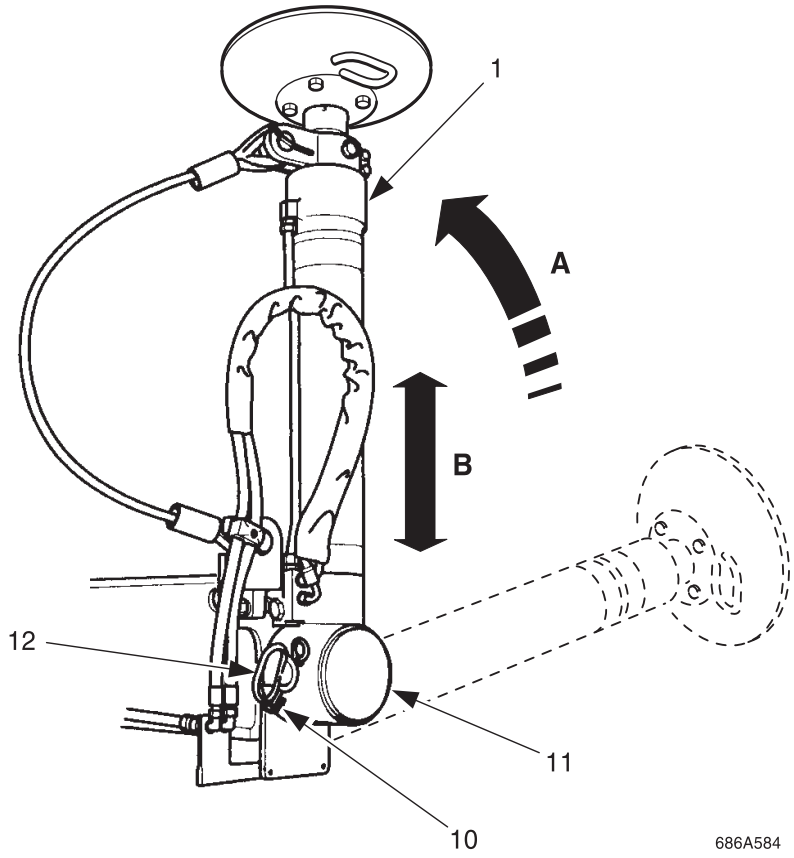
3.14.6.13 Make sure the area around the crane stabilizer legs is clear of personnel. Operate the crane stabilizer control (3) adjacent to the stabilizers to extend the stabilizers, rotating both crane stabilizer legs to the vertical position movement (A).

3.14.6.14 Make sure the hydraulic cylinders extend and rotate the crane stabilizer legs to a vertical inverted position.

NOTE

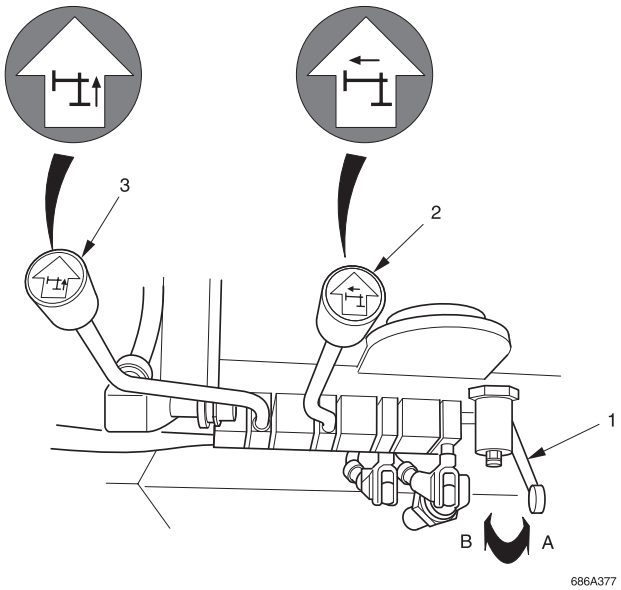
Extension of the hydraulic cylinders causes the legs to rotate upwards due to the attachment geometry of the wire stabilizer deployment strops.

3.14.6.15 Install the locking pins and clips (12) in the pivot points of the crane stabilizer legs. Secure the locking pins with the retaining clips (10,11).



Stabilizer Leg Pivot Pin and Clip

3.14.6.16 Fully retract the crane stabilizer leg by operating crane stabilizer control (3). Movement (B).



Crane Stabilizer Leg Controls

WARNING

CRUSH HAZARD. BEFORE LOWERING CRANE STABILIZER LEGS ENSURE PERSONNEL ARE STANDING CLEAR OF THE STABILIZER FEET. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SERIOUS INJURY TO PERSONNEL.

3.14.6.17 Operate the crane stabilizer controls adjacent to the stabilizers to retract both crane stabilizers inwards to the launch vehicle.

3.14.6.18 Fully retract the crane stabilizer leg by operating crane stabilizer control (3) movement (B).

3.14.6.19 Make sure the hydraulic cylinders operate and retract the crane stabilizers inward to the stowed position and insert the locking pins and retaining clips.

3.14.6.20 Set the crane controls on the crane to OFF.

Section VI. ANCHORING THE BRIDGE AND DEFILE MARKERS

3.15 BRIDGE ANCHORAGE DESIGN

3.15.1 Basic Considerations

3.15.1.1 The requirement for anchorage will be determined during site reconnaissance. Factors such as slope of finished bridge, volume and type of traffic, and bank conditions will be used to determine if anchorage is required.

3.15.2 Slope of Finished Bridge

3.15.2.1 The steeper the slope of the finished bridge the greater the possibility that anchorage is needed. Consider crossfall of bridge along with longitudinal slope. Do not consider the above to mean that completely level bridges will not need anchoring, as the volume and type of traffic and bank conditions must also be considered. Bridges constructed on solid banks or on packing may creep under a high volume of traffic (especially armored, tracked vehicles). If anchorage is not installed, a bridge should be checked during crossing of traffic for any sign of creeping. If creeping is detected, anchorage should be installed.

3.15.3 Volume and Type of Traffic

3.15.3.1 Heavy wheeled and tracked vehicles may cause the bridge to creep. This is the result of impact loads against the end of bridge, and braking/accelerating on the bridge. Control of vehicle approach speed and movement across the bridge will reduce these loads. High volume of medium to heavy vehicles in one direction may cause creeping. Vehicles may be stopped prior to impact on the end of bridge and drivers instructed to maintain a constant safe speed, not to shift gears and not to make any sudden stops.

3.15.4 Bank Conditions

3.15.4.1 Bank conditions that will allow slow settling of the end of bridge will tend to reduce the amount of creeping. Firm, solid banks will increase the need for anchorage.

3.15.5 Final Determination

3.15.5.1 After considering the basic factors, the final determination if anchorage is needed will be made by the bridge commander. If anchorage is not installed, the bridge must be checked regularly for any sign of creeping. If detected, the severity of creeping will be determined, and anchorage will be installed if deemed necessary.

3.15.6 Anchor Configuration

3.15.6.1 A DSB anchor consists of an anchorage beam, anchor earth holdfast (AEH) and anchor earth holdfast pins (AEH pins).

3.15.6.2 For soil with bearing capabilities of 1.86 ton/ft^2 (18162.6 kg/m^2), the standard anchor configuration is shown in Figure 3. 78. For soil with a bearing capability between 1.86 ton/ft^2 (18162.6 kg/m^2) and 1.00 ton/ft^2 (9764.9 kg/m^2), use the anchorage configuration shown in Figure 3. 79. For soil bearing capability of 1.00 ton/ft^2 (9764.9 kg/m^2) and less, use a dead weight.

NOTE

In this configuration, there are only 4 anchor earth holdfast pins per earth holdfast.

3.15.6.3 The anchor assembly is attached to the ends of bridge via a wire rope and Tirfor. The Tirfor enables the slack to be taken out of the wire rope but not over tensioned. The end of bridge anchorage layout is shown in Figure 3. 80.

3.15.7 Connecting the Anchor to the Bridge

WARNING

PERSONAL INJURY. WHEN HANDLING WINCH CABLE, USE THICK LEATHER GLOVES TO PREVENT INJURY TO HANDS FROM BROKEN STRANDS.

NOTE

This instruction should be read in conjunction with TIRFOR operating instructions Para 3.17.

3.15.7.1 The bridge anchor is connected to the bridge at positions either side of ramp modules. The anchor is constructed as described in Figure 3. 78 or Figure 3. 79 depending on ground hardness or bridge slope. It is placed in position as shown in Figure 3. 80, and secured to the ground with anchor earth holdfast pins. The TIRFOR winch is connected to the loose shackle of the anchor beam by:

a. Removing the pin and clip at the end of the TIRFOR winch.

b. Place the anchorage beam shackle into the recess.

3.15.7.2 The cable is secured to the ramp module by placing the open socket form end over one of the fixed 'D' shackles on the ramp module (Figure 3. 77) and securing with the pin and clip.

3.15.7.3 The cable is then laid out towards the TIRFOR winch and the tapered end is fed through the winch. The winch is then operated as described in 3.17 until the slack in the cable is taken up and the cable is just tensioned.

Figure 3. 77 Ramp Module Anchor Points

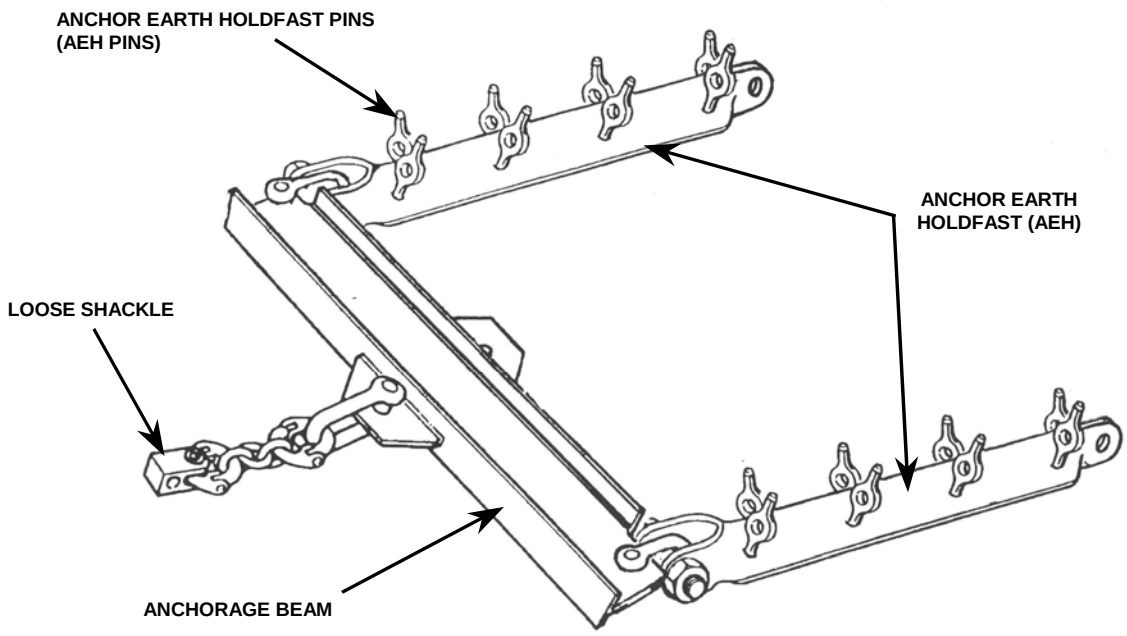


Figure 3. 78 Standard Anchorage Configuration

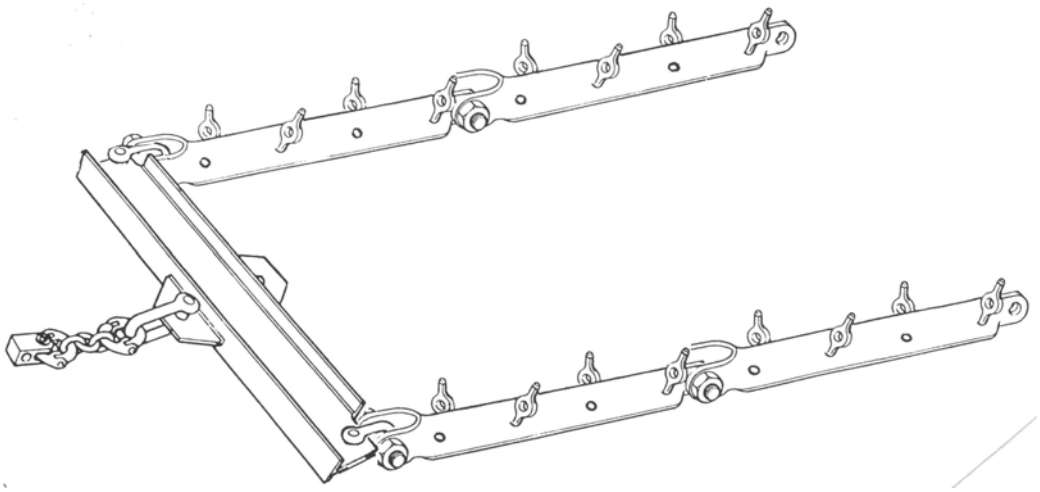


Figure 3. 79 Anchorage Configuration with Additional AEH

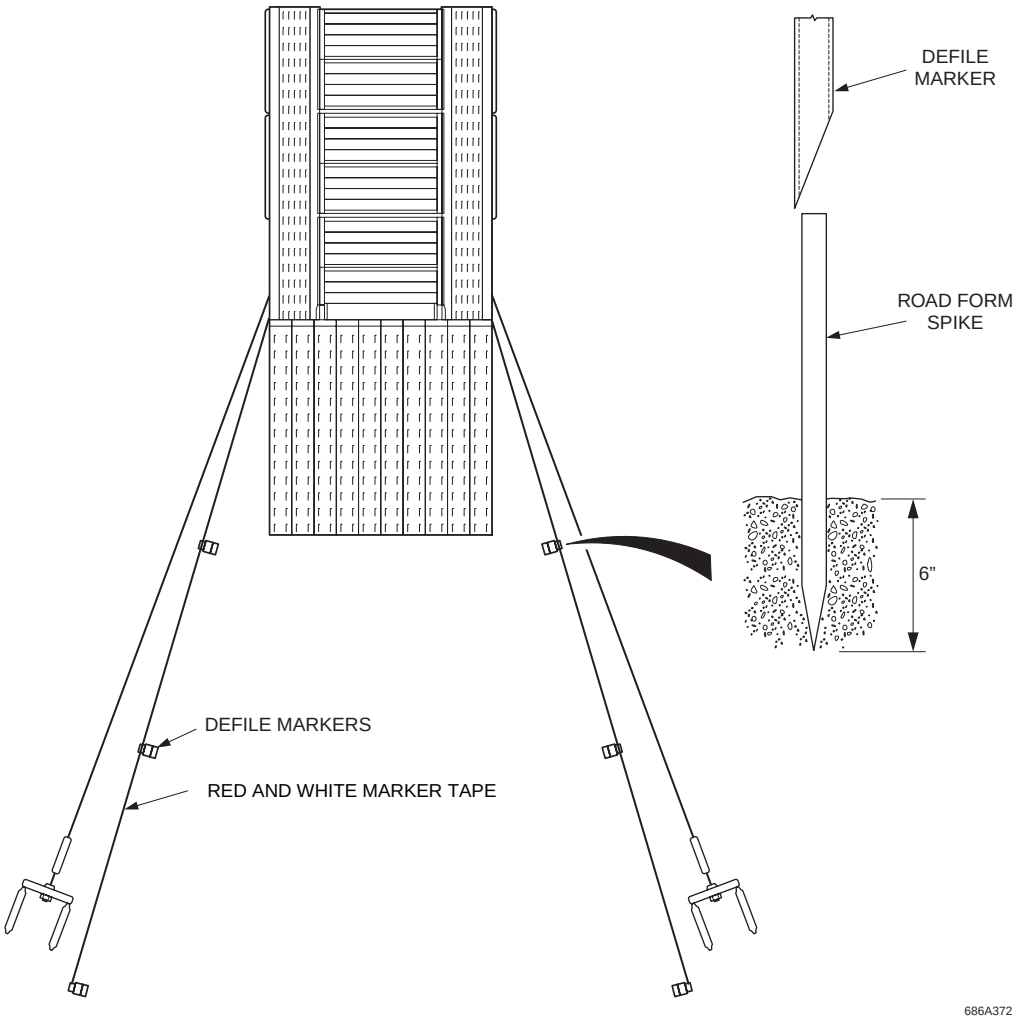


Figure 3. 80 End of Bridge Anchorage Layout

3.16 TIRFOR WINCH

3.16.1 Safety

3.16.1.1 Before using the TIRFOR winch, it is essential for the safe and correct operation of the equipment that these instructions be read and fully understood and that all the instructions are followed. These instructions should be made available to every operator.

3.16.1.2 The TIRFOR winch allows the operator to carry out work with complete safety. Ensure that this winch is only handed over for use to an operator who is trained to operate it in a responsible manner.

3.16.1.3 Never use a winch, which is not in good working condition. Replace any worn or damaged wire rope. Continuous monitoring of the condition of the winch, its wire rope and anchor pin is an important safety consideration.

3.16.1.4 Never attempt to overload the winch.

3.16.1.5 Standard TIRFOR winches are not designed for use in explosive atmospheres.

3.16.2 Description of Equipment

3.16.2.1 The TIRFOR winch is a hand-operated pulling machine for end of bridge anchors.

3.16.2.2 The unique feature of the TIRFOR winch, is the principle of operation directly on the wire rope, which passes through the mechanism rather than being reeled onto a drum of a hoist or conventional winch. The pull is applied by means of two pairs of self-energized jaws, which exert a grip on the wire rope in proportion to the load being lifted or pulled. A telescopic operating lever fitted to either the forward or the reverse lever transmits the effort to the jaw mechanism to give forward or reverse movement of the wire rope.

3.16.2.3 The winch is fitted with an anchor pin, so that it can be secured quickly to the anchor block on the anchor beam.

3.16.2.4 Each winch is supplied with a telescopic operating handle, and usually with a 40ft standard length of special TIRFOR MAXIFLEX wire rope fitted with a open socket form end and wound onto a metal reel.

3.16.2.5 TIRFOR MAXIFLEX wire rope has been specially designed to meet the particular requirements of the TIRFOR winch. The safe operation of winches used with wire rope other than TIRFOR MAXIFLEX wire rope cannot be guaranteed.

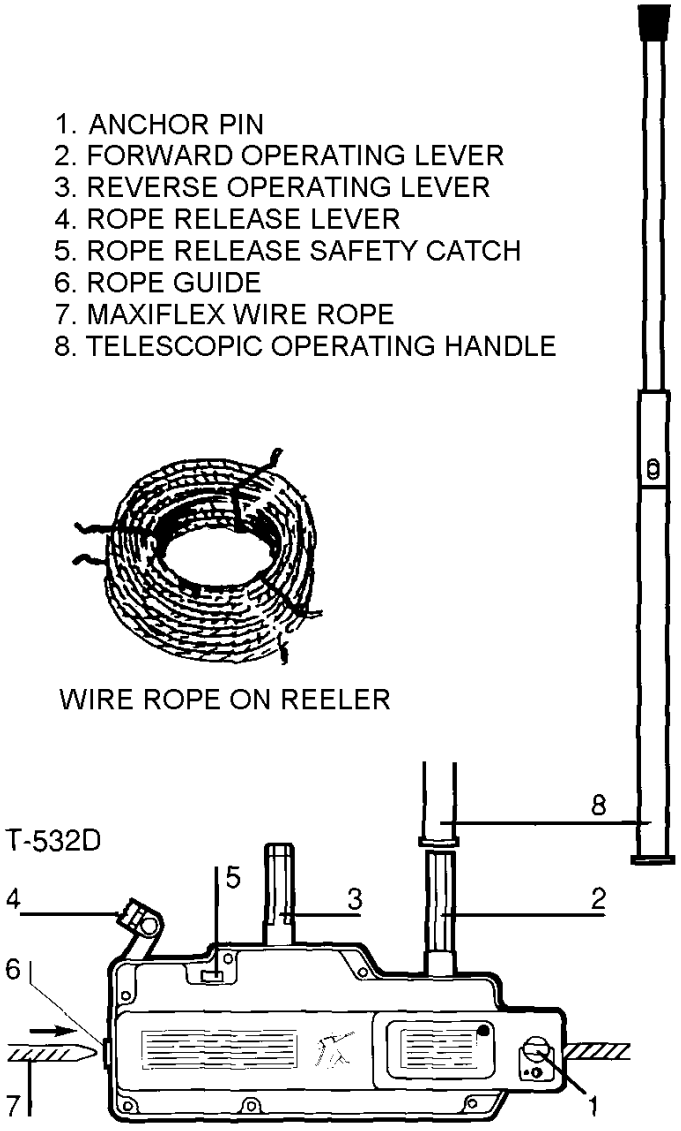


Figure 3. 81 T-532D TIRFOR Winch

Table 3. 1 Technical Data

Maximum working load	3.2 tons	2903 kg
Weight Winch Telescopic operating handle Standard 20 m of wire rope, complete	 53 lb 5 lb 58.6 lb	 24.0 kg 2.3 kg 26.6 kg
Total weight of standard equipment	116.6 lb	52.9 kg
Machine dimensions Length Height Width Telescopic handle: closed/extended	 2.7 ft 1.2 ft 5 inches	 840 mm 355 mm 130 mm 65/115 cm
TIRFOR MAXIFLEX wire rope Diameter Guaranteed breaking strain* Weight per meter	 0.6 inch 17.6 tons 2.2 lb	 16.3 mm 16000 kg 1.00 kg
Rope travel forward/backwards**	0.7/1.4 inch	18/36 mm

*Including end fittings and hook

** One complete cycle of the operating lever at the maximum working load.

3.17 OPERATION

3.17.1 Instructions Against Hazardous Operation

3.17.1.1 The TIRFOR winch **must not** be used beyond their maximum working load (3.2 tons).

3.17.1.2 TIRFOR winch **must not** be used for applications other than those for which they are intended.

3.17.1.3 **NEVER** attempt to operate the rope release mechanism whilst the winch is under load.

3.17.1.4 **NEVER** obstruct the operating levers or the rope release lever.

3.17.1.5 **NEVER** operate the forward and reverse operating levers at the same time.

3.17.1.6 **NEVER** use a handle other than the telescopic operating handle supplied to operate the TIRFOR winch.

3.17.1.7 **NEVER** replace sheared pins by anything other than genuine TIRFOR shear pins of the same model.

3.17.1.8 **NEVER** anchor the winch other than by its appropriate anchor point.

3.17.1.9 **NEVER** obstruct the winch, which could prevent the winch, the wire rope and the anchor points from operating in a straight line.

3.17.1.10 **NEVER** use the TIRFOR MAXIFLEX wire rope as a sling.

3.17.1.11 **NEVER** apply a load to the loose wire rope exiting from the anchor point of the TIRFOR winch.

3.17.1.12 **NEVER** subject the controls to sharp knocks.

3.17.1.13 **NEVER** attempt to reverse the rope completely through the winch whilst under load.

3.17.1.14 **Do not** operate the TIRFOR winch when the rope ferrule gets to within 10 cm of the winch. Otherwise the ferrule is likely to foul the casing and push the rope guide inside the winch.

3.17.2 Operating Instructions

3.17.2.1 TIRFOR winches are very easy to use. Place the telescopic operating handle on either the forward or reverse operating lever, lock it into position by twisting, and move the operating handle to-and-fro. The operating arc is variable for ease of operation.

3.17.2.2 When operation stops, both jaws automatically grip the wire rope and hold the load, which is spread equally between the jaws.

3.17.2.3 The to-and-fro operation of the forward or reverse lever gives continuous movement of the load.

3.17.3 Installing the Wire Rope

WARNING

PERSONAL INJURY. WHEN HANDLING WINCH CABLE, USE THICK LEATHER GLOVES TO PREVENT INJURY TO HANDS FROM BROKEN STRANDS.

3.17.3.1 Uncoil the wire rope in a straight line to prevent loops or kinks.

3.17.3.2 Release the internal mechanism (See 3.17.4).

3.17.3.3 Insert the wire rope through the rope guide at the end opposite to the anchor point (anchor pin).

3.17.3.4 Push the wire rope through the winch, and if necessary, helping it by operating the forward operating lever.

3.17.3.5 When the wire rope appears through the anchor point, pull the slack wire rope through the winch, to the point required.

3.17.3.6 Engage the jaws by operating the rope release mechanism (See 3.17.4).

3.17.3.7 Anchor the TIRFOR winch or the wire rope to the appropriate fixed point (See 3.17.7) taking care to ensure that the anchor point (pin) is correctly fixed.

3.17.3.8 Extend the telescopic operating handle (Figure 3. 81) until the spring locks into position. If necessary twist the two sections of the handle, one inside other, to align the spring.

3.17.3.9 Place the telescopic operating handle on the chosen operating lever (forward or reverse) and twist the handle to ensure that it is locked in position (about a half turn).

3.17.3.10 The winch is ready for operation, providing the anchorage beam is correctly fixed to the winch, and the wire rope correctly fixed to the bridge (See 3.17.7).

3.17.4 Releasing and Closing the Jaws

3.17.4.1 Each winch is fitted with a lever (Figure 3. 82 Item 1) for releasing the jaw mechanism, which should only be operated when the winch is not under load.

3.17.4.2 There are two positions for the rope release lever (Figure 3. 82) released or engaged.

NOTE

When not in operation, it is recommended that the rope release lever should be in the engaged position. The winch must therefore be released before attempting to feed in the wire rope.

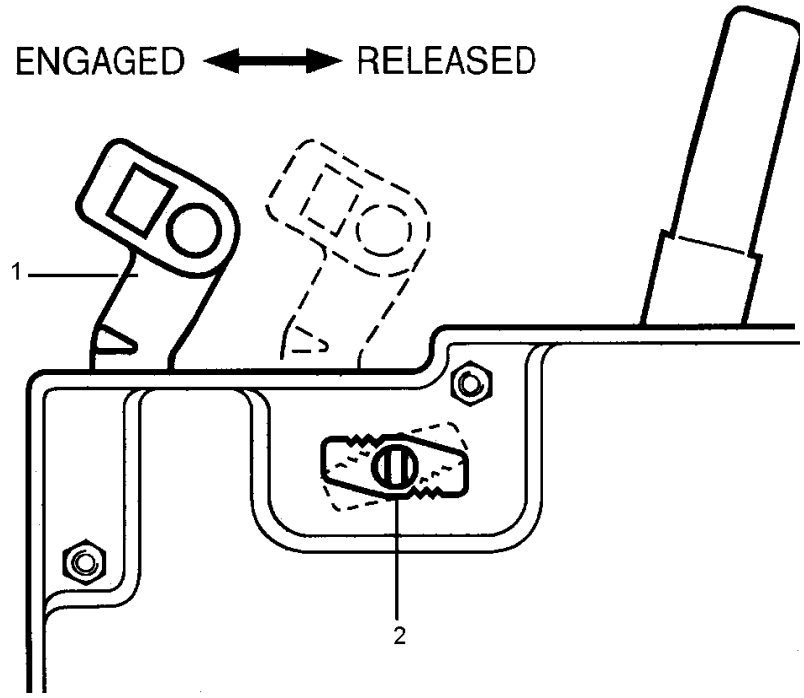


Figure 3. 82 Rope Release Lever

3.17.5 Releasing

3.17.5.1 Turn the rope release safety catch (Figure 3. 82 (2)) and push the rope release lever (Figure 3. 82 (1)) towards the anchor pin until it locks into position when raised slightly at its limit.

3.17.5.2 Release the safety catch.

3.17.6 Engaging

3.17.6.1 Turn the rope release safety catch (Figure 3. 82 (2)).

3.17.6.2 Press the rope release lever (Figure 3. 82 (1)) vertically downwards, allowing the lever to travel back to its original position under the effects of its spring. Release the safety catch (Figure 3. 82 (2)).

3.17.7 Anchoring

WARNING

IT IS ESSENTIAL FOR THE SAFE OPERATION OF THE TIRFOR WINCH TO ENSURE THAT, BEFORE LOADING THE TIRFOR WINCH, THE ANCHOR PINS ARE CORRECTLY SECURED.

3.17.7.1 Failure to anchor the TIRFOR winch correctly runs the risk of a serious accident. The user must always ensure before operation that the anchor point(s) for the winch and wire rope are correctly secured.

3.17.7.2 TIRFOR winches T-532D are anchored by means of a captivated anchor pin, fitted across the two ends of the side cases and locked in position by a spring clip.

3.17.7.3 To anchor using the anchor pin, follow the procedure below:

3.17.7.4 Open the spring clip of the anchor pin.

3.17.7.5 Remove the spring clip from the anchor pin.

3.17.7.6 Slide the anchor pin out to the stop.

3.17.7.7 Fit the anchorage beam.

3.17.7.8 Refit the anchor pin through the side cases and anchorage beam anchor block.

3.17.7.9 Refit the spring clip to the anchor pin.

3.17.7.10 Close the spring clip, ensuring that it fits correctly over the end of the anchor pin and cannot fall out.

3.17.8 Releasing the Wire Rope and Storage

3.17.8.1 It is essential to take the load off the winch before attempting to release the jaws. To do this, operate the reverse operating lever until there is no tension in the wire rope.

3.17.8.2 Remove the telescopic operating handle and return it to the closed position.

3.17.8.3 Release the winch and follow the instructions for installing the wire rope in the reverse order. Re-engage the jaws of the winch before putting it into storage.

3.17.8.4 Store the winch and wire rope in a dry place, away from the effects of the weather. The wire rope should be completely removed from the winch and rewound onto its reeler.

3.17.8.5 Before reeling the wire rope it is recommended to inspect it, clean it with a brush and then grease it. (See Chapter 10 Procedure 10. 31).

SAFETY DEVICES

3.17.9 Overload Limiting Safety Devices

3.17.9.1 All TIRFOR winches incorporate a shear pin system. In case of overload, the pin fitted to the forward operating lever, shears and prevents further operations. Reverse operation is still possible to enable the wire rope to be slackened.

3.17.9.2 Should the shear pin shear, refer to Chapter 10 procedure 10.30 for replacement instructions.

3.17.10 Rope Release Safety Device

3.17.10.1 TIRFOR winch Model T-532D is fitted with a two handed rope release system, which requires deliberate operation by the user to release the winch. (See Para 3.17.4).

3.18 MAXIFLEX WIRE ROPE

3.18.1.1 To guarantee the safe operation of TIRFOR winches, it is essential to use them exclusively with TIRFOR MAXIFLEX wire rope, which has been specially designed to meet the requirements of the TIRFOR winch.

3.18.1.2 TIRFOR MAXIFLEX wire ropes have a red strand, which is visible on new rope. One end of the wire rope has an end fitting (Figure 3. 83. (A)), the other end of the wire rope is fused and tapered (Figure 3. 83. (B)).

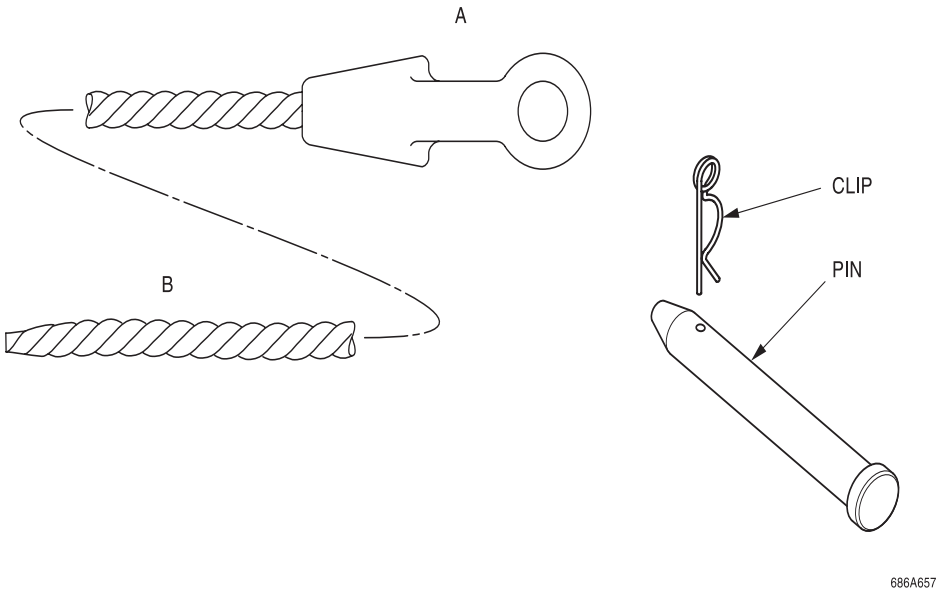


Figure 3. 83 Wire Rope Ends

3.18.1.3 A wire rope in good condition is a guarantee of safety, to the same extent as a winch in good condition. It is necessary to continuously monitor the state of the wire rope, and to clean and oil it with a rag soaked with motor oil or grease.

NOTE

DO NOT use grease or oil containing graphite additives or molybdenum disulfide to lubricate the wire rope.

3.18.1.4 Never allow a tensioned wire rope to rub over sharp edges.

3.18.1.5 Never expose the wire rope to temperatures beyond 100 degrees C.

3.18.1.6 Never use wire rope that has been subject to:

a) fire.

b) corrosive chemicals or corrosive atmosphere.

c) exposure to electric current.

3.18.2 Inspection of Wire Rope

WARNING

PERSONAL INJURY. WHEN HANDLING WINCH CABLE, USE THICK LEATHER GLOVES TO PREVENT INJURY TO HANDS FROM BROKEN STRANDS.

3.18.2.1 The wire rope should be examined daily to detect any signs of wear, damage or broken wires. (See examples in Figure 3. 84).

3.18.2.2 In case of any apparent wear, have the wire rope checked by a competent person.

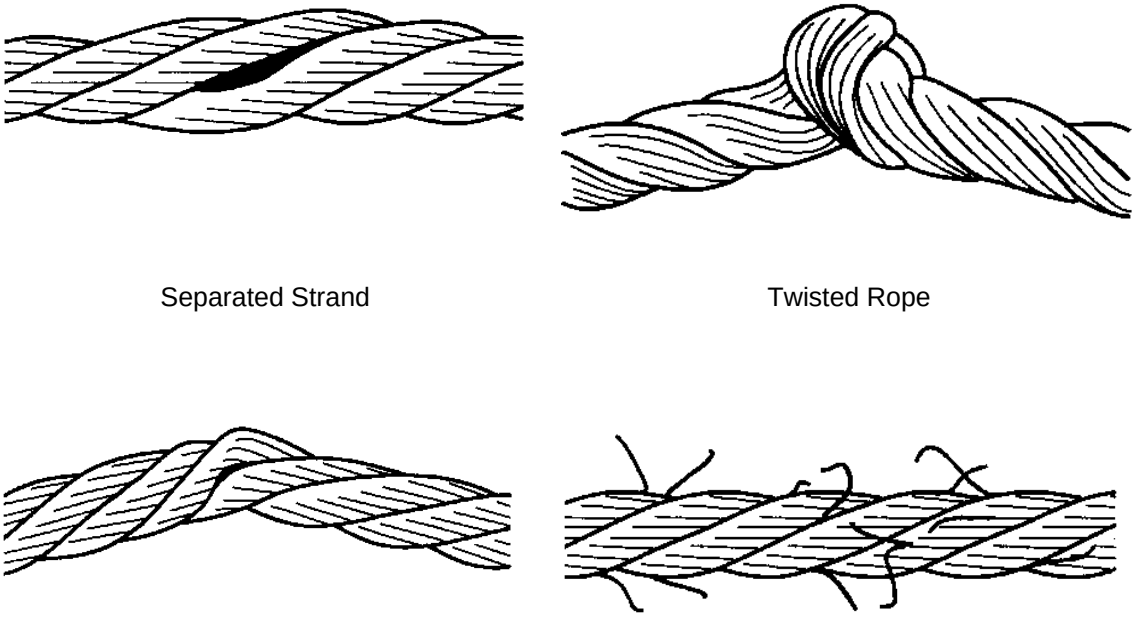


Figure 3. 84 Wire Rope Damage

3.19 AIR POWERED PNEUMATIC HAMMER

3.19.1 General Instructions

3.19.1.1 To be used **ONLY** when deploying bridge anchors, for inserting anchor earth holdfast pins (AEH) pins or the defile marker road form spikes.

3.19.1.2 Make sure that only properly trained persons, authorized to use compressed air equipment, have access to the work area.

3.19.1.3 Always wear protective clothing, safety shoes, safety glasses, gloves and noise hearing protectors.

3.19.1.4 Keep equipment clean.

3.19.1.5 Do not use equipment for purposes it was not intended for.

3.19.1.6 Never operate equipment without it being installed on top of the AEH pin.

3.19.1.7 Never allow the equipment to lean on its trigger, to avoid uncontrolled start-ups.

3.19.1.8 Never leave the equipment unprotected on the ground in dirt or mud.

3.19.1.9 Never use the pipe to move the equipment (do not drag by air pipe).

3.19.1.10 Always stop the equipment before moving it off the AEH pin.

3.19.1.11 When not in use disconnect air supply to avoid accidental re-starting.

3.19.1.12 Before starting to insert any AEH pins make sure that it can not come in contact with any ducting or container transporting or containing fluids or electrical, telephone or other cables.

3.19.2 Maintenance

3.19.2.1 Under normal service conditions lubrication should not be necessary. However with the launch vehicle having air dryers lubrication may be necessary.

3.19.2.2 If lubrication is required, use automotive oil MIL-L-20104.

3.19.2.3 Lubrication is achieved by injecting a little oil in to the equipment via the sleeve fitting, this operation should be carried out at the end of the working day and before every extended stoppage.

3.19.2.4 If the piston gums up, only lubricate with the recommended oil.

3.19.2.5 After lubrication store the equipment vertical with the handle at the top.

3.19.3 Prior To Start-Up

3.19.3.1 Check that the equipment is in good condition.

(a) Check for cracks and scaling.

(b) Make sure all bolts are undamaged and correctly tightened.

(c) Ensure that the attached air line and quick release fitting are in good order.

(d) Check that the AEH pin drive adapter is fitted and the clamp screwed tight.

3.19.4 Setting Up for Use

3.19.4.1 Each launch vehicle has its own operator's Basic Issue Items (BII) in which there is an air hose assembly; this is used to supply air for the pneumatic hammer.

3.19.4.2 On launch vehicles, the air supply quick release connector is at the rear of the vehicle to the left of the tow hook above the trailer emergency air supply hand gland connector.

3.19.4.3 On a Common Bridge Transporter (CBT) the air supply quick release is above the air tank on the right-hand side of the vehicle. The CBT connector is a smaller size so a quick release adapter is provided.

3.19.5 Using the Pneumatic Hammer

WARNING

EYE INJURY. WHEN DRIVING ROADFORM SPIKES INTO THE GROUND THERE IS A POSSIBILITY THAT SMALL METAL FRAGMENTS MAY BE CREATED. PERSONNEL MUST WEAR EYE PROTECTION. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO INJURY TO THE EYES.

3.19.5.1 Position the vehicle in the center on the approach to the bridge so the air hose will reach both sets of anchors.

3.19.5.2 Roll out the air line, remove protective cover from vehicle quick release coupling (if fitted).

3.19.5.3 Taking care fit the hose to the vehicle making sure it is properly connected, connect the pneumatic hammer to the other end, again making sure it is properly connected.

NOTE

Before starting to use the equipment make sure all the safety instructions are complied with.

3.19.5.4 Position the pin through the hole in the anchor earth holdfast (AEH), place the pneumatic hammer on the AEH pin, in the same line as the AEH pin.

3.19.5.5 Start up the equipment progressively to avoid any unexpected movement of the AEH pin.

3.19.5.6 Drive the pin in a little way slowly before going to full power.

3.19.5.7 When the required amount of pins have been driven in, move the vehicle to the other side of the bridge and repeat on the far bank anchors.

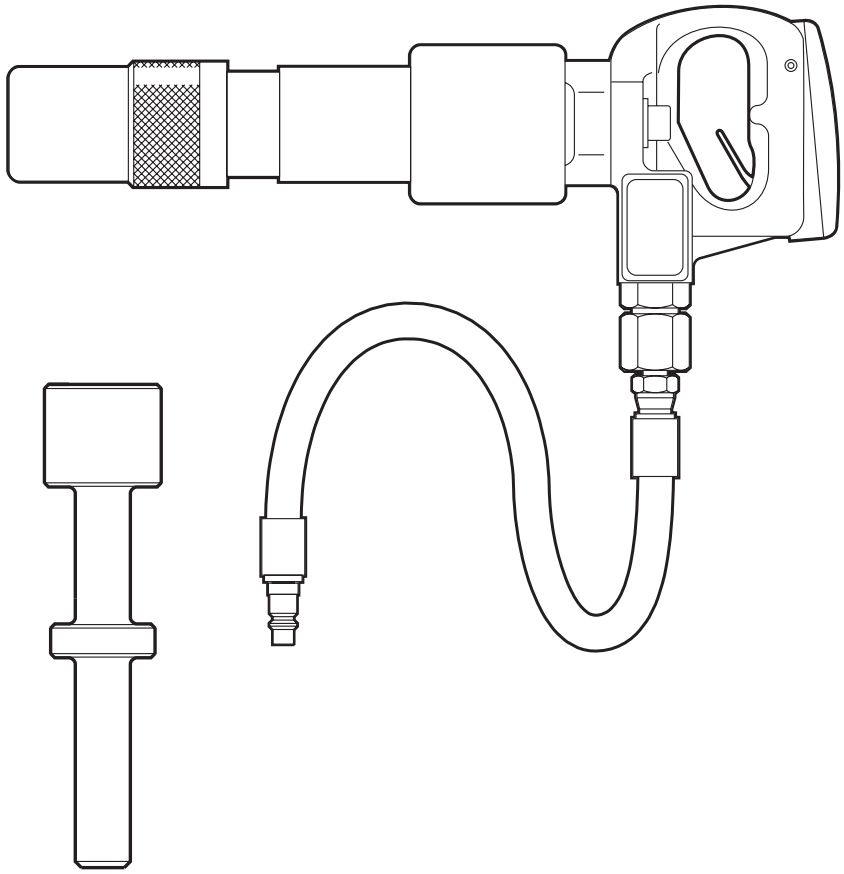


Figure 3. 85 Pneumatic Hammer and AEH pin drive adapter

3.20 DEFILE MARKERS

3.20.1 Deployment of Defile Markers

3.20.1.1 Defile markers are used to guide the traffic into the approach to the bridge.

3.20.1.2 Six defile markers are deployed, three on either side of the bridge at the approach and six at the exit of the bridge. They are positioned to form a funnel shaped area so that traffic is guided onto the center of the approach ramps of the bridge.

3.20.1.3 Red and white marker tape is tied between the defile markers to assist in guiding traffic on to the bridge.

WARNING

EYE INJURY. WHEN DRIVING ROADFORM SPIKES INTO THE GROUND THERE IS A POSSIBILITY THAT SMALL METAL FRAGMENTS MAY BE CREATED. PERSONNEL MUST WEAR EYE PROTECTION. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO INJURY TO THE EYES.

3.20.1.4 When deploying defile markers in any ground, use a road form spike pin inserted into the ground approximately 6in (152.4mm) (use sledge hammer or pneumatic hammer) and place the defile marker so that defile marker box section is fitted over the head of the road form spike.

3.20.1.5 When soft ground permits, the defile marker may be pushed into the ground for increased stability.

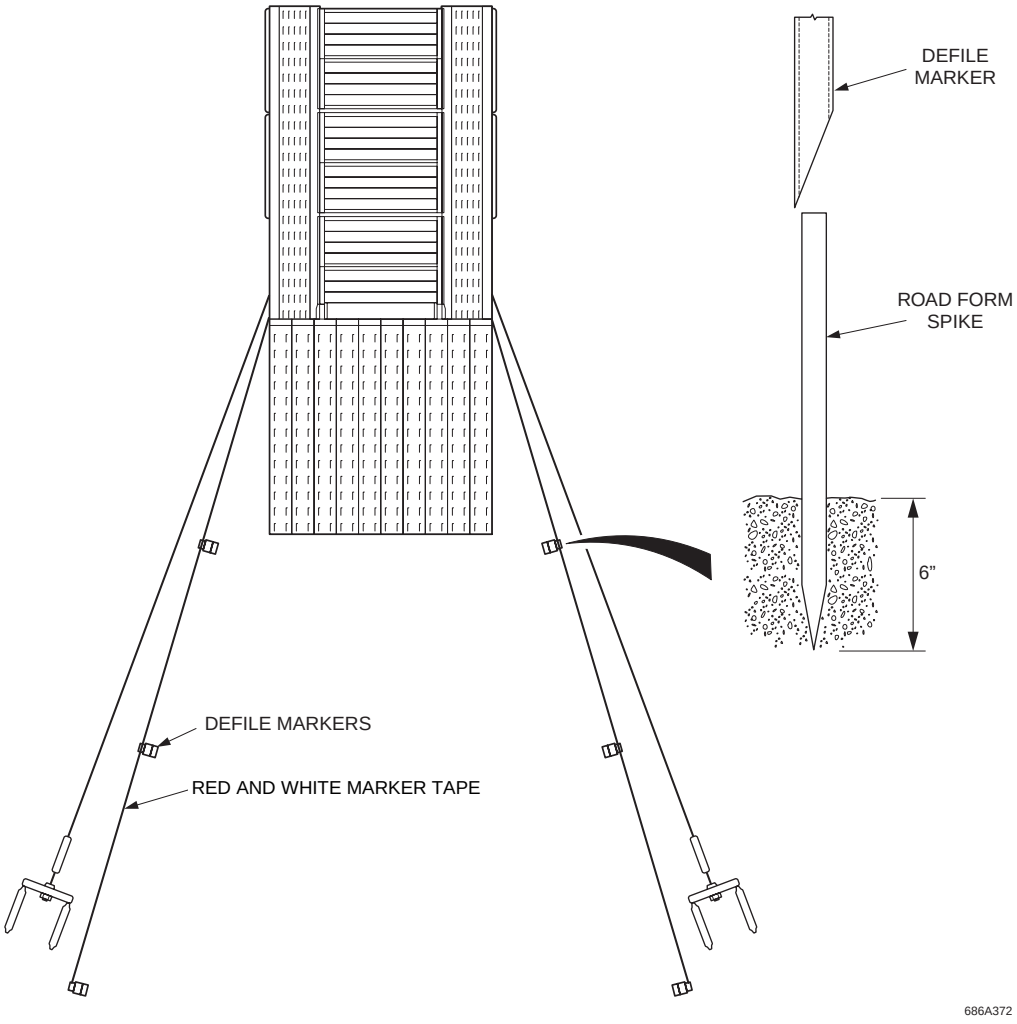


Figure 3. 86 Method of Deploying Defile Markers

Section VII. MISCELLANEOUS INFORMATION

3.21 VEHICLE MOVEMENTS

3.21.1 Positioning Flatracks

3.21.1.1 During beam and bridge build it will be necessary to move the various flatrack loads around to ensure a smooth build sequence, below is the sequence of movements that will be required to build the bridge.

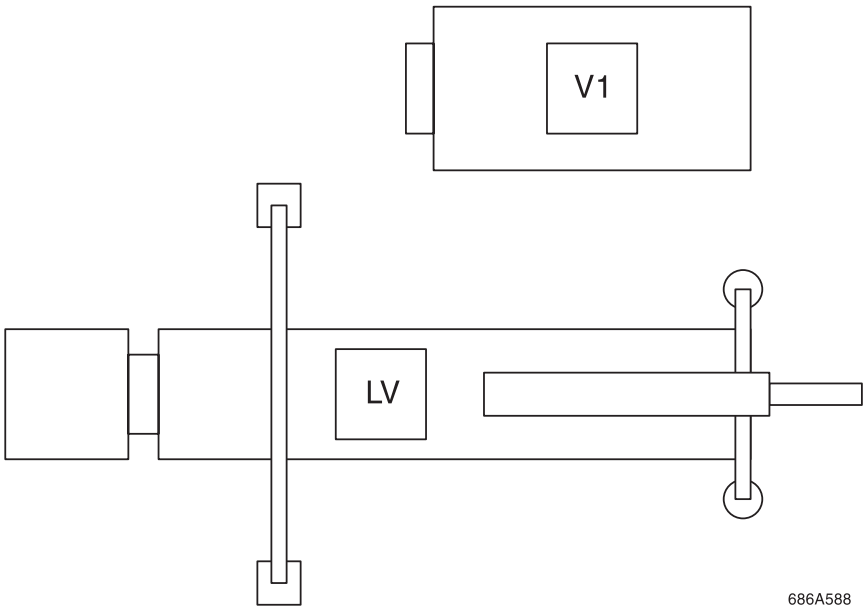
Table 3. 2 Load Designations

Vehicle	Load Designation	Trailer	Load Designation
Launch Vehicle	None	Launch Vehicle Trailer	LVT
Vehicle 1	V1	Trailer 1	T1
Vehicle 2	V2	Trailer 2	T2
Vehicle 3	V3	Trailer 3	T3

3.21.1.2 All vehicles are parked up in the staging area and all trailers are disconnected.

3.21.1.3 Vehicle V3's load is ground loaded and its trailer (T3) is parked out of the way of vehicular traffic.

3.21.1.4 Vehicle V1 takes its load V1 to the bridge site and ground loads it to the right hand side of the launch vehicle, towards the rear of the launcher.

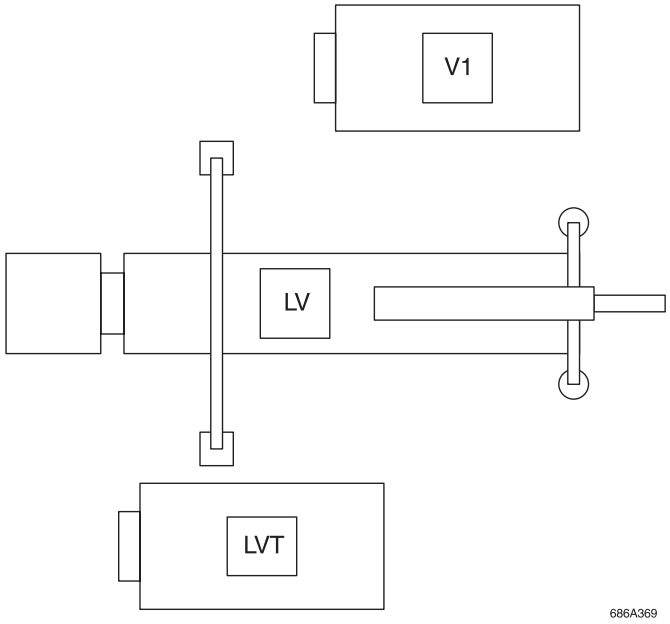


3.21.1.5 V1 returns to the staging area.

3.21.1.6 V1 transloads flatrack T2 ready for deployment to the build site.

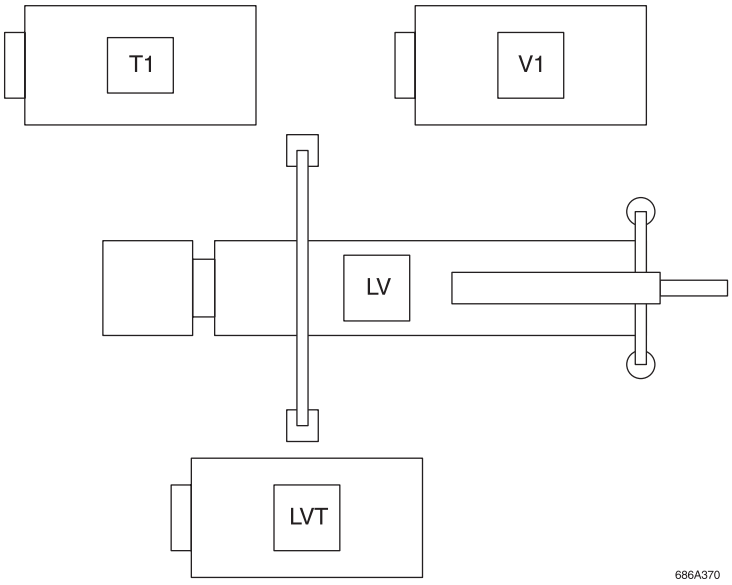
3.21.1.7 Trailer LVT's load is trans loaded onto V3.

3.21.1.8 V3 takes load LVT to the bridge site and ground loads it as shown.



3.21.1.9 V3 then returns to the staging area to trans load flatrack T1.

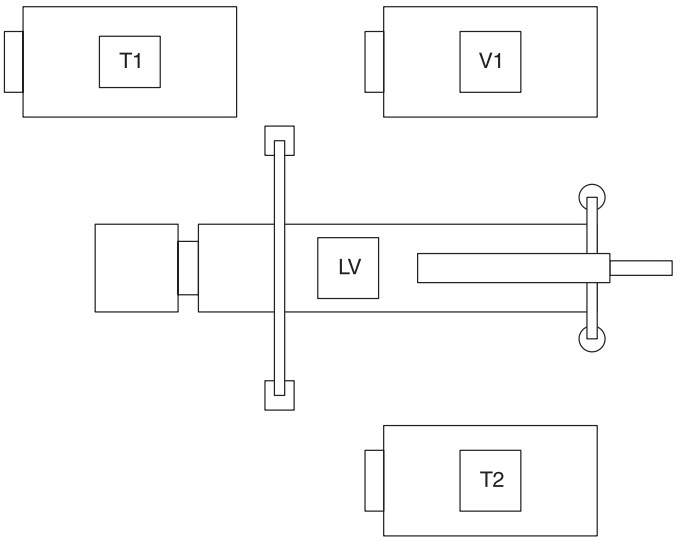
3.21.1.10 Once load T1 is trans loaded onto V3, V3 returns to the bridge site and ground loads load T1 to the right hand side of the launch vehicle.



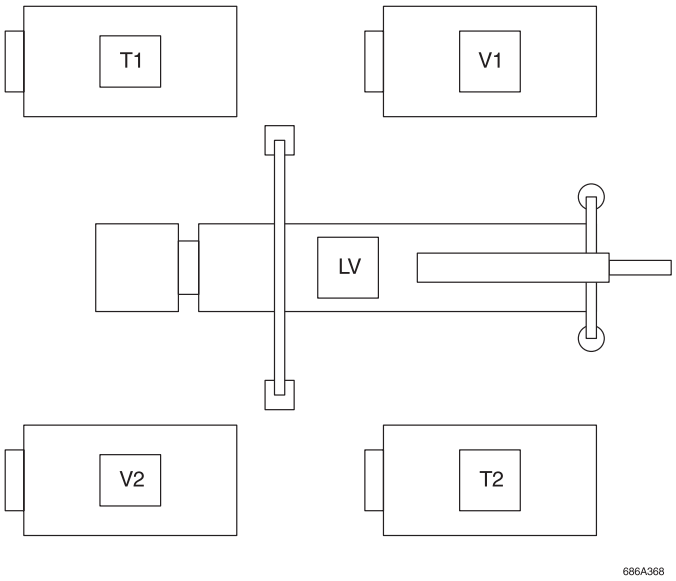
3.21.1.11 During this time, the build party constructs the launch beam.

3.21.1.12 Once the launch beam has been built, V3 removes the now empty flatrack LVT and returns to the staging area.

3.21.1.13 V1 takes flatrack T2 to the build site and ground loads it to the left of the launch vehicle towards the rear of the launcher.

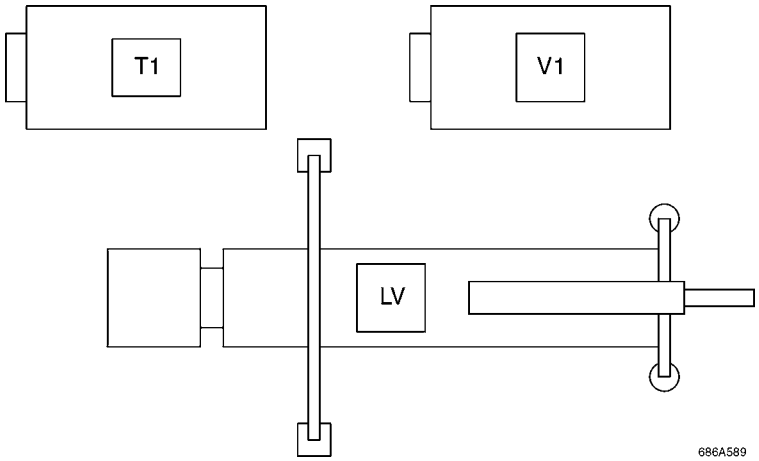


3.21.1.14 Vehicle V2 now takes its load V2 to the bridge site and ground loads it in front of flatrack T2.

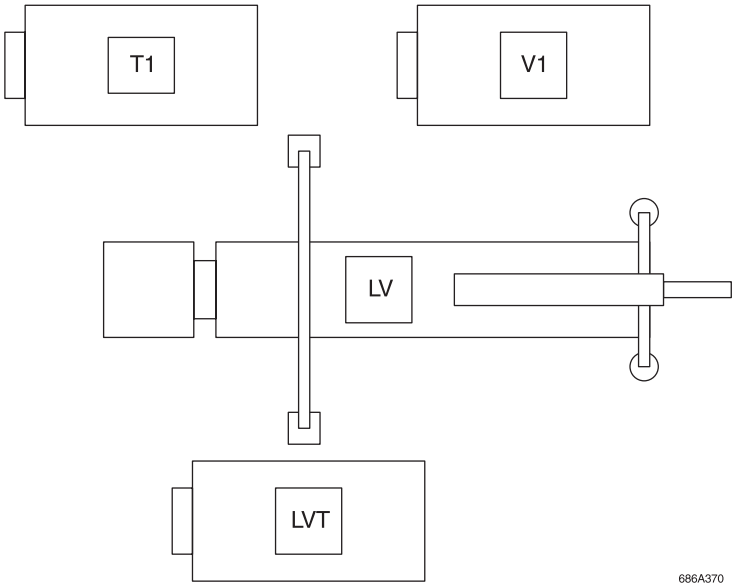


3.21.1.15 During this movement the build party builds the bridge.

3.21.1.16 Once the bridge is built flatracks V2 and T2 are no longer required and are removed by vehicles V2 and V1.

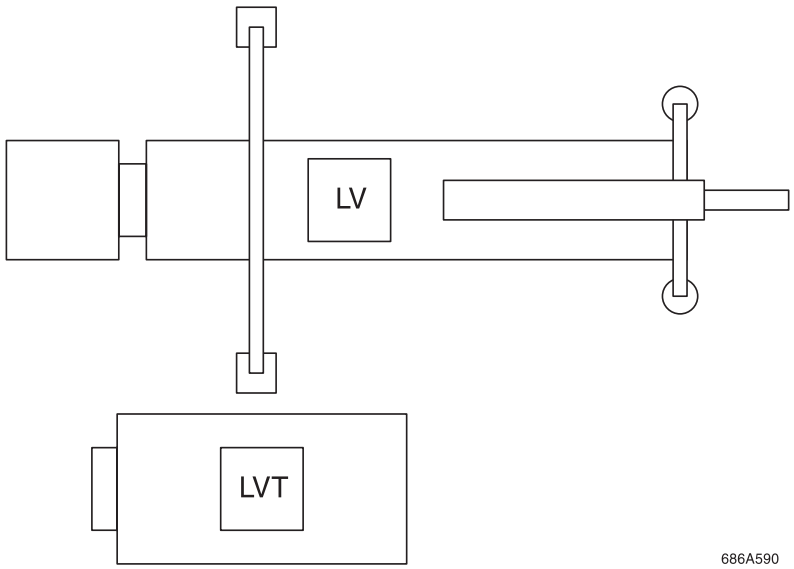


3.21.1.17 Vehicle V3 returns to the build site and ground loads flatrack LVT, ready for launch beam recovery.



3.21.1.18 V3 now loads flatrack T1 and returns to the staging area, and trans loads flatrack T1 onto trailer T1.

3.21.1.19 V1 loads flatrack V1 and returns to the staging area.



3.21.1.20 The build team recovers the launch beam.

3.21.1.21 V3 now recovers flatrack LVT and returns it to the staging area and trans loads it onto trailer LVT.

3.21.1.22 The launch vehicle is recovered and returns to the staging area.

3.21.1.23 V3 loads its flatrack V3.

3.21.1.24 All trailers are reconnected to their respective vehicles and all loads made secure.

3.21.1.25 All vehicles return to base.

3.22 TOP MAN HARNESS AND FALL ARREST LANYARD

3.22.1 General

3.22.1.1 To prevent injury while personnel are connecting the far bank carriage to the far bank ramp unit personnel are required to wear a safety harness and fall arrest device. To function safely, this equipment must be adjusted correctly fitting/adjustment instructions are shown below.

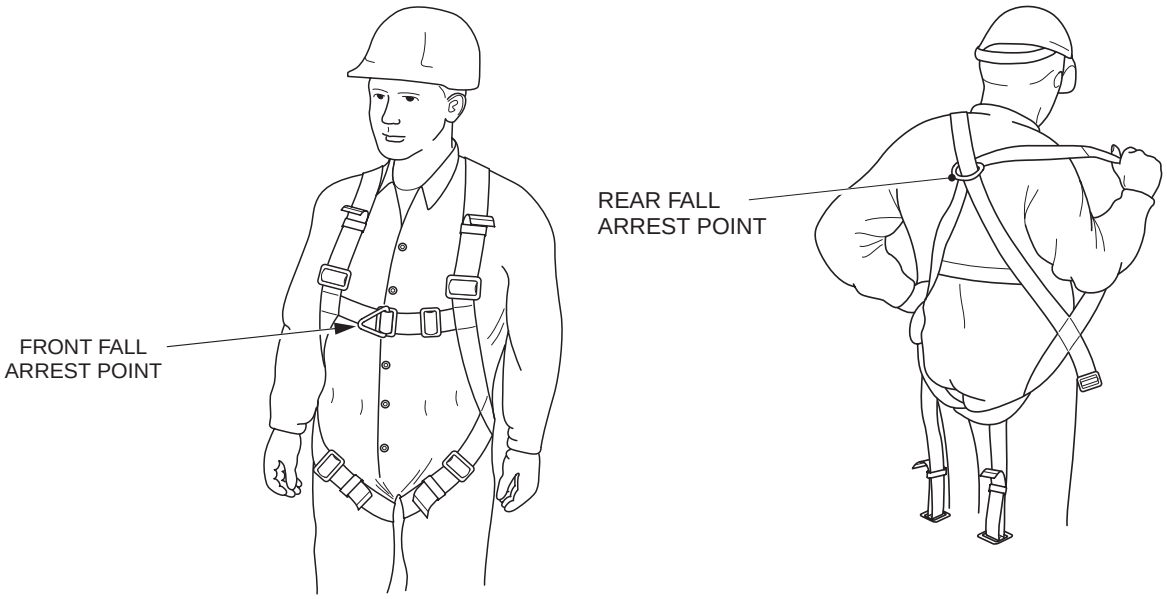


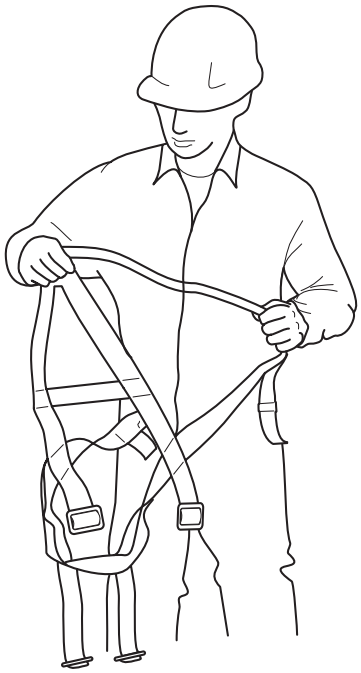
Figure 3. 87 Top Man Harness Fall Arrest Points

3.22.1.2 The top man harness and lanyard must be inspected for damage or wear prior to use. If any damage or wear is found, or if in doubt about the condition of the equipment, withdraw the equipment immediately from service and destroy/discard.

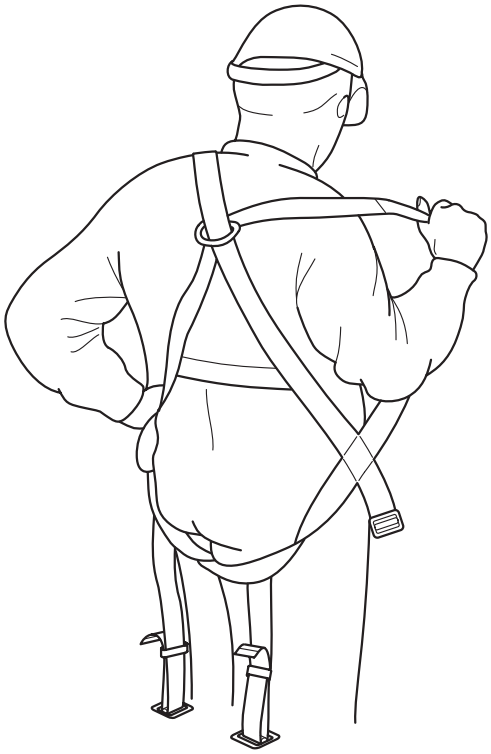
3.22.1.3 If the equipment has been used to arrest a fall, or, if it is believed to have been used to arrest a fall, it is essential that the equipment be withdrawn from use and destroyed/discarded.

3.22.2 Top Man Harness Fitting Instructions

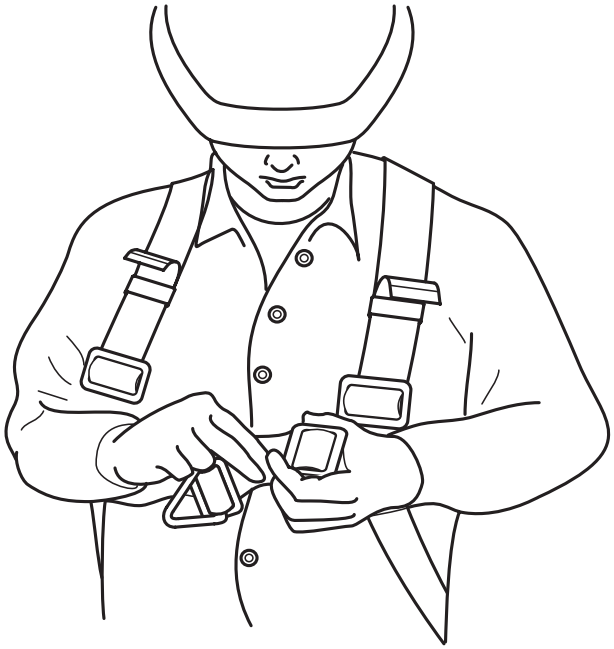
3.22.2.1 Locate the rear fall arrest link.



3.22.2.2 Fit harness over both shoulders.



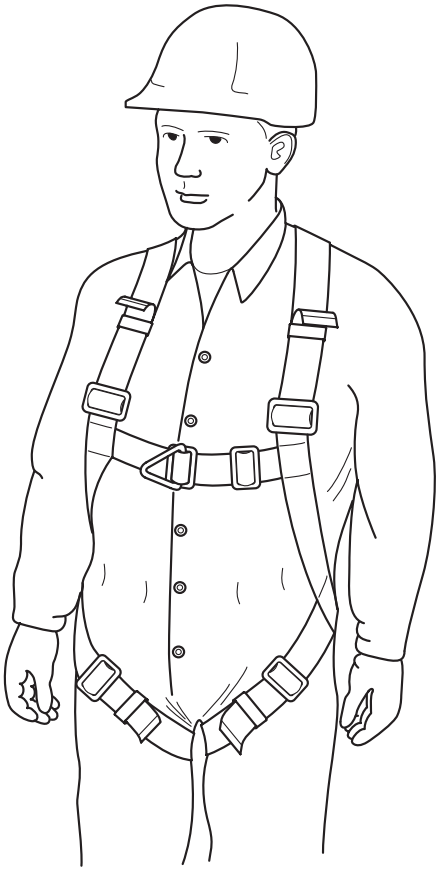
3.22.2.3 Attach chest strap. Adjust to suitable tension by pulling on the free length of webbing. Do not over tighten the chest strap. The straps from shoulders to waist should be as parallel as possible in order to minimize the risk of injury in the event of a fall.

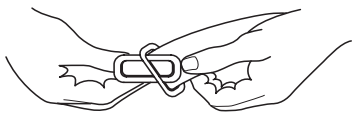


3.22.2.4 Fit thigh straps – left strap to left buckle, right strap to right buckle – **DO NOT CROSS**.

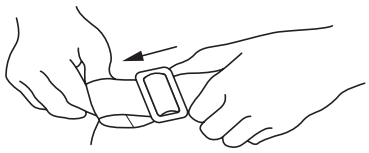
3.22.2.5 Adjust to a suitable tension by pulling the free length of webbing and side webbing.

3.22.2.6 When standing upright the harness should be comfortable, without undue pressure on the chest, shoulders, or pelvic area.

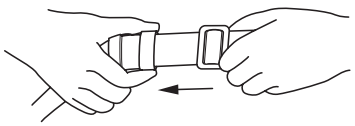




Connecting the buckle system



Tensioning the buckle system



Sliding the webbing tidy back

TABLE OF CONTENTS

CHAPTER 4

BRIDGE BUILDING

CHAPTER 4

BRIDGE BUILDING

Section 1. VEHICLE/TRAILER LOCATION

4.1 DRIVING THE LAUNCH VEHICLE AND PLS TRUCKS WITH OR WITHOUT TRAILERS ATTACHED

4.1.1 Speed Limits

4.1.1.1 The maximum speed of each M1977 CBT and M1075 PLS based launch vehicle, with or without trailers, should be limited to 40 mph when operated on improved roads. If traversal of cross-country terrain is necessary to access an operation site then the M1977 CBT and M1075 PLS based launch vehicle, with or without trailers, should be limited to a maximum speed of 15 mph. The M1076 trailers should be limited to a maximum speed of 10 mph on Belgian block, cobblestone, or surfaces with heavy washboard, ruts, or potholes.

4.1.2 Operating on Sloping Ground

4.1.2.1 Caution must be exercised when operating the DSB vehicles and trailers on slopes. The DSB vehicles should be limited to side slopes not to exceed 20%. The possibility of rollover exists on any slope (including level), but will be minimized provided that operating speeds are kept to a minimum, no sudden steering inputs are made, and depressions are avoided when traversing undulating terrain. Operators must be made aware of these operating characteristics and limitations.

4.2 VEHICLE/TRAILER LOCATION

4.2.1 Initial Vehicle Locations

4.2.1.1 On arrival at the bridge site, park all vehicles and trailers in the pre-designated staging area.

4.2.1.2 Reverse trailers into parked position.

4.2.1.3 When parked apply the parking brake on all vehicles and trailers and fit chocks to the wheels.

4.2.1.4 Disconnect trailers T1, T2, T3 and LVT from vehicles.

4.2.1.5 Ground load flatracks from V3.

4.2.1.6 Transload flatrack LVT onto V3.

4.2.1.7 Examine the vehicles, trailers and their loads for damage during transit to the launch site.

4.2.1.8 Remove any debris trapped in the equipment during transit to the launch site.

4.2.1.9 Remove the 90-degree exhaust elbow from its stowed position, next to the crane hydraulic manifold near the operators cabinet.

WARNING

BURN HAZARD. WEAR SUITABLE GLOVES WHEN HANDLING HOT EXHAUST PARTS TO AVOID BURNS. FAILURE TO OBSERVE THIS INSTRUCTION WILL RESULT IN SEVERE PERSONAL INJURY.

4.2.1.10 Remove the top section of the vehicle exhaust pipe.

4.2.1.11 Fit the 90-degree exhaust elbow to the top of the vehicle exhaust pipe ensuring that the vehicle exhaust is directed away from the crane operators position.

Section II. LAUNCH VEHICLE SET-UP

4.3 LAUNCH VEHICLE SET-UP

4.3.1 Launch Vehicle Preparation For Use

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

PERSONAL INJURY OR DEATH. BRIDGING SITES ARE DANGEROUS PLACES. PERSONNEL MUST WEAR HARD HATS, PROTECTIVE GLOVES AND SAFETY FOOTWEAR.

CAUTION

Operation of hydraulic systems that contain insufficient fluid will cause damage to the system and slow response. Make sure the level of hydraulic fluid in the reservoir is correct before commencement of operations.

This section describes the operations required to partially ready the launcher prior to deployment from the staging area to the launch site.

NOTE

When an item on the vehicle or launcher is referred to as front or rear, left or right, the cab is taken as the front of the launch vehicle, all references are taken as if personnel are looking forward towards the cab. Therefore, if the left hand side A-frame leg is being discussed, the A-frame leg on the launch vehicle's left hand side is the item being described.

When referring to the launch beam the front of the beam is to be taken as the far bank and the rear is taken as the near bank, it follows therefore that the front carriage is the far bank carriage, and the rear carriage is the home bank carriage.

4.3.2 Releasing the Tail lift and Far Bank Support

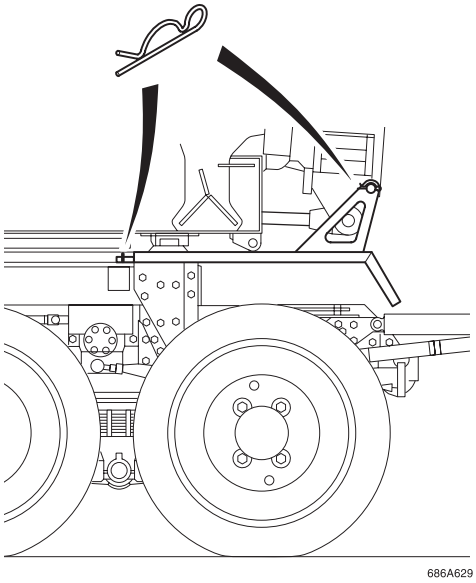
4.3.2.1 Remove the R clip and extract the shootbolt supporting the rear of the mudguard extensions.

4.3.2.2 Remove the R clips from the mudguard front securing peg.

4.3.2.3 Remove the mudguards and stow clear of the vehicle.

4.3.2.4 Replace the R clips, from the front mudguard securing peg, back into the mudguard ready for use on mudguard refit.

4.3.2.5 Replace the R clips, from the rear mudguard shootbolt on the vehicle, back into the shootbolt ready for use on mudguard refit.



Position of Mudguard R clips

4.3.2.6 Remove the two transportation securing straps restraining the tail lift.

4.3.2.7 Remove the tail lift pendant with the attached umbilical cable from its stowage.

4.3.2.8 Remove the dust cover from the tail lift umbilical connection mounted at the left side of the launch vehicle, aft of the fifth wheel axle.

4.3.2.9 Check the emergency stop button on the tail lift pendant is released by turning the knob counter-clockwise in the direction of the arrows.

4.3.2.10 Connect the tail lift umbilical cable to the tail lift vehicle connection point.

4.3.2.11 In the launch vehicle cab, to the right of the driving position, on the left side of the center console, set the 4-position mode selector rotary switch from position 1 to position 2. Make sure the engine rpm goes to high idle.

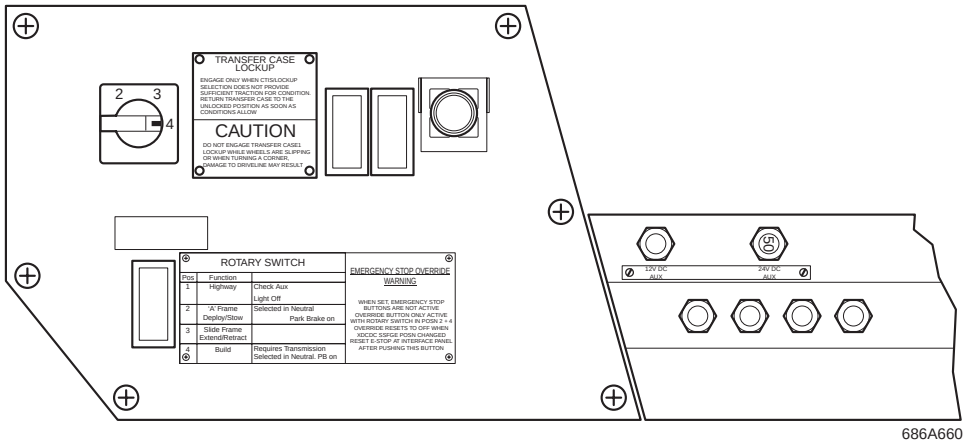


Figure 4.1 Position Switch in Cab

4.3.2.12 Press the EMERGENCY STOP RESET button. Ensure that none of the lights on the E. Stop status panel, at the top left of the main panel are illuminated, or, if illuminated that they go out. If any of the emergency status light do not extinguish check the E. Stop status panel for their location and release any that are engaged.

4.3.2.13 At the interface enclosure located on the right hand side of the launcher, check that the PTO engages approximately 2-4 seconds after the emergency stop RESET button is pressed.

4.3.2.14 Make sure the area at the rear of the launch vehicle is clear of personnel.

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

4.3.2.15 On the tail lift pendant, operate the **SWING DOWN** switch to pivot the tail lift platform downwards.

CAUTION

Ensure the tail lift does not rest on the ground at any time operations are being carried out. Damage to the equipment will occur due to loads being transmitted from the launch vehicle to the tail lift through the sub frame.

NOTE

The swing hydraulic cylinders must be fully retracted before using the tail lift as a working platform.

When traversing rough terrain, operate the LIFT UP switch on the tail lift pendant as necessary to prevent the platform striking the ground.

4.3.2.16 On the tail lift pendant, operate the tail lift **TILT UP** or **TILT DOWN** switches to level the tail lift platform.

4.3.2.17 Release the straps and remove the stepladder from the tail lift platform. Position the stepladder clear of the launch vehicle and any other possible vehicle/trailer traffic.

4.3.2.18 On the tail lift pendant, operate the **LIFT DOWN** switch to lower the tail lift platform.

NOTE

This is a two-man job; one man holds the far bank support while the other man removes the restraining strap.

4.3.2.19 Slowly remove the transportation securing straps from the far bank support. Take care, the far bank support will pivot about its attachment to the forward launch beam into a vertical position as the securing strap is released.

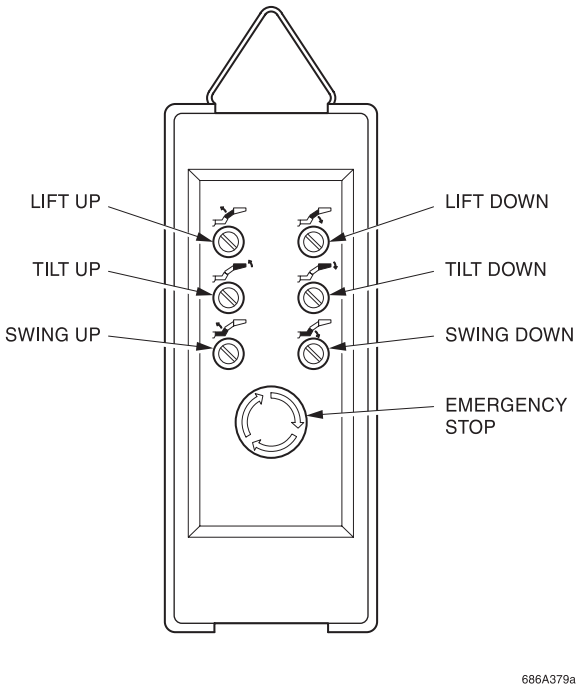


Figure 4.2 Tail Lift Pendant

CAUTION

To prevent damage to the rear marker light bracket it is essential that the far bank support bearing pads be removed from their storage positions on the far bank support before any attempt is made to extend the far bank support. Failure to comply with this instruction will result in damage to the rear marker light bracket.

4.3.2.20 Remove far bank support bearing pads from their stowed position on the far bank support, and place in a convenient position.

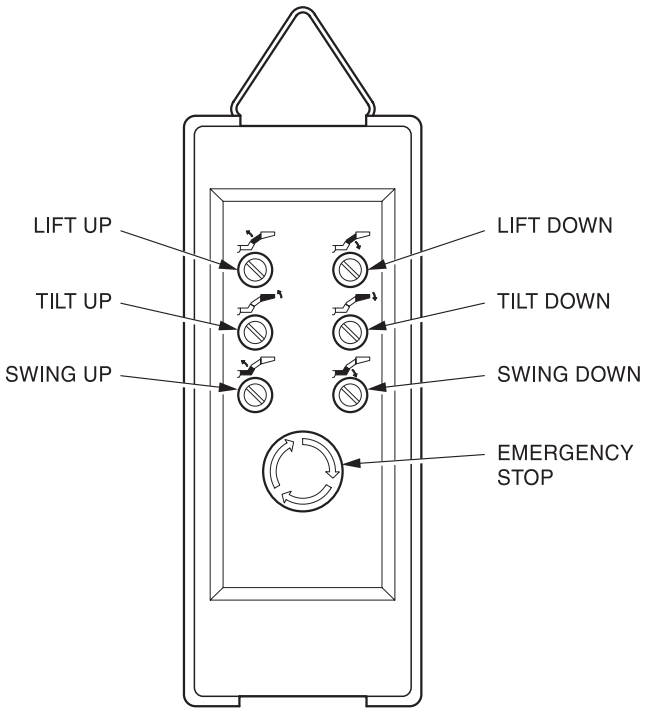
NOTE

It may be necessary to manually swing the far bank support to engage the stirrups on the tail lift platform.

4.3.2.21 On the tail lift pendant, operate the SWING UP switch to raise the tail lift platform. Make sure the lift hydraulic cylinders extend and raise the tail lift platform until the bottom beam of the far bank support engages with the stirrups attached to the tail lift.

4.3.2.22 Release the SWING UP switch when the tail lift structure supports and *lightly* compresses the far bank support.

4.3.2.23 Retract the lower shootbolt from the far bank support, and on the tail lift pendant, operate the SWING DOWN switch to lower the tail lift platform. Make sure the tail lift hydraulic cylinders operate and lower the tail lift platform, supporting the far bank support until its fully extended position is reached.



Tail Lift Pendant

4.3.2.24 Release the SWING DOWN switch when the far bank support is fully extended.

4.3.2.25 Insert the upper shootbolt and lock in place with an R clip. If necessary, adjust the position of the tail lift platform to move the far bank support to align the holes and facilitate installation of the shootbolt.

4.3.2.26 On the tail lift pendant, operate the SWING DOWN switch to lower the tail lift away from the far bank support.

4.3.3 Deploying the A-frame

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

4.3.3.1 Remove the two A-frame leg hinge pins and clips located at the upper cross member locking plate from either side of the A-frame, two (upper and lower) on the left hand side and 2 (upper and lower) on the right hand side.

4.3.3.2 On the interface enclosure, if necessary, press the A-frame **PARK** button to release the pins.

4.3.3.3 Press the A-frame Fold – **DEPLOY** button only when the A-frame hinge pins have been removed.

4.3.3.4 Make sure the area on either side of the launcher is clear of personnel and press the A-frame **DEPLOY** button.

4.3.3.5 Make sure the A-frame folding cylinders extend and pivot both outer A-frame legs outwards about the upper and lower A-frame cross members to their deployed positions.

4.3.3.6 Ensure that the A-frame **DEPLOY** lamp illuminates and that the A-frame **PARKED** lamp extinguishes.

4.3.3.7 Release the **DEPLOY** pushbutton when the outer A-frame legs are fully spread.

4.3.3.8 Install the locking pins and their R clips in the outer A-frame legs at the upper and lower cross member hinge points to lock the legs in the spread position. The longer of the two pins being inserted from front to rear in the lower cross member, the short pin being inserted from front to rear in the upper cross member.

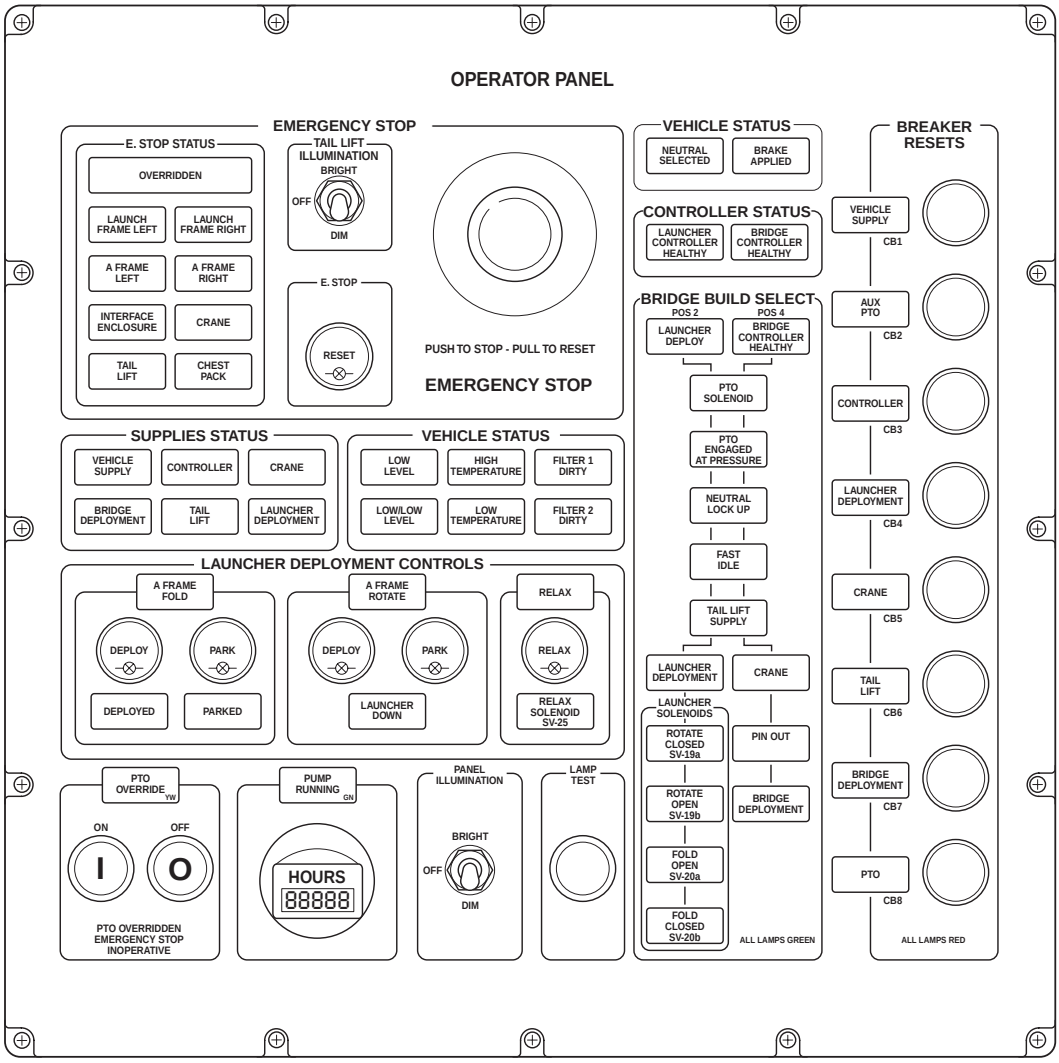
NOTE

The A-frame cannot be rotated to the vertical position unless the outer legs are in the spread position. Ensure that the A-Frame shootbolts on the lower cross member are retracted.

4.3.3.9 On the A-frame rotate panel of the interface enclosure, operate and hold the A-Frame Rotate - **DEPLOY** pushbutton, to rotate the A-frame to the vertical position. Make sure the **DEPLOYED** caption illuminates.

4.3.3.10 Make sure the hydraulic cylinders retract and pivot the A-frame out from its stowed condition to its deployed vertical position.

4.3.3.11 Release the **DEPLOY** pushbutton when the A-frame is deployed vertically.



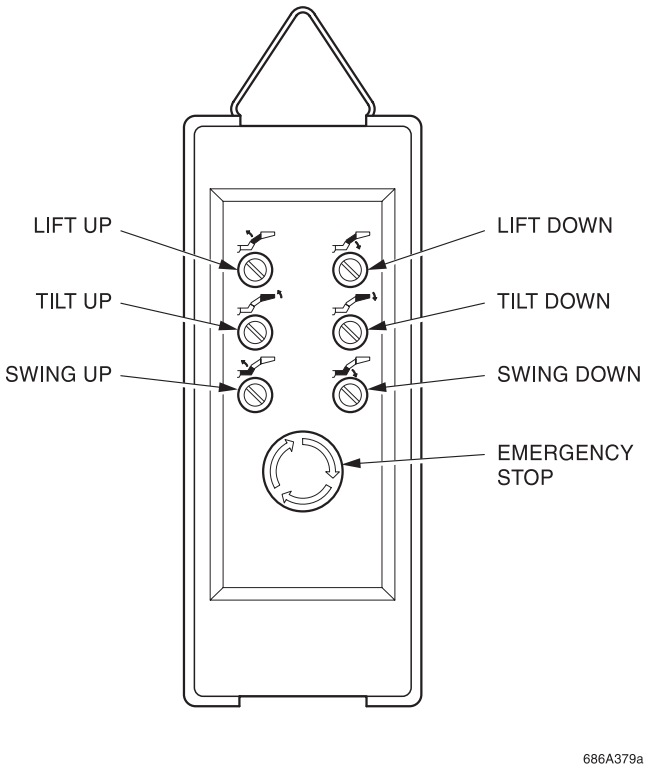
686A352a

Interface Enclosure

4.3.3.12 Install and clip the shootbolts at the slide frame hinge point and the lower transverse beam to lock the A-frame vertical.

4.3.3.13 Put the far bank support bearing pads in position on the tail lift platform.

4.3.3.14 On the tail lift pendant, operate the **LIFT UP** switch to raise the tail lift platform.



Tail lift Hand Control

4.3.3.15 Release the **LIFT UP** switch when the ball joint of the bearing pads and the sockets of the far bank support are aligned.

4.3.3.16 Connect the bearing pads to the far bank support by retracting the spring-loaded pin, inserting the ball joint and re-inserting the pin. Make sure the spring-loaded pin is fully engaged.

4.3.3.17 Replace the stepladder on the tail lift platform and re-strap to secure on to the tail lift platform.

NOTE

The following operation is only carried out if the launch vehicle is being deployed from the staging area to the bridge site.

4.3.3.18 On the tail lift pendant, operate the **LIFT UP** switch to raise the tail lift platform to support the far bank support.

4.3.4 Deploying the Crane

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

CAUTION

Operate the control levers in a smooth and considered manner. The speed of the working movements is determined by the degree to which the control lever is moved. Failure to carry out his instruction could lead to equipment damage.

When operating the crane heed the symbols on the control levers.

NOTE

There are separate independent controls on the left and right of the crane adjacent to the stabilizer legs, for the control of the left and right stabilizer slide frames and support legs.

4.3.5 Crane Operating Safety Instructions

4.3.6 Safety Instructions

4.3.6.1 Make sure you are familiar with all the information necessary for the safe operation of the crane.

4.3.6.2 Read the operating instructions.

4.3.6.3 The relevant health and safety regulations for the country of operation must be adhered to.

4.3.6.4 In addition, make sure you adhere to the relevant national regulations and road traffic laws.

4.3.6.5 Only use the crane if it is in a serviceable condition.

4.3.6.6 Carry out a visual inspection. Make a note of damage or leaks.

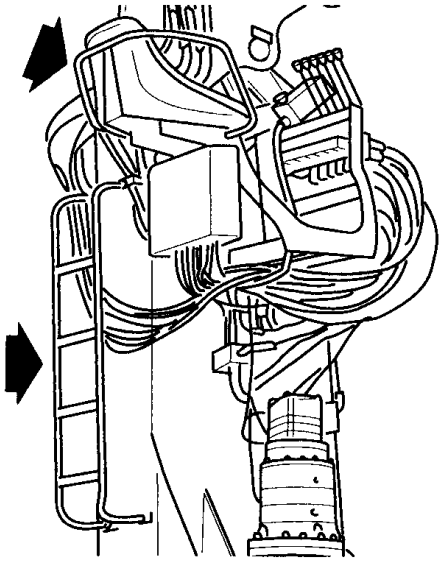
4.3.6.7 Make sure the necessary maintenance is carried out in accordance with the maintenance schedule.

4.3.6.8 The crane is only to be used for its designated purpose.

4.3.6.9 The values given on the maximum load diagram must not be exceeded.

4.3.6.10 Every time the crane is in use, the vehicle must be stabilized and secured so that it cannot roll away.

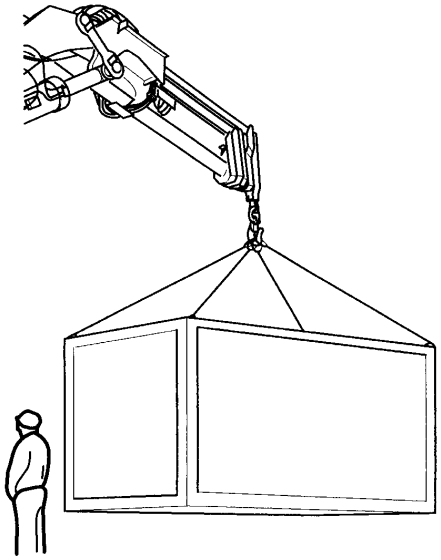
4.3.6.11 Make sure the ground is capable of bearing the load. If necessary, earth pressure can be reduced by the use of suitable load spreaders.



4.3.6.12 Only use the ladder and grip handles to get on and off the seat.

4.3.6.13 Damage *must* be repaired or reported immediately. Only resume work with the crane when the damage has been repaired.

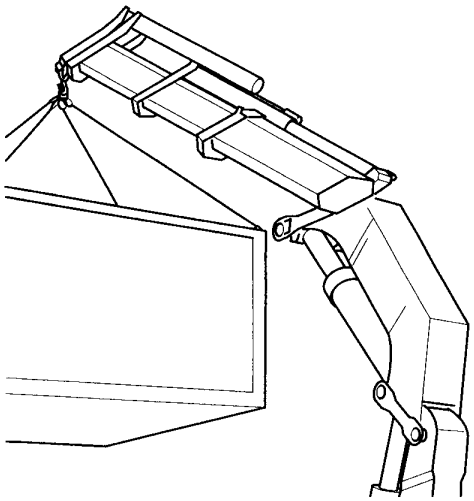
4.3.6.14 Only lift loads when the vehicle has been adequately stabilized.



4.3.6.15 No person may enter the working or rotating range.

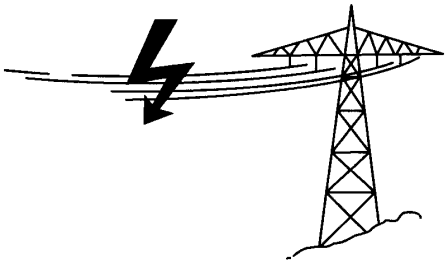
(1) Seal off the working area.

(2) Heed obstacles in the working area of the crane.



4.3.6.16 Do not rotate until the load is suspended.

4.3.6.17 Do not park the crane with a suspended load.



4.3.6.18 Keep away from overhead electrical cables.

4.3.6.19 Keep a distance of at least 5 meters from overhead cables.

4.3.6.20 In the event of a flashover:

(1) Bring the crane out of the danger area. If this is not possible:

(2) Request outsiders to keep their distance.

(3) Have the current switched off.

4.3.6.21 Never drive the vehicle with a freely suspended load.

4.3.6.22 Increasing the hydraulic operating pressure is not permitted.

4.3.6.23 Observe all safety instructions when working.

4.3.6.24 All working movements (especially rotating) must be operated with precision.

4.3.6.25 Observe maximum load capacity.

4.3.6.26 Never drive the vehicle with the hydraulic pump drive switched on.

4.3.7 Crane Loading

CAUTION

The values given on the load diagram are definitive and must not be exceeded. They apply when the crane is operated with the boom horizontal, with the jib horizontal, and with the stabilizers and slides extended on both sides. When the crane is on an incline, the maximum load is reduced.

4.3.7.1 Refer to the crane load diagram for definitive extended loading.

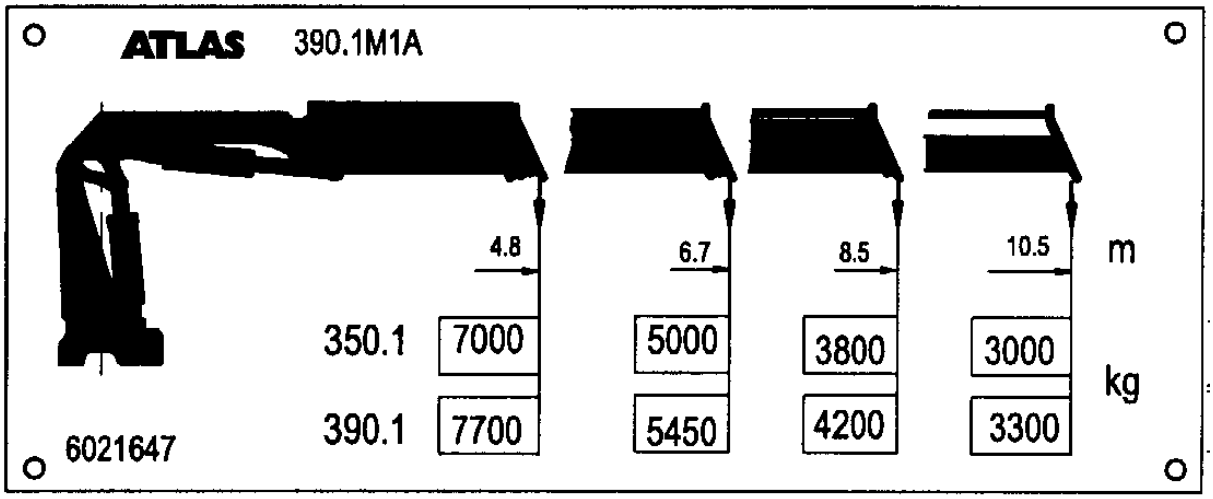


Figure 2. 1 Crane Load Diagram

4.4 DEPLOYING THE CRANE

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

4.4.1 Deploying the Stabilizer Legs

4.4.1.1 Remove the pins and clips (A and B) securing the crane stabilizer slide frames in the retracted position, stow the pins and clips in vehicle cab.

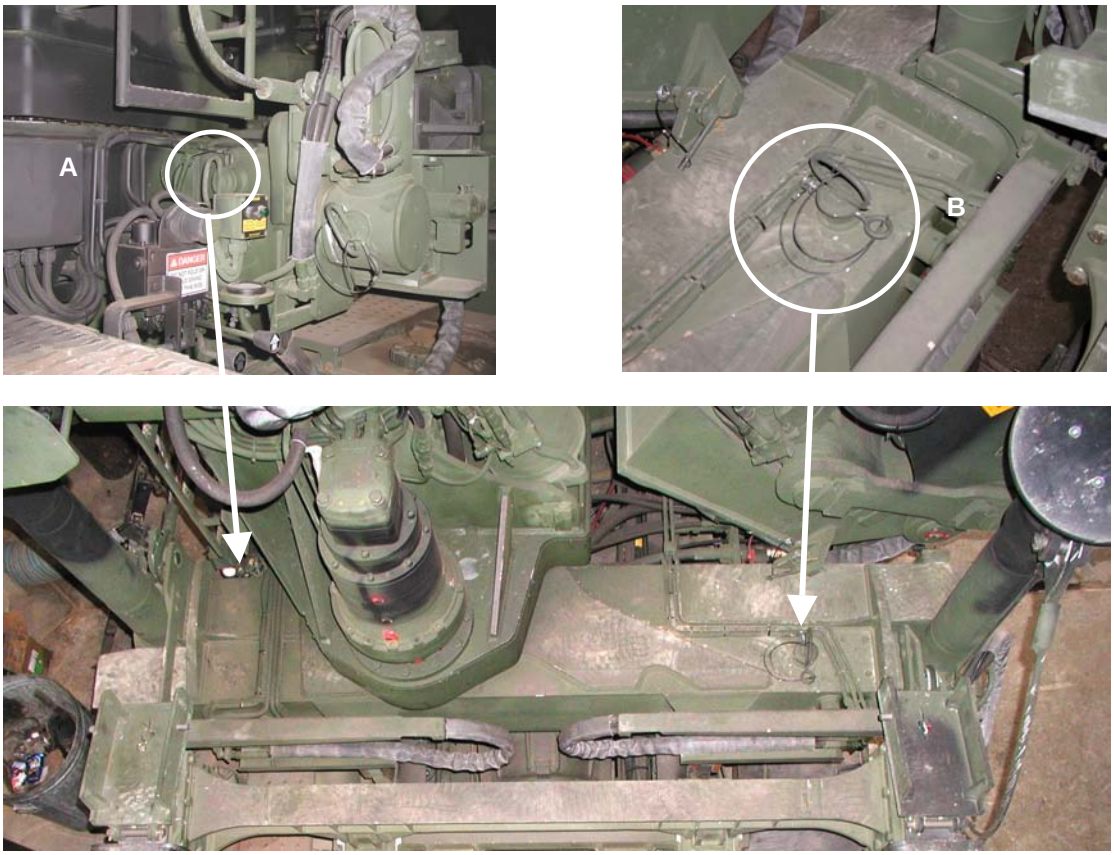
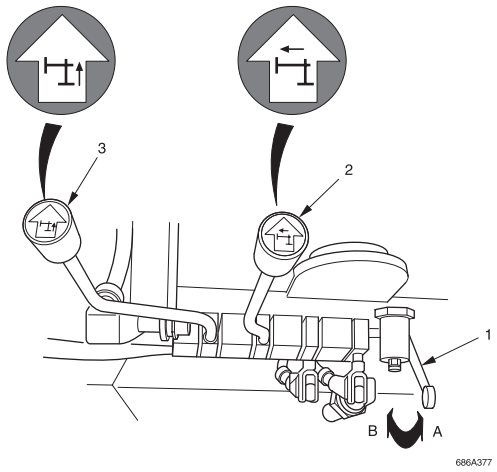


Figure 4.3 Crane Stabilizer Slide Frame Transport Pins and Clips

4.4.1.2 Move the control lever (1), from crane (B) to stabilizer (A).

4.4.1.3 Operate the stabilizer slide frame control (2) to extend the crane stabilizer slide frame outwards from the stowed position.

4.4.1.4 Operate the stabilizer leg control (3) to extend the stabilizer leg cylinder.



Crane Stabilizer Leg Controls

4.4.1.5 Release the appropriate controls when the stabilizer leg cylinder is fully extended and the steel retention cable is taut.

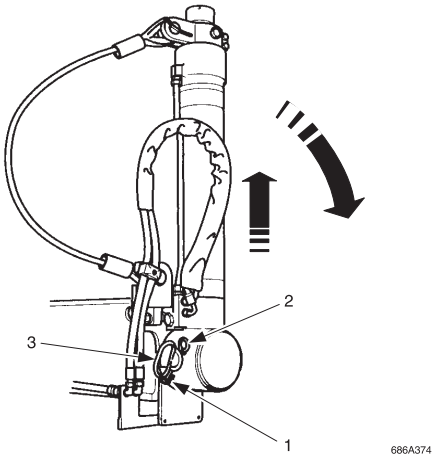
WARNING

CRUSH INJURY. REMOVAL OF THE STABILIZER ROTATE PIN PRIOR TO STABILIZER EXTENSION MAY CAUSE THE STABILIZER TO ROTATE UNEXPECTEDLY CAUSING SEVERE INJURY TO PERSONNEL.

4.4.1.6 Remove the safety pins (2), retaining clips (1) and the locking pins (3) securing the crane stabilizer legs in the vertically upright position.

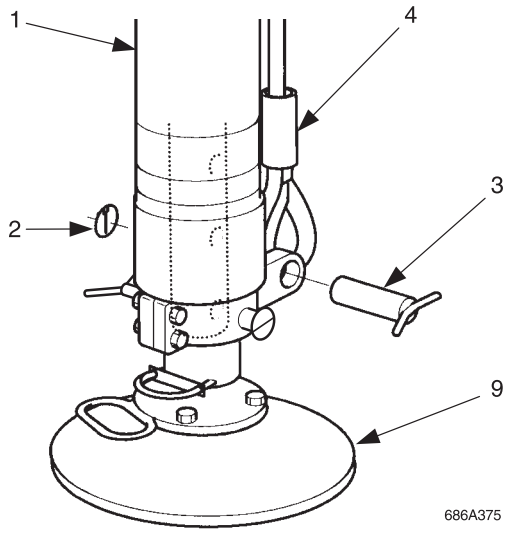
4.4.1.7 Make sure the area around the crane stabilizers is clear of personnel, operate the crane controls adjacent to the stabilizers and retract the stabilizer cylinder to rotate the crane stabilizer legs downwards to the vertically down position.

4.4.1.8 Release the appropriate controls when the stabilizers are fully vertically down and insert the locking pins (1), retaining clips (2) and safety pins (3) to secure the stabilizers in the fully rotated downwards position.



Stabilizer Leg Pins and Clips

4.4.1.9 Remove the retaining clips (2) and the pins (3) and disconnect the wire rotation cable (4) from the bottom of the crane stabilizer legs (1). Refit the pins (3) and retaining clips (2).



Wire Rotation Strap Pins and Clips

4.4.2 Securing Far Bank Support for Transport to Build Site

4.4.2.1 Ensure all pins are fitted to the A-frame hinge points in preparation for moving the launch vehicle to the bridging site.

4.4.2.2 Ensure that the launch vehicle is secured for movement to the bridging site and ensure tail lift pendant is removed and stowed.

4.4.2.3 Close the interface enclosure door.

4.4.2.4 In the vehicle cab, switch the four position switch to position 1.

4.4.2.5 Ensure the PTO disengages.

4.4.2.6 Select gear and release parking brake.

4.4.2.7 Deploy the launch vehicle to the bridge site.

4.5 BRIDGE DEPLOYMENT

NOTE

When an item is on the vehicle or launcher and is referred to as front or rear, left or right, the cab is taken as the front of the launch vehicle, all references are taken as if personnel are looking forward towards the cab. Therefore, if the left hand side A-frame leg is being discussed, the A-frame leg on the launch vehicle's left hand side is the item being described.

When referring to the launch beam the front of the beam is to be taken as the far bank and the rear is taken as the near bank, it follows therefore that the rear carriage is the home bank carriage and the front carriage is the far bank carriage.

4.5.1 Build Site Initial Vehicle/Flatrack Location

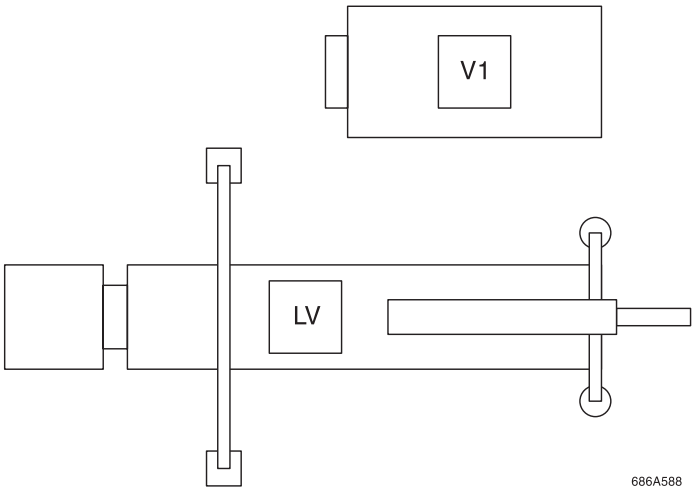
4.5.1.1 Drive the partially deployed launch vehicle onto the site.

4.5.1.2 Reverse launch vehicle with its left hand wheels along the center alignment line until the center of the A-frame stabilizer pads line up with the set back mark on the alignment line (refer to Chapter 1 Para 1.2.9, Site Marking for Bridge Build and Figure 1. 12, Build Site Marking Out).

NOTE

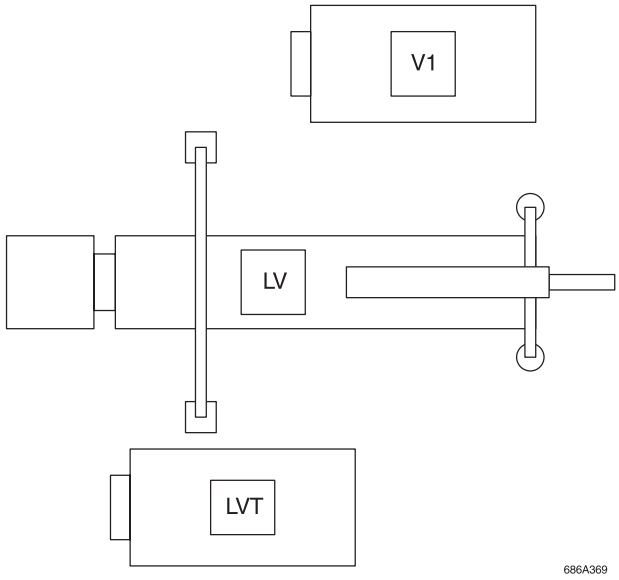
The set back distance "A" is variable, dependent on gap, and should be calculated from Chapter 1 Section II Table 1.3.

4.5.1.3 Drive vehicle V1 with V1 load onto the bridge site, reverse it with its left-hand wheels along the right hand tire alignment line placing the flatrack at its position along the pre-marked line. (Rear right hand side of launch vehicle).



Positions of Flatracks

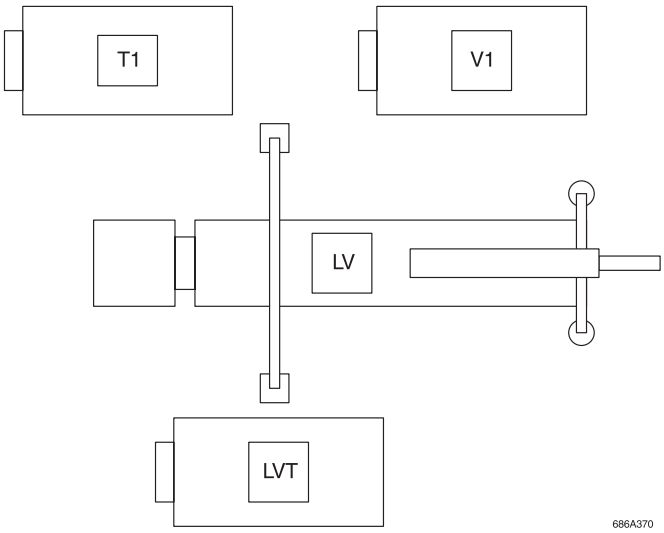
4.5.1.4 Drive vehicle V3 with LVT load onto the site and reverse it with its left-hand wheels along the left hand tire alignment line placing the flatrack at its position along the pre-marked line (rear left hand side of launch vehicle).



Positions of Flatracks

4.5.1.5 Return vehicle V3 to staging area to transload T1 flatrack.

4.5.1.6 Drive the vehicle V3 and T1 load onto the site and reverse it with its left-hand wheels along the right hand tire alignment line placing the flatrack at its position along the pre-marked line (in front of V1 load).



Positions of Flatrack

4.5.1.7 Un-strap flatrack loads T1 and V1 and LVT.

4.5.1.8 Remove the four spacer beam assemblies on the top of the load of LVT.

4.6 LAUNCH VEHICLE PREPARATION AT BUILD SITE

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

4.6.1 Deploying Launch vehicle to Build Site

4.6.1.1 This section describes the final set up of the launch vehicle at the build site.

4.6.1.2 Make sure the area at the rear of the launch vehicle is clear of personnel.

4.6.1.3 Release the launch vehicle parking brake and set its transmission to reverse.

4.6.1.4 Reverse the launch vehicle towards the gap and on to its marked out position. Use guiding personnel to make sure the area is clear and the launch vehicle is correctly positioned.

4.6.1.5 Stop the launch vehicle movement and apply the parking brake.

4.6.1.6 Remove the tail lift pendant from its stowage location and connect it to the tail lift control box.

4.6.1.7 Make sure personnel are clear of the area below the A-frame.

4.6.1.8 Release the slide frame twist-to-lock fasteners, which are located at the rear of the vehicle at the end of the crane sub-frame. The twist-to-lock fasteners are released when the handles are 90 degrees to the chassis.

4.6.1.9 Ensure that neutral is selected on the transmission and the parking brake is applied.

4.6.1.10 Set the 4-position switch in the vehicle cab to position 2. Make sure the PTO engages and the engine rpm goes to high idle.

4.6.1.11 Open the interface enclosure on the right hand side of the launch vehicle.

4.6.1.12 Ensure that the panel illumination is set to either bright or dim and press the **E STOP RESET** button if necessary.

4.6.1.13 Make sure personnel are clear of the area around the A-frame.

4.6.1.14 Press **LIFT DOWN** on the tail lift pendant to lower the tail lift away from the far bank support.

4.6.1.15 Remove the R clips and the pins securing the A-frame stabilizer legs in the retracted position. Slight extension or retraction of the stabilizer cylinders may be required to remove the pins.

4.6.1.16 At the A-frame controls on the centerline of the rear face of the A-frame lower cross member, lower the stabilizer legs simultaneously by operating both levers together.

4.6.1.17 Make sure the stabilizer leg hydraulic cylinders extend and lower both A-frame stabilizer bearing pads towards the ground.

4.6.1.18 Continue to extend the stabilizer leg hydraulic cylinders and lower both A-frame stabilizer bearing pads to the ground, lifting the slide frame clear of the chassis until the twist lock blocks are clear of the white chassis positioning aids on the chassis.

NOTE

Ensure that both stabilizer pins are in the same number hole on each leg and that both twist lock blocks are level with or above the white chassis positioning aids.

Chassis Positioning Aid

4.6.1.19 Insert the pins in the highest pinhole position available from the inside out and lock in place with the R clip in the outermost hole of the pin.

4.6.1.20 Lower the A-frame onto the pins.

4.6.1.21 Operate the switches on the tail lift pendant to position tail lift so that it will clear any obstructions on the ground and pass under the A-frame lower cross member, when the vehicle is driven forwards.

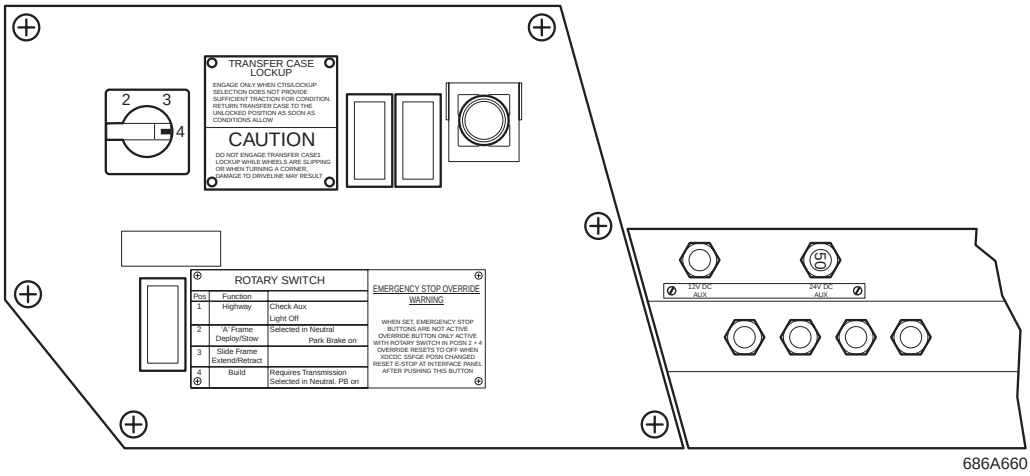
4.6.1.22 Secure tail lift pendant and its umbilical cable on tail lift to prevent damage during slide frame deployment.

NOTE

Do not level the A-frame at this stage or the slide frame could be damaged.

4.6.2 Slide Frame Deployment

4.6.2.1 Select position 3 on the rotary switch in the cab. Make sure the PTO disengages and the engine rpm reduces to idle. Ensure case lock is engaged (all wheel drive).



4 Position Rotary Switch in Cab

CAUTION

Do not engage the launch vehicle transmission and drive it forwards or backwards, in excess of 2 mph (3.2 kph), the A-frame could be damaged.

4.6.2.2 Ensure that transfer case lock is engaged.

4.6.2.3 Select a forward gear and slowly (not exceeding 2 mph (3.2kph)) drive the launch vehicle forward to fully extend the slide frame, ensuring that the holes in section 1 and 2 of the slide frame are fully exposed.

4.6.2.4 When in position select neutral on the transmission and ensure that the parking brake is properly applied.

4.6.2.5 Retrieve the chest pack from its stowage location. Connect the chest pack (see Chapter 3 Section II paragraph 3.4.2), connecting its umbilical cable to either the left hand or right hand connection points on the A-frame legs.

4.6.2.6 The chest pack operator puts on the chest pack harness and adjusts it for correct fit (see Chapter 3 Section II paragraph 3.4.1).

4.6.2.7 Select position 4 on the rotary switch in the vehicle cab.

4.6.2.8 Insert chocks at the front wheel on both sides.

4.6.2.9 Press the **EMERGENCY STOP RESET** button. Ensure that none of the lights on the E. Stop status panel, at the top left of the main panel are illuminated, or, if illuminated that they go out. If any of the emergency status light do not extinguish check the E. Stop status panel for their location and release any that are engaged.

4.6.2.10 Ensure the PTO engages and the hydraulic pump is running; check in the interface enclosure that the **PTO ENGAGED AT PRESSURE** lamp is lit and the pump run timer is operating.

4.6.2.11 Press and hold the **RELAX** button on the interface enclosure. The **RELAX SOLENOID SV-25** will illuminate.

4.6.2.12 Ensure that the relax mechanism centers.

4.6.2.13 Withdraw the relax shootbolts.

4.6.2.14 Release the **RELAX** button.

4.6.2.15 Ensure that the **PIN OUT** light illuminates on the vehicle status panel of the operator panel and approximately 2 seconds later the **BRIDGE DEPLOYMENT** light illuminates.

4.6.2.16 Close the interface enclosure door.

4.6.3 Deploying Crane Stabilizer Legs to Ground

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

CAUTION

Operate the control levers in a smooth and considered manner. The speed of the working movements is determined by the degree to which the control lever is moved.

When operating the crane heed the symbols on the control levers.

NOTE

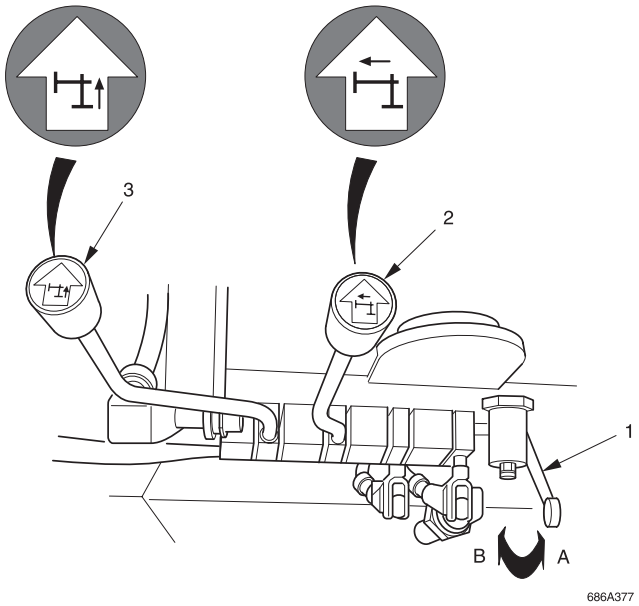
Make sure the crane operator is briefed on the hand signals to be employed to initiate the crane functions required.

There are separate independent controls on the left and right of the crane adjacent to the stabilizer legs, for the control of the left and right stabilizer slide frames and stabilizer legs.

4.6.3.1 Release the straps and remove the two crane stabilizer spreader pads and the stepladder from the tail lift platform.

4.6.3.2 Put the crane stabilizer spreader pads in position centrally below each crane stabilizer leg and make sure the area around the crane stabilizer legs is clear of personnel.

4.6.3.3 Move the control lever (1), from crane (B) to stabilizer (A) if not already carried out.

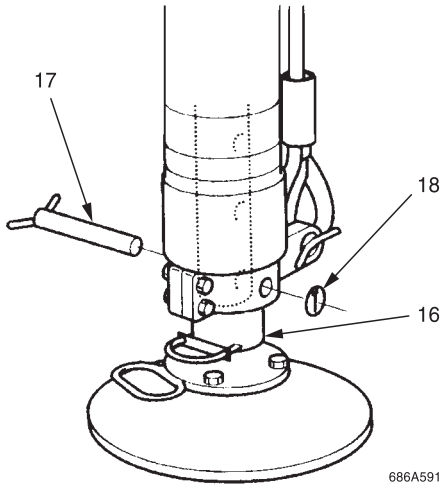


Crane Stabilizer Leg Controls

4.6.3.4 Operate the stabilizer controls to lower the crane stabilizer legs to the ground.

4.6.3.5 Make sure the hydraulic cylinders extend and position the feet of the crane stabilizer legs centrally on the crane stabilizers spreader pads.

4.6.3.6 If stabilizer cylinder runs out of stroke before the crane is horizontally level, the stabilizer extension can be used by removing clip (18) and pin (17) while supporting its weight. The extension leg (16) can then be extended and pinned at an appropriate height by reinserting pin (17) and securing with clip (18).



4.6.3.7 Continue to independently operate the crane stabilizer leg controls, for the stabilizer leg with the least extension until the bubble level on the crane leg indicates the crane is horizontally level and the stabilizer extension green light illuminates.

NOTE

The last operation must be to extend the stabilizer leg; this operation electrically locks the hydraulic pressure in the stabilizer leg.

4.6.3.8 Move the control lever (1), from stabilizer (A) to crane (B).

CAUTION

Operate the control levers in a smooth and considered manner. The speed of the working movements is determined by the degree to which the control lever is moved.

When operating the crane heed the symbols on the control levers and ensure the seat lap belt is securely fastened.

4.6.4 Unfolding the Crane

4.6.4.1 Deploy crane seat and lock into position.

4.6.4.2 The function of the control panel, adjacent to the seat, is to switch the system on and off and to switch to special functions.

4.6.4.3 Switch on the system using button (1).

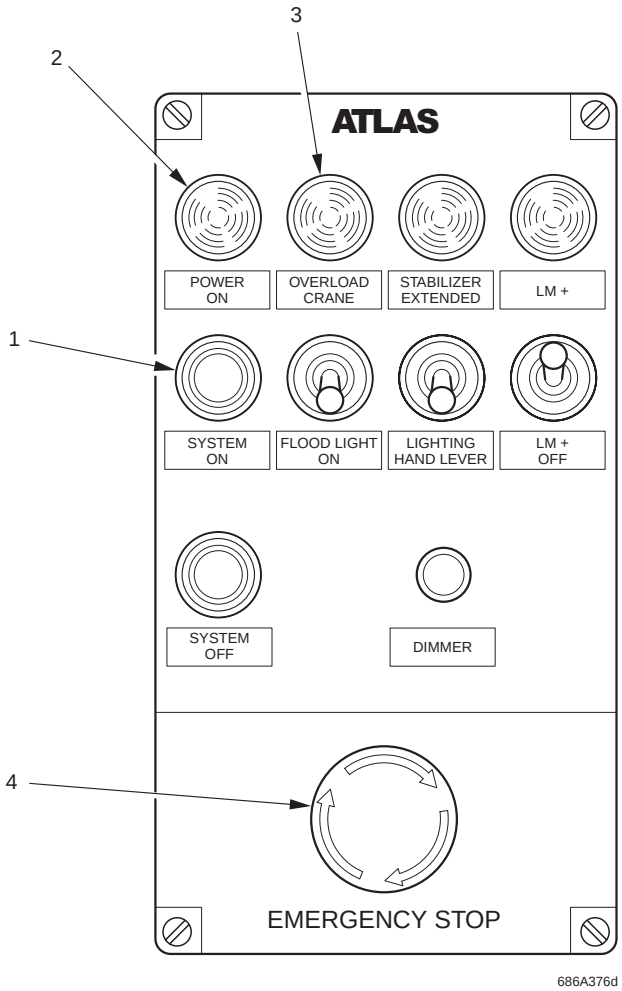
NOTE

The crane overload warning lamp (3) will flash once when the crane is switched on, this indicates that the crane overload safety circuits are operating correctly.

4.6.4.4 The green indicator lamp (2) will light up.

4.6.4.5 If the indicator lamp fails to light up, check whether the EMERGENCY STOP switch (4) is still engaged. If the switch is engaged, release it by turning it to the right. Press button (1) again.

4.6.4.6 The red indicator light will flash to show that the safety circuit is functioning correctly. If the red indicator lamp (3) remains illuminated then this indicates an overload. Press the EMERGENCY STOP switch (4) to switch off the crane's electrical system. Investigate the cause of the overload.



Crane Mounted Control Cabinet

WARNING

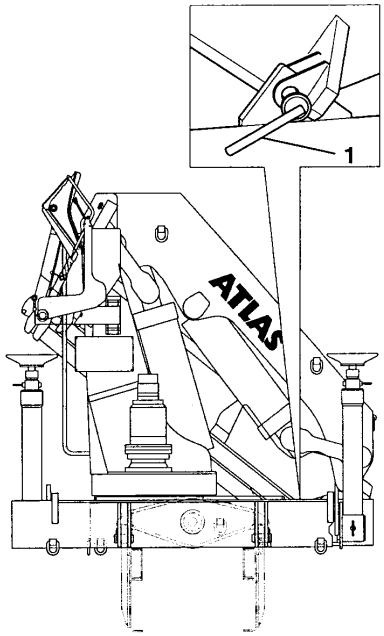
CRUSH HAZARD. DO NOT REMAIN IN DANGER AREA WHILE THE CRANE IS UNFOLDING. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO DEATH OR SEVERE INJURY.

TRIP HAZARD. BEWARE OF OBSTACLES IN THE CRANE OPERATING AREA.

CAUTION

EQUIPMENT DAMAGE. Do not rotate the crane or extend the extension piece of the jib until the boom and the jib are in working position.

4.6.4.7 Remove the locking pin (1).



Crane Jib Transport Pin

4.6.4.8 Using the boom raise - lower controls (2) lift the boom from the docking bracket until the jib can be folded out with no risk of accident.

4.6.4.9 Use the jib fold/unfold control (3) to unfold the crane jib.

4.6.4.10 Using the jib extension extend/retract control (4) extend the crane arm.

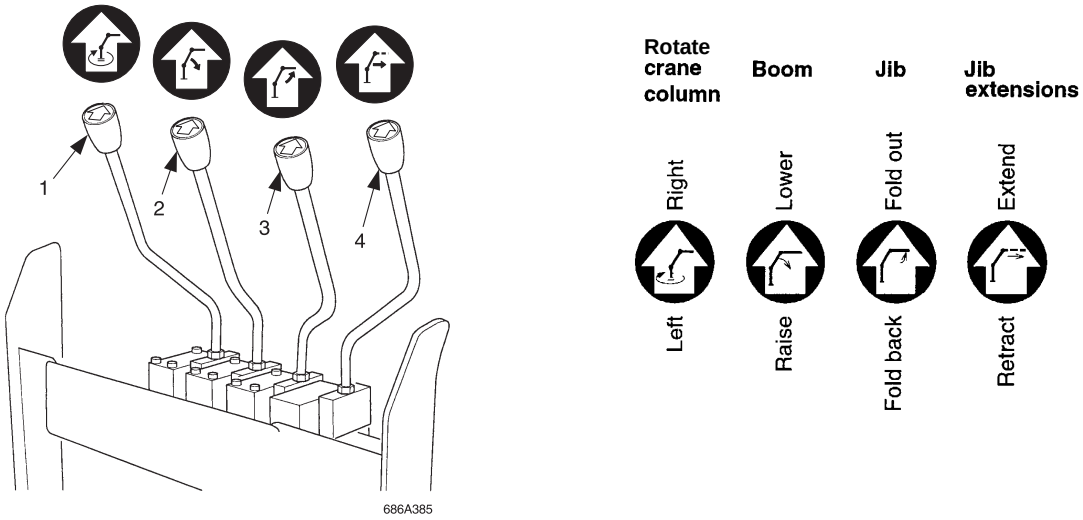


Figure 4.4 Crane Controls

4.6.5 Leveling the A-Frame

CAUTION

If the A-frame is not horizontal, the bridge modules will run at an angle making further module connection difficult and will accelerate the wear of the bridge wear pads when the bridge is boomed.

4.6.5.1 Check the level gauge on the lower A-frame cross member to confirm the A-frame is level, check that the A-Frame pin height is set within the correct range of pin holes as specified in Chapter 1 Section II Tables 1.8, 1.9 or 1.10.

4.6.5.2 Check the longitudinal slope of the slide frame to ensure that the slide frame is slightly angled either positively or negatively. If the slide frame is horizontal raise or lower the A-frame dependent on the ground slope to create a positive or negative slope on the slide frame.

4.6.5.3 If the A-frame is not level or within the specified hole range, at the A-frame controls on the centerline on the rear face of the A-frame cross member, extend the low side of the A-frame until the spirit level on the lower A-frame transverse beam indicates the A-frame is horizontal and within the required hole range.

4.6.5.4 Move the locking pin and the R clip to secure the stabilizer leg in position and retain the A-frame horizontal. Make sure the slide frame remains clear of the launch vehicle chassis.

4.6.5.5 At the A-frame controls on the centerline on the rear face of the A-frame cross member, lower the A-frame stabilizer leg until it sits on the locking pins.

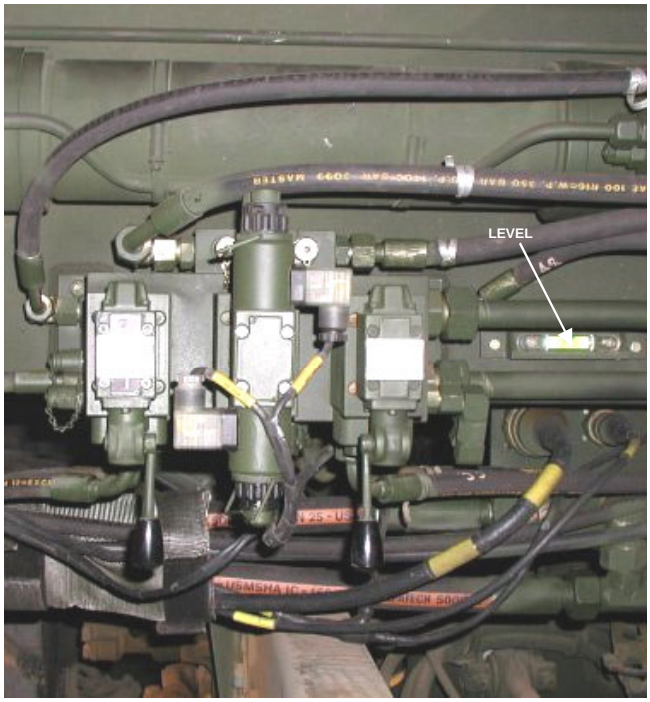


Figure 4.5 A-Frame Leveling Controls

4.6.6 Preparing the Slide Frame for Launch Beam Build

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

4.6.6.1 Send one crewmember up the center of the chassis to deploy the stowed walkways. The second crewmember is raised on the tail lift to the fixed walkway at the rear of the vehicle (under the launch frame) to un-strap and deploy the three loose walkways.

4.6.6.2 Remove the slide frame decking panels from the chassis well at the rear of the crane and the three panels located under the launch frame along with the tail lift guardrails.

4.6.6.3 Install the decking panels on the slide frame between the crane and the A-frame. Make sure the decking panels are in their correct locations.

4.6.6.4 Release the straps and R clips on the A-frame foldable walkways and lower the platform to its deployed position using the ladder for control.

4.6.6.5 Release the rubber catches, and fold out the two small walkways, insert the guard rail in its location hole.

4.6.6.6 Release the straps on A-frame vertical ladders and deploy them into position.

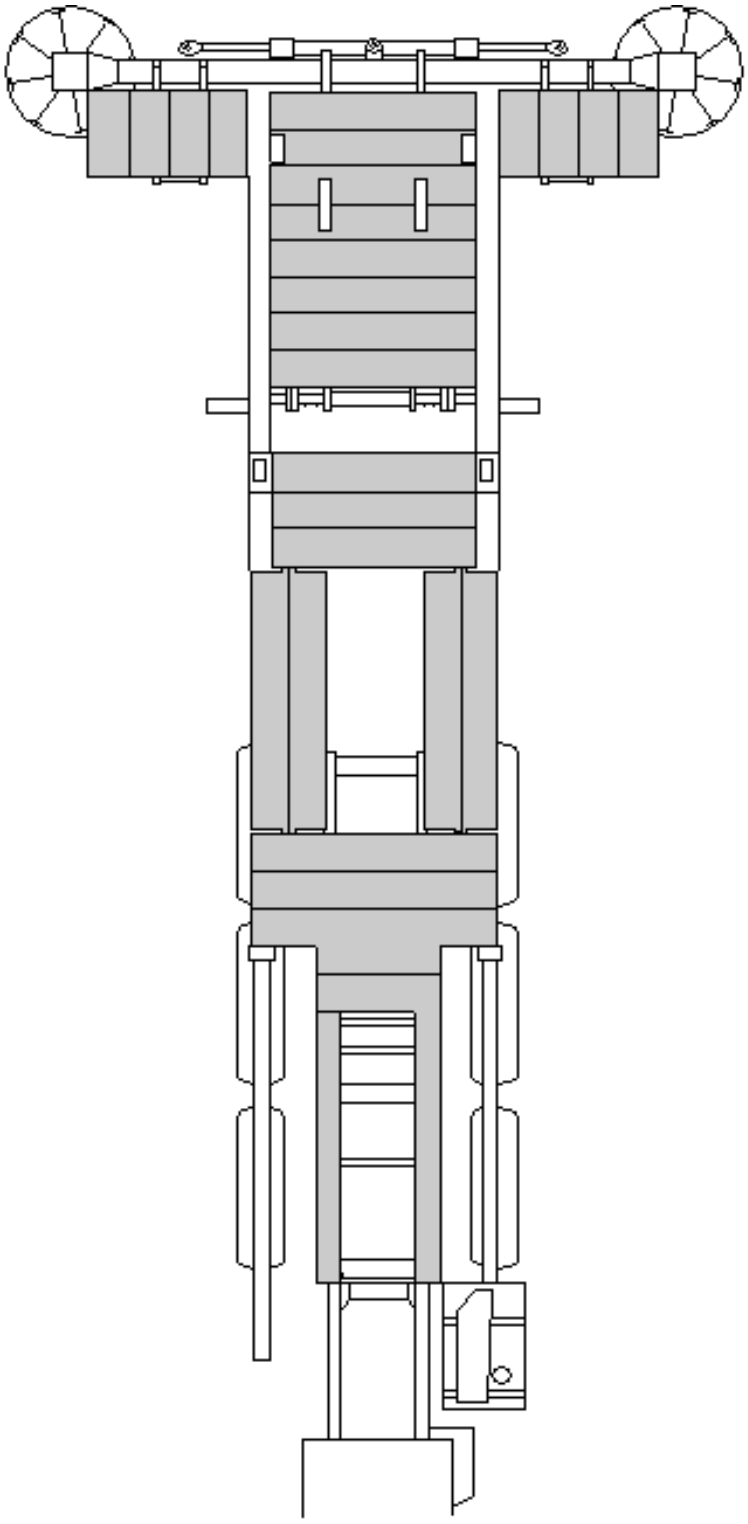


Figure 4.6 Positioning Walkways for Launch Beam Build

Section III. LAUNCH BEAM BUILD

4.7 LAUNCH BEAM BUILD

4.7.1 Preparation

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

CHEST PACK E-STOP OPERATION. IF THE CHEST PACK IS FITTED TO THE LAUNCH VEHICLE WHEN THE FOUR POSITION SWITCH, IN THE VEHICLE CAB, IS SET TO POSITION 2 THE CHEST PACK E-STOP BUTTON IS DISABLED. SHOULD IT THEN BE OPERATED IN AN EMERGENCY, ELECTRICAL POWER AND THUS HYDRAULIC POWER WILL NOT BE REMOVED FROM THE LAUNCHER. FAILURE TO HEED THIS INFORMATION COULD LEAD TO DEATH OR SEVERE INJURY TO PERSONNEL.

4.7.1.1 Un-strap load LVT and stow the straps in flatrack stowage bin.

4.7.1.2 Make sure the area within the crane-operating envelope is clear of personnel.

4.7.1.3 Operate the lift and traverse controls on the crane and position the crane hook above the stowage location for the launch beam lifter.

4.7.1.4 Remove the single leg sling, launch beam lifter and guide ropes from the stowage box on LVT.

4.7.1.5 Attach the single leg sling and the launch beam lifter to the hook of the crane.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

CAUTION

Operate the control levers in a smooth and considered manner. The speed of the working movements is determined by the degree to which the control lever is moved.

When operating the crane heed the symbols on the control levers.

NOTE

The first section of the launch beam, complete with the far bank support, is stored within the launch frame.

4.7.1.6 Operate the lift and traverse controls on the crane and position the launch beam lifter to lift the first launch beam module.

4.7.1.7 Connect the launch beam lifter to the first launch beam module to be connected at its lifting points ensuring it is correctly located and the locking latch is fully engaged.

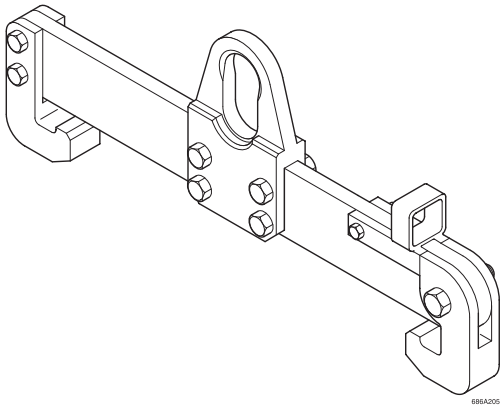
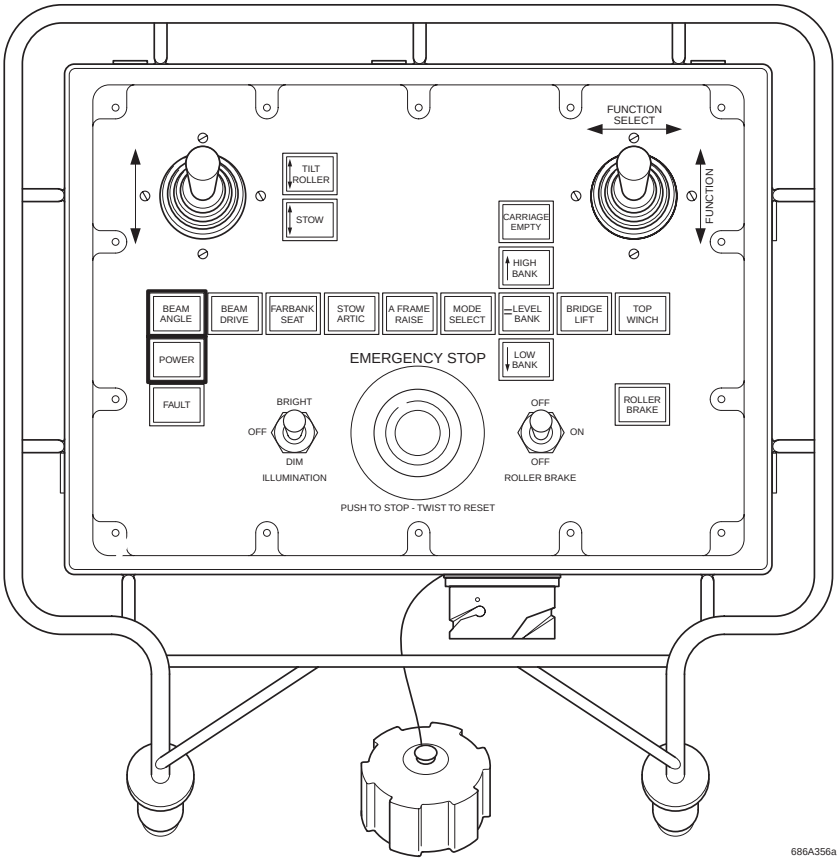


Figure 4.7 Launch Beam Lifter

4.7.1.8 Connect the tag lines to a handle at either end of the first launch beam module to be connected.

4.7.2 Connecting the Beam Modules

4.7.2.1 Ensure that the **POWER** and **BEAM ANGLE** captions are illuminated. If the **BEAM ANGLE** caption is not illuminated, move the joystick to the left until the **BEAM ANGLE** caption is illuminated.



Beam Angle Caption

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

4.7.2.2 Position pinning operatives on the decking panels of the slide frame at each side of the launch frame.

4.7.2.3 On the chest pack, move the joystick forward or rearward as necessary to adjust the launch beam angle to a suitable height for the pinner.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

4.7.2.4 Position the chest pack operator with a clear all-round view but clear of the traverse path of loads suspended from the crane before commencing launch beam deployment.

NOTE

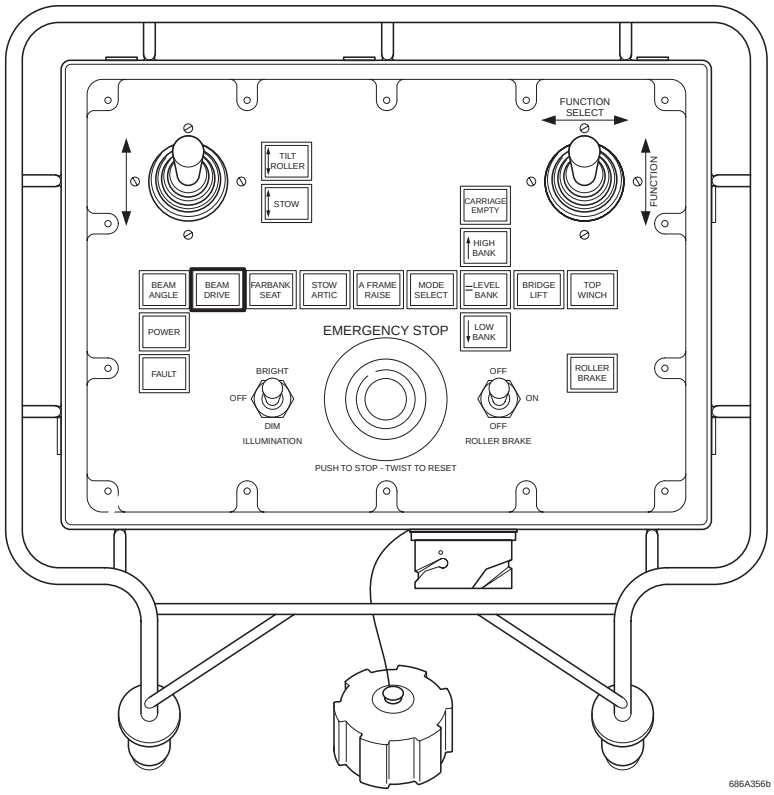
It may be necessary to carry out steps 4.7.2.6 and 4.7.2.7 to remove the locking pins.

4.7.2.5 Remove the R clip and the locking pin to release the launch beam final stop.

NOTE

Carry out the following TWO STEPS ONLY if difficulty is experienced removing the locking pin.

4.7.2.6 On the chest pack, move the joystick to the right to select the beam drive function. Make sure the **POWER** and **BEAM DRIVE** captions on the chest pack display illuminate.



Beam Drive Caption

4.7.2.7 On the chest pack, move the joystick forward and rearward as necessary to release the locking pin.

4.7.2.8 Position the pinning operatives in the shelter of the launch frame during slinging operations.

4.7.2.9 Ensure lifting sling is vertical in both directions.

WARNING

CRUSH HAZARD. THE LOAD MAY FALL FROM THE CRANE, IF A LOAD IS LIFTED WITHOUT FIRST ENSURING THAT THE LIFTING SLINGS ARE CENTERED OVER THE LOAD IN BOTH DIRECTIONS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO DEATH OR SERIOUS INJURY TO PERSONNEL.

4.7.2.10 Operate the lift and traverse controls on the crane and, using the tag lines, locate the next launch beam module into position at the launch frame.

4.7.2.11 Position the suspended launch beam module to align its upper jaws with those of the module held in the launch frame.

WARNING

CRUSH HAZARD. PERSONAL INJURY CAN RESULT IF EXTREME CAUTION IS NOT USED WHEN INSTALLING THE BEAM CONNECTING PINS. KEEP HANDS AND FINGERS CLEAR OF PIN HOLES AND COMPONENTS BEING MOVED OR CONNECTED.

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF CRANE OR LIFTING BEAM FAILURE. DO NOT STAND UNDER LOADS SUSPENDED FROM THE CRANE.

CAUTION

Damage to pins and pinholes can result if undue force is used to insert the connecting pins. Do not hammer the pins into position in the upper jaws.

4.7.2.12 Insert the launch beam connecting pin into the upper jaws, with the flat of the pin head against the block on the beam and secure it with an R clip. (Refer to Figure 4.8). ■

Figure 4.8 Beam pin fitted to beam with flat against block on the beam

4.7.2.13 Operate the lower controls from the crane and align the lower jaws to engage with those of the launch beam held in the launch frame. Continue lowering until the single leg sling just goes slack.

4.7.2.14 Disconnect the launch beam lifter and the front tag line from the connected launch beam module.

4.7.2.15 Insert the launch beam connecting pin into the lower jaws, with the flat of the pinhead against the block on the beam, and secure with an R-clip.

NOTE

Providing the single leg sling is slack, the guide system on the launch beam will ensure correct alignment for pin insertion.

4.7.2.16 Operate the traverse and raise/lower controls on the crane and reposition the launch beam lifter to attach the next launch beam module.

4.7.2.17 Connect the launch beam lifter and tag lines to the next launch beam module.

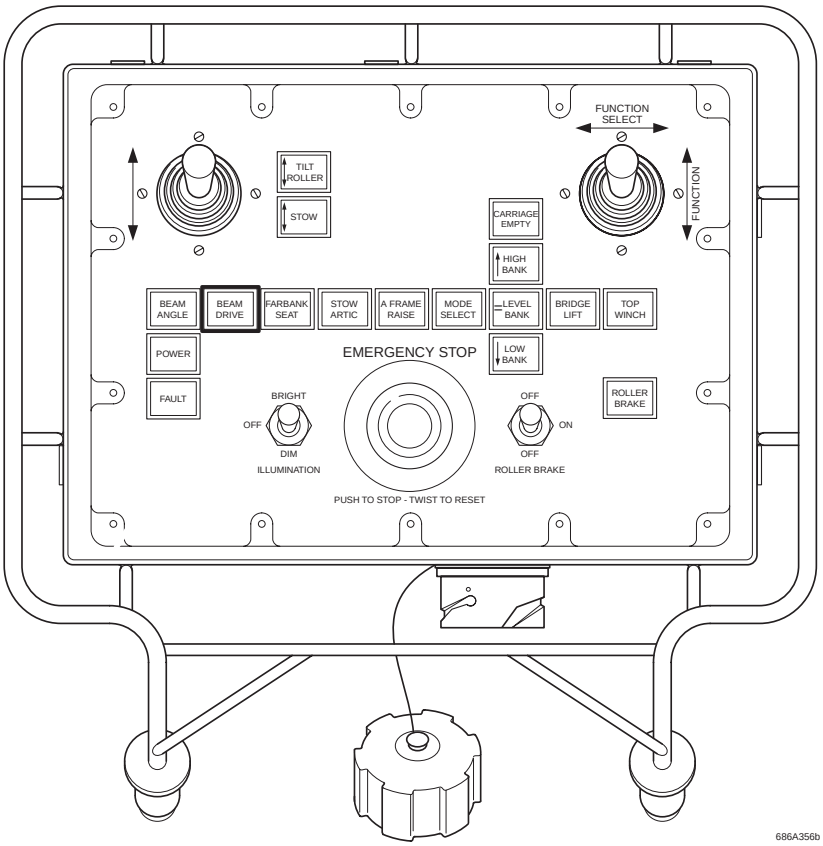
4.7.2.18 On the chest pack, move the joystick to the right once to select the beam drive function. Make sure the **POWER** and **BEAM DRIVE** captions on the chest pack display illuminate.

NOTE

To aid the pinner in removing the rear steadying rope it is advantageous if the launch beam drive is stopped 2 feet (0.6 m) before the beam reaches its final position.

4.7.2.19 Remove the rear tag line from the launch beam handle.

4.7.2.20 On the chest pack, move the joystick forwards to advance the connected launch beam modules.



Beam Drive Caption

CAUTION

Take care not to overshoot the beam maximum forward position or damage may occur. The travel stop provided is for emergency use only.

4.7.2.21 Release the joystick when the rear jaws of the last launch beam connected still protrude 5.5 in (140 mm) from the rear of the launch frame and the lever arm has dropped into position. Make sure the launch beam slows and then stops in this position.

NOTE

The launch beam is now correctly positioned to receive the next launch beam module.

4.7.2.22 Repeat steps 4.7.2.10 through 4.7.2.21 until all the launch beam modules are connected and the launch beam spans the gap. A total of 4 beams should be added for a 20 m (65.61 ft) bridge and 7 for a 40 m (131.23 ft) bridge.

WARNING

CRUSH HAZARD. FAILURE TO INSTALL THE FINAL LOCKING PIN AND ITS R CLIPS WILL CAUSE THE LAUNCH BEAM TO FLEX AND CREEP BACKWARDS. FAILURE TO HEED THIS INSTRUCTION COULD RESULT IN SEVERE PERSONAL INJURY.

4.7.2.23 Install the final locking pin and its R clip to engage the launch beam final stop.

NOTE

It may be necessary to carry out steps 4.7.2.6 and 4.7.2.7 to install the locking pins.

4.7.3 Lowering the Far Bank Support

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

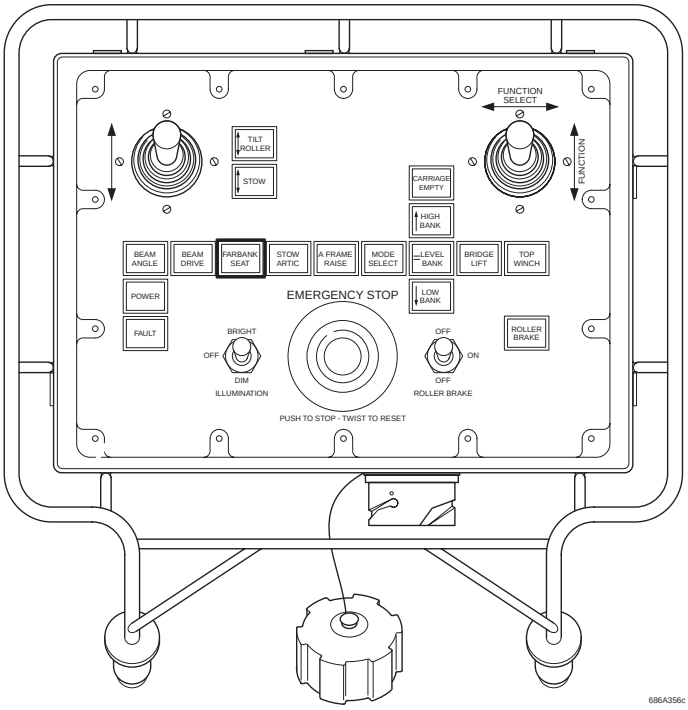
HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

4.7.3.1 On the chest pack, move the joystick to the right. Make sure the **POWER** and **FAR BANK SEAT** captions on the chest pack display illuminate.

4.7.3.2 On the chest pack pull the joystick rearward to extend the articulator cylinders and thus lower the far bank support to the ground.

4.7.3.3 On lowering the far bank support to the ground, make sure the far bank support tell-tail indicator flags deploy.

4.7.3.4 If the indicator flags do not deploy, raise and lower the far bank support again.



Far Bank Seat Caption

NOTE

If on the second deployment of the far bank support only one flag deploys continue build. If no flags are seen then abort mission and retrieve the launch beam and launch vehicle.

4.8 PREPARATION FOR BRIDGE BUILD

4.8.1 Preparation for Parallel Module Deployment

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

4.8.1.1 Make sure the area within the crane operating envelope is clear of personnel. Operate the controls on the crane or from the chest pack to lower the crane hook to the ground.

4.8.1.2 Disconnect the launch beam lifter and the single leg sling from the crane and remove it to a safe stowage area.

4.8.1.3 Remove all required loose items from the basket on flatrack (LVT).

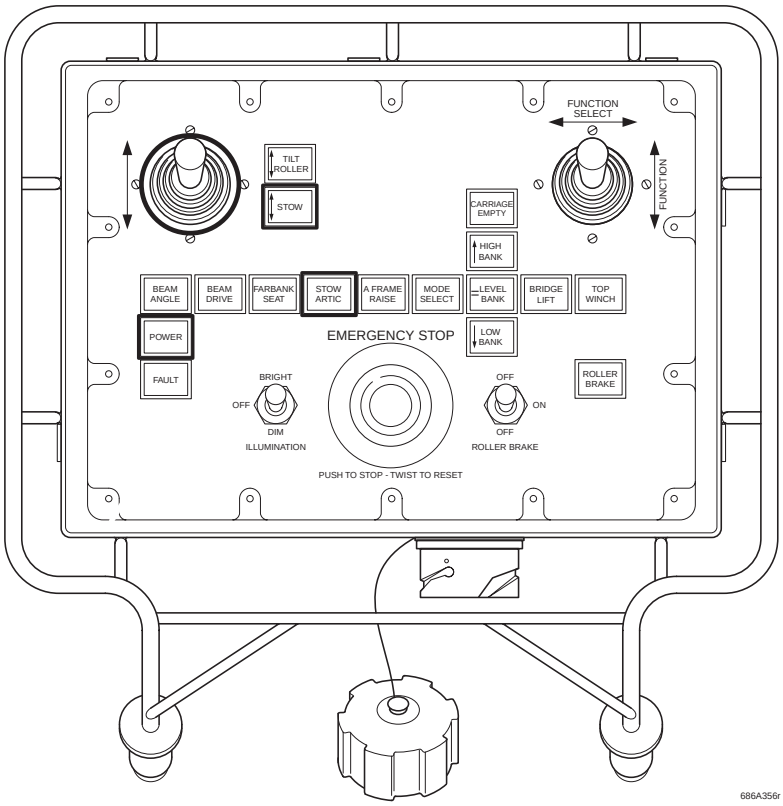
4.8.1.4 Position two removable rollers and one end beam guide on the ground down each side of the launch vehicle.

4.8.2 Stowing the Launch Frame Articulator Cylinders

4.8.2.1 Continue to extend the articulator cylinders in the **FAR BANK SEAT** mode until the articulator cylinder shootbolts can be released, and then fully retract the shootbolts.

4.8.2.2 On the chest pack, move the joystick forward to retract the articulator cylinders. Release the joystick when the cylinders are fully retracted.

4.8.2.3 On the chest pack, move the joystick once to the right to select the **STOW ARTIC** function. Make sure the **POWER, STOW ARTIC** and **STOW** captions on the chest pack display illuminate.



Stow Articulator Caption

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

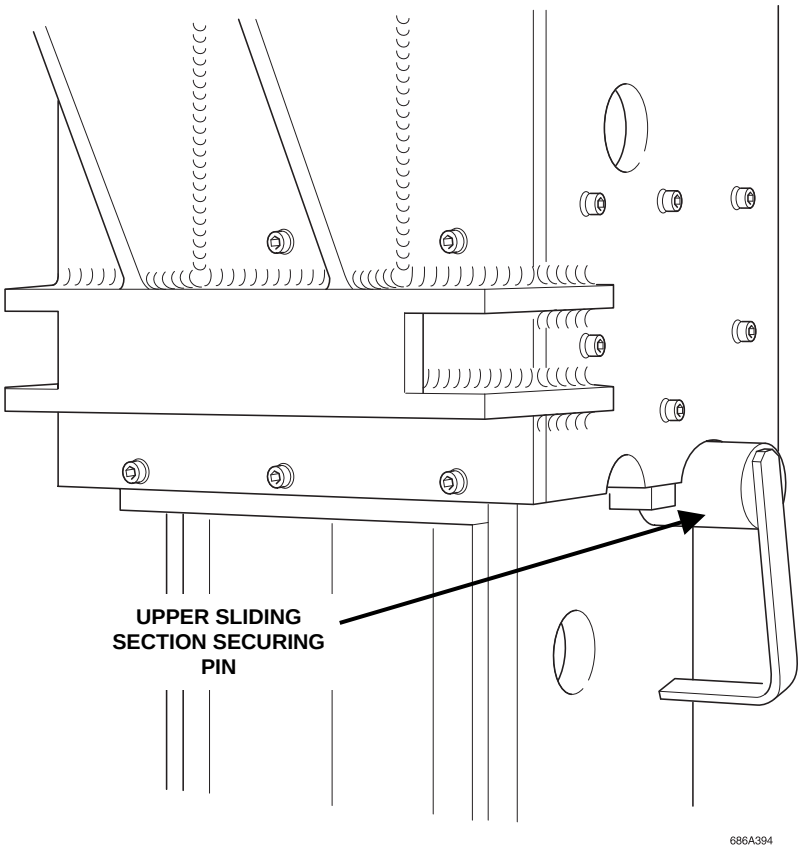
CRUSH HAZARD. PERSONNEL MUST BE CLEAR OF THE ARTICULATOR CYLINDERS DURING STOWING. INADVERTENT USE OF THE ARTICULATOR CYLINDER EXTEND FUNCTION MAY CAUSE THE ARTICULATOR STOW CYLINDERS TO FAIL. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY TO PERSONNEL.

4.8.2.4 In the forward left hand corner of the chest pack, move the joystick forward to retract the articulator stowing cylinders. Make sure the articulator stowing cylinders fully retract.

4.8.3 Raising the A-frame

4.8.3.1 On the chest pack, move the joystick once to the right. Make sure the **POWER** and A-frame **RAISE** captions on the chest pack display illuminate.

4.8.3.2 Remove the R clips and the pins securing the A-frame upper sliding section in the lower position.



A-Frame Upper Sliding Section Securing Pin

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

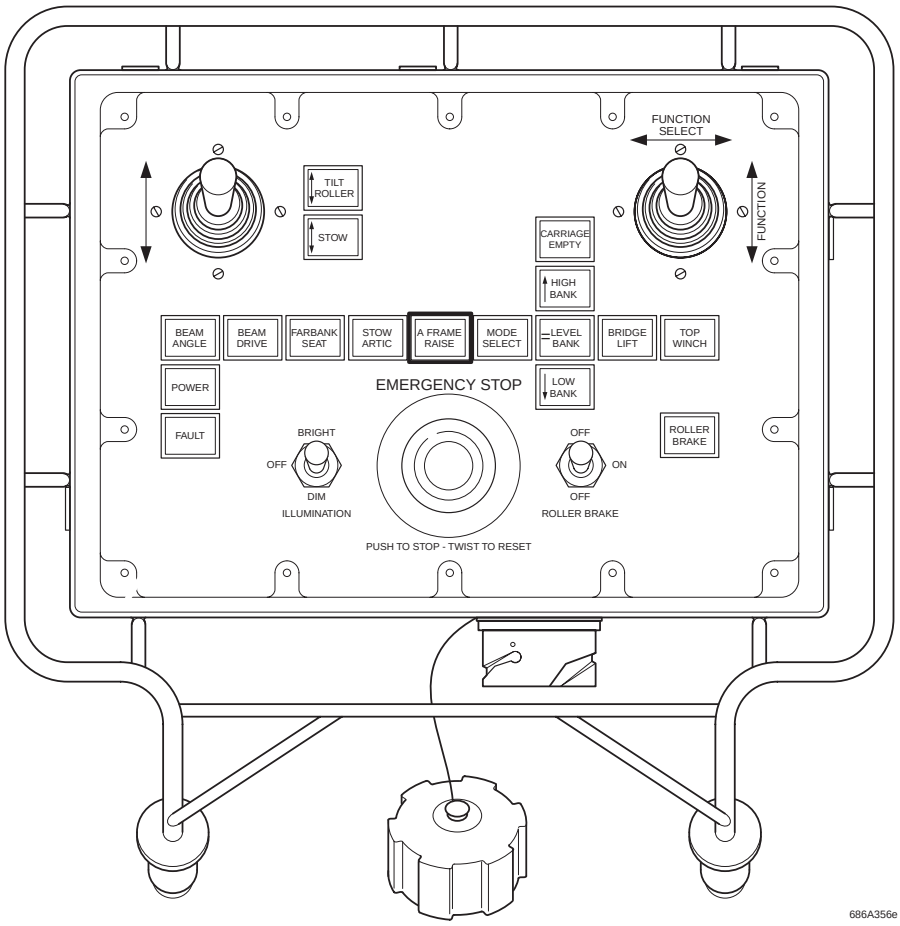
HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

CAUTION

Ensure that the A-frame ladders have been deployed before raising the A-frame. Failure to observe this instruction will result in damage to the A-frame ladders.

4.8.3.3 Hold A-frame ladders outwards and off the ground to prevent damage to ladders.

4.8.3.4 On the chest pack, move the joystick forwards to raise the A-frame and provide clearance for the parallel modules to pass. Make sure the A-frame raise cylinders extend and raise the A-frame to the upper sliding section.



A-frame Raise Caption

NOTE

The choice of locking pinholes to be used during bridge build in the A-frame stabilizer legs is determined during the site reconnaissance stage.

4.8.3.5 Release the joystick when the A-frame has been raised above the pre-selected hole and insert the locking pins and R clips. (For pinhole selection, see Chapter 1 Section II Table 1. 5 Upper A-frame Setting).

NOTE

A choice of two hole locations to secure the A-frame in the upper position is available. The holes located at the lower positions are used if the launch beam slopes from the horizontal to a higher far bank. The holes located at the upper positions are used if the launch beam slopes from the horizontal to a lower far bank.

4.8.3.6 On the chest pack, move the joystick rearwards to lower the A-frame until it sits on the locking pins.

4.8.3.7 Lift the A-frame supports and rotate them down to their stowed position.

4.8.3.8 Reconfigure the decking and walkway panels above the slide frame for parallel module deployment (see Figure 4.9).

4.8.3.9 Remove the two guardrails from the A-frame folding walkways and place them on the walkway below the launch frame.

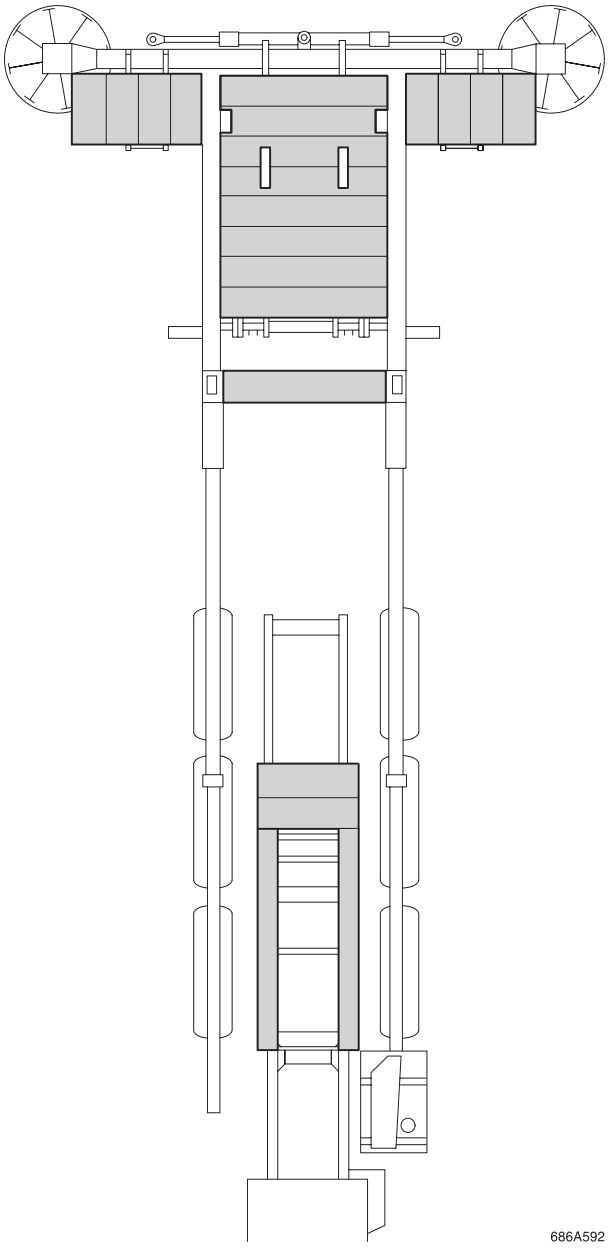


Figure 4.9 Slide Frame Decking Positions for Bridge Build

Section IV. BRIDGE BUILD

4.9 BRIDGE BUILD

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

4.9.1 Assembling the Far Bank Ramp Module

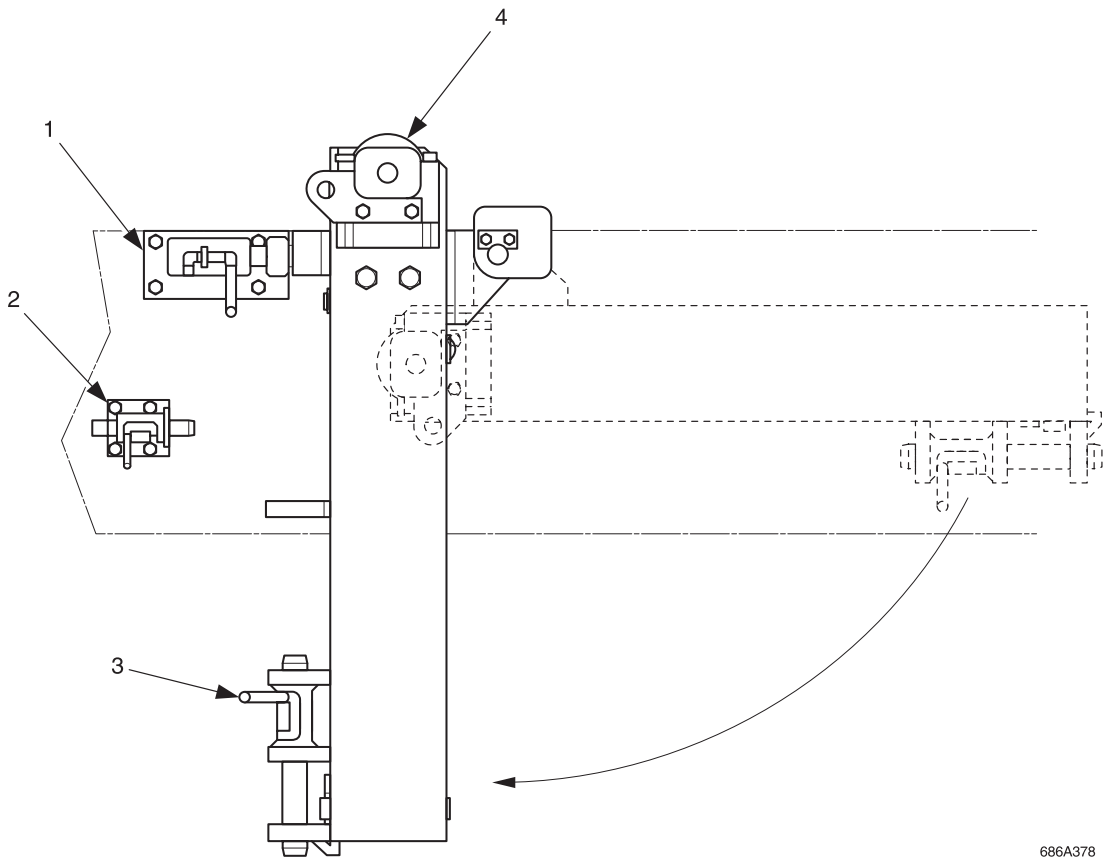
4.9.1.1 Install the removable rollers on the center two sections of the slide frame at the four positions marked on the inside of the slide frame in white. Ensure the rollers are fitted so that the roller sits on the outside of the slide frame.

Slide Frame Roller Fitted to Slide Frame

4.9.1.2 Position the two end beam guides on section 3 of the slide frame, ensuring that they are correctly located and that the pivot arms are rotated up.

WARNING

CRUSH HAZARD. TAKE CARE DURING DEPLOYMENT OF THE TILT ROLLERS, THE TILT ROLLERS WEIGH 114 LB (52 KG) AND COULD CAUSE INJURY TO PERSONNEL.



Tilt Roller Shootbolt Positions

4.9.1.3 Remove the lower shootbolt (2) securing the tilt roller head (4) in position.

4.9.1.4 Rotate the tilt roller head (4) outwards.

4.9.1.5 Remove tilt roller leg shootbolt (3) whilst supporting the weight of the tilt roller assembly.

4.9.1.6 Rotate the tilt roller assembly to the vertical position.

4.9.1.7 Secure in the vertical position with upper shootbolt (1).

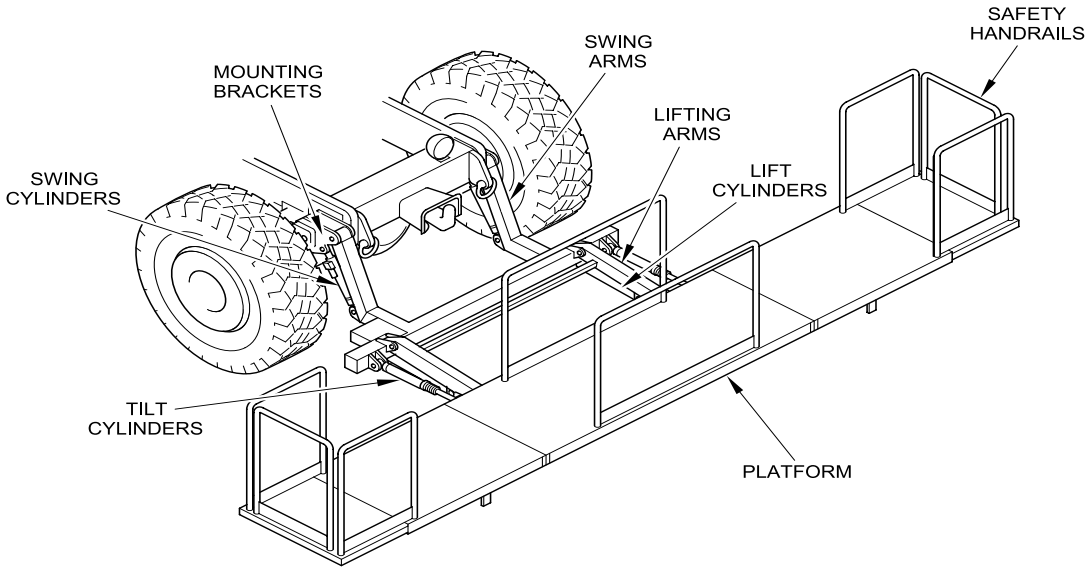
4.9.1.8 Fold out the folding sections of the tail lift platform, extend the sliding sections of the tail lift and erect the guardrails.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

4.9.1.9 Operate the lift and traverse controls on the crane and position the crane to lift the far bank end beam from the flatrack T1.

4.9.1.10 Retrieve the two lifting slings and sling the end beam, refer to Figure 4.10. Each sling is to be attached around the beam at the bridge lifting points to ensure a straight lift.



Tail lift Fully Deployed

CAUTION

To prevent damage to the lifting slings it is important that care is exercised when connecting the slings to the crane hook. Ensure that the sling is fitted correctly and does not become trapped by the hook safety clip.

4.9.1.11 Attach both slings to the crane hook.

4.9.1.12 Connect a tag line to the far bank end beam by passing a loop of rope through the pinning hole and securing with the snap hook.

End Beam Slings Positioned

Tag Rope Positioned

Figure 4.10 Method of Connecting Slings and Tag Rope to End Beam

4.9.1.13 Operate the lift and traverse controls on the crane and lift the far bank end beam from flatrack T1 into position on the end beam guides on the launch vehicle. Ensure that the gutter faces the far bank and that the location lugs on the end beam locate on either side of the end beam guide arms.

4.9.1.14 Disconnect the slings and tag lines from the far bank end beam.

4.9.1.15 Operate the lift and traverse controls on the crane and position the crane to lift the near bank end beam from the flatrack T1.

4.9.1.16 Connect a tag line to the home bank end beam.

4.9.1.17 Operate the lift and traverse controls on the crane and lift the near bank end beam from flatrack T1 into position on the ground between flatrack T1 and flatrack V1.

4.9.1.18 Remove the wooden blocks from flatrack T1 and place on the ground.

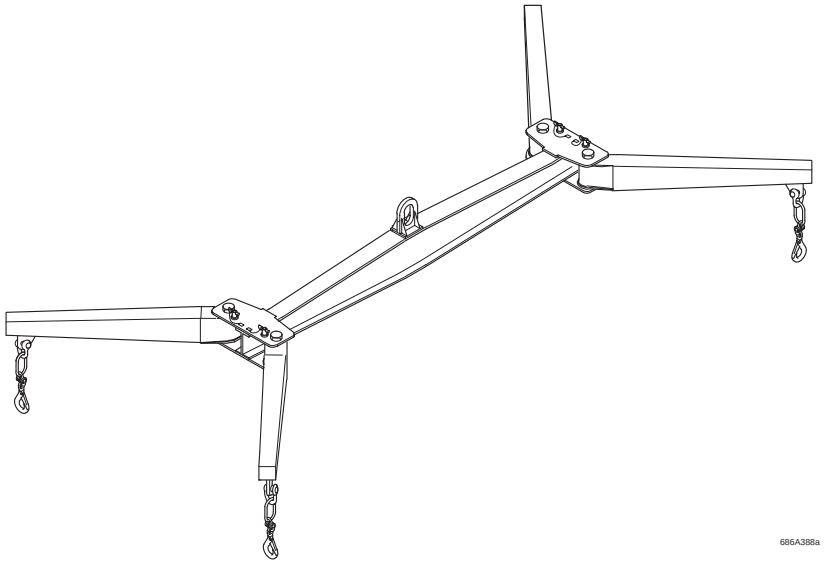
4.9.1.19 Remove the tag lines from the home bank end beam.

4.9.1.20 Operate the lift and traverse controls on the crane and position the crane to lift the module lifting beam from flatrack LVT.

4.9.1.21 Attach the single leg-lifting sling to the crane hook and connect the sling to the module lifting beam.

4.9.1.22 Operate the lift controls on the crane and lift the module lifting beam so that it can be adjusted to its widest setting.

4.9.1.23 Adjust the module lifting beam to its widest setting. Ensure that all the shootbolts are fully inserted and locked.



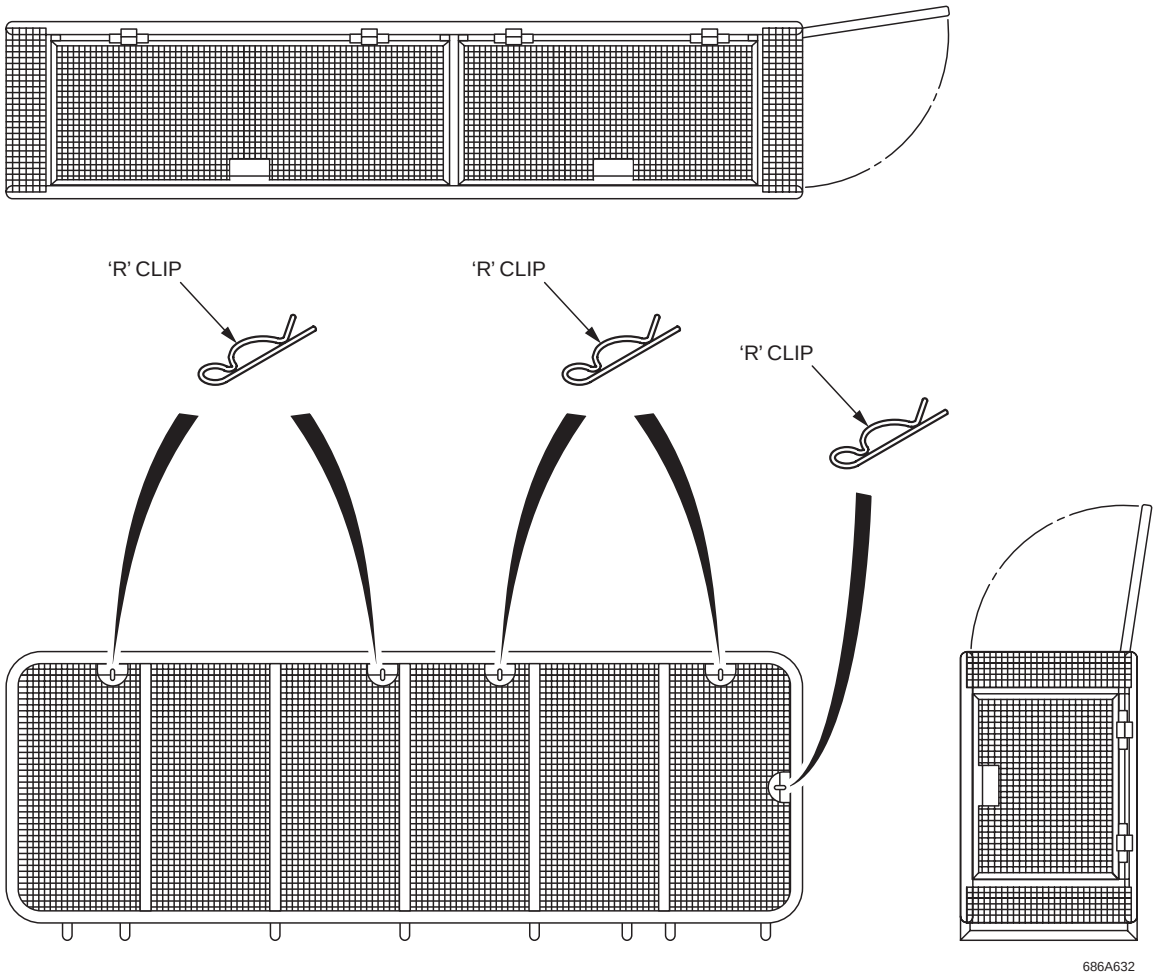
Module Lifting Beam In Widest Position (Opening Modules)

Figure 4. 11 Module Lifting Beam

4.9.1.24 Operate the lift and traverse controls on the crane and position the crane to lift the far bank ramp module from the flatrack V1.

4.9.2 Replace Flatrack LVT

4.9.2.1 Strap down the launch equipment storage box to LVT flatrack ensuring that the R clips have been inserted in the doors. Ensure all required loose items have been removed for bridge building.



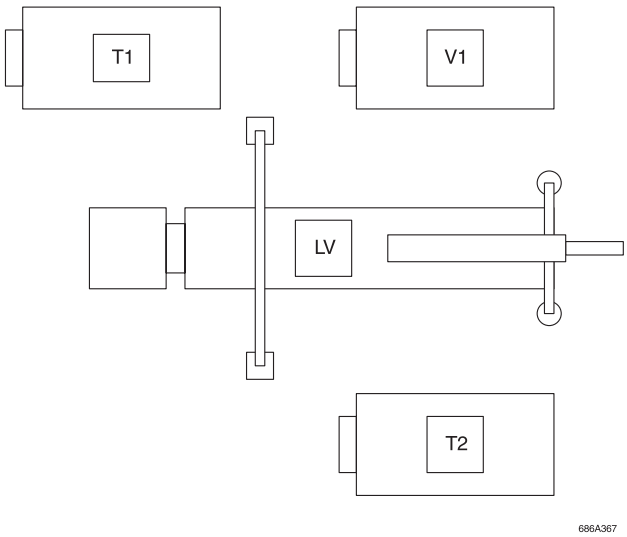
4.9.2.2 Reverse vehicle V3 with its left hand wheels along the left hand tire alignment line and load flatrack LVT.

4.9.2.3 Return vehicle V3 and flatrack LVT to staging area and ground load flatrack LVT.

4.9.2.4 Transload flatrack T2 onto V2.

4.9.2.5 Drive vehicle V2 with flatrack T2 onto bridge site.

4.9.2.6 Reverse vehicle V2 with its left hand wheels on the left hand tire alignment line and ground load flatrack T2 in line with V1 on the opposite side.

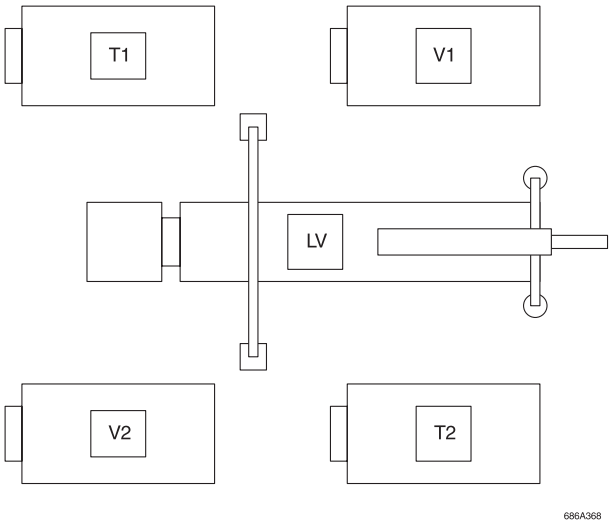


Position of Flatracks

4.9.2.7 Load flatrack V2 onto vehicle V1 at staging area.

4.9.2.8 Drive vehicle V1 and flatrack V2 to bridge site.

4.9.2.9 Reverse vehicle V1 with its left hand wheels on the left hand tire alignment line and ground load flatrack V2 into position in front of flatrack T2.



Position of Flatracks

NOTE

Flatrack loads V2 and T2 are identical with both flatracks carrying parallel modules only. All parallel modules are identical and may be positioned in the bridge in any order. To stop parallel modules being craned high and over other flatrack loads the parallel modules from the flatrack nearest the gap (T2) should be used first. Once empty the parallel modules from the flatrack furthest from the gap (V2) can be craned into position over the now empty flatrack.

4.9.2.10 Un-strap flatrack loads T2 and V2.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

CAUTION

To prevent damage to the lifting slings it is important that care is exercised when connecting the slings to the crane hook. Ensure that the sling is fitted correctly and does not become trapped by the hook safety clip.

NOTE

When lifting bridge modules, connect both steadying rope lines to the side it is being built from. If building from the right attach both rope lines to the right hand side, if building from the left attach both lines to the left hand side.

4.9.2.11 Connect the bridge module lifter at POSITION 2 to the far bank ramp module and tag lines to the far bank ramp module handle and through an end beam pinning hole.

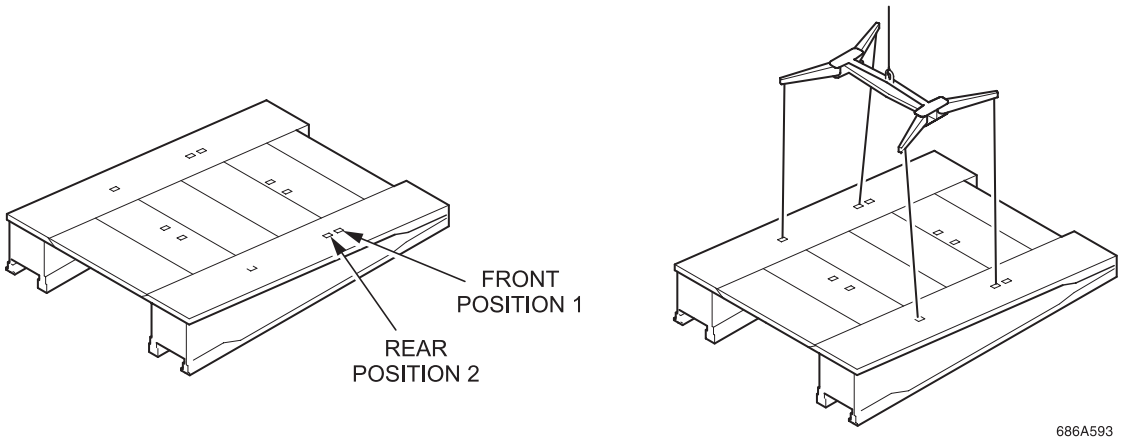


Figure 4.12 Bridge Lifter Fitted to POSITION 2 of Ramp Module

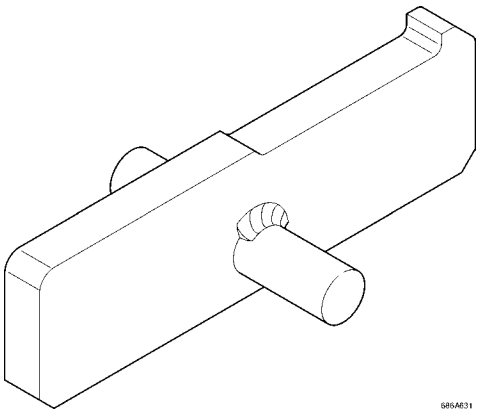
4.9.2.12 Operate the lift controls on the crane and lift the far bank ramp module from flatrack V1. Make sure the module opens slowly and progressively as it is lifted by the crane. Do not operate the traverse controls of the crane until the ramp module is clear of the flatrack load.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

4.9.2.13 Operate the lift and traverse controls on the crane and, using the tag lines, guide the far bank ramp module into position over the far bank end beam.

4.9.2.14 Remove and stow the four transportation aides, two per side, from in between the deck units of the remaining parallel module on the flatrack. The brackets are located between the deck units through which the closing slings are accessed.



Parallel Module Transport Aid

4.9.2.15 Retrieve two end beam pins from loose items removed from LVT basket.

WARNING

CRUSH HAZARD. WHEN JOINING THE END BEAM AND RAMP MODULE, THE PERSONNEL OPERATING THE END BEAM WRENCHES MUST ENSURE THAT BOTH OF THEIR HANDS ARE KEPT CLEAR OF THE RAMP MODULE AND END BEAM INTERFACE. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY.

4.9.2.16 Attach the end beam wrenches to the end beam gutter, one at each end and remove the tag line from end beam pinhole on the ramp module.

Figure 4.13 End Beam Wrench and Operation

NOTE

Slight retraction of the crane jib may be required during end beam connection to stop the end beam from being pulled off its guides.

4.9.2.17 Position personnel on the drivers side of the vehicle ensure that the ramp module is lowered squarely, this is best being done by watching the angle of the single leg sling and signaling the crane operator as necessary.

4.9.2.18 Align the ramp module with the guide on the end beam and slowly lower the ramp module until the two are fully engaged.

4.9.2.19 Insert the end beam connecting pins and secure them by twisting to lock.

4.9.2.20 Disconnect the bridge module lifter from the position 2 lifting points on the far bank ramp module.

4.9.2.21 Operate the lift and traverse controls on the crane and position the bridge module lifter for attachment to the far bank approach ramps and frames on flatrack T1.

4.9.2.22 Remove the end beam wrenches and stow.

4.9.2.23 Add ramp lead in brackets to ramp module ensuring that the arrows on the ramp and bracket point in the same direction, secure with R clips (See Figure 4.14).

Figure 4.14 Ramp Module Lead in Bracket

CAUTION

To prevent damage to the lifting slings it is important that care is exercised when connecting the slings to the crane hook. Ensure that the sling is fitted correctly and does not become trapped by the hook safety clip.

4.9.2.24 Connect the bridge module lifter to the lifting ring of the top pair of approach ramp frames (far bank approach ramps) ensuring all frame-to-frame hooks are correctly engaged, refer to Chapter 3 Para 3.9.11 Approach Ramp Transport Frame.

4.9.2.25 Attach tag lines to upper frame strap lugs.

4.9.2.26 Operate the lift and traverse controls on the crane, and using the tag lines to control the load, lower the far bank approach ramp frame into position, to the left of the approach ramp module centerline at the marked position, ensuring that the location lugs on the bottom of the frame sit between the deck units.

4.9.2.27 Disconnect the wire ropes on the lower section of the approach ramp frame from the upper lifting points on the top section of the frame and stow inside frame.

4.9.2.28 Operate the lift and traverse controls on the crane, and using the tag lines to control the load, lift the upper section of the approach ramp frame, together with its five approach ramps, into position to the right of the far bank ramp module centerline. Ensure that the location lugs on the bottom of the frame sit between the deck units.

4.9.2.29 Disconnect the tag lines and the bridge module lifter from the upper section of the approach ramp frame.

4.9.2.30 Operate the lift and traverse controls on the crane and lower the bridge module lifter onto the parallel module on flatrack V1.

4.9.2.31 Connect the bridge module lifter to the bridge module and connect tag lines to a handle at either end of the module.

4.9.2.32 Disconnect the single leg sling and module lifting beam from the crane hook.

4.9.2.33 Operate the lift and traverse controls on the crane and position the crane hook at the far bank ramp module push/pull sling.

4.9.2.34 Unhook the push sling from the stowed position and connect the crane hook to the push/pull sling on the far bank ramp module.

4.9.2.35 Lower the end beam guide arms by rotating them inwards and down.

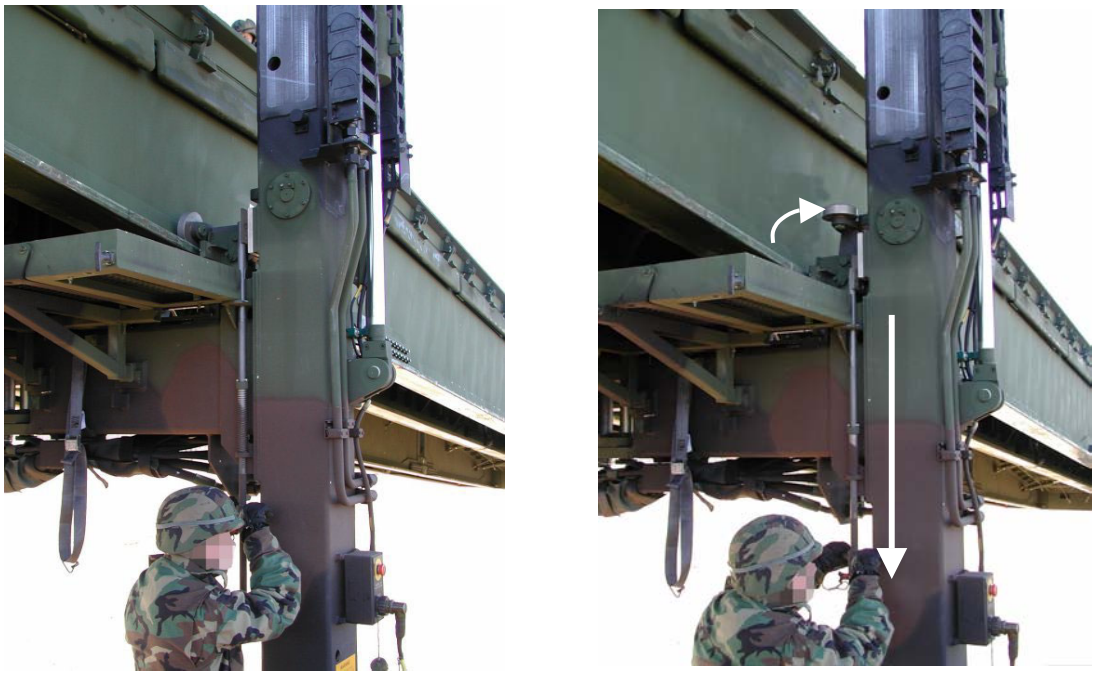
4.9.2.36 Operate the boom controls on the crane and push the far bank ramp module towards the home bank carriage attachment position.

4.9.2.37 Operate the boom controls on the crane and continue to push the far bank ramp module until the end beam of the far bank ramp module approaches the bridge stops emergency.

CAUTION

Take care not to push the far bank ramp module beyond the far bank carriage attachment position and ensure that the crane jib does not hit the launch beam storage rack.

4.9.2.38 Pull down on both handles to release the bridge stops emergency (Figure 4.15) and continue to push the far bank ramp module until it is correctly positioned to attach the far bank carriage. Release the bridge stop emergency once the ramp front end has passed the stop.



Bridge stop emergency in down position **Bridge stop emergency in raised position**

Figure 4.15 Operation of Bridge Stop Emergency

WARNING

FALL HAZARD. PERSONNEL ON TOP OF THE BRIDGE MUST WEAR THE SAFETY HARNESS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY.

4.9.2.39 Position a person wearing a safety harness on top of the module ensure harness lanyard is securely connected to A-frame top cross member.

CAUTION

Slings should not be pulled should they become snagged, but lifted off the carriage shootbolts. Damage to equipment could result if this instruction is not followed.

4.9.2.40 Lift the far bank carriage lifting slings from their stowed position over the carriage shootbolts.

4.9.2.41 Remove the R clip from the sling retractable pin and retract the pin.

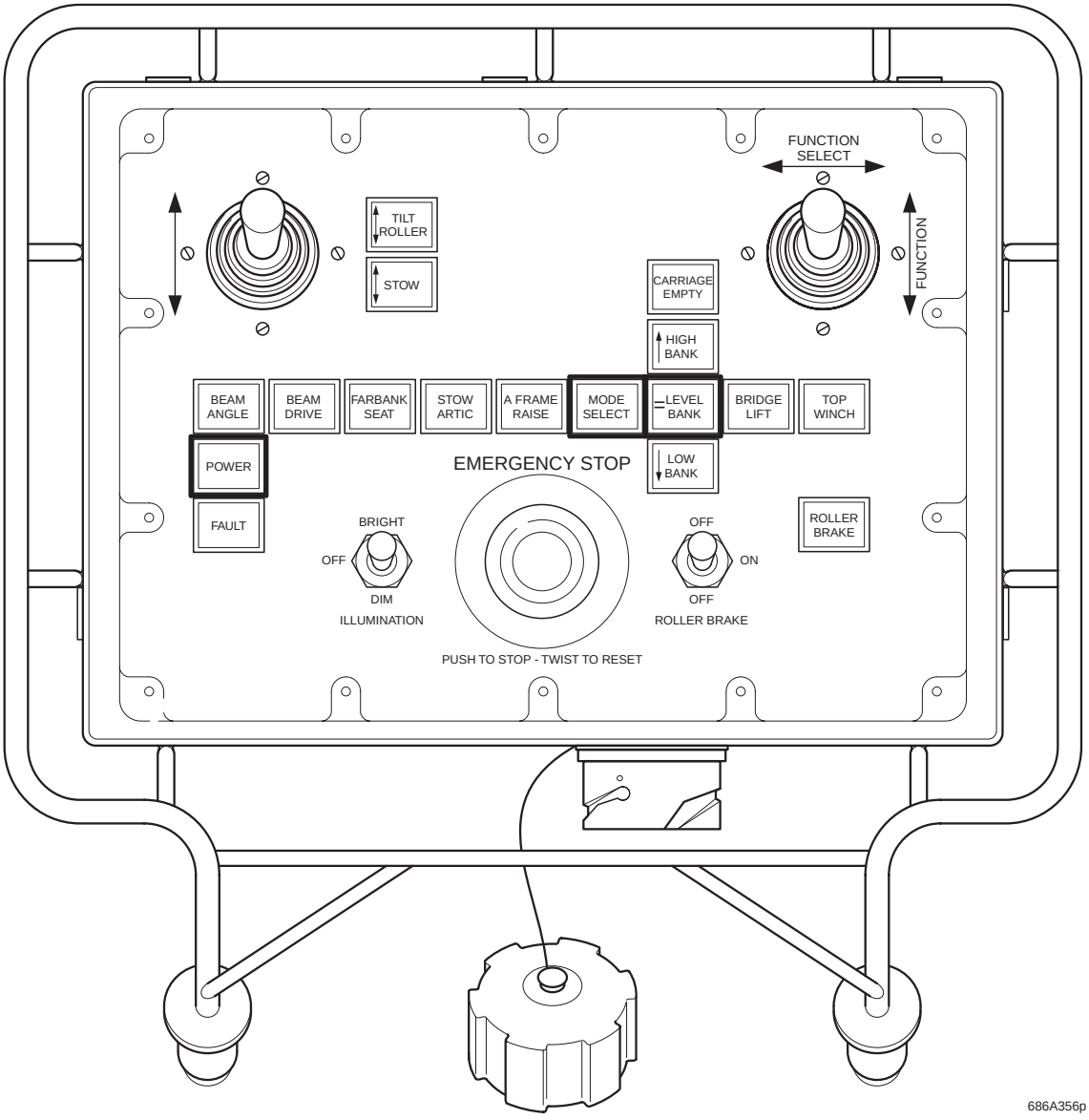
4.9.2.42 Route the carriage slings through the end beam bridge lifting points and re-connect the sling to the carriage. Ensure that the sling straps do not cross.

4.9.2.43 Make sure the sling retractable pin is fully located and secured with the R clip.

NOTE

Do not detach the crane from the ramp module until the far bank carriage has been attached and secured.

4.9.2.44 On the chest pack, move the joystick to the right or left until the **POWER** and **LEVEL BANK** captions on the chest pack display illuminate and the caption **MODE SELECT** flashes.



Level Bank Caption

4.9.2.45 On the chest pack, ensure that the appropriate bank condition dependent on home bank slope condition is selected.

NOTE

During bridge build it is important that the correct build mode is selected, the mode required will be determined by the height of the far bank:

Far bank above the home bank: **HIGH BANK**

Far bank below the home bank: **LOW BANK**

Far bank at the same height as the home bank: **LEVEL BANK**

If during bridge build in HIGH BANK mode, a situation arises where the chest pack FAULT light and the TOP WINCH light flash simultaneously, this is an indication that the top winch cable has become slack. The software controlling the system will stop the top winch from paying out any more cable. To rectify the condition the chest pack operator should carefully move the right hand joystick rearward to pay in cable until the top winch cable is re-tensioned and the fault condition is removed. Should this condition occur, it should be confirmed that the correct build mode has been selected for bridge build, i.e. is HIGH bank being used in a LEVEL bank situation?

During the early stages of a bridge build the bank condition selected on the chest pack may differ from that selected during site reconnaissance. The launcher itself may be on an incline. This would require the bridge to be pulled up an incline before its center of gravity passes the A-frame and the bridge then slopes down hill. For the first two modules the bridge build selections are:

Slide frame slopes down: **Low bank**

Slide frame slopes up: **High bank**

Slide frame level: **Refer to Chapter 4 Section 4 paragraph 4.6.5.2**

4.9.2.46 On the chest pack, move the joystick forward/rearward once to set the appropriate build condition as described above.

4.9.2.47 Move the joystick once to the right to confirm the setting and make sure the **POWER** and the required bridge drive logic **HIGH** or **LOW** captions are illuminated and the **MODE SELECT** caption goes off. Make sure the **TILT ROLLER** caption in the forward left corner of the chest pack illuminates/flashes.

4.9.2.48 If required move the chest pack right-hand joystick slowly forward to move the far bank carriage so that any slack in the bridge lifting slings is removed.

4.9.2.49 Disconnect the crane from the far bank ramp module push/pull sling.

4.9.3 Connecting the Parallel Modules

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

CAUTION

To prevent damage to the lifting slings it is important that care is exercised when connecting the slings to the crane hook. Ensure that the sling is fitted correctly and does not become trapped by the hook safety clip.

NOTE

The bridge drive mode setting is determined at the site surveillance stage (Chapter 1 Section II Table 1.11)

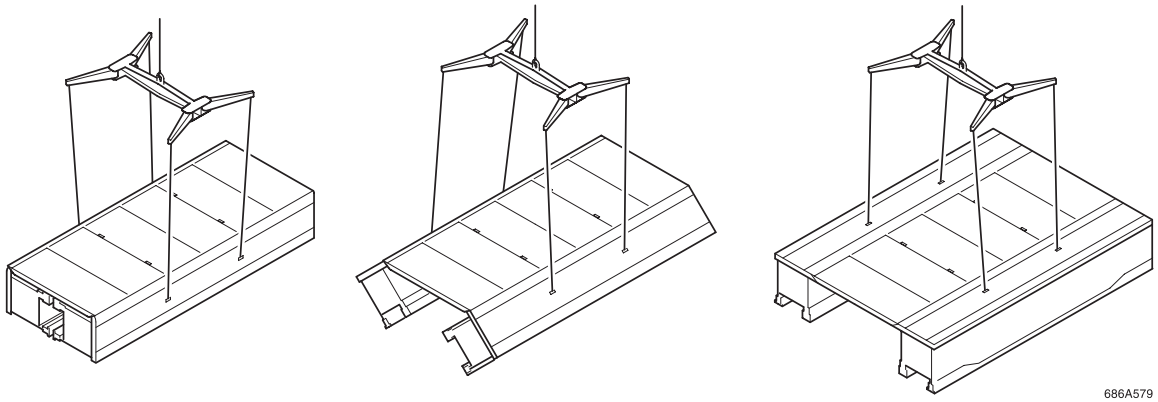


Figure 4.16 Slinging Position for Parallel Module Opening

4.9.3.1 Reposition the crane over the parallel module on flatrack V1 and re-connect the single leg sling.

4.9.3.2 Remove the slide frame removable rollers and end beam guides and place them on the ground either side of the launch vehicle for use later.

4.9.3.3 Operate the lift controls on the crane and raise the 1st parallel module. Make sure the module opens slowly and progressively as it is lifted by the crane.

4.9.3.4 Continue to operate the lift and traverse controls on the crane, and using the tag lines, guide the 1st parallel module into position on the launch vehicle.

WARNING

TAIL LIFT OPERATION. THE TAIL LIFT IS DESIGNED TO CARRY A MAXIMUM OF FOUR PERSONS (500KG (1102.31LBS)). DO NOT OVERLOAD THE TAIL LIFT OR PERSONS COULD BE KILLED OR INJURED AND THE TAIL LIFT DAMAGED IN THE EVENT OF A FAILURE.

CRUSH INJURY. RAISING THE TAIL LIFT WITH THE GUARD RAILS ERECTED MAY CAUSE A TRAPPING HAZARD. KEEP ALL LIMBS CLEAR DURING TAIL LIFT MOVEMENT.

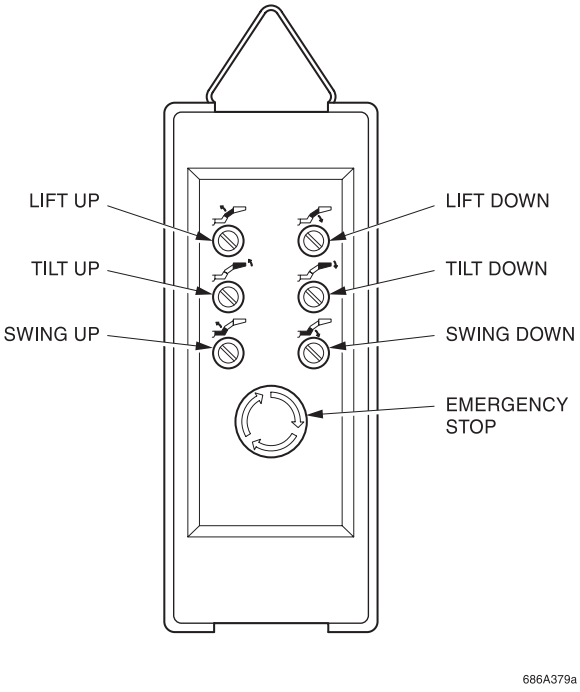
CAUTION

The tail lift is designed to carry a maximum of four persons (1102.31 lbs (500 kg)). Do not overload the tail lift. The tail lift will be damaged in the event of a failure.

4.9.3.5 Position 3 personnel on the tail lift, one at each end and one in the middle.

4.9.3.6 Remove the walk way fitted at the launch frame end of the slide frame.

4.9.3.7 On the tail lift pendant, press and hold the **LIFT UP** switch. Make sure the lift hydraulic cylinders extend and raise the tail lift platform.



Tail Lift Pendant

4.9.3.8 Release the **LIFT UP** switch when the tail lift platform positions the pinning operatives at their convenient height.

WARNING

CRUSH HAZARD. DEATH OR SEVERE INJURY COULD RESULT IF PERSONNEL STAND BETWEEN THE SUSPENDED LOAD AND THE MODULE LOCATED ON THE LAUNCH FRAME.

4.9.3.9 Remove the R clips and bridge pins from the jaws of the 1st parallel module and ramp module and place them on the tail lift.

NOTE

If due to the angle of the ramp module, the lower jaws connect first. Align the jaws and the jaw alignment system. Jib forward with the crane so that the module rotates around the jaws until the dowels are aligned. For further information refer to Chapter 3 Paragraphs: 3.10.3 Connecting Modules Where the Upper Dowels Contact First and 3.10.4 Connecting Modules Where the Jaws Contact First.

It should be noted that the parallel modules are interchangeable and reversible when connecting to each other and ramp modules.

4.9.3.10 Align the dowels of the 1st parallel module and the far bank ramp module.

CAUTION

Extreme caution should be observed when raising the crane while shootbolts are inserted. Damage to the bridge can occur.

4.9.3.11 Insert the shootbolts to connect the two modules, ensuring that they are locked.

4.9.3.12 Disconnect the tag line nearest the tail lift.

4.9.3.13 Operate the lower controls on the crane and locate the birds beaks on the bush resilient mounts. Continue lowering until the module lifting slings just goes slack.

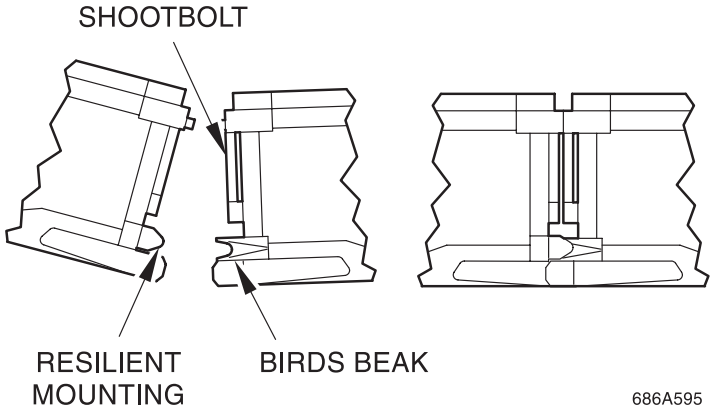


Figure 4.17 Joining Modules

4.9.3.14 Insert the pins to connect the 1st parallel module to the far bank ramp module and secure the pins with the R clips. The pins on the outside of the bridge being inserted from the outside in and the inner pins from the inside out.

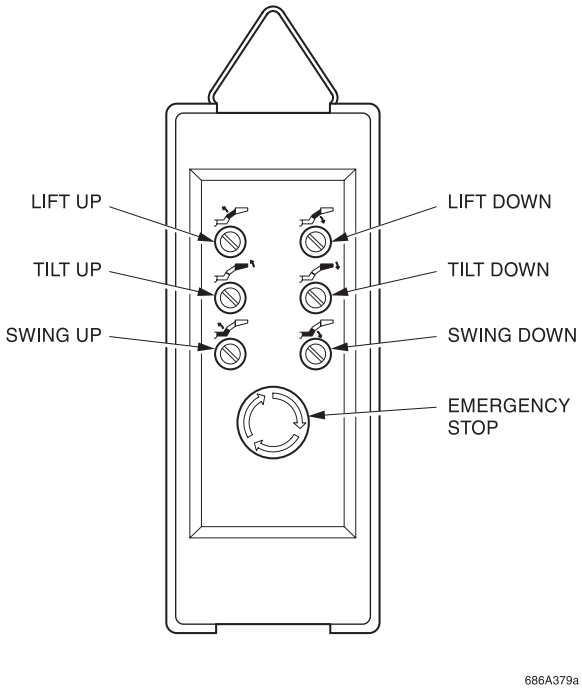
4.9.3.15 Disconnect the tag line at the rear of the parallel module.

NOTE

Providing the four slings are slack, the guide system on the parallel modules will ensure correct alignment for pin insertion.

If the pins can not be inserted, the weight of the module may be taken by the crane until the pins can be inserted. If connection problems persist disconnect all pins and shootbolts and rotate the panel through 180 degrees so that the opposite end may be connected.

4.9.3.16 On the tail lift pendant operate the **LIFT DOWN** switch, and lower the tail lift platform and the pinning operatives clear of the path of the parallel module.



Tail lift Hand Control

4.9.3.17 Disconnect the bridge module lifter from the 1st parallel module and instruct the top man to either "**HOLD ON TIGHT**", while the bridge is boomed forward or descend to the ground.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

4.9.3.18 Operate the lift controls on the crane and position the bridge module lifter for attachment to the 2nd parallel module. Stored on flatrack T2.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

4.9.3.19 Connect the bridge module lifter and tag lines to the 2nd parallel module on flatrack T2.

4.9.3.20 On the chest pack, slowly move the right hand joystick forward to move the far bank carriage and boom forward the connected far bank ramp module and the 1st parallel module.

WARNING

CRUSH HAZARD. THE BRIDGE STOP EMERGENCY MUST BE RAISED TO ALLOW THE JAW SYSTEM TO PASS THROUGH THE A-FRAME. THE BRIDGE STOP EMERGENCY MUST BE RE-ENGAGED AS SOON AS THE JAW SYSTEM HAS PASSED. FAILURE TO HEED INSTRUCTION CAN RESULT IN THE BRIDGE FALLING FROM THE LAUNCHER CAUSING DEATH OR SEVERE INJURY TO SURROUNDING PERSONNEL.

4.9.3.21 Once the ramp jaws are within 12 inches of the bridge stop emergency, raise the two bridge stops emergency by pulling down on their handles until they are vertical (see Figure 4.15).

4.9.3.22 Continue to drive the bridge until the white center of gravity marker located above the fifth bolt on the far bank ramp module jaws, is in line with the home bank side of the A-frame.

4.9.3.23 Using the roller brake switch on the chest pack apply the breaks to the damped rollers by placing the switch to the center ON position.

4.9.3.24 If the slide frame is sloping up hill and the launch beam is not sloping uphill perform tasks 4.9.3.25 onwards, otherwise perform tasks 4.9.3.29 onwards.

NOTE

If the tilt rollers do not raise the bridge, boom the bridge another 6 inches forward and raise the tilt rollers to level the bridge. DO NOT BOOM SO THAT THE WHITE MARK PASSES THE FRONT FACE OF THE A-FRAME.

4.9.3.25 Operate the tilt rollers by moving the left-hand joystick forward until the level on the ramp module indicates that the bridge is horizontal (level).

4.9.3.26 Operate the right-hand joystick to move the far bank carriage rearwards until the bridge lifting slings just restrain the bridge.

4.9.3.27 Move the right hand joystick forward to raise the tilt rollers until the bridge is slightly angled toward the gap.

4.9.3.28 Manually hold the roller brake switch down in the OFF position by moving the switch rearwards. Once the brakes are OFF the tilt rollers can be fully raised.

4.9.3.29 Move the right joystick once to the left so that the **MODE SELECT** light flashes.

4.9.3.30 Move the joystick either forward or rearward to select the build sequence function determined during site reconnaissance and then confirm and set the build sequence by moving the joystick once to the right. (See Chapter 1 Section II Table 1.11)

4.9.3.31 Using the roller brake switch on the chest pack release the brakes on the damped rollers by placing the switch to the OFF position by moving the switch to the forward most position.

4.9.3.32 While holding the tilt roller joystick forward, boom the bridge forward by moving the right hand joystick forward until the jaws at the end of the parallel module are in line with the center of the tail lift.

4.9.3.33 Apply the two bridge stops emergency once the parallel module jaws are clear of the stops.

WARNING

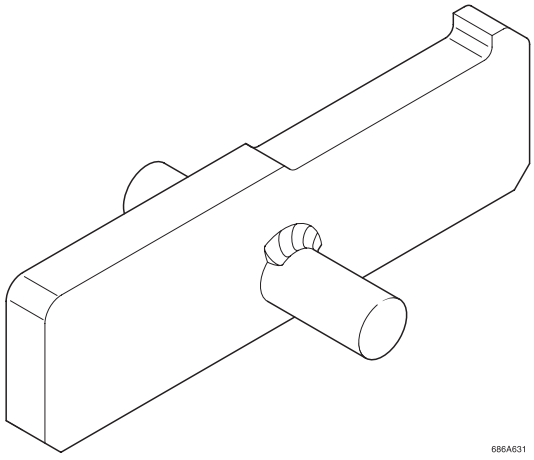
CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

4.9.3.34 Operate the lift controls on the crane and raise the 2nd parallel module. Make sure the module opens slowly and progressively as it is lifted by the crane.

4.9.3.35 Continue to operate the lift and traverse controls on the crane, and using the tag lines, guide the 2nd parallel module into position on the launch vehicle.

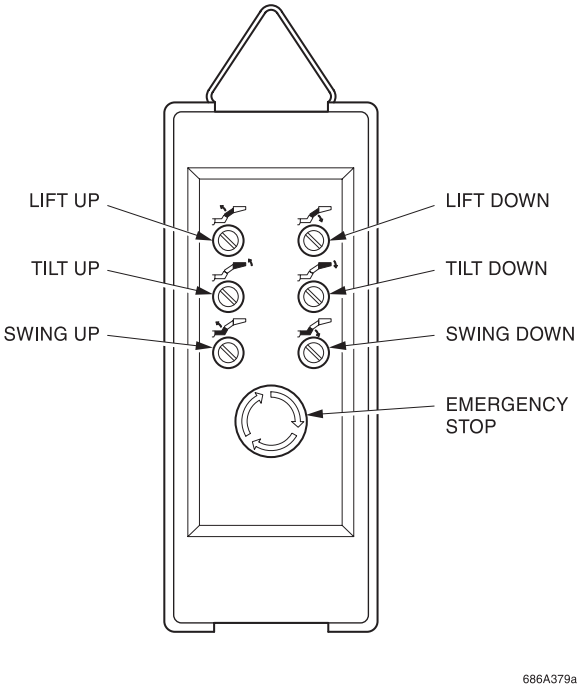
4.9.3.36 Remove the four transportation aides, two per side, from in between the deck units of the remaining parallel module on the flatrack. The brackets are located between the deck units through which the closing slings are accessed. Stow in the flatrack storage box.



Bridge Unit Transport Aid

4.9.3.37 Place one person on top of the bridge, if removed during previous booming operation.

4.9.3.38 On the tail lift pendant, press and hold the **LIFT UP** switch. Make sure the lift hydraulic cylinders extend and raise the tail lift platform.



Tail lift Hand Control

4.9.3.39 Release the **LIFT UP** switch when the tail lift platform positions the pinning operatives at their convenient height.

WARNING

CRUSH HAZARD. DEATH OR SEVERE INJURY COULD RESULT IF PERSONNEL STAND BETWEEN THE SUSPENDED LOAD AND THE MODULE LOCATED ON THE LAUNCH FRAME.

4.9.3.40 Remove the R clips and bridge pins from the jaws of the rear of the 1st parallel module and the front of the 2nd parallel module, place the pins on the tail lift platform.

NOTE

If due to the angle of the ramp module, the lower jaws connect first. Align the jaws and the jaw alignment system. Jib forward with the crane so that the module rotates around the jaws until the dowels are aligned. For further information refer to Chapter 3 Paragraphs: 3.10.3 Connecting Modules Where the Upper Dowels Contact First and 3.10.4 Connecting Modules Where the Jaws Contact First.

4.9.3.41 Align the dowels of the 1st and 2nd parallel modules.

CAUTION

Extreme caution should be observed when raising the crane while shootbolts are inserted. Damage to the bridge can occur

4.9.3.42 Insert the shootbolts to connect the 1st and 2nd parallel modules, ensuring that they are locked.

4.9.3.43 Operate the lower controls on the crane and locate the birds beaks on the bush resilient mounts. Continue lowering until the module lifting slings just go slack.

NOTE

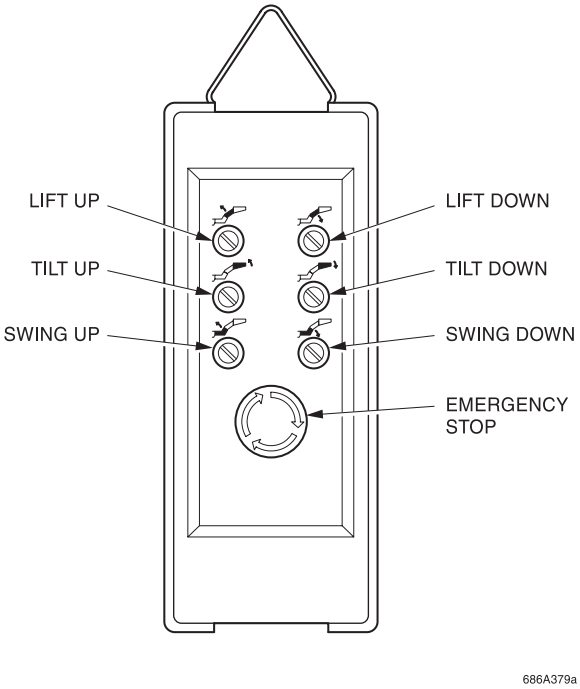
Providing the four slings are slack, the guide system on the parallel modules will ensure correct alignment for pin insertion.

If the pins cannot be inserted, the weight of the module may be taken by the crane until the pins can be inserted.

4.9.3.44 Insert the four pins to connect the 1st and 2nd parallel modules, and secure the pins with the R clips. Outer pins from the outside in, inner pins from inside out.

4.9.3.45 Disconnect the tag line from the 2nd parallel module nearest the tail lift.

4.9.3.46 On the tail lift pendant, operate the **LIFT DOWN** switch and lower the tail lift platform and the pinning operatives clear of the path of the parallel module. Make sure the lift hydraulic cylinders retract to lower the tail lift platform.



Tail lift Hand Control

4.9.3.47 Disconnect the bridge module lifter from the 2nd parallel module.

4.9.3.48 While holding the tilt roller joystick forward, boom the bridge out using the right-hand joystick.

4.9.3.49 As the join between the modules jaws approaches the bridge stops emergency, pull down on the bridge stops emergency handles. Once the jaws are clear, engage the bridge stops emergency.

4.9.3.50 Boom bridge until jaws of module are in line with the center of the tail lift platform.

NOTE

During the addition of further parallel modules, the tilt rollers are not required. They should remain fully lowered at all times.

All further bridge movements should be carried out using the drive mode, selected prior to the commencement of bridge build. i.e. Drive logic determined by bank height rather than the slide frame angle.

4.9.3.51 On the chest pack, using the left-hand joystick, fully lower the tilt rollers.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

NOTE

For a 20 m bridge, continue from Para 4.9.4.7.

4.9.3.52 Operate the lift controls on the crane and position the bridge module lifter for attachment to the 3rd parallel module. Stored on flatrack T2.

4.9.3.53 Connect the bridge module lifter and tag lines to the 3rd parallel module on flatrack T2.

4.9.3.54 Operate the lift controls on the crane and raise the 3rd parallel module. Make sure the module opens slowly and progressively as it is lifted by the crane.

4.9.3.55 Continue to operate the lift and traverse controls on the crane, and using the tag lines, guide the 3rd parallel module into position on the launch vehicle.

4.9.3.56 On the tail lift pendant, press and hold the **LIFT UP** switch. Make sure the lift hydraulic cylinders extend and raise the tail lift platform.

4.9.3.57 Release the **LIFT UP** switch when the tail lift platform positions the pinning operatives at their convenient height.

WARNING

CRUSH HAZARD. DEATH OR SEVERE INJURY COULD RESULT IF PERSONNEL STAND BETWEEN THE SUSPENDED LOAD AND THE MODULE LOCATED ON THE LAUNCH FRAME.

4.9.3.58 Remove the R clips and bridge pins from the jaws of the rear of the 2nd parallel module and the front of the 3rd parallel module, place the pins on the tail lift platform.

NOTE

If due to the angle of the ramp module, the lower jaws connect first. Align the jaws and the jaw alignment system. Jib forward with the crane so that the module rotates around the jaws until the dowels are aligned. For further information refer to Chapter 3 Paragraphs: 3.10.3 Connecting Modules Where the Upper Dowels Contact First and 3.10.4 Connecting Modules Where the Jaws Contact First.

4.9.3.59 Align the dowels of the 2nd and 3rd parallel modules.

CAUTION

Extreme caution should be observed when raising the crane while shootbolts are inserted. Damage to the bridge can occur

4.9.3.60 Insert the shootbolts to connect the two modules, ensuring that they are locked.

4.9.3.61 Operate the lower controls on the crane and locate the birds beaks on the bush resilient mounts. Continue lowering until the module lifting slings just go slack.

NOTE

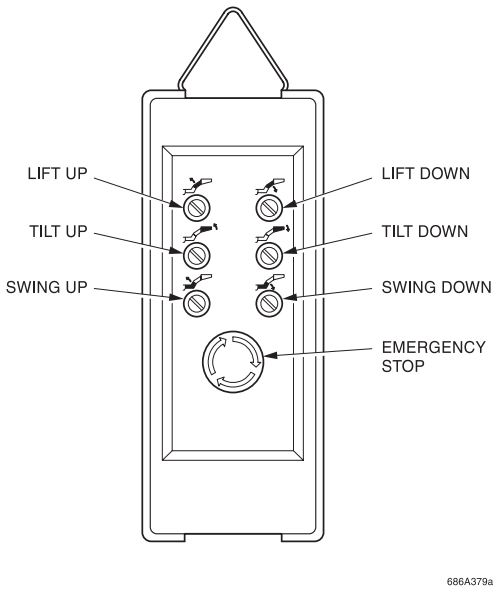
Providing the four slings are slack, the guide system on the parallel modules will ensure correct alignment for pin insertion.

If the pins cannot be inserted, the weight of the module may be taken by the crane until the pins can be inserted.

4.9.3.62 Insert the four pins to connect the two parallel modules and secure the pins with the R clips. Outer pins from the outside in, inner pins from inside out.

4.9.3.63 Disconnect the tag lines from the 3rd parallel module nearest the tail lift.

4.9.3.64 On the tail lift pendant, operate the **LIFT DOWN** switch and lower the tail lift platform and the pinning operatives clear of the path of the parallel module.



Tail lift Hand Control

4.9.3.65 Disconnect the bridge module lifter from the 3rd parallel module.

4.9.3.66 Move the right hand joystick on the chest pack forward to move the far bank carriage and boom the connected far bank ramp and three parallel modules towards the far bank.

4.9.3.67 Raise the two bridge stops emergency by pulling down on their handles once the module jaws are within 12 inches of the bridge stops emergency. Release the stops once the module jaws are clear of the bridge stop rollers.

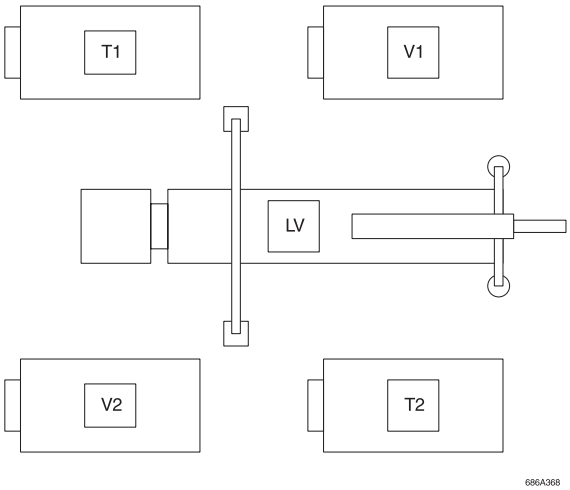
4.9.3.68 Continue to boom the bridge forward until the jaws at the end of the 3rd parallel module are in line with the center of the tail lift platform.

NOTE

When deploying a 131 ft (40 m) bridge, repeat steps 4.9.3.52 through 4.9.3.68 and connect the remaining two parallel modules (4th and 5th), substituting references to flatrack V2 for flatrack T2 and references to the 3rd module for the 4th and 5th modules.

When removing the 4th parallel module from on top of the 5th parallel module on flatrack T2 remember to remove the transport aids from between the deck units of parallel module five after the 4th module has been lifted clear, and store them in the flatrack stowage box.

4.9.4 Assembling the Home Bank Ramp Module



Position of Flatracks

4.9.4.1 At the bridge site use vehicle V2 to pickup flatrack V2 and return to staging area, ground load flatrack V2.

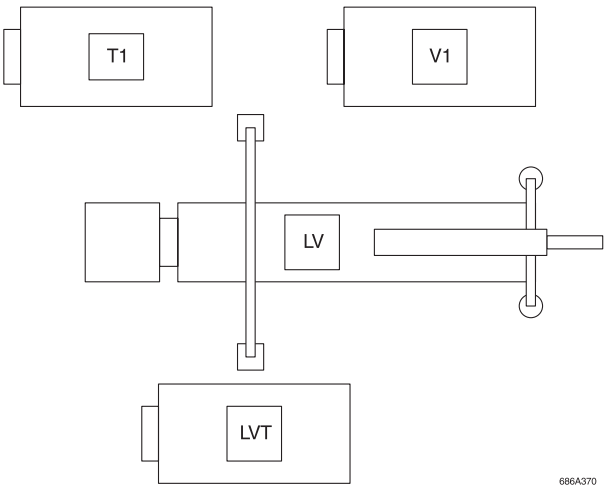
4.9.4.2 At the bridge site use vehicle V1 to pickup flatrack T2 and return to staging area, ground load flatrack T2.

4.9.4.3 Use vehicle V3 to load flatrack LVT.

4.9.4.4 Drive vehicle V3 with flatrack LVT onto bridge site.

4.9.4.5 Reverse vehicle V3 with its left hand wheels on the left hand tire alignment line and ground load flatrack LVT in position.

4.9.4.6 Remove the transport straps on the launch equipment storage box.



Position of Flatracks

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

4.9.4.7 Operate the crane controls on the crane and position the bridge module lifter above the approach ramps located on flatrack T1.

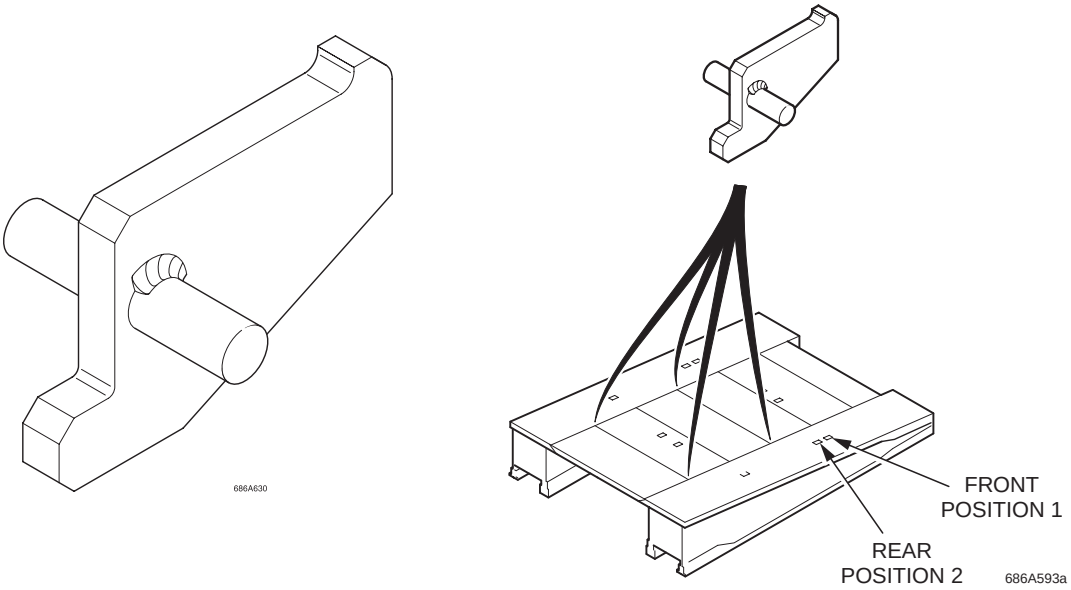
WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE RAMP MODULE.

4.9.4.8 Connect the bridge module lifter to the four lifting rings on the upper approach ramp frame and connect two tag lines.

4.9.4.9 Operate the crane controls on the crane to lift the approach ramps and position them on flatrack V1.

4.9.4.10 Remove the four transport aids located between the deck units of the ramp module and stow in flatrack stowage box.



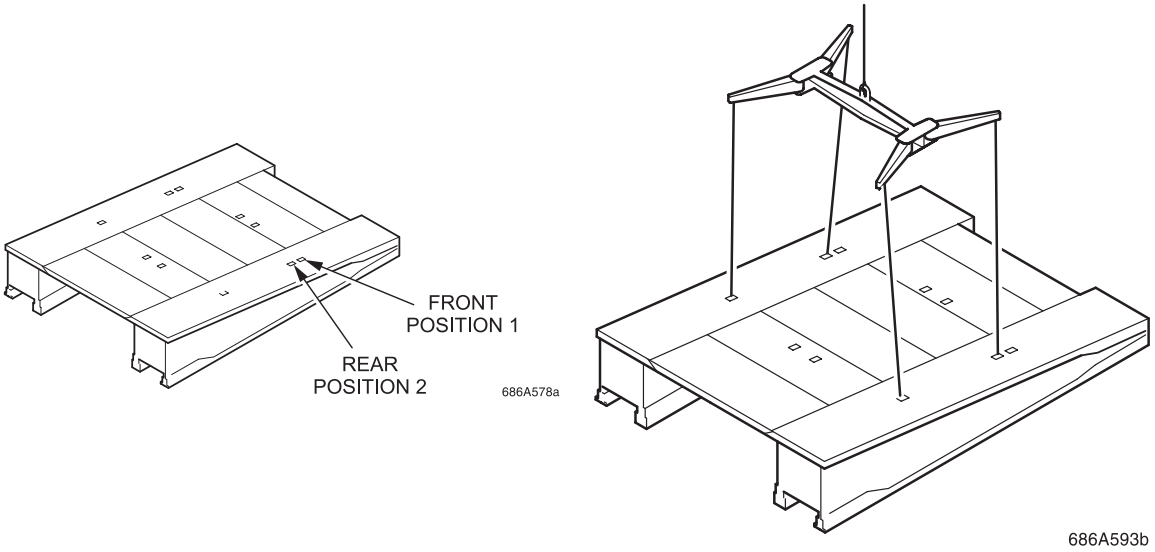
Ramp frame Transport Aid

4.9.4.11 Disconnect the bridge module lifter and tag lines, from the approach ramp frame.

NOTE

When placing the bridge module lifter on the ramp module, ensure that the lifting hooks do not slip between the gaps separating the deck units.

4.9.4.12 Operate the crane controls on the crane to move the bridge module lifter, to the home bank ramp module located on flatrack T1, attach lifting slings at POSITION 2 and tag lines to the module handles. Lower the bridge module lifter onto the ramp module.



Bridge Module Lifter in POSITION 2 of Ramp Module

4.9.4.13 Disconnect the single leg sling from the crane hook.

4.9.4.14 Retrieve the two end beam slings and secure them around the end beam at the bridge lift points, to ensure a straight lift and attach a guide rope (refer to Chapter 3 Para 3.9.2 End Beam Slinging).

4.9.4.15 Place two removable rollers onto the second section of the slide frame at the white marks on slide frame section three.

4.9.4.16 Remove the retaining R clip and deploy the end beam guide adapters, located at the end of section one of the slide frame nearest the crane.

4.9.4.17 Locate the two end beam guides onto the adapters ensuring that they are securely seated and that the locking arms are in the up position.

4.9.4.18 Operate the crane controls on the crane and position the crane hook above the end beam slings.

CAUTION

To prevent damage to the lifting slings it is important that care is exercised when connecting the slings to the crane hook. Ensure that the sling is fitted correctly and does not become trapped by the hook safety clip.

4.9.4.19 Attach the end beam slings to the crane hook, ensuring that they are secure.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

4.9.4.20 Operate the lift and traverse controls on the crane and lift the home bank ramp end beam, from the ground between flatracks T1 and V1 into position on the end beam adapter so that the gutter faces away from the gap.

4.9.4.21 Disconnect the crane hook and tag lines from the home bank ramp end beam.

4.9.4.22 Operate the lift and traverse controls on the crane and position the crane to pick up the bridge module lifter from flatrack T1.

4.9.4.23 Connect the bridge module lifter to the crane hook.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE RAMP MODULE.

4.9.4.24 Operate the lift controls on the crane and lift the home bank ramp module from flatrack T1. Make sure the home bank ramp module opens slowly and progressively as it is lifted by the crane. Do not operate the traverse controls of the crane until the module is clear of the flatrack.

4.9.4.25 Continue to operate the lift and traverse controls on the crane, and using the tag lines, guide the home bank ramp module into position over the home bank ramp end beam.

4.9.4.26 Attach an end beam wrench to the end beam ramp gutter as required.

WARNING

CRUSH HAZARD. SEVERE PERSONAL INJURY CAN RESULT IF HANDS ARE NOT KEPT CLEAR OF MATING SURFACES DURING END BEAM CONNECTION.

CAUTION

Retraction of the crane jib may be required during the lowering of the ramp module onto the end beam. Failure to lower the home bank ramp vertically may cause the end beam to be pulled from its guides.

4.9.4.27 Place one person at the side of launch vehicle to ensure that the single leg sling remains vertical during module lowering.

4.9.4.28 Using the tag lines and the end beam wrench align the home bank ramp module with the guide-in on the end beam and slowly lower the home bank ramp module until the two are fully engaged.

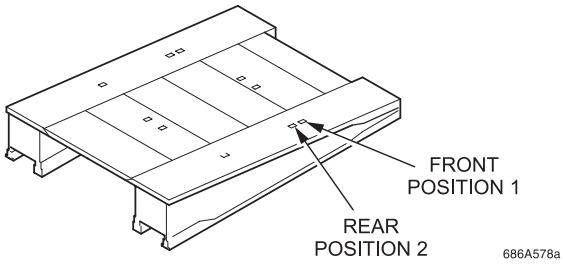
4.9.4.29 Remove end beam wrench from end beam.

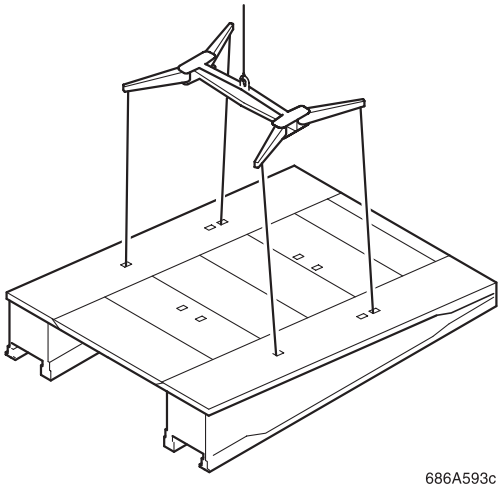
4.9.4.30 Insert the end beam connecting pins, twist to lock.

NOTE

If pins will not insert correctly check the stabilizer legs of the crane are still level adjust if necessary.

4.9.4.31 Disconnect the bridge module lifter from the position 2 lifting points on the home bank ramp module and attach it to the position 1 slinging points. This will compensate for the change in the center of gravity caused by the connection of the end beam to the home bank ramp module.





Bridge Module Lifter in POSITION 1 of Ramp Module

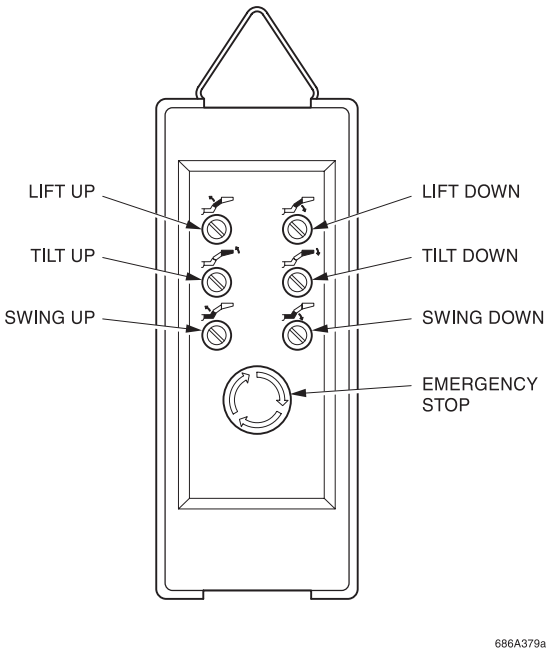
WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

4.9.4.32 Operate the lift controls on the crane and raise the ramp module ensuring slings are vertical prior to lifting.

4.9.4.33 Operate the lift controls on the crane and, using the tag lines, guide the home bank ramp module into position at the rear of the last parallel module deployed.

4.9.4.34 On the tail lift pendant, press and hold the **LIFT UP** switch. Make sure the lift hydraulic cylinders extend and raise the tail lift platform.



Tail lift Hand Control

4.9.4.35 Release the **LIFT UP** switch when the tail lift platform positions the pinning operatives at their convenient height.

WARNING

CRUSH HAZARD. DEATH OR SEVERE INJURY COULD RESULT IF PERSONNEL STAND BETWEEN THE SUSPENDED LOAD AND THE MODULE LOCATED ON THE LAUNCH FRAME.

4.9.4.36 Remove the R clips and bridge pins from the rear jaws of the parallel module and the front jaws of the home bank ramp module and place them on the tail lift platform.

4.9.4.37 Align the dowels of the parallel module and the home bank ramp module.

NOTE

If due to the angle of the ramp module, the lower jaws connect first. Align the jaws and the jaw alignment system. Jib forward with the crane so that the module rotates around the jaws until the dowels are aligned. For further information refer to Chapter 3 Paragraphs: 3.10.3 Connecting Modules Where the Upper Dowels Contact First and 3.10.4 Connecting Modules Where the Jaws Contact First.

4.9.4.38 Insert the shootbolts to connect the home bank ramp module and the parallel module, ensuring that they are locked.

CAUTION

Extreme caution should be observed when raising the crane while shootbolts are inserted. Damage to the bridge can occur

4.9.4.39 Operate the lower controls on the crane and locate the birds beaks on the bush resilient mounts. Continue lowering until the module lifting slings just go slack.

4.9.4.40 Insert the pins to connect the home bank ramp to the parallel module and secure the pins with the R clips. Outer pins from outside in, inner pins inside out.

NOTE

Providing the four slings are slack, the guide system on the parallel modules will ensure correct alignment for pin insertion.

If the pins cannot be inserted, the weight of the module may be taken by the crane until the pins can be inserted.

4.9.4.41 Disconnect the tag line nearest the tail lift.

4.9.4.42 On the tail lift pendant, operate the **LIFT DOWN** switch and lower the tail lift platform and the pinning operatives clear of the path of the parallel module.

4.9.4.43 Disconnect the bridge module lifter from the lifting points on the home bank ramp module.

4.9.4.44 Operate the lift and traverse controls on the crane and, position the bridge module lifter near flatrack LVT.

4.9.4.45 Withdraw the shootbolts and close the arms on module lifter, insert shootbolts.

4.9.4.46 Disconnect the bridge module lifter after stowing on LVT flatrack.

CAUTION

To prevent damage to the lifting slings it is important that care is exercised when connecting the slings to the crane hook. Ensure that the sling is fitted correctly and does not become trapped by the hook safety clip.

4.9.4.47 Attach the launch beam lifter to the crane hook in preparation for launch beam retrieval.

4.9.5 Lowering the Bridge

4.9.5.1 Make sure the **POWER** and the bridge drive mode selected (**LEVEL**, **HIGH**, or **LOW**) captions on the chest pack display illuminate.

4.9.5.2 Move the right hand joystick on the chest pack forward to boom the bridge forward.

WARNING

CRUSH HAZARD. THE BRIDGE STOP EMERGENCY MUST BE RAISED TO ALLOW THE JAW SYSTEM TO PASS THROUGH THE A-FRAME. THE BRIDGE STOP EMERGENCY MUST BE RE-ENGAGED AS SOON AS THE JAW SYSTEM HAS PASSED. FAILURE TO HEED INSTRUCTION CAN RESULT IN THE BRIDGE FALLING FROM THE LAUNCHER CAUSING DEATH OR SEVERE INJURY TO SURROUNDING PERSONNEL.

4.9.5.3 Pull on the handle of the bridge stops emergency, to release them, until the last set of module connecting jaws has passed the A-frame.

4.9.5.4 Engage the bridge stops emergency as soon as the jaws of the bridge module and home bank ramp module have passed.

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

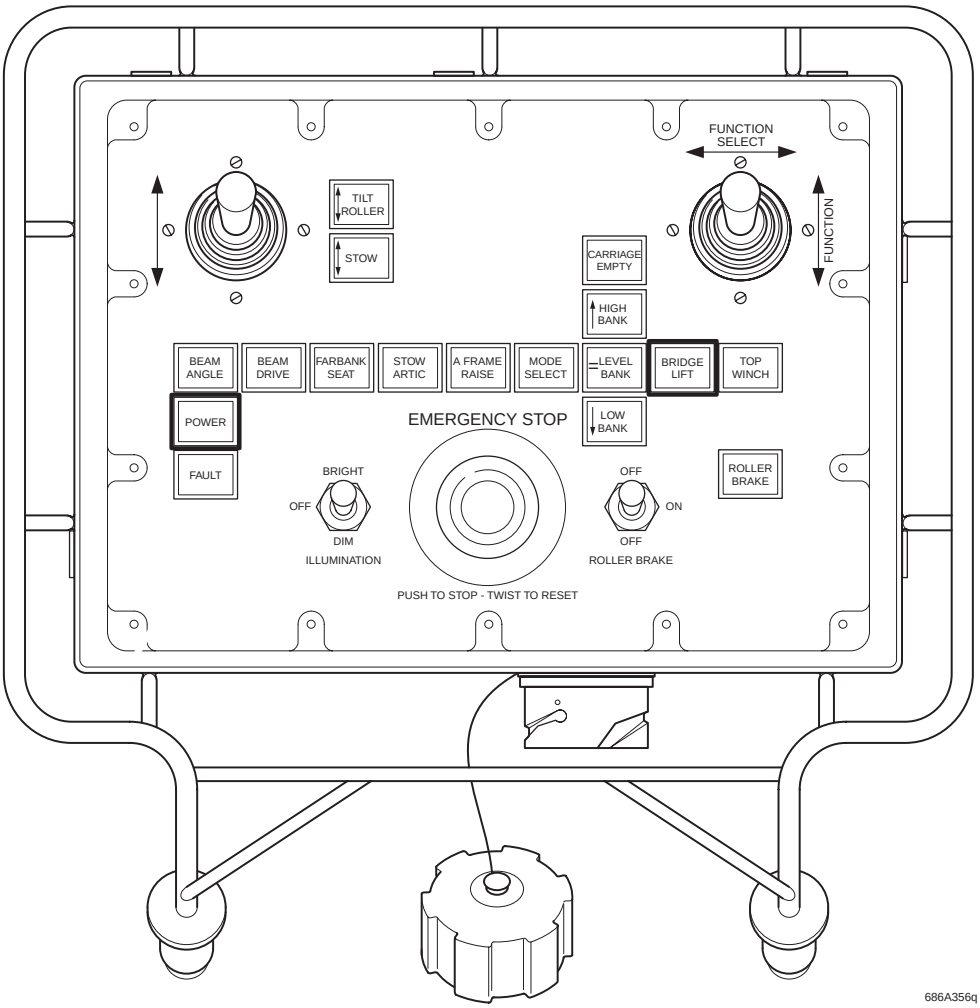
4.9.5.5 On the chest pack continue to move the joystick forward to drive the bridge outwards until it is correctly positioned against the bridge emergency stops, to attach the home bank carriage. **DO NOT RELEASE THE BRIDGE STOPS EMERGENCY**.

CAUTION

Slings should not be pulled should they become snagged but lifted off the carriage shootbolts. Damage to equipment could result if this instruction is not followed.

4.9.5.6 Lift the carriage lifting slings from their stored position over the home bank carriage shootbolts.

4.9.5.7 On the chest pack, move the joystick to the right to select the bridge lift function. Make sure the **POWER** and the **BRIDGE LIFT** captions on the chest pack display illuminate.



Bridge Lift Caption

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

4.9.5.8 On the chest pack, move the joystick forwards to raise the home bank carriage beam slightly and take the weight of the carriage beam.

4.9.5.9 Retract the shootbolts on the home bank carriage beam.

CAUTION

Do not allow the carriage beam to rest on the bridge or the winch wire ropes may become entangled.

4.9.5.10 On the chest pack, move the joystick rearwards to lower the home bank carriage beam. Continue lowering until the cable running under the launch beam rests on the bridge and the beam is lowered sufficiently to attach the slings to the ramp module.

NOTE

Do not allow the carriage beam to rest on the bridge, as this will cause the lower winch rope to become too slack, and may cause it to become double wrapped (nested) around the winch drum.

4.9.5.11 Remove the R clips from the sling retractable pins and retract the pins.

4.9.5.12 Route the slings of the far bank carriage through the bridge lifting points on the home bank ramp module and reconnect the sling to the carriage. Make sure the retractable pin is fully located and secured with the R clip.

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

4.9.5.13 On the chest pack, slowly move the joystick forward to partially raise the home bank carriage beam, and tension slings so that they can be balanced/squared off.

NOTE

It is extremely important that the two carriage parts are in line vertically and horizontally. Failure to ensure correct alignment will result in the bottom half of the carriage becoming jammed in the top half of the carriage when it is raised.

4.9.5.14 Continue to raise the bridge, ensuring that as soon as the bridge rolls rearwards the bridge end stops are released to allow upward travel of the bridge.

NOTE

If the carriage beam does not correctly align, lower the bridge ensuring that the Bridge Stops are lowered to restrain the bridge. Re-align the lift beam and slings.

4.9.5.15 Once the carriage beam is fully raised, insert the shootbolts in the home bank carriage beam.

NOTE

Tension is released from the lower cable once it starts to separate from the underside of the launch beam.

4.9.5.16 On the chest pack move the joystick slowly rearwards to release the tension in the bottom winch cable.

4.9.5.17 On the chest pack, move the joystick to the left to select the required bridge drive function and make sure the **POWER** and the bridge drive mode selected (**LEVEL**, **HIGH**, or **LOW**) captions on the chest pack display illuminate. Make sure the **BRIDGE LIFT** caption on the chest pack display goes off.

4.9.5.18 On the chest pack, slowly move the joystick rearwards until the home bank carriage restraint latches raise.

4.9.5.19 Release both carriage restraint latches from the launch frame, and on the chest pack, move the joystick forward to drive the bridge outwards until the home bank carriage restraint arm is fully extended.

4.9.5.20 Once the carriages are clear of the restraint latches lower the latches.

WARNING

CRUSH HAZARD. RELEASE OF THE BRIDGE STOP EMERGENCY MAY CAUSE THE BRIDGE TO ROCK. MOVE PERSONNEL CLEAR OF THE BRIDGE DURING RELEASE OF THE BRIDGE STOP EMERGENCY. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY TO PERSONNEL.

4.9.5.21 On the chest pack, move the joystick to the right to select the bridge lift function. Make sure the **POWER** and the **BRIDGE LIFT** captions on the chest pack display illuminate. Make sure the bridge drive mode selected (**LEVEL**, **HIGH**, or **LOW**) caption on the chest pack display goes off.

NOTE

Personnel are also required to deploy the far bank approach ramps and defile markers. Ramp carrying handles, and marker tape, should be carried across the bridge at this time.

4.9.5.22 Send two persons across the bridge to the far bank to retract the shootbolts on the far bank carriage beam.

4.9.5.23 On the chest pack, move the joystick forwards to lift the bridge.

4.9.5.24 Retract the shootbolts on the far bank carriage beams.

4.9.5.25 Make sure personnel are cleared from the area. On the chest pack, move the joystick rearward to lower the bridge into position across the gap. Make sure the drum winches operate and lower the far bank end of the bridge towards the ground stopping about one foot from the ground.

4.9.5.26 When the bridge is about one foot from the ground, one person jumps onto the far bank and removes the ramp module skids from the far bank ramp module.

4.9.5.27 Store the ramp module skids and R clips in the LV basket.

4.9.5.28 Continue to lower the bridge on the joystick until the far bank carriage slings are slack.

WARNING

PERSONAL INJURY. WHEN HANDLING WINCH CABLE, USE THICK LEATHER GLOVES TO PREVENT INJURY TO HANDS FROM BROKEN STRANDS.

NOTE

To allow the carriage slings to go slack, perform the following procedure:

1 One of the two far bank operative stands at the center of the bridge.

2 Operate the lower winch to pay out the rope.

3 Just prior to the slack rope touching the center of the bridge, the first operative grabs hold of the rope and pulls it towards the far bank. This allows the second operative to pull down on the far bank carriage and thus slacken the slings.

4 It is important to continually pull on the rope as the winch is operated. This prevents the rope from double wrapping.

5 FAILURE TO ADHERE TO THIS PROCEDURE WILL ALLOW THE ROPE TO DOUBLE WRAP ON THE WINCH DRUM.

4.9.5.29 Disconnect the far bank carriage slings from the far bank ramp module and reconnect the slings to the far bank carriage.

NOTE

Ensure that the lower section of the far bank carriage is correctly aligned with the upper section; personnel should use the lifting slings to assist in aligning the two halves of the far bank carriage.

4.9.5.30 On the chest pack, move the joystick forwards to raise the far bank carriage beam.

4.9.5.31 Place the lifting slings over the shootbolts so they are clear of the bridge.

4.9.5.32 On the chest pack, move the joystick forward to lift the still connected home bank end of bridge so that the carriage shootbolts can be retracted.

4.9.5.33 Retract the home bank carriage shootbolts.

4.9.5.34 On the launcher chest pack, move the joystick rearwards so that the two home bank carriage halves separate and the home bank end of the bridge is lowered.

4.9.5.35 Continue to lower the bridge until the bridge is grounded and the carriage slings are slack.

4.9.5.36 Disconnect the home bank carriage slings from the home bank ramp module and reconnect the two slings to the carriage.

NOTE

Ensure that the lower section of the home bank carriage is correctly aligned with the upper section; personnel should use the lifting slings to assist in aligning the two halves.

4.9.5.37 On the chest pack, move the joystick forward to raise the home bank carriage. Continue to slowly raise the carriage using the slings to assist in aligning. It is important to raise the carriage to the stops but not necessary to insert the shootbolts at this time as they are out of reach.

CAUTION

The CARRIAGE EMPTY function is only to be selected when both carriages are supporting no load. It is to be used for carriage retrieval or deployment only. It MUST NOT be used while the bridge is suspended.

4.9.5.38 On the launcher chest pack, move the joystick to the left twice so that the **MODE SELECT** light flashes. Move the joystick forwards until the **CARRIAGE EMPTY** function is selected.

NOTE

The CARRIAGE EMPTY function light will continuously flash. This is to act as a warning for the circumstances of its use.

4.9.5.39 Move the joystick once to the right to confirm the selection.

4.9.5.40 On the chest pack, move the joystick rearward to retrieve the home bank and far bank carriages to the launch vehicle. Make sure the drum winches operate and move the home bank and far bank carriages back to the launch vehicle.

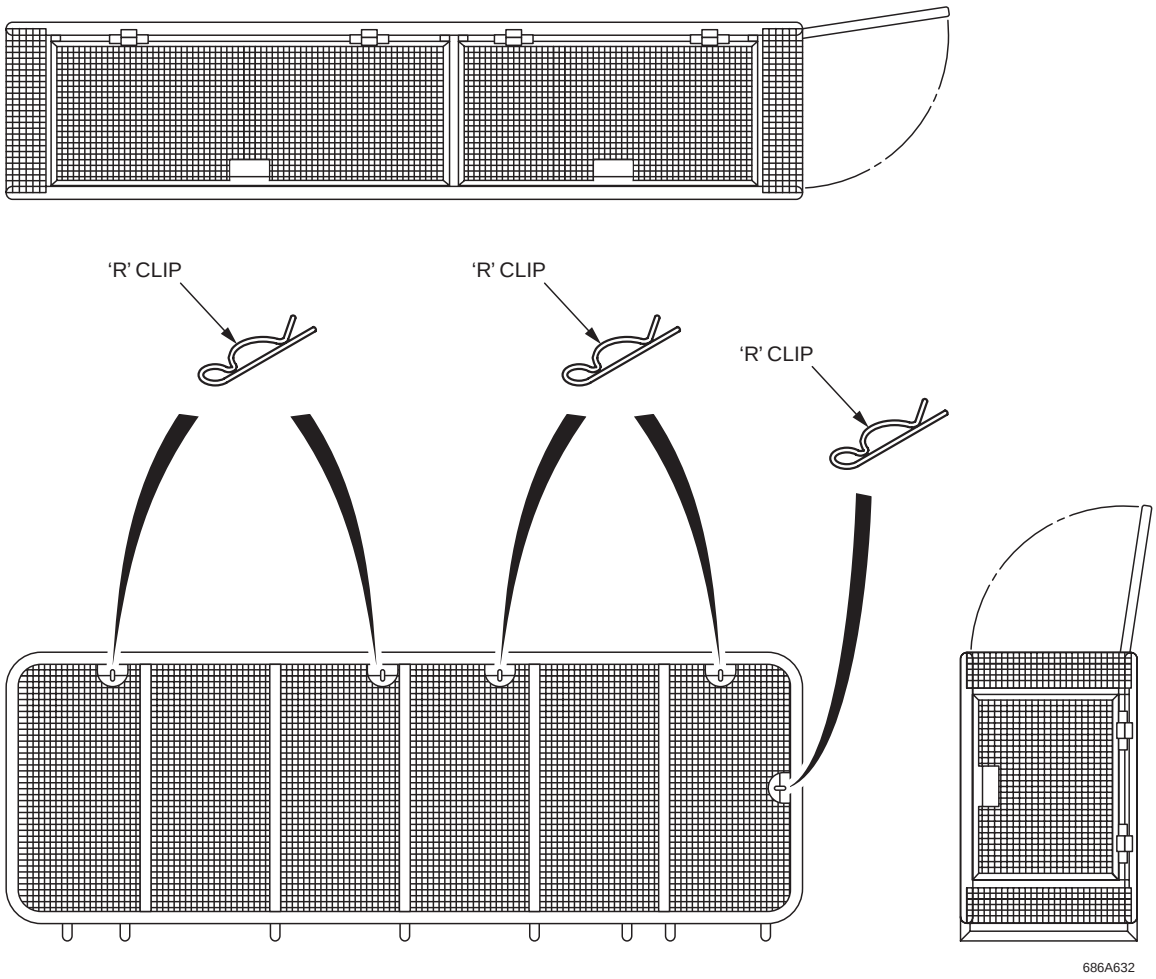
4.9.5.41 Make sure the home bank carriage restraint latch engages on the launch frame.

4.9.5.42 Remove the two end beam guides and removable rollers from the slide frame and place them on the flatrack LVT for stowing.

4.9.5.43 Stow and clip the end beam guide adapters.

4.9.5.44 Remove the removable rollers placed alongside the launcher for stowing on flatrack LVT.

4.9.5.45 Recover loose items and tail lift guardrails and them place in the storage basket on flatrack LVT. Once all loose items are stowed in the two large compartments, lock with R Clips.



4.9.5.46 Ensure module lifter is in its stowed configuration and craned onto LVT, secure with tie-down straps.

4.9.5.47 Retrieve the removable walkways from their stowed position and position in accordance for beam build.

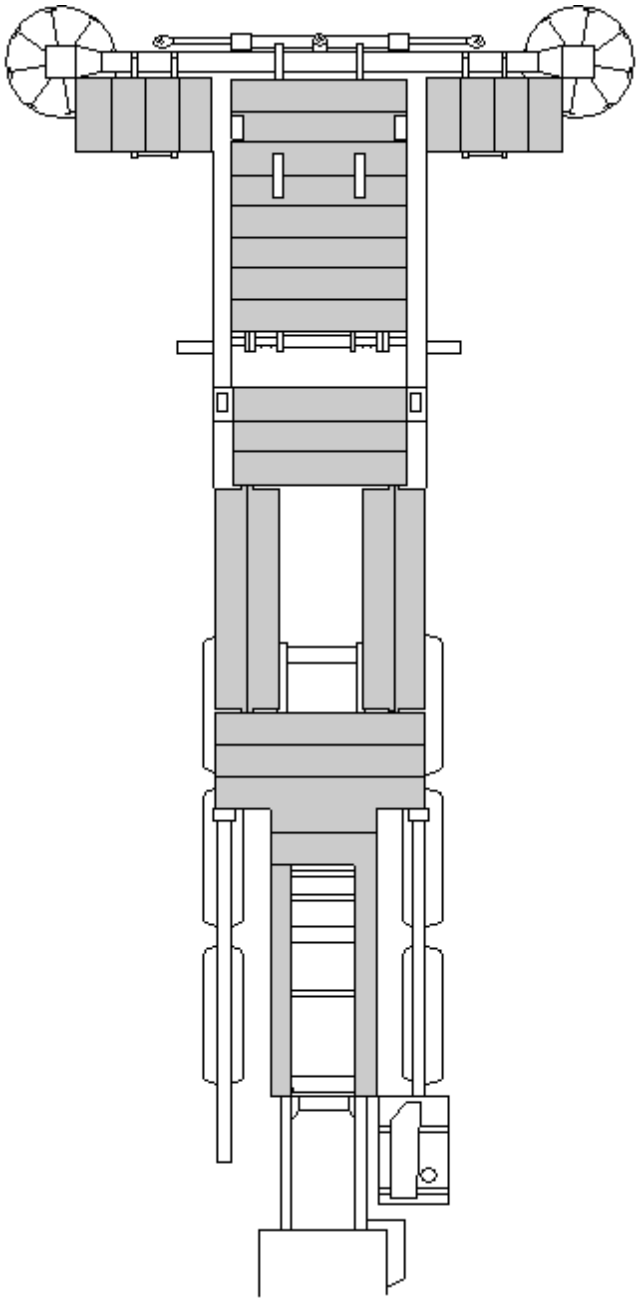


Figure 4.18 Slide Frame Decking Positions for Beam Build

4.9.5.48 Retrieve the A-frame foldable walkway guardrails and position in their location holes.

4.9.5.49 Slide in the tail lift extensions and fold the tail lift platform. Secure to the tail lift with the two rubber catches.

4.10 CURB DEPLOYMENT

4.10.1 Deploying The Curbs

WARNING

FALL HAZARD. ATTEMPTS TO DEPLOY THE CURBS WITH TWO HANDS MAY CAUSE PERSONNEL TO FALL OFF THE BRIDGE RESULTING IN DEATH OR SERIOUS INJURY.

NOTE

Curbs should be deployed by one hand with the body facing along the bridge. This operation should be carried out from a kneeling position.

4.10.1.1 Deploy the curbs along both sides of the bridge by pulling the release catch upwards, then rotating the curbs up and round in a single motion.

4.10.1.2 Ensure that the curbs are located in the slots along the edge of the bridge.

4.10.1.3 Deploy the bridge edge marker on each central curb by releasing it from its stowage catch and rotating it to the vertical.

4.11 FAR BANK APPROACH RAMP DEPLOYMENT

4.11.1 Deploying Far Bank Approach Ramps

WARNING

CRUSH HAZARD. ONCE THE TRANSPORT STRAPS ARE RELEASED FROM THE APPROACH RAMP TRANSPORT FRAME, THE APPROACH RAMPS MAY FLIP UPWARDS SHOULD PERSONNEL WALK ON THE TAPERED END OF THE RAMP.

FALL HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE APPROACH RAMPS ARE NOT PULLED TOWARDS THE CENTER OF THE BRIDGE BEFORE DEPLOYMENT. PERSONNEL SHOULD NOT ATTEMPT TO DEPLOY APPROACH RAMPS WHILE POSITIONED AT THE EDGE OF THE BRIDGE. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO PERSONNEL FALLING INTO THE GAP AND SUFFERING SEVERE INJURY OR DEATH.

NOTE

This operation CAN ONLY be carried out once the launch beam has started to be retracted and the far bank support is clear of the far bank ramp module.

4.11.1.1 Un-strap the far bank approach ramps from their frames and remove the four retaining bars.

4.11.1.2 Place the straps and the bars at the side of the bridge.

4.11.1.3 Using the approach ramp carrying handle lift the rear end of the central ramp of one of the two approach ramp frames clear of its location blocks and push forward.

4.11.1.4 Place a carrying handle in each location on the front of the approach ramp and lift it ready for deployment.

4.11.1.5 With the end of the approach ramp on the deck, drag the approach ramp forward until the approach ramp approaches the gutter.

4.11.1.6 Remove the two handles and locate them in the gutter end of the approach ramp.

NOTE

The gutter has cut outs along its bottom edge to allow the approach ramps to be inserted. Sliding the approach ramps sideways locks them in position.

4.11.1.7 Lift the approach ramp and locate with the gutter in the ramp module. Place the lifting handles on the same side at either end of the approach ramp and position the ramp to the outside edge of bridge.

4.11.1.8 Slide the next approach ramp into the central location on the approach ramp frame and repeat the procedure, working from the center outwards.

NOTE

The approach ramps located toward the center of the bridge may be deployed without bringing inboard.

4.11.1.9 Once all the approach ramps have been put in place from one transport frame repeat the procedure for the other transport frame.

4.11.1.10 Using two personnel, lift the two empty approach ramp frames, and store them on the empty flatrack.

4.11.1.11 Position three defile marker posts on either side of the bridge to form a lead onto the bridge for traffic. When deploying defile markers in any ground, uses a road form spike pin inserted into the ground (use sledge hammer or pneumatic hammer) and place the defile marker so that defile marker box section is fitted over the shaft of the road form spike (refer to Chapter 3 Para 3.20.1 Deployment of Defile Markers).

4.11.1.12 Wrap marker tape between the posts securing it in the defile marker post slot and tie back to the ramp module.

4.12 HOME BANK APPROACH RAMP DEPLOYMENT

4.12.1 Deploying Home Bank approach Ramps

WARNING

FALL HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE APPROACH RAMPS ARE NOT PULLED TOWARDS THE CENTER OF THE BRIDGE BEFORE DEPLOYMENT. PERSONNEL SHOULD NOT ATTEMPT TO DEPLOY APPROACH RAMPS WHILE POSITIONED AT THE EDGE OF THE BRIDGE. FAILURE TO HEED THIS INSTRUCTION CAN LEAD TO PERSONNEL FALLING INTO THE GAP AND SUFFERING SEVERE INJURY OR DEATH.

CRUSH HAZARD. ONCE THE TRANSPORT STRAPS ARE RELEASED FROM THE APPROACH RAMP TRANSPORT FRAME, THE APPROACH RAMPS MAY FLIP UPWARDS SHOULD PERSONNEL WALK ON THE TAPERED END OF THE RAMP.

4.12.1.1 Un-strap the home bank approach ramps stored on flatrack V1 from their frames and remove the four retaining bars.

4.12.1.2 Place the straps and the bars at the side of flatrack V1.

4.12.1.3 Using four personnel with carrying handles lift the approach ramp from the approach ramp frame and offer up approach ramp to the home bank ramp module.

NOTE

The gutter has cut outs along its bottom edge to allow the approach ramps to be inserted. Sliding the approach ramps sideways locks them in position.

4.12.1.4 Lift the approach ramp and locate with the gutter in the center of the ramp module, slide sideways to the edge of the bridge. Repeat procedure to fully ramp bridge.

4.12.1.5 Lift the two approach ramp frames and store on an empty flatrack.

4.12.1.6 Position 3 defile marker posts on either side of the bridge to form a lead onto the bridge for traffic. When deploying defile markers in any ground, uses a road form spike pin inserted into the ground (use sledge hammer or pneumatic hammer) and place the defile marker so that defile marker box section is fitted over the head of the road form spike.

4.12.1.7 Wrap marker tape between the posts securing it in the defile marker post slot and tie back to the ramp module.

4.13 ANCHORING THE BRIDGE

4.13.1 Bridge Anchorage

4.13.1.1 If anchoring the bridge is required, anchor the DSB as described in Chapter 3, Section VI. 3.15 Bridge Anchorage Design.

Section V. RETRIEVING LAUNCH BEAM

4.14 RETRIEVING LAUNCH BEAM

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

4.14.1 Lowering the A-frame

4.14.1.1 On the chest pack, move the joystick to the left to select the A-frame **RAISE** function. Make sure the **POWER** and the A-frame **RAISE** captions on the chest pack display illuminate.

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

CAUTION

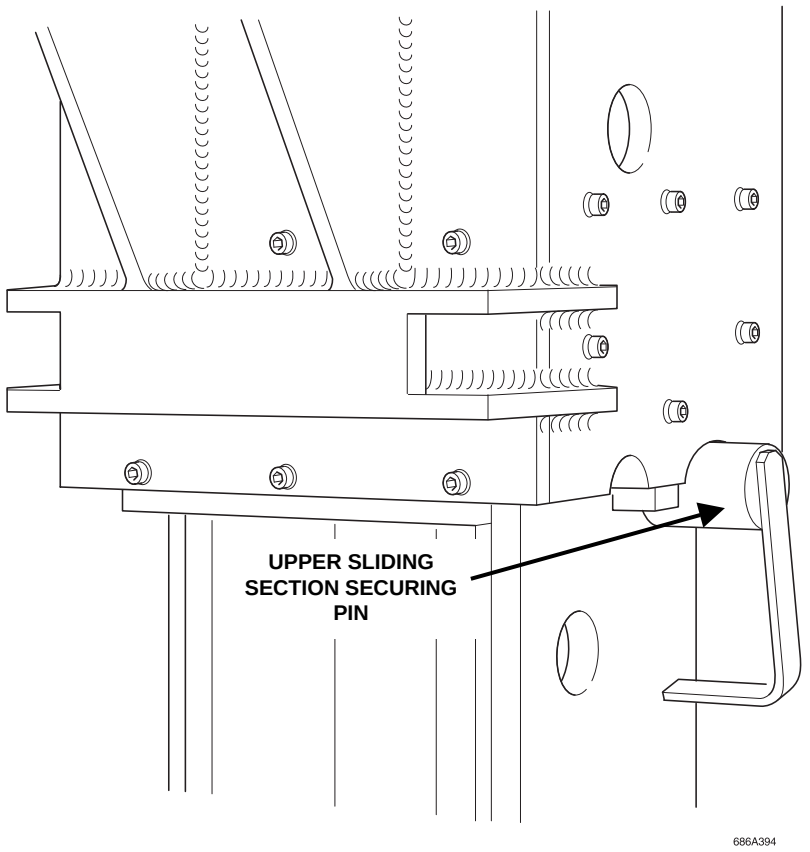
Ensure that the A-frame ladders are lifted clear of the ground and held while the A-frame is lowered. Failure to observe this instruction will result in damage to the A-frame ladders.

4.14.1.2 Support the A-frame outer ladder away from the A-frame and clear of the ground.

4.14.1.3 Rotate the A-frame support struts to their vertical position. Ensure that the struts are correctly seated on their location boss.

4.14.1.4 On the chest pack, move the joystick forwards to raise the A-frame slightly.

4.14.1.5 Remove the R clips and the pins securing the A-frame upper sliding section in the upper position.



A-frame Upper Sliding Section Securing Pin

4.14.1.6 On the chest pack, move the joystick rearwards to lower the A-frame until its weight is supported by the fixed pins and the support struts.

4.14.1.7 Insert the upper sliding section securing pin in the transport position on the A-frame and secure them with R clips.

4.14.2 Launch Beam Retrieval

4.14.2.1 This section describes the operations required to retrieve the launch beam.

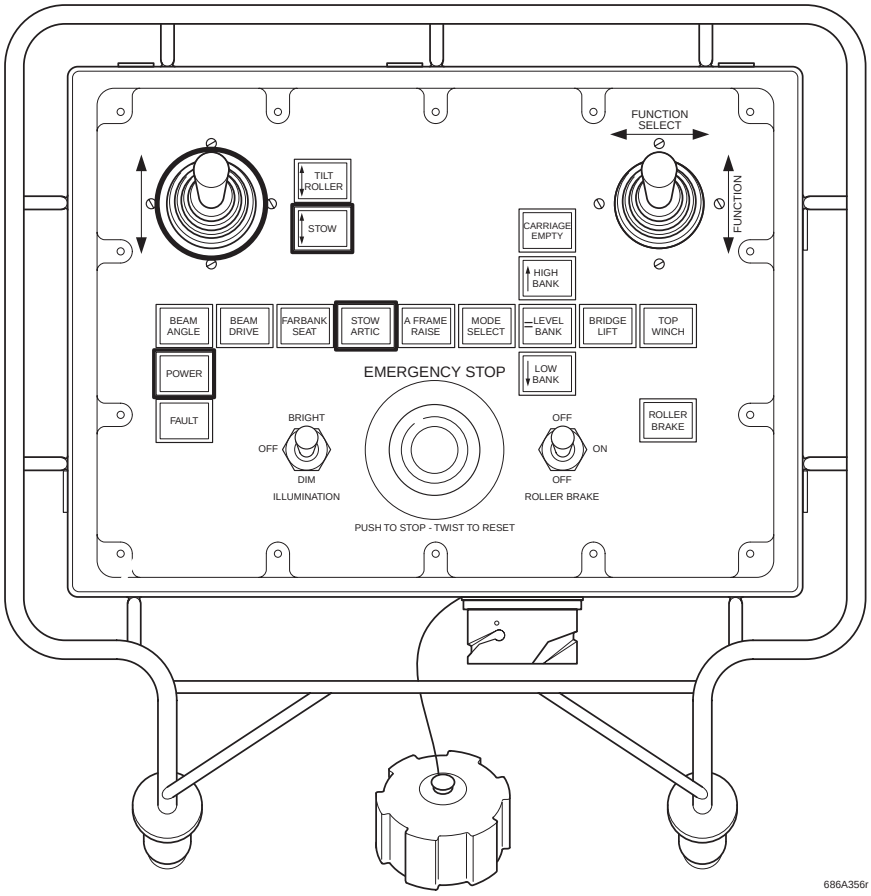
WARNING

CRUSH HAZARD. OPERATION OF THE ARTICULATOR CYLINDERS BEFORE THEY ARE ROTATED TO THE VERTICAL MAY CAUSE SERIOUS INJURY TO PERSONNEL.

NOTE

The first section of the launch beam complete with the far bank support is not removed during retrieval but remains stored on the launch frame.

4.14.2.2 On the chest pack, use the joystick to select the **STOW ARTIC** function. Make sure both the **POWER** and **STOW ARTIC** captions on the chest pack display illuminate.



Stow Articulator Caption

4.14.2.3 Operate the **TILT ROLLER/STOW ARTICULATOR** joystick in the forward left corner of the chest pack to extend the articulator stowing cylinder.

4.14.2.4 On the chest pack, move the joystick to the left to select **FAR BANK SEAT**.

4.14.2.5 On the chest pack, move the right hand joystick rearwards to extend the articulator cylinders until they are just above the articulator cylinder cross member location blocks.

4.14.2.6 Manually align the articulator cylinders with the location blocks by pulling on the articulator cylinder cross member.

NOTE

One cylinder may engage before the other. Continue to extend the remaining cylinder until it fully engages.

4.14.2.7 On the launcher chest pack move the joystick slowly rearwards to extend the articulator cylinders until they seat in the location blocks and the shootbolts can be inserted.

4.14.2.8 Insert shootbolts.

4.14.3 Raising the Far Bank Seat

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

4.14.3.1 On the chest pack, move the joystick forwards to lift the far bank support until the upper jaw of the end of the last launch beam is at a convenient height for pin extraction by the operative.

4.14.3.2 On the chest pack, use the joystick to select the **BEAM DRIVE** function. Make sure the **POWER** and **BEAM DRIVE** captions on the chest pack display illuminate.

NOTE

It may be necessary to drive the beam forwards or rearwards to aid in the removal of the final stop pin.

4.14.3.3 Remove the pin from the launch beam final stop.

4.14.3.4 Attach a tag line to the handle at the rear of the launch beam when sufficiently retracted.

4.14.3.5 Raise the launch beam safety stop and hold in position until the launch beam stop block is clear.

CAUTION

Do not overshoot the reverse drive such that the launch beam contacts the launch beam safety stop. The control of the launch beam by the operation of the right hand joystick on the chest pack is such that the beam can be decelerated before the launch beam contacts the emergency stop. Failure to heed this instruction will lead to equipment damage.

4.14.3.6 On the chest pack, move the joystick rearwards to reverse drive the launch beam until the safety stops lowers and just moves away from the launch beam roller.

4.15 DISCONNECTING THE LAUNCH BEAM MODULES

4.15.1 Launch Beam Module Disconnection

WARNING

CRUSH HAZARD. PERSONAL INJURY CAN RESULT IF EXTREME CAUTION IS NOT USED WHEN INSTALLING THE BEAM CONNECTING PINS. KEEP HANDS AND FINGERS CLEAR OF PIN HOLES AND COMPONENTS BEING MOVED OR CONNECTED.

CAUTION

Damage to pins and pinholes can result if undue force is used to remove the connecting pins. Do not hammer the pins out of the lower jaws.

4.15.1.1 Connect a tag line to the front handle of the launch beam to be removed.

4.15.1.2 Remove the R clip and the pin from the lower jaws. Place the pin in the pin storage rack and secure with the R clip.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

4.15.1.3 Operate the traverse and raise/lower controls on the crane and position the launch beam lifter for attachment to the rearmost launch beam module.

4.15.1.4 Connect the launch beam lifter to the launch beam to be removed ensuring that it is located between the channel at the center of the beam, and the locking catch is fully down.

4.15.1.5 Operate the raise/lower controls on the crane as necessary to adjust the position of the rearmost launch beam module to allow easy removal of the upper pins.

4.15.1.6 Remove the R clip and the pin from the upper jaws and using the tag lines to control the slung beam move it away from the away from the still connected launch beam.

4.15.1.7 Place the pin in the storage rack and secure with the R clip.

4.15.1.8 Position the pinning operatives in the shelter of the launch frame during craning operations.

4.15.1.9 Operate the raise and traverse controls on the crane and position the rearmost launch beam module on flatrack LVT. Use the tag lines to guide the launch beam.

4.15.1.10 Repeat 4.14.3.4 through 4.15.1.9 until the three lower launch beams are positioned on LVT.

4.15.1.11 Place the 4 central spacer bars on the flatrack load.

4.15.1.12 Repeat 4.14.3.4 through 4.15.1.9 to recover the remaining beams.

NOTE

The forward launch beam module remains within the launch frame.

4.15.1.13 Disconnect the launch beam lifter and the steadying rope lines from the launch beam module when it is securely positioned in its transportation guides on flatrack LVT.

4.15.1.14 Position the 4 upper transportation spacers on flatrack load LVT.

NOTE

It may be necessary to drive the beam forwards or rearwards to aid in the fitting of the final stop pin.

4.15.1.15 Align the forward launch beam with the final stop pinhole on the launch frame and insert the final stop pin.

CAUTION

System damage can occur if steps 4.15.1.16 to 4.15.1.19 are not carried out.

NOTE

If no slack can be seen on the bottom winch rope, perform procedures 4.15.1.16 and 4.15.1.17 otherwise go to 4.15.1.18.

4.15.1.16 On the chest pack move the joystick to the right until the **BRIDGE LIFT** function is illuminated.

4.15.1.17 Move the joystick rearwards slowly until the home bank carriage beam is seen to rotate and hang freely.

4.15.1.18 On the chest pack move the joystick to the left until the **BEAM ANGLE** function is illuminated.

4.15.1.19 Move the joystick forward and fully retract the articulator cylinders.

4.15.1.20 Secure the launch beam modules and loose items storage basket to the launch vehicle flatrack LVT with ratchet straps.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

4.15.1.21 Operate the lower and traverse controls on the crane and lower the launch beam lifter to the ground.

4.15.1.22 Disconnect the launch beam lifter and single leg sling from the crane hook and locate them in their stowed position in the basket located on LVT.

Section VI. STOWING LAUNCHING VEHICLE ASSEMBLIES

4.16 STOWING LAUNCHING VEHICLE ASSEMBLIES

4.16.1 Crane stowage

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

CRUSH HAZARD. DO NOT REMAIN IN DANGER AREA WHILE THE CRANE IS DOCKING. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SERIOUS PERSONAL INJURY OR DEATH.

CRANE OPERATION. THE CRANE OPERATOR MUST BE AWARE OF PERSONNEL AND OBSTACLES IN THE DANGER AREA. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SERIOUS INJURY OR DEATH TO PERSONNEL.

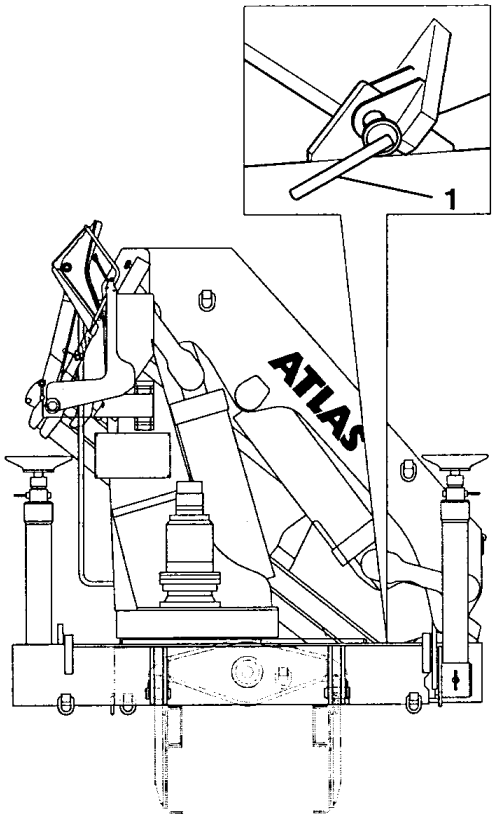
HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

4.16.1.1 Make sure the area within the crane operating envelope is clear of personnel. Operate the controls on the crane to retract the crane jib, and then fold and stow the crane to the transportation position.

4.16.1.2 Place the boom into the docking bracket.

4.16.1.3 Install the locking pin (1).



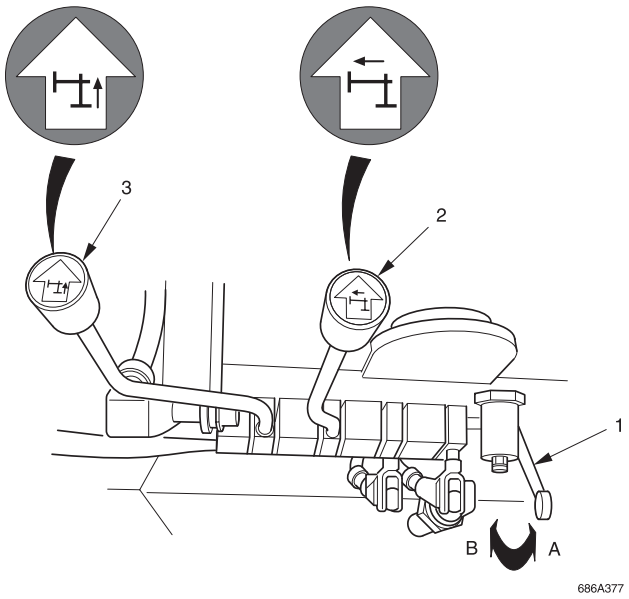
Crane Jib Transport Pin

4.16.1.4 Set the crane controls to the off position.

4.16.1.5 Fold the crane operator's seat to the stowed position and secure it with the shootbolt.

4.16.1.6 Make sure the area around the crane stabilizer legs is clear of personnel. Move the crane stabilizer lever (1) from crane (B) to stabilizer (A).

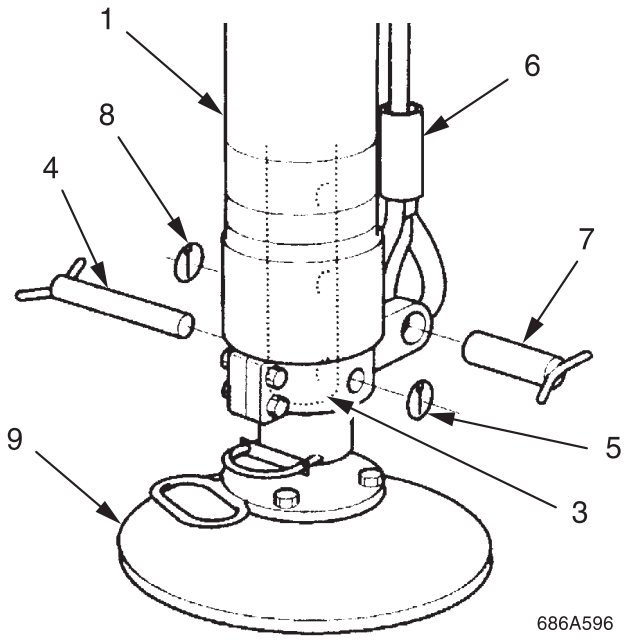
4.16.1.7 Operate the crane stabilizer controls adjacent to both stabilizers and retract both stabilizer legs using lever (3).



Crane Stabilizer Leg Controls

4.16.1.8 Make sure the hydraulic cylinders fully retract for convenient attachment of the wire retention cable.

4.16.1.9 Remove the crane stabilizer spreader pads from beneath the crane stabilizer legs.

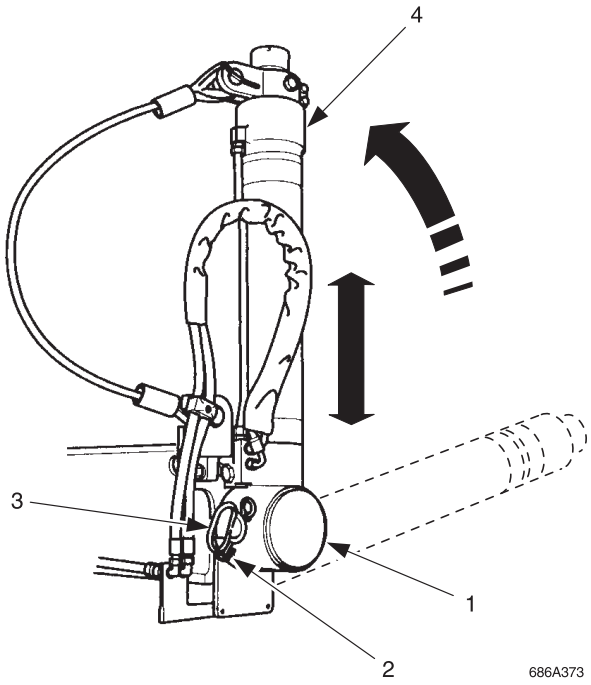


Crane Leg, Deployment Strap Pin Arrangement

4.16.1.10 If the stabilizer extension pieces have been used, support their weight and remove pins (4) and (5). Retract the leg extension and refit pins (4) and (5) to secure the leg extension.

4.16.1.11 Remove the retaining clip (8) and the pin (7) from the retention cable (6) attachment bracket on each crane stabilizer leg (1).

4.16.1.12 Put the wire retention cable (6) in position and re-insert the pins (7). Secure the pins (7) with the retaining clips (8).



Crane Leg Safety Pins

4.16.1.13 Remove the retaining clip (2) and the locking pin (3) from the pivot of the crane stabilizer leg.

4.16.1.14 Make sure the area around the crane stabilizer legs is clear of personnel. Operate the crane stabilizer control adjacent to the stabilizers to extend the stabilizers, rotating both crane stabilizer legs to the vertical position.

4.16.1.15 Make sure the hydraulic cylinders extend and rotate the crane stabilizer legs to a vertical inverted position.

NOTE

Extension of the hydraulic cylinders causes the legs to rotate upwards due to the attachment geometry of the wire stabilizer deployment strops.

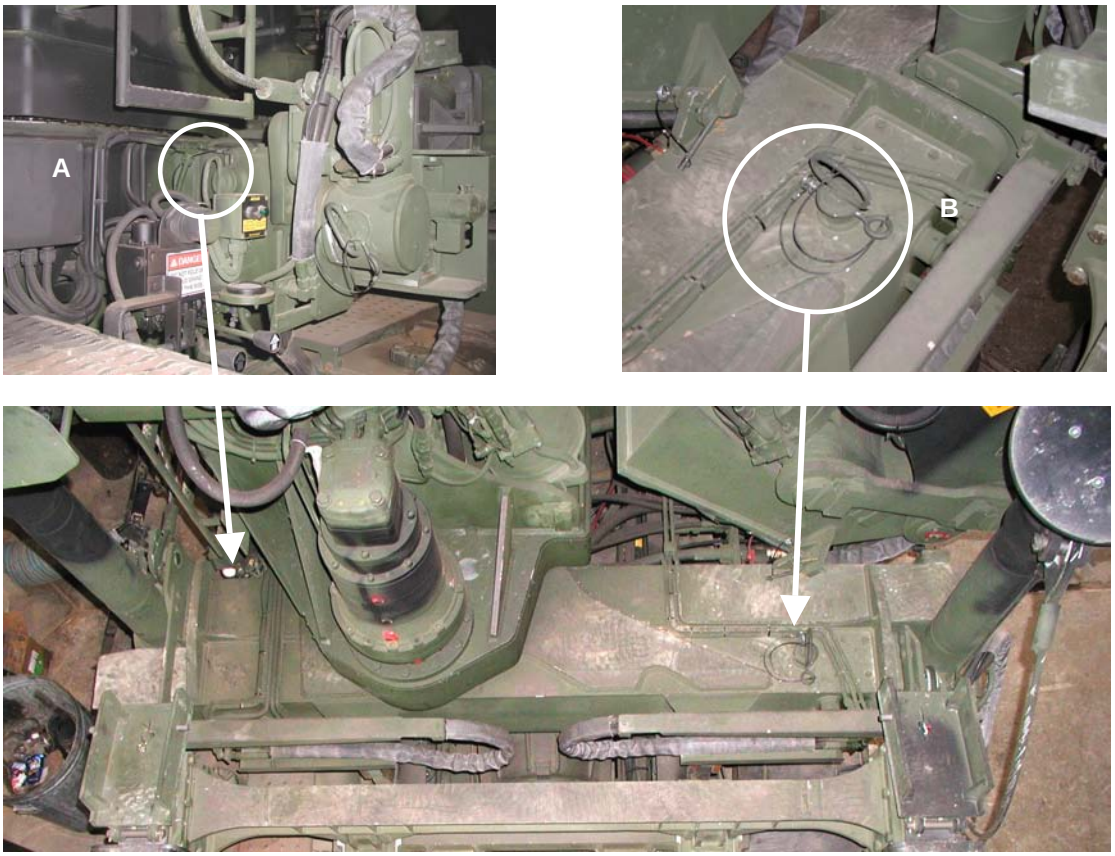
4.16.1.16 Install the locking pin (3) in the pivot points of the crane stabilizer legs. Secure the locking pins with the retaining clip (2).

4.16.1.17 Operate control lever to fully retract the stabilizer cylinder

4.16.1.18 Make sure the area around the crane stabilizer legs is clear of personnel. Operate the crane stabilizer controls adjacent to the stabilizers to retract both crane stabilizer slide frames inward to the launch vehicle.

4.16.1.19 Make sure the hydraulic cylinders operate and retract the crane stabilizer slide frames inward to the stowed position.

4.16.1.20 Recover the locking pins and securing clips from the vehicle cab, and insert the locking pins and retaining clips into position to secure the stabilizer sliding frames.



Crane Stabilizer Slide Frame Transport Pins and Clips

4.17 LAUNCH VEHICLE RECOVERY

4.17.1 Retracting the Slide Frame

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

4.17.1.1 On the interface panel, press and hold the **RELAX** button. Release the **RELAX** switch when shootbolt holes in the relax mechanism are aligned and the pins are inserted.

4.17.1.2 Engage the relax mechanism shootbolts. Make sure the **PIN OUT** caption on the interface panel extinguishes.

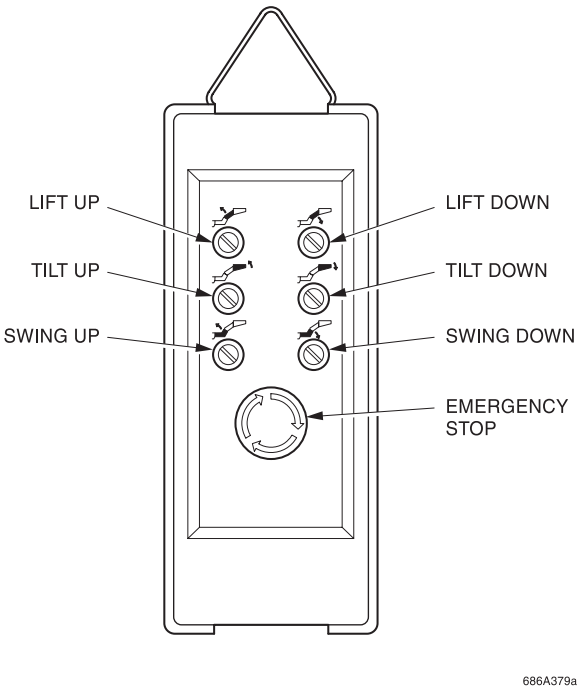
4.17.1.3 Stow the walkway decking panels in their stowage locations.

4.17.1.4 Operate both A-frame stabilizer leg Retract/Extend controls together. Make sure the stabilizer leg hydraulic cylinders operate to extend the legs. Release the controls when the stabilizer cylinders extend the legs to position the A-frame at its maximum height.

A-frame Stabilizer Leg Controls

4.17.1.5 Refit A-frame stabilizer pins and clips at the highest hole position.

4.17.1.6 Lower the A-frame onto stabilizer pins.

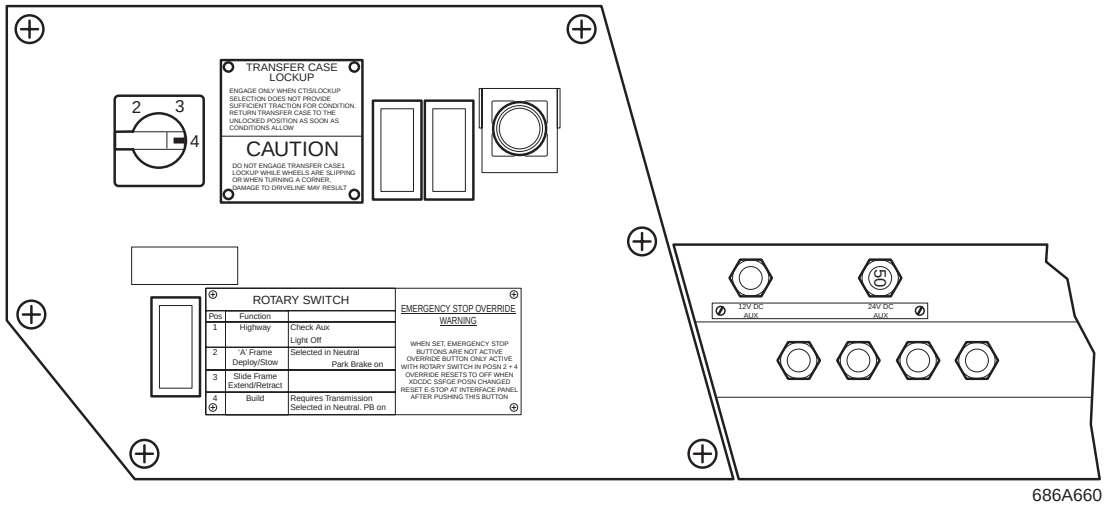


Tail lift Hand Control

4.17.1.7 On the tail lift pendant, press and hold the **LIFT UP** switch to raise the tail lift platform. Make sure the lift hydraulic cylinders extend to raise the tail lift platform.

4.17.1.8 Release the **LIFT UP** switch on the tail lift pendant when the tail lift platform height is sufficient to pass through the space between the top of the home bank ramp module and the underside of the lower cross member of the A-frame.

4.17.1.9 In the launch vehicle cab, to the right of the driving position, on the left side of the center console, set the 4-position mode selector rotary switch to position 3. Make sure the PTO disengages and the engine rpm reduces to idle.



4 Position Rotary Switch in Cab

4.17.1.10 Remove the chocks from the launch vehicle LV front axle wheels.

CAUTION

Do not engage the launch vehicle transmission and drive it backwards, in excess of 2 mph (3.2 kph), the A-frame could be damaged.

When retracting the slide frame, it is essential that the vehicle chassis and the slide frame are both in line longitudinally. If the vehicle chassis is at a different angle to the slide frame the energy chains that run down the inside of the slide frame beams will be damaged, and the launcher will not sit on the twist lock blocks when lowered.

4.17.1.11 Set the launch vehicle transmission to reverse and release the parking brake. Ensure the case lock is engaged (all wheel drive).

4.17.1.12 Place personnel at either side of the rear of the slide frame to watch and ensure that the energy chains do not become trapped between the vehicle chassis and the slide frame.

CAUTION

Stop the reverse and adjust the height of the tail lift if the tail lift will not pass under the energy chain or between the top of the home bank ramp module and the underside of the A-frame lower cross member of the A-frame. Failure to observe this instruction will result in equipment damage.

4.17.1.13 Slowly reverse the launch vehicle and retract the slide frame.

4.17.1.14 If the tail lift WILL clear the slide frame energy chain and pass between the top of the home bank ramp module and the underside of the A-frame lower cross member of the A-frame then move to 4.17.1.20.

NOTE

Carry out procedures 4.17.1.15 to 4.17.1.18 ONLY if tail lift will NOT pass under the energy chain or between the top of the home bank ramp module and the underside of the A-frame lower cross member.

4.17.1.15 Stop the launch vehicle, set the transmission to neutral and apply the parking brake.

4.17.1.16 In the launch vehicle cab, to the right of the driving position, on the left side of the center console, set the 4-position mode selector rotary switch from 3 to position 2. Make sure the PTO engages and the engine rpm goes to high idle.

4.17.1.17 On the tail lift pendant, press and hold the **LIFT UP** switch to raise the tail lift platform. Make sure the lift hydraulic cylinders extend to raise the tail lift platform.

4.17.1.18 Release the **LIFT UP** switch on the tail lift pendant when the tail lift platform height is sufficient to clear the slide frame energy chain or pass through the space between the top of the home bank ramp module and the underside of the A-frame lower cross member.

4.17.1.19 Set the 4 position switch to position 3 and continue to fully close the slide frame.

4.17.1.20 Set the 4-position mode selector rotary switch from 3 to position 2. Make sure the PTO engages and the engine rpm goes to high idle.

CAUTION

As the weight of the A-frame is lowered onto the twist locks the vehicle suspension will lower, and may cause the tail lift to contact the bridge. Bridge contact with the tail lift must be avoided to prevent damage to the tail lift.

4.17.1.21 Operate both A-frame stabilizer leg raise controls to allow the pins to be removed.

4.17.1.22 Operate both A-frame stabilizer leg lower controls and lower the slide frame onto the chassis twist-to-lock fasteners. Make sure the stabilizer leg hydraulic cylinders operate and retract the legs.

4.17.1.23 Adjust the height of the tail lift as required to ensure that it does not come into contact with either the far bank support or the bridge, while the A-frame is being lowered onto the twist locks.

4.17.1.24 Make sure the twist-to-lock fasteners on the slide frame are correctly located. Continue to retract the stabilizer legs until they are fully retracted and the feet are clear of the ground. Install the locking pins in the retracted A-frame stabilizer legs from the outside in.

4.17.1.25 As the A-frame is lowered from its maximum height the slide frame may partially open causing the twist to lock fasteners not to align. If this occurs lower both A-frame stabilizer legs and repeat steps 4.17.1.19 to 4.17.1.24.

4.17.1.26 Engage the twist-to-lock fasteners on the slide frame.

4.17.2 Disconnecting the Chest Pack

NOTE

The chest pack must not be disconnected from the launch vehicle until this point. If the chest pack is disconnected before this point and the four position switch in the vehicle cab is in position 4, the emergency stop system will operate and shut down the launch vehicle operating systems.

4.17.2.1 Set the chest pack to OFF.

4.17.2.2 Disconnect the chest pack umbilical cable from the chest pack and the launch vehicle connection point. Fit dust covers to the electrical connections at the chest pack and the launch vehicle ends of the umbilical cable.

4.17.2.3 Coil the chest pack umbilical cable and return the cable and the chest pack to their stowage position.

4.17.2.4 On the tail lift pendant, press and hold the **LIFT UP** switch to raise the tail lift platform to support the far bank support bearing pads. Make sure the lift hydraulic cylinders extend to raise the tail lift platform.

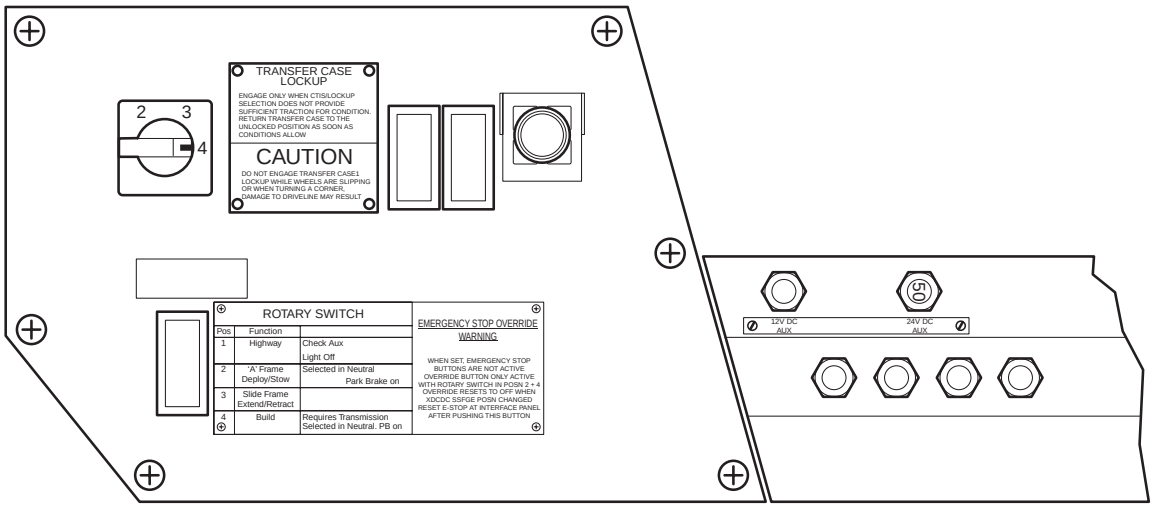
4.17.2.5 Disconnect the tail lift umbilical cable from the launch vehicle connection point. Fit dust covers to the electrical connections at the umbilical cable end and the launch vehicle.

4.17.2.6 Coil the tail lift umbilical cable and return the cable and the tail lift pendant to their stowage position.

NOTE

At this point, the launcher can be driven off site to allow the approach ramps to be laid and trafficking to commence. If this is to be carried out, the tail lift should be raised to support the far bank support.

4.17.2.7 In the launch vehicle cab, to the right of the driving position, on the left side of the center console, set the 4-position mode selector rotary switch from 2 to 1. Make sure the PTO disengages and the engine rpm reduces to idle.



686A660

4 Position Rotary Switch in Cab

4.17.2.8 Disengage case lock (all wheel drive).

4.17.2.9 Engage the launch vehicle transmission and release the parking brake. Drive the launch vehicle to the staging area.

4.17.2.10 On arrival at the staging area, position the launch vehicle for A-frame recovery.

4.17.2.11 Disengage the launch vehicle transmission, apply the parking brake, and fit chocks to the front wheels.

4.18 LAUNCH VEHICLE CONFIGURING FOR ROAD USE

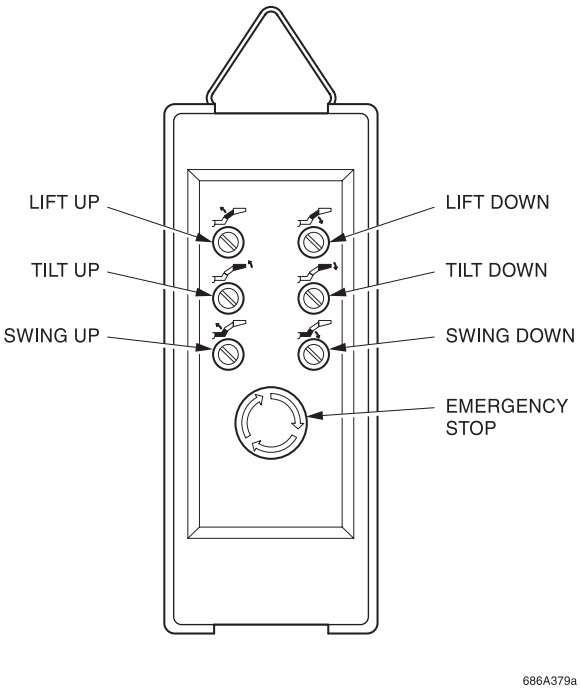
4.18.1 Stowing the A-frame

4.18.1.1 Recover the tail lift pendant from its storage position, and connect the tail lift umbilical cable to the tail lift vehicle connection point.

4.18.1.2 In the launch vehicle cab, to the right of the driving position, on the left side of the center console, set the 4-position mode selector rotary switch from 1 to 2.

4.18.1.3 Retract shootbolts holding far bank support bearing pads and slowly lower the tail lift until both pads can be removed from the tail lift.

4.18.1.4 On the tail lift pendant operate the **LIFT DOWN** switch to lower the tail lift platform so that it is just off the ground.



Tail lift Hand Control

4.18.1.5 Disengage the shootbolts securing the A-frame in the vertical position.

NOTE

If the locking pins are difficult to disengage, press and hold momentarily, the DEPLOY pushbutton on the A-frame rotate, in the interface cabinet.

4.18.1.6 Make sure personnel are clear from the area around the A-frame.

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

NOTE

During the rotation of the launch frame, ensure that the far bank support correctly aligns with the stirrups on the tail lift.

4.18.1.7 On the A-frame rotate panel of the interface cabinet, press and hold the A-frame rotate **PARK** pushbutton. Make sure the hydraulic cylinders operate and rotate the A-frame to the stowed position.

4.18.1.8 Release the **PARK** pushbutton when the A-frame is fully rotated to the stowed position. Make sure the **LAUNCHER DOWN** caption on the A-frame rotate panel of the interface cabinet illuminates.

4.18.1.9 Remove the retaining clips and the locking pins in the A-frame upper and lower cross members, which lock the A-frame legs in the spread position.

NOTE

If the shootbolts are difficult to disengage, press and hold momentarily the DEPLOY pushbutton, on the A-frame fold panel of the interface cabinet.

4.18.1.10 Make sure personnel are clear from the area around the A-frame.

4.18.1.11 On the A-frame fold panel of the interface cabinet, press and hold the A-frame fold **PARK** pushbutton. Make sure the hydraulic cylinders operate and fold the A-frame stabilizer legs to the stowed position.

4.18.1.12 Release the **PARK** pushbutton when the A-frame stabilizer legs are in the folded position. On the A-frame fold panel of the interface cabinet, make sure the **DEPLOYED** caption goes off.

4.18.1.13 Install the locking pins and their retaining clips at the hinge point of the upper cross member to lock the A-frame legs in the folded position. Insert the short pin in the outermost hole from front to rear and the long pin from rear to front securing with R clips.

4.18.2 Stowing the Far Bank Support

WARNING

TAIL LIFT OPERATION. THE TAIL LIFT IS DESIGNED TO CARRY A MAXIMUM OF FOUR PERSONS (500KG (1102.31LBS)). DO NOT OVERLOAD THE TAIL LIFT OR PERSONS COULD BE KILLED OR INJURED AND THE TAIL LIFT DAMAGED IN THE EVENT OF A FAILURE.

CRUSH INJURY. RAISING THE TAIL LIFT WITH THE GUARD RAILS ERECTED MAY CAUSE A TRAPPING HAZARD. KEEP ALL LIMBS CLEAR DURING TAIL LIFT MOVEMENT.

CAUTION

The tail lift is designed to carry a maximum of four persons (1102.31 lbs (500 kg)). Do not overload the tail lift. The tail lift will be damaged in the event of a failure.

4.18.2.1 Operate the **SWING UP** switch until the tail lift structure supports the far bank support ensuring that the far bank support locates in the stirrups on the tail lift.

4.18.2.2 Step onto the far bank support and retract the shootbolt securing it in the extended position and clip it into its retracted position.

4.18.2.3 Operate the **SWING UP** switch until the tail lift platform compresses the far bank support and the retracted position locking holes are aligned.

4.18.2.4 Insert the lower shootbolt in the far bank support at its retracted position and clip.

4.18.2.5 Operate the **LIFT DOWN** switch until the tail lift platform is at ground level and its support of the far bank support is removed.

4.18.2.6 Install the far bank support bearing pads in their stowed position on the far bank support.

4.18.2.7 Install the transportation securing straps on the far bank support and secure it in its stowed position on the launch vehicle.

4.18.2.8 Recover the crane spreader pads to their stowage on the tail lift and secure them with transport straps.

4.18.2.9 Recover the stepladder, locate it in its stowed position on the tail lift, and strap.

4.18.2.10 On the tail lift pendant, operate the **SWING UP** switch to set the tail lift platform to the stowed position. Make sure the swing hydraulic cylinders operate and the tail lift platform moves to the transport position.

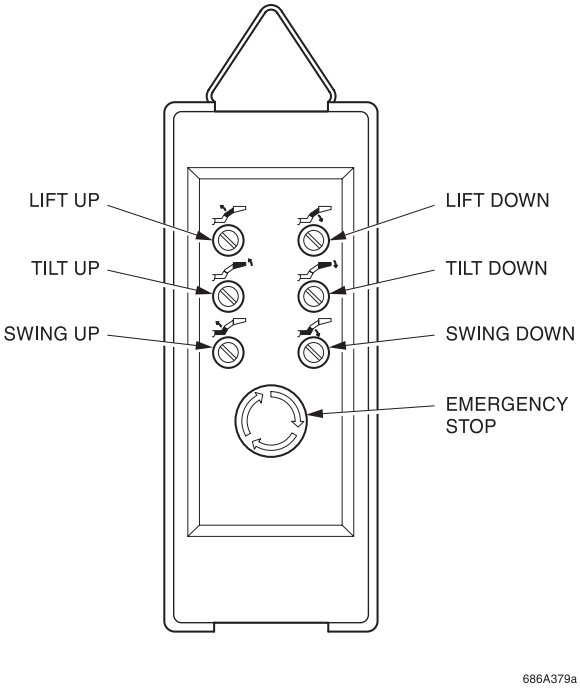
4.18.2.11 On the tail lift pendant, release the **SWING UP** switch when the tail lift platform is stowed in the transport position.

4.18.2.12 On the tail lift pendant, operate the **LIFT UP** or **LIFT DOWN** switches to move the tail lift platform to the position ready for stowing. Make sure the lift hydraulic cylinders operate and the tail lift platform moves to the position ready for stowing.

4.18.2.13 On the tail lift pendant, release the **LIFT UP** or **LIFT DOWN** switches when the tail lift platform is in position ready for stowing.

4.18.2.14 On the tail lift pendant, operate the **TILT UP** or **TILT DOWN** switch to set the tail lift platform vertical. Make sure the tilt hydraulic cylinders operate and the tail lift platform moves to the horizontal position.

4.18.2.15 On the tail lift pendant, release the **TILT UP** or **TILT DOWN** switch when the tail lift platform is vertical.

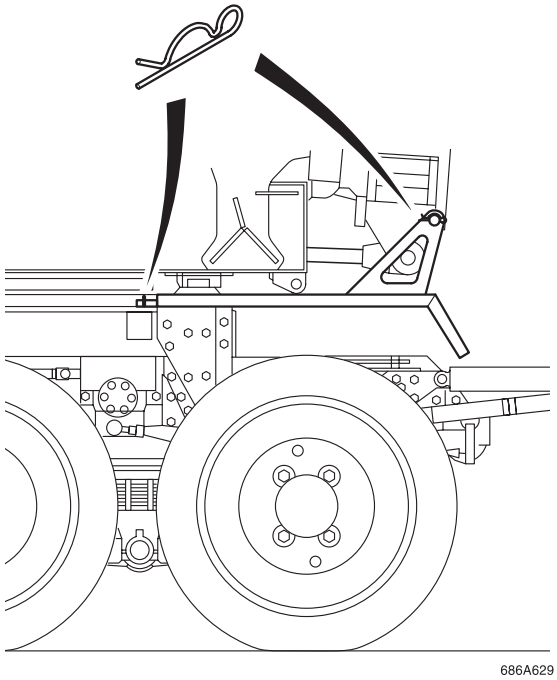


Tail lift Hand Control

NOTE

It may be necessary to adjust the tail lift to the transport position by further operation of the TILT UP, TILT DOWN, LIFT UP or LIFT DOWN switches.

4.18.2.16 Refit the mudguards to the launch vehicle ensuring shootbolts and front securing pegs are fully engaged and R clipped.



Position of Mudguard R clips

4.18.2.17 Disconnect the tail lift umbilical cable from the launch vehicle connection point. Fit dust covers to the electrical connections at the umbilical cable end and the launch vehicle.

4.18.2.18 Coil the tail lift umbilical cable and return the cable and the tail lift pendant to their stowage position.

4.18.2.19 Install the two transportation securing straps from the launch vehicle to the tail lift.

WARNING

BURN HAZARD. WEAR SUITABLE GLOVES WHEN HANDLING HOT EXHAUST PARTS TO AVOID BURNS. FAILURE TO OBSERVE THIS INSTRUCTION WILL RESULT IN SEVERE PERSONAL INJURY.

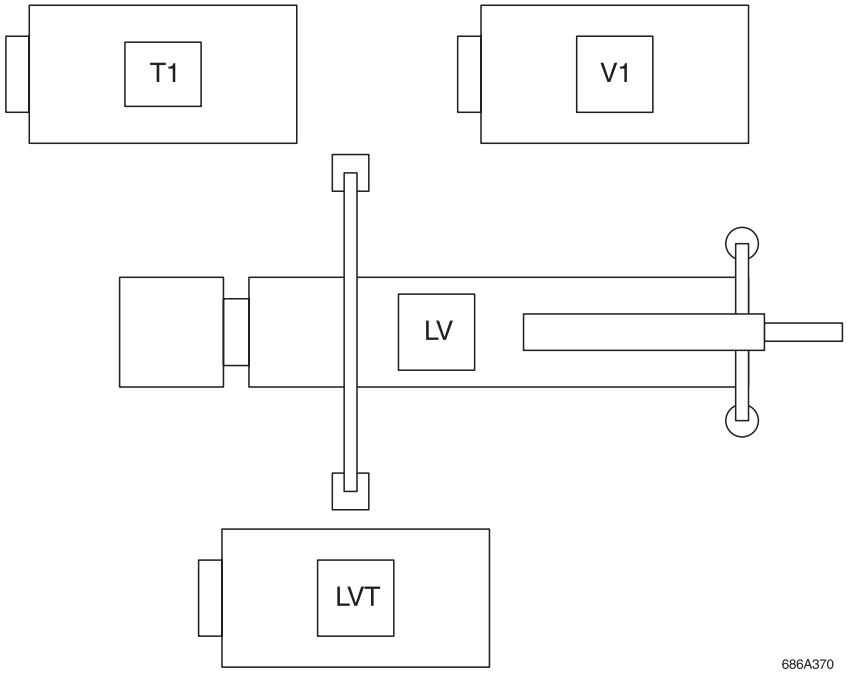
4.18.2.20 Remove the 90 degree exhaust elbow from the top of the vehicle exhaust pipe.

4.18.2.21 Refit the top section of the vehicle exhaust pipe.

4.18.2.22 Stow the 90 degree exhaust elbow back in its stowage next to the crane hydraulic manifold and interface enclosure.

4.19 RECOVERING THE FLATRACKS AND VEHICLES

4.19.1 Flatrack Recovery



Position of Flatracks

4.19.1.1 Load approach ramp transport frames onto flatrack V1 and secure with straps.

4.19.1.2 Load flatrack T1 onto vehicle V3 and return to staging area.

4.19.1.3 Transload flatrack T1 onto trailer T1.

4.19.1.4 Load flatrack LVT on to vehicle V3 and return to staging area, transload flatrack LVT onto trailer LVT.

4.19.1.5 Return vehicle V1 to bridge site, load flatrack V1 and return to staging area.

4.19.1.6 Connect trailer T1 to vehicle V1.

4.19.1.7 Load flatrack T2 onto vehicle V2 and transload flatrack T2 onto trailer T2

4.19.1.8 Load flatrack V2 onto vehicle V2.

4.19.1.9 Connect trailer T2 to vehicle V2.

4.19.1.10 Load flatrack V3 onto vehicle V3.

4.19.1.11 Connect trailer T3 to vehicle V3.

4.19.1.12 Engage the launch vehicle transmission and release the handbrake. Drive the launch vehicle to the parked position of the launch vehicle trailer LVT.

4.19.1.13 Reverse launch vehicle to allow the connection of trailer LVT. Connect the launch vehicle to the launch vehicle trailer LVT.

4.19.1.14 Remove chocks from trailer wheels and release trailer handbrake.

4.19.1.15 Engage the launch vehicle transmission and release the handbrake. Drive the launch vehicle and trailer LVT from the staging area.

NOTE

If a second 65.5 ft (20 m) bridge is to be deployed, drive the launch vehicle and its trailer LVT to a suitable position to continue this task.

4.19.1.16 All vehicles return to base, observe all speed limitations concerning the driving of the launch vehicle and CBT vehicles when returning to base, refer to 4.1 Driving the Launch Vehicle and CBT Trucks with or without Trailers Attached.

4.19.2 No transit light

4.19.2.1 Should the no transit light on the vehicle dash come on check that both relax pins are in, the A-frame fold micro switches are closed, at least one E-STOP button is pressed in, the PTO manual override switch is not set and the launcher is down.

4.19.2.2 Should the no transit light come on during transit to base, stop the vehicle, apply the parking brake, set the transmission to neutral, set the four position switch to 2.

4.19.2.3 Go to the interface enclosure and check which E-Stop is pressed in and reset it to the out position.

4.19.2.4 Press E-STOP reset and allow the vehicle to set itself up for A-frame deployment.

4.19.2.5 Press the **PARK** button on the A-frame rotate sub panel of the interface enclosure. This will lower the A-frame and extinguish the no transit light.

4.19.2.6 Press the interface enclosure E STOP button and leave it set, close the interface enclosure and continue with the transit back to base.

Section VII. POST-BUILD INSPECTION

4.20 POST-BUILD INSPECTION

4.20.1 Inspection Checks

4.20.1.1 Check the hydraulic oil level in the hydraulic reservoir is between the maximum and minimum marks.

4.20.1.2 Check the launch beam is stowed and secure.

4.20.1.3 Check all transportation pins are in place.

4.20.1.4 Check the transportation straps and harnesses of all vehicles and trailers are secure.

4.20.1.5 Check the tail lift and the associated walkway panels are stowed and fully secured.

4.20.1.6 Check the dust covers are secure on the tail lift pendant, the chest pack and their associated umbilical cables.

4.20.1.7 Make sure all guards and covers are closed and secured.

4.20.1.8 Check the crane is secured in the stowed position and the seat is fully folded.

TABLE OF CONTENTS

CHAPTER 5

BRIDGE RETRIEVAL

CHAPTER 5

BRIDGE BUILDING

Section I. OVERVIEW

5.1 BRIDGE RETRIEVAL

The bridge can be retrieved from either its original home or far bank sides of the spanned gap, however it may not always be possible to retrieve the bridge from all far bank sides. The operating parameters for retrieval should accommodate a normal construction site of 134 ft 6 in (41 m) by 49 ft 3 in (15 m) symmetrical about the bridge centerline.

5.1.1 Overview

5.1.1.1 Retrieval involves the removal of the home bank approach ramps and their stowage, in the frames on flatrack V1. The launch vehicle is located and set up and the launch beam subsequently deployed along the centerline of the bridge. When the launch beam is deployed and supported on the far bank, the articulator cylindes are stowed and the A-frame raised to the upper position. The far bank approach ramp frames are positioned on the far bank ramp module and the approach ramps loaded into them prior to the set down of the launch beam.

5.1.1.2 The forward and far bank carriages are driven out along the launch beam and attached to the bridge, which is then raised. The bridge is reversed towards the home bank until the home bank ramp module can be connected to the bridge module lifter already attached to the crane. The pins and shootbolts are removed from the parallel module and the end beam is removed. The module is then transferred to its transportation vehicle by the crane. This process continues until all bridge sections have been stowed and the home bank carriage has been disconnected from the far bank ramp module as it is retrieved.

5.1.1.3 The A-frame is set to the lower position and the articulator cylinders deployed. The launch beam is then raised from the far bank by the chest pack operator and one beam module is withdrawn for removal. The launch beam is connected to and supported by the crane while the connection pins are removed and it is then stowed on the flatrack LVT which has been positioned alongside. The next module is withdrawn, stowed and the process continued until only the first beam module is remaining.

5.1.1.4 When the launch beam has been retrieved, the A-frame, crane, launch frame and slide frame are stowed and secured before the launch vehicle is moved from the site to the staging area.

Section II. DRIVING THE LAUNCH VEHICLE

5.2 DRIVING THE LAUNCH VEHICLE AND PLS TRUCKS WITH OR WITHOUT TRAILERS ATTACHED

5.2.1 Speed Limits

5.2.1.1 The maximum speed of each M1977 CBT and M1075 PLS based launch vehicle, with or without trailers, should be limited to 40 mph when operated on improved roads. If traversal of cross-country terrain is necessary to access an operation site then the M1977 CBT and M1075 PLS based launch vehicle, with or without trailers, should be limited to a maximum speed of 15 mph. The M1076 trailers should be limited to a maximum speed of 10 mph on Belgian block, cobblestone, or surfaces with heavy washboard, ruts, or potholes.

5.2.2 Operating on Sloping Ground

5.2.2.1 Caution must be exercised when operating the DSB vehicles and trailers on slopes. The DSB vehicles should be limited to side slopes not to exceed 20%. The possibility of rollover exists on any slope (including level), but will be minimized provided that operating speeds are kept to a minimum, no sudden steering inputs are made, and depressions are avoided when traversing undulating terrain. Operators must be made aware of these operating characteristics and limitations.

Section III. PREPARATION

5.3 PREPARATION

5.3.1 Preparing the Bridge for Retrieval

WARNING

CRUSH HAZARD. WHEN PREPARING TO RETRIEVE A BRIDGE, ALWAYS MAKE SURE THAT THE BRIDGE SURFACE HAS BEEN SWEPT AND IS FREE OF MUD, ICE AND SNOW, IN SEVERE CASES IF A BUILD UP IS ALLOWED THE EXTRA WEIGHT COULD OVERLOAD THE CRANE. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY OR DEATH TO PERSONNEL.

5.3.1.1 Make sure that the bridge surface has been swept and it is free of mud, ice and snow. As much dirt and compacted dirt as practical must be removed from the hinge areas to prevent folding problems during recovery.

5.3.1.2 Rotate the bridge edge markers and clip in their stowed position.

5.3.1.3 Drop all the curbs to their stowed positions and clip. It may be necessary to use the handles to raise them so they can be dropped.

5.3.1.4 Clean the bridge surface by scraping if necessary and sweep over the bridge sides.

5.3.1.5 Make sure that the curb locations are clean.

5.3.1.6 Recover the defile markers and road form spikes from approach and exits of bridge and stow.

5.3.2 Preparing the Bridge Site for Bridge Retrieval

5.3.2.1 Refer to Chapter 1, Section II, Table 1.12 and make sure the soil bearing capacity has not been adversely affected by bridge traffic and is within the limits set down in Table 1.12.

5.3.2.2 Refer to Chapter 1, Section II Fig 1.9 and make sure the bridge approach slopes have not been adversely affected by bridge traffic and are within the limits.

NOTE

This is particularly important if retrieval is effected from the opposite bank to that used for the bridge deployment.

5.3.2.3 Refer to Chapter 1, Section II paragraph 1.2.11.5 and make sure the retrieval construction site is of sufficient size and meets the slope and height parameters set out in Fig 1.9.

5.3.2.4 Refer to Chapter 1, Section II paragraph 1.2.11.6 and make sure the local weather conditions have not adversely affected the site.

NOTE

This is particularly important if retrieval is effected from the opposite bank to that used for the bridge deployment.

5.3.2.5 Refer to Chapter 1, Section II paragraph 1.2.9 and site mark-out Figure 1.12, and mark out the retrieval site.

5.3.2.6 Refer to Chapter 4 Section II paragraph 4.5.1 Build Site Initial Vehicle/Flatrack Location, and set up the flatracks for beam/bridge retrieval.

NOTE

Accurate alignment of the launch vehicle on the bridge centerline is essential.

5.3.2.7 Project the centerline of the bridge onto the construction site and use this as the datum for marking out the vehicle positions.

5.3.3 Recovering the Near and Far Bank Approach Ramps

5.3.3.1 Recover the two home bank approach ramp frames from their stored location on V1 and position one at the side of the bridge, out of the way of personnel, for future use.

5.3.3.2 Recover the two far bank approach ramp frames from their stored location carry them across the bridge and secure them in position on the far bank ramp module, ensure that the approach ramp frame lifting slings are placed to the outside of the frame.

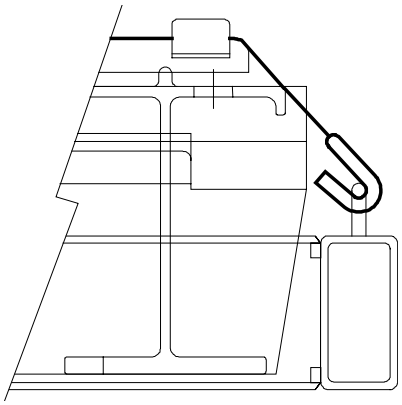
5.3.3.3 Remove five home bank approach ramps, and stow them from alternate sides from the outside in, on the pre-positioned frame on flatrack V1. Secure in position with transport beams and straps.

5.3.3.4 Stack the second approach ramp transport frame onto the lower ramp transport frame and connect the lifting hooks to the upper frame. Fill the upper frame with the remaining five approach ramps and secure.

5.3.3.5 Disconnect the far bank approach ramps and stow them in the transport frames on the far bank ramp module, stowing them from alternate sides from the outside in.

5.3.3.6 Secure both sets of approach ramps onto their frames with the transport straps and retaining bars.

5.3.3.7 Ensure that the hook at the end of the transport strap is located so that the opening is facing toward the inside of the load.



Method of Strapping Approach Ramps

5.3.4 Preparing the Launcher for Bridge Retrieval

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

CHEST PACK E-STOP OPERATION. IF THE CHEST PACK IS FITTED TO THE LAUNCH VEHICLE WHEN THE FOUR POSITION SWITCH, IN THE VEHICLE CAB, IS SET TO POSITION 2 THE CHEST PACK E-STOP BUTTON IS DISABLED. SHOULD IT THEN BE OPERATED IN AN EMERGENCY, ELECTRICAL POWER AND THUS HYDRAULIC POWER WILL NOT BE REMOVED FROM THE LAUNCHER. FAILURE TO HEED THIS INFORMATION COULD LEAD TO DEATH OR SEVERE INJURY TO PERSONNEL.

5.3.4.1 Refer to Chapter 4, Section II paragraph 4.3 Launch Vehicle Set-up and 4.6 Launch Vehicle Preparation at Build Site, set up the launch vehicle for launch beam module deployment.

5.3.4.2 When reversing the vehicle up to the in place bridge make sure that the tail lift will not come into contact with the bridge.

5.3.4.3 Extend A-frame stabilizers to their highest position and extend the slide frame.

5.3.4.4 Once the slide frame is fully extended, lower the A-frame to its working height (For pinhole selection, see Chapter 1 Section II Table 1. 5 Upper A-frame Setting).

5.3.5 Launch Beam Deployment

5.3.5.1 Refer to the steps in Chapter 4, Section III Para 4.7 through 4.7.3.4 inclusive and deploy the launch beam in preparation for bridge recovery.

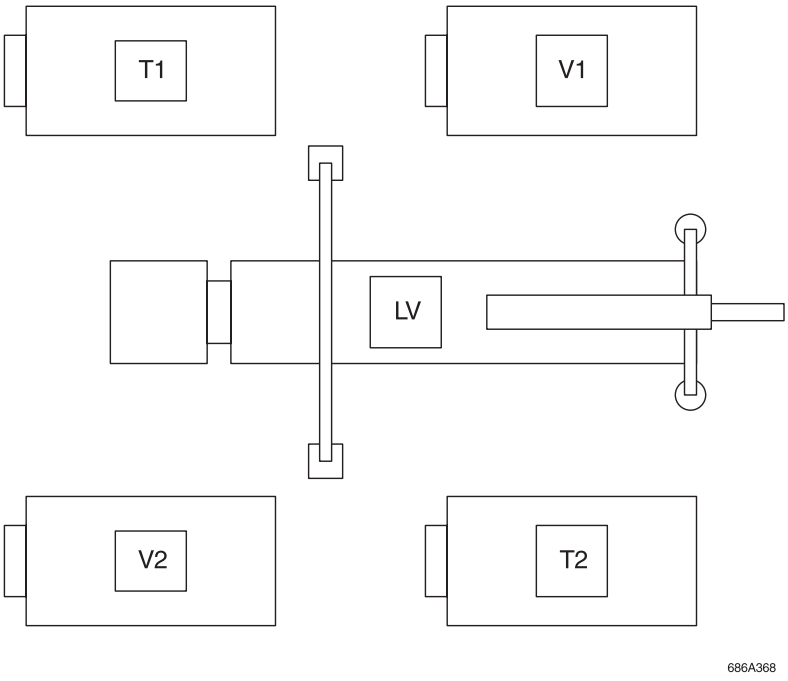
NOTE

Once the launch beams is fully deployed and prior to lowering the far bank support, check that the launch beam is central to the bridge within 1 ft (0.304 m) of the center line. If the launch beam is off center by more than 1 ft (0.304 m) and up to 2 ft (0.6m) pull the beam over using a tag line, until at least half the offset is removed, and lower the far bank support onto the ground. DO NOT pull the far bank support across the ground; ensure that the beam is in the raised position before attempting to correct the beam position. If error is greater than 2 ft (0.6m) and is not due to cross wind, recover the launch beam and launcher and reposition. If the far bank support is not set properly, the launch beam could collapse during bridge recovery

5.3.6 Positioning the Flatracks for Bridge Retrieval

5.3.6.1 Remove flatrack LVT to staging area.

5.3.6.2 Position the flatracks V1, T1, T2 and V2 in readiness for bridge module retrieval.



Position of Flatracks

Section IV. PROCEDURE

5.4 BRIDGE RETRIEVAL

WARNING

LOSS OF HEARING. PERSONNEL MUST WEAR HEARING PROTECTIVE DEVICES WHEN OPERATING THE CRANE DURING LAUNCH AND RECOVERY OPERATIONS OR WHEN WORKING WITHIN 10FT (3M) OF A LAUNCH VEHICLE AT HIGH ENGINE IDLE.

5.4.1 Raising the Bridge

NOTE

When an item on the vehicle or launcher is referred to as front or rear, left or right, the cab is taken as the front of the launch vehicle, all references are taken as if personnel are looking forward towards the cab. Therefor if the left hand side A-frame leg is being discussed, the A-frame leg on the launch vehicle's left hand side is the item being described. (i.e. the driver's side)

When referring to the launch beam the front of the beam is to be taken as the far bank and the rear is taken as the near bank, it follows therefore, that the front carriage is the far bank carriage and the rear carriage is the home bank carriage.

Before bridge retrieval is commenced, the appropriate bridge drive setting must be selected to take account of the site conditions (see Chapter 1 Section II Table 1.11).

5.4.1.1 Refer to the steps in Chapter 4, Section II, Para 4.8 through 4.8.3.9 inclusive and configure launcher to retrieve the parallel modules.

NOTE

Prior to raising the A-frame (Chapter 4, Section III, Para 4.8.3), select bridge drive LOW on the chest pack. Slowly move the joystick rearwards until the far bank carriage restraint latches raise slightly. By standing on the A-frame walkways the carriage restraint latches may now be rotated to the vertical position.

5.4.1.2 On the chest pack, make progressive movements to the right on the joystick until the required bridge drive mode is selected. Make sure the **POWER** and **MODE SELECT** captions on the chest pack display flashes and the **LEVEL** caption illuminates.

CAUTION

Equipment damage. The CARRIAGE EMPTY function is only to be selected when both carriages are supporting no load. It is to be used for carriage retrieval or deployment only. It MUST NOT be used while the bridge is suspended.

NOTE

The CARRIAGE EMPTY function light will continuously flash. This is to act as a warning for the conditions of its use.

In this mode, forward or rearward movement of the joystick on the chest pack results in no physical effect on the hydraulic system.

5.4.1.3 On the chest pack, move the joystick forwards until the **CARRIAGE EMPTY** function is selected. Move the joystick once to the right and make sure the POWER caption remains illuminated and the **CARRIAGE EMPTY** caption is illuminated. Make sure the **MODE SELECT** caption goes off.

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

5.4.1.4 Release the latches holding the home bank carriage to the launcher frame. Move carriages rearwards if necessary.

5.4.1.5 On the chest pack, move the joystick forward to drive the home bank and far bank carriages away from the launch vehicle until the home bank carriage restraint linkage is fully extended. Ensure that the far bank carriage is touching the stops on the beam or the slings are approximately 12 inches beyond the end beam lifting points at the far bank.

5.4.1.6 On the chest pack, select the bridge lift function. Make sure the **POWER** and **BRIDGE LIFT** captions on the chest pack display illuminate, and the bridge drive selected caption (**LEVEL**, **HIGH** or **LOW**) extinguishes.

5.4.1.7 Send two personnel to the far bank to assist the far bank carriage in lowering.

5.4.1.8 Position one man by the far bank carriage ready to pull on the lower half of the carriage.

5.4.1.9 Position one man at the mid way point of the bridge ready to pull on the wire winch rope.

5.4.1.10 On the chest pack, move the joystick forward to raise the far bank carriage so that the shootbolts can be retracted.

NOTE

Continuing to operate bridge lift will create a build up of tension in the lower winch cable, which could cause the cable to nest on the winch drum.

5.4.1.11 Retract the shootbolts on the far bank carriage.

WARNING

PERSONAL INJURY. WHEN HANDLING WINCH CABLE, USE THICK LEATHER GLOVES TO PREVENT INJURY TO HANDS FROM BROKEN STRANDS.

5.4.1.12 To allow the far bank carriage slings to go slack, perform the following:

CAUTION

Equipment damage. Failure to adhere to this procedure will allow the rope to double wrap on the winch drum.

5.4.1.13 One of the two far bank operatives stands at the center of the bridge.

5.4.1.14 Operate the lower winch to pay out the rope.

5.4.1.15 Just prior to the slack rope touching the center of the bridge, the first operative grabs hold of the rope and pulls it towards the far bank. This allows the second operative to pull down on the far bank carriage and thus slacken the slings.

5.4.1.16 It is important to pull on the rope in a continuous motion as the winch is operated, to prevent the rope from double wrapping on the winch drum.

5.4.1.17 On the chest pack, move the joystick rearward to lower the far bank carriage. Do not allow the beam to rest on the bridge as this may cause the winch cables to become entangled.

5.4.1.18 Route the far bank carriage slings through the far bank ramp end beam lifting points and reconnect to the carriage beam. Ensure the slings do not cross and do not become twisted. Ensure that the carriage is level horizontally and vertically, prior to lifting, with respect to the upper part of the carriage.

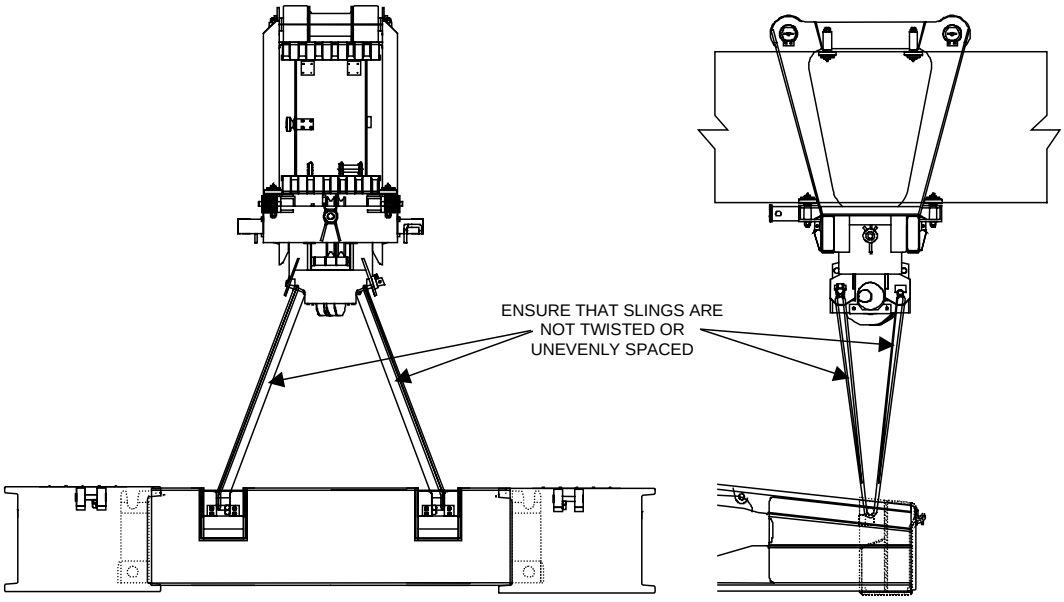


Figure 5. 1 Method and Location of Slinging Far Bank Ramp Module

NOTE

It is extremely important that the two carriage parts are in line vertically and horizontally. Failure to ensure correct alignment will result in the bottom half of the carriage becoming jammed in the top half of the carriage when it is raised.

5.4.1.19 Make sure personnel are clear of the area. On the chest pack, move the joystick forward to partially raise the far bank carriage beam and the bridge until slings are lightly tensioned.

5.4.1.20 Adjust far bank carriage slings to ensure evenly distributed loads through both left and right slings. Ensure that the carriage lifting slings are pushed to the outside of the carriage to assist in a balanced lift. Ensure that lifting slings are not twisted

NOTE

The bridge may lift out of balance, due to mud or personnel on the bridge. To overcome this situation lower the bridge and re-sling or ensure that personnel on the bridge are as close to the centerline as possible. If the bridge still lifts out of balance then it is permissible to have personnel on the bridge to one side or other of the centerline to assist in balancing the bridge.

5.4.1.21 Continue to slowly raise the far bank carriage and the bridge, until the shootbolts in the far bank carriage beam can be inserted to reconnect the two halves.

NOTE

Ensure that the lower section of the far bank carriage is correctly aligned with the upper section of the far bank carriage. Personnel should use the lifting slings to assist in aligning the two halves of the far bank carriage.

5.4.1.22 Move the joystick on the chest pack rearwards to release the tension in the lower winch cable. Tension is sufficiently released when the cable starts to move away from the underside of the launch beam.

5.4.1.23 On the chest pack, move the joystick forward to raise the home bank carriage so that the shootbolts can be retracted.

5.4.1.24 Retract the shootbolts on the home bank carriage.

5.4.1.25 On the chest pack, move the joystick rearward to lower home bank carriage. Do not allow the beam to rest on the bridge as this may cause the cables to become entangled.

5.4.1.26 Route the carriage slings through the front ramp module bridge lifting points (Figure 5. 2) and re-connect the sling to the carriage. Ensure the slings do not cross and thus become twisted. Ensure that the carriage is level horizontally and vertically, prior to lifting, with respect to the upper part of the carriage.

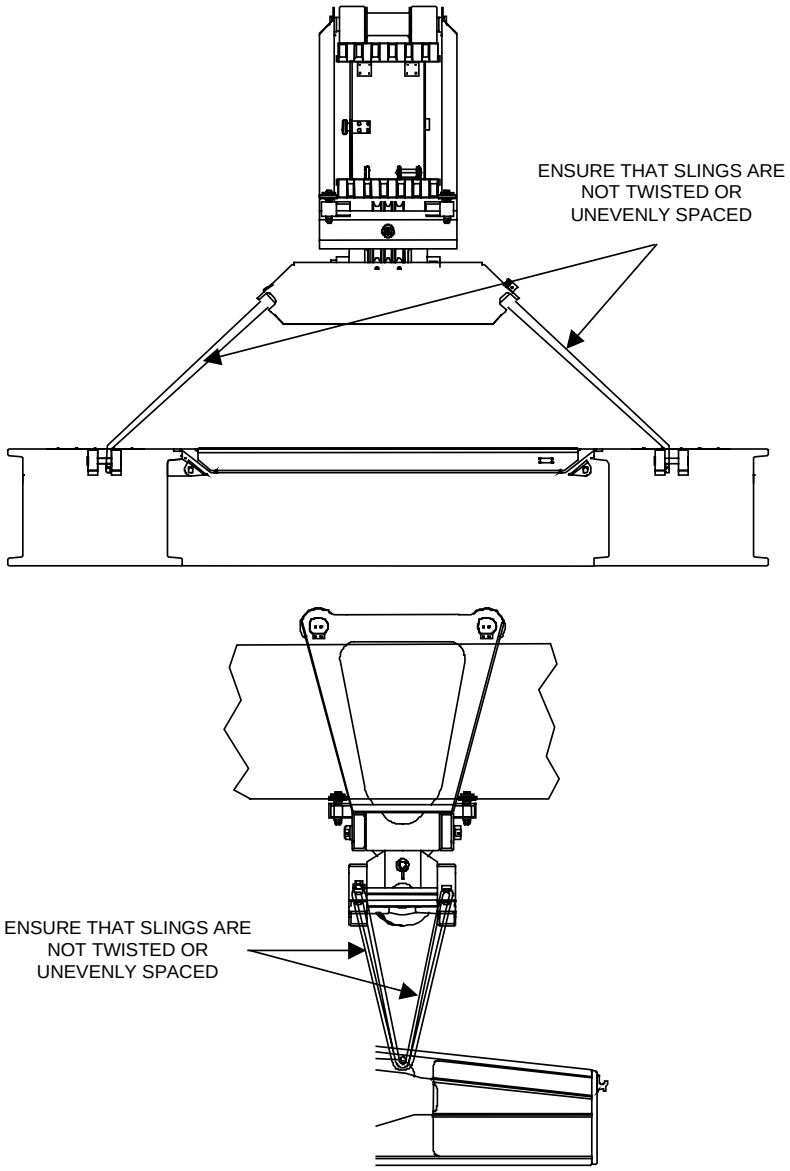


Figure 5. 2 Method and Location of Slinging Home Bank Carriage

NOTE

It is extremely important that the two carriage parts are in line vertically and horizontally. Failure to ensure correct alignment will result in the bottom half of the carriage becoming jammed in the top half of the carriage when it is raised.

5.4.1.27 Make sure personnel are clear of the area. On the chest pack, move the joystick forward to partially raise the home bank carriage beam and the bridge until the slings are lightly tensioned.

5.4.1.28 Adjust home bank carriage slings to ensure evenly distributed loads through both left and right slings.

NOTE

The bridge may lift out of balance, due to mud or personnel on the bridge. To overcome this situation lower the bridge and re-sling or ensure that personnel on the bridge are as close to the centerline as possible. If the bridge still lifts out of balance then it is permissible to have personnel on the bridge to one side or other of the centerline, to assist in balancing the bridge.

5.4.1.29 Continue to slowly raise the home bank carriage and the bridge, until the shootbolts in the far bank carriage beam can be inserted to reconnect the two halves.

NOTE

Ensure that the lower section of the home bank carriage is correctly aligned with the upper section of the home bank carriage. Personnel should use the lifting slings to assist in aligning the two halves of the far bank carriage.

5.4.1.30 On the chest pack, move the joystick to the left to select the **BRIDGE DRIVE** function.

5.4.1.31 Make sure the **POWER** and the bridge drive mode previously selected captions (**LEVEL**, **HIGH** or **LOW**) on the chest pack display illuminate. Make sure the **BRIDGE LIFT** caption on the chest pack display goes off. **DO NOT OPERATE IN EMPTY CARRIAGE MODE**.

5.4.1.32 On the chest pack, move the joystick rearward to reverse the bridge towards the launch vehicle. Release the joystick when the home bank carriage is fully retracted and the restraint latches engage locking the home bank carriage to the launch frame.

5.4.1.33 Place two removable rollers onto the second section of the slide frame at the marks located nearest the A-frame.

5.4.1.34 Remove the retaining pin and deploy the end beam guide adapters located at the end of section one of the slide frame, nearest the crane.

5.4.1.35 Locate two end beam guides onto the end beam adapters ensuring that they are properly seated and that the locking arms are in the up position.

5.4.1.36 Pull down the bridge stops emergency handles to raise the bridge stops emergency.

5.4.1.37 On the chest pack, select the lift bridge function. Make sure the **POWER** and **BRIDGE LIFT** captions on the chest pack display illuminate.

5.4.1.38 On the chest pack, move the joystick forward to take the weight of the bridge and allow the retraction of both home bank carriage beam shootbolts.

5.4.1.39 On the chest pack, move the joystick rearward to lower the home bank carriage and the home bank end of the bridge onto the A-frame rollers. As the bridge is lowered onto the A-frame rollers, ensure the bridge stops emergency are lowered, and fully lock in position.

5.4.1.40 Continue the lowering function until the slings of the home bank carriage are slack. Disconnect the slings of the home bank carriage from the ramp module and reconnect to the home bank carriage.

WARNING

CRUSH HAZARD. DEATH OR SEVERE INJURY COULD OCCUR IF THE BRIDGE STOP EMERGENCY (BSE) ARE NOT FULLY LOCKED DURING THE DISCONNECTION OF THE HOME BANK CARRIAGE. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO UNEXPECTED MOVEMENT OF THE BRIDGE.

5.4.1.41 On the chest pack, move the joystick forward to raise the home bank carriage beam. Make sure the drum winches operate to raise the home bank carriage beam and insert the shootbolts to connect the two carriage halves.

5.4.1.42 Place the carriage slings over the shootbolts to prevent them dragging on the bridge.

5.4.1.43 On the chest pack, move the joystick to the left to select the **BRIDGE DRIVE** function.

5.4.1.44 Make sure the **POWER** and the bridge drive mode previously selected captions (**LEVEL**, **HIGH** or **LOW**) on the chest pack display illuminate. Make sure the **BRIDGE LIFT** caption on the chest pack display goes off.

5.4.1.45 On the chest pack, move the joystick rearward to reverse the bridge towards the launch vehicle.

5.4.1.46 Pull down the bridge stops emergency handles to raise the bridge stops emergency once the jaws of the ramp module are within 12 inches of the end stop rollers. Release the bridge stops emergency as soon as the ramp jaws are clear of the bridge stops emergency.

5.4.1.47 Continue to reverse the bridge. Release the joystick when the pins connecting the home bank ramp module to the parallel module, are in line with the center of the tail lift.

5.4.2 Recovering the Home Bank Ramp Module

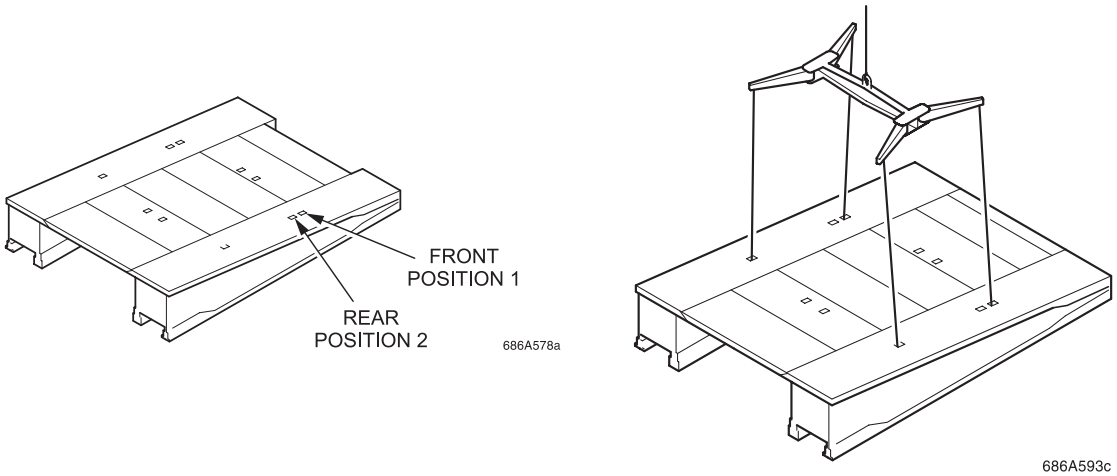
5.4.2.1 Make sure the bridge module lifter is adjusted to its widest setting and secured in this position with the locking pins.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

5.4.2.2 Operate the lift and traverse controls on the crane, and position the bridge module lifter at the home bank ramp module.

5.4.2.3 Connect the bridge module lifter to the front lifting points (POSITION 1) on the outboard sides of the home bank ramp module box sections.



Bridge Module Lifter Connected to POSITION 1 on Ramp Module

5.4.2.4 Operate the **LIFT UP** switch, on the tail lift pendant, to position the pinning operatives at the optimum convenient height.

5.4.2.5 Attach one tag line to the ramp module and one to the parallel module.

5.4.2.6 Remove the retaining clips and the pins connecting the home bank ramp module to the end parallel module and place them on the tail lift.

5.4.2.7 Operate the controls on the crane until the shootbolts can be retracted.

5.4.2.8 Disengage the shootbolts from the home bank ramp module and the end of the 1st parallel module.

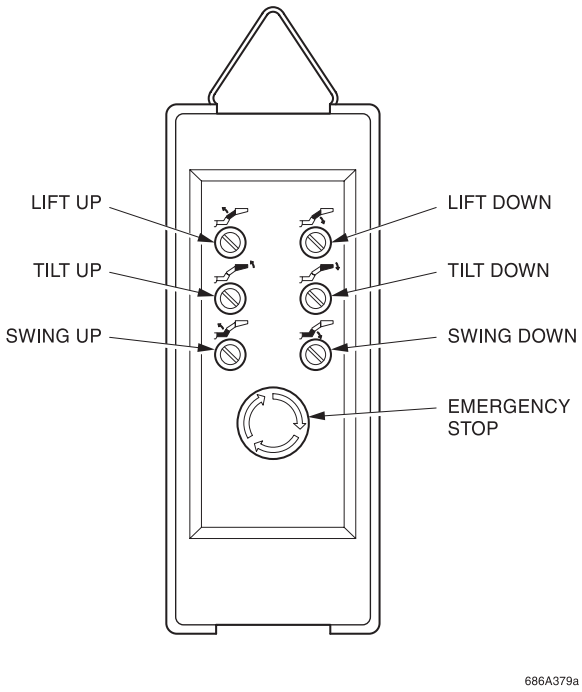
5.4.2.9 Operate the crane to separate the two modules.

WARNING

CRUSH HAZARD. DEATH OR SEVERE INJURY COULD RESULT IF PERSONNEL STAND BETWEEN THE SUSPENDED LOAD AND THE MODULE LOCATED ON THE LAUNCH FRAME.

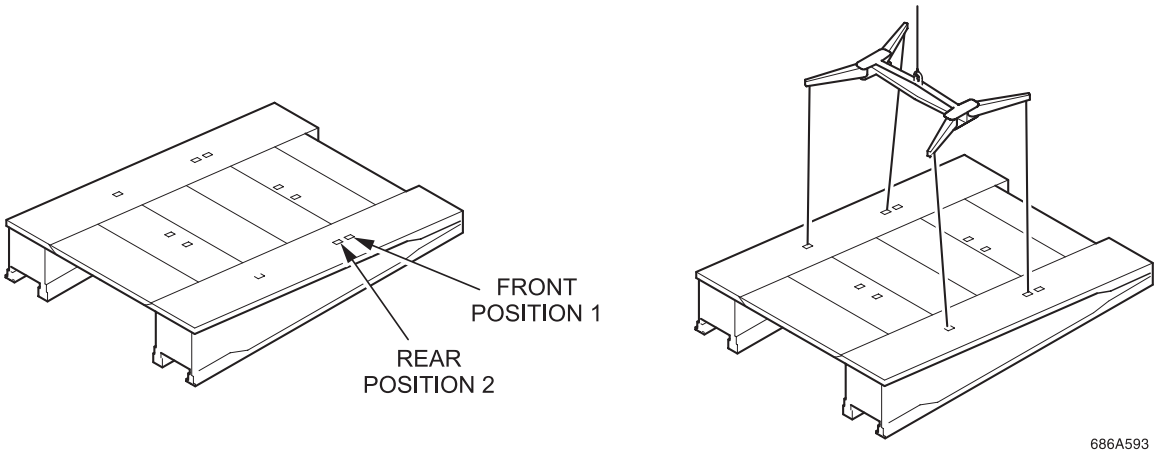
5.4.2.10 Insert the pins and retaining clips already removed into the lugs on the home bank ramp module and parallel module inner jaws, from the inside out (2 per module).

5.4.2.11 Operate the **LIFT DOWN** switch on the tail lift pendant to lower the pinning operatives to the ground.



Tail lift Pendant

5.4.2.12 Lower the home bank ramp and end beam onto the end beam adapters and removable rollers.



Bridge Module Lifter Connected to POSITION 2 on Ramp Module

5.4.2.13 Remove the end beam pins securing the home bank ramp module to its end beam and re-sling the home bank ramp module to POSITION 2 to take into account the shift in the center of gravity, of the ramp module due to the removal of the end beam

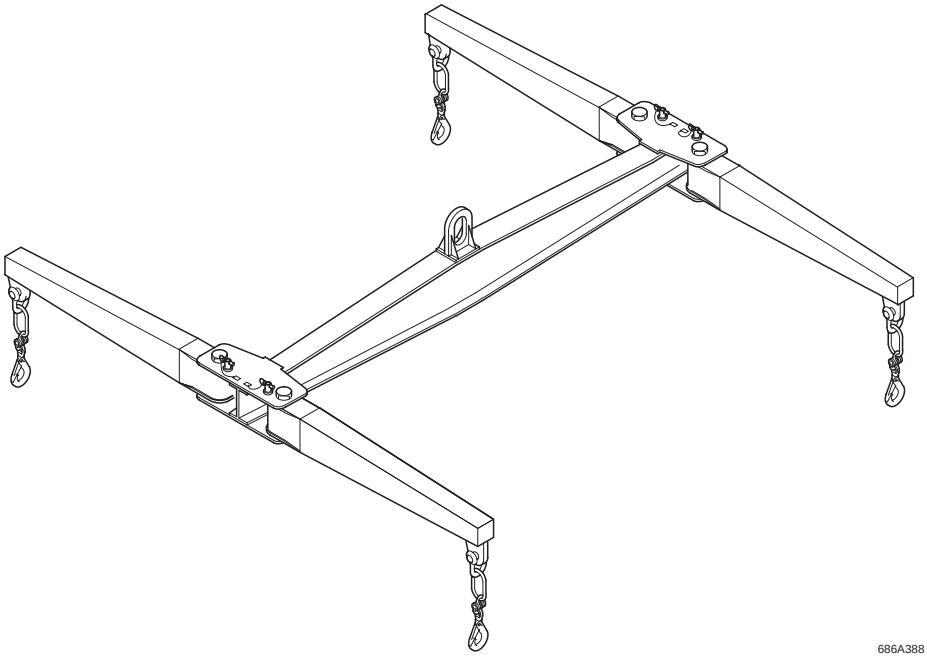
WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

5.4.2.14 Place one personnel at the side of the launch vehicle to ensure that the single leg sling remains vertical as the ramp module is lifted clear of the end beam.

5.4.2.15 Operate the lift and traverse controls on the crane, to raise the home bank ramp module clear of the end beam, attach a tag line to the end beam pinhole on the ramp module. Crane the ramp module towards flatrack T1, and position it at 90° across flatrack T1.

5.4.2.16 Disconnect the bridge module lifter from the POSITION 2 lifting points on the home bank ramp module.



Bridge Module Lifter in Middle Setting

5.4.2.17 Adjust the bridge module lifter to its middle setting and secure it in position with the shootbolts.

5.4.2.18 Connect the bridge module lifter to the wire ropes located between the deck units of the home bank ramp module.

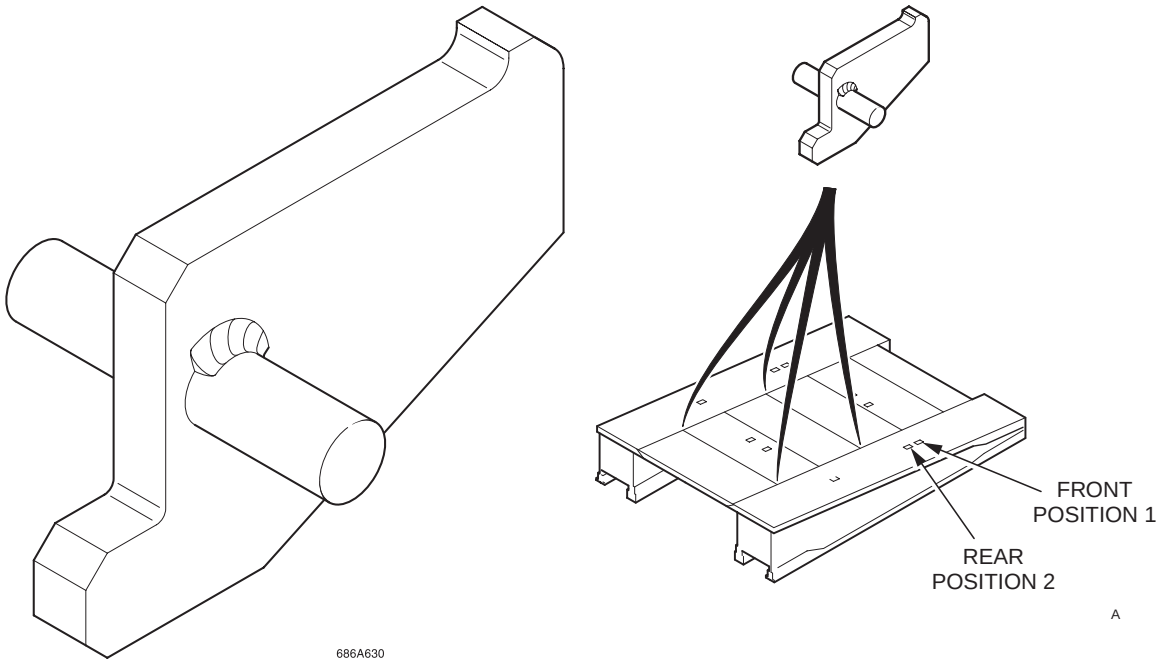
5.4.2.19 Remove any debris or stones from the hinge lines of the home bank ramp module.

5.4.2.20 Operate the lift and traverse controls on the crane. Make sure the home bank ramp module closes slowly and progressively as it is lifted by the crane. Do not operate the traverse controls of the crane until the module has fully closed.

5.4.2.21 Use the tag lines to guide the home bank ramp module into position on flatrack T1 with the jaw end of the ramp module against the front of the flatrack.

5.4.2.22 Recover the four approach ramp frame transport aids from the bridging basket.

5.4.2.23 Fit four approach ramp transport aids to the ramp module deck units between the 1st and the 2nd deck unit from the jaw end and between 3rd & 4th deck unit from the jaw end. The bracket is fitted with the white face up and facing outwards.



Approach Ramp Transport Aid Locations

5.4.2.24 Reconfigure the module lifting beam to its widest setting and secure with shootbolts.

5.4.2.25 Operate the crane controls on the crane and position the bridge module lifter above the stacked approach ramp transport frames positioned on flatrack V1.

5.4.2.26 Connect the bridge module lifter to the four connecting slings on the upper approach ramp frame and connect two guide ropes.

5.4.2.27 Operate the crane controls on the crane to lift the approach ramps and position them centrally on the ramp module on flatrack T1. Ensure the frame aligns with the white marks on the ramp module and the transport aids located between the ramps deck units.

5.4.2.28 Disconnect the bridge module lifter and tag lines from the approach ramp frame.

5.4.2.29 Disconnect the bridge module lifter and single leg sling from the crane and the tag lines from the home bank ramp module.

5.4.2.30 Operate the controls on the crane and position the crane hook to lift the home bank end beam.

5.4.2.31 Attach the end beam slings to the end beam as shown in Figure 5. 3.

Figure 5. 3 Method for Slinging End Beam

5.4.2.32 Connect the crane hook to the end beam slings and steadying rope lines to the home bank end beam positioned on the slide frame.

5.4.2.33 Place two bridging timbers on the ground next to flatrack T1 to support the end beam to allow the slings to be removed.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

5.4.2.34 Operate the lift and traverse controls on the crane. Use the tag lines and guide the home bank end beam from the launch vehicle into position on the bridging timbers.

5.4.2.35 Disconnect the crane hook from the home bank end beam slings.

5.4.2.36 Operate the crane controls on the crane and position the crane hook above the module lifting beam.

5.4.2.37 Connect the single leg sling to the module lifting beam.

5.4.2.38 Remove the end beam adapters and the removable rollers and place on the ground at the side of the launcher out of the way of personnel. Ensure end beam adapters are stowed and clipped.

5.4.3 Recovering the Parallel Modules

5.4.3.1 Operate the lift and traverse controls on the crane and position the crane ready to recover the parallel module.

5.4.3.2 On the chest pack, make sure the bridge drive function is selected.

5.4.3.3 Make sure the **POWER** and the bridge drive mode previously selected captions (**LEVEL**, **HIGH** or **LOW**) on the chest pack display are illuminated.

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

5.4.3.4 On the chest pack, move the joystick rearward to reverse the bridge towards the launch vehicle.

NOTE

Should the bridge continuously rub against the A-frame side rubbing pads then the bridge should be boomed forward until the bridge becomes more central between the left and right pads.

The bubble level at the rear of the A-frame should also be checked and the A-frame leveled if safe to do so.

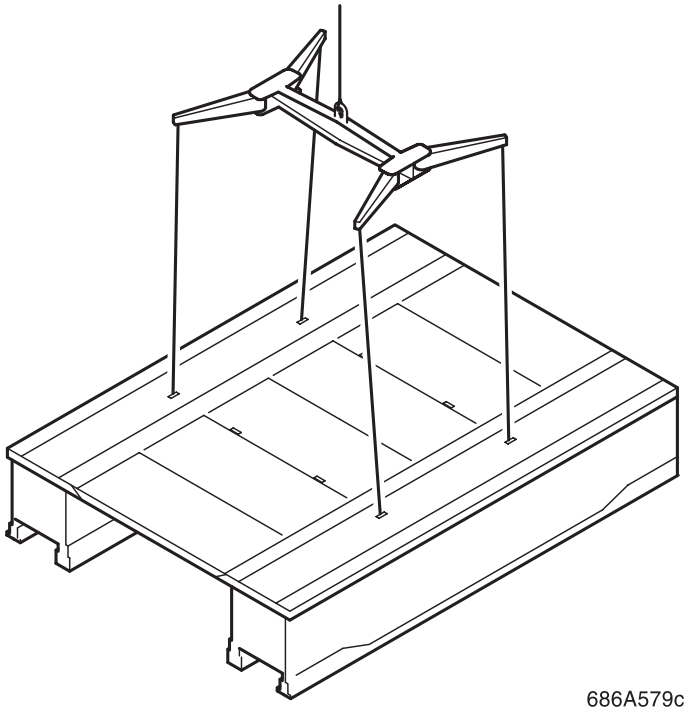
5.4.3.5 Hold down the bridge stops emergency once the rear jaws of the module are within 12 inches of the bridge stop emergency rollers. Release the bridge stops emergency as soon as the module jaws are clear of the bridge stop emergency rollers.

5.4.3.6 Continue to reverse the bridge, release the joystick, when the pins connecting the 1st and 2nd modules are in line with the center of the tail lift.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

5.4.3.7 Connect the bridge module lifter to the lifting points on the outboard sides of the 1st parallel module.



Bridge Module Lifter Connected to Bridge Module

5.4.3.8 On the tail lift pendant, operate the **LIFT UP** switch to position the pinning operatives at the optimum convenient height. Attach tag lines to either end of the module.

5.4.3.9 Remove the retaining clips and the pins connecting the two parallel modules and place them on the tail lift platform.

5.4.3.10 Operate the lift controls on the crane, and disengage the shootbolts from the 1st and 2nd parallel modules.

5.4.3.11 Guide the 1st parallel module away from the still connected 2nd module. Place the bridging pins in the inner jaws of the two parallel modules from inside out and secure them with their R clips.

5.4.3.12 On the tail lift pendant, operate the **LIFT DOWN** switch to lower the pinning operatives to the ground.

5.4.3.13 Operate the lift and traverse controls on the crane, and position the 1st parallel module at 90 degrees across flatrack V2.

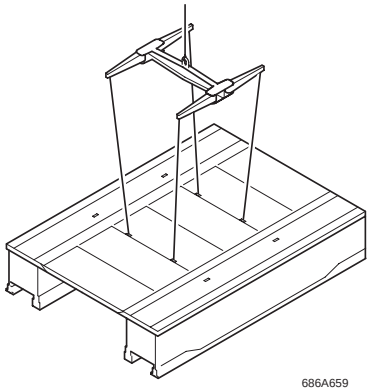
5.4.3.14 Disconnect the bridge module lifter from the lifting points on the outboard sides of the 1st parallel module box sections.

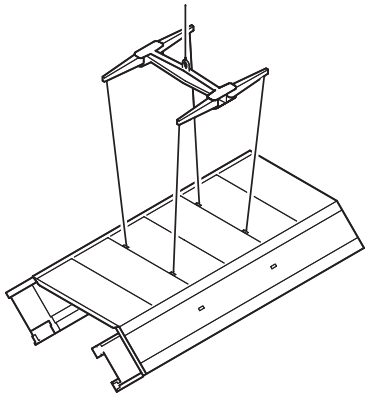
WARNING

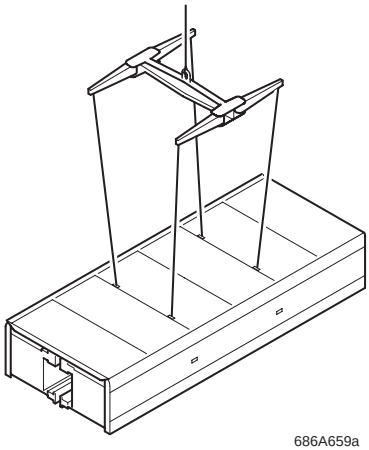
CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

5.4.3.15 Adjust the bridge module lifter to its middle setting and secure it in position with the shootbolts.

5.4.3.16 Connect the bridge module lifter to the wire ropes located between the deck units on the parallel module.







Sequence of Closing Bridge Module

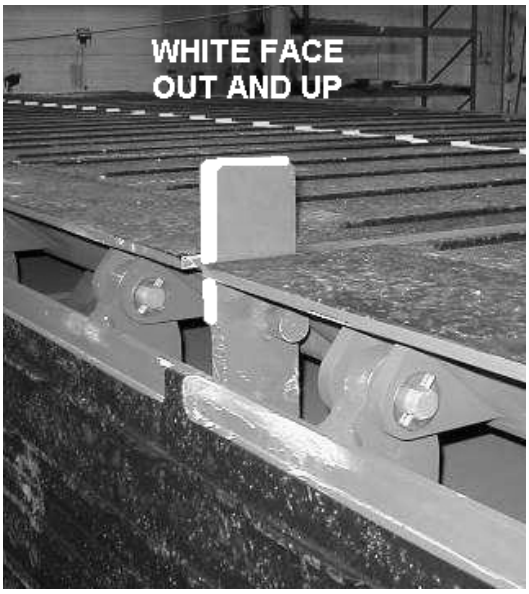
5.4.3.17 Remove any debris or stones from the hinge lines of the parallel module.

5.4.3.18 Operate the lift and traverse controls on the crane. Using the tag lines, stack the parallel module onto flatrack V2. Make sure the parallel module folds slowly and progressively as it is lifted by the crane. Do not operate the traverse controls of the crane until the module has fully closed.

5.4.3.19 Disconnect the bridge module lifter and the tag lines from the parallel module and reconfigure the bridge module lifter to its widest setting.

5.4.3.20 Recover the four transportation aides from their stowed positions in the bridging basket.

5.4.3.21 Fit four transportation aides to the parallel module, two per side, in between the deck units as shown. The brackets being place between the deck units through which the closing slings are accessed. The bracket is fitted with the white face up and facing outwards see Figure 5. 4.



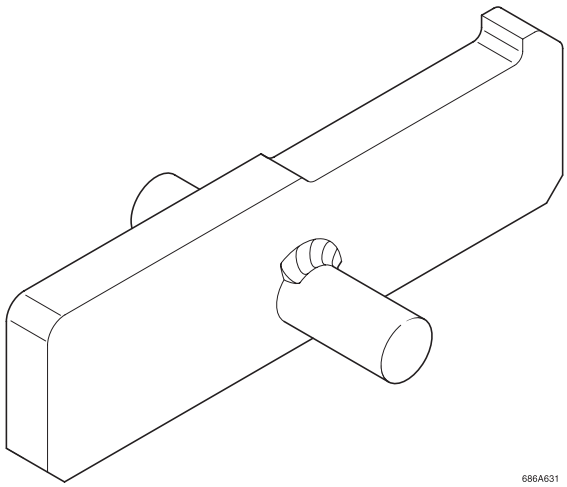


Figure 5. 4 Transport Aid fitted to Module

5.4.3.22 Make sure the area within the crane-operating envelope is clear of personnel. Operate the controls on the crane and position ready for next module.

5.4.3.23 On the 131 ft (40 m) bridge, repeat steps 5.4.3.3 to 5.4.3.21 removing two more parallel modules (three in all) and stowing them on flatracks V2 and T2. Then continue the bridge recovery as specified below.

5.4.3.24 On the 65.5 ft (20 m) bridge continue the bridge recovery as specified below.

5.4.4 Positioning and Deploying the Tilt Rollers

WARNING

CRUSH HAZARD. KEEP CLEAR DURING MOVEMENT OF THE TILT ROLLERS. THE TILT ROLLERS WEIGH 114 LB (52 KG) AND COULD CAUSE INJURY TO PERSONNEL.

NOTE

The bridge should now consist of the two parallel modules and the far bank ramp module with the far bank approach ramps fitted to their transport frame either side of the ramp module centerline.

5.4.4.1 Remove the lower shootbolt (2) securing the tilt roller head (4) in position.

5.4.4.2 Rotate the tilt roller head (4) outwards.

5.4.4.3 Remove tilt roller leg shootbolt (3) while supporting the weight of the tilt roller assembly.

5.4.4.4 Rotate the tilt roller assembly to the vertical position.

5.4.4.5 Secure in the vertical position with upper shootbolt (1).

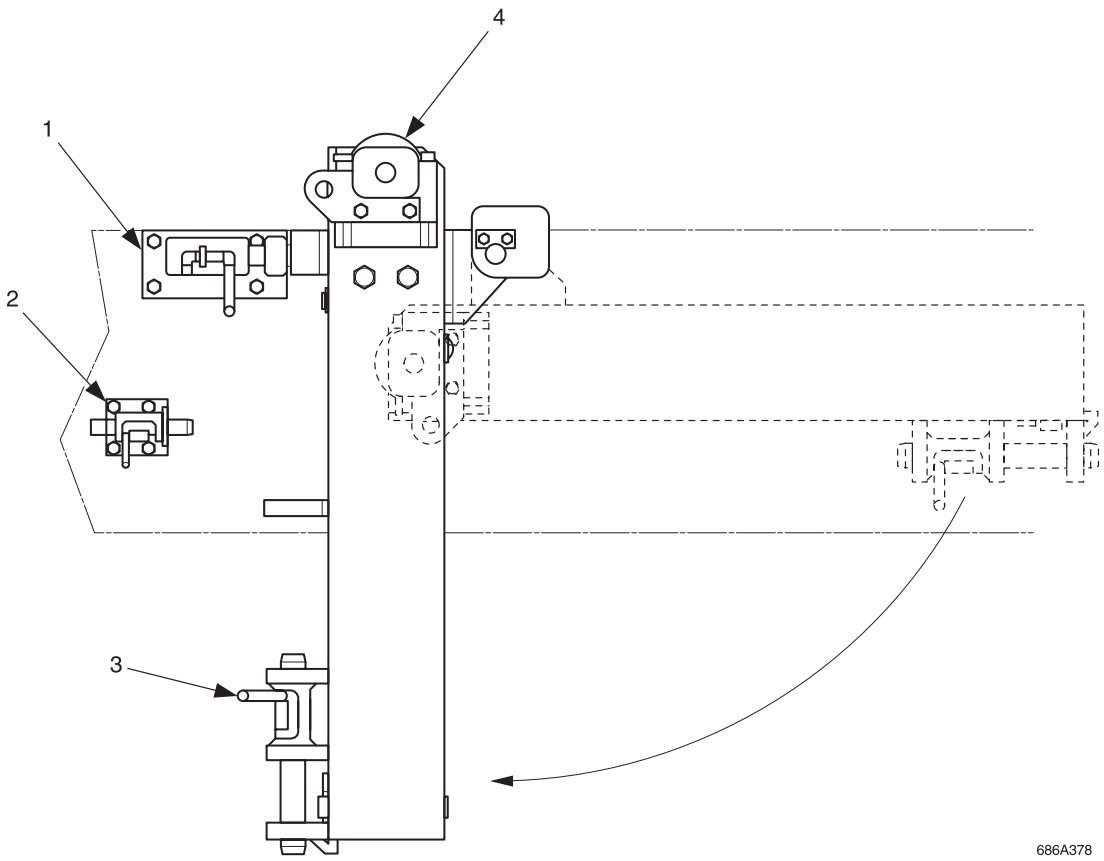


Figure 5. 5 Tilt Roller Shootbolt Positions

NOTE

The tilt rollers adjust the module approach angle required, to compensate for the launch beam angle created by the up/down slope of the banks, and ensure the correct tension is maintained on the far bank carriage slings.

If the tilt rollers do not raise, switch the roller brakes on and then off and retry the tilt rollers.

5.4.4.6 Using the tilt roller joystick on the left of the chest pack raise the tilt rollers to contact the underside of the bridge.

5.4.5 Recovering the 4th and 5th Parallel Modules

5.4.5.1 On the chest pack, make sure the **BRIDGE DRIVE** function is selected.

5.4.5.2 Make sure the **POWER** and the bridge drive mode previously selected captions (**LEVEL**, **HIGH** or **LOW**) on the chest pack display are illuminated.

5.4.5.3 On the chest pack, move the right hand joystick rearward to reverse the bridge towards the launch vehicle.

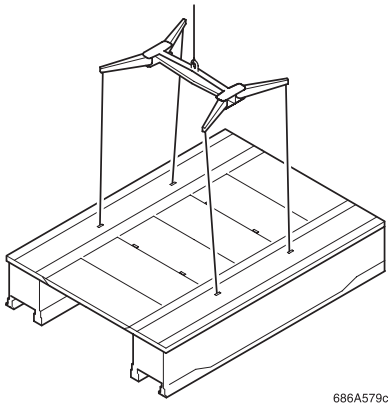
5.4.5.4 Hold down the bridge stops emergency once the jaws of the module are within 12 inches of the bridge stops emergency rollers. Release the bridge stops emergency as soon as the module jaws are clear of the bridge stops emergency rollers.

5.4.5.5 Continue to reverse the bridge and release the joystick when the pins connecting the modules are in line with the center of the tail lift.

WARNING

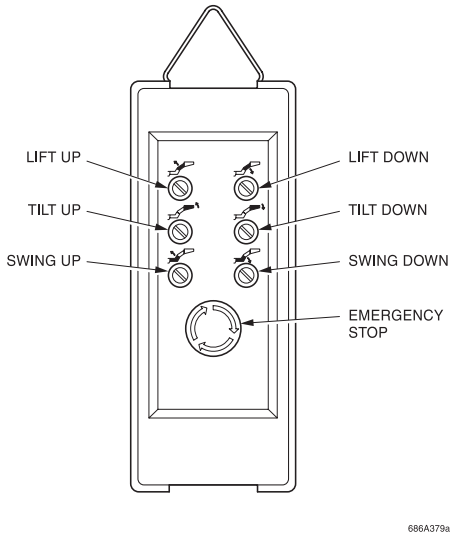
CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

5.4.5.6 Connect the bridge module lifter to the lifting points on the outboard sides of the parallel module.



Bridge Module Lifter Positioned for Lift

5.4.5.7 On the tail lift pendant operate the **LIFT UP** switch to position the pinning operatives at a convenient height, and attach one guide rope to each module.



Tail Lift Pendant

5.4.5.8 Remove the retaining clips and the pins connecting the parallel modules and place them on the tail lift platform.

5.4.5.9 On the chest pack, during module disconnection, hold the tilt roller joystick forward until the module is fully disconnected.

5.4.5.10 Operate the controls on the crane until the shootbolts can be retracted.

5.4.5.11 Disengage the shootbolts from the parallel modules.

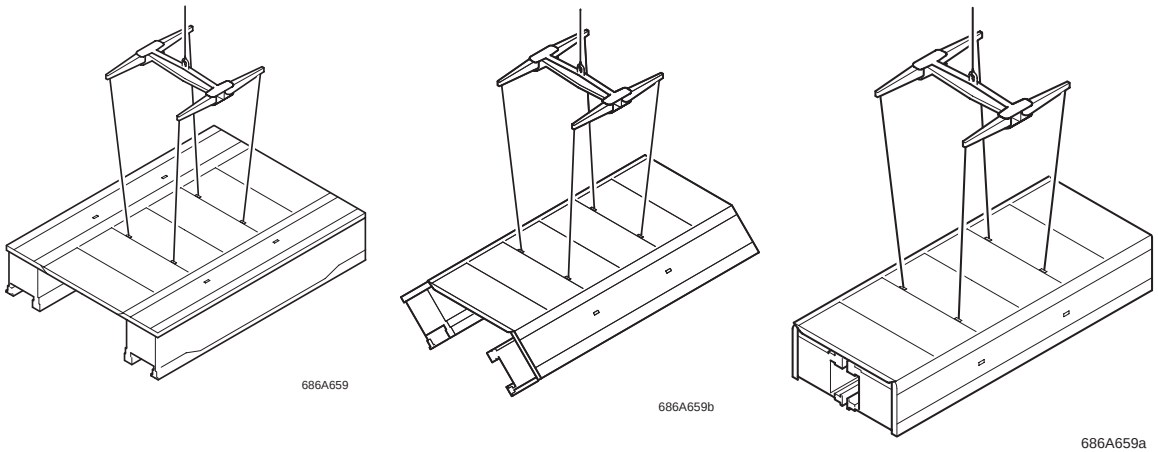
5.4.5.12 Guide the parallel module away from the still connected module. Place the bridging pins in the inner jaws of both modules from the inside out and retain them with their R clips.

5.4.5.13 On the tail lift pendant, operate the **LIFT DOWN** switch to lower the pinning operatives to the ground.

5.4.5.14 Operate the lift and traverse controls on the crane. Position the parallel module on the already stacked parallel module on flatrack T2 so that it is at 90 degrees to the stacked module.

5.4.5.15 Disconnect the bridge module lifter from the lifting points on the outboard sides of the parallel module.

5.4.5.16 Adjust the bridge module lifter to its middle setting and secure it in position with the shootbolts.



Sequence of Closing Bridge Module

5.4.5.17 Connect the bridge module lifter to the steel wire ropes located between the deck units of the parallel module.

NOTE

When one module is stacked on top of another, transport aids are fitted to the lower module between the deck units where the wire-closing slings are accessed. The bracket is fitted with the white edges facing up and out (refer to Figure 5. 4).

5.4.5.18 Remove any debris or stones from the hinge lines of the parallel module.

5.4.5.19 Operate the lift and traverse controls on the crane. Using the tag lines, stack the parallel module on top of the parallel module on flatrack T2. Make sure the parallel module folds slowly and progressively as it is lifted by the crane. Do not operate the traverse controls of the crane until the module has fully closed.

5.4.5.20 Disconnect the module lifting beam, reconfigure it to its widest position and secure it in position with the shootbolts.

5.4.5.21 Remove tag lines from module.

5.4.5.22 Make sure the area within the crane operating envelope is clear of personnel. Operate the controls on the crane and position ready for next module.

WARNING

HYDRAULIC EQUIPMENT. OPERATION OF EQUIPMENT POWERED BY HYDRAULIC PRESSURE IS HAZARDOUS. KEEP CLEAR OF MOVING PARTS.

HYDRAULIC PRESSURE. EXPOSURE TO HYDRAULIC FLUID UNDER PRESSURE IS HAZARDOUS. IN THE EVENT OF A HOSE OR COMPONENT FAILURE, REMOVE ALL FLUID CONTAMINATION FROM THE SKIN AND EYES WITH CLEAN WATER AND SEEK MEDICAL ASSISTANCE.

5.4.5.23 On the chest pack, move the joystick rearward to reverse the bridge towards the launch vehicle.

5.4.5.24 Pull down on the bridge stops emergency handle once the rear jaws of the parallel module and the far bank ramp module are within 12 inches of the bridge stops emergency rollers.

5.4.5.25 Reverse bridge until white center of gravity marker is in line with the outer face of the A-frame.

5.4.5.26 Apply the roller brakes.

5.4.5.27 Lower the rear of bridge using the tilt rollers until level gauge on ramp module indicates that bridge is horizontal.

5.4.5.28 Move the carriage forward until the slings are lightly tensioned.

5.4.5.29 Using the tilt rollers, lower the rear end of the bridge so that the bridge slopes slightly towards the cab.

5.4.5.30 Hold down the roller brake switch to the OFF position to release roller brakes.

5.4.5.31 Slowly lower, tilt rollers until they are fully retracted.

WARNING

CRUSH HAZARD. DEATH OR PERSONNEL INJURY CAN OCCUR IF THE BRIDGE EMERGENCY STOPS ARE NOT LOWERED AS SOON AS THE JAWS ARE CLEAR. FAILURE TO HEED THIS INSTRUCTION COULD RESULT IN THE BRIDGE FALLING FROM THE LAUNCHER.

5.4.5.32 If the bridge will not move rearwards as the carriage moves, check that the bridge is not rubbing on the side wear pads. If the bridge is rubbing on the wear pads pull the bridge forward to re-centralize the bridge and continue retrieval.

5.4.5.33 Continue to slowly reverse the bridge and release the bridge stops emergency as soon as the module jaws are clear of the bridge stops emergency rollers. Release the joystick when the pins, connecting the parallel module and the far bank ramp module are in line with the center of the tail lift.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

5.4.5.34 Connect the bridge module lifter to the lifting points on the outboard sides of the parallel module.

5.4.5.35 On the tail lift pendant, operate the **LIFT UP** switch to position the pinning operatives at convenient height and attach tag lines to the parallel module.

5.4.5.36 Remove the retaining clips and the pins connecting the parallel module and the far bank ramp module and place them on the tail lift.

5.4.5.37 Operate the controls on the crane and disengage the shootbolts.

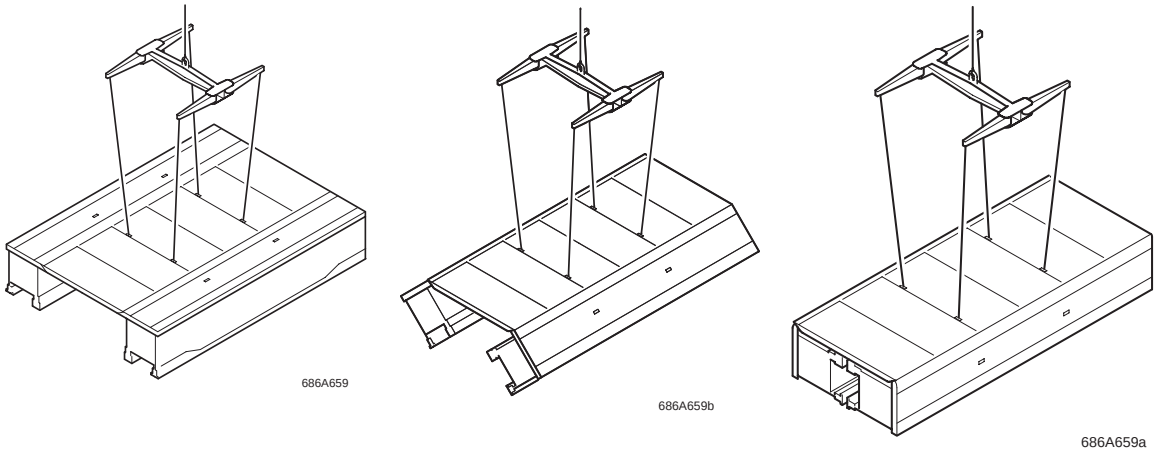
WARNING

CRUSH HAZARD. DEATH OR SEVERE INJURY COULD RESULT IF PERSONNEL STAND BETWEEN THE SUSPENDED LOAD AND THE MODULE LOCATED ON THE LAUNCH FRAME.

5.4.5.38 Guide the parallel module away from far bank ramp module. Place the bridging pins in the inner jaws of the parallel module and the far bank ramp module from the inside out and retain them with their R clips.

5.4.5.39 Operate the **LIFT DOWN** switch on the tail lift handset to lower the pinning operatives to the ground.

5.4.5.40 Operate the lift and traverse controls on the crane and position the parallel module at 90° across flatrack V1.



Sequence of Closing Bridge Module

5.4.5.41 Disconnect the bridge module lifter from the lifting points on the parallel module.

5.4.5.42 Adjust the bridge module lifter to its middle setting and secure it in position with the shootbolts.

5.4.5.43 Connect the bridge module lifter to the wire ropes located between the deck units of the parallel module.

5.4.5.44 Remove any debris or stones from the hinge lines of the parallel module.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

NOTE

When one module is stacked on top of another, transport aids are fitted to the lower module between the deck units where the wire-closing slings are accessed. The bracket is fitted with the white edges facing up and out, refer to Figure 5. 4.

5.4.5.45 Operate the lift and traverse controls on the crane to lift the parallel module.

5.4.5.46 Using the tag lines, stack the parallel module on flatrack V1. Make sure the parallel module folds slowly and progressively as it is lifted by the crane. Do not operate the traverse controls of the crane until the module has fully closed.

5.4.5.47 Disconnect the bridge module lifter and the steadying rope lines from the parallel module, reconfigure the lifting beam to its widest position, and lower onto the module.

5.4.5.48 Recover the four transport aids from the bridging basket.

5.4.5.49 Fit four transportation aides to the parallel module, two per side, in between the deck units as shown in Figure 5. 4. The four transportation aides being place between the deck units through which the closing slings are accessed. The four transportation aides are fitted with the white face up and facing outwards.

5.4.5.50 Disconnect the single leg sling.

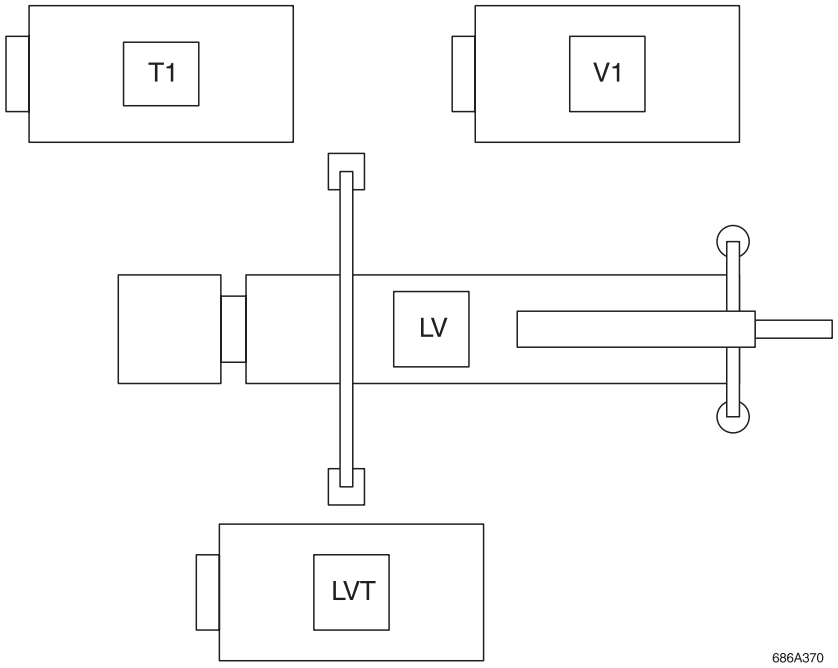
5.4.5.51 Secure loads to flatracks V2 and T2 in preparation for recovery to staging area.

5.4.6 Flatrack Repositioning

5.4.6.1 Drive vehicle V2 to bridge site and load flatrack V2, return flatrack V2 to the staging area.

5.4.6.2 Drive vehicle V1 to bridge site and load flatrack T2, return flatrack T2 to the staging area and transload flatrack onto trailer T2.

5.4.6.3 With vehicle V3 load flatrack LVT and return to bridge site. Ground load flatrack LVT in position.



Position of Flatrack

5.4.7 Recovering the Far Bank Ramp Module

5.4.7.1 Operate the lift and traverse controls on the crane to position the crane hook ready for attachment to the far bank ramp module push/pull sling.

5.4.7.2 Connect the crane hook to the far bank ramp module push/pull sling.

CAUTION

Equipment damage. Do not extend the jib sufficient to cause damage to the launch beam pin storage rack.

5.4.7.3 Using the chest pack controls retract the far bank carriage until the slings become loose and the push pull sling retains the bridge.

5.4.7.4 Fit the four removable rollers on section 2 of the slide frame at the positions marked.

5.4.7.5 Fit the end beam guides with the arms folded down.

WARNING

CRUSH HAZARD. SEVERE INJURY CAN RESULT IF HANDS ARE NOT KEPT CLEAR OF MATING PARTS DURING RAISING AND LOWERING OF THE CARRIAGE LIFTING BEAMS.

FALL HAZARD. PERSONNEL ON TOP OF THE BRIDGE MUST WEAR THE SAFETY HARNESS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY.

5.4.7.6 Remove the retaining clips from the sling retractable pin and retract the pin.

5.4.7.7 Remove the carriage slings from the far bank end beam lifting points and reconnect the slings to the carriage. Make sure that the retractable pin is fully inserted and secured with a retaining clip.

5.4.7.8 Remove any personnel from on top of the bridge.

5.4.7.9 Using the chest pack fully retrieve the far bank carriage so that it is latched to the home bank carriage.

5.4.7.10 Raise the bridge stops emergency by pulling down on the handles.

5.4.7.11 Operate the controls on the crane to pull the far bank ramp module until the module is just clear of the end beam guide location.

5.4.7.12 Using the crane, pull the ramp slowly forward to position the end beam on the end beam guides so that the arms can be raised.

5.4.7.13 Position the far bank end beam within the end beam guides by raising the arms.

5.4.7.14 Disconnect the crane from the far bank ramp module push/pull sling.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IN THE EVENT OF A SUSPENDED LOAD FALLING FROM THE CRANE. DO NOT STAND CLOSE TO LOADS SUSPENDED FROM THE CRANE.

5.4.7.15 Add one section of walkway to the slide frame under the launch frame.

5.4.7.16 Make sure the area within the crane-operating envelope is clear of personnel. Operate the controls on the crane and position the crane hook above the module lifting beam. Attach the module lifting beam and single leg sling to the crane hook.

5.4.7.17 Operate the lift and traverse controls on the crane and position the bridge module lifter at the far bank approach ramp top frame.

5.4.7.18 Connect the module lifting beam, to the lifting points on the upper section of the approach ramp frame.

5.4.7.19 Operate the lift and traverse controls on the crane, to lift the upper section of the approach ramp frame together with its five approach ramps.

5.4.7.20 Guide the approach ramp upper frame onto the lower frame ensuring that the stacking lugs engage.

5.4.7.21 Connect the lifting hooks on the lower section of the approach ramp frames to the oval rings on the upper approach ramp frame.

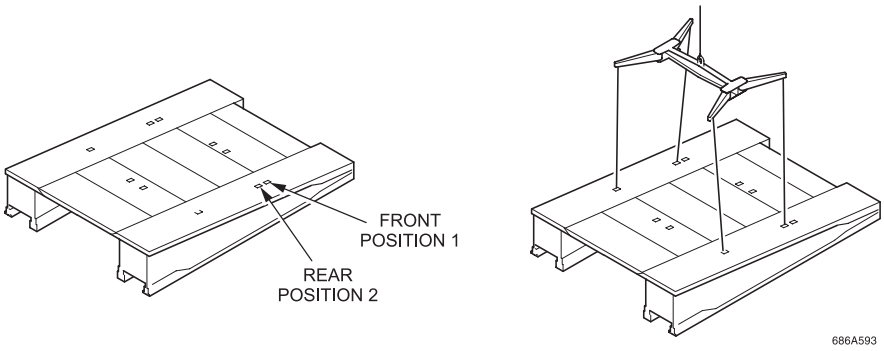
5.4.7.22 Position tag lines onto the upper section of the approach ramp frame.

5.4.7.23 Operate the lift and traverse controls on the crane and recover the complete frame with its 10 approach ramps and stack them on the home bank approach ramps on flatrack T1, ensuring that the transportation lugs engage with the sockets.

5.4.7.24 Disconnect the bridge module lifter and the tag lines from the approach ramp frames.

5.4.7.25 Operate the lift and traverse controls on the crane and position the bridge module lifter at the far bank ramp module.

5.4.7.26 Connect the bridge module lifter to the rear lifting points (POSITION 2) on the outboard sides of the far bank ramp module.



Bridge Module Lifter in POSITION 2

5.4.7.27 Remove the end beam pins securing the far bank ramp module to its end beam and remove the ramp lead in bracket.

Ramp Module Lead in Bracket

5.4.7.28 Position personnel to the side of the launcher to ensure the single leg sling remains vertical during ramp module lifting.

5.4.7.29 Connect tag lines to the end beam pinning hole once the ramp module is raised above the end beam.

5.4.7.30 Operate the lift controls on the crane and slowly raise the far bank ramp module clear of the end beam.

NOTE

To assist in the separation of the ramp module and the end beam use the end beam wrenches to apply back and forwards rocking movement to the end beam as the crane lifts the ramp module.

End Beam Wrench and Operation

5.4.7.31 Use the traverse controls on the crane and rotate the far bank ramp so that it is 90° across flatrack V1 and resting on the 5th parallel module stacked on flatrack V1.

WARNING

CRUSH HAZARD. DEATH OR PERSONAL INJURY CAN RESULT IF THE CORRECT PROCEDURE IS NOT FOLLOWED FOR ATTACHMENT OF THE BRIDGE MODULE LIFTER TO THE PARALLEL MODULE.

5.4.7.32 Disconnect and adjust the bridge module lifter to its middle setting and secure it in position with shootbolts.

5.4.7.33 Connect the bridge module lifter to the wire ropes located between the deck units of the far bank ramp module.

5.4.7.34 Remove any debris or stones from the hinge lines of the far bank ramp module.

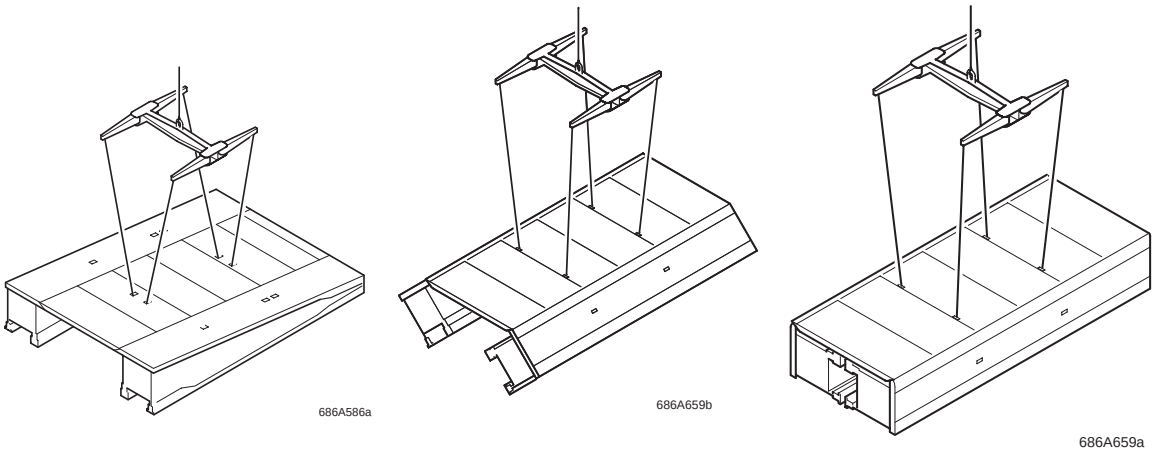
5.4.7.35 Operate the lift and traverse controls on the crane and, using the tag lines, guide the far bank ramp module into position on top of the parallel module on flatrack V1 with the jaws located at the front of the flatrack.

NOTE

Flatracks T1 and V3 are modified with a wooden spacer fitted to prevent the ramp jaws damaging the flatrack storage box. The wooden spacer is fitted to the flatrack when a ramp module is stored on top of another bridge module.

5.4.7.36 Make sure the far bank ramp module closes slowly and progressively as it is lifted by the crane. Do not operate the traverse controls of the crane until the module has fully closed.

5.4.7.37 Ensure that the ramp module is correctly located over the transport aids fitted to the parallel module.



Sequence of Closing Ramp Module

5.4.7.38 Disconnect the bridge module lifter and the tag lines from the far bank ramp module.

5.4.7.39 Operate the lift and traverse controls on the crane, and position the bridge module lifter over flatrack LVT.

5.4.7.40 Close the arms on bridge module lifter to the stowed position, and lower onto flatrack LVT for stowing.

5.4.7.41 Disconnect the bridge module lifter from the crane hook.

5.4.7.42 Secure the bridge module lifter to the flatrack LVT with ratchet lashings.

5.4.7.43 Stow the single leg sling in the basket on LVT.

5.4.7.44 Operate the lift and traverse controls on the crane and position the crane hook at the home bank end beam positioned on the ground.

5.4.7.45 Sling the home bank end beam, Refer to Figure 5. 3.

5.4.7.46 Connect the crane hook to the end beam slings and attach tag lines to the home bank end beam positioned on the ground.

5.4.7.47 Place two bridging timbers on to flatrack T1 ready to receive the far bank end beam.

5.4.7.48 Operate the lift and traverse controls on the crane, and using the tag lines, guide the home bank end beam into its stowed position on the flatrack T1, adjust the bridging timbers so that the lifting slings can be removed.

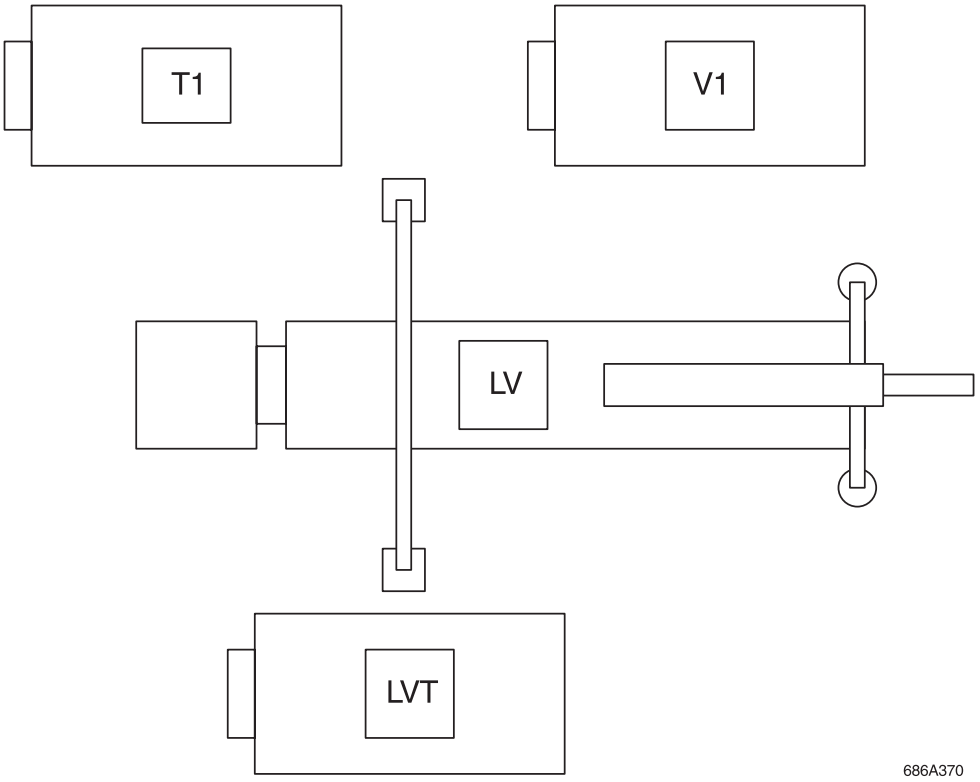
5.4.7.49 Disconnect the crane hook from the home bank end beam slings.

5.4.7.50 Stow the end beam guides, removable rollers, and all loose items in the bridging basket on flatrack LVT.

5.4.7.51 Strap all flatrack loads with ratchet lashings.

5.4.7.52 Ensure all flatrack loads are secure.

5.4.8 Recovering the Launch vehicle after Bridge Recovery



Position of Flatrack

5.4.8.1 Using vehicle V3, load flatrack T1, return it to the staging area and transload flatrack T1 onto trailer T1.

5.4.8.2 Return vehicle V1 to the build site and recover flatrack V1, return it to the staging area.

5.4.8.3 Using vehicle V3, load flatrack LVT, return it to the staging area and transload flatrack LVT onto trailer LVT.

5.4.8.4 In the staging area load vehicle V3 with load V3.

5.4.8.5 Retrieve the removable walkways from their stowed position and position in accordance with beam build.

5.4.8.6 Refer to the steps in Chapter 4 Section V Para 4.14 through 4.15.1.22 inclusive to recover the launch beam.

5.4.8.7 Refer to the steps in Chapter 4 Section VI Para 4.17 through 4.18.2.22 inclusive to recover the launch vehicle.

5.4.8.8 Connect all trailers to their respective vehicles and ensure all loads are secure prior to transport back to base.

5.4.8.9 Refer to Para 5.2 Driving the Launch Vehicle and PLS trucks With or Without Trailers Attached, and observe speed limits.

TABLE OF CONTENTS

CHAPTER 6

BUILD SEQUENCE FOR 40 METER BRIDGE

6.1 BUILD A 40 M DRY SUPPORT BRIDGE

6.1.1 Manpower Requirements

6.1.1.1 Table 6.1 outlines the manpower required to build a 40-meter bridge.

6.1.1.2 The manpower for construction of the bridge is drawn from the personnel required to operate the bridge load transportation vehicles.

Table 6.1 Manpower

Man No.	Operator Name	Abbreviation	Vehicle
1	Chest Pack Operator	CPO	(LV) + LVT
2	Crane Operator	COP	
3	Slinger 3/Top Man	SL3/TM	V1 + T1
4	Pin Man 1	PM1	
5	Pin Man 2	PM2	V2 + T2
6	Pin Man 3	PM3	
7	Slinger 1	SL1	V3 + T3
8	Slinger 2	SL2	

6.2 DSB BUILD SEQUENCE

6.2.1 Critical Task List

6.2.1.1 An analysis of the critical stages of building the 40-meter bridge follows.

6.2.1.2 The list should not be used to build the bridge as there is insufficient detail, but it may be used by the bridge commander to keep track on the procedures while bridge build is underway.

6.2.1.3 Should problems occur during the build sequence refer to Chapter 9 Bridge Build Possible Mechanical Faults.

1 Position the vehicle on the centerline.

2 Apply the parking brake and place the transmission in neutral.

3 Position and unstrap flatrack LVT on the build site.

4 Remove the mudguards.

5 Add the exhaust 90 degree elbow.

6 Unstrap the tail-lift.

7 Connect the tail-lift pendant.

8 Turn the rotary switch in the cab to position 2.

9 Lower the tail-lift.

10 Remove the crane pads and the step ladder.

11 Unstrap the far bank support.

12 Remove the A-frame hinge locking pins.

13 Unfold the A-frame.

14 Pin the A-frame at the 4 hinge points.

15 Remove the far bank support feet from their stowed position.

16 Extend the far bank support.

17 Rotate the A-frame and insert the shootbolt.

18 Add the far bank support feet.

19 Release the twist locks.

20 Remove the A-frame stabilizer pins.

21 Extend the stabilizers to clear launcher of the launch vehicle chassis and pin stabilizer legs.

22 Turn the rotary switch in the cab to position 3.

23 Fully extend the slide frame.

24 Connect the chest pack.

25 Turn the rotary switch in the cab to position 4.

26 Retract the relax mechanism shootbolts.

27 Deploy the A-frame walkways and ladders for launch beam build configuration.

28 Deploy the crane and crane spreader pads.

29 Position and unstrap flatrack V1 and T1 on the build site.

30 Check and level the A-frame using the A-frame stabilizer legs.

31 Set the beam angle.

32 Remove the launch beam final stop.

33 Build the launch beam.

34 Insert the launch beam final stop.

35 Lower the launch beam and far bank support on to the far bank.

36 Remove flatrack LVT from the build site.

37 Position and unstrap flatracks V2 and T2 on the build site.

38 Stow the articulator cylinders.

39 Raise the A-frame.

40 Stow the A-frame support struts.

41 Reconfigure the walkways to bridge build configuration.

42 Deploy the tail-lift.

43 Deploy the tilt rollers.

44 Add the 4 Removable rollers and the end beam guides.

45 Place the end beam on the guides.

46 Add the far bank ramp and pin.

47 Add the ramp lead brackets to the front face of the ramp.

48 Add the approach ramps to the far bank ramp.

49 Attach the crane push/pull sling.

50 Lower the end beam guide arms and push the far bank ramp with the crane.

51 Attach the far bank ramp to the far bank carriage.

52 Detach the crane push/pull sling.

53 Remove the end beam guides and the removable rollers.

54 Add a parallel module.

55 Boom forward and release the bridge stops emergency.

56 Boom to the white C of G marker, using the roller brakes and tilt roller; angle the bridge to the launch beam.

57 Continue to boom using the tilt rollers and the lower bridge stops emergency.

58 Add the second parallel module.

59 Boom forward while holding the tilt roller joystick forward.

60 Release the bridge stops emergency only to allow the jaws to pass.

61 Boom until the jaws are over the center of the tail-lift.

62 Fully lower the tilt rollers.

63 Add and boom further parallel modules as required.

64 Deploy the end beam guide adapters.

65 Add the end beam guides.

66 Add the 2 removable rollers at the white marks furthest from the crane.

67 Position the home bank end beam on the guides.

68 Add the home bank ramp and pin.

69 Reposition the slings on ramp to allow for the end beam.

70 Add the ramp module to the bridge.

71 Remove and stow the end beam guides, adapters, removable rollers and the tilt rollers.

72 Remove flatracks V2 and T2 from the build site.

73 Place flatrack LVT on the build site.

74 Boom the bridge until the end plate of ramp contacts the bridge stops emergency.

75 Remove the home bank carriage shootbolts and lower the carriage lifting beam.

76 Attach the slings to the bridge lift points on the ramp.

77 Raise the bridge and release the bridge stops emergency once the bridge starts to move.

78 Re-shootbolt the home bank carriage.

79 Release the tension in the cable.

80 Reverse the bridge to release the home bank carriage latches.

81 Release the carriage latches and boom the bridge forward.

82 Stop the bridge boom when the carriage restraint arms are fully extended.

83 Raise Bridge and release the far bank carriage shootbolts.

84 Lower the far bank end of the bridge to ground.

85 Un-sling the far bank carriage, raise and shootbolt.

86 Raise the bridge and release the home bank carriage shootbolts.

87 Lower the home bank end of the bridge to ground.

88 Un-sling the home bank carriage and raise.

89 Retrieve the carriages and lock.

90 Stow the tail-lift.

91 Deploy the A-frame support struts and lower the A-frame.

92 Re-attach the articulator cylinders.

93 Reconfigure the launcher walkways for launch beam build configuration.

94 Raise the launch beam clear of the far bank.

95 Remove the launch beam final stop.

96 Manually raise the launch beam stop and reverse the launch beam.

97 Deploy the far bank approach ramps.

98 Deploy the curbs and bridge markers.

99 Strip out the launch beam.

100 Re-insert the launch beam final stop.

101 Stow all the walkways and ladders.

102 Fully retract the articulator cylinders.

103 Using the bridge lift function allow some slack in the bottom winch cable.

104 Stow the crane and the exhaust elbow.

105 Extend the A-frame stabilizers to their maximum height and pin.

106 Raise the tail-lift clear of the bridge and A-frame hydraulics.

107 Insert the relax mechanism shootbolts.

108 Turn the rotary switch in the cab to position 3.

109 Remove and stow the chest pack.

110 Reverse the launch vehicle to fully retract the slide frame.

111 Lower the A-frame onto chassis twist locks and fully retract the stabilizers.

112 Lock the twist locks.

113 Support the far bank support with the tail-lift.

114 Drive the launch vehicle clear of the bridge.

115 Deploy the home bank approach ramps.

116 Deploy the defile markers and road signs.

117 Turn the rotary switch in the cab to position 2.

118 Lower the tail-lift and remove the far bank support feet.

119 Retract the A-frame shootbolts and rotate the A-frame to the stowed position.

120 Stow the far bank support.

121 Stow the far bank support feet and strap far bank support to the launcher.

122 Remove the A-frame hinge pins and fold the A-frame.

123 Insert the A-frame pins into the transportation position.

124 Secure the far bank support with its transport strap.

125 Strap the crane spreader pads and step ladder to the tail-lift.

126 Stow the tail-lift to the transportation position.

127 Strap the tail-lift.

128 Stow the tail-lift pendant.

129 Refit the removable mudguards.

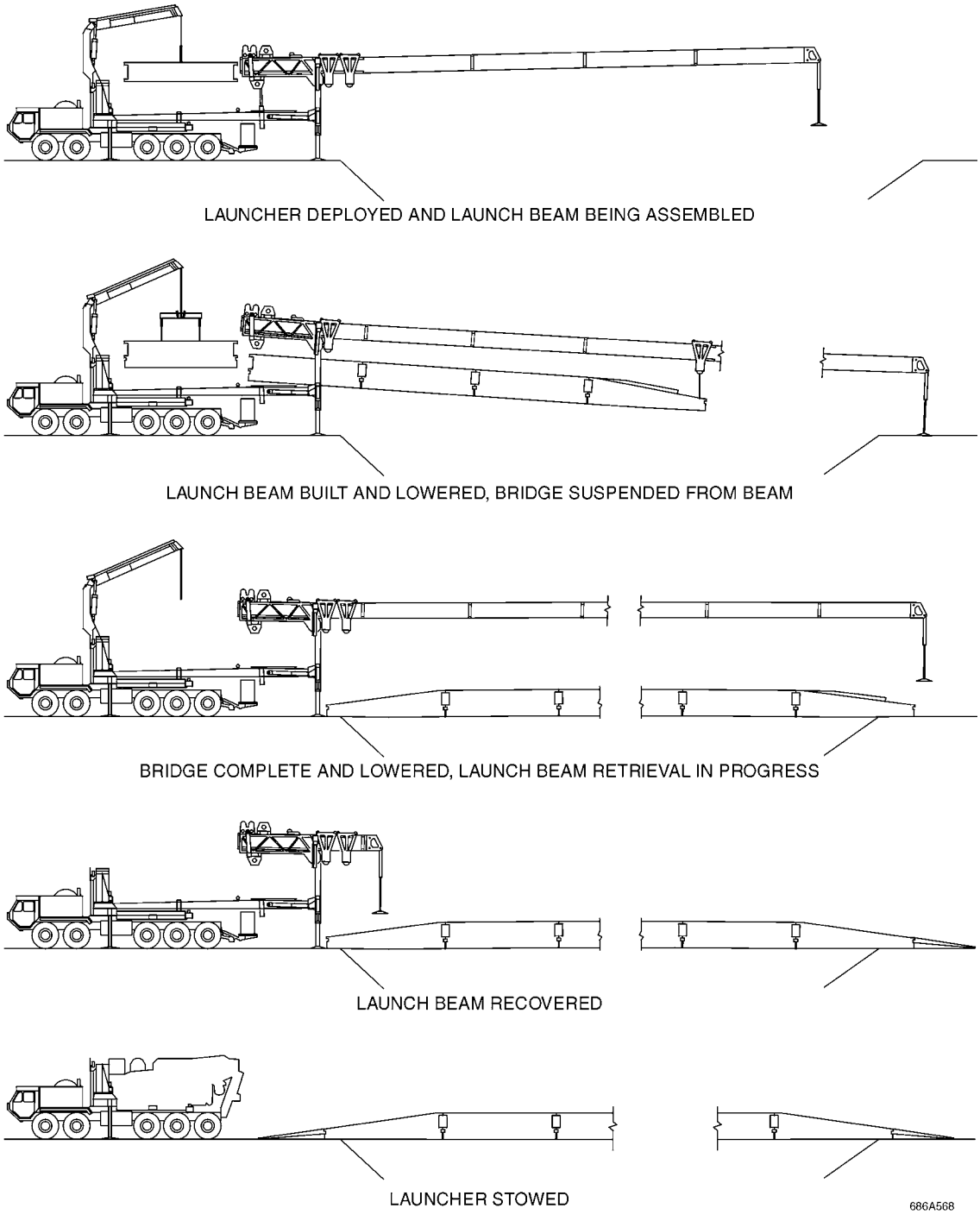


Figure 6. 1 Bridge Build Sequence

TABLE OF CONTENTS

CHAPTER 7

OPERATION IN BACK-UP MODE

Section I. OVERVIEW

7.1 BACK-UP MODE OPERATION

7.1.1 Overview

7.1.1.1 The back up mode of operation for the launcher system, is designed to give safe operation without electrical control being available, due to damage or failure of any of the electrical control systems.

7.1.1.2 The launcher deployment control (folding, rotate) is achieved by manually operating the relevant solenoid valves.

7.1.1.3 The bridge launching controls use two remote manual valves (see Figure 7.2), one to control the function of the main proportional valve the other to release the winch brakes. These control valves are operated from ground level at the left hand (when looking at the bridge/gap) A-frame stabilizer leg.

7.1.1.4 The valves, which set the hydraulic sequencing for each bridge function, are manually set by clipping the mushroom buttons on the relevant solenoid valves and then controlling the function/direction using the two remote levers.

7.1.1.5 The function of the back up mode valve is dependent on the direction of lever operation (see Figure 7.1). The back up brake valve is independent of the direction of lever operation.

	Proportional Control		Winch Brake Release
Function	**Motion**	**Lever Action**	
Beam Drive	In	Push Lever	Push or Pull Lever
	Out	Pull Lever	Push or Pull Lever
Articulator	Extend	Push Lever	-
	Retract	Pull Lever	-
A-frame	Raise	Push Lever	-
	Lower	Pull Lever	-
Top Winch	Pull	Pull Lever	Push or Pull Lever
Bottom Winch	Pull	Pull Lever	Push or Pull Lever

Figure 7.1 Back Up Mode Valve Lever Operation

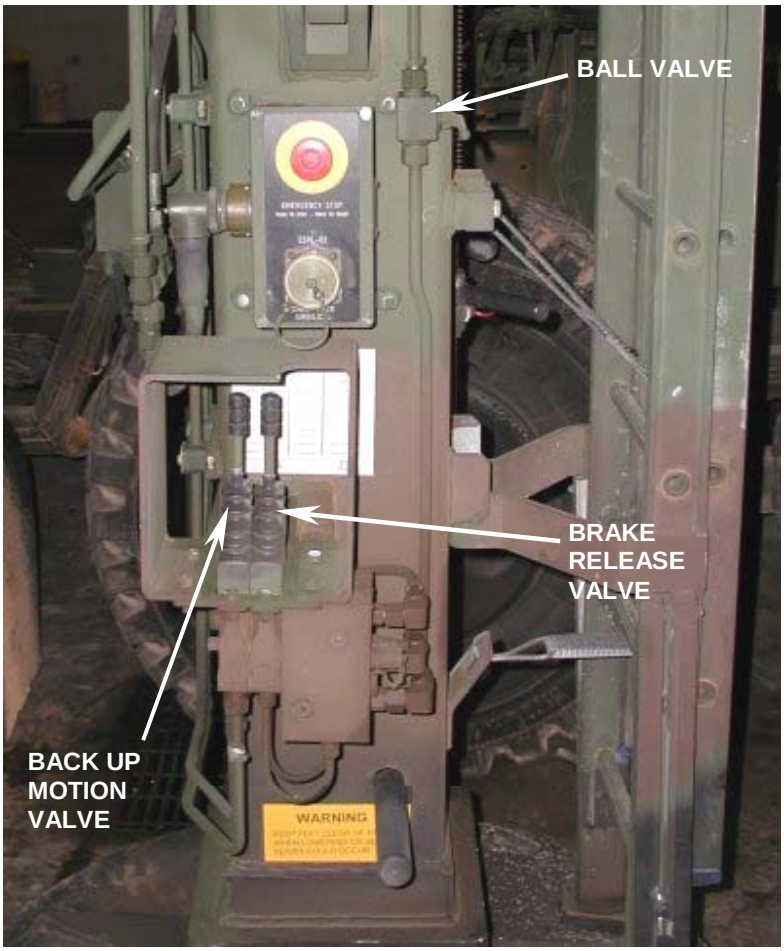


Figure 7.2 Back Up Mode Valve Control Levers

Section II. PROCEDURES

7.2 HYDRAULIC OIL

7.2.1 Pressure Source

7.2.1.1 If through an electrical fault, control of the launcher with the chest pack is not possible then the back up mode of operation can be adopted.

7.2.1.2 Dependent on the level of the electrical failure hydraulic power is developed in one of the following ways, in order of preference:

(1) With the launch vehicle's engine running, select position 2 on the four position rotary switch in the cab and press reset on the Interface Panel, ensuring that the PTO engages by observing whether the **PTO ENGAGED AT PRESSURE** caption is illuminated.

(2) With the launch vehicle's engine running, on the Interface Panel, depress the **PTO OVERRIDE** "ON" switch (and ensure that the PTO engages. If no electrical circuits are live, the PTO pressure switch will not indicate **PTO ENGAGED AT PRESSURE**.

(3) (3) Cross connect the launch vehicle to a slave vehicle. (See paragraph 7.21).

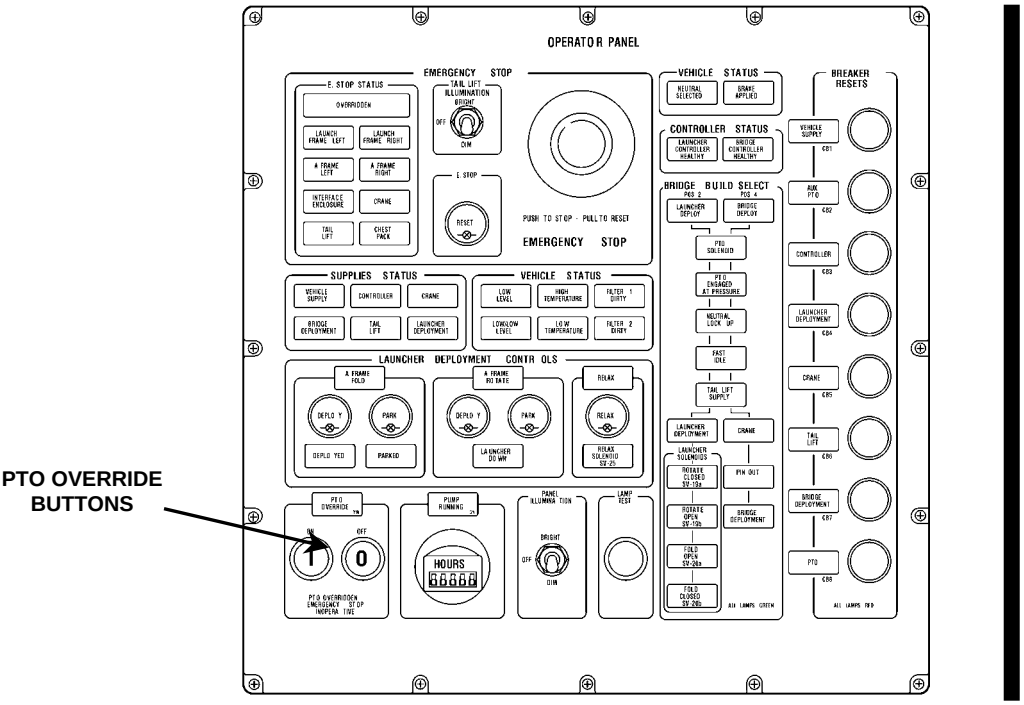


Figure 7. 3 Location of PTO Override Buttons

7.3 BACK UP MODE

7.3.1 Operating Procedures

WARNING

CRUSH HAZARD. BEFORE CARRYING OUT TROUBLESHOOTING INVOLVING SV10, A SUSPENDED OR PART BUILT BRIDGE MUST BE MADE SAFE EITHER BY COMPLETING THE BUILD OPERATIONS IN BACK-UP MODE OR BY RETRIEVING THE BRIDGE. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE DEATH OR SEVERE INJURY TO PERSONNEL.

CRUSH HAZARD. A SUSPENDED BRIDGE WILL MOVE IF SV10 IS MANUALLY OPERATED AND THE CHEST PACK RIGHT-HAND JOYSTICK IS MOVED FROM THE CENTRAL POSITION CAUSING ACTIVATION OF OTHER SOLENOID VALVES. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE DEATH OR SEVERE INJURY TO PERSONNEL.

DEATH OR SEVERE INJURY. WHEN ELECTRICAL POWER IS NOT PRESENT ON THE LAUNCH VEHICLE, THE EMERGENCY STOP SYSTEM IS INOPERATIVE. EXERCISE GREAT CARE WHEN OPERATING THE SYSTEM AS THERE IS NO QUICK WAY OF STOPPING THE OPERATION ONCE IT IS STARTED. ALL PERSONNEL MUST BE AWARE OF THE POTENTIAL DANGER OF MOVING COMPONENTS AND MODULES.

NOTE

When an item on the vehicle or launcher is referred to as front or rear, left or right, the cab is taken as the front of the launcher vehicle, all references are taken as if personnel are looking forward towards the cab. Therefore, if the left hand side A-frame leg is being discussed, the A-frame leg on the launcher vehicle's left hand side is the item being described.

7.3.1.1 Open the ball valve mounted on the front face of the left hand stabilizer leg. (See Figure 7.2). This admits oil to the back up mode control valves and makes them live. With the ball valves closed the back up mode control valves will not operate.

7.3.1.2 Remove all the access covers from the launch frame guards.

7.3.1.3 Check that **none** of the solenoid valves are clipped and held in.

7.3.1.4 From the following list select the desired function and clip the mushroom buttons to the in position accordingly.

NOTE

Unclip the solenoid after completion of the operation.

7.3.1.5 Before the operation of any of the functions, ensure that the correct stage within the build sequence has been achieved and that all pins etc. are in place or have been removed as appropriate.

NOTE

Solenoid valve numbers can be seen on the yellow tags, which are attached to each electrical lead connected to the solenoid or on the etched plates adjacent to the valves on the manifolds.

7.4 A-FRAME FOLDING

7.4.1 Opening

7.4.1.1 Ensure that all the correct procedures have been carried out prior to folding out the A-frame legs. Go to rear of the vehicle at the center of the A-frame, and locate solenoid valve **SV20a** (Figure 7.14) in the center of the stabilizer manifold. Operate the solenoid by depressing the mushroom button. The stabilizer legs will then open away from the operator until they are fully extended and the pins can be fitted. As soon as the solenoid is released, the motion will stop.

7.4.2 Closing

7.4.2.1 Ensure that all the correct procedures have been carried out prior to folding in the A-frame legs. Go to rear of the vehicle at the center of the A-frame, and locate solenoid valve **SV20b** (Figure 7.14) in the center of the stabilizer manifold and depress the mushroom button. The A-frame legs will rotate inwards and the motion will stop once the button is released.

7.5 ROTATE

7.5.1 Open

7.5.1.1 Ensure that all the correct procedures have been carried out prior to rotating the A-frame. Locate **SV16** on the launch frame pilot manifold (Figure 7.17), depress the mushroom button and clip **SV16** to release the articulator stowing cylinder. Go to the left hand side of the vehicle and operate the solenoid valve **SV19b** on the A-frame rotate manifold (Figure 7.15). The launcher A-frame stabilizer legs will then rotate toward the operator. Hold the button until it is fully raised and the shootbolts can be fitted. As soon as the solenoid is released, the motion will stop.

7.5.1.2 Unclip solenoid **SV16** after completion of the operation.

7.5.2 Closing

7.5.2.1 Ensure that all the correct procedures have been carried out prior to lowering the A-frame. Operate and clip **SV16** on the launch frame pilot manifold (Figure 7.17) to release the articulator stowing cylinder. Go to the left hand side of the vehicle and operate the solenoid valve **SV19a** on the A-frame rotate manifold (Figure 7.15). The launcher A-frame stabilizer legs will then rotate away from the operator. Hold the button until the launcher is fully lowered. As soon as the solenoid is released, the motion will stop.

7.5.2.2 Unclip solenoid **SV16** after completion of the operation.

7.6 RELAX PIN

7.6.1 Releasing

7.6.1.1 To remove or insert the relax pins operate the mushroom head of **SV25** on the interface manifold (Figure 7.16) and clip it in the operated position.

7.6.1.2 Unclip solenoid **SV25** after completion of the operation.

7.7 BEAM ANGLE ARTICULATOR

7.7.1 Operating

7.7.1.1 Set and clip only the following solenoids:

SV2 On the launch frame articulator manifold (Figure 7.18)

SV16 On the launch frame pilot manifold (Figure 7.17)

7.7.1.2 Operate only the back up mode valve lever, which will extend and retract the articulator cylinder. Refer to Figure 7.1 for lever actions.

7.7.1.3 Unclip all solenoids after completion of operation unless required for next operation.

7.8 BEAM DRIVE

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.8.1 Out

7.8.1.1 Set and clip only the following solenoids:

SV4 On the launch frame winch control manifold (Figure 7.18)

SV6 On the launch frame pilot manifold (Figure 7.17)

SV7 On the launch frame pilot manifold (Figure 7.17)

SV8 On the launch frame pilot manifold (Figure 7.17)

SV13a On the launch frame winch control manifold (Figure 7.18)

SV14a On the launch frame winch control manifold (Figure 7.18)

SV15a On the launch frame winch control manifold (Figure 7.18)

SV16 On the launch frame pilot manifold (Figure 7.17)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.8.1.2 Operate the back up mode valve by *pulling* the lever, which will drive the beam out (refer to Figure 7.1 for lever actions). At the same time, operate the brake release valve, which will allow the top winch brake to release, and the top winch to pay rope off (refer to Figure 7.1 for lever actions).

7.8.1.3 Unclip all solenoids after completion of operation unless required for next operation

BEAM DRIVE CONTINUED

7.8.2 In

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.8.2.1 Set and clip only the following solenoids:

SV4 On the launch frame winch control manifold (Figure 7.18)

SV6 On the launch frame pilot manifold (Figure 7.17)

SV7 On the launch frame pilot manifold (Figure 7.17)

SV8 On the launch frame pilot manifold (Figure 7.17)

SV13a On the launch frame winch control manifold (Figure 7.18)

SV14a On the launch frame winch control manifold (Figure 7.18)

SV15b On the launch frame winch control manifold (Figure 7.18)

SV16 On the launch frame pilot manifold (Figure 7.17)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.8.2.2 Operate the back up motion valve by *pushing* the lever, which will drive the beam in. At the same time, operate the brake release valve, which will allow the top winch brake to release, and the top winch to reel in rope.

7.8.2.3 Unclip all solenoids after completion of operation unless required for next operation.

7.9 FAR BANK SEAT

7.9.1 Raise at Far Bank

7.9.1.1 Set and clip only the following solenoids:

SV1 On the launch frame articulator manifold (Figure 7.18)

SV16 On the launch frame pilot manifold (Figure 7.17)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.9.1.2 Operate only the back up motion valve lever, which will retract the articulator cylinders (refer to Figure 7.1 for lever actions). The speed of movement in this mode is limited hydraulically so extra movement of the back up mode valve will not give greater speed.

7.9.1.3 Unclip all solenoids after completion of operation unless required for next operation.

7.9.2 Lower at Far Bank

WARNING

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.9.2.1 Set and clip only the following solenoids:

SV1 On the Launch Frame Articulator Manifold (Figure 7.18)

SV9 On the Launch Frame Pilot Manifold (Figure 7.17)

SV16 On the Launch Frame Pilot Manifold (Figure 7.17)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.9.2.2 Operate only the back up motion valve lever, which will extend the articulator cylinders (refer to Figure 7.1 for lever actions). The speed of movement in this mode is limited hydraulically so extra movement of the back up mode valve will not give greater speed.

NOTE

Backup brake mode valve lever should be operated in far bank lowering direction only to allow the top winch to pay off rope.

7.9.2.3 Unclip all solenoids after completion of operation unless required for next operation.

7.10 STOW ARTIC

7.10.1 Stow / Extend

7.10.1.1 Operate the following solenoid:

SV17a On the launch frame pinch roller manifold (Figure 7.17)

7.10.1.2 This will directly operate the stowing cylinder to extend.

7.10.1.3 Unclip all solenoids after completion of operation unless required for next operation.

7.10.2 Retract

7.10.2.1 Operate the following solenoid:

SV17b On the launch frame pinch roller manifold (Figure 7.17)

7.10.2.2 This will directly operate the stowing cylinder to retract the cylinder.

7.10.2.3 Unclip all solenoids after completion of operation unless required for next operation.

7.11 A-FRAME

7.11.1 Raising and Lowering

7.11.1.1 Set and clip only the following solenoids:

SV 3 On the launch frame articulator manifold (Figure 7.18)

7.11.1.2 Operate only the back up motion valve lever (refer to Figure 7.1 for lever actions) which will extend and retract the A-frame raise cylinders.

7.11.1.3 Unclip all solenoids after completion of operation unless required for next operation.

7.12 CARRIAGE EMPTY

7.12.1 Carriage Out

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.12.1.1 Set and clip only the following solenoids:

SV5 On the launch frame pilot manifold (Figure 7.17)

SV6 On the launch frame pilot manifold (Figure 7.17)

SV7 On the launch frame pilot manifold (Figure 7.17)

SV8 On the launch frame pilot manifold (Figure 7.17)

SV13b On the launch frame winch control manifold (Figure 7.18)

SV14b On the launch frame winch control manifold (Figure 7.18)

SV15a On the launch frame winch control manifold (Figure 7.18)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.12.1.2 Operate the back up motion valve, *pulling* the lever only, which will pull the rope onto the top winch. Only operate the back up brake valve once the motion lever has been moved and pressure is applied to the winches.

7.12.1.3 Unclip all solenoids after completion of operation unless required for next operation.

7.12.2 Carriage In

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.12.2.1 Set and clip only the following solenoids:

SV5 On the launch frame pilot manifold (Figure 7.17)

SV6 On the launch frame pilot manifold (Figure 7.17)

SV7 On the launch frame pilot manifold (Figure 7.17)

SV8 On the launch frame pilot manifold (Figure 7.17)

SV13a On the launch frame winch control manifold (Figure 7.18)

SV14a On the launch frame winch control manifold (Figure 7.18)

SV15a On the launch frame winch control manifold (Figure 7.18)

MAKE SURE THAT SV10 IS <u>NOT</u> CLIPPED.

7.12.2.2 Operate the back up motion valve, *pulling* the lever only, which will pull the rope onto the bottom winch. Only operate the back up brake valve once the motion lever has been moved and pressure is applied to the winches.

7.12.2.3 Unclip all solenoids after completion of operation unless required for next operation.

7.13 HIGH BANK

7.13.1 Carriage Out

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.13.1.1 Set and clip only the following solenoids:

SV5 On the launch frame pilot manifold (Figure 7.17)

SV6 On the launch frame pilot manifold (Figure 7.17)

SV8 On the launch frame pilot manifold (Figure 7.17)

SV13b On the launch frame winch control manifold (Figure 7.18)

SV14b On the launch frame winch control manifold (Figure 7.18)

SV15a On the launch frame winch control manifold (Figure 7.18)

MAKE SURE THAT SV10 IS <u>NOT</u> CLIPPED.

7.13.1.2 Operate the back up motion valve, *pulling* the lever only, which will pull the rope onto the top winch. Only operate the back up brake valve once the motion lever has been moved and pressure is applied to the winches.

7.13.1.3 Unclip all solenoids after completion of operation unless required for next operation.

HIGH BANK CONTINUED

7.13.2 Carriage In

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.13.2.1 Set and clip only the following solenoids:

SV5 On the launch frame pilot manifold (Figure 7.17)

SV6 On the launch frame pilot manifold (Figure 7.17)

SV8 On the launch frame pilot manifold (Figure 7.17)

SV13b On the launch frame winch control manifold (Figure 7.18)

SV14b On the launch frame winch control manifold (Figure 7.18)

SV15b On the launch frame winch control manifold (Figure 7.18)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.13.2.2 Operate the back up motion valve, *pushing* the lever only, which will pay rope off the top winch. Only operate the back up brake valve once the motion lever has been moved and pressure is applied to the winches.

7.13.2.3 Unclip all solenoids after completion of operation unless required for next operation.

7.14 LEVEL BANK

7.14.1 Carriage Out

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.14.1.1 Set and clip only the following solenoids:

SV5 On the launch frame pilot manifold (Figure 7.17)

SV6 On the launch frame pilot manifold (Figure 7.17)

SV8 On the launch frame pilot manifold (Figure 7.17)

SV13b On the launch frame winch control manifold (Figure 7.18)

SV14b On the launch frame winch control manifold (Figure 7.18)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.14.1.2 Operate the back up motion valve, *pulling* the lever only, which will pull the rope onto the top winch. Only operate the back up brake valve once the motion lever has been moved and pressure is applied to the winches.

7.14.1.3 Unclip all solenoids after completion of operation unless required for next operation.

LEVEL BANK CONTINUED

7.14.2 Carriage In

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.14.2.1 Set and clip only the following solenoids:

SV5 On the launch frame pilot manifold (Figure 7.17)

SV6 On the launch frame pilot manifold (Figure 7.17)

SV7 On the launch frame pilot manifold (Figure 7.17)

SV13a On the launch frame winch control manifold (Figure 7.18)

SV14a On the launch frame winch control manifold (Figure 7.18)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.14.2.2 Operate the back up motion valve, *pulling* the lever only, which will pull rope onto the top winch. Only operate the back up brake valve once the motion lever has been moved and pressure is applied to the winches.

7.14.2.3 Unclip all solenoids after completion of operation unless required for next operation.

7.15 LOW BANK

7.15.1 Carriage Out

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.15.1.1 Set and clip only the following solenoids:

SV5 On the launch frame pilot manifold (Figure 7.17)

SV6 On the launch frame pilot manifold (Figure 7.17)

SV7 On the launch frame pilot manifold (Figure 7.17)

SV13a On the launch frame winch control manifold (Figure 7.18)

SV14a On the launch frame winch control manifold (Figure 7.18)

SV15b On the launch frame winch control manifold (Figure 7.18)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.15.1.2 Operate the back up motion valve, *pushing* the lever only, which will pay the rope off the bottom winch. Only operate the back up brake valve once the motion lever has been moved and pressure is applied to the winches.

7.15.1.3 Unclip all solenoids after completion of operation unless required for next operation.

LOW BANK CONTINUED

7.15.2 Carriage In

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.15.2.1 Set and clip only the following solenoids:

SV5 On the launch frame pilot manifold (Figure 7.17)

SV6 On the launch frame pilot manifold (Figure 7.17)

SV7 On the launch frame pilot manifold (Figure 7.17)

SV13a On the launch frame winch control manifold (Figure 7.18)

SV14a On the launch frame winch control manifold (Figure 7.18)

SV15a On the launch frame winch control manifold (Figure 7.18)

MAKE SURE THAT SV10 IS <u>NOT</u> CLIPPED

7.15.2.2 Operate the back up motion valve, *pulling* the lever only, which will pull rope onto the bottom winch. Only operate the back up brake valve once the motion lever has been moved and pressure is applied to the winches.

7.15.2.3 Unclip all solenoids after completion of operation unless required for next operation.

7.16 TILT ROLLER

7.16.1 Up

7.16.1.1 Operate **SV18a** on the rotate manifold (Figure 7.15) by pushing in the mushroom head on the valve to extend the rollers.

7.16.1.2 Unclip all solenoids after completion of operation unless required for next operation.

7.16.2 Down

7.16.2.1 Operate **SV18b** on the rotate manifold (Figure 7.15) by pushing in the mushroom head on the valve to extend the rollers.

7.16.2.2 Unclip all solenoids after completion of operation unless required for next operation.

7.17 BRIDGE LIFT

7.17.1 Operating

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.17.1.1 Set and clip only the following solenoids:

SV5 On the launch frame pilot manifold (Figure 7.17)

SV13a On the launch frame winch control manifold (Figure 7.18)

SV14a On the launch frame winch control manifold (Figure 7.18)

SV15a On the launch frame winch control manifold (Figure 7.18)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.17.1.2 Operate the back up motion valve (refer to Figure 7.1 for lever actions), which will lift and lower the bridge by operating the bottom winch. Only operate the back up brake valve once the motion lever has been moved and pressure is applied to the winches.

7.17.1.3 Unclip all solenoids after completion of operation unless required for next operation.

7.18 TOP WINCH

7.18.1 Operating

WARNING

CRUSH HAZARD. UNDER NO CIRCUMSTANCES IS SV10 TO BE MANUALLY OPERATED OR CLIPPED IN THE OPERATED POSITION DURING OPERATIONS BEING CARRIED OUT IN BACK-UP MODE. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

CRUSH HAZARD. OPERATION OF THE WINCH BACK UP BRAKE LEVER PRIOR TO THE MOTION LEVER BEING MOVED CAN CAUSE THE BRIDGE TO RUN AWAY. FAILURE TO OBSERVE THIS INSTRUCTION CAN RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

7.18.1.1 Set and clip only the following solenoids:

SV6 On the launch frame pilot manifold (Figure 7.17)

SV13b On the launch frame winch control manifold (Figure 7.18)

SV14b On the launch frame winch control manifold (Figure 7.18)

SV15a On the launch frame winch control manifold (Figure 7.18)

MAKE SURE THAT SV10 IS NOT CLIPPED.

7.18.1.2 Operate the back up motion valve (refer to Figure 7.1 for lever actions), which will operate the top winch. At the same time, operate the back up brake valve, which will release the brakes on top winch.

7.18.1.3 Unclip all solenoids after completion of operation unless required for next operation.

7.19 NOTES ON SOLENOID USAGE

Table 7.1 Solenoid Usage

Valve No.	Valve Action
SV1	Far Bank Seat
SV2	Beam Angle
SV3	A-Frame Raise
SV4	Beam Drive
SV5	Carriage Drive Bridge Lift
SV6	Beam Drive Carriage Drive Top Winch
SV7	Beam Drive Carriage Drive
SV8	Beam Drive Carriage Drive
SV9	Far Bank Seat
SV10 SHOULD NEVER BE USED IN BACK UP MODE	Beam Drive Far Bank Seat Carriage Drive Bridge Lift Top Winch
SV13a SV14a	Beam Drive Carriage Drive Bridge Lift
SV13b SV14b	Carriage Drive Top Winch
SV15a	Beam Drive Carriage Drive Bridge Lift Top Winch
SV15b	Beam Drive Carriage Drive
SV16	A-Frame Rotate Beam Angle Beam Drive Far Bank Seat
SV17a Sv17b	Stow
SV18a	Tilt Roller Up
SV18b	Tilt Roller Down
SV19a	A-Frame Rotate Close
SV19b	A-Frame Rotate Open
SV20a	A-Frame Fold Open
SV20b	A-Frame Fold Close
SV21a, b, c, d	Roller Brake
SV24	PTO
SV25	Relax

7.20 TAIL LIFT

7.20.1 Operating

WARNING

CRUSH HAZARD. GREAT CARE MUST BE EXERCISED WHEN OPERATING THE TAIL LIFT IN BACK UP MODE, ESPECIALLY WHEN PERSONNEL ARE STANDING ON THE TAIL LIFT PLATFORM. UNEXPECTED MOVEMENT MAY OCCUR IF THE SEQUENCE OF OPERATION IS INCORRECT. SERIOUS INJURY CAN OCCUR TO PERSONNEL IF THIS INSTRUCTION IS NOT COMPLIED WITH.

NOTE

Two personnel are required to carry out back up operation of the tail lift.

7.20.1.1 The tail lift manifold (Figure 7. 4) is situated next to the right hand rear wheel. There are two mushroom button manual overrides. These two buttons change direction of flow. The valves are numbered **SV30a** and **SV30b**.

7.20.1.2 **SV30a** will allow the tail lift to go down.

7.20.1.3 **SV30b** will allow the tail lift to go in the up direction.

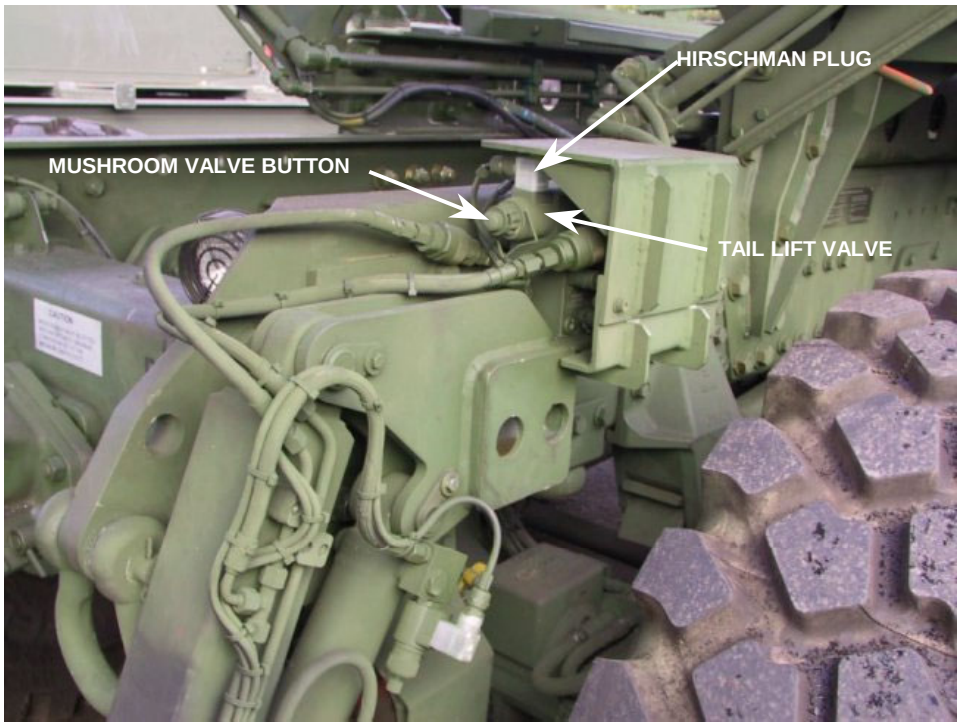


Figure 7. 4 Tail lift Manifold

7.20.1.4 Each cylinder has a solenoid with an electrical Hirschman plug, as do all the solenoid valves. However rather than a mushroom button they have a small knurled screw with a hexagon socket in the head. (Refer to Figure 7. 5).

7.20.1.5 When the knurled screw is screwed in, the valve opens and oil can flow. To lower the tail lift the knurled screws are screwed in and the tail lift will drop on its own, i.e. oil flows out of the cylinder.

NOTE

Both knurled screws have to be turned at the same time or else the entire load will be taken by one cylinder. If the platform is empty this is not a problem, but it should be avoided.

7.20.1.6 To stop the lowering process screw the knurled screws back out.

NOTE

Stop turning the knurled screws out when a light resistance on the screw is felt. The knurled screws can be screwed all the way out if personnel are not careful.

7.20.1.7 To extend any pair of cylinders, check none of the knurled screws are screwed in, operate the correct mushroom button on the tail lift manifold and slowly screw in the knurled screws on the required left and right cylinders of the tail lift.

NOTE

If the mushroom button on SV30a or b is RELEASED with the valves screwed in, the tail lift will drop.

7.20.1.8 To stop the cylinders extending screw both the knurled screws out in unison until a light resistance is felt.

7.20.1.9 Once complete ensure all knurled screws are screwed out until slight resistance is felt.

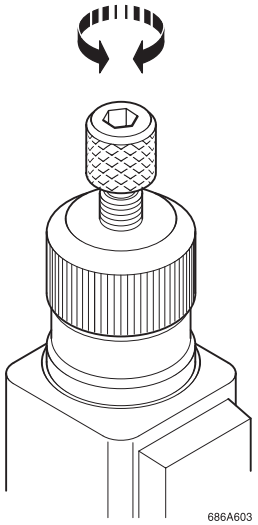


Figure 7. 5 Tail lift Valve Head

7.20.1.10 To swing down the tail lift operate **SV30b**, screw in both the **SWING** cylinder knurled screws (one on each cylinder) (refer to Figure 7. 6 for location) slowly until movement occurs. To stop the swing down, screw out the knurled screws on the valves.

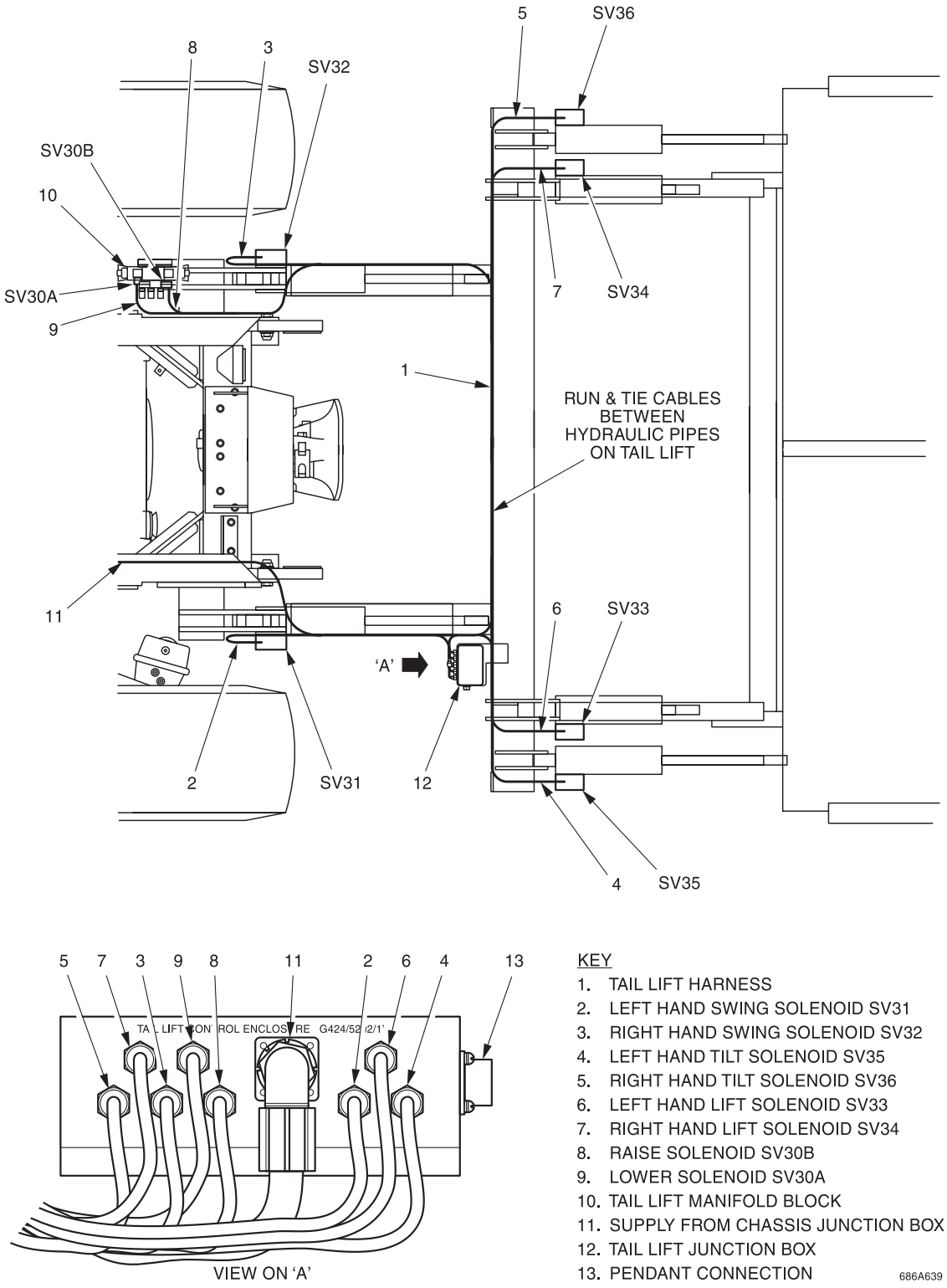
NOTE

The slower the action of screwing in or out the knurled screws the more control is exercised over the movement of the tail lift.

7.20.1.11 To lower the platform operate **SV30b**, screw in both the **LIFT** cylinder (refer to Figure 7. 6 for location) knurled screws slowly until movement occurs. Screw the knurled screws out when the platform is at the desired level.

7.20.1.12 To level the platform operate **SV30b** or **SV30a** depending on which way the platform is required to travel, screw in both the **TILT** cylinder (refer to Figure 7. 6 for location) knurled screws slowly until movement occurs. Screw the knurled screws out when the platform is at the desired position.

7.20.1.13 To reverse the operation of the tail lift, push in the head of **SV30a** or **SV30b** depending on the direction required and clip. Repeat procedures above for desired action.



KEY

1. TAIL LIFT HARNESS
2. LEFT HAND SWING SOLENOID SV31
3. RIGHT HAND SWING SOLENOID SV32
4. LEFT HAND TILT SOLENOID SV35
5. RIGHT HAND TILT SOLENOID SV36
6. LEFT HAND LIFT SOLENOID SV33
7. RIGHT HAND LIFT SOLENOID SV34
8. RAISE SOLENOID SV30B
9. LOWER SOLENOID SV30A
10. TAIL LIFT MANIFOLD BLOCK
11. SUPPLY FROM CHASSIS JUNCTION BOX
12. TAIL LIFT JUNCTION BOX
13. PENDANT CONNECTION

686A639

Figure 7. 6 Location of Tail lift Cylinders

7.21 CRANE

7.21.1 Normal Operation/Emergency Operation Change over Switch

7.21.1.1 The crane can be used when electrical power fails by means of the normal operation/ emergency operation change over valve located on the main control lever console at the crane operator's position (Figure 7.7).

7.21.1.2 The valve is moved forwards to allow hydraulic pressure to bypass the safe load control (SLC) valve, which has shut off the hydraulics to the crane, and permit the crane to be operated.

WARNING

CRUSH HAZARD. THE SAFE LOAD CONTROL (SLC) OVERLOAD PROTECTION SYSTEM IS INOPERATIVE WHEN ELECTRICAL POWER HAS FAILED. GREAT CARE MUST BE TAKEN TO ENSURE THAT LOADS DO NOT EXCEED THE RECOMMENDED SAFE BOOM DISTANCES. SERIOUS INJURY CAN OCCUR TO PERSONNEL IF THIS INSTRUCTION IS NOT COMPLIED WITH.

7.21.1.3 It is essential that the normal operation/emergency operation change over valve be returned to the normal position as soon as electrical power is restored.

Figure 7.7 Location of Normal Operation/Emergency Operation Change Over Valve

7.22 CROSS CONNECTION OF LAUNCH VEHICLE FROM SECOND VEHICLE

7.22.1 Preparation

NOTE

This procedure can only be used if there are no leaks or breaks in the launch vehicle/launcher hydraulic system.

This procedure is used to enable the completion of the mission with a failed hydraulic pump or other failure, which prevents operation of the launcher hydraulic system.

Each CBT truck and launch vehicle is equipped with one hydraulic slave hose. Two hoses (one from the CBT truck and one from the launch vehicle) are required to perform cross connection of the launcher hydraulics.

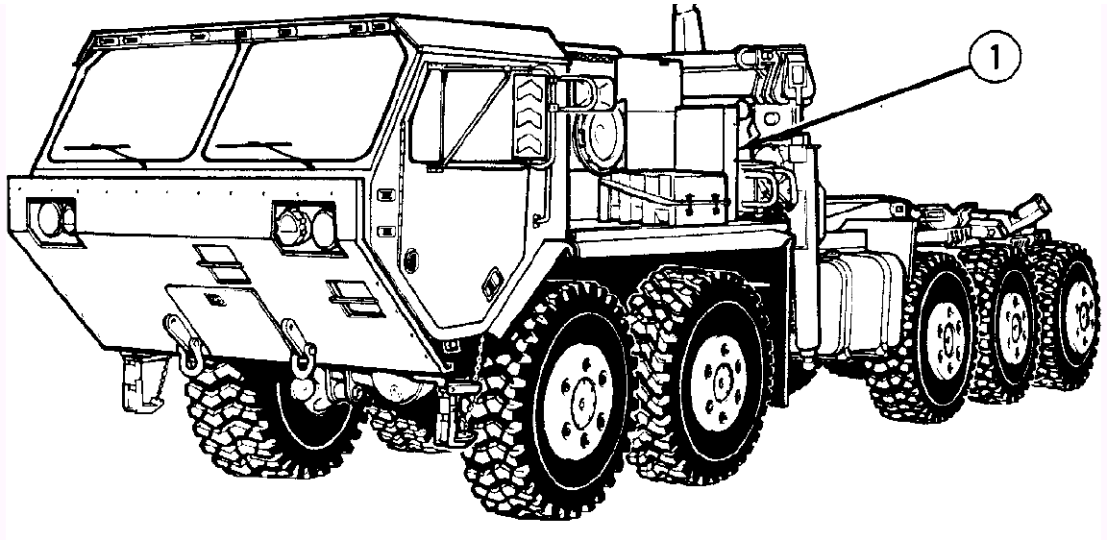


Figure 7.8 Position of Hydraulic Interconnect on PLS Truck

7.22.1.1 Move the truck and launcher into position so that the L/H control box (Figure 7.8 (1)) on PLS truck and cross connection pump (Figure 7.9 (1)) on launch vehicle are side by side if possible. The donor truck should be in a suitable position to allow for safe operation of crane and launcher.

7.22.1.2 Shut off the engines and apply the parking brakes on both trucks.

7.22.1.3 Remove the hoses from stowage boxes of trucks.

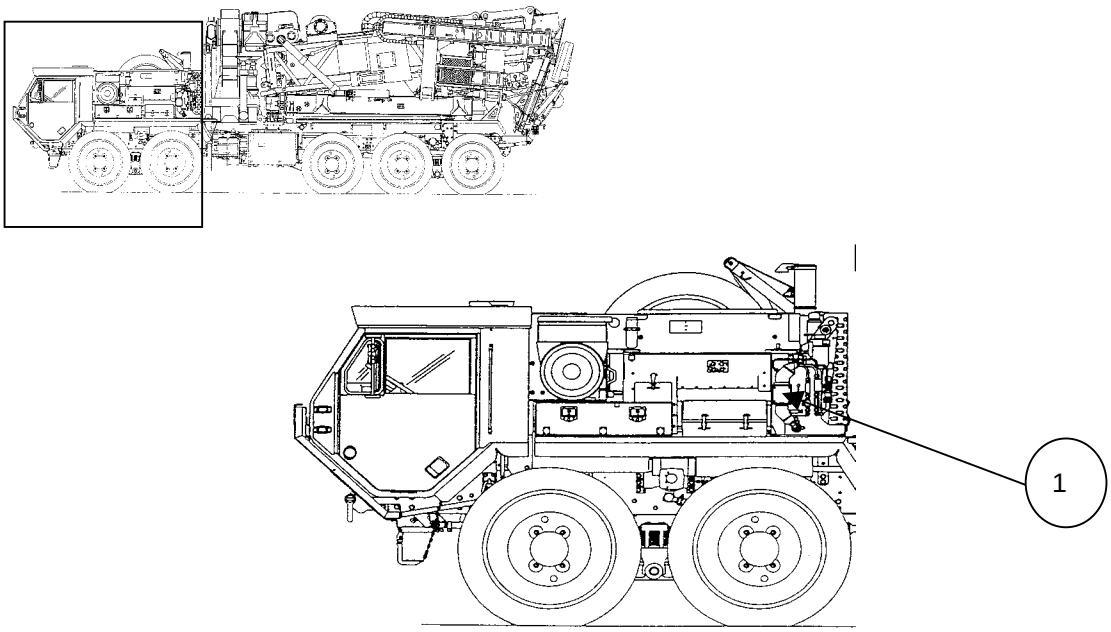


Figure 7.9 Position of Cross Connection Pump on the Launch Vehicle

WARNING

HYDRAULIC PRESSURE. THE HYDRAULIC FLUID IS UNDER GREAT PRESSURE. ENGINES ON BOTH TRUCKS MUST BE SHUT OFF WHILE DISCONNECTING HYDRAULIC LINES. FAILURE TO DO SO COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL.

CAUTION

Equipment damage. To prevent hydraulic contamination, keep the hydraulic quick disconnects clean, or damage to hydraulic system may result.

7.22.2 For Donor PLS Truck

7.22.2.1 The quick disconnects are located on the back of the L/H box on the donor PLS truck (Figure 7.10 (1)).

7.22.2.2 Disconnect the hydraulic lines (Figure 7.10 (2)) on the donor truck at the quick disconnects (Figure 7.10 (3)) located on the back of the L/H control box (Figure 7.10 (1)).

7.22.2.3 Using the first slave hose, connect the male end of the slave hose to the female end of the supply hose on the operable PLS truck.

7.22.2.4 Using the second slave hose, connect the female end of the slave hose to the male end of the return hose on operable the PLS truck.

7.22.2.5 It is possible to daisy chain two or more hoses together but this should be avoided if at all possible as it can create backpressure in the tank line.

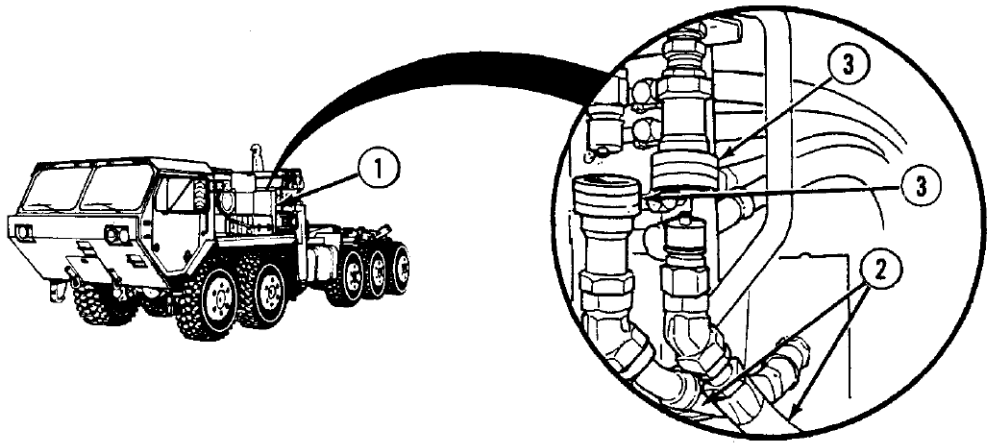


Figure 7.10 Donor Truck Connections

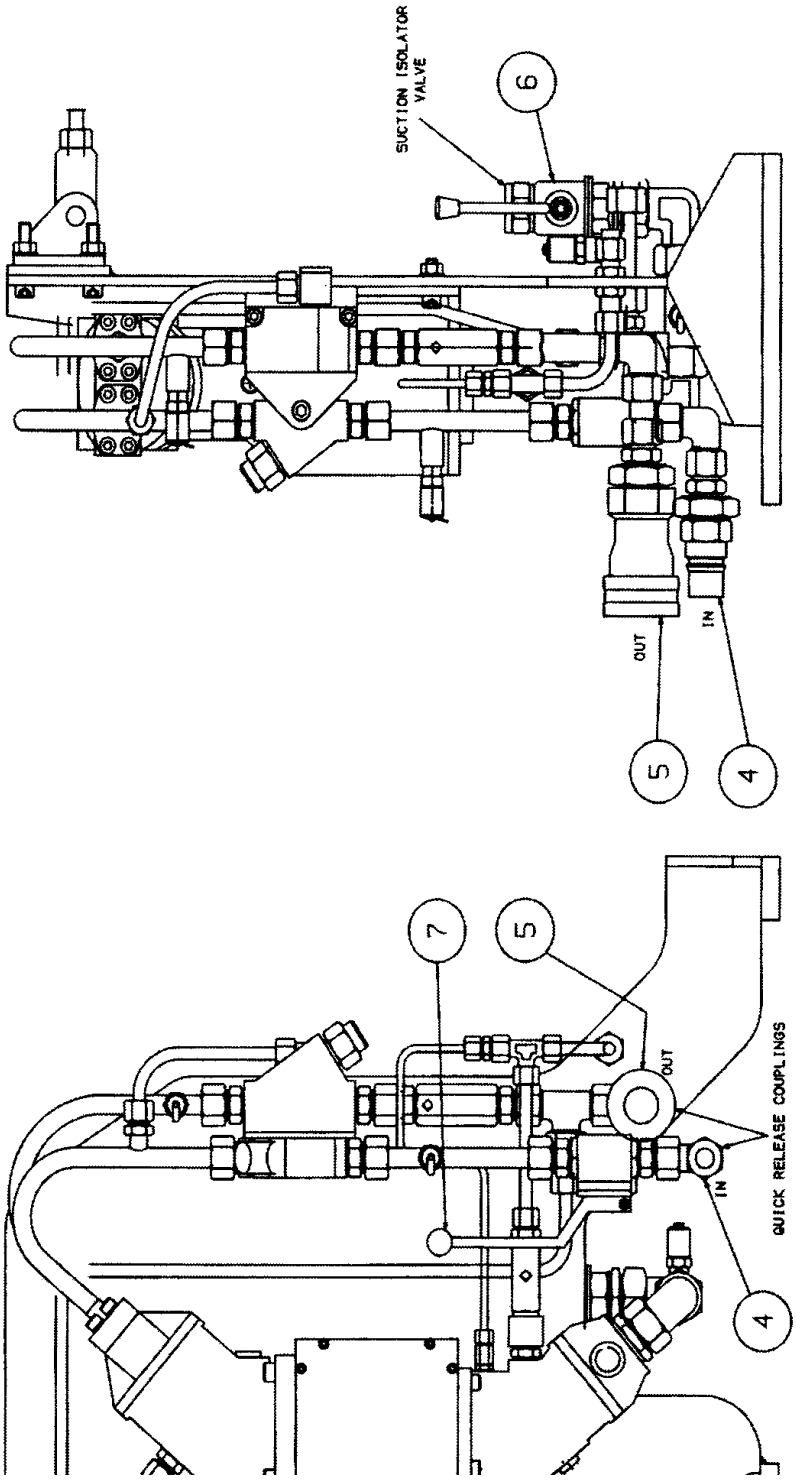


Figure 7. 11 Launch Vehicle Cross Connection Equipment

7.22.3 For Disabled Launcher

7.22.3.1 The quick disconnects are located on the front of the cross connection pump (Figure 7. 11).

7.22.3.2 Remove the dust caps from the quick disconnect couplings.

7.22.3.3 Using the first slave hose (supply), connect the female end of the slave hose to the male end of the quick disconnect coupling (Figure 7. 11 (4)) on cross connection pump.

7.22.3.4 Using the second slave hose (return) connect the male end of the slave hose to the female end of the quick disconnect coupling (Figure 7. 11 (5)) on cross connection pump.

7.22.3.5 Open the suction isolation valve (Figure 7. 11 (6)) at the rear of the assembly.

CAUTION

Equipment damage. Engine speed on the donor PLS truck must be at idle before using hydraulic selector switch, or damage to equipment may result.

Equipment damage. Do not adjust the flow control as over-speeding the motors could cause damage.

Equipment damage. Check connection to donor vehicle and particularly that the tank hose is fitted correctly.

7.22.3.6 Start the engine on the operable donor truck and engage the PTO only. **DO NOT ENGAGE HIGH IDLE**.

7.22.3.7 If disabled the launcher has a failure in the hydraulic system, but not the electrical system, go to Para (7.22.3.8). If both systems have failed, refer to operator's manual Section 7 for back up mode operation.

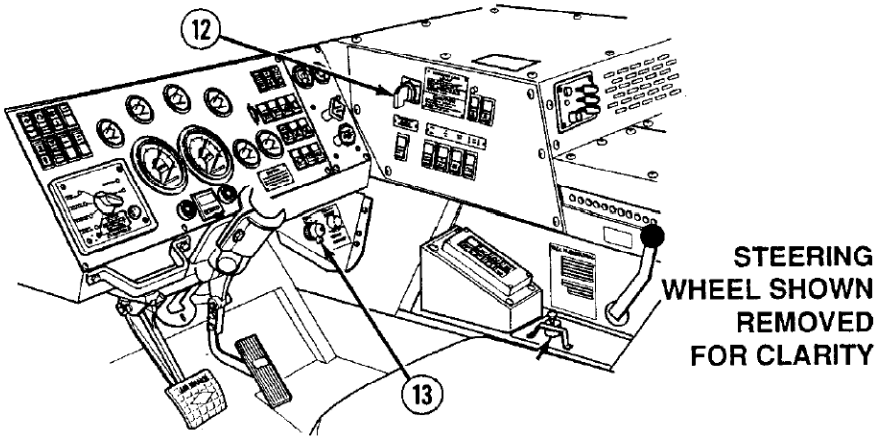


Figure 7.12 Switch Positions in Launcher Cab

CAUTION

Equipment damage. Only one function at a time should be operated when using the cross connection pump unit.

Equipment damage. If hydraulic functions are not being operated for any length of time, the donor truck should be turned off to avoid the hydraulic system overheating.

Equipment damage. Keep a constant watch on the hydraulic oil temperature on the donor vehicle, to ensure that it does not overheat. If overheating occurs stop build in a safe condition and allow the donor vehicle hydraulic oil to return to normal temperature.

NOTE

If temperature of hydraulic fluid on disabled launcher is above 212 degrees F (100 degrees C) the high temperature oil light will illuminate (assuming that electrical power is available) on the interface panel and the chest pack fault light will flash. If the HIGH TEMPERATURE warning does come on, do the following:

a Stop launch in safe position and turn donor PLS truck off.

b When the HIGH TEMPERATURE warning light goes off, restart donor truck and continue build.

c If the electrical system has failed and no warning lights are available, check the temperature of the hydraulic oil by placing a hand on the hydraulic tank. If you cannot keep your hand on the side of the tank, stop launch in a safe position and allow to cool down by turning off donor PLS Truck.

d When tank has sufficiently cooled off, restart donor truck and continue build.

The speed of operations will be much slower than in normal operation.

There is sufficient pressure to operate the crane system to lift a full load.

7.22.3.8 On the disabled launcher turn the ignition switch to ON and turn the 4-position rotary selector switch to position 2 for launcher stowing or 4 if bridge building.

7.22.3.9 The cross connection pump will not operate as the ball valve (Figure 7. 11 (7)) is closed.

7.22.3.10 Slowly open the ball valve (Figure 7. 11(7)).

7.22.3.11 Continue to operate functions as normal.

7.22.3.12 When operating try to operate each function sequentially, without any delay in between, as this will minimize operating time and also reduce heat generation. This may mean operating a launcher function and then immediately operating a crane function.

7.22.3.13 If the hydraulics are not to be used for any length of time unload the donor vehicle pump (PLS PTO disengage) if possible or stop the engine to prevent overheating.

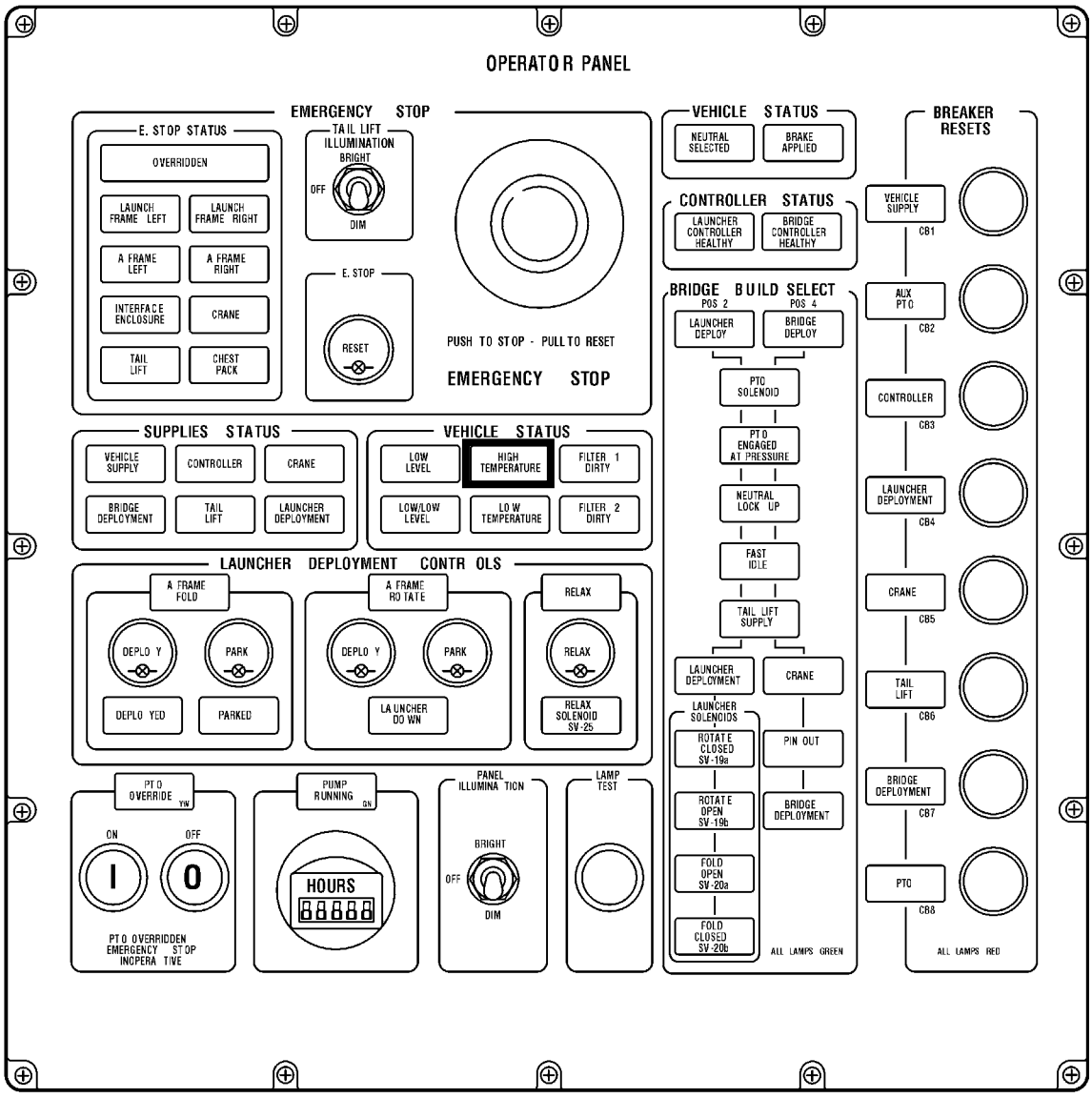


Figure 7.13 Interface Panel - High Oil Temperature Indicator

7.22.4 After Completion of Operation

WARNING

HYDRAULIC PRESSURE. THE HYDRAULIC FLUID IS UNDER GREAT PRESSURE. ENGINES ON BOTH TRUCKS MUST BE SHUT OFF WHILE DISCONNECTING HYDRAULIC LINES. FAILURE TO DO SO COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL.

CAUTION

Equipment damage. To prevent hydraulic contamination, keep the hydraulic quick disconnects clean, and replace all plastic covers after use, or damage to hydraulic system may result.

7.22.4.1 Stop the donor vehicle and close all the ball valves on the cross connection unit.

7.22.4.2 Remove the hoses and re-stow in the relevant vehicle.

NOTE

Allow the pressure to decay in hoses before disconnecting from both units.

7.23 SOLENOID VALVES

7.23.1 Locations

7.23.1.1 The following illustrations give the location of the solenoid valves that will be required during backup operation.

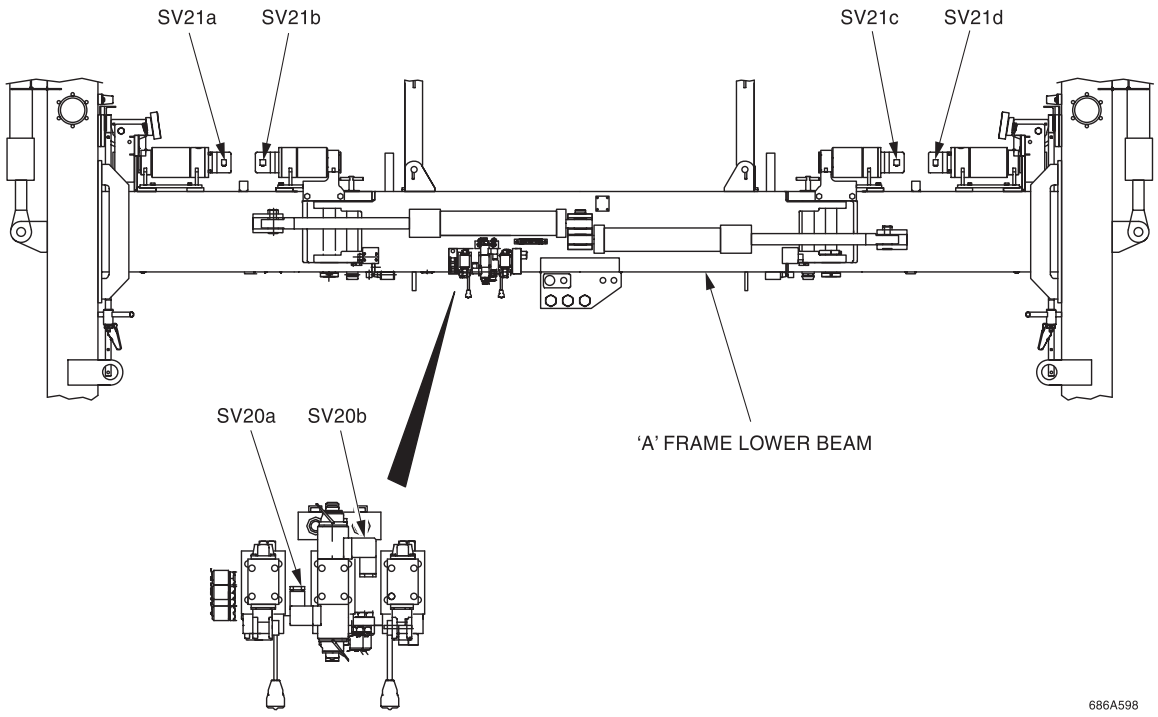


Figure 7.14 A-frame Stabilizer Leg Manifold and Roller Brake Solenoid Valves

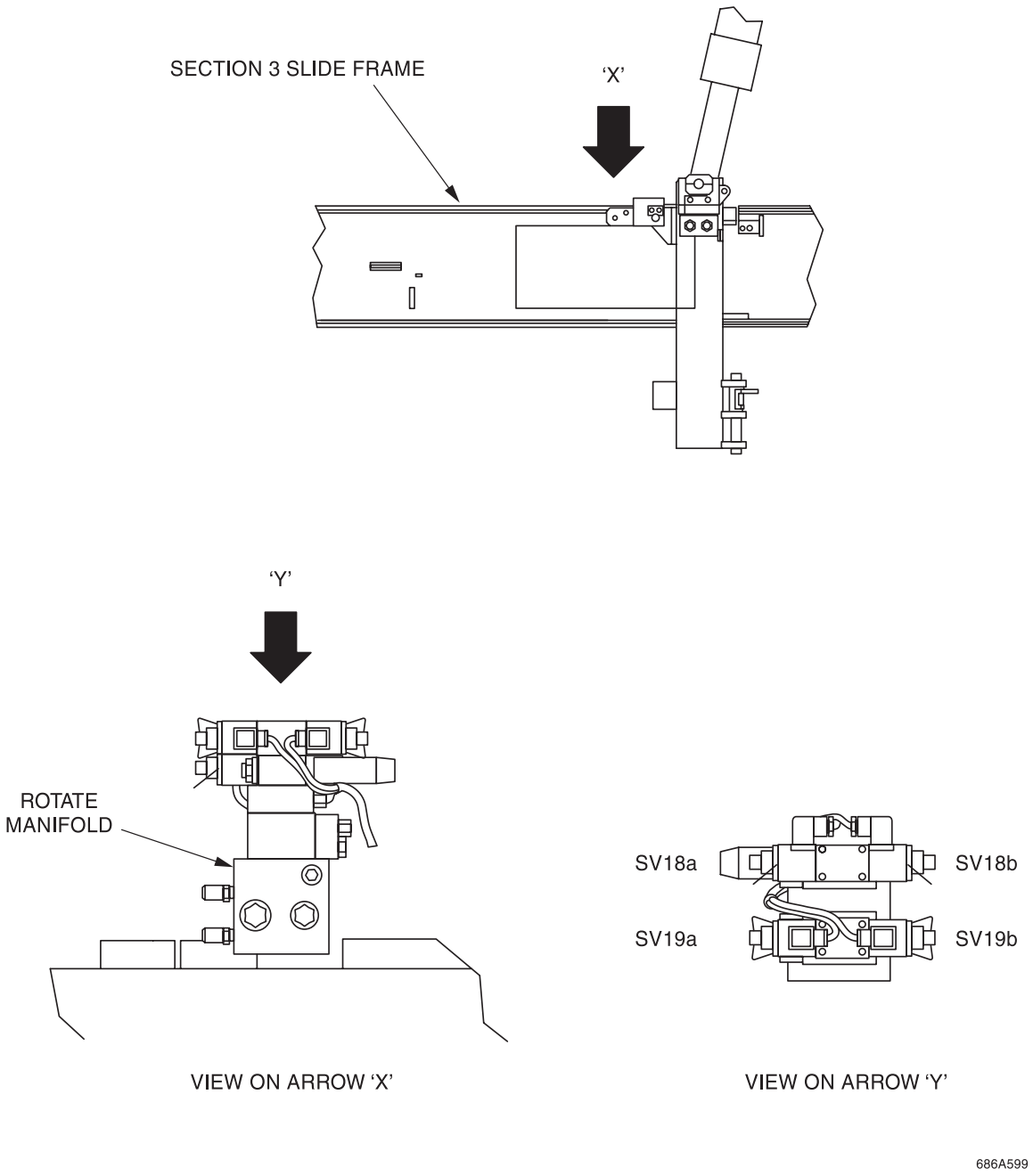


Figure 7.15 A-frame Rotate Manifold

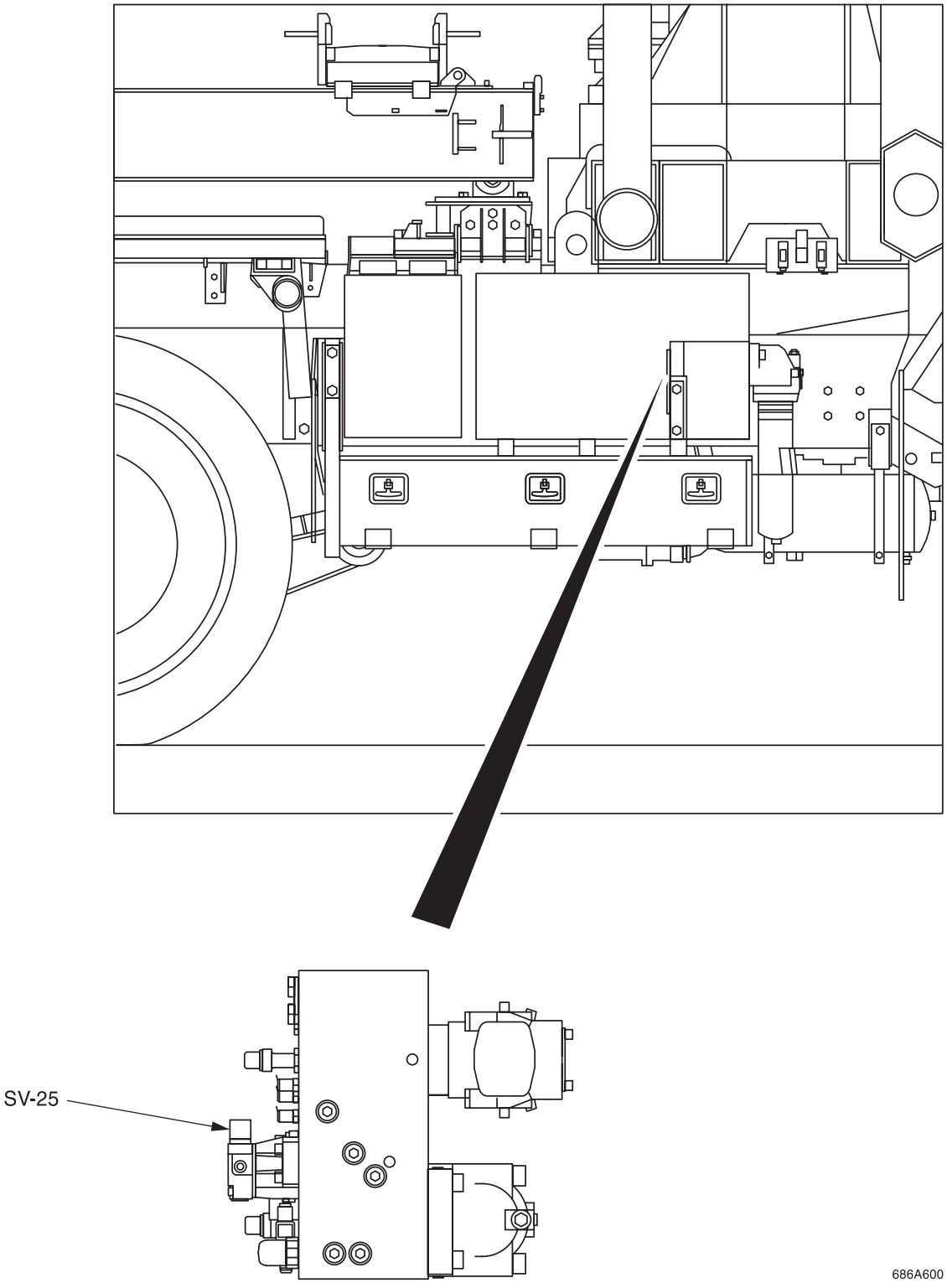


Figure 7.16 Interface Manifold

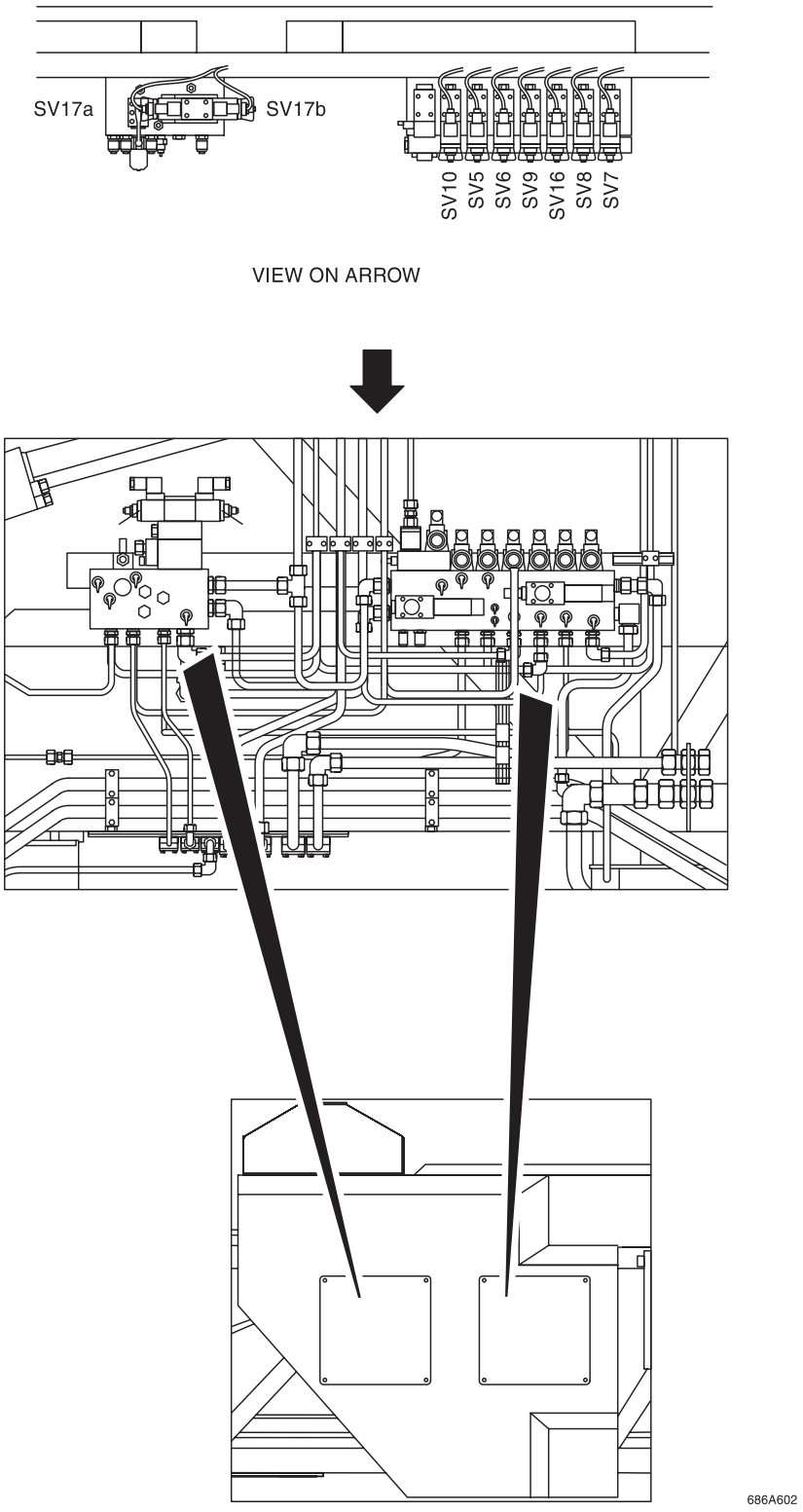


Figure 7.17 Launch Frame Pinch Roller Stowing Manifold and Launch Frame Pilot Manifold

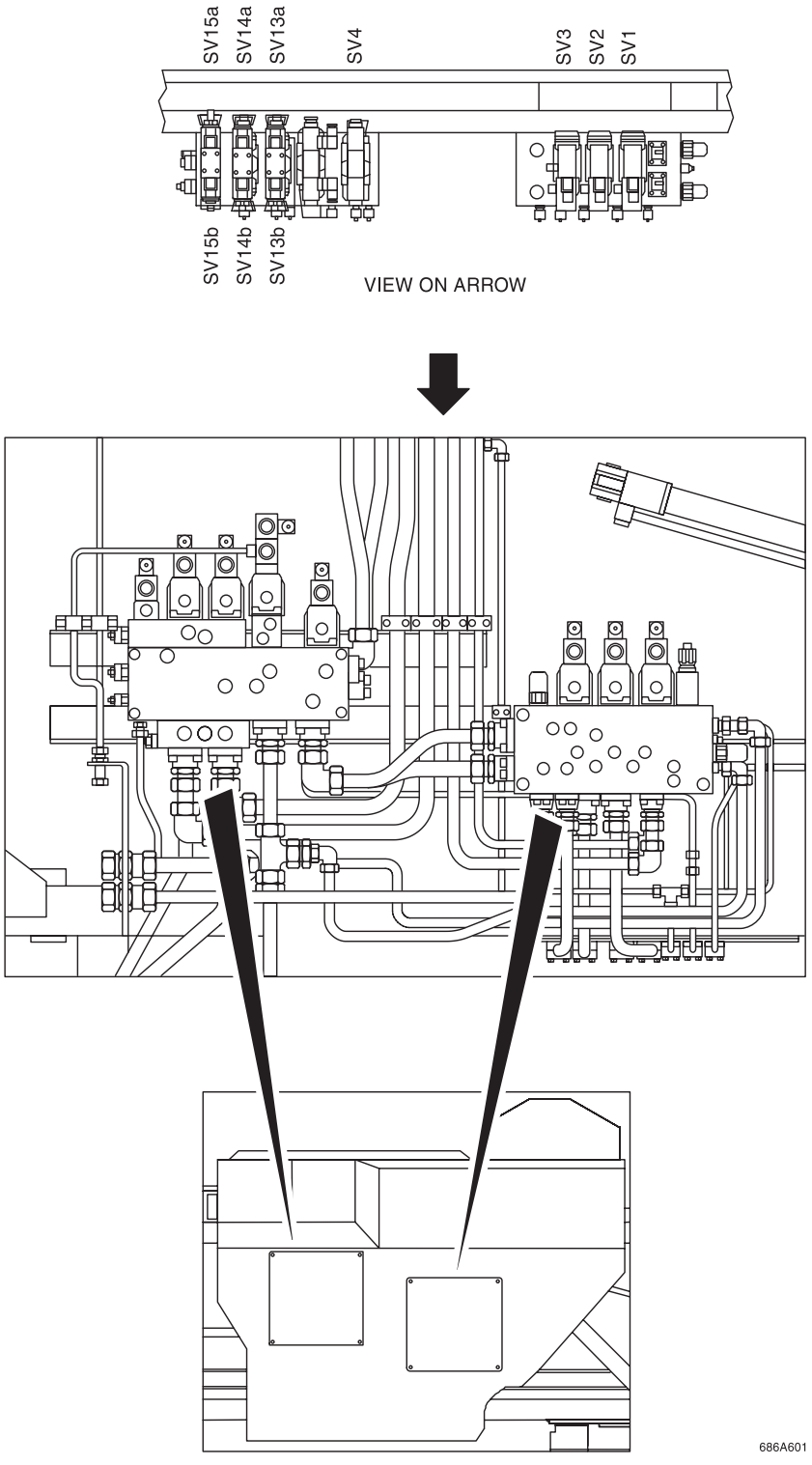


Figure 7.18 Launch Frame Winch Control Manifold and Launch Frame Articulator Manifold

TABLE OF CONTENTS

CHAPTER 8

PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

NOTE

Before commencing with PMCS on the DSB launch equipment, ensure that the PMCS has been carried out on the PLS vehicle. The instructions for this can be found in the PLS manual TM 9-2320-364-10.

Section I. INTRODUCTION

8.1 PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

8.1.1 General

8.1.1.1 This section contains PMCS requirements for the bridge. The PMCS tables contain checks and services necessary to ensure that the bridge is ready for operation. Using PMCS tables, perform maintenance at specified intervals.

8.1.1.2 Cleaning instructions and precautions. During PMCS keep the following general maintenance procedures in mind:

(i) Cleanliness. Dirt, grease, oil and debris may cause or cover a serious problem. Clean all metal surfaces.

(ii) Bolts, nuts and screws. Check bolts, nuts and screws for obvious looseness, missing, bent, or broken condition. Look for chipped paint, bare metal, or rust around bolt heads. If any part seems loose, tighten it, or have the part repaired or replaced.

(iii) Welds. Look for loose or chipped paint, rust, or gaps on welds. If a bad weld is found, notify unit maintenance.

(iv) Electrical wires and connectors. Look for cracked or broken insulation, bare wires and loose or broken connectors. Tighten loose connectors and make sure wires are in good shape. If a wire or connector is bad, notify unit maintenance.

(v) Fluid lines and fittings. Look for wear, damage and leaks, and make sure clamps and fittings are tight. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out and can not be fixed with tools available, notify unit maintenance.

8.1.2 Warnings and Cautions

8.1.2.1 Always observe the warnings and cautions appearing in your PMCS table. Warnings and cautions appear before applicable procedures. You must observe these warnings and cautions to prevent serious injury to yourself and others or prevent equipment from being damaged.

Section II. PMCS TABLES

8.2 EXPLANATION OF TABLE ENTRIES

8.2.1 General

8.2.1.1 Item No column. Items in this column are for reference. When completing DA Form 2404 (equipment inspection and maintenance worksheet), include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do the checks and services for the intervals listed.

8.2.1.2 Interval column. This column describes when, and how often, the check is to be made. Thus, if a given check is performed before operation, the word **Before** is opposite the check in the interval column.

(vi) Perform the (Before) CHECKS before operating bridge.

(vii) Perform the (During) CHECKS while operating bridge. During operation means to monitor bridge and its related components while being operated.

(viii) Perform the (After) CHECKS right after operating the bridge or at the end of the mission.

(ix) Perform the (Storage) CHECKS once every six months.

8.2.1.3 Location/Item to Check Service column. The items listed in this column are divided into groups indicating the portion of the equipment of which they are a part, i.e. front, left, engine. Under these groupings, a few common words are used to identify the specific item being checked.

8.2.1.4 Procedure column. This column contains a brief description of the procedure by which the check is performed.

8.2.1.5 Not Fully Mission Capable If: column. This column contains the criteria that causes the equipment to be classified as NOT READY/NOT AVAILABLE because of inability to perform its primary mission. An entry in this column will identify conditions that will make the equipment not ready/available for readiness reporting purposes.

8.2.2 Shortened Maintenance Intervals

8.2.2.1 Extreme weather conditions, periods of high use, or combat conditions may dictate that PMCS is performed more often than is required in the PMCS tables.

8.2.3 Lubrication Requirements

8.2.3.1 For lubrication requirements and procedures, refer to section 8.7.

8.2.4 Leakage Classification and Definition

CAUTION

Equipment operation is allowable with minor leak (Class I or II). Consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify the supervisor. When operating with Class I or II leaks, continue to check fluid levels as required in the PMCS. Class III leaks should be repaired using tools available, if possible. If not, use "Not Fully Mission Capable" column criteria.

8.2.4.1 If leakage is detected, further investigation is needed to determine the location and cause of the leak. If there is any doubt, contact your supervisor or unit maintenance.

8.2.4.2 **Class I.** Leakage of fluid as indicated by wetness or discoloration not great enough to form drops.

8.2.4.3 **Class II.** Leakage of fluid great enough to form drops but not enough to cause drops that fall from item being checked/inspected.

8.2.4.4 **Class III.** Leakage of fluid great enough to form drops that fall from the item being checked/inspected. Try to fix leak using tools available.

8.2.5 Tools and Equipment

8.2.5.1 For a complete list of tools and equipment refer to Appendices:

D. Basic Issue Items (BII)

E. Component of End Item (COEI)

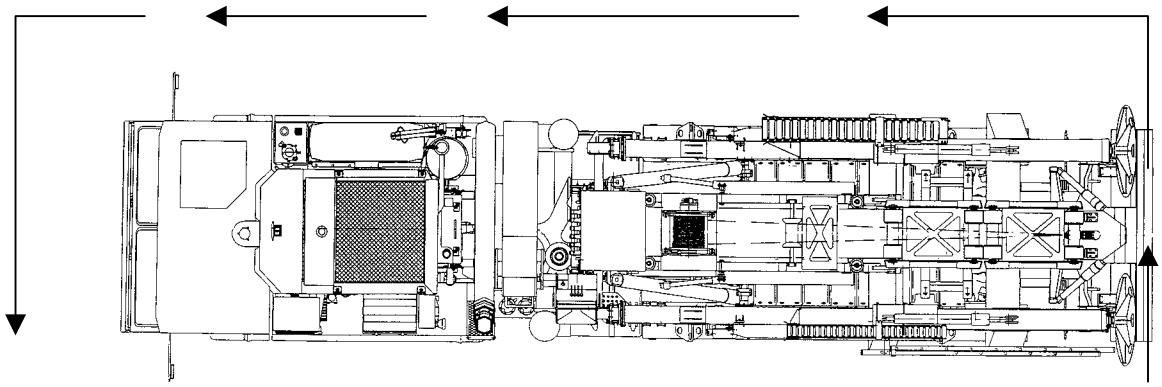
F. Additional Authorization List (AAL)

G. Expendable and Durable Items List

8.3 PREVENTIVE MAINTENANCE CHECKS AND SERVICES

8.3.1 Operators Tables

8.3.1.1 Refer to Table 8.1 through Table 8.5 for Operators Preventive Maintenance Checks and Services (PMCS) for the launcher. The routing diagram will be of help to complete the PMCS. It shows the general path an operator will follow to complete the PMCS.



PMCS Walk-around

NOTE

PMCS instructions for the Launch Vehicle chassis can be found in TM 9-2320-364-10.

Table 8.1 Operators PMCS (Before)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
1	Before	Bridge controls	(a) Open stowage box (1) and check chest pack and tail-lift pendant for signs of damage. (b) Check that the stowage box is secure and the lid locks when shut.	Electrical cables are damaged.
2	Before	Cross connection assembly	(a) Check for hydraulic leaks. (b) Check that the outlet pipe covers are in place (2). (c) Check the cross connection assembly for damage.	Class III leak evident. Damage evident.

Table 8.2 Operators PMCS (Before) - (continued)

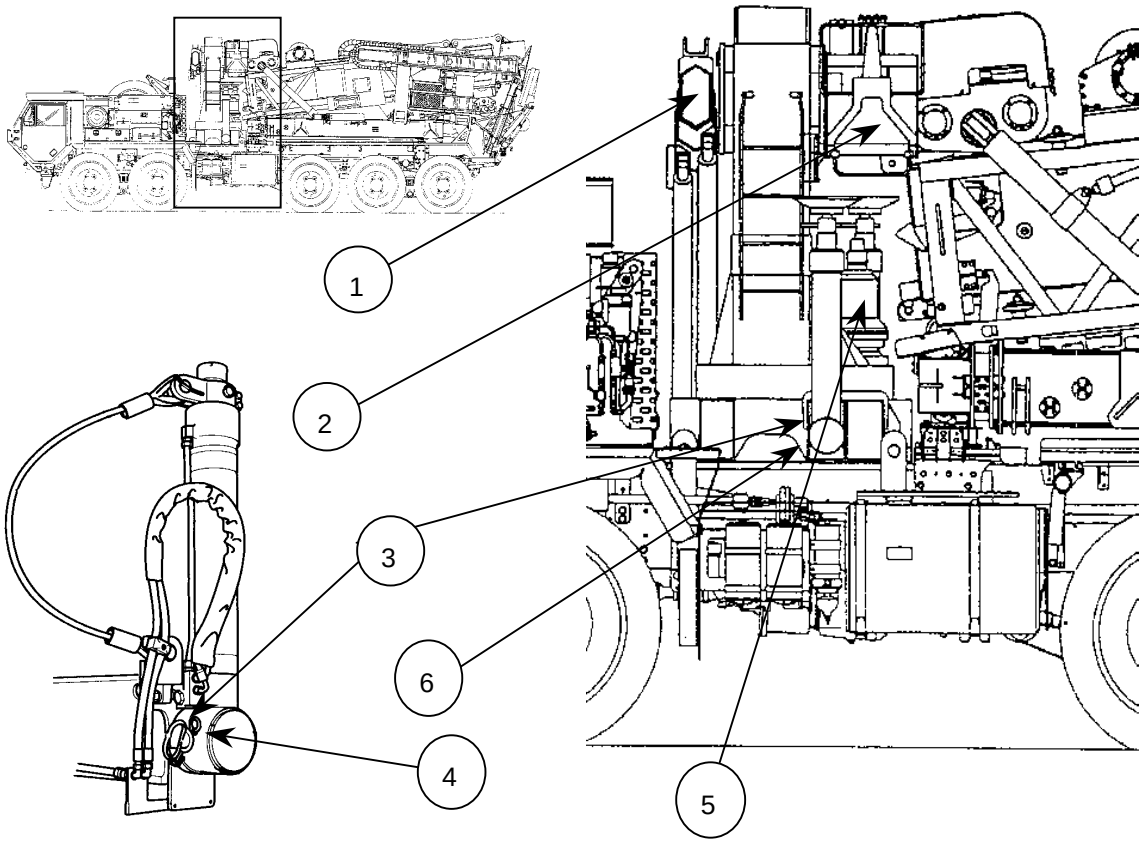
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
3	Before	Crane	(a) Check oil levels in rotate drive (5).	Levels must be half way up sight glasses.
			(b) Check for hydraulic fluid leaks around crane hoses and pistons (1).	Class III leak is evident.
			(c) Check seat is in locked into stowed position (2).	
			(d) Check left hand stabilizer leg locking pin (3) is fitted and locked into position with clip (4).	
			(e) Check for hydraulic fluid leaks on left hand stabilizer leg	Class III leak is evident.
			(f) Check stabilizer leg slide frame locking pin and clip (6).	

Table 8.2 Operators PMCS (Before) - (continued)

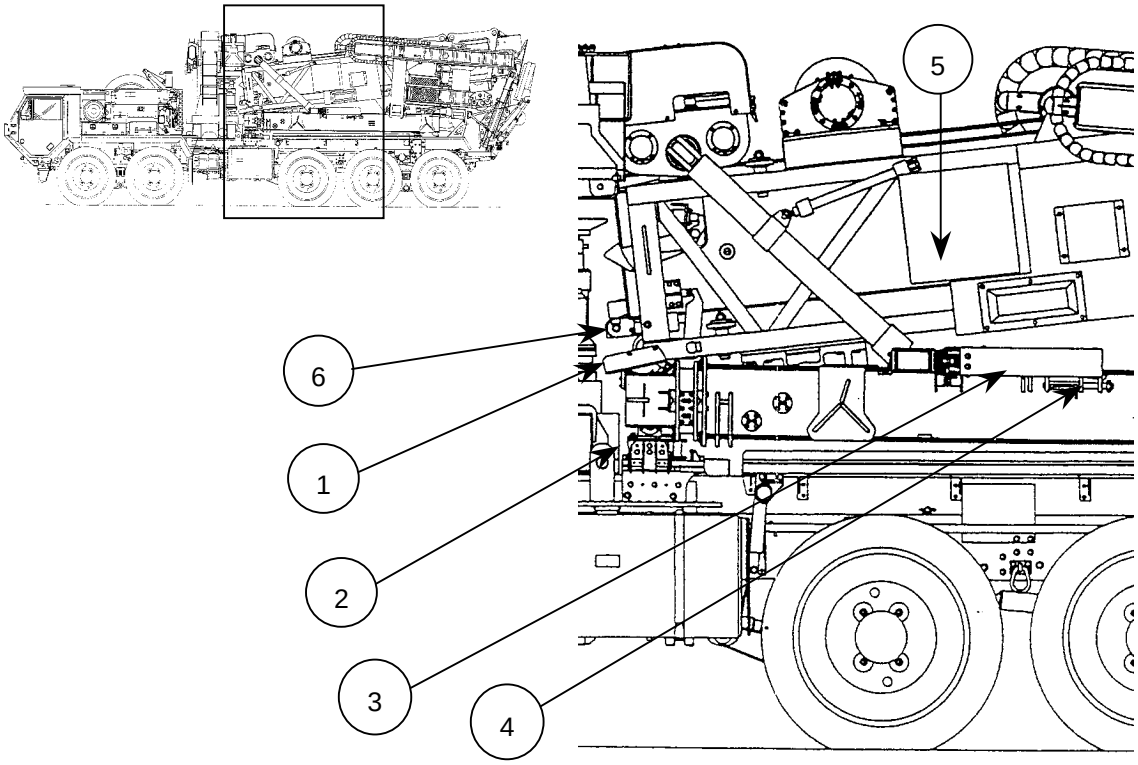
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
4	Before	Slide frame	Check R clips are fitted correctly to home bank end beam adapter plate (1).	
5	Before	Relax mechanism	Check that the relax mechanism shootbolts are locked in the lowest position (2).	
6	Before	Electrical enclosure	Check that the electrical enclosure is not damaged and secure (5).	
7	Before	Tilt roller assembly	(a) Check that the tilt roller is stowed in the horizontal position (3).	
			(b) Check that the shootbolts are secure and the R clips are in position (4).	
			(c) Check for hydraulic leaks.	Class III leak is evident.
8	Before	Front Launch beam	Check the front launch beam (6) is pinned and secured into launch frame.	

Table 8.2 Operators PMCS (Before) - (continued)

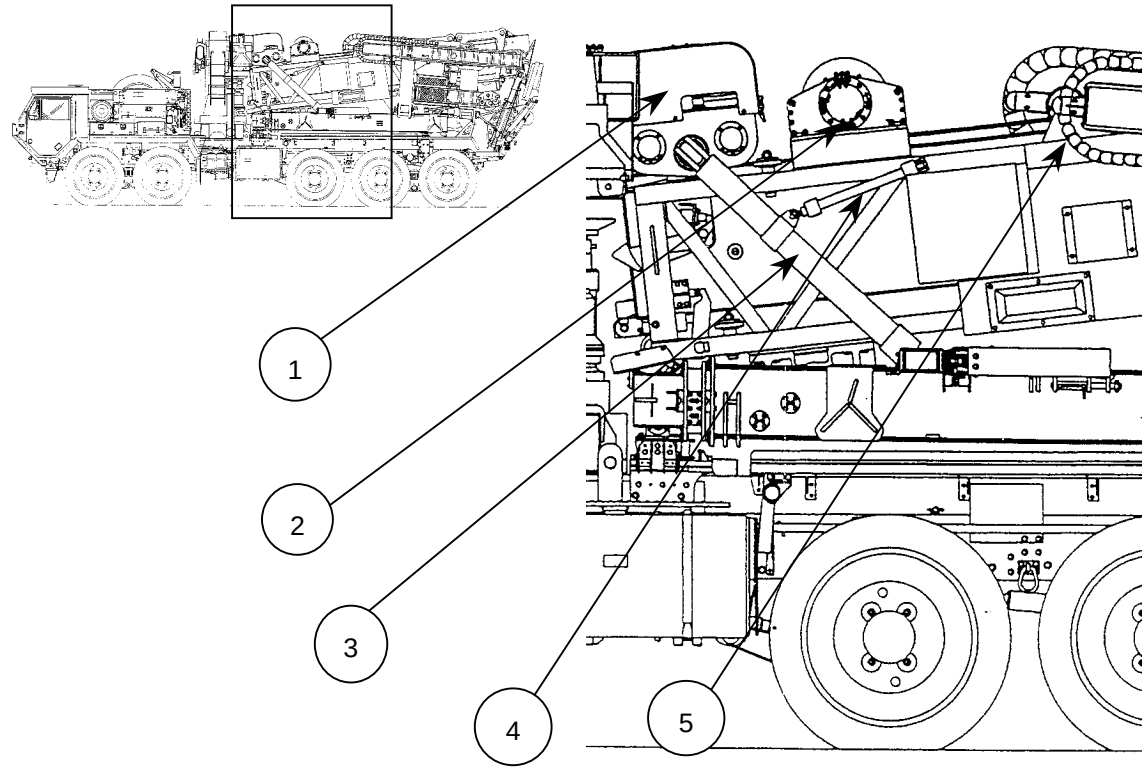
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
9	Before	Beam drive motors	Check for hydraulic leaks (1).	Class III leak is evident.
10	Before	Winch motors	Check for hydraulic leaks (2).	Class III leak is evident.
11	Before	Articulator cylinder	Check for hydraulic leaks (3).	Class III leak is evident.
12	Before	Stow cylinder	Check for hydraulic leaks (4).	Class III leak is evident.
13	Before	Energy chain	Check for damage and security of links (5).	Links not secure or damaged

Table 8.2 Operators PMCS (Before) - (continued)

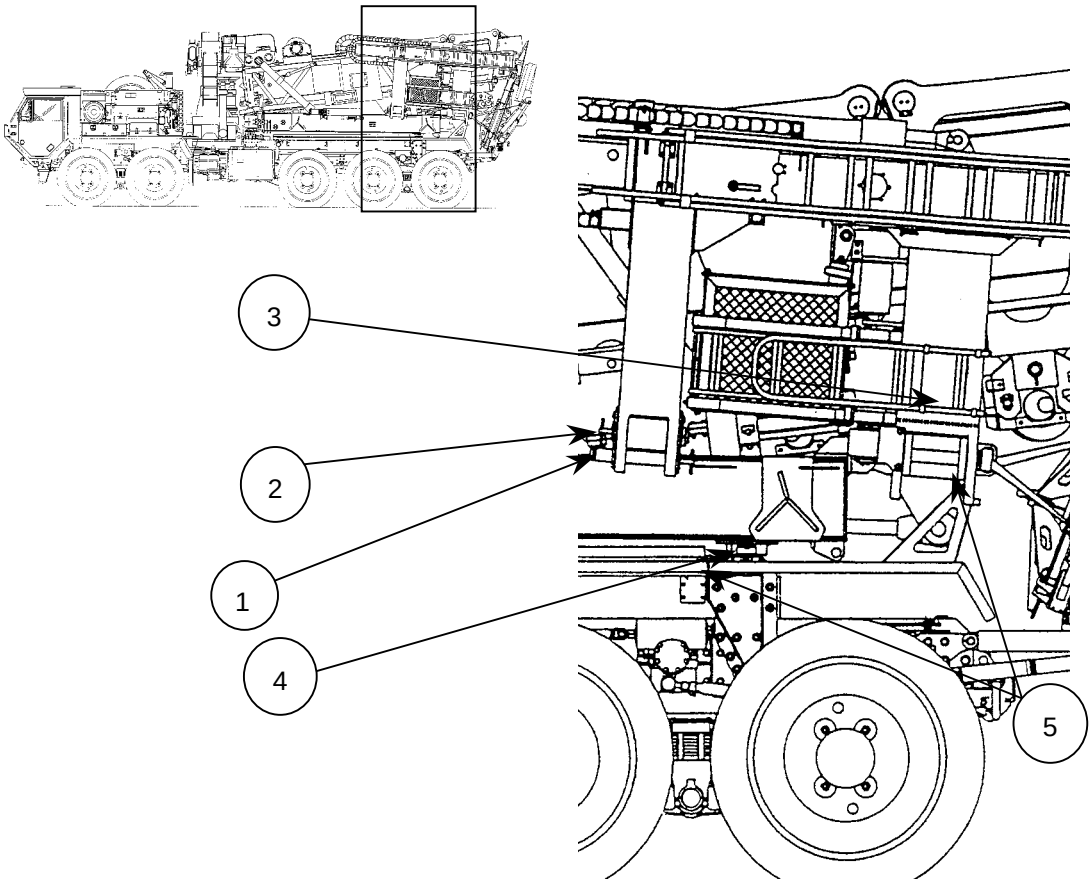
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
14	Before	A-frame fold hinge	(a) Check bottom hinge locking pin is inserted from the front (1). (b) Check top hinge locking pin is inserted from the rear (2). (c) Check security of the two hinge locking pins with R clips in position (1) and (2).	
15	Before	A-frame walkway ladder.	(a) Check security of ladder retaining strap (3).	
16	Before	Slide frame twist lock	(a) Check that the L/H slide frame twist lock is locked in position (4).	Twist lock not locked in position
17	Before	Left hand fender	(a) Check security of fender locking shootbolts (5) and R clips.	

Table 8.2 Operators PMCS (Before) - (continued)

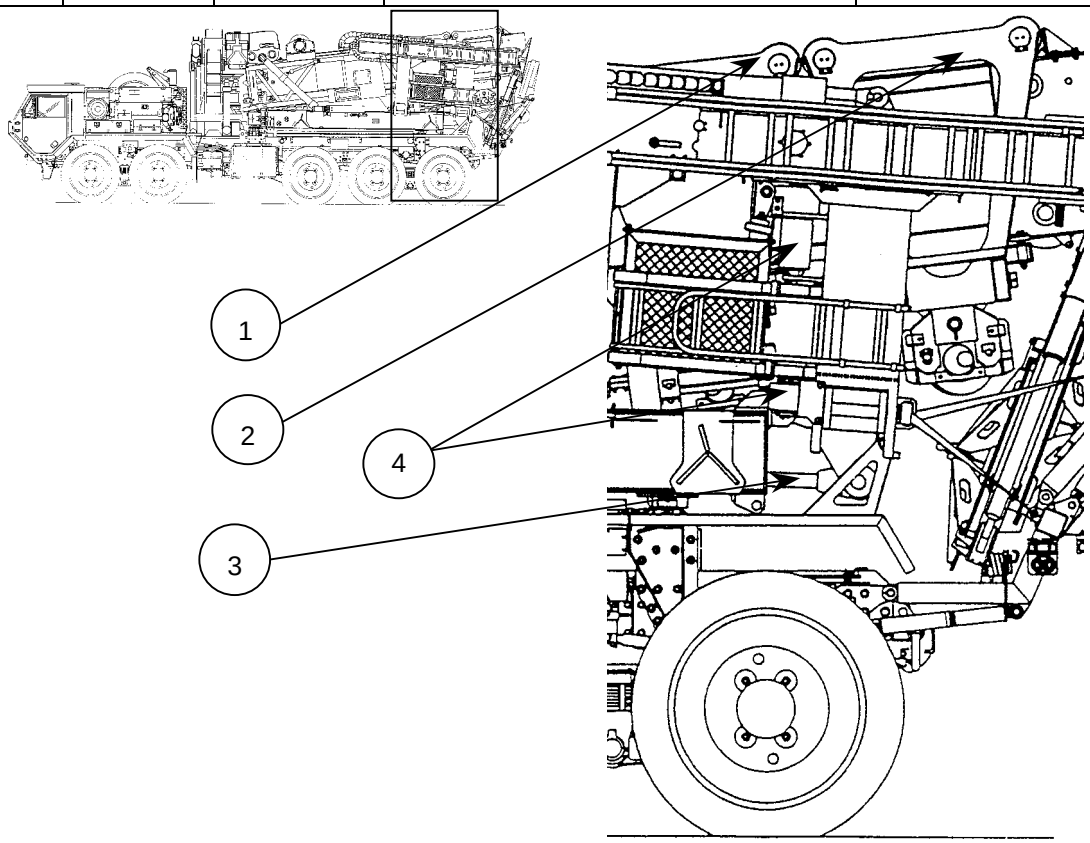
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
18	Before	Home bank carriage	Check shootbolts on lower carriage beam are secure (1).	
19	Before	Far bank carriage	Check shootbolts on lower carriage beam are secure (2).	
20	Before	Rotate cylinders	Check rotate cylinders for hydraulic leaks (3).	Class III leak evident.
20.1	Before	Roller Brakes	(a) Check for signs of hydraulic leak (4).	Class III leak evident.
			(b) Check roller brake assemblies and piping for damage.	Damage evident.

Table 8.2 Operators PMCS (Before) - (continued)

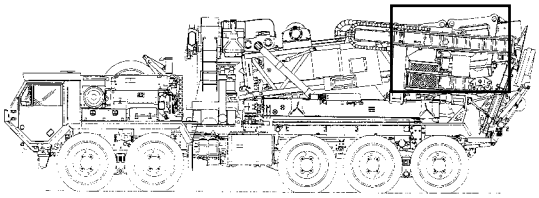
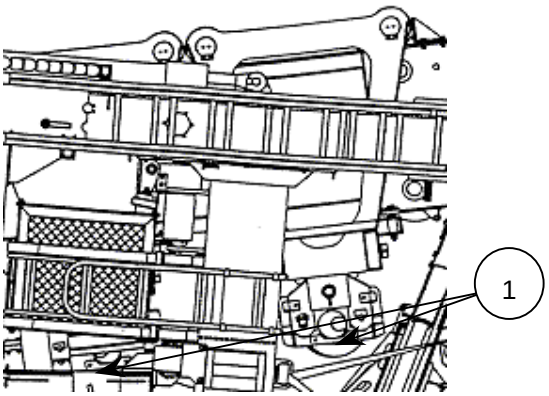
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
			 	
21	Before	Home bank and far bank carriage slings	Check home bank and far bank carriage slings (1) for: (a) Surface chaffing. (b) Local abrasion. (c) Cuts. (d) Chemical attack. (e) Loose webbing (f) Missing or illegible markings. (g) Severe soiling. **NOTE** **Refer to Para 8.6 for explanation of damage to lifting slings.**	 Surface chaffing evident. Local abrasion evident. Cuts evident. Chemical attack evident. Loose webbing evident. Markings missing or illegible. Severe soiling evident.

Table 8.2 Operators PMCS (Before) - (continued)

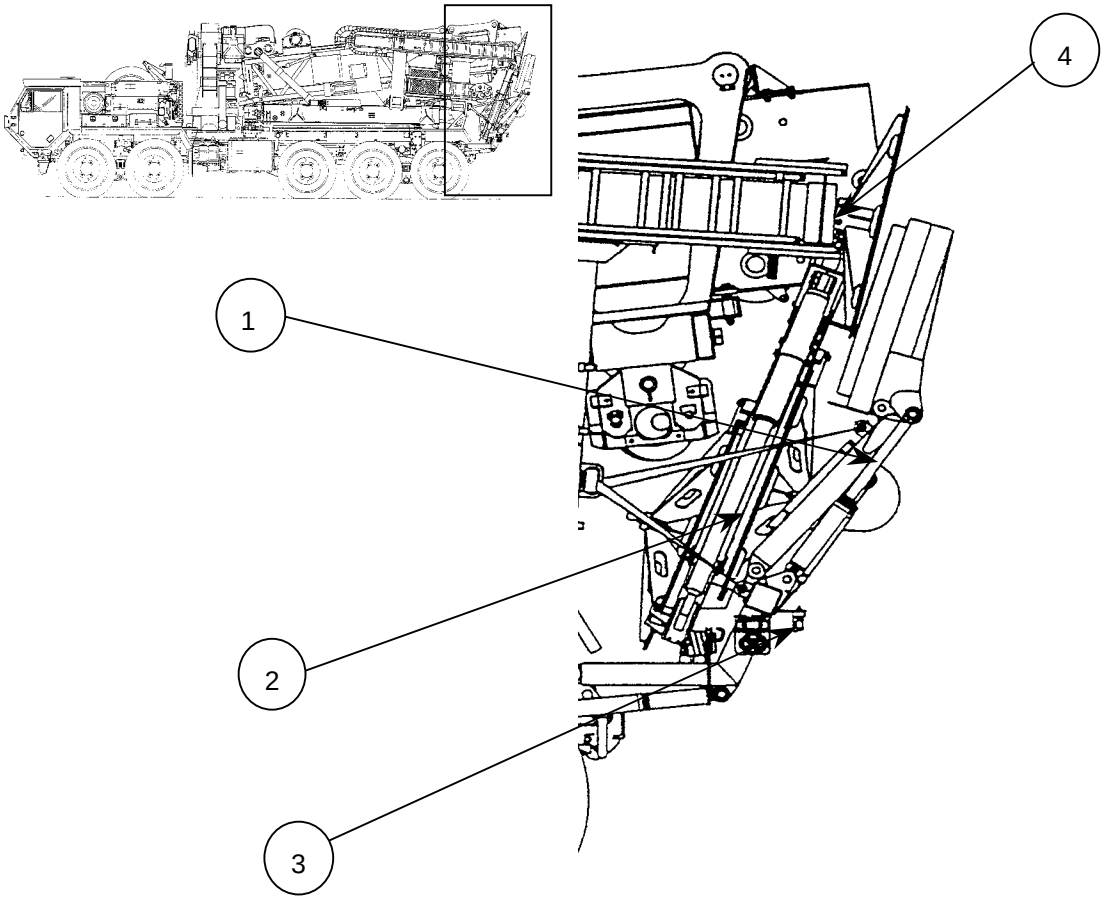
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
22	Before	Tail-lift securing strap	(a) Check for security of strap (1). (b) Check strap for fraying, cuts or damage.	Strap cut or frayed.
23	Before	Far bank support securing strap	(a) Check for security of strap (2). (b) Check strap for fraying, cuts or damage.	Strap cut or frayed.
24	Before	Rear marker light bracket	(a) Check security of rear marker light bracket unit (3). (b) Check all light lenses for damage. (c) Check light cables for damage and security.	Rear marker light bracket not secure. Lenses damaged. Cables damaged or not secure.
25	Before	L/H A-frame stabilizer leg securing pin	Check pin is secure and R clip is in position (4).	Pin missing.

Table 8.2 Operators PMCS (Before) - (continued)

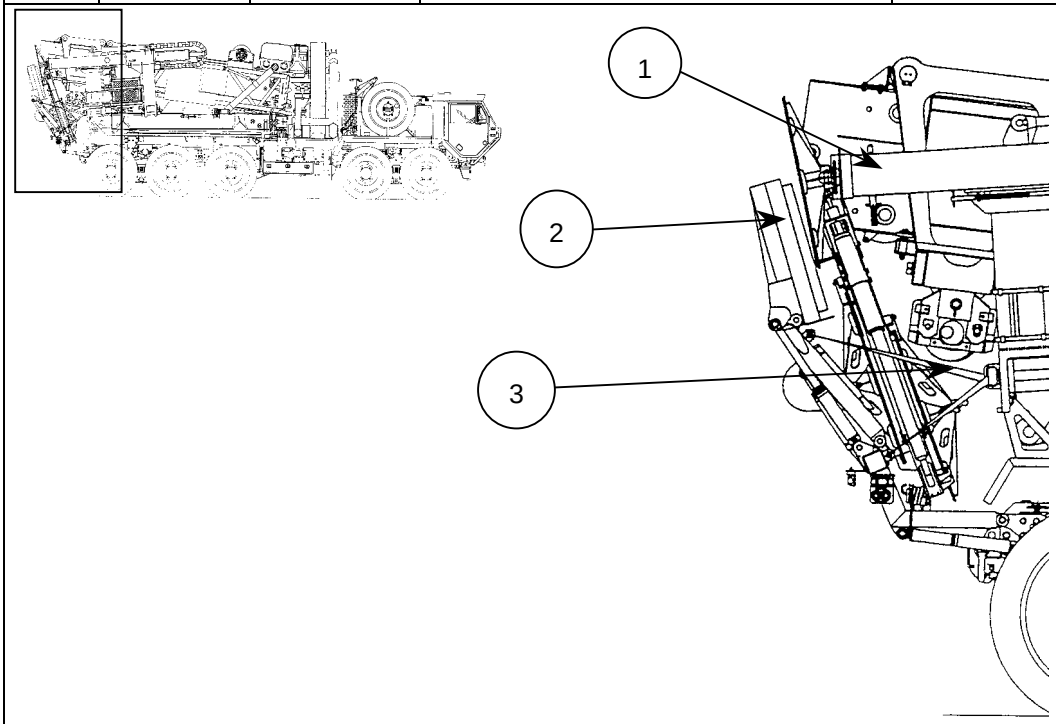
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
26	Before	A-frame stabilizer leg R/H	Check securing pin is fitted and R clip is in position (1).	Pin missing.
27	Before	Tail-lift	(a) Check that there are two crane stabilizer load spreader plates (2) fitted to tail-lift.	Crane stabilizer load spreader plates missing.
			(b) Check security of small stepladder.	Stepladder missing.
28	Before	Tail-lift securing strap	(a) Check for security of strap (3).	
			(b) Check strap for fraying, cuts or damage.	Strap cut or frayed.

Table 8.2 Operators PMCS (Before) - (continued)

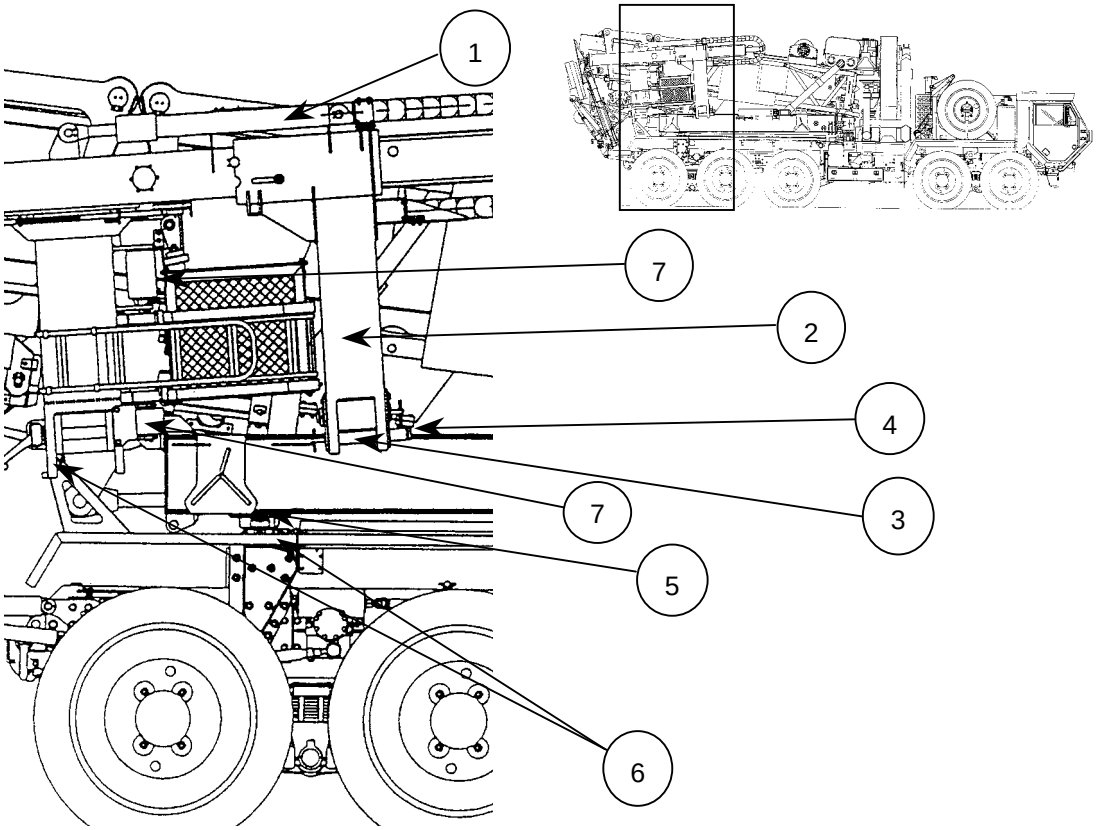
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
29	Before	A-frame raise cylinder	Check the A-frame raise cylinder for hydraulic leaks (1).	Class III leak evident.
30	Before	A-frame walkway ladder	Check security of ladder retaining strap (2).	
31	Before	Right hand fender	Check security of fender locking shootbolts (6) and R clips.	
32	Before	A-frame fold hinge	(a) Check bottom hinge locking pin is inserted from the front (3).	
			(b) Check top hinge locking pin is inserted from the rear (4).	
			(c) Check security of the two hinge locking pins with R clips in position (3) and (4).	
33	Before	Slide frame twist lock	Check that the R/H slide frame twist lock is locked in position (5).	
33.1	Before	Roller brake	(a) Check for signs of hydraulic leaks.	Class III leak evident.
			(b) Check roller brake assembly and piping for damage (7).	Damage evident.

Table 8.2 Operators PMCS (Before) - (continued)

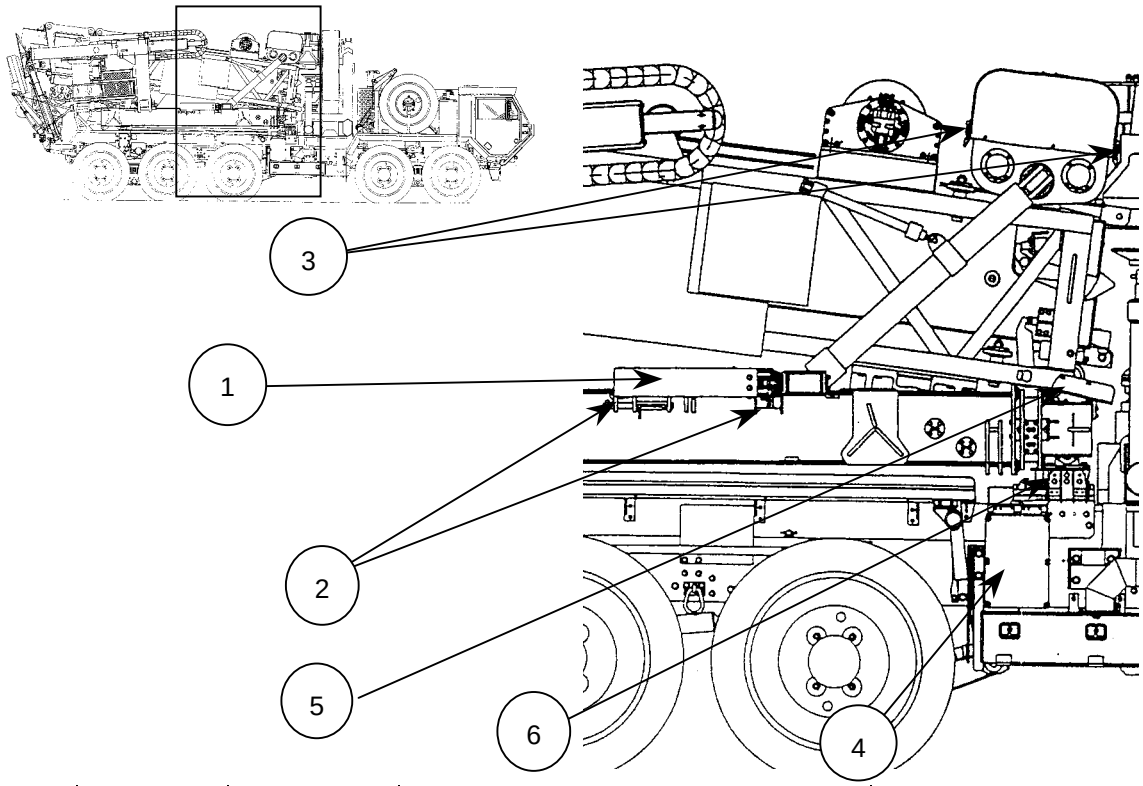
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
34	Before	Tilt roller assembly	(a) Check that the tilt roller is stowed in the horizontal position (1).	
			(b) Check that the shootbolts are secure and the R clips are in position (2).	Shootbolts not secure and clipped.
			(c) Check for hydraulic leaks.	Class III leak evident.
35	Before	Drive motor cover	Check drive motor cover is secure with rubber straps (3).	
36	Before	Interface enclosure	Check security of interface enclosure (4).	
37	Before	Slide frame	Check securing pins are fitted correctly to home bank end beam adapter plate (5).	
38	Before	Relax mechanism	(a) Check that the relax mechanism shootbolts are locked in the lowest position (6).	
			(b) Check for hydraulic leaks.	Class III leak evident.

Table 8.2 Operators PMCS (Before) - (continued)

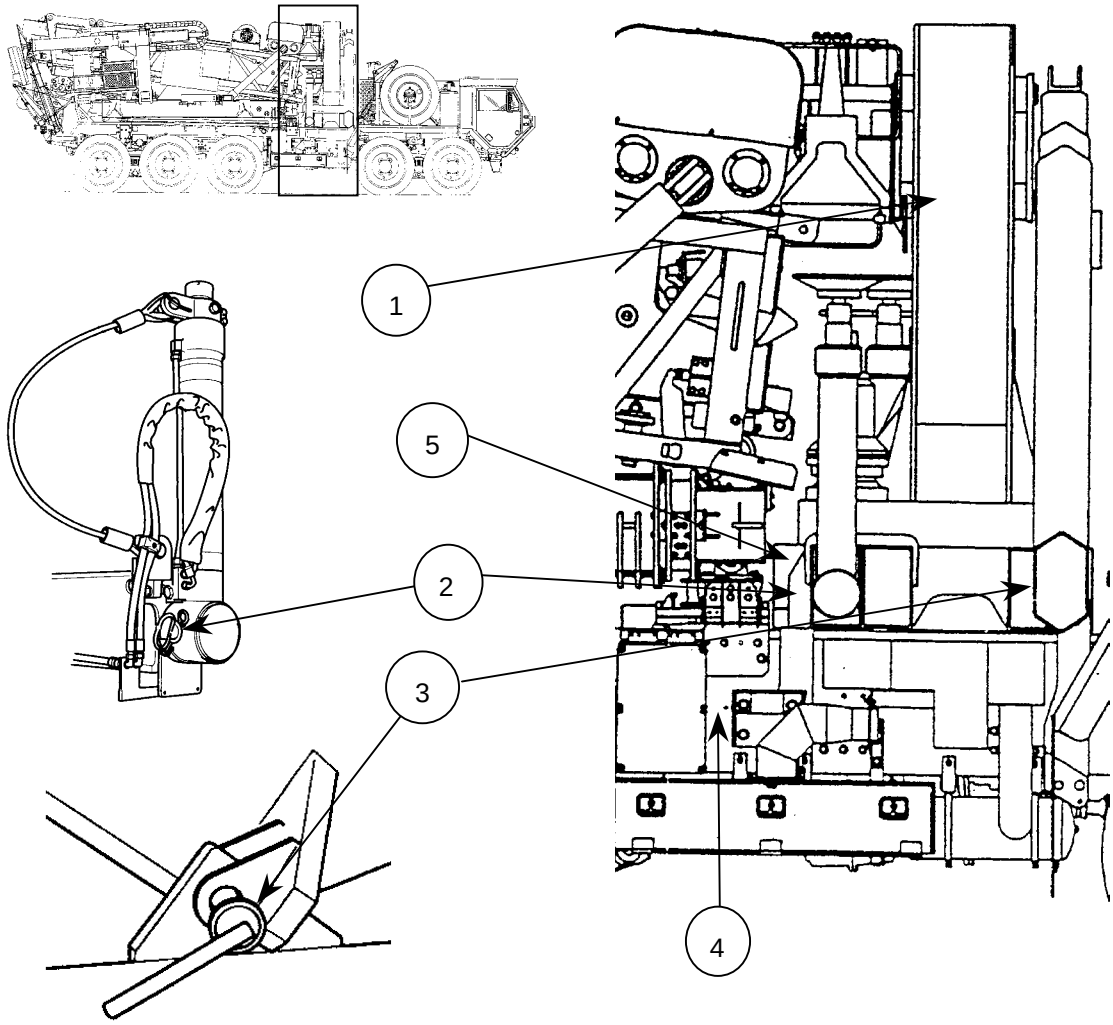
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
39	Before	Crane	(a) Check for hydraulic fluid leaks around crane hoses and pistons (1). (b) Check right hand stabilizer leg locking pin is fitted and locked into position with clip (2). (c) Check crane transport locking pin is secure (3). (d) Check crane quick release connectors (4) for security and hydraulic fluid leaks. (e) Check stabilizer leg slide frame locking pin and clip (5).	Class III leak is evident. Class III leak is evident.

Table 8.2 Operators PMCS (Before) - (continued)

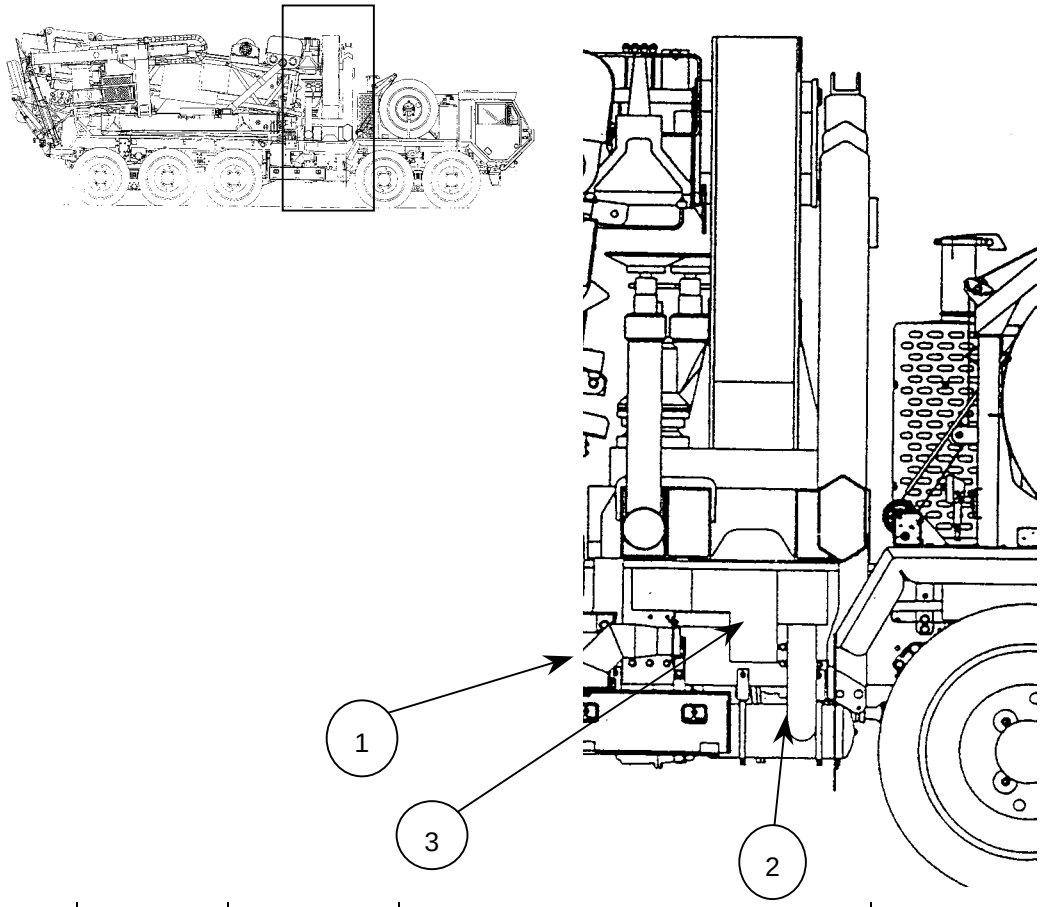
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
40	Before	Exhaust extension	(a) Check security of exhaust extension (1). (b) Check exhaust extension for damage.	Exhaust extension damaged.
41	Before	Hydraulic oil filters	(a) Check that the hydraulic oil filters are secure (2). (b) Check for hydraulic fluid leaks at interface manifold (3).	Class III leak evident Class III leak evident.

Table 8.2 Operators PMCS (Before) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
42	Before	Start engine	Park the vehicle and apply the parking brake in accordance with TM 9-2320-364-10, select neutral on transmission, start engine.	
43	Before	Tail-lift and far bank support	Deploy the tail-lift and far bank support in accordance with Chapter 3, Section I Para. 3.2.1.1 through 3.2.1.13.	
44	Before	Interface enclosure	(a) Open the interface enclosure door (1).	
			(b) Check for damage.	Damage evident.

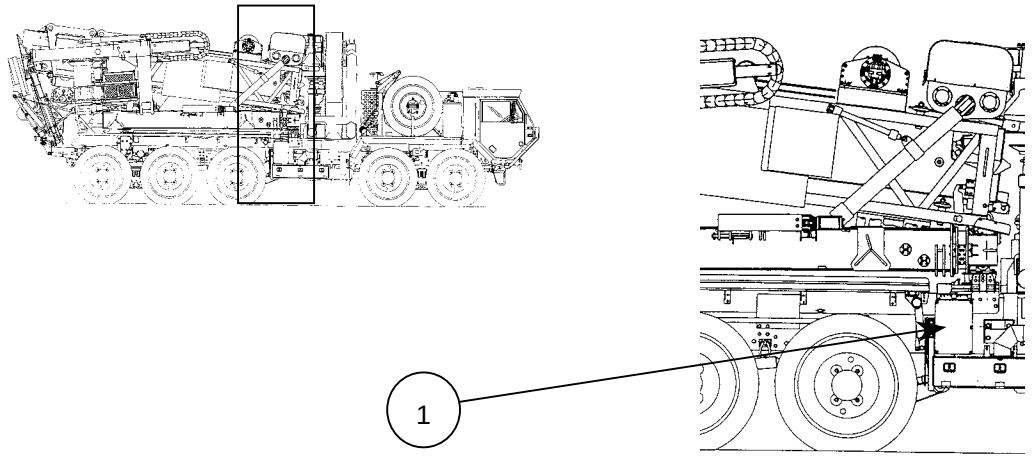


Table 8.2 Operators PMCS (Before) - (continued)

Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
45	Before	Interface enclosure (continued)	(c) Check that the panel illumination switch is set to bright or dim (2).	

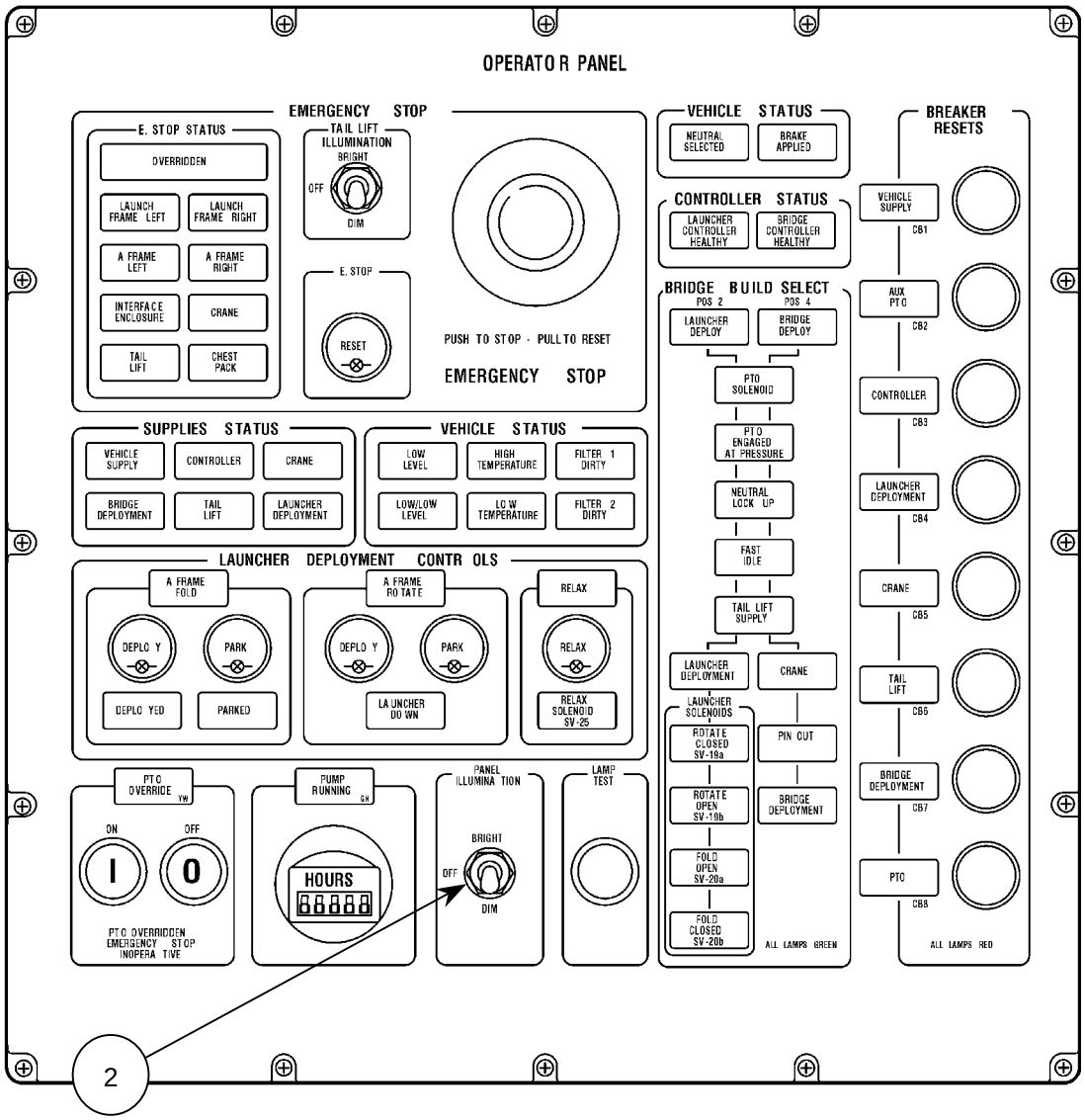


Table 8.2 Operators PMCS (Before) - (continued)

Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
46	Before	A-frame unfold	(a) Unfold the A-frame in accordance with Chapter 3, Section II, Para. 3.5.1.1 through 3.5.1.22.	
			NOTE **Do not deploy the far bank support at this time**	
			(b) During deployment check that:	
			(1) Lamp test is satisfactory.	Lamp test fails.
			(2) Lamps are illuminated or extinguished as applicable at the interface enclosure.	Emergency stop reset button cannot be extinguished.
			(3) Condition of A-frame leg retaining clips and pins.	A-frame pins and clips damaged.
			(4) A-frame folding cylinders extend.	Folding cylinders do not extend.
			(5) Locking pins can be installed when A-frame unfolded.	A-frame locking pins cannot be installed.
			(6) There are no hydraulic fluid leaks from hoses or cylinders.	Class III leak is evident.
			NOTE **The A-frame cannot be rotated to the vertical position unless the outer legs are fully unfolded.**	
47	Before	A-frame rotate	(a) Rotate the A-frame in accordance with Chapter 3, Section II, Para. 3.5.1.23 through 3.7.1.29.	
			(b) During rotation check that:	
			(1) The rotate hydraulic cylinders retract and the A-frame is deployed to the vertical position.	Rotate cylinders do not retract.
			(2) There are no hydraulic fluid leaks from hoses or cylinders.	Class III leak is evident.
			(3) A-frame shootbolts will engage.	Shootbolts will not engage.

Table 8.2 Operators PMCS (Before) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
48	Before	A-frame fold stop pads	Check that the A-frame fold stop pads are in place and secure.	Loose/not secure.
49	Before	A-frame rotate stop pads	Check that the A-frame rotate stop pads are in place and secure.	Loose/not secure.
50	Before	Slide Frame twist locks	Release the twist lock fasteners in accordance with Chapter 3, Section II, Para. 3.5.1.39.	Twist locks seized.
51	Before	A-frame stabilizer leg extension	(a) Extend the A-frame stabilizer legs in accordance with Chapter 3, Section II, Paras. 3.5.1.40 through 3.7.1.46.	
			(b) During stabilizer leg extension check that:	
			(1) The stabilizer leg hydraulic cylinders extend and retract when operated.	Stabilizer leg hydraulic cylinders fail to extend or retract when operated.
			(2) Check for hydraulic fluid leaks.	Class III leak evident.
			(3) Check condition and security of stabilizer leg pins.	Pins damaged.
			NOTE **When deploying the slide frame it is important that the launch vehicle is driven forward in a straight line. Use a string lined up with the rear and front road wheels and extended forward of the vehicle to assist the driver to drive in a straight line. If the vehicle is not driven forward in a straight line the slide frame will twist as it extends causing difficulties when closing the slide frame.**	
52	Before	Slide frame deploy	(a) Deploy slide frame in accordance with Chapter 3, Section II, Paras 3.5.2.1 through 3.7.2.12.	
			(b) During slide frame deployment, ensure slide frame extends smoothly.	

Table 8.2 Operators PMCS (Before) - (continued)

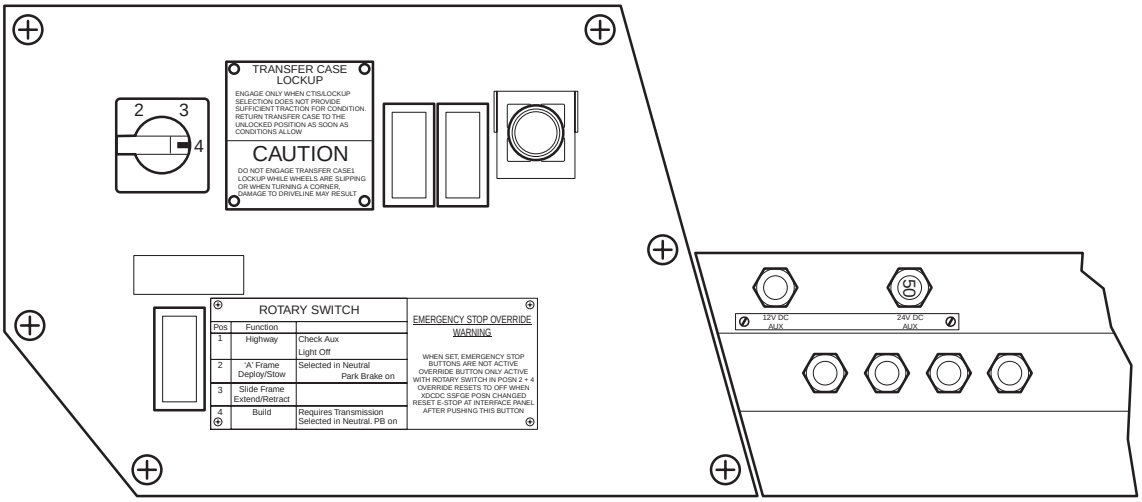
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
53	Before	Cab 4 position selector switch	(a) Connect chest pack in accordance with Chapter 3, Section II Para. 3.4.2. through 3.4.2.6. (b) Set the 4-position mode selector rotary switch to position 4. (c) Press the E stop reset on the interface enclosure. (d) Ensure the PTO engages and the hydraulic pump is running, check in interface cabinet that the **PTO ENGAGED AT PRESSURE caption** is lit and the pump run timer is operating.	PTO does not engage.

Table 8.2 Operators PMCS (Before) - (continued)

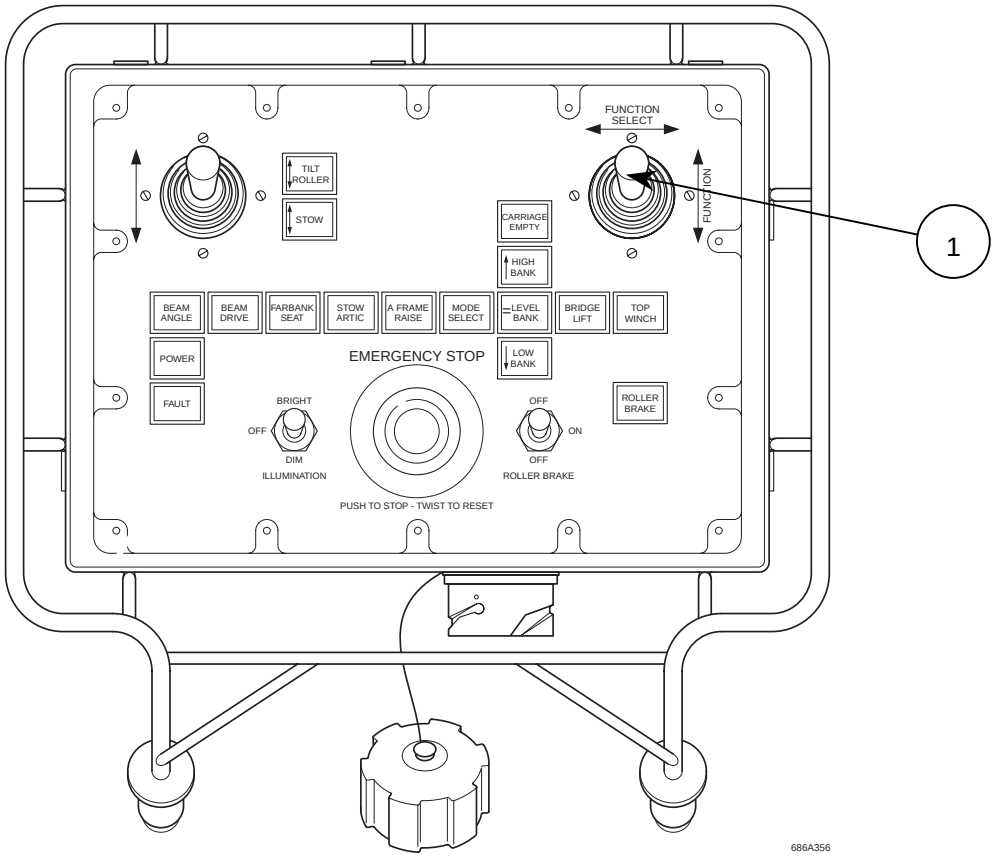
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
54	Before	Articulating cylinder operation	(a) Operate the right hand joystick (1) on the chest pack by moving it rearward to partially extend the articulating cylinder. Move the right hand joystick forward/backwards to fully retract/extend the articulating cylinders. (b) During articulating cylinder extension/retraction check for: (1) Hydraulic fluid leaks. (2) The articulating cylinders operate smoothly.	 Class III leak evident. Articulating cylinders operate erratically.

Table 8.2 Operators PMCS (Before)- (continued)

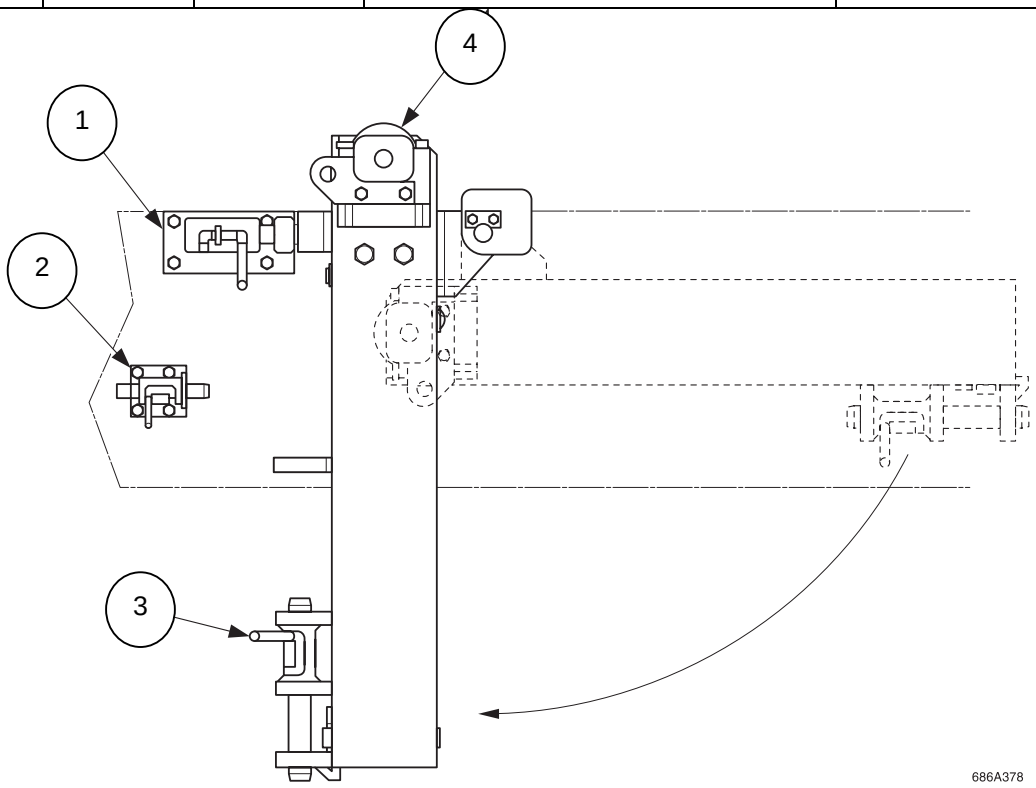
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
55	Before	Deploy tilt roller	(a) Deploy tilt roller in accordance with Chapter 3, Section II, Para. 3.5.3 through 3.5.3.6.	
			(b) Ensure that tilt roller shootbolts (1, 2 and 3) are not damaged.	
			(c) Check for hydraulic fluid leaks.	Class III leak evident.
			(d) Operate tilt rollers (4) by use of the left hand joystick, ensure that tilt rollers are in fully lowered position after test.	Tilt rollers operate erratically.
56	Before	Bridge stop emergency	(a) Check operation of both left and right bridge stop emergency mechanisms.	Not free to move. Handles do not return fully to their upper position under spring operation.
			(b) Check rollers operate smoothly.	Rollers seized.
56.1	Before	Bridge stop rollers	(a) Check all four rollers rotate freely.	Rollers seized.
			(b) Check for signs of impact damage.	Damage evident.

Table 8.2 Operators PMCS (Before) - (continued)

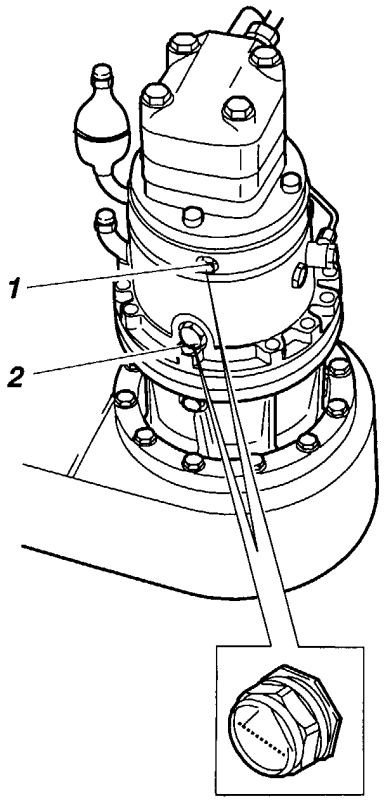
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
57	Before	Crane	Check oil level in crane gearbox is at the center of the oil inspection glasses (1 & 2). Top up if required.	Oil level low.
58	Before	Deploy crane stabilizers	(a) Deploy the crane stabilizers legs in accordance with Chapter 3, Section V. Para. 3.14.2 through 3.14.2.14.	
			(b) During deployment of the crane stabilizers, check for hydraulic leaks at the quick release couplings.	Class III leak evident
59	Before	Crane hook	Check hook for damage.	Safety lock missing or damage evident.

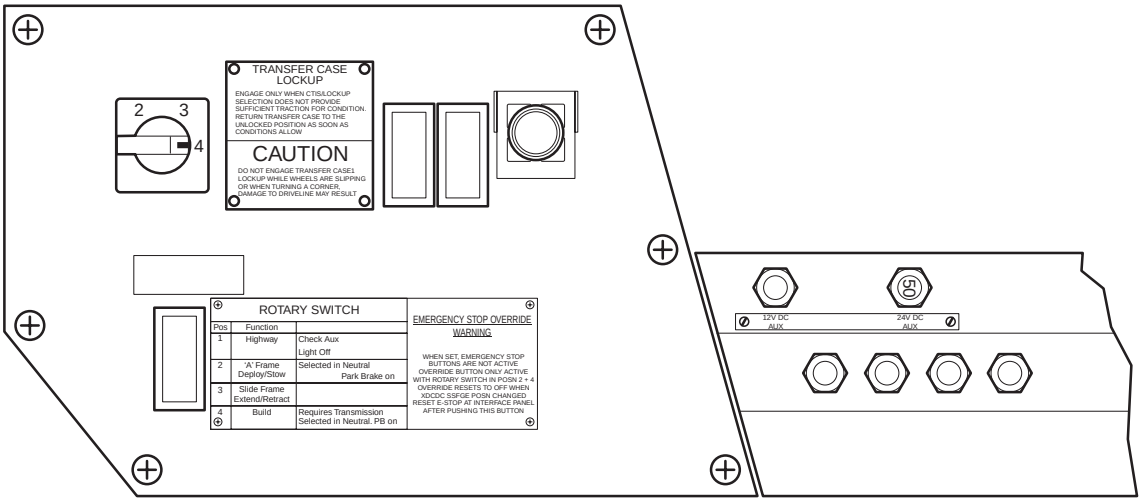
Table 8.2 Operators PMCS (Before) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
60	Before	Deploy crane	Deploy the crane in accordance with Chapter 3, Section IV. Para. 3.14.3 through 3.14.3.6.	
			During crane deployment check for:	
			(a) Hydraulic fluid leaks at:	
			(1) Hydraulic couplings.	Class III leak evident.
			(2) Lifting, jib and extension cylinders.	Class III leak evident.
			(3) Hydraulic manifolds.	Class III leak evident.
			(4) Hydraulic valves.	Class III leak evident.
			(5) Hydraulic motor.	Class III leak evident.
			(b) Check that all cylinders move smoothly.	Erratic movement evident.
			(c) Gearbox/motor runs smoothly when crane is rotated.	Erratic movement evident.

Table 8.2 Operators PMCS (Before) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
61	Before	Stow crane	Stow the crane in accordance with Chapter 3, Section V, Paras. 3.14.5. through 3.14.5.6.	
62	Before	Stow crane stabilizer legs	Stow the crane stabilizer legs in accordance with Chapter 3 Section V Para. 3.14.6.1 through 3.14.6.20.	
63	Before	Stow tilt rollers	Stow the tilt rollers in accordance with Chapter 3, Section II, Paras. 3.6.1. through 3.6.1.4.	
64	Before	Retracting the slide frame	Retract the slide frame in accordance with Chapter 3, Section II, Paras. 3.6.2.1 through 3.6.2.24.	
65	Before	Stow A-frame	Stow the A-frame in accordance with Chapter 3, Section II, Paras. 3.6.3.1 3.6.3.12.	
66	Before	Mudguards	Reinstall removable mudguards by inserting the 2 location pins into the fixed mudguards and locking in place with R clips at the front end and the shootbolts on the lower cross member of the A-frame. Secure shootbolts with R clips.	R clips not present and securing mudguards.
67	Before	Stow the far bank support and tail-lift	Stow the far bank support and tail-lift in accordance with Chapter 3, Section I, Paras. 3.2.2.11, 3.2.2.13 through 3.2.2.17.	
68	Before	Interface enclosure	Close and secure interface enclosure door.	

Table 8.2 Operators PMCS (Before) - (continued)

Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
 686A660				
69	Before	Cab	Set four position switch to position 1 check that:	
			(a) Neutral lock up disengages.	Neutral lock up does not disengage.
			(b) Engine RPM drops to idle.	RPM does not drop to idle.
70	Before	Cab	Switch off engine in accordance with TM 9-2320-364-10.	
71	Before	Top man safety harness and lanyard	(a) Check for damage or cuts to harness assembly.	Damage or cuts apparent.
			(b) Inspect Scaffold hook and karabiner for distortion or damage.	Distortion or damage apparent.
			(c) Check all buckles for distortion or damage.	Distortion or damage apparent.

NOTE

If any damage or wear is found on the top man safety harness and lanyard, or if in doubt about the condition of the equipment, withdraw the equipment immediately from service and seek advice from your supervisor on the subsequent action to be taken.

Table 8.2 Operators PMCS (Before) - (continued)

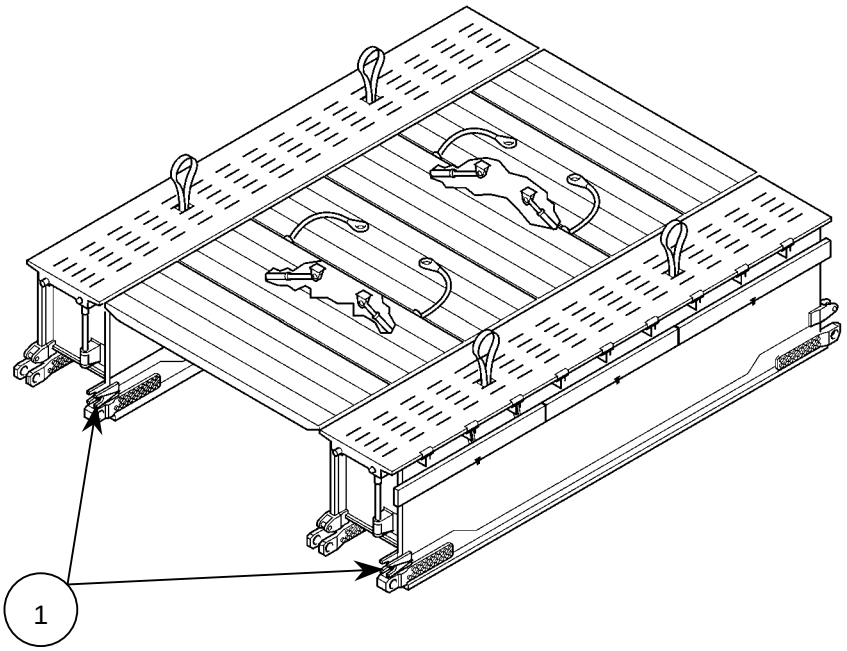
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
72	Before	Parallel or ramp unit, dowel pins and dowel holes	Check for damage of dowel pins beyond normal wear and tear, ensure present and inspect dowel holes for blockage.	Excessive damage or wear evident, pin not present, hole blocked
73	Before	Parallel or ramp unit, shootbolts	(a) Examine shootbolts and holes for damage beyond normal wear and tear.	Excessive damage evident.
			(b) Check they correctly operate up and down.	Will not operate.
74	Before	Parallel or ramp unit, mount resilient and birds beak	Inspect mount resilient and birds beak (1) for damage beyond normal wear and tear.	Excessive damage evident.
				
75	Before	Parallel or ramp unit, compression faces	Check for damage of compression faces, beyond normal wear and tear.	Excessive damage evident.
76	Before	Parallel or ramp unit, top chords and track-way decking.	Check for distortion and damage beyond normal wear and tear.	Excessive damage evident.

Table 8.3 Operators PMCS Parallel or Ramp Unit (Before) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
77	Before	Bridge pins, jaws and jaw holes and securing clips (R clips)	(a) Check bridge pins are present and have no damage, beyond normal wear and tear, (b) Check jaws and jaw holes for damage beyond normal wear and tear. (c) Check R clips for deformity.	Excessive damage evident to bridge pins and jaw holes. Clips deformed. **NOTE** **If deformed replace R clips with new item from supply.**

Table 8.3 Operators PMCS Parallel or Ramp Unit (Before) - (continued)

Item No.	Interval	Location	Procedure	Not Fully Mission Capable If:
		Item to Check Service		
78	Before	Parallel or ramp unit, hinges	Ensure hinges are free from debris.	
			Check all pins are present, secure. and undamaged beyond normal wear and tear.	Excessive damage evident or pin missing or loose attachment.
79	Before	Ramp unit end beam and pins	Ensure end beam and beam jaws are undamaged beyond normal wear and tear.	Damage evident.
			Pins and guide plates are present and undamaged beyond normal wear and tear.	Pins not present Excessive damage evident. Guide plates missing.
		Securing clips (R clips)	Check R clips for deformity.	R clips deformed.
80	Before	Parallel or ramp unit, deck	Examine for excessive damage beyond normal wear and tear. and security of attachment to side girders. (See Hinges).	Severe damage present or loose attachment.
81	Before	Parallel or ramp unit, slings	Check lifting slings and push slings for tearing or wear beyond normal wear and tear. any damage to inner fibers and security of attachment.	Loose or excessive damage evident to outer wear sleeve. Any damage to inner fibers.
82	Before	Ramp unit	Ensure all holes, pins, guide plates, location assemblies at ends of ramp for end beam location and lead in brackets have no excessive damage beyond normal wear and tear.	Excessive damage evident. Plates or pins missing.
83	Before	Approach ramp frame, slings	Ensure wire rope sling are not damaged beyond normal wear and tear and securely attached.	Severe damage present or loose attachment.
84	Before	Launch beams	Ensure jaws are undamaged beyond normal wear and tear.	Excessive damage evident to jaws.
			All rollers are present.	Roller and mount resilient missing.
			Inspect mount resilient and birds beaks for damage beyond normal wear and tear.	Damage evident.
85	Before	Transport aids	Ensure fitted to lower parallel modules on flatracks.	Transport aids missing.

Table 8.3 Operators PMCS Parallel or Ramp Unit (Before) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
86	Before	Ramp module push/pull sling	Check for: (a) Surface chaffing.	Surface chaffing evident.
			(b) Local abrasion.	Local abrasion evident.
			(c) Cuts.	Cuts evident.
			(d) Chemical attack.	Chemical attack evident.
			(e) Loose webbing.	Loose webbing evident.
			(f) Missing or illegible markings.	Markings missing or illegible.
			(g) Severe soiling.	Severe soiling evident.
			NOTE	
Refer to Para 8.6 for explanation of damage to lifting slings.				

Table 8.3 Operators PMCS (During)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
87	During	Controls and indicators	Monitor all indicator lights and warning lights on crane control panel (1) and in interface enclosure (2).	Warning lights indicating a malfunction and immediate corrective action from the operator does not correct the problem.

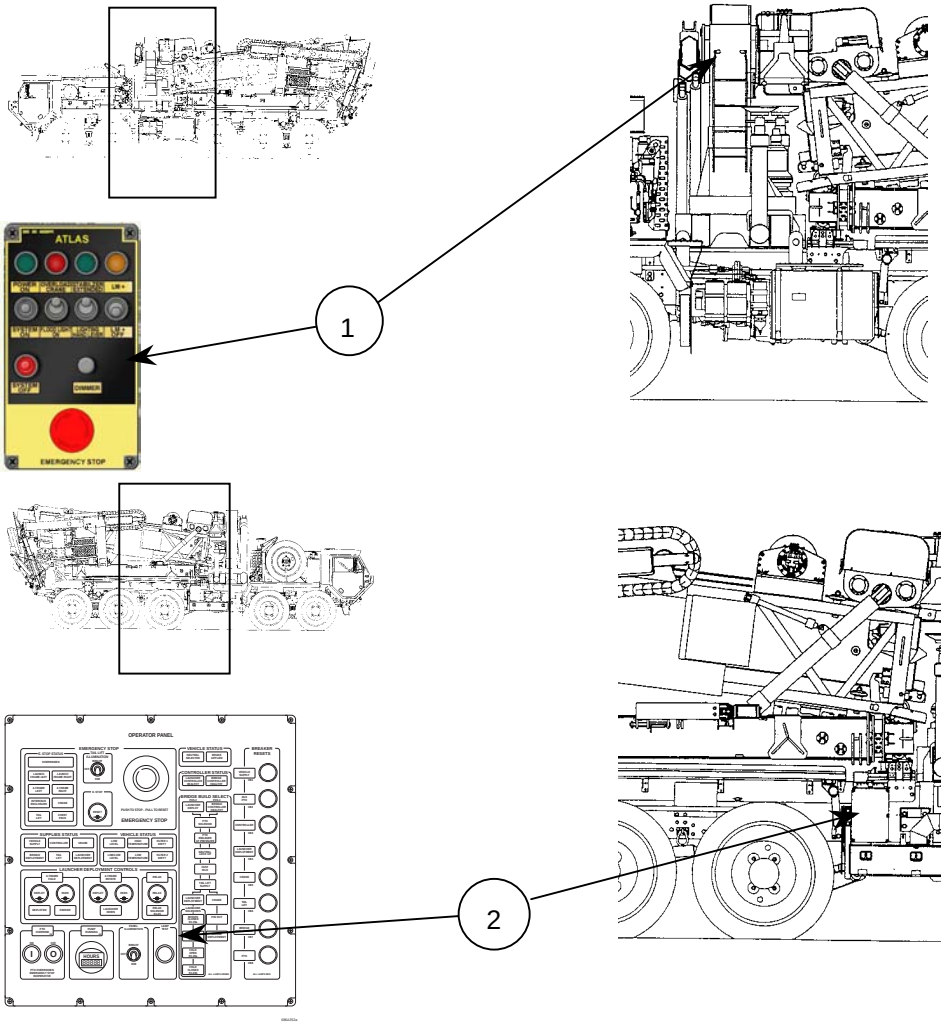


Table 8.3 Operators PMCS (During) (continued)

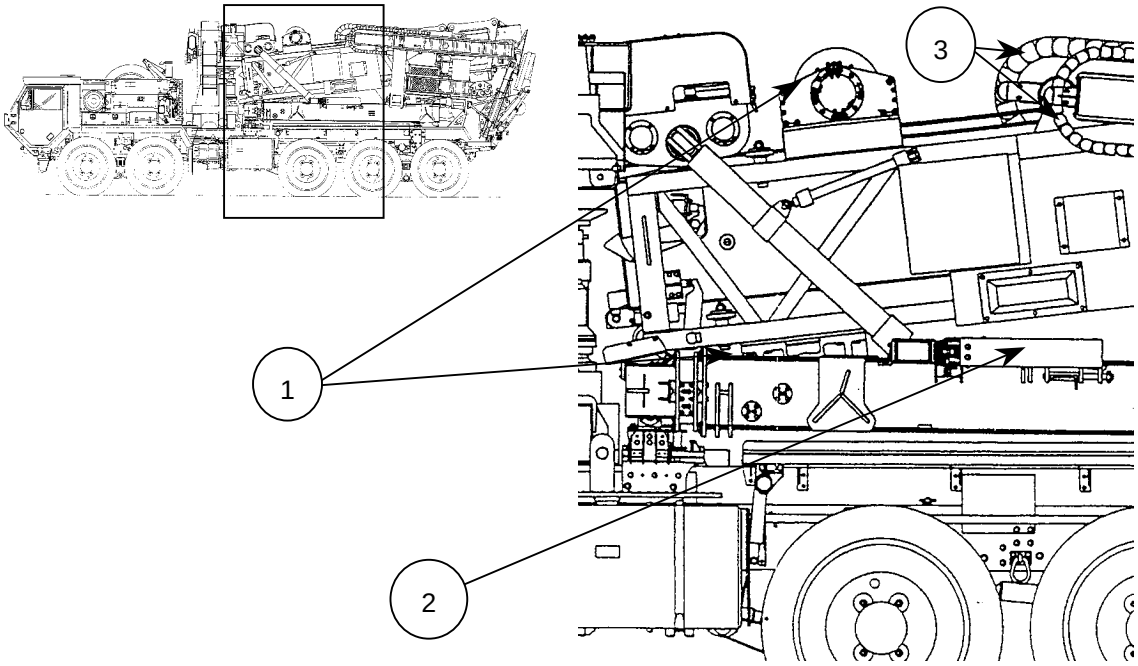
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
88	During	Launcher	Listen for unusual noises, look for erratic movement, monitor hydraulic system, and visually check for hydraulic fluid leaks.	Launcher makes unusual noises, movement is erratic, hydraulic pressure fluctuates over wide range or class III hydraulic leak evident.
				
89	During	Winch cable	Check winch cable (1) pays out smoothly during winch operation.	Winch operation erratic.
90	During	Energy chains	Check that energy chains (3) stay connected, and electrical cable looms and hydraulic pipes run smoothly within the energy chains.	Energy chains disconnect from each other.
91	During	Energy chains	Check that energy chain under launcher (2) does not contact the tail-lift, when spreading and closing the slide frame.	
92	During	Far bank support	Check far bank support self-leveling operates correctly.	Far bank support self-leveling system ineffective.

Table 8.3 Operators PMCS (During) (continued)

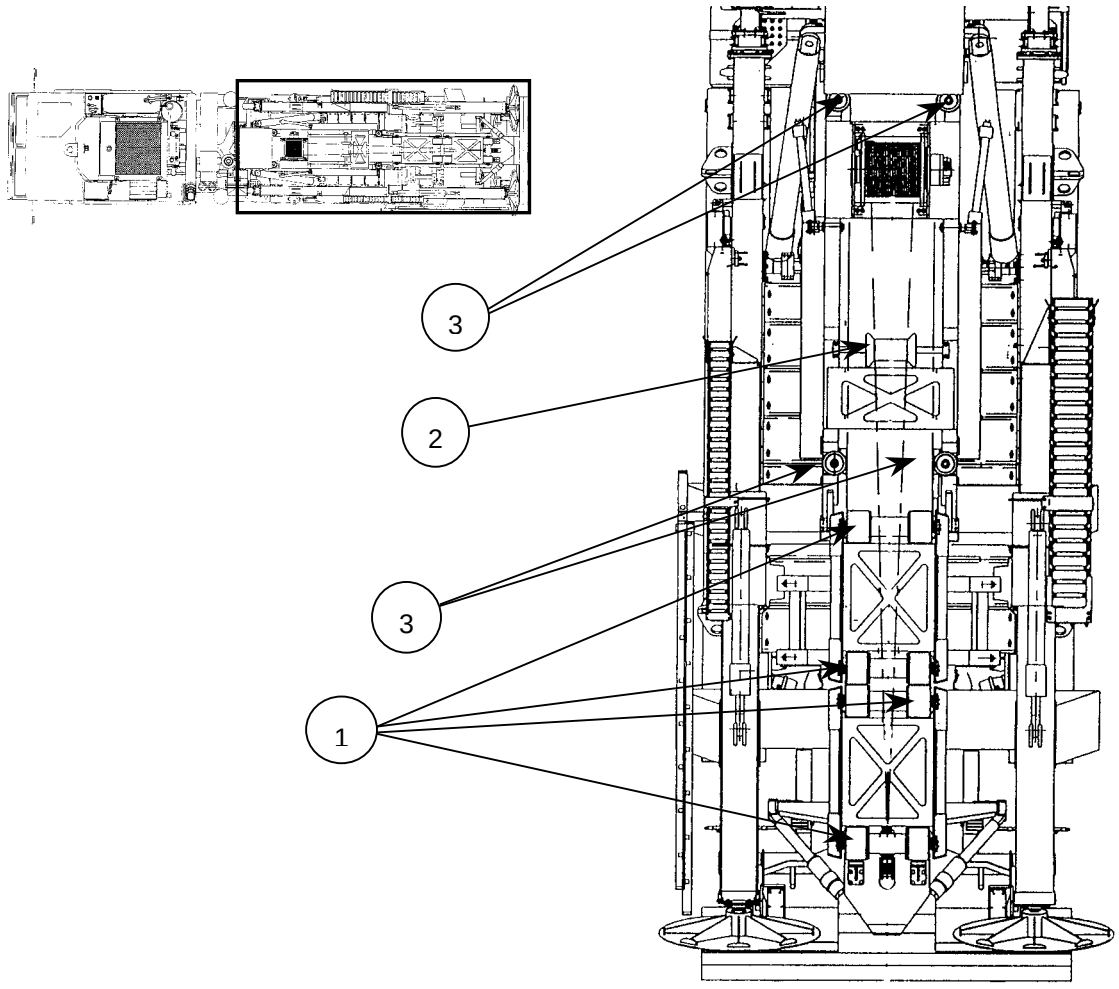
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
93	During	Top and Bottom rollers	Check home/far bank carriage rollers (1) rotate as beam is moved.	No rotation apparent.
94	During	Cable roller	Check top cable roller (2) rotate as beam is moved.	No rotation apparent.
95	During	Beam side rollers	Check beam side rollers (3) rotate as beam is moved.	No rotation apparent.
96	During	All L/H and top exposed hydraulic piping	Check all L/H and top exposed hydraulic pipes rigid and flexible, for leaks.	Class III leak evident.

Table 8.4 Operators PMCS Parallel or Ramp Unit (During)

Item No.	Interval	Location	Procedure	Not Fully Mission Capable If:
		Item to Check Service		
97	During	Parallel or ramp unit, jaws and connecting pins	Ensure no serious damage to jaws and pinning holes beyond normal wear and tear. Ensure all jaw connecting pins fitted and secured with R clip.	Excessive damage evident. Jaw Pin or R clip missing.
98	During	Parallel or ramp unit, shootbolts	Ensure all shootbolts raised and locked.	Shootbolts not raised and locked.
99	During	Ramp unit end beam, fixing pins	Ensure end beam fixing pins are inserted and in locked position.	End beam fixing pins missing or unlocked.
100	During	Ramp unit, approach ramps	Ensure approach ramps fitted correctly and secure. Ensure no serious damage or distortion beyond normal wear and tear.	Approach ramps not fitted correctly. Excessive damage evident.

Item numbers 101 thru 108 have rolled to next page.

Table 8.4 Operators PMCS Parallel or Ramp Unit (During) – (continued)

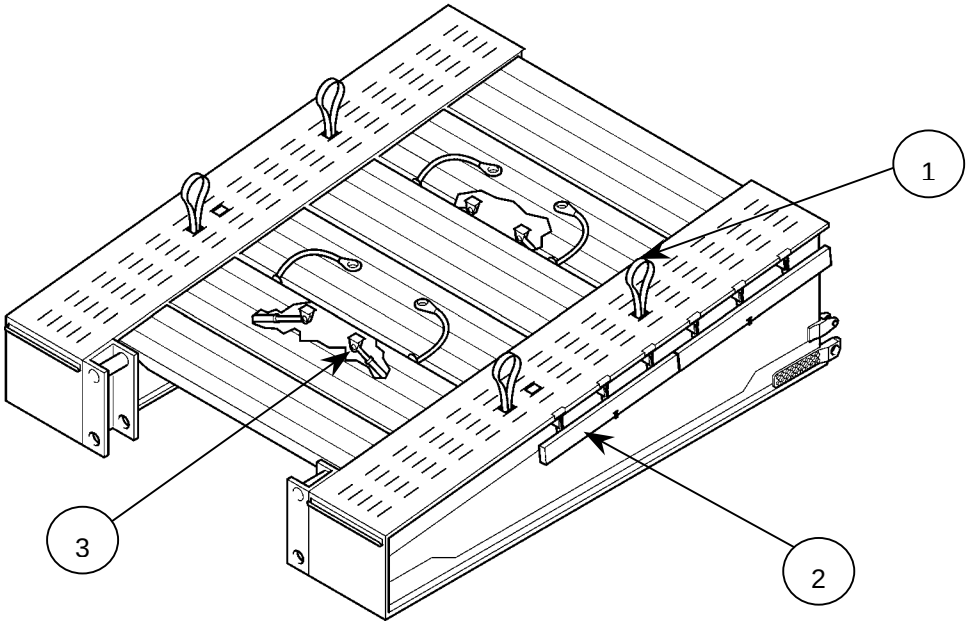
Item No.	Interval	Location	Procedure	Not Fully Mission Capable If:
				
101	During	Parallel or ramp unit, lifting sling	Ensure lifting sling (1) secured under deck and out of way of traffic.	
102	During	Parallel or ramp unit, curb	Check curb (2) secured in upright position.	
103	During	Parallel or ramp unit, bridge edge	Check bridge edge marker in upright position.	
104	During	Parallel or ramp unit, decks	Ensure no serious damage or distortion to top surface of bridge beyond normal wear and tear.	Excessive damage evident.
105	During	Parallel or ramp unit, side panels	Ensure no serious damage or distortion to bridge side panels beyond normal wear and tear.	Excessive damage evident.
106	During	Parallel or ramp unit, bottom chords	Ensure no serious damage or distortion to bridge bottom chords beyond normal wear and tear.	Excessive damage evident.
107	During	Parallel or ramp unit, dampers	Ensure no serious damage to dampers, look for signs of leaking or abnormal operation and secure damper attachments (3).	Damage evident, Class II leak evident. Loose attachment.
108	During	Ramp units grounding and anchorage	Ensure correct ground bearing and anchorage.	Not correctly grounded and anchored.

Table 8.3 Operators PMCS (After)

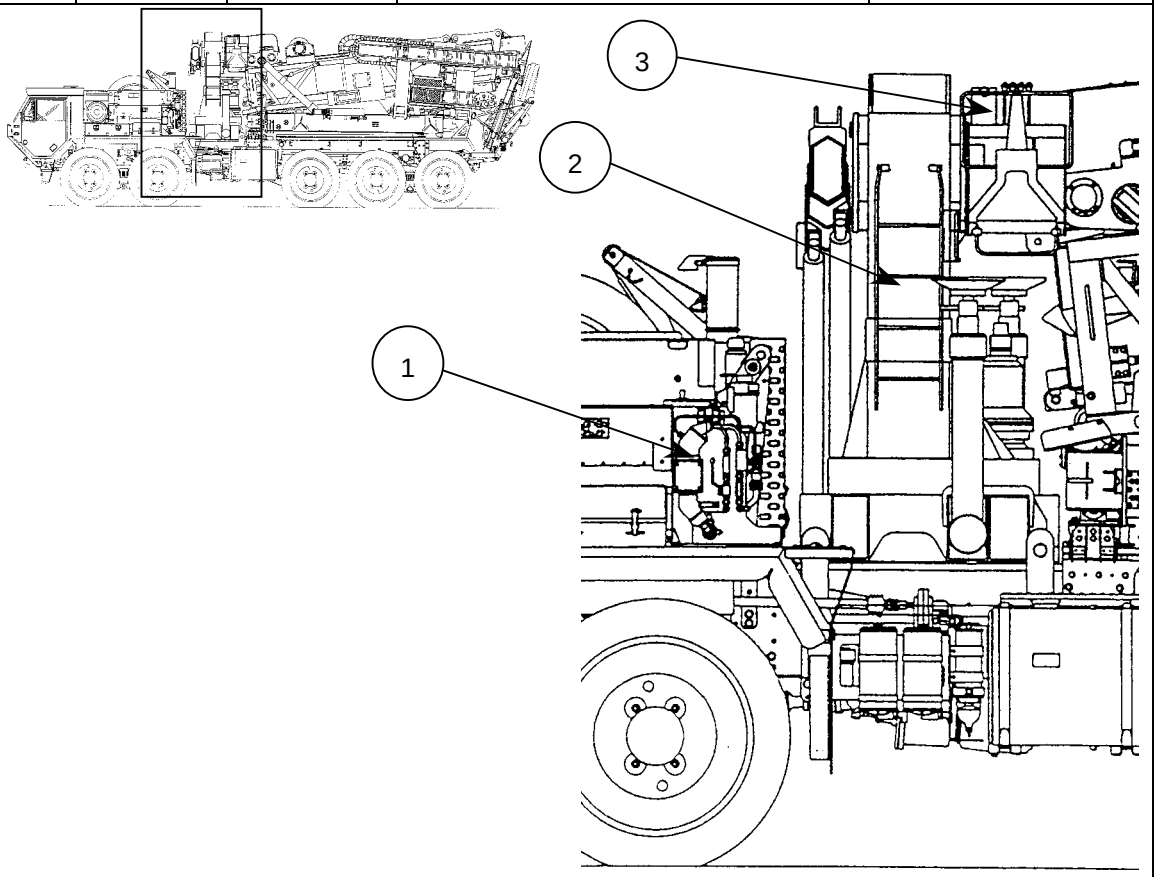
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
109	After	Cross connection assembly	(a) Check cross connection assembly for damage and hydraulic fluid leaks. (b) Check that inlet manifold stopcock handle (1) is in the off position.	Damage or class III leak evident.
110	After	Crane	(a) Visually, examine the crane (2) for damage. (b) Visually, examine crane hydraulics for fluid leaks.	Damage evident. Class III leak evident.
111	After	Crane operating controls	Check crane-operating controls (3) for damage and hydraulic fluid leaks.	Damage or class III leak evident.

Table 8.5 Operators PMCS (After) - (continued)

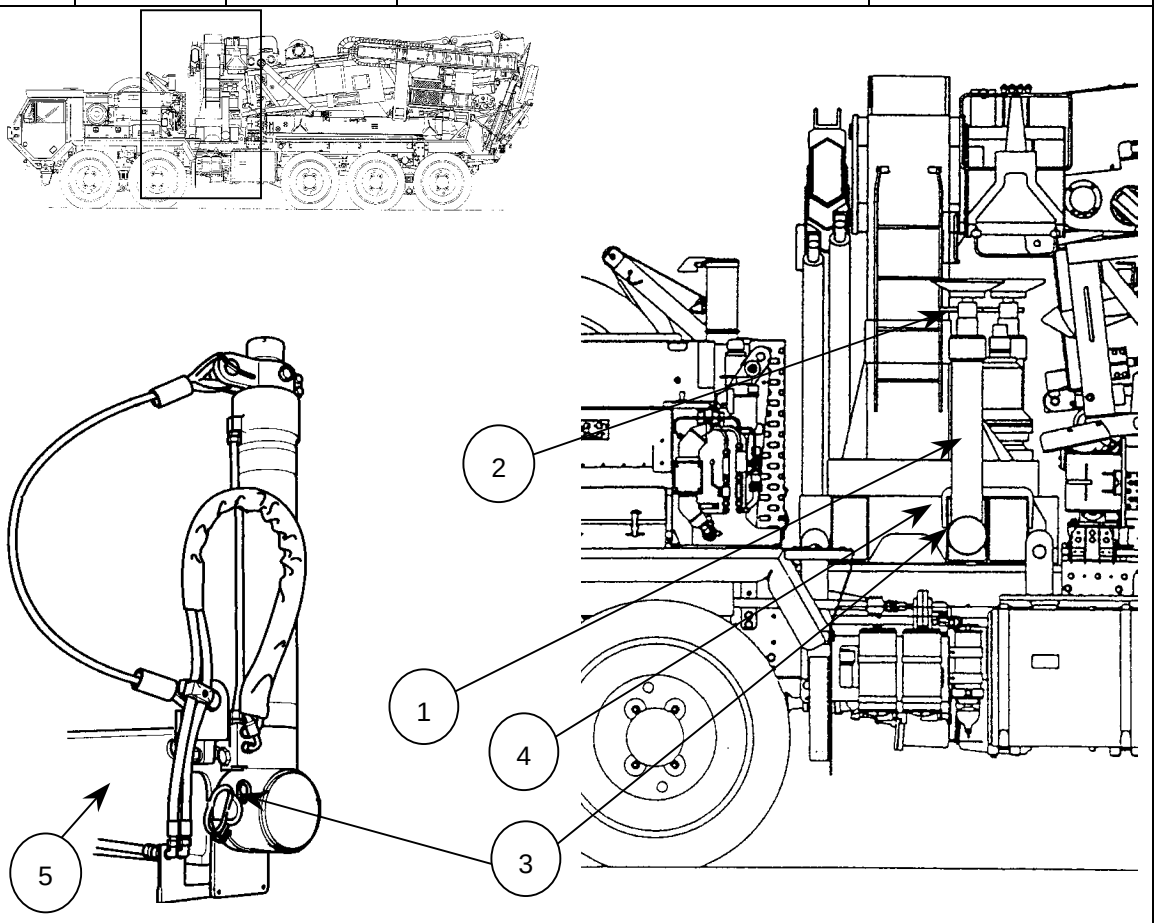
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
112	After	Crane left hand (L/H) stabilizer leg	(a) Visually, examine the crane L/H stabilizer leg (1) for damage.	Damage evident.
			(b) Visually, examine the crane L/H stabilizer leg cylinder (2) for damage or fluid leaks.	Damage or class III fluid leak evident.
113	After	Crane (L/H) stabilizer leg securing pin	(a) Check crane (L/H) stabilizer leg securing pin (3) is fitted from front (cab side) and R clip is fitted.	
			(b) Check pin for damage.	Damage evident.
114	After	Crane (L/H) stabilizer leg extension beam	Check crane (L/H) stabilizer leg extension beam (5) is fully retracted and pin and R clip is fitted.	R clip not fitted.
115	After	Crane (L/H) stabilizer leg	Check crane (L/H) stabilizer leg cable (4) is fitted and secured with pin and clip.	Cable not fitted or not secured with pin and clip.

Table 8.5 Operators PMCS (After) - (continued)

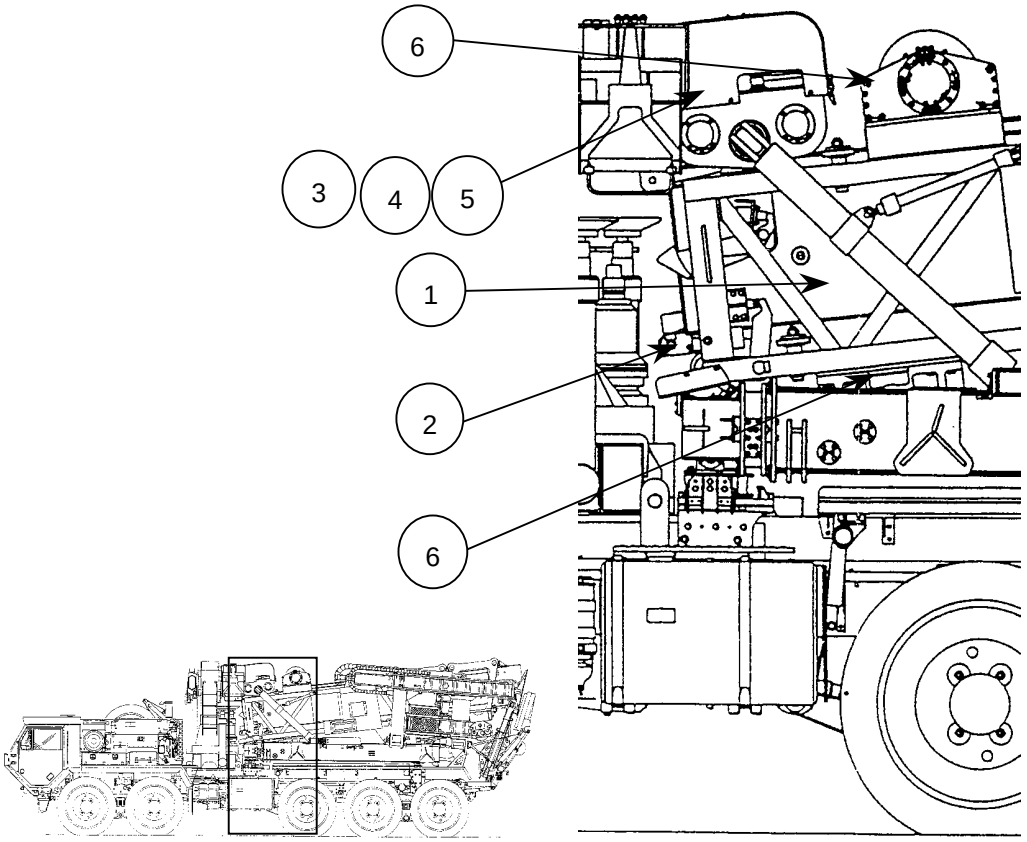
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
116	After	Front launch beam	Check the front launch beam (1) is pinned and R clipped (2) and secured into the launch frame.	Front launch beam not pinned and R clipped.
117	After	Beam drive motors	(a) Remove the beam drive motor cover (3) to gain access to the beam drive motors.	
			(b) Check the beam drive motors (4) for hydraulic fluid leaks.	Class III leak evident.
			(c) Check the beam drive tiers (5) for damage or excessive wear.	Damage or excessive wear evident.
			(d) Replace beam drive motor cover (3).	
118	After	Top & bottom winch	Check both winches for damage and hydraulic fluid leaks (6).	Class III leak evident.

Table 8.5 Operators PMCS (After) - (continued)

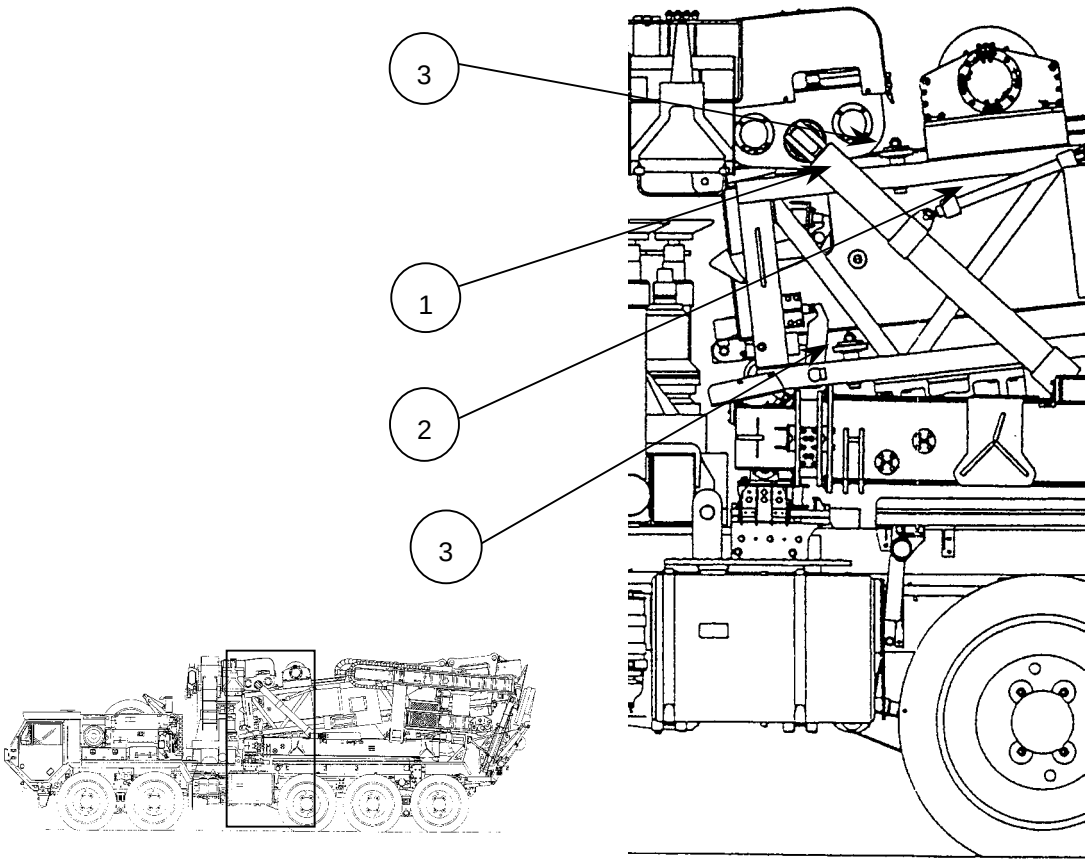
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
119	After	L/H articulating cylinder	Check the L/H articulating cylinder (1) for damage and hydraulic fluid leaks.	Damage or class III leak evident.
120	After	L/H stow cylinder	Check the L/H stow cylinder (2) for damage and hydraulic fluid leaks.	Damage or class III leak evident.
121	After	L/H launch frame side rollers top and bottom	Check the R/H launch frame side guide rollers (1) for:	
			(a) Damage.	Damage evident.
			(b) Seized bearings.	Bearings seized
			(c) Excessive wear.	Excessive wear evident.

Table 8.5 Operators PMCS (After) - (continued)

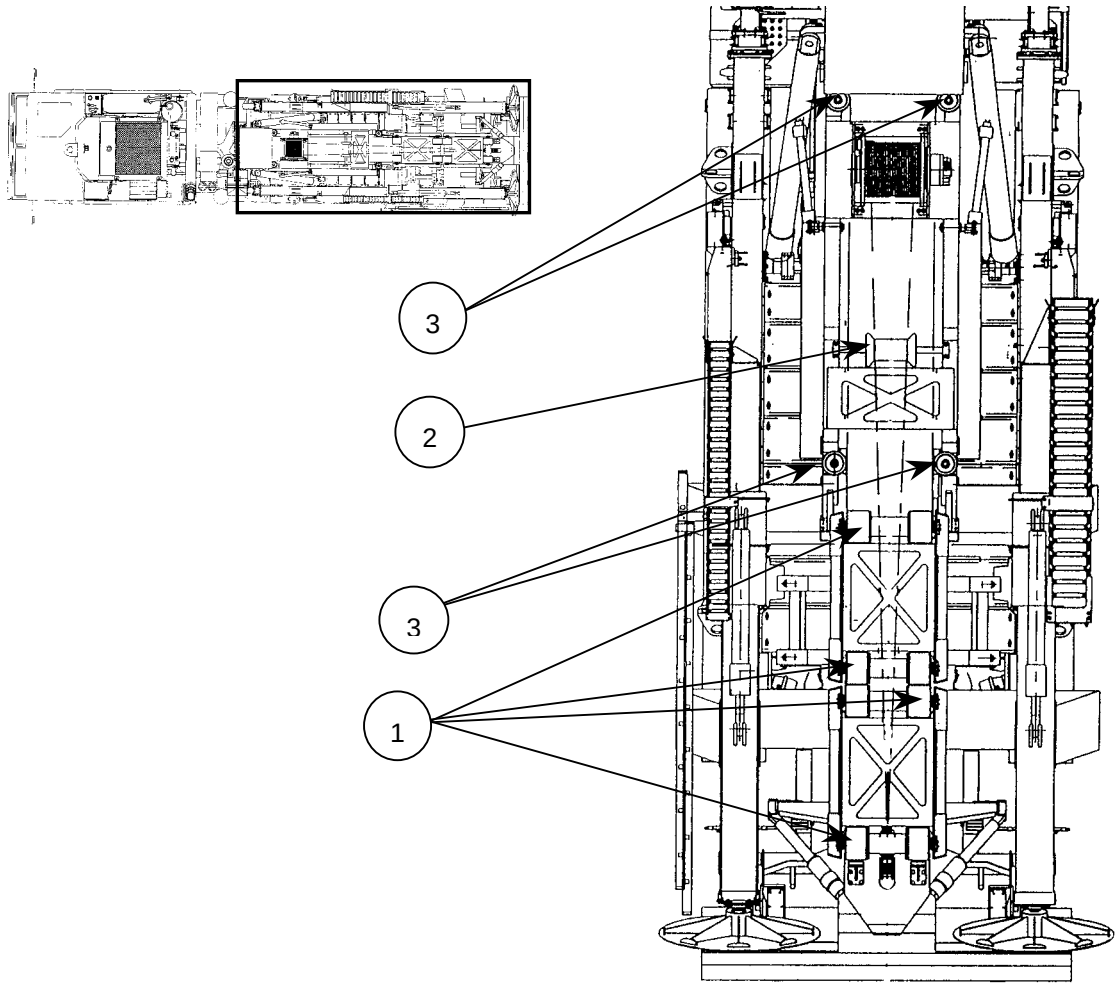
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
122	After	Top and Bottom rollers	Check carriage rollers (1) for damage and excessive wear.	Damage or excessive wear evident.
123	After	Cable roller	Check top cable roller (2) for damage and excessive wear.	Damage or excessive wear evident.
124	After	Beam side rollers	Check beam side rollers (3) for damage and excessive wear.	Damage or excessive wear evident.
125	After	All L/H and top exposed hydraulic piping	Check, all L/H and top exposed hydraulic pipes rigid and flexible, for cracks chafing and obvious damage.	Cracks, chafing or damage evident. Class III leak evident

Table 8.5 Operators PMCS (After) - (continued)

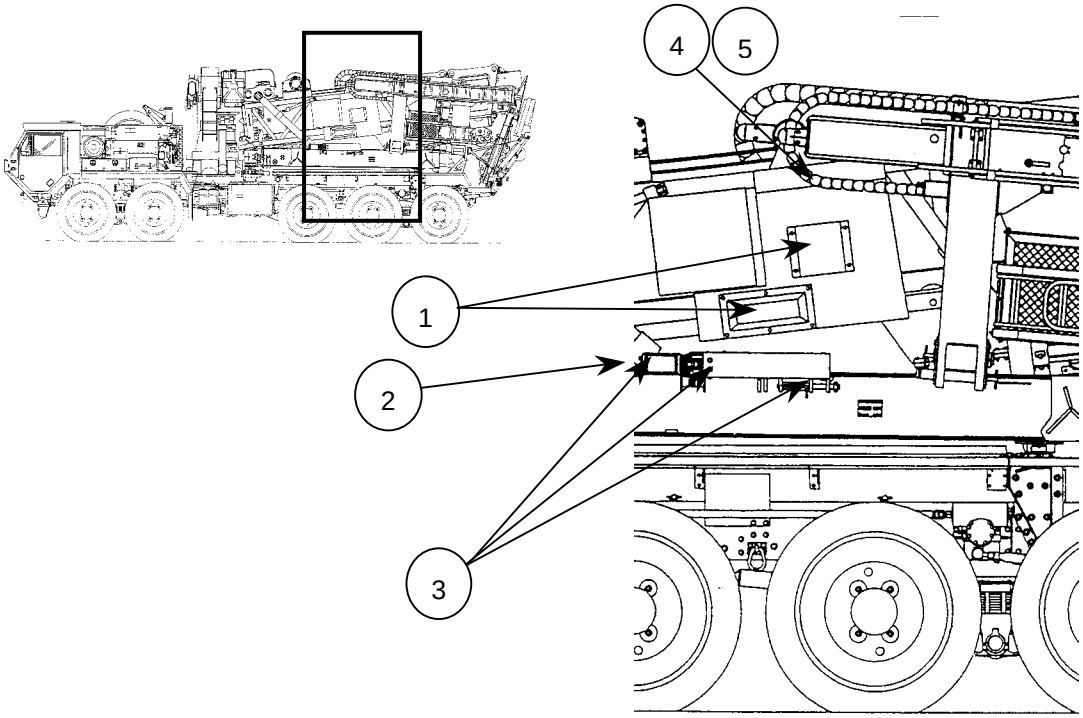
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
126	After	Hydraulic manifolds/ valves L/H side	Open inspection doors (1) to gain access to the PINCH/STOW and LAUNCH FRAME PILOT manifolds.	
			(a) Check as far as possible for hydraulic fluid leaks.	Class III leak evident.
			(b) Check electrical cables as far as possible for damage and chafing.	Damaged or chafed cables evident.
127	After	Tilt roller	Check tilt roller (2) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
128	After	Tilt roller	Check tilt roller shootbolts (3) for:	
			(a) Damage.	Damage evident.
			(b) Ensure shootbolts correctly inserted into restraining locator holes.	
129	After	L/H stabilizer leg energy chain	Check the L/H stabilizer leg energy chain (4) and (5) for:	
			(a) Damage.	Damage evident.
			(b) Separated links.	Separated links evident.

Table 8.5 Operators PMCS (After) - (continued)

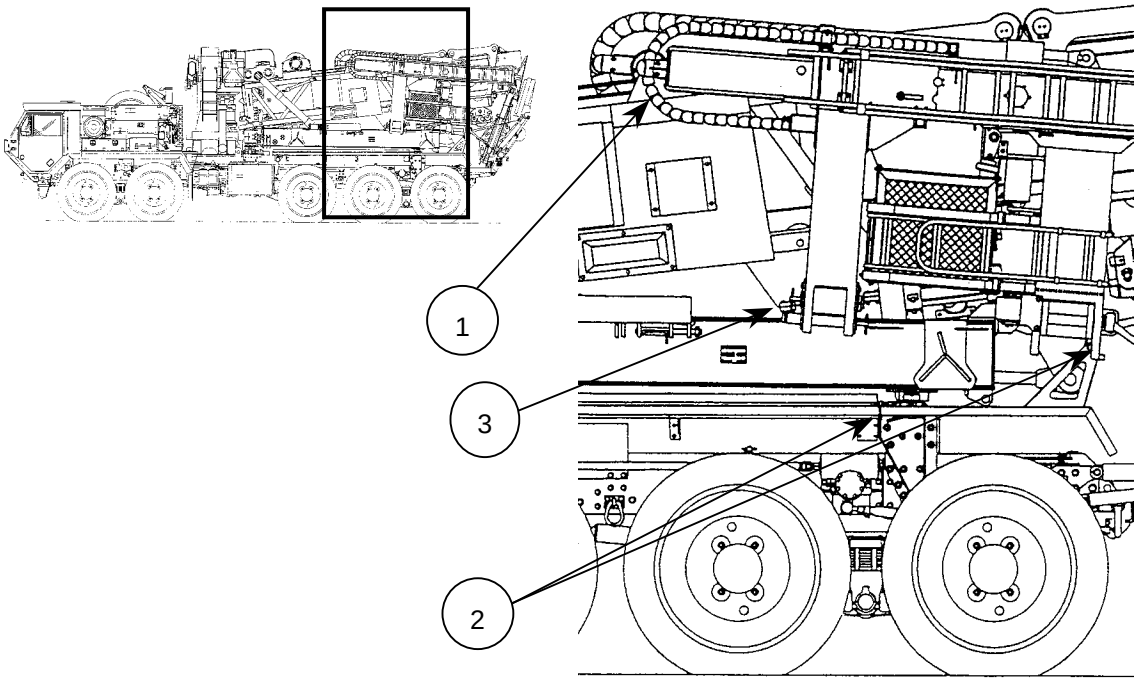
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
130	After	L/H stabilizer leg energy chain	Check L/H stabilizer leg energy chain cables and hydraulic pipes (1) for: (a) Damage. (b) Hydraulic fluid leaks. (c) Ensure that cables and hydraulic pipes are laying correctly (no crossed pipes or cables).	 Damage evident. Class III leak evident. Crossed cables or pipes.
131	After	L/H rear mudguard extension	Check the rear mudguard extension (2) is R clipped at the front and secured with shootbolt and R clip at rear.	Not secured with R clips and shootbolts.
132	After	A-frame hinge pins	(a) Check that the A-frame hinge pins, top and bottom hinges, are fitted correctly. 1. Top hinge (3) lower pin fitted from front and R clipped. 2. Lower top hinge (3) pin fitted from rear and R clipped.	Hinge pins not fitted correctly or not R clipped.

Table 8.5 Operators PMCS (After) - (continued)

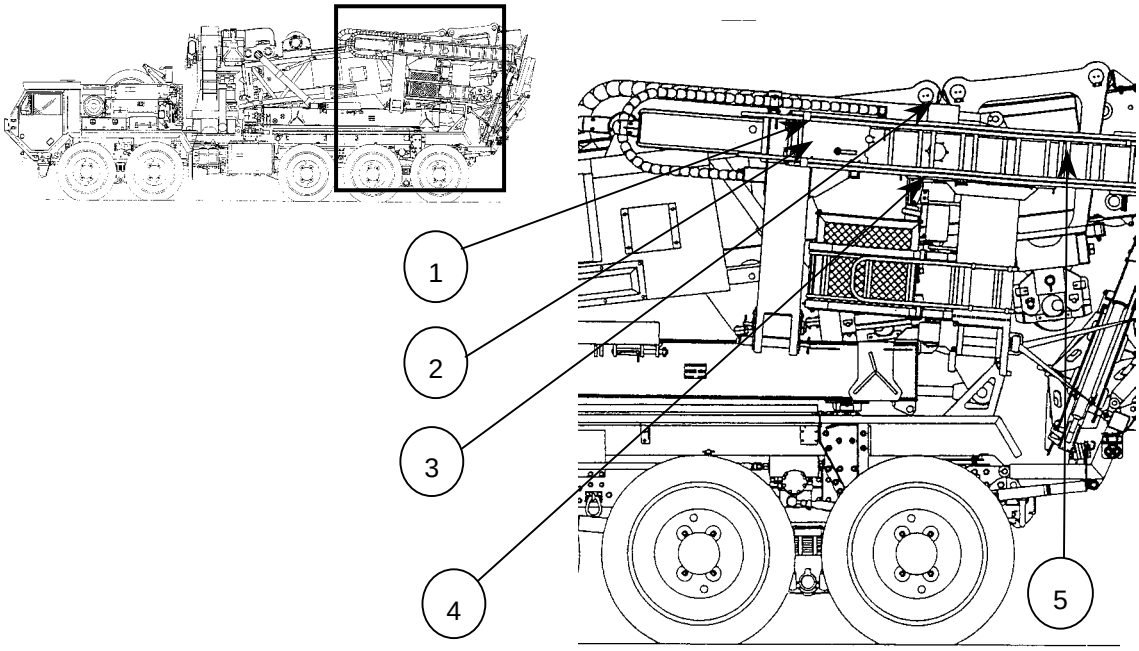
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
133	After	A-frame upper sliding frame	Check upper A-frame sliding section (1) for: (a) Damage. (b) Correct fit of securing pin (2).	 Damage evident.
134	After	A-frame raise cylinder	Check A-frame raise cylinder (5) for: (a) Damage. (b) Hydraulic fluid leaks.	 Damage evident. Class III leak evident.
135	After	A-frame L/H leg hydraulic pipes	Check A-frame L/H leg hydraulic pipes (3) for: (a) Damage. (b) Hydraulic fluid leaks.	 Damage evident. Class III leak evident.
136	After	Bridge stop emergency mechanism	Check the bridge stop emergency (4) for: (a) Damage. (b) Excessive wear on the rubbing strips.	 Damage evident. Excessive wear evident.

Table 8.5 Operators PMCS (After) - (continued)

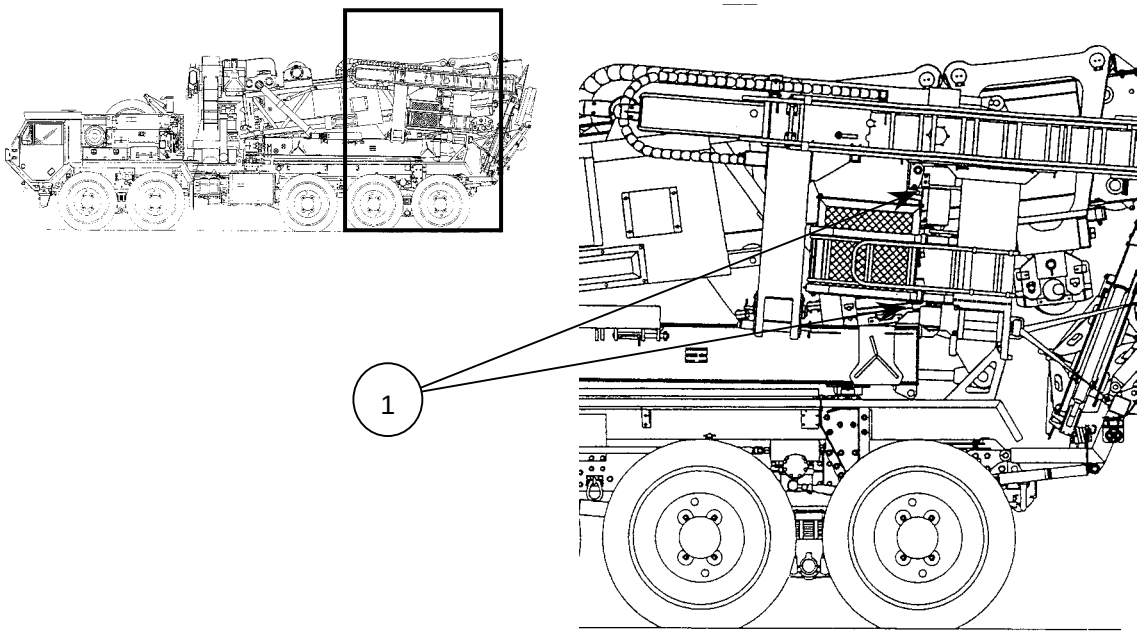
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
137	After	L/H roller brake rollers	Check L/H roller brake rollers (1) for: (a) Damage. (b) Hydraulic fluid leaks.	 Damage evident. Class III leak evident.

Table 8.5 Operators PMCS (After) - (continued)

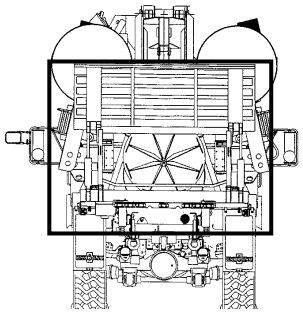
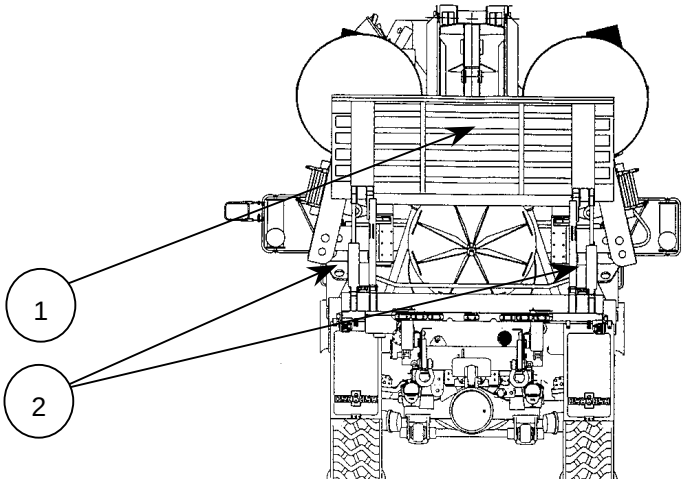
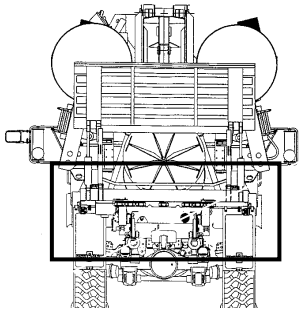
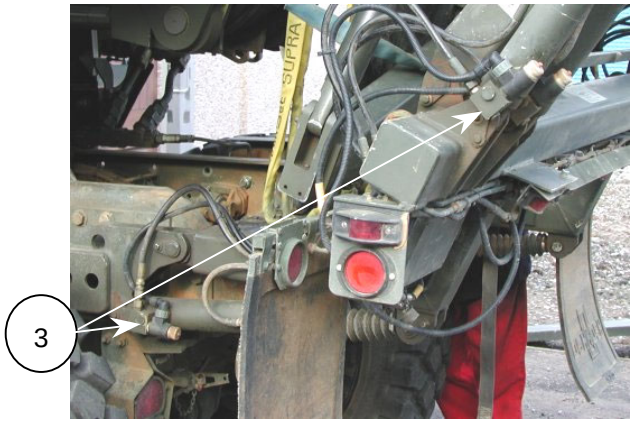
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
			 	
138	After	Tail-lift and far bank support	Lower tail-lift (1) and release far bank support in accordance with Chapter 3, Section I, Para. 3.2.1.1 through 3.2.1.26 Observe all safety precautions.	
139	After	Tail-lift	Check tail-lift for damage.	Damage evident.
140	After	Tail-lift hydraulic cylinders	Check tail-lift hydraulic cylinders (2) 6 each, 3 on L/H side, 3 on R/H sides for: (a) Damage. (b) Hydraulic fluid leaks.	 Damage evident. Class III leak evident.
			 	
141	After	Tail-lift hydraulic valves	Check tail-lift hydraulic valves (3) 6 each, 3 on L/H 3 on R/H sides for: (a) Damage. (b) Hydraulic fluid leaks.	 Damage evident. Class III leak evident.

Table 8.5 Operators PMCS (After) - (continued)

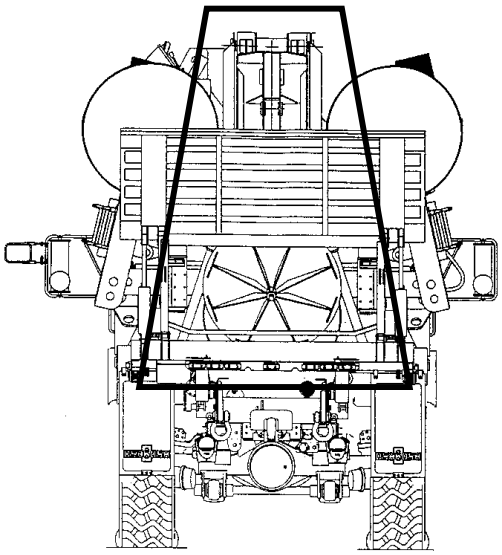
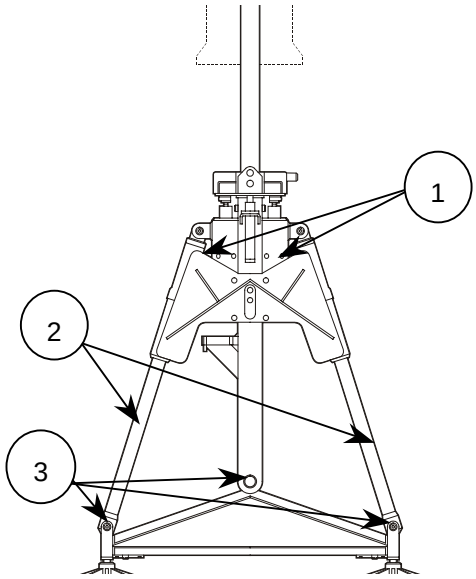
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
142	After	Tail-lift straps	Check all tail-lift straps for:	
			(a) Cuts.	Cuts in fabric evident.
			(b) Chafing.	Chafing evident.
143	After	Tail-lift stores	Check all stored items on the tail-lift for damage i.e. Crane spreader pads and step ladder.	Damage evident.
			 	
144	After	Far bank support	Check oil level in far bank support reservoir.	
145	After	Far bank support	Check far bank support hydraulic pipes (1) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic leaks.	Class III leak evident.
146	After	Far bank support	Check far bank support hydraulic pistons (2) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic leaks.	Class III leak evident.
147	After	Far bank support	Check far bank support hinge points (3) for:	
			(a) Damage.	Damage evident.
			(b) Excessive play.	Excessive play evident.

Table 8.5 Operators PMCS (After) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
148	After	A-frame upper and lower cross members	Check the A-frame upper and lower cross members, for damage.	Damage evident.
149	After	A-frame lower cross member hydraulic system	(a) Check A-frame lower cross member hydraulic pipes (1) for:	
			(1) Damage.	Damage evident.
			(2) Cracks in flexible pipes.	Cracks evident.
			(3) Hydraulic fluid leaks.	Class III leak evident.
			(b) Check A-frame lower cross member hydraulic cylinders (2) for:	
			(1) Damage.	Damage evident.
			(2) Hydraulic fluid leaks.	Class III leak evident.
			(c) Check A-frame lower cross member hydraulic control valves (3) for:	
			(1) Damage.	Damage evident.
			(2) Hydraulic fluid leaks.	Class III leak evident.

Table 8.5 Operators PMCS (After) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
150	After	**Under rear of launcher**.	Check rotate cylinders as far as possible for:	
		Rotate cylinders L/H & R/H	(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
151	After	Rotate cylinders L/H & R/H	(a) Check rotate cylinders support brackets for security.	Support brackets loose.
			(b) Check rotate cylinders hydraulic pipe-work for:	
			(1) Damage.	Damage evident.
			(2) Hydraulic fluid leaks.	Class III leak evident.
152	After	Twist Locks L/H & R/H	Check twist locks L/H & R/H for:	
			(a) Damage.	Damage evident.
			(b) Security of attachment.	Twist Lock loose.
153	After	Lower energy chain	Check lower energy chain for:	
			(a) Damage.	Damage evident.
			(b) Separated links.	Separated links evident.
154	After	Lower energy chain	Check lower energy chain cables and hydraulic pipes for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
			(c) Ensure that cables and hydraulic pipes are laying correctly (no crossed pipes or cables).	Crossed cables or pipes.
155	After	Rear A-frame shootbolts	Check the rear A-frame shootbolts for:	
			(a) Damage.	Damage evident.
			(b) Security of attachment.	Shootbolts loose.

Table 8.5 Operators PMCS (After) - (continued)

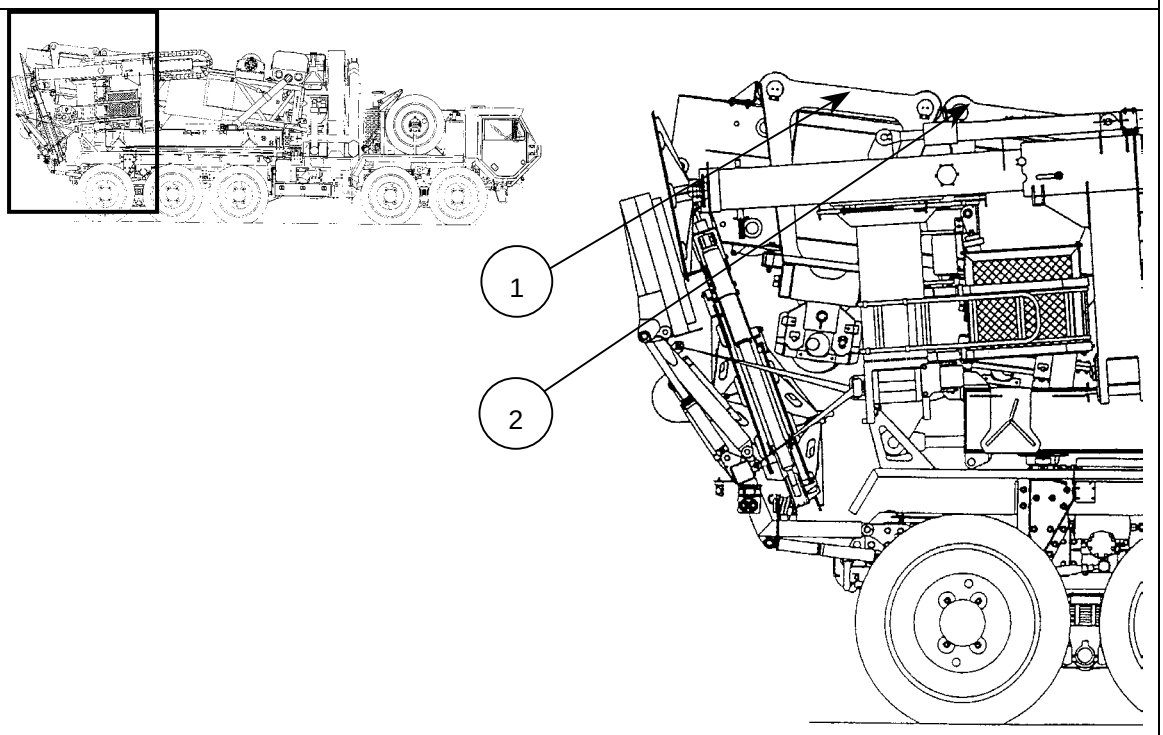
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
156	After	Far bank carriage	Check far bank carriage (1) for:	
			(a) Damage.	Damage evident.
			(b) Excessive wear to side roller.	Excessive wear evident.
			(c) Damage to shootbolts.	Shootbolts damaged.
			(d) Excessive wear to top roller.	Excessive wear evident.
157	After	Home bank carriage	Check Home bank carriage (2) for:	
			(a) Damage.	Damage evident.
			(b) Excessive wear to side roller.	Excessive wear evident.
			(c) Damage to shootbolts.	Shootbolts damaged.
			(d) Excessive wear to top roller.	Excessive wear evident.
158	After	Tail-lift and far bank support	Stow tail-lift and far bank support in accordance with Chapter 3, Section I, Para. 3.2.2.1 through 3.2.2.17.	

Table 8.5 Operators PMCS (After) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
159	After	**Under rear of launcher A-frame** Rotate micro-switch	Check the A-frame rotate micro-switch for: (a) Damage. (b) Security of attachment.	 Damage evident. Micro-switch loose.
160	After	A-frame hinge pins	(a) Check that the A-frame hinge pins, top and bottom hinges, are fitted correctly. (b) Top hinge (1) lower pin fitted from front and R clipped. (c) Lower top hinge (2) pin fitted from rear and R clipped.	
161	After	R/H rear mudguard extension	(a) Check the rear mudguard extension (3) is secured at the front by an R clip and at the rear by the shootbolt and an R clip.	R clips and shootbolts not fitted.

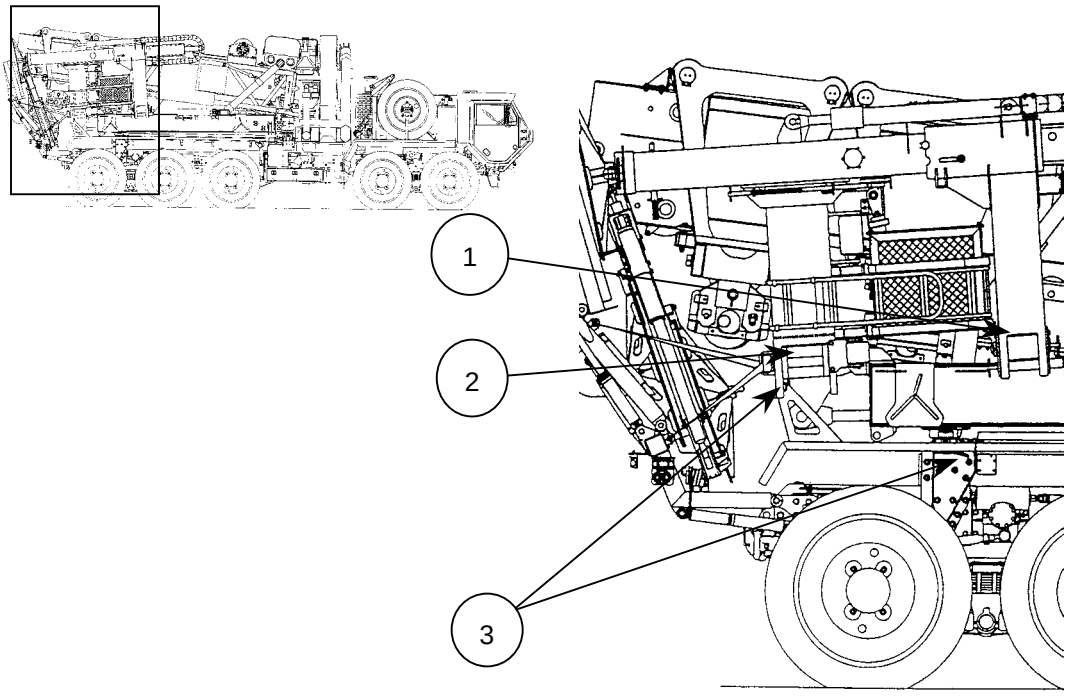


Table 8.5 Operators PMCS (After) - (continued)

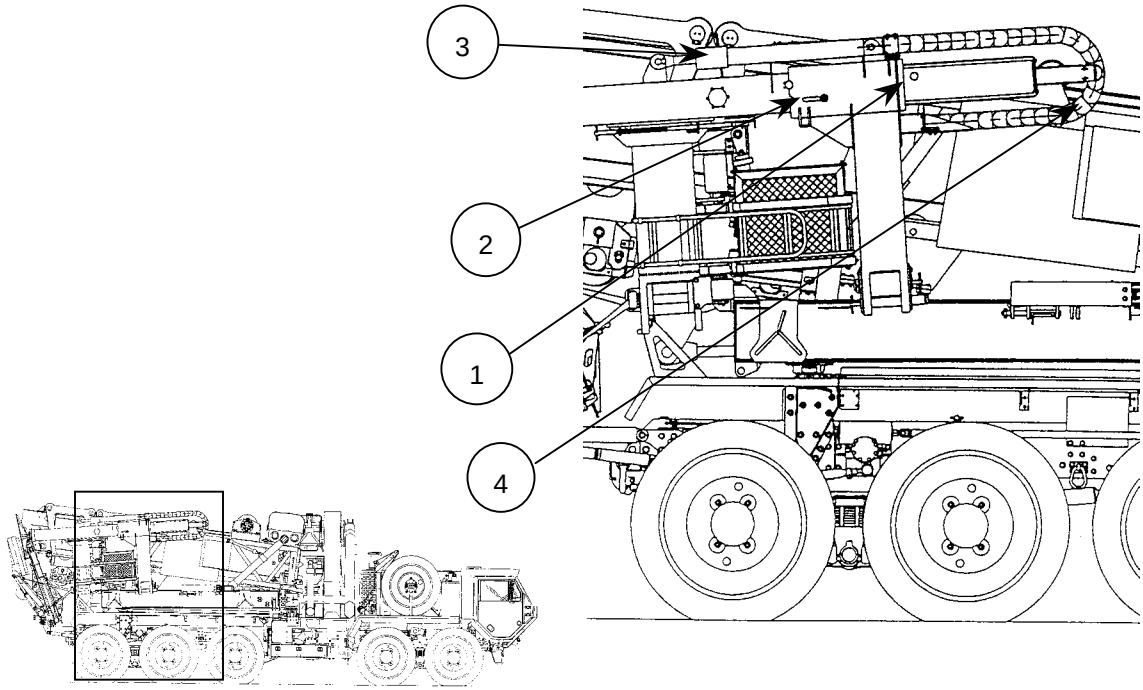
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
162	After	R/H stabilizer leg sliding Frame	(a) Check R/H A-frame upper sliding section (1) for damage.	Damage evident.
			(b) Check sliding frame pin (2) fitted correctly.	
163	After	R/H stabilizer leg energy chain	Check R/H stabilizer leg energy chain (4) cables and hydraulic pipes for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
			(c) Ensure that cables and hydraulic pipes are laying correctly (no crossed pipes or cables).	Crossed cables or pipes.
164	After	R/H stabilizer leg energy chain	Check R/H stabilizer leg energy chain (4) links for:	
			(a) Damage.	Damage evident.
			(b) Separated links.	Separated links evident.
165	After	R/H A-frame raise cylinder	Check the R/H A-frame raise cylinder (3) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.

Table 8.5 Operators PMCS (After) - (continued)

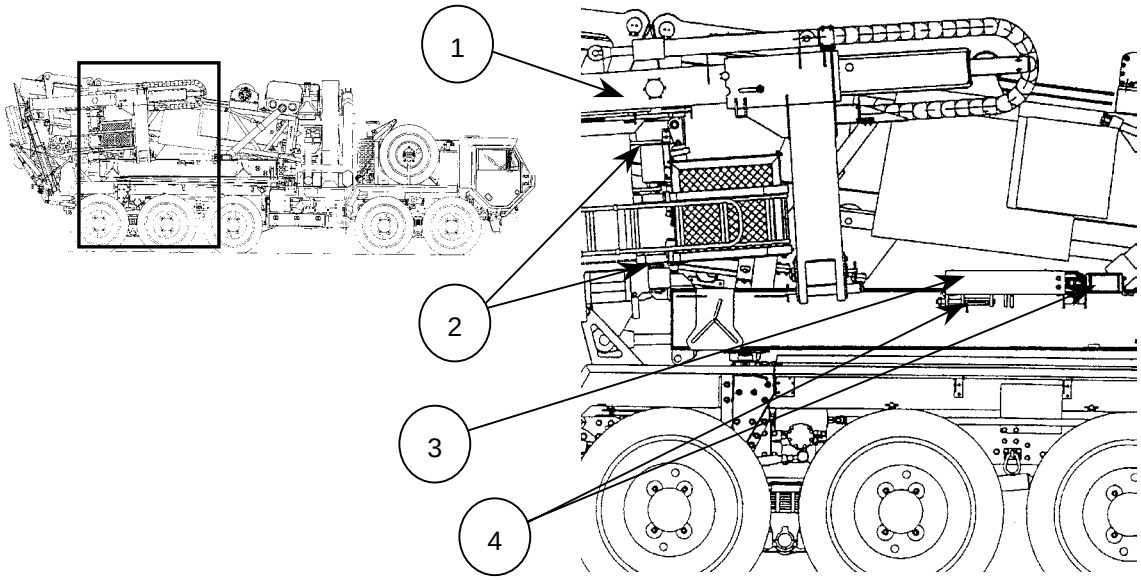
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
166	After	R/H bridge stop emergency	Check the R/H bridge stop emergency (1) for :	
			(a) Damage.	Damage evident.
			(b) Excessive wear on the rubbing strips.	Excessive wear evident.
167	After	R/H A-frame stabilizer leg	Check the R/H A-frame stabilizer leg hydraulic pipes for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
168	After	R/H roller brake	Check R/H roller brake (2) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
169	After	Tilt roller	(a) Check tilt roller (3) for:	
			(1) Damage.	Damage evident.
			(2) Hydraulic fluid leaks.	Class III leak evident.
			(b) Check tilt roller shootbolts (4) for:	
			(1) Damage.	Damage evident.
			(2) Ensure shootbolts correctly inserted into restraining locator holes.	

Table 8.5 Operators PMCS (After) - (continued)

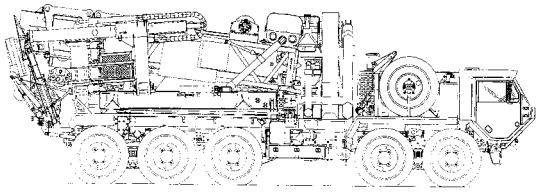
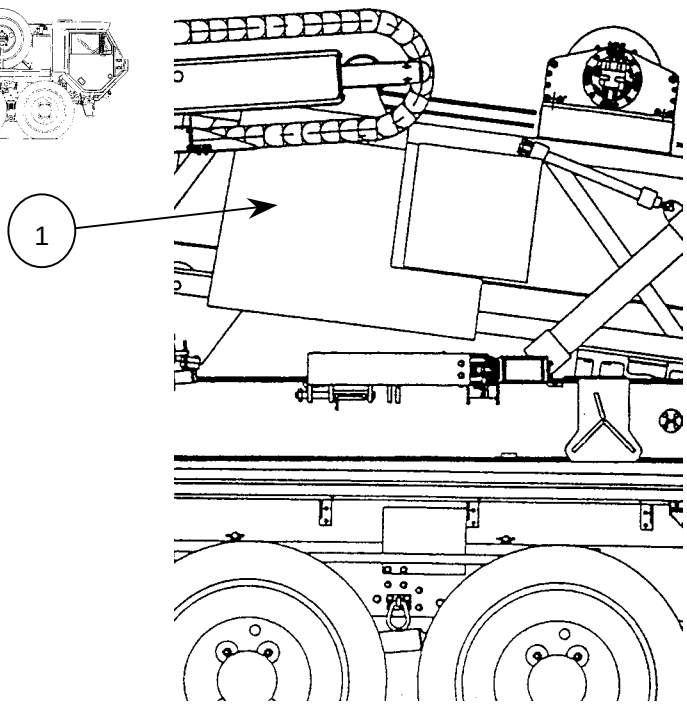
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
 				
170	After	Launch frame winch control manifold	Open inspection doors (1) to gain access to the winch control manifold.	
			a) Check as far as possible for hydraulic fluid leaks.	Class III leak evident.
			(b) Check electrical cables as far as possible for damage and chafing.	Damaged or chafed cables evident.
171	After	Launch frame articulator manifold and synchronization manifold	Open inspection doors (1) to gain access to the articulator manifold and synchronization manifold.	
			(a) Check as far as possible for hydraulic fluid leaks.	Class III leak evident.
			(b) Check electrical cables as far as possible for damage and chafing.	Damaged or chafed cables evident.
			(c) Close R/H manifold cover doors.	

Table 8.5 Operators PMCS (After) - (continued)

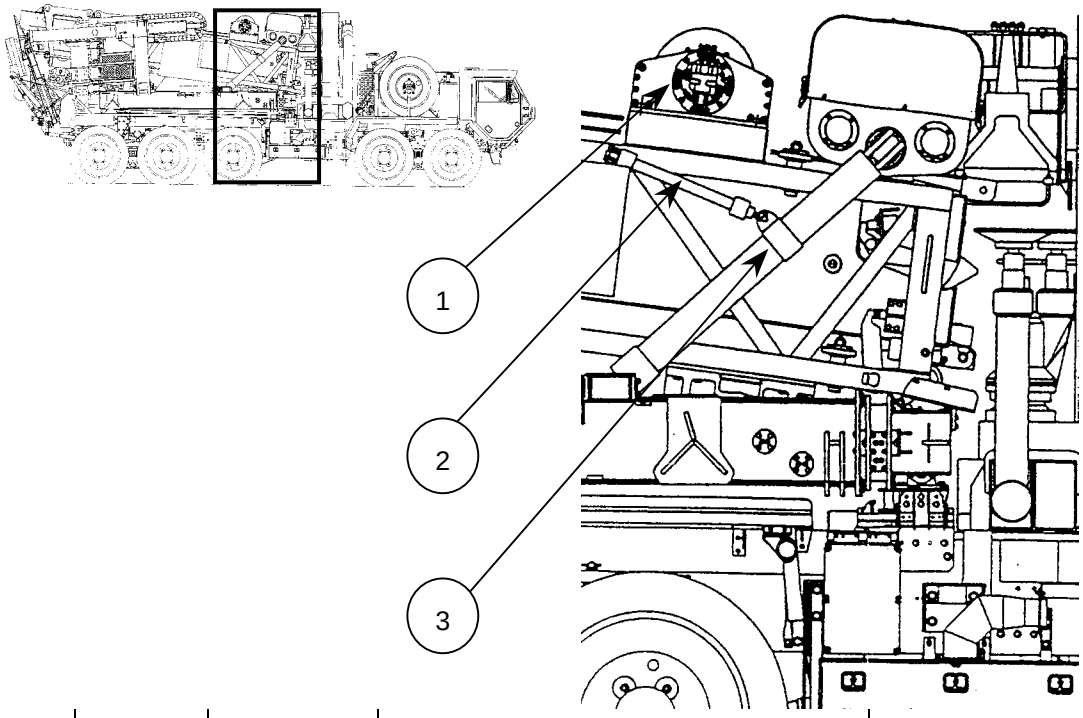
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
172	After	Top winch motor	Remove winch guard. Check the top winch motor (1) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
173	After	Top winch cable	Check the top winch cable as far as possible for:	
			(a) Damage.	Damage evident.
			(b) Kinks.	Kinks evident.
174	After	R/H stow cylinder	Check the R/H stow cylinder (2) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
175	After	R/H articulating cylinder	Check the R/H articulating cylinder (3) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.

Table 8.5 Operators PMCS (After) - (continued)

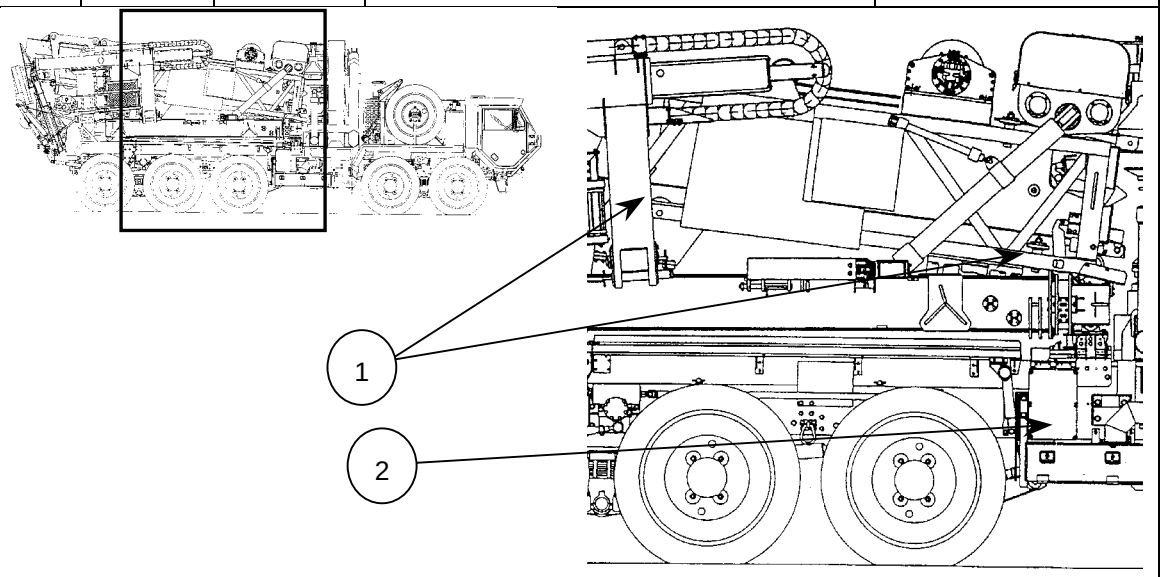
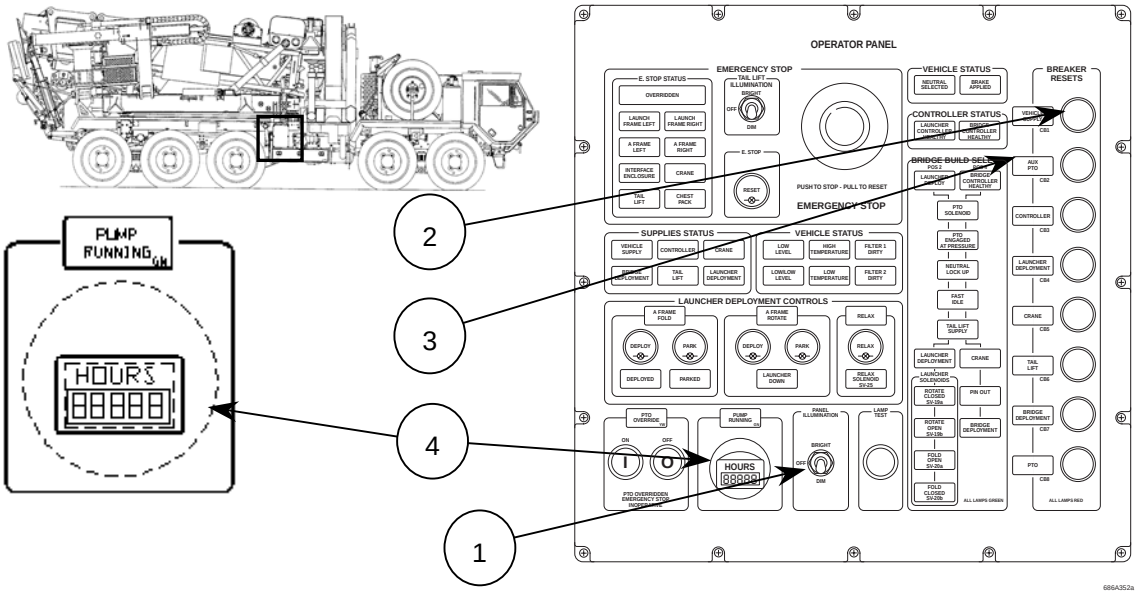
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
				
176	After	R/H launch frame side guide rollers	Check the R/H launch frame side guide rollers (1) for: (a) Damage. (b) Seized bearings. (c) Excessive wear.	 Damage evident. Bearings seized. Excessive wear evident.
177	After	Interface enclosure	Check interface enclosure (2) for damage.	Damage evident.

Table 8.5 Operators PMCS (After) - (continued)

Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
178	After	Interface enclosure	Open interface enclosure door. Check for (a) Damage. (b) Carry out LAMP TEST (1). (c) Check that no circuit breakers (2) have tripped. Indicated by illuminated caption (3) next to tripped circuit breaker. (d) Record pump run hours (4) reading.	 Damage evident. Not all lamps illuminate. Circuit breaker tripped (see note).

NOTE

It is permissible to reset a tripped circuit breaker ONCE ONLY. If the circuit breaker trips again DO NOT RESET, report defect to maintenance.

Table 8.5 Operators PMCS (After) - (continued)

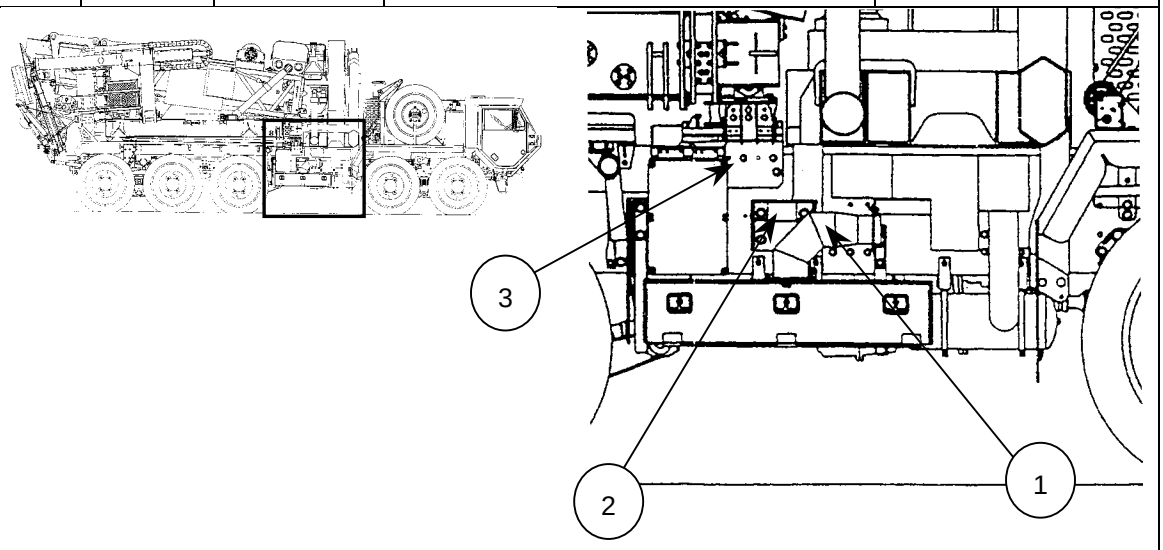
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
179	After	Exhaust extension stowage	Check the exhaust extension (1) is present and securely stowed.	Exhaust extension not present.
180	After	Exhaust extension	Check the exhaust extension (1) for damage.	Exhaust extension damaged.
181	After	Interface hydraulic manifold	Check interface hydraulic manifold valves (2) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
182	After	Crane hydraulic quick release couplings	Check crane hydraulic quick release couplings (3) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
			(c) Security of attachment.	
183	After	Crane hydraulic quick release coupling pipe-work	Check the crane hydraulic quick release coupling pipe-work for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.
			(c) Chafing.	Chafing evident.
			(d) Cracks.	Cracks evident.

Table 8.5 Operators PMCS (After) - (continued)

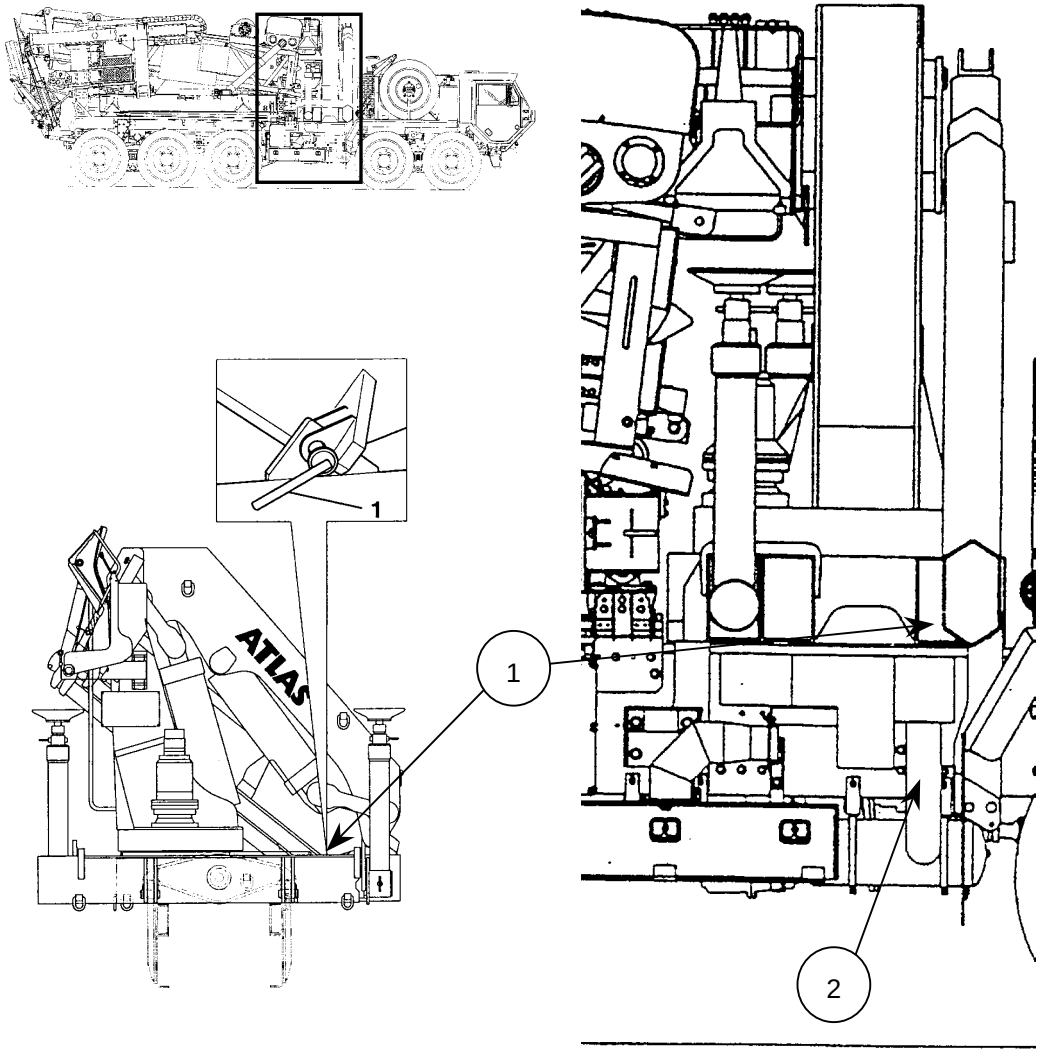
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
184	After	Crane jib securing pin	Check that the crane jib-securing pin (1) is fitted and jib is secure.	
185	After	Hydraulic filters	Check hydraulic filters (2 each) (2) for:	
			(a) Damage.	Damage evident.
			(b) Hydraulic fluid leaks.	Class III leak evident.

Table 8.5 Operators PMCS (After) - (continued)

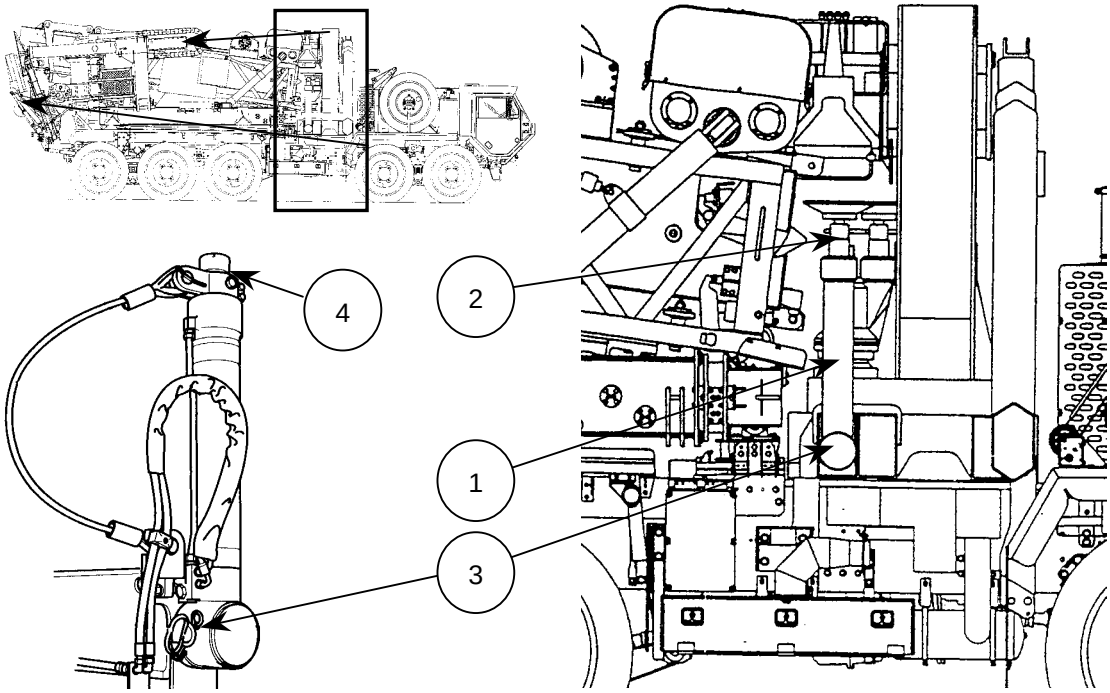
Item No.	Interval	Location: Item to Check Service	Procedure	Not Fully Mission Capable If:
				
186	After	Crane right hand (R/H) stabilizer leg	(a) Visually, examine the crane R/H stabilizer leg (1) for damage.	Damage evident.
			(b) Visually, examine the crane R/H stabilizer leg cylinder (2) and pipes for damage or fluid leaks.	Damage or class III leak evident.
			(c) Check crane (R/H) stabilizer leg cable (4) is fitted and secured with pin and clip (5).	Pin and clip not fitted.
			(d) Check cable for damage.	Damage evident.
NOTE **R/H crane stabilizing leg pin must be fitted from REAR (launcher side).**				
187	After	Crane (R/H) stabilizer leg securing pin	(a) Check crane (R/H) stabilizer leg securing pin (3) is fitted from REAR (launcher side) and R clip is fitted.	
			(b) Check pin for damage.	Damage evident.
188	After	Crane (R/H) stabilizer extension beam	Check crane (R/H) stabilizer extension beam is fully retracted and pin and R clip is fitted.	Not pinned and R clipped.

Table 8.5 Operators PMCS (After) - (continued)

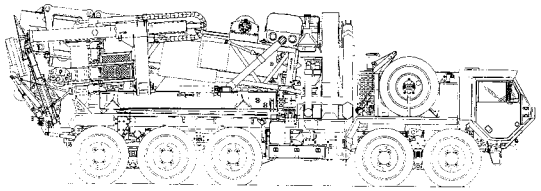
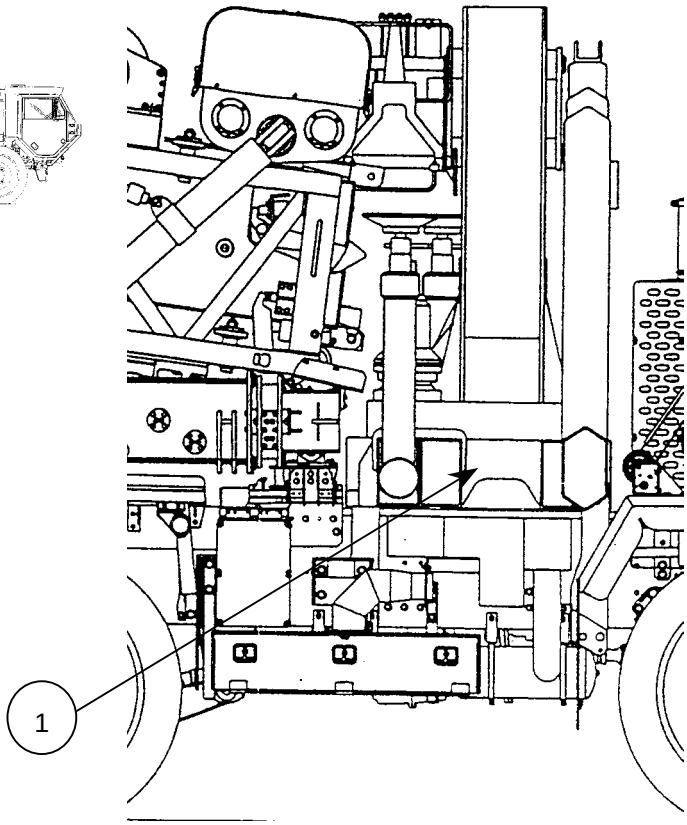
Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
 				
189	After	R/H crane stabilizer leg controls	Check the R/H crane stabilizer leg controls (1) for damage or hydraulic leaks.	Damage evident class III leak evident.

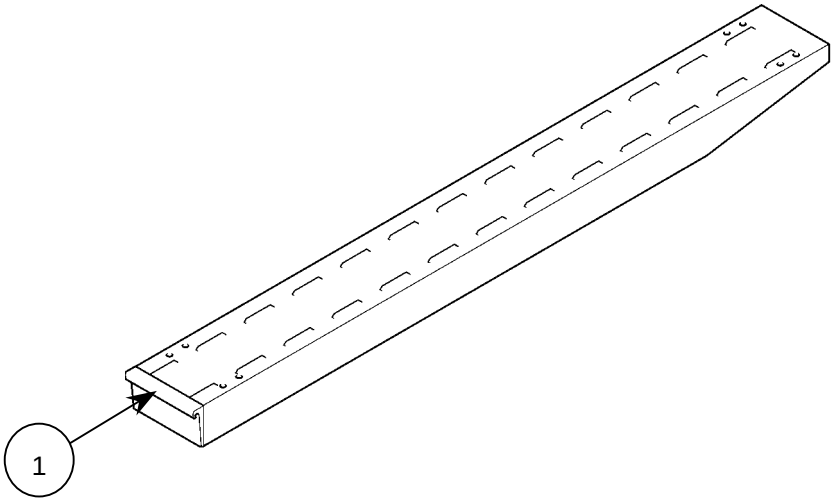
Table 8.6 Operators PMCS Parallel or ramp unit (After)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
190	After	Parallel or ramp unit, damper	Visually examine the bridge unit dampers (x4) for damage or fluid leaks	Damage or class 2 leak evident.
			Attachment points secure	Attachments loose.
191	After	Parallel or ramp unit, dowel pins and dowel holes	Check for damage of dowel pins beyond normal wear and tear. Ensure dowel pins present and inspect dowel holes for blockage	Excessive damage or wear evident. Pin not present, hole blocked.
192	After	Parallel or ramp unit, shootbolts	Examine shootbolts and holes for damage beyond normal wear and tear. Check they correctly operate up and down.	Excessive damage evident. Will not operate.
193	After	Parallel or ramp unit, mount resilient and birds beak	Inspect mount resilient and birds beak for damage beyond normal wear and tear.	Excessive damage evident.
194	After	Parallel or ramp unit, rotabolts on jaws	Check the tightness of jaw securing bolts. Grip the rotabolt cap as if you are holding a pen. Gently attempt to rotate the bolt cap, when correctly tightened no rotation is possible. **NOTE** **When the torque setting is 95% of the correct torque, rotation is possible with a slight drag being felt.**	More than 4 bolts of the 19 fitted to any jaw will rotate (15 Fully tight). **NOTE** **Carry out after every 500 crossings or yearly which ever is first.**
195	After	Parallel or ramp unit, compression faces	Check for damage of compression faces beyond normal wear and tear.	Excessive damage evident.
196	After	Parallel or ramp unit, top chords and track-way decking	Check for distortion and damage, beyond normal wear and tear.	Excessive damage evident.
197	After	Parallel or ramp unit, bottom chord	Check for, distortion and damage, beyond normal wear and tear.	Excessive damage evident.

Table 8.6 Operators PMCS Parallel or Ramp Unit (After) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
198	After	Bridge pins, jaws, jaw holes and securing clips (R clips)	(a) Check bridge pins are present and have no damage, beyond normal wear and tear. (b) Check jaws and jaw holes for damage beyond normal wear and tear.	Missing or excessive damage evident to bridge pins. Excessive damage evident jaws and jaw holes.
			(c) Check clips for deformity.	Clips are deformed.
			NOTE **If clips are deformed, replace with new items from supply.**	
199	After	Parallel or ramp unit, curb	(a) Inspect for distortion or damage beyond normal wear and tear, freedom of movement and locking. (b) Check bridge edge markers are fully working and undamaged.	Distortion or damage evident. Damage evident.
200	After	Parallel or ramp unit, hinges	Ensure free from debris. Check all pins are present, secure and undamaged beyond normal wear and tear.	Excessive damage evident. Pin missing or loose attachments.
201	After	Ramp unit end beam	(a) Ensure beam and beam jaws are undamaged beyond normal wear and tear. (b) Pins are secured with R clips and guide plates are present and they are undamaged beyond normal wear and tear.	Excessive damage evident. Pins and guide plates missing.
202	After	Parallel or ramp unit, deck	Examine for excessive damage beyond normal wear and tear and security of attachment to side girders. (See Hinges item 200)	Severe damage present or loose attachment.
203	After	Parallel or ramp unit, lifting slings	Check lifting slings and push slings for tearing or wear beyond normal wear and tear.	Loose attachment excessive damage evident to outer wear sleeve.
			Damage to inner fibers and security of attachment	Any damage to inner fibers.
204	After	Parallel or ramp unit	Ensure bridging components are clean wash with fresh water to remove all dirt.	
205	After	Ramp unit	Ensure all holes, pins, guide plate location assemblies at ends of ramp for end beam location and lead in brackets have no excessive damage beyond normal wear and tear.	Excessive damage evident. Plates or pins missing.

Table 8.6 Operators PMCS Parallel or Ramp Unit (After) - (continued)

Item No.	Interval	Location Item to Check Service	Procedure	Not Fully Mission Capable If:
206	After	Approach ramp frame slings	Ensure wire rope slings are not damaged beyond normal wear and tear and securely attached.	Damage beyond normal wear and tear present or loose attachment.
				
207	After	Approach ramp frame hooks and safety latches	Check hooks (1) and their respective safety latches for damage and distortion.	Damage or distortion on safety latches.
208	After	Approach ramp frame lifting slings	Check lifting slings for security of attachment and correct routing.	Loose or incorrectly routed.
209	After	Launch beams	Ensure jaws are undamaged beyond normal wear and tear. All rollers are present. Inspect mount resilient and birds beaks for damage beyond normal wear and tear.	Excessive damage evident to jaws, rollers and birds beaks. Mount resilient missing.
210	After	Pin R clips	Ensure that all R clips are not deformed and are undamaged.	Replace any deformed/damaged R clip.
			NOTE **Pay particular attention to the distance between the straight part of the clip and the tail of the R, this distance should not be excessive, this indicates deformity.**	
211	After	Transport aids	Ensure fitted to lower bridge modules on flatracks.	Transport aids missing.

8.4 PERIODIC CHECKS

8.4.1 Winch Rope

8.4.1.1 Once a year the winch rope will be subject to inspection. This can be best achieved by building a beam as described in Chapter 4, Section II, paragraphs 4.3. through 4.7.3.4.

8.4.1.2 Inspection of the winch rope will entail looking for kinks, crush damage, excessive stretching and broken strands. Refer to 8.4.2.

8.4.2 Discard Criteria for Winch Rope

8.4.2.1 The rope should be discarded if a maximum of five broken wires per 5 $^{1}/_{2}$ inches (140mm) of rope length is found. (See Figure 8. 2).

8.4.2.2 The rope should be discarded if the nominal rope diameter is found to be less than 0.55 in (14 mm). (See Figure 8. 1).

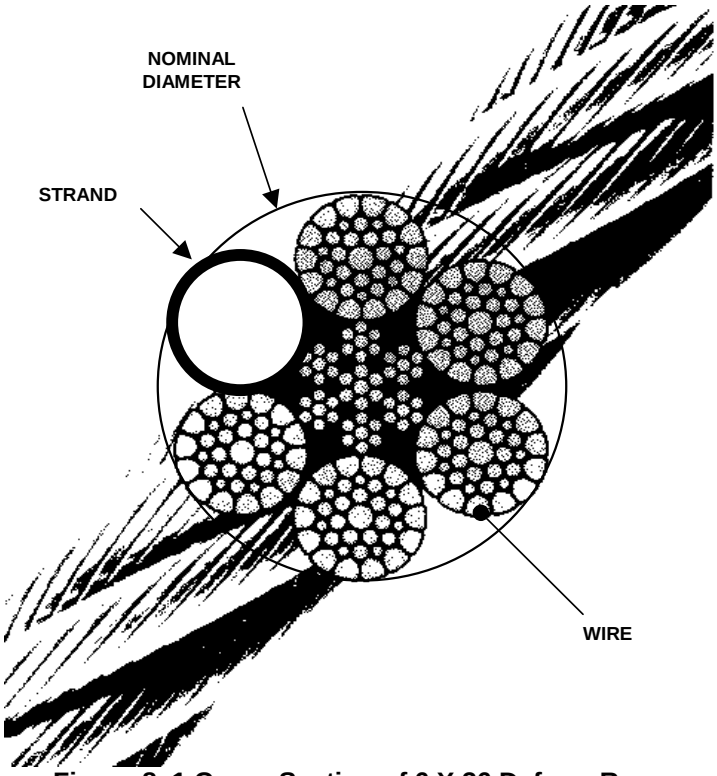
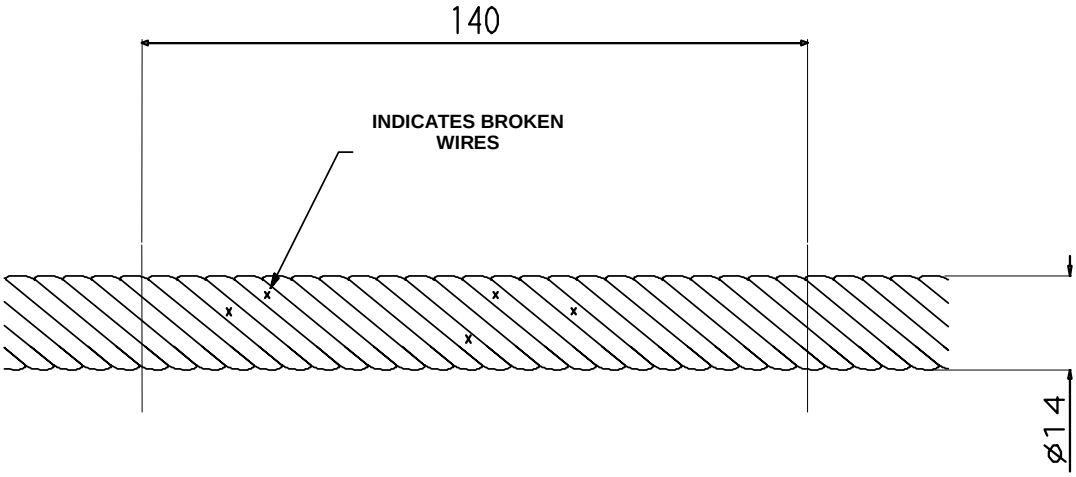


Figure 8. 1 Cross-Section of 6 X 36 Dyform Rope



Dimentions in Milimeters

Figure 8. 2 Winch Rope Damage

8.5 STORAGE PMCS CHECKS

8.5.1 Six Monthly Checks

8.5.1.1 Storage PMCS Checks are carried out every six months while the launch vehicle is in storage. They consist of the normal Before PMCS, which includes the deployment of the A-frame and the cycling of cylinders.

8.6 LIFTING SLINGS

8.6.1 Limitations as to Use Due to Environmental Conditions

8.6.1.1 The material from which the slings are manufactured is polyester (PES). Polyester is resistant to chemical attack from mineral acids but can be attacked by strong alkalis. Take contaminated slings out of service at once, thoroughly soak in water, and allow to dry naturally. In case of any doubt about the condition of any sling following contamination, refer to the manufacturer.

8.6.1.2 Beware of formation of ice at low temperatures, which can have an abrasive or cutting effect on the slings.

8.6.1.3 When bridge modules are stowed, water can pool in the inside of the panels. As the opening slings hang down inside the panels, they can become frozen to the panel in cold weather.

8.6.1.4 During non-operational periods when the system is stored at temperatures below 32 degrees Fahrenheit (zero degrees Centigrade) or when freezing is expected to occur, to prevent the slings freezing to the insides of the bridge sections, all the module opening slings should be pulled out from the modules so that they hang externally.

CAUTION

Transportation of bridge modules with incorrectly stowed slings may cause system damage.

8.6.1.5 Prior to transportation, all slings must be re-inserted, using the module sling tool if necessary.

8.6.1.6 Slings should be protected from prolonged exposure to direct sunlight or sources of ultra-violet radiation.

8.6.2 Checks Prior to Each Use/Period of Use for Slings

8.6.2.1 Prior to each use, the sling should be inspected for:

a) any defects

b) correct identification and specification

8.6.2.2 In addition to the examination by a competent person, the responsible person should make regular in-service inspections. The interval between inspections will depend on the conditions of service but as slings can be damaged in use, the operative should visually check them on each occasion prior to slinging the load.

8.6.2.3 If any of the following defects are found the sling should be withdrawn from service and referred to a competent person:

a) **Surface chafe**. In normal use some chafing will occur and is unavoidable. If this is confined to the surface fibers as opposed to the yarns it has no effect on the safe use however in extreme cases the faces of the webbing can become so worn that the outer yarns are severed.

b) **Local abrasion**. If the webbing shows signs of local abrasion, as opposed to general wear, serious loss of strength may occur.

c) **Cuts**. Both longitudinal and cross cuts into the surface of the webbing result in loss of strength.

d) **Chemical attack**. While polyester fibers have a good resistance to selected chemicals, chemical attack to the webbing results in local weakening and softening of the material. This is indicated by flaking of the surface fibers which can be plucked or rubbed off.

e) **Heat damage**. The surface fibers take on a glazed appearance and in extreme cases fusion of the fibers occurs.

f) **Damaged stitching**. Any damage to the stitching or noticeable loosening of the threads must be treated seriously.

g) **Loose webbing**. The webbing becomes loose and soft to the touch so that the weft can be moved or split with the fingers.

h) **Missing or illegible marking**. The sling should **NOT** be used if the identifying markings are missing or illegible.

i) **Soiling**. Heavy soiling can obscure damage making detection during inspection difficult. It can also make identification difficult by obscuring any marking or color-coding. Grit and dirt will collect on the face of soiled webbing and can cause rapid wear and abrasion. Clean the sling in an approved manner but if the soiling is such that cleaning has little or no effect withdraw from service and refer to a Competent Person.

NOTE

Only use clean water and mild detergent to clean lifting slings.

Section III. LUBRICATION AND FLUID LEVEL CHECKS

8.7 LUBRICATION

8.7.1 General

WARNING

TO ENSURE THE SAFETY OF PERSONNEL, ALL TOOLS AND EQUIPMENT MUST BE KEPT CLEAN AND DRY TO PREVENT THE OPERATOR FROM SLIPPING AND CAUSING PERSONAL INJURY.

Note

The DRY SUPPORT BRIDGE (DSB) Launch Frame is NOT enrolled in the Army Oil Analysis Program.

Lubrication instructions for the PLS Vehicle, including the hydraulic fluid for the DSB Launcher can be found in TM 9-2320-364-10.

8.7.1.1 The lubrication and hydraulic fluid requirements of the PLS vehicle can be found in **TM 9-2320-364-10 - APPENDIX G - LUBRICATION INSTRUCTIONS.** Also, see paragraph 8.8.1.2 for instructions on changing the hydraulic fluid in the DSB Launcher without bleeding the system.

8.7.1.2 These instructions only detail lubrication of the DSB Launcher A-frame, launch frame, crane and tail-lift, not the hydraulic system which is covered in the PLS manuals.

8.7.1.3 Keep all lubricants in sealed containers to prevent contamination from foreign particles, e.g. dust or dirt. The containers must be stored in a clean dry place away from external heat sources.

8.7.1.4 Lubrication tools and equipment shall be kept clean and ready for use at all times.

8.7.2 Lubrication Periods

8.7.2.1 Lubrication maintenance is based on hours run rather than launches and retrieves, as the time to launch and retrieve is variable.

8.7.2.2 The time is obtained from the hours run counter on the operators interface panel.

8.7.2.3 The lubrication on the launcher, crane and tail-lift is to be carried out every 50 hours unless otherwise stated in Table 8.5. This periodicity will take into account any extreme conditions the launcher may encounter.

Table 8.5 Lubrication Periodicity

System	Period
A-frame	50 Hours
Launcher	50 Hours
Crane	50 Hours
Tail-lift	50 Hours

8.7.3 Lubricants Used

Table 8.6 below is a list of lubricants used on the launcher. In order to prevent component failure no other lubricants are to be used.

Table 8.6 Lubricants Used on the DSB

Lubricant	Manufacturer	Remarks
Grease	MIL-PRF-10924 G	All grease fittings
Gear lubricant	MIL-PRF-2105 GO-80/90 (NORMAL USE) MIL-PRF-2105 GO-75 (ARCTIC USE)	Main reservoir winches
Hydraulic fluid	MIL-H-46170 Type 1	Far bank support reservoir
Gear lubricant	MIL-PRF-2105 GO-80/90 (NORMAL USE) MIL-PRF-2105 GO-75 (ARCTIC USE)	Beam drive gearbox
Grease	“SPRAY ON” GREASE	Beam drive chain
Automotive oil	MIL-PRF-2104 (NORMAL USE) MIL-PRF-46167 (ARCTIC USE)	Beam drive brake
Automotive oil	MIL-PRF-2104 (NORMAL USE) MIL-PRF-46167 (ARCTIC USE)	Crane - oil can points
Gear lubricant	MIL-PRF-2105 GO-80/90 (NORMAL USE) MIL-PRF-2105 GO-75 (ARCTIC USE)	Crane rotate gear
Automotive oil	MIL-PRF-2104 (NORMAL USE) MIL-PRF-46167 (ARCTIC USE)	Twist locks
Automotive oil	MIL-PRF-2104	Pneumatic hammer

8.7.4 Bridge Launcher

The components requiring periodic lubrication are shown in Table 8.7 below.

Table 8.7 Launcher Component Lubrication

Component	Lubricant Required	Frequency
Beam drive - Chain	"SPRAY ON" GREASE	
- Gearbox	MIL-PRF-2105 GO-80/90 (NORMAL USE) MIL-PRF-2105 GO-75 (ARCTIC USE)	Change after the first 50/100 hours running and then 2 yearly.
- Drive rollers	MIL-PRF-10924 G	Every 50 operating hours.
- Drive brake		
Forward launch beam rope sheaves	MIL-PRF-10924 G	Every 50 operating hours.
Winches - Gearboxes		
- Upper and lower	MIL-PRF-2105 GO-80/90 (NORMAL USE) MIL-PRF-2105 GO-75 (ARCTIC USE)	After 50 hours of use then every 2 years.
- Hydraulic motor		
- Wire rope		At each wire rope inspection.
A-frame	MIL-PRF-10924 G	Every 50 operating hours.
- Upper center beam		
- Bridge rollers	MIL-PRF-10924 G	Every 50 operating hours.
Launch Frame - Rope guides	MIL-PRF-10924 G	Every 50 operating hours.
Carriages		
- Sheave blocks	MIL-PRF-10924 G	Every 50 operating hours.
- Side rollers	MIL-PRF-10924 G	Every 50 operating hours.
- Top rollers	MIL-PRF-10924 G	Every 50 operating hours.
Far Bank Support		
- Hydraulic oil	MIL-H-46170 Type 1	2 yearly.
- Lube points	MIL-PRF-10924 G	Every 50 operating hours.
Cylinder mountings		Annually.
Strut pin		Annually.

continued

Table 8. 9 Launcher Component Lubrication (continued)

Component	Lubricant Required	Frequency
Twist lock	MIL-PRF-2104 (NORMAL USE) MIL-PRF-46167 (ARCTIC USE)	If necessary.
Crane - As necessary lubrication points Crane rotate gear	 MIL-PRF-10924 G MIL-PRF-2105 GO-80/90 (NORMAL USE) MIL-PRF-2105 GO-75 (ARCTIC USE)	
Tail-lift	MIL-PRF-10924 G	Every 50 operating hours.
Hydraulics - Reservoir - Filters	MIL-PRF-2104 Replace	As per PLS vehicle manual. When indicated on operator panel.
PTO drive to hydraulic pump	MIL-PRF-10924 G	Every 50 hours

8.8 RENEWING LAUNCH VEHICLE FLUIDS

WARNING

DANGER OF INJURY TO PERSONNEL WHEN WORKING NEAR ENGINE COOLING FAN, ENGINE MUST BE TURNED OFF AND THE BATTERY ISOLATION SWITCH TURNED TO OFF.

HYDRAULIC FLUIDS SPILLAGE. PERSONNEL MAY SLIP ON SPILT HYDRAULIC FLUID. SUITABLE CONTAINER AND ABSORBENT MATERIAL ARE TO BE USED TO CONTAIN SPILLAGE.

NOTE

This procedure should be read in conjunction with Chapters 4 (Bridge Build) and 5 (Bridge Recovery) for procedures required to deploy and recover the launch vehicle, and beam deployment.

8.8.1 Introduction

8.8.1.1 For instructions on changing lubricants in the following components, refer to Chapter 10 of this manual and TM 5-5420-279-23.

TM 5-5420-279-10 Chapter 10 procedure 10-24 Crane Rotate Gear.

TM 5-5420-279-10 Section 5-036 Launch Beam Drive Oil Replacement.

TM 5-5420-279-10 Section 5-039 Launch Beam Drive Brake Oil Replacement.

TM 5-5420-279-10 Section 5-042 Winch Gearbox Oil.

8.8.1.2 This procedure is for changing the fluid in the main DSB launch system without the need to re-bleed the cylinders or the system. It is more wasteful of fluid than draining the whole system down but is more efficient in time. This method will not remove all traces of the fluid but will make sure that any old fluid left in the system is mixed with the new fluid. The procedure assumes that the fluids are completely miscible and compatible.

8.8.2 Preparation

8.8.2.1 Deploy the launch vehicle, Extend the articulator for fitting launch beams remove the final stop pin. Crane a launch beam, connect it to, and pin it to the forward launch beam. Make sure that the crane is in a position so it that it can remove the launch beam later.

8.8.2.2 Drain the vehicle hydraulic tank using the drain procedure for the PLS vehicle.

8.8.2.3 Remove the cover on top of the main hydraulic return line filter, remove the filter complete, replace the cover, and tighten.

8.8.2.4 Remove the hydraulic return pipe, the larger of the two pointing to the rear of the vehicle, from the top of the oil tank. Cover both the open ends with plastic bags and tape to prevent the entry of dirt and the loss of oil.

8.8.2.5 Remove the rear engine cover and place to one side.

8.8.2.6 Remove the tywraps and clip from the pipe and feed it back through the engine compartment, being careful not to damage the end fitting. It may be necessary to remove the spare wheel to get to the pipe clip.

8.8.2.7 Place the open end of the pipe over the right hand side of the vehicle into a suitable container or drum to collect the old oil for disposal. MAN A should be stationed here to operate the E-stop button to prevent overfilling and to allow him to put the hose into another container or drum.

8.8.2.8 Fill the hydraulic oil tank with new oil using a pump with an in-line filter to ensure that the system is clean. **DO NOT POUR OIL DIRECTLY FROM THE DRUM INTO HYDRAULIC TANK**.

8.8.2.9 Position MAN B to keep the tank topped up using the vehicle low warning as a guide. **DO NOT OVERFILL THE HYDRAULIC TANK**.

8.8.3 Procedure

8.8.3.1 MAN A should be prepared for either the old oil drum overfilling or the interface cabinet control **LOW LEVEL** indicator illuminating and then must operate the Emergency stop button on the interface enclosure to prevent air being sucked into the hydraulic pump.

8.8.3.2 MAN B should keep the oil tank between minimum and half full at all times.

8.8.3.3 MAN C should now carry out the following build sequence in order to exchange the oil.

8.8.4 Sequence

8.8.4.1 This sequence requires pins and shootbolts to be operated as per a normal build sequence. However, as the beam will only be extended one section, no action with respect to the far bank support is required apart from partial deployment, **DO NOT EXTEND** the far bank support.

1 Make sure parking brake is on and the vehicle is in neutral.

2 Make sure both the tail-lift pendant and the chest pack are fitted.

3 Ensure that the rotary switch is in position 4.

4 Connect one launch beam.

5 Extend the beam one section only and insert the final stop pin.

6 Operate the far bank carriage, move carriage one beam section and return.

7 Remove the launch beam pins, retrieve the launch beam, and place it on flat rack and re-place the final stop pin in the launch fame.

8 Operate the crane stabilizer legs one complete cycle.

9 Operate the crane one for one complete cycle of all motions finishing in the stowed position.

10 Manually operate articulator stowing free valve (clip **SV16**).

11 Extend the articulator cylinders fully.

12 Remove the pins and fully extend and retract the A-frame raise, once only replace the pins in the lower position.

13 Unclip **SV16**.

14 Fully retract the articulator cylinder.

15 Deploy the tilt rollers.

16 Fully extend and retract the tilt roller cylinders one time only and then re-stow.

17 Refit the relax shootbolts.

18 Turn the rotary switch, in vehicle cab, to position 3, reverse the vehicle to close the slide frame keeping pipe in drum.

19 Remove the chest pack.

20 Fully extend the A-frame legs, lower the A-frame onto the twist lock brackets, and fully retract the legs and pin.

21 Release the A-frame rotate shootbolts, operate for one cycle, and finish in the stowed position. Reinsert the A-frame rotate shootbolts.

22 Remove the A-frame folding pins, operate for one cycle, finish in the stowed position replace pins.

23 Stow the far bank support.

24 Operate the tail-lift through one complete cycle of all motions, finish in the stowed position.

25 Replace the oil return pipe, making sure it is clear of the cooling fan, clipping, and tying it into place.

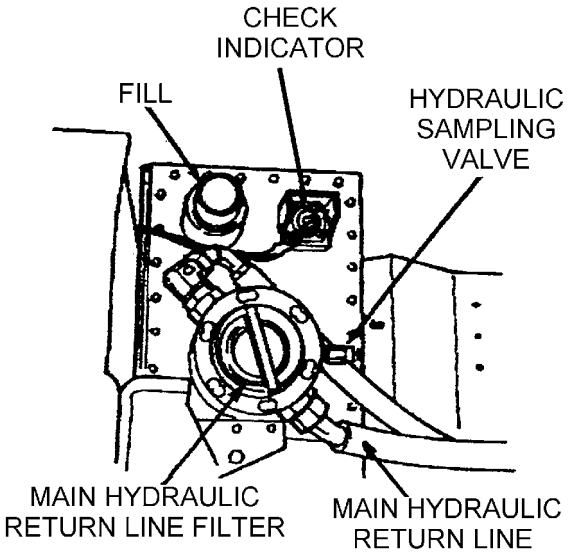
26 Replace the pressure and return filter elements (use new O-rings when fitting the new elements) at interface the manifold by interface enclosure.

27 Top up the oil tank to the fill mark.

28 Replace the filler cap and the strainer.

29 Remove the cover on top of the main hydraulic return line filter, renew the filter complete, replace the cover, and tighten.

30 Dispose of the old oil in accordance with local environmental orders.



Vehicle Hydraulic Reservoir

8.9 LUBRICATION

8.9.1 Vehicle Interface

Table 8.8 Vehicle Interface Component Lubrication

Component	Lubricant Required	Frequency
PTO drive to hydraulic pump	MIL-PRF-10924 G	Every 50 hours

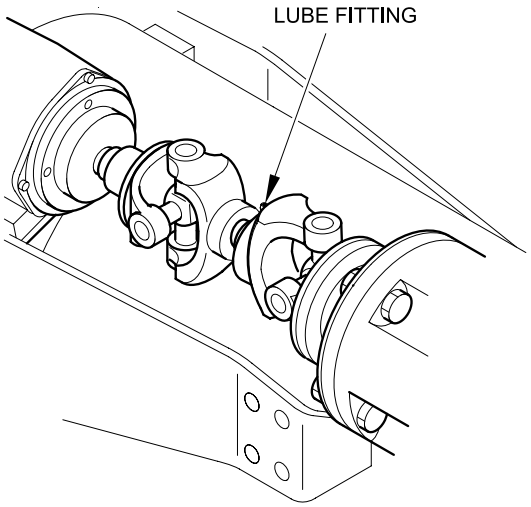


Figure 8.3 PTO/Hydraulic Pump Drive

8.9.2 Launcher Components

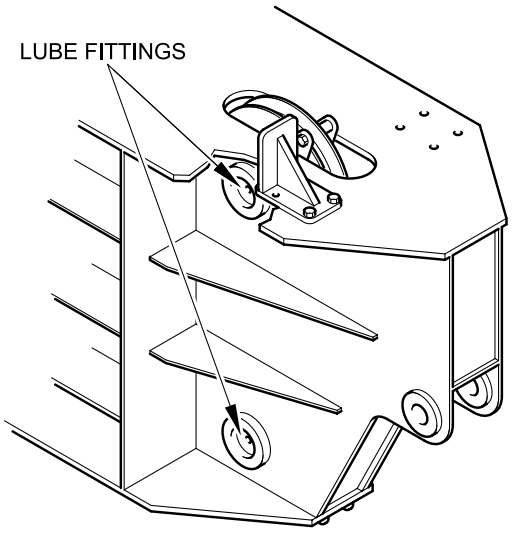


Figure 8.4 Forward Launch Beam Rope Sheaves

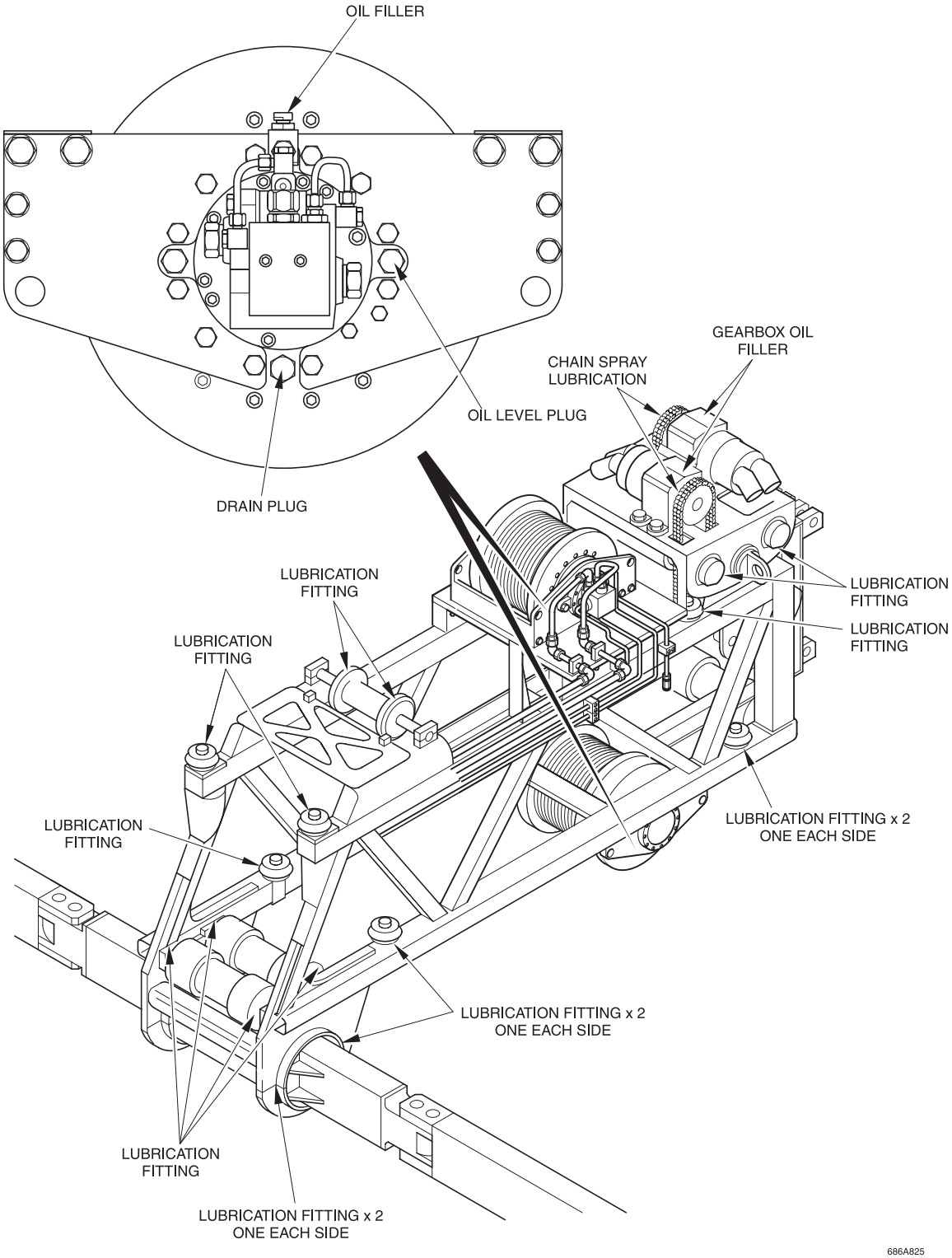


Figure 8.5 Lubrication Points Launch Frame

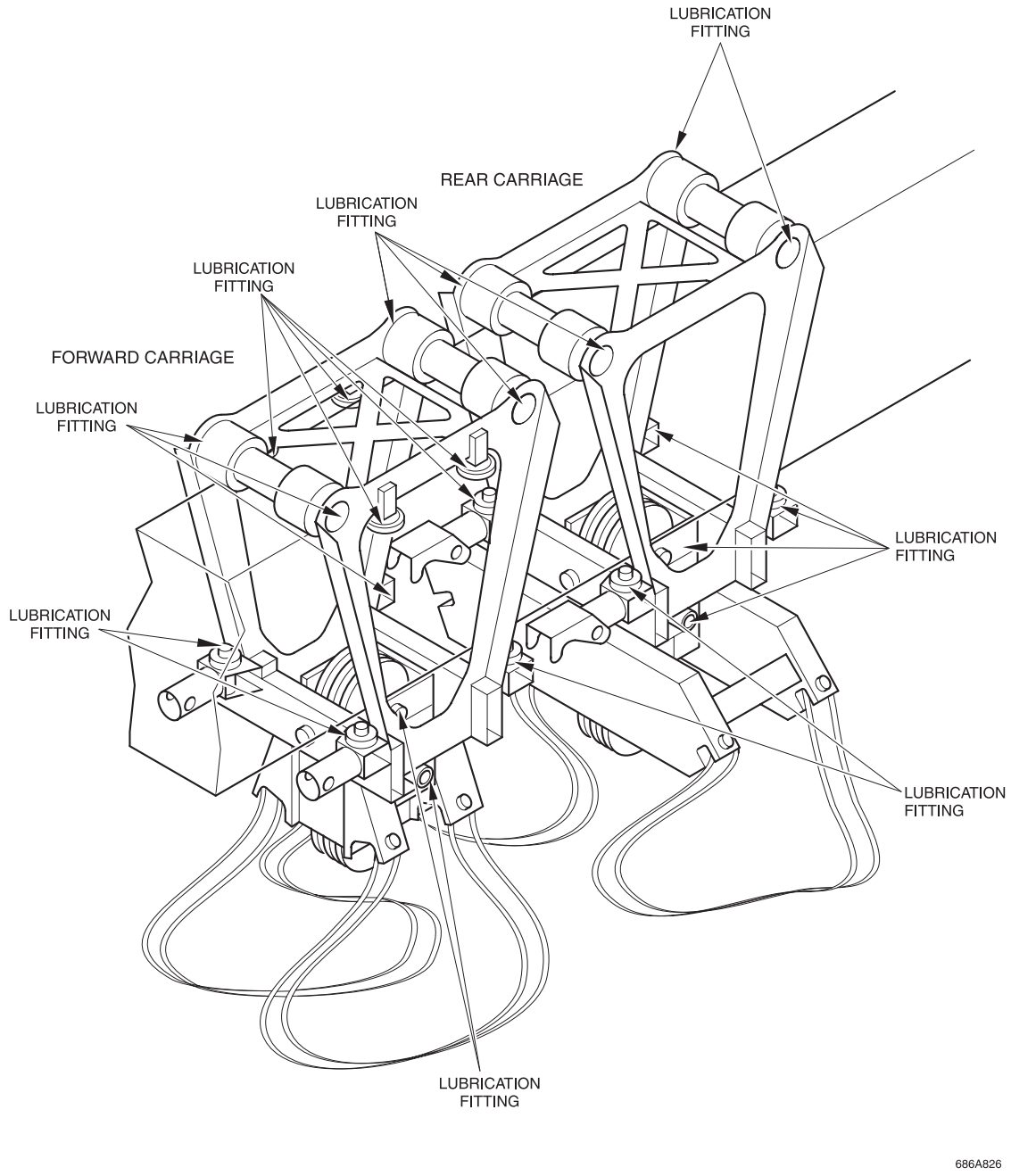


Figure 8.6 Lubrication Points Home and Far Bank Carriages

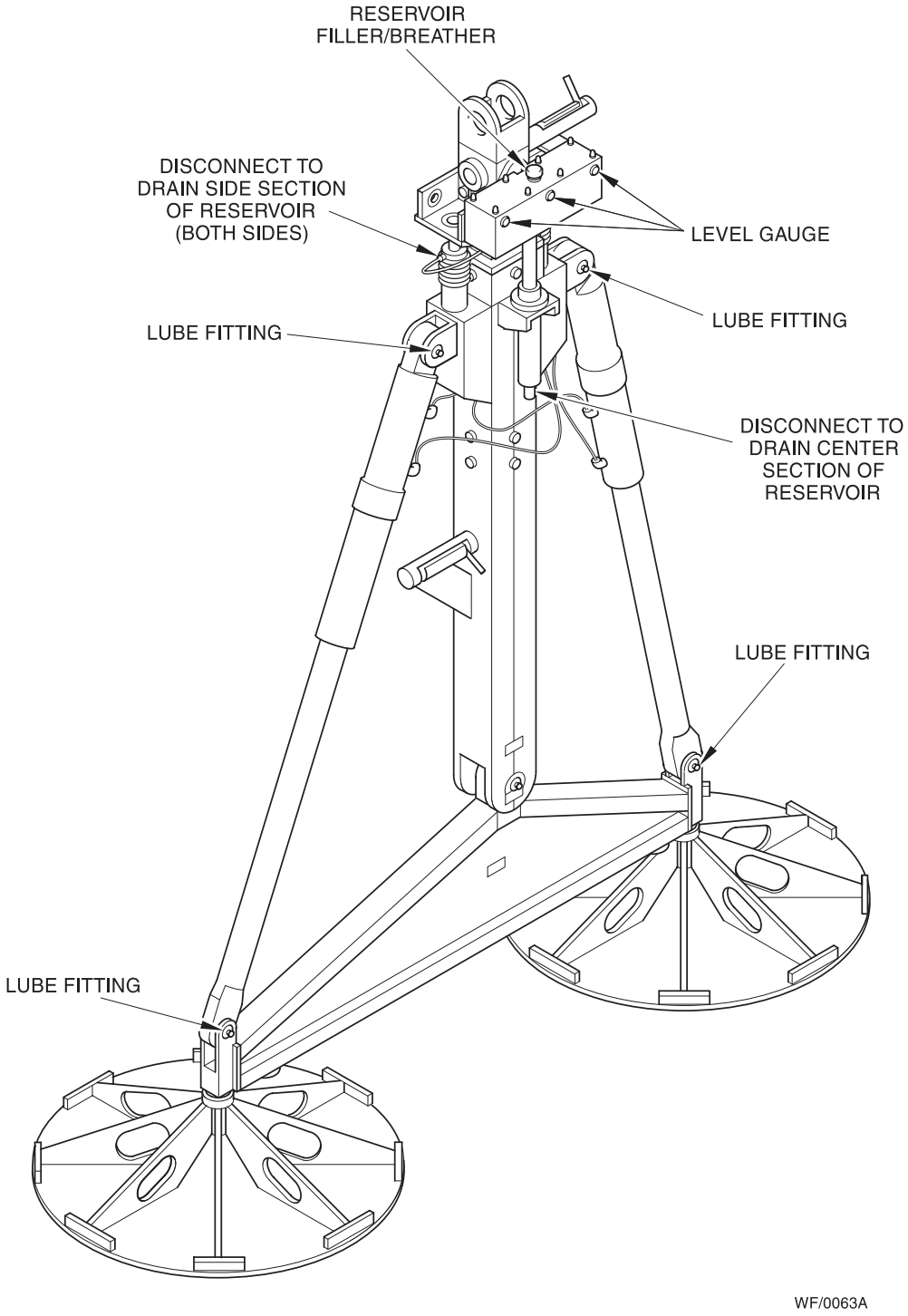


Figure 8.7 Lubrication Points Far Bank Support

8.9.3 Tail-lift - Lubrication

8.9.3.1 The locations of the lubrication points are indicated in Figure 8.8.

8.9.3.2 The lubrication points are located on each platform pivot pin, on the top and bottom pivot pins of each cylinder and on the lower pivot pins of the lifting arm.

NOTE

Use MIL-PRF-10924 G grease to lubricate the tail-lift lubrication points.

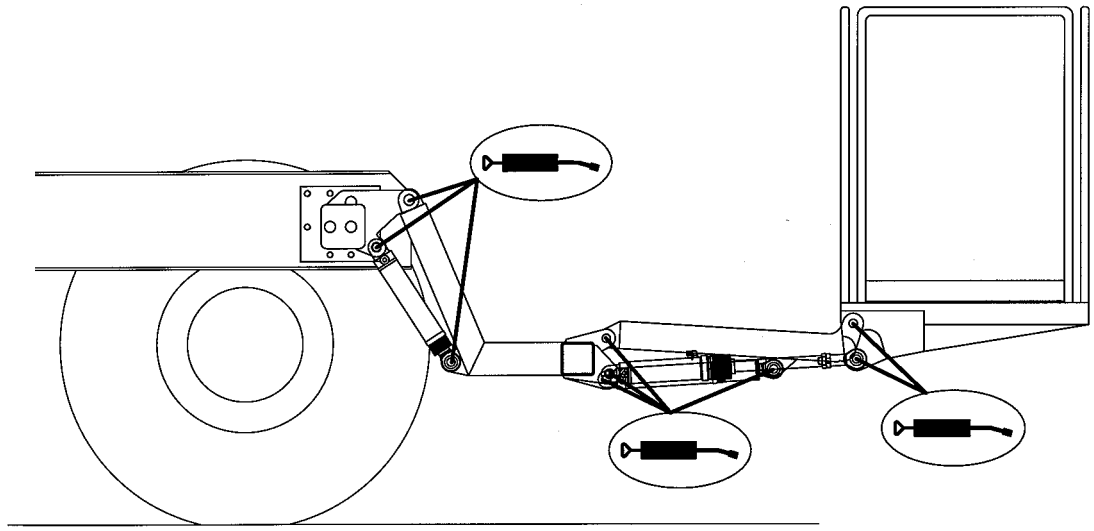


Figure 8.8 Tail-lift Lubrication

8.9.3.3 Lubrication of the tail-lift should be carried every 50 hours of launcher operating time.

NOTE

Failure to grease at regular intervals can result in operating troubles and premature wear on the bearings.

8.9.4 Crane - Lubrication

8.9.4.1 The lubrication points on the crane **MUST** be lubricated every 50 hours:

(1) The central lubrication point for the rotate gear ring (1).

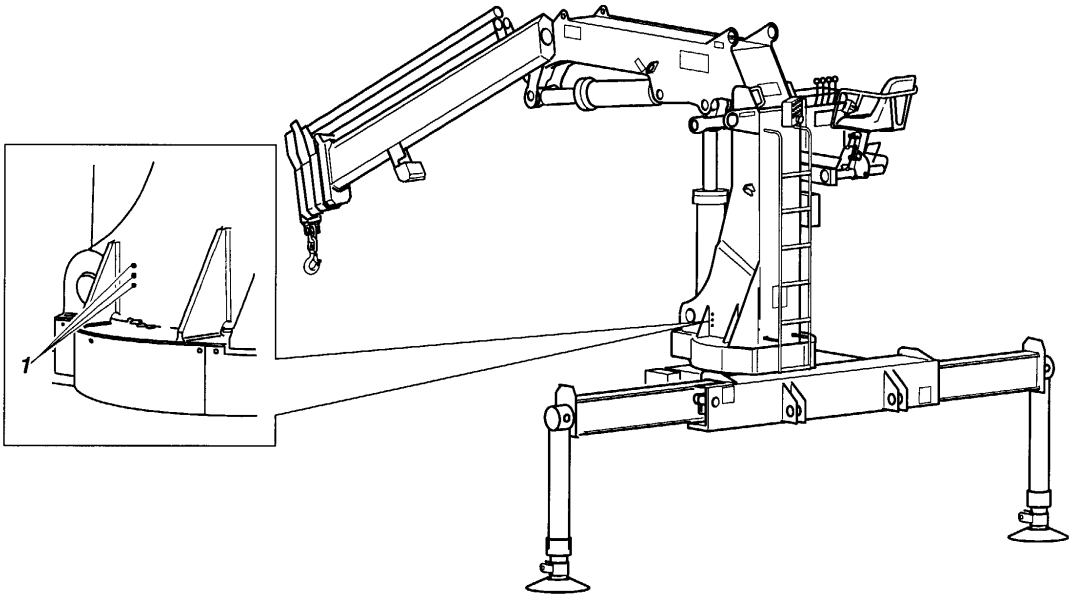


Figure 8.9 Central Lubrication Point for the Rotate Gear Ring

WARNING

DEATH OR PERSONAL INJURY. THESE LUBRICATION PROCEDURES MUST BE PERFORMED WITH GREAT CARE OR DEATH OR SERIOUS PERSONAL INJURY COULD RESULT.

CAUTION

Equipment damage. Crane column bearings should be lubricated with the vehicle engine and the PTO engaged. Failure to observe this instruction could lead to damage to the equipment

8.9.4.2 Lubricate with MIL-PRF-10924 G grease unless otherwise indicated.

8.9.4.3 The procedure is as follows:

(1) Clean the lubrication points thoroughly.

(2) Grease the lubrication points.

(3) Rotate the crane column in both directions.

(4) Apply grease a second time.

8.9.5 Crane - Low Maintenance Lubrication Points

8.9.5.1 Low maintenance lubrication points should be lubricated after 50 hours of operation.

8.9.5.2 The time is obtained from the hours run counter on the interface enclosure.

8.9.5.3 The following lubrication points fall into this category:

(1) The pivot points for the crane boom (2).

(2) The pivot points for the lift cylinder linkage (3).

(3) The pivot points for the lift cylinder crane column (4).

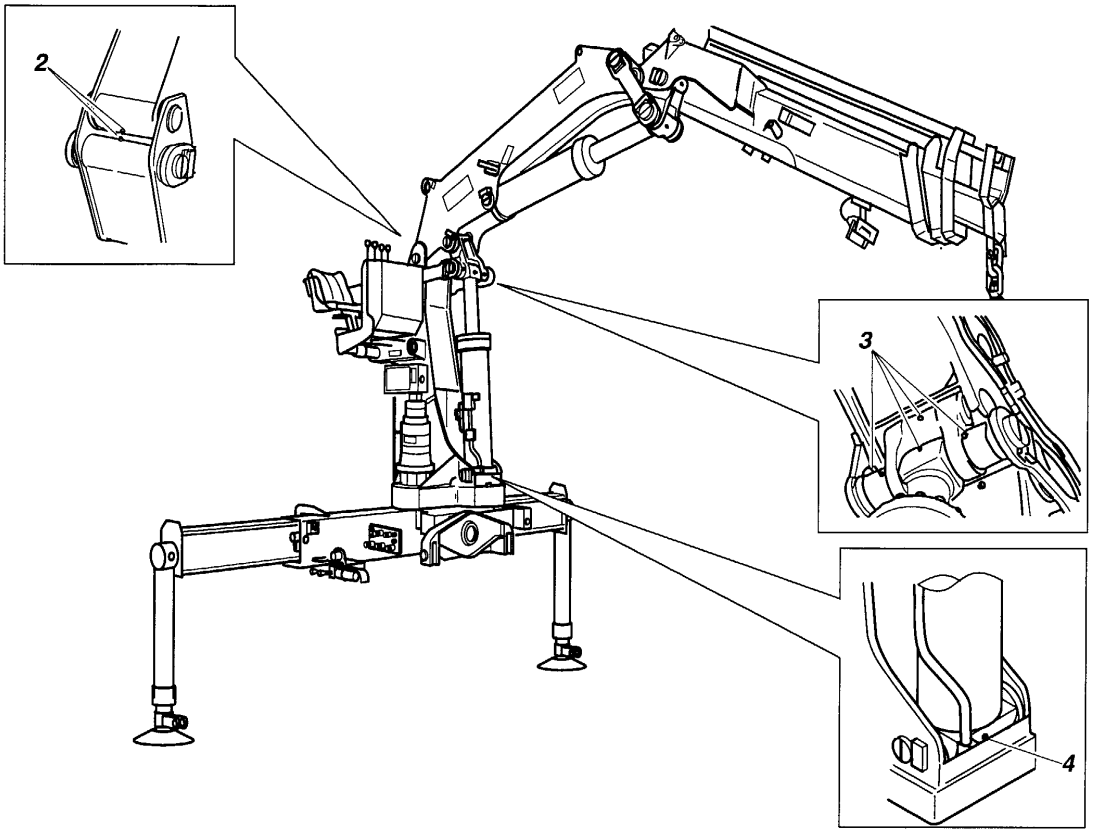


Figure 8.10 Low Maintenance Lubrication Points Crane Column

(5) The pivot points for the jib cylinder-boom (5).

(6) The pivot points for the jib cylinder-linkage (6).

(7) The pivot points for the boom-jib (7).

(8) The pivot points for the jib cylinder-linkage (8).

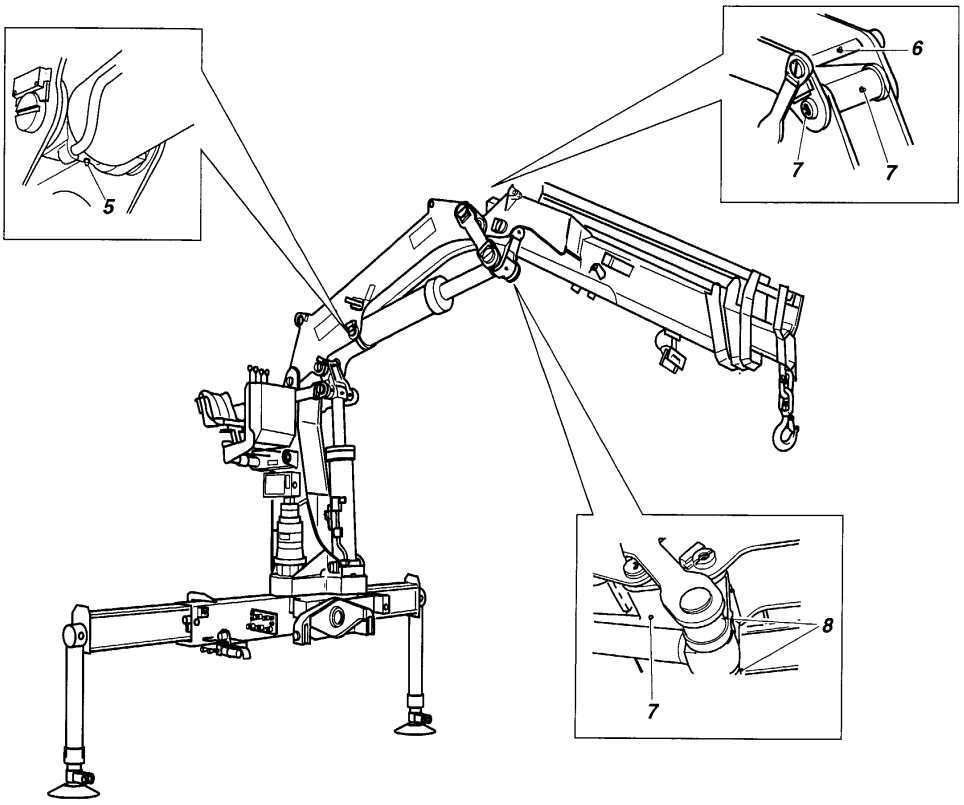


Figure 8.11 Low Maintenance Lubrication Points Crane Jib

8.9.5.4 The procedure is as follows:

(1) Clean the lubrication points thoroughly.

(2) Grease the lubrication points.

8.9.6 Crane - As Necessary Lubrication Points

8.9.6.1 As necessary lubrication points, should be inspected at the 50 hour point and lubricated if required.

8.9.6.2 The following lubrication points fall into this category:

(1) Cam locks at the seat (9).

(2) Stabilizer pivot points (10).

8.9.7 Crane - Sliding Surface Lubrication

8.9.7.1 Sliding surfaces should be inspected at the 50 hour point and lubricated when required, i.e. difficult to operate or sliding surfaces do not have a complete film of lubricant present.

8.9.7.2 The following lubrication points fall into this category:

(1) Stabilizer legs (11).

(2) Side wear pads (12).

(3) Jib extension wear pads (13).

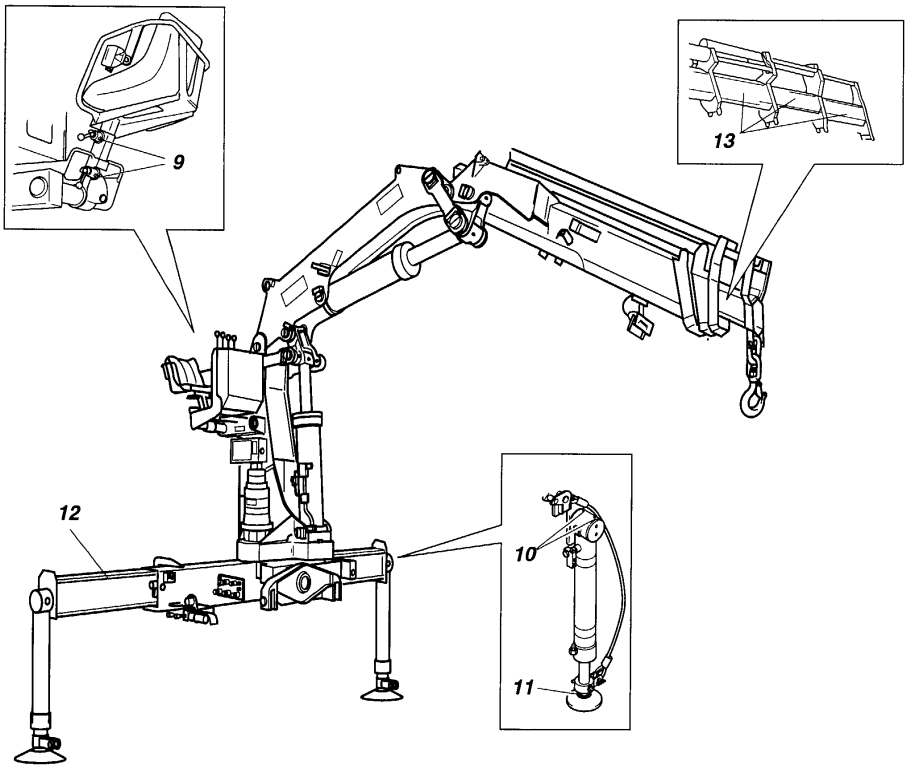


Figure 8.12 Sliding Surface Lubrication Points

8.9.7.3 The procedure for both as necessary lubrication points and sliding surface lubrication is as follows:

(1) Clean the lubrication points thoroughly.

(2) Grease the lubrication points.

8.9.8 Crane - Oil Lubrication as Necessary

8.9.8.1 The crane has three areas that require lubrication with OE HDO-10 general purpose lubrication oil to maintain their efficient operation, they are:

(1) The load hook (14).

(2) The hand lever linkages (15).

(3) The hand lever linkages at the operator seat position (16).

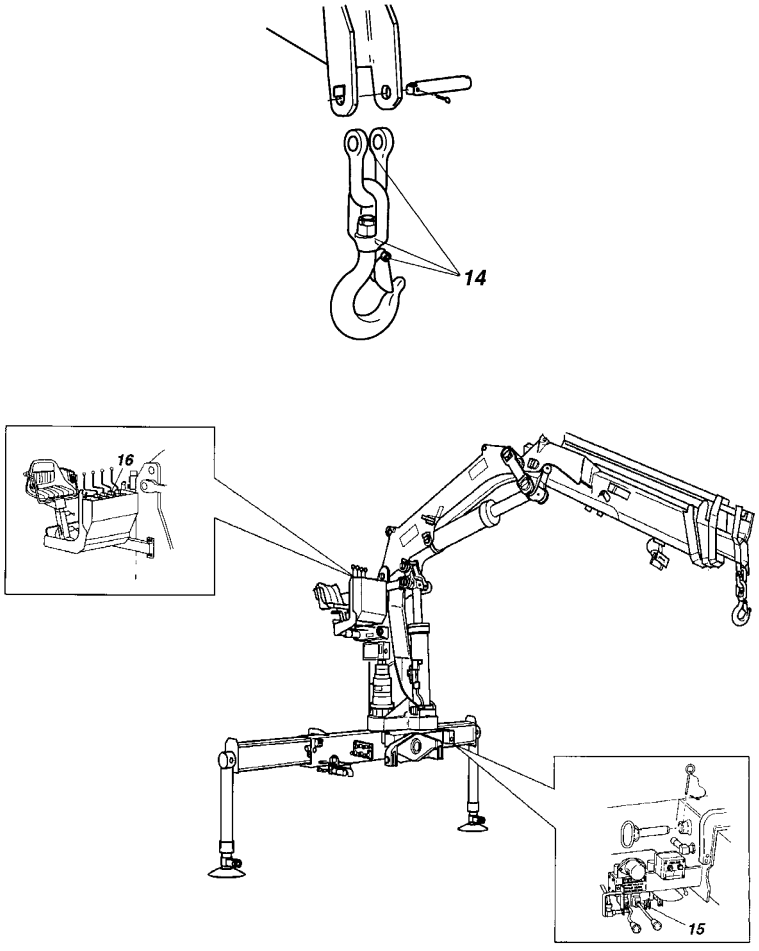


Figure 8.13 Crane Lubrication Points

8.9.8.2 The procedure is as follows:

(1) Clean the lubrication points thoroughly.

(2) Apply oil to the lubrication points.

8.9.8.3 Lubricate with OE HDO-10 general-purpose lubrication oil.

8.9.9 Crane - Checking Oil in Rotate Drive Gear Box

8.9.9.1 Check the oil level in the rotate drive before use of the crane.

8.9.9.2 The hydraulic fluid level must be half way up the inspection glasses (1A) and (2A).

8.9.9.3 To fill gear box reservoir to correct level:

8.9.9.4 Unscrew ventilation screw (1B).

8.9.9.5 Pour oil through ventilation pipe (3B) to half way up sight glass (4B).

8.9.9.6 Clean up any spilt oil.

8.9.9.7 Refit ventilation cap (1B).

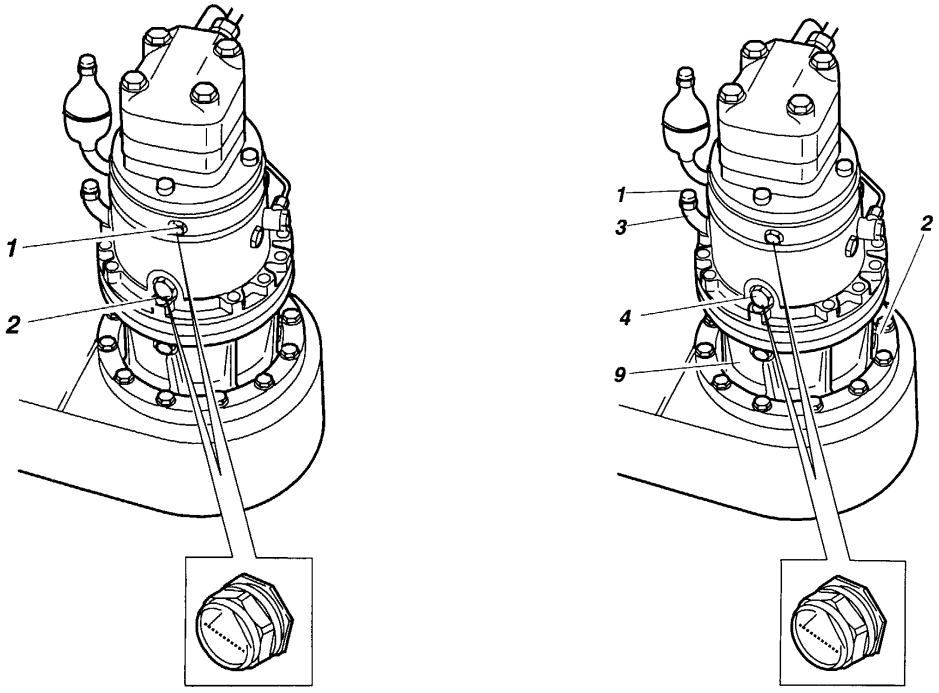


Figure 8.14 Rotate Drive Gearbox Fill Points and Sight Glass

8.9.10 Crane - Checking Oil in Rotate Drive Brake

8.9.10.1 To fill brake reservoir (10) to correct level:

(1) Unscrew ventilation screw (5).

(2) Pour oil through ventilation pipe (7) to half way up sight glass (8).

(3) Clean up any spilt oil.

(4) Refit ventilation cap (5).

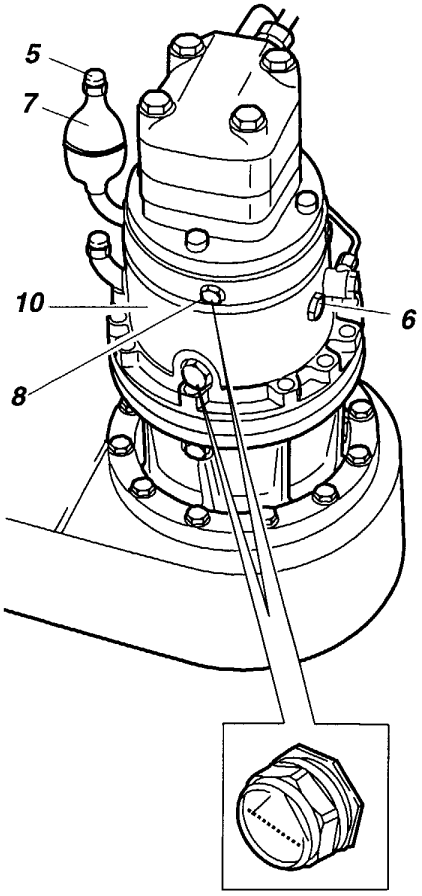


Figure 8.15 Rotate Drive Brake Filler and Sight Glass

8.9.10.2 Transmission oil:

API-GL5

From -10°C to +15°C use SAE 80W W90 MIL-L-2105C

From +5°C to +30°C use SAE 90 or SAE 140 MIL-L-2105B

TABLE OF CONTENTS

CHAPTER 9

FAULT-FINDING AND OPERATOR TROUBLESHOOTING

CHAPTER 9

FAULT-FINDING AND OPERATOR TROUBLESHOOTING

Section I. Interface Enclosure MIMIC

9.1 INTERFACE ENCLOSURE MIMIC

9.1.1 Overview

9.1.1.1 Although the interface enclosure is primarily intended to allow the setting up of the launcher for beam build, the panel also has a MIMIC function. The interface enclosure is mounted on the right side of the vehicle chassis. The enclosure consists of a cabinet with a protecting door. The door offers general impact damage, with the control/MIMIC panel being mounted on the inside case. The door is sealed to offer protection from the external environment.

9.1.1.2 The interface enclosure MIMIC also affects the indications of the launch frame electrical control enclosure major and minor fault lights, these being inter-linked with the FAULT light on the chest pack.

9.1.1.3 describes the captions, their normal state, their functions and what to check should they not be in their normal state.

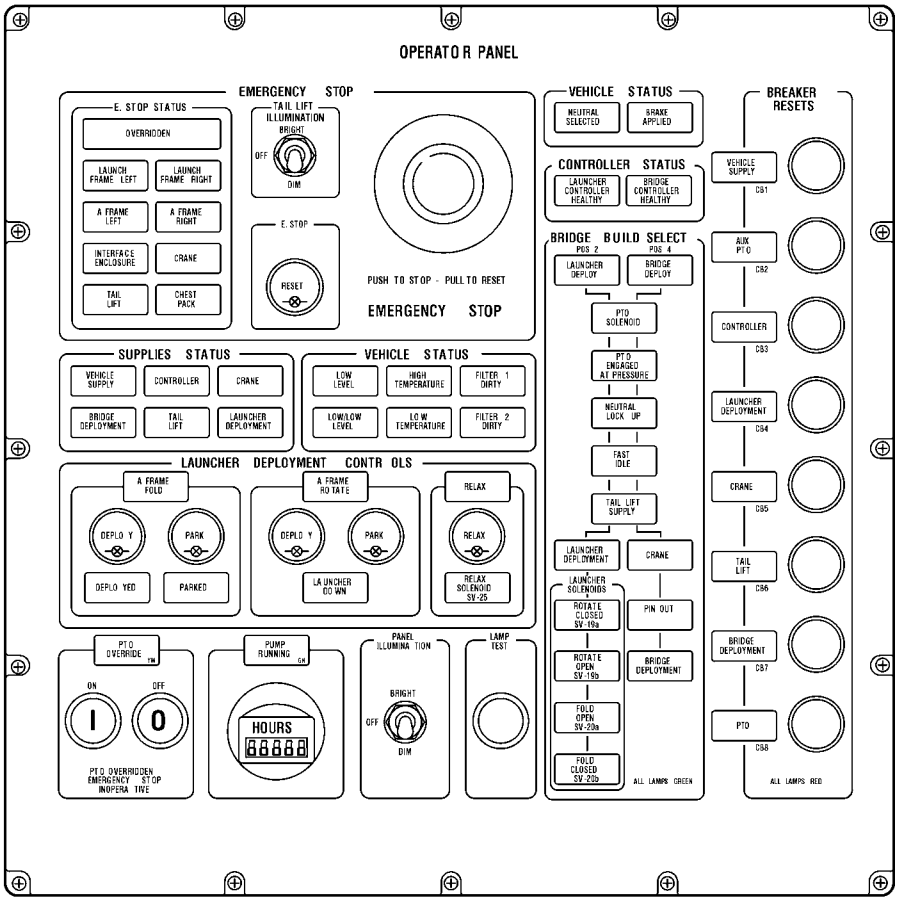


Figure 9. 1 Interface Enclosure

Table 9. 1 Interface Enclosure MIMIC

Indicator	Light Normal Status	Notes	Checks of Non Normal Status
E-Stop Status Sub Panel E-Stop status sub panel indicators only illuminate when relevant E-Stop button is pressed in. **Shuts down launcher and illuminates the MAJOR fault light on in the launch frame electrical control enclosure.**			
Overridden	OFF		E-Stop override in vehicle cab has been engaged. **E-Stop system inoperative**.
Launch Frame Left	OFF		
Launch Frame Right	OFF		
A-frame Left	OFF	When operated hydraulic power is removed from the launcher.	Check indicated E-Stop button is reset to the out position.
A-frame Right	OFF		
Interface Enclosure	OFF		
Crane	OFF		
Tail lift	OFF		
Chest Pack	OFF		
Supplies Status Sub Panel These captions indicate that power is being supplied to the interface enclosure and that the supplies are being distributed through the cabinet.			
Vehicle Supply	ON	**CB1** labeled **VEHICLE SUPPLY**	Ignition switch not on. Check **CB26** (located at upper front of dog box and labeled **24V AUX** in vehicle cab) has not tripped. Reset once, if CB trips again report to maintenance.
Controller	ON	**CB3** labeled **CONTROLLER**	Check **CB3** on interface enclosure. Reset once, if CB trips again report to maintenance.
Crane	ON	CB5 labeled **CRANE**	Check **CB5** on interface enclosure. Reset once, if CB trips again report to maintenance.
Bridge Deployment	ON	**CB7** labeled **CONTROLLER**	Check **CB7** on interface enclosure. Reset once, if CB trips again report to maintenance.
Tail lift	ON	**CB6** labeled **TAIL LIFT**	Check **CB6** on interface enclosure. Reset once, if CB trips again report to maintenance.
Launcher Deployment	ON	CB4 labeled **LAUNCHER DEPLOYMENT**	Check **CB4** on interface enclosure. Reset once, if CB trips again report to maintenance.

continued

Table 9. 1 Interface Enclosure MIMIC (continued)

Indicator	Light Normal Status	Notes	Checks of Non Normal Status
Oil Status Sub Panel (Vehicle Status)			
Low Level	OFF	Illuminates **MINOR** fault light on launch frame electrical control enclosure.	Hydraulic oil reservoir requires filling. Check for leaks on launcher/vehicle.
LOW/LOW Level	OFF	Illuminates **MAJOR** fault light on launch frame electrical control enclosure. Fault shuts down launcher.	Hydraulic oil reservoir requires filling. Check for leaks on launcher/vehicle.
High Temperature	OFF	Illuminates **MINOR** fault light on launch frame electrical control enclosure.	Temperature is more than 158 degrees F (70 degrees C). Stop launch and allow hydraulic oil to return to normal temperature.
Low Temperature	OFF	Illuminates **MINOR** fault light on launch frame electrical control enclosure.	Temperature is less than 32 degrees F (0 degrees C). Operate launcher with care until hydraulic oil warms up.
		Both High Temperature and Low Temperature flash if sensor out of range (broken).	
Filter 1 Dirty	OFF	Illuminates **MINOR** fault light on launch frame electrical control enclosure.	Filter blocked for more than 10 seconds, Continue with launch, replace filter as soon as possible. Cab switch must be in position 2 or 4.
Filter 2 Dirty	OFF	Illuminates **MINOR** fault light on launch frame electrical control enclosure.	Filter blocked for more than 10 seconds, Continue with launch, replace filter as soon as possible. Four position switch in cab at position 2 or 4.
Vehicle Status Sub Panel			
Neutral Selected	ON	Vehicle gear box is set to **NEUTRAL**	Set vehicle gear box to **NEUTRAL**.
Brake Applied	ON	Vehicle parking brake is set to on	Set vehicle parking brake to on.

continued

Table 9. 1 Operators Panel MIMIC (continued)

Indicator	Light Normal Status	Notes	Checks of Non Normal Status
Controller Status Sub Panel			
Launcher Controller Healthy	ON	Interface enclosure controller is functioning correctly.	Fault with interface enclosure controller. Report to maintenance.
Bridge Controller Healthy	ON	Launch frame electrical control enclosure controller is functioning correctly.	Four position switch in cab at position 4 and bridge build select sequence complete. Fault with interface enclosure controller. Report to maintenance.
Launcher Solenoids Sub Panel			
Rotate Closed SV19a	On only when **SV19a** is powered	Illuminates when the A-frame **ROTATE PARK** button is operated.	Check LED on plug of **SV19a** (Refer to Chapter 7 figure 7.15 for location) illuminates when button is pushed, if LED does not illuminate report to maintenance.
Rotate Open SV19b	On only when **SV19b** is powered	Illuminates when the A-frame **ROTATE DEPLOY** button is operated.	Check LED on plug of **SV19b** (Refer to Chapter 7 figure 7.15 for location) illuminates when button is pushed, if LED does not illuminate report to maintenance.
Fold Open SV20a	On only when **SV20a** is powered	Illuminates when the A-frame **FOLD DEPLOY** button is operated.	Check LED on plug of **SV20a** (Refer to Chapter 7 figure 7.14 for location) illuminates when button is pushed, if LED does not illuminate report to maintenance.
Fold Closed SV20b	On only when **SV20b** is powered	Illuminates when the A-frame **FOLD PARK** button is operated.	Check LED on plug of **SV20a** (Refer to Chapter 7 figure 7.14 for location) illuminates when button is pushed, if LED does not illuminate report to maintenance.
Breaker Resets			
Vehicle Supply	OFF	On when CB tripped.	Reset relevant CB **ONCE**, if fault persists (CB trips again) report to maintenance.
AUX PTO	OFF	On when CB tripped.	
Controller	OFF	On when CB tripped.	
Launcher Deployment	OFF	On when CB tripped.	
Crane	OFF	On when CB tripped.	

continued

Table 9. 1 Operators Panel MIMIC (continued)

Indicator	Light Normal Status	Notes	Checks of Non Normal Status
Breaker Resets (continued)			
Tail lift	OFF	On when CB tripped.	
Bridge Deployment	OFF	On when CB tripped.	
PTO	OFF	On when CB tripped.	
Bridge Build Select Sub Panel			
Launcher Deploy	ON	Only after four position switch in cab is in position 2 and A-frame is deployed.	Check the four position switch in cab is in position 2.
PTO Solenoid	ON	Only as part of Programmable Logic Controller (PLC) setup after four position switch in cab is in position 2 and tail lift pendant is connected.	Check the four position switch in cab is in position 2. Check the tail lift hand set is connected. Internal fault in interface enclosure report to maintenance.
PTO Engaged And At Pressure	ON	On when PTO engages and hydraulic pump is producing pressure.	Fault with the PTO hydraulic pump pressure switch report to maintenance.
Neutral Lock Up	ON	Vehicle gearbox is set to neutral lockup.	Fault with interface enclosure controller or vehicle ATEC shift control unit. Report to maintenance.
Fast Idle	ON	Vehicle engine is set to fast idle.	Fault with interface enclosure controller or vehicle ATEC shift control unit. Report to maintenance.
Tail lift Supply	ON	PLC in Operators Cabinet has made power available to the tail lift.	Fault with interface enclosure controller. Report to maintenance.
Launcher Deployment	ON	Power has been made available to operate the A-frame fold and rotate functions.	Rotate pins not in correct position. Fault with interface enclosure controller. Report to maintenance.

continued

Table 9. 1 Interface Enclosure mimic (continued)

Indicator	Light Normal Status	Notes	Checks of Non Normal Status.
Bridge Build Select Sub Panel Continued			
Bridge Deploy	ON	Only after A-frame is deployed, four position switch in cab is in position 4, chest pack is connected and relax pins are out.	Deploy A-frame. Is the four position switch in vehicle cab set to position 4? Is the chest pack connected? Are the RELAX pins are out? Fault with interface enclosure controller. Report to maintenance.
Crane	ON	Only after A-frame is deployed, four position switch in cab is in position 4, chest pack is connected and relax pins are out.	Deploy A-frame. Is the four position switch in vehicle cab set to position 4? Is the chest pack connected? Are the RELAX pins are out? Fault with interface enclosure controller. Report to maintenance.
Pin Out	ON	RELAX Pins withdrawn from RELAX mechanism.	Withdraw the RELAX Pins. Fault with interface enclosure controller. Report to maintenance.
Bridge Deployment	ON	Power available to solenoids controlled by launcher interface cabinet.	Is power available? Fault with interface enclosure controller. Report to maintenance.

Section II. LAUNCH FRAME ELECTRICAL CONTROL ENCLOSURE MIMIC PANEL

9.2 LAUNCH FRAME ELECTRICAL CONTROL ENCLOSURE MIMIC PANEL OPERATION

9.2.1 Overview

9.2.1.1 The launch frame electrical control enclosure MIMIC panel is designed to assist in fault finding the launcher electro-hydraulic system and is an integral part of the launcher control cabinet. The control cabinet is located on the side of the launch frame and consists of a cabinet with a protective door. The door offers general impact damage, with the MIMIC panel being mounted on the inside case. The door is sealed to offer protection from the external environment.

9.2.1.2 The MIMIC panel has been designed to visually display which of the solenoids are activated during any stage of the bridge build, and which are activated at that stage. This indication is then used to quickly narrow down the identification of any fault to within a particular circuit or to differentiate whether the fault is electrical or hydraulic.

9.2.2 Description of MIMIC Panel

9.2.2.1 The MIMIC panel consists of a matrix chart, which cross-references the bridge build sequence when the required controlling solenoids are energized. Two arrays of LEDs are used to indicate which solenoids are being energized during a particular stage in the build sequence. The matrix itself indicating which of the solenoids should be activated at each stage. The bridge build sequence mode being a direct reflection of the current selection on the chest pack. The four and two direction arrows at the bottom of the MIMIC panel reflect the direction the chest pack right and left hand joysticks are being moved in.

9.2.2.2 Two different states of solenoid operation exist for each bridge build sequence. The initial stage occurs when the joystick is in its central position. The MIMIC panel will display the solenoids, which are being energized prior to the commencement of any component movement. The second stage occurs once the joystick is moved either forwards or rearward. The display will change to reflect which solenoids are being activated during component movement.

9.2.2.3 Along the top edge of the MIMIC panel there are four groups of LEDs, which display the supply status, launch controller signals, chest pack signals and the condition of the interface enclosure signal.

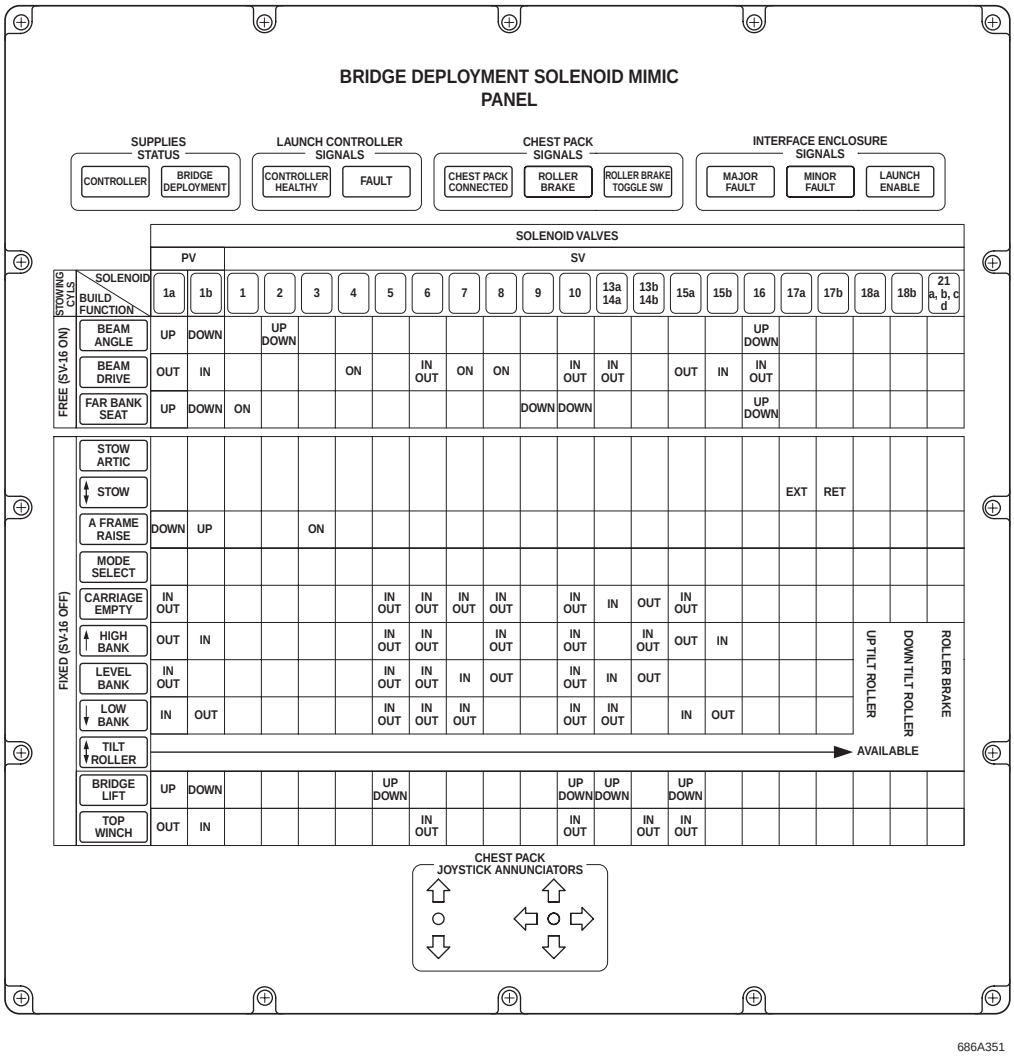


Figure 9. 2 Launch Frame Electrical Control Enclosure MIMIC Panel

9.2.3 Immediate Checks

9.2.3.1 If a system fault occurs or the system stops operating for no obvious reason, check that one of the emergency stop buttons has not been pressed by interrogating the Interface Enclosure situated on the right hand side of the vehicle. If an emergency stop button has been pressed accidentally then the system can be reset.

9.2.3.2 If no emergency stops have been activated then check that the limit switches have made the correct contacts for the current stage in the build sequence. This can be determined from the Interface Enclosure.

9.2.3.3 Check that the **LOW LOW OIL** level indicator has not illuminated and that the controller healthy light is illuminated. The **LOW LOW OIL** warning will shut down the PTO automatically. This is also checked from the interface enclosure.

9.2.3.4 If none of the above quick checks indicate a system fault then the launch frame electrical control enclosure MIMIC panel should be referred to.

9.3 MIMIC PANEL ANALYSIS

9.3.1 System Indicators

9.3.1.1 The operator first opens the outside door of the launch frame electrical control enclosure, thus revealing the MIMIC panel. Opening the outer door still maintains the environmental integrity of the cabinet.

9.3.1.2 With the chest pack connected and switched on check the status of the top row of system indicator lights.

Table 9. 2 Launch Frame Electrical Control Enclosure MIMIC Panel; Indicator lights

Indicator	Light Normal Status	Notes	Checks of Non Normal Status
Controller	ON	Permanent 24vDC controller supply from interface enclosure active. The annunciator should be lit at all times the vehicle ignition is active.	Ignition on. Cab breaker 50 Amp set. interface enclosure breaker 45 Amp **CB-1** set. Check that the interface enclosure breaker control supply 4 Amp **CB-3** is set. All Connectors are made correctly.
Bridge Deployment	ON	Switched 24vDC supply from interface enclosure that supplies the solenoids directly associated with bridge deployment. This supply is only active if the normal startup criteria for bridge deployment have been met.	Ignition on. Vehicle in NEUTRAL. Parking brake applied. E stop reset. All circuit breakers set (breaker critical for startup 50A cab, 45A **CB-1**, 4A **CB-3** and 15A **CB-7**). Cab rotary switch in position 4. Launch frame is folded open (**LS-02**, **LS04** both active). Launch frame is rotated upright (**LS-05** not active). Both relax pins lifted and rotated (**LS-06**, **LS07** both active).
Controller Healthy	ON	Confirms that the PLC controller is serviceable.	Internal PLC checks only. Replace PLC.

continued

Table 9. 2 Launch Frame Electrical Control Enclosure MIMIC Panel; Indicator lights (continued)

Indicator	Light Normal Status	Notes	Checks of Non Normal Status
Fault	OFF	Indicates a fault signal from the Hydraulic System. This is the same signal as Check Pack “Fault” light.	The top winch cable has become slack and the top winch tension indicator has operated, signified by the TOP WINCH and the FAULT light flashing. This indication only operates when build mode is in HIGH BANK. Can be cleared by operating chest pack right hand joystick rearward to re-tension the top winch cable. Chest Pack Joystick Failure i.e. Track Down or out of range. A communications fault is briefly indicated (2-3 seconds) on initial power up while the controller sets up and establishes communication with both expansion modules (this is normal). A System Fault identified on Interface Cabinet Panel. Minor Fault – Light Flashes 4 times a second. Check Oil Filters Check Low Oil Level Check High Temp Oil Check Low Temp Oil Major Fault – Light Continuously ON PTO will cut out and can only be caused by dangerously low oil level – Low-Low Oil Level. See Faults as detailed below.

continued

Table 9. 2 Launch Frame Electrical Control Enclosure MIMIC Panel; Indicator lights (continued)

Indicator	Light Normal Status	Notes	Checks of Non Normal Status
Chest Pack On	ON	The launcher controller has detected at least one of the three joystick output signals within normal operating range.	Make sure the chest pack is connected. Make sure the chest pack On / Dim / Off switch is in On or Dim. **NOTE** **If the chest pack On / Dim / Off switch is in the OFF position all chest pack lights are switched off.**
Roller Brake	OFF	Illuminated constantly if the roller brake toggle switch is in its center position (roller brake on). However, the annunciator will flash (along with tilt roller) if the operator steps from mode select into build mode with the roller brake toggle switch NOT centered (roller brake off). This acts as a warning to the operator that the roller brakes are not applied. The tilt roller joystick function is also disabled until the roller brake toggle switch has been centered and the brakes applied at least once (at which point both annunciators will illuminate continuously).	Indication only.
Roller Brake Toggle switch	OFF	This annunciator is fed directly from the chest packs roller brake toggle switch and as such provides indication of its status. The annunciator will illuminate when the switch is in either of its OFF positions (not centered).	Indication only.

continued

Table 9. 2 Launch Frame Electrical Control Enclosure MIMIC Panel; Indicator lights (continued)

Indicator	Light Normal Status	Notes	Checks of Non Normal Status
Major Fault	OFF	Indicates a **MAJOR** fault with the launcher.	**LOW / LOW** oil level signal (active low alarm) in alarm condition for a continuous period more than 5 seconds. One or more E-stop buttons have been depressed or the E-stop relay has not been reset (requires resetting after vehicle ignition applied or after an E-stop button has been depressed). A communications fault has been detected with one of the two interface enclosure 8 channel output expansion modules. Typical reason for a communications error would be a failure of the respective module. **NOTE** **A communications fault is briefly indicated (2-3 seconds) on initial power up while the controller sets up and establishes communication with both expansion modules (this is normal).** The top winch cable has become slack and the top winch tension indicator has operated, signified by the **TOP WINCH** and the **FAULT** light flashing. This indication only operates when build mode is in **HIGH BANK**. Can be cleared by operating chest pack right hand joystick rearward to re-tension the top winch cable.

continued

Table 9. 2 Launch Frame Electrical Control Enclosure MIMIC Panel; Indicator lights (continued)

Indicator	Light Normal Status	Notes	Checks of Non Normal Status
Minor Fault	OFF	Indicates a **MINOR** fault with the launcher.	**LOW OIL** level signal in an alarm condition for a continuous period for more than 5 seconds. **OIL TEMP** sensor alarm, sensor signal out of normal operating range of less than 4mA or more than 20mA for a continuous period of more than 1 second. **OIL TEMP** sensor indicating an oil temp of more than 158 degrees Fahrenheit (70 degrees centigrade). **OIL TEMP** sensor indicating and oil temp of less than 32 degrees Fahrenheit (0 degrees centigrade). **FILTER 1** differential pressure switch in an alarm condition for a continuous period of more than 5 seconds (cab switch must be in position 2 or 4). **FILTER 2** differential pressure switch in an alarm condition for a continuous period of more than 5 seconds (cab switch must be in position 2 or 4).

continued

Table 9. 2 Launch Frame Electrical Control Enclosure MIMIC Panel; Indicator lights (continued)

Indicator	Light Normal Status	Notes	Checks of Non Normal Status
Minor Fault continued	Off	**Slow flash** (1 flash/second) - launcher controller has detected a minor fault from the interface enclosure as defined above. **Fast flash** (4 flashes/second) - a communications fault has been detected with one of the two interface enclosure 8 channel output expansion modules (and minor fault is not present). Typical reason for a communications error would be a failure of the respective module. A communications fault is briefly indicated (2-3 seconds) on initial power up while the controller sets up and establishes communication with both expansion modules (this is normal). **Constant** - launcher controller has detected a major fault from the interface enclosure as defined above or a joystick failure has been detected. One or more of the three analogue signals associated with the two joysticks is out of normal operating range (less than 2mA or more than 20.4mA).	System fault identified on interface enclosure. **MINOR** fault - light flashes. Check oil filters. Check low oil level. Check high temp oil. Check low temp oil. **MAJOR** fault - light continuously on. PTO will cut out and can only be caused by dangerously low oil level – **LOW/LOW** oil level.
Launch Enable	N/A	Not connected.	Function duplicated by bridge deployment annunciator. **NOTE** **Will illuminate on lights test.**

9.3.2 Launch Frame Electrical Control Enclosure MIMIC Panel Grid

9.3.2.1 Looking at the MIMIC panel as the chest pack is cycled through the functions, the lights in the LEFT hand column of the grid will each illuminate in turn reflecting the condition of the lights on the chest pack.

9.3.2.2 Using the chest pack select the build sequence at which the fault is evident. This selection should be echoed on the LEFT hand column of the MIMIC grid.

9.3.2.3 Following the horizontal row associated with this function look at the cells that contain a legend (see Table 9.3). The legend within each cell indicates that the solenoid named on the top row directly above the cell should be activated during one of several states.

9.3.2.4 For a particular function solenoids can be activated at different times, therefore the legend refers to the state during which the solenoid is active.

Table 9.3 Legend/Meaning

Legend	Notes
ON	This indicates that the solenoid is energized whenever the function is selected.
IN/OUT	This indicates that the solenoid is energized only when the joystick is operating.
IN	This indicates that the solenoid is energized only when the joystick is operated to give the IN function.
OUT	This indicates that the solenoid is energized only when the joystick is operated to give the OUT function.
DOWN	This indicates that the solenoid is energized only when the joystick is operated to give the DOWN function.
UP	This indicates that the solenoid is energized only when the joystick is operated to give the UP function.

NOTE

All the Solenoid valve (SV) LEDs are either On/Off.

9.3.2.5 The proportional solenoids (PV), PV01a and PV01b are illuminated to a level which approximates to the strength of signal applied. The higher the signal applied to the proportional solenoid the faster the function will operate and the brighter the light will glow. The signal varying with the amount of joystick movement from center.

NOTE

In the non-operated condition, the two lights PV01a and PV01b may glow slightly. This is caused by a low pilot current feeding the solenoids to give smooth operation. When either one of the solenoids is energized the light increases in brightness for one and the other light will go out.

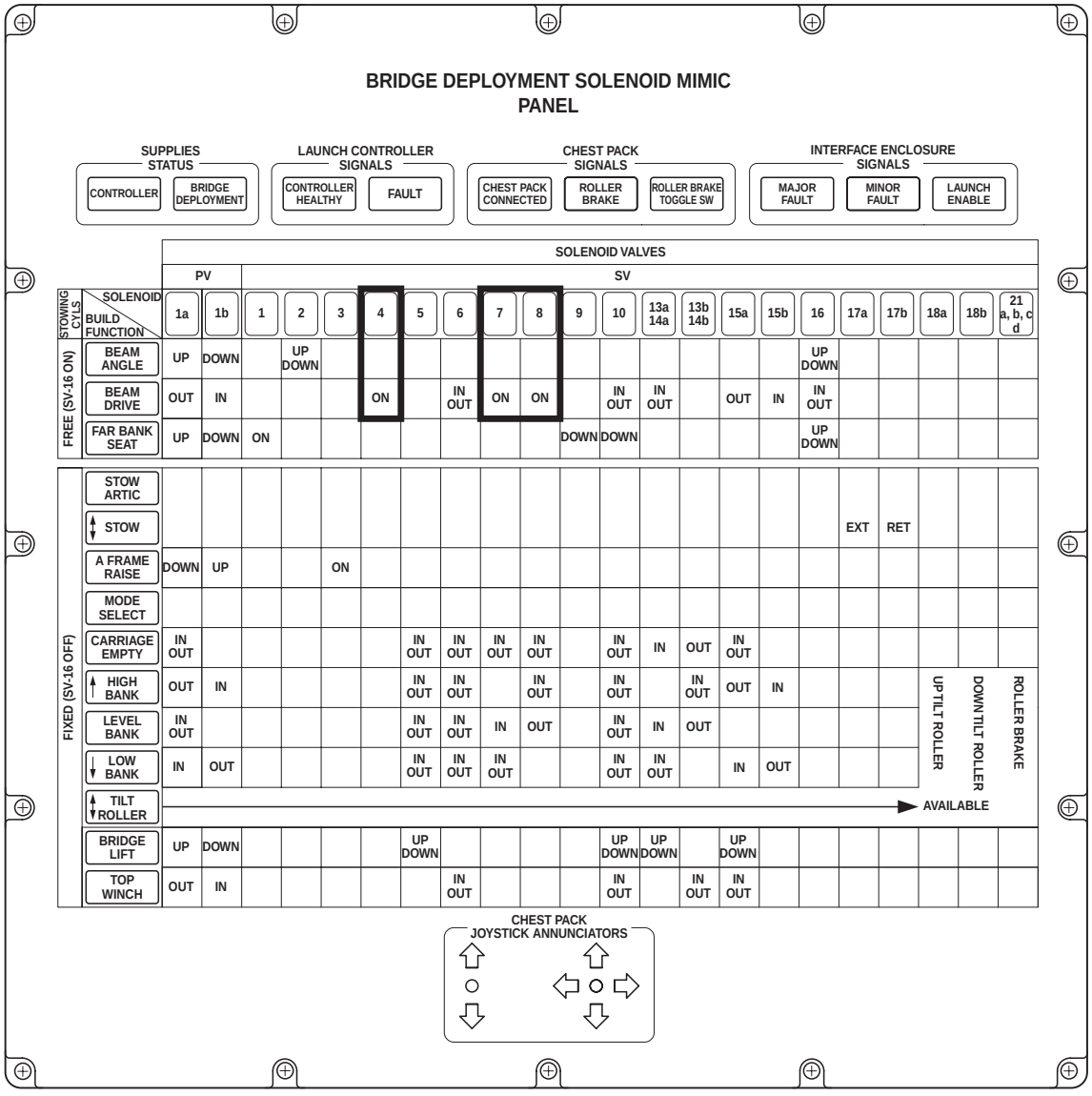
9.3.3 Fault Finding Example for Beam Drive

9.3.3.1 Select BEAM DRIVE on the chest pack.

9.3.3.2 Check that BEAM DRIVE illuminates on the LEFT hand column of the launch frame electrical control enclosure MIMIC grid.

9.3.3.3 Follow the horizontal line and note which solenoids should be active and when.

9.3.3.4 With the joystick in the central position only SV4, SV7 and SV8 should be lit.



686A351a

9.3.3.5 When the joystick is moved to drive the beam **OUT** the following solenoids will light: SV4, SV6, SV7, SV8, SV10, SV13a, SV14a, SV15a and SV16.

9.3.3.6 When the joystick is moved to drive the beam **IN** the following solenoids will light: SV4, SV6,SV7, SV8, SV10, SV13a, SV14a, SV15b and SV16.

9.3.3.7 If any one of the above LEDs fails to illuminate then either the LED is broken or an internal problem exists in the control cabinet. This may be either in the wiring or the PLC itself.

9.3.3.8 To check that the LED on the launch frame electrical control enclosure MIMIC panel is not faulty operate the lights test switch on the **Interface Enclosure**. If all the LEDs on the launch frame electrical control enclosure MIMIC panel function as described on the MIMIC panel grid then check that, the LEDs on the actual plugs for each solenoid are working.

WARNING

CRUSH HAZARD. BEFORE CARRYING OUT TROUBLESHOOTING INVOLVING SV10, A SUSPENDED OR PART BUILT BRIDGE MUST BE MADE SAFE EITHER BY COMPLETING THE BUILD OPERATIONS IN BACK-UP MODE OR BY RETRIEVING THE BRIDGE. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE DEATH OR SEVERE INJURY TO PERSONNEL.

CRUSH HAZARD. A SUSPENDED BRIDGE WILL MOVE IF SV10 IS MANUALLY OPERATED AND THE CHEST PACK RIGHT-HAND JOYSTICK IS MOVED FROM THE CENTRAL POSITION CAUSING ACTIVATION OF OTHER SOLENOID VALVES. FAILURE TO HEED THIS INSTRUCTION COULD CAUSE DEATH OR SEVERE INJURY TO PERSONNEL.

9.3.3.9 Identify the actual solenoid in question and check that the LED within the connector is functioning. If the LED is illuminated on the solenoid valve connector, then the problem is likely to be within the solenoid itself or the valve block. To operate the valve manually, refer to Back up Mode (Chapter 7) and set the valves as described for the current function and operate the system. If the system works correctly then the solenoid itself may be faulty or the valve may be seized.

9.3.3.10 If the LED is not illuminated then the fault is likely to lie within the cabling between the control cabinet and the solenoid or within the plug itself. To operate the valves manually refer to Back up Mode (Chapter 7) and set the valves as described for the current function and operate the system.

NOTE

The tilt roller, stow functions and roller brakes work independently of the main joystick. The operation is only available at certain functions, and the solenoids only function when the joystick on the left of the chest pack is operated.

Section III. OPERATOR TROUBLESHOOTING

9.4 OPERATOR TROUBLESHOOTING

9.4.1 Troubleshooting

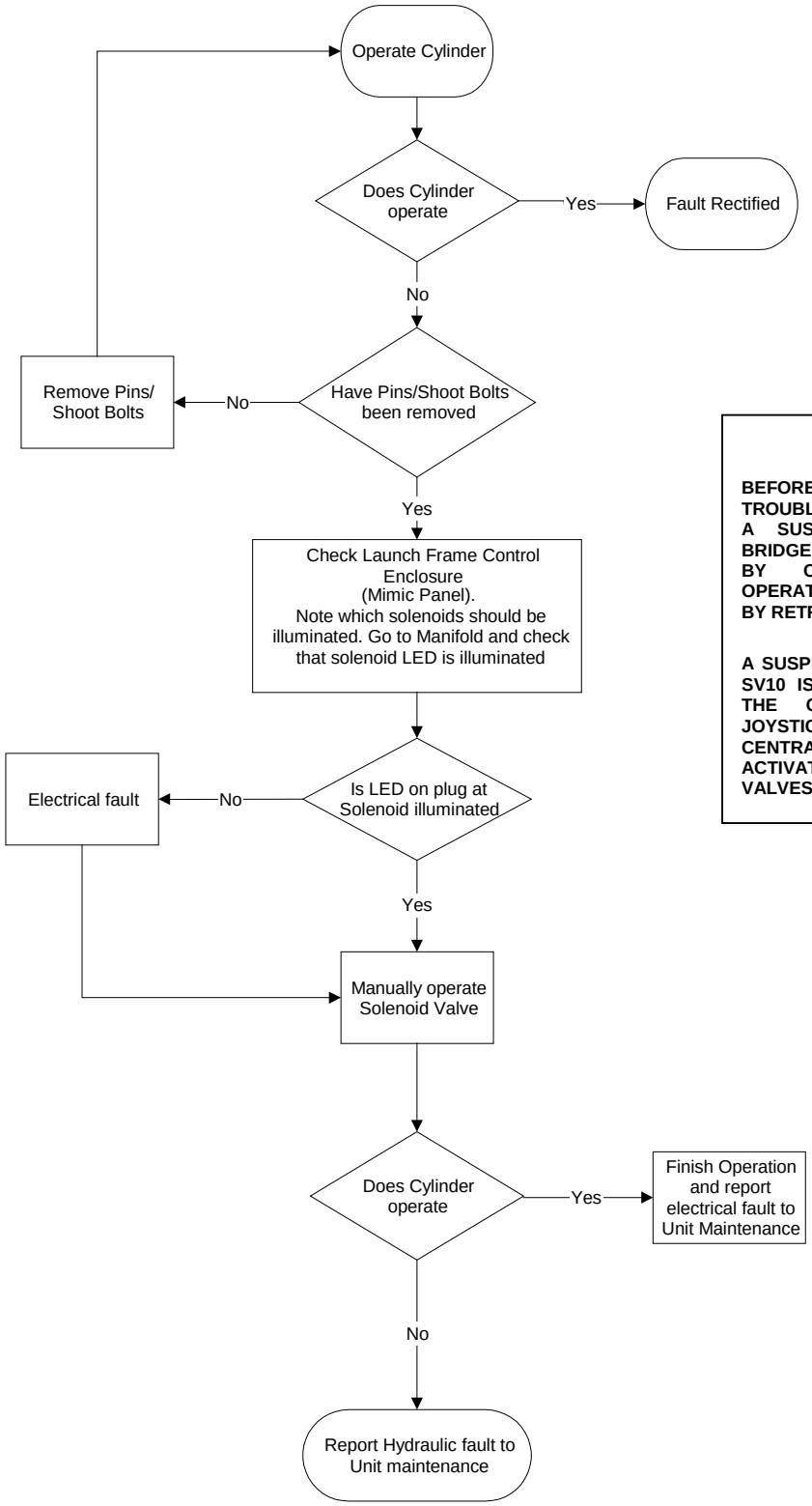
9.4.1.1 This section provides inspection and rectification information to enable the user to accurately diagnose the cause of malfunctions, which may occur during the deployment and retrieval procedures, and the remedial actions necessary to rectify these faults.

9.4.1.2 The following flow diagrams and text enable the operator to diagnose and rectify defects within the capabilities of the user.

NOTE

“Bridge module” refers to both the parallel module and the ramp module, as the faults that can occur on these units are common to both modules.

9.4.2 TS 001 - Hydraulic System

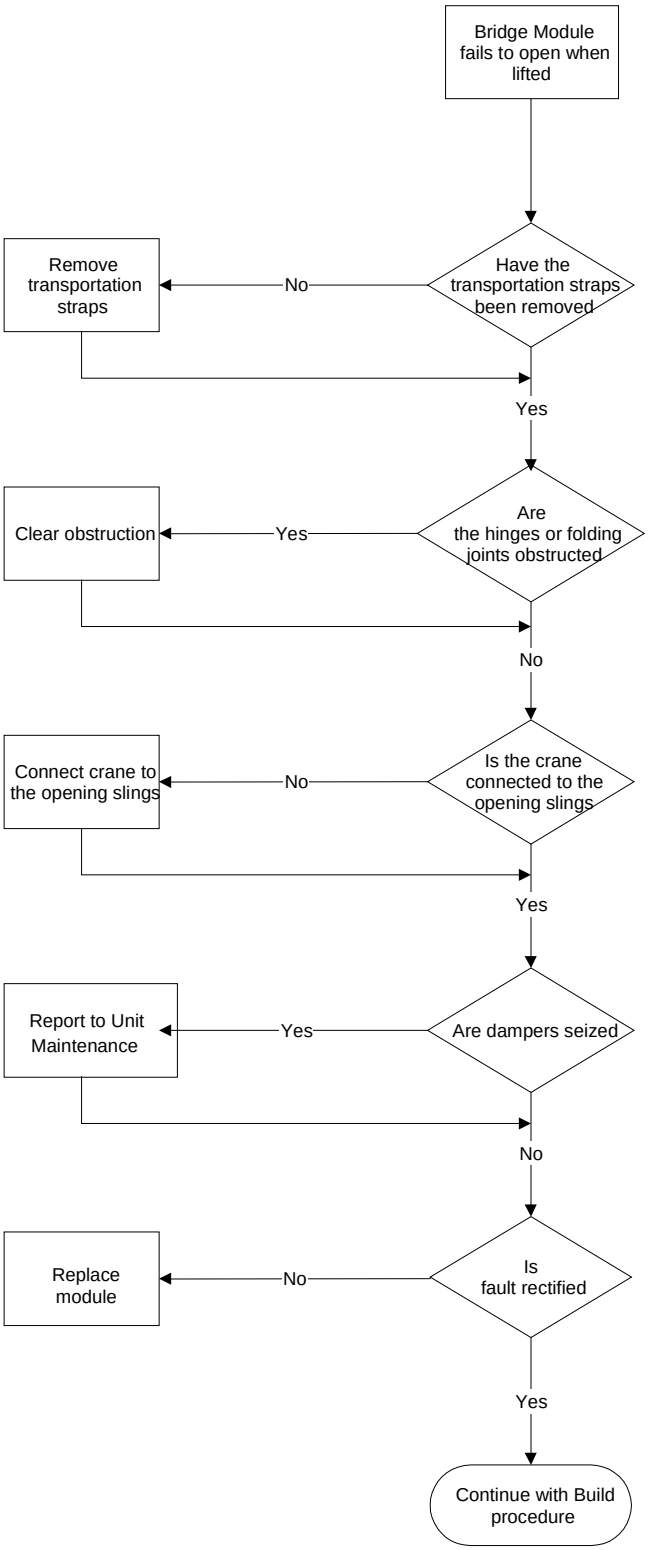


WARNING

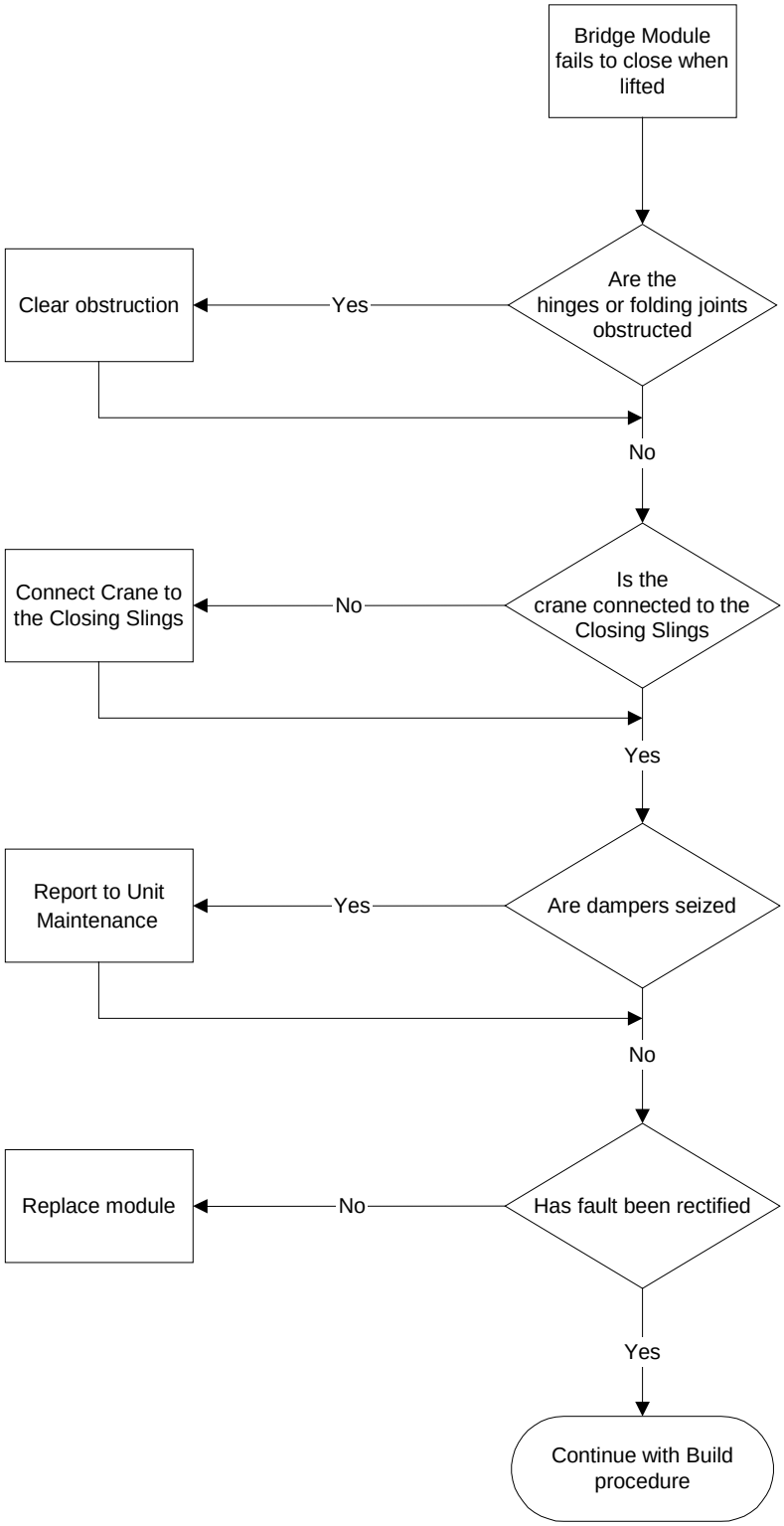
BEFORE CARRYING OUT TROUBLESHOOTING INVOLVING SV10, A SUSPENDED OR PART BUILT BRIDGE MUST BE MADE SAFE EITHER BY COMPLETING THE BUILD OPERATIONS IN BACK-UP MODE OR BY RETRIEVING THE BRIDGE.

A SUSPENDED BRIDGE WILL MOVE IF SV10 IS MANUALLY OPERATED AND THE CHEST PACK RIGHT-HAND JOYSTICK IS MOVED FROM THE CENTRAL POSITION CAUSING ACTIVATION OF OTHER SOLENOID VALVES.

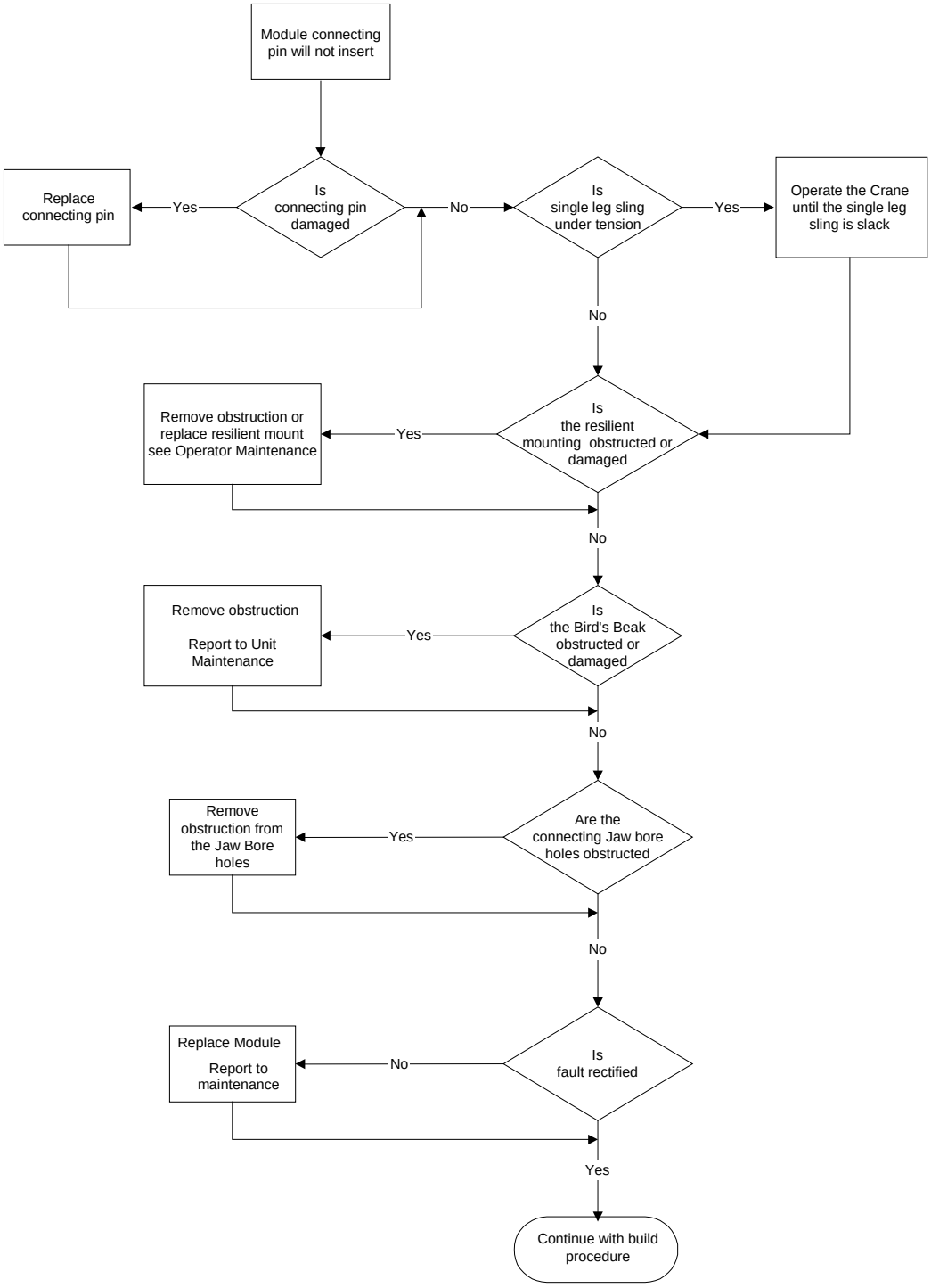
9.4.3 TS 002 - Bridge Module Fails To Open



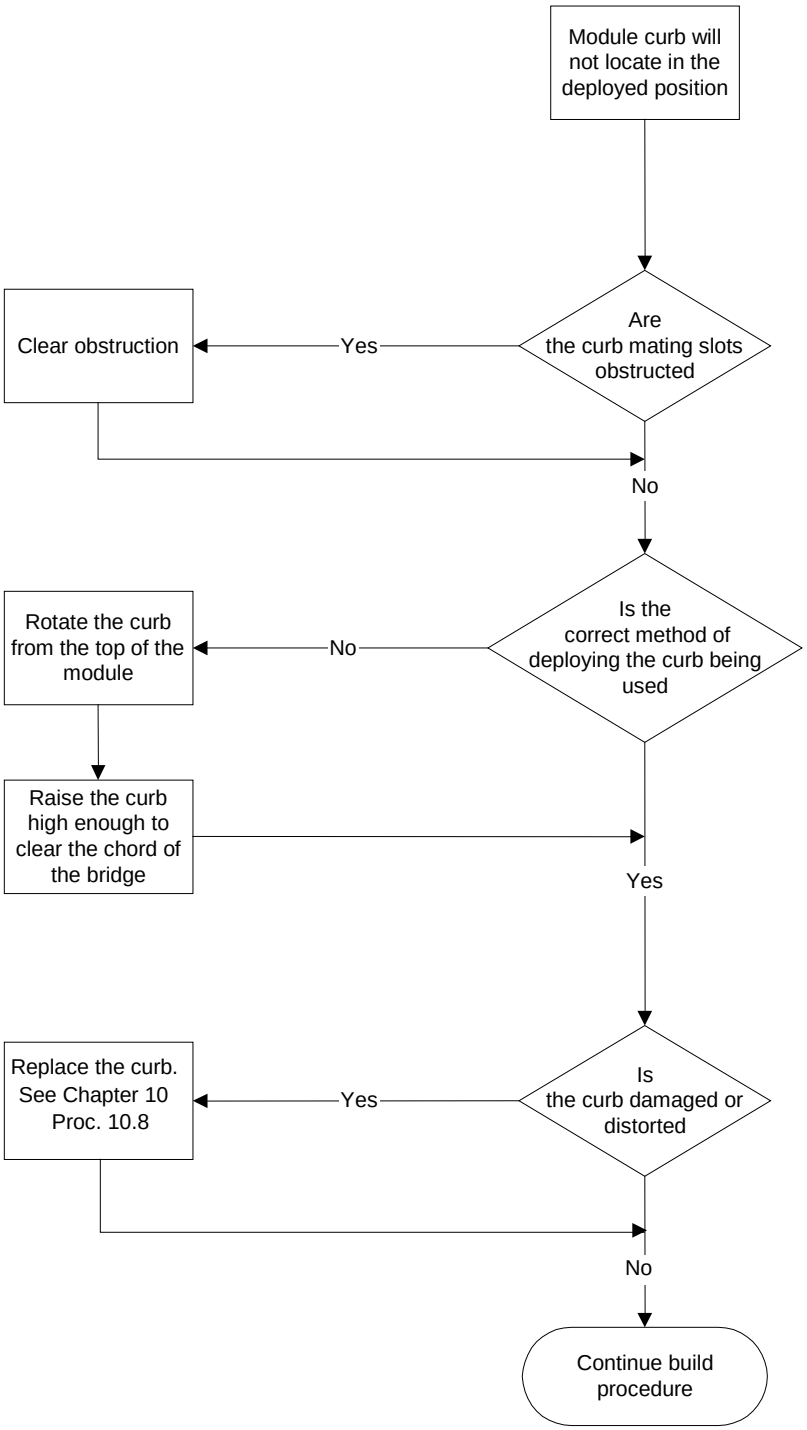
9.4.4 TS 003 - Bridge Module Fails To Close



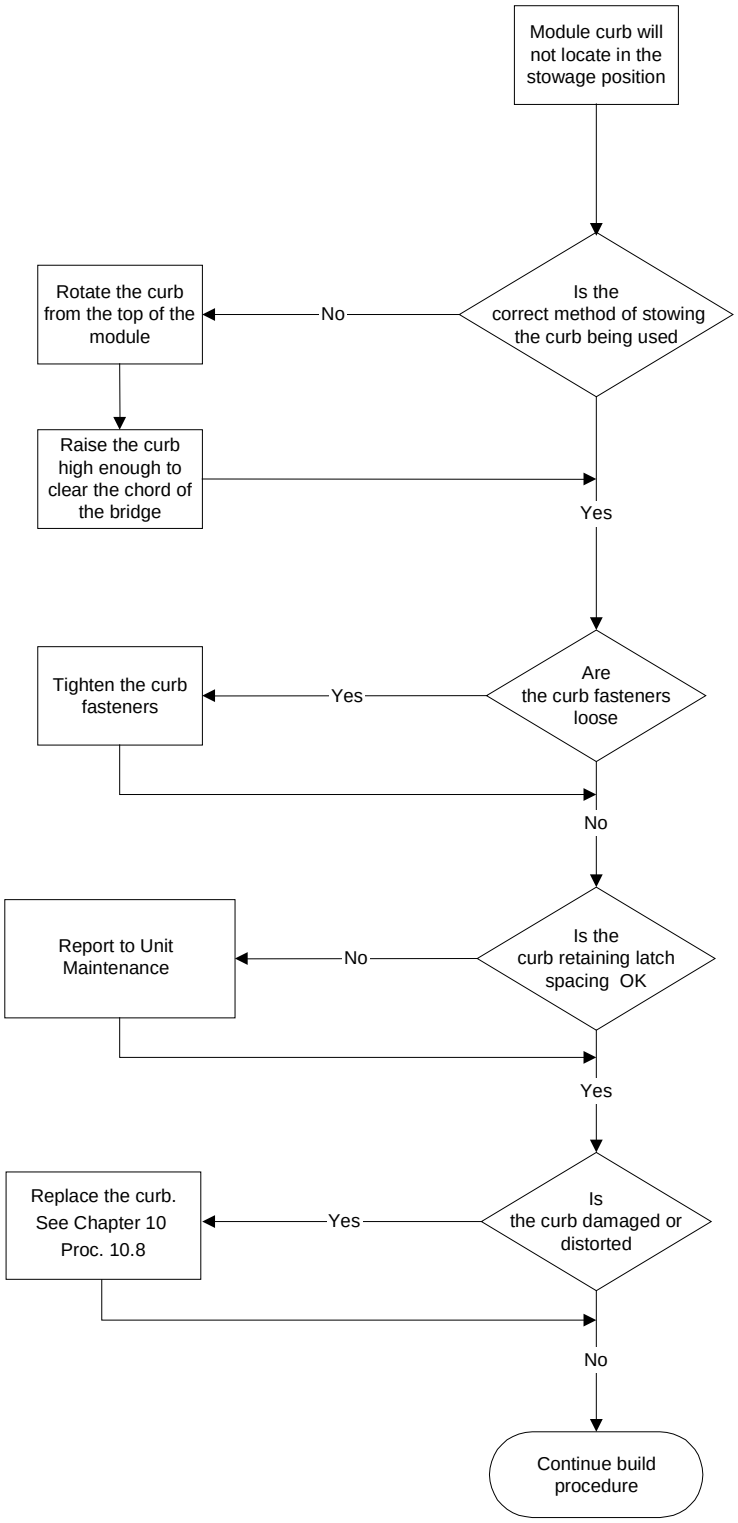
9.4.5 TS 004 - Bridge Module Connecting Pin Will Not Engage



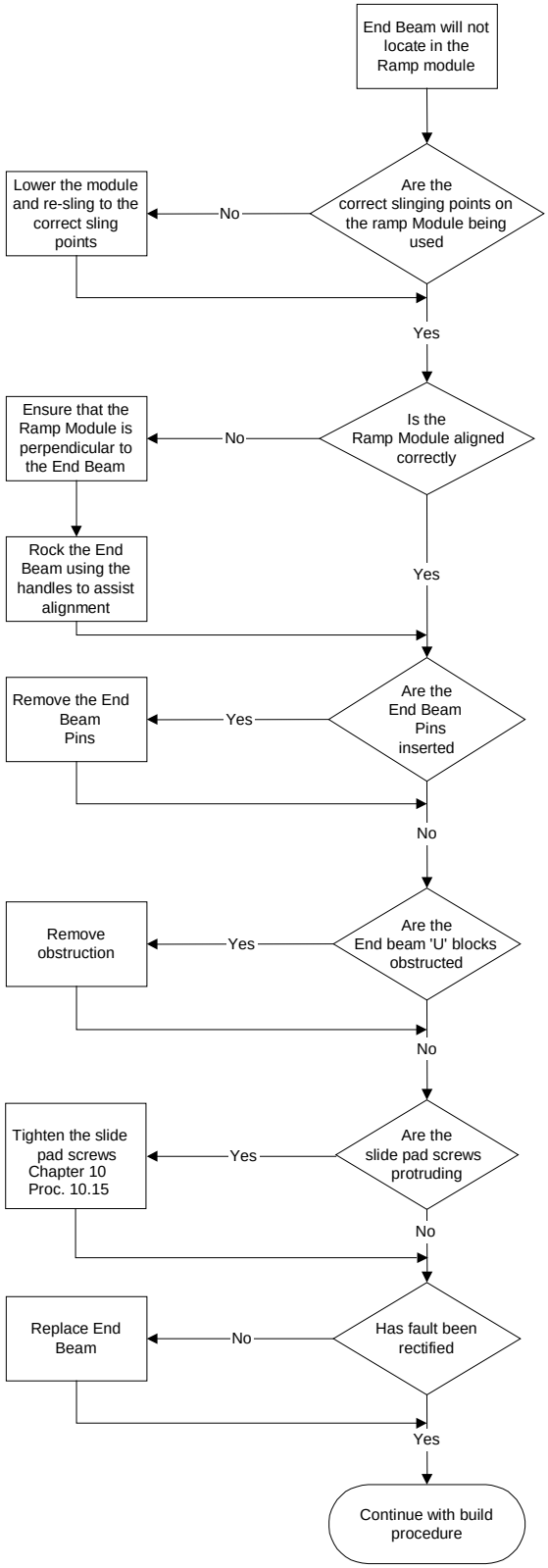
9.4.6 TS 005 - Bridge Module Curb Will Not Locate In Position



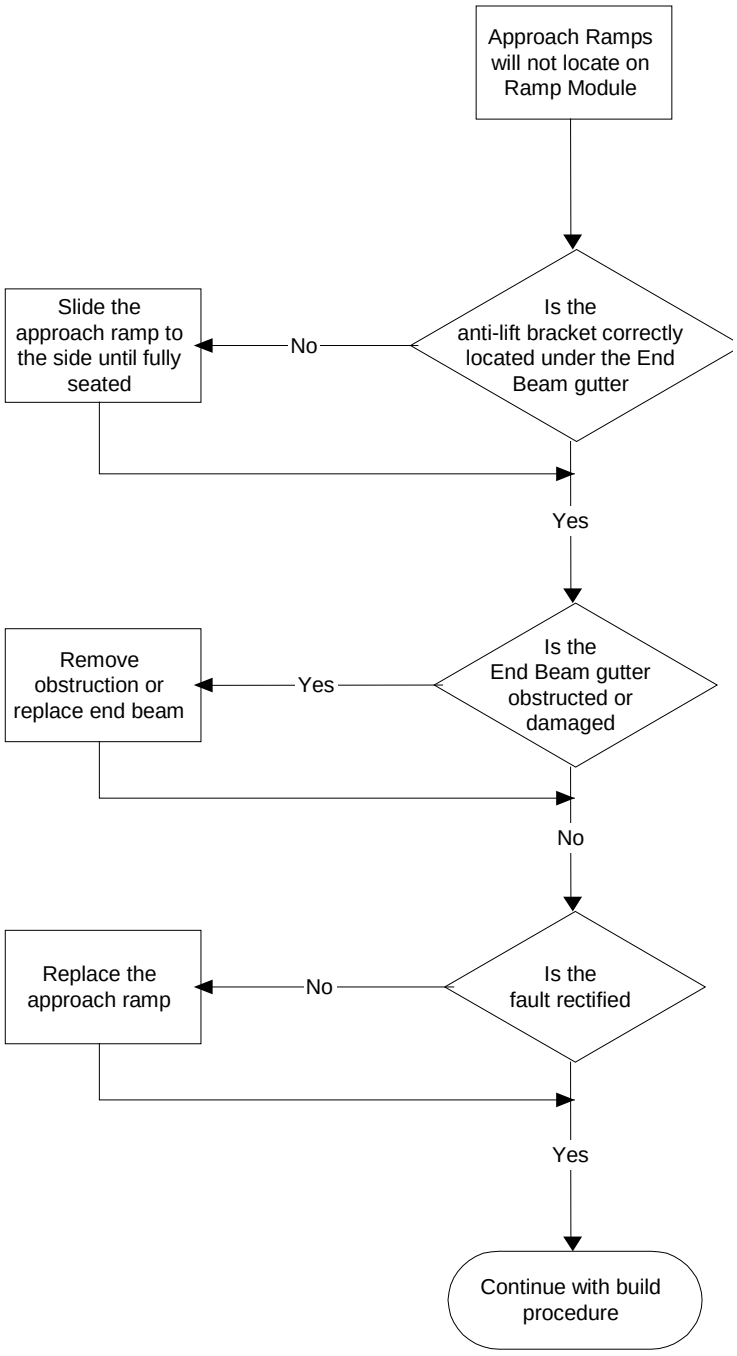
9.4.7 TS 006 - Bridge Module Curb Will Not Locate In Stowage Position



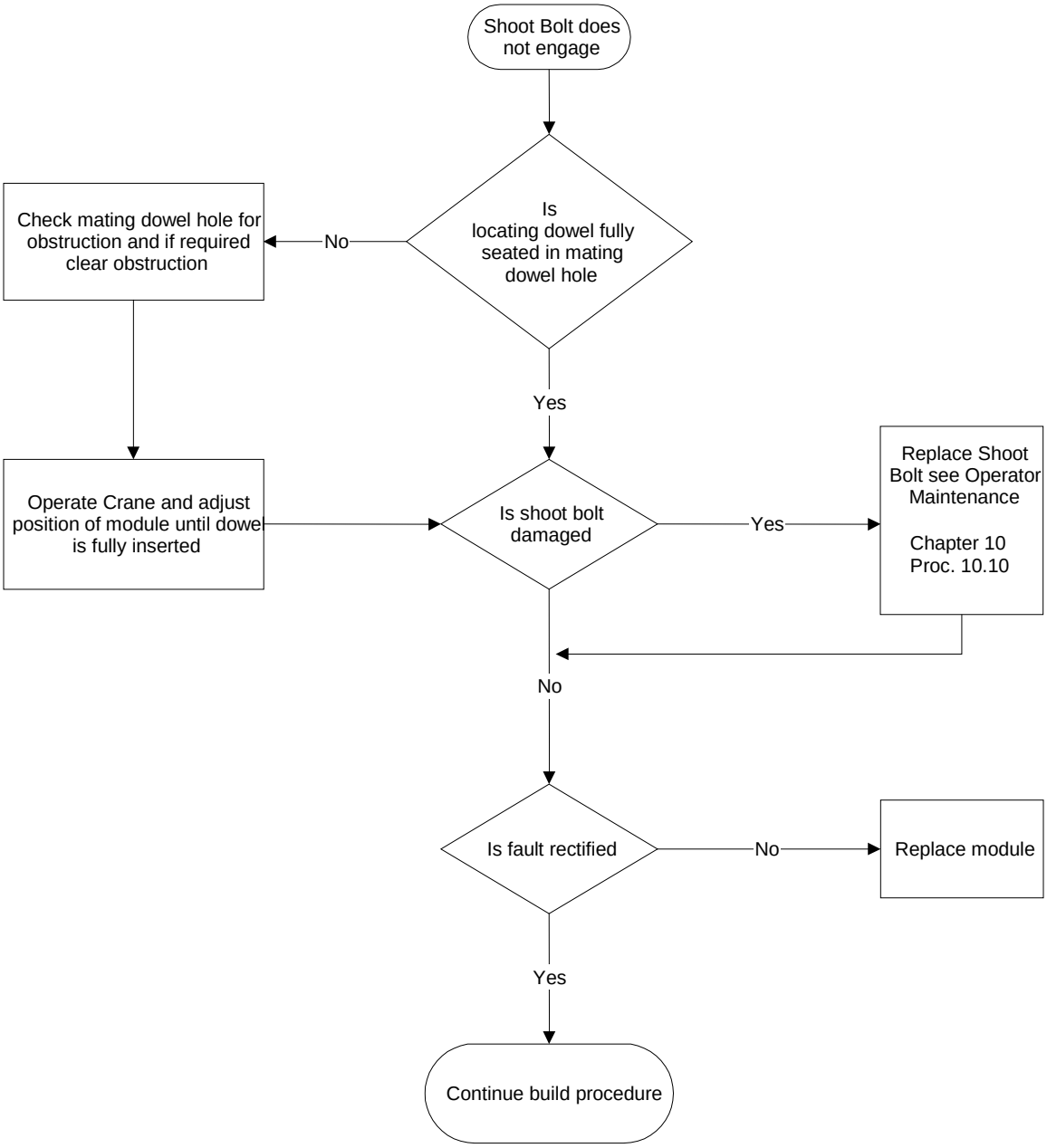
9.4.8 TS 007 - Ramp Module - End Beam Will Not Locate



9.4.9 TS 008 - Ramp Module - Approach Ramps do Not Align



9.4.10 TS 009 - Bridge Module - Shootbolts Will Not Engage



9.5 TIRFOR WINCH TROUBLESHOOTING

9.5.1 Forward Operating Lever

9.5.1.1 If the forward operating lever moves freely but does not operate the mechanism the machine has been overloaded and the shear pins have sheared. (See Chapter 10 Procedure 10.30 for replacing the shear pins).

9.5.2 Pumping

9.5.2.1 A lack of lubricant in a TIRFOR machine sometimes brings about a condition known as pumping which is not at all dangerous, but which is inconvenient. This situation occurs when the jaw, which is gripping the rope, becomes locked onto it preventing the other jaw from taking over the load. As the operating lever is moved in one direction the machine travels a few centimeters, but when the operating lever travels in the other direction the machine moves back the same distance in conjunction with the jaw which is locked onto the rope.

9.5.2.2 The TIRFOR machine should be thoroughly lubricated and it will recommence working normally. (See Chapter 10 Procedure 10.32).

9.5.3 Jerkiness

9.5.3.1 This is also a symptom of lack of lubrication. The TIRFOR machine should be thoroughly lubricated. (See Chapter 10 Procedure 10.32).

9.5.4 Blockage

9.5.4.1 If the wire rope becomes blocked in the machine, generally because a damaged section of wire rope is stuck within the jaws, it is imperative to stop operating the machine. The load should be taken by another machine on a separate wire rope, or by another means, while ensuring that all safety precautions are taken. When the blocked machine is no longer under load, the damaged rope may be released and removed. Should this not be possible, return the machine and wire rope to the manufacturer.

9.6 BRIDGE BUILD POSSIBLE MECHANICAL FAULTS

9.6.1.1 The following mechanical faults may be encountered as the bridge is constructed. Repairs not covered in Chapter 10 of this manual must be reported to Unit maintenance.

1. **Position vehicle on centerline.**
2. **Apply parking brake and place in transmission into neutral.**
3. **Position and unstrap flatrack LVT on build site.**
4. **Remove mudguards.**
   - Check that the R clips have been removed from the mudguard stub pins.
   - Is the lower A-frame shootbolt fully retracted?

WARNING

BURN HAZARD. ITEMS MAY BE HOT WEAR PROTECTIVE GLOVES WHEN HANDLING EXHAUST COMPONENTS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY.

5. **Add exhaust 90-degree elbow.**
   - Should excessive force be required to fit the exhaust clamp, ensure that the exhaust 90-degree elbow is correctly seated, adjust the diameter of the clamp using the screwed adjuster.
6. **Unstrap tail lift.**
   - If the transport strap will not unhook, check the safety latch for deformation. Replace the damaged transport strap.
7. **Connect tail lift pendant.**
   - Ensure the MIL connector is correctly aligned; align dots on free socket and fixed plug.
   - Check that both halves are round and not crushed. Report damaged connectors to maintenance.
8. **Turn rotary switch to position 2.**
   - Rotary switch has to be rotated 1 thru 4 and backwards 4 thru 1.
   - Engine will not go into hi-idle.
     - ♦ Check that no E-stops are activated.
     - ♦ Check that parking brake and neutral are selected.
     - ♦ Check that no circuit breakers are tripped. If circuit breaker is tripped reset it once only, if it trips immediately report fault to maintenance.
     - ♦ Check engine goes into **HIGH IDLE** – If engine does not go into **HIGH IDLE** report to maintenance.
9. **Lower tail lift.**

   The procedure below is relevant to any pair of cylinders on the tail lift.

   - Ensure that all straps are removed.
   - Ensure tail lift pendant is correctly attached.
   - Perform standard system checks - Hi-Idle, tail lift supply etc.
   - Check for obvious signs of hydraulic pipe failure.
   - Check cylinder mounting points to ensure that pins are in place and secure.
   - Press **SWING DOWN** button on tail lift pendant.
     - ♦ Tail lift does not move.

- ♦ Press **SWING UP** on tail lift pendant - If tail lift moves, solenoids are functioning correctly.
  - ▪ Check **SWING DOWN** button. Report defective switch on tail lift pendant to maintenance.
- ♦ While pressing the **SWING DOWN** button on tail lift pendant check for illumination in the caps attached to the swing cylinders. If one or both of the caps are not illuminated then suspect an electrical wiring fault. Report electrical fault to maintenance.
  - ▪ Maintenance should carry out a cable continuity/cable short check on cable.
- ♦ If both caps are illuminated, manually screw in one override valve while pressing **SWING DOWN** switch on tail lift pendant. If the tail lift lowers, report the defective solenoid to maintenance. If tail lift does not lower, screw in the override knurled screw and repeat the procedure on the opposite side. If tail lift does not lower, ensure that both override-knurled screws are out (**DO NOT** fully remove knurled screws), screw both valves knurled screws in simultaneously, if the tail lift lowers report both defective solenoid valves to maintenance. Refer to Chapter 7 paragraph 7.20 for back-up operation.

- If cylinders appear to be functioning, check for any mechanical obstruction, check all hinge points, clean and lubricate hinge points. Report defective cylinder assembly to maintenance.

10. Remove crane pads and step ladder.

- If the transport strap will not unhook, check safety latch for deformation. Replace defective transport strap.

11. Unstrap far bank support.

- If the transport strap will not unhook, check safety latch for deformation. Replace defective transport strap.

12. Remove A-frame hinge locking pins.

- Remove R clips from hinge locking pins.
- If pins can not be extracted or rotated:
  - ♦ Press and release the A-frame **FOLD PARK** button on the operators panel to release pins. Use a combination of A-frame **FOLD PARK** and A-frame **FOLD OPEN** to release the hinge pins.

WARNING

CRUSH HAZARD. DO NOT INSERT FINGERS IN PIN HOLES, WHEN CLEANING OUT ACCUMULATED DIRT USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

- ♦ Check pin holes for dirt build up or corrosion, clean and lubricate.

13. Unfold A-frame.

- Perform standard checks.
- Check all four pins are removed.
- Check Operators Interface Control Enclosure for correct lights. Report any faults to maintenance.
- Check A-frame unfold cylinder mounting points to ensure pins are in place and secure.
- If A-frame unfold cylinders appear to be functioning correctly, check for any mechanical obstruction, check all hinge points, clean and lubricate. Report any defect to maintenance.

14. Pin A-frame at the 4 hinge points.

- Ensure that the A-frame is fully folded open.
- Press and hold A-frame FOLD DEPLOY button - Insert all possible pins. Press and release the A-frame FOLD PARK button, insert pin. Try a maximum of 3 times then fully fold and deploy A-frame again.
- After the mission is complete, maintenance should re-shim the A-frame fold stop blocks.

15. Remove far bank support feet from stowed position.

16. Rotate A-frame and shootbolt.

- Carry out standard checks. (R clips, pins etc.)
- Check that the removable mudguards are removed.
- Is A-frame fully unfolded – carry out lights check on operators panel.
- Are the A-frame rotate shootbolts fully retracted?
- Press and hold the A-frame ROTATE DEPLOY button - release and allow final stage of rotation to occur. The rotate cylinders are damped at the end of their stroke; they may take time to deploy if the hydraulic oil is cold.

Caution

Do not press A-frame Rotate PARK button with one shootbolt inserted.

- Check the security of the A-frame rotate shootbolt housing - tighten the securing bolts if necessary or report defective bolts to maintenance.
- Check the alignment of both shootbolt housing holes.
  - ♦ If misalignment is fore and aft then maintenance should re-shim A-frame stop pads. Report defect to maintenance.
  - ♦ If misalignment is vertical then check for excessive hinge bush wear. Report defect to maintenance.
- Check the rotate cylinder mounting points to ensure pins are in place and secure.
- If cylinders appear to be functioning correctly check for any mechanical obstruction, check all rotate hinge points, clean and lubricate. Report defect to maintenance.

17. Extend far bank support.

- Ensure that the lower shootbolt is fully retracted.
- If far bank support lower shootbolt can not be retracted:
  - ♦ Check R clip is removed and the weight of far bank support is fully taken by the tail lift. **DO NOT** apply too much pressure as excessive pressure will trap the shootbolt.

18. Add far bank support feet.

WARNING

CRUSH HAZARD. DO NOT INSERT FINGERS IN PIN HOLES, WHEN CLEANING OUT ACCUMULATED DIRT USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

- Is there any dirt build up in the socket of the lower pivot beam restricting insertion? Clean the dirt from the socket of the lower pivot beam.
- Can the catch on the far bank support pivot beam be fully retracted to allow insertion of the ball on the far bank support pad? If not inspect catch for damage/deformation. Report any defect to maintenance.

19. Release twist locks.

- Ensure that the launcher is fully seated on the twist locks. A-frame stabilizers should *not* be on the ground.

- Inspect for damage. Clean and lubricate twist lock. Report any damage to maintenance.

20. Remove A-frame leg stabilizer pins.

- Ensure that the R clips are removed.
- Carefully retract stabilizer legs to align pin holes so that pins can be retracted.
- Check for obvious signs of pin and hole damage. Report any defect to maintenance.

21. Extend stabilizers to clear launcher of chassis and pin.

- Have stabilizer pins been removed?
- Are twist locks released?
- Assuming that the Hydraulic and Electrical systems are functioning correctly.
  - ♦ Check the A-frame stabilizer cylinder mounting points to ensure pins are in place and secure.
  - ♦ Check for significant distortion of A-frame leg and stabilizer for damage. Report any distortion/damage to maintenance.

22. Turn rotary switch to position 3.

23. Fully extend slide frame.

- Launch vehicle wheels spin - Launch vehicle struggles to pull out slide frame sections:
  - ♦ Remove wheel chock blocks.
  - ♦ Ensure that the transportation turnbuckles are not attached to the slide frame.
  - ♦ Ensure that the vehicle transmission is in LOW, and TRANSFER LOCK UP is engaged.
  - ♦ Ensure that the launcher has been raised high enough so that it is clear of the twist locks and is at or above the A-frame height aids.
  - ♦ If the A-frame support pads slide on soft ground, place anchorage spikes around the front edge (edge facing the vehicle cab) of the pads to stop sliding.
  - ♦ Have maintenance check the slide frame wear pads for thickness. Report wear of slide frame wear pads to maintenance.
  - ♦ Check slide frame sections for severe damage. Report deformation/damage to maintenance.

24. Connect chest pack.

- Ensure chest pack MIL connector is correctly aligned; align the dots on the free connector and fixed connector before rotating the twisting section of the free connector to lock connectors.
- Check that both halves are round and not crushed. Report damaged connectors to maintenance.

25. Turn rotary switch to position 4.

26. Retract relax mechanism shootbolts.

- Check that the launch vehicle is straight and the slide frame is not twisted - re-position vehicle if required.
- Release the launch vehicle parking brake and let any tension in slide frame dissipate, re-try shootbolts.
- Release one shootbolt if possible, roll vehicle forward or rearward SLOWLY until second shootbolt releases. Once mission is complete, report defect to maintenance.

27. Deploy A-frame walkways and ladders (launch beam build configuration).

- LADDERS will not deploy correctly.
  - ♦ Ensure all straps are released.
  - ♦ Ensure upper pivot is secure and not deformed. Report any deformation/damage to maintenance.
  - ♦ Ensure that the rung hooks are not deformed. Report deformation/damage to maintenance.
  - ♦ Check ladder for deformity. Report deformation/damage to maintenance.
- FOLDING WALKWAYS will not deploy correctly.
  - ♦ Check that the R clip is removed.
  - ♦ Check that the rubber catches (there are two) are released.
  - ♦ Check folding walkway hinge points for deformation/obstruction. Clear any obstructions. Report any deformation/damage to maintenance.

28. Deploy crane and crane spreader pads.

- Ensure that all transport pins have been removed.
- Check fuses in crane control box, replace as required. Refer to Chapter 10 procedure 10.1.

WARNING

MANUAL OPERATION OF CRANE. WITH THE CRANE IN THE MANUAL OVERRIDE CONDITION THE OVERLOAD SAFETY SYSTEM IS INOPERATIVE, SHOULD THE CRANE BE INADVERTENTLY OVERLOADED CATASTROPHIC FAILURE OF THE CRANE MAY OCCUR. DEATH OR SEVERE INJURY COULD RESULT IF THIS INSTRUCTION IS NOT HEEDED.

- If crane will not deploy normally operate the crane manual override lever at crane operating lever console. Operate crane with great care.

29. Position and unstrap flatrack V1 and T1 on build site.

30. Check and level A-frame using A-frame stabilizer legs.

- Ensure A-frame stabilizer leg pin is NOT inserted through the transportation hole.
- Check that A-frame pin is correctly positioned in the stabilizer leg and the A-frame is sat on the pin.
- Check A-frame stabilizer leg cylinder mounting points to ensure pins are in place and secure.
- Check for significant distortion of A-frame leg and stabilizer for damage. Report any distortion/damage to maintenance.

31. Set beam angle.

- Is BEAM ANGLE selected on the chest pack?
- Has the chest pack right hand joystick been moved rearward to lower the far bank support?
- Check for any signs of twisting at the launch frame to A-frame upper transverse beam, this would indicate a seizure of the center pivot bushing. Report any signs of seizure to maintenance.

32. Remove launch beam final stop.

- Remove R clip from launch beam final stop pin.
- Is the pinch roller ball valve closed (located on the Launch Frame Pinch Roller Stowing Manifold)? If NO, close pinch roller ball valve.
- Using BEAM DRIVE mode on the chest pack, move the chest pack right hand joystick forward or rearward to move the launch beam forward or rearward slowly as required to remove the final stop pin.

- Check jaws and pin for deformation. Report any defect to maintenance

33. Build launch beam.

- Beam will not drive out or launch beam drive wheels spin.
- Is BEAM DRIVE selected on chest pack?
- Has the launch beam final stop pin been removed?
- Is the pinch roller ball valve closed (located on the Launch Frame Pinch Roller Stowing Manifold)? If NO, close pinch roller ball valve.
- Is the launch beam safety stop assembly lever arm free to move? Report tightness/seizure to maintenance.
- If ambient air temperature is cold, check for ice on top of launch beam, this can cause the launch beam drive rollers to skid on the launch beam.
  - ♦ Use BEAM ANGLE mode to bring launch beam horizontal and BEAM DRIVE to drive launch beam out using the chest pack right hand joystick. Set chest pack to BEAM ANGLE and re-angle launch beam to connect the next beam.
- Pins will not insert.
  - ♦ Has the launch beam final stop pin been removed?
  - ♦ For connection of the lower beam module pin - has the crane released all the launch beam weight? If not release launch beam weight.
  - ♦ Check pins for straightness.
  - ♦ Check jaw holes for dirt build up.
  - ♦ Check the jaw alignment system for any burrs or deformation. Report any burrs/deformation to maintenance.

34. Insert launch beam final stop.

- Using BEAM DRIVE mode on chest pack, move the chest pack right hand joystick forward or rearward to move launch beam forward or rearward slowly as required to align holes.
- Check the final stop pin for straightness.

WARNING

CRUSH HAZARD. DO NOT INSERT FINGERS IN PIN HOLES, WHEN CLEANING OUT ACCUMULATED DIRT USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

- Check, the beam module jaws for dirt build up. Clean as required.
- Check the security and alignment of launch beam safety stop arms. Report any damage to maintenance.

35. Lower launch beam on to far bank.

- Is the chest pack set to **FAR BANK SEAT**?
- Has the chest pack right hand joystick been moved rearward to lower the far bank support?
- Check for any signs of twisting at the launch frame to A-frame upper transverse beam this would indicate seizure of the center pivot bushing. Report twisting/seizure to maintenance.

36. Remove flatrack LVT from build site.

37. Position and unstrap flatracks V2 and T2 on build site.

38. Stow articulator cylinders.

Retract articulator cylinders.

- Ensure that the articulator cylinder shootbolts have been fully retracted.
- Shootbolt/s will not release (This operation is carried out in **FAR BANK SEAT** only).
  - ♦ Ensure that far bank support is fully lowered and that the launch beam is sagging under load along with the slide frame. Move the chest pack right hand joystick rearward and hold until no further movement of the articulator cylinders can be seen. If both shootbolts retract continue operations.
- If one shootbolt can be retracted.
  - ♦ Leave both right hand and left hand shootbolts inserted. Apply a light pressure to the stuck shootbolt handle while the chest pack operator **slowly** moves the right hand joystick forward. Release the chest pack right hand joystick when the shootbolt becomes loose. Should the slide frame cross beam start to show signs of taking load prior to the shootbolt becoming loose, move the chest pack right hand joystick rearward while attempting to free the shootbolt. Repeat the procedure until the shootbolt can be retracted. Retract shootbolt. Move chest pack right hand joystick rearward until second shootbolt becomes loose, retract shootbolt and continue operations.
  - ♦ Report defect to maintenance so that re-shimming of the cylinder attachment guide can be carried out at the next opportunity.
- If both shootbolts can NOT be retracted.
  - ♦ Apply light pressure to the stuck shootbolt handles and slowly move the chest pack right hand joystick forward. Release the joystick when one or both of the shootbolts becomes loose. Should the slide frame cross beam start to show signs of taking load prior to the shootbolts becoming loose, move chest pack right hand joystick rearward while attempting to free the shootbolts. Repeat procedure until both the shootbolts have been retracted.
  - ♦ Report defect to maintenance so that re-shimming of the cylinder attachment guide can be carried out at the next opportunity.

WARNING

CRUSH HAZARD. DO NOT INSERT FINGERS IN SHOOTBOLT HOLES WHEN CLEANING OUT ACCUMULATED DIRT, USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

- Check for dirt build up/corrosion in shootbolt slide hole. Clean/Report corrosion to maintenance.
- Check for tightness of shootbolt housing bolts. Tighten if required.
- Check for shootbolt housing deformation. Report deformation to maintenance

39. Stow articulator cylinders.

- Has ARTIC STOW been selected on chest pack? Operate the chest pack left hand joystick to control the operation of the stow cylinders.
- Have the articulator cylinders been disconnected from slide frame cross member and are they fully retracted? Disconnect articulator cylinders and stow.
- Check for seizure of the articulator cylinder to launch beam drive upper pivot. Report seizure to maintenance.

40. Raise A-frame.

- Have both upper A-frame pins been removed?
- Have the articulator cylinders been disconnected and stowed?
- Check both A-frame raise cylinder mounting points to ensure pins are in place and secure.
- If excessive noise is heard during A-frame raise check wear pads on upper A-frame sliding sections. Report wear to maintenance.
- Check for obvious signs of A-frame leg distortion. Report any distortion to maintenance.

41. Stow A-frame support struts.

- Check for deformation of strut hinge connection. Report any distortion to maintenance.

42. Reconfigure walkways to bridge build configuration.

- Check for deformation of walkways, attachment features and dirt build up in holes. Replace any damaged walkways, clean any dirt from walkway holes.

43. Deploy tail lift.

Unfold platform.

- Are all rubber straps released?
- Check for integrity and deformation of the folding section hinge. Report deformation to maintenance.

Extend Sliding Sections.

- Check for deformation of walkway surface which would impede sliding. Report deformation to maintenance.
- Check for dirt build up into the central section of the platform. Pull the sliding section out and clean.

44. Deploy tilt rollers.

- Check all shootbolts for ease of use. Report any defect to maintenance.
- Check the tilt roller pivot for seizure/deformation. Report seizure/deformation to maintenance.
- Check tilt roller head pivot for seizure. Report seizure to maintenance.

45. Add 4 removable rollers and end beam guides.

Removable rollers.

- Ensure that the removable rollers are placed at the white markers on the inside of section 2 of the slide frame.
- Ensure section 2 of the slide frame is clean and the removable roller connection slot is clean.
- Check for excessively worn edges on the removable roller connection slot. Report any wear to maintenance.
- Check the edges of the slide frame in the area of the white marks for excessive edge damage. Report any damage to maintenance.

End beam guides.

- Check for deformation of the main body and L shaped connection slot. Report any damage to maintenance.
- Check the operation of the latch.
- Check for deformation of connection spigots on section 3 of the slide frame. Report any damage to maintenance.

46. Place end beam on guides.

- Check that the end beam guide locking arms rotate freely. Report any damage to maintenance.

47. Add far bank ramp and pin.

Ramp does not open, open fully or open evenly.

- Check that the ramp has been lifted at the correct lifting points for opening.
- Check that the module lifting beam is in correct configuration for opening and that all the arms are locked.
- Check that the deck units align with the machined slot on the bridge panels.
  - ♦ Refold ramp module and check for correct position of deck spacers. Report defect to maintenance.
  - ♦ Refold ramp module and check for correct thickness of deck spacers. Replace as required.
- Support the partially opened ramp module and check dampers on non-opening side for free play. The damper with no free play will be the defective unit. Report defective damper to maintenance.

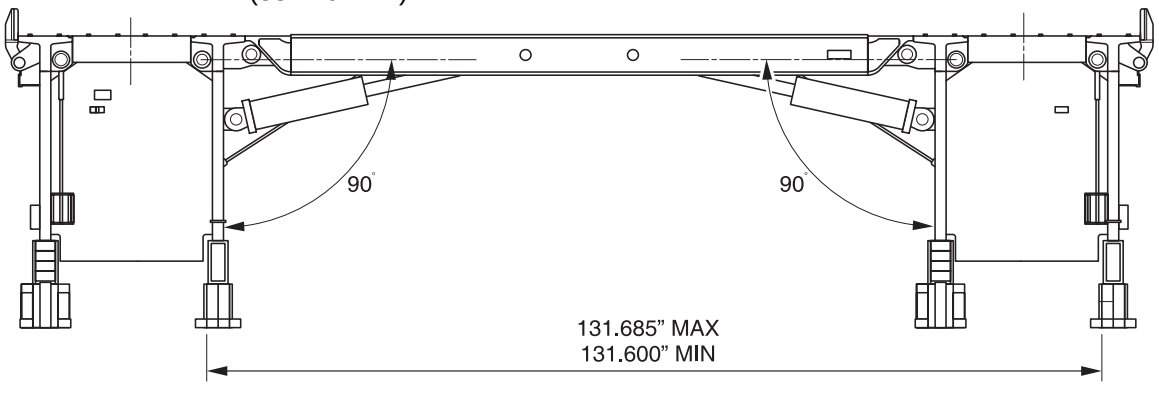
Ramp and end beam will not pin.

- Ensure that all the weight is released from the crane.
- Raise ramp module slightly, ensure that the lifting sling is vertical, lower the module. Using the end beam wrenches fitted onto the ramp module to push down.
- Ensure that the A-frame and crane are level.

WARNING

CRUSH HAZARD. DO NOT INSERT FINGERS IN HOLES WHEN CLEANING OUT ACCUMULATED DIRT, USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

- Separate the two components and check bores for dirt build up. Clean if required.
- Check the end beam upper “V” slot is clear of dirt. Clean if required.
- Check the end beam side alignment pads for damage. Report any damage to maintenance.
- Check the end beam for any obvious damage. Replace end beam.
- Check the ramp module to end beam alignment pads for excessive wear/damage. See Chapter 10 procedure 10.15.
- Check the width between the ramp module inner jaw outer face and the outer jaw inner face. The measurement between the edges of the jaws should be between 131.685in (3344.799mm) MAX and 131.6in (3342.64mm) MIN.



686A894

- If measurement is under size the ramp module is not fully open. Perform ramp does not open procedure (above). If measurement is over size, check

the tightness of the damper to side skin connection. Tighten damper to side skin connection and re-check measurement. Report over size fault to maintenance.

- Replace ramp module.

48. Add ramp skids to front face of ramp.

- Check the ramp skids for dirt build up. Clean as required.
- Check the pins on front face of ramp for deformation. Replace as required see Chapter 10 procedure 10.14.
- Check R clip for deformation. Replace deformed R clip with new item.

49. Add approach ramps to far bank ramp.

Approach ramps fitted to transport frame do not lift evenly.

- Check all slings are attached and are not twisted.
- Check that the module lifting beam is correctly orientated and secured in the widest position and shootbolted.
- Check for an excessive build up of mud in the toe end of the approach ramps. Clean if required.
- Check that the ramps are correctly seated within the transport frame and are secure with the frame.

Approach ramp frames do not sit on ramp module.

- Check for deformation of lugs on lower edge of ramp frame. Report deformation to maintenance.
- Ensure slings on adjacent frame are stowed and do not impede lowering of second frame.
- Check the space between the deck units is clear and that the approach ramp frames align correctly.

50. Lower end beam guide arms and push far bank ramp with crane.

- Ensure that the end beam guides are correctly orientated. Remove ramp and end beam. Rotate end beam guides to inboard position. Arms fold inboard.
- Ensure that the ramp is not pushed against the end beam guide arms. Move ramp with crane using push/pull sling.
- Ensure end beam guide arms are free to rotate. Report any defects to maintenance.

51. Attach far bank ramp to far bank carriage.

Carriage shootbolt will not retract.

- Check R clip is removed.
- Check for seizure/deformation of the pin. Report any seizure/deformation to maintenance.

Sling will not route through lifting point.

- Check that slings are being connected to end beam lift points, and not ramp lift points.
- Clear lifting pocket of any dirt.
- Check lifting pin and bracket for security of attachment. Report any defect to maintenance.

52. Detach crane push sling.

- Check for any deformation of crane hook safety catch. Report any deformation to maintenance.

53. Remove end beam guides and removable rollers.

Removable rollers.

- Ensure removable roller aligns with the white marks on the inside of slide frame. Tap sideways until free.
- End beam guides.
- Check the operation of the catch and any deformation of slide frame spigots. Report any deformation to maintenance.
- Check for deformation of the end beam guide body. Report any deformation to maintenance.

54. Add parallel module.

Parallel module does not open, open fully or open evenly.

- Check that the module lifting beam is in the correct configuration for module opening and all arms are shootbolted.
- Check that the deck units align with the machined slot on the parallel panels.
  - ♦ Refold the parallel module and check for correct position of deck spacers. Refer to Chapter 10 maintenance procedure 10.4.
  - ♦ Refold parallel module and check for correct thickness of the deck spacers. Refer to Chapter 10 maintenance procedure 10.4.
- Support the partially opened parallel module, and check the dampers on non-open side for free play. The damper with no free play will be the defective unit. Report defective damper to maintenance.

Module will not connect.

- Have all the removable rollers been removed from the slide frame?

Dowels will not connect.

- Ensure that all the shootbolts on both modules are in the fully lowered position. Connect the dowels and shootbolt.

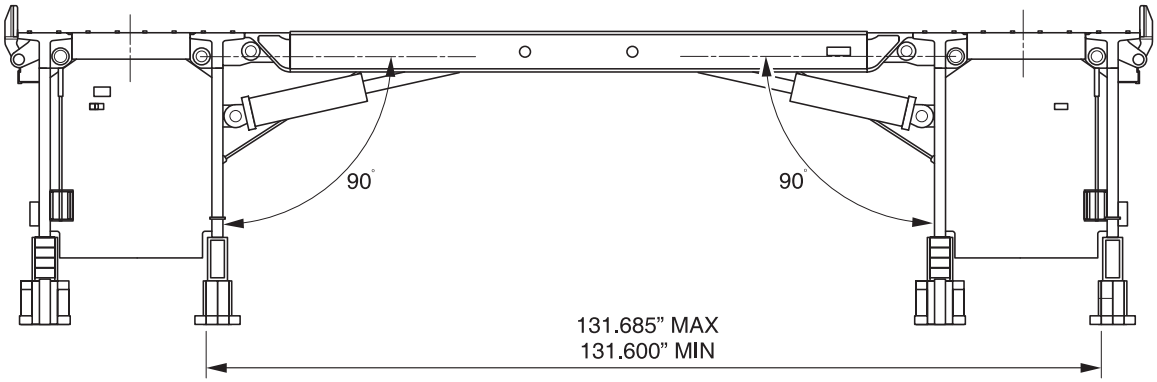
WARNING

CRUSH HAZARD. DO NOT INSERT FINGERS IN SHOOTBOLT HOLES WHEN CLEANING OUT ACCUMULATED DIRT, USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

- Clean any dirt from the parallel module pin holes.

Pins.

- Ensure that all the weight of the parallel module is released from the crane.
- Ensure that the crane and the A-frame are level.
- Pull down on the open end of the parallel module (Rear of the bridge).
- Disconnect the parallel module, rotate the module through 180 degrees and connect.
  - ♦ If the parallel module will still not connect - check the measurement between the outer face of the inner jaw and the inner face of the outer jaw. The measurement between the faces of the jaws should be between 131.685in (3344.799mm) MAX and 131.6in (3342.64mm) MIN.



686A894

- ♦ If the measurement is under size the parallel module is not fully open, carry out module does not open procedure step above. If measurement is over size, check the damper to side skin connection for tightness. If loose tighten damper to side skin connection and re-check the measurement. If the damper to side skin connection is tight and the measurement is incorrect return the parallel module for jaw alignment system repair. Report over size fault to maintenance.
- ♦ Retrieve the bridge parallel module and replace.

- Check that the tilt rollers are in their lowest position.
  - ♦ If tilt rollers will not lower, strip the bridge and report defect to maintenance.
- Check the slide frame wear pads for uneven wear. Report wear to maintenance.

55. Boom forward and release bridge stops.

56. Boom to white C of G marker, using roller brakes and tilt roller, angle the bridge to launch beam.

NOTE

The following sequence covers operations 55 and 56 combined.

Bridge will not move.

- Have the far bank carriage latches been released from the home bank carriage? If yes, is the tilt roller setting height correct? If not adjust setting height of tilt rollers.
- Is the carriage caught on a launch beam pin, which is not fully inserted? Pull back bridge and boom slowly forward to see if pin head is cleared. If excessive interference, strip out bridge and beam.

Booming forward - difficult/noisy.

- Check that the bridge is not continuously rubbing against A-frame side wear pad. Check and level A-frame.
- Check for the free rotation of tilt and A-frame brake rollers during booming. Report any seized rollers to maintenance.
- Check that all carriage main upper rollers rotate during movement. Report seized carriage main upper rollers to maintenance.
- Check that all side rollers rotate. Report seized rollers to maintenance.
- Bridge stop emergency will not release.
- Check that bridge stop emergency are not being released too early and are consequently under load.
- Check the bridge stop emergency pivot for seizure. Clean/lubricate as required. Report seized bridge stop emergency to maintenance.

- Check the bridge stop emergency handle and shaft for deformation/obstruction. Report deformation to maintenance.
- Check the V notch in A-frame side rubbing pad for wear limit. Report wear to maintenance.

Tilt roller will not raise.

- Is a BRIDGE DRIVE mode selected on the chest pack?
- Is the tilt roller light flashing on the chest pack? If YES, switch the roller brakes to on.
- Is the bridge boomed so that the white marker on the bridge module is in line with inside face of A-frame? If YES, continue to next sequence. If NO, operate the chest pack right hand joystick to boom the bridge so that the white marker on the bridge module is in inline with inside face of A-frame. If tilt roller still does not raise continue to next sequence.

WARNING

CRUSH HAZARD. DO NOT EXCEED 6 INCHES WHEN BOOMING THE BRIDGE. THE BRIDGE MAY TIP INJURING PERSONNEL.

- ♦ Boom the bridge up to 6 inches further forward.
- Check hydraulic and electrical systems are working correctly, report any defect to maintenance.
- Check the tilt roller assembly for deformation/obstruction. Report any deformation to maintenance.

Roller brakes do not work.

- Is roller brake switch on the chest pack set to the ON position (switch is located at lower right hand side of chest pack)?
- Check roller brakes for class III hydraulic leaks. Report any leaks to maintenance (Tighten joints. Re-seal motor or replace as required).
- Check hydraulic and electrical systems are working correctly, report any defect to maintenance.

Rollers not damped.

- Check for any hydraulic oil leaks around motor/roller housings. Report any leaks to maintenance (re-seal or replace motor/roller housings as required).

57. Continue boom using tilt rollers and lower bridge stops emergency.

- See Operation 55 and 56.

58. Add second parallel module. (This procedure is slightly different from RAMP to PARALLEL.

Parallel module does not open, open fully or open evenly.

- Check that the module lifting beam is in the correct configuration for opening and all arms are shootbolted.
- Check that all deck units align with the machined slot on the parallel panels.
  - ♦ Refold the parallel module and check for correct positioning of deck spacers. Refer to Chapter 10 maintenance procedure 10.4.
  - ♦ Refold the parallel module and check for correct thickness of deck spacers. Refer to Chapter 10 maintenance procedure 10.4.
- Support the partially opened parallel module; check the dampers on the non-open side for free play. The damper with no free play will be the defective unit. Report defective damper to maintenance.

Module will not connect.

Dowels will not connect.

- Ensure that all the shootbolts on both modules are fully lowered. Connect dowels and shootbolt.

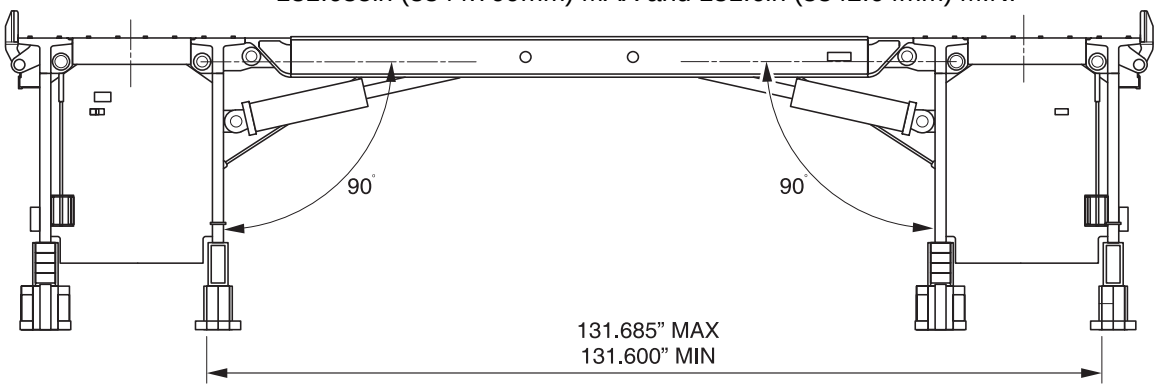
WARNING

CRUSH HAZARD. DO NOT INSERT FINGERS IN PIN HOLES, WHEN CLEANING OUT ACCUMULATED DIRT USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

- Clean any dirt from pin holes.

Pins.

- Ensure that all the weight of the parallel module is released from the crane.
- Ensure that the crane and the A-frame are level.
- Pull down on the open end of the module (rear of the bridge).
- Disconnect the parallel module, rotate module 180 degrees and connect parallel module.
- Replace parallel module.
  - ♦ If the parallel module will still not connect - check the measurement between the outer face of the inner jaw and the inner face of the outer jaw. The measurement between the faces of the jaws should be between; 131.685in (3344.799mm) MAX and 131.6in (3342.64mm) MIN.



686A894

  - ♦ If measurement is under size the module is not fully open, carry out module does not open procedure step 54. If measurement is over size, check damper to side skin connection for tightness. If loose, tighten damper to side skin connection and re-check measurement. If damper to side skin connection is tight and measurement is incorrect return module for jaw alignment system repair. Report over size fault to maintenance.

59. Boom forward while holding tilt roller joystick forward.

Bridge will not move.

- Have the far bank carriage latches been released from home bank carriage? If yes, is the setting height of tilt rollers correct? Adjust as required.
- Is the carriage caught on a launch beam pin which is not fully inserted? Pull back bridge and boom slowly forward to see if pin head is cleared. If excessive interference, strip out bridge and beam.

Booming forward - difficult/noisy.

- Check that bridge is not continuously rubbing against the A-frame side wear pad. Check and level A-frame.
- Check for free rotation of the tilt and A-frame rollers during booming. Report any seized rollers to maintenance.
- Check that the forward carriage main upper rollers rotate during bridge booming. Report any seized rollers to maintenance.
- Check that the forward carriage side rollers rotate during bridge booming. Report any seized rollers to maintenance.

Bridge stops will not release.

- Check stops are not being released too early and are under load.
- Check the bridge stop pivot for freedom of movement/seizure. Clean as required. Report defect to maintenance.
- Check bridge stop handle and shaft for deformation/obstruction. Report any deformation to maintenance.
- Check the V notch in the A-frame side rubbing pad for wear limit. Report wear to maintenance.

Tilt roller will not raise.

- Is a BRIDGE DRIVE mode selected on the chest pack?
- Is the tilt roller light flashing on the chest pack. If yes, switch roller brake switch on chest pack to ON and then to OFF.
- Check the hydraulic and electrical system for correct operation. Report any defects to maintenance.
- Check the tilt roller assembly for deformation/obstruction. Report deformation to maintenance.

60. Release bridge stops emergency only to allow jaws to pass.

61. Boom until jaws are over the center of the tail lift.

62. Fully lower tilt rollers.

Tilt roller will not lower.

- Is a BRIDGE DRIVE mode selected on the chest pack?
- Is the tilt roller light flashing? If yes, switch roller brake switch on chest pack to ON and then to OFF.
- Check the hydraulic and electrical systems for correct operation. Report any defects to maintenance.
- Check the tilt roller assembly for deformation/obstruction. Report any deformation to maintenance.

63. Add and boom further parallel modules as required.

64. Deploy end beam guide adapters.

- Is the R clip removed from the end beam guide adapters?
- Check the end beam guide adapters assembly for deformation of side plates and hinge. Replace defective end beam guide adapter assembly.

65. Add end beam guides.

- Check for any deformation of the end beam guide main body and L shaped connection slot. Report any damage to maintenance.
- Check the operation of the end beam guide latch.
- Check for any deformation of the connection spigots on the end beam guide adapters. Report any deformation to maintenance.

66. Add 2 removable rollers at white marks furthest from crane.

- Ensure that the removable rollers are placed at white markers on the inside face of section 2 of the slide frame.
- Ensure that section 2 of the slide frame is clean and that the removable roller connection slot is clean. Clean as required.
- Check for excessively worn edges on removable roller connection slot. Report any wear to maintenance.
- Check the edges of the slide frame in the area of white marks, for excessive edge damage. Report any damage to maintenance.

67. Position home bank end beam on guides.

- Check the end beam guide locking arms rotate freely. Report any defect to maintenance.

68. Add home bank ramp and pin.

- See step 47 above.

69. Reposition slings on ramp to allow for end beam.

70. Add ramp module to bridge.

Module will not connect.
Dowels will not connect.

- Ensure that all shootbolts on both modules are fully lowered. Connect Dowels and shootbolt.

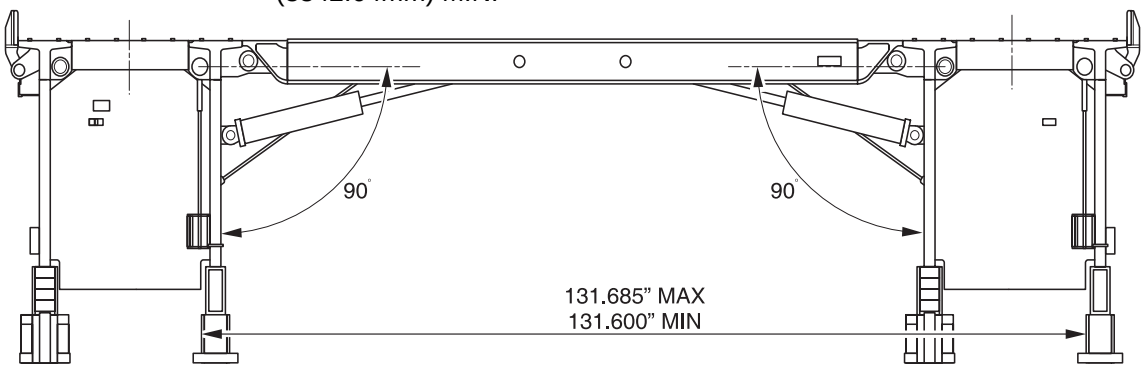
WARNING

CRUSH HAZARD. DO NOT INSERT FINGERS IN PIN HOLES, WHEN CLEANING OUT ACCUMULATED DIRT USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

- Clean any dirt from pin holes.

Pins.

- Ensure that all the weight of the ramp module is released from the crane.
- Ensure that the crane and the A-frame are level.
- Pull down on the open end of the module (rear of the bridge).
- Replace ramp module.
  - ♦ Check the width between the ramp module inner jaw outer face and the outer jaw inner face. The measurement between the faces of the jaws should be between; 131.685in (3344.799mm) MAX and 131.6in (3342.64mm) MIN.



686A894

  - ♦ If measurement is under size the module is not fully open, carry out ramp module does not open procedure detailed in step 47. If measurement is over size, check the tightness of the damper to side skin connection. Tighten damper to side skin connection and re-check measurement. Report over size measurement to maintenance.
  - ♦ Retrieve last parallel module and replace.

71. Remove and stow end beam guides, adapters, removable rollers and tilt rollers.

Removable rollers.

- Ensure that the removable roller aligns with the white marks on the slide frame. Tap side ways until free.

End beam guides.

- Check the operation of the catch and for any deformation of end beam guide spigots. Report any damage/deformation to maintenance.

- Check for any deformation of the end beam guide body. Report any damage/deformation to maintenance.
- End beam guide adapter.
- Check the end beam guide adapter assembly for deformation of side plates and hinge. Report any deformation to maintenance.

Tilt rollers (See Operation 44).

- Check all shootbolts for ease of use. Report any defect to maintenance.
- Check the tilt roller pivot for seizure/deformation. Report any seizure/deformation to maintenance.
- Check the tilt roller head pivot point for seizure. Report seizure to maintenance.

72. Remove flatracks V2 and T2 from build site.

73. Place flatrack LVT on build site.

74. Boom the bridge forwards until end plate of ramp contacts the bridge stops emergency.

Booming forward - difficult/noisy.

- Check that the bridge is not continuously rubbing against A-frame side wear pad. Check and level A-frame.
- Check for free rotation of tilt and A-frame rollers during booming. Report seized rollers to maintenance.
- Check the V notch in A-frame side rubbing pad for wear limit. Report wear to maintenance.

75. Remove home bank carriage shootbolts and lower carriage lifting beam.

- Check the home bank carriage lift beam to main carriage body shootbolts for deformation/seizure. Report deformation/seizure to maintenance.
- Check that the chest pack is in **BRIDGE LIFT** Mode.

Carriage sling shootbolt will not retract.

- Check that the R clip is removed.
- Check for seizure/deformation of the pin. Report seizure or deformation to maintenance.

Carriage lifting beam will not lower.

- Check for dirt build up or binding of the mating faces on the upper and lower halves of the forward carriage. Clean as required.
- Check that the winch cable is seated in the grooves of the grooved pulleys. If winch cable is not seated in grooves inform maintenance.
- Check that the winch is operating correctly. Report any defect to maintenance

76. Attach slings to bridge lift points on ramp.

Sling will not route through lifting point.

- Check that the slings are being connected to ramp bridge lift points, and NOT end beam lift points.
- Clear the lifting pocket of any dirt. Clean as required.
- Check for integrity of lifting pin and bracket. Report any defect to maintenance.

77. Raise bridge and release bridge stops emergency once bridge starts to move.

- Ensure that the chest pack is in **BRIDGE LIFT** mode.

WARNING

CRUSH HAZARD. DO NOT RELEASE BRIDGE STOPS EMERGENCY UNTIL BRIDGE IS CONNECTED TO THE CARRIAGE AND IT STARTS TO MOVE REARWARD. FAILURE TO HEED THIS INSTRUCTION COULD RESULT IN THE BRIDGE FALLING OFF THE LAUNCHER WITH CONSEQUENT DEATH OR SERIOUS INJURY TO PERSONNEL.

- Ensure that bridge stops emergency are not being released too soon as bridge moves rearward.
- Bridge stops will not release.
- Check bridge stops emergency are not being released too early/late and are under load.
- Check bridge stop emergency pivot for seizure. Clean/lubricate. Report seizure to maintenance.
- Check bridge stop emergency handle and shaft for deformation/obstruction. Report any deformation to maintenance.
- Check V notch in A-frame side rubbing pad for wear limit. Report wear to maintenance.

78. Re-shootbolt home bank carriage.

- Ensure that the bridge is fully lifted and shootbolt holes align.

79. Release tension in winch cable.

80. Reverse bridge to release home bank carriage latches.

81. Release carriage latches and boom bridge forward.

- Check home bank carriage latches for stiffness/seizure. Report seizure to maintenance.

82. Stop bridge boom when carriage restraint arms are fully extended.

- Check carriage arm pivots and connections for freedom of movement. Report any defect to maintenance.

83. Raise bridge and release far bank carriage shootbolts.

- Check that the chest pack is in BRIDGE LIFT mode.
- Ensure that the bridge is fully lifted and far bank carriage shootbolts become loose.
- Check carriage lift beam to main carriage body shootbolts for deformation/seizure. Report any deformation/seizure to maintenance.

84. Lower far bank of bridge to ground.

- Check that the chest pack is in BRIDGE LIFT mode.
- Check that both carriage shootbolts are fully retracted.
- Lowering is not smooth or is noisy.
- Check the rotation of all carriage pulleys. Report any defects to maintenance.
- Check far bank carriage for severe damage to carriage. Report damage to maintenance.

85. Unsling far bank carriage, raise and shootbolt.

Carriage shootbolt will not retract.

- Check that the bridge is fully lowered and carriage lifting slings are slack.
- Check R clip is removed.
- Check for seizure or deformation of the pin. Report seizure/deformation to maintenance.

Sling will not route through lifting point.

- Check for integrity of lifting pin and bracket. Report any defects to maintenance.
- Carriage lifting beam will not connect with upper carriage body.
- Ensure the two halves of the carriage are aligned correctly, use the carriage lifting slings as guide ropes.
- Ensure that the two carriage shootbolts are fully retracted.
- Check for any deformation of the carriage. Report any deformation to maintenance.

86. Raise bridge and release home bank carriage shootbolts.

- Check that the chest pack is in **BRIDGE LIFT** mode.
- Ensure that the bridge is fully lifted and shootbolts become loose.
- Check carriage lift beam to main carriage body shootbolts for deformation/seizure. Report any damage to maintenance.

87. Lower home bank of bridge to ground.

- Check that the chest pack is in BRIDGE LIFT mode.
- Check both shootbolts are fully retracted.

Lowering is not smooth or is noisy.

- Check rotation of all carriage pulleys. Report any defect to maintenance.

88. Unsling home bank carriage and raise.

Home bank carriage shootbolt will not retract.

- Check that the bridge is fully lowered and home bank carriage lifting slings are slack.
- Check R clip is removed.
- Check for seizure/deformation of the pin. Report any damage to maintenance.
- Sling will not route through lifting point.
- Check for integrity of lifting pin and bracket. Report any damage to maintenance.

Carriage lifting beam will not connect with upper carriage body.

- Ensure the two halves of the carriage are aligned correctly, use the carriage lifting slings as guide ropes.
- Ensure that the two shootbolts are fully retracted.
- Check for any deformation of the carriage. Report deformation to maintenance.

89. Retrieve carriages and lock.

Excessive noise from carriages on retrieve.

- Check that the carriage main upper rollers rotate freely. Report any seized rollers to maintenance.
- Check that all side rollers rotate freely. Report any seized rollers to maintenance.

Latches

- Ensure that the home bank carriage latch is lowered and free to rotate. Report any defect to maintenance.
- Ensure far bank carriage latch is free to rotate. Report any defect to maintenance.

90. Stow tail lift.

Retract sliding sections.

- Check for any deformation of walkway surface, which would impede sliding. Report deformation to maintenance.
- Check for any dirt build up in the central section of the platform. Strip the sliding section out and clean.
- Fold.
- Check that the deck surface is clear of obstruction and dirt. Clean as required.
- Check for integrity and deformation of folding section hinge. Report any damage to maintenance.

91. Deploy A-frame support struts and lower A-frame.

- Check for deformation of strut hinge connection. Report any deformation to maintenance.

Lower A-frame.

- Have both upper A-frame top pins been removed? If not, remove both A-frame top pins.
- Check A-frame raise cylinder mounting points to ensure pins are in place and are secure.
- If excessive noise is heard during lowering, check the wear pads on upper A-frame sliding sections. Report wear to maintenance.
- Check for obvious signs of A-frame leg distortion. Report any A-frame leg distortion to maintenance.

92. Re-attach articulator cylinders.

Deploy articulator cylinders. (Ensure that the chest pack is set to **ARTIC STOW**).

- Check for seizure of the articulator cylinder to launch beam drive upper pivot. Report any defects to maintenance.

Attach articulator cylinders.

- Ensure that the articulator cylinder shootbolts have been fully retracted.
- Shootbolt/s will not insert (this operation carried out in **FAR BANK SEAT** only).
  - ♦ Move the chest pack right hand joystick rearward and extend the articulator cylinders. As they extend align the articulator cylinders with the shootbolt guide, aim the clevis to contact the guide on the tapered portion of guide. Continue to hold the chest pack right hand joystick until no further movement of the articulator cylinders can be seen. If both shootbolts insert continue operations.
  - ♦ If one shootbolt can be inserted.
    - ▪ Leave the shootbolt inserted. Apply light pressure to the stuck shootbolt handle and slowly move the chest pack right hand joystick forward. Release the chest pack right hand joystick when the shootbolt can be inserted. Should the slide frame cross beam start to show signs of taking load prior to the shootbolt becoming loose, or the clevis is obviously above the housing, move the chest pack right hand joystick rearward while attempting to insert the shootbolt. Repeat procedure until the shootbolt can be inserted. Insert shootbolt.
    - ▪ Report difficulty in inserting shootbolt to secure articulator cylinder to maintenance so that re-shimming of the cylinder attachment guide can be carried out at the next opportunity.
  - ♦ If both shootbolts can NOT be inserted.
    - ▪ Apply light pressure to the stuck shootbolt handles and slowly move the chest pack right hand joystick forward. Release the chest pack right hand joystick when one shootbolt can be inserted.

- If the clevis is obviously above the housing, move the chest pack right hand joystick rearward while attempting to insert the first shootbolt.
- With one shootbolt inserted perform previous operation.

♦ If one shootbolt can be inserted.

- Report difficulty in inserting shootbolt to secure articulator cylinder to maintenance so that re-shimming of the cylinder attachment guide can be carried out at the next opportunity.

WARNING

CRUSH HAZARD. DO NOT INSERT FINGERS IN PIN HOLES, WHEN CLEANING OUT ACCUMULATED DIRT USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

- Check shootbolt holes for dirt build up/corrosion. Clean as required. Report any corrosion to maintenance.
- Check for tightness of shootbolt housing bolts. Tighten as required.
- Check for shootbolt housing deformation. Report deformation to maintenance.

93. Reconfigure launcher walkways (launch beam build configuration).

- Check for deformation of walkways, attachment features and dirt build up in holes.
- Clean dirt from walkway holes as required. Report any deformation to maintenance.

94. Raise launch beam clear of far bank.

- Is the chest pack set to FAR BANK SEAT?
- Has the chest pack right hand joystick been moved forwards to raise the far bank support?
- Check for any signs of twisting at the launch frame to A-frame upper transverse beam, this can indicate a seizure of the center pivot bushing. Report any signs of seizure to maintenance.

95. Remove launch beam final stop.

- Set the chest pack to BEAM DRIVE.
- Move the chest pack right hand joystick forward or rearward to move the launch beam forward or rearward as required to free the final stop pin.
- Check the final stop pin for deformation. Replace the final stop pin with serviceable item.
- Check security and alignment of the launch beam final stop arms. Report any defects to maintenance.

96. Manually raise launch beam final stop and reverse the launch beam.

- Check that the launch beam final stop pin is removed.
- Check the launch beam final stop pivot for seizure/obstruction. Report any defects to maintenance.

97. Deploy far bank approach ramps.

WARNING

CRUSH HAZARD. DO NOT INSERT FINGERS IN END BEAM GUTTERS WHEN CLEANING OUT ACCUMULATED DIRT, USE A SUITABLE TOOL. SEVERE INJURY CAN RESULT IF THIS INSTRUCTION IS NOT ADHERED TO.

- Ensure that ramp and end beam gutters are clean. Clean dirt from ramp and end beam gutters as required.

- Check for deformation of approach ramp anti-lift bracket. Replace defective ramp.
- Check for deformation of ramp or end beam gutter. Report any defect to maintenance.

98. Deploy curbs and bridge markers.

Curbs.

- Check curb latch assembly for signs of damage. Report any defect to maintenance.
- Check the curb slots, in the panel, for any obstruction. Remove obstructions.
- Check the curb hinge bracket for deformation. Replace curb accordance with Chapter 10 Procedure 10.8.
- Check the curb hinge pins for damage. Replace curb in accordance with Chapter 10 Procedure 10.8.
- If bridge module curb hinge bracket is damaged report damage to maintenance.

Marker.

- Check the marker storage location hook for deformation. Replace in accordance with Chapter 10 Procedure 10.9.
- Check marker pivot for damage. Replace in accordance with Chapter 10 Procedure 10.9.

99. Strip out launch beam.

Lower pin can not be extracted from launch beam.

- Ensure R clip is removed.
- Ensure that the crane IS NOT taking the weight of launch beam.
- Ensure that the crane IS NOT pulling the launch beam laterally (side to side).
- Check for pin and launch beam jaw damage. Replace defective pin, report launch beam jaw damage to maintenance.

Upper pin can not be extracted.

- Ensure R clip is removed.
- Ensure crane IS taking weight of beam.
- Ensure crane IS NOT pulling launch beam laterally (side to side).
- Check for pin and launch beam jaw damage. Replace defective pin, report launch beam jaw damage to maintenance.

100. Re-insert launch beam final stop.

- Move launch beam forwards or rearward to align holes.
- Using **BEAM DRIVE** mode on the chest pack, move the chest pack right hand joystick forward or rearward to move the launch beam forward or rearward slowly as required to allow the launch beam final stop pin to be inserted.
- Check pin for straightness. Replace pin if deformed.
- Check launch beam jaw for dirt build up. Clean as required
- Check security and alignment of launch beam final stop arms. Report any defect to maintenance.

101. Stow all walkways and ladders.

Walkways.

- Check for any deformation of walkways. Report any damage to maintenance.

Ladders.

- Check ladder hinge points for damage/obstruction. Report any damage to maintenance.
- Check straps for security. Tighten/report any damage to maintenance.

- Check for obvious damage/distortion to ladder. Report damage to maintenance.

102. Fully retract articulator cylinders.

103. Using bridge lift function allow some slack in bottom winch cable.

104. Stow crane.

- Ensure that all transit pins have been removed.
- Check Fuses in crane control box, replace as required. Refer to Chapter 10 procedure 10.1.

WARNING

MANUAL OPERATION OF CRANE. WITH THE CRANE IN THE MANUAL OVERRIDE CONDITION THE OVERLOAD SAFETY SYSTEM IS INOPERATIVE, SHOULD THE CRANE BE INADVERTENTLY OVERLOADED CATASTROPHIC FAILURE OF THE CRANE MAY OCCUR. DEATH OR SEVERE INJURY COULD RESULT IF THIS INSTRUCTION IS NOT HEEDED.

- If crane will not stow normally operate the crane manual override lever at crane operating lever console. Operate crane with great care. Report defect to maintenance.

WARNING

BURN HAZARD. ITEMS MAY BE HOT WEAR PROTECTIVE GLOVES WHEN HANDLING EXHAUST COMPONENTS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY.

- Stow exhaust elbow.

105. Extend A-frame stabilizers to maximum height and pin.

- Check that the A-frame is sat on the pin, and pin **IS NOT** inserted through the transportation hole.
- Check the A-frame stabilizer cylinder mounting points to ensure pins are in place and secure.
- Check for any significant distortion of the A-frame leg and stabilizer for damage. Report any damage to maintenance.

106. Raise tail lift clear of bridge and A-frame hydraulics.

107. Insert relax mechanism shootbolts.

Relax mechanism shootbolts will not insert.

- Release the vehicle parking brake and let any tension in the slide frame relax, re-try inserting the relax shootbolts.
- Insert one relax shootbolt if possible, move the vehicle forward or rearward SLOWLY until second shootbolt inserts. Once mission is complete, Report defect to maintenance so that the relax mechanism can be re-shimmed.

108. Turn rotary switch to position 3.

109. Remove and stow the chest pack.

- Check for any deformation of the MIL connector at the A-frame leg connection. Replace the umbilical cable if the connector is deformed.

110. Reverse the **vehicle to fully retract slide frame.**

Vehicle wheels spin - launcher struggles to close slide frame sections.

- Remove chock blocks from wheels.
- Ensure slide frame locking pins are not inserted.

- Ensure vehicle transmission is set to **LOW**, and **TRANSFER LOCK UP** is engaged.
- If the A-frame support pads slide on soft ground, place anchorage spikes around the rear edge of the pads (edge facing the bridge) to stop sliding.
- Check the left, right and central energy chains do not foul the slide frame or chassis. Report any damaged links to maintenance.
- Extend the slide frame and re-align vehicle. Report any damaged links to maintenance.
- Check that the A-frame has not been prematurely lowered. Raise A-frame if required.
- Ensure that the tail lift is raised sufficiently to clear the bridge.
- Check the slide frame wear pads for thickness. Report wear to maintenance.
- Check slide frame sections for severe damage. Report damaged sections to maintenance.

111. Fully lower A-frame onto chassis twist locks.

- Have A-frame stabilizer leg pins been removed?
- Are twist lock handles pointing outboard (red handle faces away from vehicle chassis).
- Are the upper and lower twist lock halves in line, within 5-6 inches laterally across the vehicle?
  - ♦ Lower one A-frame stabilizer, to throw the A-frame over to align twist lock halves at one side.
  - ♦ If twist locks will not align raise A-frame, partially extend slide frame and then close slide frame aligning twist locks as the vehicle reverses.
- Check the A-frame stabilizer leg cylinder mounting points to ensure pins are in place and secure.
- Check for any significant distortion of A-frame leg and stabilizer for damage. Report defect to maintenance.

112. Lock twist locks.

- Check that the A-frame is fully lowered with the stabilizer feet clear of the ground.
- Raise the A-frame clear of twist lock and check for free rotation of twist lock. If seized clean and lubricate. If seized, report seizure to maintenance.
- If free, check the upper twist lock housing for debris/distortion. Clean as required. Report any damage to maintenance.

113. Support far bank support with tail lift.

114. Drive vehicle clear of bridge.

115. Deploy home bank approach ramps.

- See Procedure 97.

116. Turn rotary switch to position 2.

117. Lower tail lift and remove far bank support feet.

Tail lift will not lower.

- If the tail lift will not lower check for obstruction. Clear obstruction.
- Use the manual over ride valves on swing cylinders to lower tail lift. Refer to Chapter 7 paragraph 7.20.

Far bank feet can not be removed.

- Check the release catch for deformation/debris. Clean any debris from the release catch. Report any damage to maintenance.

118. Retract A-frame shootbolts and rotate the A-frame to stowed position.

A-frame shootbolts will not retract.

- Press and hold the A-frame ROTATE DEPLOY button on the interface enclosure. Release shootbolt/s.
- Check for security of the A-frame rotate shootbolt housing - tighten the A-frame rotate shootbolt housing if necessary. Report any adjustment to maintenance.
- Remove the shootbolt handle and retract the shootbolt pins from opposite side.
- Check for housing distortion. Report damage to maintenance.
- Check the alignment of holes.
  - ♦ If holes are out of alignment report defect to maintenance so that the A-frame stop pads can be re-shimmed.
  - ♦ If the misalignment is fore and aft. Report to maintenance so that re-shimming of the A-frame stop pads can be carried out.
  - ♦ If the misalignment is vertical then check for excessive hinge bush wear. Report any wear to maintenance
- Check rotate cylinder mounting points to ensure pins are in place and secure.
- If rotate cylinders appear to be functioning check for mechanical obstruction, check all hinge points, clean and lubricate as required. Report any damage/deformation to maintenance.

119. Stow far bank support.

- Check the far bank support upper shootbolt is fully retracted.
- If shootbolt can not be retracted, check R clip is removed and the weight of far bank support is fully taken with the tail lift. **DO NOT** apply too much pressure, this will prevent the shootbolt being released.
- Check that the far bank support lower shootbolt is fully retracted.
- Ensure that the tail lift **SWING** cylinders are being used to move tail lift. NOT the RAISE cylinders.

Once the far bank support is retracted, if lower shootbolt can not be inserted.

- Extend the far bank support slightly and check for free play in sliding sections. Push the central column by hand and raise, insert the lower shootbolt. Report excessive free play to maintenance.

120. Stow far bank support feet.

- Check that the far bank support feet and brackets are not deformed. Refer to Chapter 10 procedure 10.19.
- Check the locking catch for free rotation. Refer to Chapter 10 procedure 10.19.

121. Remove the A-frame hinge pins and fold the A-frame.

- Press and hold the A-frame **FOLD DEPLOY** button on the interface enclosure - Remove all possible hinge pins.
- Press and release the A-frame FOLD PARK button, remove pin/s. Try a maximum of 3 times then fully unfold A-frame again. Repeat until all pins are removed.
- After the mission is complete inform maintenance of the difficulty in pinning A-frame hinges so that the A-frame fold stop blocks can be re-shimmed.
- If all hinge pins are removed and if cylinders appear to be functioning correctly check for mechanical obstruction, check all hinge points, clean and lubricate. Report defect to maintenance.

- Check A-frame fold cylinder mounting points to ensure pins are in place and secure.

122. Insert the A-frame pins in the transportation position.

- Press and hold the A-frame FOLD PARK button on the interface enclosure until all cylinder movement stops. Insert Pins.
- Check the fixing of the A-frame hinge locking plate. Rotate to align and insert pins. Report defect to maintenance at next opportunity,
- Check for free play at the A-frame fold hinge. Report defect to maintenance.

123. Strap the crane spreader pads and step ladder to tail lift.

124. Stow the tail lift to transportation position.

125. Strap the tail lift.

- If the strap will not hook, check the safety latch for deformation. Replace defective transport strap.

126. Stow the tail lift pendant.

- Check the MIL connector for deformation/damage. Report damage to maintenance.

127. Add removable mudguards.

- Ensure that the correct side mudguard is being fitted. Note they are handed.
- Ensure that the lower A-frame shootbolt is fully retracted.
- Check for any deformation of removable mudguard. Report defect to maintenance.
- Check for security of the fixed mudguards. Report defect to maintenance.
- Ensure that the launcher is fully folded and rotated, and that all transport pins are fitted correctly.

TABLE OF CONTENTS

CHAPTER 10

OPERATOR MAINTENANCE

CHAPTER 10

OPERATOR MAINTENANCE

10.1 CRANE - CHANGING FUSES

10.1.1 Coverage

10.1.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.1.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Equipment Conditions

Power removed from launch vehicle.

10.1.3 Removal

NOTE

When faults occur in the electrical system of the crane, check all fuses Figure 10. 1 B (1) in the main switching cabinet Figure 10. 1 A.

10.1.3.1 To replace a fuse remove cover of main switching cabinet.

10.1.4 Service/repair

10.1.4.1 Check whether fuse(s) Figure 10. 1 B (1) are defective.

10.1.4.2 Each fuse has its own LED. The LED will illuminate if the fuse is defective.

10.1.4.3 Switch off electrical power to the crane.

CAUTION

Equipment damage. Never bridge or repair defective fuses as damage to equipment can occur.

10.1.4.4 Replace the defective fuse ensuring that replacement is of the correct ampere rating.

10.1.4.5 Switch on electrical power to the crane.

10.1.4.6 Ensure that the fuse does not rupture.

10.1.4.7 If the fuse ruptures again, further investigation is required to rectify the fault.

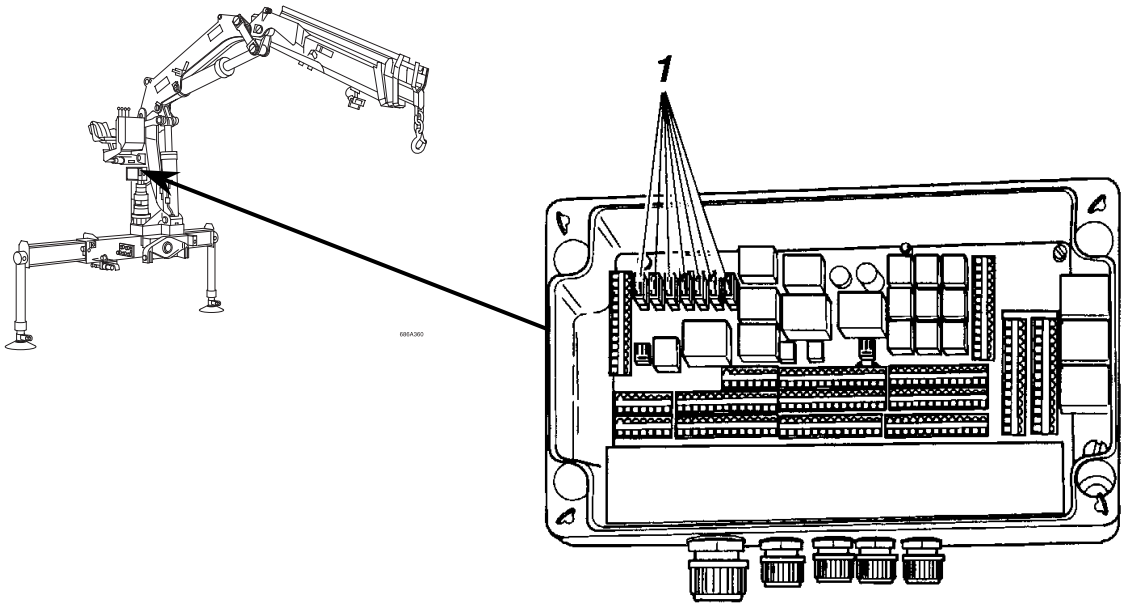


Figure 10. 1 Crane Electrical Cabinet and Fuse Locations

10.1.5 Installation

10.1.5.1 If the fuse does not rupture, check the seal on the lid of the cabinet for damage. Replace seal if damage is evident.

10.1.5.2 Refit seal and cabinet cover and secure.

10.2 CRANE - CHANGING INDICATOR FILAMENT

10.2.1 Coverage

10.2.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.2.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Equipment Conditions

Power removed from launch vehicle.

10.2.3 Removal

10.2.3.1 Unscrew the lamp cap (1).

10.2.4 Service/repair

10.2.4.1 Unscrew the filament lamp by turning it counter-clockwise 90 degrees.

10.2.4.2 Replace filament lamp with lamp of the same rating.

10.2.5 Installation

10.2.5.1 Refit cap (1).

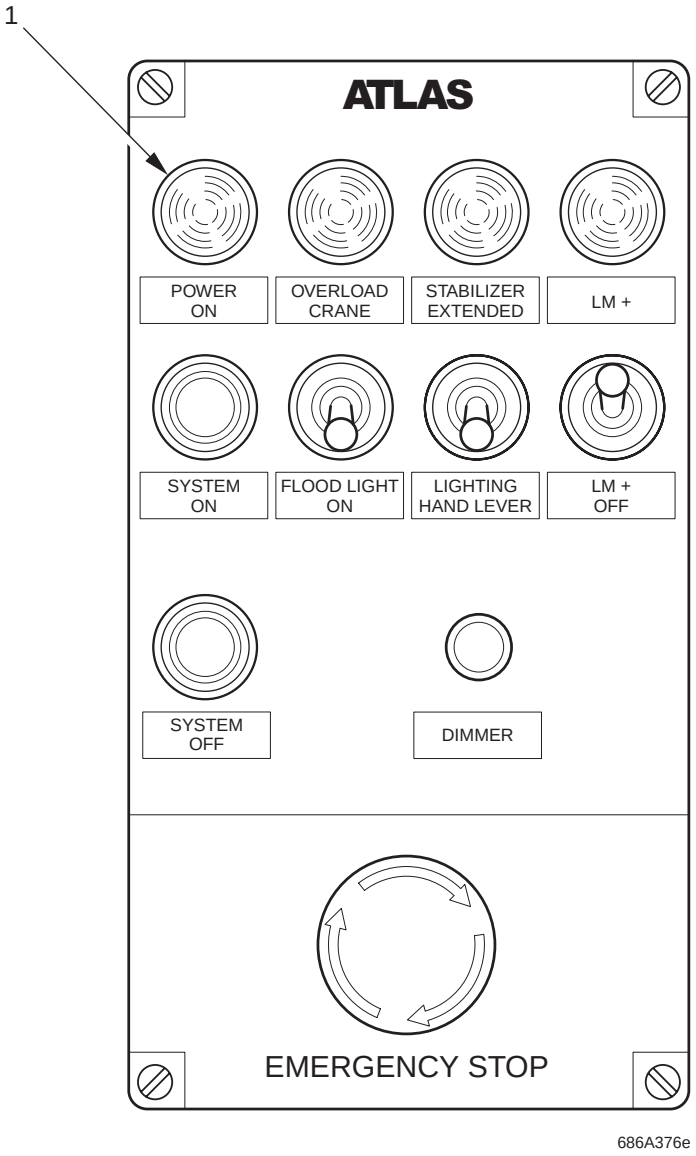


Figure 10. 2 Crane Control Panel

10.3 CRANE - HAND LEVER FILAMENT

10.3.1 Coverage

10.3.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.3.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Equipment Conditions

Power removed from launch vehicle.

10.3.3 Replacing Hand Lever Light Filament

10.3.3.1 To replace the hand lever light filament, unscrew the two securing bolts (1) from protective cover (2).

10.3.4 Service/repair

10.3.4.1 Unscrew the filament lamp by turning it counter-clockwise 90degrees.

10.3.4.2 Replace filament lamp with lamp of the same type and rating.

10.3.5 Installation

10.3.5.1 Screw protective cover (2) back into place.

10.3.5.2 Fit the two securing bolts to secure the protective cover in place.

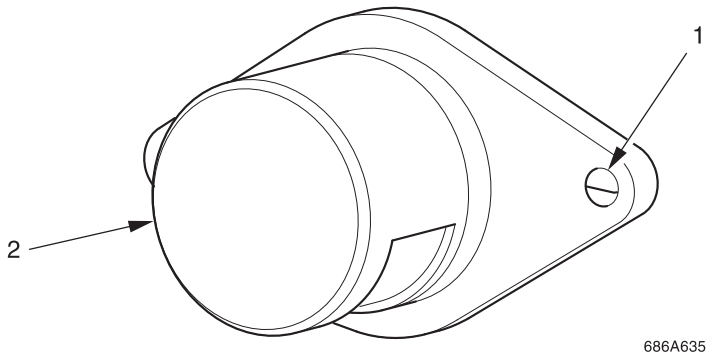


Figure 10. 3 Hand Lever Light Assembly

10.4 BRIDGE MODULE - BRIDGE MODULE DECK UNITS

10.4.1 Coverage

10.4.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.4.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Equipment Conditions

Bridge module open and on a raised flat surface, for access to underside.

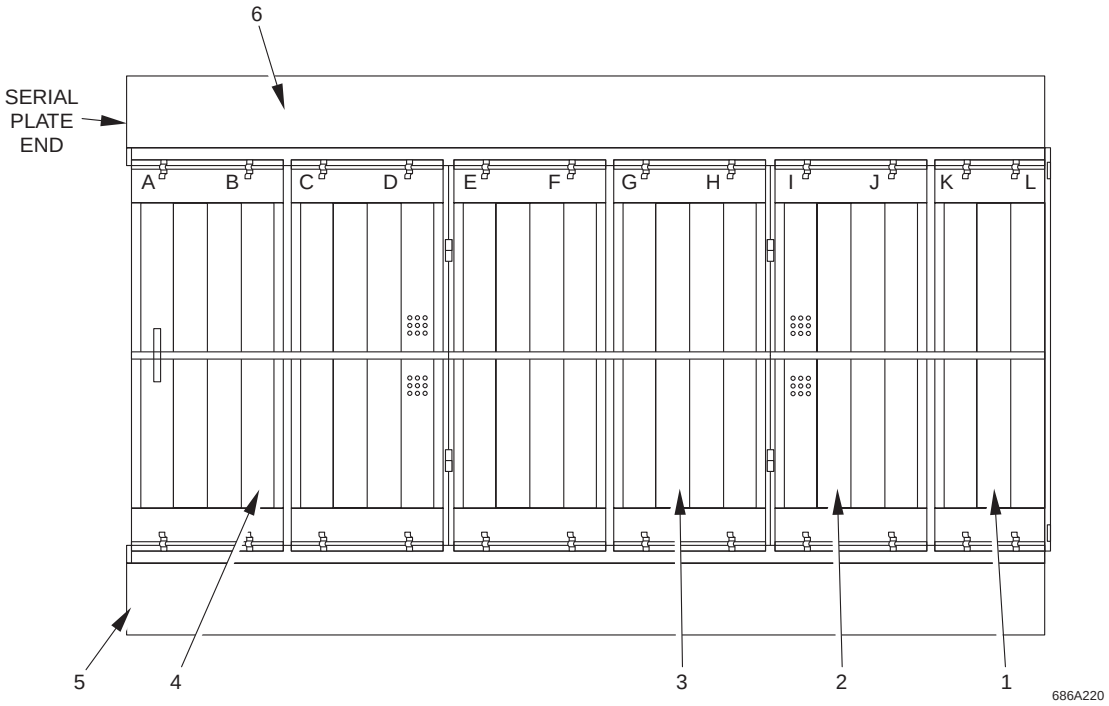


Figure 10. 4 Bridge Module Decking Units

NOTE

This maintenance procedure details the typical removal and installation of deck units on a ramp module and it is also applicable to the parallel module taking into consideration the differences in construction.

There are four types of deck units fitted to the ramp module. All deck units have the same hinge arrangement but are different sizes. When changing the deck units check the TM-5-5420-279-24P to obtain the correct deck unit.

The combination deck unit (3) is different to the other three deck units. The bridge module upper damper mounting and two opening/closing pulleys are fitted to it.

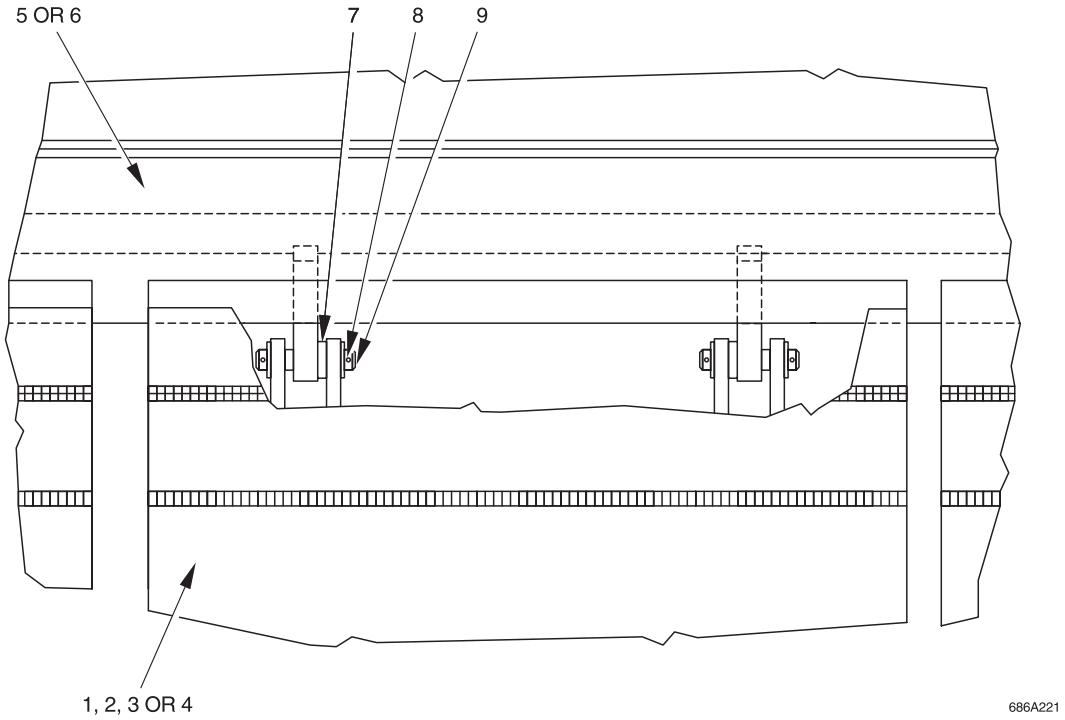


Figure 10. 5 Deck Unit Hinge

10.4.3 Removal

(Deck units 1, 2 and 4)

10.4.3.1 This removal procedure is for deck units 1,2 and 4.

10.4.3.2 Locate the hinge assembly for the deck unit.

10.4.3.3 Remove the spring pin (8).

10.4.3.4 Remove the hinge pin (9).

10.4.3.5 Retain the spacer (7). Take note of which side the spacer is fitted, each spacer is fitted only to in that position. The spacer has a number stamped on it. The reference point is taken from the serial plate end of the panel and the washers are lettered A, B, C etc with the panel serial plate number first (See Figure 10. 4). For example if the panel serial No. is 34 and it is the first spacer from the serial number end, the washer will be numbered 34-A.

10.4.3.6 Steps 10.4.3.2 through 10.4.3.5 must be carried out on each of the deck units four hinges.

10.4.3.7 Remove the deck unit.

(Combination deck unit 3)

10.4.3.8 Remove the upper damper mounting in accordance with TM-5-5420-279-23 Maintenance Manual.

10.4.3.9 Remove the split pin (10) and pin (11).

NOTE

Para 10.4.3.9 will release the closing sling cable from the combination deck unit.

10.4.3.10 Carry out steps 10.4.3.2 through 10.4.3.7.

10.4.3.11 Remove the Nyloc nut (16), washer (15). Discard the Nyloc nut (16).

10.4.3.12 Remove the pulley shaft (13) complete with pulley assembly (14), rope guards (12) and (17).

10.4.4 Service/repair

10.4.4.1 Check all threaded components for wear or damage.

10.4.4.2 Check the pulley shaft (13) for wear or damage.

10.4.4.3 Check the closing sling for wear or damage.

10.4.4.4 Check all hinge points for wear or damage.

10.4.4.5 Replace components as necessary.

10.4.5 Installation

(Deck units 1, 2 and 4).

10.4.5.1 Locate the deck unit on the bridge module.

10.4.5.2 Fit the spacer (7) and hinge pin (9).

10.4.5.3 Fit the spring pin (8).

10.4.5.4 Carry out steps 10.4.5.2 through 10.4.5.3 on all hinge assemblies.

(Combination deck unit 3)

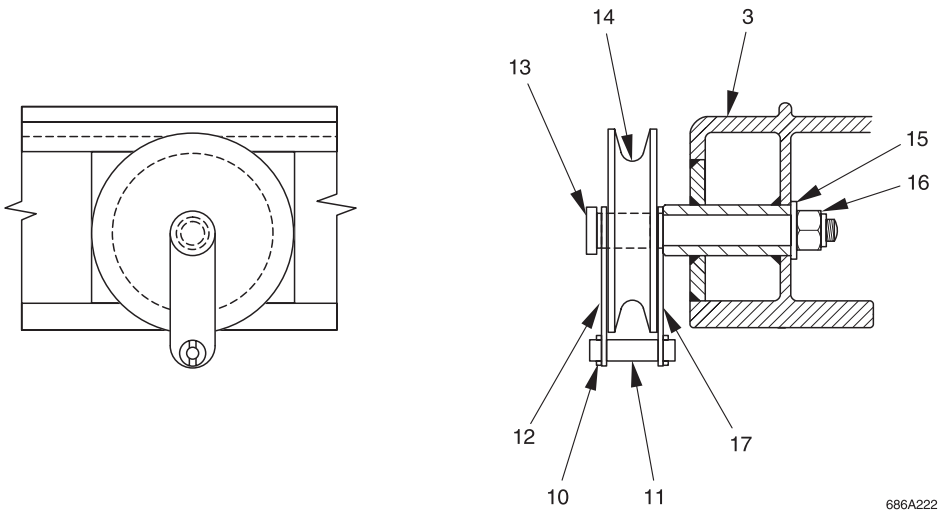


Figure 10. 6 Deck Unit No. 3 Pulley

10.4.5.5 Fit the pulley shaft (13) complete with rope guards (12 and 17) and pulley assembly to the combination deck unit (3).

10.4.5.6 Secure the pulley shaft with the washer (15) and a new Nyloc nut (16).

10.4.5.7 Locate the combination deck unit (3) on the bridge module.

10.4.5.8 Carry out steps 10.4.5.2 through 10.4.5.3 on all hinge assemblies.

10.4.5.9 Fit the closing sling cable to the pulley assembly (14).

10.4.5.10 Fit the pin (11) through the rope guards (12 and 17).

10.4.5.11 Fit the split pin (10).

10.4.5.12 Install the upper damper mounting in accordance with TM-5-5420-279-23 Maintenance Manual.

10.4.5.13 Check the operation of the bridge module.

10.5 BRIDGE MODULE - CLOSING SLING

10.5.1 Coverage

10.5.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.5.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Equipment Conditions

Bridge module open and on a raised flat surface to gain access to underside.

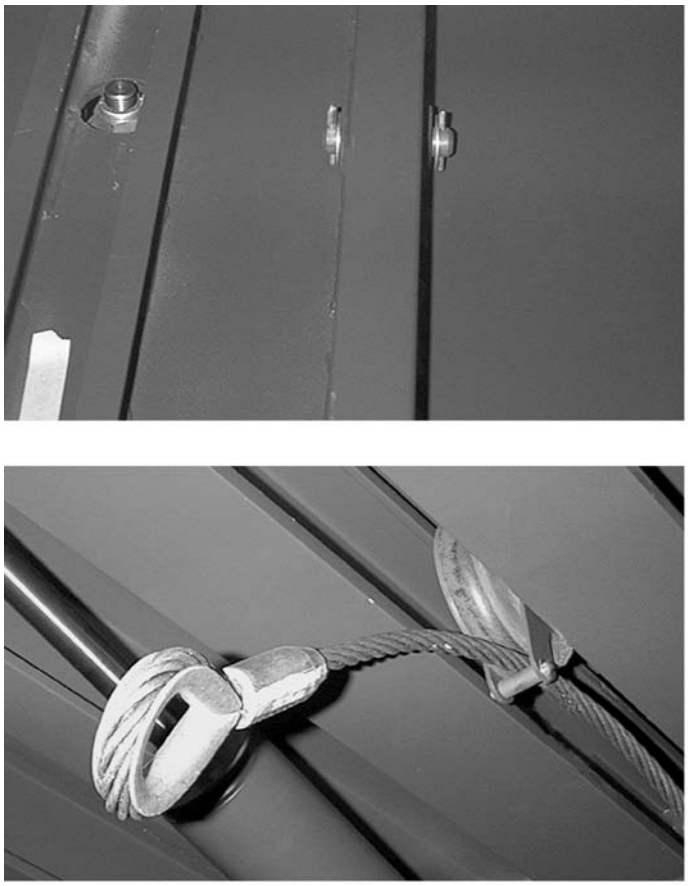


Figure 10. 7 Closing Sling Connections

10.5.3 Removal

10.5.3.1 Remove one split pin (1) and washer (2) from one side of pin (3). Discard the spring pin.

10.5.3.2 Remove pin (3), ensuring that as the pin is withdrawn the four inner washers (4) are recovered.

10.5.3.3 Remove the two split pins (5) and washers (6) from the guard plates (7) on the pulley (8). Discard the split pins.

10.5.3.4 Remove the pin (9) and release the closing sling (10).

10.5.4 Service/repair

10.5.4.1 Inspect all components for damage and corrosion.

10.5.4.2 Inspect closing sling for frayed or broken strands.

10.5.4.3 Replace components as required.

10.5.5 Installation

10.5.5.1 Partly insert pin (3) into mounting boss. Fit two washers (4) onto the pin. Fit closing sling (10) onto the pin. Fit two more washers (4) onto the pin and insert the pin fully into the boss.

10.5.5.2 Fit washer (2) to pin (3) and secure with new split pin (1).

10.5.5.3 Place closing sling against lower half of pulley (8) and fit pin (9) between guard plates (7).

10.5.5.4 Fit washers (6) and split pins (5). Secure split pins.

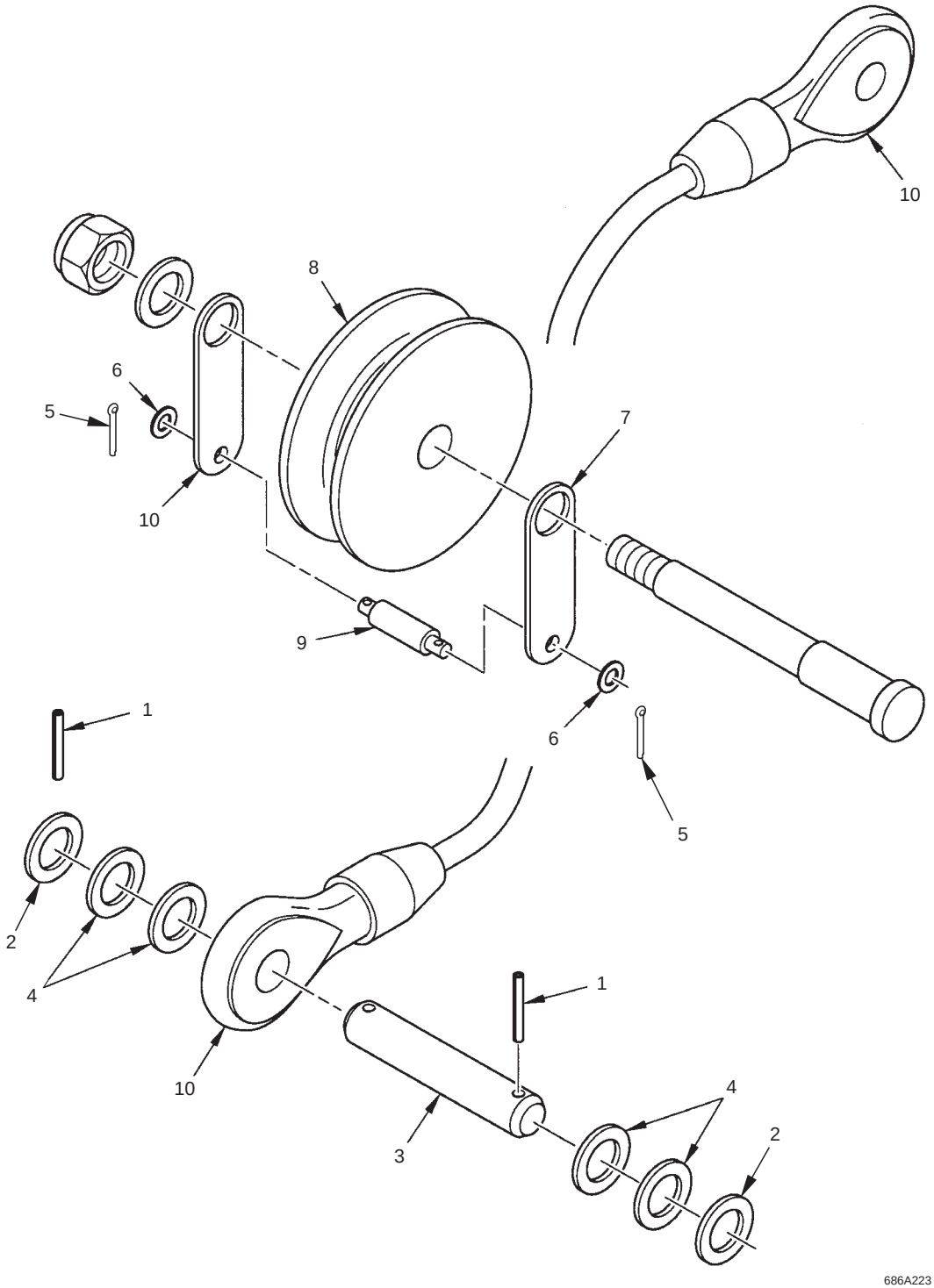


Figure 10. 8 Pulley Disassembly

10.6 BRIDGE MODULE - CLOSING SLING PULLEY

10.6.1 Coverage

10.6.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.6.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Equipment Conditions

Bridge module in open position on raised flat surface.

Figure 10. 9 Closing Sling Pulley

10.6.3 Removal

10.6.3.1 Remove and discard the two split pins (1), remove washers (2) from the guard plate pin (3).

10.6.3.2 Open the guard plates (4) and remove the pin (3) and release the closing sling (9) from the pulley assembly.

10.6.3.3 Remove and discard the nut (5) and remove the plain washer (6).

10.6.3.4 Withdraw the pulley shaft (7) complete with pulley (8) and guard plates (4).

10.6.3.5 Remove the pulley (8) and guard plates (4) from the shaft (7).

10.6.4 Service/repair

10.6.4.1 Inspect all components for damage and corrosion.

10.6.4.2 Check pulley (8) is free running on shaft (7).

10.6.4.3 Examine threads on shaft for damage.

10.6.4.4 Replace components as required.

10.6.5 Installation

10.6.5.1 Fit onto shaft (7) one guard plate (4), pulley (8) and second guard plate (4).

10.6.5.2 Locate shaft (7) into bush on the deck unit and secure using plain washer (6) and new nut (5).

10.6.5.3 Place closing sling against lower half of pulley and fit pin (3).

10.6.5.4 Secure pin (3) using plain washer (2) each side and new split pins (1). Secure split pins.

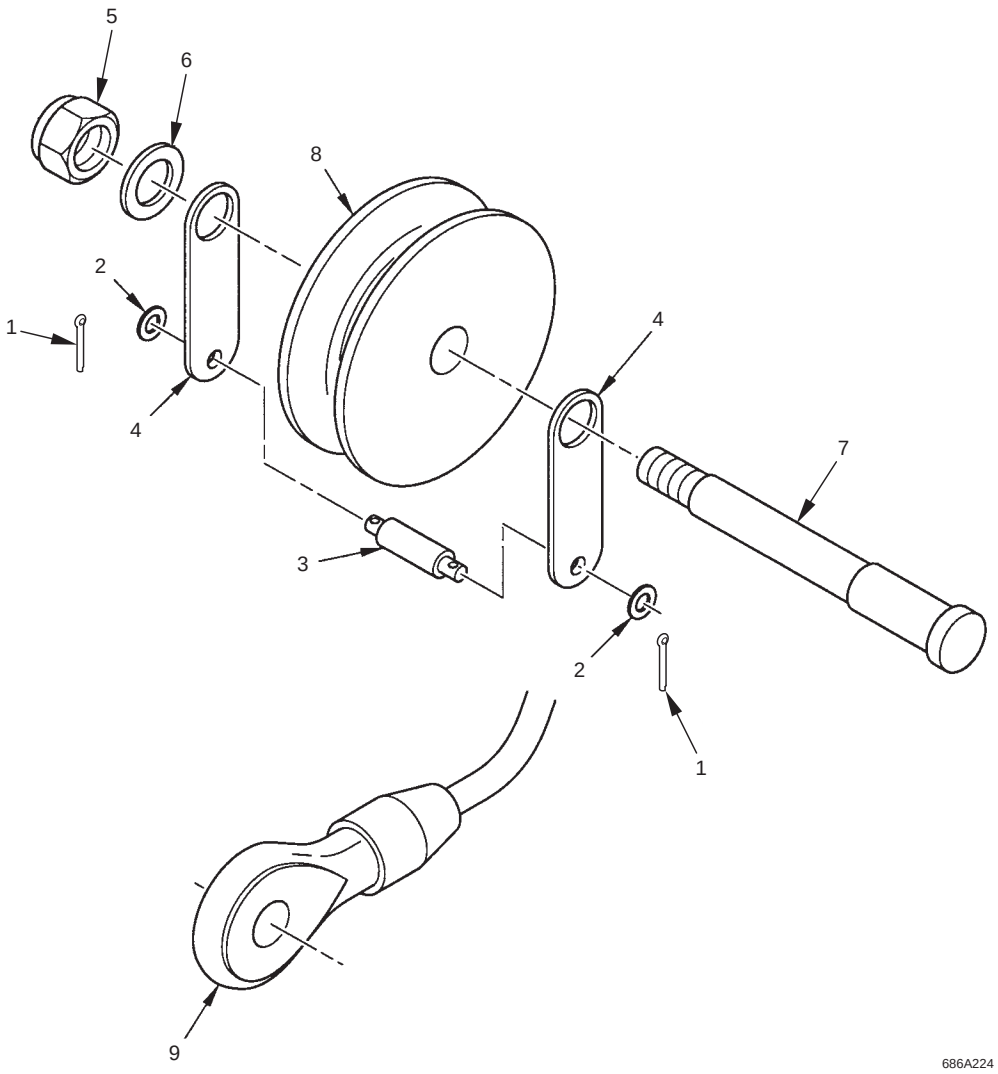


Figure 10. 10 Closing Sling Pulley Disassembly

10.7 BRIDGE MODULE - OPENING SLING REPLACEMENT

10.7.1 Coverage

10.7.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.7.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Equipment Conditions

Bridge module open and on a secure raised flat surface to gain access to inside of side panel.

Figure 10. 11 Bridge Module Opening Sling

10.7.3 Removal

10.7.3.1 Remove one spring pin (1) and washer (2) from one side of pin (3). Discard the spring pin.

10.7.3.2 Remove pin (3) and release opening sling (4).

10.7.4 Service/repair

10.7.4.1 Inspect components for damage and corrosion.

10.7.4.2 Inspect opening sling for cuts to outer sleeve. Small cuts in outer sleeve can be taped-up to stop the entry of dirt and moisture, after checking there is no internal damage.

10.7.4.3 Replace components as required.

10.7.5 Installation

10.7.5.1 Position opening sling between support brackets and insert pin (3).

10.7.5.2 Fit washer (2) to pin (3) and secure with new spring pin (1).

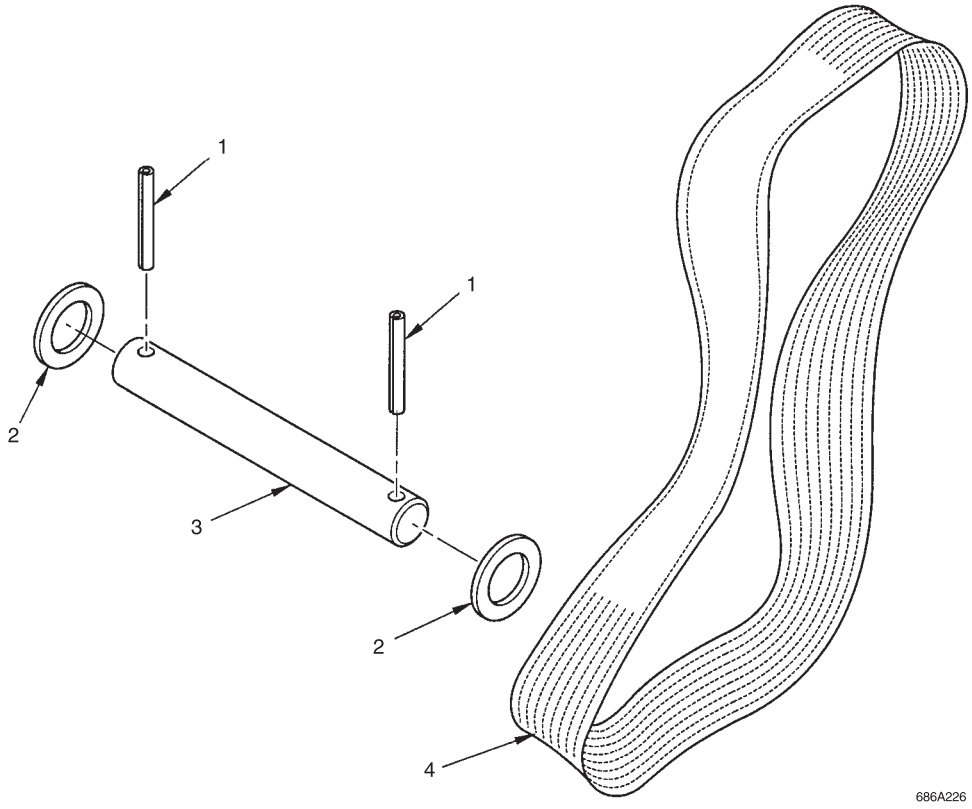


Figure 10. 12 Opening Sling Disassembly

10.8 BRIDGE MODULE - CURB REPLACEMENT

10.8.1 Coverage

10.8.1.1 This task covers:

d. Removal

e. Service/repair

f. Installation

10.8.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Equipment Conditions

Bridge module open and on a flat surface. Curb in deployed position.

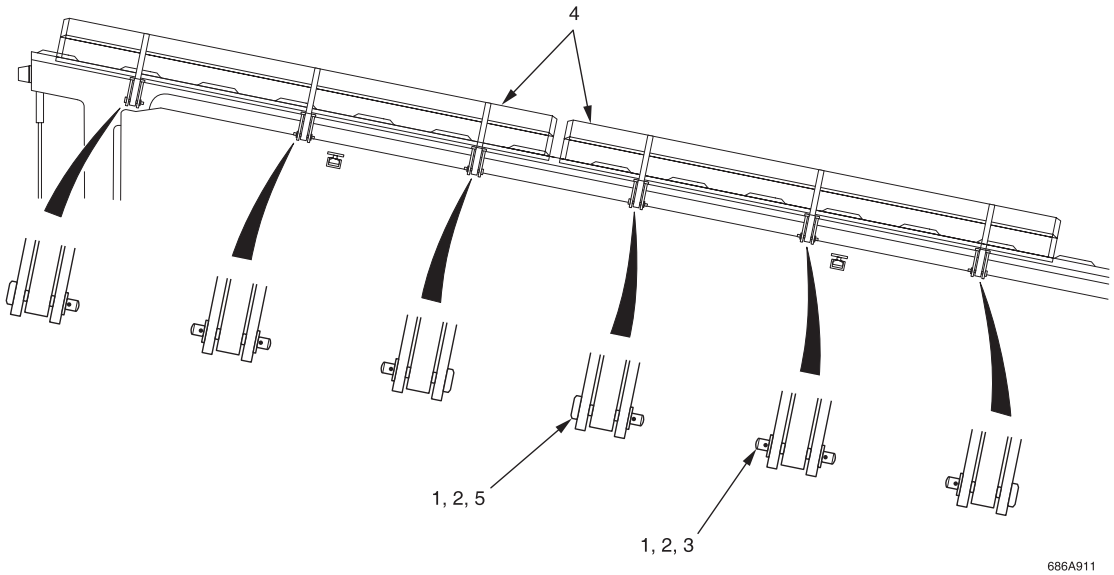


Figure 10. 13 Bridge Module Curb

WARNING

HEAVY OBJECTS. THE CURB WEIGHS 33 LBS APPROXIMATELY. TAKE CARE WHEN LIFTING AND MANEUVERING THE CURB.

10.8.3 Removal

10.8.3.1 Remove spring pins (1) and washer (2) at the center hinge position.

10.8.3.2 Discard the spring pins.

10.8.3.3 Remove the center hinge pin (3).

10.8.3.4 Remove spring pins (1) and washer (2) at the two outer hinge positions.

10.8.3.5 Discard the spring pins.

10.8.3.6 Remove both headed hinge pins (5) and remove the curb (4).

10.8.4 Service/repair

10.8.4.1 Examine the curb and component parts for damage and corrosion.

10.8.4.2 Examine curb hinge brackets for cracks and corrosion.

10.8.4.3 Replace components as required.

10.8.5 Installation

10.8.5.1 Position the curb (4) in its deployed position with hinge brackets correctly located.

10.8.5.2 Insert the three hinge pins (3 and 5) through the hinge brackets.

NOTE

Headed pins are fitted so that the heads are facing outward from the center of the curb

10.8.5.3 Fit the washers (2) each side of the headless hinge pin and the inside facing side of the headed pins, secure with new spring pins (1).

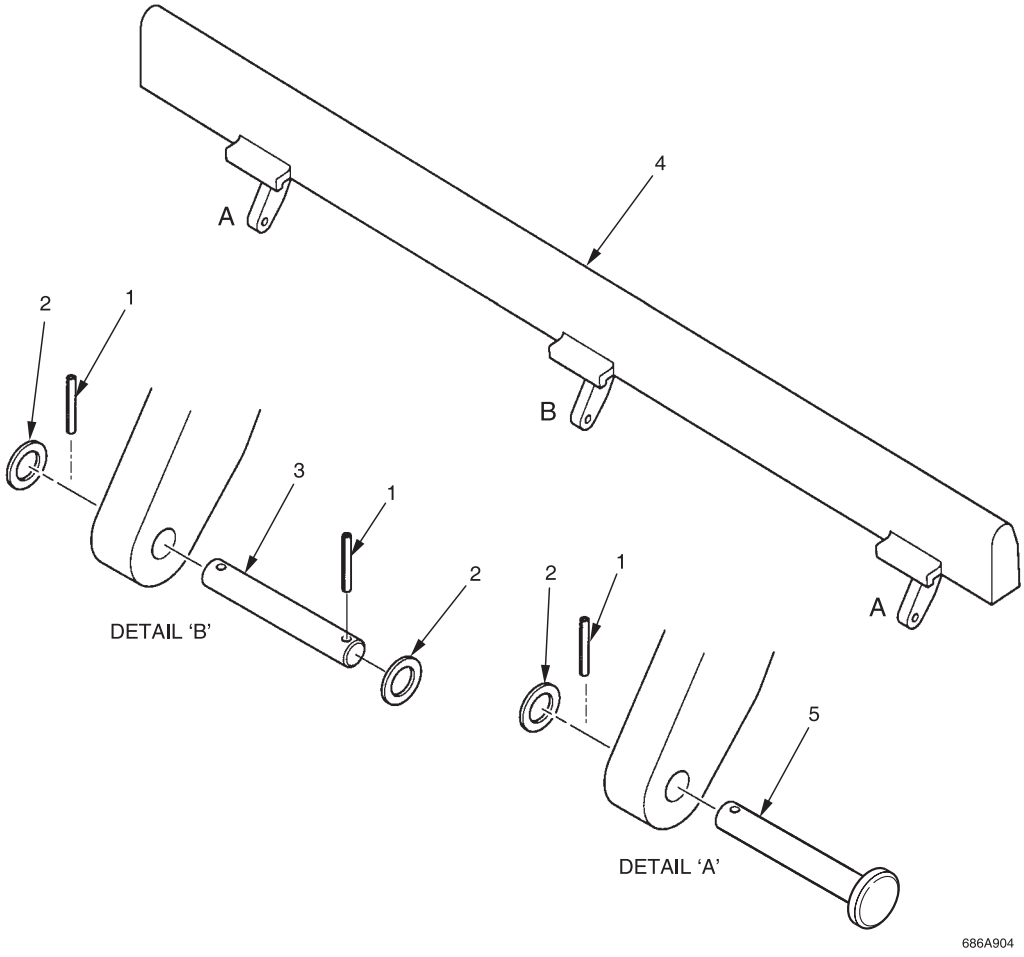


Figure 10. 14 Curb Disassembly

10.9 BRIDGE MODULE - BRIDGE MARKER REPLACEMENT

10.9.1 Coverage

10.9.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.9.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Thread-locking compound type Loctite 243.

Equipment Conditions

Bridge module open on a raised flat platform.

10.9.3 Removal

10.9.3.1 Remove lock nut (1), washer (2) and Belleville disk spring (3).

10.9.3.2 Withdraw bolt (5), washer (4) and remove bridge edge marker (10).

10.9.3.3 Remove two nuts (9), lock washers (8) and bolts (7) and remove bracket (6).

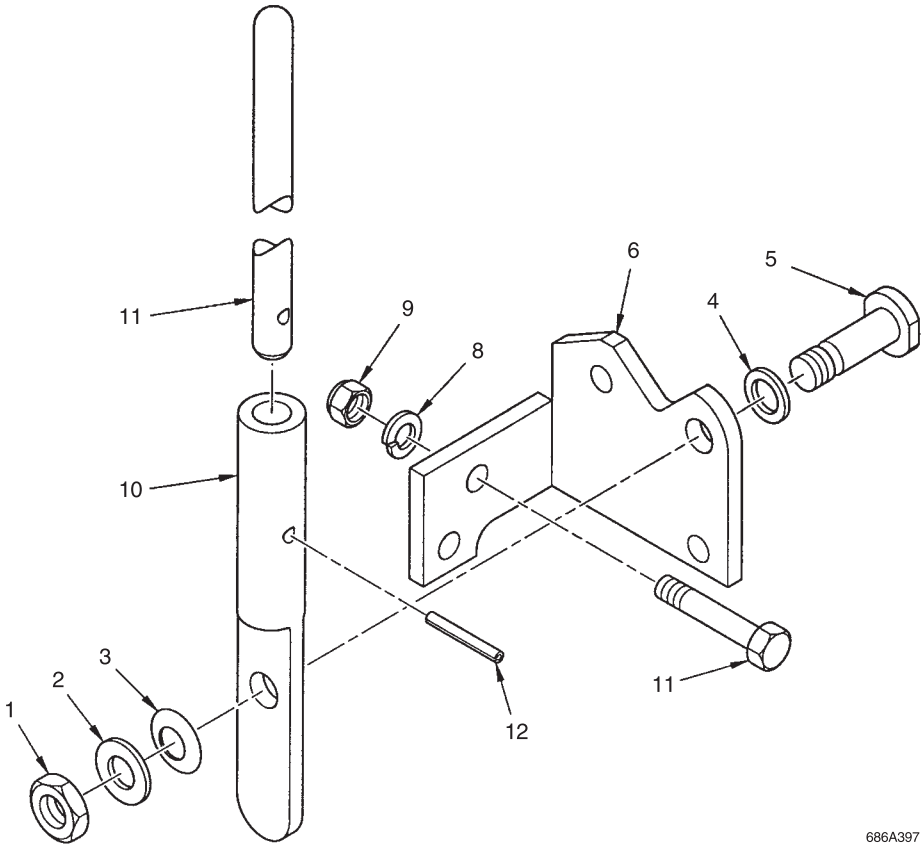


Figure 10. 15 Bridge Marker Disassembly

10.9.4 Service/repair

10.9.4.1 Inspect components for damage and corrosion.

10.9.4.2 Examine bolts and nuts for damage to bolt heads and threads.

10.9.4.3 Replace components as required.

10.9.4.4 Examine the rod (11) for damage and replace as required. To replace, remove the spring pin (12), fit a new rod (11) and secure in place with a new spring pin (12).

10.9.5 Installation

10.9.5.1 Locate bracket (6) on bridge module and secure with two bolts (7), lock washers (8) and nuts (9). Use thread-locking compound on the bolt threads.

10.9.5.2 Locate bridge edge marker (10) on bracket (6).

10.9.5.3 Fit a washer (4) to bolt (5). Insert bolt (5) through bracket (6) and bridge marker (10), secure with Belville disk spring (3), washer (2), and nut (1). Use thread-locking compound on the bolt threads.

10.10 BRIDGE MODULE - SHOOTBOLT REPLACEMENT

10.10.1 Coverage

10.10.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.10.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Thread-locking compound type Loctite 243.

Equipment Conditions

Bridge module open raised on a flat platform.

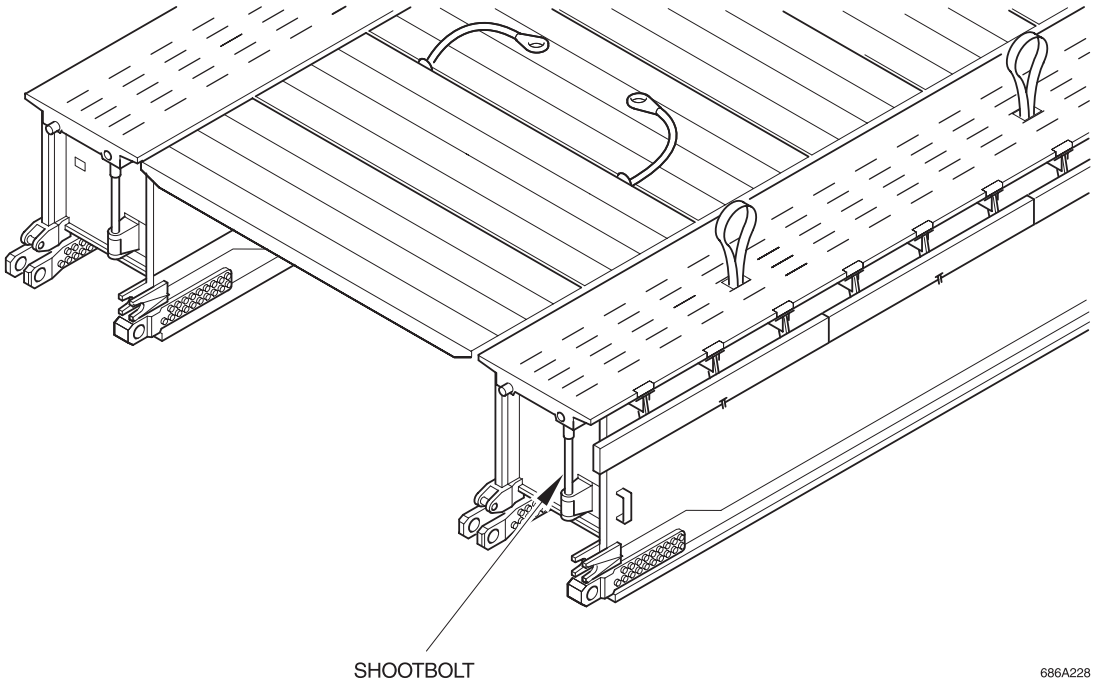


Figure 10. 16 Bridge Module Shootbolt

10.10.3 Removal

10.10.3.1 Remove the four Nyloc nuts (3), plain washers (4) and bolts (5).

10.10.3.2 Remove the shootbolt bracket (6). Discard the Nyloc nuts (3).

10.10.3.3 Unscrew pin (1) from shootbolt (2).

10.10.3.4 Remove shootbolt (2) from bracket (6).

10.10.4 Service/repair

10.10.4.1 Examine all components for damage and corrosion.

10.10.4.2 Examine the bolts (5) for damage to bolt heads and threads.

10.10.4.3 Replace components as required.

10.10.5 Installation

10.10.5.1 Locate the shootbolt (2) in the bracket (6). Ensure the top of the shootbolt (2) is aligned with its locating hole in the dowel.

10.10.5.2 Apply thread-locking compound to thread of pin (1). Align the threaded hole in shootbolt (2) with slot in the bracket (6) and screw, pin (1) into shootbolt (2).

10.10.5.3 Tighten pin (1).

10.10.5.4 Position the shootbolt bracket (6) on the bridge module and secure the bracket using bolts (5), plain washers (4) and new Nyloc nuts (3).

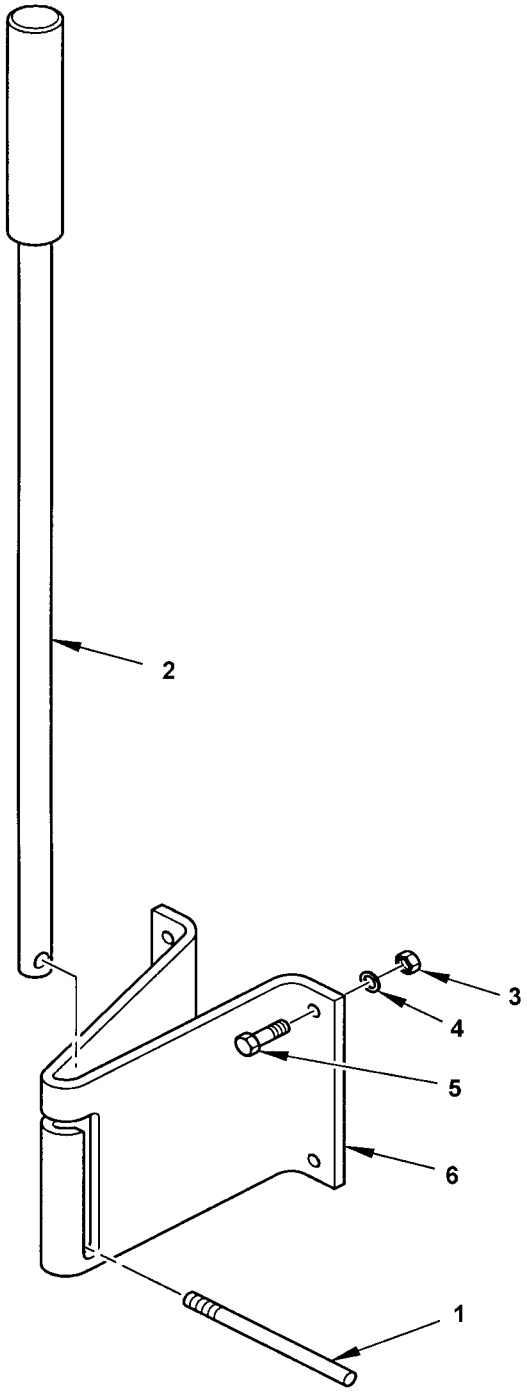


Figure 10. 17 Shootbolt

10.11 BRIDGE MODULE – BUSH RESILIENT MOUNT

10.11.1 Coverage

10.11.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.11.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Equipment Conditions

Ramp module on raised flat surface.

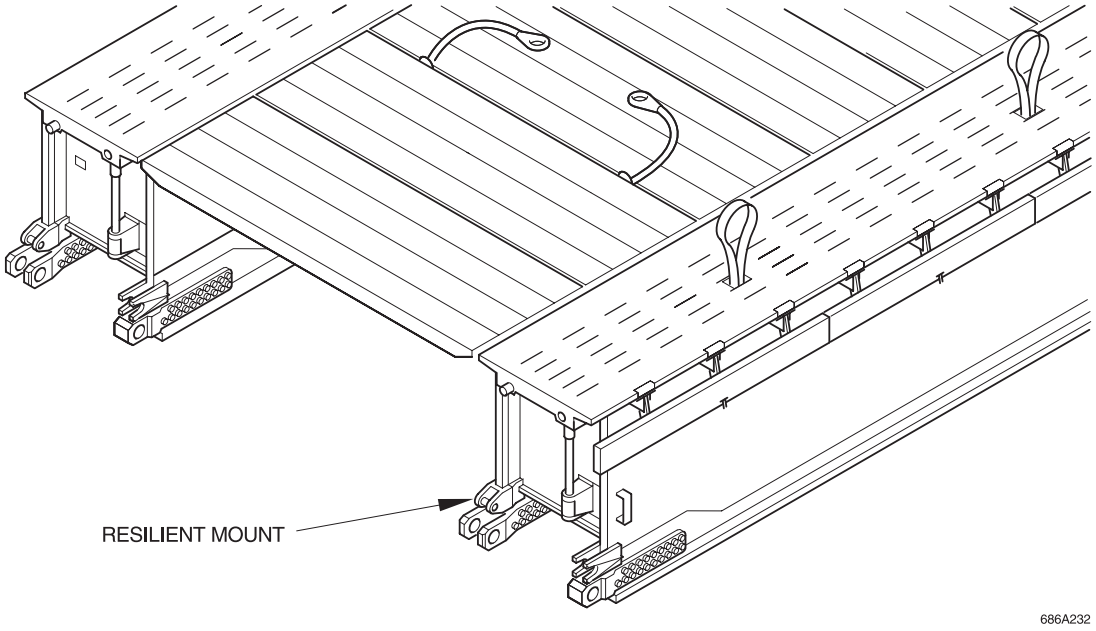


Figure 10. 18 Bridge Module - Bush Resilient Mount

NOTE

This procedure applies to the ramp module and the parallel module.

10.11.3 Removal

10.11.3.1 Remove spring pin (4) and washer (2). Discard spring pin.

10.11.3.2 Withdraw pin (3) and remove bush resilient (1).

10.11.4 Service/repair

10.11.4.1 Examine bush resilient (1) and pin (3) for damage wear and corrosion.

10.11.4.2 Replace components as required.

10.11.5 Installation

10.11.5.1 Spray pin (3) with anti-seize spray oil.

10.11.5.2 Position bush resilient (1) between mounting brackets.

10.11.5.3 Insert pin (3) with head of pin facing outwards.

10.11.5.4 Fit washer (2) and secure with new spring pin (1).

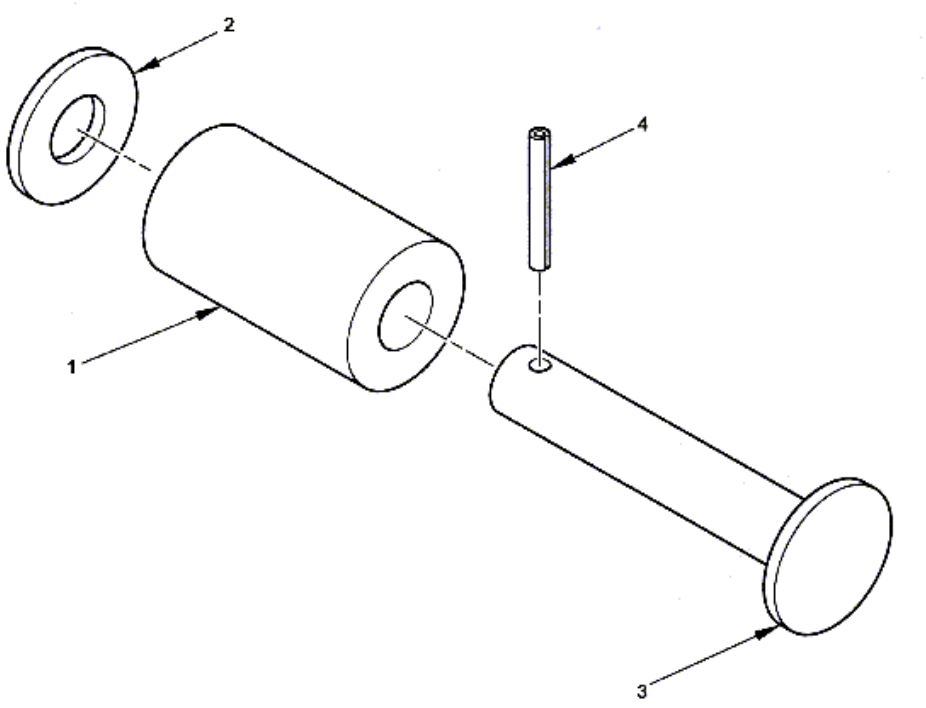


Figure 10. 19 Bush Resilient Mount, Disassembly

10.12 BRIDGE MODULE - PARALLEL MODULE - FATIGUE MONITOR

10.12.1 Coverage

10.12.1.1 This task covers:

a. Inspection

10.12.2 Initial Setup

Tools Required

None.

Equipment Conditions

Bridge module open on a raised flat surface.

NOTE

Fatigue monitors are only fitted to parallel modules.

10.12.3 Inspection

10.12.3.1 Examine the fatigue monitor located centrally on the inner face of each parallel panel.

10.12.3.2 If a crack has developed between the two holes in a monitor, this indicates that the bridge module is within 1000 full load crossings of its design life.

10.12.3.3 If the monitor has cracked across its whole length, the bridge module has reached the end of its useful design life; it must be taken out of service.

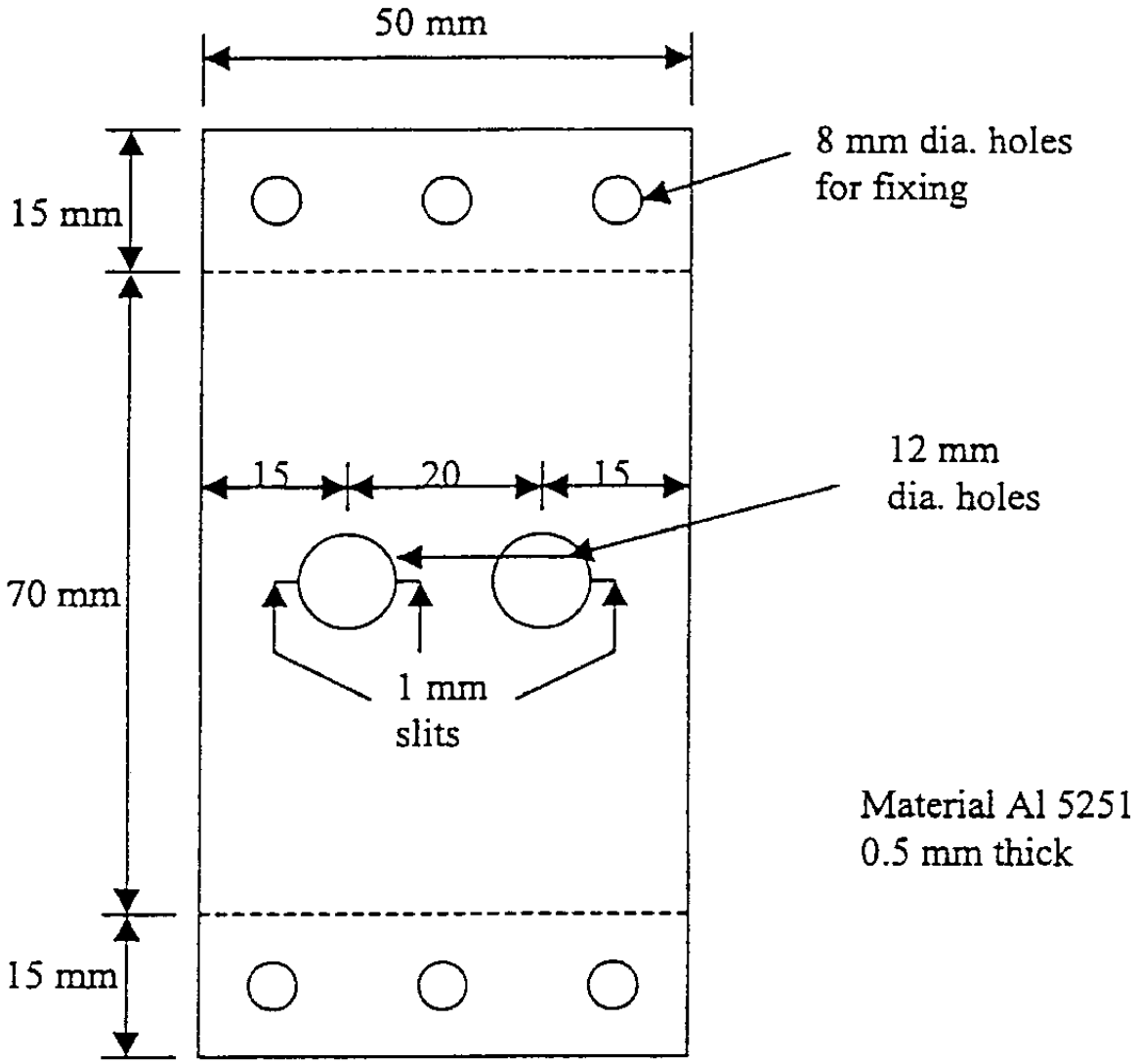


Figure 10. 20 Fatigue Monitor

10.13 BRIDGE MODULE – RAMP PUSH/PULL SLING

10.13.1 Coverage

10.13.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.13.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Thread-locking compound Loctite 243.

Equipment Conditions

None.

10.13.3 Removal

10.13.3.1 Remove the two bolts and washers securing the bracket to the bridge module.

10.13.3.2 Remove the bracket.

10.13.3.3 Remove the sling.

10.13.4 Service/repair

10.13.4.1 Check the sling for wear and damage.

10.13.4.2 Check the bolts and washers for damage.

10.13.4.3 Change components as required.

10.13.5 Installation

10.13.5.1 Place the bracket over the sling.

10.13.5.2 Apply thread-locking compound to the bolt threads.

10.13.5.3 Fit the bracket to the bridge module with the bolts and washers.

NOTE

Make sure that the bracket does not trap the sling when tightening the bolts.

Figure 10. 21 Ramp Module Push/Pull Sling

10.14 BRIDGE MODULE - RAMP LEAD IN BRACKET BOLTS

10.14.1 Coverage

10.14.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.14.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Thread-locking compound Loctite 243.

Equipment Conditions

None.

10.14.3 Removal

10.14.3.1 Remove the R clip (3).

10.14.3.2 Remove the ramp lead in bracket (2).

10.14.3.3 Remove the ramp lead in bracket mounting bolts (1).

NOTE

If the bolts have been sheared flush with the ramp, module leave the skid off and continue with build. Inform maintenance crew of damage.

10.14.4 Service/repair

10.14.4.1 Check the bracket for damage.

10.14.4.2 Check the bolts for damage.

10.14.4.3 Check the bolt hole threads for damage.

10.14.4.4 Check the R clip for damage.

10.14.4.5 Replace components as required.

10.14.5 Installation

10.14.5.1 Apply thread-locking compound to the bolts (1).

10.14.5.2 Fit the bolts (1) to the ramp module.

10.14.5.3 Fit the bracket (2) to the bolts.

10.14.5.4 Check that the bracket fits correctly; it may be removed if not in use and stowed in the appropriate place.

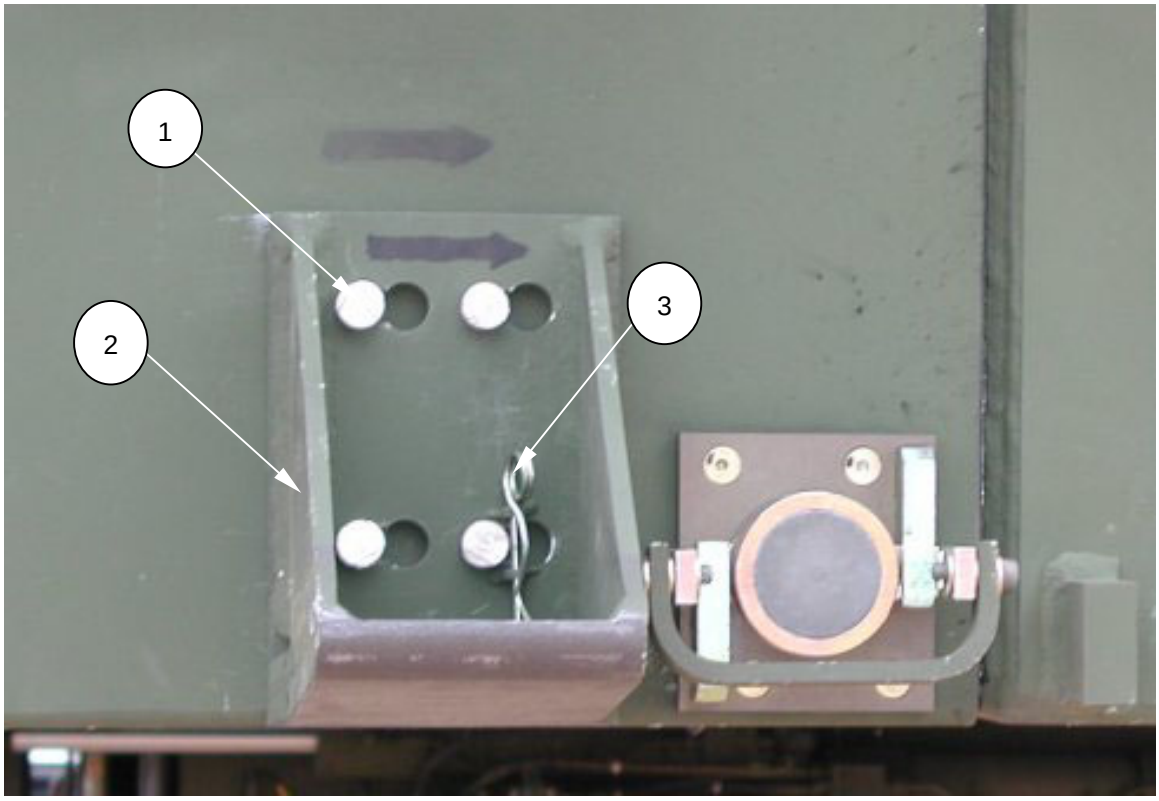


Figure 10. 22 Ramp Lead in Bracket

10.15 BRIDGE MODULE - END BEAM AND RAMP MODULE SLIDE PLATES

10.15.1 Coverage

10.15.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.15.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Thread-locking compound Loctite 243.

Equipment Conditions

None.

NOTE

There are two slide plates fitted to each ramp module end beam and each ramp module.

10.15.3 Removal

10.15.3.1 Remove the four screws securing the slide plate to the end beam or ramp module.

10.15.3.2 Remove the slide plate.

10.15.4 Service/repair

10.15.4.1 Check the slide plate for wear and damage.

10.15.4.2 Check the screws for damage.

10.15.4.3 Change components as required.

10.15.5 Installation

10.15.5.1 Apply thread-locking compound to the screws.

10.15.5.2 Fit the slide plate to the end beam or ramp module.

10.15.5.3 Secure the slide plate with the screws.

Ramp Module End Beam

Ramp Module

Figure 10. 23 End Beam Side Plates

10.16 BRIDGE MODULE - RAMP MODULE LEVEL

10.16.1 Coverage

10.16.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.16.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Glue.

Equipment Conditions

None.

10.16.3 Removal

10.16.3.1 Using a suitable tool prise the level body (1) away from the ramp module (2).

10.16.4 Clean

10.16.4.1 Using a suitable solvent clean the residual glue from the position that the damaged level was removed from on the ramp module. Ensure that all glue residue is removed.

10.16.5 Installation

10.16.5.1 Apply glue to the back of the new bubble level ensuring an even coating.

10.16.5.2 Ensuring that the ramp module is level, position the bubble level in position, making sure that the two bubbles are centered in the marked area (3).

10.16.5.3 Press the bubble level firmly into position on the ramp module, ensuring that the bubbles are still centered in the marked area (3).

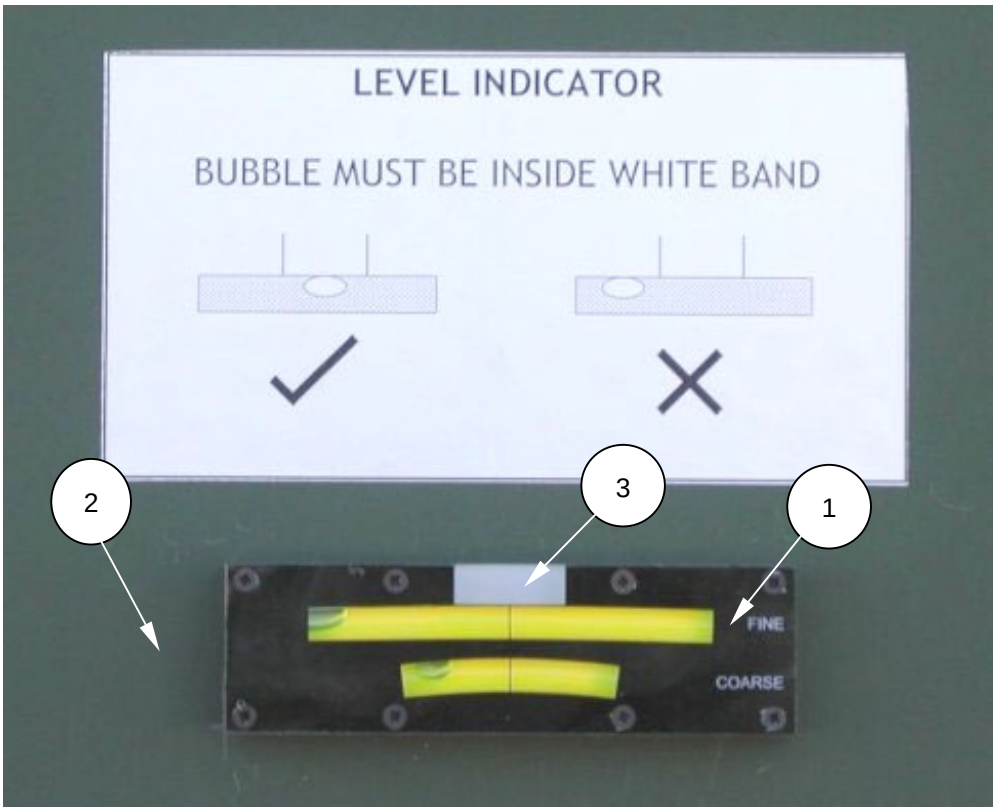


Figure 10. 24 Ramp Module Levels

10.17 A-FRAME - STOP PAD

10.17.1 Coverage

10.17.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.17.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Thread-locking compound Loctite 243.

Equipment Conditions

Launch frame deployed.

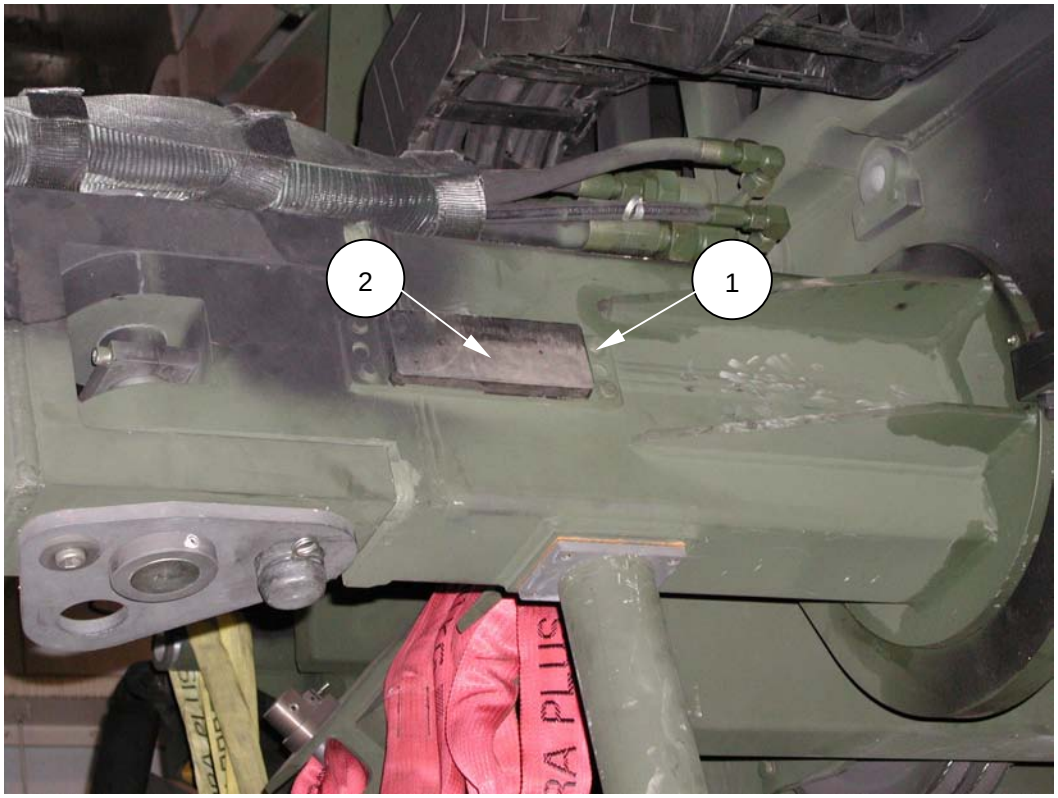


Figure 10. 25 A-Frame Stop Pad

10.17.3 Removal

10.17.3.1 Remove the four bolts (1) securing the stop pad (2) to the A-frame.

10.17.3.2 Remove the stop pad (2).

10.17.4 Service/repair

10.17.4.1 Check that the threads on the bolts are not damaged.

10.17.4.2 Change components as required.

10.17.5 Installation

10.17.5.1 Apply thread-locking compound to the thread of the bolts (1).

10.17.5.2 Fit the stop pad (2) to the A-frame and secure in place with the bolts (1).

10.18 LAUNCH FRAME – GUARDS

10.18.1 Coverage

10.18.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.18.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

None.

Equipment Conditions

A-frame deployed.

WARNING

HEAVY OBJECTS. THE LAUNCH FRAME GUARDS ARE HEAVY AND TWO PERSONNEL ARE REQUIRED TO LIFT THEM.

NOTE

Two personnel are required to lift the guards from the launch vehicle. A further two personnel will be required on the ground to receive the guards.

The upper winch guard and the top guard must be removed before the left and right hand guards can be removed.

The front access panel on the Left hand and Right Hand Guards must be removed to gain access to the front mounting bolts.

10.18.3 Removal

10.18.3.1 Remove the bolts (1), Nyloc nuts (3) and washers (2) securing the guards (4 through 9) to the launch frame.

10.18.3.2 Retain the bolts (1) and washers (2). Discard the Nyloc nuts (3).

10.18.3.3 Remove the guards.

10.18.4 Service/repair

10.18.4.1 Examine all threaded components for wear and damage.

10.18.4.2 Change components as required.

10.18.5 Installation

NOTE

The left and right hand guards must be replaced before the top guard and upper winch guard.

10.18.5.1 Position the guard on the launch frame.

10.18.5.2 Secure the guard to the launch frame with the bolts (1), washers (2) and new Nyloc nuts (3).

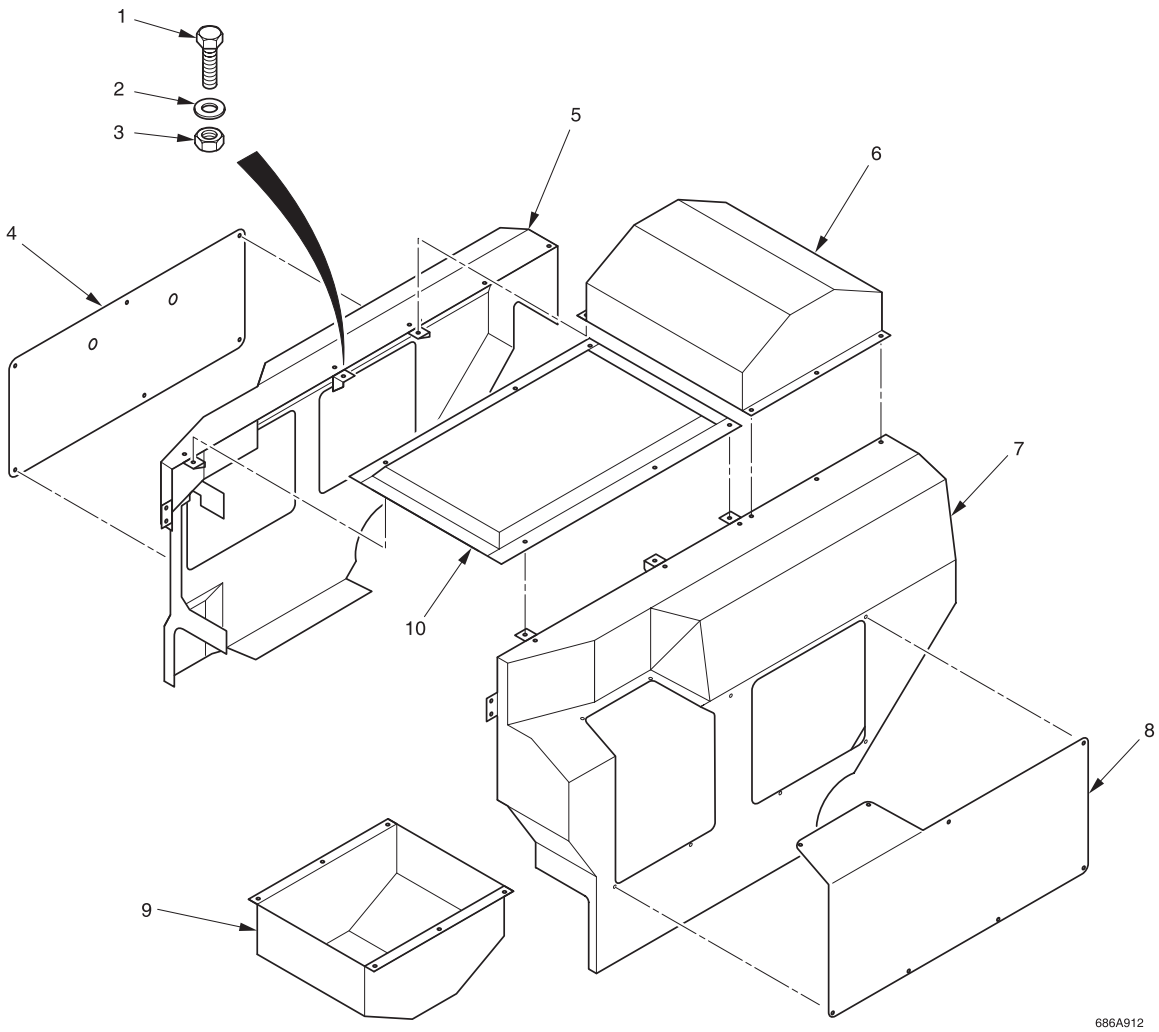


Figure 10. 26 Launch Frame Guards

10.19 FAR BANK SUPPORT - SUPPORT BEARING PAD LATCH

10.19.1 Coverage

10.19.1.1 This task covers:

a. Removal

b. Installation

10.19.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

None.

Equipment Conditions

Far bank support lowered with support bearing pads removed from storage position.

10.19.3 Removal

10.19.3.1 Remove the R clip (1).

10.19.3.2 Remove spring pin (5) securing the latch (3) to the far bank support latch shaft (2).

10.19.3.3 Remove washer (4) from latch shaft (2).

10.19.3.4 Remove the latch (3).

10.19.4 Installation

10.19.4.1 Fit the latch (3) to the far bank support latch shaft (2).

10.19.4.2 Fit washer (4) to latch shaft (2).

10.19.4.3 Fit spring pin (5) through hole in latch shaft (2).

10.19.4.4 Fit the R clip (1).

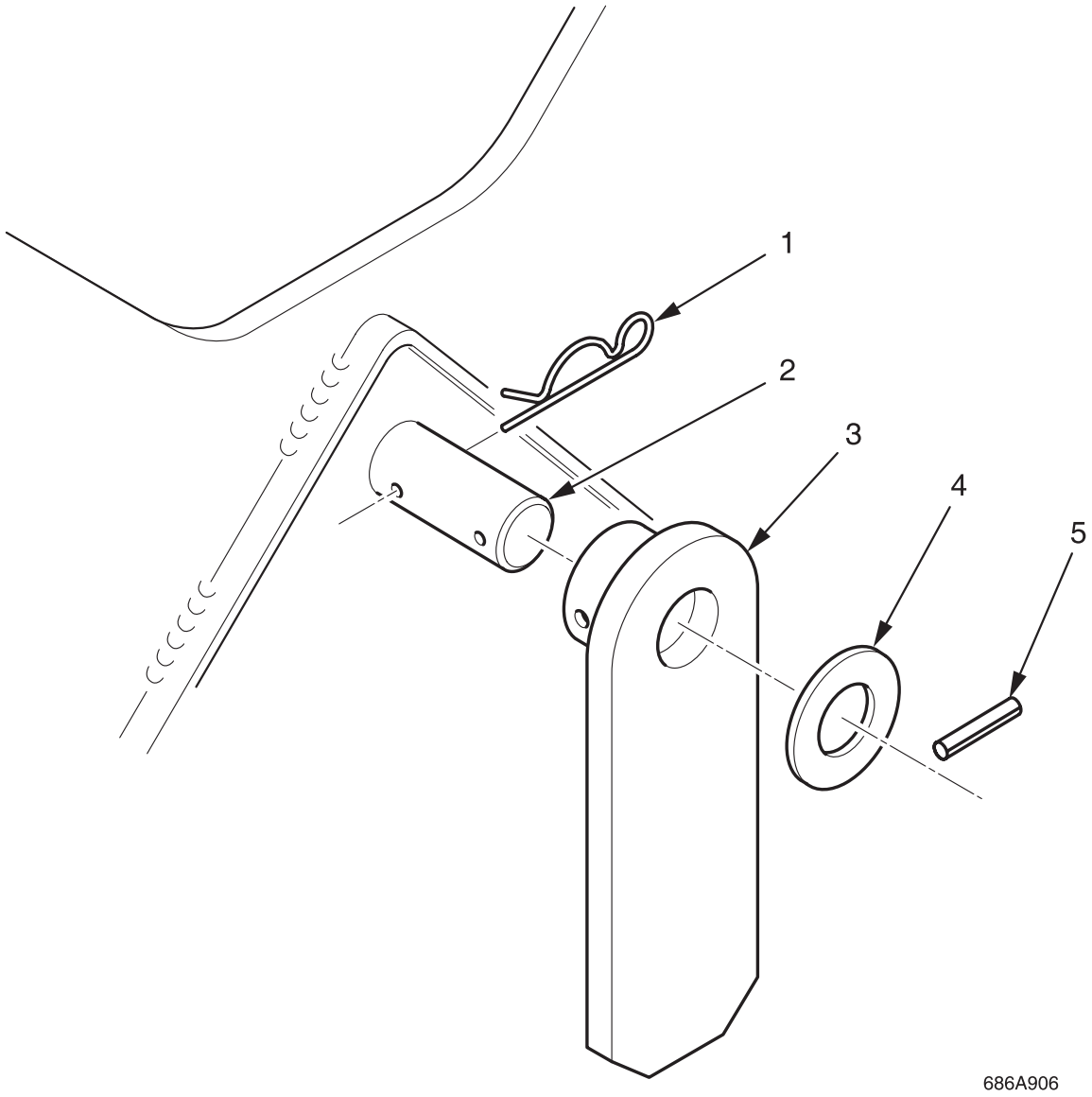


Figure 10. 27 Support Bearing Pad Latch

10.20 FAR BANK SUPPORT - STOWING PAD ADJUSTMENT

10.20.1 Coverage

10.20.1.1 This task covers:

a. Adjust

10.20.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Equipment Conditions

Far bank support and tail lift in stowed position. Tail lift swing cylinders fully extended.

10.20.3 Adjust

NOTES

This procedure should only be carried out when necessary or, when the stowage pads are being changed.

The bracket should be positioned so that when the tail lift is stowed (swing cylinders fully extended) the bracket lightly pushes the far bank support so that it is restrained during transportation. If the bracket is pushed too far forward, the FBS can be damaged when the tail lift is being stowed.

10.20.3.1 Support the weight of the mud flap assembly (1).

10.20.3.2 Undo the two nuts and bolts (2) on each pad bracket (3).

10.20.3.3 Position the bracket so that the pads are in full contact with the far bank support.

10.20.3.4 Tighten the two nuts and bolts (2) securing the bracket (3).

10.20.3.5 Check that the far bank support is fully supported between the tail lift pads and the forward launch beam.

NOTE

When stowing the tail lift the swing cylinders need to be fully extended, then the lift cylinders are operated until the platform hits the A-frame pads, then tilt is used to position the platform against the A-frame feet.

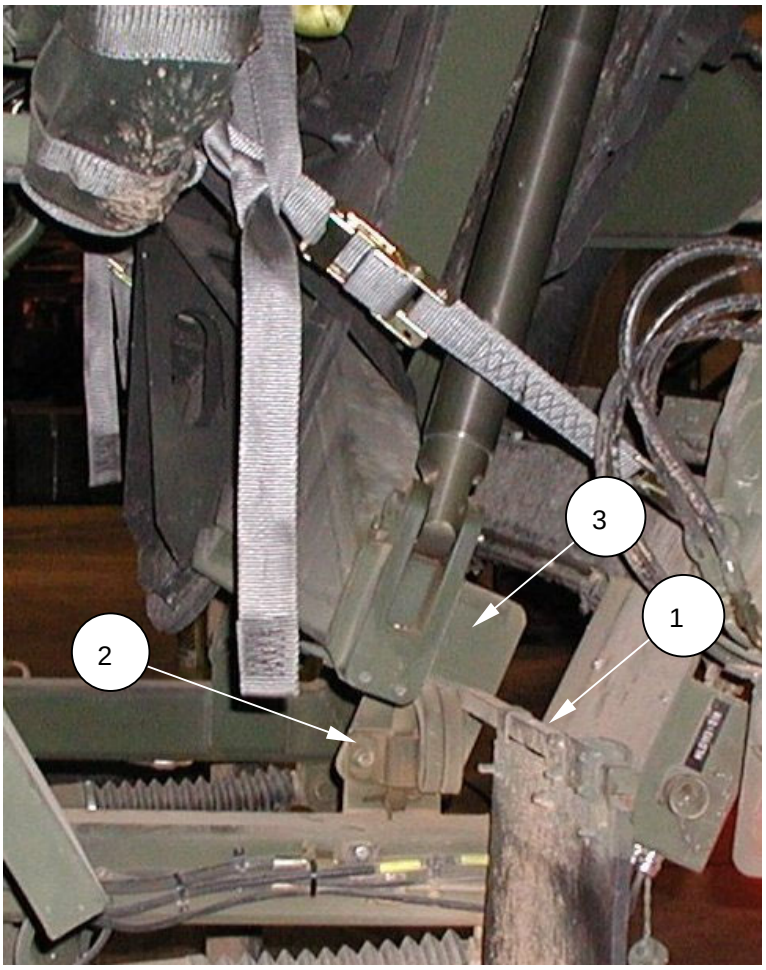


Figure 10. 28 Far Bank Support Stowed

10.21 FAR AND HOME BANK CARRIAGE - SLING AND RETAINING PIN

10.21.1 Coverage

10.21.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.21.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Thread-locking compound. Type Loctite 243.

Equipment Conditions

A-frame unfolded (for far bank carriage slings)

A-frame fully rotated forward and then rotated back to 45 degrees.

WARNING

DANGER TO PERSONNEL. ENSURE THAT NO OTHER MAINTENANCE IS BEING CARRIED OUT ON THE HYDRAULIC SYSTEM DURING SLING REMOVAL AND REPLACEMENT ON THE HOME BANK CARRIAGE

NOTES

To gain access to the far bank slings and retaining pins, the A-frame must be unfolded.

To gain access to the home bank carriage slings and retaining pins, the A-frame must be fully rotated forward and then rotated back to 45 degrees.

The maintenance procedure for removing and replacing the far and home bank carriage slings and retaining pins is the same.

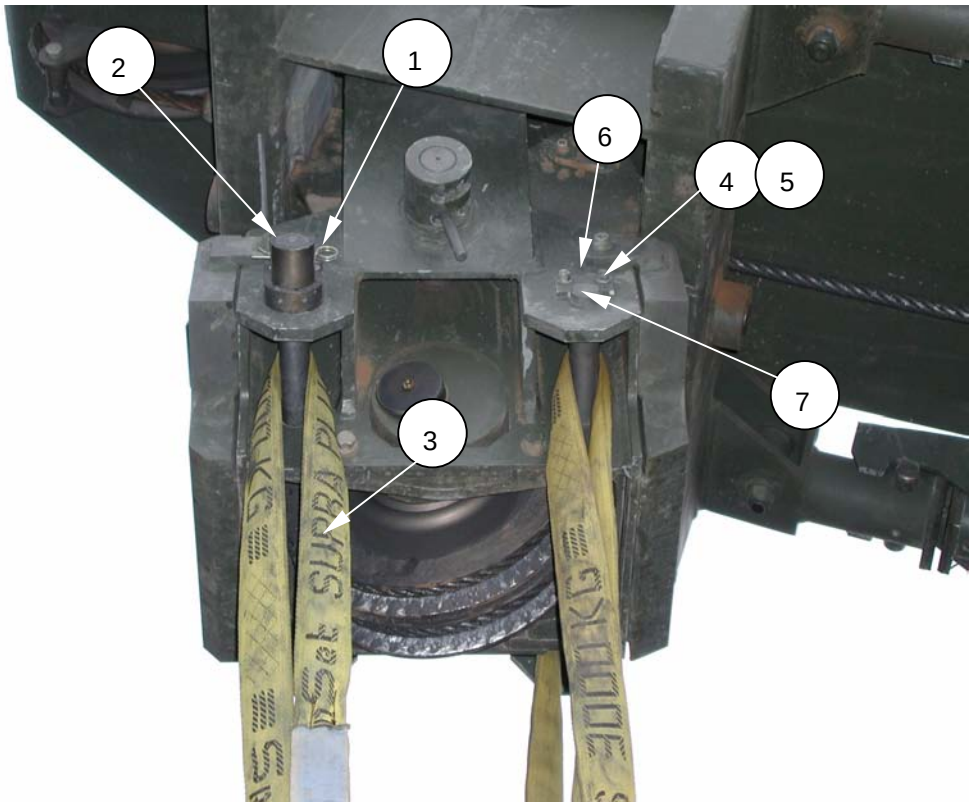


Figure 10. 29 Carriage Slings and Retaining Pins

10.21.3 Removal

10.21.3.1 Remove the retaining clip (1) from the removable sling retaining pin (2) and withdraw the pin allowing the sling (3) to fall clear.

10.21.3.2 Remove the retaining pin/button screw from the toe of the removable sling retaining pin (2) and withdraw the pin (2) from the housing.

10.21.3.3 Remove the two screws (4) and the lock washers (5).

10.21.3.4 Remove the retaining plate (6) and withdraw the fixed retaining pin (7) allowing the sling (3) to fall clear.

10.21.4 Service/repair

10.21.4.1 Replace the fixed retaining pin (7).

10.21.4.2 Replace the removable retaining pin (2).

10.21.4.3 Replace the sling (3).

10.21.4.4 Examine all components for damage and corrosion.

10.21.4.5 Examine screws (3) for damage to wrench faces and threads.

10.21.4.6 Replace components as required.

10.21.5 Installation

10.21.5.1 Hold the sling (3) in position and insert the fixed retaining pin (7).

10.21.5.2 Align the slot in the head of the retaining pin (7) and fit the retaining plate (6).

10.21.5.3 Fit the two screws (4) and the lock washers (5), and tighten using thread-locking compound on the screw threads.

10.21.5.4 Fit the removable retaining pin (2) into the housing. Fit the retaining pin/button screw to the toe of the removable sling retaining pin (2), securing the screw threads with thread-locking compound.

10.21.5.5 Fit the sling (3) into the housing and push the removable retaining pin (2) fully home.

10.21.5.6 Fit the retaining clip (1).

10.22 FAR AND HOME BANK CARRIAGE - RELEASE LOCK

10.22.1 Coverage

10.22.1.1 This task covers:

a. Adjustment

10.22.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

None.

Equipment Conditions

Far bank carriage deployed to gain access.

10.22.3 Adjustment

10.22.3.1 Ensure that the cam (3) is on the shaft (2) with the cam facing up and the spring pin (5) in the shaft recess.

10.22.3.2 Ensure that the R clip is through the cam (4) and shaft (2).

10.22.3.3 Recover the far bank carriage so that the latch assembly (1) engages with the far bank carriage buffer post.

10.22.3.4 Adjust the adjusting screw (8) until the latch assembly (1) has a gap of 1/8 inch (2.1mm) at the center line of the far bank carriage buffer post.

10.22.3.5 Tighten the lock nut (9).

10.22.3.6 Remove the R clip and turn the cam (3) through 90 degrees towards the front of the vehicle. (Refer to Figure 10. 32)

10.22.3.7 Fit the R clip (4).

10.22.3.8 Check the operation of the latch assembly by driving the forward carriage towards the far bank.

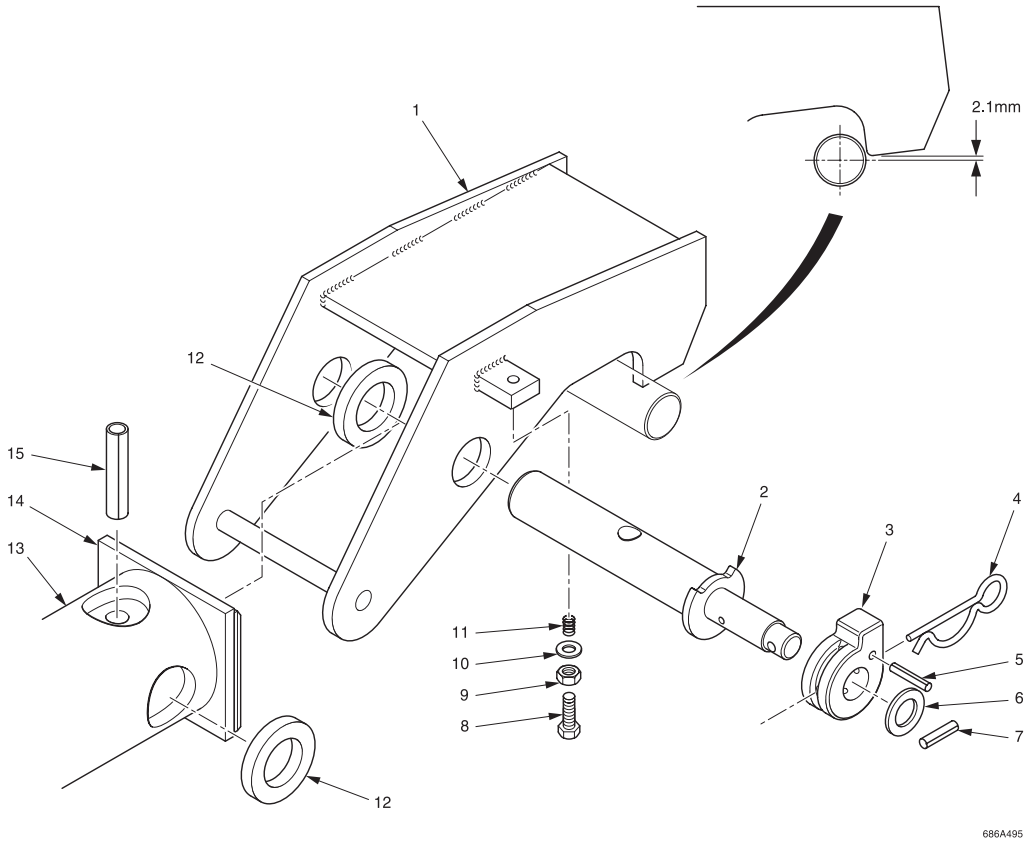


Figure 10. 30 Home Bank Carriage Release Lock

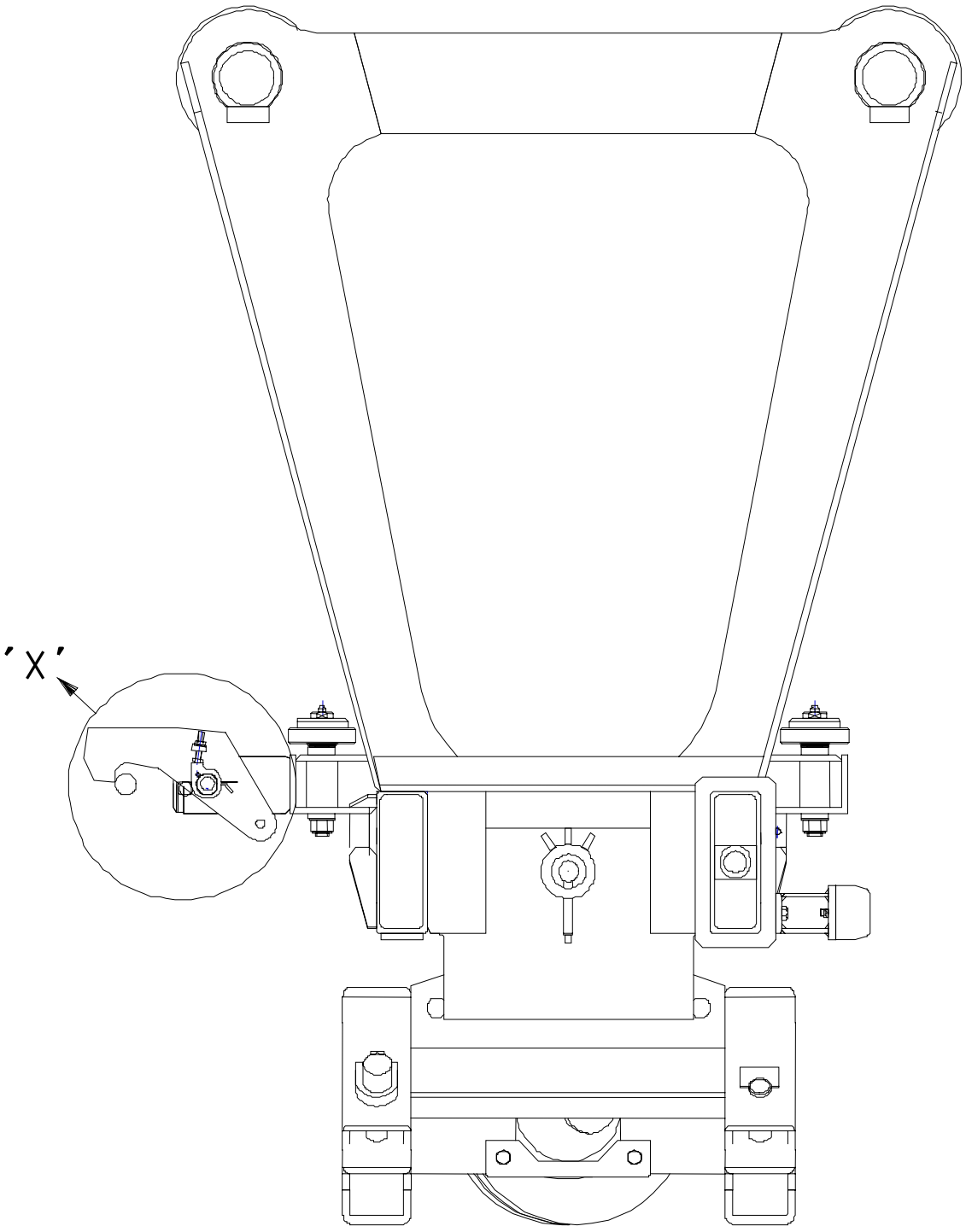


Figure 10. 31 HOME BANK CARRIAGE

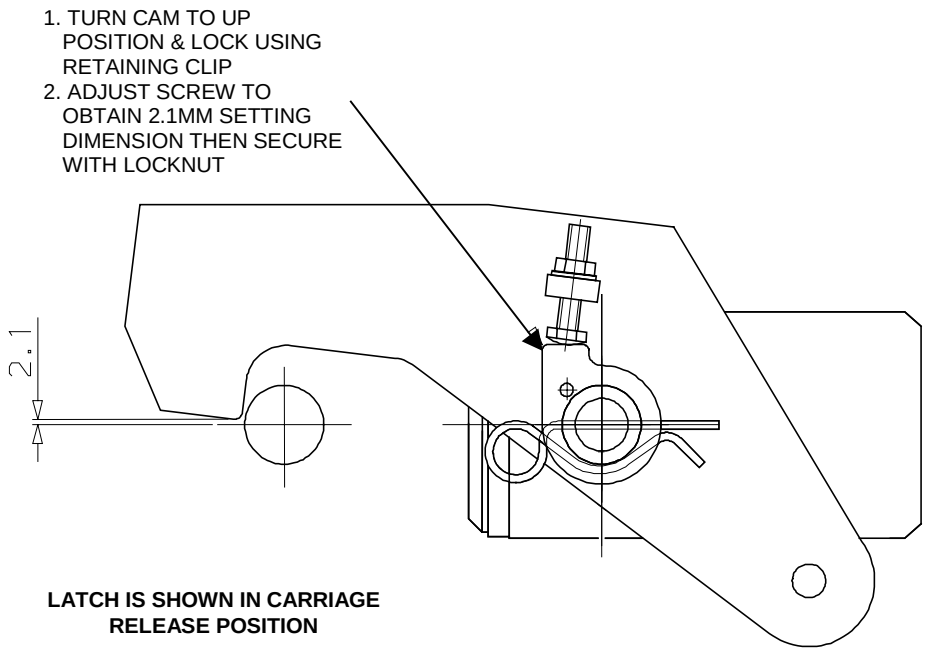


Figure 10. 32 View Within Circle X

10.23 CHASSIS - POSITIONING AID

10.23.1 Coverage

10.23.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.23.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Thread-locking compound Loctite 243.

Equipment Conditions

Slide frame deployed.

10.23.3 Removal

10.23.3.1 Remove the two nuts, bolts and washers securing the positioning aid to its mounting bracket.

10.23.3.2 Remove the positioning aid.

10.23.4 Service/repair

10.23.4.1 Examine all threaded components for wear and damage.

10.23.4.2 Change components as required.

10.23.5 Installation

10.23.5.1 Apply thread-locking compound to the bolts.

10.23.5.2 Fit the positioning aid to its mounting bracket.

10.23.5.3 Secure the positioning aid with the nuts, bolts and washers.

Figure 10. 33 Positioning Aid

10.24 CRANE - ROTATE GEAR OIL CHANGE

10.24.1 Coverage

10.24.1.1 This task covers:

a. Removal of Gear Oil

b. Refill Gear Oil

c. Removal of Brake Oil

d. Refill Brake Oil

10.24.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Oil. (MIL-PRF-2105 GO-80/90 normal use) (MIL-PRF-2105 GO-75 Arctic use)

Oil collecting vessel.

Equipment Conditions

Slide Frame deployed.

NOTE

Changing Oil in Rotate Drive is to be carried out every 1500 operating hours or, at the latest, after 1 year.

The oil should be replaced after 100 hours following commissioning, and after repair of the gear train.

10.24.3 Removal of Gear Oil

10.24.3.1 Position collecting vessel.

10.24.3.2 Unscrew ventilation screw (1).

10.24.3.3 Unscrew oil drain screw (2) for gear, collect old oil and dispose according to local regulations.

10.24.3.4 Clean oil drain screw (2) and refit.

10.24.4 Refill Gear Oil

10.24.4.1 Add new oil (approx. 1.2 - 1.3 US gallons (4.5 - 5.0 liters)) through the ventilation pipe (3).

10.24.4.2 The correct oil level is at the center of the oil inspection glass (8).

10.24.4.3 Refit ventilation screw (1).

10.24.5 Removal of Brake Oil

10.24.5.1 Unscrew ventilation screw (5).

10.24.5.2 Unscrew oil drain screw (6) for brake, collect old oil and dispose of according to regulations.

10.24.6 Refill Brake Oil

10.24.6.1 Clean oil drain screw (6) and refit.

10.24.6.2 Add new oil (approx. 0.24 - 0.26 US gallons (0.9 - 1.0 liters)) through the ventilation pipe (7).

10.24.6.3 The correct oil level is at the center of the oil inspection glass (4).

10.24.6.4 Refit ventilation screw (5).

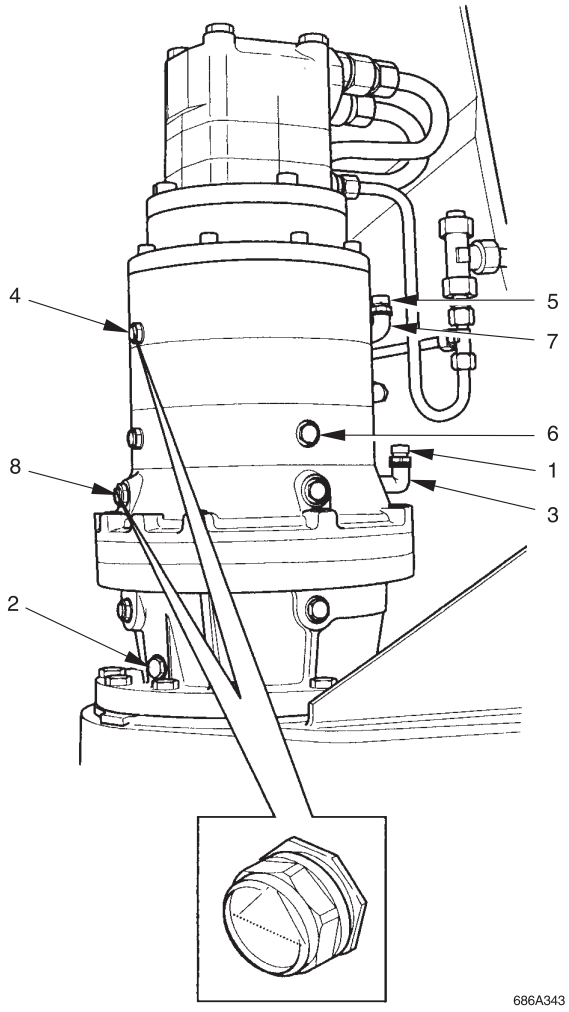


Figure 10. 34 Crane Gear Box and Drive Housing

10.25 CRANE - LOAD HOOK

10.25.1 Coverage

10.25.1.1 This task covers:

a. Removal

b. Service/repair

c. Installation

10.25.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Grease

Equipment Conditions

None

10.25.3 Removal

10.25.3.1 Remove the split pin (1) from the shackle pin (2).

10.25.3.2 Hold the shackle pin (2) and remove the nut (3).

10.25.3.3 Hold the load hook (9) and remove the spring pin (6) and nut (7). Retain the washer (8).

10.25.3.4 Remove the nut (11) from the bolt (10).

10.25.3.5 Retain the spring (12) and catch (13).

10.25.4 Service/repair

10.25.4.1 Check all components for wear and damage.

10.25.5 Installation

10.25.5.1 Place the spring (12) inside the catch (13).

10.25.5.2 Secure the spring and catch to the load hook (9) with the nut (11) and bolt (12).

10.25.5.3 Attach the load hook (9) to the D-ring (5) with the washer (8) and nut (7).

10.25.5.4 Insert the spring pin (6) through the nut (7).

10.25.5.5 Place the shackle through the D-ring (5).

10.25.5.6 Locate the shackle on the crane extension and secure in place using the shackle pin (2).

10.25.5.7 Hold the shackle pin and secure in place with the nut (3) and split pin (1).

10.25.5.8 Grease the load hook (9), shackle pin (2) and spring (12).

10.25.5.9 Check that the catch (13) closes against spring pressure on the load hook.

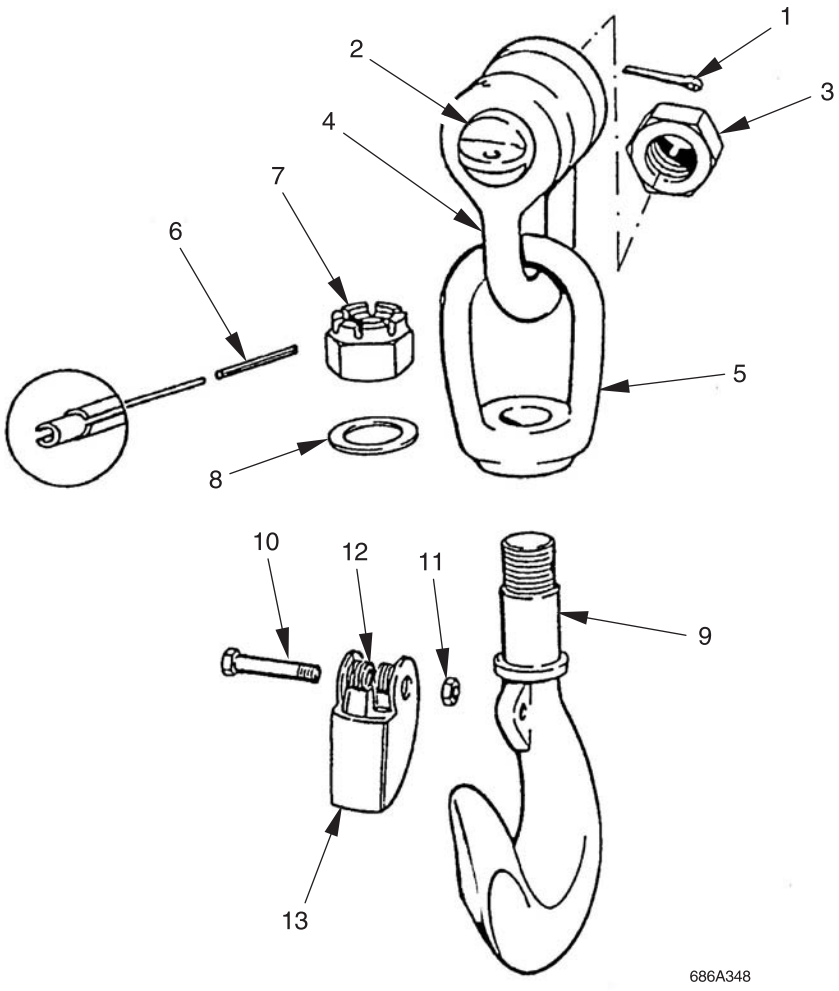


Figure 10. 35 Crane Load Hook

10.26 FLATRACK - WOODEN BUFFER

10.26.1 Coverage

10.26.1.1 This task covers:

a. Fitting

b. Service/repair

c. Removal

10.26.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

Wooden buffer .

Qty. 2 bolts, qty. 4 washers, qty 2 nuts.

Equipment Conditions

Not in use, with no bridge modules loaded.

10.26.3 Fitting

10.26.3.1 Place one washer (3) over bolt shaft (2).

10.26.3.2 Insert one bolt (2) and washer (3) into holes at both ends of wooden buffer (1).

10.26.3.3 Put wooden buffer (1) into position, and locate protruding bolt shafts (2) into holes in flatrack tool box support.

10.26.3.4 Have one person hold the wooden buffer (1) in position.

10.26.3.5 Place washer (3) and nut (5) over bolt shaft (2) inside box section of tool box support.

10.26.3.6 Finger tighten nut (5).

10.26.3.7 Repeat for bolt (2) at other end of wooden buffer (1).

10.26.3.8 Using a suitable wrench fitted to the nut (5) and a suitable socket wrench fitted to the bolt head (2), tighten the nut (5) and bolt (2).

10.26.4 Service/repair

10.26.4.1 Check all components for wear and damage.

10.26.5 Removal

10.26.5.1 Using a suitable wrench fitted to the nut (5) and a suitable socket wrench fitted to the bolt head (2), loosen the nut (5) and bolt (2) until they are finger tight.

10.26.5.2 Have one person hold the wooden buffer (1) in position.

10.26.5.3 Remove the nuts (5) and washers (3) from the bolts (2) at each end of the wooden buffer (1).

10.26.5.4 Remove the wooden buffer (1) from its position on the flatrack.

10.26.5.5 Recover the nuts (5), washers (3) and bolts (2).

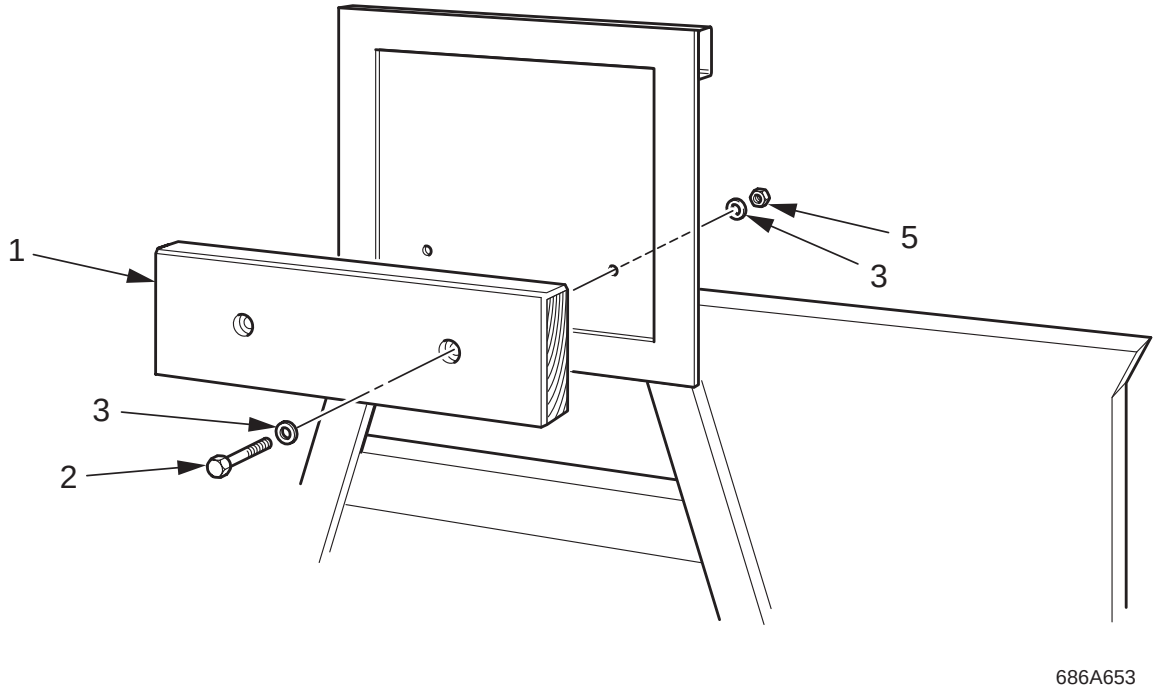


Figure 10. 36 Wooden Buffer Fitting

10.27 TAIL LIFT - HYDRAULIC SYSTEM - BLEEDING

10.27.1 Coverage

10.27.1.1 This task covers:

a. Bleeding system

10.27.2 Initial Setup

Tools Required

Tool Kit, General Mechanic's, Automotive (GMTK).

Materials Required

None.

Equipment Conditions

Tail lift lowered, hydraulic power on vehicle.

10.27.3 Bleeding system

10.27.3.1 Lower tail lift as described in Chapter 3 section 1 paragraphs 3.2 through 3.2.1.11 inclusive, ignoring any unnecessary instructions.

10.27.3.2 Air from the swing cylinders will be removed when swing arms are moved repeatedly up and down.

10.27.3.3 Air from the lifting cylinders will be removed when lifting arms are moved repeatedly up and down.

10.27.3.4 When bleeding the tilting cylinders do as follows:

(1) Lower the platform near the ground (approx. 40 cm above).

(2) Tilt the platform to the vertical position as far as the structure allows.

(3) Tilt it down again to the ground by pushing the **Tilt Down** button. 

(4) Repeat the movement a few times until all the air is removed.

NOTE

Always check hydraulic reservoir oil level after bleeding.

10.27.3.5 Stow tail lift as described in chapter 3 section 1 Paragraph 3.2.2 through paragraph 3.2.2.17 inclusive, ignoring any unnecessary instructions.

10.28 TOP MAN HARNESS AND LANYARD

10.28.1 Coverage

10.28.1.1 This task covers:

a. Inspection
b. Cleaning
c. Storage

10.28.2 Initial Setup

Tools Required

None.

Materials Required

None.

Equipment Conditions

None.

10.28.3 Inspection

10.28.3.1 The equipment must be, visually examined every 12 months, and by a competent person prior to use, the results of each examination should be recorded. When the equipment is supplied new, the initial examination need only take place before use.

10.28.3.2 Particular attention should be directed to the following points when carrying out examination.

10.28.3.3 **WEBBING.** Check for cuts, cracks, tears, abrasion, scorch marks, burns, undue stretching and damage caused by gradual deterioration or chemical attack.

10.28.3.4 Local abrasion, as distinct from general wear, caused by the passage of the webbing over sharp edges or protrusions, while under tension, may cause serious loss of strength. Slight damage to outer fibers and an occasional torn yarn may be considered harmless, but serious reduction in width or thickness of the webbing, or serious distortion to the weave pattern should lead to rejection.

10.28.3.5 **STITCHING.** Look for broken stitching, loose or worn threads. If in doubt, withdraw the equipment immediately from service and return it, with a covering note to the issuing store. If the equipment has been used to arrest a fall, or if it is thought to have been used to arrest a fall it is essential that the equipment is withdrawn from use and returned to the issuing store. From there, it may be returned to the manufacturer for evaluation or repair.

10.28.3.6 **METAL FITTINGS.** buckles, links, tensioners, karabiners etc. Inspect for damage and signs of distortion, check for mechanical integrity and function. Check for worn, weak or damaged springs.

10.28.4 Cleaning

10.28.4.1 **CLEANING.** Whenever necessary, cleaning should be carried out using mild detergent powders/ordinary soap, and hand hot water. When webbing becomes wet, either when in use or because of cleaning, it should be allowed to dry naturally, away from an open fire or any other source of heat.

10.28.5 Storage

10.28.5.1 **STORAGE.** The equipment should be looked after and stored correctly when not in use. The equipment should not be left lying around the site. It should be properly stored to prevent contact with sharp objects and harmful substances, and kept in a cool dry place free from direct sunlight.

Figure 10. 37 Top Man Harness and Lanyard

10.29 LOWER WINCH PILOT VALVE - ADJUSTMENT

10.29.1 Coverage

10.29.1.1 This task covers:

a. Adjustment

10.29.2 Initial Setup

Tools Required

None.

Materials Required

None.

Equipment Conditions

Bridge is in a position to be lifted.

10.29.3 Adjustment

10.29.3.1 On the lower winch, unscrew the cap (2). This will expose a hexagon socket grub screw.

10.29.3.2 While in **BRIDGE LIFT** mode on the chest pack move the right hand joystick slowly forward until the winch tries to lift the bridge.

NOTE

The bridge may start to lift and then stall.

10.29.3.3 While the chest pack operator holds the right hand joystick forward, release the lock nut on the grub screw and *slowly* rotate the grub screw anti-clockwise.

10.29.3.4 Keep rotating the grub screw anti-clockwise until the bridge starts to move upward.

10.29.3.5 Once bridge starts to lift, stop rotating the grub screw anti-clockwise.

10.29.3.6 Hold the grub screw steady and tighten the lock nut.

10.29.3.7 Replace the cap (2) and continue operations.

10.29.3.8 Once the launcher is returned to base, the complete pilot valve assembly (1) will require replacement.

Figure 10. 38 Lower Winch Pilot Valve Adjustment

10.30 TIRFOR WINCH - REPLACING THE SHEAR PINS

10.30.1 Coverage

10.30.1.1 This task covers:

a. Removal

b. Installation

10.30.2 Initial Setup

Tools Required

None.

Materials Required

None.

Equipment Conditions

None.

10.30.3 Removal

10.30.3.1 Figure 10. 39 shows the position of the shear pin for the T-532D winch. Spare shear pins are in the rope release lever, behind the plastic cap.

10.30.3.2 Remove the sheared pins with a suitable punch.

10.30.4 Installation

NOTE

The manufacturer declines any responsibility for the consequences of dismantling or altering the winch by any unauthorized person. Specially excluded is the replacement of original parts by parts of another manufacturer.

10.30.4.1 For the T-532D winch, align the holes of the upper and lower sections of the forward operating lever.

10.30.4.2 Position the spare shear pin and drive it in carefully with a hammer.

WARNING

SEVERE INJURY. IT IS IMPERATIVE THAT SHEAR PINS ARE ONLY REPLACED WITH GENUINE TIRFOR SHEAR PINS FOR THE CORRECT MODEL OF WINCH. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO UNEXPECTED FAILURE OF THE SHEAR PIN, WHICH COULD RESULT IN SEVERE INJURY TO PERSONNEL.

10.30.4.3 Before putting the winch back into operation, ensure that the cause of the overload is removed.

NOTE

Remember to re-order sheared pins, put them back in the storage place in the rope release lever, and ensure that the plastic cap is refitted correctly.

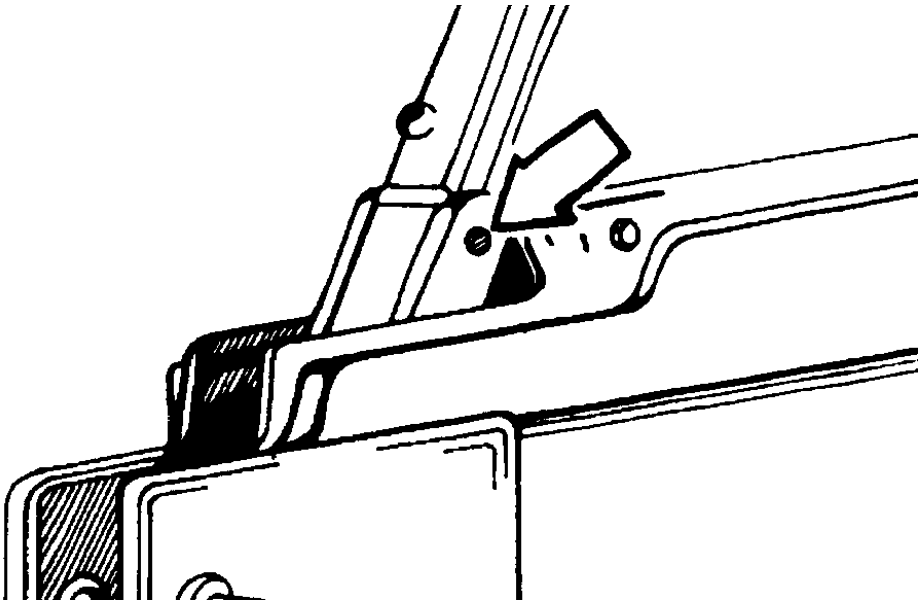


Figure 10. 39 Shear Pin

10.31 TIRFOR WINCH - VISUAL EXAMINATION OF THE WIRE ROPE

10.31.1 Coverage

10.31.1.1 This task covers:

a. Inspection

10.31.2 Initial Setup

Tools Required

None.

Materials Required

None.

Equipment Conditions

Rope removed from winch and NOT in use.

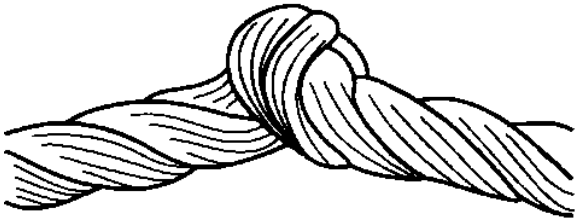
10.31.3 Inspection

10.31.3.1 The wire rope should be examined before use to detect any signs of wear, damage or broken wires. (See examples in Figure 10. 40).

10.31.3.2 Any wire rope with a reduction from the nominal diameter by more than 10% should be replaced. Checks should be carried out every 12 months, (see Figure 10. 41 for the correct method of measuring the diameter of a wire rope).

10.31.3.3 In case of any apparent wear, have the wire rope checked by a competent person. **If in doubt DO NOT use the wire rope.**

Separated Strand



Twisted Rope

Kinked Strands

Broken Strand Wires

Figure 10. 40 Wire rope damage

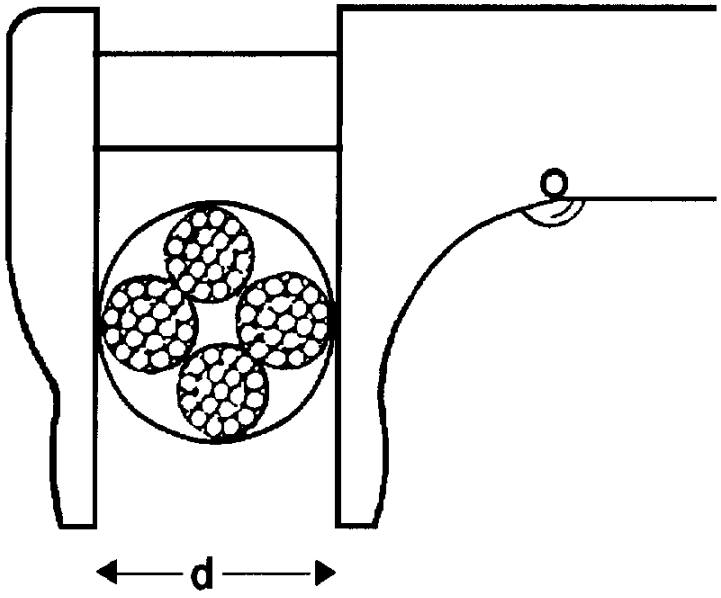


Figure 10. 41 Correct Method of Measuring Rope Diameter

10.32 TIRFOR WINCH - CLEAN/LUBRICATION

10.32.1 Coverage

10.32.1.1 This task covers:

a Safety

b Clean/Lubrication

10.32.2 Initial Setup

Tools Required

Tool Kit, General Mechanics, Automotive (GMTK)

Materials Required

Type SAE 90-120 motor oil.

Cleansing fluid.

Equipment Conditions

Not in use, with rope removed and in the released position.

10.32.3 Safety

10.32.3.1 All lifting equipment must be supplied, operated, maintained and tested according to the applicable regulations.

10.32.4 Clean/Lubrication

10.32.4.1 The winch should be inspected, cleaned and lubricated at regular intervals, at least annually, by an approved TRACTEL UK repairer.

NOTE

Never use grease or oil containing graphite additives or molybdenum disulfide.

10.32.4.2 To clean the winch, allow the winch to soak in a bath of proprietary cleansing fluid but **NOT acetone and its derivatives or ethylene trichloride and its derivatives.**

10.32.4.3 Remove the winch from the cleaning bath and shake the winch vigorously to loosen foreign matter and turn it upside down to allow the dirt to come out through the openings for the operating levers. Repeat immersion and shaking if required to remove stubborn dirt.

10.32.4.4 Allow the winch to drain and become dry.

10.32.4.5 After this treatment, ensure that the winch is well lubricated by applying a quantity of oil (type SAE 90-120) onto the internal mechanism through the openings for the operating levers.

10.32.4.6 Alternatively, operate the forward and reverse operating levers to allow the lubricant to penetrate all parts of the winch.

NOTE

Excess lubrication will not cause the winch or wire rope to slip.

10.32.4.7 Any winch where the side cases show signs of dents or damage, should be returned to an approved repairer of TRACTEL UK.

10.33 PNEUMATIC HAMMER - LUBRICATION

10.33.1 Coverage

10.33.1.1 This task covers:

a Lubrication

10.33.2 Initial Setup

Tools Required

Oil can.

Materials Required

Type MIL-PRF-2104 oil.

Equipment Conditions

Not in use.

10.33.3 Lubrication

10.33.3.1 Under normal service conditions lubrication should not be necessary. However, with the launch vehicle having air dryers lubrication may be necessary.

10.33.3.2 If lubrication is required, use automotive oil MIL-PRF-2104.

10.33.3.3 Lubrication is achieved by injecting a little oil in to the equipment via the sleeve fitting. This operation should be carried out at the end of the working day and before every extended stoppage.

10.33.3.4 If the piston gums up, only lubricate with the recommended oil.

10.33.3.5 After lubrication, store the equipment vertically with the handle at the top.

10.34 A-FRAME - UPPER ACCESS LADDER

10.34.1 Coverage

10.34.1.1 This task covers:

a. Remove

b. Install

10.34.2 Initial Setup

Tools Required

Wrench.

Materials Required

Thread Locking Compound.

Equipment Conditions

A-Frame Open but not deployed.

10.34.3 Remove

10.34.3.1 Undo the ladder stowage strap.

10.34.3.2 Remove the ‘R’-clip (2) and washer (3).

10.34.3.3 Support the weight of the ladder (1).

10.34.3.4 Remove the location pin (5).

10.34.3.5 Remove the ladder (1) from the fixing bracket (4).

10.34.3.6 If required the, fixing bracket (4) can be replaced by removing the four screws (6) and washers (7) securing the bracket (4) to the A-Frame stabilizer leg (8).

10.34.4 Install

10.34.4.1 If the fixing bracket (4) was removed apply thread locking compound to the four screws (6).

10.34.4.2 Secure the fixing bracket (4) to the A-Frame stabilizer leg (8) with the four screws (6) and washers (7).

10.34.4.3 Position the ladder (1) on the fixing bracket (4) and fit the location pin (5) through the ladder (1) and fixing bracket (4).

10.34.4.4 Fit the washer (3) and ‘R-clip (2).

10.34.5 Follow on task

10.34.5.1 Secure the ladder to the A-Frame stabilizer leg with the stowage strap.

10.34.5.2 Stow the A-Frame.

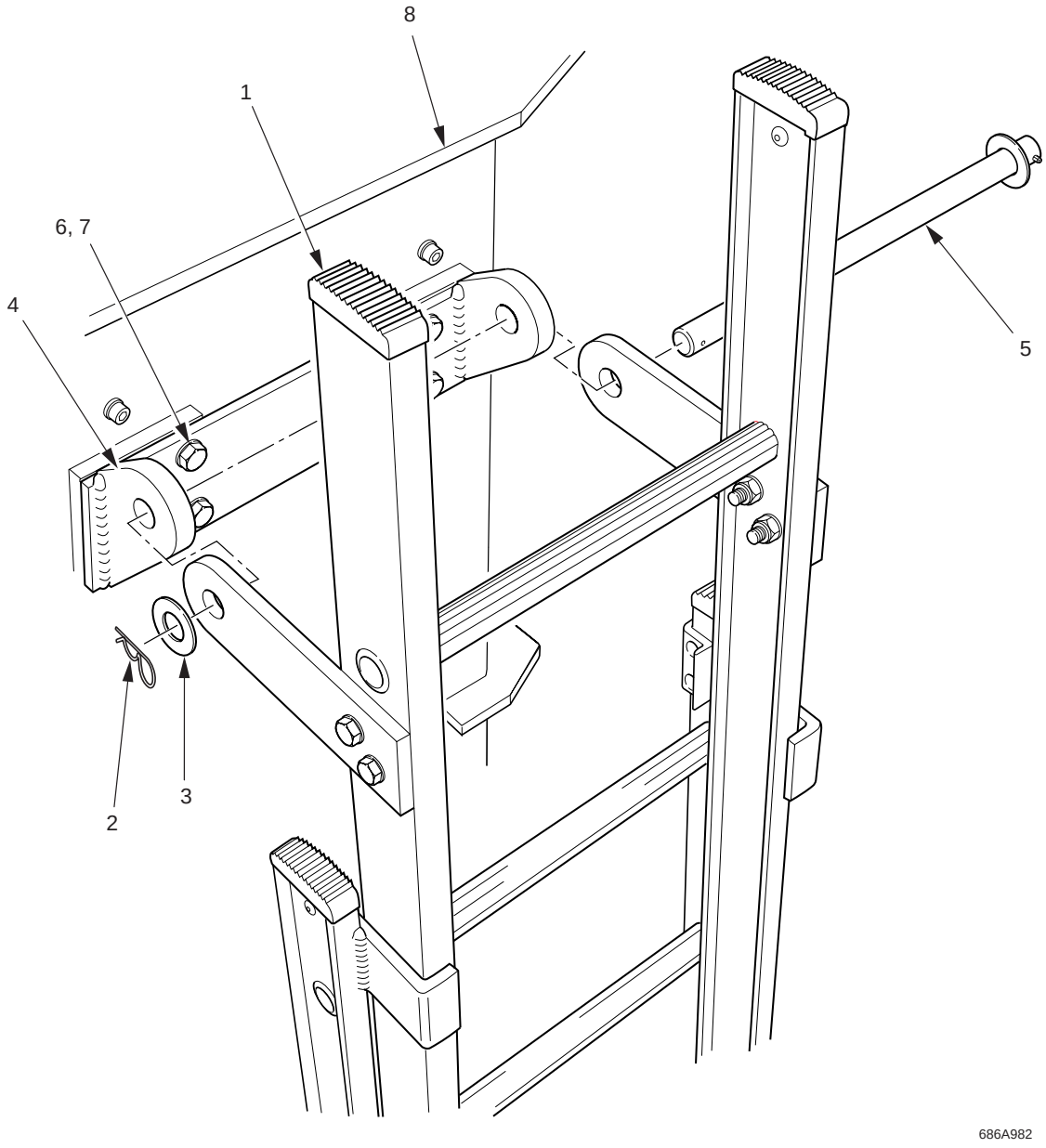


Figure 10. 42 Upper Access Ladder Attachment

10.35 TAIL LIFT - CRADLE BUFFER PAD

10.35.1 Coverage

10.35.1.1 This task covers:

a. Removal

b. Install

10.35.2 Initial Setup

Tools Required

BII wrench.

Allen key Set

Materials Required

Nyloc Nuts (Qty 14).

Equipment Conditions

Tail Lift Deployed.

10.35.3 Remove

10.35.3.1 Remove the 14-nyloc nuts (4) and washers (3) securing the buffer pad (5) to the tail lift cradle (1).

10.35.3.2 Discard the nyloc nuts (4).

10.35.3.3 Remove and retain the 14 screws (2).

10.35.3.4 Remove the buffer pad (5)

10.35.4 Install

10.35.4.1 Ensure the tail lift cradle (1) is clean.

10.35.4.2 Place the buffer pad (5) on the tail lift cradle (1).

10.35.4.3 Secure the buffer pad (5) to the tail lift cradle (1) with the 14 screws (2), washers (3) and new nyloc nuts (4).

10.35.5 Follow on Task

10.35.5.1 Stow the tail lift.

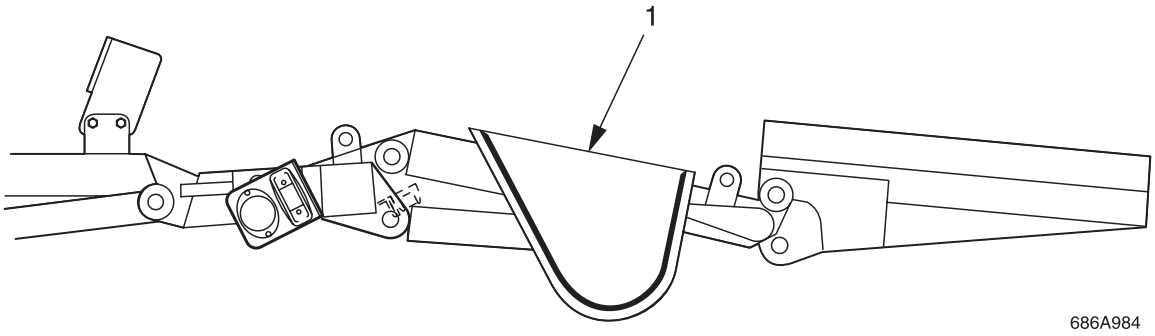


Figure 10. 43 Tail Lift Cradle

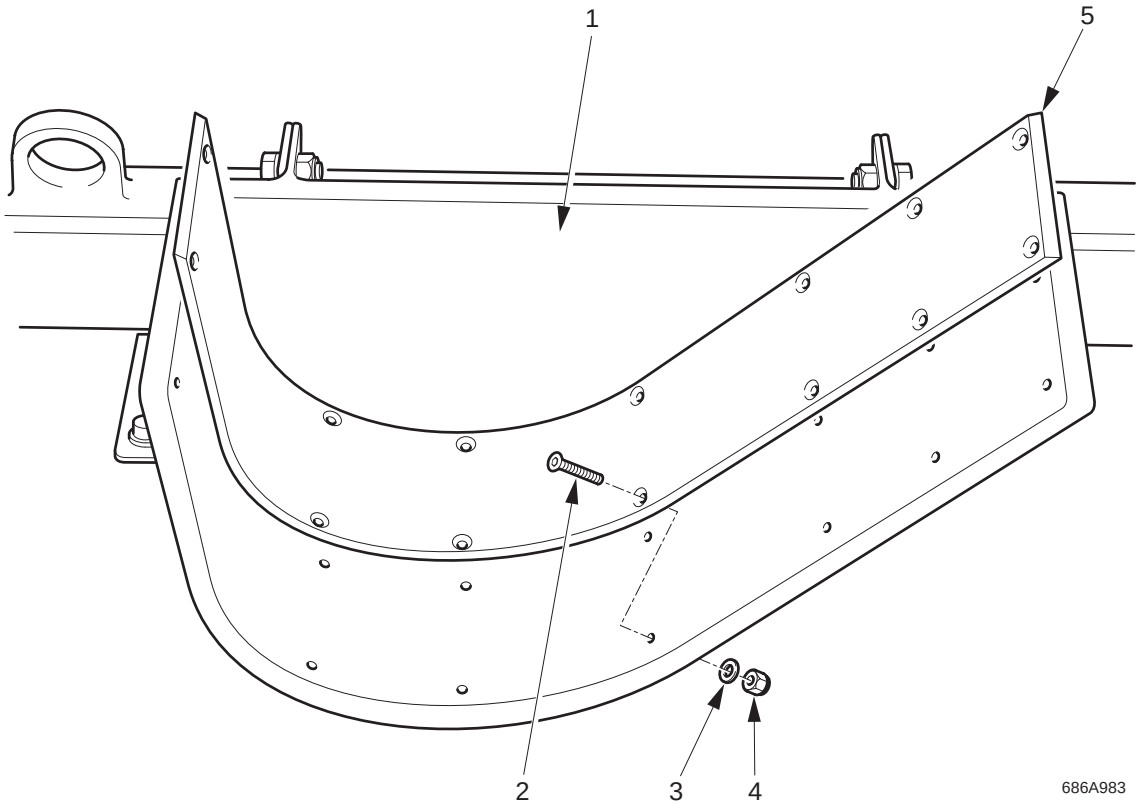


Figure 10. 44 Buffer Pad Attaching Parts

TABLE OF CONTENTS

CHAPTER 11

DSB TRANSPORTATION AND LOADING PLANS

CHAPTER 11

DSB TRANSPORTATION AND LOADING PLANS

Section I. TRANSPORTATION

11.1 TRANSPORTING

11.1.1 DSB Transportability

The DSB system is fully transportable by road, its components have been designed to be carried on M1077 flatracks by M1977 CBT, M1075, vehicles and M1076 trailers. The DSB System, is capable of constructing one 40 meter span or two 20 meter spans, is transported by four trucks and four trailers including the launcher and its trailer. The combination is shown in Figure 11. 86.

11.2 HIGHWAY

11.2.1 Launcher Highway Self Propelled

11.2.1.1 The launcher is mounted on an Oshkosh M1075 PLS chassis. The launch vehicle general arrangement is shown in Figure 11. 1. The launch vehicle can be driven on North American and foreign roads but as it exceeds the width requirement of 96 inches for un-restricted CONUS transport, as defined in MIL-STD-1366D section 5.1.2.1, it may be subject to restriction or require permits. The overall length is less than the 40 feet restriction imposed in many States for straight trucks and the height is below 13.5 feet (4-meters).

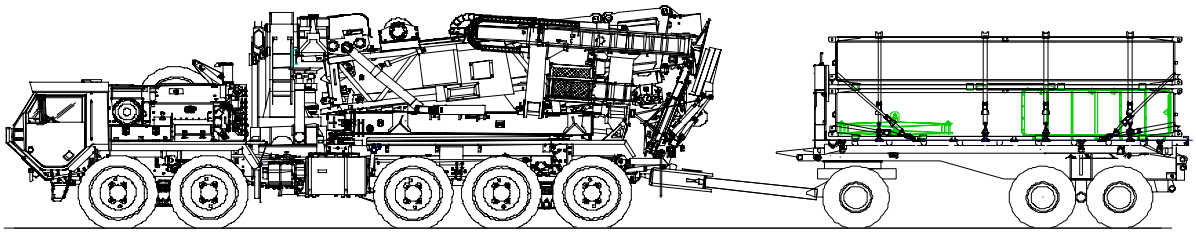


Figure 11. 1 Launch Vehicle and Trailer Combination

11.2.1.2 Summary of dimensional data is presented in Table 11. 1. Weight data is given in Table 11. 4.

Table 11. 1 Launcher Dimensional Data

LAUNCHER	
Width – inches - (mm)	117 (2971)
Length – inches - (mm)	475 (12065)
Height – inches - (mm)	157.5 (4000)
NOTE **Maximum width can be reduced to 2792 mm if the A-frame stabilizer feet and ladders are removed.**	

11.2.1.3 When drawing the M1076 trailer with launch beam load, the trailer must be fitted with the extended drawbar conversion, which should be set at its longest length.

11.2.2 Launch Vehicle: Highway Carried

11.2.2.1 The M1075 launch vehicle can be sectionalized in accordance with the data presented in 11.8 Sectionalization of Launch Vehicle and TM-5-5420-279-23 allowing it to be transported by truck and semi trailer. The launch vehicle slide frame based equipment, crane and tail lift platform once de-mounted can be transported as separate loads.

11.2.2.2 The tail lift and crane do not present exceptional loads and thus, may be transported on flat bed vehicles having deck heights up to 1420 mm (55.9 inches). The launching equipment can be transported on semi trailers with a maximum deck height of 1453 mm (57 inches) and a 7600 mm (25 feet) long well.

11.2.2.3 The M1075 chassis may be transported subject to its normal procedures as specified in Palletized Load System (PLS) M1074/M1075 Truck, M1076 Trailer, M1077 Flatrack Transportability Report CDRL A095 - Contract DAAE07-90-C-R035.

11.2.3 Launch Vehicle: Rail

The launch vehicle equipment and tie-downs have been designed to MIL-STD-209J and will withstand all loading imposed by rail transportation.

11.2.4 North America - Complete Launch Vehicle

11.2.4.1 The launch vehicle carried on a rail car, with the standard worst-case deck height of 50 inches above the rail, exceeds the AAR outline height of 15 ft 1 inch and as such is considered a dimensional load and therefore will be subject to clearance checks.

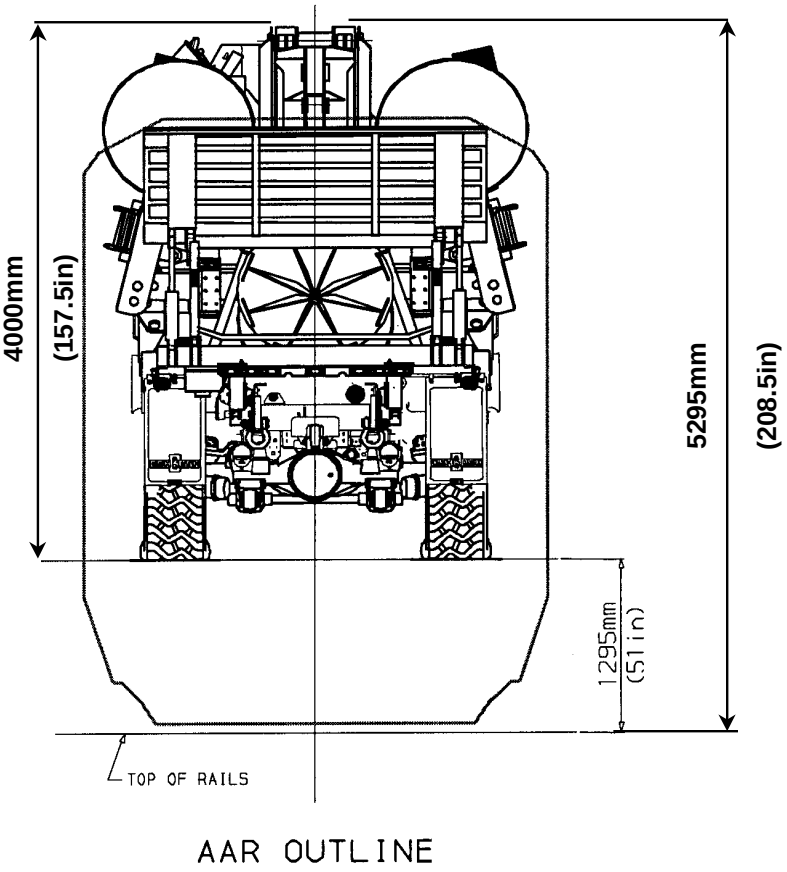


Figure 11. 2 Complete Launch Vehicle (AAR Outline)

11.2.4.2 In its fully configured state the DSB launch vehicle is capable of withstanding loads expected during railroad humping and should be attached to the rail car as specified in Palletized Load System (PLS) M1074/M1075 Truck, M1076 Trailer, M1077 Flatrack Transportability Report CDRL A095 - Contract DAAE07-90-C-R035.

11.2.5 Sectionalized Launcher

11.2.5.1 In order to allow unrestricted travel the launch vehicle may be sectionalized. This operation includes the removal of the tail lift, launching system, crane and far bank support (See 11.8 Sectionalization of Launch Vehicle and TM-5-5420-279-23).

11.2.5.2 Each of these components include integral lifting and lashing points and when transported on a rail car with a deck height of 50 inches this falls within the AAR gauge for unrestricted travel.

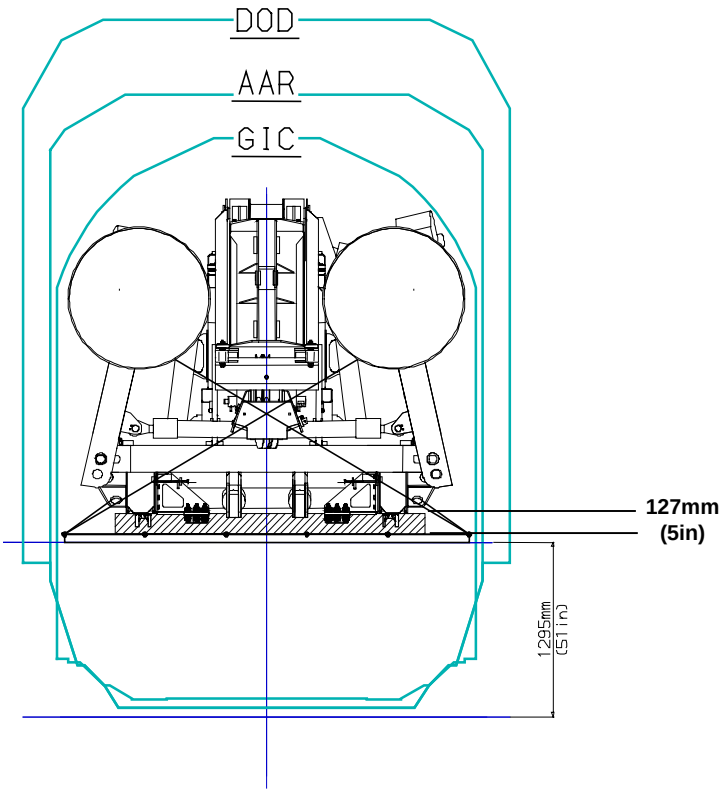


Figure 11. 3 Launch Vehicle (DOD, AAR, GIC Rail Gauge)

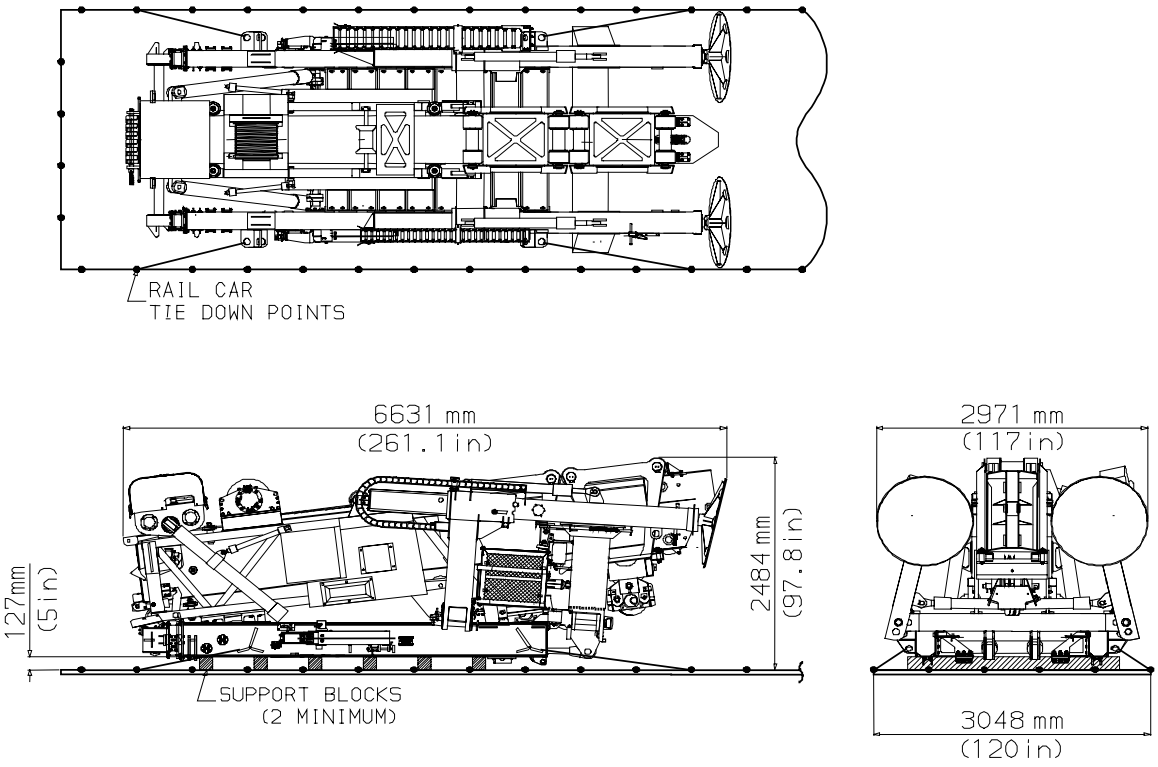


Figure 11. 4 Rail Tie-Down of the Launch Vehicle

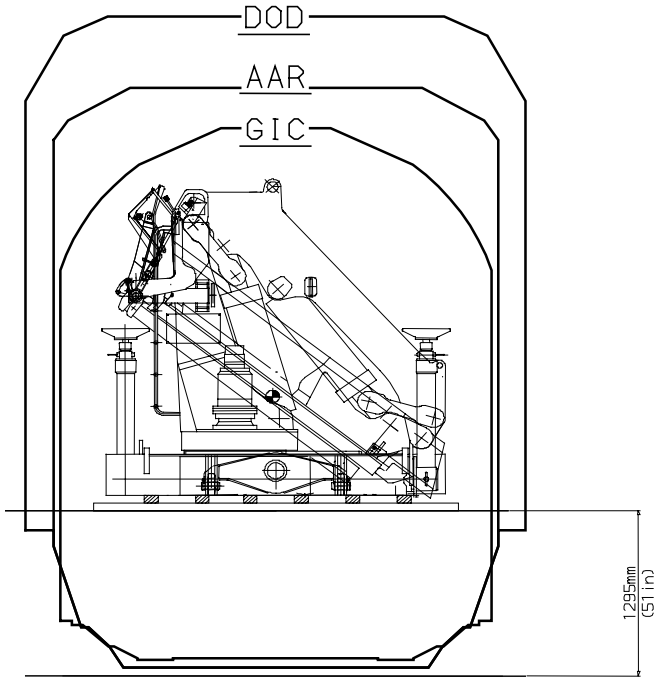


Figure 11. 5 Crane (DOD, AAR, GIC Rail Gauge)

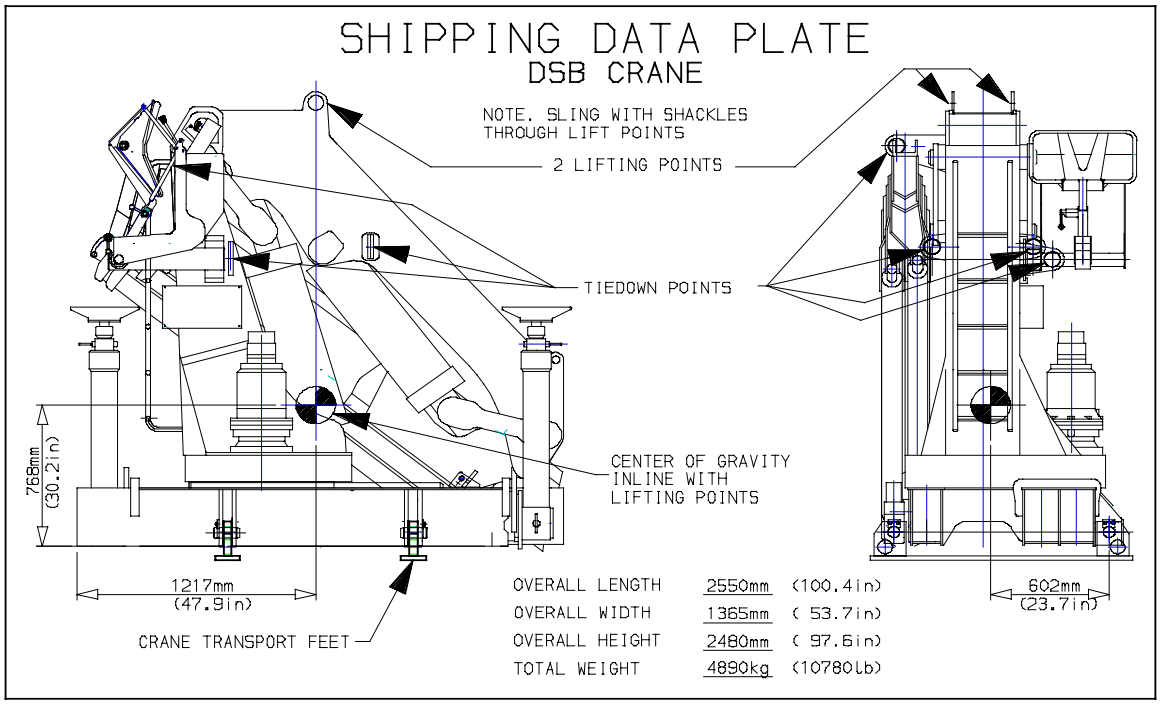


Figure 11. 6 Crane Shipping Data

11.2.5.3 The launch vehicle chassis will be subject to the limitations and the requirements of the Palletized Load System (PLS) M1074/M1075 Truck, M1076 Trailer, M1077 Flatrack Transportability Report CDRL A095 - Contract DAAE07-90-C-R035.

11.2.6 Foreign Rail - Complete Launch Vehicle

11.2.6.1 Refer to Para. 11.2.4.

11.2.7 Sectionalized Launch Vehicle

11.2.7.1 Sectionalization as described in 11.8 Sectionalization of Launch Vehicle and TM-5-5420-279-23 launch vehicle is necessary to comply with the maximum height and width permitted by GIC and NATO envelope B gauges for the crane, tail lift and launching system if unrestricted travel is required.

11.2.7.2 The launch vehicle chassis will be subject to the limitations and requirements of the Palletized Load System (PLS) M1074/M1075 Truck, M1076 Trailer, M1077 Flatrack Transportability Report CDRL A095 - Contract DAAE07-90-C-R035.

11.2.8 Launcher Ocean and Waterways

The launch vehicle, towing its trailer, may be shipped by US Army and Navy lighter vessels of type LCU-2000 and larger. The launch vehicle may be driven on and off and should be secured in accordance with the Palletized Load System (PLS) M1074/M1075 Truck, M1076 Trailer, M1077 Flatrack Transportability Report CDRL A095 - Contract DAAE07-90-C-R035.

11.2.9 Launcher, Air, Fixed Wing

11.2.9.1 Air transportability by C5 and C17 and C130 aircraft. Transportation of the launch vehicle as a whole by C130 is not possible, although when sectionalized the crane, tail lift and launching system can be transported by the C-130 with the launch vehicle chassis being subject to any restrictions within the M1075 Transportability Report CDRL A095 - Contract DAAE07-90-C-R035.

11.2.9.2 The height of the launch vehicle exceeds the recommended height of 156 inches (3962 mm) by 1.5 inches (38 mm) for transportation in the C5 and C17 aircraft, but is within the 6 inch buffer zone. The maximum allowable single axle load of 36,00 lbs not being exceeded. The launch vehicle can therefore be loaded in to both the C17 and C5 aircraft without reconfiguration; external dimensions and gross vehicle weight being within acceptable limits.

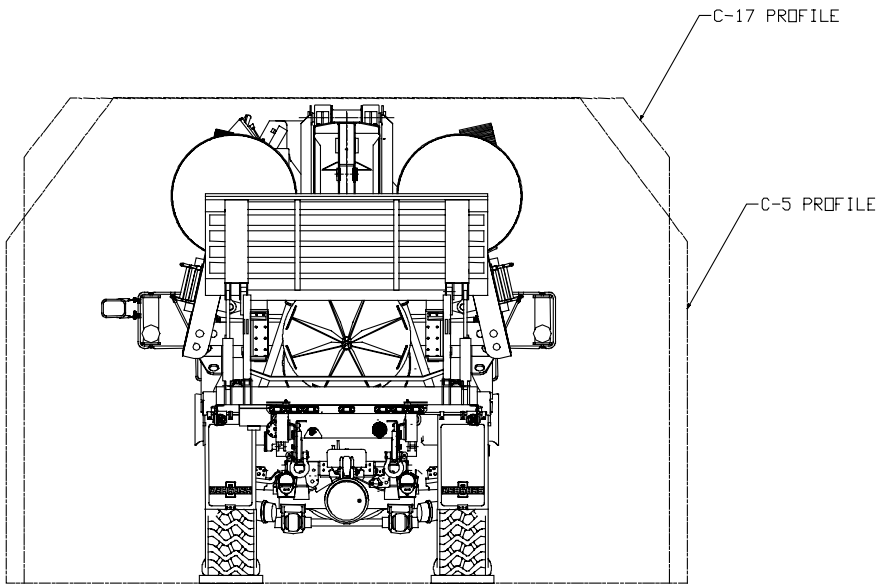


Figure 11. 7 C17 and C-5 Space Envelopes (End View)

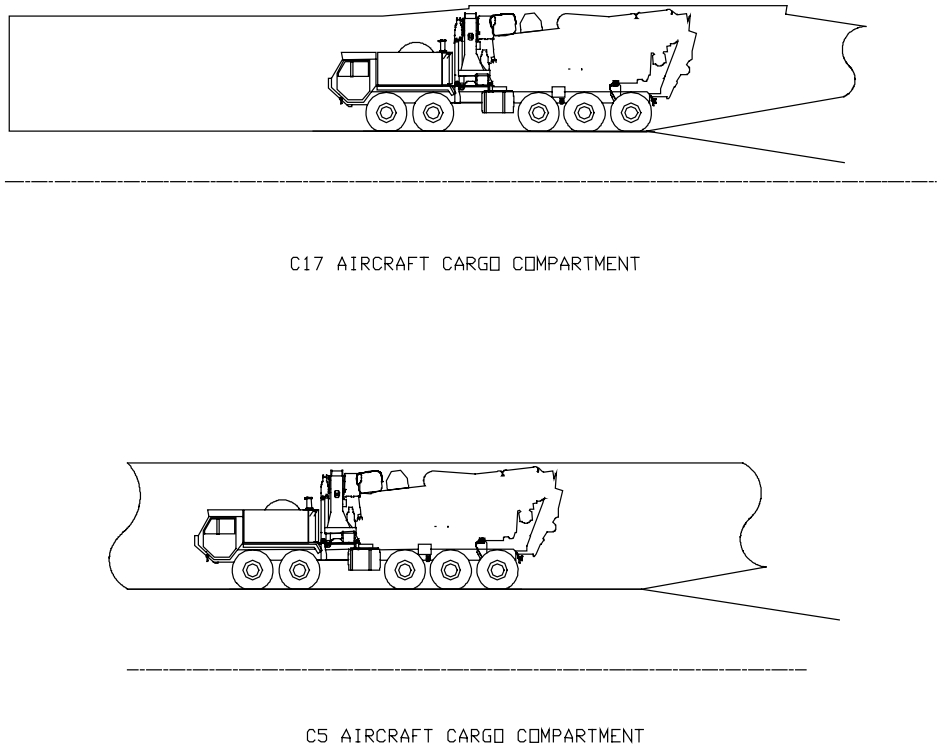


Figure 11. 8 C17 and C-5 Space Envelopes (Side View)

11.2.9.3 For C-130 transport, the tail lift can be carried by a single 463L pallet. The crane requires a pallet with a capacity of 4900 kg (10780 lbs), which is outside the capacity of a single 463L pallet. It is therefore necessary to attach 2 pallets together, spreading the load using timber packing. Packing of 63 mm (see Figure 11. 9, 11.10 and 11.11) would be required to keep the overall height of the load within the guide line dimension of 2659 mm. Similarly, the launching system utilizes three 463L pallets during transport within the C-130. See Figure 11. 12.

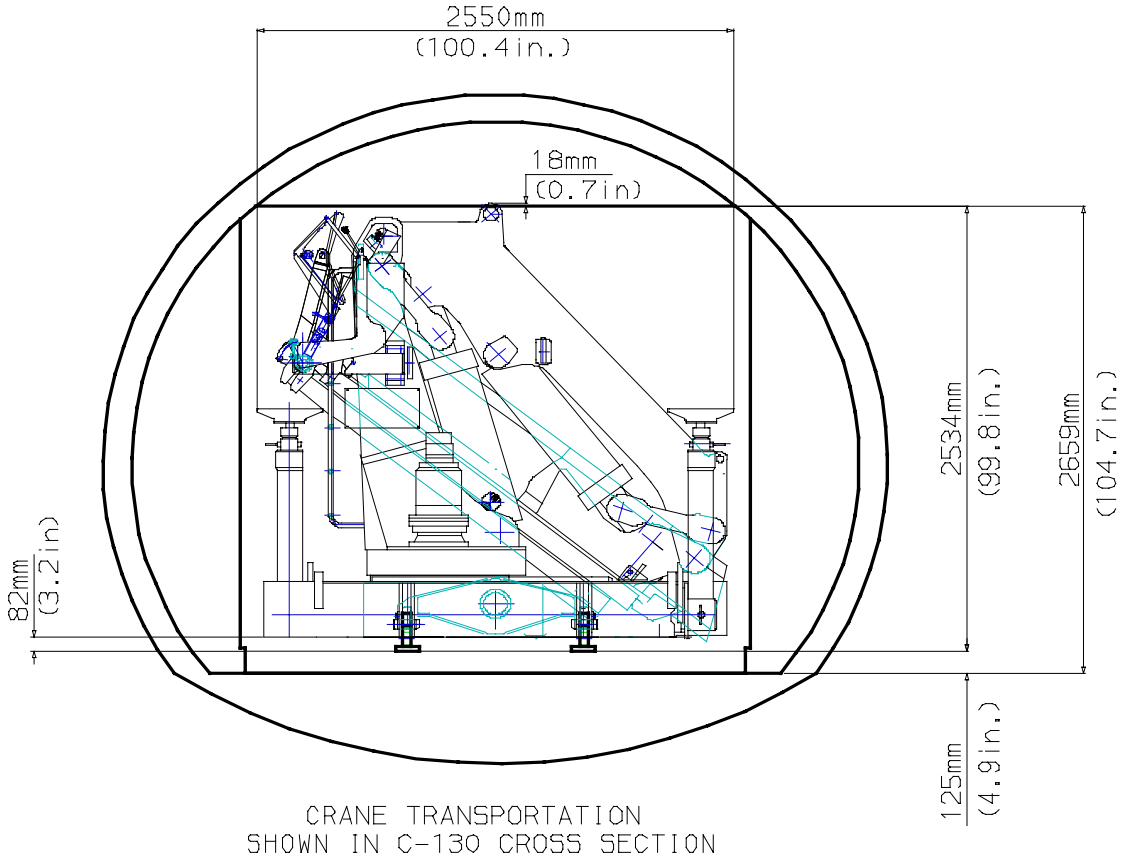


Figure 11. 9 Crane Packing Requirements for C-130 Gauge

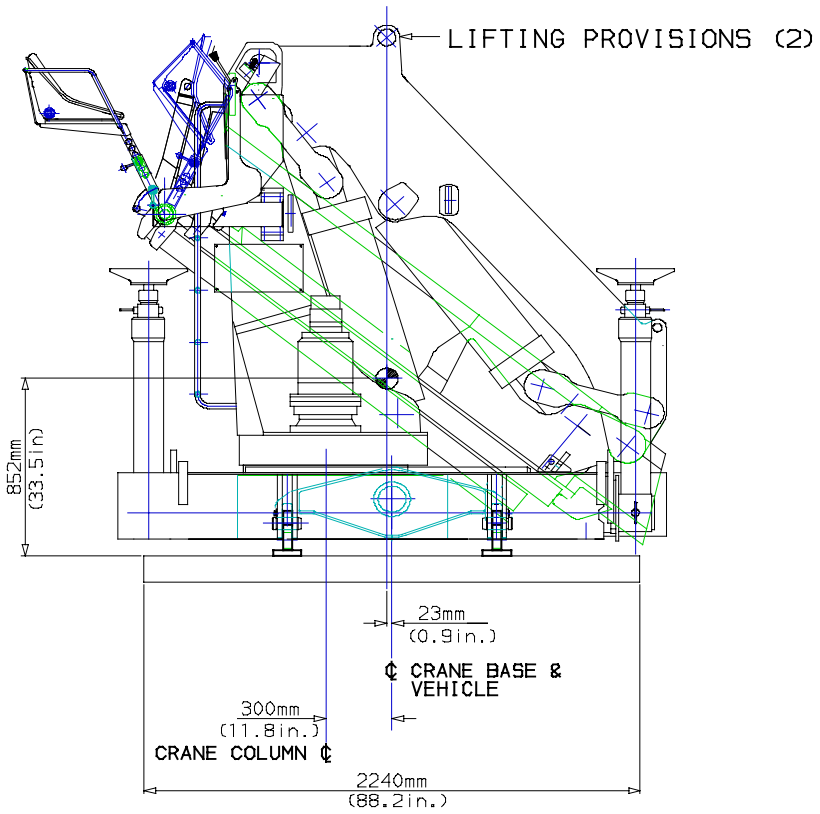


Figure 11. 10 C-130 Crane Transportation Side View

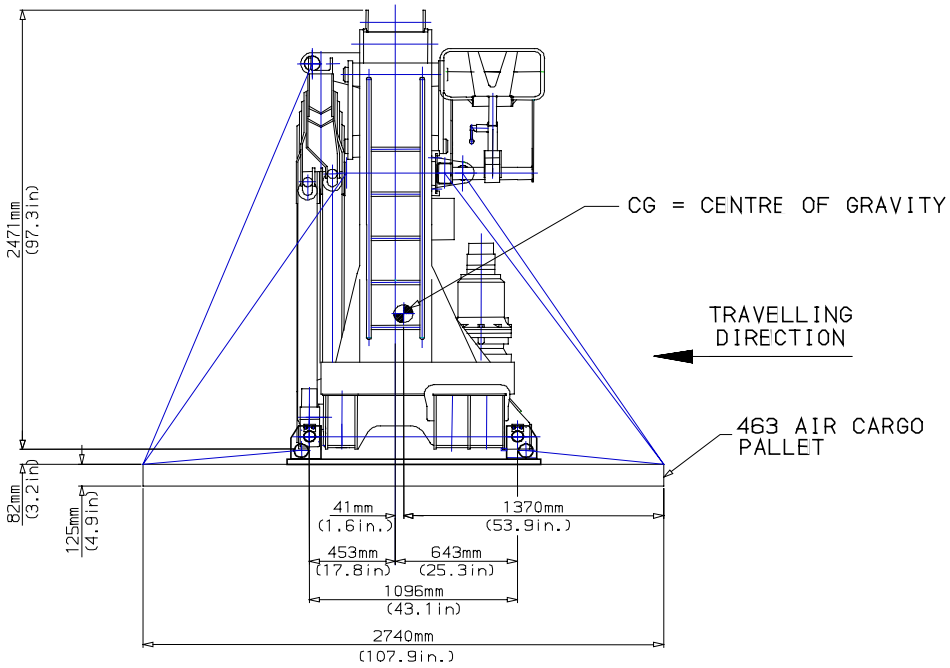


Figure 11. 11 C-130 Crane Transportation End View

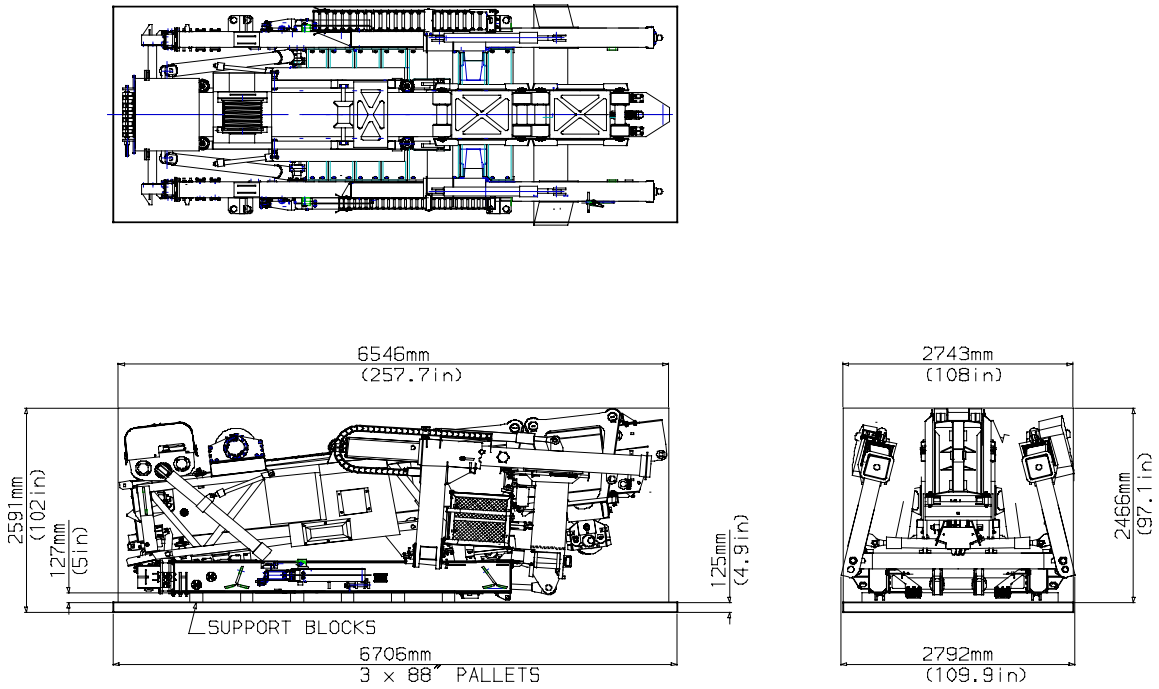


Figure 11. 12 Launch Vehicle C-130 Transportation

11.3 DSB FLATRACK LOADS

11.3.1 Introduction

11.3.1.1 Prime transportation of DSB bridge loads is by standard M1077 PLS flatrack. These flatracks being carried by either the M1075, M1074 or M1977 CBT vehicles and the M1076 PLS Trailer.

11.3.1.2 The standard 40-meter bridge set including the additional set of ramp modules etc. comprises the following PLS pallet loads:

Table 11. 2 Flatrack Designation and Loading

Designation	Load
V1	1 ramp module, 1 parallel module
V2	2 parallel modules
T2	2 parallel modules
V3	20 approach ramps, 2 end beams, 12 defile markers, 2 anchorage sets
T1	Ramp module, 20 approach ramps, 2 end beams, 2 module access ladders, 12 defile markers
T3	2 ramp modules
LVT	7 launch beams, ancillary launching equipment

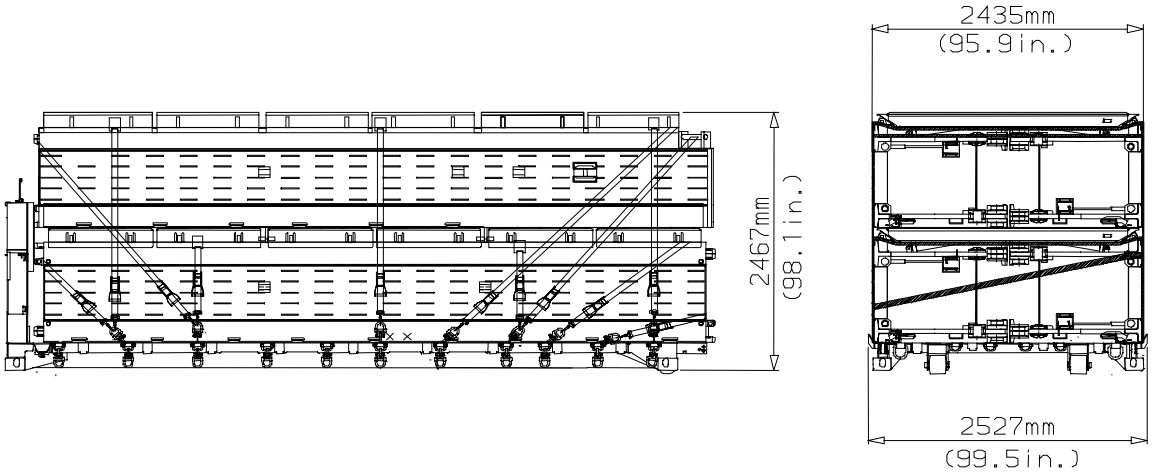


Figure 11. 13 Flatrack Load V1

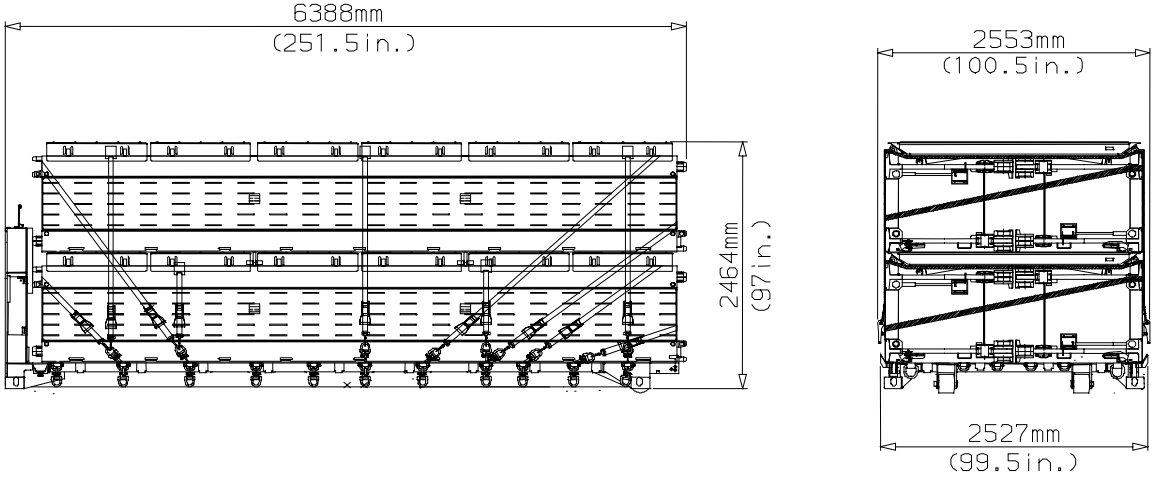


Figure 11. 14 Flatrack Load V2 and T2

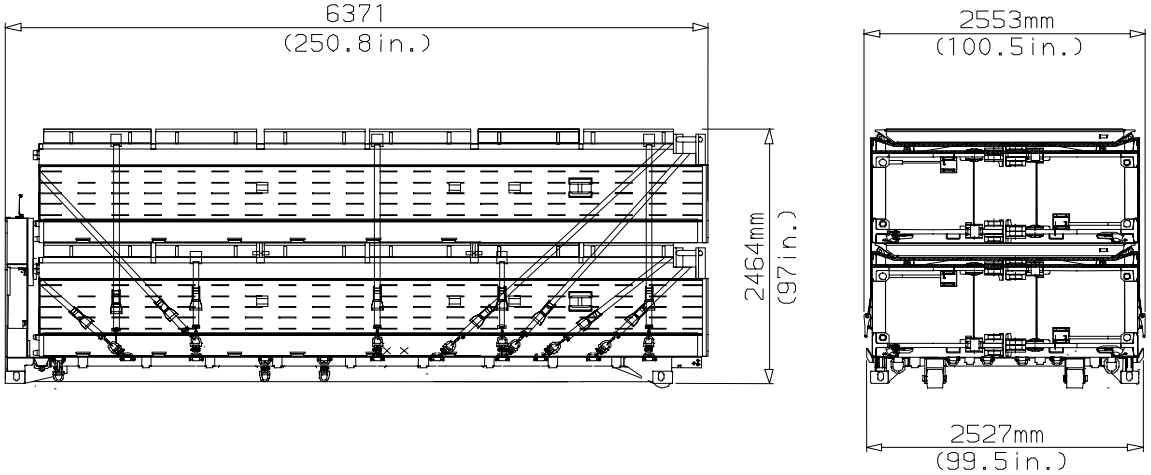


Figure 11. 15 Flatrack Load V3

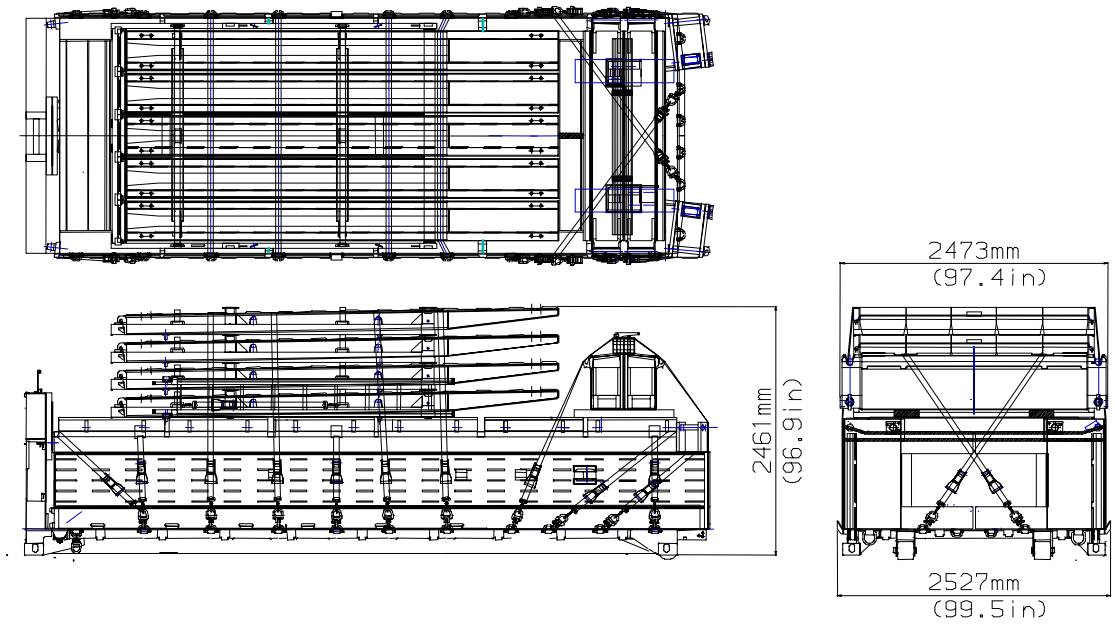


Figure 11. 16 Flatrack Load T1

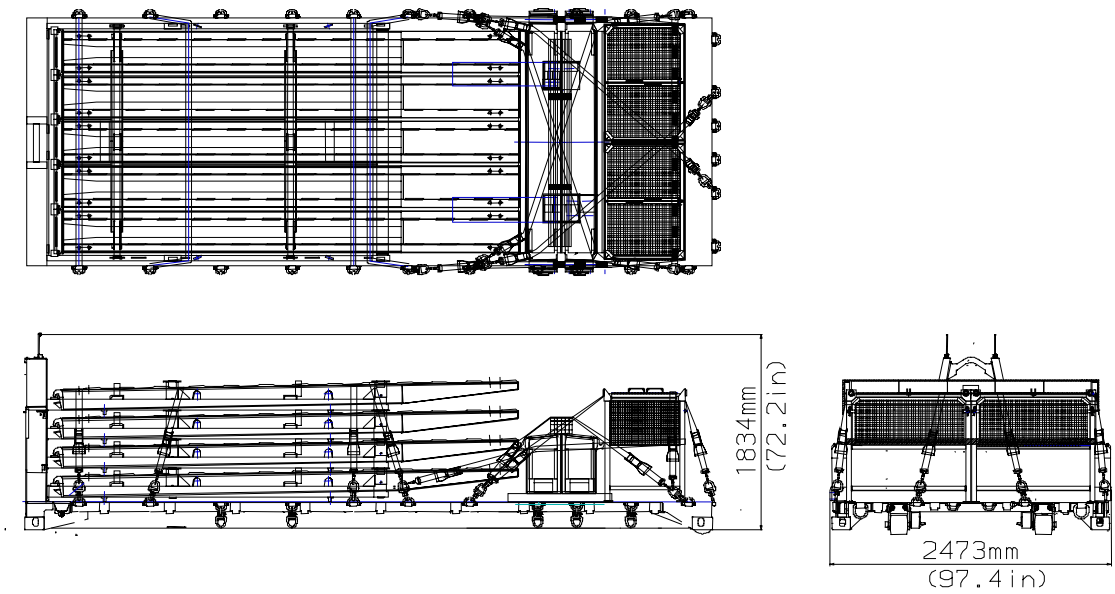


Figure 11. 17 Flatrack Load T3

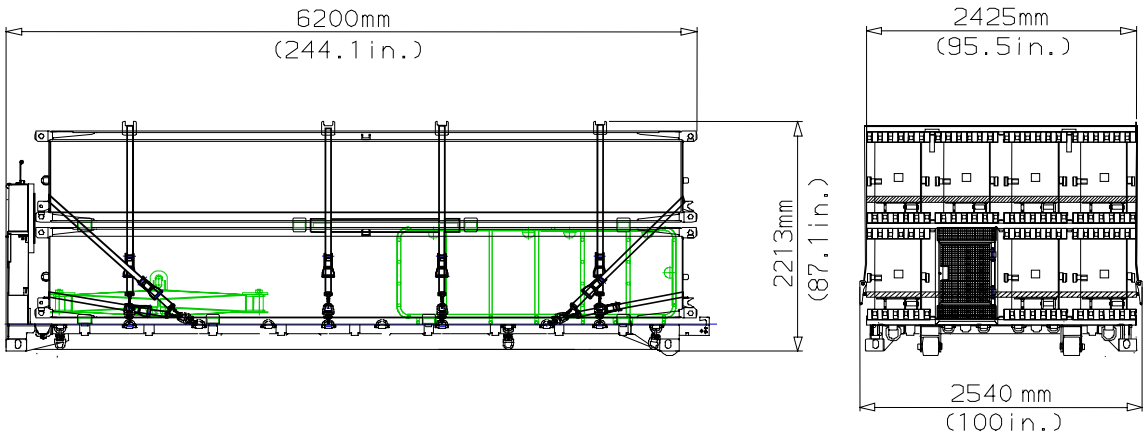


Figure 11. 18 Flatrack Load LVT

11.3.2 Flatrack Loads: Highway

11.3.2.1 Table 11. 3 specifies the overall dimensions of the various flatrack loads:

Table 11. 3 Flatrack Load Dimensions

Flatrack	Height		Length		Width	
	in	mm	in	mm	in	mm
LVT	87.1	2213	244.1	6200	100	2540
V1	97	2464	251.5	6388	100.5	2553
V2	97	2464	251.5	6388	100.5	2553
V3	97	2464	250.8	6371	100.5	2553
T1	96.9	2461	250.8	6371	100.5	2553
T2	97	2464	251.5	6388	100.5	2553
T3	72.2	1834	238.1	6046	98.5	2502

11.3.2.2 The bridge and launch beam loads overhang the end of the flatrack by up to 14 inches (355 mm) but this is not considered to degrade flatrack trans-loadability or transportability.

11.3.2.3 The maximum height of a flatrack load is 97 inches (2464 mm) above the underside of the ISO block. This load when carried on the M1977 CBT is below the 13.12ft (4m) height restriction.

11.3.3 Flatrack loads: Rail - North America

11.3.3.1 The DSB flatrack loads have unrestricted transport by rail when carried on a flatcar of 50 inch (1.27m) deck height. The flatracks themselves are to be tied down to the railcar in accordance with the requirements and guidelines of their respective Transportability Reports.

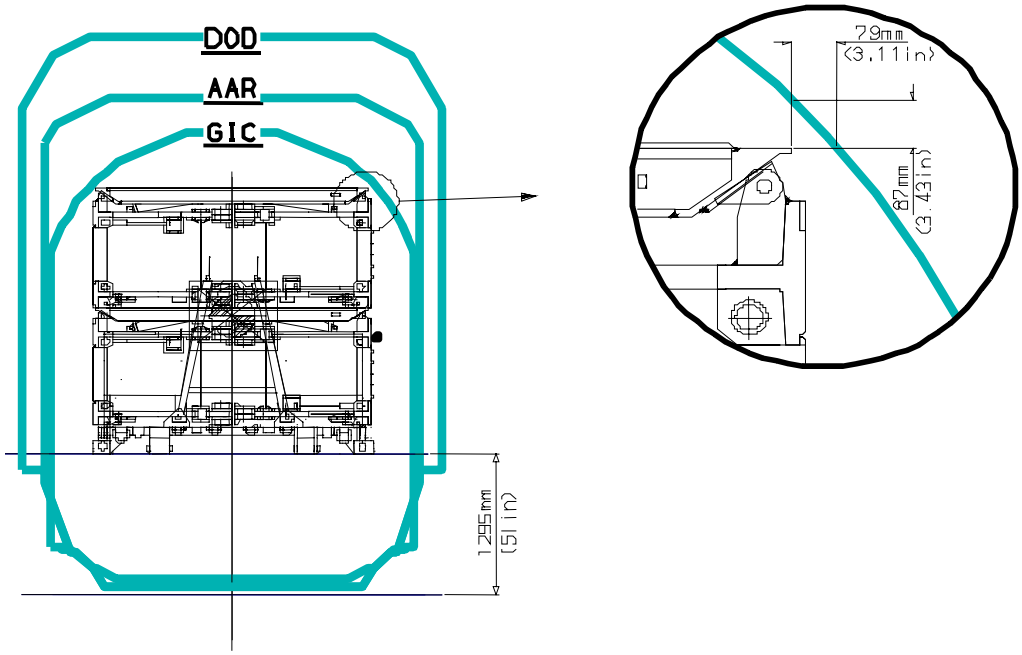


Figure 11. 19 Maximum Height Flatrack Load Rail Gauge Comparison

11.3.3.2 DSB flatrack loads when transported by any of the specified vehicles or the M1076 trailer exceed the AAR outline height of 15 ft 1in (4.572 m) and are as such, considered as dimensional loads which will be subject to clearance checks. The tie-down of these loads to the railcar should also be performed in accordance with the requirements and guidelines of their respective Transportability Reports.

11.3.4 Foreign Rail

The flatrack and DSB loads will fit into GIC gauges as shown in Figure 11. 19. The tie-down of these loads to the railcar should also be performed in accordance with the requirements and guidelines of their respective Transportability Reports.

11.3.5 Flatrack Loads, Ocean and Waterway

There is no restriction to transportation by any of the specified vehicles pulling M1076 trailers on vessels of LCV-2000 or larger. The tie-down of these loads to the vessel should also be performed in accordance with the requirements and guidelines of their respective Transportability Reports.

11.4 FLATRACK LOADS: AIR

11.4.1 Fixed Wing

11.4.1.1 DSB flatrack loads can be transported by C5 and C17. At 97 inches (2464 mm) high, they can also be loaded into the C130 aircraft.

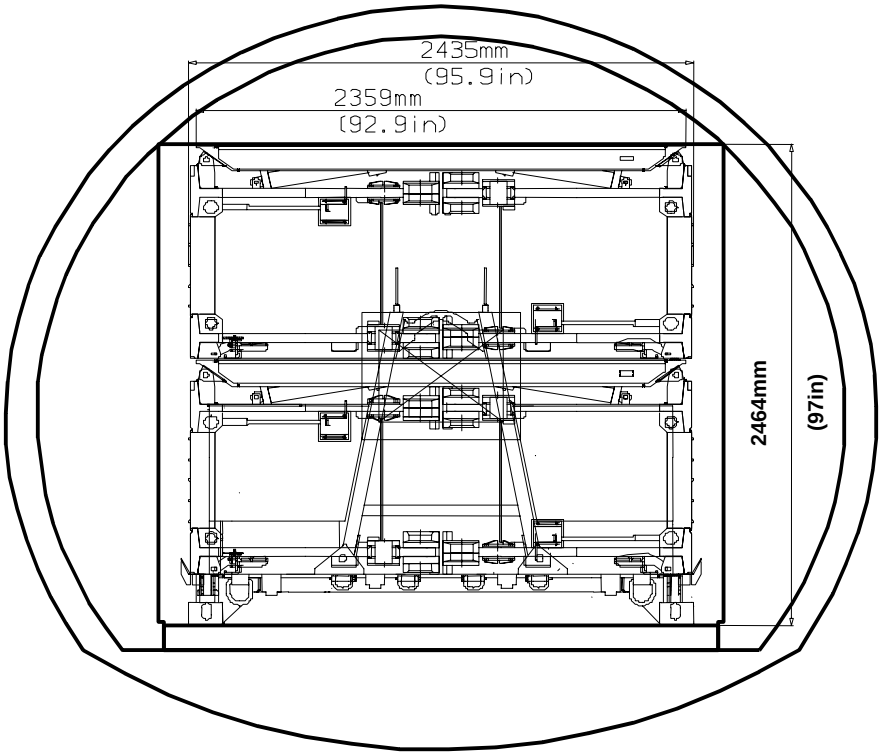


Figure 11. 20 Flatrack Load in C-130 Cross Section

11.4.1.2 At a maximum height of 13.08 ft (3987 mm), loaded M1075, M1074, M1977 CBT and M1076 trailers may be loaded on to C5 and C17 aircraft without reconfiguration.

11.4.2 Rotary Wing

11.4.2.1 The External Air Transport (EAT) is possible with CH-47D, which has a 25150 lb (11400 kg) payload capacity. All the DSB pallet loads fall within this capacity the heaviest being 23,040 lbs (10473 kg) gross including flatrack (see Table 11. 5). To achieve the most stable lift, multi-point slinging using four equal length slings attached to the fore and aft cargo hooks is used. The DSB payload configuration demands that the sling legs be attached to the lower ISO corner fittings of the flatracks. The slings consist of a 12 ft (3.65 m) nylon portion and 8 ft (2.43 m) of chain doubled back through the ISO fitting on the flatrack to make a final length of 16ft (4.87 m). To prevent damage occurring wood/rubber etc. should be secured between the sling chain and the load.

11.4.2.2 The stacked bridge module loads are of a size equivalent to an ISO container and this load should therefore be handled in accordance with the guidelines of the Palletized Load System (PLS) M1074/M1075 Truck, M1076 Trailer, M1077 Flatrack Transportability Report CDRL A095 - Contract DAAE07-90-C-R035 Section 4.5.4.

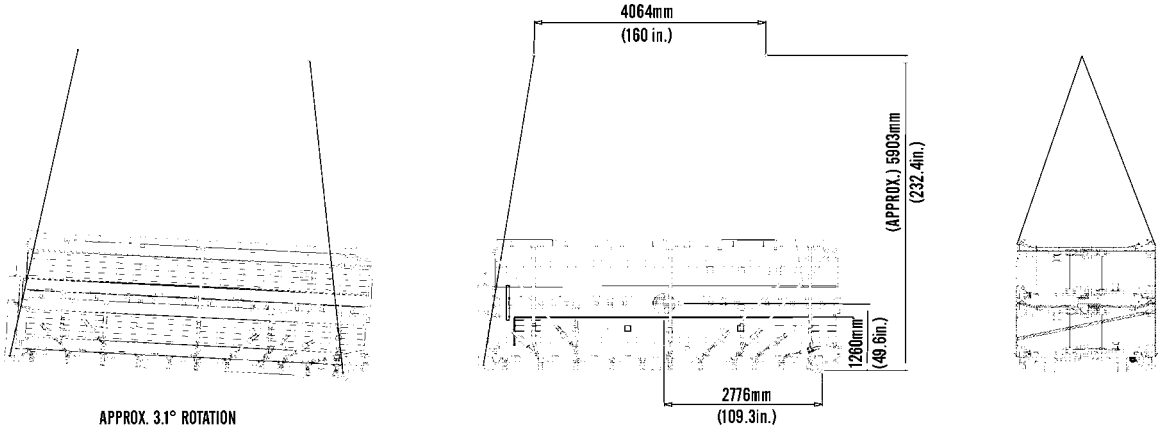


Figure 11. 21 EAT Lift of Flatrack V1

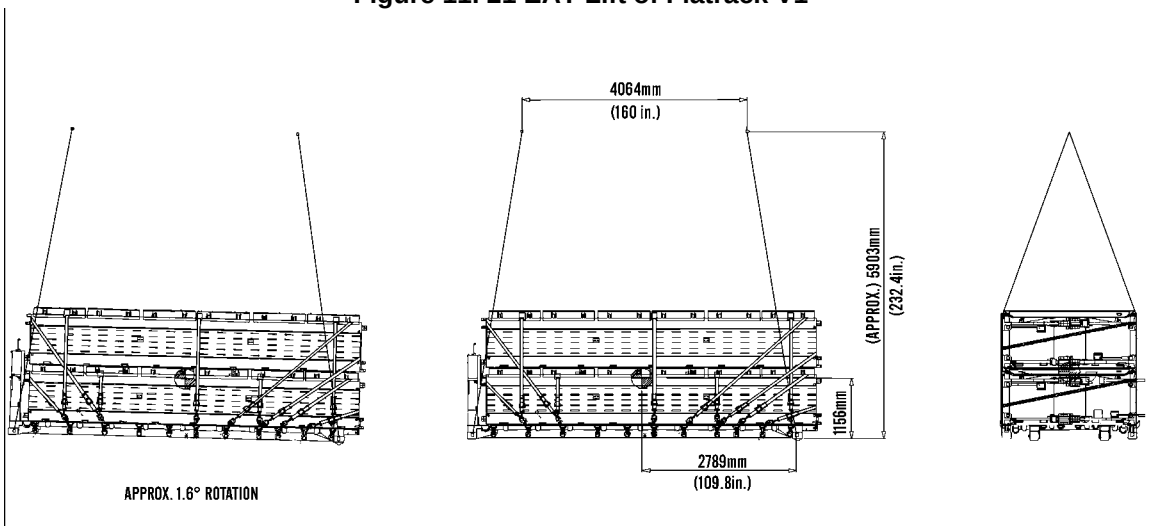


Figure 11. 22 EAT Lift of Flatracks V2 and T2

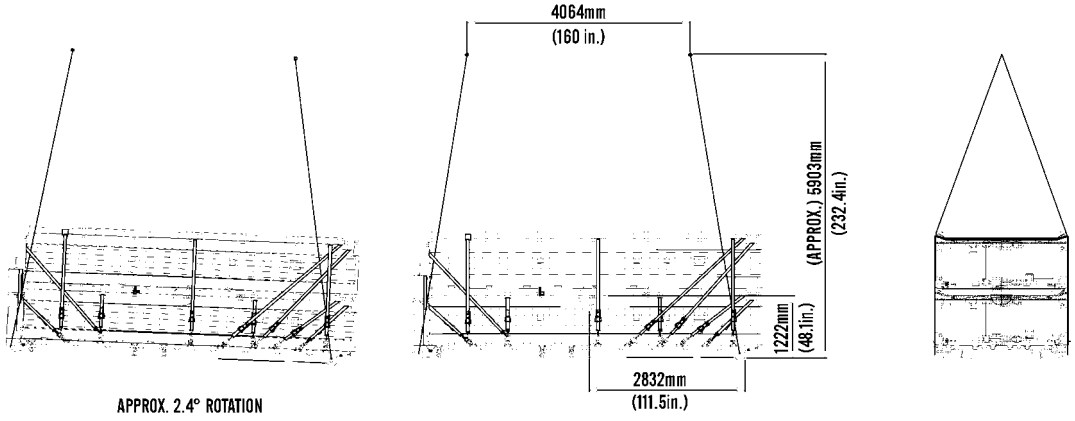


Figure 11. 23 EAT Lift of Flatrack V3

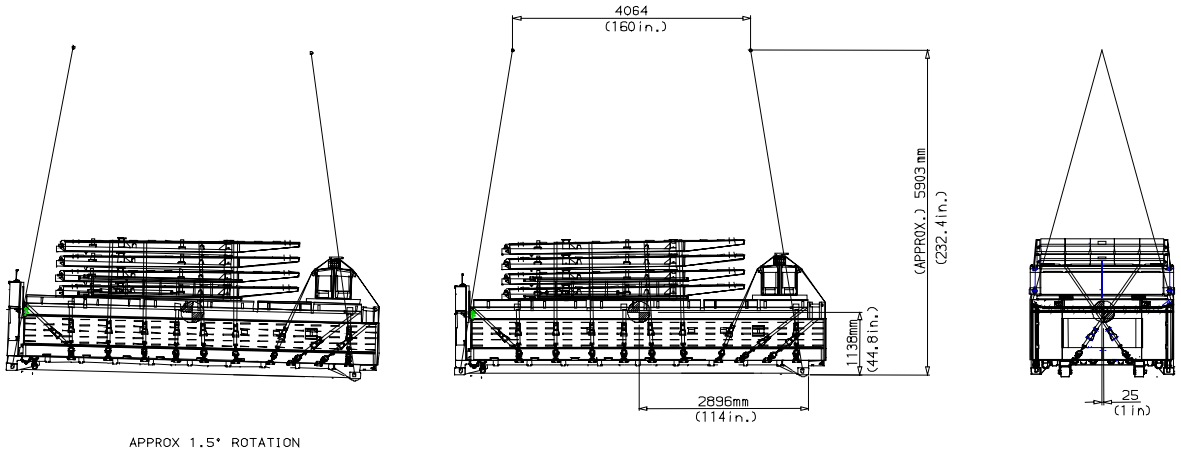


Figure 11. 24 EAT Lift of Flatrack T1

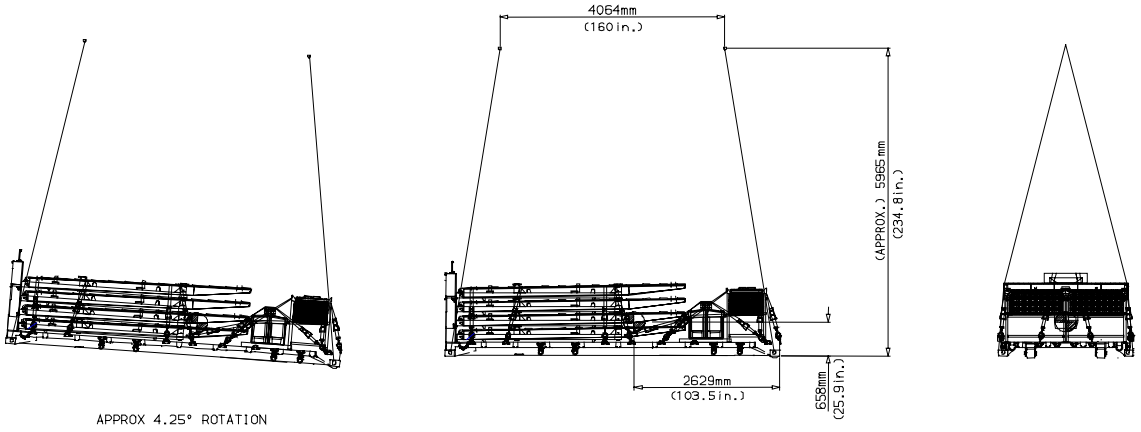


Figure 11. 25 EAT Lift of Flatrack T3

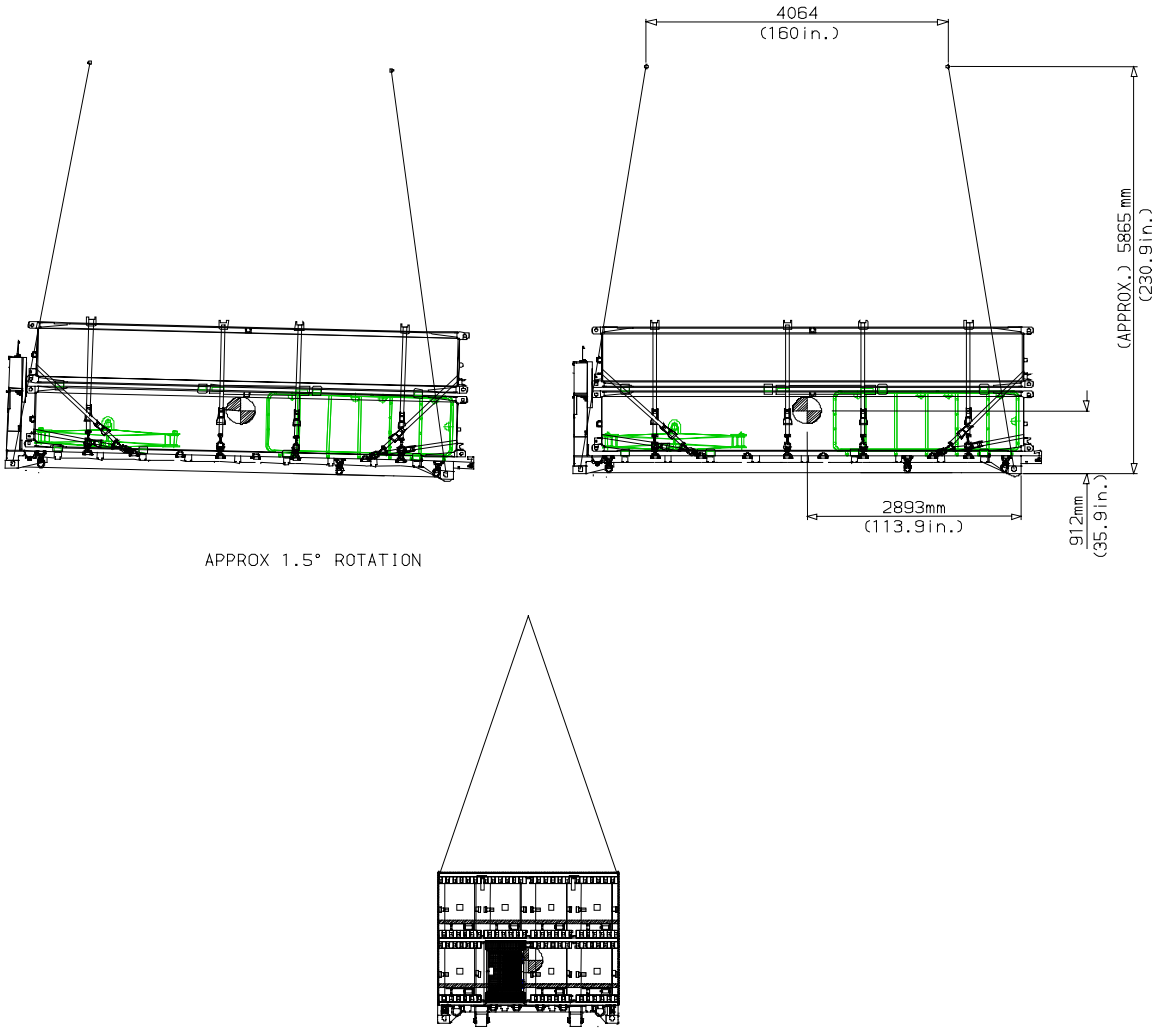


Figure 11. 26 EAT Lift of Flatrack LVT

Section II. LIFTING DSB COMPONENTS

11.5 LIFTING

11.5.1 Launch Vehicle

11.5.1.1 The launch vehicle may be lifted as a complete unit or by its individual components when sectionalized. Lifting of the launch vehicle as a complete unit utilizes the PLS specific sling set attached to the PLS forward lifting lugs located behind the engine and the rear most lifting points on the slide frame of the launch vehicle.

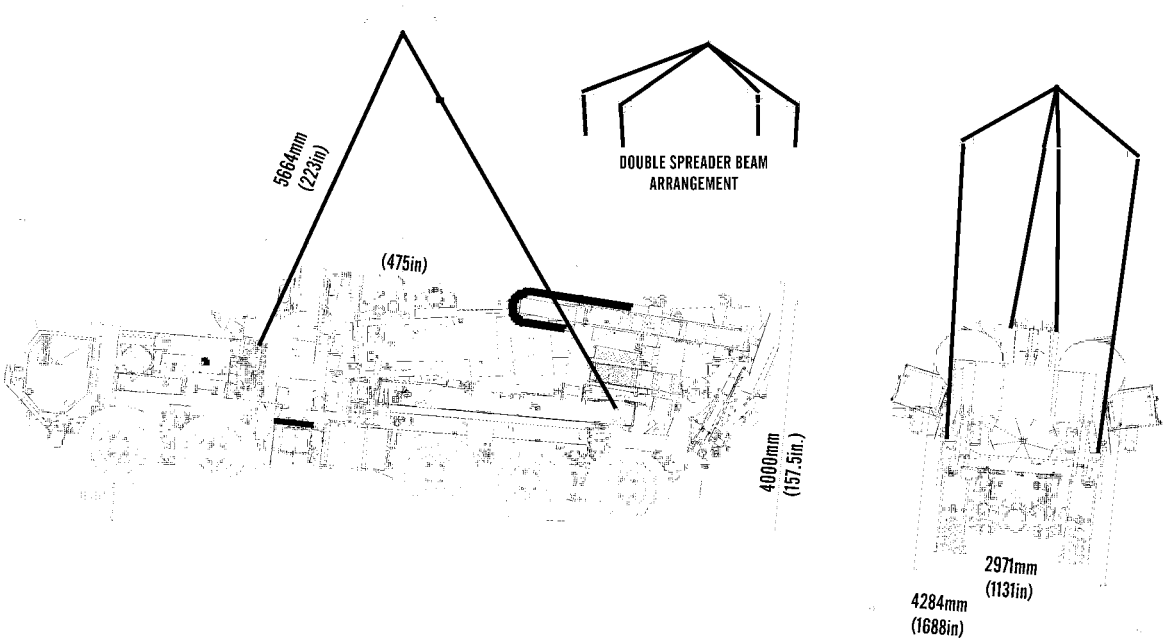


Figure 11. 27 Lifting Complete DSB Launch Vehicle

NOTE

Attach only ONE hook from a common spreader beam to the rear lifting points on EACH side of the launch vehicle.

11.5.2 Launch Vehicle Lifting Procedure

11.5.2.1 Connect the tail lift pendant.

11.5.2.2 Switch the four-position switch in the vehicle cab to position 2.

11.5.2.3 Start up the vehicle engine in accordance with TM 9-2320-364-10.

11.5.2.4 Press the E-Stop reset.

11.5.2.5 Unstrap the tail lift and using the tail lift pendant move it clear of the A-frame pads.

11.5.2.6 Remove the A-frame hinge pins.

11.5.2.7 Partially unfold the A-frame and pass the lifting slings through the A-frame to the lifting points.

11.5.2.8 Continue to unfold the A-frame until the slings do not contact launch vehicle. (Cylinders have check valves and can be stopped in any position).

11.5.2.9 Deploy the folding walkways.

11.5.2.10 Raise the tail lift so that it touches the A-frame pads, and re-strap it.

11.5.2.11 Remove the crane jib transportation pin.

11.5.2.12 Ensure the lever for crane /stabilizer is in the crane position.

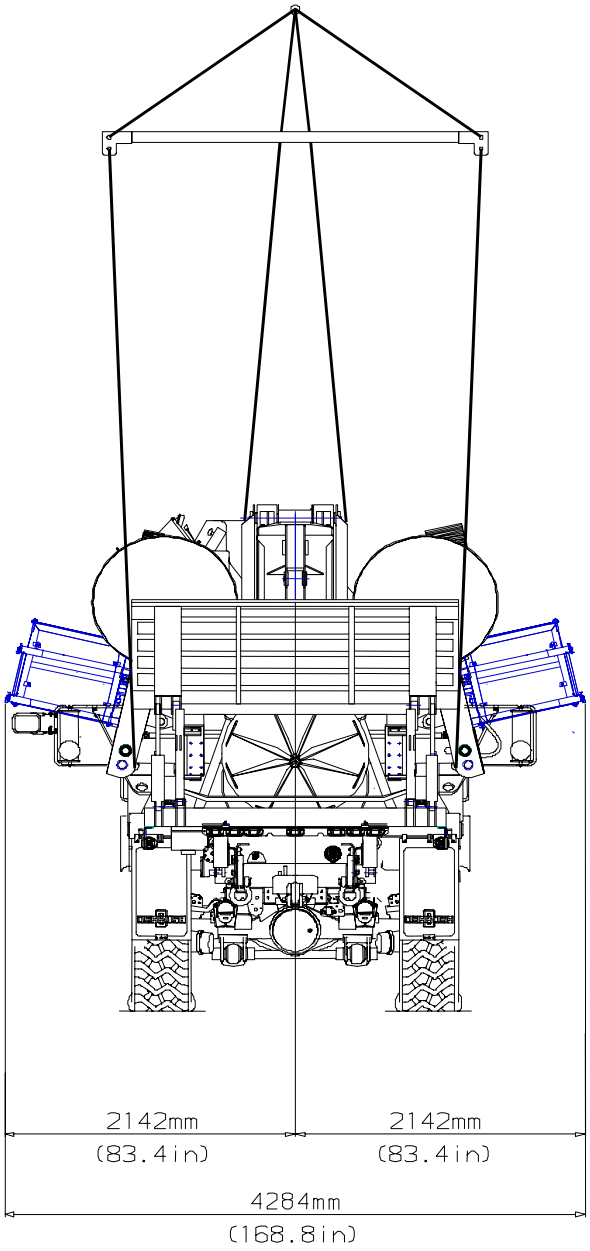


Figure 11. 28 A-frame With Walkways Unfolded

NOTE

Crane stabilizers do not have to be deployed.

11.5.2.13 Rotate the crane hydraulic lever to manual. (This is the lever next to crane controls)

11.5.2.14 Raise the crane boom several inches.

11.5.2.15 Lower the crane jib several inches.

11.5.2.16 Repeat until the sling is clear of the crane jib.

NOTE

During this process ensure that jib does not contact the crane column & hydraulic lever is returned to upright position when finished.

11.5.2.17 For sectionalization, lifting points are provided on the crane and on the slide frame based launching equipment.

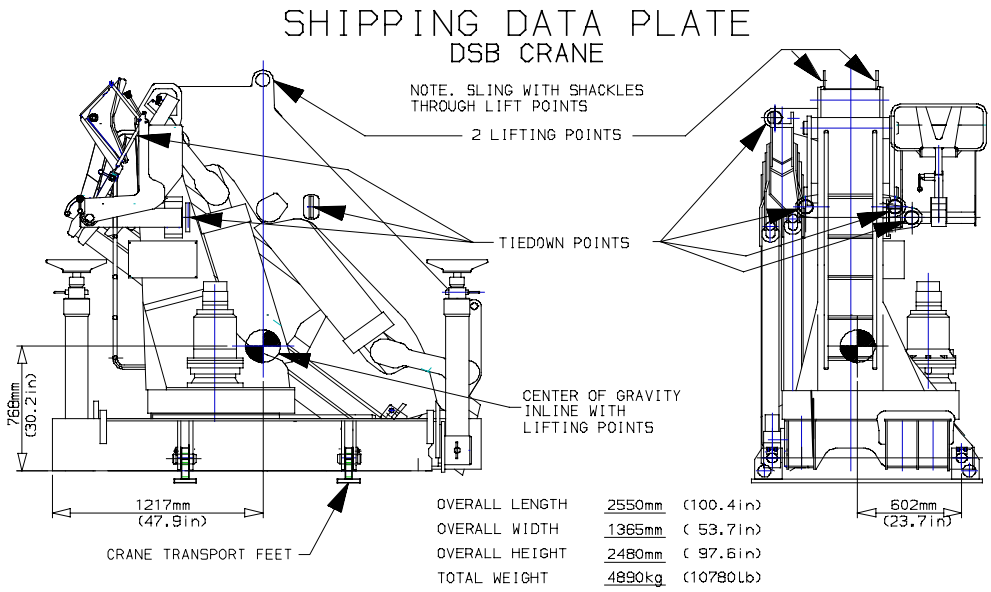


Figure 11. 29 Crane Lifting and Tie Down Provisions

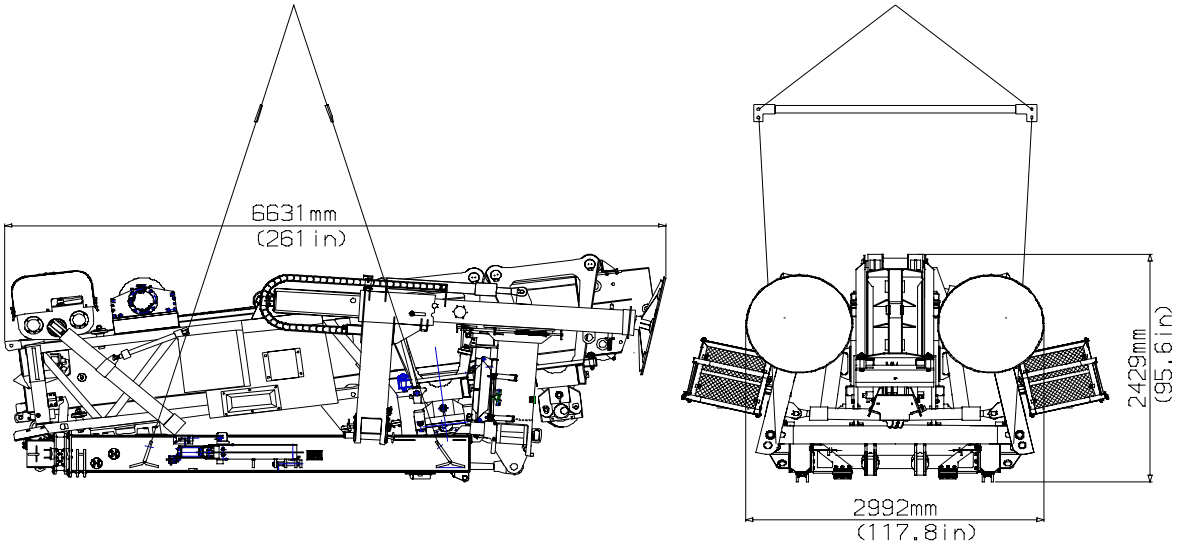


Figure 11. 30 Launch Vehicle Lifting Provisions

11.5.2.18 The launch vehicle M1075 chassis after sectionalization can be lifted according to normal procedures using the rear tie-down provisions as lifting points in conjunction with the forward lift points.

11.6 SHIPPING DATA PLATES

The following illustrations represent the shipping data plates affixed to the various components of the DSB system. They detail lifting and slinging positions, centers of gravity, overall weights, length, width and height, they also indicate the position of the tie-down points where appropriate.

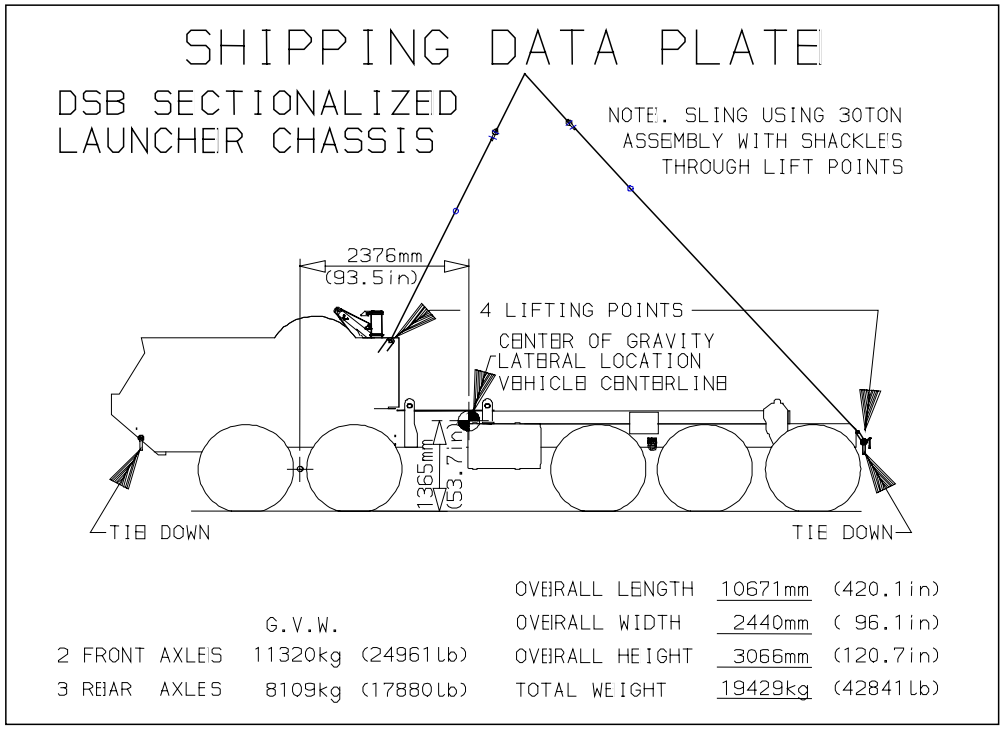


Figure 11. 31 Shipping Data Plate - Truck

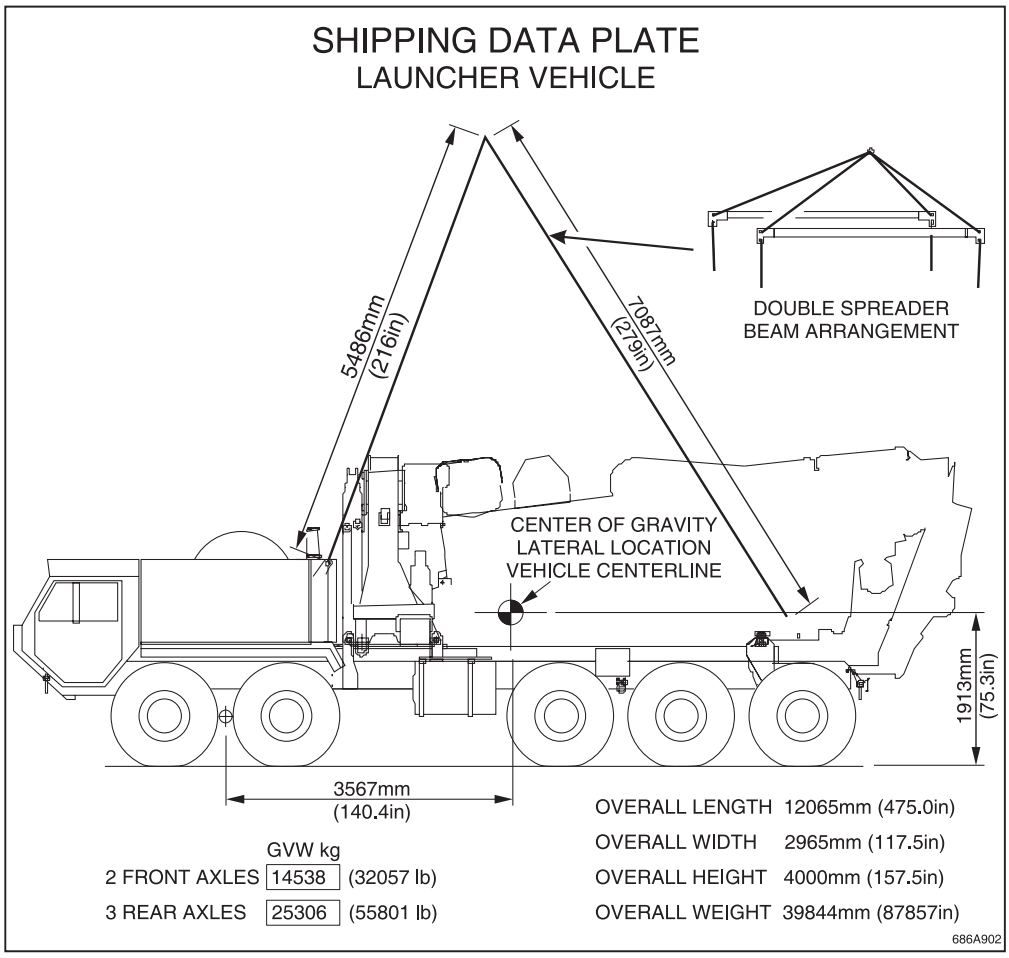


Figure 11. 32 Shipping Data Plate - Launch Vehicle

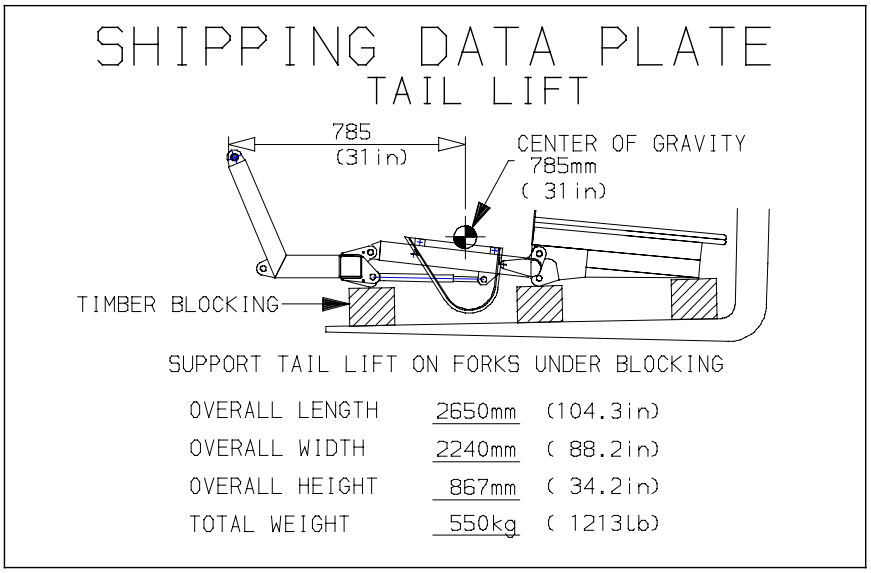


Figure 11. 33 Shipping Data Plate - Tail lift

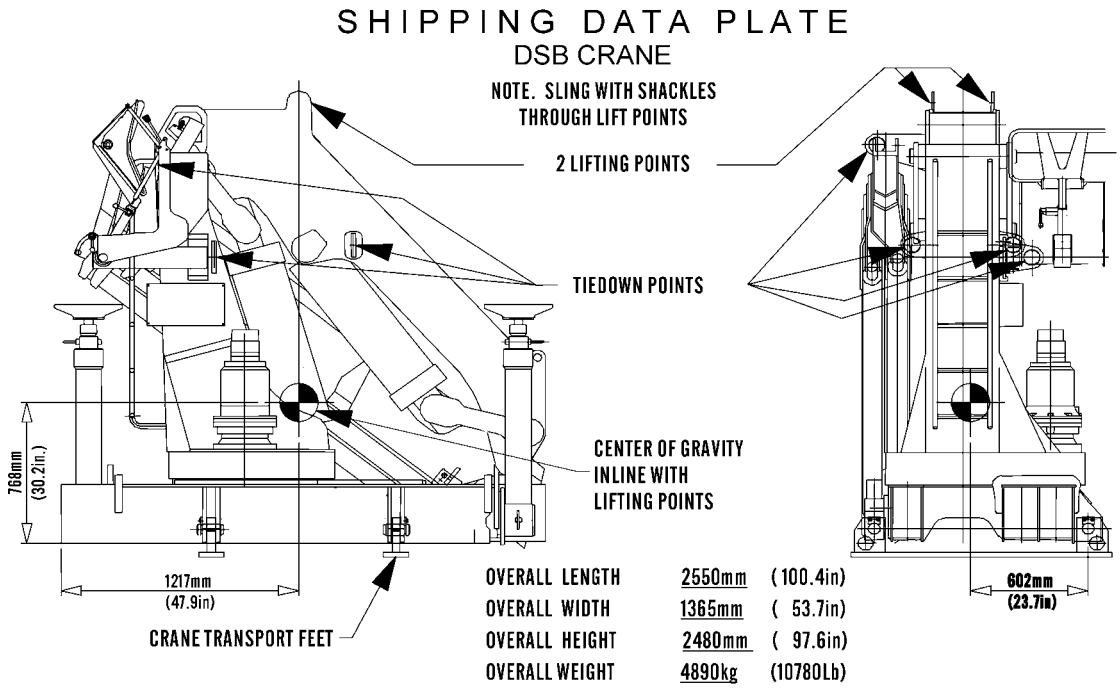


Figure 11. 34 Shipping Data Plate - Crane

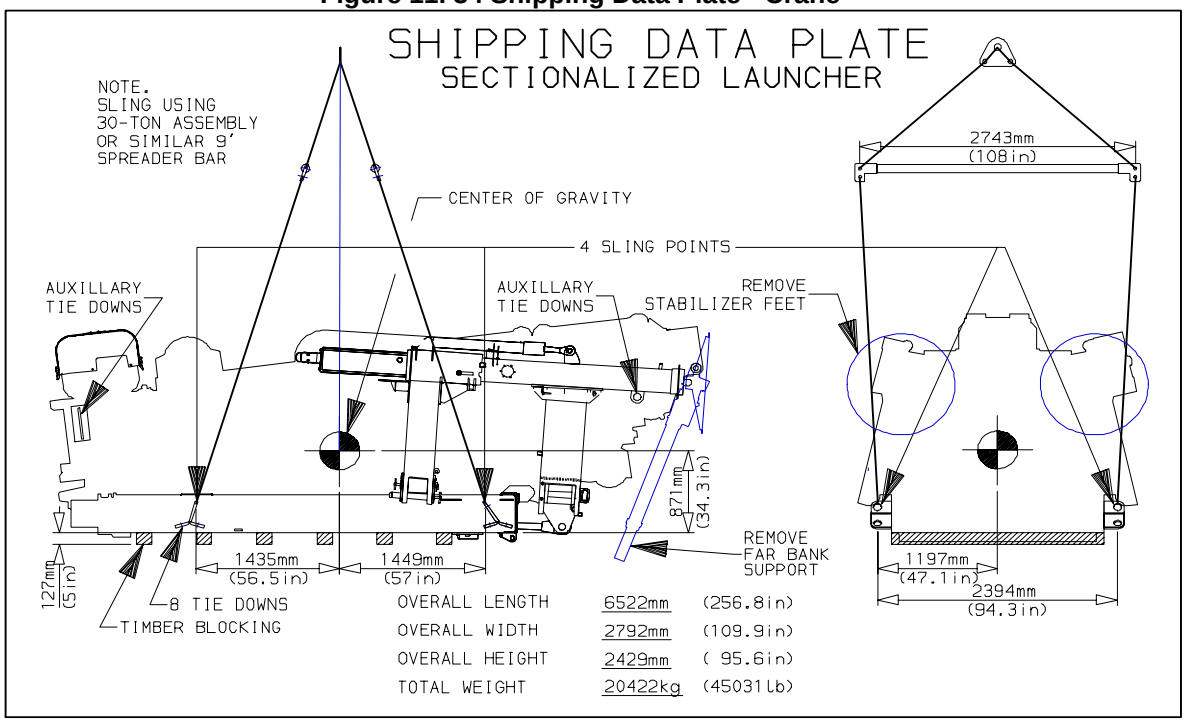


Figure 11. 35 Shipping Data Plate - Sectionalized Launch Vehicle

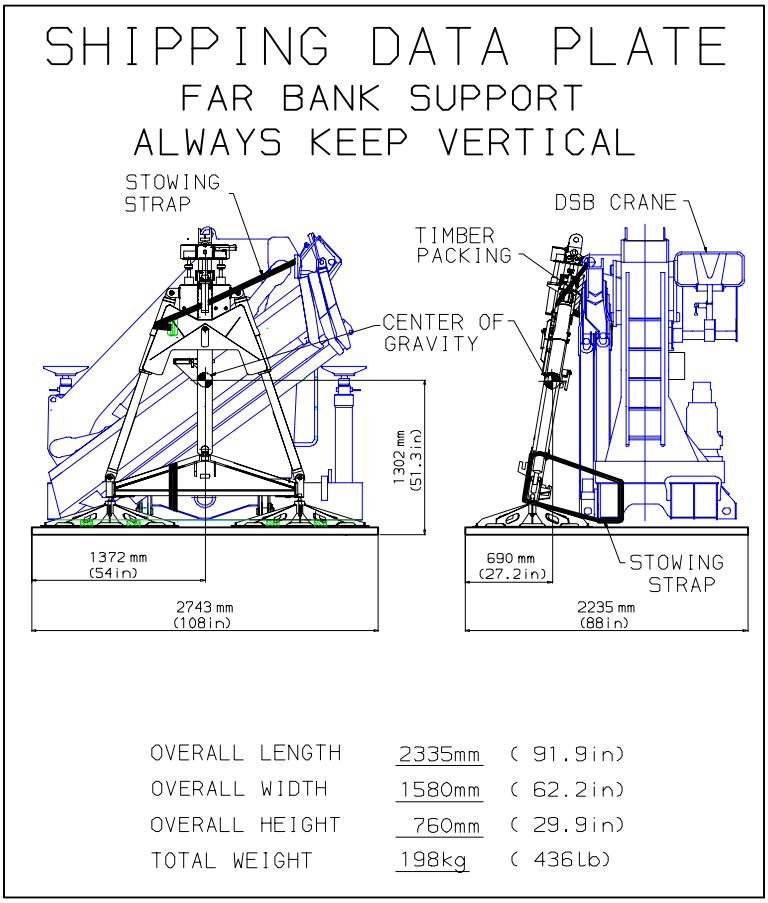


Figure 11. 36 Shipping Data Plate - Far Bank Support

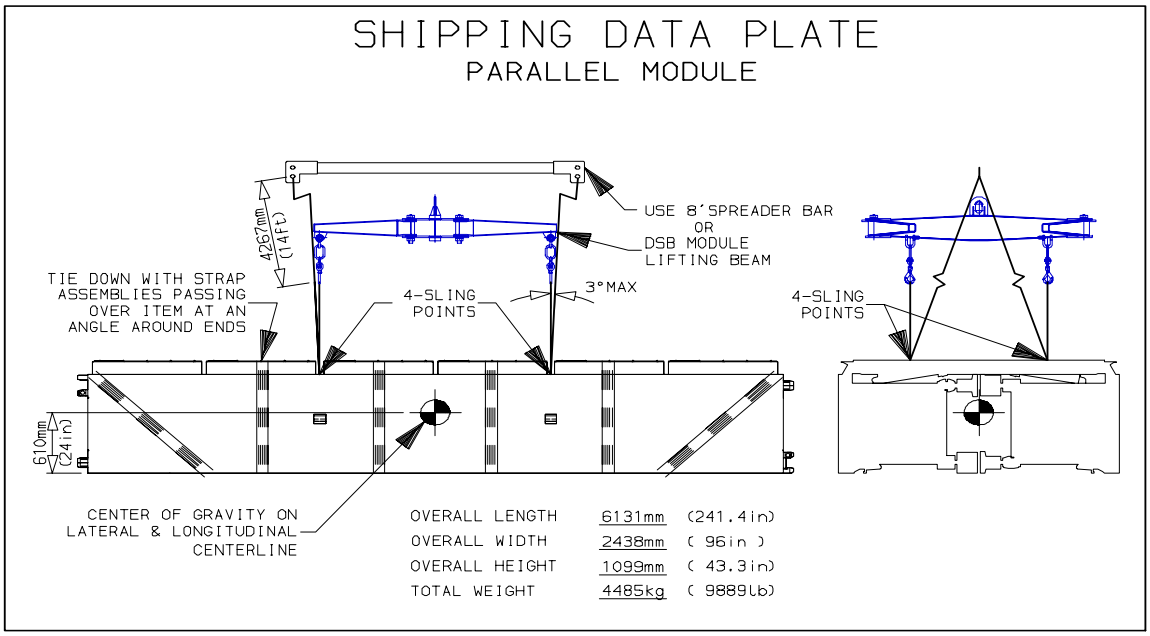


Figure 11. 37 Shipping Data Plate - Parallel Module

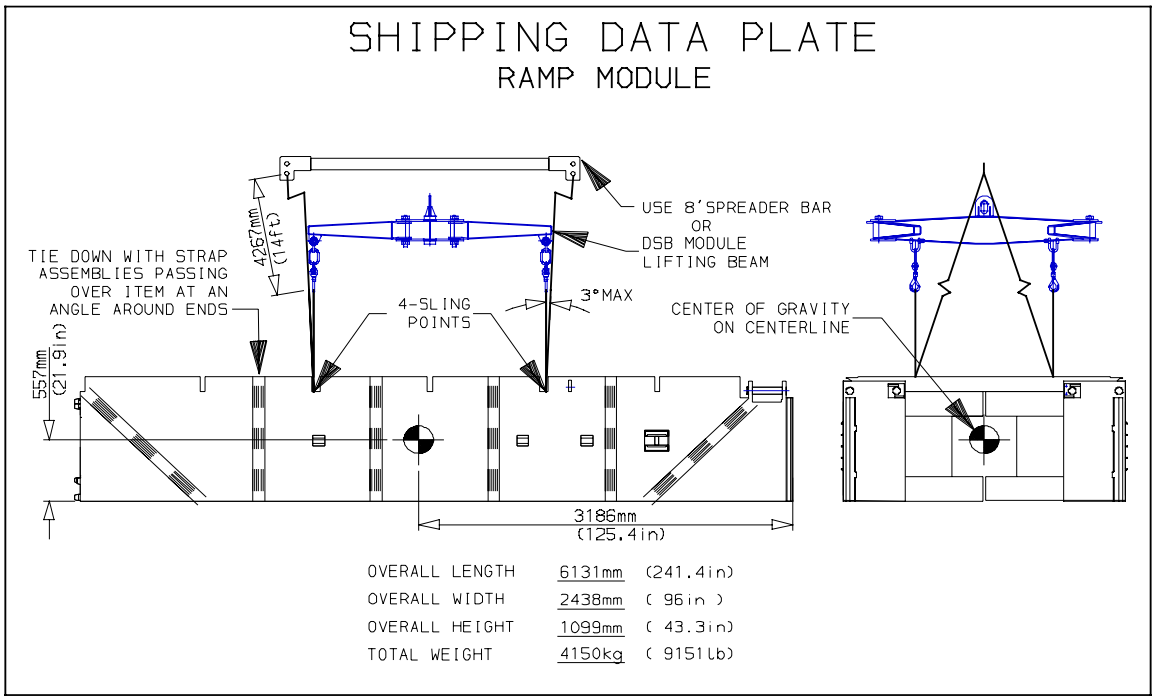


Figure 11. 38 Shipping Data Plate - Ramp Module

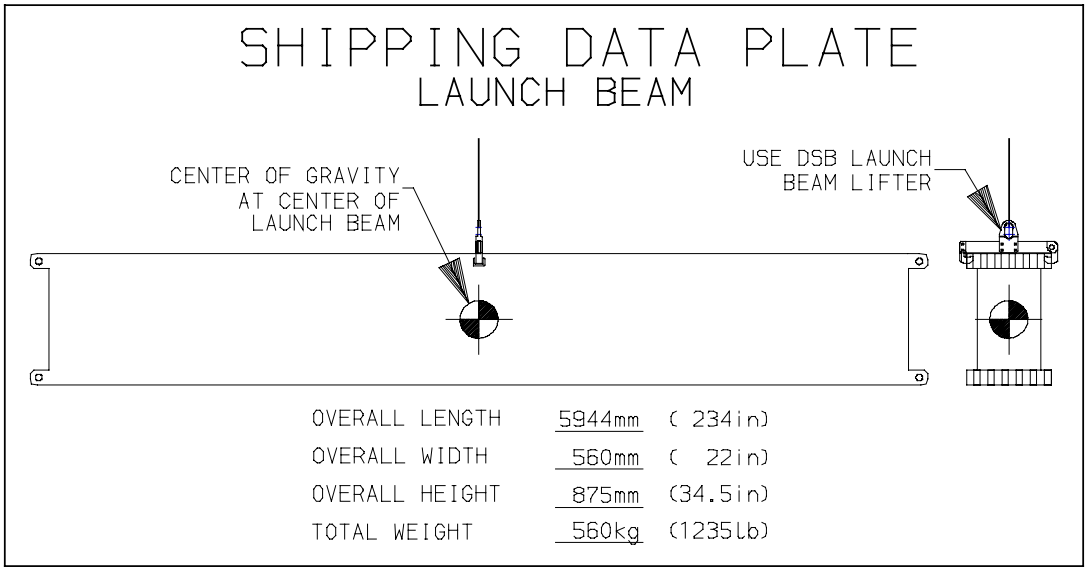


Figure 11. 39 Shipping Data Plate - Launch Beam

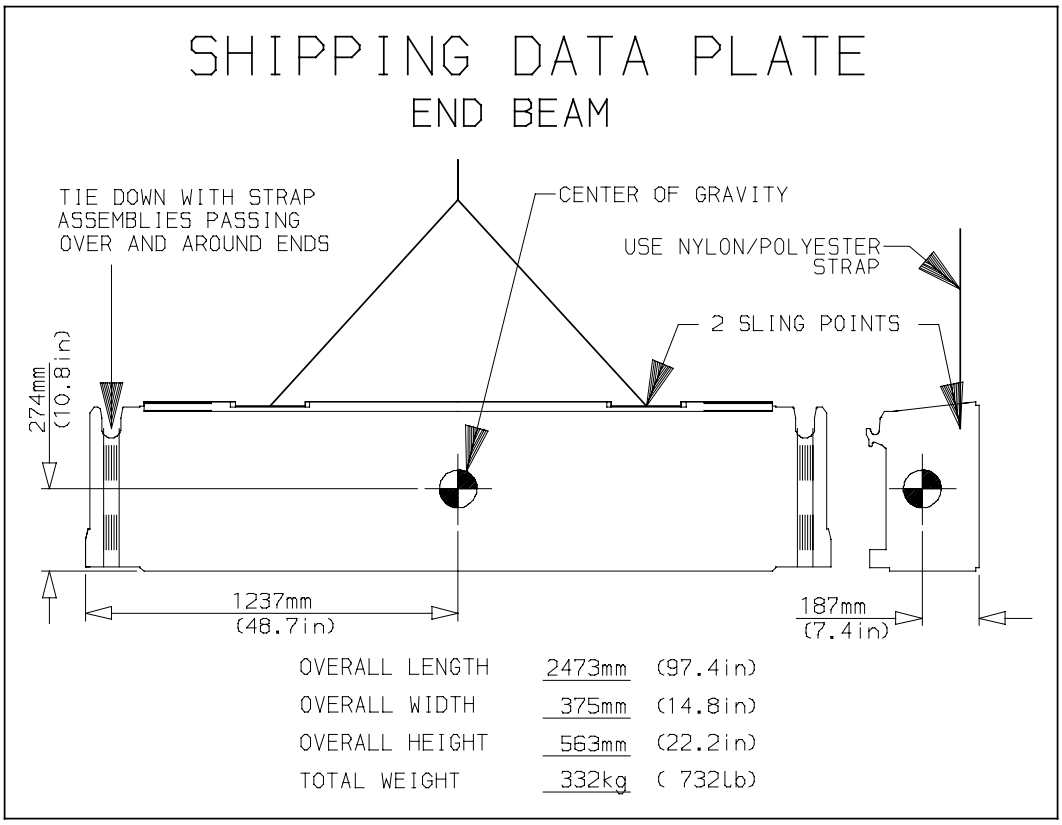


Figure 11. 40 Shipping Data Plate - End Beam (Ramp)

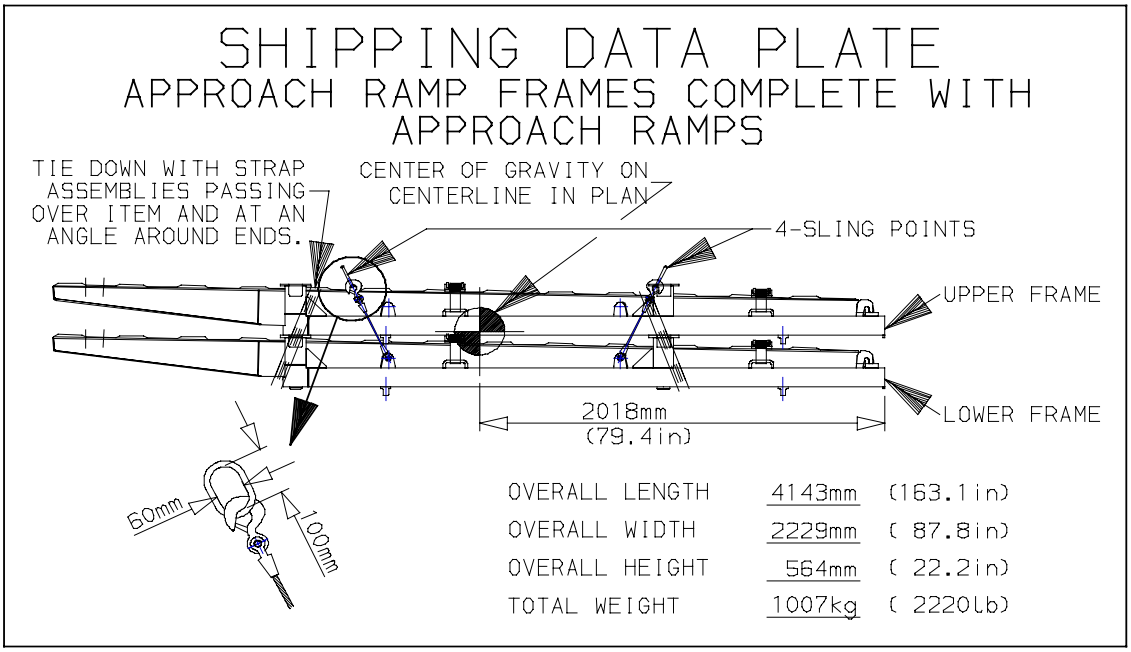


Figure 11. 41 Shipping Data Plate - Approach Ramps & Transport frames

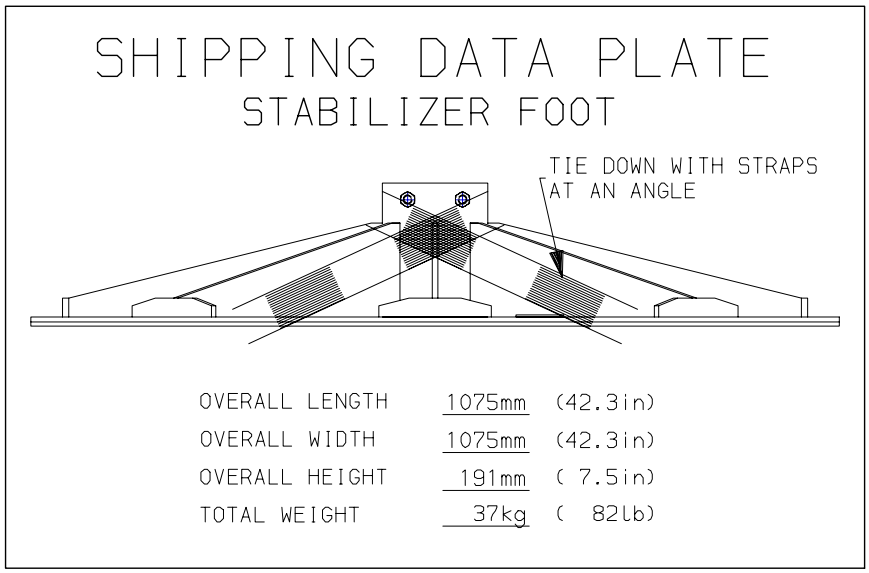


Figure 11. 42 Shipping Data Plate - Stabilizer Foot

11.7 LIFTING FLATRACK LOADS

11.7.1 Crane Lift

11.7.1.1 The load lifting arrangements for the various flatrack loads are shown below, with each utilizing the PLS specific sling set.

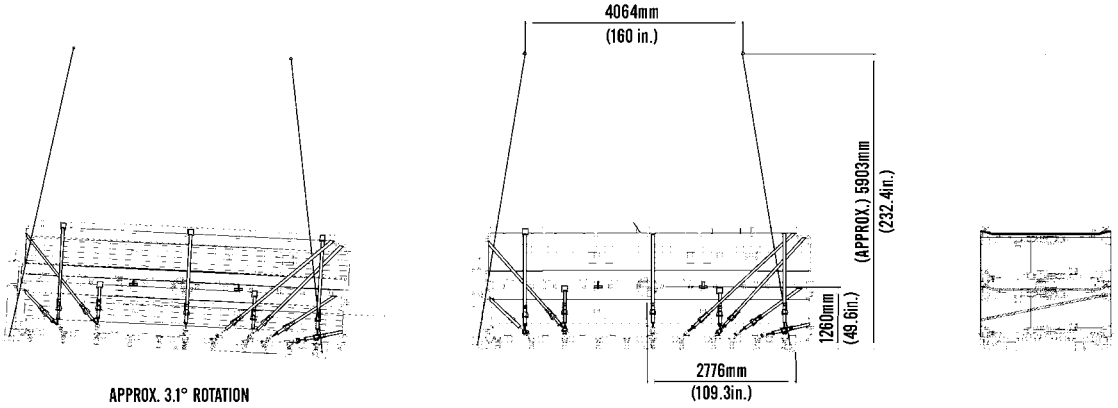


Figure 11. 43 Crane Lift of Flatrack Load V1

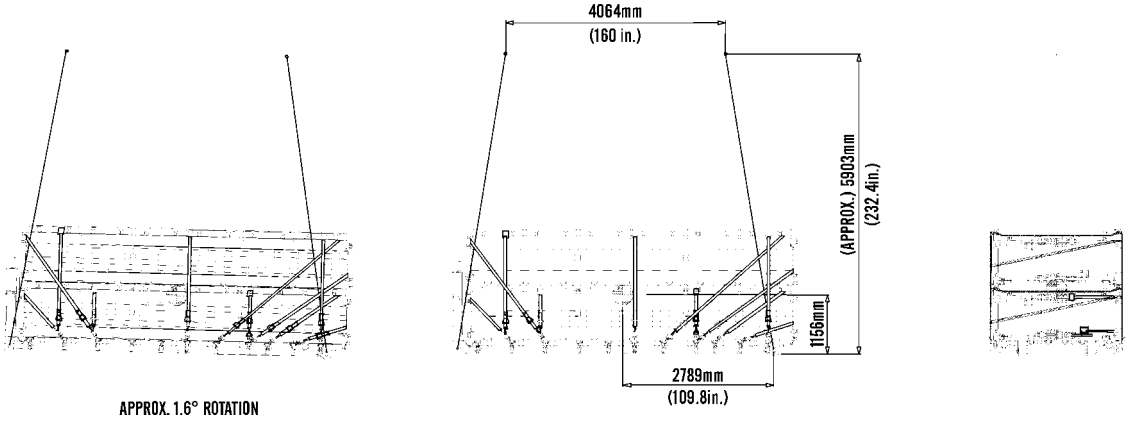


Figure 11. 44 Crane Lift of Flatrack Load V2 and T2

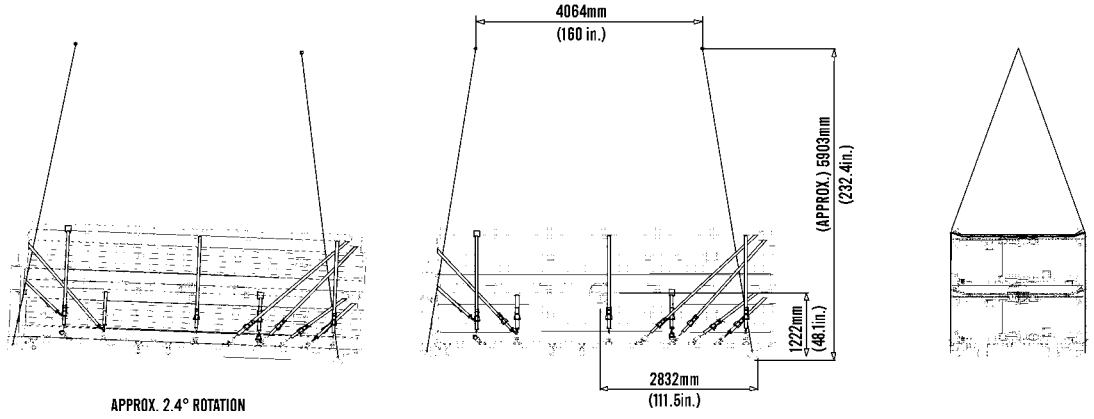


Figure 11. 45 Crane Lift of Flatrack Load V3

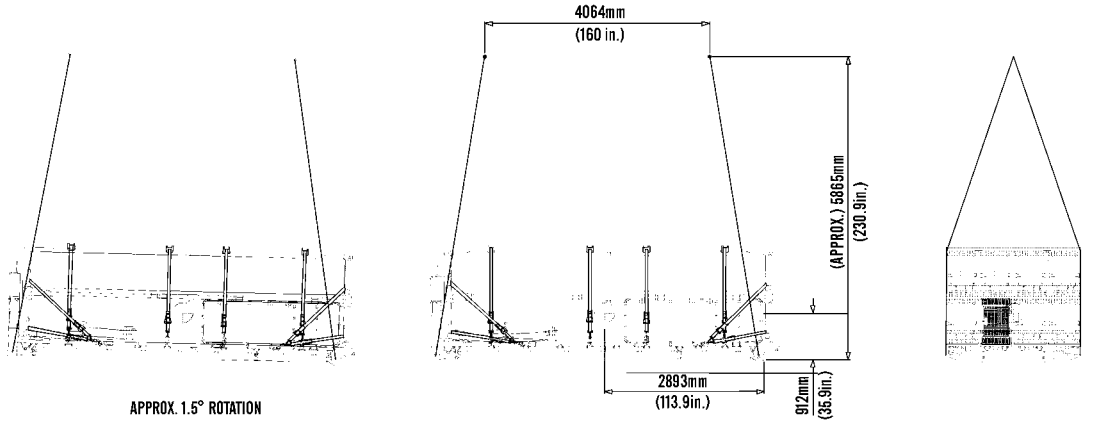


Figure 11. 46 Crane Lift of Flatrack Load LVT

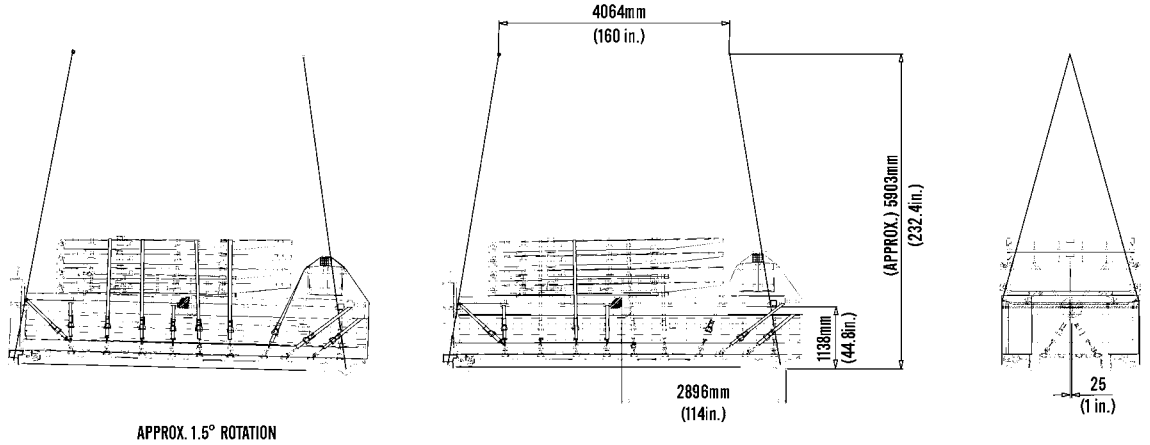


Figure 11. 47 Crane Lift of Flatrack Load T1

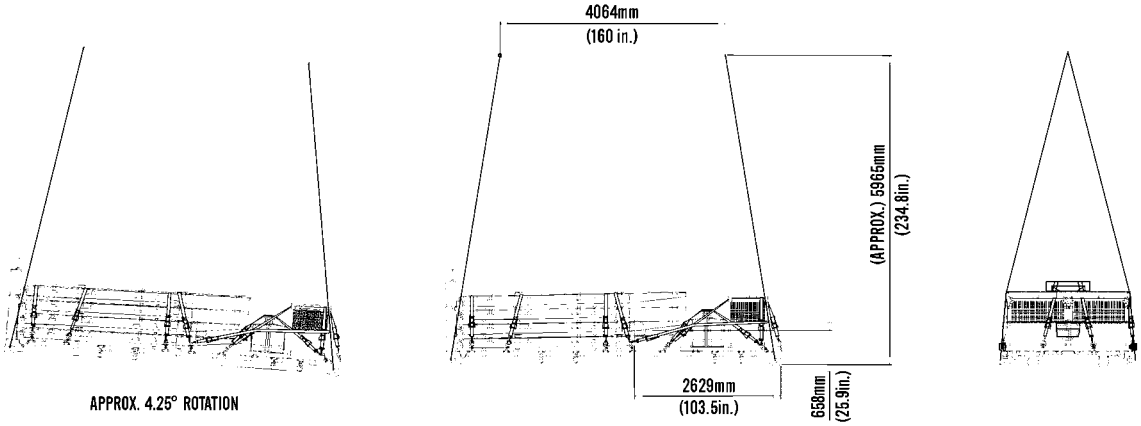


Figure 11. 48 Crane Lift of Flatrack Load T3

Section III. LAUNCH VEHICLE TRANSPORTATION

11.8 SECTIONALIZATION OF LAUNCH VEHICLE

11.8.1 Introduction

11.8.1.1 To reduce the overall weight and dimensional envelope of the launch vehicle, it has been designed for easy and rapid sectionalization. The crane, tail lift and slide frame based launcher and A-Frame stabilizer feet are all removable. This is achieved through the use of quick disconnect hydraulic hoses, plug and socket electrical connections and wide use of simple pinned mechanical attachments. Lifting and tie-down points are provided on the crane and launcher to aid lifting.

11.8.1.2 Sectionalization of the launcher can be achieved within 1 hour and should be performed as outlined in the section below.

11.8.2 Sectionalization Procedure

11.8.2.1 The procedure below is to be used to remove the launcher, crane, far bank support and tail lift from the launch vehicle for transport.

11.8.3 DSB Far Bank Support Removal

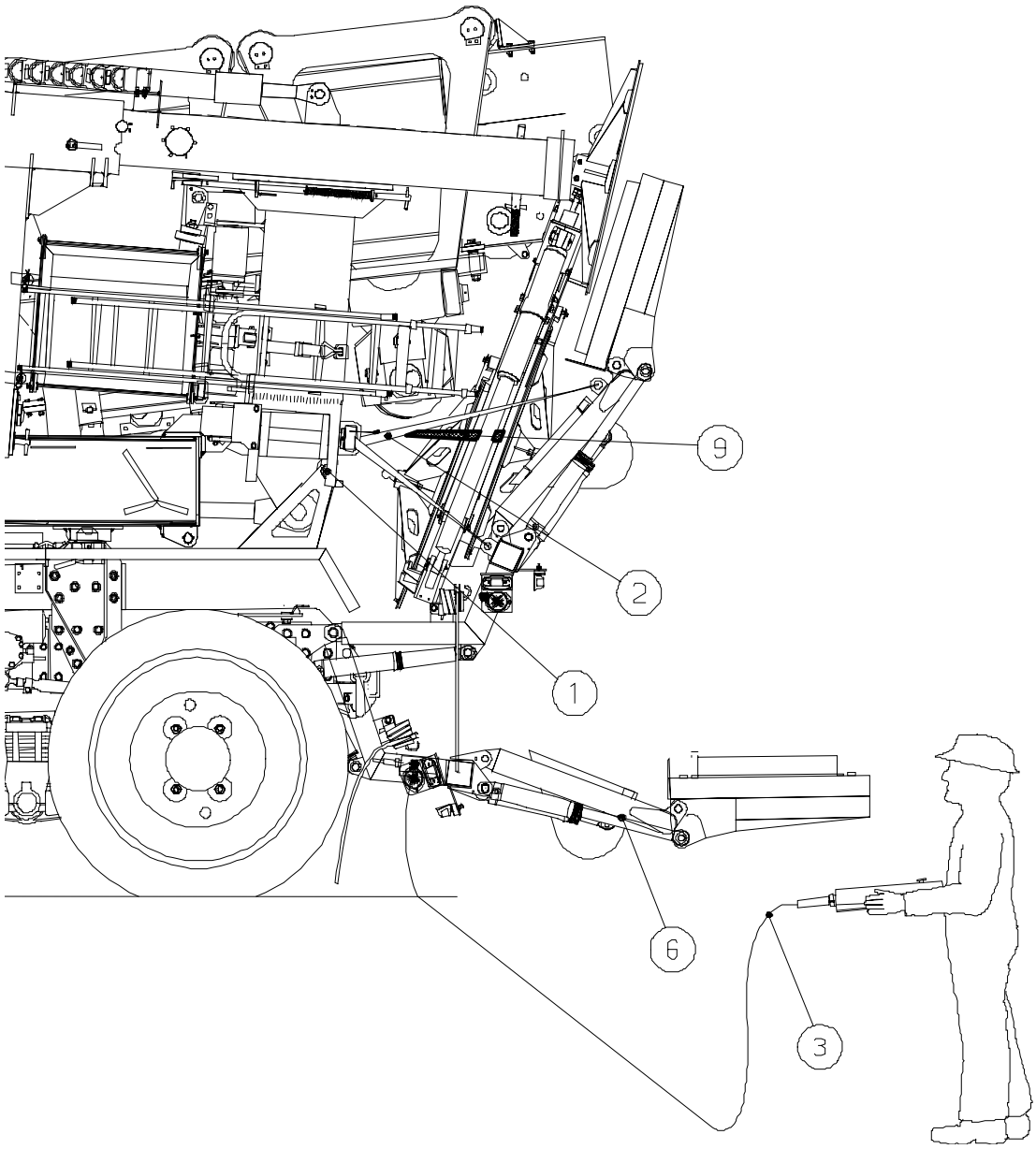
11.8.3.1 To remove the far bank support follow the procedure below:

NOTE

The Numbers on the diagrams refer to the Sub.Paragraph Numbers of the Text.

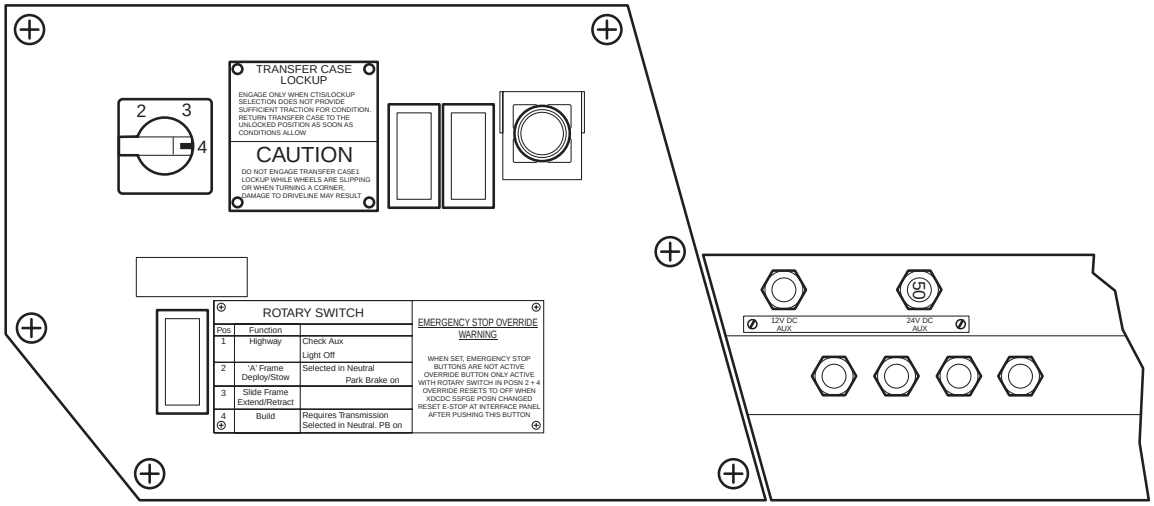
1 Release the A-frame shootbolts and remove the left and right hand mudguards.

2 Remove both the tail lift transport straps.



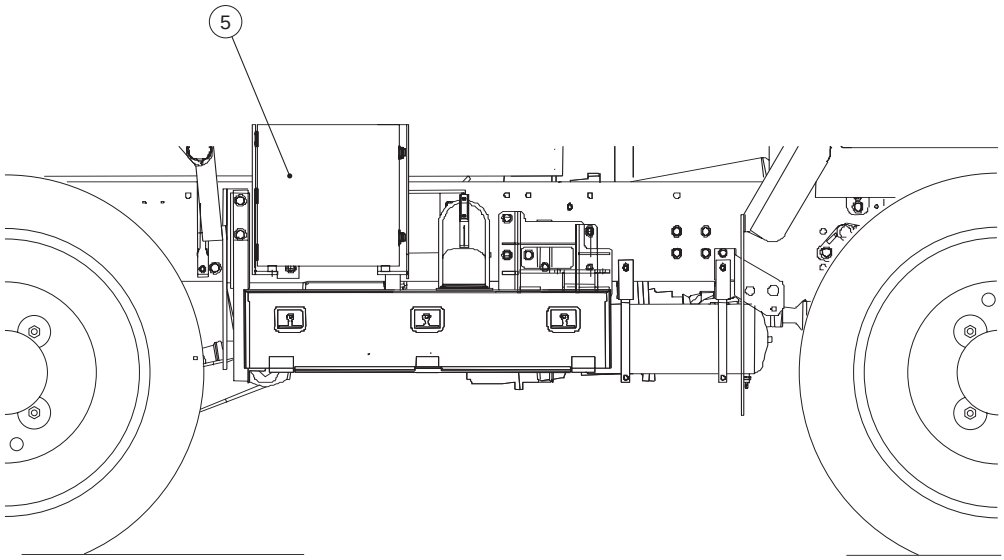
3 Attach the tail lift pendant.

4 With launch vehicle engine running, turn the 4 position rotary selector switch to position 2.



686A660

5 Re-set the emergency stops in the interface panel.

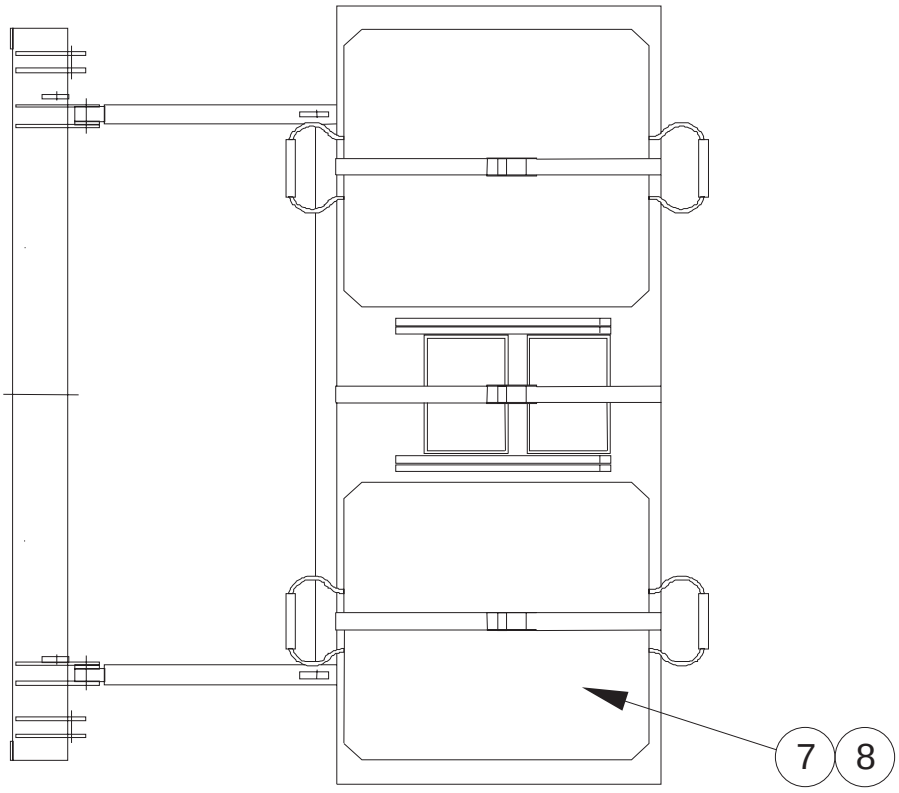


686A828

6 Lower the tail lift.

7 Remove the tail lift straps.

8 Remove the crane feet pads and steps from the tail lift platform.



VIEW ON TAIL LIFT

686A682

WARNING

UNEXPECTED MOVEMENT OF EQUIPMENT. KEEP WEIGHT ON FAR BANK SUPPORT WHEN RELEASING STRAPS TO CONTROL SWINGING. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO INJURY OF PERSONNEL.

9 Remove the far bank support transport straps and slowly allow the far bank support to swing vertical.

10 Remove the far bank bearing pads.

11 Using the Tail lift, lift/lower the Far Bank Support, with 2 average sized personnel supporting the Far Bank Support in the upright position.

12 Use a crane with lifting slings to support the weight (436lbs (198kg)) of the Far Bank Support.

13 Remove two 8 mm screws and the pivot pin retaining plate.

WARNING

CRUSH HAZARD. NEVER USE FINGERS TO PUSH PINS IN OR OUT OF HOLES. SERIOUS PERSONAL INJURY WILL RESULT IF THIS INSTRUCTION IS NOT OBSERVED.

14 Remove the pivot pin.

15 Thread a sling through the pivot pin hole of the far bank support, and connect both ends to the crane hook.

WARNING

UNEXPECTED MOVEMENT OF EQUIPMENT. ENSURE ALL SHOOTBOLTS ON THE FAR BANK SUPPORT ARE FULLY INSERTED AND LOCKED BEFORE LIFTING OPERATIONS COMMENCE.

16 Using a crane lift the Far Bank Support clear, and remove the support bearing pads from their stored position on the far bank support. Connect the two support bearing pads to the far bank support into their deployed position.

17 Pack the Far Bank Support against the crane as described in Figure 11. 50.

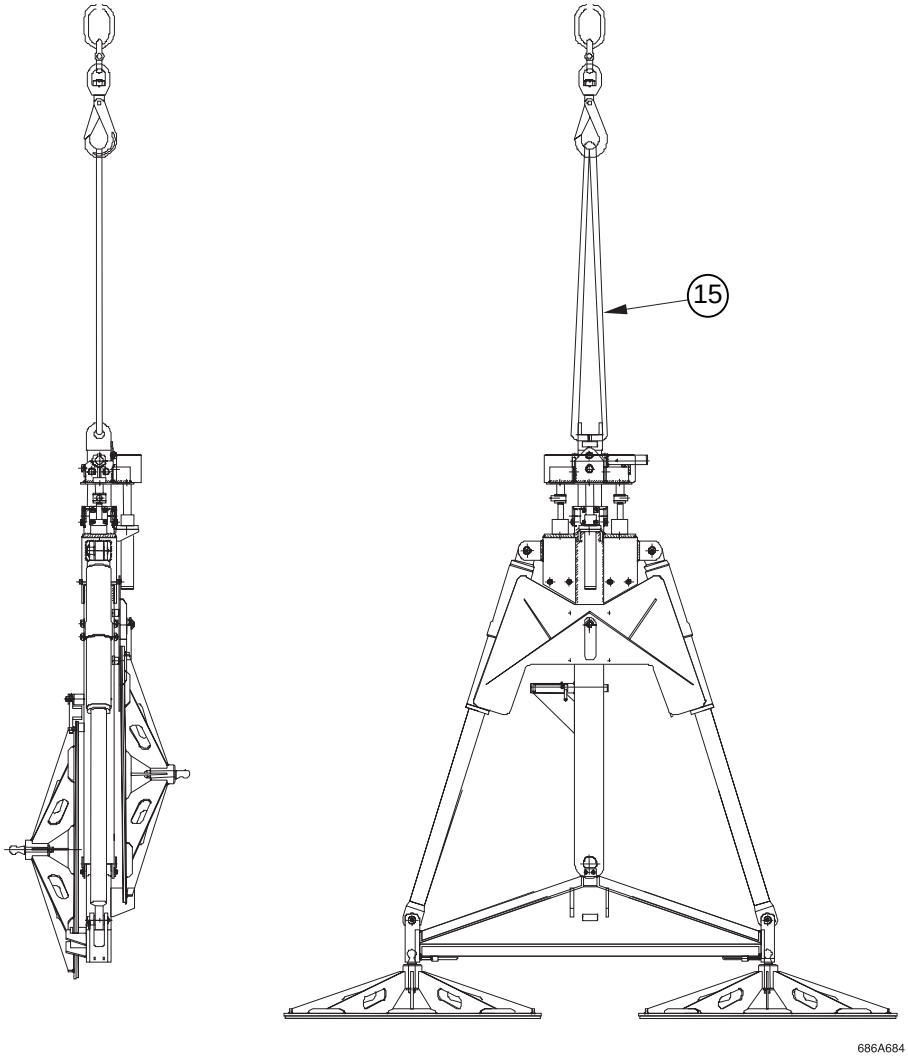


Figure 11. 49 Method of Slinging Far Bank Support

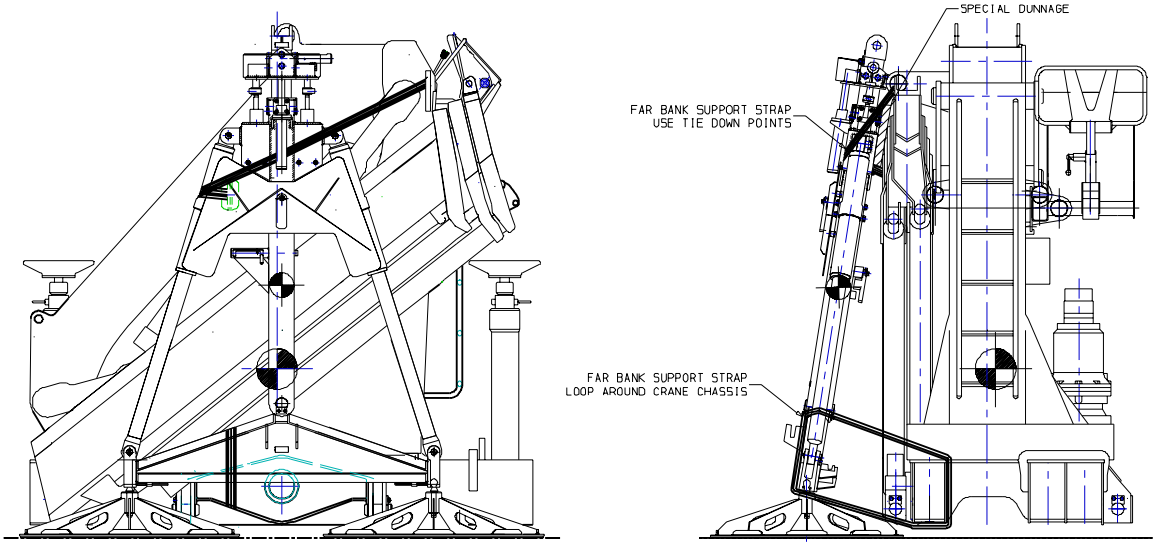


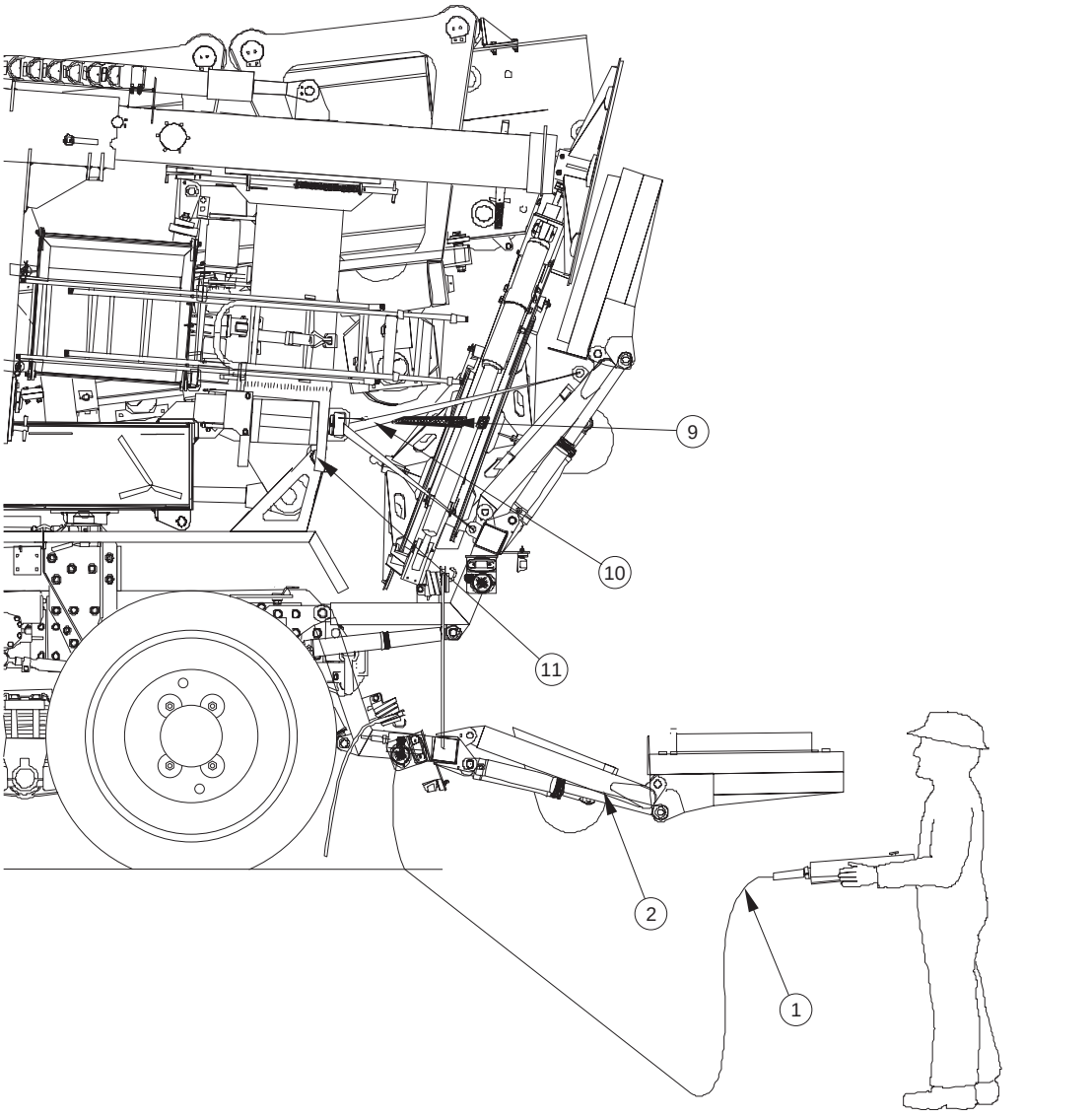
Figure 11. 50 Method of Packing Far Bank Support and Crane

11.8.4 DSB Far Bank Support Re-Fitting

11.8.4.1 With the launch vehicle engine running and the 4-position rotary selector switch in position 2:

1 Attach the tail lift pendant.

2 Lower the tail lift



WARNING

UNEXPECTED MOVEMENT OF EQUIPMENT. ENSURE ALL SHOOTBOLTS ON THE FAR BANK SUPPORT ARE FULLY INSERTED AND LOCKED BEFORE LIFTING OPERATIONS COMMENCE.

3 Use a crane with lifting slings to support the weight (436lbs (198 kg)).

4 Remove the support bearing pads from the far bank support and put to one side. Reposition the far bank support and align the holes.

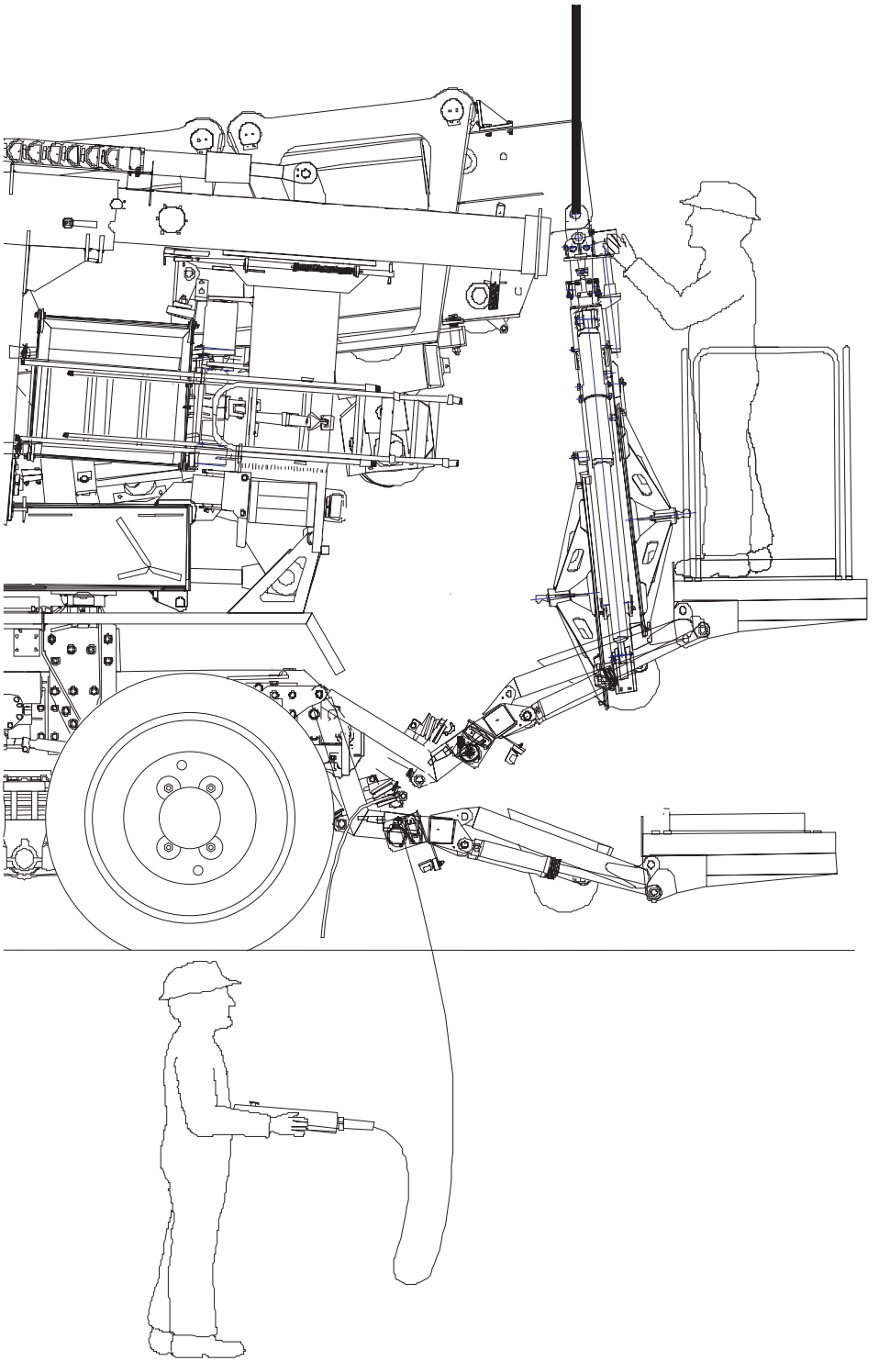


Figure 11. 51 Method of Supporting the Far Bank Support

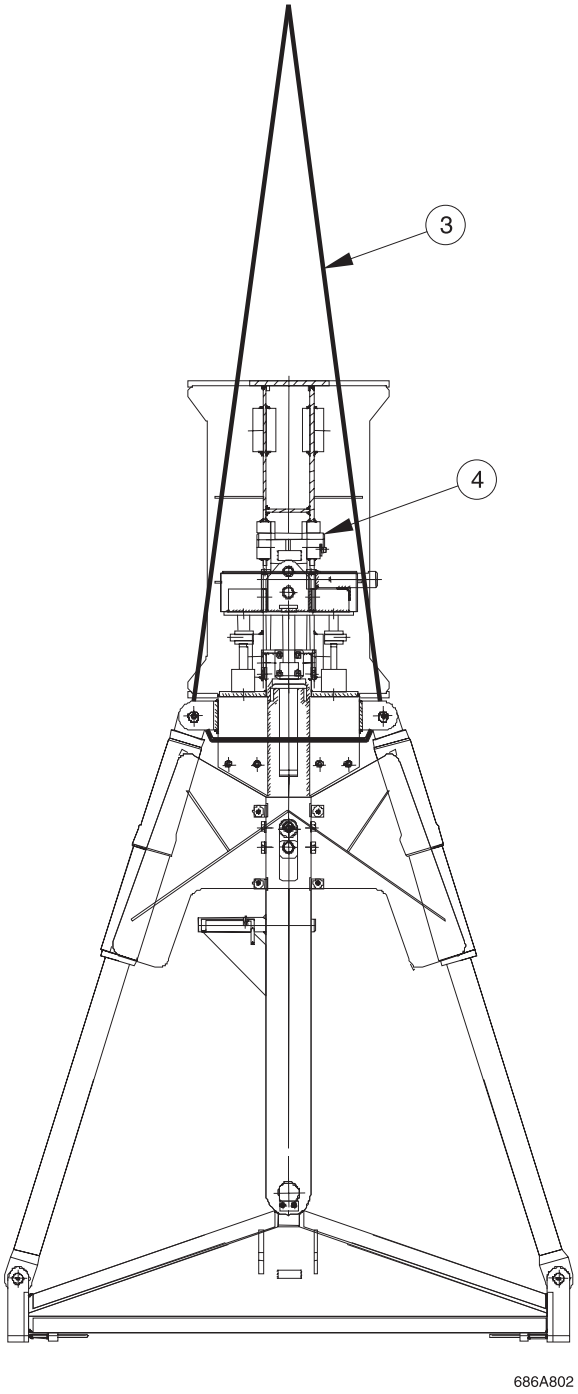
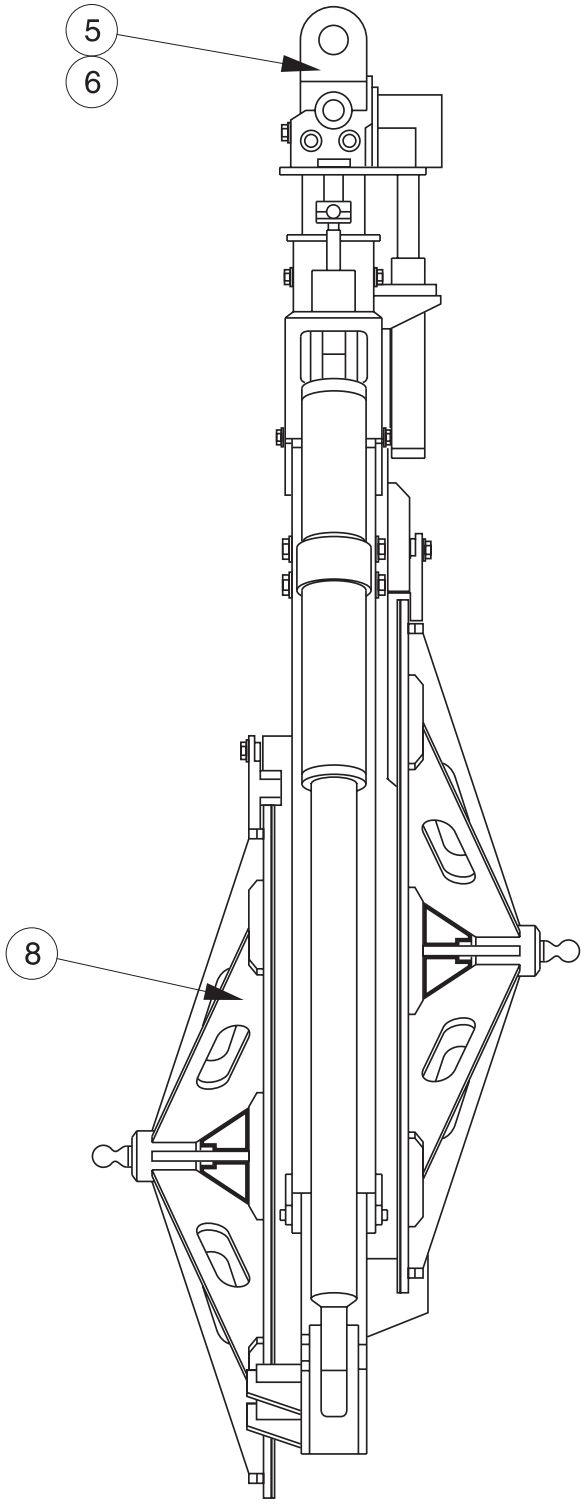


Figure 11. 52 Method of Slinging the Far Bank Support


5
6
8
686A803

WARNING

CRUSH HAZARD. NEVER USE FINGERS TO PUSH PINS IN OR OUT OF HOLES. SERIOUS PERSONAL INJURY WILL RESULT IF THIS INSTRUCTION IS NOT OBSERVED.

5 Replace the pivot pin.

6 Replace two the 8 mm screws and the pivot pin retaining plate.

7 Release the crane slings.

8 Replace the far bank support bearing pads in the transportation position.

9 Replace the far bank support transport strap.

10 Stow the far bank support, re-fit the crane pads and stepladder with straps, and prepare launch vehicle for transport.

11.8.5 Tail lift Removal

11.8.5.1 To remove the tail lift for transport proceed as follows:

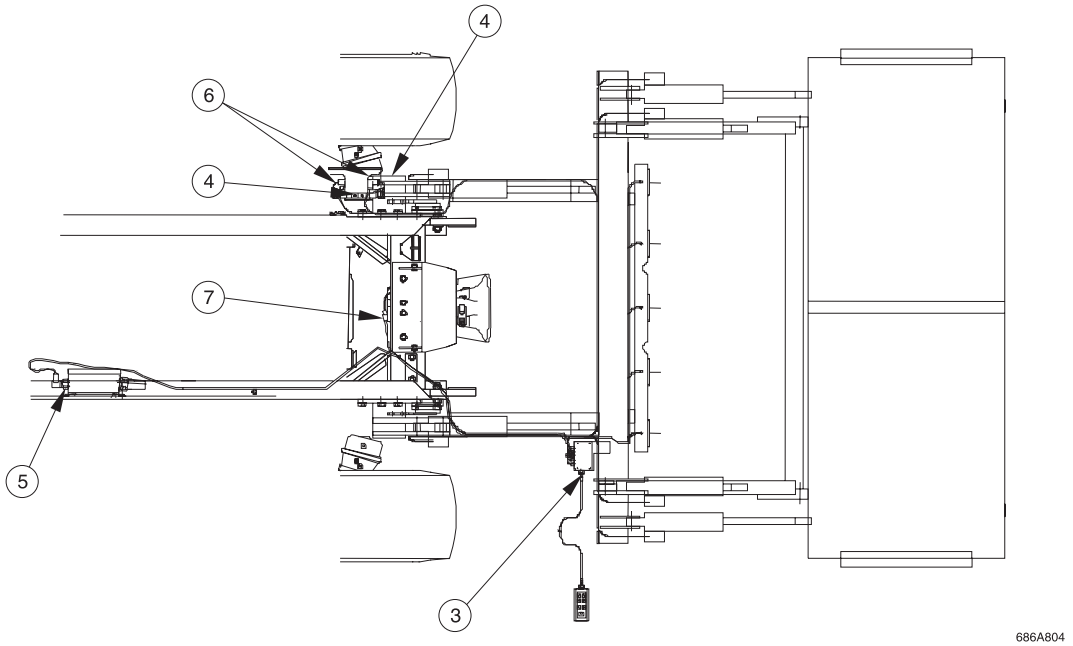
NOTE

The numbers on the figures refer to the Sub Paragraph numbers in the procedure.

1 Rotate the tail lift to a horizontal position; remove the crane pads, and stepladder.

2 Using a forklift truck support the tail lift.

3 Disconnect the handset and replace the dust cap onto the socket. Stow the handset.



WARNING

POWER SUPPLY CONNECTION OR DISCONNECTION. ENSURE HYDRAULIC AND ELECTRICAL SYSTEMS ARE SWITCHED OFF WHEN CONNECTING OR DISCONNECTING HYDRAULIC COUPLINGS AND ELECTRICAL CONNECTORS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY TO PERSONNEL.

NOTE

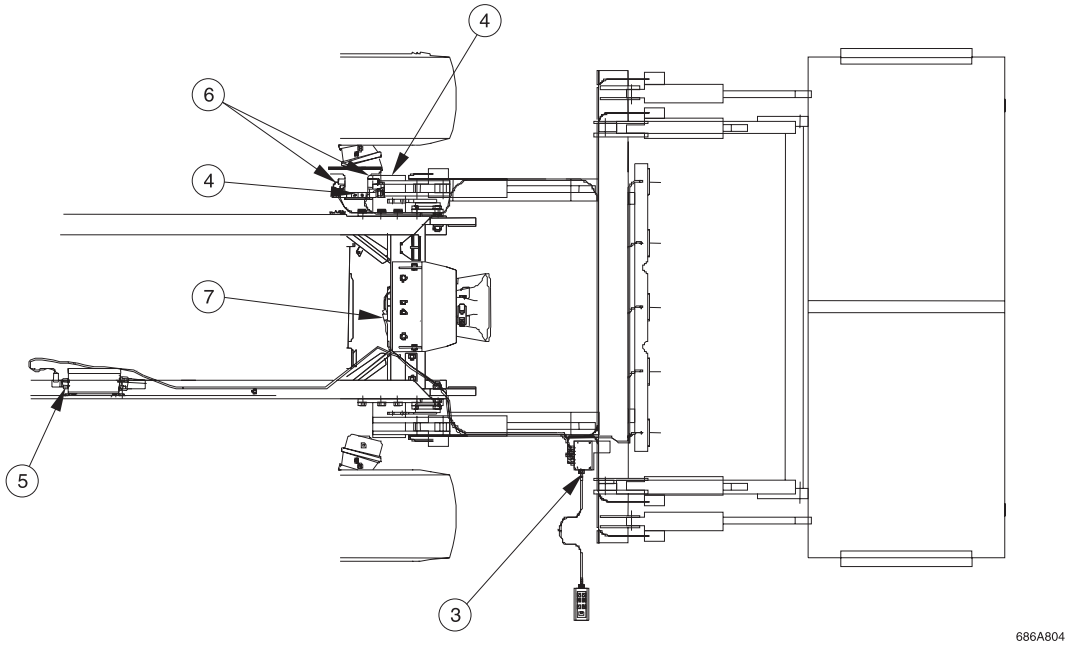
Protect open coupling and plugs against the entry of dirt during transport, contamination or damage to plugs and systems may result.

4 Disconnect the hydraulic plug-in couplings.

5 Disconnect the electrical harness from the vehicle main junction box, remove any cable ties to the truck chassis, and roll back and secure to the tail lift.

6 Disconnect the electrical harness from both the solenoid valves, remove any cable ties to truck the chassis and roll back and secure to the tail lift.

7 Disconnect the electrical harness from the rear light cluster, remove any cable ties to truck the chassis and roll back and secure to the tail lift.



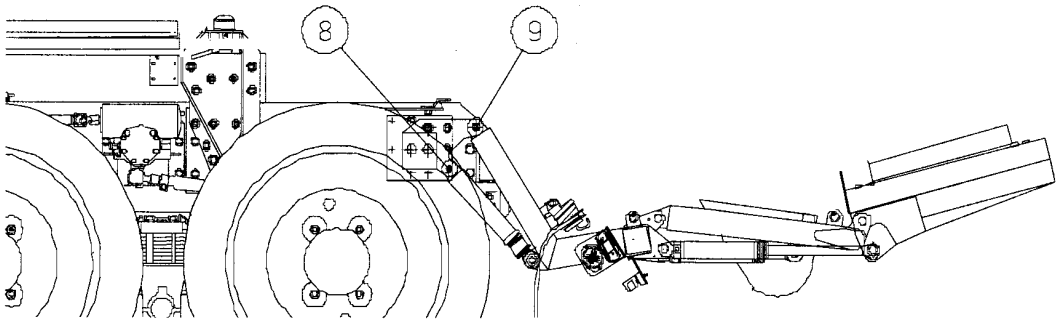
WARNING

CRUSH HAZARD. NEVER USE FINGERS TO PUSH PINS IN OR OUT OF HOLES. SERIOUS PERSONAL INJURY WILL RESULT IF THIS INSTRUCTION IS NOT OBSERVED.

8 Using the forks of the forklift truck, support the tail lift.

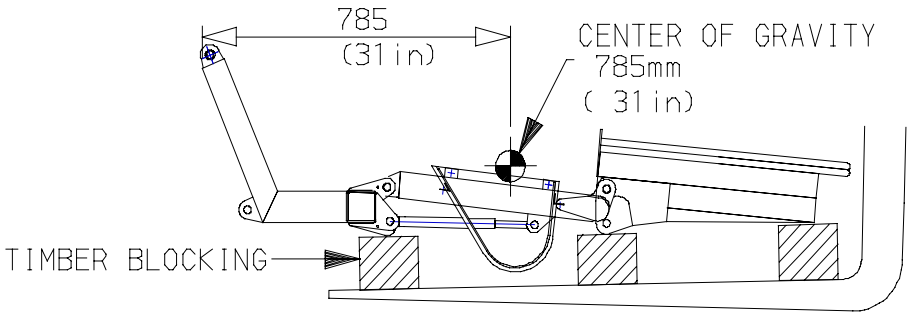
9 Remove the swing cylinder pivot pins on both sides. Secure the cylinders to the tail lift to avoid damage during lifting or stowing for transport.

10 Remove the swing arm pivot pins on both sides.



11 The tail lift can now be lifted clear with the forklift truck, and packed as described on the shipping data plate.

SHIPPING DATA PLATE
TAIL LIFT



SUPPORT TAIL LIFT ON FORKS UNDER BLOCKING

OVERALL LENGTH	2650mm	(104.3in)
OVERALL WIDTH	2240mm	(88.2in)
OVERALL HEIGHT	867mm	(34.2in)
TOTAL WEIGHT	550kg	(1213lb)

11.8.6 Tail lift Re-Assembly

11.8.6.1 To refit the tail lift after transport proceed as follows:

NOTE

The numbers on the figures refer to the Sub Paragraph numbers in the procedure.

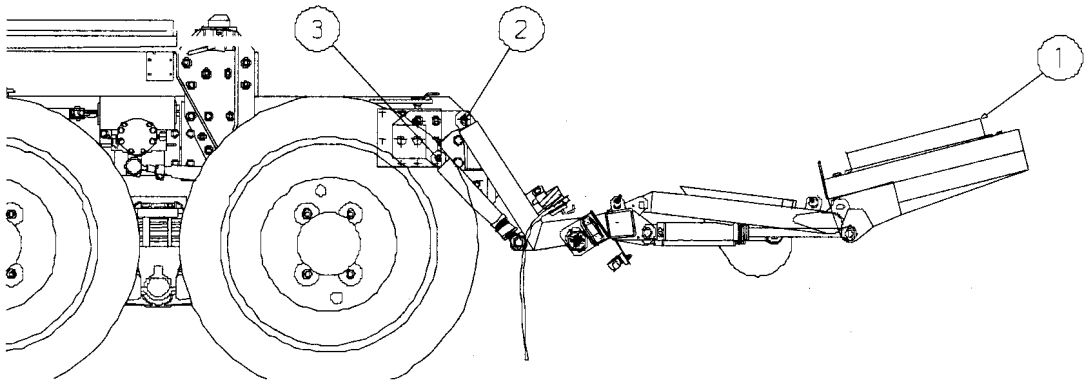
1 Move the tail lift into position using the forklift truck and align the pivot holes.

CRUSH HAZARD.

NEVER USE FINGERS TO PUSH PINS IN OR OUT OF HOLES. SERIOUS PERSONAL INJURY WILL RESULT IF THIS INSTRUCTION IS NOT OBSERVED.

2 Insert the swing arm pivot pins on both sides.

3 Insert the swing cylinder pivot pins on both sides.



WARNING

POWER SUPPLY CONNECTION OR DISCONNECTION. ENSURE HYDRAULIC AND ELECTRICAL SYSTEMS ARE SWITCHED OFF WHEN CONNECTING OR DISCONNECTING HYDRAULIC COUPLINGS AND ELECTRICAL CONNECTORS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY TO PERSONNEL.

CAUTION

Equipment damage. Protect open coupling and plugs against the entry of dirt during transport, contamination or damage to plugs and systems may result.

4 Connect the electrical harness to rear light cluster.

5 Re-attach to the chassis where appropriate.

6 Connect the electrical harness to both the solenoid valves. Re-tighten the center screws in the plugs. Re-attach to the chassis where appropriate.

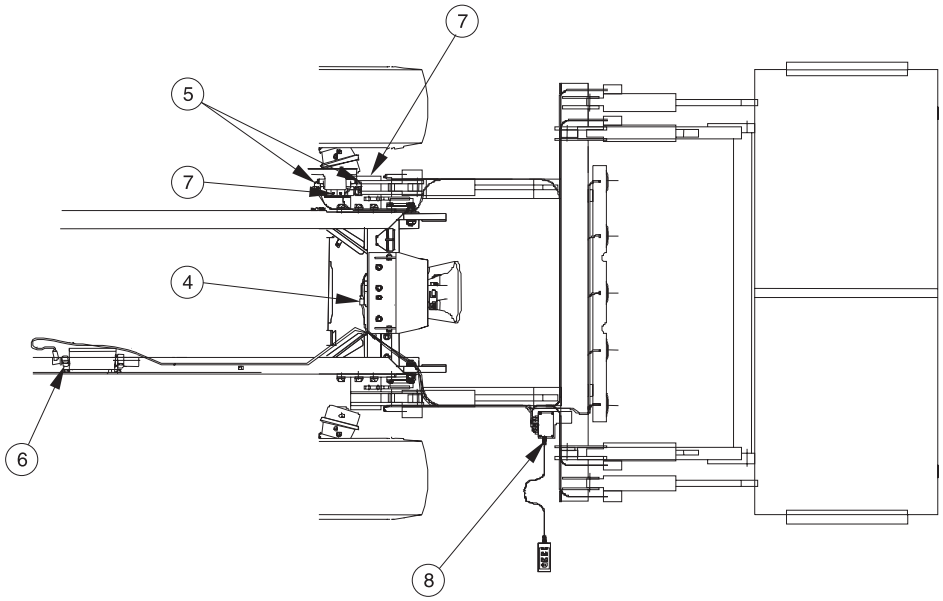
7 Connect the electrical harness to the vehicle main junction box. Re-attach to the chassis where appropriate.

8 Connect the hydraulic plug-in couplings.

9 Connect the tail lift handset. Re-start the launch vehicle electric and hydraulic systems

10 Rotate the tail lift to an upward position until the slings slacken.

11 Disconnect the lifting slings.



12 Exercise the tail lift hydraulics and check all functions are working safely and correctly.

13 Stow the tail lift and prepare launch vehicle for transport.

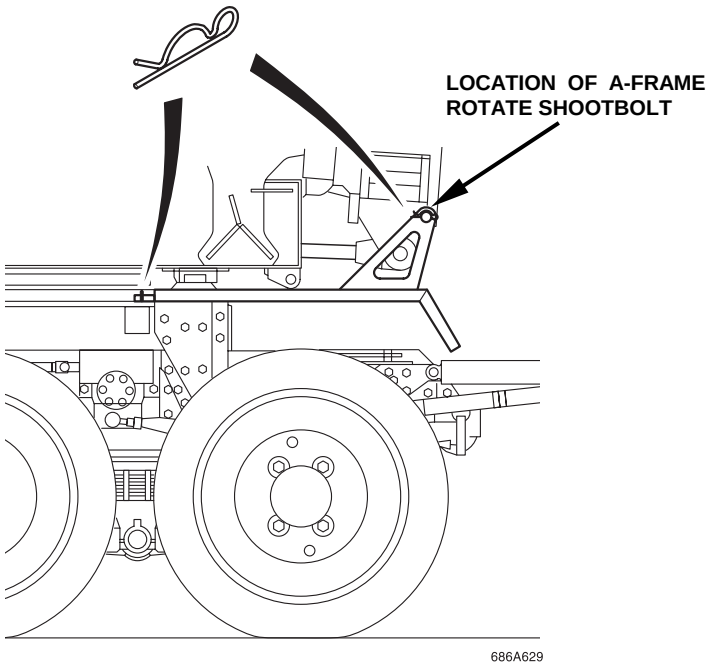
11.8.7 Launch Equipment Removal.

11.8.7.1 To remove the launch frame from the launch vehicle for rail or air transport proceed as follows:

NOTE

The numbers on the figures refer to the Sub Paragraph numbers of the text.

1 Remove the 'R' clips securing the removable mudguards, release the shootbolts and remove the mudguards.

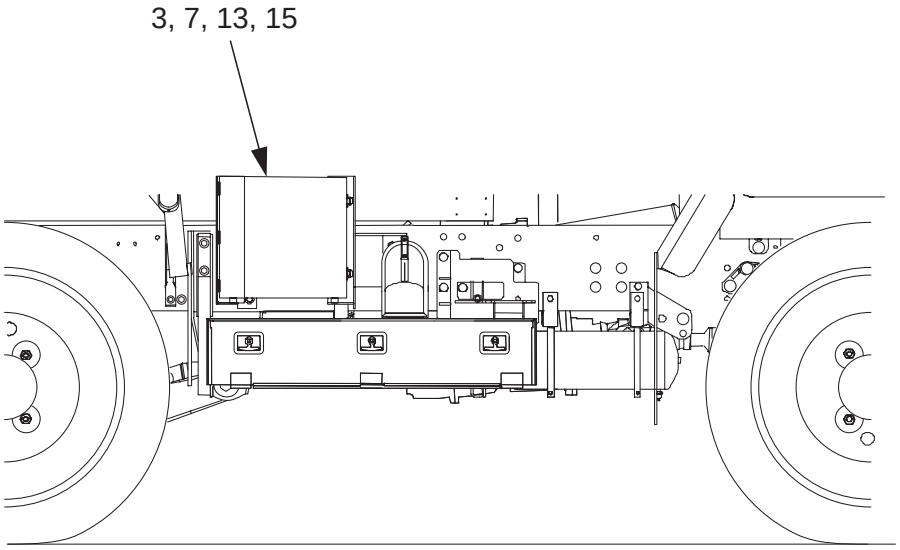


WARNING

CRUSH HAZARD. NEVER USE FINGERS TO PUSH PINS IN OR OUT OF HOLES. SERIOUS PERSONAL INJURY WILL RESULT IF THIS INSTRUCTION IS NOT OBSERVED.

2 Remove the two A-frame hinge locking pins and 'R' clips from each side-leg.

3 Unfold the A-frame by pressing the A-frame fold deploy button on interface panel.



686A668

4 Insert the two A-frame hinge-locking pins and 'R' clips on each side.

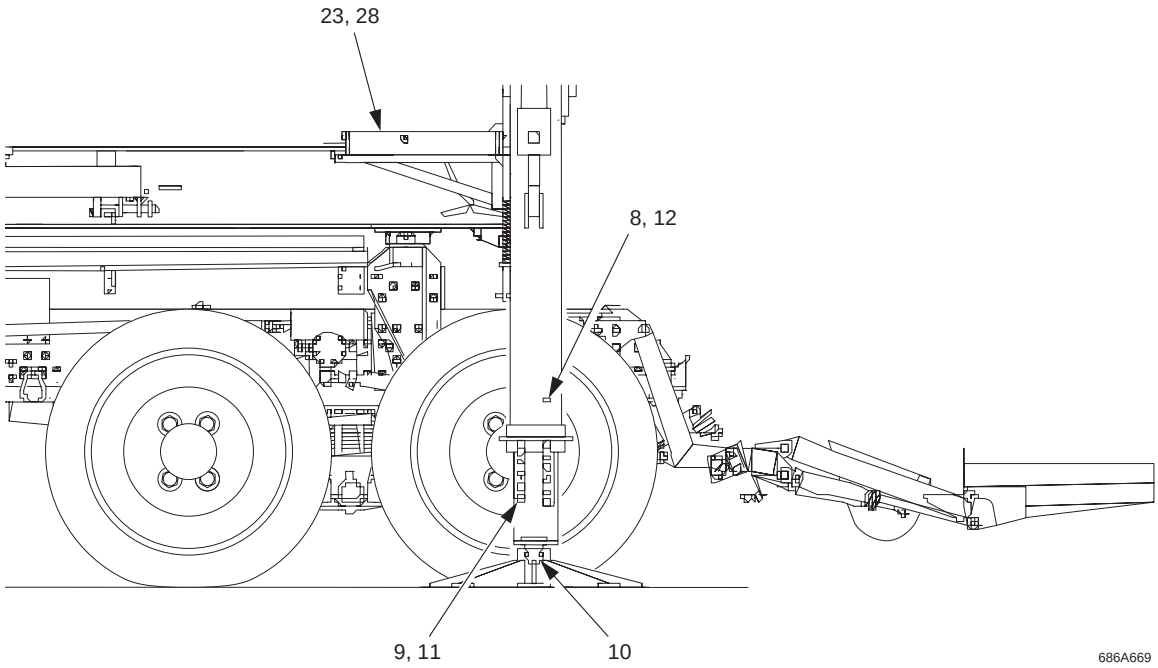
5 Remove the A-frame upper ladder by removing the 'R' clip in the pivot pin, support the weight of the ladder, undo and release retaining strap, remove the pivot pin, lift ladder clear, replace pivot pin in the ladder, replace R- clip in pivot.

6 Remove both folding walkway ladders, remove the R-clip in the pivot pin, support the weight of the ladder, undo and release retaining strap, remove pivot pin, lift ladder clear, replace pivot pin in the ladder, replace R-clip in pivot pin. Repeat for other side.

7 Rotate the A-frame leg: Press A-frame rotate **DEPLOY** button on the interface panel, insert the shootbolts at the position used to hold mudguards on the vehicle.

8 Remove A-frame stabilizer leg 'R' clips and pins.

9 Lower the stabilizer legs to the ground using controls at center of A-frame lower cross member, **do not apply load** to legs.



10 Remove the stabilizer feet, by removing the nyloc nuts and the securing U-bolts.

11 Raise the stabilizer legs using the controls at center of the A-frame lower cross-member. Re-insert the U-bolt and nyloc nuts in the feet for safekeeping.

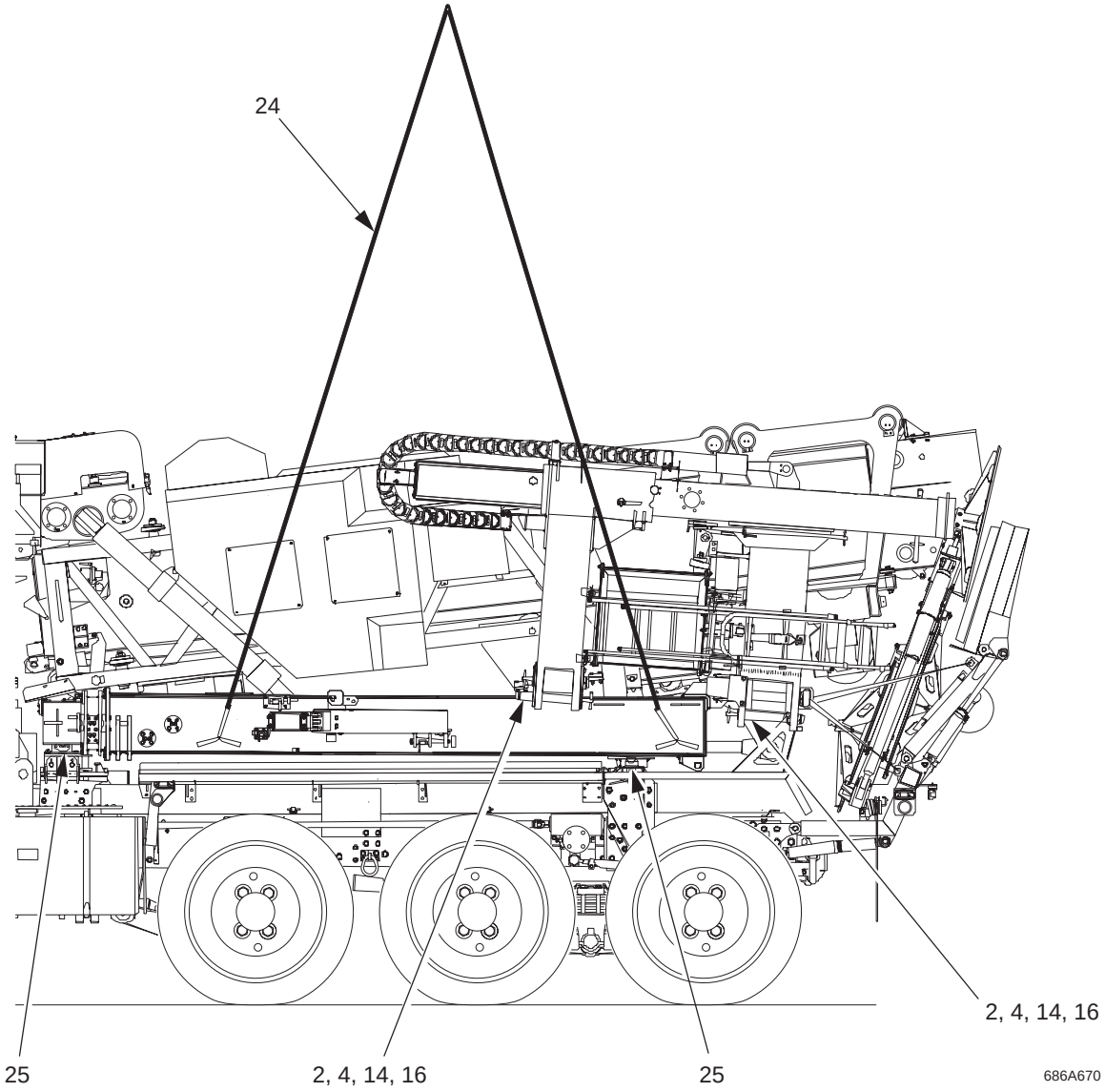
12 Replace the A-frame stabilizer pins and R-clips.

13 Rotate the A-frame down. Remove the shootbolts, at position used to hold mudguards on the vehicle, press A-frame rotate **PARK** button on the interface panel until **PARKED** light comes on.

14 Remove the two A-frame hinge-locking pins from each side.

15 Fold the A-frame legs. Press A-frame fold **PARK** button on interface panel until parked light comes on.

16 Insert the two A-frame hinge-locking pins and 'R' clips on each side.



17 Fit the two rigging screws to the forward end of the slide frame with the pins and 'R' clips.

WARNING

POWER SUPPLY CONNECTION OR DISCONNECTION. ENSURE HYDRAULIC AND ELECTRICAL SYSTEMS ARE SWITCHED OFF WHEN CONNECTING OR DISCONNECTING HYDRAULIC COUPLINGS AND ELECTRICAL CONNECTORS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY TO PERSONNEL.

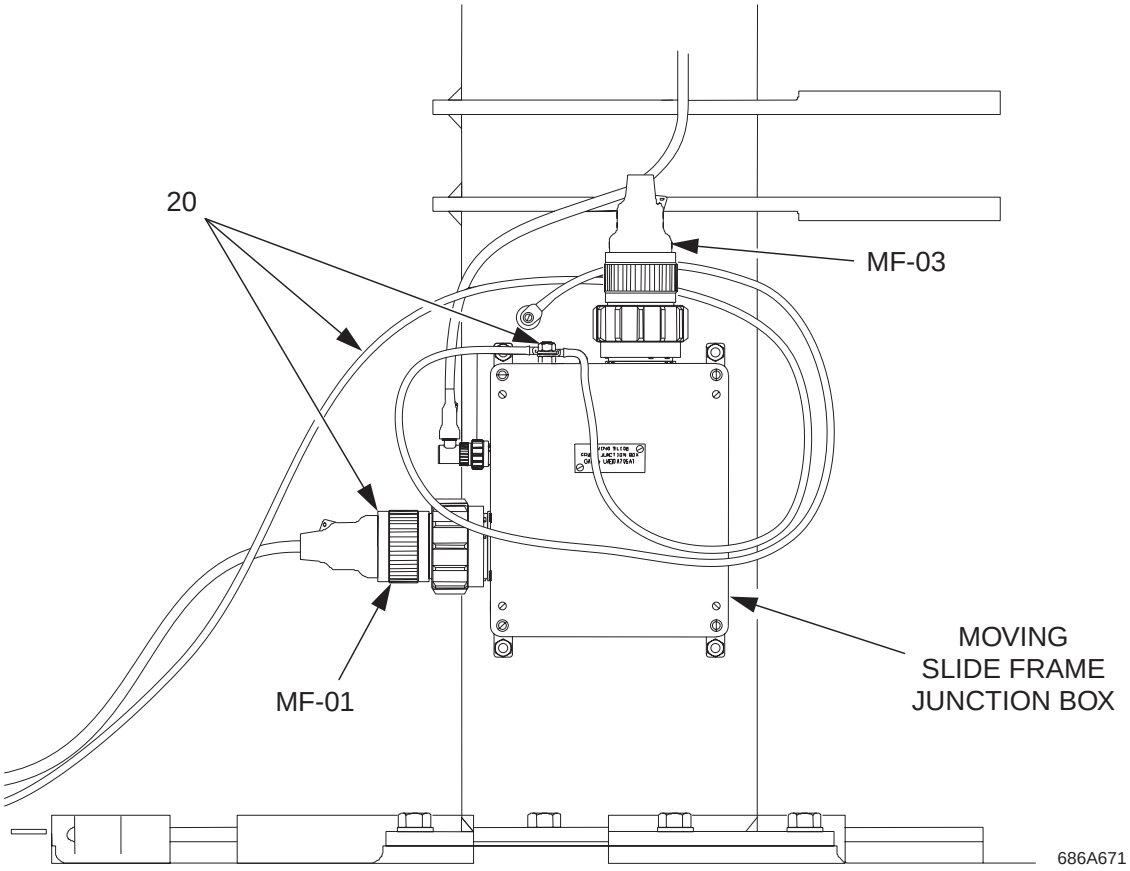
CAUTION

Equipment damage. Protect open couplings and plugs against entry the of dirt during transport, contamination or damage to plugs and systems may result.

18 Using a small screwdriver remove some of the energy chain spreader bars on the radius to allow the hydraulic pipe to be pulled back when disconnecting.

19 Disconnect the hydraulic quick release couplings inside both sides of the slide frame.

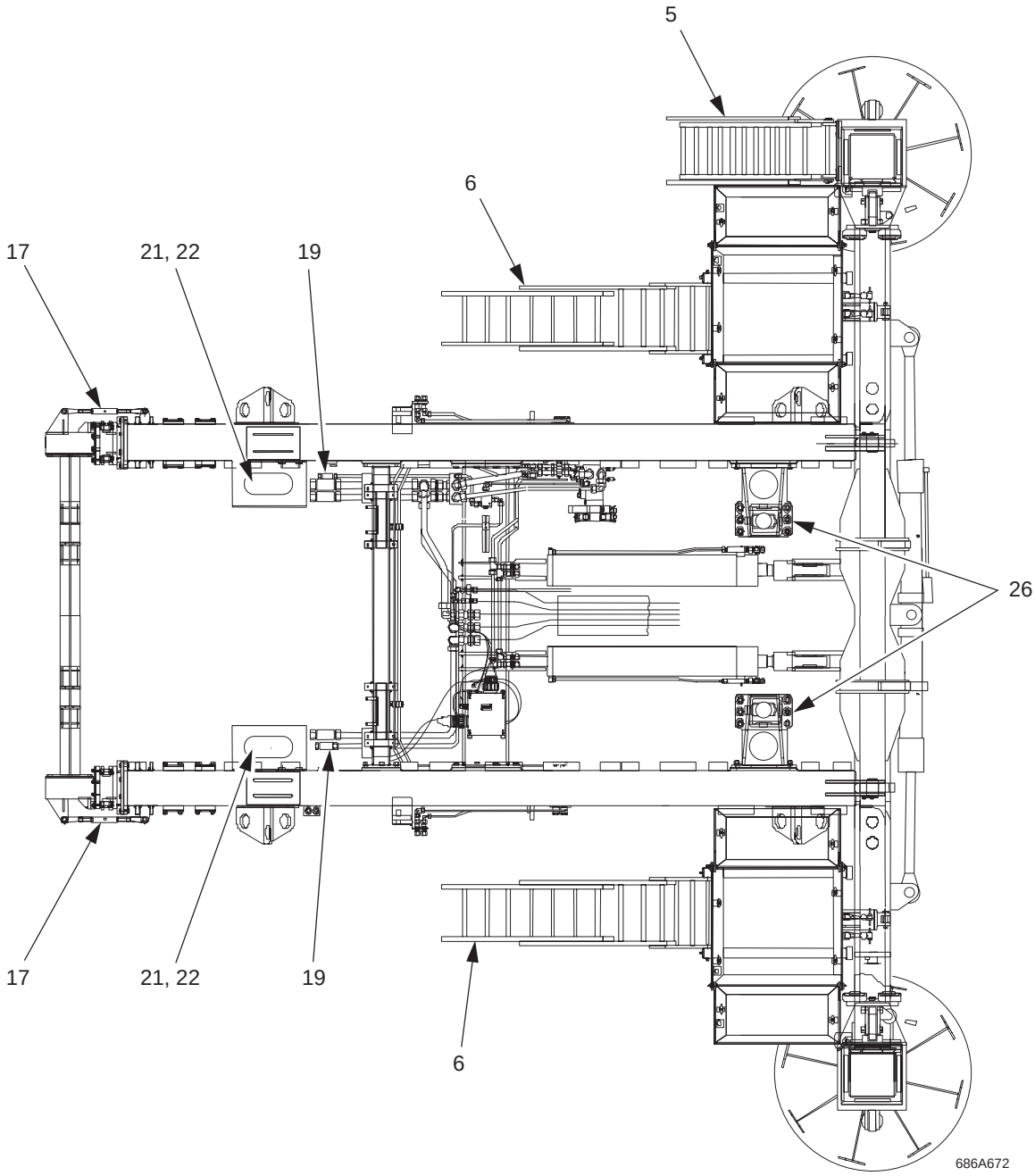
20 Disconnect the mil-coupling on the moving slide frame junction box. Disconnect the earth strap on the moving slide frame junction box, remove any cable ties to the slide frame and roll back the cable to the dovetail bracket and secure.



21 Remove the two bolts holding the dovetail brackets to the slide frame.

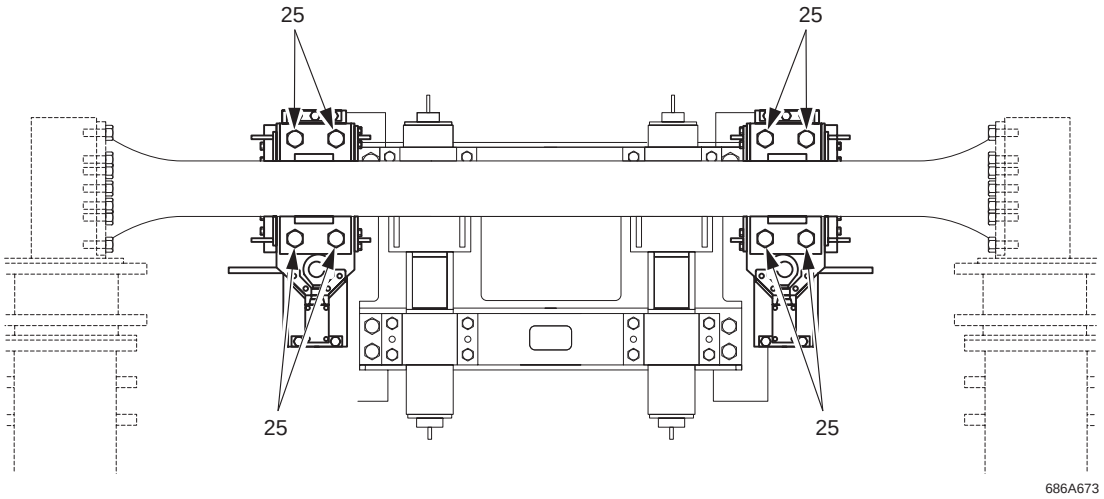
22 Lift to disconnect the dovetail brackets from the slide frame to disconnect the energy chain from the slide frame.

23 Unclip the A-frame folded walkways and them swing out, hold them in place with the ladder retaining straps, this is to stop the walkway being compressed by the lifting slings.



24 Connect the 30-ton (9 foot SPREADER BEAMS) sling assembly to the slide frame lifting points.

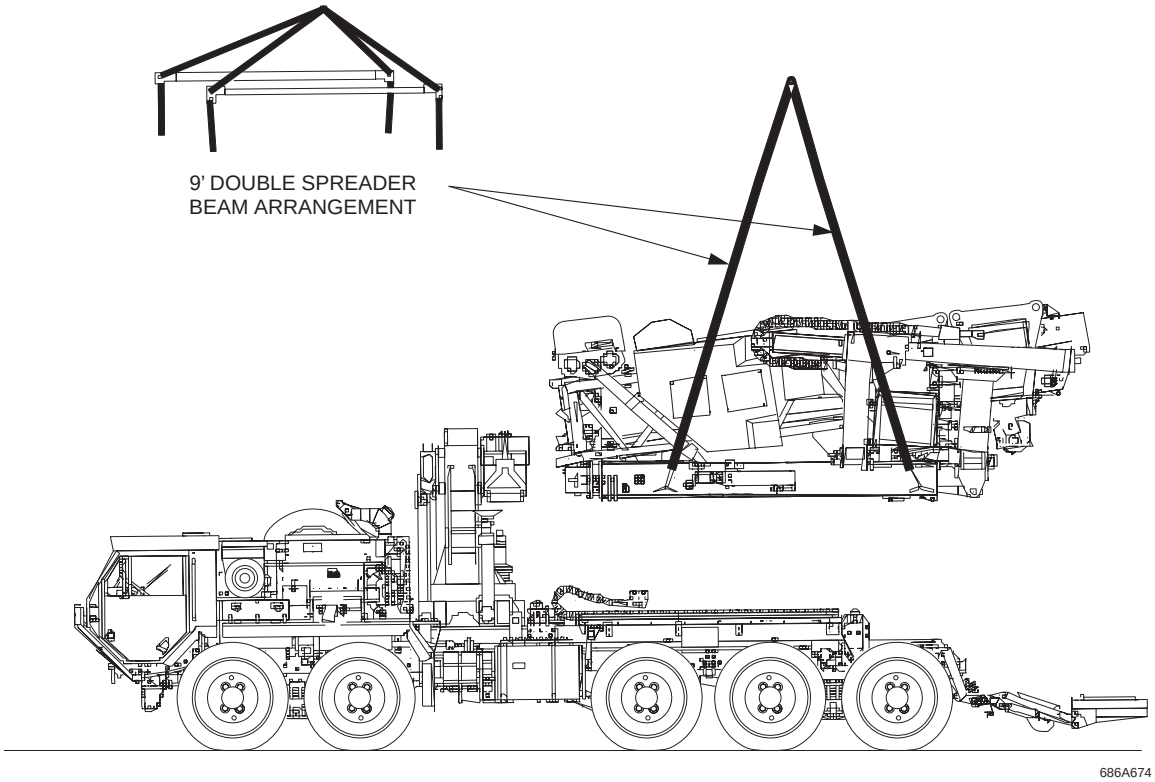
25 Disconnect the relax mechanism by removing the eight M-20 bearing housing bolts.



26 Unlock the twist locks on both sides of the slide frame.

27 Lift the launch equipment clear of the vehicle and place on support blocks of at least 5 in (127mm) thick. The A-frame and launch frame weigh 34833lbs (15800 kg) (17.5 ton).

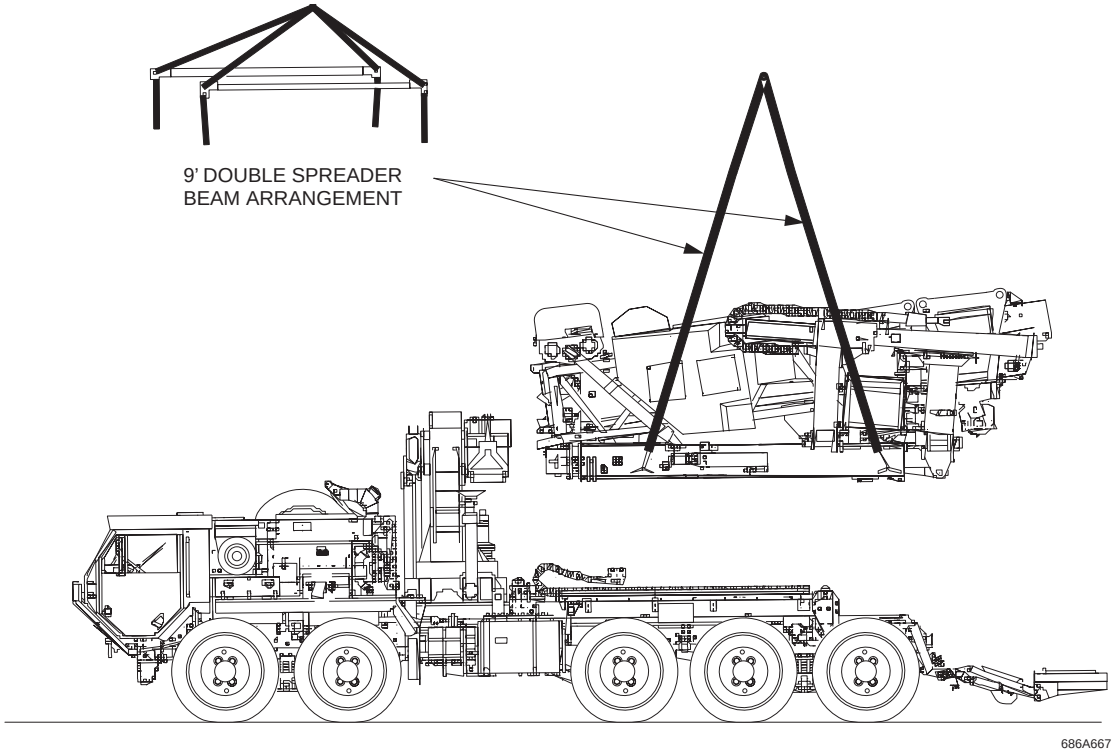
28 Disconnect the lifting slings, close the A-frame folding walkways and re-clip.



11.8.8 Launch Equipment Re-Fit

11.8.8.1 To reconnect the launch frame to the launch vehicle proceed as follows:

1 Unclip the A-frame folding walkway and swing out. Hold in place with the ladder retaining strap, to clear lifting slings.



2 Connect the 30-ton (9 foot SPREADER BEAMS) sling assembly to the slide frame lifting points.

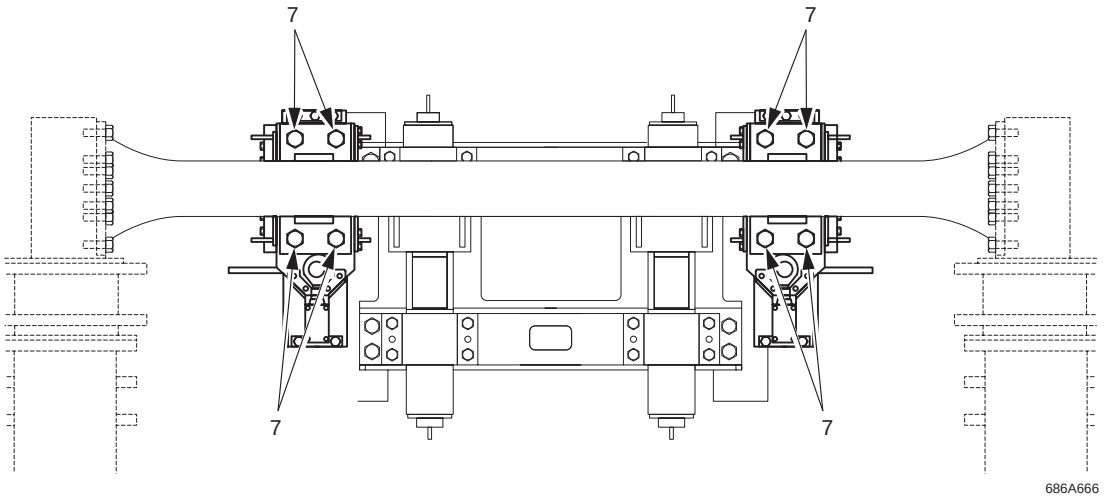
3 Lift the launch equipment clear of the packers and place on the vehicle. Making sure that the front ball joint mounting assembly sits on the location studs on the slide housings of the relax mechanism and the twist locks at the rear end of the slide frame.

4 Lock the twist locks on both sides of slide frame.

5 Disconnect the 30-ton (9 foot SPREADER BEAMS) sling assembly from the slide fame lifting points.

6 Close the folding walkways and re-clip.

7 Reconnect the relax mechanism by re-fitting the eight M-20 ball joint housing bolts using new nyloc nuts, tighten to a torque of 406 lbs ft (550 Nm).



WARNING

POWER SUPPLY CONNECTION OR DISCONNECTION. ENSURE HYDRAULIC AND ELECTRICAL SYSTEMS ARE SWITCHED OFF WHEN CONNECTING OR DISCONNECTING HYDRAULIC COUPLINGS AND ELECTRICAL CONNECTORS. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY TO PERSONNEL..

CAUTION

Equipment damage. Protect couplings and plugs against entry the of dirt during transport, contamination or damage to plugs and systems may result.

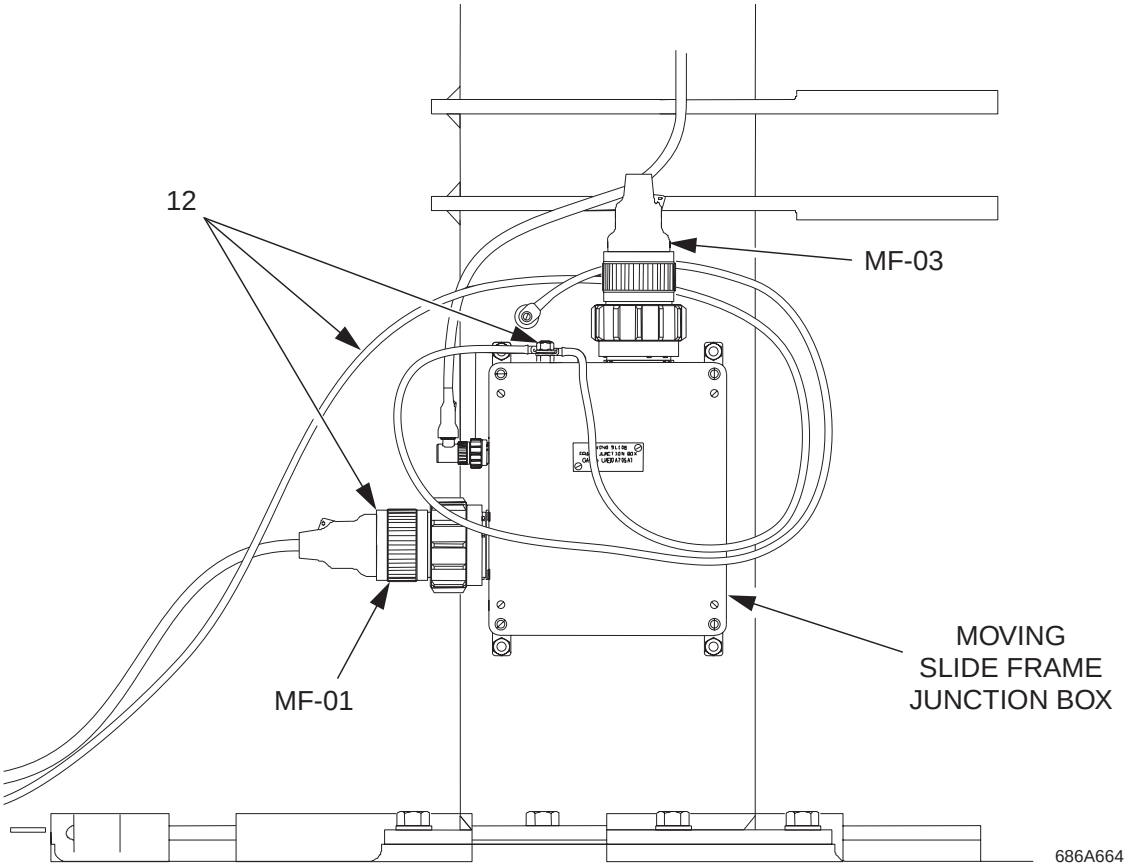
8 Reconnect both the dovetail brackets to connect the energy chains to slide frame.

9 Refit two bolts holding the dovetail brackets to the slide frame.

10 Reconnect the hydraulic quick release couplings inside both the sides of the slide frame

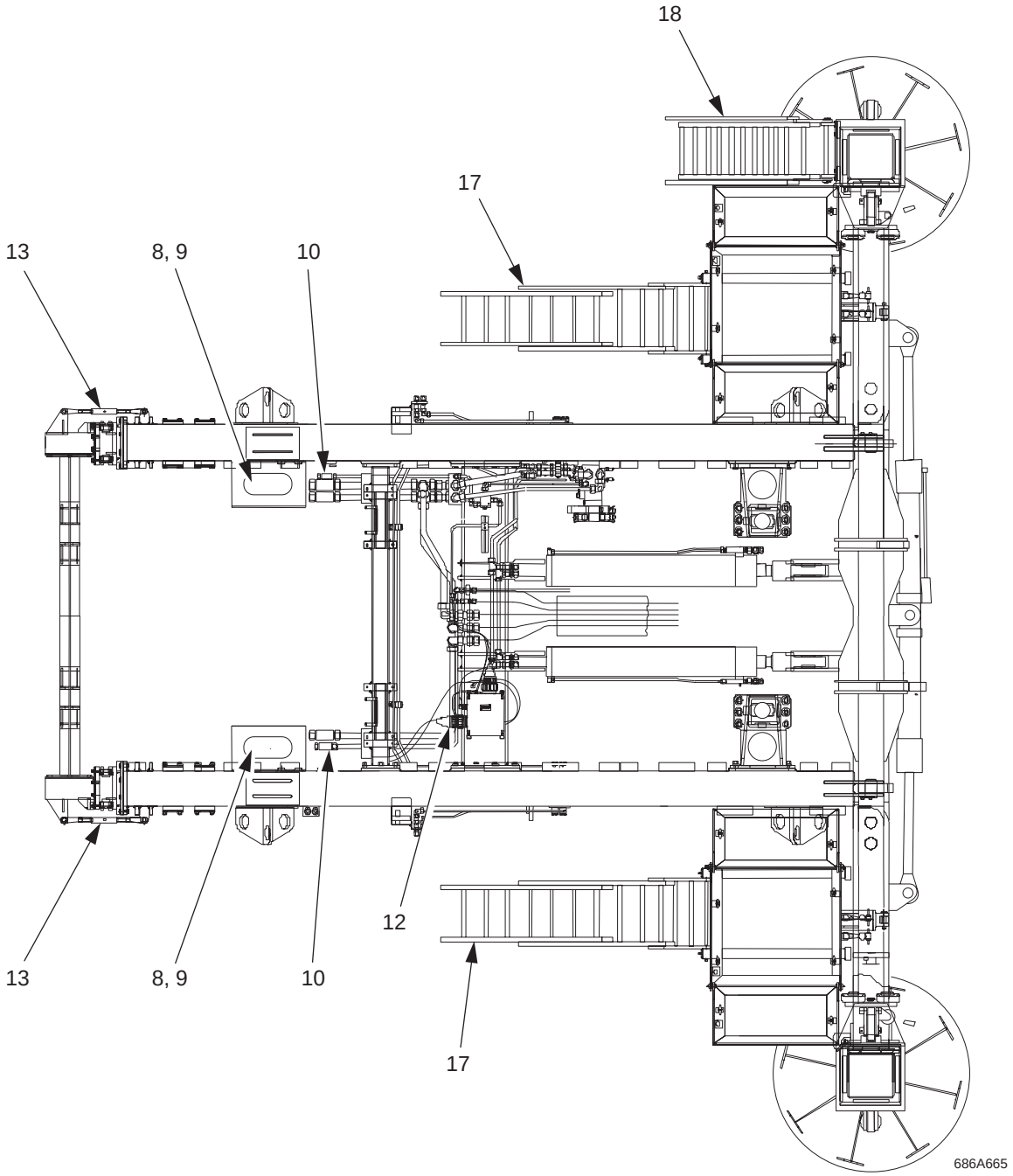
11 Replace the spreader bars on the energy chains.

12 Reconnect the electrical supply to moving the slide frame junction box, earth strap at mil-connector and replace any cable-ties to secure cables to the slide frame pipe work.



13 Remove the two rigging screws holding the slide frame together.

14 Remove the two A-frame hinge locking pins and clips from each side.



WARNING

EQUIPMENT FAILURE. STAND WELL CLEAR OF EQUIPMENT WHEN FIRST UNFOLDING A-FRAME. SERIOUS PERSONAL INJURY OR DEATH COULD RESULT IF EQUIPMENT FAILS.

CAUTION

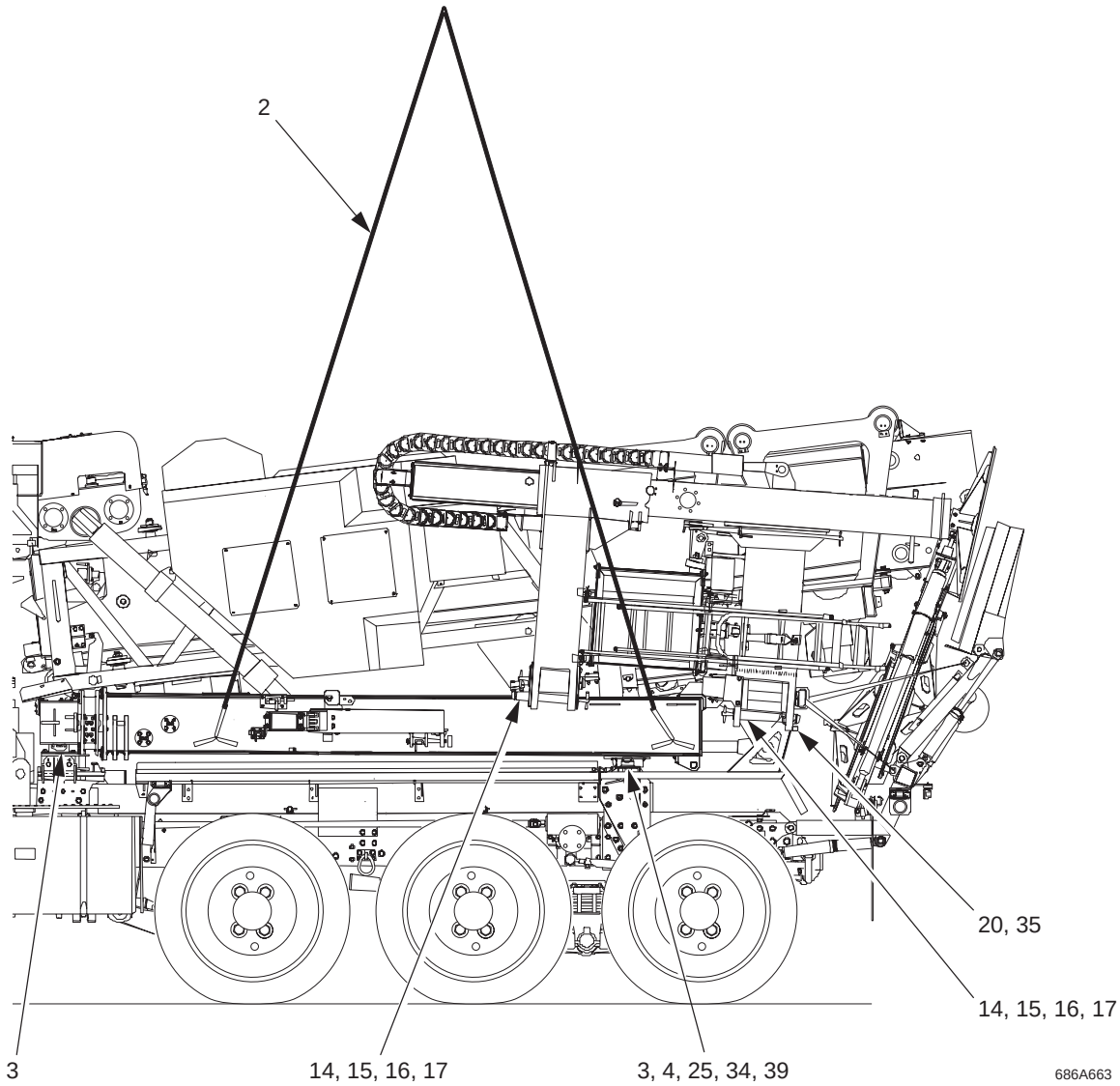
Equipment damage. Before operating, check equipment for signs of damage or hydraulic leaks due to handling or transportation.

15 Unfold the A-fame legs. Press the A-frame fold **DEPLOY** button on the interface panel, until the **DEPLOYED** light comes on.

WARNING

CRUSH HAZARD. NEVER USE FINGERS TO PUSH PINS IN OR OUT OF HOLES. SERIOUS PERSONAL INJURY WILL RESULT IF THIS INSTRUCTION IS NOT OBSERVED.

16 Insert the two a-frame hinge locking pins and clips on each side.



17 Refit both folding walkway ladders by removing the R-clip from the pivot pin, remove pivot pin from the ladder. Hold the ladder in place; replace the pivot pin and R-clip, secure the ladder in the stowed position with a retaining strap.

18 Replace the A-frame upper ladder by removing the R-clip from the pivot pin remove the pivot pin from the ladder, hold the ladder in place, replace the pivot pin and R-clip, secure the ladder in the stowed position with a retaining strap.

19 Rotate the A-frame legs, by pressing A-frame rotate **DEPLOY** button on the interface panel until the **DEPLOYED** light illuminates.

20 Insert the A-frame rotate shootbolts.

21 Position the stabilizer feet under the stabilizer legs.

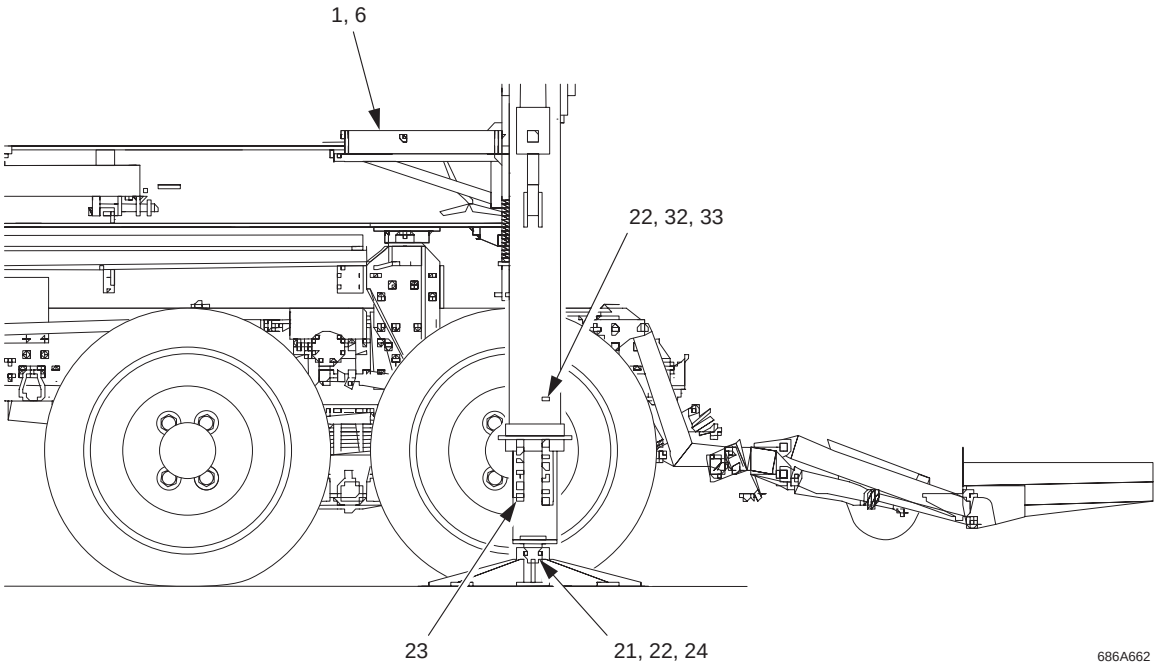
22 Remove the stabilizer leg pins and R clips.

23 Lower the stabilizer legs onto the feet.

NOTE

Only just rest the feet on the ground DO NOT start to lift the A-frame.

24 Refit the stabilizer feet by fitting the securing U-bolt and new nyloc nuts.



25 Release the twist locks on both sides, raise the stabilizer legs to pin hole No. eleven. Replace the pins and clips.

26 Drive the launch vehicle forward to extend the launch frame.

27 Plug the launcher chest pack in, and remove the shootbolts on the relax mechanism.

28 Go to position 4 on 4 position rotary switch in the vehicle cab.

29 Go to **BEAM ANGLE** on the chest pack. Operate the right hand joystick to exercise the articulator cylinders up and down to check for correct operation.

30 Insert the shootbolts on the relax mechanism and unplug the chest pack.

31 Turn the rotary switch to position 3, reverse vehicle to close slide frame.

32 Remove the pins and clips from the A- frame stabilizer legs.

33 Retract the stabilizer legs and replace the pins and R clips.

34 Rotate the twist lock handles to the lock position.

35 Remove the shootbolts where the mudguards are fitted to the A-frame.

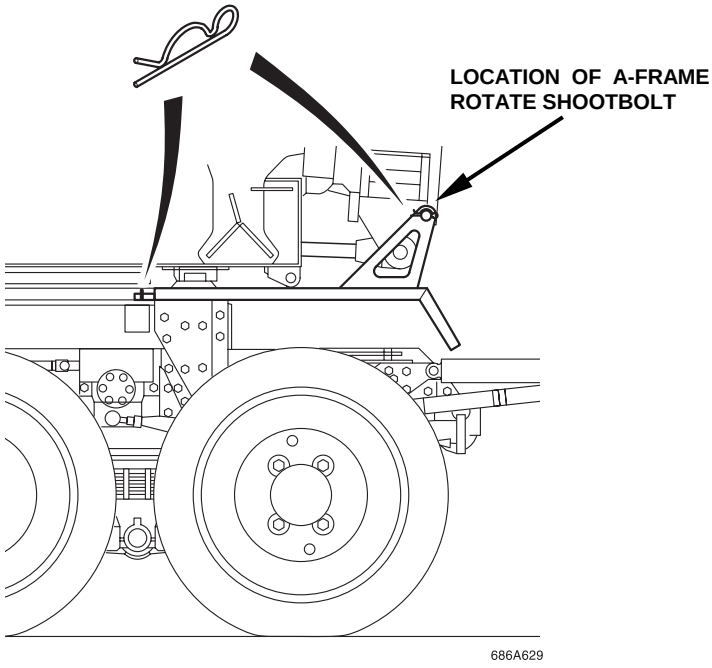
36 Rotate the A-frame legs, press A-frame rotate **PARK** button on the interface panel until the **PARKED** light illuminates.

37 Remove the two A-frame hinge locking pins from each side.

38 Fold the A-frame legs by pressing A-frame fold **PARK** button on the interface panel until the **PARK** light is illuminated.

39 Insert the two A-frame hinge locking pins and clips on each side.

40 Replace the two removable mudguards, and secure with R clips.



41 Fit the transport strap to the far bank support.

42 Close the tail lift to the transport position and fit the transport straps.

43 Stow the chest pack and tail lift pendant in their storage box.

11.9 CRANE

11.9.1 Removal for Transport

11.9.1.1 De-pressurize the hydraulic system.

11.9.1.2 Disconnect the electrical supply cable (Figure 11. 56 item 1) to the crane.

11.9.1.3 Unscrew, counter clockwise, the five crane hydraulic couplings (Figure 11. 57 item 5) and fit the plugs and caps. These are situated under the crane on the right hand side of the vehicle.

11.9.1.4 Connect the lifting facility to the crane lifting point (Figure 11. 58 A & B).

11.9.1.5 Release the home bank end beam adapters and tie them out of the way of the crane (Figure 11. 58 C).

11.9.1.6 Refer to Figure 11. 55. Remove the bolts (2) and washers retaining the crane mounting pin locking plates (4).

NOTE

There are four mounting points, two forward of the Crane and two to the rear of the Crane.

11.9.1.7 Connect slings with shackles to lifting points, take weight until the pins become loose enough to extract.

11.9.1.8 Remove the four crane mounting pins (Figure 11. 55 item 3) using the pin extraction tool (Figure 11. 59).

11.9.1.9 Lift the crane clear of the launch vehicle; the crane weighs 10,868 lbs (4930 kg.).

11.9.1.10 To allow the fitting of the crane transport feet, place the crane on wooden blocks to lift the crane chassis mounting holes clear of the floor.

11.9.1.11 Fit the crane transport feet to the crane mounting holes and secure with clips.

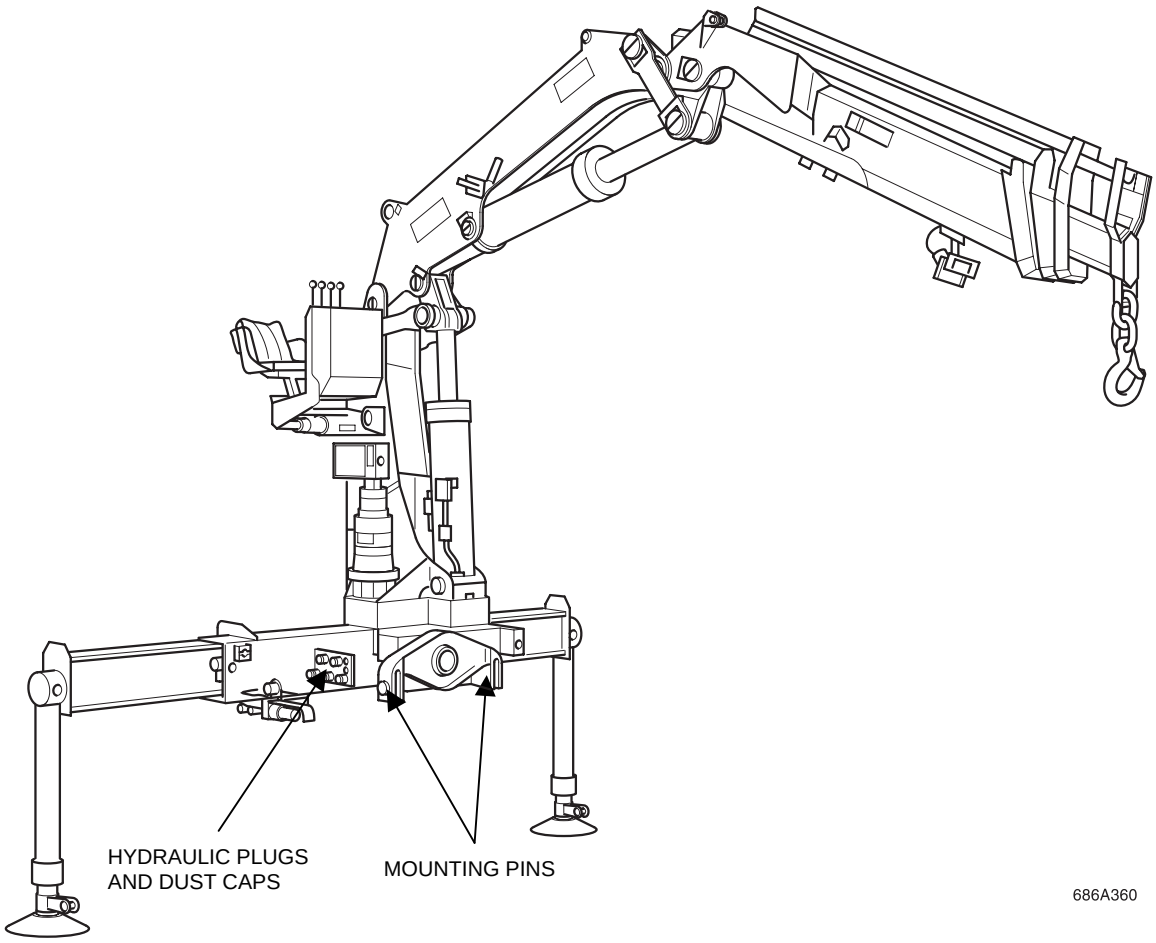


Figure 11. 53 Location of Mounting Pins Front of Crane

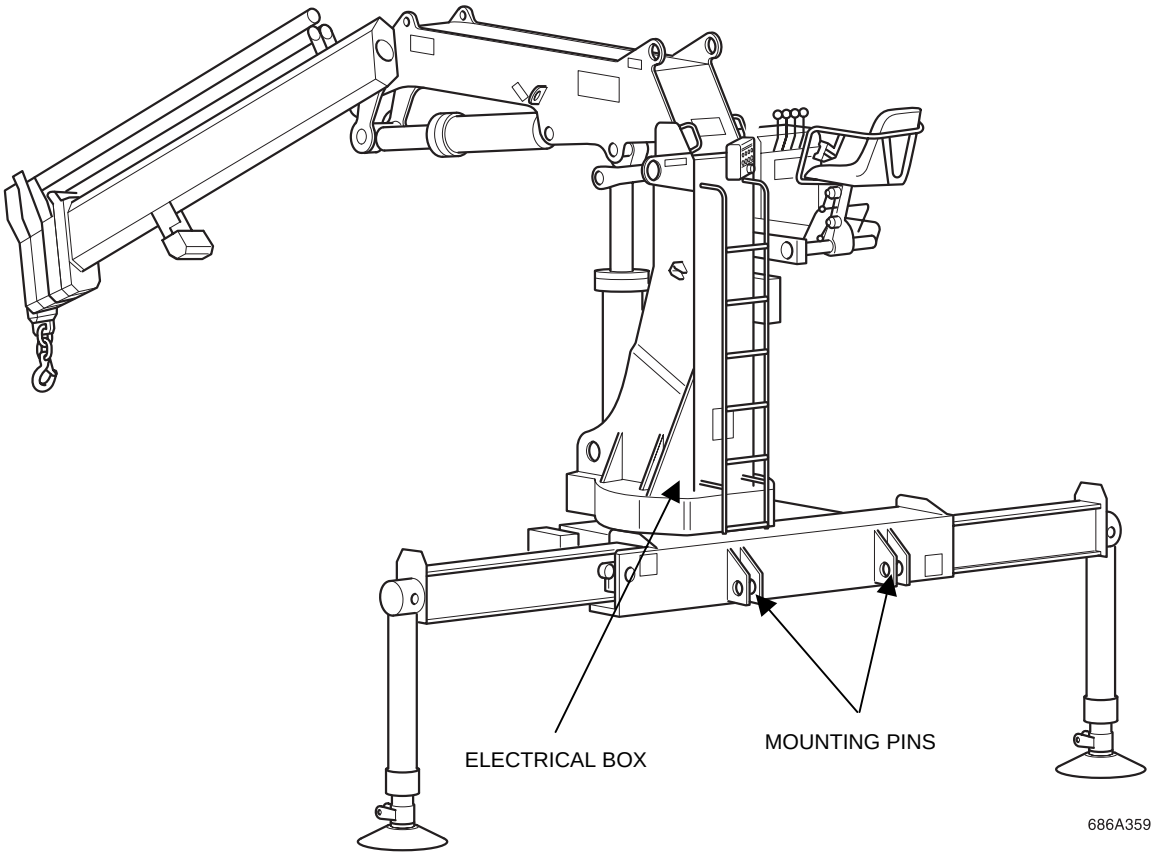


Figure 11. 54 Location of Mounting Pins Rear of Crane

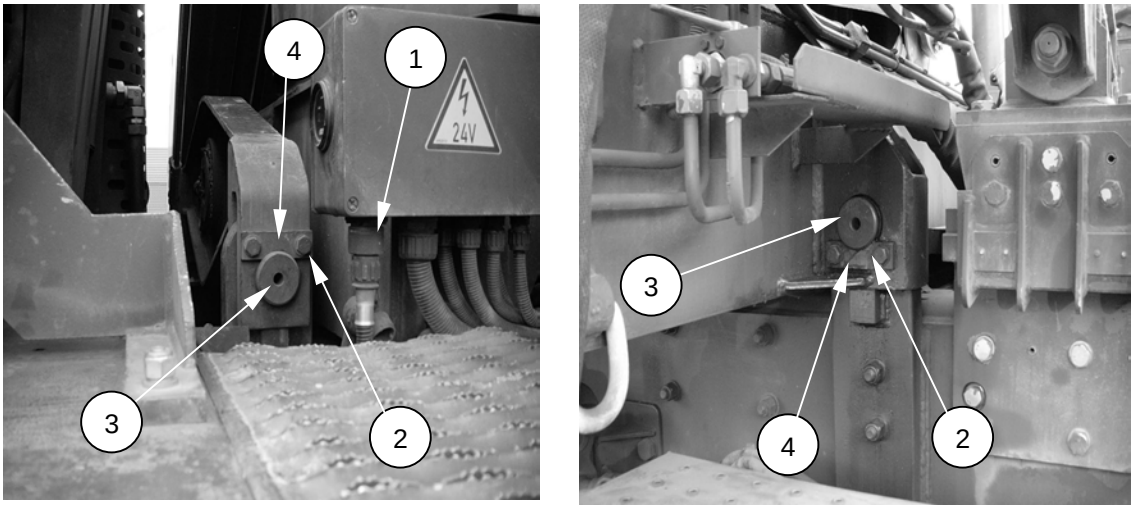


Figure 11. 55 Crane Mounting Pins

Figure 11. 56 Crane Electrical Connection

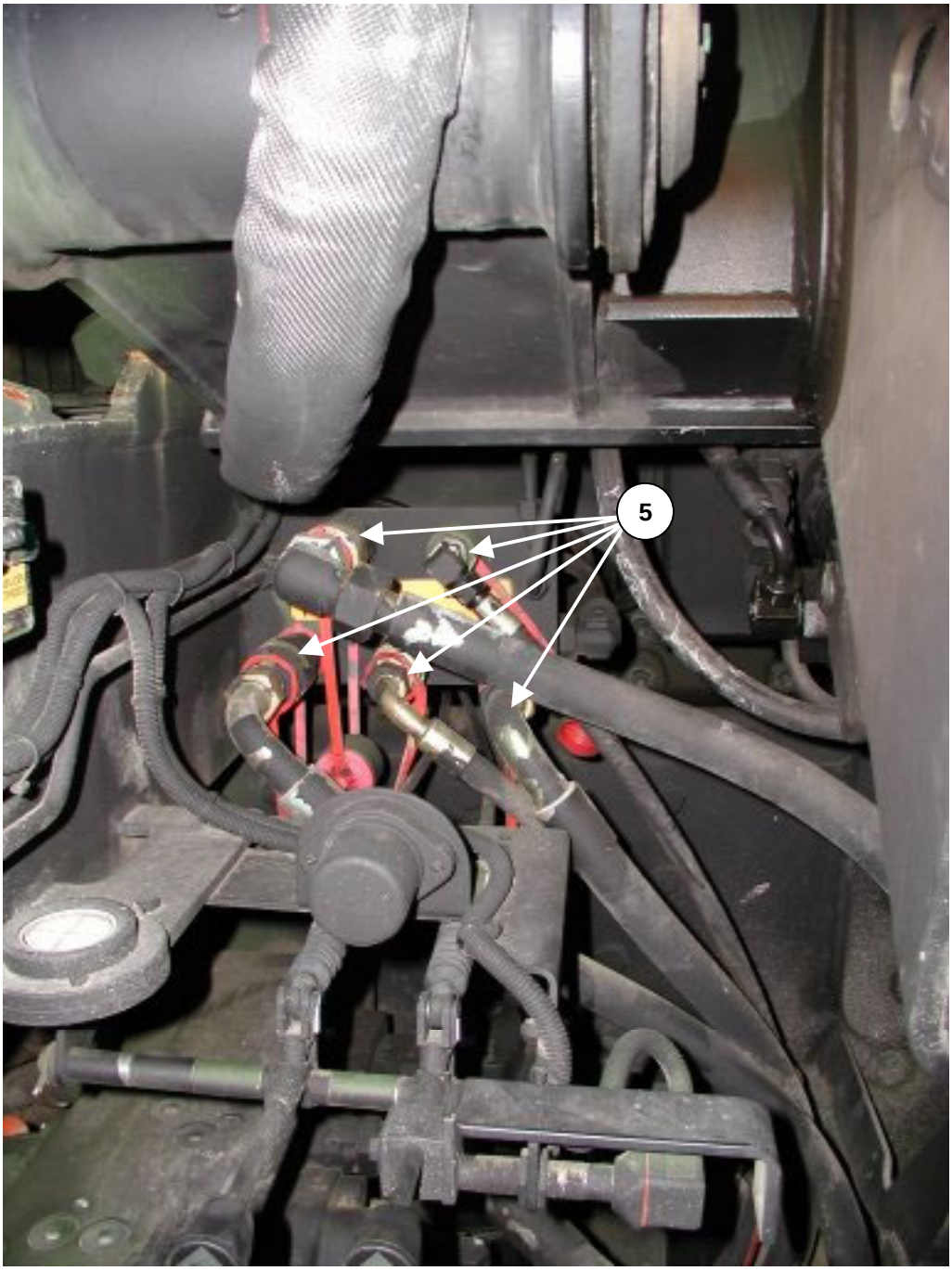


Figure 11. 57 Crane Hydraulic Connections

A

B

C

Figure 11. 58 Crane Lifting

Figure 11. 59 Crane Pin Extractor

11.10 CRANE

11.10.1 Fitting after Transport

11.10.1.1 Place the crane on wooden blocks to allow removal of the transportation feet.

11.10.1.2 Remove the transportation feet.

11.10.1.3 Lift the crane and align with the crane mounting points.

11.10.1.4 It may be necessary to adjust one or all of the crane mounting cams (Figure 11. 60 item 9) if the mounting points cannot be aligned with the brackets on the chassis (Figure 11. 60 item 8).

11.10.1.5 Release the cam-mounting bolt (Figure 11. 60 item 11) by knocking back the lock washer tab (Figure 11. 60 item 10).

11.10.1.6 Turn the cam mounting bolt (Figure 11. 60 item 11) counter clockwise until the cam can be rotated clear of the crane mounting (Figure 11. 60 item 7).

11.10.1.7 Align the crane (Figure 11. 60 item 6) with the crane mounting points (Figure 11. 60 item 7).

11.10.1.8 Insert the crane mounting pins (Figure 11. 55 item 3).

11.10.1.9 Fit the crane mounting pin-locking plates (Figure 11. 55 item 4).

11.10.1.10 Secure the locking plates with bolts (Figure 11. 55 item 2) and washers. Use thread-locking compound on the bolts (2).

11.10.1.11 Align the cam (Figure 11. 60 item 9) with the crane (Figure 11. 60 item 6).

11.10.1.12 Tighten the cam mounting bolts (Figure 11. 60 item 11) and lock in place with the lock washer (Figure 11. 60 item 10).

11.10.1.13 Reconnect the five crane hydraulic couplings (Figure 11. 57 item 5) and screw on clockwise.

11.10.1.14 Reconnect the electrical supply cable (Figure 11. 56 item 1) to the crane.

11.10.1.15 Reposition and secure the home bank end beam adapters.

11.10.1.16 Disconnect the lifting device and sling.

11.10.1.17 Switch the battery shutoff switch to the on position.

11.10.1.18 Functionally operate the crane in accordance with Chapter 3 Section IV Para 3.14.

11.10.1.19 Check for hydraulic leaks.

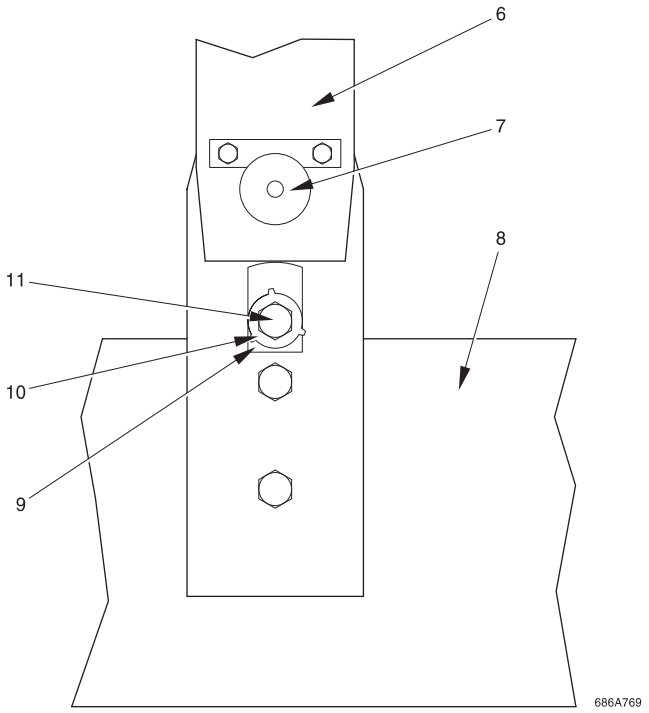


Figure 11. 60 Crane Pin Adjustment

11.11 TRUCK PREPARATION FOR TRANSPORT

11.11.1 Truck Preparation for Lift

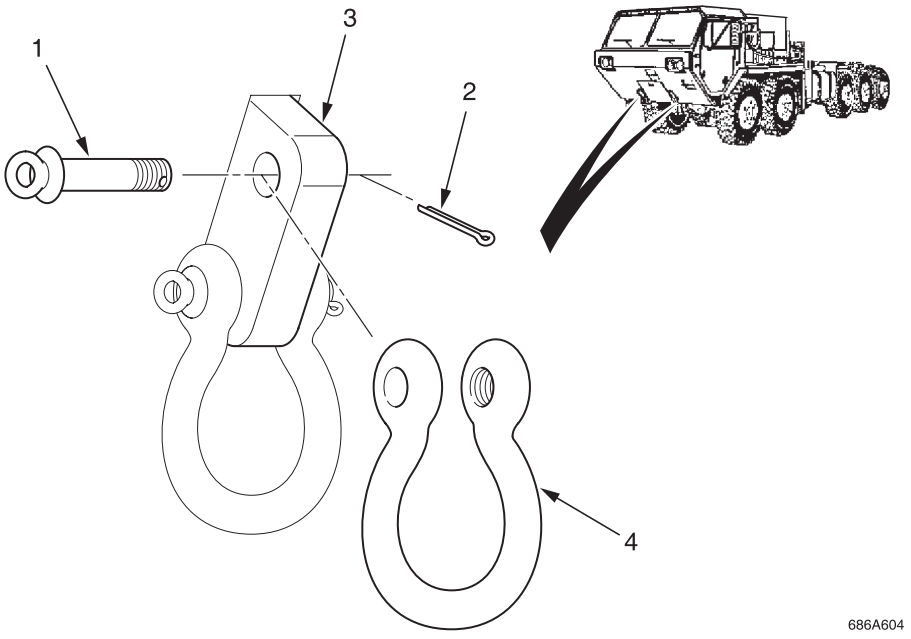


Figure 11. 61 Lifting Shackle

NOTE

Both shackles are removed the same way. Left shackle is shown.

11.11.1.1 Remove the cotter pin (2) from the screw (1).

11.11.1.2 Remove the screw (1) and towing shackle (4) from the towing-eye (3).

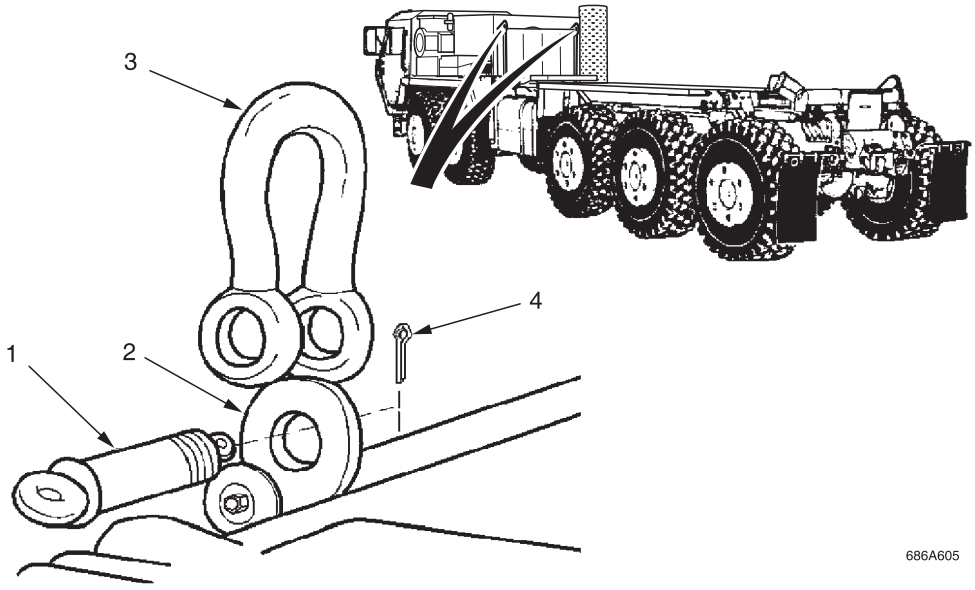


Figure 11. 62 Position of Lifting Shackle

NOTE

Both shackles are installed the same way. Left shackle is shown.

11.11.1.3 Attach the towing shackle (3) to the bracket (2) using the screw (1), and cotter pin (4).

11.11.1.4 Repeat steps (11.11.1.1) through (11.11.1.3) to install right shackle.

11.11.2 Preparation after Lift

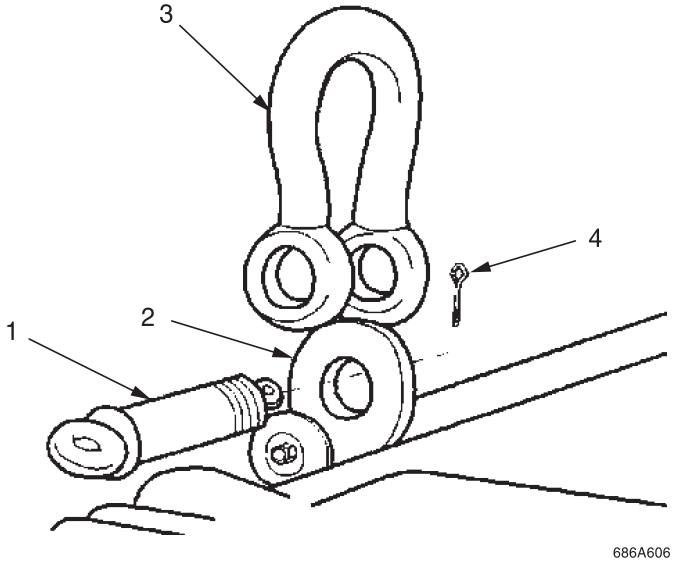


Figure 11. 63 Lifting Shackle

NOTE

Both shackles are removed the same way. Left shackle is shown.

11.11.2.1 Remove the cotter pin (4), screw (1) and towing shackle (3) from the bracket (2).

11.11.2.2 Repeat step 11.11.2.1 to remove the right shackle.

11.11.2.3 Install the towing shackle (4) onto the towing-eye (3) with screw (1).

11.11.2.4 Install the cotter pin (2) into the screw (1).

11.11.2.5 Repeat steps (11.11.2.1 and 11.11.2.2) for the right shackle.

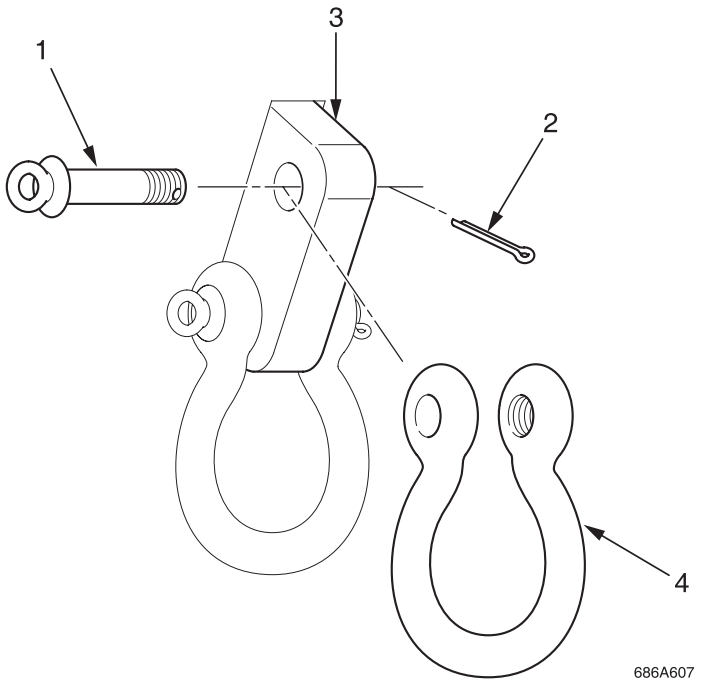


Figure 11. 64 Lifting Shackle Fitting

11.11.3 Truck Preparation for Air Transport

11.11.3.1 Remove the far bank support. (Refer to Para 11.8.3).

11.11.3.2 Remove the launch equipment. (Refer to Para 11.8.7).

11.11.3.3 Remove the tail lift. (Refer to Para 11.8.5).

11.11.3.4 Remove the crane. (Refer to Para 11.9.1)

WARNING

HEAVY OBJECT. TIRE ASSEMBLY IS VERY HEAVY 500 LB. (227 KG). DO NOT TRY TO LIFT OR CATCH TIRE ASSEMBLY. INJURY TO PERSONNEL COULD RESULT.

11.11.3.5 Remove the spare tire (1) (TM 9-2320-364-10 Para 3-5). Roll the tire to the back of the truck and lay it down flat with valve stem facing up.

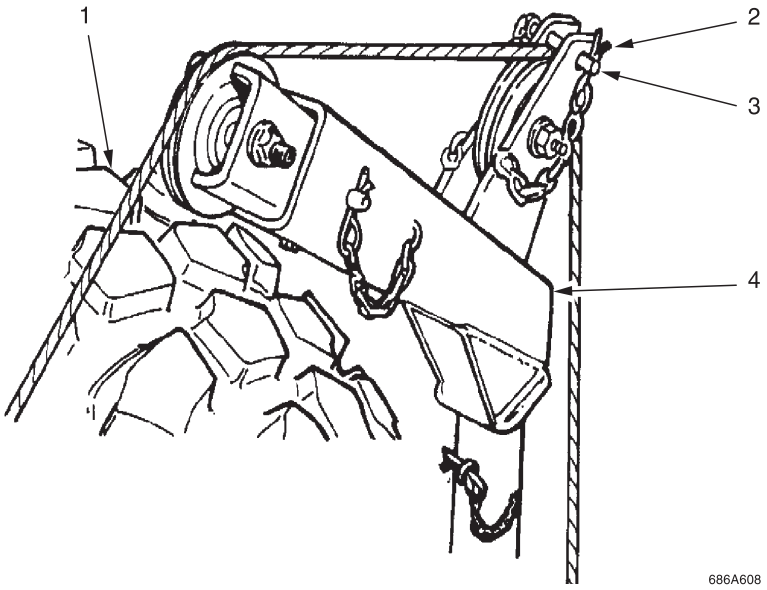


Figure 11. 65 Tire Davit

11.11.3.6 Remove the safety pin (2) and pin (3) from the tire davit (4).

11.11.3.7 Pull the cable (5) back from the davit support (3) and attach the hook (1) to the crane sub-frame (2).

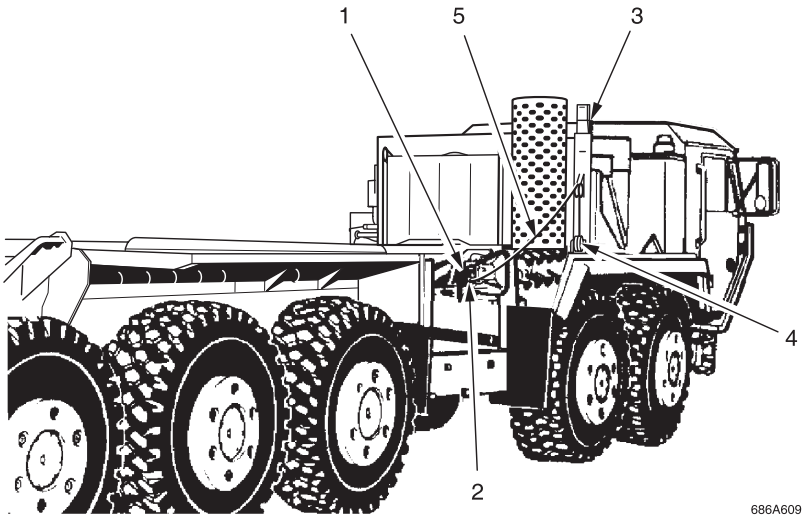


Figure 11. 66 Tire Davit Cable Securing

CAUTION

Equipment damage. Do not wind cable too tight on winch. Cable should be wound snug. Winding cable too tight could cause damage to equipment.

11.11.3.8 Wind the excess cable (5) back onto the winch (4).

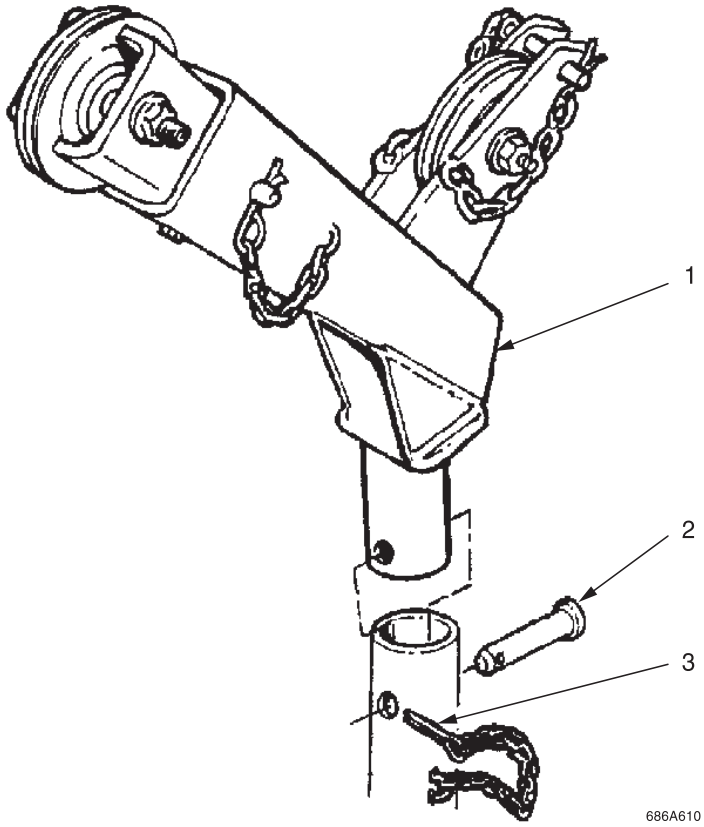


Figure 11. 67 Tire Davit Assembly

11.11.3.9 Remove the safety pin (3), pin (2).

11.11.3.10 Remove the tire davit (1).

11.11.3.11 Remove the chain (8), clevis (4) and ratchet strap from the stowage box.

11.11.3.12 Install the clevis (4) to the spare tire carrier plate (5) with the screw (3), nut (2) and cotter pin (1).

11.11.3.13 Thread the chain (8) through the clevis (4).

11.11.3.14 Count out 50 links (9) of chain and make a loop with the chain (8) by draping it over the crane hook (7) and placing the chain hook (6) around a chain link (9).

WARNING

RISK OF ELECTROCUTION. CHECK FOR OVERHEAD POWER LINES OR OTHER OBSTRUCTIONS BEFORE ATTEMPTING CRANE OPERATION. SERIOUS INJURY OR DEATH TO PERSONNEL COULD RESULT FROM CONTACT WITH ELECTRICAL POWER LINES.

CAUTION

Equipment damage. Do not allow spare tire to swing back and forth while raising tire. Raise tire slowly during lifting operation. Failure to comply could cause serious damage to equipment.

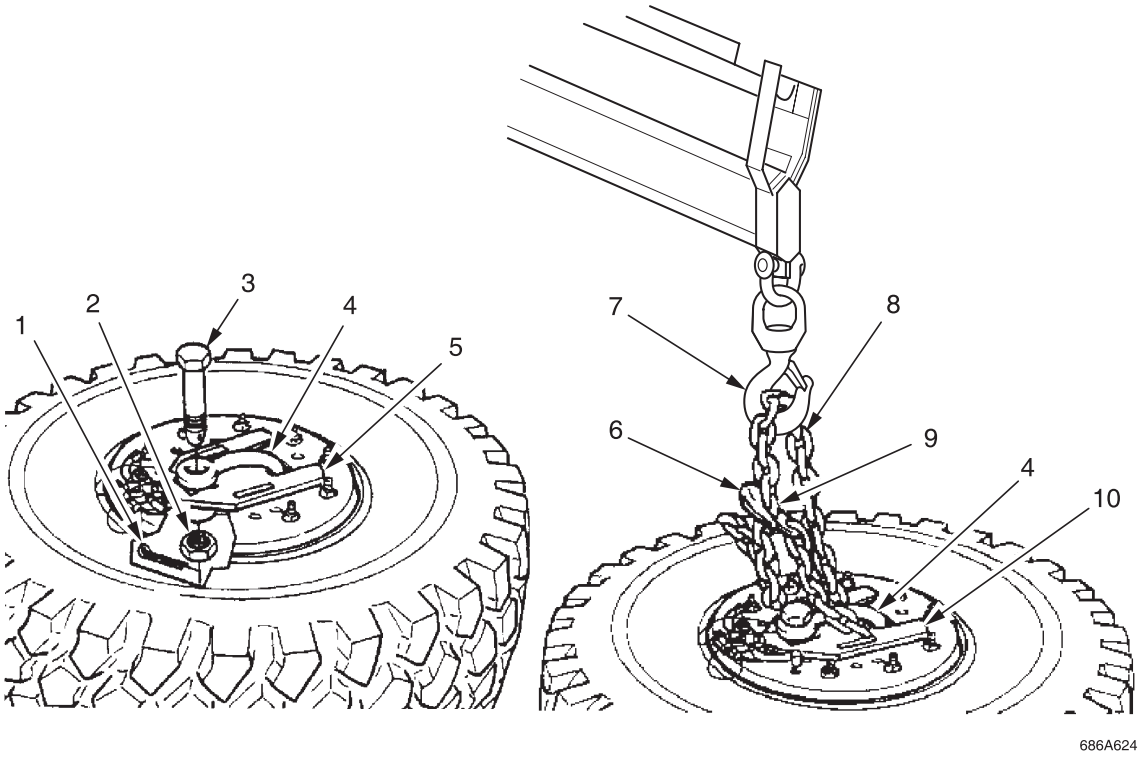


Figure 11. 68 Method of Craning Tire

11.11.3.15 Using the vehicle crane, set into manual operation by moving the manual operation lever next to the operators controls, move the spare tire to its stowed position at the rear of the vehicle (see Figure 11. 70).

11.11.3.16 Remove the chain (8) and return it to stowage box.

NOTE

Ensure the strap does not overlap the wheel valve.

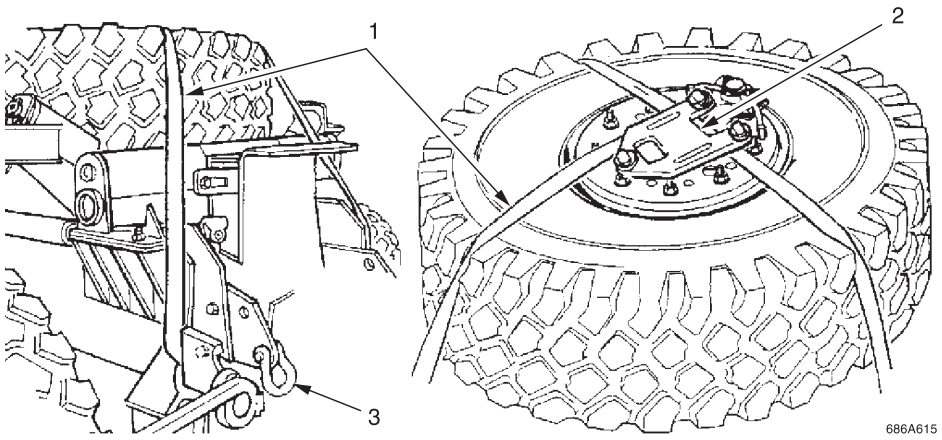


Figure 11. 69 Method of Securing Tire

11.11.3.17 Thread a ratchet strap (1) through two slots in the spare tire carrier plate (2).

11.11.3.18 Hook one end of the strap (1) on the lifting shackle (3).

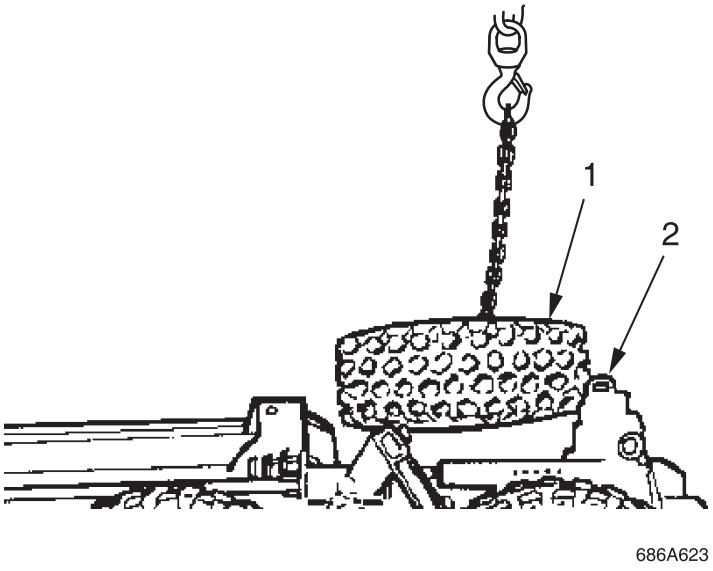


Figure 11. 70 Position of Spare Tire for Transport

11.11.3.19 Hook the ratchet strap ends diagonally to the lifting eyes (1) on rear of the frame (2).

11.11.3.20 Tighten the ratchet straps securely.

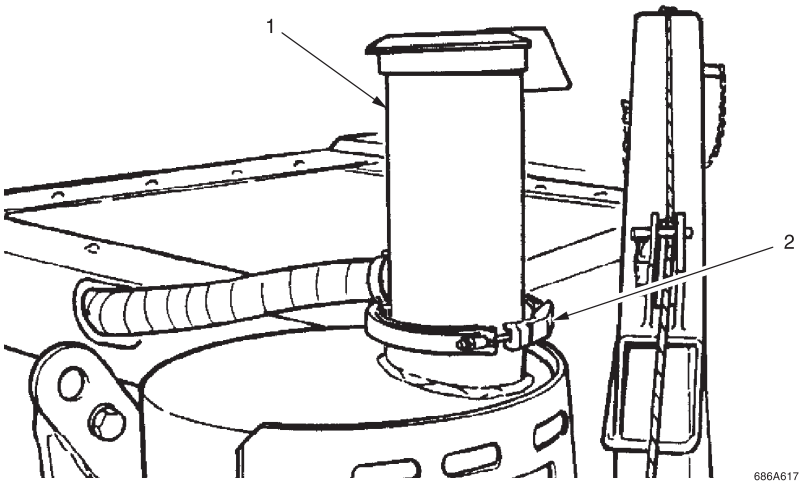


Figure 11. 71 Muffler Stack Clamp Removal

11.11.3.21 Pull up on the clamp lever (2) and remove the muffler stack (1)

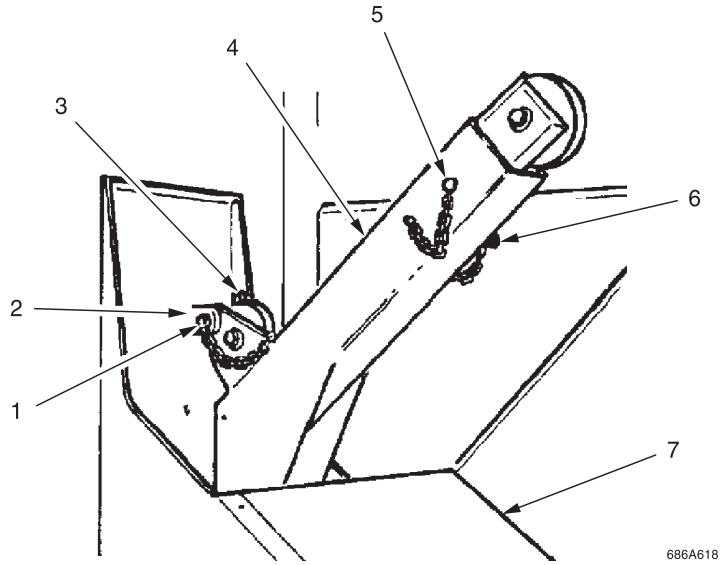


Figure 11. 72 Tire Davit Transport Position

11.11.3.22 Move the tire davit (4) down to the spare tire carrier (7), install the pin (1) through the bracket (2) and install the safety pin (3) to lock the davit in place.

11.11.3.23 Ensure that the tire davit (4) is in its retracted position and is locked in place with the pin (5) and safety pin (6).

11.11.3.24 Fold in the mirrors.

11.11.4 Truck Preparation After Air Transport

11.11.4.1 Chock the wheels (TM 9-2320-364-10 Para 2-19).

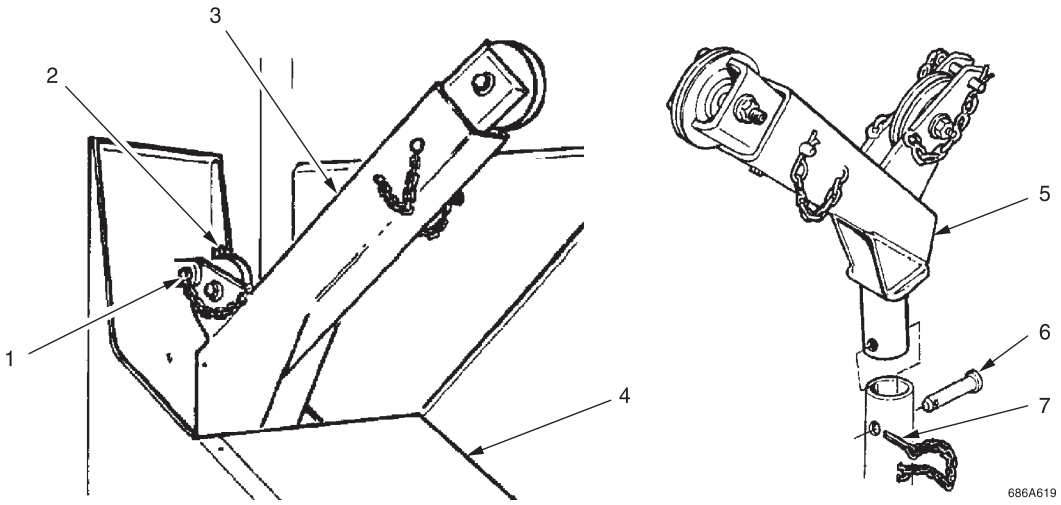


Figure 11. 73 Tire Davit Removal from Transport Position

11.11.4.2 Remove the safety pin (2), the pin (1) and the tire davit (3) from spare tire carrier (4).

11.11.4.3 Install the tire davit (3) with the pin (5) and the safety pin (6).

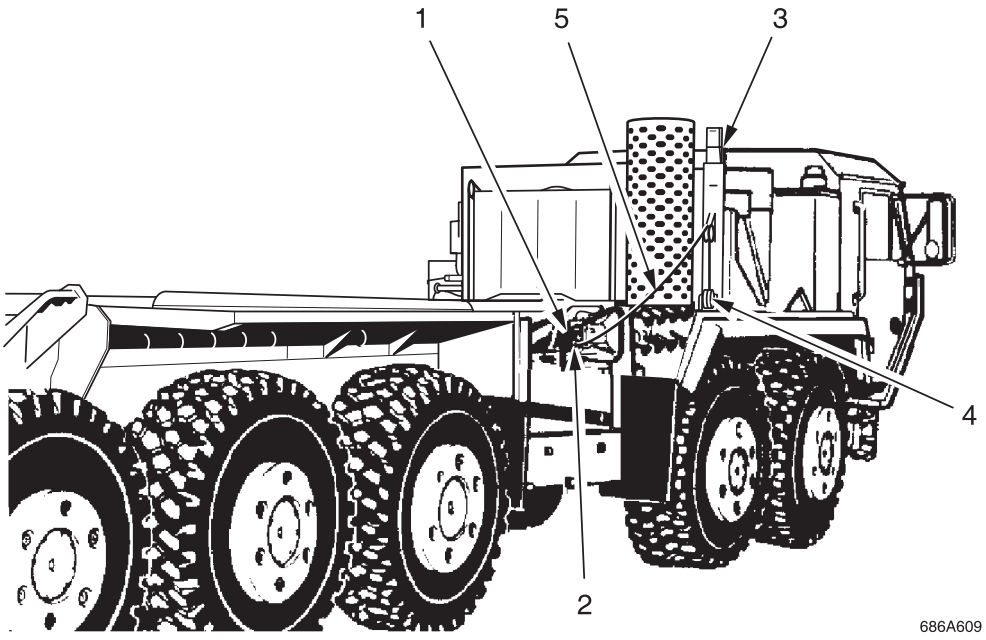


Figure 11. 74 Recovery of Tire Davit Cable

11.11.4.4 Loosen the cable (5) on the winch (4).

11.11.4.5 Remove the hook (1) from the crane sub-frame eyelet (2).

11.11.4.6 Pull the cable (5) up along the davit support (3).

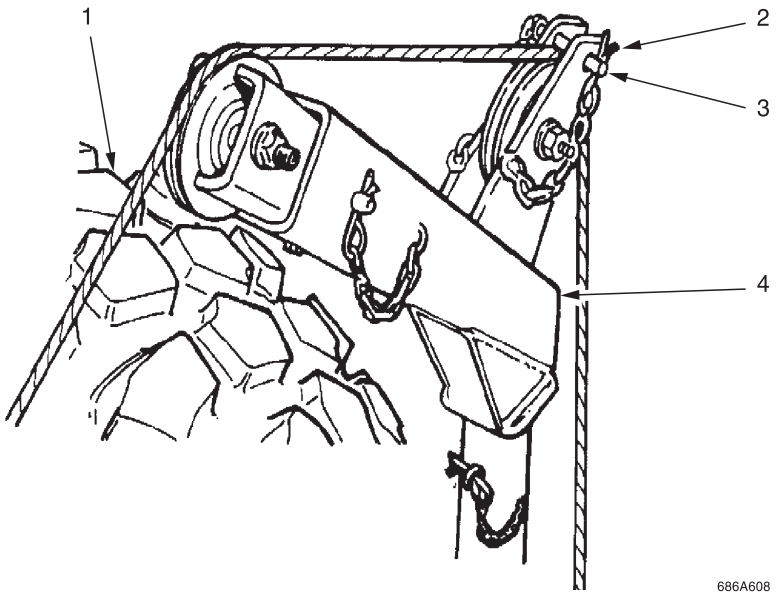


Figure 11. 75 Fitting Tire Davit Cable to Davit

11.11.4.7 Install the cable (4) to the davit (3) with the pin (2) and the safety pin (1).

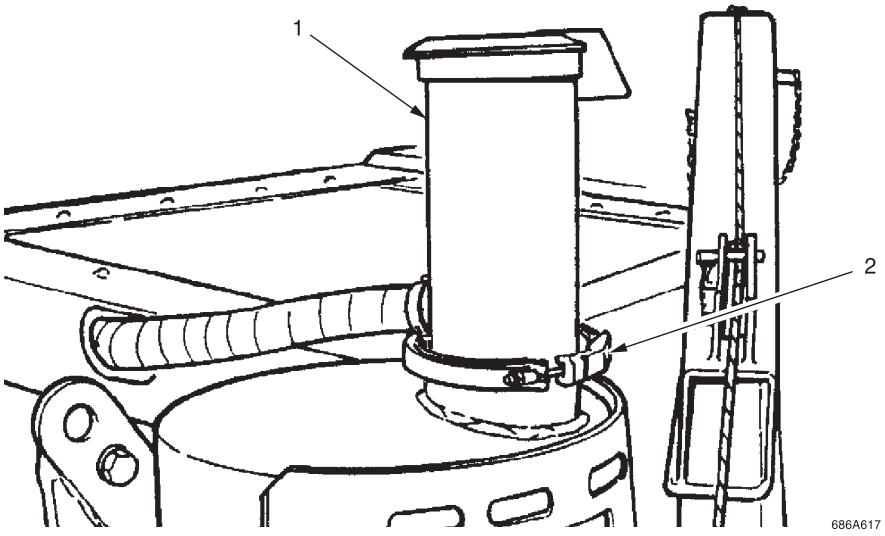


Figure 11. 76 Muffler Stack Clamp Fitting

11.11.4.8 Install the muffler stack (1) with its clamp (2).

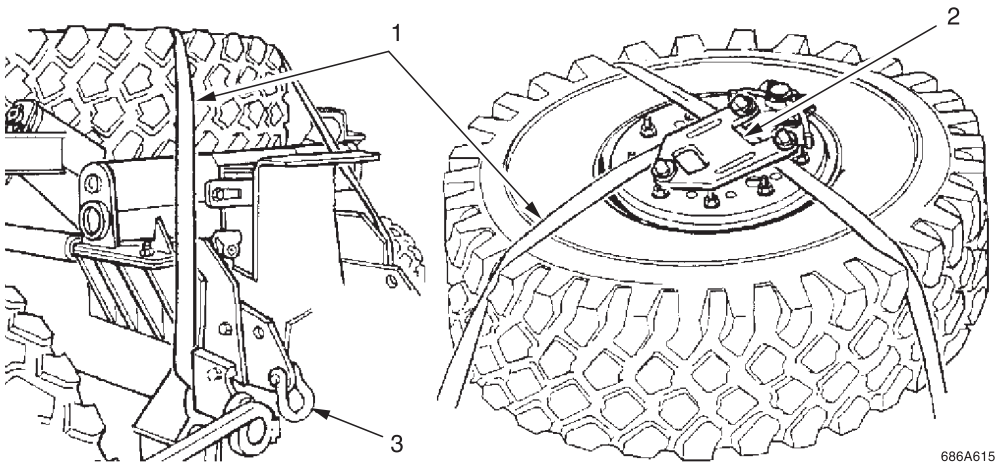


Figure 11. 77 Tire Securing for Transport

11.11.4.9 Remove the ratchet straps (1) from the lifting shackles (3) and the spare tire carrier plate (2).

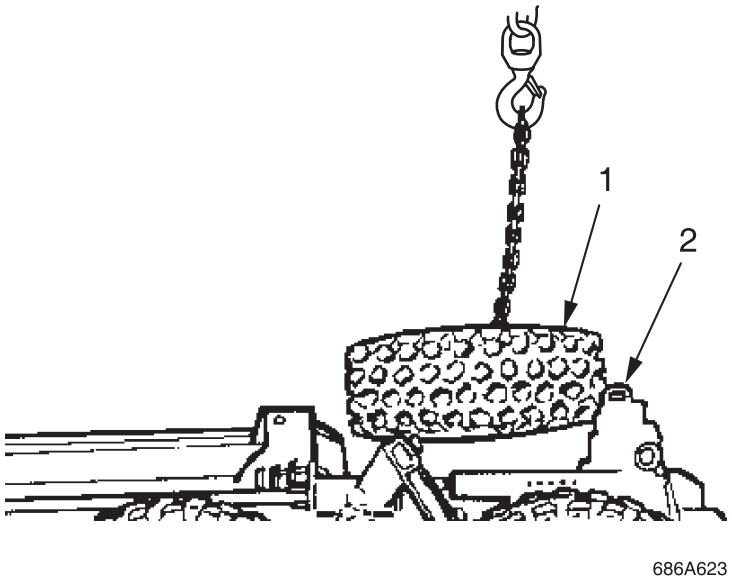


Figure 11. 78 Tire Transport Position

11.11.4.10 Remove the ratchet straps (2) from the lifting eyes (1) on the rear of frame (3) and return them to their stowage position.

11.11.4.11 Fold out the mirrors.

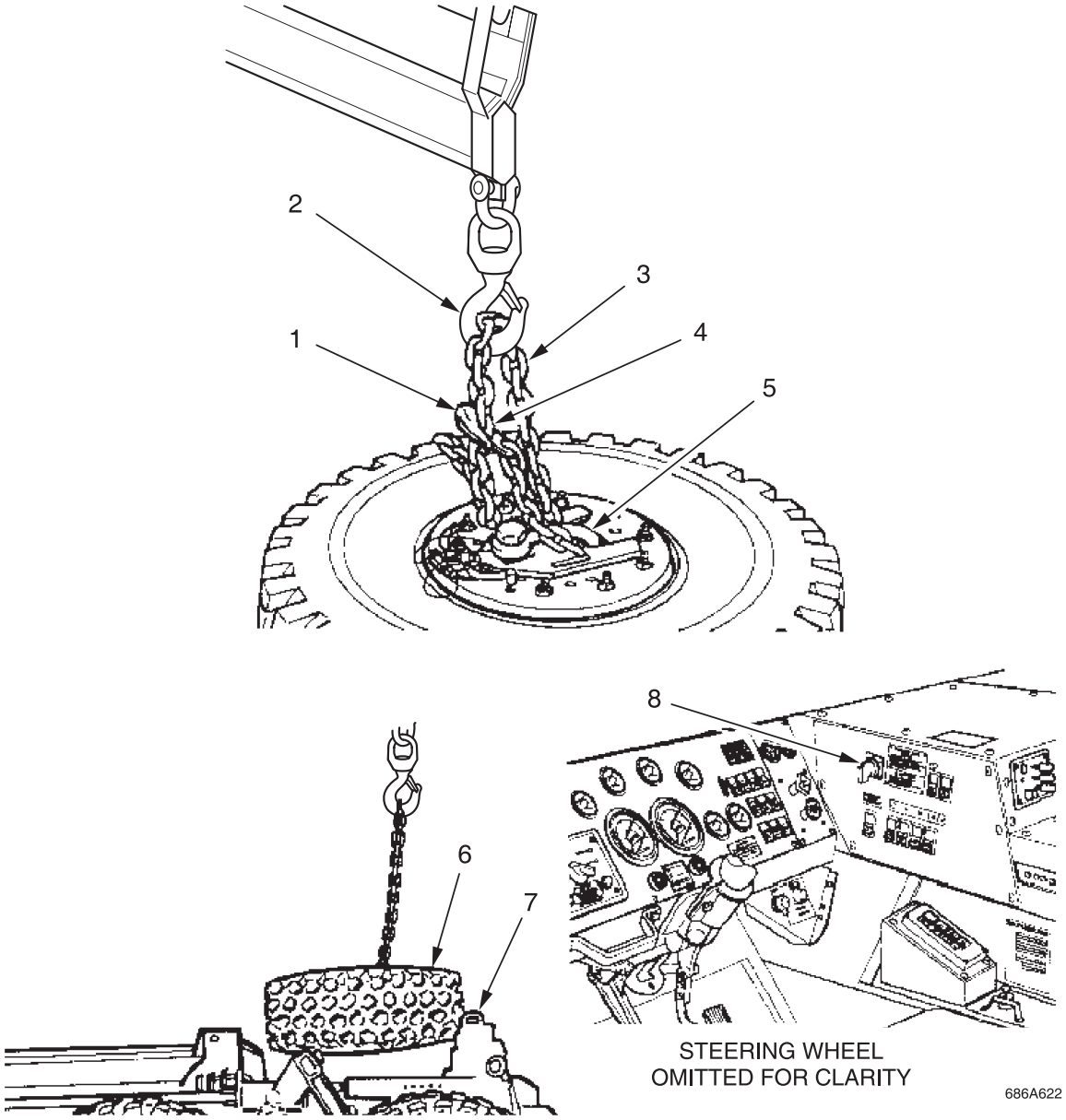


Figure 11. 79 Attaching Crane Hook for Tire Lift

11.11.4.12 Remove the chain (3) from its stowage position.

11.11.4.13 Thread the chain (3) through the clevis (5).

11.11.4.14 Count out 50 links of chain (4) and make a loop with the chain (3) by draping it over the vehicle crane hook (2) and placing the chain hook (1) around a chain link (4).

11.11.4.15 Using the vehicle crane, set into manual operation by moving the manual operation lever next to the operators controls, move the spare tire from its stowed position at the rear of the vehicle chassis (see Figure 11. 79).

11.11.4.16 Swing the crane boom and tire and lower tire to ground.

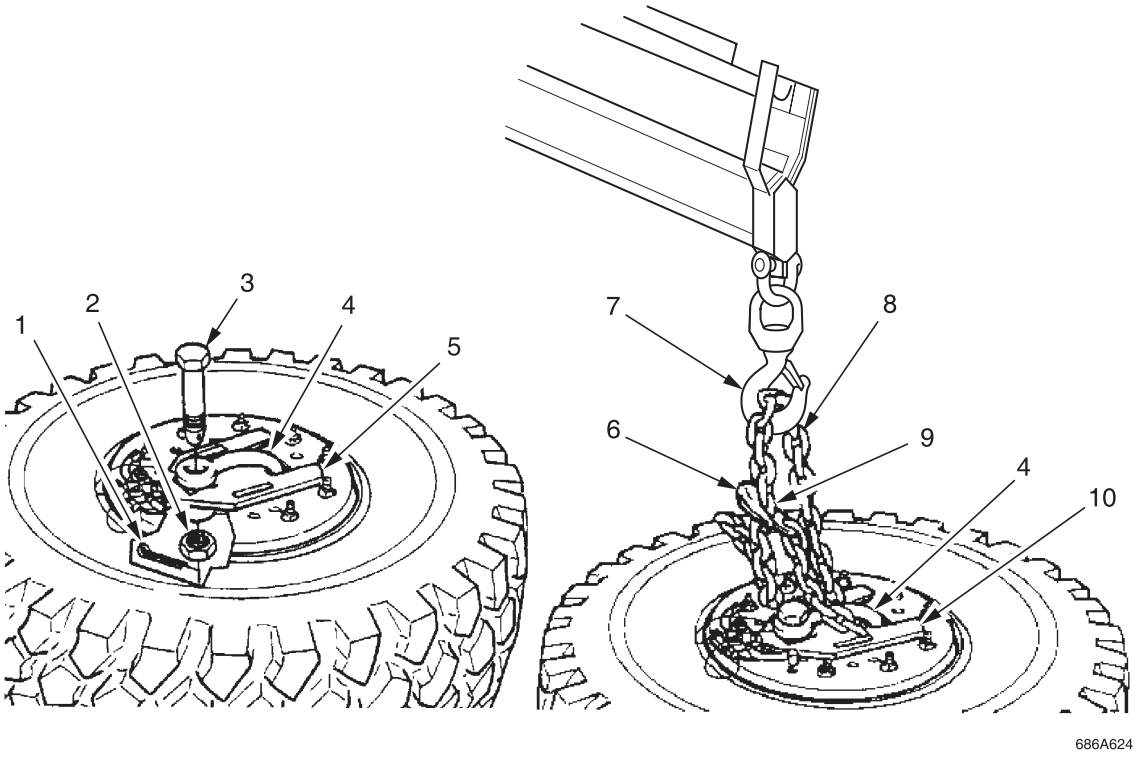


Figure 11. 80 Removing Crane from Tire

11.11.4.17 Remove the chain hook (6) from the link (9).

11.11.4.18 Remove the chain (8) from the crane hook (7), the clevis (4) and the spare tire carrier plate (10) and return it to stowage position.

11.11.4.19 Remove the cotter pin (1), nut (2), screw (3) and clevis (4) from the spare tire carrier (5) and return to stowage position.

11.11.4.20 Return the spare tire to the tire stowage position (TM 9-2320-364-10 Para 3-5).

11.11.5 Truck Preparation for Rail Transport

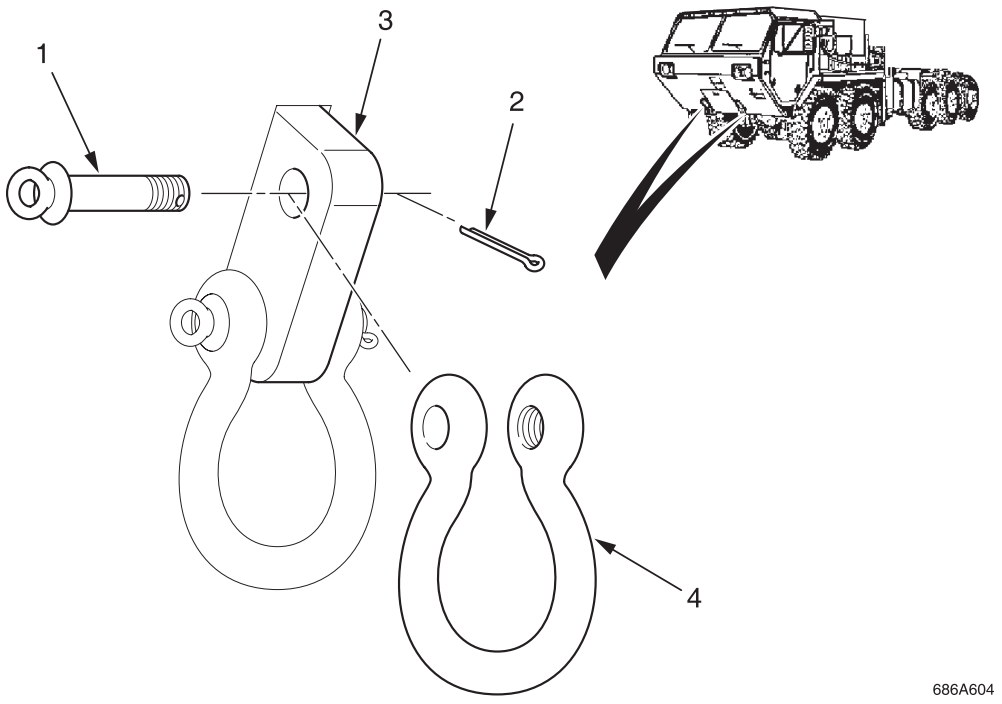


Figure 11. 81 Fitting Lifting Shackle

NOTE

Both front shackles are installed the same way. Right side is shown.

11.11.5.1 Remove the four shackles from the stowage box and install the shackle (4) in the upper towing-eye (3) with the clevis pin (1).

11.11.5.2 Install a cotter pin (2) in the clevis pin (1) and bend the cotter pin (2).

11.11.5.3 Repeat steps (11.11.5.1) and (11.11.5.2) for the left side.

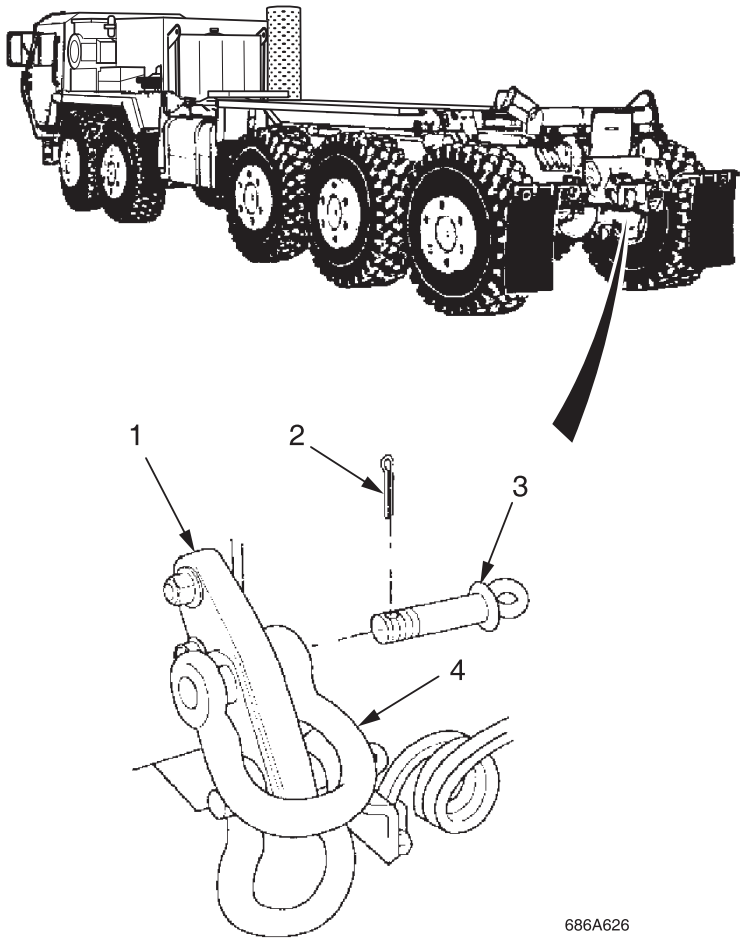


Figure 11. 82 Shackle Fitted to Upper Towing-eye

NOTE

Both rear shackles are installed the same way. Right side is shown.

11.11.5.4 Install the shackle (4) in the upper towing-eye (1) with the clevis pin (3).

11.11.5.5 Install a cotter pin (2) in the clevis pin (3) and bend the cotter pin (2).

11.11.5.6 Repeat steps (11.11.5.4) and (11.11.5.5) for the left side.

NOTE

Both hitch pins are installed the same way. Right side is shown.

11.11.6 Truck Preparation after Rail Transport

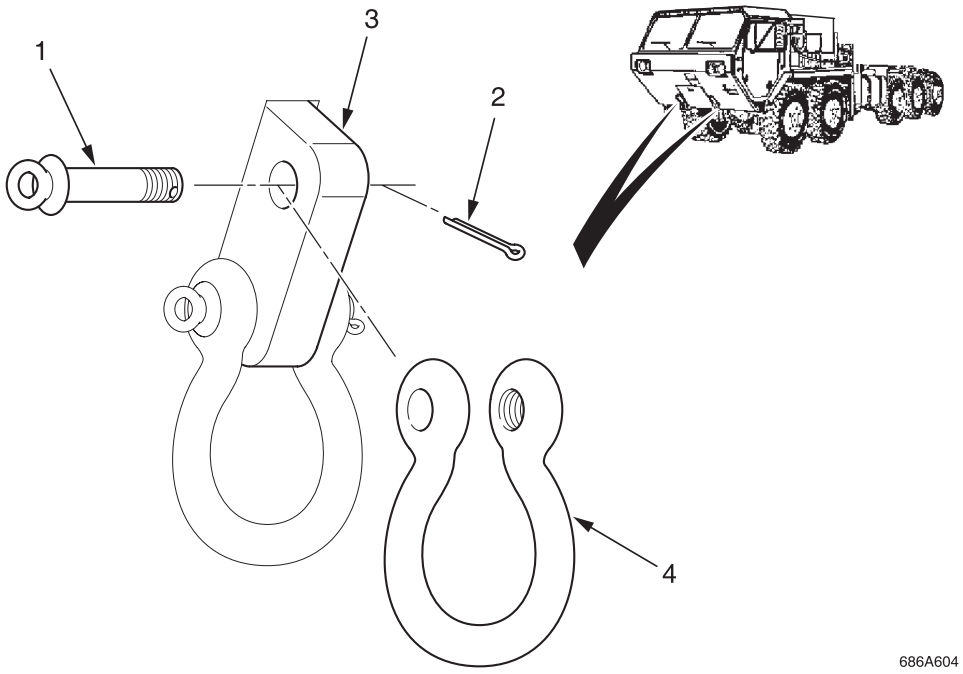


Figure 11. 83 Removal of Shackle

NOTE

Both front shackles are removed the same way. Right side is shown.

11.11.6.1 Straighten and remove the cotter pin (2) from the clevis pin (1).

11.11.6.2 Remove the clevis pin (1) and shackle (4) from the upper towing-eye (3). Stow the shackle (3) in stowage box.

11.11.6.3 Repeat steps (11.11.6.1) and (11.11.6.2) for left side.

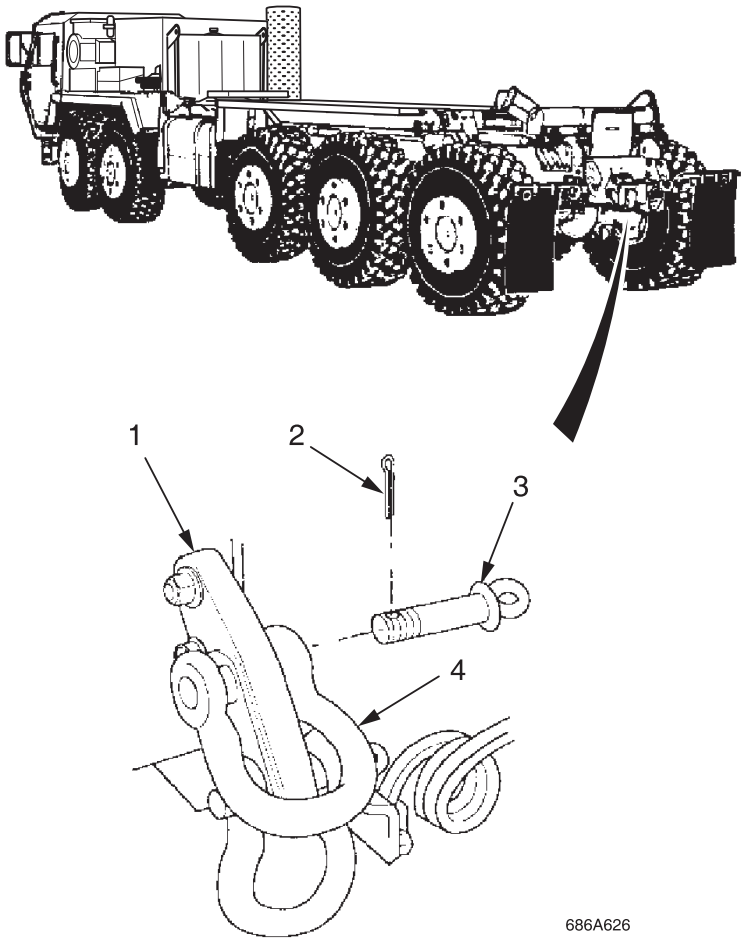


Figure 11. 84 Removal of Shackle From Top Towing-eye

NOTE

Both rear shackles are removed the same way. Left side is shown.

11.11.6.4 Straighten and remove the cotter pin (2) from the clevis pin (3).

11.11.6.5 Remove the clevis pin (3) and shackle (4) from the upper towing-eyes (1). Stow shackle (4) in stowage box.

11.11.6.6 Repeat steps (11.11.6.4) and (11.11.6.5) for left side.

NOTE

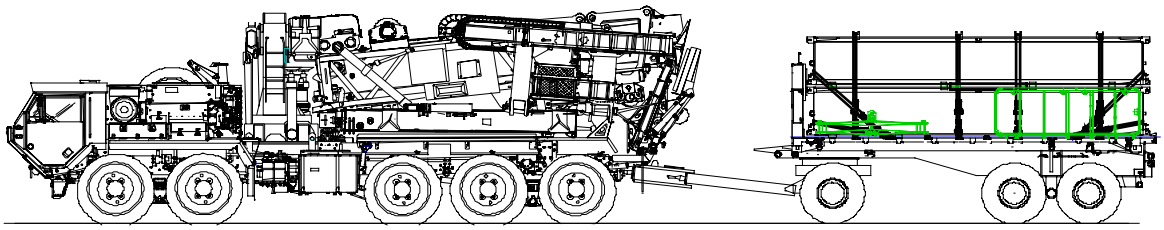
Both hitch pins are removed the same way. Right side is shown.

Section IV. LOAD CONFIGURATION

11.12 TRANSPORT CONFIGURATION

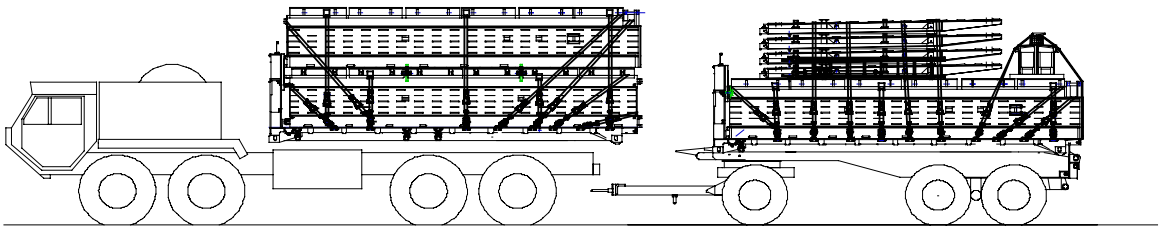
11.12.1 General

11.12.1.1 The diagrams below show the various load configurations for the DSB flatracks.



LAUNCH VEHICLE (LV)
A-frame and forward Launch Beam

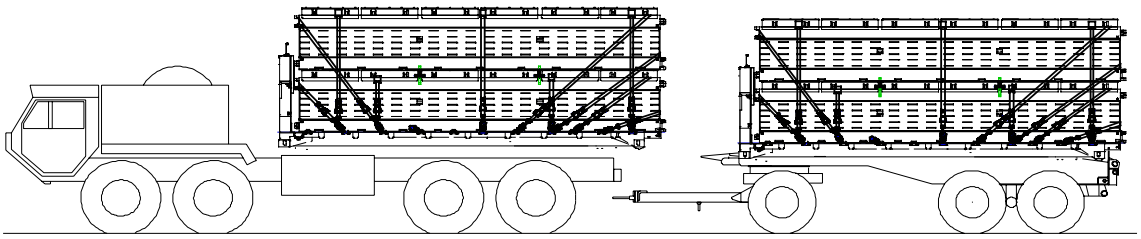
LAUNCH VEHICLE TRAILER
Consists of: 1 Module Lifting Beam
1 Launch Equipment Storage Box
7 Launching Beams
2 Crane Transport Foot



VEHICLE LOAD 1 (V1)
Consists of : Far Bank Ramp Module
1 Parallel Bridging Module

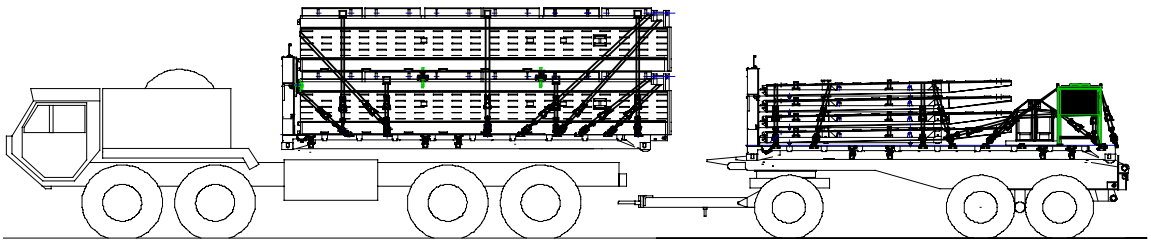
TRAILER LOAD 1 (T1)
Consists of: 1 Home bank Ramp Module
20 Approach ramps
2 End Beams
2 Module Access Ladders
12 Defile Markers
2 Packing Timber Bridge
9"Wx36"LGx3"THK

Figure 11. 85 V1, T1, V2 and T2 Loads



VEHICLE LOAD 2 (V2)
Consists of:2 Parallel Bridge Modules

TRAILER LOAD 2 (T2)
Consists of:2 Parallel Bridge Modules



VEHICLE LOAD 3 (V3)
Consists of:2 Ramp Modules

TRAILER LOAD 3 (T3)
Consists of : 20 Approach Ramps
2 End Beams
12 Defile Markers
2 Anchorage storage Boxes
2 Packing Timber Bridge
9"Wx36"LGx3"THK

Figure 11. 86 V2, T2, V3 and T3 Loads

11.12.2 Weight and Axle loading

Table 11. 4 Axle Loading

	GVW	Axle 1	Axle 2	Axle 3	Axle 4	Axle 5
lb	87857	15652	16405	18264	18771	18766
Kg	39844	7098	7440	8283	8513	8511

NOTES

1 Axles are numbered from front of the launch vehicle.

2 Weights are inclusive of crew, but exclusive of fuel 700 lbs (317 kg) and BII 375 lbs. (170 kg) and special kits.

11.12.3 Launch Vehicle Load Class

11.12.3.1 The launch vehicle is classed as MLC 40 wheeled.

11.12.4 DSB M1077 Flatrack Loads

11.12.4.1 The weights of the various flatrack loads are shown in Table 11. 5:

Table 11. 5 Weights of M1077 Flatrack Loads

Designation	Lbs	Kg
LVT	13939	6322
V1	22247	10091
T1	19635	8905
V2	23028	10445
T2	23028	10445
V3	21478	9742
T3	13740	6232

11.13 DSB TRANSPORTATION LOADS

11.13.1 Loading and Securing

11.13.1.1 The DSB system has been designed to be normally transported using M1077 PLS flatracks. The standard bridge set, capable of building one 40-meter bridge or two 20-meter bridges, can be transported, including launching parts, on seven flatracks in addition to the launcher vehicle.

11.13.1.2 The configuration of the flatracks on each vehicle and trailer allows delivery of the items at the necessary location on the bridge site, in the order that they will be required for use.

11.13.2 Transport Parts

11.13.2.1 To assist loading of DSB onto the flatracks a number of de-mountable adapters are provided to aid location of the components. These are loose items, which may readily be applied to any M1077 flatrack without modification.

11.13.3 Launch Beam Adapters

11.13.3.1 These ensure the launch beams are correctly spaced on the flatrack, and prevent the beams shifting when the tie-down straps are tightened. They are of three types:

Bottom - locate on the flatrack deck.

Intermediate - fit on the upper surface of the first tier of launch beams.

Top - fit on the upper surface of the second tier of launch beams.

11.13.4 Buffer

11.13.4.1 A rectangular aluminum plate that attaches to the wall/hookbar frame at the end of the flatrack to provide a location and to prevent the modules jaws from jamming in the hookbar frame.

11.13.5 Module Location Pieces

11.13.5.1 These items assist in the positioning of the bridge modules onto the flatracks. They are of two types:

Bottom - located in the stakeholder pockets of the flatrack and remain in-situ during transportation

Top - located in lower bridge module on flatrack to guide placement of second module, remain in-situ for transportation. They are removed during bridge construction.

Figure 11. 87 Module Location Piece

11.13.6 Special Dunnage Blocks

11.13.6.1 The special dunnage blocks are two hardwood items that are used to support the module lifting beam on the flatrack.

11.13.7 Tie-Down Straps

Three main types of tie down-straps are employed for securing the loads:

(1) A 7-meter long assembly comprising a ratchet with hooks at each end, with a 11023lb (5000kg) minimum breaking strength.

(2) A standard M1077 basic issue item (BII) tie-down strap.

(3) A 2.5m ramp and parallel strap.

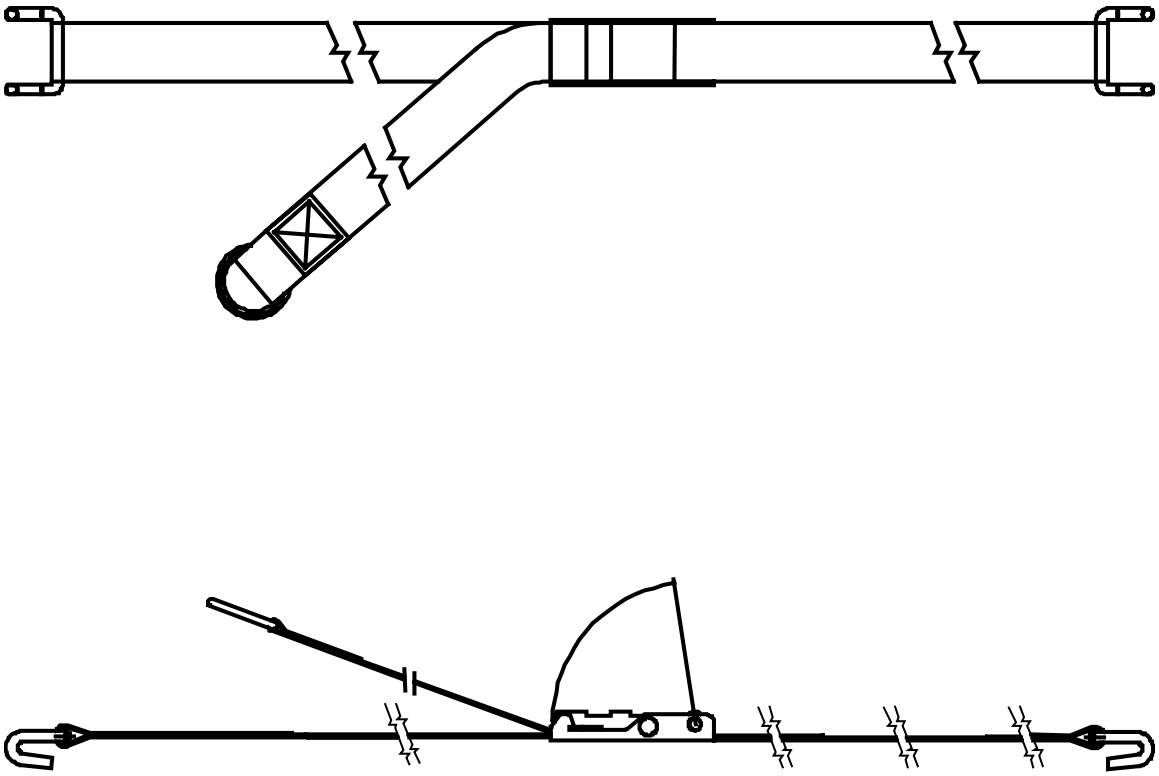


Figure 11. 88 Tie-Down Straps

11.14 LOADING ARRANGEMENTS

11.14.1 Items Lists

11.14.1.1 A summary of the storage arrangements for the items on the launch vehicle is presented in Table 11. 6.

11.14.1.2 The load for flatrack LVT is listed in Table 11. 7 and the load for the LVT storage basket is listed in Table 11. 8.

11.14.1.3 The load for flatrack V1 is listed in Table 11. 9 and for T1 in Table 11. 10.

11.14.1.4 The load for flatrack V2 is listed in Table 11. 11 and for T2 in Table 11. 12.

11.14.1.5 The load for flatrack V3 is listed in Table 11. 13 and for T3 in Table 11. 14.

Table 11. 6 Launcher Load

Component Partcode	Description	Quantity
LAUNCHER COMPRISING:		
G409/5012	LAUNCHER	1
G417/4817	OSHKOSH M1075 CHASSIS	1
G418/4949	ATLAS CRANE 390.1	1
G415/4685	RELAX MECHANISM	1
G415/4640	SLIDE FRAME	1
G414/4614	A-FRAME	1
G414/4597	A-FRAME STABILIZER FOOT	2
G413/4633	LAUNCH FRAME	1
G410/4514	FORWARD LAUNCH BEAM	1
G411/4531	FAR BANK SUPPORT	1
G412/4567	HOME BANK CARRIAGE	1
G412/4568	FAR BANK CARRIAGE	1
G416/4654	TAIL LIFT	1
G416/4815/2	LH REMOVABLE MUDGUARD	1
G416/4815/3	RH REMOVABLE MUDGUARD	1
G416/4872	VEHICLE EXHAUST ELBOW ASSEMBLY	1
G413/4642/2	LOCKING PIN-LAUNCH BEAM	1
G414/4646/12	LOCKING PIN-STABILIZER LEG	2
G414/4646/1	LOCKING PIN-UPPER SLIDE SECTION	2
G414/4646/16	LOCKING PIN-A-FRAME LOWER	2
G414/4646/19	LOCKING PIN-A-FRAME UPPER	2

Table 11. 7 Flatrack LVT

Component Partcode	Description	Quantity
G409/4505	LAUNCH BEAM	7
G416/4674	BOTTOM SPACER BEAM ASSEMBLY	4
G416/4675	INTERMEDIATE SPACER BEAM ASSEMBLY	4
G416/4676	TOP SPACER BEAM ASSEMBLY	4
G416/4680/1	BUFFER ASSEMBLY	1
G416/4785	DOUBLE ENDED RATCHET STRAP	8
G416/4822	MODULE LIFT BEAM TRANSPORT PACKER	2
G418/4967	CRANE RAIL TRANSPORT ADAPTOR	2
G420/4558	MODULE LIFTING BEAM	1

Table 11. 8 LVT Storage Basket

Component Partcode	Description	Quantity
LAUNCH VEHICLE BASKET INCLUDING:		
G416/4933	LVT STORAGE BASKET	1
43550	CLIP PANEL PIN 6653	75
G000/5570/11	ZEBRA TAPE RED/WHITE	1
G016/5024/2	ROAD SIGN POST	4
G016/5024/7	ROAD SIGN	4
G101/5592	CURB LEVER/CARRYING HANDLE	8
G202/6041	END BEAM PINS	8
G316/4740/1	END BEAM GUIDE ASSEMBLY L./H.	1
G316/4740/19	END BEAM WRENCHES	2
G316/4740/2	END BEAM GUIDE ASSEMBLY R/H.	1
G316/5018	END BEAM LIFTING SLING	2
G409/4579	LAUNCH BEAM PIN	2
G413/4749/4	LAUNCH BEAM PIN CLIP	75
G416/4653	MODULE LIFTING SLING	1
G416/4662	LAUNCH BEAM LIFTER	1
G416/4669	REMOVABLE ROLLER ASSEMBLY	4
G416/4680/6	LOCATION PIECE, BOTTOM ASSEMBLY	2
G416/4703	LANYARD	4
G416/4773/1	LAUNCH BEAM PEG SOCKET ASSEMBLY (SPECIAL TOOLS)	1
G416/4773/4	PEG SPANNER OPEN ENDED (SPECIAL TOOLS)	1
G416/4773/5	SLIDE FRAME LOCKING PIN (SPECIAL TOOLS)	4
G416/4943/2	1.75M SAFETY LANYARD	1
G416/4943/7	2 POINT ARRESTER HARNESS	1
G416/4944/1	R/H RAMP LEAD BRACKET	1
G416/4944/2	L/H RAMP LEAD BRACKET	1
G416/4961	BRIDGE SLING HOOK (EXTRACTION TOOL)	2
G416/4968/1	JAW BRUSH	3
G416/4968/2	SCRAPER/BRUSH	2
G418/4615/8	CRANE PIN EXTRACTION TOOL	1
G419/5012/57	PIN PUNCHES	1
G419/5012/58	HEXAGON WRENCH SET (METRIC)	1
G419/5012/59	OFFSET HEXAGON WRENCH	1
VARIOUS	TAIL LIFT PLATFORM HANDRAILS	8

Table 11. 9 Flatrack V1

Component Partcode	Description	Quantity
G101/5575	PARALLEL MODULE	1
G101/5645/2	JAW CONNECTION PIN INCLUDING CLIP	6
G202/6000	RAMP MODULE	1
G416/4680/1	BUFFER ASSEMBLY	1
G416/4680/6	LOCATION PIECE, BOTTOM ASSEMBLY	4
G416/4785	DOUBLE ENDED RATCHET STRAP	6
G416/4912	2.5M RAMP AND PARALLEL STRAP	10
G416/4957	MODULE TRANSPORT AID	4

Table 11. 10 Flatrack T1

Component Partcode	Description	Quantity
5420-99-931-9228	3"X9"X36" PACKING TIMBER	2
G008/4528/8	DEFILE MARKER STRAP ENDLESS 1.5M	2
G016/5016	DEFILE MARKER ASSEMBLY	12
G101/5645/2	JAW CONNECTION PIN INC CLIP	2
G202/6000	RAMP MODULE	1
G303/6102	END BEAM ASSEMBLY (MINUS PINS)	2
G416/4680/1	BUFFER ASSEMBLY	1
G416/4680/6	LOCATION PIECE, BOTTOM ASSEMBLY	4
G416/4776	APPROACH RAMP TRANSPORT BEAM	8
G416/4783	LADDER ASSEMBLY-MODULAR ACCESS	2
G416/4785	DOUBLE ENDED RATCHET STRAP	7
G416/4912	2.5M RAMP AND PARALLEL STRAP	6
G416/4960	APPROACH RAMP TRANSPORT AID	4
G416/4963	RAMP BUFFER ASSEMBLY	1
G507/7000	APPROACH RAMP	20
G507/7003/2	TRANSPORT FRAME (LOWER)	2
G507/7003/3	TRANSPORT FRAME (UPPER)	2
G507/7003/6	APPROACH RAMP STRAP	8

Table 11. 11 Flatrack V2

Component Partcode	Description	Quantity
G101/5575	PARALLEL MODULE	2
G101/5645/2	JAW CONNECTION PIN INCLUDING CLIP	8
G416/4680/1	BUFFER ASSEMBLY	1
G416/4680/6	LOCATION PIECE, BOTTOM ASSEMBLY	4
G416/4785	DOUBLE ENDED RATCHET STRAP	6
G416/4912	2.5M RAMP AND PARALLEL STRAP	10
G416/4957	MODULE TRANSPORT AID	4

Table 11. 12 Flatrack T2

Component Partcode	Description	Quantity
G101/5575	PARALLEL MODULE	2
G101/5645/2	JAW CONNECTION PIN INCLUDING CLIP	8
G416/4680/1	BUFFER ASSEMBLY	1
G416/4680/6	LOCATION PIECE, BOTTOM ASSEMBLY	4
G416/4785	DOUBLE ENDED RATCHET STRAP	6
G416/4912	2.5M RAMP AND PARALLEL STRAP	10
G416/4957	MODULE TRANSPORT AID	4

Table 11. 13 Flatrack V3

Component Partcode	Description	Quantity
G101/5645/2	JAW CONNECTION PIN INCLUDING CLIP	4
G202/6000	RAMP MODULE	2
G416/4680/1	BUFFER ASSEMBLY	1
G416/4680/6	LOCATION PIECE, BOTTOM ASSEMBLY	4
G416/4785	DOUBLE ENDED RATCHET STRAP	6
G416/4912	2.5M RAMP AND PARALLEL STRAP	10
G416/4957	MODULE TRANSPORT AID	4
G416/4963	RAMP BUFFER ASSEMBLY	1

Table 11. 14 Flatrack T3

Component Partcode	Description	Quantity
5420-99-931-9228	3"X9"X36" PACKING TIMBER	2
G008/4528/8	DEFILE MARKER STRAP ENDLESS 1.5M	2
G016/5016	DEFILE MARKER ASSEMBLY	12
G303/6102	END BEAM ASSEMBLY (MINUS PINS)	2
G416/4776	APPROACH RAMP TRANSPORT BEAM	8
G416/4785	DOUBLE ENDED RATCHET STRAP	8
G507/7000	APPROACH RAMP	20
G507/7003/2	TRANSPORT FRAME (LOWER)	2
G507/7003/3	TRANSPORT FRAME (UPPER)	2
G507/7003/6	APPROACH RAMP STRAP	8
ANCHOR BASKET INCLUDING:		
25083	PIN BRACING MEMBER	8
G016/5016/7	ROAD FORM SPIKES	24
G016/5210	BAG FOR ROAD FORM SPIKES	2
36770	BEAM ANCHORAGE C/W SHACKLES	8
FV598860	ANCHOR EARTH HOLDFAST	16
G000/5570/15	TIRFOR T532 C/W HANDLE	8
G101/5597	HOLD FAST SPIKE	128
G416/4939	ANCHORAGE STORAGE BOX	2
G416/4968/3	PNEUMATIC DRIVE ADAPTOR	1
G416/4968/4	PNEUMATIC HAMMER INC HOSE & ADAPTOR	1
G616/5032	WIRE ROPE 40FT	8

Section V. FLATRACK LOADING AND STRAPPING

11.15 LOADING FLATRACKS

11.15.1 Vehicle Load V1, V2, V3, and Trailer Load T2

NOTE

All latch points shown are identified by circled callouts.

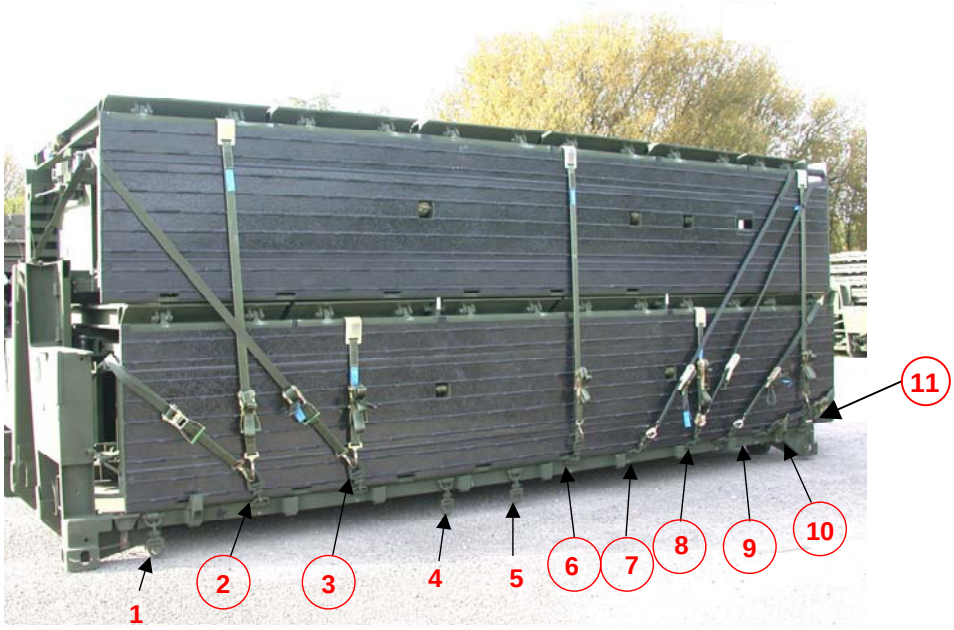


Figure 11. 89 V1 - Parallel and Ramp

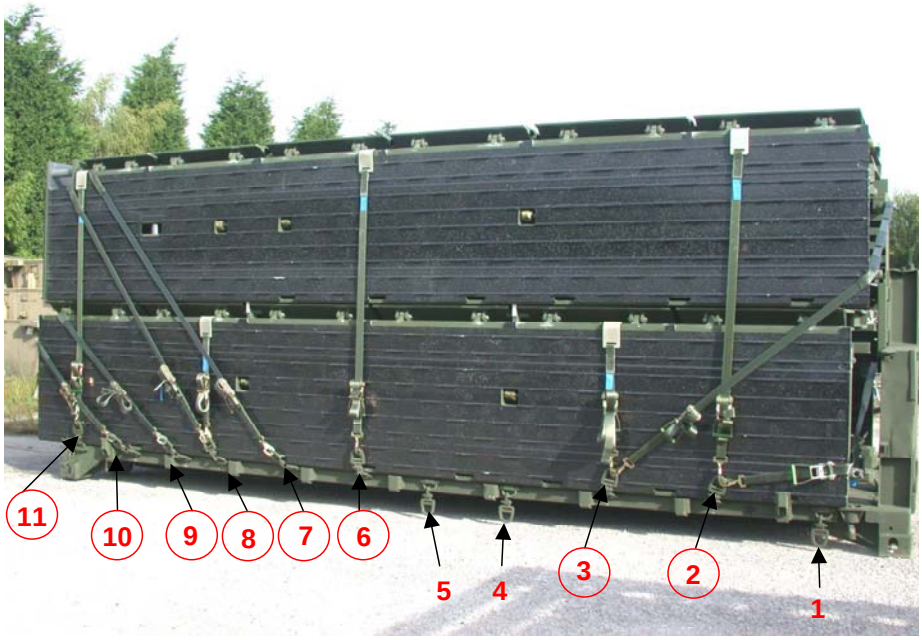


Figure 11. 90 V1 - Parallel and Ramp Module End Strapping

NOTE

All latch points shown are identified by circled callouts.

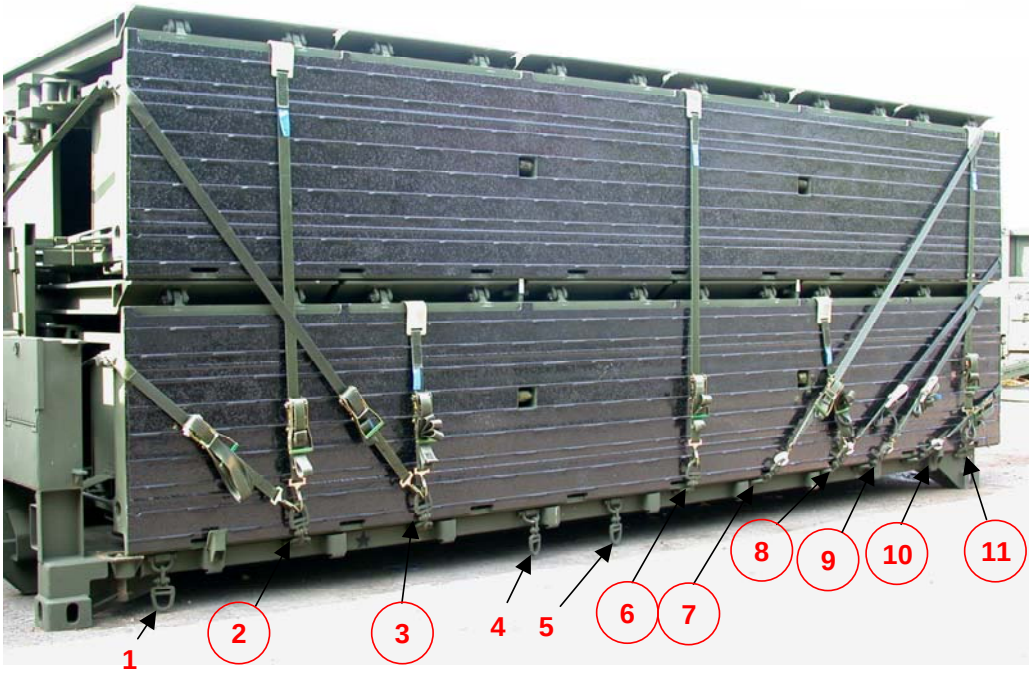


Figure 11. 91 V2 - Parallel and Parallel

Figure 11. 92 V2 - Parallel and Parallel (End Strapping)

NOTE

All latch points shown are identified by circled callouts.

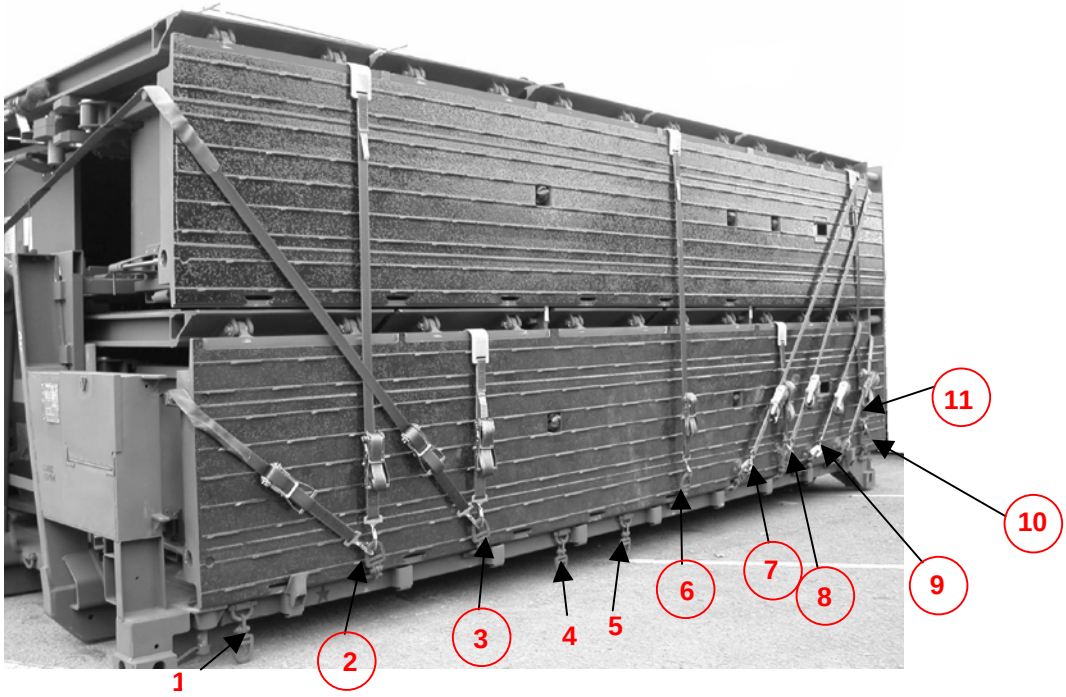


Figure 11. 93 V3 - Ramp and Ramp (Front View)

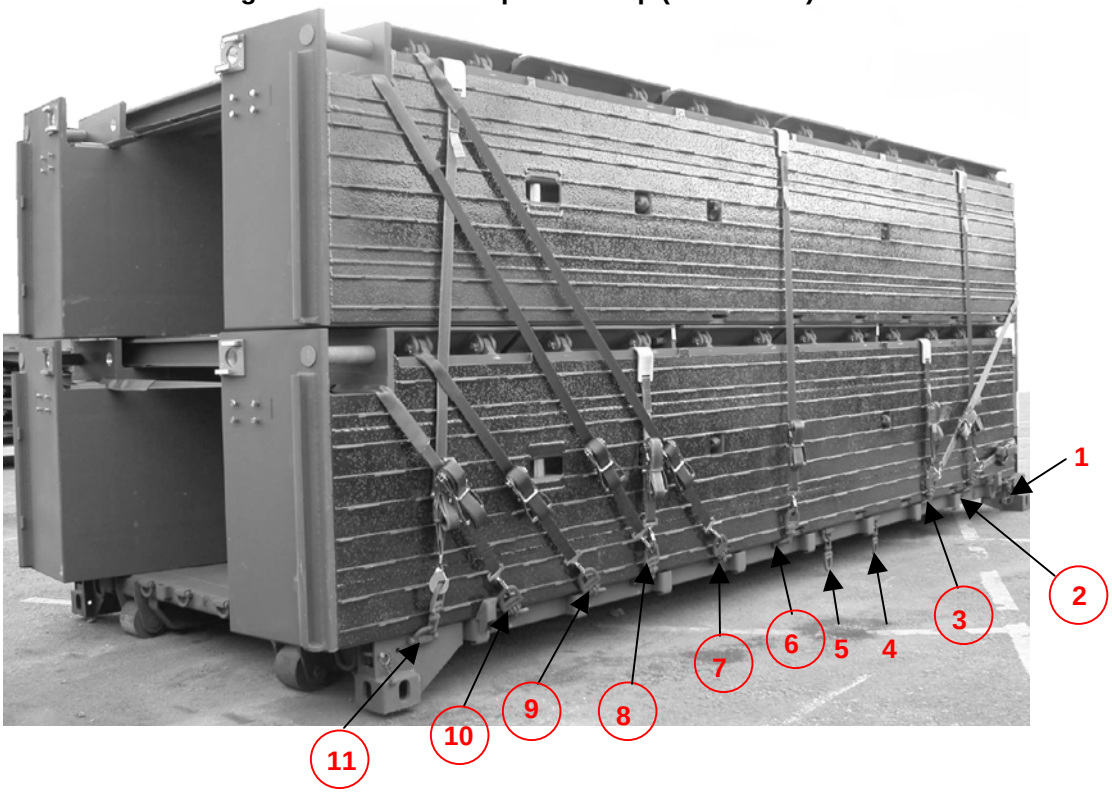


Figure 11. 94 V3 - Ramp and Ramp (End View)

NOTE

All latch points shown are identified by circled callouts.

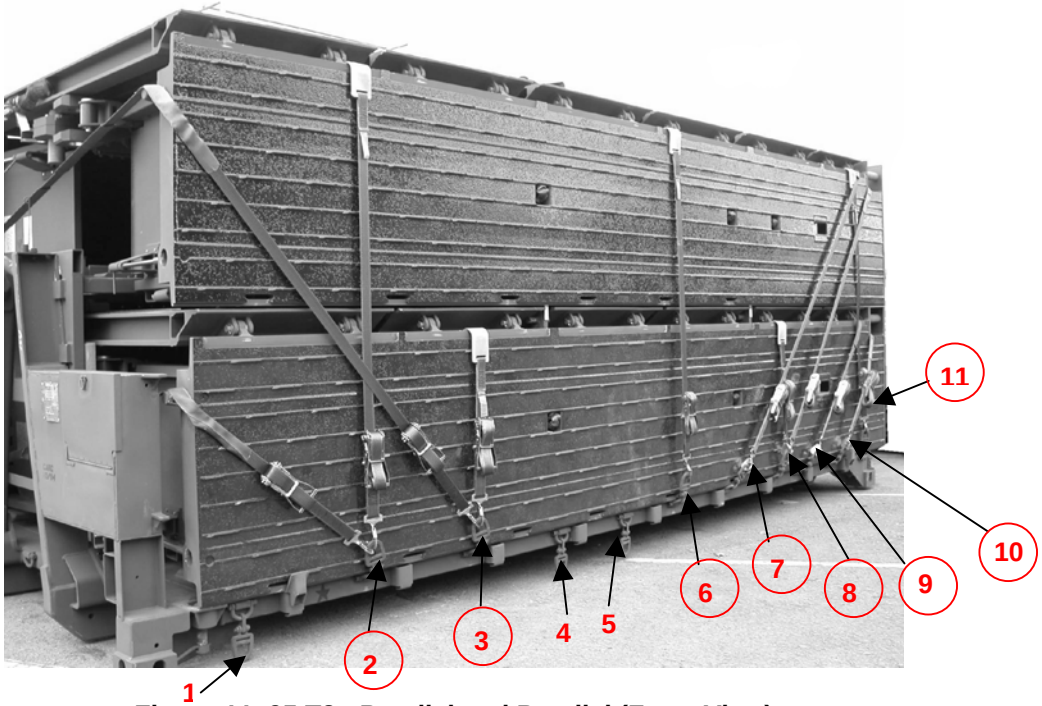


Figure 11. 95 T2 - Parallel and Parallel (Front View)

Figure 11. 96 T2 - Parallel and Parallel Module (End Strapping)

NOTE

The ramp module jaws and dowel end must face the front of the flatrack. Load T1 and V3 have a wooden spacer (Ramp Buffer assembly) to prevent the jaws from fouling the flatrack.

11.15.1.1 Install buffer to flatrack wall/hookbar (see Figure 11. 116).

11.15.1.2 Fit four bottom location pieces, one at each corner, into convenient stake pockets of the flatrack. Place a bridge module on to the flatrack using the location pieces as a guide, positioning the module as close to the buffer on the front of the flatrack as possible.

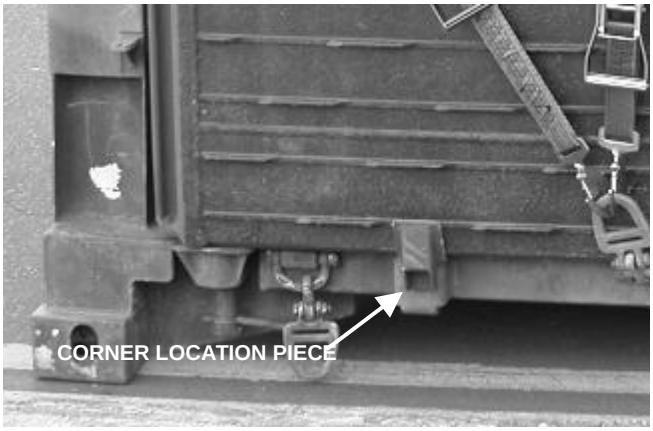


Figure 11. 97 Corner Location Piece Fitted to Flatrack

11.15.1.3 Fit four transportation aides, two per side, in between the deck units as shown. The transportation aides being placed between the deck units through which the closing slings are accessed.

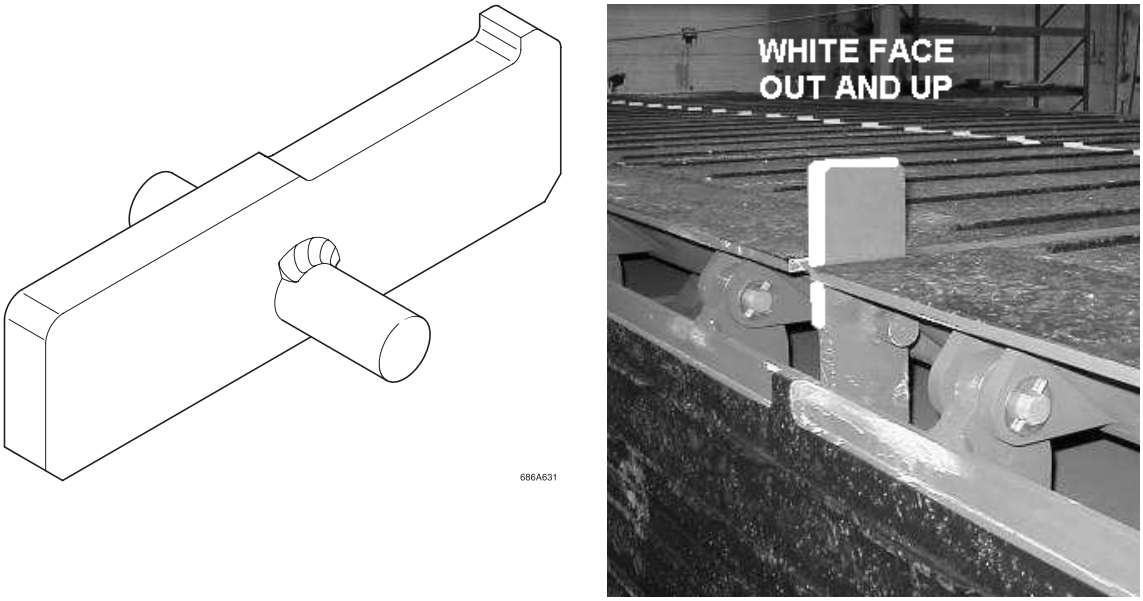


Figure 11. 98 Transportation Bracket Fitted to Bridging Module

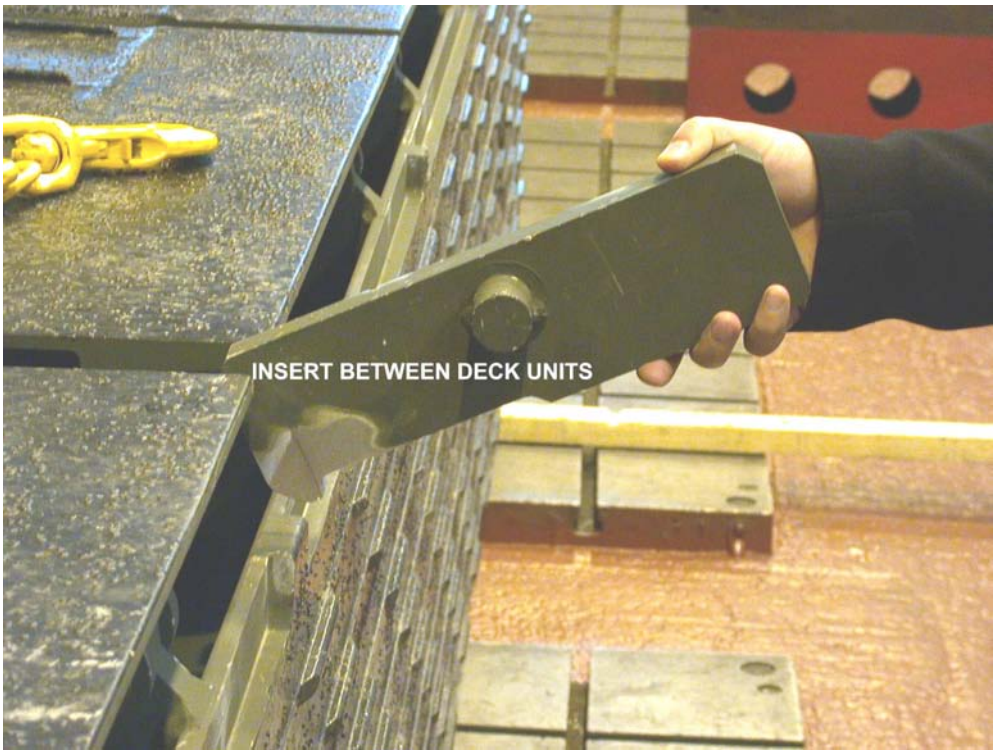


Figure 11. 99 Transport Aid Insertion

Figure 11. 100 Transport Aid Inserted Under Deck Unit

Figure 11. 101 Final Position

Figure 11. 102 Lower Top Module Onto Aid

WARNING

CRUSH HAZARD. KEEP HANDS CLEAR OF THE TWO MODULES AS THE UPPER MODULE IS LOWERED INTO PLACE. FAILURE TO HEED THIS INSTRUCTION COULD LEAD TO SEVERE INJURY TO PERSONNEL.

NOTE

When a ramp module is placed on top of another module the jaw and dowel end must face the front of the flatrack.

11.15.1.4 Place the second bridge module on to the first using the transportation brackets as a guide, positioning the module as close to the buffer as possible.

11.15.1.5 Fit five tie-down straps to each side of the stacked modules, and two diagonal straps at the front end of the flatrack and four diagonal straps at the open end of the flatrack. Tighten using the ratchets.

11.15.2 Trailer Load T1

NOTE

All latch points shown are identified by circled callouts.

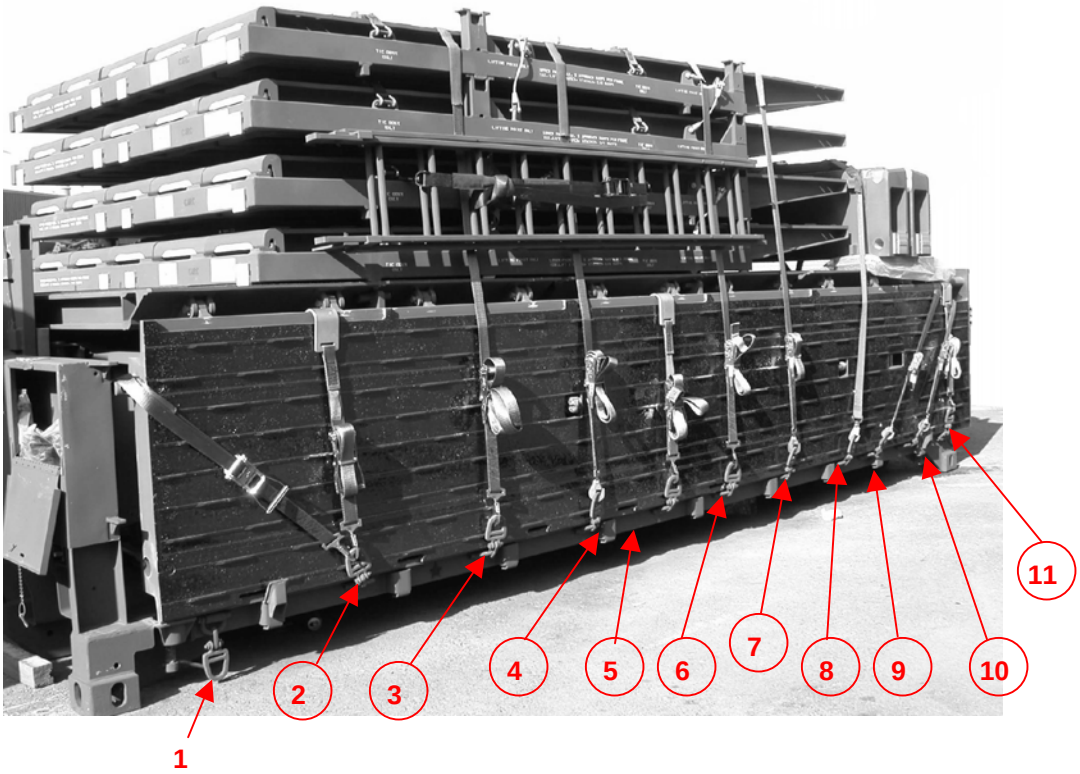
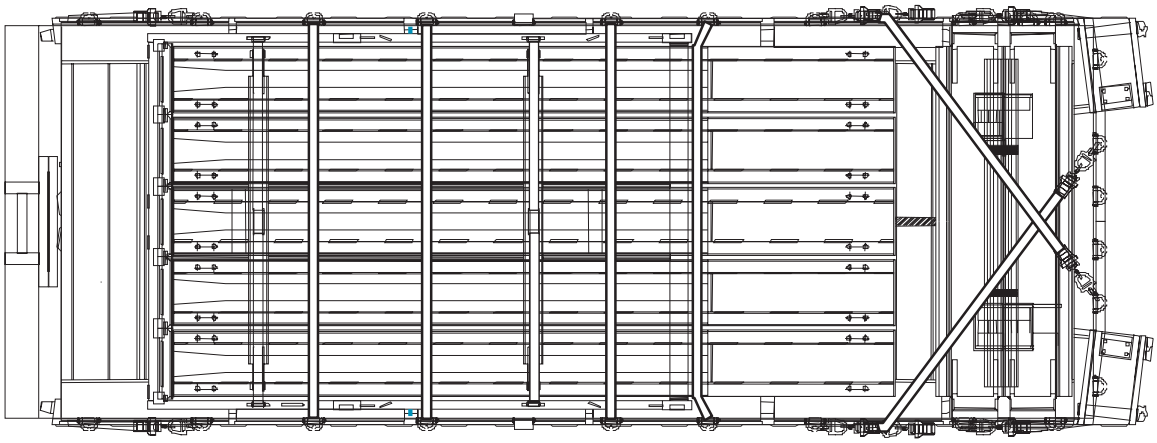


Figure 11. 103 T1 - Ramp, Approach Ramps, Access Ladders and End Beams

Figure 11. 104 T1- Ramp, Approach Ramps, Access Ladders and End Beams Diagonal Strapping



686A814b

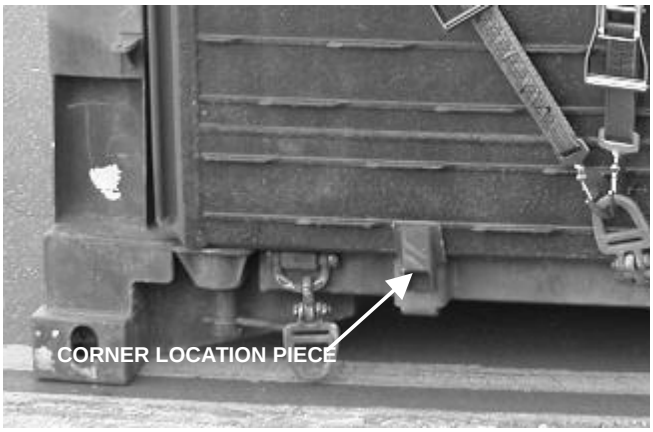
Figure 11. 105 Plan View of Flatrack T1 strapping

NOTE

When ramp modules are positioned directly onto a flatrack the jaw end of the ramp must face rearwards.

11.15.2.1 Install buffer to flatrack wall/hookbar (see Figure 11. 116).

11.15.2.2 Fit four bottom location pieces, one at each corner, into convenient stake pockets of the flatrack. Place a ramp module on to the flatrack using the location pieces as a guide, positioning the module as close to the buffer as possible.



Corner Location Piece Fitted to Flatrack

11.15.2.3 Fit three transportation straps along each side of the module and tighten using the ratchets.

11.15.2.4 Fit a diagonal transportation strap at each end of the ramp module and tighten using the ratchets.

11.15.2.5 Fit the four approach ramp transport aids to the ramp module deck units between the 1st and the 2nd deck unit from the jaw end and between 3rd and 4th deck unit from the jaw end.

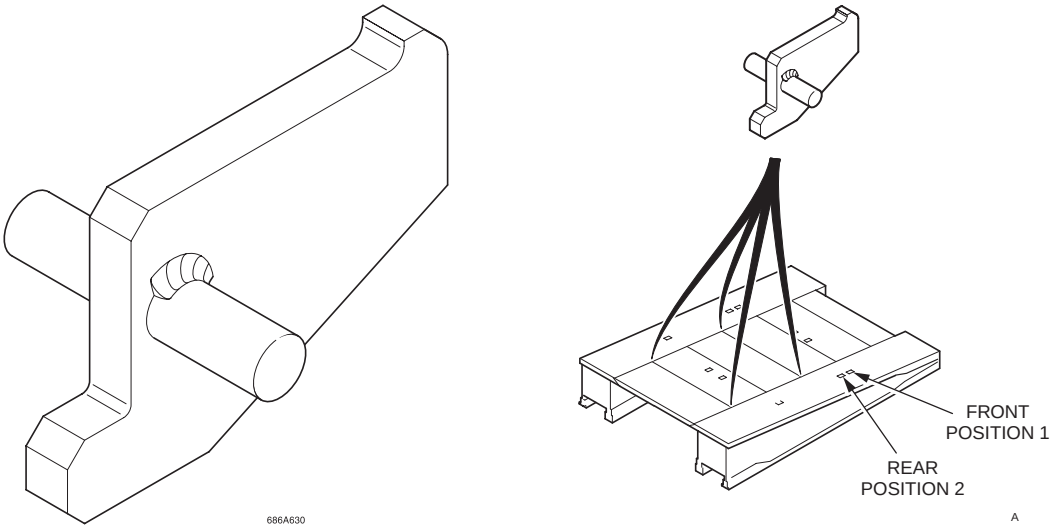


Figure 11. 106 Approach Ramp Frame Transport Aid

11.15.2.6 Position and centralize a loaded approach ramp frame onto the ramp module ensuring that the location pads locate into the gaps in between the decks. Use the centerline marked along the module deck as a guide. Place a further three approach ramp frames on top ensuring that the location pads fit into the recesses in the posts of the frame below.

11.15.2.7 On each side, hook the top end of a module access ladder around the approach ramp frame posts allowing the other end to rest on the deck of the ramp module. Secure each ladder by passing a BII strap through the rungs and around the frame posts.

11.15.2.8 Fit four transportation straps around and over the top of the stack of approach ramp frames and tighten using the ratchet. Two straps pass diagonally around the posts on the upper frame.

11.15.2.9 Position two bridging timbers longitudinally on the edges of the module deck towards the rear. Place two end beams with their lipped rails facing outwards on these timbers. Bundle the 12 defile markers into two nesting layers of six. Secure together using two 1.5-meter cam buckle straps and place the bundle on top of the end beams.

11.15.2.10 Fit two flatrack BII straps around the end beams and tighten using the ratchets.

NOTE

All latch points shown are identified by circled callouts.

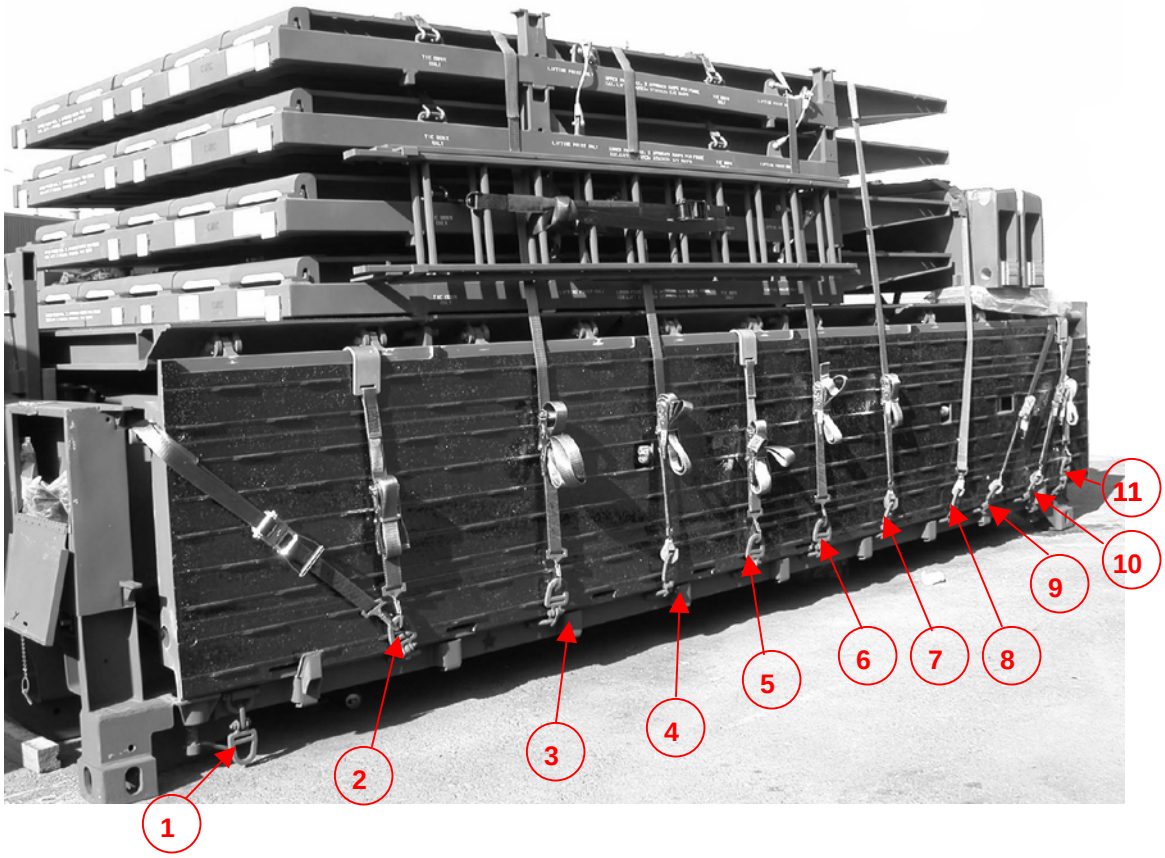


Figure 11. 107 T1 - Strapping of Approach Ramps and End Beams

11.15.3 Vehicle Load V3 and T3

NOTE

All latch points shown are identified by circled callouts.

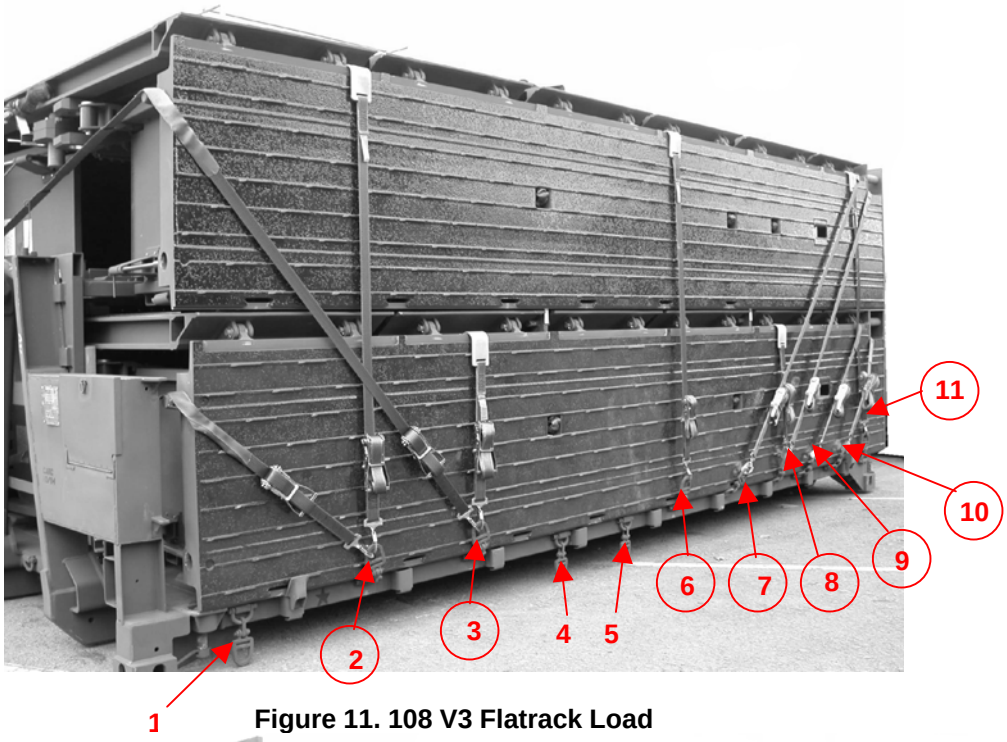


Figure 11. 108 V3 Flatrack Load

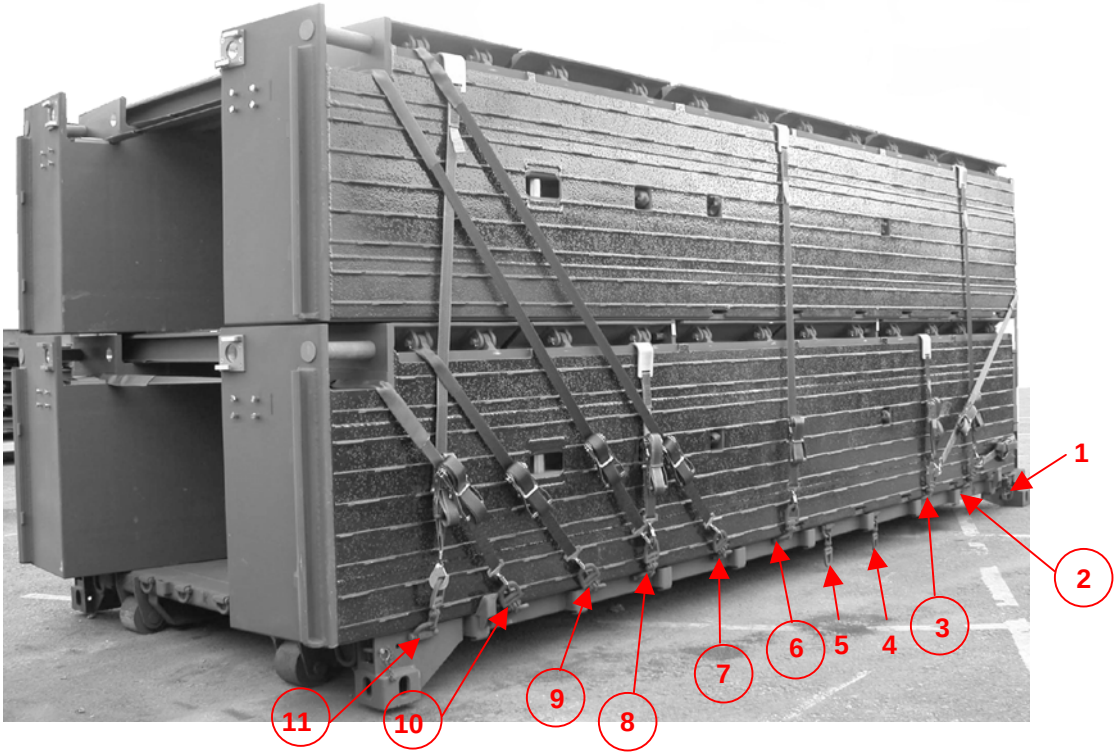


Figure 11. 109 Flatrack Load V3 End Strapping

NOTE

All latch points shown are identified by circled callouts.

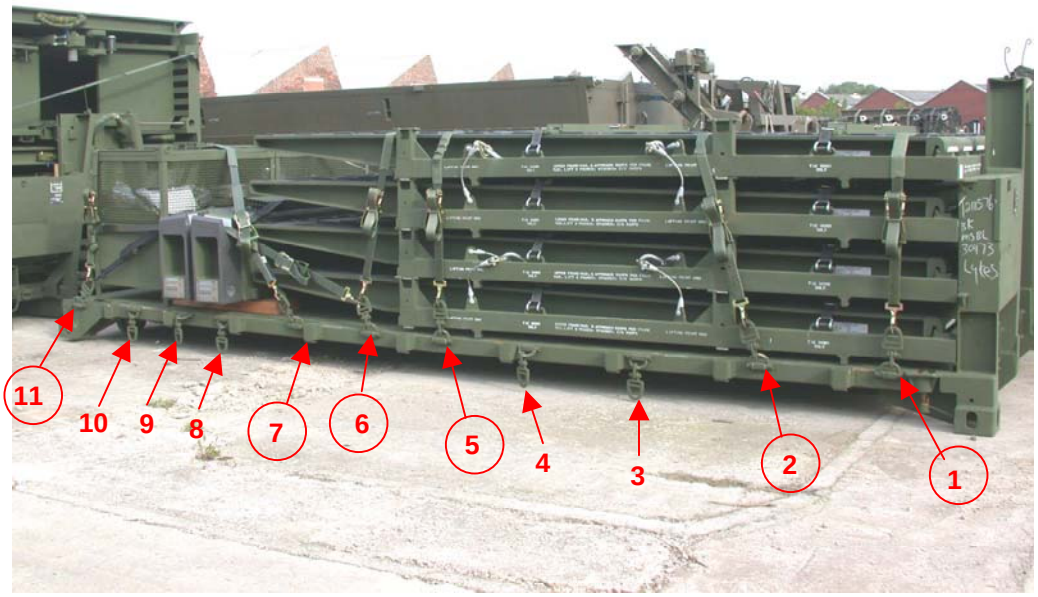


Figure 11. 110 T3 Flatrack Load

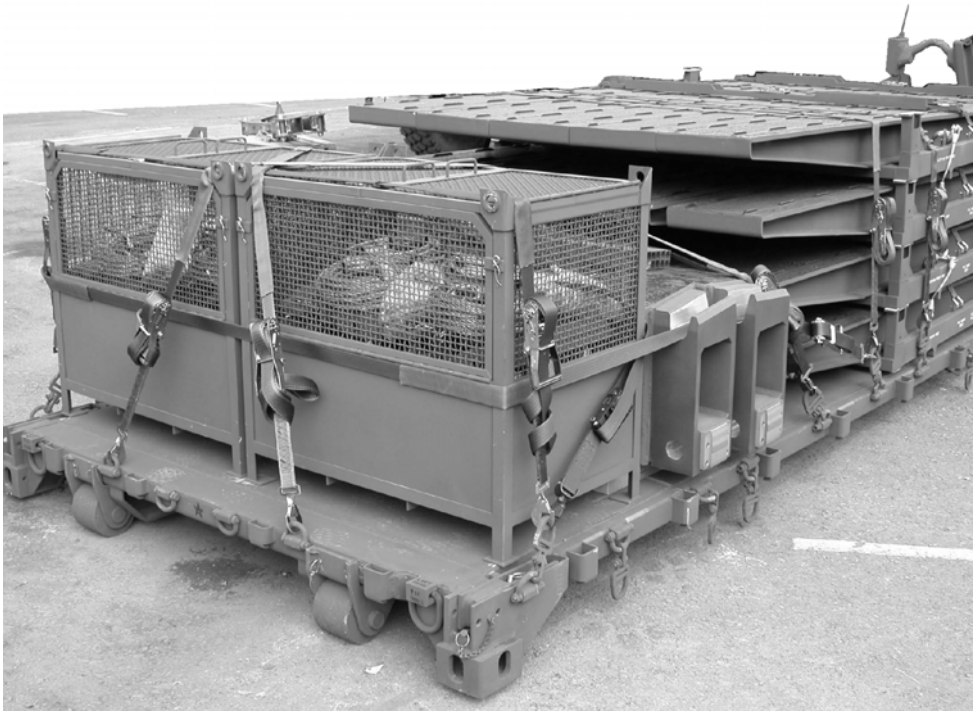
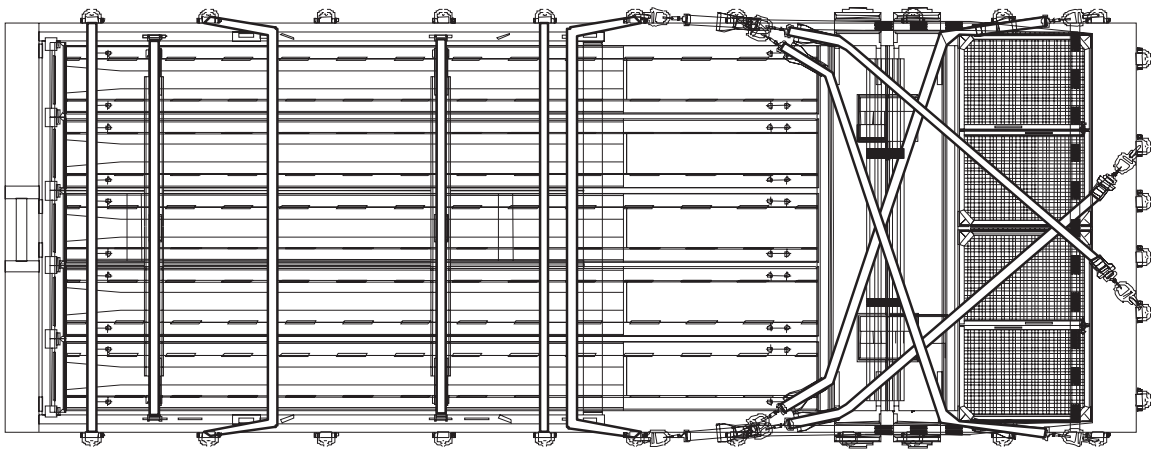


Figure 11. 111 T3 Flatrack End Strapping



686A810b

Figure 11. 112 T3 Flatrack Plan View of Strapping

11.15.3.1 Install the buffer to flatrack wall/hookbar (see 11.116).

11.15.3.2 Position and centralize a loaded approach ramp frame onto the flatrack. Place a further three approach ramp frames on top, ensuring that the location pads fit into the recesses in the posts of the frame below.

11.15.3.3 Fit four transportation straps around and over the top of the stack of approach ramp frames and tighten using the ratchet. Two straps pass diagonally around the posts on the upper frame.

11.15.3.4 Position two bridging timbers longitudinally on the edges of the module deck towards the rear. Place two end beams with their lipped rails facing outwards on these timbers. Bundle the 12 defile markers into two nesting layers of six. Secure together using two 1.5-meter cam buckle straps and place the bundle on top of the end beams.

11.15.3.5 Fit two flatrack BII straps around the end beams and tighten using the ratchets.

11.15.3.6 Place the two anchorage baskets at the rear of the flatrack and secure using three transportation straps. One strap running across the load from left to right, the remaining two running diagonally opposite across the anchorage baskets.

11.15.4 The LVT Flatrack

NOTE

All latch points shown are identified by circled callouts.

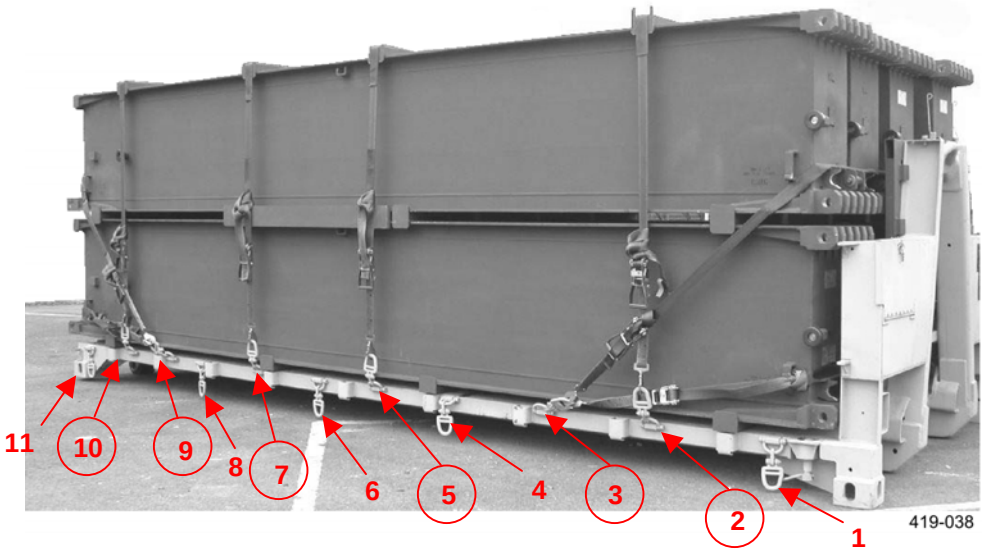


Figure 11. 113 Flatrack LVT Load Strapping

11.15.4.1 Install buffer to flatrack wall/hookbar (see Figure 11.116).

11.15.4.2 Fit four bottom launch beam adapters to the flatrack at the positions indicated, locating them in the stake pockets. Thread a BII strap under each of the two adapters nearest the front of the flatrack. Locate the straps as shown above.

NOTE

The adapters are fitted with pads on their underside, which provide necessary clearance for the straps. Ensure that the straps do not sit beneath the pads.

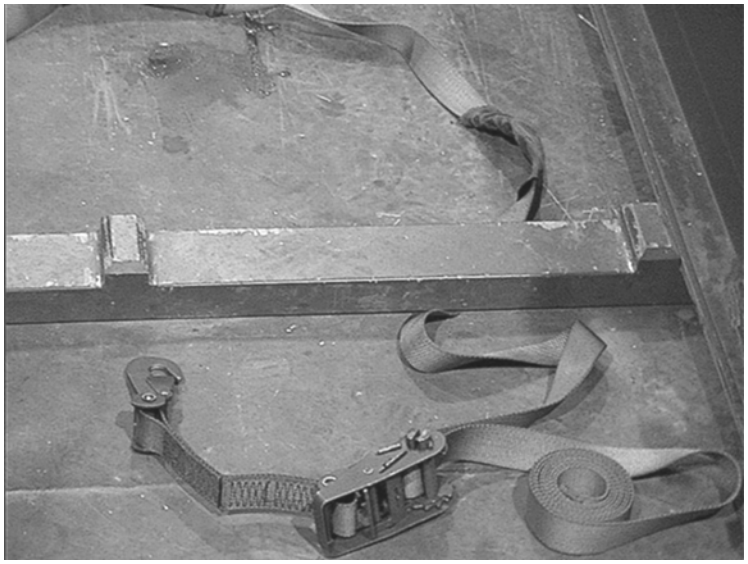


Figure 11. 114 Launch Beam Adapter

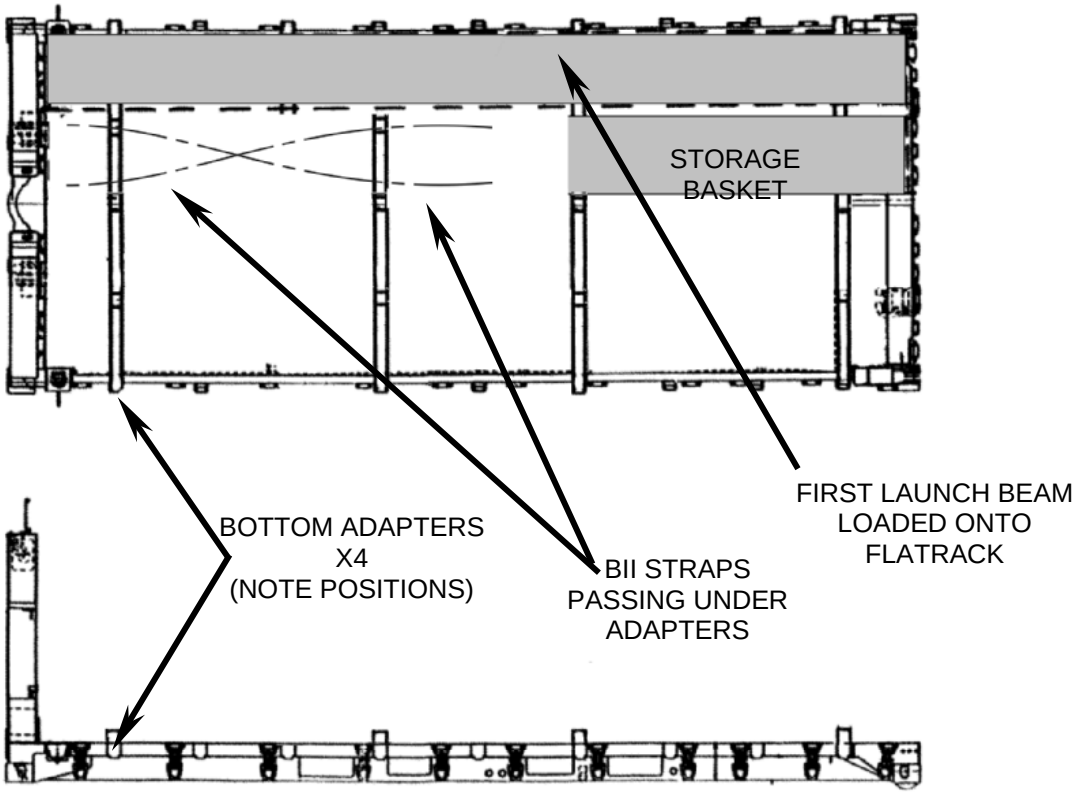


Figure 11. 115 Positioning of Launch Beams on Flatrack

11.15.4.3 Place the launch equipment storage basket in position as shown ensuring that it is correctly seated over the launch beam adapters.

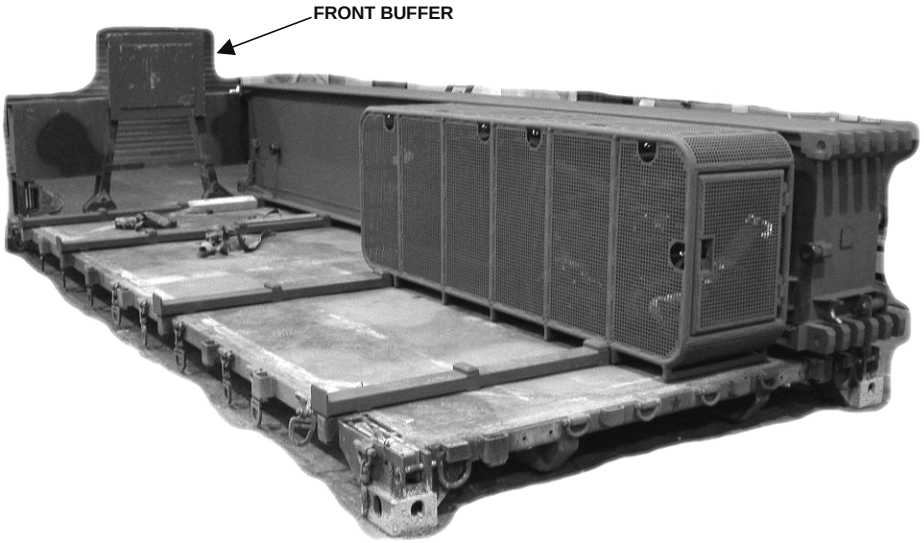


Figure 11. 116 Location of Front Buffer

11.15.4.4 Stow all loose items listed in Section 11-98 Table 11. 7 into the launch equipment storage basket as described in Section 11.15.4.

Figure 11. 117 LVT BII Bridging Basket

11.15.4.5 Position the two special dunnage blocks, one over each of the two adapters towards the front of the flatrack. The dunnage fits over the adapter and should be located against the spacers. Note that the width of the dunnage makes allowance for the BII straps.

11.15.4.6 Fold in the arms of the module lifting beam and secure with the shootbolts.

11.15.4.7 Crane in the module lifting beam, positioning it as close to the hook frame as possible and centrally between the (launch beam) spacers of the adapters. Lower onto the dunnage. Ensure that it does not sit on the lifting hooks attached to the ends of the arms. To prevent this, lift the hooks clear before lowering.

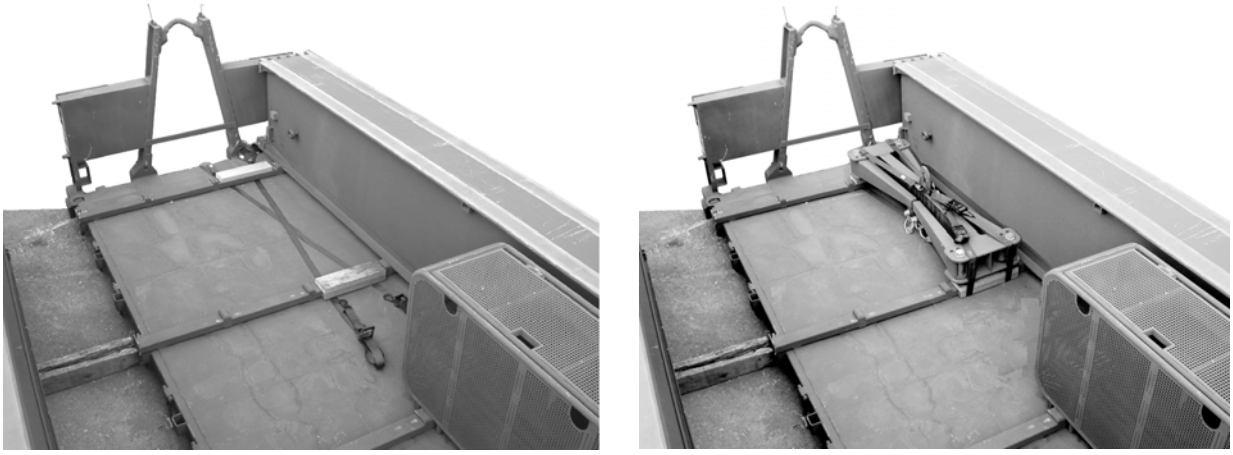


Figure 11. 118 Bridge Module Lifter Folded and in Position on LVT Flatrack

11.15.4.8 Disconnect the 2-meter lifting sling from the module lifting beam.

11.15.4.9 Place the lifting beam and secure using the two previously placed straps which pass beneath the adapters.

11.15.4.10 Place two launch beams onto the flatrack, one positioned on the outside, the other next to it, adjacent to the previously installed BII straps and basket. Locate the launch beams in between the spacer blocks on the adapters and close against the end wall of the flatrack.

11.15.4.11 Place a third launch beam on to the flatrack ensuring that it does not foul the module lifting beam or basket loads.

11.15.4.12 Place four intermediate flatrack adapters across the launch beams at the positions shown. Load the remaining four launch beams onto these adapters.

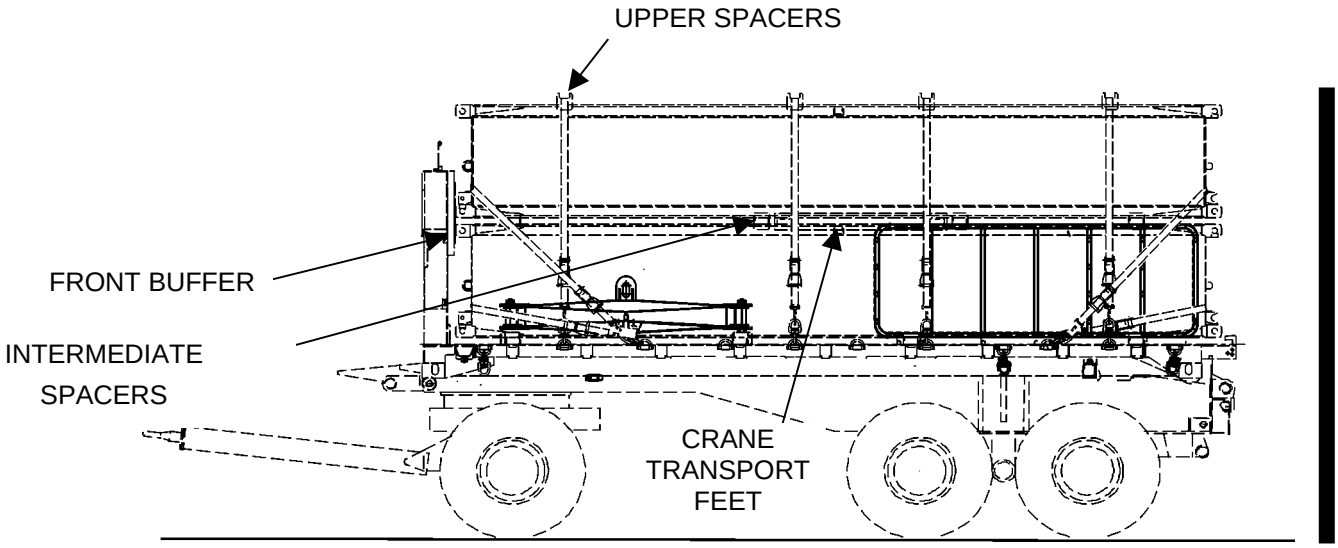


Figure 11. 119 Location and Positioning of Spacers and Crane Transport Feet

11.15.4.13 Place four top flatrack adapters across the launch beams at the positions shown. Secure with eight tie-down straps, one at each spacer position and two diagonals at each end of the load. Slide the crane transport feet between the lower and upper tiers of launch beams in the position shown. Ensure that the straps pass through the guides in the top adapters and that two diagonal straps are located at each end of the flatrack load.

11.15.5 LVT Bridging Basket

11.15.5.1 Bridging baskets are used to store loose items of equipment to help prevent loss and damage in transit. There are two types of bridging basket supplied as part of the DSB system, a single long basket, which is part of the LVT flatrack load, and two smaller baskets which form part of T3 flatrack load.

11.15.5.2 It is essential that after the bridging baskets have been packed that, their doors are secured with an R Clip (See Figure 11.120).

11.15.5.3 The LVT bridging basket is loaded as follows:

1 Tail lift hand rails.

2 Road sign poles.

3 Road signs.

4 Removable rollers.

5 End beam guide.

6 All remaining small items.

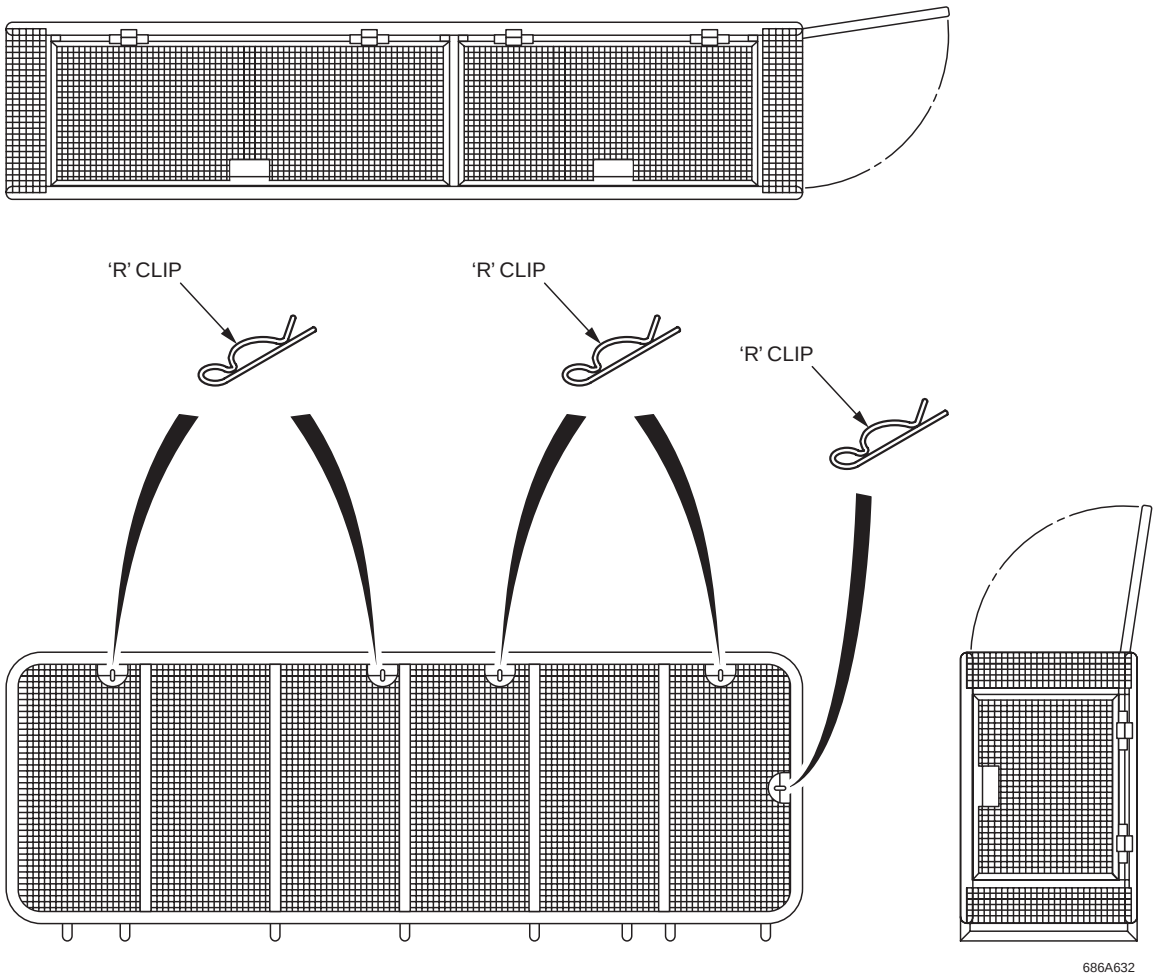


Figure 11. 120 Securing Bridging Basket Doors

11.15.5.4 The following figures illustrate the loading sequence of the LVT basket.

Figure 11. 121 Tail-lift Handrails and Removable Rollers Stowed

Figure 11. 122 Position of Equipment in LVT Bridging Basket

Figure 11. 123 Ramp End Beam Adapter Stowed

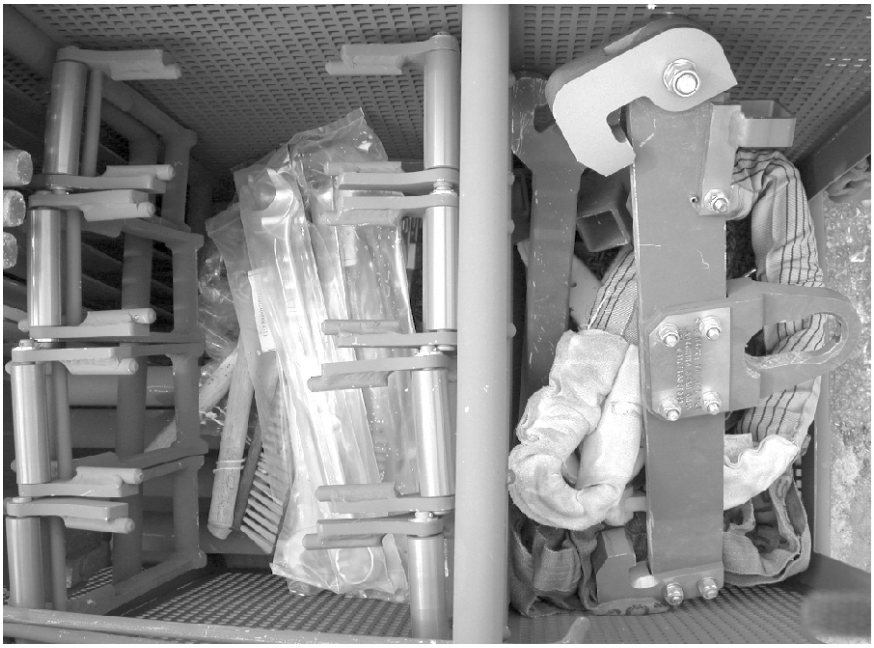


Figure 11.124 Launch Beam Lifter and Small Items Stowed

Figure 11. 125 LVT Bridging Basket Packed

TABLE OF CONTENTS

CHAPTER 12

OPERATING UNDER UNUSUAL CONDITIONS

Section I. OPERATING IN EXTREME CONDITIONS

12.1 OPERATING THE LAUNCH VEHICLE IN EXTREME HEAT

CAUTION

Equipment damage. When operating launch vehicle in very hot temperatures of above 100 degrees F (38 degrees C), extra care must be taken to prevent overheating engine (temperatures over 230 degrees F (110 degrees C)) and transmission (temperatures over 250 degrees F (121 degrees C)). Watch water and transmission temperature gauges closely.

Equipment damage. Check oil levels often and keep operating temperatures as low as possible. Truck cooling and lubrication systems support each other. Failure of one system may rapidly cause failure of other system.

Equipment damage. Check interface panel for any warning lights when in launch conditions.

12.1.1 In Transit Conditions

12.1.1.1 Keep operating temperature as low as possible.

12.1.1.2 Put the transmission range selector (Figure 12. 1.1) in Neutral (N) position while engine is running. Let the engine idle for about two minutes before shutting down. Idling will cool the engine faster than quick shutdown and may prevent damage from remaining engine heat.

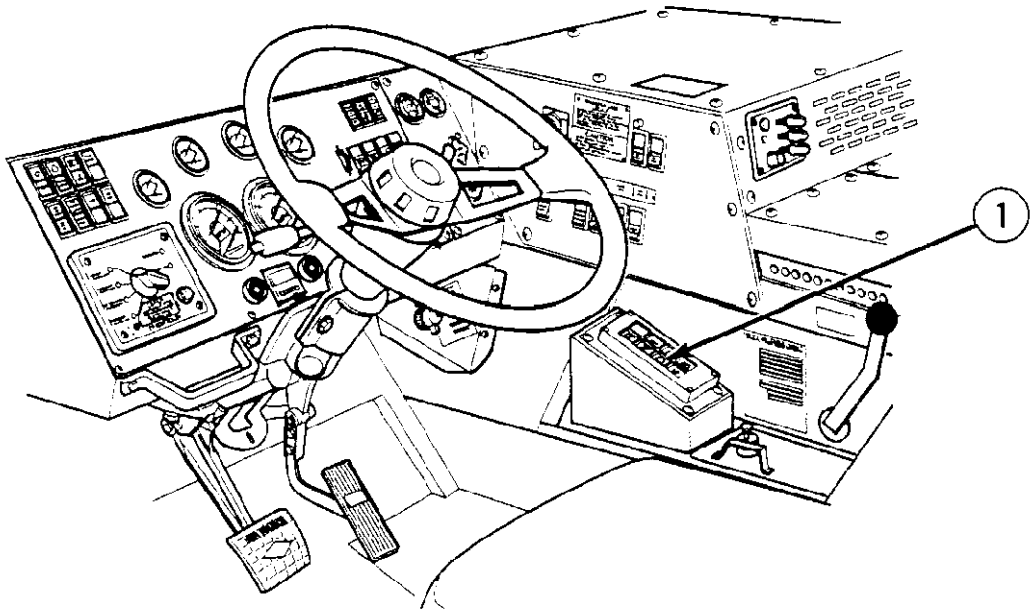


Figure 12. 1 Transmission Selector

12.1.1.3 Stop the launch vehicle for cooling off periods. Idle engine as often as possible.

12.1.1.4 Check the oil levels often. Oil seals are more likely to leak in extreme hot weather.

NOTE

If the temperature of the transmission fluid is above 270 degrees F (132 degrees C) the CHECK TRANS light will come on.

12.1.1.5 If the TRANS TEMP gauge (Figure 12. 2. (2)) reads higher than 250 degrees F (121 degrees C), do the following:

a. Stop the launch vehicle and put the selector (Figure 12. 1 (1)) in the Neutral (N) position while the engine is running to reduce the idle speed.

b. When the TRANS TEMP gauge (Figure 12. 2. (2)) reads in the normal range, return the selector (Figure 12. 1 (1)) to its correct position and continue the journey.

c. If the TRANS TEMP gauge (Figure 12. 2. (2)) does not return to the normal range, stop the truck and let the transmission cool.

d. When the TRANS TEMP gauge (Figure 12. 2. (2)) reads in normal range, start engine, return rotary switch to its previous position and continue build.

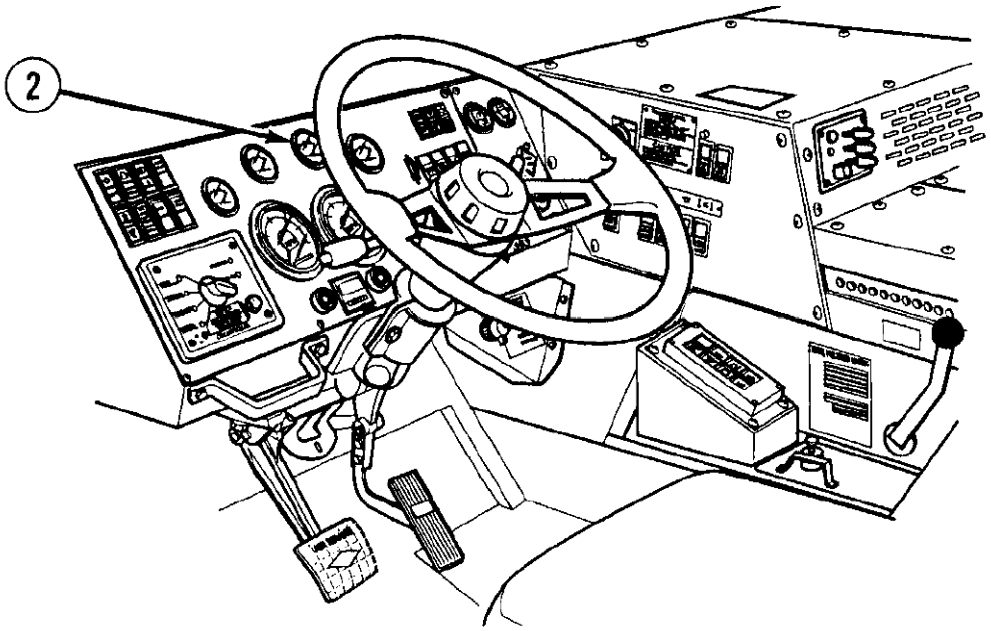


Figure 12. 2 Trans Temp Gauge

12.1.2 In Launch Conditions

12.1.2.1 Keep the operating temperature as low as possible.

12.1.2.2 Stop the launch in safe condition, turn the 4 position rotary switch to position 1 to reduce the idle speed while engine is running. Let the engine idle for about two minutes before shutting down. Idling will cool the engine faster than quick shutdown and may prevent damage from remaining engine heat.

12.1.2.3 Stop the launch vehicle for cooling off periods. Idle engine as often as possible.

12.1.2.4 Check the oil levels often. Oil seals are more likely to leak in extreme hot weather.

12.1.2.5 If the temperature of the transmission fluid is above 270 degrees F (132 degrees C) the CHECK TRANS light will illuminate.

12.1.2.6 If the TRANS TEMP gauge (Figure 12. 2. (2)) reads higher than 250 degrees F (121 degrees C), do the following:

e. Stop launch in safe position and turn 4 position rotary switch to position 1 whist engine is running to reduce idle speed.

f. When the TRANS TEMP gauge (Figure 12. 2. (2)) reads in normal range, return rotary switch to its previous position and continue build.

g. If the TRANS TEMP gauge (Figure 12. 2. (2)) does not return to normal range, stop engine and let transmission cool.

h. When the TRANS TEMP gauge (Figure 12. 2. (2)) reads in normal range, start engine, return rotary switch to its previous position and continue build.

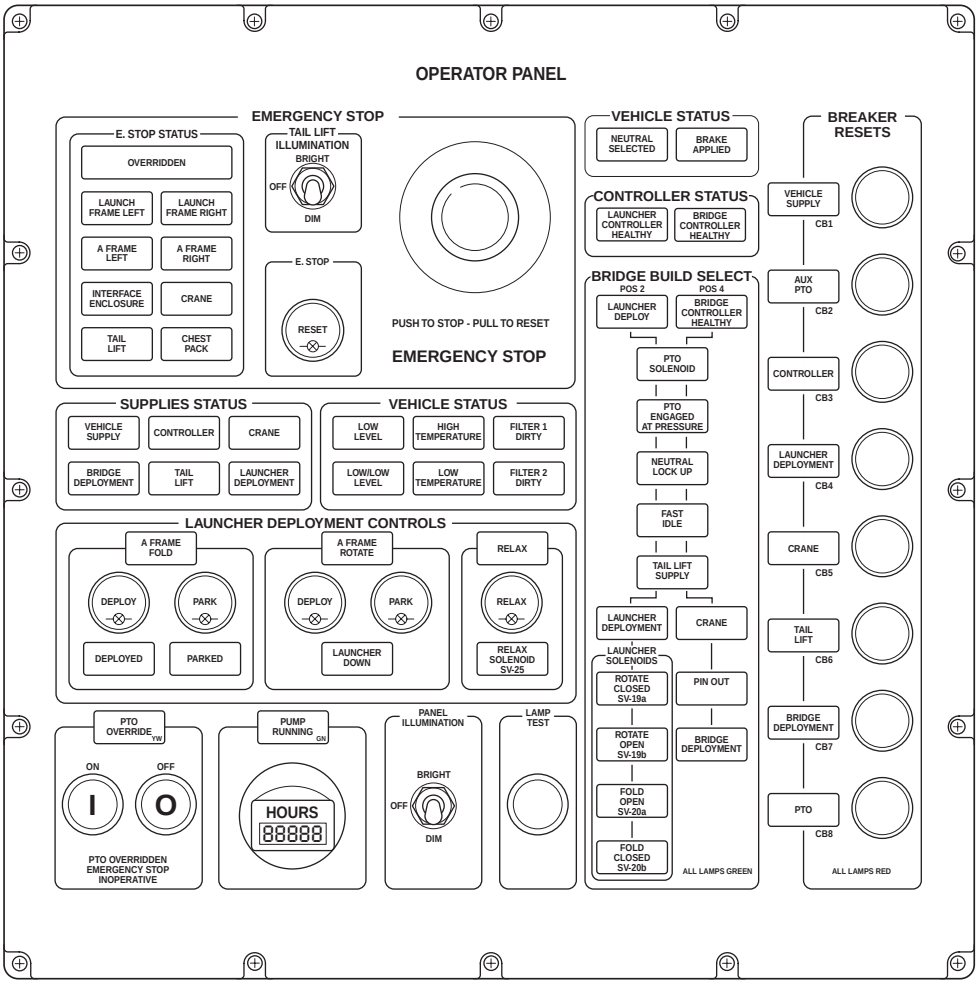
12.1.2.7 If temperature of the hydraulic fluid is above 212 degrees F (100 degrees C), the **HIGH TEMPERATURE** oil light will illuminate on the interface panel and the chest pack fault light will flash. If the HIGH TEMPERATURE warning comes on, do the following:

a. Stop launch in safe condition and turn 4 position rotary switch to position 1 to reduce idle speed.

b. When the HIGH TEMPERATURE warning light goes off, return rotary switch to its previous position and continue build.

c. If the HIGH TEMPERATURE warning light does not go off, stop truck and let the hydraulic oil cool.

d. When the HIGH TEMPERATURE warning light goes off, return rotary switch to its previous position and continue the build.



686A352a

Figure 12. 3 Interface Front Panel

12.1.3 In Transit or Launch Conditions

12.1.3.1 Check the cooling system often. If any of the following conditions are found, notify Unit Maintenance:

a. Low coolant level in radiator.

b. Leaking hose connections which have been tightened but still leak.

c. Cracked or leaking hoses.

d. Radiator fins plugged with dust, leaves or insects.

NOTE

Batteries do not hold charge well in extreme heat. Battery will be tagged for use in tropical conditions and will have a white circle printed on top. Battery specific gravity must be changed to adjust for heat (TM 9-6140-200-14).

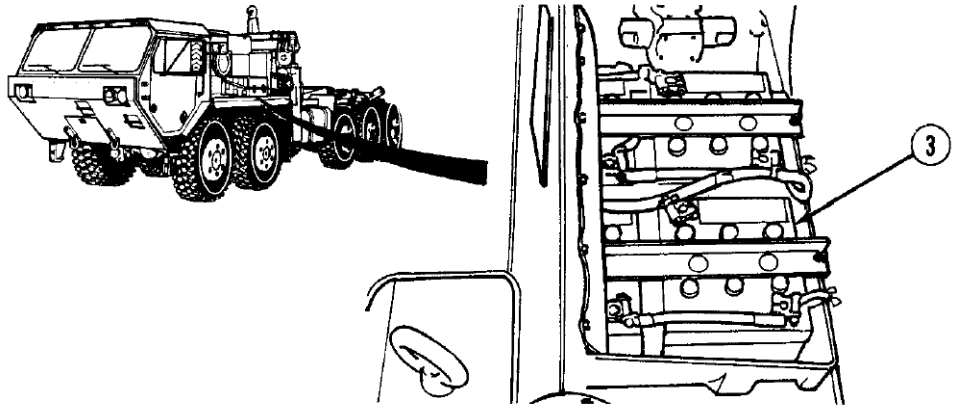


Figure 12. 4 Vehicle Batteries

12.1.3.2 Keep batteries (Figure 12. 4. (3)) full of electrolyte, but do not overfill.

12.1.3.3 In hot, damp climates check body and chassis often and notify Unit Maintenance if any of the following are found:

a. Signs of pitting or paint blistering on metal surfaces.

b. Signs of mildew, mold or fungus on fabrics or rubber.

12.2 OPERATING THE LAUNCH VEHICLE IN EXTREME DUST

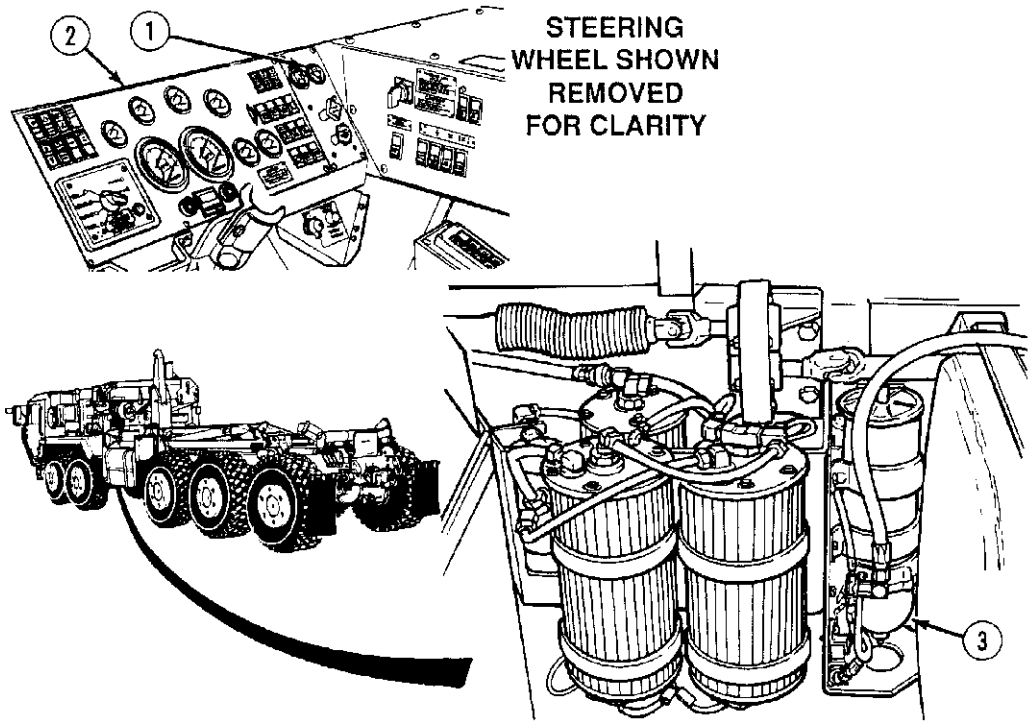


Figure 12. 5 Air Filter Restriction Indicator

CAUTION

Equipment damage. Clouds of dust can scratch glass and plastic surfaces. Keep glass and plastic surfaces covered as much as possible in dusty conditions to prevent scratching and ensure that both the interface and launch vehicle cabinet doors are closed.

Equipment damage. Keep dust caps on all unused electrical and hydraulic connection points.

Equipment damage. Extreme care should be taken when building or retrieving the bridge in poor visibility. Stand well clear of opening bridge modules in case of falling dirt that may have built up in panel recesses.

12.2.1 In Transit Condition

12.2.1.1 Leave glass/plastic surfaces covered if not needed for operations. Take extra care when cleaning glass/plastic to prevent scratching surfaces.

12.2.1.2 Keep a close watch on the air filter restriction indicator (Figure 12. 5. 1), gauges and warning lights on the driver's instrument panel (Figure 12. 5. 2). Ensure dust does not affect equipment.

12.2.1.3 Allow as much distance as possible between trucks and operate at low speeds.

12.2.1.4 At stops, check and drain the fuel/water separator (Figure 12. 5. 3).

12.2.1.5 When possible, park so the launch vehicle does not face into wind.

12.2.1.6 Check all cylinder bellows for cuts, and report any damage to unit maintenance if found.

12.2.1.7 Keep dust caps on all unused electrical and hydraulic connection points and all launch vehicle cabinet doors closed.

12.2.2 In Launch Condition

12.2.2.1 Leave glass/plastic surfaces covered if not needed for operations. Take extra care when cleaning glass/plastic to prevent scratching surfaces.

12.2.2.2 Keep close watch on the air filter restriction indicator (Figure 12. 5. 1), gauges and warning lights on the driver's instrument panel (Figure 12. 5. 2) and the interface panel. Ensure dust does not affect equipment.

12.2.2.3 When not viewing the interface panel keep the outer door closed.

12.2.2.4 Whenever possible stop the launch in safe condition and turn the 4 position rotary switch to position 1 to reduce the idle speed.

12.2.2.5 Before the start of build, check and drain the fuel/water separator (Figure 12. 5. 3).

12.2.2.6 Check all cylinder bellows for cuts, report any damage to unit maintenance if found.

12.2.2.7 Keep dust caps on all unused electrical and hydraulic connection points.

12.2.2.8 All pinholes should be free from dirt and dust to avoid difficulty pinning or locating modules. Any dirt build up should be removed before build or retrieval.

12.3 OPERATING THE LAUNCH VEHICLE IN MUD, SAND OR SNOW

CAUTION

Equipment damage. Before backing the launch vehicle in mud, sand or snow, the mud flaps must be pinned on the stowage hook located on mud flap bracket. If the mud flap is not pinned, damage may result.

Equipment damage. The tail-lift should be in raised position to avoid damage if sinking occurs. Suitable ground conditions should always be established prior to bridge build or retrieval.

Equipment damage. Blowing sand may scratch glass/plastic surfaces. Glass/plastic surfaces should remain covered as much as possible in these conditions to prevent scratching.

Equipment damage. Electrical panel doors should always be fastened when not in use. Keep dust caps on all unused electrical and hydraulic connection points.

Equipment damage. Extreme care should be taken when building or retrieving the bridge in poor visibility.

NOTE

Driving in mud can degrade launch vehicle braking and speed up brake shoe wear. If braking degrades while operating in mud, dry brakes by driving launch vehicle approximately 500ft. (153m) with service brakes frequently applied. This must be done with brake drums totally out of mud so that drying action can take place. If drying brakes does not restore adequate braking, notify Unit Maintenance.

12.3.1 In Transit Conditions

12.3.1.1 Leave glass/plastic surfaces covered if not needed for operations. Extra care should be taken when cleaning glass surfaces to prevent scratching surfaces. Electrical panel doors should always be fastened when not in use. Keep caps on all unused electrical and hydraulic connection points.

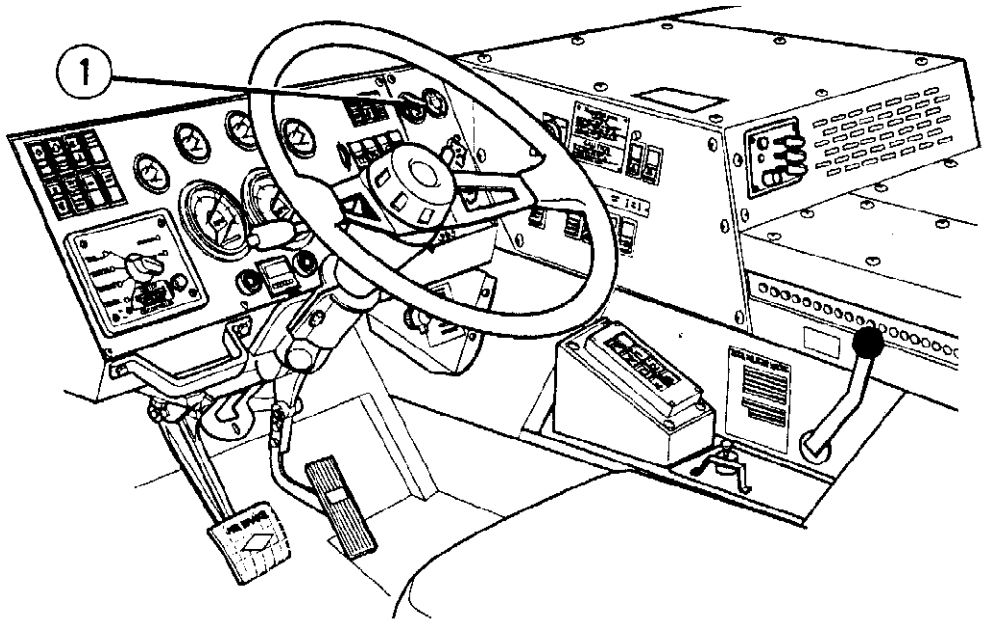


Figure 12. 6 Air filter Restriction Indicator

NOTE

The principles of driving in sand can also be applied to driving in mud.

The best time to drive on sand is at night or early morning when sand is damp. Damp sand gives better traction.

12.3.1.2 Check the air filter restriction indicator (Figure 12. 6. (1)) frequently.

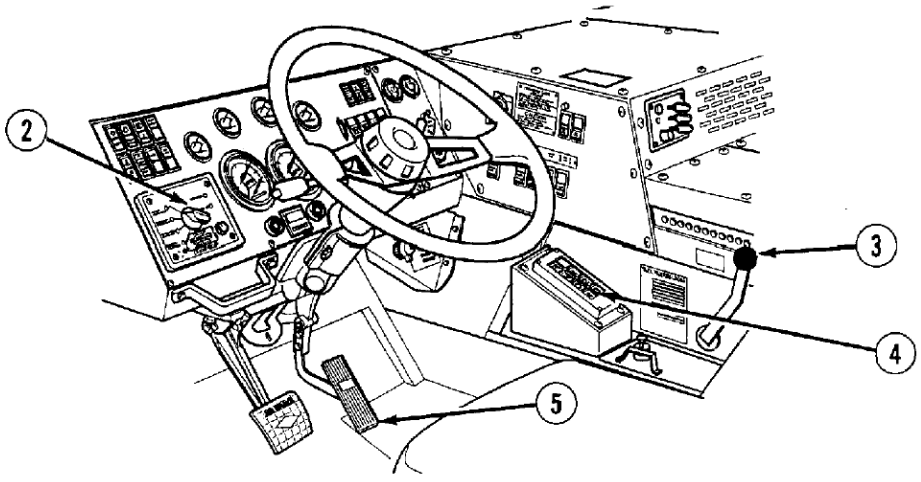


Figure 12. 7 Transmission Controls

12.3.1.3 Set the Centralized Tire Inflation System (CTIS) switch (Figure 12. 7. (2)) to the desired position.

12.3.1.4 Set the transfer case shift lever (Figure 12. 7. (3)) to **LO**.

12.3.1.5 Start slowly. Do not spin the wheels when starting to move the launch vehicle.

12.3.1.6 Set the transmission range selector (Figure 12. 7. (4)) to 2 or 1, as needed, for added traction.

12.3.1.7 Do not straddle sand mounds or drive on the sides of two sand mounds. Loose sand will not support the truck on steep slopes.

12.3.1.8 Keep the throttle control (Figure 12. 7. 5) steady after the truck reaches desired speed.

12.3.1.9 Turn the launch vehicle slowly when on loose sand or mud.

12.3.1.10 Steer the launch vehicle straight up and down hills if possible.

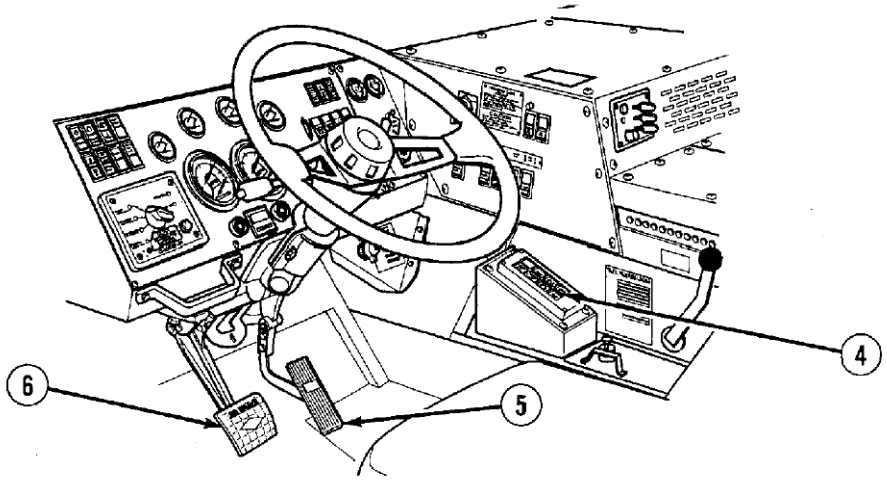


Figure 12. 8 Throttle Control And Brake Control

12.3.1.11 To move the launch vehicle forward and turn after launch vehicle is stopped in loose sand or mud, do the following:

a. Set the transmission range selector (Figure 12. 8. 4) to Reverse (R).

b. Press the throttle control (Figure 12. 8. 5) and move launch vehicle straight back about 20ft. (6.1m).

c. Release the throttle control (Figure 12. 8. 5) and press service brake pedal (Figure 12. 8. 6).

d. Set transmission range selector (Figure 12. 8. 4) to 1.

e. Release service brake pedal (Figure 12. 8. 6) and press the throttle control (Figure 12. 8. 5) to move the launch vehicle forward.

f. Turn launch vehicle gradually.

g. Move transmission range selector (Figure 12. 8. 4) to position D when launch vehicle picks up speed and is moving forward smoothly.

12.3.1.12 If launch vehicle starts to skid, do the following:

a. Release the throttle control (Figure 12. 8. 5).

b. Steer in direction of skid until the launch vehicle stops skidding.

c. Press the throttle control (Figure 12. 8. 5) slowly and steer the launch vehicle on straight course.

12.3.2 In Launch Conditions

12.3.2.1 Leave glass / plastic surfaces covered if not needed for operations. Extra care should be taken when cleaning glass surfaces to prevent scratching surfaces. electrical panel doors should always be fastened when not in use. Keep dust caps on all unused electrical and hydraulic connection points.

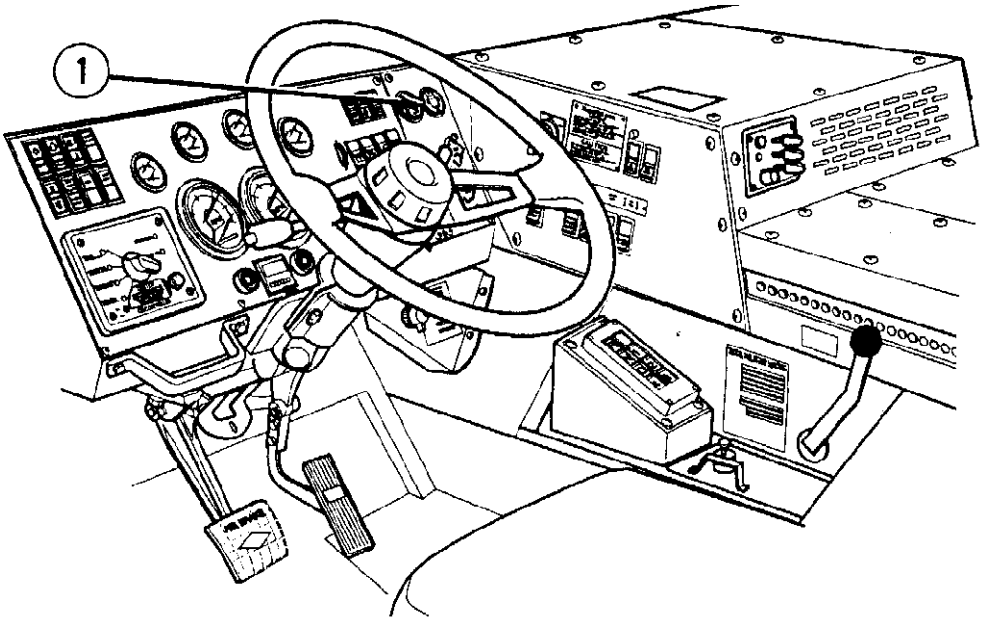


Figure 12. 9 Air filter Restriction Indicator

12.3.2.2 Check the air filter restriction indicator (Figure 12. 9. (1)) often.

12.3.2.3 Never deploy the launch vehicle, build or retrieve the bridge with unsuitable ground conditions.

12.3.2.4 If there is a likelihood of the A-frame feet sliding, ground stakes should be driven in to stop the feet dragging or sliding.

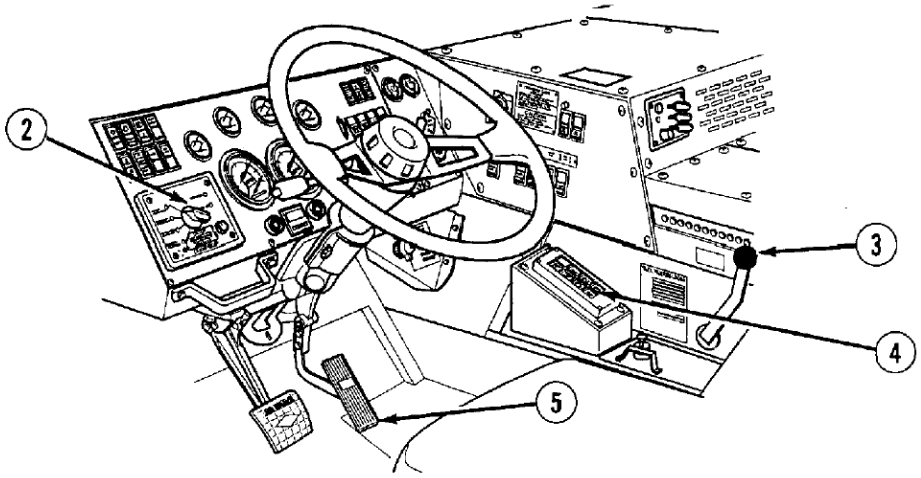


Figure 12. 10 Transmission Controls

12.3.2.5 Set the CTIS switch (Figure 12. 10. (2)) to the desired position.

12.3.2.6 Set the transfer case shift lever (Figure 12. 10. (3)) to **LO**.

12.3.2.7 Start slowly. Do not spin the wheels when starting to open or close slide frame.

12.3.2.8 Set the transmission range selector (Figure 12. 10. (4)) to 2 or 1, as needed, for added traction.

12.3.2.9 Do not straddle sand mounds or drive on the sides of two sand mounds. Loose sand will not support launch vehicle on steep slopes.

12.3.2.10 Turn the launch vehicle slowly when on loose sand or mud, when positioning launch vehicle for build.

12.3.2.11 Keep the throttle control (Figure 12. 10. 5) steady when the slide frame is being opened or closed.

12.3.2.12 Always clear mud, sand, or snow off the top of the bridge and pinning holes before commencement of bridge build or retrieval.

12.3.2.13 When not viewing interface panel keep the outer door closed.

12.3.2.14 Whenever possible stop launch in safe condition and turn the 4 position rotary switch to position 1 to reduce idle speed.

12.3.2.15 Before starting build, check and drain the fuel/water separator (Figure 12. 5. 3).

12.3.2.16 Check all cylinder bellows for cuts, and report any damage to unit maintenance if found.

12.3.2.17 Keep dust caps on all unused electrical and hydraulic connection points.

12.3.2.18 Park the launch vehicle as follows:

a. Park so that the launch vehicle does not face into wind.

b. Ensure all dust caps are replaced on unused electrical and hydraulic connection points and all panel doors are securely fastened.

c. Clean mud off launch vehicle as soon as possible. Do not direct high pressure water stream at glass/plastic surfaces, seals, air intake, exhaust outlet, electrical junction boxes or any other component of launch vehicle that could be easily damaged by high pressure water stream.

d. Clean mud from the wheels, brakes, axles, universal joints, steering mechanism and radiator as soon as possible.

12.4 OPERATING LAUNCH VEHICLE IN DESERT ENVIRONMENT

NOTE

FM 90-3 contains detailed instructions for living and working in the desert.

12.4.1.1 Principles for operating in extreme heat and extreme dust, sand or mud apply to desert environment.

12.4.1.2 Temperatures may change as much as 70 degrees F (21 degrees C) between day and night. These changes may damage equipment if launch vehicle is not properly prepared. Due to expansion and contraction of all fluids and air, care should be taken when filling fuel tank and fluid reservoirs to prevent overflow when temperatures change.

12.5 OPERATING IN A COLD ENVIRONMENT

12.5.1 Operating Launch vehicle in Cold Environment +45°F to -25°F (+7°C to -32°C).

CAUTION

Equipment damage. In severe cold, engine coolant, fluid in windshield washer can freeze, batteries can freeze and crack, oil and grease may get thick and stiff and rubber may crack or break easily.

Equipment damage. If engine fails to start after four tries, refer to troubleshooting, TM 9-2320-364-10 Chapter 3. Do not turn engine switch to START position while engine is still running or engine damage may result.

NOTE

Before operating launch vehicle in severe cold environment, make sure it has been prepared as described in chapter 8-7. For the replacement of fluids for ARCTIC use and FM 9-207, refer to FM 31-70, FM 31-71 and FM 21-305 for additional information on operation in cold environment.

Perform Paragraph (12.5.1.1):

One time for temperatures between +45 degrees F to +10 degrees F (+7 degrees C to -12 degrees C).

Two times for temperatures between +10 degrees F to -10 degrees F (-12 degrees C to -23 degrees C).

Three times for temperatures between -10 degrees F to -25 degrees F (-23 degrees C to -32 degrees C).

Repeat Steps (1) and (2) up to four times.

If engine fails to start, wait 15 seconds before next start attempt to allow starter motor to cool.

12.5.1.1 Press and hold ether start switch (Figure 12. 11. (1)) for five seconds, release and wait five seconds.

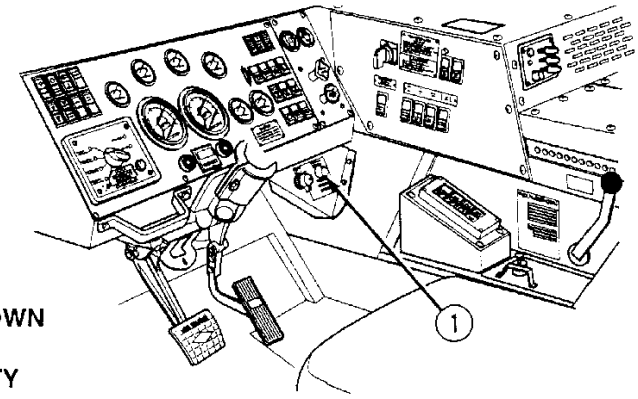


Figure 12. 11 Ether Start Switch

12.5.1.2 Ensure rotary switch (Figure 12. 12. (6)) is in position 1.

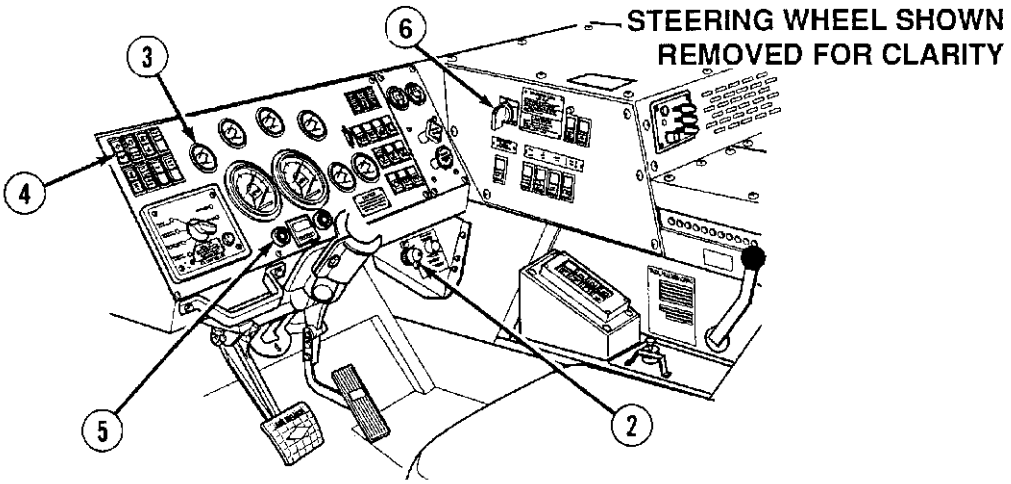


Figure 12. 12 Engine start controls

12.5.1.3 Turn the engine ON/OFF/START switch (Figure 12. 12. (2)) to START for no more than 15 seconds. Release the engine ON/OFF/START switch (Figure 12. 12. (2)). The engine ON/OFF/START switch will spring back to the ON position. The oil pressure indicator (Figure 12. 12. (30)) and oil pressure lamp (Figure 12. 12. (4)) may light and the buzzer (Figure 12. 12. (5)) may sound briefly.

12.5.1.4 Engine speed must be at idle before using the 4 position rotary selector switch (Figure 12. 12. (6)), or damage to equipment may result.

NOTE

The Central Tire Inflation System (CTIS) should be in the ON position only when parked during starts in COLD environments. The CTIS will adjust tire pressures during the warm-up period while the launch vehicle is parked.

12.5.1.5 Let the engine idle for five minutes.

NOTE

When running the engine at 1200 to 1500 rpm, return engine to idle every two minutes and check that DO NOT SHIFT light is out.

12.5.1.6 Run the engine at 1200 to 1500 rpm until DO NOT SHIFT light goes out.

CAUTION

Equipment damage. The engine speed must be at idle before using the 4 position rotary selector switch, or damage to equipment may result.

Equipment damage. The 4 position rotary selector switch in the cab must be in position 1 before driving the vehicle.

12.5.1.7 Turn the 4 position rotary selector switch (Figure 12. 12. (6)) to 1.

12.5.1.8 Move the CTIS switch (Figure 12. 7. (2)) to the OFF position.

CAUTION

Equipment damage. Do not use low (LO) position on transfer case to move launch vehicle, if tires are frozen to the ground or brakes are frozen to the drums. Damage to driveline may result.

Equipment damage. Watch the instrument panels closely. If there are any unusual readings, stop the launch vehicle or stop the build in safe condition and shut off the engine. Check immediately.

Equipment damage. All snow and ice should be removed from launch vehicle as soon as possible. Snow and ice may slow or stop movement of critical parts if allowed to pile up. All ladders and walkways should always be cleared of snow and ice before use.

Equipment damage. Ice and snow should be removed from launch beams and bridge modules before starting to build.

Equipment damage. If there is any possibility of the A-frame feet slipping when deploying or stowing the launch vehicle on ice or snow, ground stakes should be driven in to avoid movement.

12.5.1.9 If transmission fluid temperature is:

a. Below -20 degrees F (-29 degrees C), the TRANS CHECK and DO NOT SHIFT lights will illuminate and transmission will only operate in Neutral (N).

b. 20 degrees F to +20 degrees F (-29 degrees C to -7 degrees C), the TRANS CHECK and DO NOT SHIFT lights will illuminate. When the DO NOT SHIFT light extinguishes, the transmission will operate in Neutral (N), Reverse (R) and First (1) ranges only.

c. Above +20 degrees F (-7 degrees C), the TRANS CHECK light will extinguish and the transmission will operate in all ranges.

12.5.1.10 Set the TRANSFER CASE shift lever (Figure 12. 7. (7)) to high (**HI**) and the transmission range selector lever (Figure 12. 7. (8)) to first gear and drive the launch vehicle three to five miles to warm the drive line components and tires.

12.5.2 Launch vehicle Hydraulic System

CAUTION

Equipment damage. The pinch roller ball valve must never be opened unless the launch beam transport pin is in place.

12.5.2.1 If the low temperature warning light illuminates, on the interface control panel, this means the oil temperature is 32 degrees F (0 degrees C) the following procedure should be observed.

a. If not in build sequence, open the pinch roller ball valve (Figure 12. 13) on the launch frame and operate the A-frame fold cylinders to generate pressure in the launch vehicle system. This will heat the oil and circulate the oil through the pressure and tank lines.

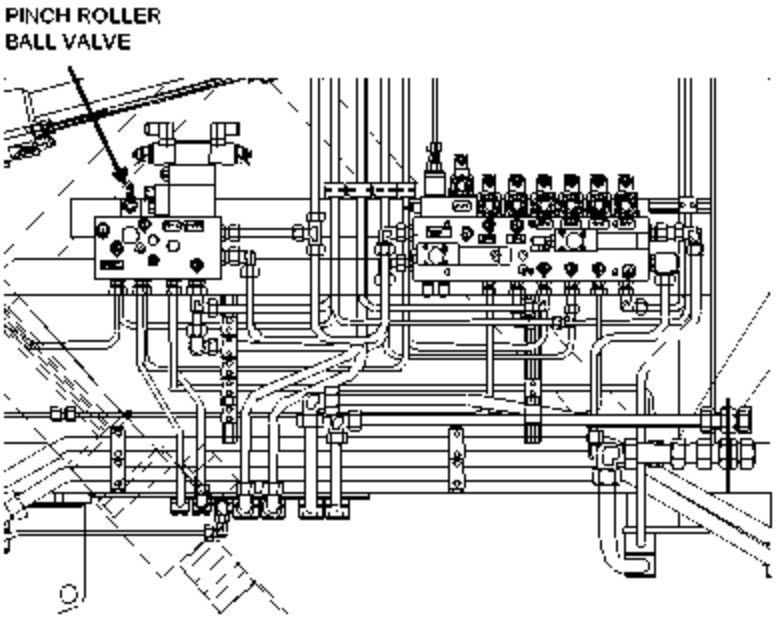


Figure 12. 13 Location of the Pinch Roller Ball Valve

b. While building the bridge the build should be completed, or if at a convenient/safe point on the build, open the pinch roller ball valve on the launch frame and exercise stabilizer cylinders against the pins to create pressure in circuit without any movement.

12.5.2.2 When operating a function, if it is slow to move or will not move at all, operate a function that is already pinned, such as A-frame fold, or rotate, stabilizer legs against the pins or deploy the crane, this will put the pump into high pressure setting which is available to the rest of the system.

CAUTION

Equipment damage. When warming up exercise is complete, the pinch roller ball valve must be closed. The valve should not be operated if the launch beam is being built or retrieved.

12.5.3 Deploying Bridge Modules

12.5.3.1 When deploying bridge modules in cold conditions. If the module is slow to open sit it down on top of a module or flatrack at 90 degrees until it is fully open then continue the build.

12.5.3.2 When closing bridge modules in cold conditions. If the module is slow to close sit it down on top of a module or flatrack at 90 degrees until it is fully closed then continue.

12.6 DRIVING THE LAUNCH VEHICLE

12.6.1 Speed Limits

12.6.1.1 The maximum speed of each M1977 CBT and M1075 PLS based launch vehicle, with or without trailers, should be limited to 40 mph when operated on improved roads. If traversal of cross-country terrain is necessary to access an operation site then the M1977 CBT and M1075 PLS based launch vehicle, with or without trailers, should be limited to a maximum speed of 15 mph. The M1076 trailers should be limited to a maximum speed of 10 mph on Belgian block, cobblestone, or surfaces with heavy washboard, ruts, or potholes.

12.6.2 Operating on Sloping Ground

12.6.2.1 Caution must be exercised when operating the DSB vehicles and trailers on slopes. The DSB vehicles should be limited to side slopes not to exceed 20%. The possibility of rollover exists on any slope (including level), but will be minimized provided that operating speeds are kept to a minimum, no sudden steering inputs are made, and depressions are avoided when traversing undulating terrain. Operators must be made aware of these operating characteristics and limitations.

12.6.3 On Slippery Surfaces

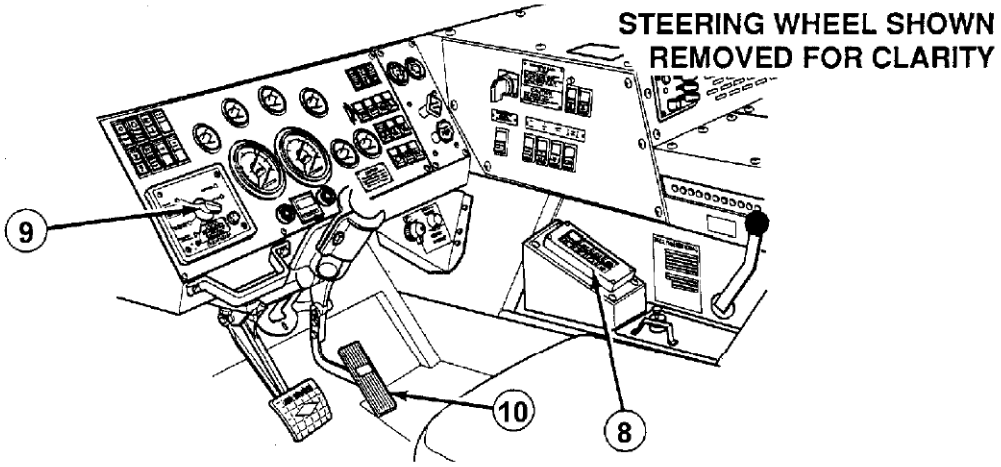


Figure 12. 14 Central Tire Inflation System Switch

12.6.3.1 Drive on mud, snow, ice and slippery surfaces as follows:

a. Move the CTIS switch to ON position and set the CTIS rotary selection switch (Figure 12. 14. (9)) to MUD, SAND AND SNOW.

b. Press the throttle control (Figure 12. 14. (10)) slowly when changing speed.

c. Keep the throttle control (Figure 12. 14. (10)) steady after the launch vehicle reaches the desired speed.

d. Turn the launch vehicle slowly when on slippery surfaces.

e. Steer the launch vehicle away from ruts and large snow banks.

f. Steer the launch vehicle straight up and down hills if possible.

g. Set the transmission range selector (Figure 12. 14. (8)) to 2nd or 3rd gear to go down medium grades.

h. Drive at slower speeds and keep twice the normal distance from the vehicle ahead.

i. Activate turn signals sooner.

j. Never deploy launch vehicle in unsuitable ground conditions.

k. If there is a likelihood of the A-frame feet sliding, ground stakes should be driven in to stop the feet dragging or sliding.

l. Install tire chains, if needed.

m. Keep the throttle control (Figure 12. 14. (10)) steady when the slide frame is being opened or closed.

n. Always clear snow & ice off the top of the bridge and pinning holes before commencement of bridge build or retrieval.

o. When not viewing the interface panel keep the outer door closed.

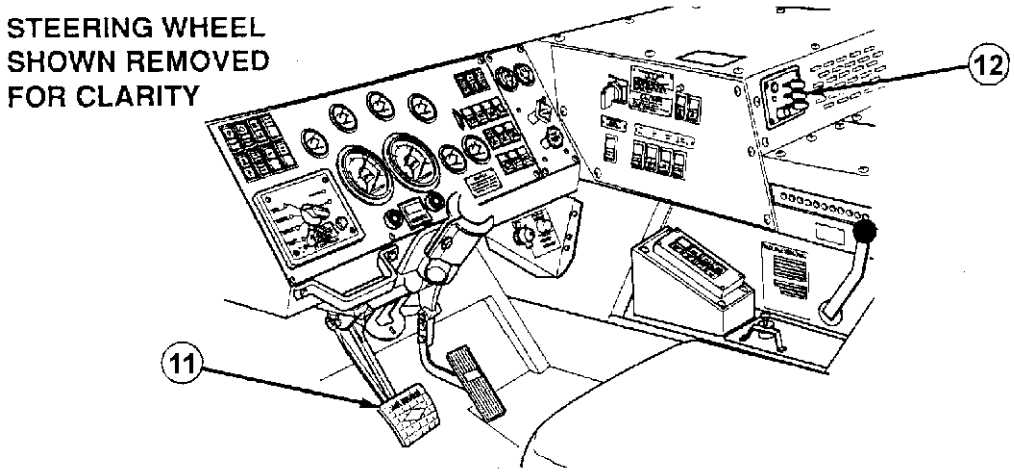


Figure 12. 15 Windscreen De-mist Controls

WARNING

RISK OF SKIDDING. APPLY ENGINE BRAKE ONLY WHEN THE LAUNCH VEHICLE TIRES HAVE GOOD TRACTION. USE OF ENGINE BRAKE ON SLICK SURFACES CAN CAUSE LAUNCH VEHICLE TO SKID AND CAUSE INJURY OR DEATH.

NOTE

Pressing the brake lightly will help keep launch vehicle from skidding.

p. Apply the brakes sooner and press the service brake pedal (Figure 12. 15. (11)) lightly to give early warning that the launch vehicle will slow or stop.

q. Downshift, if necessary, when slowing or stopping the launch vehicle on slick surfaces.

CAUTION

Equipment damage. Park in shelter when possible, if shelter is not available; park so the front of the launch vehicle does not face wind. Place planks or brush under wheels so the launch vehicle will not freeze in place.

Equipment damage. The fuel/water separator should be drained before topping off the fuel tank. Keep the fuel tank as full as possible during cold operations. Water forms in empty fuel tank as it cools. Water in the fuel system could freeze and block the system.

r. Keep the windshield, windows, mirrors, headlights, stoplights and body lights clean and free of snow and ice. Use the defroster (Figure 12. 15. (12)) and the windshield wipers to keep windshield free of snow and ice.

12.6.3.2 Drive slowly and test the brakes after driving through slush or water. If the brakes slip, do the following:

a. Continue to drive slowly.

b. Apply moderate pressure on the service brake pedal (Figure 12. 15. (11)) to cause slight brake drag.

c. When the brakes are dry and no longer slip, let up on the service brake pedal (Figure 12. 15. (11)).

d. Resume normal driving speed.

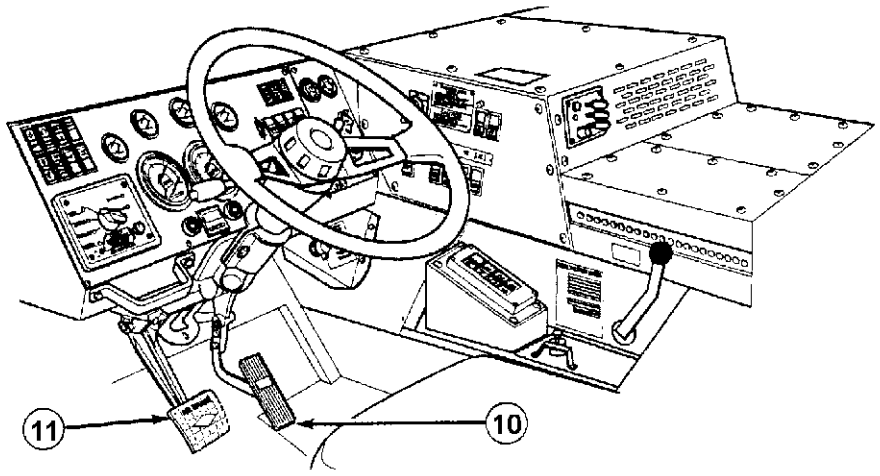


Figure 12. 16 Accelerator Pedal

NOTE

Refer to FM 21-305 for additional information on driving in dangerous conditions.

12.6.3.3 If the rear of the launch vehicle skids, do the following:

a. Let up on the throttle control (Figure 12. 16. (10)).

b. Steer in same direction in which the launch vehicle is skidding.

c. When the launch vehicle is under control, press service brake pedal (Figure 12. 16. (11)) lightly.

d. Steer the launch vehicle on straight course and slowly press the throttle control (Figure 12. 16. (10)).

12.6.3.4 If the launch vehicle starts to slide while climbing hill, do the following:

a. Let up on the throttle control (Figure 12. 16. (10)).

b. Steer the launch vehicle in direction of slide until the launch vehicle stops.

c. Slowly press the throttle control (Figure 12. 16. (10)) and steer the launch vehicle on straight course.

CAUTION

Equipment damage. Do not change the CTIS setting when cornering or when wheels are slipping. Damage to drive line may result.

12.6.3.5 If absolutely necessary for better traction, set CTIS rotary selection switch (Figure 12. 14 (9)) to EMERGENCY position. Drive at low speed (five mph (eight km/h)) when the tire air pressures are reduced.

NOTE

Refer to FM 20-22 for detailed information on launch vehicle recovery.

12.6.3.6 If the launch vehicle becomes stuck, do the following:

a. Shovel a clear path ahead of each wheel. Put boards, brush, or similar material in cleared paths to get better traction. Set CTIS rotary selection switch (Figure 12. 14. (2)) to EMERGENCY position, transfer case lever (Figure 12. 17. (7)) to low and engage the transfer case lockup switch . Drive at low speed (five mph (eight km/h)) if in transit, or dead slow if deploying the launch vehicle, only when tire air pressures are reduced.

b. If there is any possibility of the A-frame feet slipping when deploying or stowing the launch vehicle on ice or snow, ground stakes should be driven in to avoid movement.

c. If the launch vehicle remains stuck, use another vehicle to winch or tow the stuck launch vehicle. Always fully stow the launching equipment and follow correct towing guidelines.

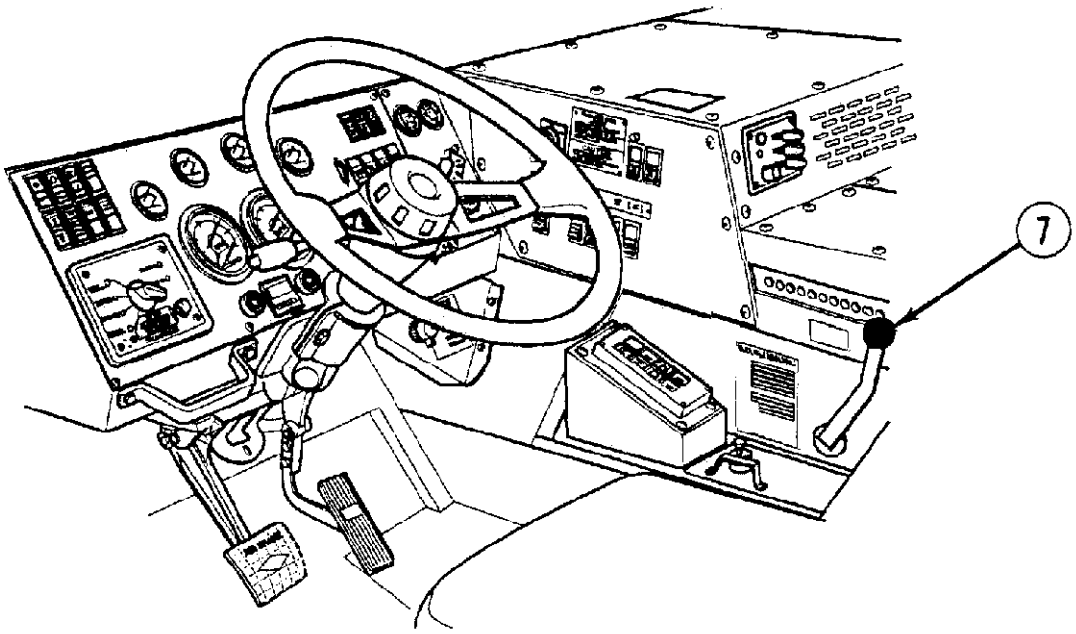


Figure 12. 17 Transfer Case Shift Lever

12.6.3.7 Park the launch vehicle as follows:

a. Park the launch vehicle in sheltered area out of wind if possible. If no shelter is available, park so the launch vehicle does not face into wind.

b. Park the launch vehicle on high, dry ground if possible. If high, dry ground is not available, spread out planks or brush to make a raised and dry area so the tires will not freeze in snow, water, ice or mud.

c. Park the launch vehicle on level ground so that the chassis does not twist.

d. Set the transfer case shift lever (Figure 12. 17. (7)) to **LO**.

e. Clean snow, ice and mud off the launch vehicle as soon as possible.

f. Clean mud, snow and ice from the wheels, brakes, axles, universal joints, mirrors, steering mechanism and radiator as soon as possible.

12.6.4 Operating in Extreme Cold Environment -26°F to -50°F (-32°C to -46°C)

WARNING

FROST BURN. DO NOT TOUCH EXTREMELY COLD METAL (BELOW -26 DEGREES F [-32 DEGREES C]). BARE SKIN MAY FREEZE TO COLD METAL AND CAUSE INJURY TO PERSONNEL.

NOTE

Principles for operating in cold environment apply to extreme cold environment. Refer to Para 12.5 for operating in cold environment.

12.6.4.1 Before operating the launch vehicle in extreme cold environment make sure arctic kits are installed and the launch vehicle has been prepared as described in FM 9-207. The bridge launching equipment should not be used below 20 degrees F (-29 degrees C). The 4 position rotary selector switch should remain in position 1 for transit purposes only.

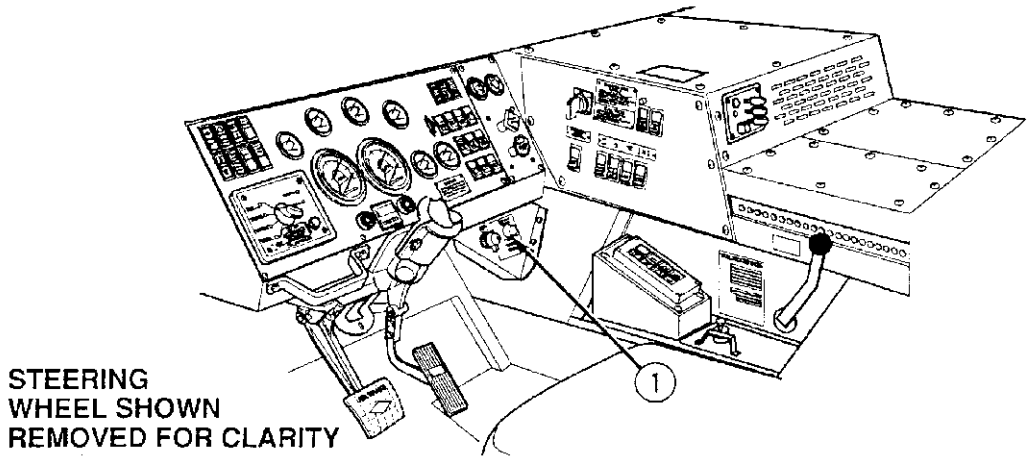


Figure 12. 18 Ether Start Switch

12.6.4.2 Operate the arctic heater.

NOTE

Repeat Steps (12.6.4.3) and (12.6.4.4) sequence up to four times if required.

12.6.4.3 Press and hold the ether start switch (Figure 12. 18. 1) for five seconds release and wait five seconds. Perform this sequence three times.

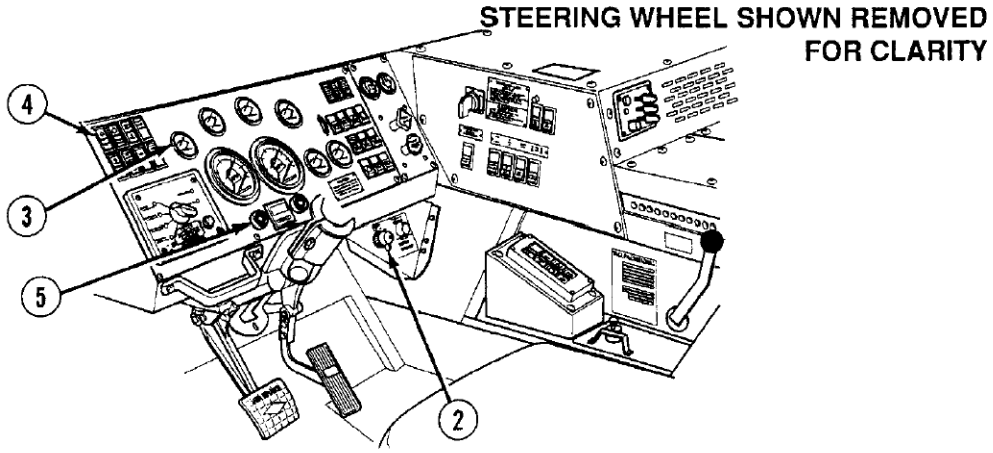


Figure 12. 19 Engine Cold Start Controls

NOTE

Watch the instrument panel closely. If any unusual readings occur, stop the launch vehicle and shut off the engine. Check immediately.

If the engine fails to start, wait 15 seconds before the next start attempt to allow the starter motor to cool.

12.6.4.4 Turn the engine switch (Figure 12. 19. (2)) to START for about 15 seconds. Release the engine switch. The engine switch will spring back to the ON position. The oil pressure indicator (Figure 12. 19. (3)) and the oil pressure lamp (Figure 12. 19. (4)) may light and the buzzer (Figure 12. 19. (5)) may sound briefly.

NOTE

If the transmission fluid temperature is below -20 degrees F (-29 degrees C) the TRANS CHECK and DO NOT SHIFT lights will illuminate, and the transmission will only operate in Neutral (N) range.

The CTIS system should be in the ON position only when parked, during starts in extremely cold environments. The CTIS will adjust the tire pressure during the warm-up period while the launch vehicle is parked.

12.6.4.5 Run the engine for five minutes, then increase the engine speed to 1200 to 1500 rpm until the transmission DO NOT SHIFT light goes out.

CAUTION

Equipment damage. The Fuel/water separator should be drained before topping off the fuel tank. Keep the fuel tank as full as possible during cold operations. Water forms in empty fuel tanks as it cools. Water in the fuel system could freeze and the block system.

Equipment damage. All snow and ice should be removed from the launch vehicle as soon as possible. Snow and ice may slow or stop the movement of critical parts if allowed to pile up.

Equipment damage. In severe cold, the engine coolant and fluid in the windshield washer can freeze, batteries can freeze and crack, oil and grease may become thick and stiff and rubber may crack or break easily.

12.6.4.6 Perform warm-up before the crane is to be operated.

Section II. OPERATING ON RESTRICTED SITES

12.7 BRIDGE BUILDING

12.7.1 Bridge Building on Restricted Site

12.7.1.1 Restricted sites are those sites where the build site has a reduced area such as when building an OVERBRIDGE or building in a ravine. Figure 12. 20 gives the site plan and the minimum dimensions required.

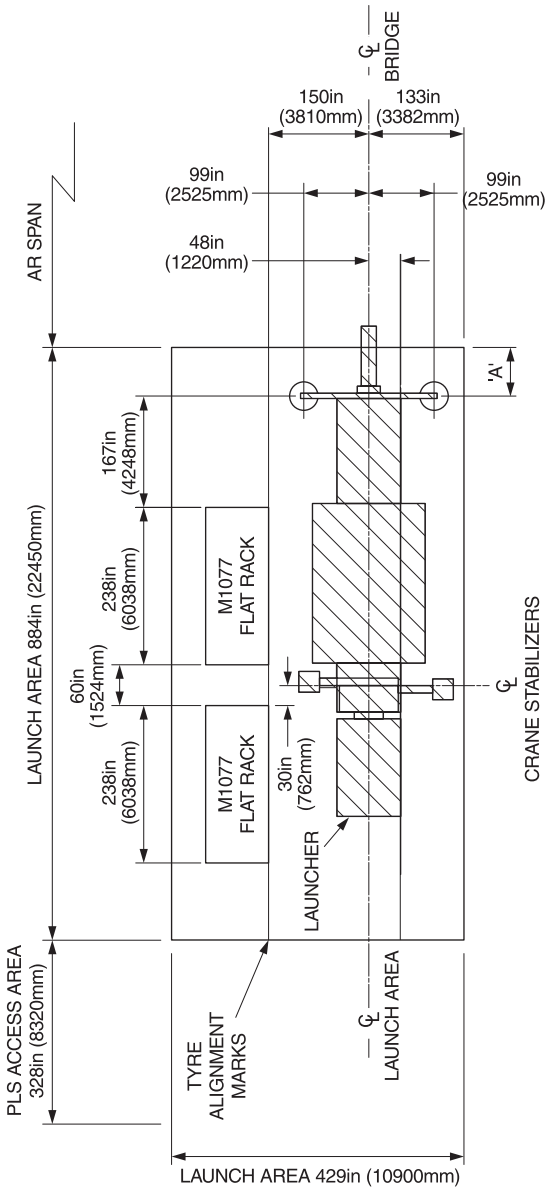
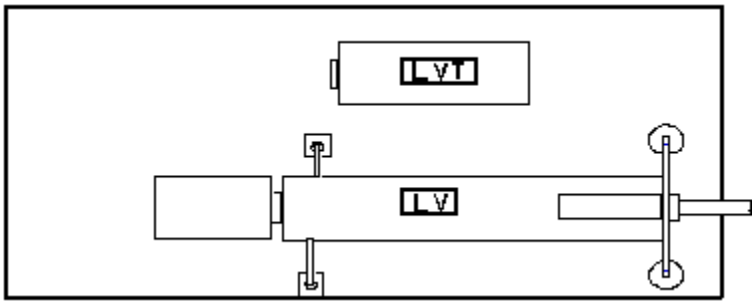


Figure 12. 20 Restricted Site Lay Out

12.7.2 Flatrack Movements for Restricted Site

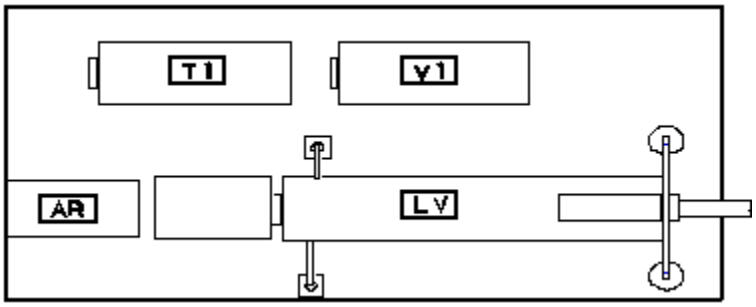
12.7.2.1 When operating on a site that has restricted width it will be necessary to modify the flatrack positioning procedure to accommodate the reduced width of the site.

12.7.2.2 The first flatrack brought on to the build site will be flatrack LVT, so that the launch beam can be constructed.

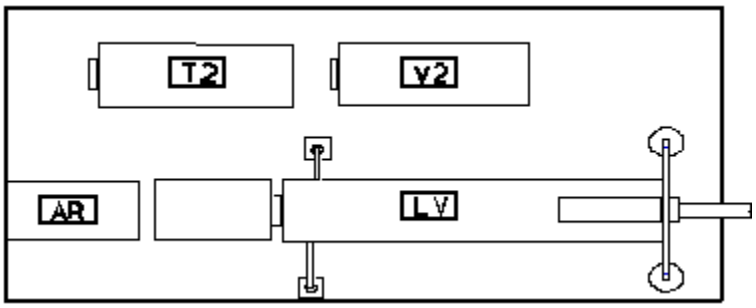


12.7.2.3 Once the launch beam has been built flatrack LVT is removed to the staging area and flatrack V1 is brought to the site and positioned towards the rear of the crane stabilizer leg, the next flatrack T1 is brought to the site and positioned in front of flatrack V1.

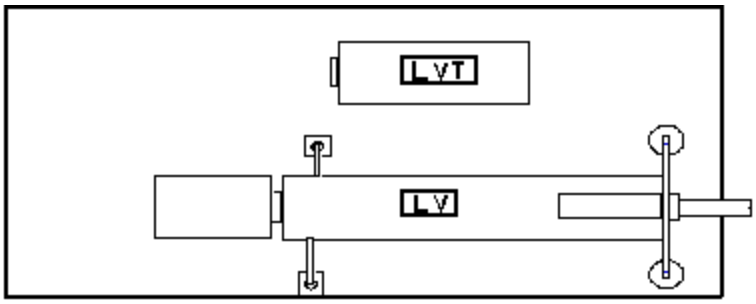
12.7.2.4 The approach ramps (AR) are removed from the ramp module and stored, until required, in front of the launch vehicle.



12.7.2.5 Bridge construction is commenced and once flatracks T1 and V1 are empty, they are removed and replaced with flatracks V2 and T2.



12.7.2.6 When the bridge has been constructed flatracks V2 and T2 are removed to the staging area and flatrack LVT is returned to the build site, the launch beam is then recovered.



12.7.2.7 The site is then cleared and the launch vehicle removed to the staging area prior to recovery back to base.

Section III. FORDING

12.8 DEEP WATER FORDING

WARNING

DEEP WATER FORDING. DO NOT FORD WATER UNLESS ITS DEPTH IS KNOWN. WATER DEEPER THAN 4FT (1.2 M) MAY ENTER THE LAUNCH VEHICLE. FAILURE TO OBSERVE THIS INSTRUCTION COULD RESULT IN PERSONNEL INJURY.

CAUTION

Equipment damage. Ensure both the cab floor drain caps are securely in place before attempting to ford water. Failure to comply may result in damage to equipment.

12.8.1.1 Ensure the depth of fording site is not more than 4ft. (1.2 m).

12.8.1.2 Ensure the bottom at fording site is firm enough that 4ft. (1.2 m) maximum fording depth will not be exceeded and the launch vehicle will not become mired.

12.8.1.3 Ensure all the electrical control box covers are closed and secured. All electrical plugs are connected or dust caps fitted.

12.8.1.4 Stop the launch vehicle at edge of water.

12.8.1.5 If the brakes have been used heavily and are hot, allow drums and shoes to cool before entering the water if possible.

12.8.1.6 Ensure the engine is operating correctly before entering the water.

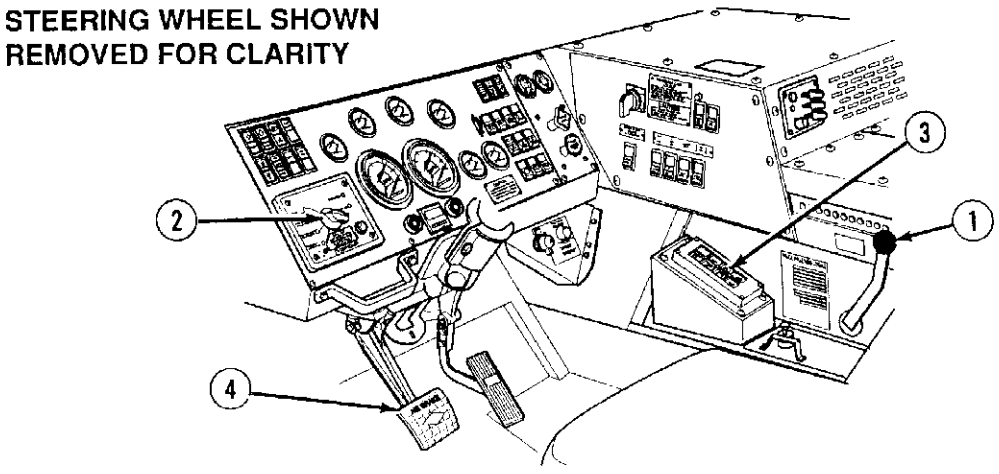


Figure 12. 21 Transmission Controls

12.8.1.7 Set the TRANSFER CASE shift lever (Figure 12. 21. (1)) to **LO**.

12.8.1.8 Set the CTIS rotary selector switch (Figure 12. 21. (2)) to desired position.

12.8.1.9 Set the transmission range selector (Figure 12. 21. (3)) to 1.

12.8.1.10 Drive the launch vehicle slowly into the water.

12.8.1.11 If the engine stops, immediately attempt to restart the engine. If the launch vehicle will not start, tow or winch the launch vehicle from the water with another vehicle as soon as possible.

12.8.1.12 Drive the launch vehicle at three to four mph (6.43 km/h), or less, through the water.

12.8.1.13 Unless absolutely necessary, do not stop while in the water.

12.8.1.14 If the launch vehicle accidentally enters water deeper than four ft. (1.2 m), perform the following:

a. Press on the service brake pedal (Figure 12. 21. (4)) and hold to stop the launch vehicle.

b. Set the transmission range selector (Figure 12. 21.(3)) to Reverse (**R**).

c. Let up on the service brake pedal (Figure 12. 21. (4)).

d. Slowly back the launch vehicle out of deep water.

12.8.1.15 After leaving the water, press the service brake pedal (Figure 12. 21. (4)) lightly and hold while driving slowly to dry out the brake linings.

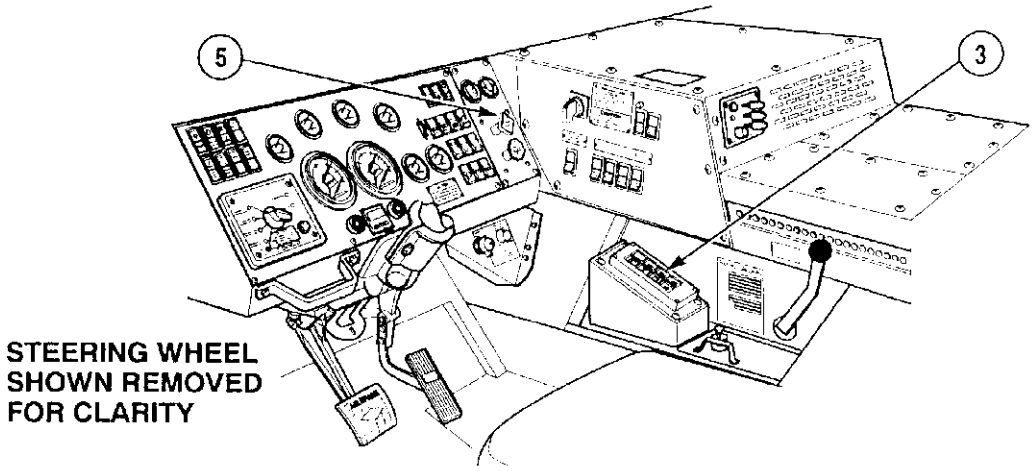


Figure 12. 22 Parking Brake

12.8.1.16 When clear of the fording area, stop the launch vehicle.

12.8.1.17 Apply and release the parking brake (Figure 12. 22. (5)) several times to remove water from brake components.

12.8.1.18 If the CTIS EMERGENCY was selected, set the transmission range selector (Figure 12. 22. (3)) to Reverse (**R**).

12.8.1.19 Back up approximately 5 to 10 ft. (1.5 to 3 m) to relieve the driveline loading.

12.8.1.20 Set the transmission range selector (Figure 12. 22. (3)) to Neutral (**N**).

12.8.1.21 Remove water and clean deposits from all launch vehicle parts as soon as possible.

12.8.1.22 Lubricate and perform the PMCS check as soon as possible.

12.8.1.23 For further information refer to TM 9-238.

Section IV. LAUNCH VEHICLE RECOVERY

12.9 PREPARING LAUNCH VEHICLE FOR TOWING

WARNING

TIPPING HAZARD. THE DISABLED LAUNCH VEHICLE BEING TOWED MUST WEIGH LESS THAN THE TOWING VEHICLE. THE LAUNCH VEHICLE MUST BE FULLY STOWED AND IN TRANSIT CONDITION. FAILURE TO FOLLOW PROPER PROCEDURES MAY CAUSE SERIOUS INJURY OR DEATH.

CAUTION

Equipment damage. When towing another vehicle do not go over GCWR given by the data plate on driver's side door. Going over GCWR may cause damage to disabled and towing launch vehicle.

Equipment damage. When towing disabled launch vehicle, speed must not exceed 35 mph (56 km/h) and towing distance must not exceed 100 miles (161 km). Failure to comply may result in damage to equipment.

Equipment damage. Transfer case of disabled launch vehicle must be in Neutral (N) and in the UNLOCKED position or damage to transfer case may result.

Equipment damage. Transfer case lock-up switch of disabled launch vehicle must be in the OFF position or damage to equipment may result.

Equipment damage. Transmission of disabled launch vehicle must be set in Neutral (N) position or damage to transmission may result.

Equipment damage. CTIS of disabled launch vehicle must be set to highway position or damage to axles may result.

Equipment damage. If launch vehicle is being towed because of a steering hydraulic failure resulting in fluid loss, both output propeller shafts from transfer case must be disconnected or damage to emergency steering pump may result. Contact Unit Maintenance to remove propeller shafts.

12.9.1.1 Chock the wheels of the disabled launch vehicle.

12.9.1.2 Set the parking brake (Figure 12. 23. (1)) of the disabled launch vehicle.

CAUTION

Equipment damage. Tires should be inflated to highway pressure or damage to tires may result.

Equipment damage. Do not attempt to start engine if there is obvious engine damage or damage to equipment may result.

12.9.1.3 Start the engine of the disabled launch vehicle and place the CTIS rotary selector switch (Figure 12. 23. (2)) of disabled launch vehicle in the HIGHWAY position. If the CTIS does not work or the engine is inoperative, manually inflate the tires.

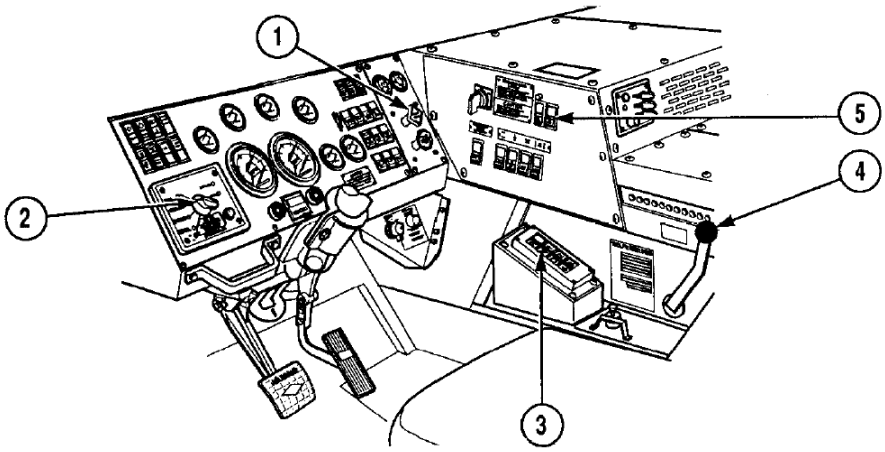


Figure 12. 23 Transfer case lockup

12.9.1.4 Place the transmission (Figure 12. 23. (3)) of the disabled launch vehicle in Neutral (**N**) position.

12.9.1.5 Place the TRANSFER CASE shift lever (Figure 12. 23. (4)) of the disabled launch vehicle in the NEUTRAL position.

12.9.1.6 Place the TRANSFER CASE LOCKUP switch (Figure 12. 23. 5) of the disabled launch vehicle in the OFF position.

WARNING

UNEXPECTED VEHICLE MOVEMENT. IF BRAKES ON DISABLED LAUNCH VEHICLE MUST BE MANUALLY RELEASED, ENSURE THAT THE WHEELS OF THE DISABLED LAUNCH VEHICLE ARE CHOCKED PRIOR TO MANUALLY RELEASING THE BRAKES. FAILURE TO CHOCK WHEELS COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL.

NOTE

If the engine of the disabled launch vehicle cannot be started, if there is an air leak that cannot be repaired, or if brakes on axle No. 3, 4 or 5 will not release, then one or all of the rear axle brake chambers on the disabled launch vehicle will have to be manually released.

12.9.1.7 Allow the air pressure of the disabled launch vehicle to build to 125 psi (862 kPa) or manually release the rear brakes.

12.9.1.8 Install a beacon light on the towing launch vehicle if required.

12.9.1.9 Turn on the beacon light.

12.9.1.10 Hookup the disabled launch vehicle to towing vehicle.

WARNING

UNEXPECTED VEHICLE MOVEMENT. WHEELS ON DISABLED LAUNCH VEHICLE MUST BE CHOCKED PRIOR TO DISCONNECTING FROM TOWING VEHICLE. FAILURE TO CHOCK WHEELS ON DISABLED LAUNCH VEHICLE COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL.

12.9.1.11 Chock wheels of the disabled launch vehicle prior to disconnecting towing vehicle.

12.10 VEHICLE RECOVERY

12.10.1 Overturned Launch vehicle

12.10.1.1 Recovery of an overturned DSB launch vehicle is generally in accord with Army manual
FM 9-43-2 'RECOVERY AND BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR'. With particular reference to sections on: 'SPECIAL RECOVERY SITUATIONS - OVERTURNED LAUNCH VEHICLE and RECOVERY METHODS USING WHEEL RECOVERY VEHICLES'.

12.10.1.2 To upright an overturned launch vehicle, the use of two recovery vehicles is required. The required capacity for each of these vehicles is as follows: -

1 Winch capacity 60000 lb (27223 kg)

2 Boom hoist winch capacity 30000 lb (13612 kg). This assumes an equal lift on each boom

12.10.1.3 The first recovery vehicle attaches both its winch and boom hoist winch to the forward shackle on the high side of the overturned launch vehicle. (See Figure 12. 24 for forward attachment points and Figure 12. 25 for rear attachment points). The second recovery vehicle attaches its winch to the rear high side vehicle shackle and its boom hoist winch to the slide frame lifting lug. (See Figure 12. 26). The launch vehicle is then recovered using the methodology as described in the FM 9-43-2 Manual.

12.10.2 Towing of Recovered Launch Vehicle

12.10.2.1 The recovered launch vehicle may be towed using a vehicle of sufficient capacity.

NOTE

The fully laden launch vehicle weighs 88,600 lb (40,181 kg). The launch vehicle MUST be FLAT TOWED and NOT LIFT TOWED.

12.10.2.2 For further information on towing a launch vehicle vehicle, refer to TM 9-2320-364-10 section 2-55.

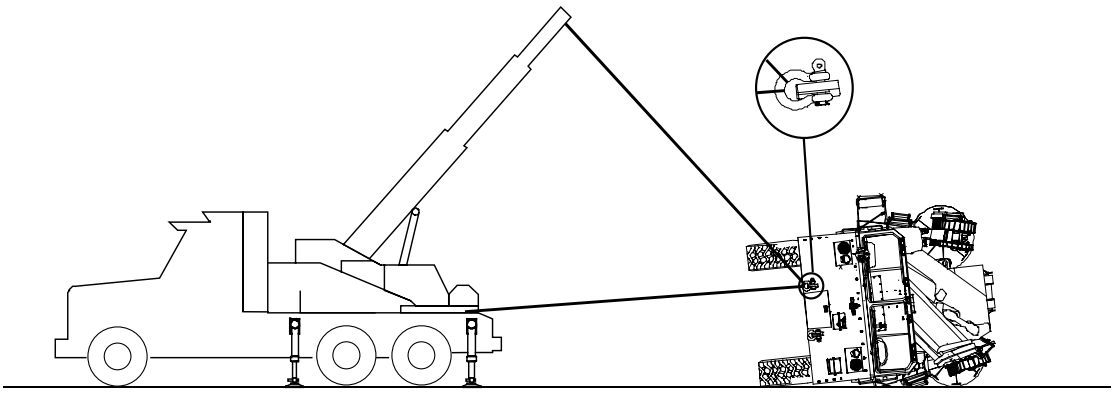


Figure 12. 24 Side View Forward Attachment Point

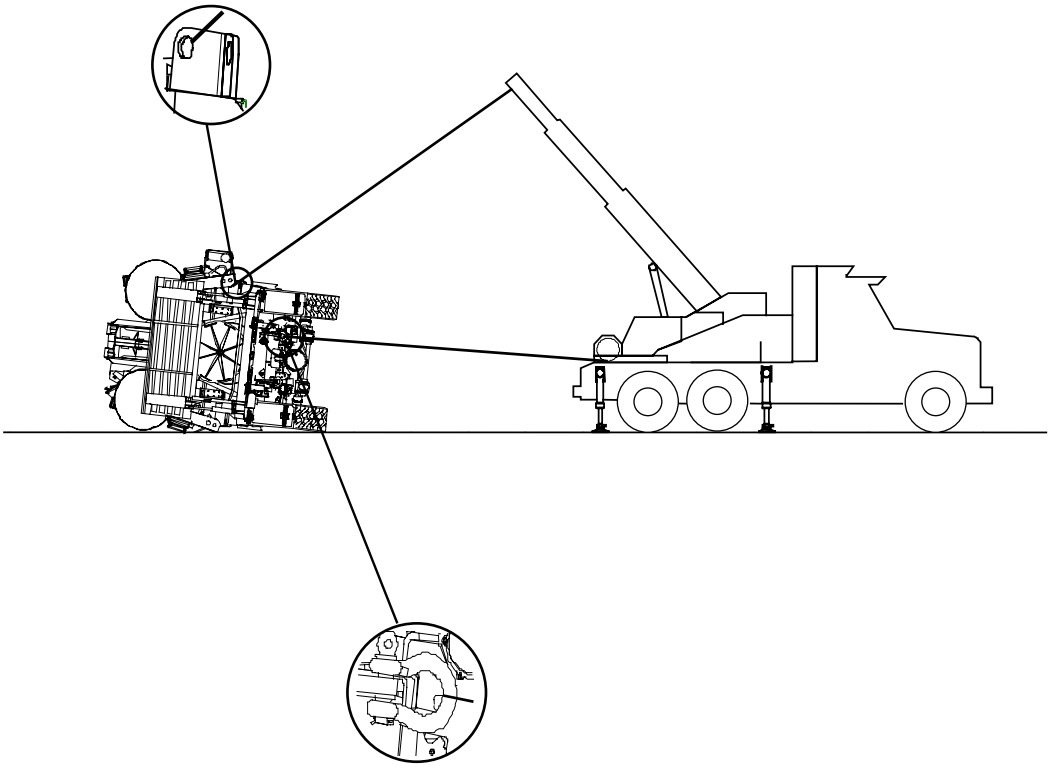


Figure 12. 25 Side View Showing Rear Attachment Points

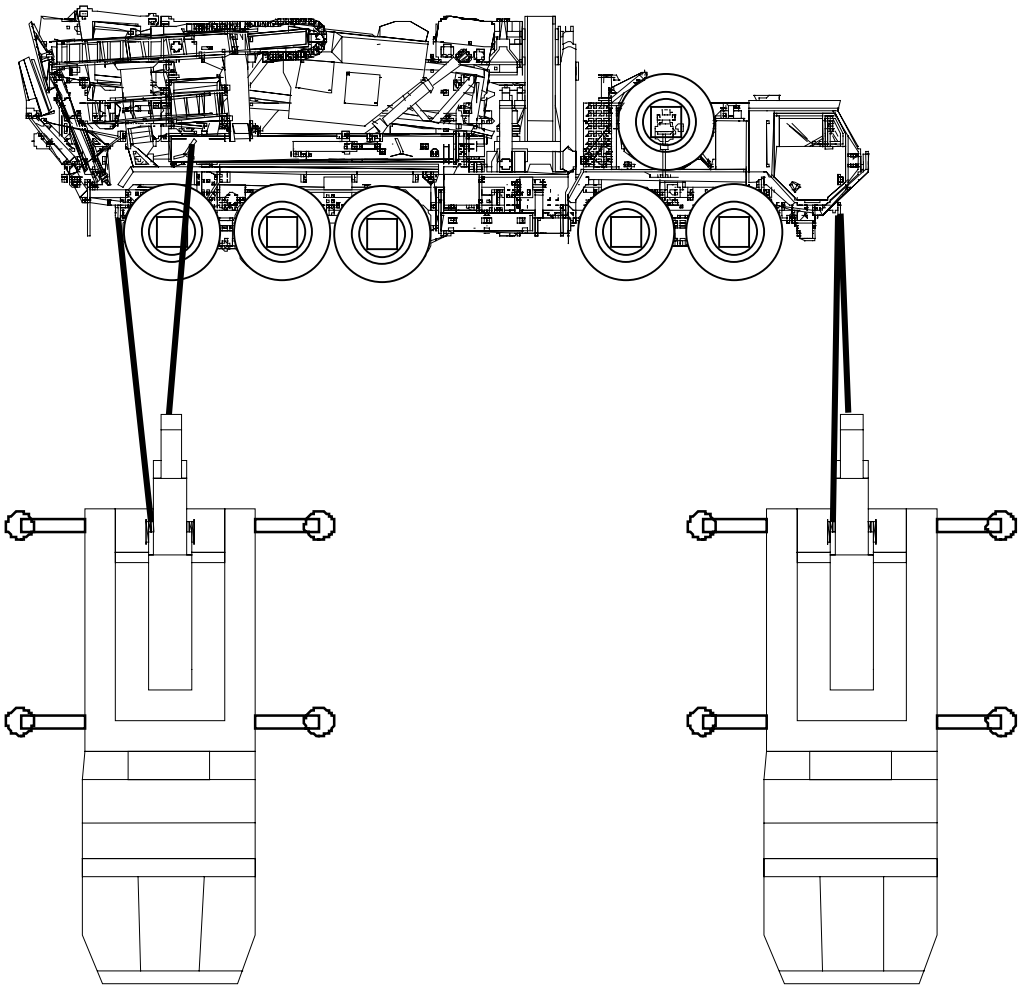


Figure 12. 26 Plan View Showing Attachment Points to Overturned Launch Vehicle

12.11 TOW HOOKUP PROCEDURES

12.11.1 Emergency Procedures - Slave Start of Launch vehicle

CAUTION

Equipment damage. Ensure the CTIS ON/OFF switch is in the OFF position and the LHS selector switch is in the OFF position on both slave truck and launch vehicle while performing the slave starting procedure. Failure to comply may result in damage to equipment.

NOTE

Slave starting is a two-person task.

12.11.1.1 Start truck (A).

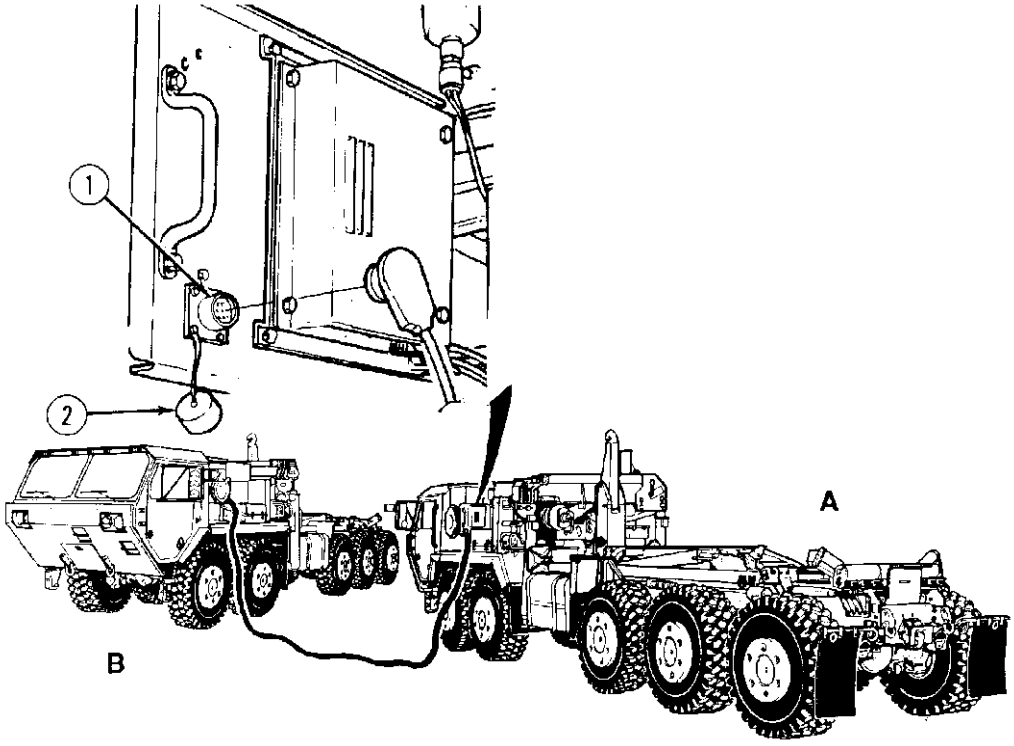


Figure 12. 27 Slave Receptacle

12.11.1.2 Move truck (A) into position beside the launch vehicle (B) so that the slave receptacles (Figure 12. 27. (1)) on truck and launch vehicle are side by side.

12.11.1.3 Park truck (A).

12.11.1.4 Shut off truck (A) engine.

12.11.1.5 Remove the caps (Figure 12. 27. (2)) from slave receptacles (Figure 12. 27. (1)) on truck (A) and launch vehicle (B)

WARNINGS

RISK OF ELECTRIC SHOCK. REMOVE ALL JEWELRY SUCH AS RINGS, DOG TAGS, BRACELETS, ETC. IF JEWELRY OR TOOLS CONTACT POSITIVE ELECTRICAL CIRCUITS A DIRECT SHORT MAY RESULT. DAMAGE TO EQUIPMENT, INJURY OR DEATH TO PERSONNEL MAY OCCUR.

ACID BURN. BATTERY ACID (ELECTROLYTE) IS EXTREMELY HARMFUL. ALWAYS WEAR SAFETY GOGGLES AND RUBBER GLOVES, AND DO NOT SMOKE WHEN PERFORMING MAINTENANCE ON BATTERIES. INJURY WILL RESULT IF ACID CONTACTS SKIN OR EYES. WEAR RUBBER APRON TO PREVENT CLOTHING FROM BEING DAMAGED.

CAUTION

Equipment damage. Ensure connectors and receptacles are free of dirt, sand and debris.

12.11.1.6 Plug the NATO slave cable connectors (Figure 12. 28. (3)) into the slave receptacles (Figure 12. 28. (1)) on truck (A) and launch vehicle (B).

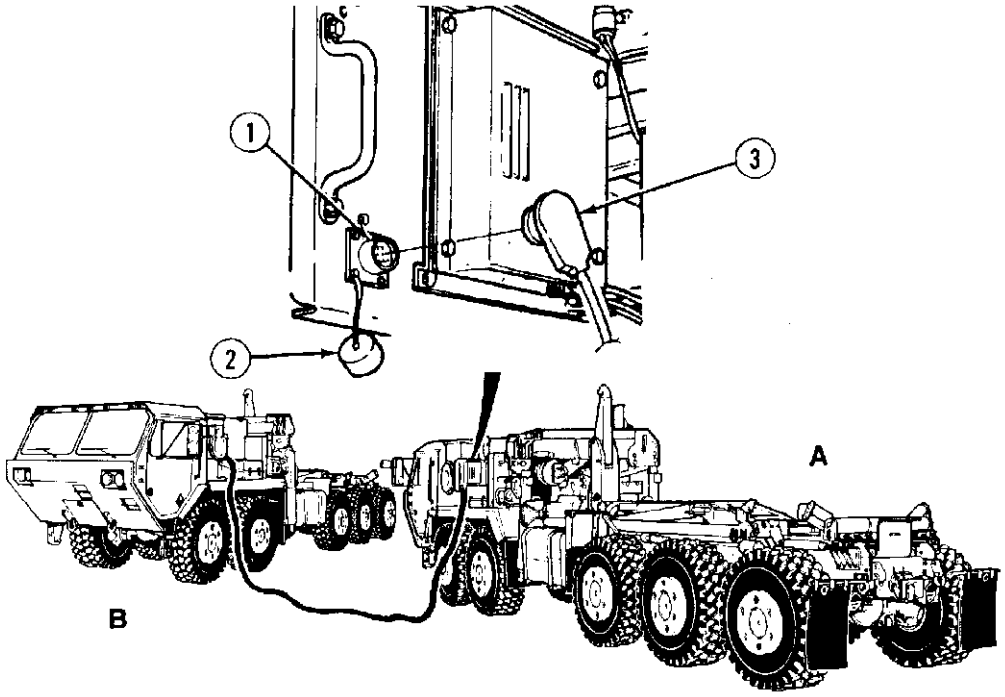


Figure 12. 28 Slave Cable

12.11.1.7 Start truck (A).

12.11.1.8 Operate truck (A) at more than 1,000 rpm while attempting to start the launch vehicle (B) engine.

12.11.1.9 When the launch vehicle engine is running smoothly, remove the NATO slave cable connectors (Figure 12. 28. (3)) from slave receptacles (Figure 12. 28. (1)) on trucks (A and B).

12.11.1.10 Install the caps (Figure 12. 28. (2)) on slave receptacles (Figure 12. 28 (1)) of truck (A) and launch vehicle (B).

12.11.1.11 Move and park truck (A).

12.11.1.12 Shut off truck (A).

Section V. OPERATING CRANE IN EMERGENCY CONDITIONS

12.12 CRANE EMERGENCY PROCEDURES

12.12.1 Overload Safety Feature

12.12.1.1 If the maximum load capacity is exceeded, all working movements that increase the load moment and ‘lower boom’ are switched off.

12.12.1.2 Shortly before the maximum load is reached, the crane overload warning lamp (Figure 12. 29. 7) on the crane column illuminates.

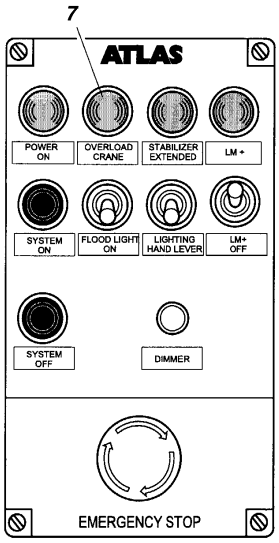


Figure 12. 29 Crane Overload Warning Light

12.12.1.3 The crane load is reduced by working movements, which decrease the load moment Figure 12. 30, once this is done the full working functions are restored.

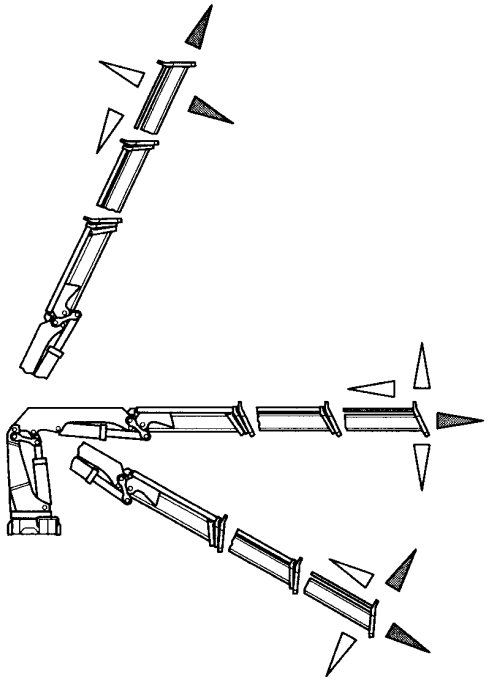


Figure 12. 30 Crane Load Moments

NOTE

The clear triangle shows decreasing load moments. The filled triangle shows the increasing load moments. (See Figure 12. 30).

12.12.2 Emergency Boom Lowering Switch

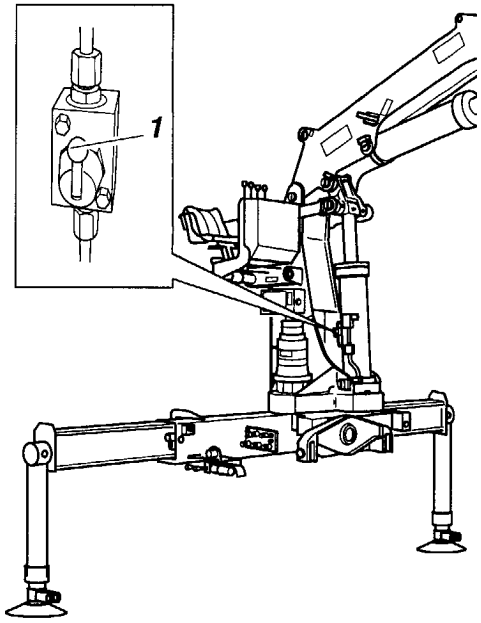


Figure 12. 31 Emergency Boom Lowering Switch

12.12.2.1 The crane is equipped with an emergency lowering switch for the boom. If the lift cylinder is extended as far as it will go, the overload protection device switches off operations that will increase the load moment. The boom can be retracted should this occur by means of the emergency lowering switch.

12.12.2.2 To enable emergency lowering of the boom pull the switch (Figure 12. 31. (1)).

TABLE OF CONTENTS

CHAPTER 13

SUPPORT INFORMATION

13.1 REFERENCE INFORMATION

13.1.1 References to Technical Manuals

13.1.1.1 The technical manuals listed in Table 13. 1 are referred to within this manual

TABLE 13. 1 MANUAL REFERENCES

Technical Manual Number	Title
TM 9-2320-364-10	Operators Manual Truck PLS
TM-5-5420-279-24	DSB Maintenance Manual
FM 9-43-2	Recovery and Battlefield Damage Assessment and Repair

13.1.2 Acronym List

Acronym	Meaning
AAL	Additional Authorization List
AEH	Anchor Earth Holdfast
AR	Approach Ramps
'AR'	Angle of Repose
ATEC	Allison Transmission Electronic Control
AUX	Auxiliary
BII	Basic Issue Items
BITE	Built in Test Equipment
BSE	Bridge Stop Emergency
C	Celsius
C of G	Center of Gravity
C/W	Complete With
CB	Circuit Breaker
CBT	Common Bridge Transport
CL	Center Line
COEI	Component of End Item
COP	Crane Operator
CPO	Chest Pack Operator
CTIS	Central Tier Inflation System
DSB	Dry Support Bridge
EAT	External Air Transport
E-stop	Emergency Stop
F	Fahrenheit

Acronym	Meaning
FBS	Far Bank Support
Ft	Foot
ft2	Foot Squared
H	Height
In	Inch
ISO	International Standards Organization
kN/m2	Kilo Newton per Square Meter
kPa	Kilo Pascal
kph	Kilometers per Hour
L/H	Left Hand
lb/in2	Pounds per Square Inch
LV	Launch Vehicle
LVT	Launch Vehicle Trailer
M	Meter
MLC	Military Load Classification
mm	Millimeter
mph	Miles per Hour
OPH	Holdfast Earth Anchor Pin
PES	Polyester
PLC	Programmable Logic Controller
PLS	Pallet Loading System
PM1	Pin Man 1
PM2	Pin Man 2
PM3	Pin Man 3
PMCS	Preventive Maintenance Checks and Services
PTO	Power Take Off
PV	Proportional Valve
R/H	Right Hand
RPM	Revolutions per Minute
SBC	Soil Bearing Capacity
SL1	Slinger 1
SL2	Slinger 2
SL3	Slinger 3
SV	Solenoid Valve
T1	Trailer 1
T2	Trailer 2

Acronym	Meaning
T3	Trailer 3
TM	Top Man
V1	Vehicle 1
V2	Vehicle 2
V3	Vehicle 3

13.1.3 Quick Conversion Table

13.1.3.1 This table allows a quick conversion from metric units to standard units and vice versa.

IN	MM
1	25
2	51
3	76
4	102
5	127
6	152
7	178
8	203
9	229
10	254
11	279
12	305

MM	IN
1	0.04
2	0.08
3	0.12
4	0.16
5	0.20
6	0.24
7	0.28
8	0.31
9	0.35
10	0.39
20	0.79
30	1.18
40	1.57
50	1.97
60	2.36
70	2.76
80	3.15
90	3.54
100	3.94
200	7.87
300	11.81
400	15.75
500	19.69
600	23.62
700	27.56
800	31.50
900	35.43
1000	39.37
1100	43.31
1200	47.24
1300	51.18
1400	55.12
1500	59.06
1600	62.99
1700	66.93
1800	70.87
1900	74.80
2000	78.74

FT	MTR
1	0.30
2	0.61
3	0.91
4	1.22
5	1.52
6	1.83
7	2.13
8	2.44
9	2.74
10	3.05
11	3.35
12	3.66
13	3.96
14	4.27
15	4.57
16	4.88
17	5.18
18	5.49
19	5.79
20	6.10
21	6.40
22	6.71
23	7.01
24	7.32
25	7.62
26	7.92
27	8.23
28	8.53
29	8.84
30	9.14
31	9.45
32	9.75
33	10.06
34	10.36
35	10.67
36	10.97
37	11.28
38	11.58
39	11.89
40	12.19

MTR	FT
1	3.28
2	6.56
3	9.84
4	13.12
5	16.41
6	19.69
7	22.97
8	26.25
9	29.53
10	32.81
15	49.22
20	65.62
25	82.03
30	98.43
35	114.84
40	131.24
50	164.05
60	196.86
70	229.67
80	262.48
90	295.29
100	328.10

NOTE

Figures are rounded up to nearest decimal point

APPENDIX A

FRACTURE CONTROL PLAN

A.1 FRACTURE CONTROL IN FIELD

A.1.1.1 The regions of the bridge have been divided into five zones A to E as shown in Figure A. 1.

A.1.1.2 Zone A involves the bottom chords and regions with welded attachments at the bottom of the side skin. This is the most critical, as tolerance for cracks in these regions are extremely small.

A.1.1.3 Zone B covers the top chords and trackway deck. Cracks are more likely to affect serviceability of the bridge, and repair will be a viable option provided any cracks are found at an early stage.

A.1.1.4 Zone C covers the ends of the panels. Attention should be focused in particular on the jaws and jaw pinning holes.

A.1.1.5 Zones D and E cover the middle of the side skins and diaphragms respectively. Inspections can be limited to checking for external damage.

A.1.1.6 The fracture control plan (Table A. 1) has been drawn up to detail the inspection and any resulting action to be carried out on the bridge panels.

A.1.1.7 This system includes the use of **CRACK FIRST** fatigue-monitoring gauges. See Figure A. 3 and Figure A. 4. The gauge has two 12mm holes, which are pre-notched so that a crack will start from a known point. As the panel is trafficked, the crack will grow in length until the coupon finally fails. Once failed the bridge module must be taken out of service. The fatigue monitoring gauges are only fitted to the Parallel Modules.

A.1.1.8 The gauge is designed to give an initial warning that the end of the design fatigue life is being approached. This is indicated by the crack extending between the two 12mm holes. When the crack extends completely from top to bottom of the gauge then the design life has been reached and the panel must be taken out of service. The bridge panel should also be removed from service when one of the conditions listed in the Action Column in Table A. 1 is identified.

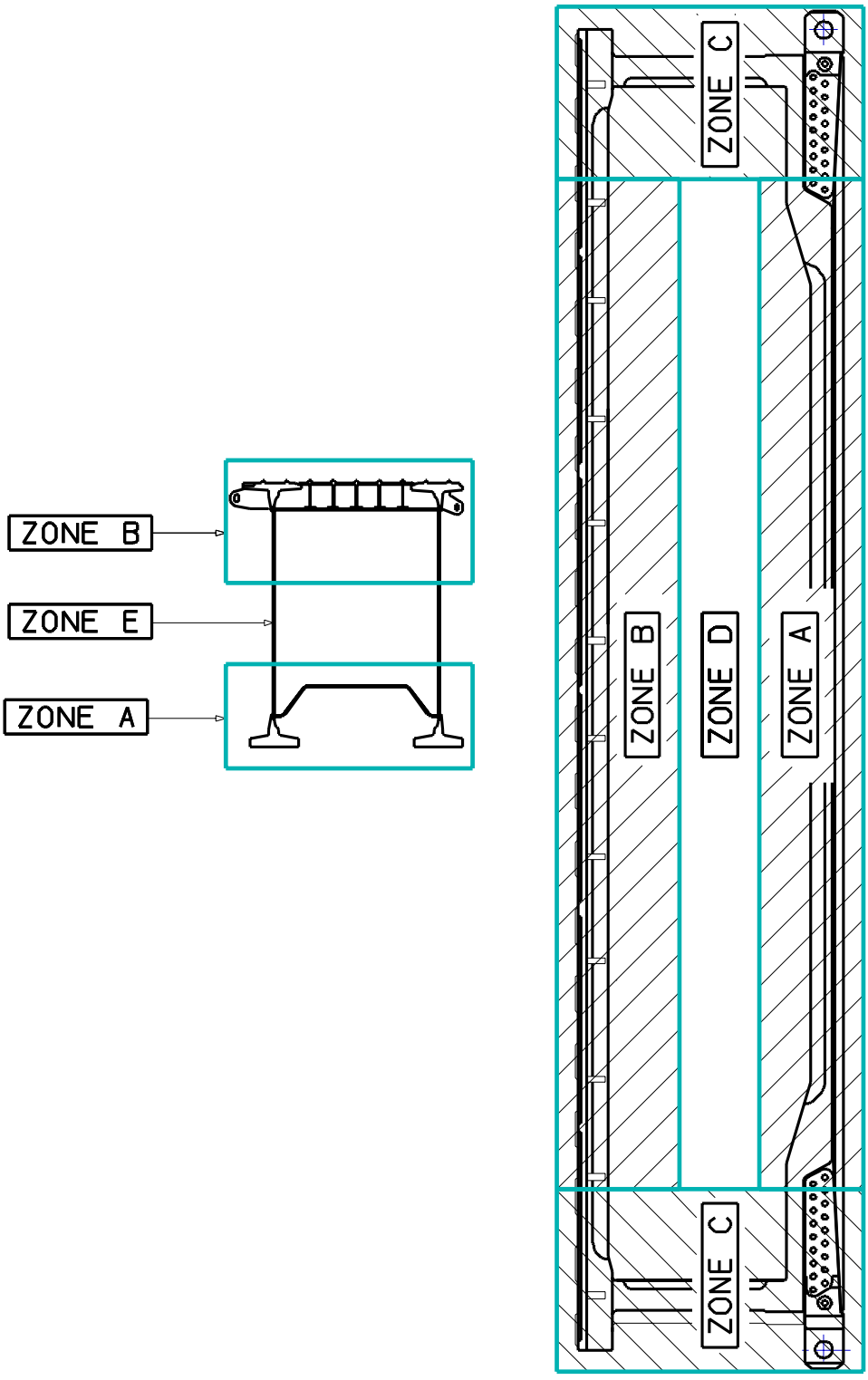
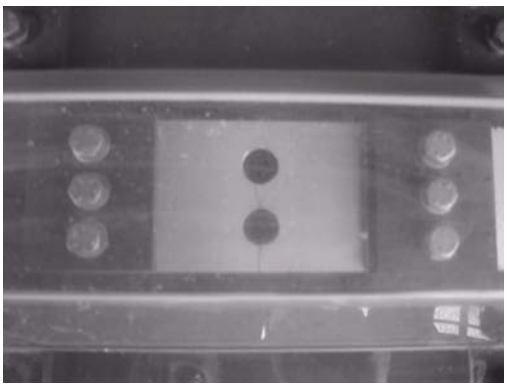


Figure A. 1 Location of Fracture and Fatigue Control Plan Zones for Parallel Panel.

A.2 INSPECTION AND ACTION REQUIREMENTS

A.2.1.1 The following are the requirements for inspection and action when the bridge is in service.

Table A. 1 Inspection and action requirements

Location	Time Interval	Inspection Method	Action
Zone A - CrackFirst Fatigue Monitoring Gauges	Every 12 months until central band between 12 mm holes has failed then as detailed under 'Action'.	Visual	Check extent of cracking in central area between 12mm holes and external area from 12mm holes to outside edge of gauge. If central area is more than 50% cracked, increase inspection frequency to 6 months or 3 missions. If central area is fully cracked, increase inspection frequency to every 2 months or each mission. If whole gauge has cracked, completely remove unit from service.
			

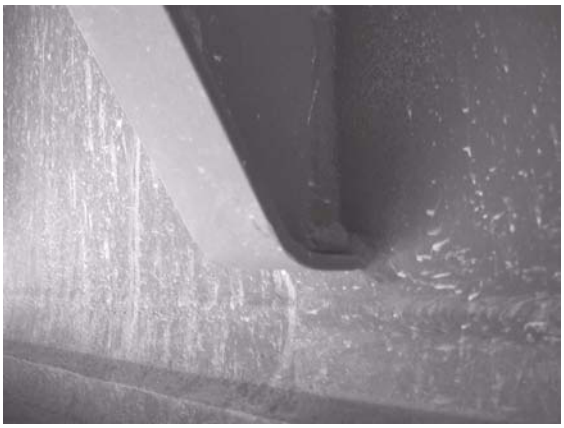
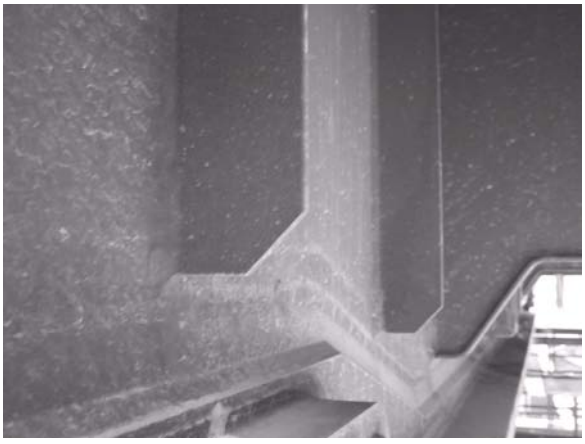
continued

Table A. 1 Inspection and action requirements (continued)

Location	Time Interval	Inspection Method	Action
Zone A - Top side of bottom chord at weld to side skin	When CrackFirst gauge has cracked across central band between 12 mm holes until gauge has cracked completely.	Visual	Check for transverse (vertical) cracks across side skin to bottom chord weld. Remove from service if any cracks longer than 25 mm are found.
			
Zone A - Weld toes of blocks for fatigue monitoring gauges	When CrackFirst gauge has cracked across central band between 12 mm holes until gauge has cracked completely.	Visual	Check for cracks at weld toes in vertical direction. Remove from service if any cracks longer than 25 mm are found.
			

continued

Table A. 1 Inspection and action requirements (continued)

Location	Time Interval	Inspection Method	Action
Zone A - Ends of welds attaching diaphragm bottom flanges to side skins.	When CrackFirst gauge has cracked across central band between 12 mm holes until gauge has cracked completely.	Visual	Check for cracks at weld toes in vertical direction. Remove from service if any cracks longer than 25 mm are found.
			
Zone A - Toes of welds attaching vertical stiffeners to side skins at bottom	When CrackFirst gauge has cracked across central band between 12 mm holes until gauge has cracked completely.	Visual	Check for cracks at weld toes in vertical direction. Remove from service if any cracks longer than 25 mm are found.
			

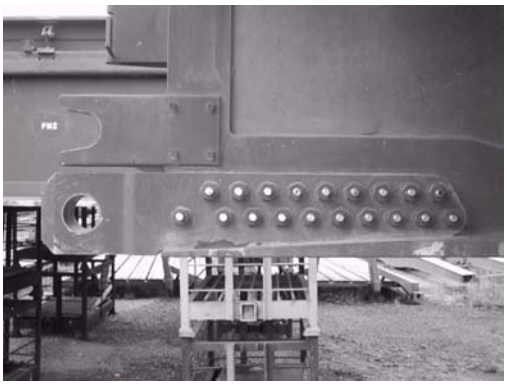
continued

Table A. 1 Inspection and action requirements (continued)

Location	Time Interval	Inspection Method	Action
Zone B - Mid span under top chord at weld to side skins	When CrackFirst gauge has cracked across central band between 12 mm holes until gauge has cracked completely.	Visual	Check for transverse (vertical) cracks across weld. Remove from service and arrange repair if any cracks longer than 36 mm are found.
			
Zone B - Welds attaching bottom of trackway deck to top flange of diaphragms	When CrackFirst gauge has cracked across central band between 12 mm holes until gauge has cracked completely.	Visual	Check for cracks at weld toes in either bottom of trackway deck or diaphragm flange. Remove from service and arrange repair if any cracks longer than 36 mm are found.
			

continued

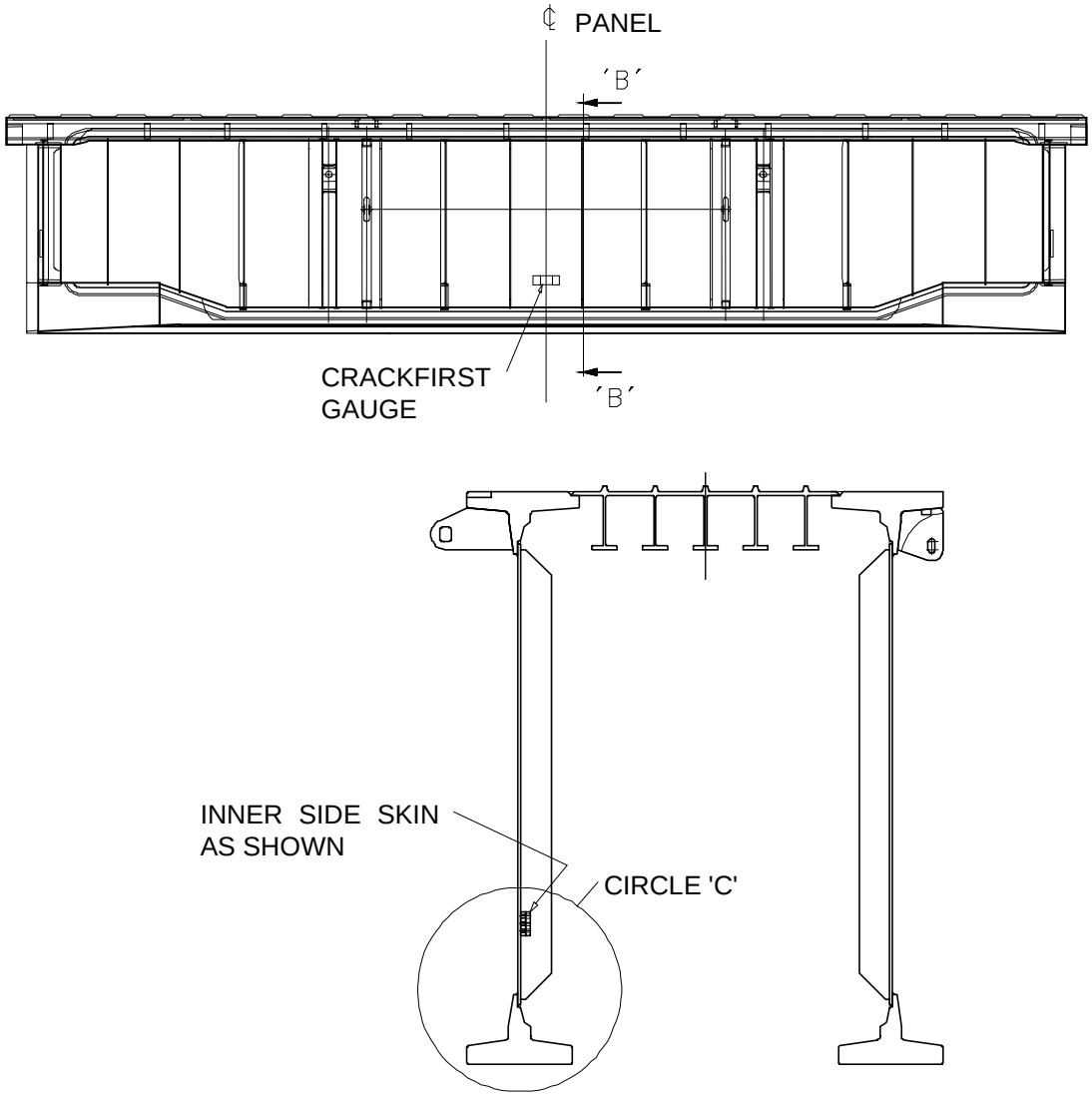
Table A. 1 Inspection and action requirements (continued)

Location	Time Interval	Inspection Method	Action
Zone C - Ends of welds attaching the end diaphragm to the side skins.	When CrackFirst gauge has cracked across central band between 12 mm holes until gauge has cracked completely.	Visual	Check for cracks at weld toes in vertical direction. Remove from service if any cracks longer than 25 mm are found.
			
Zone C - Connecting jaws at ends close to holes for pins	When CrackFirst gauge has cracked across central band between 12 mm holes until gauge has cracked completely.	Visual	Check for any evidence of cracks from bore of jaw pin holes. Remove from service and replace component if any cracks are found
			

continued

Table A. 1 Inspection and action requirements (continued)

Location	Time Interval	Inspection Method	Action
Zone D - Central side skin regions of main panels	Each mission.	Visual	Check for evidence of external damage. Assess whether damage affects ability of unit to continue in service.
			
Zone E - Central side skins region of transverse diaphragms	Each mission.	Visual	Check for evidence of external damage. Assess whether damage affects ability of unit to continue in service.
			



CROSS SECTION B-B

Figure A. 2 Location of CrackFirst Fatigue Monitoring Gauge on Parallel Panel

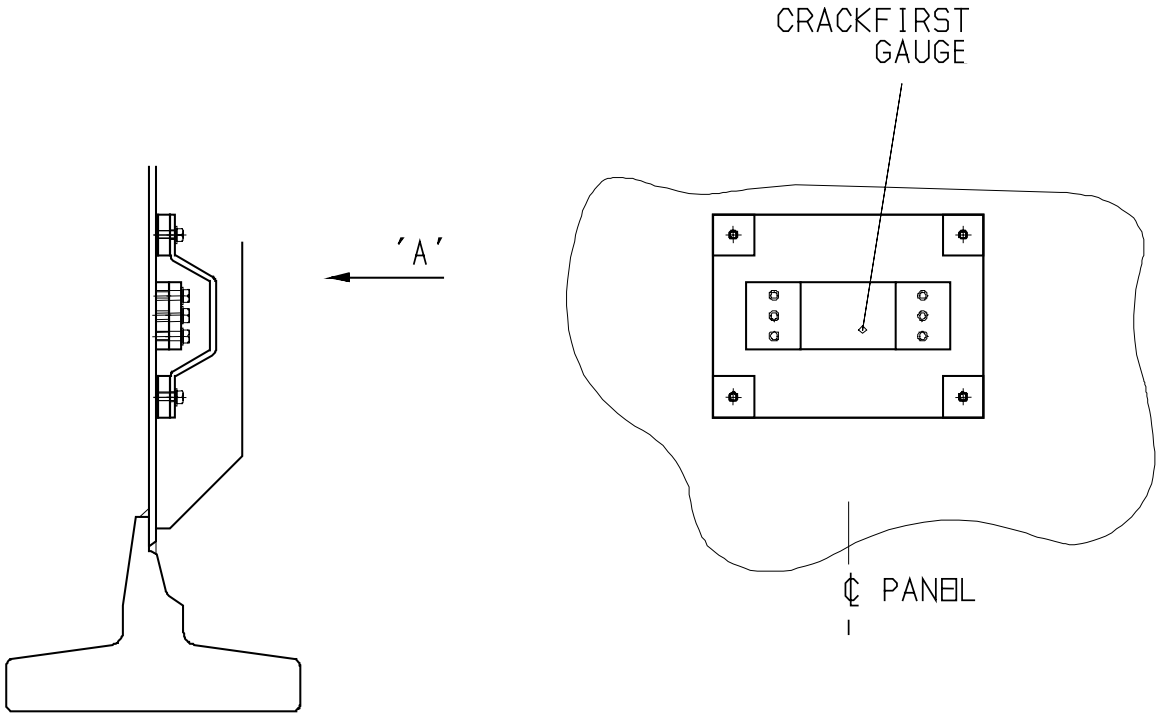


Figure A. 3 Scrap View in Circle C on Inside Face of Panel

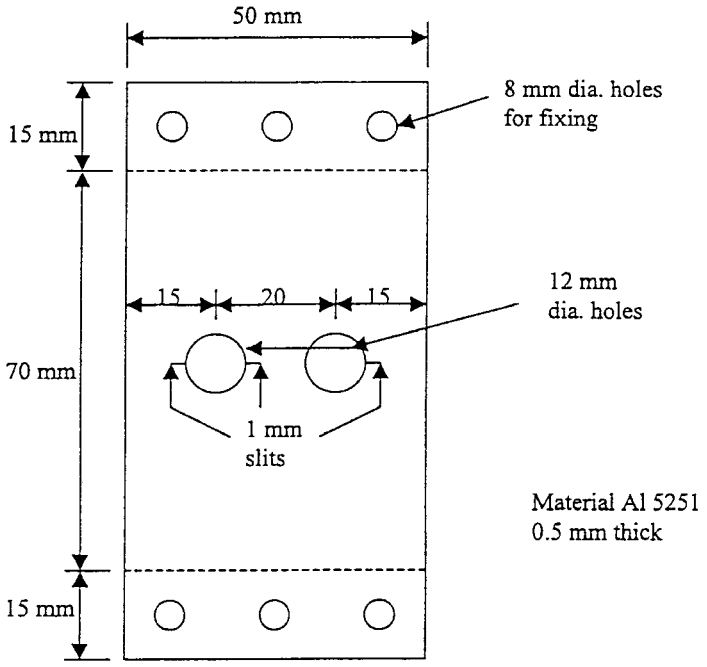


Figure A. 4 Detail CrackFirst Fatigue Monitoring Gauge Plate

APPENDIX B

MAINTENANCE ALLOCATION CHART (MAC)

B.1 INTRODUCTION

B.1.1.1 This Appendix provides an explanation of maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept. The Maintenance Allocation Chart (MAC), shown in Table B 1, designates overall authority and responsibility for the performance of maintenance functions on the identified items. (For the purposes of this section, “item” refers to a module, component or assembly.) The application of the maintenance functions to the item is consistent with the capacities and capabilities of the designated maintenance level, detailed in column (4) of the MAC, as follows:

Unit - two sub-columns, C (operator/crew) and O (unit) maintenance.

Direct Support - one sub-column, F.

General Support / Specialized Repair Activity - one sub-column, H.

Depot / Specialized Repair Activity - has one sub-column, D.

B.1.1.2 Paragraph B.1.4 and Table B 2 detail the tool sets, special tools, common test equipment and special test equipment, required for each maintenance function, as referenced from the maintenance levels in column (4) of the MAC.

B.1.1.3 Paragraph B.1.5 contains supplemental instructions and explanatory notes for particular maintenance functions.

B.1.2 Maintenance Functions

B.1.2.1 Maintenance functions are limited to and defined as:

Adjust. To maintain or regulate within prescribed limits, by bringing into proper position or by setting the operating characteristics to specified parameters.

Align. To adjust specified variable elements of an item, to bring about optimum or desired performance.

Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or Test Measurement and Diagnostic Equipment (TMDE), used in precision measurement. Calibration is the comparison of two instruments (one of which is to a certified standard of known accuracy), to detect and adjust any discrepancy in the accuracy of the instrument being compared.

Inspect. To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards, through examination (e.g., by sight, sound or feel).

Overhaul. The maintenance effort (service[1] /action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (e.g., depot maintenance work requirement). Overhaul is normally the highest degree of maintenance performed by the army. (Overhaul does not normally return an item to a like-new condition).

Rebuild. Those services/actions necessary for the restoration of unserviceable equipment to a like-new condition, in accordance with the original manufacturing standards. Rebuild is the highest degree of material maintenance applied to army equipment. The rebuild operation includes the act of returning to zero; those age measurements (e.g., hours/miles), considered in classifying Army equipment/components.

Remove/Install. To remove and install the same item when required to perform service1 or other maintenance functions. Install may be the act of replacing, seating or fixing into position, a spare, repair part or item, in a manner that allows the proper functioning of an equipment or a system.

Repair. The application of maintenance services, including fault location[2]/trouble shooting, removal/installation and disassembly/assembly[3], procedures and maintenance actions[4]; to identify troubles and restore serviceability to an item, by correcting specific damage, faults, malfunctions or failures.

Replace. To remove an unserviceable item and install a serviceable counterpart in its place. The MAC authorizes replacement and the assigned maintenance level is shown as the reference code in Table 3.

Service. Operations required periodically to keep an item in proper operating condition: e.g., to clean (including decontaminate), preserve, drain and paint. Service also includes replenishment of fuel, lubricants, chemical fluids and gases.

Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic or electrical characteristics of an item and comparing those characteristics with prescribed standards. The Test function is also used in the location of faults.

B.1.3 Maintenance Allocation Chart (MAC)

B.1.3.1 The MAC, in Table B 1, designates overall authority and responsibility for the performance of maintenance functions on the identified items. The MAC is divided into six columns and the function of each column is explained as follows:

B.1.3.2 **Column (1) Group No**. The purpose of the Group No. is to identify maintenance-significant items with their next higher assembly.

B.1.3.3 **Column (2) Component/Assembly**. Column (2) contains the names of items for which maintenance is authorized.

---

[1] Services. - Inspect, test, service, adjust, align, calibrate and/or replace.

[2] Fault location/troubleshooting. - The process of investigating and detecting the cause of equipment malfunctioning: the act of isolating a fault within a system or item under test.

[3] Disassembly/assembly. - The step-by-step breakdown (taking apart) of a spare/functional group-coded item, to the level of its least component that is identified as maintenance significant, (i.e. assigned a reference code in Table 1).

[4] Actions. - Welding, grinding, riveting, straightening, facing, machining and/or resurfacing.

B.1.3.4 **Column (3) Maintenance Function**. This column lists the functions (explained in paragraph 2) that can be performed on the items listed in Column (2).

B.1.3.5 **Column (4) Maintenance Level**. Column (4) specifies each level of maintenance, authorized by the listing in Column (3), and indicates, in the appropriate sub-column, the man-hours required to perform the task. The man-hours shown represents the average time required to restore an item to a serviceable condition, under typical field operating conditions and includes preparation time, fault location time and quality assurance time. The symbols for the various maintenance levels, shown at the top of the Column (4) sub-columns, are as follows:

C Operator or Crew maintenance

O Unit Maintenance

F Direct Support Maintenance

H General Support Maintenance / SRA

D Depot Maintenance / SRA

B.1.3.6 **Column (5) Tool or Test Equipment Reference Code**. Column (5) specifies, by code, common tool sets (not individual tools), special tools, common and special TDME and special support equipment, required to support the maintenance functions. The code numbers refer to the list of tools and test equipment in Table B 2.

B.1.3.7 **Column (6) Remarks**. Where applicable, this column contains a code letter, defined in Table B 3, which refers to a maintenance note or instruction.

Table B 1 Maintenance Allocation Chart (MAC)

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
100	**Bridge**	Inspect Service Repair	1.3 1.0	1.0				1	P W
10010	Launch Beam Lifter	Inspect Remove / Install Test		0.1 1.0			0.5	2	P F
10020	Lifting Beam Support Arm	Inspect Remove / Install Test		0.1 1.0			0.3	2	P F
10030	Lifting Beam Links and Shackle	Inspect Remove / Install Test		0.1 0.2 1.0				2	P
10040	End Beam Lifting Pin	Remove / Install		0.5				2	
10050	End Beam and Ramp Module Slide Plates	Remove / Install	0.5					1	
1010	**Parallel Module**	Inspect Service Remove / Install Repair	0.5	1.0			8.0	1, 8	P W, F
101010	Deck Units	Remove / Install	1.5					8	
101020	Bridge Marker Assembly	Remove / Install	0.5					1	
101030	Curb	Remove / Install	1.0					1	
101040	Curb Clamp Assembly	Inspect Remove / Install		0.1 0.5				2	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
101050	Pin Jaw Connection System	Inspect Adjust Remove Install		0.2	0.2 1.0 2.0		4.0	2	P F
101060	Birds Beak	Inspect Remove Install		0.1 0.3			2.0	2	P F
101070	Dowel	Remove / Install		0.5				2	
101080	Damper	Inspect Remove / Install		0.1 1.0				2	P
101090	Damper Upper Mounting	Remove / Install		1.0				2	
101100	Damper Lower Mounting	Remove / Install		1.0				2	
101110	Fatigue Monitor	Inspect Service		0.1 0.2				2	P
101120	Closing Sling	Remove / Install	1.0					1	
101130	Closing Sling Pulley	Remove / Install	1.0					1	
101140	Opening Sling	Remove / Install	1.0					1	
101150	Shoot Bolt	Remove / Install	0.5					1	
101160	Bush Resilient	Remove / Install	0.5					8	
1020	**Ramp Module**	Inspect Service Remove / Install Repair	 0.5 0.1	1.0			 8.0	 7, 8	P W, F
102010	Deck Units	Remove / Install	1.5					7, 8	
102020	End Beam Pin Locating Bracket	Inspect Remove / Install		0.1 0.5				2	P
102030	Push/Pull Sling	Remove / Install	0.5					7	

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
102040	Ramp Skid Mounting Bolt	Inspect Remove / Install	0.5	0.1				1	P
102050	Level	Remove / Install	0.5					7	
102060	Ramp Module Lifting Pin	Remove / Install		1.0				2	
102070	Curb	Remove / Install	1.0					1	
102080	Curb Clamp Assembly	Inspect Remove / Install		0.1 0.5				2	P
102090	Pin Jaw Connection System	Inspect Adjust Remove Install		0.2	0.2 1.0 2.0		4.0	2	P F
102100	Birds Beak	Inspect Remove Install		0.1 0.3			2.0	2	P F
102110	Dowel	Remove / Install		0.5				2	
102120	Damper	Inspect Remove / Install		0.1 1.0				2	P
102130	Damper Upper Mounting	Remove / Install		1.0				2	
102140	Damper Lower Mounting	Remove / Install		1.0				2	
102150	Closing Sling	Remove / Install	1.0					1	
102160	Closing Sling Pulley	Remove / Install	1.0					1	
102170	Opening Sling	Remove / Install	1.0					1	
102180	Shoot Bolt	Remove / Install	0.5					1	
102190	Bush Resilient	Remove / Install	0.5					8	
102200	Bridge Marker Assembly	Remove / Install	0.5					1	

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
1030	**Approach Ramp**	Remove / Install Repair	0.1						W
200	**A-Frame Assembly**	Inspect Service Remove / Install Repair	2.9 0.2	0.2	 80.0			 1 2, 10, 11, 12	P W
2010	Folding Cylinder	Inspect Remove / Install Repair		0.2 3.0			 5.0	 2, 24	P CA
2020	Raise Cylinder	Inspect Remove / Install Repair		0.2 3.0			 5.0	 2, 24	P CA
2030	Cylinder Locking Plate	Remove / Install		0.2				2	
2040	Guide Roller Hydraulic Motor	Inspect Remove / Install		0.1 2.0				 2	P
2050	Guide Support Roller	Inspect Remove / Install		0.1 2.5				 2	P
2060	Bridge Bearing Pads	Inspect Remove / Install		0.1 0.5				 2	P
2070	Upper Sliding Section Bearing Pads	Inspect Remove / Install		1.0 0.7				 2	P
2080	Stabilizer Foot Assembly	Inspect Remove / Install		0.2 0.5				 2	P
2090	Bridge Stop Emergency	Inspect Remove / Install		0.2 4.0				 2, 5	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
2100	Limit Switches	Inspect Remove / Install Adjust		0.7 0.5 0.5				2	P
2110	Back-up Mode Operation Controls	Remove / Install		0.5				2	
2120	Folding Walkway	Inspect Remove / Install		0.1 1.0				2	P
2130	Shoot Bolt	Inspect Remove / Install		0.1 0.3				2	P
2140	Support Strut Assembly	Remove / Install		0.5				2	
2150	Lower Emergency Stop	Remove / Install		0.7				2	
2160	Stabilizer Manifold Assembly	Inspect Remove / Install Repair		0.2	4.0		2.0	2	P F
2170	Stabilizer Leg and Stabilizer Cylinder	Inspect Remove / Install Repair		0.2	12.0		5.0	2, 24	P CA
2180	Upper Center Beam	Inspect Remove /Install Repair		0.2	16.0		1.0	2	P F
2190	Lower Center Beam	Inspect Remove /Install Repair		0.2	60.0		1.0	2	P F
2200	Stabilizer Leg Assembly	Inspect Remove / Install Repair		0.2	40.0		1.0	2	P F
2210	Electrical Junction Box	Remove / Install			0.5			2	

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
2220	Stop Pad	Remove / Install	0.5					2	
2230	Electrical Harness	Inspect		0.2					P
		Remove / Install			10.0			2	
2240	Upper Access Ladder	Remove /Install	0.5					1	
		Repair							W
300	**Launcher Assembly**	Inspect		12.0					P
		Service	2.0					7, 8	
		Remove / Install			8.0			2, 3, 4, 5, 6,	
		Repair							W
3010	Sectionalization	Remove / Install		8.0				2	
3020	**Launch Frame**	Inspect	1.1	1.0					P
		Service	0.5					7, 8	
		Remove / Install			40.0			2	
		Repair							W
302010	Rear Pinch Roller Assembly	Inspect		0.1					P
		Remove / Install		0.7				2	
		Repair					1.0		F
302020	Rear Pinch Roller Bearings	Inspect		0.3					P
		Remove / Install		3.0				2, 14	
		Service		0.2				2	
302030	Rope Roller Upper	Inspect		0.1					P
		Remove / Install		1.0				2	
302040	Forward Roller Assembly	Inspect			0.2				P
		Remove / Install			8.0			2	
302050	Forward Roller Bearings	Remove / Install			2.0			2, 14	
302060	Center Pivot Bushings	Inspect		0.1					P
		Remove / Install		4.0				2, 20	

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
302070	Launch Beam Final Stop	Remove / Install Repair			0.5		 1.0	2	 F
302080	Launch Beam Drive Top Cover	Remove / Install		0.5				2	
30208010	Swivel Load Ring	Remove / Install		0.5				2, 22	
302090	Drive Chain	Inspect Remove / Install Adjust		0.3 0.5 1.5				 2	P
302100	Beam Drive Gearbox Oil	Service		0.3				2	
302110	Drive Sprocket	Remove / Install		0.5				2, 22	
302120	Beam Drive Brake Oil	Service		0.3				2	
302130	Front Roller Assembly	Inspect Service Remove / Install	 0.5	0.1 0.3				 1 2	P
302140	Side Roller Assembly	Inspect Service Remove / Install	 0.5	0.1 0.3				 1 2	P
302150	Winch Gearbox Oil	Service	0.2	0.5				1, 2	
302160	Lower Winch	Inspect Remove / Install		0.1	 2.0			 2	P
302170	Lower Winch Rope Tensioner	Remove / Install		1.0				2	
302180	Upper Winch	Inspect Remove / Install		0.1	 2.0			 2	P
302190	Upper Winch Rope Tensioner	Remove / Install		1.5				2	
302200	Upper Winch Rope Tension Indicator	Remove / Install		0.5				2	

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
302210	Emergency Winch Drum Release	Align		1.0				2	
302220	Electrical Enclosure Assembly	Remove / Install		0.5				2	
302230	Articulator Cylinder	Remove / Install Repair		3.0			 5.0	2, 24	 CA
302240	Articulator Cylinder Cross Member	Remove / Install		2.0				2	
302250	Stow Cylinder	Remove / Install Repair		1.5			 5.0	2, 24	 CA
302260	Stow Cylinder Top Mounting	Remove / Install		1.0				2	
302270	Emergency Stop	Remove / Install Repair		0.7			 0.5	2	 F
302280	Pin Storage Rack	Remove / Install		0.5				2	
302290	Safety Stop Assembly	Remove / Install Repair			1.0		 1.0	2, 3	 F
302300	Launch Beam Drive	Inspect Service Remove / Install	 0.5	0.2	 16.0			 1 2, 7, 8, 9, 14	P
30230010	Launch Beam Drive Manifold	Inspect Remove / Install Repair		0.3	0.5 4.0		 2.0	 2	P F
302310	Winch Manifold Assembly	Inspect Remove / Install Repair		0.3	0.5 4.0		 2.0	 2	P F
302320	Launch Beam Drive Wheels	Inspect Remove / Install			0.3 8.0			 2, 7, 9, 14	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
302330	Drive Motor and Gearbox Assembly	Inspect Remove / Install		0.3 3.0				2	P
302340	Upper Winch Rope	Inspect Service Remove / Install		1.0 1.0	6.0			2, 23	P
302350	Lower Winch Rope	Inspect Service Remove / Install		1.0 1.0	8.0			2	P
302360	Articulator Manifold Assembly	Inspect Remove / Install Repair		0.1	10.0		2.0	2	P F
302370	Pinch/Roll Stow Manifold Assembly	Inspect Remove / Install Repair		0.3	4.0		2.0	2	P F
30237010	Pinch/Roll Cylinder	Remove / Install Repair			2.0		2.0	2	F
302380	Pilot Manifold Assembly	Inspect Remove / Install Repair		0.3	8.0		2.0	2	P F
302390	Launch Frame Guards	Remove / Install	1.5					1	
302400	Electrical Harness	Inspect Remove / Install		0.2	8.0			2	P
302410	Lower Winch Pilot Valve	Adjust	1.0					1	
3030	**Forward Launch Beam**	Inspect Service Remove / Install Repair	0.7 0.3	0.3	16.0			2	P W

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
303010	Fail Safe Roller	Inspect Remove / Install		0.1 0.5				2, 3	LB
303020	Location Block	Inspect Remove / Install		0.1 0.3				2	LB
303030	Carriage Stops	Inspect Remove / Install		0.1 0.5				2	P
303040	Bushing Resilient	Inspect Remove / Install		0.2 0.2				2	LB
303050	Pulleys	Inspect Remove / Install		0.2 2.0				2	P
3040	**Launch Beam**	Inspect Remove / Install Repair	0.5 0.1	0.1				2, 3, 7, 8	P W
304010	Fail Safe Roller	Inspect Remove / Install		0.1 0.5				2, 3	P
304020	Location Block	Inspect Remove / Install		0.1 0.3				2	P
304030	Bushing Resilient	Inspect Remove / Install		0.2 0.2				2	P
3050	**Far and Home Bank Carriage**								
305010	**Far Bank Carriage**	Inspect Service Remove / Install Repair	1.1 0.5	1.0	 16.0			 1 2, 7, 8	P W
30501010	Top Roller	Inspect Remove / Install		0.3 2.0				2	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
30501020	Top Roller Bearings	Inspect Remove / Install		0.3 2.0				2	P
30501030	Side Roller	Inspect Remove / Install		0.1 1.0				2, 20	P
30501040	Upper Pulleys	Inspect Remove / Install		1.0	8.0			2	P
30501050	Lower Pulleys	Inspect Remove / Install		1.0	6.0			2	P
30501060	Sling and Retaining Pin	Remove / Install	0.5					1	
30501070	Wear Pad	Remove / Install		1.5				2	
30501080	Rope Guide Roller	Service Remove / Install		0.1 0.5				2	
30501090	Restraint	Inspect Remove / Install		0.1 1.0				2	P
305020	**Home Bank Carriage**	Inspect Service Remove / Install Repair	1.1 0.5	1.0	16.0			2, 7, 8	P W
30502010	Top Roller	Inspect Remove / Install		0.3 2.0				2	P
30502020	Top Roller Bearings	Inspect Remove / Install		0.3 2.0				2	P
30502030	Side Roller	Inspect Remove / Install		0.1 1.0				2, 20	P
30502040	Upper Pulleys	Inspect Remove / Install		1.0	8.0			2	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
30502050	Lower Pulleys	Inspect		1.0					P
		Remove / Install			6.0			2	
30502060	Sling and Retaining Pin	Remove / Install	0.5					1	
30502070	Latch	Remove / Install		0.3				2	
30502080	Wear Pad	Remove / Install		1.5				2	
30502090	Rope Guide Roller	Service		0.1					
		Remove / Install		0.5				2	
30502100	Release Lock	Inspect		0.1					P
		Adjust	1.0					1	
		Remove / Install		1.5				2	
30502110	Buffer Stop	Remove / Install		0.5				2	
3060	**Far Bank Support**	Inspect	1.4	1.0					P
		Service	0.3					7	
		Remove / Install		1.0				2	
		Repair					10.0		W, F
306010	Slide Pad	Inspect		1.0					P
		Remove / Install		1.0				2	
306020	Center Post	Inspect		0.1					P
		Remove / Install		4.0				2, 7	
306030	Telescopic Tube	Inspect		0.1					P
		Remove / Install		1.5				2,9	
306040	Support Bearing Pad and Retaining clip	Inspect		0.1					P
		Remove / Install		0.5				2	
306050	Mounting Pin	Inspect		0.1				2	P
		Remove / Install		0.5					
306060	Hydraulic System	Inspect		0.2					P
		Service		1.0				2, 19, 20	

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
306070	Cross Beam	Remove / Install		1.0				2	
306080	Bearing Pad Latch	Remove / Install	0.5					2	
306090	Stowing Pad Adjustment	Remove / Install	0.5					2	
3070	**Slide Frame Assembly**	Inspect	2.9	0.3					P
		Service		0.5				2	
		Remove / Install			80.0			2	
		Repair							W
307010	Rotate Cylinder	Inspect		0.2				2, 24	P
		Remove / Install		2.0					
		Repair					5.0		F
307020	Home Bank End Beam Adapter	Remove / Install		0.5				2	
307030	Twist Lock Assembly	Inspect		0.1				2	P
		Remove / Install		1.7					
307040	Section 1	Inspect		0.3					P
		Service		0.5				2	
		Remove / Install			20.0			2	
307050	Section 2	Inspect		0.3					P
		Service		0.5				2	
		Remove / Install			40.0			2	
307060	Section 2 Wear Pads and Stop Plugs	Inspect		0.3				2	P
		Remove / Install		0.5					
307070	Section 3	Inspect		0.3					P
		Service		0.5				2	
		Remove / Install			60.0			2	
307080	Section 3 Wear Pads and Stop Plugs	Inspect		0.3					P
		Remove / Install		0.5				2	

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
307090	Upper Slide Twistlock Mounts	Inspect Remove / Install		0.1 1.5				2	P
307100	Tilt Roller Assembly	Inspect Remove / Install		0.1 1.5	2.0			2	P
307101	Tilt Roller Slide Pads	Inspect Remove / Install		0.1	2.0			2	P
307110	Tilt Roller Support	Inspect Remove / Install		0.1 1.0				2	P
307120	Tilt Roller Cylinder	Inspect Remove / Install Repair		0.2 2.5			5.0	2, 20	P CA
307130	Tilt Roller Shoot Bolt Housing	Inspect Remove / Install		0.1 0.2				2	P
307140	End Wear Pads	Inspect Remove / Install		0.1 0.5				2	P
307150	Removable Roller	Inspect Remove / Install		0.1 0.5				2	P
307160	Electrical Junction Box	Remove / Install		1.0				2	
307170	Walkways	Inspect Remove / Install		0.1 0.5				2	P
307180	End Beam Guide	Inspect Remove / Install		0.1 1.0				2	P
307190	Articulator Cross Beam	Inspect Remove / Install		0.3	2.0			2	P
307200	Rotate Cylinder Cross Beam	Inspect Remove / Install		0.3	5.0			2	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
307210	Rotate Manifold Assembly	Inspect Remove / Install Repair		0.2	4.0		2.0	2	P F
307220	Electrical Harness	Inspect Remove / Install		0.2	4.0			2	P
3080	**Relax Mechanism**	Inspect Remove / Install	1.5	0.7	20.0			2	P
308010	Cylinder	Inspect Remove / Install		0.2 4.0				2	P
308020	Slide Pad	Inspect Remove / Install		0.1 1.0				2	P
308030	Limit Switch and Shoot Bolt	Inspect Remove / Install		0.1 0.5				2	P
308040	Ball Joint	Inspect Remove / Install		0.1 2.0				2	P
308050	Cross Member	Inspect Remove / Install		0.1	4.0			2	P
308060	Cylinder Support Bracket	Inspect Remove / Install		0.1	4.0			2	P
308070	Structural Arm (Slide Frame)	Inspect Remove / Install		0.1	8.0			2	P
3090	**Energy Chain**								
309010	Link	Inspect Remove / Install	0.1	0.5				2	P
309020	Energy Chain Assembly	Inspect Remove / Install	0.1	3.0				2	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
400	**Chassis**	Inspect Repair	0.9						P W
40010	Interface Enclosure	Inspect Remove / Install		0.2 0.5				2	P
40020	Interface Enclosure E-Stop Relay	Remove / Install		0.5				2, 22	
4002010	Interface Enclosure Front Panel	Remove / Install		0.5				2	
4002020	Interface Enclosure Hours Run Meter	Remove / Install		0.5				2	
4002030	Interface Enclosure Electrical Relays	Remove / Install		0.5				2	
4002040	Interface Enclosure Emergency Stop	Remove / Install		0.5				2	
4002050	Interface Enclosure Toggle and Button Switch	Remove / Install		1.0				2, 22	A
4002060	Interface Enclosure Circuit Breakers	Remove / Install		1.0				2	
40030	Cross Connection Assembly	Remove / Install		2.0				2	P
4003010	Cross Connection Assembly Pump and Motor	Remove / Install		2.0				2	P
40040	Interface Manifold Assembly	Inspect Remove / Install Repair		0.2	6.0		2.0	2	P F
40050	Positioning Aid	Inspect Remove / Install	0.5	0.2				2	P
40060	Electrical Junction Box	Remove / Install		1.0				2	

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
40070	Electrical Harness	Inspect Remove / Install		0.1 	 8.0			 2	P
40080	Hydraulic Tank Fluid Level Float Switch	Remove / Install		1.0				2	
40090	Chest Pack	Inspect Remove / Install		0.1 1.0				 2, 22	P
4009010	Chest Pack Emergency Stop	Inspect Remove / Install		0.1 1.0				 2	P
4009020	Chest Pack Toggle Switch	Inspect Remove / Install		0.1 1.0				 2	P A
4009030	Chest Pack Joy Stick Control	Inspect Remove / Install		0.1 1.0				 2	P
4009040	Chest Pack Harness	Inspect Remove / Install Test Repair		0.1 0.5 1.0 			 1.0	 2 	P F
40100	Butterfly Valve	Remove / Install		1.0				2	
40110	Cab Rotary Switch	Remove / Install		1.0				2	
40120	Cab Emergency Override Switch	Remove / Install		1.0				2	
40130	Cab Circuit Breaker	Remove / Install		1.0				2	
500	**General Hydraulic System**	Inspect	2.0						P
50010	De-pressurize	Service		0.5				2, 19	
50020	Filters	Inspect Remove / Install		0.1 1.0				 2	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
50030	Stack Valve	Remove / Install		2.0				2	
50040	Cartridge Valve	Remove / Install		0.5				2	
50050	Directional Control Valve	Remove / Install		1.0				2	
50060	Cylinder Pressure Release	Service		0.5				2	
50070	Solenoid	Remove / Install Test		0.5 0.1				2 20	
50080	Shuttle Valve	Remove / Install		0.5				2	
50090	Synchronizing Flow Divider Valve	Remove / Install		0.5				2	
50100	Stabilizer Manual Control Valve	Remove / Install		0.3				2	
50110	Stabilizer Manual Control Stack Valve	Remove / Install		2.0				2	
50120	Pinch/Roll Stow Manifold Valves	Remove / Install		0.5				2	
50130	Launch Frame Pilot Manifold Valves	Remove / Install		0.5				2	
50140	Articulator Manifold Valves	Remove / Install		0.5				2	
50150	Winch Control Manifold Valves	Remove / Install		0.5				2	
50160	Interface Manifold Shuttle Valve	Remove / Install		0.5				2	
50170	Articulator Counterbalance Valve	Remove / Install		1.0				2	
50180	Winch pilot valve	Adjust Remove / Install	0.5	 3.0				1 2	
50190	Pump	Inspect Remove / Install		0.2	 8.0			 2	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
50200	Power Take Off	Inspect Remove / Install		0.5	6.0			2	P
50210	PTO Solenoid	Remove / Install		2.0				2	
50220	PTO Pressure Switch	Remove / Install		2.0				2	
50230	Cylinder Counterbalance Manifolds	Remove / Install		1.5				2	
600	**General Electrical System**	Inspect	2.0						P
60010	Harness	Remove / Install							V
60020	Military Plug	Remove / Install		0.2				2	
60030	Spade Plug Connection	Remove / Install		0.1				2	
60040	Cable Continuity Test	Test		1.5				2	
60050	Cable Shorting Test	Test		0.5				2	
60060	Voltage Drop Test	Test		0.5				2	
700	Crane	Inspect Remove / Install Repair	6.3	3.0	2.0			2, 6, 16, 17, 18, 19	P W
70010	Seat	Inspect Remove / Install		0.1 0.4				2	P
70020	Seat Base and Foot Plate	Inspect Remove / Install		0.1 2.0				2	P
70030	Rotate Coupling	Remove / Install			8.0			2	
70040	Stabilizer Leg	Inspect Remove / Install		0.2 1.5				2	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
70050	Rotate Gear Assembly	Inspect Remove / Install		0.2	2.0			2, 22	P
70060	Rotate Gear, Brake Motor and Transmission	Remove / Install Repair			3.0		3.0	2, 22	F
70070	Stabilizer Arm	Inspect Remove / Install		0.2	16.0			2	P
70080	Lifting Cylinder	Inspect Remove / Install Repair		0.2	6.0		5.0	2	P CA
70090	Jib Cylinder	Inspect Remove / Install Repair		0.2	6.0		5.0	2	P CA
70100	Extension Cylinder De-pressurize	Remove / Install			0.3			2	
70110	Extension Cylinder Assembly	Inspect Remove / Install Repair		0.2	1.2		2.0	2, 20	P CA
70120	Extension Cylinders	Remove / Install Repair			0.5		5.0	2	CA
70130	Support Assembly Crane	Remove / Install			20.0			2	
70140	Boom Emergency Lowering Switch	Remove / Install Service			0.5 0.5			2	
70150	Boom Crane	Inspect Remove / Install Repair		0.2	16.0		5.0	2	P F
70160	Crane Base Assembly	Remove / Install			24.0			2	

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
70170	Electrical Junction Box	Inspect Remove / Install		0.1	8.0			2	P
70180	Emergency Operation Rotary Control Valve	Remove / Install			0.3			2	P
70190	Jib Housing	Inspect Remove / Install Repair		0.2	4.0		1.0	2	P F
70200	Jib Extensions	Remove / Install Repair			2.3		2.0	2	F
70210	Lever Remote Control	Inspect Remove / Install		0.2	3.0			2	P
70220	Operator's Control Panel	Inspect Remove / Install Repair		0.1	2.0		2.0	2	P F
70230	PCB Junction Box	Inspect Remove / Install		0.1	5.0			2	P
70240	Stabilizer Control Panel	Inspect Remove / Install		0.1	0.3			2	P
70250	Crane/Stabilizer Flow Control Valve	Remove / Install			0.5			2, 11, 12	
70260	Stabilizer Extension and Leg Controls	Inspect Remove / Install		0.2	4.0			2	P
70270	Preferred Position for Maintenance	Align			0.5				
70280	Stabilizer Extension Proximity Switch	Inspect Remove / Install		0.1	1.0			2	

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
70290	Stabilizer Extension Controls (Proximity Switch)	Inspect Remove / Install		0.1	0.1			2	
70300	Stabilizer Leg Pressure Switch	Remove / Install			0.2			2	
70310	Valve Control Block	Inspect Remove / Install		0.2	8.0			2, 16, 17, 18, 19	
70320	Valve Control Block Pressure Release Valve	Inspect Remove / Install		0.2	0.5			2, 16, 17, 18, 19	
70330	Valve Control Block Solenoid Dump Valve	Remove / Install Test			0.2 0.1			2, 22	
70340	Stabilizer Valve Control Block	Inspect Remove / Install		0.2	3.0			2, 16, 17, 18, 19	P
70350	Jib Cylinder Brake Valve	Inspect Remove / Install		0.2	3.0			2	P
70360	Jib Cylinder (Retract) Load Holding Valve	Inspect Remove / Install		0.2	3.0			2	P
70370	Jib Cylinder (Extend) Load Holding Valve	Inspect Remove / Install		0.2	3.0			2	P
70380	Lifting Cylinder Brake Valve	Inspect Remove / Install		0.2	3.0			2	P
70390	Lifting Cylinder Load Holding Valve	Inspect Remove / Install		0.2	3.0			2	P
70400	Lifting Cylinder Pilot Operated Check Valve	Inspect Remove / Install		0.2	3.0			2	P
70410	Jib Extension Cylinders Load Holding Valve	Inspect Remove / Install		0.2	0.5			2	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
70420	Pressure Transducer	Inspect Remove / Install		0.2 	 1.5			 2	P
70430	Rotate Motor Load Holding Valve	Remove / Install			3.0			2	P
70440	Electrical Harness	Inspect Remove / Install		0.2 	 0.5			 2	P
70450	Rotate Gear Oil Change	Remove / Install	1.0					2	
70460	Load Hook	Remove / Install	0.5					2	
70470	Fuses	Remove / Install	0.5					1	
70480	Indicator Filament	Remove / Install	0.5					1	
70490	Hand Lever Filament	Remove / Install	0.5					1	
800	**Tail Lift**	Inspect Service Remove / Install Repair	1.3 0.5	1.8	 6.0			 2	P W
80010	Cylinder	Inspect Remove / Install Repair		0.1 1.5			 3.0	 2	P CA
8001010	Cylinder Bellows	Remove / Install	1.0					2	
80020	Platform	Inspect Remove / Install		0.1 1.5				 2	P
80030	Electrical Harness	Inspect Remove / Install		0.2 2.0				 2	P
80040	Solenoid Valve	Inspect Remove / Install		0.2 0.5				 2	P

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
80050	Swing arm	Inspect Remove / Install		0.1			 1.0		P F
80060	Lifting arm	Inspect Remove / Install		0.1			 1.0		P F
80070	Light Installation	Remove / Install		0.5				2	P
80080	Tail Lift Manifold Assembly	Inspect Remove / Install Repair		0.2	 1.0		 2.0	2	P F
80090	Electrical Junction Box	Inspect Remove / Install		0.2	 1.5			 2	P
8009010	Electrical Relays and Diode Block	Remove / Install			1.5			2	
80100	Mounting bracket	Remove / Install			4.0			2	
80110	Cradle Buffer Pad	Remove / Install	1.0					1,7	
80120	Tail Lift Pendant	Inspect Remove / Install		0.2	 1.5			 2	P
8012010	Tail Lift Pendant Harness	Remove / Install		1.5				2,22	P A
8012020	Tail Lift Pendant Emergency Stop	Remove / Install		1.0				2	P
8012030	Tail Lift Pendant Control Switch	Remove / Install		1.0				2, 22	P A
900	**General Mechanical**								
90010	Flat Rack Wooden Buffer	Remove / Install	1.0					1	
90020	Tirfor Winch	Inspect Service	0.4 0.5					 1	P
90030	Thread Inserts	Remove / Install		1.0				2, 22	
990	**Special Tools**								

(1) Group Number	(2) Component/ Assembly	(3) Maint. Function	(4) Maintenance Level					(5) Tool or Test Equipment Reference Code	(6) Remarks
			Field			Sustainment			
			Unit		Direct Support	General Support / SRA	Depot / SRA		
			C	O	F	H	D		
99010	Pneumatic Hammer	Inspect	0.2						P
		Service	0.2					1	

B.1.4 Tools and Test Equipment Chart

B.1.4.1 Table B 2 lists the tool sets, special tools, common test equipment and special test equipment, required for each maintenance function, as referenced from the maintenance levels in column (4) of the MAC.

Table B 2 Tools and Test Equipment Chart

Tool or Test Equipment Reference Code	Maintenance Level	Nomenclature	National Stock Number	Tool Number
1	C	Basic Issue Items	TBA	TBA
2	O, F	Tool Kit, General Mechanic's: Automotive	5180-00-177-7033	SC 5180-90-N26
3	O, F	Launch Beam Peg Socket	5120-99-582-5640	G416/4773/1
4	O, F	Adjustable Wrench	TBA	G419/5012/59
5	O, F	BSE Peg Wrench	5120-99-833-2481	G416/4773/4
6	C, O, F	Crane Mounting Pin Extractor	5120-99-186-9110	G418/4615/8
7	C, O, F	Allen Keys Metric	TBA	G419/5012/58
8	C, O, F	Pin Punch Set	TBA	G419/5012/57
9	O, F	Bearing Locknut Socket	5120-99-243-2280	G816/4969/4
10	O, F	Wrench 36mm	TBA	G816/4969/12
11	O, F	Wrench 41mm	TBA	G816/4969/13
12	O, F	Wrench 46mm	TBA	G816/4969/14
13	O, F	Hook Wrench HN17	5120-99-984-7875	G816/4969/3
14	O, F	Hook Wrench HN15	5120-99-549-5514	G816/4969/2
15	O, F	Hook Wrench HN11	5120-99-856-3850	G816/4969/1
16	O, F	Pressure Gauge, 63mm, 400 BAR (4424 psi), (30495 kPa)	TBA	SMD20-G1/4-400
17	O, F	Gauge Adapter	TBA	SMK20 - G 1/8 - PC
18	O, F	Test Coupling With Cap	TBA	SMK20 - G 1/8 - PC
19	O, F	Test Hose Gauge Adapter	TBA	SMS 20/M - 400A
20	O, F	Shop Equipment Automotive maintenance and Repair: OM Common #1 (SC 4910-95-CL-A74)	4910-00-754-0654	W32593
21	O, F	Shop Equipment Automotive maintenance and Repair: OM Common #2 (SC 4910-95-A72)	4910-00-754-0650	W32730
22	O, F	Shop Set Contact Maintenance Truck HMMWV	4940-01-333-8470	SC4940-95-B25
23	C, O, F	Snatch Block	TBA	G816/4969/9
24	C, O, F	3 Tonne Soft Sling	TBA	G816/4969/10

B.1.5 Instructions and Notes

B.1.5.1 The **Remarks** column of Table B 3 contains supplemental instructions and explanatory notes for particular maintenance functions. The letters in the **Reference Code** column, refer to corresponding letters in the **Remarks** column [column (6)] of the MAC.

Table B 3 Instructions and Notes

Reference Code	Remarks
P	See PMCS in TM-5-5420-279-23 Chapter 5 Unit Maintenance for inspection details.
W	Only welding authorized in Appendix K of TM-5-5420-279-23 should be carried out on the DSB system. All other welding should only be carried out at the contractor's premises under a Contractor Logistic Support contract, by WFEL, Stockport England.
F	All General Support and Depot Support procedures are to be carried out under a Specialized Repair Activity (SRA) contract at WFEL Stockport England.
T	Time not specified, a general procedure applicable to more than one assembly or component.
LB	See launch beam entries for specific procedure timings.
V	Variable times see the specific MAC component.
CA	Cylinder Assemblies should be returned to WFEL, Stockport England complete with any associated Hydraulic and Pipe Assemblies for SRA.

APPENDIX C

OVERBRIDGING

Sect/ Para **Contents** **Page**

C.1 INTRODUCTION

C.1.1.1 This section provides the information needed to construct the DSB over an existing bridge, which has been damaged or has a low military load class capability.

C.2 OVERBRIDGES

C.2.1 General

C.2.1.1 Overbridges are constructed over existing bridges that are not strong enough to carry the expected traffic weight.

C.2.1.2 The overbridge uses the existing bridges abutments as bearing points.

C.2.1.3 It is essential that the overbridge **does not** come into contact with the existing bridge span while traffic is crossing.

C.2.1.4 It is important to ensure that the existing span is capable of supporting any weight, which may be applied to it during the construction of the overbridge.

C.3 BANK PREPARATION

NOTE

9.8ft (3 meters) is the maximum the DSB system can build up or downhill. Bank conditions other than flat and level will not give an approach angle of 1 in 9.

C.3.1.1 For all overbridges, the amount of bank preparation is determined using the following procedures. This is to ensure that the overbridge does not come into contact with the existing bridge underneath.

C.3.2 Access from both sides of an existing Bridge

C.3.2.1 Bank Height = Overbridge Deflection + h = 35.4in (900mm) + h (Bank Height = DSB Overbridge Deflection + h = 35.4in (900mm) + h) see Figure C. 2.

C.3.2.2 h = Height of existing bridge above the bank projection line through bearing points at ends of existing bridge (see Figure C. 1).

C.3.3 **Access from one side of an existing bridge only**

C.3.3.1 Bank Height = (2 x DSB Overbridge Deflection) + (2 x h) = 70.8in (1800mm) + (2 x h) (see Figure C. 3).

C.3.3.2 The maximum Bank Height is 9.8ft (3 meters).

C.3.3.3 h = Height of existing bridge above the bank projection line through bearing points at ends of existing bridge. (see Figure C. 1)

NOTE

The ground bearing capabilities are to be in accord with Chapter 1 Section 1 Paragraph 1.2.11.3.

On completion of ground preparations, the bridge build is to be conducted in accord with relevant build sequences and criteria.

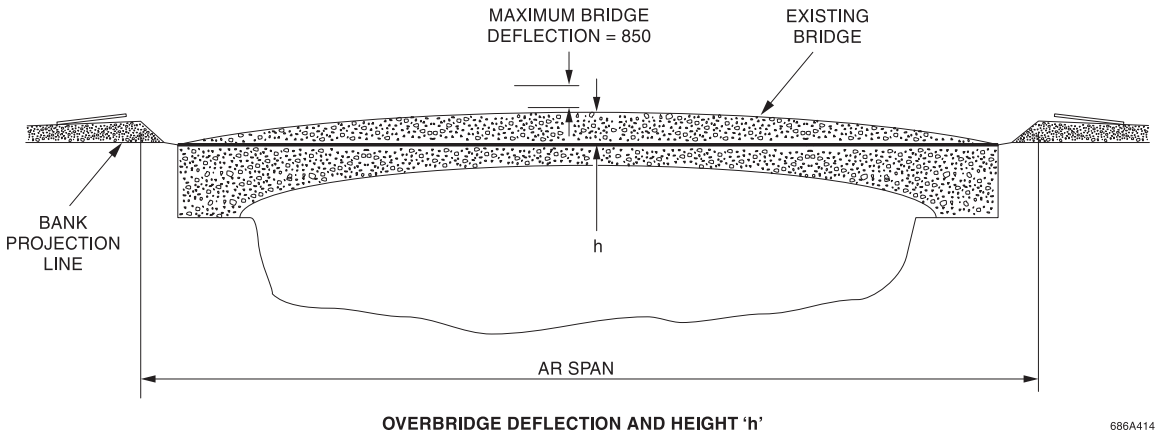
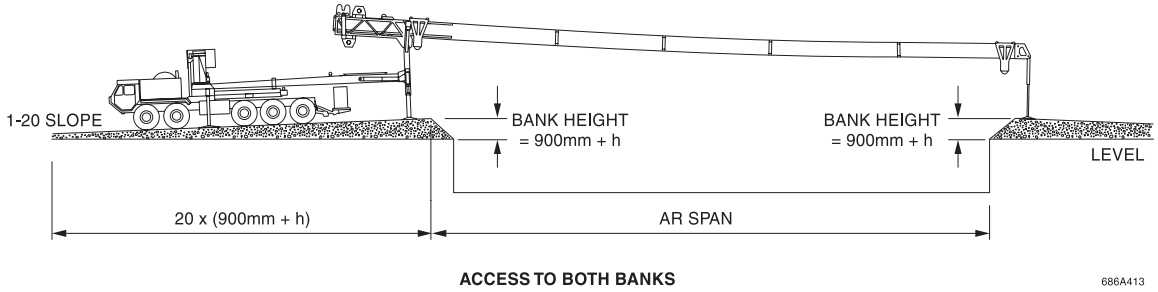


Figure C. 1 Overbridge Deflection and Height (h)

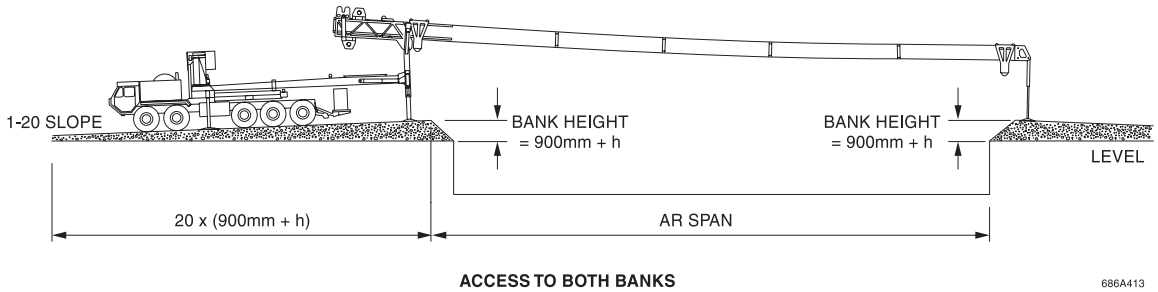
Overbridge Deflection = Maximum Bridge Deflection + 1.9in (50mm) Clearance = 33.4in (850mm) + 1.9in (50mm) = 35.4in (900mm).

h = Height of existing bridge above the bank projection line through bearing points at ends of existing bridge.



Bank Height = DSB Overbridge Deflection + h = 35.4in (900mm) + h

Figure C. 2 Access From Both Sides of an Existing Bridge



Bank Height = (2 x Overbridge Deflection) + (2 x h) = 70.8in (1800mm) + (2 x h)

Figure C. 3 Access From One Side of Existing Bridge Only

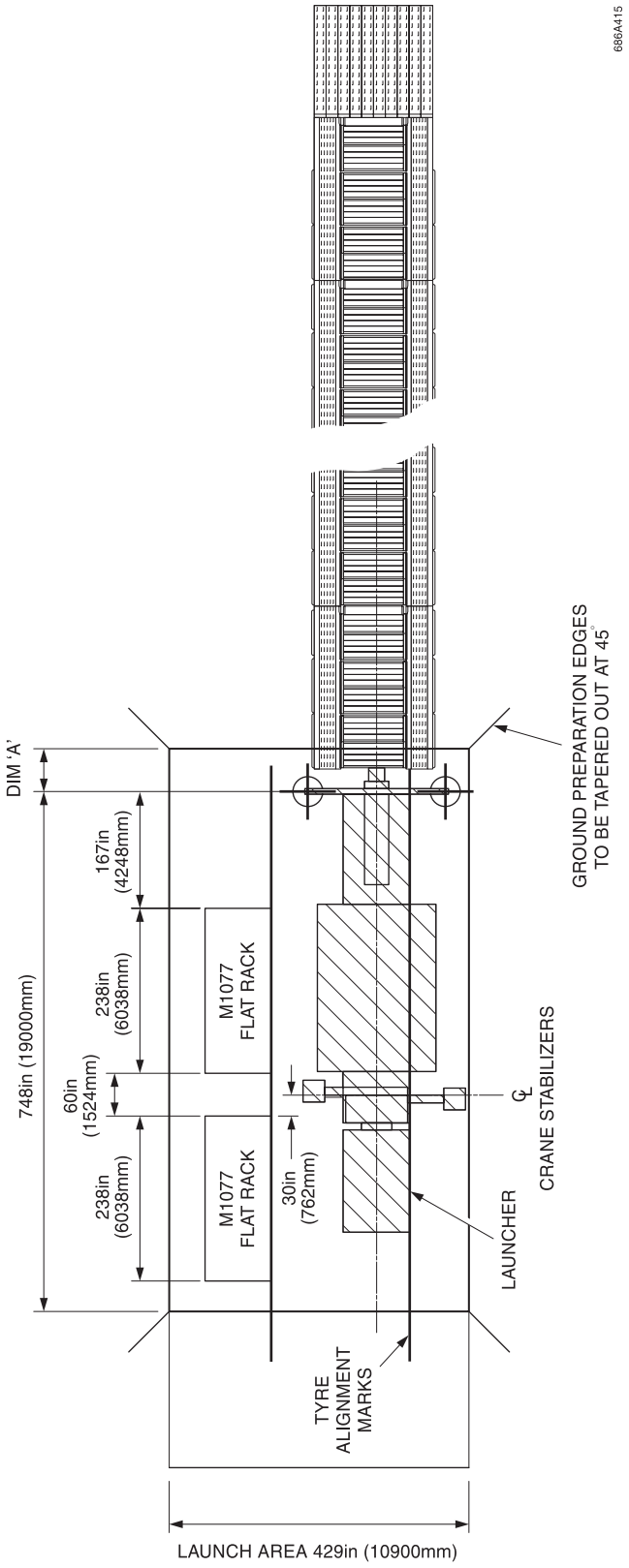


Figure C. 4 Plan View of Bridge Site

APPENDIX D

BASIC ISSUE ITEMS (BII)

D.1 INTRODUCTION

D.1.1.1 This Appendix lists the BII for the DSB launcher and bridge components to help you inventory items for safe and efficient operation of the equipment

D.2 BII LIST

D.2.1.1 **Basic Issue Items**. These essential items are required to place the DSB launcher and bridge components in operation, operate the system and do emergency repairs. These items are part of the DSB and must be with the DSB during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of end item by the TOE/MTOE.

D.2.1.2 Table D 1 lists the basic issue items that are supplied with the DSB Launch vehicle.

D.2.2 Explanation of Columns in the BII List

D.2.2.1 **Column (1) – Illus No.** Gives the number of the item illustrated.

D.2.2.2 **Column (2) – National Stock No.** Indicates the stock number of the item to be used for requisitioning purposes.

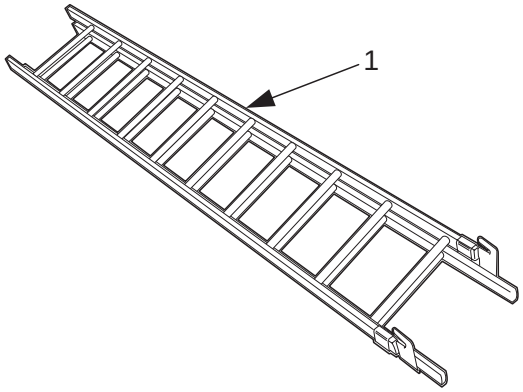
D.2.2.3 **Column (3) – Description, CAGEC, and Part Number.** Indicates the Federal item name (all in capital letters) follower by a minimum description when needed. The last line below the description is the CAGEC (Commercial and Government Entity Code) (in parentheses) and the part number.

D.2.2.4 **Column (4) – Usable on code.** When applicable, gives you a code if item you need is not the same for different models of equipment.

D.2.2.5 **Column (5) –Unit of Measure.** Indicates the physical measurement or count of the item as issued per National Stock Number shown in column (2).

D.2.2.6 **Column (6) –Qty/Req.** Indicates the quantity required.

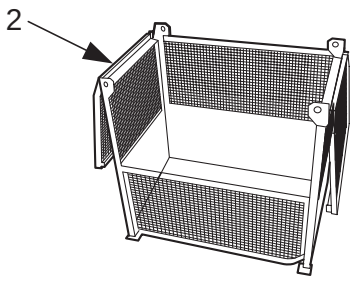
Table D 1 Basic Issue Items (BII)

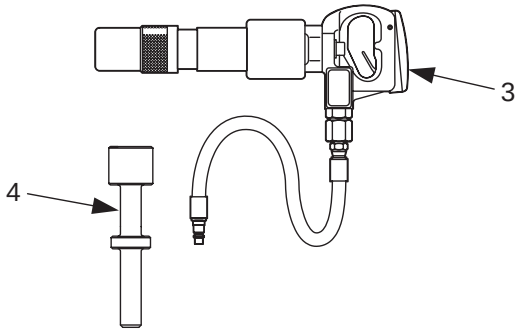


(1) Illus No.	(2) National Stock Number	(3) Description, CAGEC, and Part No.	(4) Usable On Code	(5) U/M	(6) Qty Req
BRIDGE					
1.	2540-99-372-5040	LADDER ASSEMBLY-MODULAR ACCESS (K7705) G416/4783/1	HSS		2

continued

Table D 1 Basic Issue Items (BII) (continued)

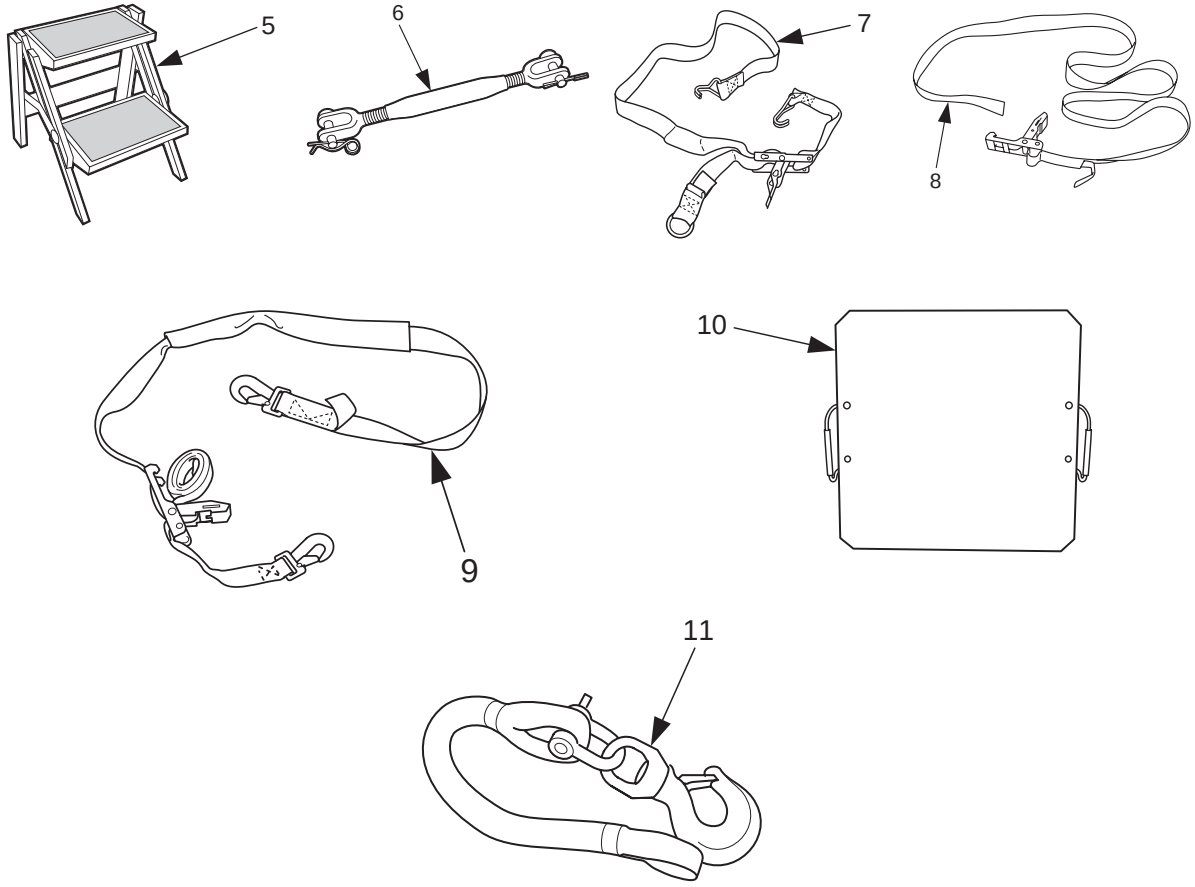




(1) Illus No.	(2) National Stock Number	(3) Description, CAGEC, and Part No.	(4) Usable On Code	(5) U/M	(6) Qty Req
BRIDGE ANCHORAGE					
2.	2540-99-359-4375	ANCHORAGE STORAGE BOX (K7705) G416/4939/1	HSS		2
3.	5130-99-738-7229	PNEUMATIC HAMMER INC HOSE & ADAPTER (K7705) G416/4968/4	HSS		1
4.	5130-99-724-1641	PNEUMATIC DRIVE ADAPTER (K7705) G416/4968/3	HSS		1

continued

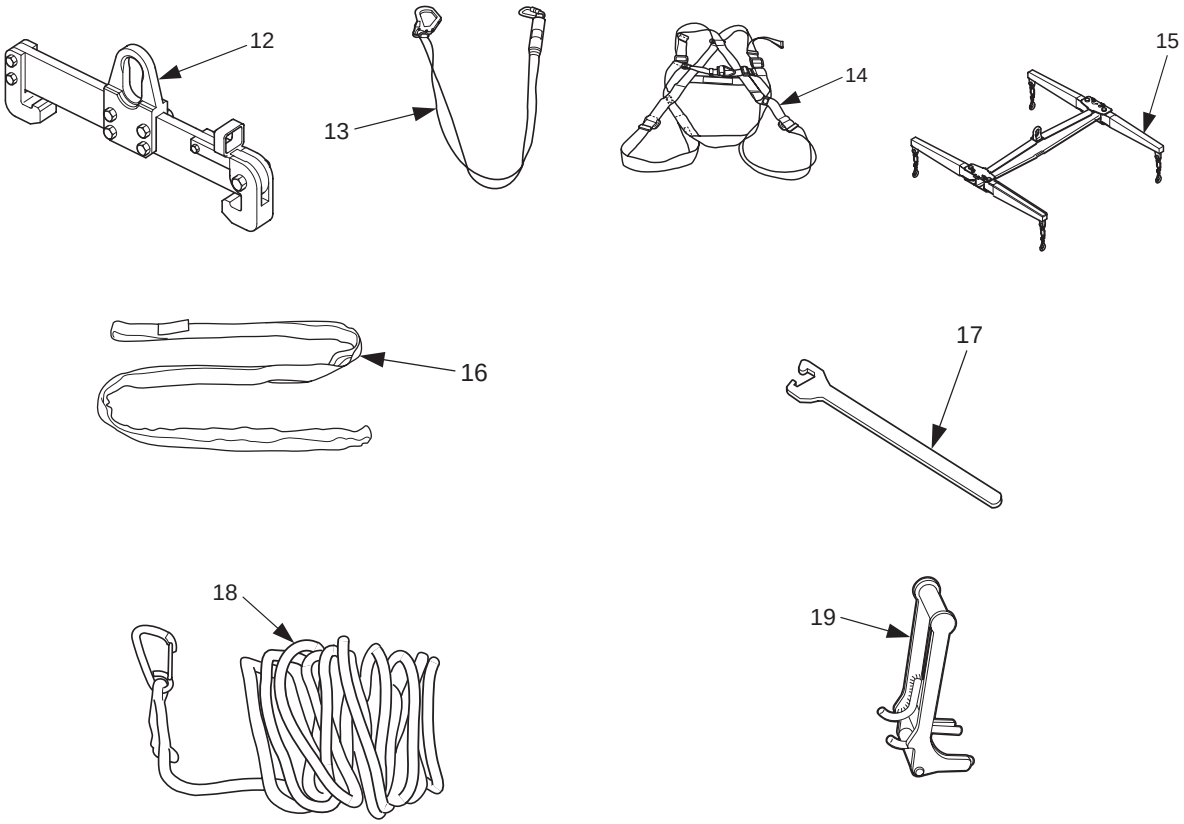
Table D 1 Basic Issue Items (BII) (continued)



(1) Illus No.	(2) National Stock Number	(3) Description, CAGEC, and Part No.	(4) Usable On Code	(5) U/M	(6) Qty Req
LAUNCHER LOOSE ITEMS					
5.	5440-99-288-9384	FOLDING STEPS (K7705) G016/5034/1	HSS		1
6.	5340-99-863-1408	SLIDE FRAME RIGGING SCREW (K7705) 62162018IZ1	HSL		2
7.	3990-99-376-1754	REMOVABLE FOOTPLATE STRAP - 2M (K7705) G416/4825/1	HSL		2
8.	5340-99-510-3882	CRANE PAD AND STOOL STRAP - 3M (K7705) 6794110-3MB	HSL		3
9.	5340-99-382-4234	TAIL LIFT TRANSPORT STRAP (K7705) G416/4771/4	HSL		3
10.	3940-99-549-5524	CRANE PAD (K7705) G418/4615/7	HSL		2
11.	3940-99-700-6075	MODULE LIFTING SLING (K7705) G416/4653/1	HSB		1

continued

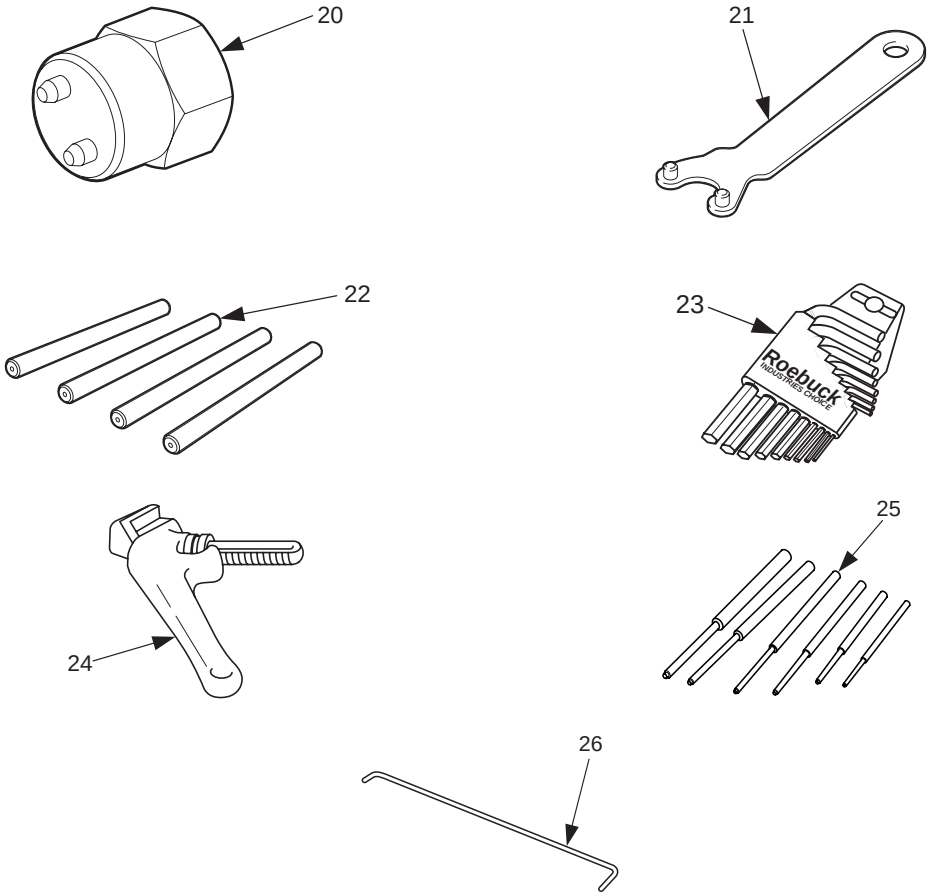
Table D 1 Basic Issue Items (BII) (continued)



(1) Illus No.	(2) National Stock Number	(3) Description, CAGEC, and Part No.	(4) Usable On Code	(5) U/M	(6) Qty Req
LAUNCHER LOOSE ITEMS (continued)					
12.	3940-99-614-0548	LAUNCH BEAM. LIFTER (K7705) G416/4662/1	HSB		1
13.	4240-99-908-2249	1.75M SAFETY LANYARD (K7705) 381.75LANNATO	HSS		2
14.	4240-99-895-4094	2 POINT ARRESTER HARNESS (K7705) 382PNTHARNATO	HSS		1
15.	3940-99-450-6562	MODULE LIFTING BEAM (K7705) G420/4558/1	HSB		1
16.	3940-99-865-1617	END BEAM LIFTING SLING (K7705) 3825401000	HSB		2
17.	5120-99-874-3085	END BEAM WRENCH (K7705) G316/4732/1	HSB		2
18.	4020-99-505-2082	LANYARD (K7705) G416/4703/1	HSB		4
19.	5340-99-225-7868	CURB LEVER/CARRYING HANDLE (K7705) G101/5592/1	HSB		8

continued

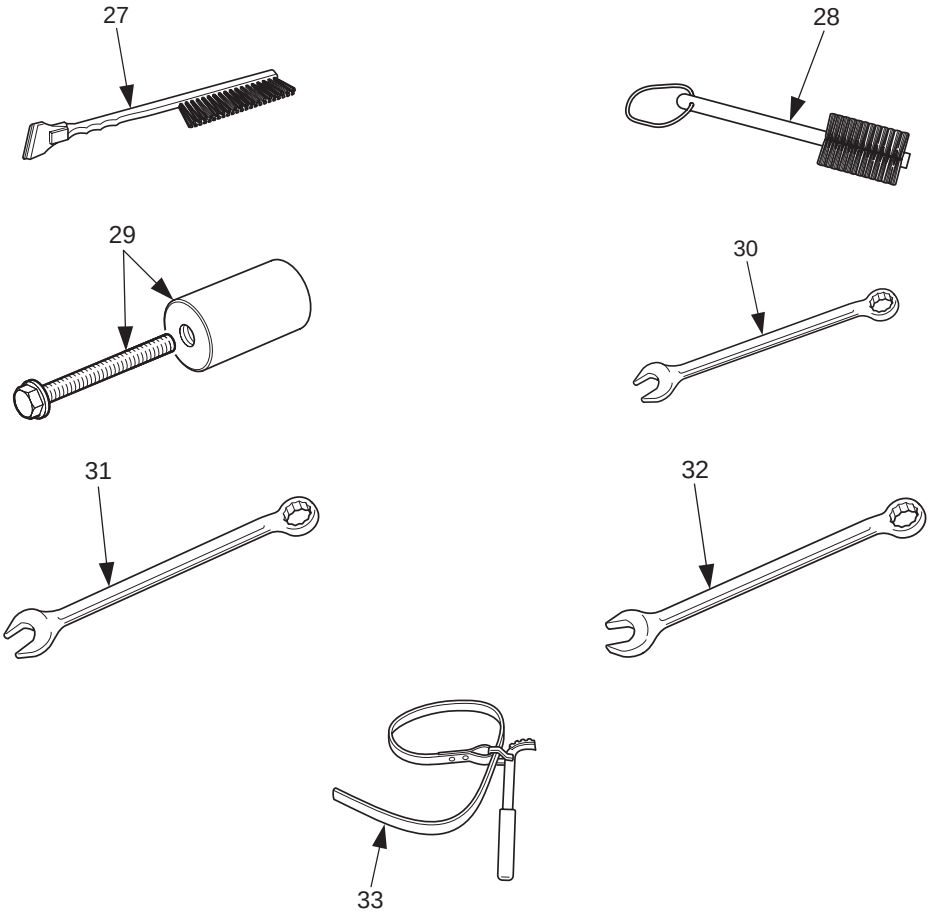
Table D 1 Basic Issue Items (BII) (continued)



(1) Illus No.	(2) National Stock Number	(3) Description, CAGEC, and Part No.	(4) Usable On Code	(5) U/M	(6) Qty Req
OPERATOR TOOLS – 1 set per launcher					
20.	5120-99-582-5640	LAUNCH BEAM PEG SOCKET ASSEMBLY (K7705) G416/4773/1	HSB		1
21.	5120-99-833-2481	PEG SPANNER OPEN ENDED (K7705) T1112189007467	HSS		1
22.	5340-99-940-0289	SLIDE FRAME LOCKING PIN (K7705) G416/4773/5	HSL		4
23.		HEXAGON WRENCH SET METRIC (K7705) T0940000067739	HSS		1
24.		OFFSET HEXAGON WRENCH (K7705) T1060000007098	HSS		1
25.		PIN PUNCHES (K7705) T1480000037650	HSS		1
26.		BRIDGE SLING HOOK EXTRACTION TOOL (K7705) G416/4961/1	HSB		2

continued

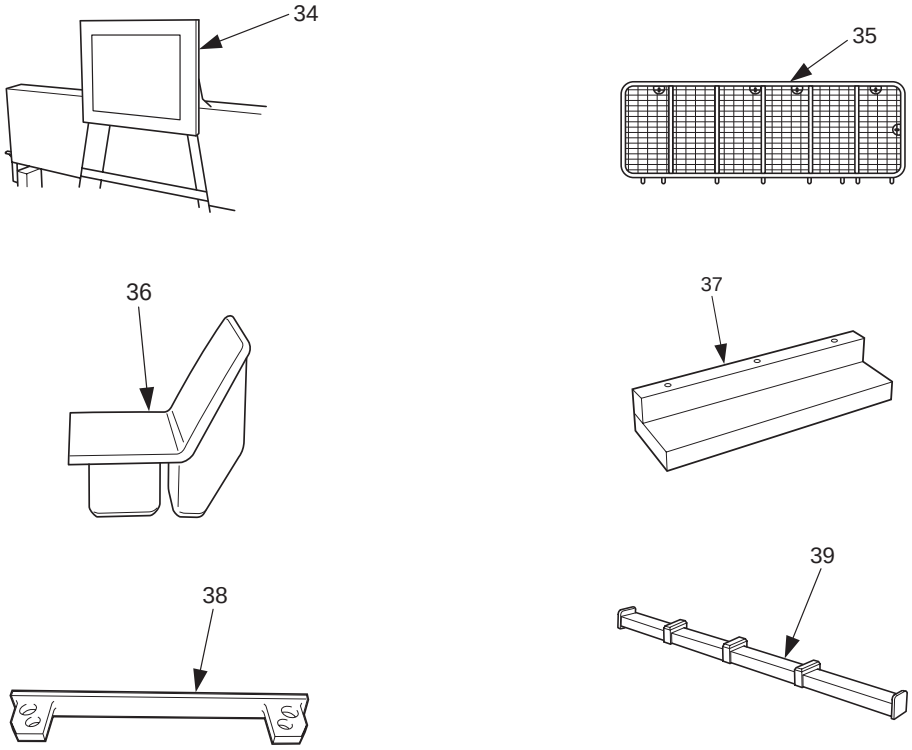
Table D 1 Basic Issue Items (BII) (continued)



(1) Illus No.	(2) National Stock Number	(3) Description, CAGEC, and Part No.	(4) Usable On Code	(5) U/M	(6) Qty Req
OPERATOR TOOLS – 1 set per launcher (continued)					
27.	7920-99-397-6870	SCRAPER/BRUSH (K7705) C0009005193	HSB		3
28.	7920-99-665-8683	JAW BRUSH (K7705) C0009004208	HSB		2
29.	5120-99-186-9110	CRANE PIN EXTRACTION TOOL (K7705) G418/4615/8	HSL		1
30.		36mm COMBINATION SPANNER (K7705) T1002400001431	HSS		1
31.		41mm COMBINATION SPANNER (K7705) T1002700001432	HSS		1
32.		46mm COMBINATION SPANNER (K7705) T1003000001433	HSS		1
33.		STRAP WRENCH (K7705) 15539-457	HSS		1

continued

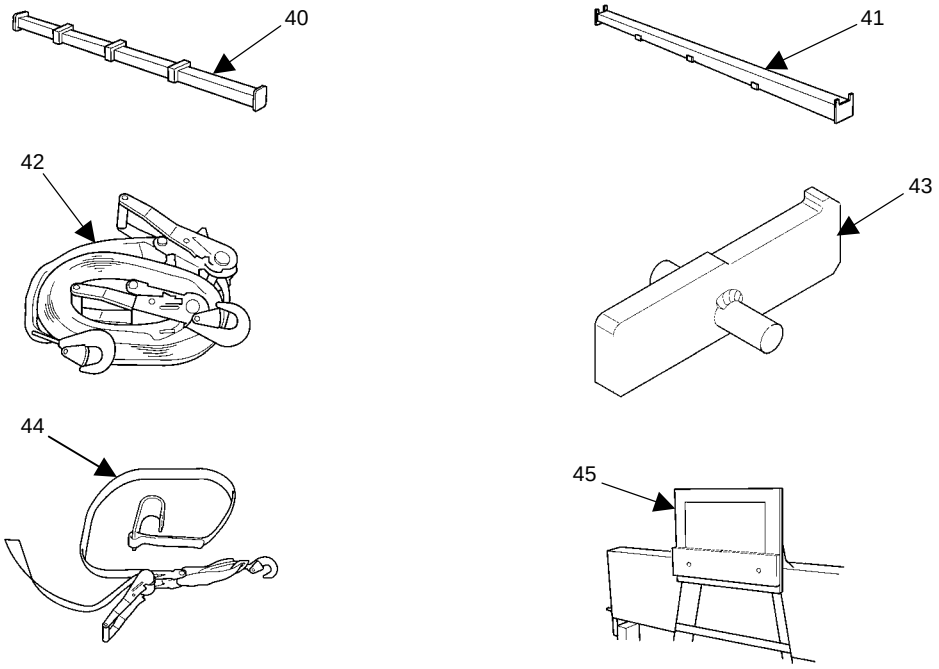
Table D 1 Basic Issue Items (BII) (continued)



(1) Illus No.	(2) National Stock Number	(3) Description, CAGEC, and Part No.	(4) Usable On Code	(5) U/M	(6) Qty Req
TRANSPORTATION					
34.	5420-99-334-5333	BUFFER ASSEMBLY (K7705) G416/4680/1	HSB		6
35.	2540-99-458-1532	LVT STORAGE BASKET (K7705) G416/4933/1	HSS		1
36.	5420-99-985-2153	LOCATION PIECE, BOTTOM ASSEMBLY (K7705) G416/4680/6	HSB		22
37.	5680-99-549-4818	MODULE LIFT BEAM TRANSPORT PACKER (K7705) G416/4822/1	HSB		2
38.	5420-99-483-2225	CRANE RAIL TRANSPORT ADAPTOR (K7705) G418/4967/1	HSS		2
39.	5420-99-471-2640	BOTTOM SPACER BEAM ASSEMBLY (K7705) G416/4674/1	HSB		4

continued

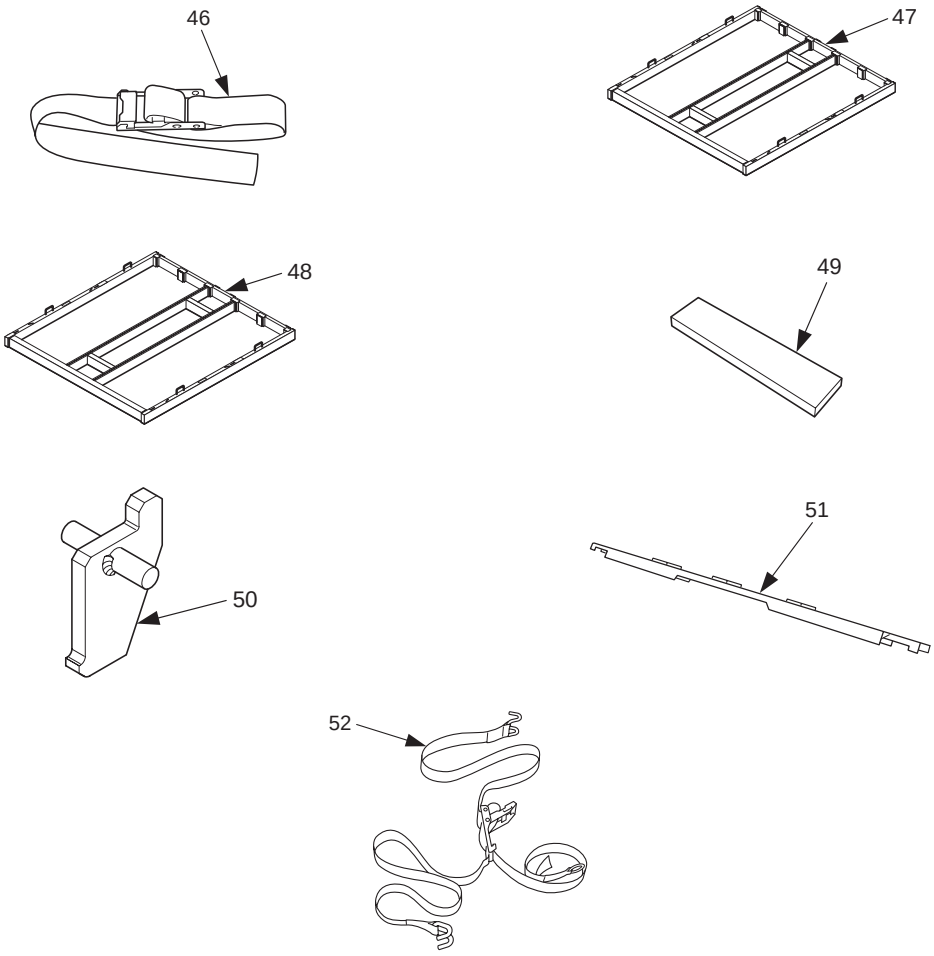
Table D 1 Basic Issue Items (BII) (continued)



(1) Illus No.	(2) National Stock Number	(3) Description, CAGEC, and Part No.	(4) Usable On Code	(5) U/M	(6) Qty Req
TRANSPORTATION (continued)					
40.	5420-99-164-4008	INTERMEDIATE SPACER BEAM ASSEMBLY (K7705) G416/4676/1	HSB		4
41.	5420-99-549-4878	TOP SPACER BEAM ASSEMBLY (K7705) G416/4675/1	HSB		4
42.	3990-99-833-2492	DOUBLE ENDED RATCHET STRAP (K7705) G416/4785/1	HSB		47
43.	5420-99-480-7812	MODULE TRANSPORT AID (K7705) G416/4957/1	HSB		16
44.	3990-99-928-3325	2.5M RAMP AND PARALLEL STRAP (K7705) G416/4912/1	HSB		46
45.		RAMP BUFFER ASSEMBLY (K7705) G416/4963/1	HSB		2

continued

Table D 1 Basic Issue Items (BII) (continued)



(1)	(2)	(3)	(4)	(5)	(6)
Illus No.	**National Stock Number**	**Description, CAGEC, and Part No.**	**Usable On Code**	**U/M**	**Qty Req**
TRANSPORTATION (continued)					
46.	3990-99-131-4555	DEFILE MARKER STRAP ENDLESS 1.5M (K7705) 6794110-1.5MB	HSS		4
47.	5420-99-549-5947	TRANSPORT FRAME (LOWER) (K7705) G507/7003/2	HSB		4
48.	5420-99-665-9604	TRANSPORT FRAME (UPPER) (K7705) G507/7003/3	HSB		4
49.	5420 99 9319228	3"X9"X36"PACKING TIMBER 5420-99-931-9228	HSS		4
50.	5420-99-754-9558	APPROACH RAMP TRANSPORT AID (K7705) G416/4960/1	HSB		4
51.	5420-99-845-3073	APPROACH RAMP TRANSPORT BEAM (K7705) G416/4776/1	HSB		16
52.	3990-99-562-5467	APPROACH RAMP STRAP (K7705) G507/7003/6	HSB		16

APPENDIX E

COMPONENT OF END ITEM (COEI)

E.1 INTRODUCTION

E.1.1.1 This Appendix lists the Component of End Item (COEI) for the DSB launcher and bridge components to help you inventory items for safe and efficient operation of the equipment

E.1.2 **Component of End Item (COEI)**

E.1.2.1 **Component of End Item (COEI).** This list is for information purposes only and is not authority to requisition replacements. These items are part of the DSB system. As part of end item, these items must be with the end item whenever it is issued or transferred between property accounts. Items of COEI are removed and separately packaged for transportation or shipment only when necessary.

E.1.2.2 Table E 1 lists the basic issue items that are supplied with the DSB Launch vehicle.

E.2 EXPLANATION OF COLUMNS IN THE COEI LIST

E.2.1.1 **Column (1) – National Stock No.** Indicates the stock number of the item to be used for requisitioning purposes.

E.2.1.2 **Column (2) – Description, CAGEC, and Part Number.** Indicates the Federal item name (in all capital letters) follower by a minimum description when needed. The stowage location of COEI is also included in this column. The last line below the description is the CAGEC (Commercial and Government Entity Code) (in parenthesis) and the part number.

E.2.1.3 **Column (3) – Usable on code.** When applicable, gives you a code if item you need is not the same for different models of equipment.

E.2.1.4 **Column (4) –Unit of Measure.** Indicates the physical measurement or count of the item as issued per National Stock Number shown in column (2).

E.2.1.5 **Column (5) –Qty/Req.** Indicates the quantity required.

Table E 1 Component of End Item (COEI)

(1) National Stock Number	(2) Description, CAGEC, and Part No.	(3) Usable On Code	(4) U/M	(5) Qty Req
BRIDGE				
	ZEBRA TAPE RED/WHITE (K7705) C0093335555	HSS		1
	ROAD SIGN POST (K7705) G016/5024/2	HSS		4
9905-99- 611-7379	ROAD SIGN (K7705) G016/5024/7	HSS		4
5340- 99-993-0301	END BEAM PINS (K7705) G202/6041/1	HSB		8
5315-99-931-6653	CLIP PANEL PIN (K7705) 6653 43550	HSB		75
5420-99-257-7028	RAMP MODULE (K7705) G202/6000	HSB		4
5420-99-127-3844	PARALLEL MODULE (K7705) G101/5575	HSB		5
5315-99-707-3333	JAW CONNECTION PIN INC. CLIP (K7705) G101/5645/2	HSB		28
5420-99-371-9023	END BEAM ASSEMBLY MINUS PINS) (K7705) G303/6102/1	HSB		4
9905-99-517-2184	DEFILE MARKER ASSEMBLY (K7705) G016/5016/1	HSS		24
5420-99-551-0521	APPROACH RAMP (K7705) G507/7000	HSB		40
BRIDGE ANCHORAGE				
5120-99-762-0805	TIRFOR T532 C/W HANDLE (K7705) G000/5570/15	HSB		8
5420-99-931-8717	PIN BRACING MEMBER (K7705) 25083	HSB		8
5420-99-931-8146	BEAM ANCHORAGE C/W SHACKLES (K7705) 36770	HSB		8
2590-99-445-7991	ANCHOR EARTH HOLDFAST (K7705) FV598860	HSB		16
	HOLD FAST SPIKE (K7705) G101/5597/1	HSS		128
4010-99-317-5231	WIRE ROPE 40FT (K7705) G616/5032/1	HSB		8

continued

(1) National Stock Number	(2) Description, CAGEC, and Part No.	(3) Usable On Code	(4) U/M	(5) Qty Req
LAUNCHER LOOSE ITEMS				
5670-99-368-0690	FOOTPLATE WELDED ASSEMBLY NO:1 (K7705) G416/4723/3	HSL		1
5670-99-325-6300	FOOTPLATE WELDED ASSEMBLY NO:2 (K7705) G416/4723/2	HSL		1
5670-99-833-1252	FOOTPLATE WELDED ASSEMBLY NO:3 (K7705) G416/4723/1	HSL		1
5670-99-891-0293	FOOTPLATE WELDED ASSEMBLY NO:4 (K7705) G416/4720/1	HSL		1
5670-99-239-2273	FOOTPLATE WELDED ASSEMBLY NO:5 (K7705) G416/4720/2	HSL		1
5670-99-852-5775	FOOTPLATE WELDED ASSEMBLY NO:6 (K7705) G416/4826/1	HSL		1
5670-99-131-3929	L./H. FOOTPLATE WELDED ASSEMBLY (K7705) G416/4724/1	HSL		1
5670-99-981-3659	R./H. FOOTPLATE WELDED ASSEMBLY (K7705) G416/4724/2	HSL		1
3810-99-616-1521	FAR BANK SUPPORT PADS (K7705) G411/4532/1	HSL		2
2590-99-517-5288	LAUNCHER REMOVABLE HANDRAIL (K7705) G414/4779/10	HSL		2
5420-99-492-8971	CHEST PACK (K7705) G406/8660	HSL		1
6150-99-577-1749	CHEST PACK CABLE (K7705) G406/8744	HSL		1
5420-99-613-1186	TAIL LIFT PENDANT ASSEMBLY (K7705) G424/5201/1	HSL		1
5315-99-179-5014	LAUNCH BEAM PIN (K7705) G409/4579/1	HSL		16
	LAUNCH BEAM PIN CLIP (K7705) G413/4749/4	HSL		89
5420-99-225-8048	END BEAM GUIDE ASSEMBLY L/H (K7705) G316/4740/1	HSL		1
5420-99-611-7402	END BEAM GUIDE ASSEMBLY R/H (K7705) G316/4740/2	HSL		1
5420-99-882-6041	R/H RAMP LEAD BRACKET (K7705) G416/4944/1	HSB		1
5420-99-989-6188	L/H RAMP LEAD BRACKET (K7705) G416/4944/2	HSB		1

continued

(1) National Stock Number	(2) Description, CAGEC, and Part No.	(3) Usable On Code	(4) U/M	(5) Qty Req
5420-99-601-8388	REMOVABLE ROLLER ASSEMBLY G416/4669	HSL		4
5420-99-723-4050	LAUNCH BEAM (K7705) G409/4505	HSL		7
2590-99-601-8445	TAIL LIFT PLATFORM HANDRAILS (K7705) G416/4654/12/E	HSL		4
2590-99-665-7525	TAIL LIFT PLATFORM HANDRAILS (K7705) G416/4654/12/AI	HSL		4

APPENDIX F

ADDITIONAL AUTHORIZATION LIST (AAL)

F.1 INTRODUCTION

F.1.1.1 This Appendix identifies the items that do not have to accompany the DSB, and do not have to be turned in with it. These items are authorized to you by CTA, MTOE, TDA or JTA.

F.2 EXPLANATION OF COLUMNS IN THE AAL

F.2.1.1 **Column (1) – Description.** Identifies the Federal item name, followed by a minimum description where needed.

F.2.1.2 **Column (2) - National Stock Number**. Identifies the stock number of the item to be used for requisitioning purposes.

Table F 1 ADDITIONAL AUTHORIZATION LIST (AAL)

(1) Description	(2) National Stock Number
Tape measure (50 meters, graduated in mm)	5210-00-221-1862
Barricade tape	9905-01-342-5933
Chem. Light (8 hour)	6260-01-178-5560
Cotton string	Local purchase
6 inch Nail	5315-00-010-4668
Sledge hammer	5120-00-900-6097
Carpenter pencil	7510-00-275-7213
Clay crayon (red)	7510-00-272-9437
Clay crayon (yellow)	7510-00-264-4102
Clay crayon (blue)	7510-00-161-5675
Clay crayon (black)	7510-00-281-2693
Clay crayon (green)	7510-00-782-6210
Chalk stick	Local purchase
Measuring laser range finder	1240-01-484-7213
Soil penetrometer (Ground bearing measurement equipment)	6635-00-679-5761
Single PTT	5820-99-739-4033
PRR body	5820-99-721-8335
Light weight headset	5820-99-280-7276
PRR Carriage Pouch	5820-99-425-3999
Work gloves	8415-00-268-7870

APPENDIX G

EXPENDABLE AND DURABLE ITEMS LIST

G.1 INTRODUCTION

G.1.1.1 This Appendix lists the expendable and durable items that you will need to operate and maintain the DSB. This list is for information only and is not authority to requisition the listed items. These are authorized to you by CTA 50-970, *Expandable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items)*, or CTA 8-100, *Army Medical Department Expendable/Durable Items*.

G.2 EXPLANATION OF COLUMNS IN THE EXPENDABLE AND DURABLE ITEMS LIST

G.2.1.1 **Column (1) - National Stock Number.** This is the National Stock Number assigned to the item; use it to request or requisitely the item.

G.2.1.2 **Column (2) - Description.** Indicates the item name and, if required, a description to identify the item. The last line for each item indicates the Commercial and Government Entity (CAGE) code in parentheses followed by the part number.

G.2.1.3 **Column (3) - Unit of Measure.** Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in. or pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

G.2.1.4 **Column (4) – Remarks.** Gives a brief description of where the item is to be used.

Table G 1 EXPENDABLE AND DURABLE ITEMS LIST

(1) NSN	(2) DESCRIPTION	(3) U/M	(4) REMARKS
	Grease, Automotive And Artillery		All grease fittings
	(70878) 5542P		
	(81349) MIL-PRF-10924 G		
9150-01-197-7688	2.25 oz tube	oz	
9150-01-197-7690	1.75 lb can	lb	
9150-01-197-7689	6.5 lb can	lb	
	Lubricating Oil, Gear GO 80W/90		Normal use:
	(81349) MIL-PRF-2105		Main reservoir, Beam
9150-01-035-5392	1 quart can	qt	drive gearbox, Crane
9150-01-313-2191	1 gallon can	gl	rotate gear, winches
9150-00-001-9395	5 gallon can	gl	
	Lubricating Oil, Gear GO 75W		Arctic use:
	(81349) MIL-PRF-2105		Main reservoir, Beam
9150-01-035-5390	1 quart can	qt	drive gearbox, Crane
9150-01-048-4593	1 gallon can	gl	rotate gear, winches
9150-01-035-5391	5 gallon can	gl	
	Lubricating Oil, Engine OE/HDO 40		Normal use:
	(81349) MIL-PRF-2104		Beam drive brake,
9150-00-189-6730	1 quart can	qt	Crane oil can points,
9150-00-188-9862	55 gallon drum	gl	Twist locks, Pneumatic
9150-00-405-2987	Bulk	gl	hammer
	Lubricating Oil, Engine OEA		Arctic use:
	(81349) MIL-PRF-46167		Beam drive brake,
9150-00-402-4478	1 quart can	qt	Crane oil can points,
9150-00-402-2372	5 gallon can	gl	Twist locks, Pneumatic
9150-00-491-7197	55 gallon can	gl	hammer
	Hydraulic Fluid Fire Resistant		MIL-H-46170B
9150-00-111-6256	MIL-H-46170B AM Type 1	qt	
	Lubricating Oil, Engine OE/HDO 15W/40		MIL-PRF-2104
	(81349) MIL-PRF-2104		
9150-01-152-4117	1 quart can	qt	
9150-01-178-4725	12 quart box	qt	
9150-01-152-4118	5 gallon can	gl	
9150-01-152-4119	55 gallon drum	gl	
	Lubricating Oil, Engine OEA		MIL-PRF-46167
	(81349) MIL-PRF-46167		
9150-00-402-4478	1 quart can	qt	
9150-00-402-2372	5 gallon can	gl	
9150-00-491-7197	55 gallon can	gl	
	Anti-seize Compound		Anti-seize Compound
	(81349) MIL-A-907		
8030-00-155-6444	16 oz aerosol can	oz	
	Anti-seize Compound		Anti-seize Compound
	(81349) MIL-A-907		
8030-00-251-3980	1 lb can	lb	

continued

Table G 1 EXPENDABLE AND DURABLE ITEMS LIST (Continued)

(1) NSN	(2) DESCRIPTION	(3) U/M	(4) REMARKS
8030-00-597-5367	Anti-seize Compound, High Temperature (81349) MIL-A-907 2-1/2 lb can	lb	Antiseize Compound
8030-01-104-5392 8030-01-014-5869 8030-01-025-1692	Sealing Compound (05972) Loctite #242 (80244) MIL-S-46163A Type 2 Grade N 10 ml bottle 50 ml bottle 250 ml bottle	 ml ml ml	Loctite 242
8030-01-475-2444	250 cc bottle Thread Locking Compound Loctite 243		Loctite 243
8030-01-475-2007	250 cc bottle Multi-gasket Loctite 574		Loctite 574
8030-01-488-4272	50 cc Adhesive Loctite 641		Loctite 641
8030-01-388-5604	1.75 fl oz Primer - activator Loctite T7471		Loctite T7471

APPENDIX H

SITE RECONNAISSANCE WORKSHEET

SITE RECONNAISSANCE

DETERMINE CENTER LINE OF BRIDGE. [Fig 1.11]				
DETERMINE A.R. PEG ON HOME BANK				
DETERMINE GAP (A.R. SPAN) **[Fig 1.11]**	MAX. 40 m TO MIN. 20 m		GAP (A.R. SPAN)	
DETERMINE FAR BANK HEIGHT. [Fig 1.10]	MAX. + OR - 3 m FOR 40 m MAX. + OR - 2 m FOR 20 m		BANK HEIGHT	
CHECK BUILD SITE ON HOME BANK	NORMAL. [Fig 1.12] 41 m LG x 15 m W [7.5 m either side of center line]		RESTRICTED. [Fig 1.13] 22.45 m LG x 10.9 m W	
DETERMINE BANK GROUND BEARING **[Table 1.12]**	MINIMUM SOIL BEARING CAPACITY AT BEARING AREA OF BRIDGE (200 KN per SQUARE METER)		SOIL BEARING CAPACITY	
DETERMINE HOME BANK LONGITUDINAL SLOPE **[Fig 1.9]**	NORMAL: MAX 1 IN 20 RESTRICTED: BETWEEN 1 IN 20 TO 1 IN 10 POSITIVE OR NEGATIVE		SLOPE	
	i.e., POSITIVE: UPSLOPE TOWARDS GAP NEGATIVE: DOWNSLOPE TOWARDS GAP			
DETERMINE HOME & FAR BANK TRANSVERSE SLOPE [Fig 1.9]	MAX 1 IN 20 i.e., SLOPE ACROSS BUILD SITE PARALLEL TO GAP		SLOPE HOME	FAR
OTHER CONSIDERATIONS	MAX. WIND SPEED 35 mph	ACCESS ROUTE ON & OFF BRIDGE	OVERHEAD CABLES	GROUND BEARING CRANE & A-FRAME FEET

APPENDIX I

BRIDGE DESIGN WORKSHEET

BRIDGE DESIGN				
A.R. SPAN RANGE	**20 m to 22 m**	**22 m to 28 m**	**28 m to 34 m**	**34 m to 40 m**
MAX. & MIN. FAR BANK HEIGHT ABOVE OR BELOW HOME BANK	2 m	2.5 m	3 m	3 m
LAUNCH BEAMS [Table 1.6]	1 x Forward + 4	1 x Forward + 5	1 x Forward + 6	1 x Forward + 7
BRIDGE CONFIGURATION [Table 1.6]	2 parallel + 2 ramp	3 parallel + 2 ramp	4 parallel + 2 ramp	5 parallel + 2 ramp
LOADS REQUIRED	LVT+ V1+T1+V2 V3+T3+T2 (2x 20 m)	LVT+ V1+T1+V2 V3+T3+T2 (2x 20 m)	LVT+ V1+T1+V2+T2	LVT+ V1+T1+V2+T2
BRIDGE LENGTH [Table 1.7]	23.9 m	29.8 m	35.8 m	41.7 m
DIMENSION 'A' BRIDGE BUILD Offset from AR Peg to A Frame Feet [Table 1.3]	23.7 m – 'AR' span A=	29.7 m – 'AR' span A=	35.7 m – 'AR' span A=	41.7 m – 'AR' span A=
DIMENSION 'A' BRIDGE RETRIEVAL [Table 1.4]	0.8 m FROM EDGE OF BRIDGE	0.8 m FROM EDGE OF BRIDGE	0.8 m FROM EDGE OF BRIDGE	0.8 m FROM EDGE OF BRIDGE
HOME BANK BEARING (END OF BRIDGE) [Table 1.7; FIG 1.7 & FIG 1.8]	23.05 m – 'AR' span HOME BANK BEARING	28.95 m – 'AR' span HOME BANK BEARING	34.95 m – 'AR' span HOME BANK BEARING	40.85 m – 'AR' span HOME BANK BEARING
	MAXIMUM BEARING AREA: IF HOME BANK SLOPE IS LESS THAN LEVEL AND THE GROUND BEARING AREA IS GREATER THAN 0.85 m, GROUND PREPARATION IS REQUIRED. CHECK BANK CONDITIONS.			
SITE MARKOUT	**MARK OUT BUILD SITE FOR LAUNCHER & FLAT RACK POSITIONING AS DETAILED IN FIG 1.12: NORMAL & FIG 1.13: RESTRICTED**			

APPENDIX I
BRIDGE DESIGN WORKSHEET

BRIDGE DESIGN				
A.R.SPAN RANGE	**20 m to 22 m**	**22 m to 28 m**	**28 m to 34 m**	**34 m to 40 m**
UPPER A-FRAME PIN HOLE SETTING [Table 1.5]				
FAR BANK HIGH	BOTTOM PIN	BOTTOM PIN	BOTTOM PIN	BOTTOM PIN
FAR BANK LEVEL OR LOW	TOP PIN	TOP PIN	TOP PIN	TOP PIN
CHEST PACK SELECTION [Table 1.11 & Fig 1-10] **BANK HEIGHTS BELOW MAY NOT APPLY WHEN RAMP AND PARALLEL ARE ON SLIDE FRAME TILT ROLLERS SEE PARAGRAPH 4.9.2.45 FOR DETAILS**				
HIGH BANK			+2.5 to +3.0 m	+2.5 to +3.0 m
LEVEL BANK	+1.5 m to + 2 m	+2.0 m to +2.5 m	+2.0 to +2.5 m	+2.0 to +2.5 m
LOW BANK	+1.5 m to – 2 m	+2.0 m to -2.5 m	+2.0 to -3.0 m	+2.0 to -3.0 m

STABILIZER LEG PIN HOLE SETTING [Fig 1.6]				
	HOME BANK SLOPE +1 IN 20 UPSLOPE TOWARDS GAP [Table 1.8]	**HOME BANK SLOPE -1 IN 20 DOWNSLOPE TOWARDS GAP [Table 1.8]**	**HOME BANK SLOPE +1 IN 20 TO +1 IN 10 UPSLOPE TOWARDS GAP [Table 1.9]**	**HOME BANK SLOPE -1 IN 20 TO -1 IN 10 DOWNSLOPE TOWARDS GAP [Table 1.10]**
FAR BANK HEIGHT +1 m TO + 3 m	STABILIZER HOLE 14 ½ OR ABOVE	STABILIZER HOLE 14 ½ OR ABOVE	BANK HEIGHT LIMITATIONS	BANK HEIGHT LIMITATIONS
FAR BANK HEIGHT +1 m TO – 1 m	STABILIZER HOLE 10 OR ABOVE	STABILIZER HOLE 10 OR ABOVE	BANK HEIGHT LIMITATIONS	BANK HEIGHT LIMITATIONS
FAR BANK HEIGHT –1 m TO – 3 m	STABILIZER HOLE 6 OR BELOW	STABILIZER HOLE 6 OR BELOW	BANK HEIGHT LIMITATIONS	BANK HEIGHT LIMITATIONS
FAR BANK HEIGHT +0.7 m to – 0.7 m			STABILIZER HOLE 6 OR BELOW	STABILIZER HOLE 14 ½ OR ABOVE
TRANSVERSE (CROSS SLOPES): LAUNCHER SLIDE FRAME SHOULD BE OPENED & CLOSED ON STABILIZER PIN HOLE 10 BOTH SIDES. THEN LEVELED FOR BRIDGE BUILD. **LONGITUDINAL SLOPE: LAUNCHER SLIDE FRAME, ONCE SET FOR CROSS SLOPE, SHOULD BE SET TO GIVE SLIDE FRAME A SLIGHT ANGLE EITHER POSITIVE OR NEGATIVE TOWARDS GAP. IF LEVEL EITHER RAISE OR LOWER BOTH SIDES OF A FRAME ACCORDINGLY.**				

INDEX

B **PAGE**

B continued **PAGE**

C

C continued **PAGE**

D

D continued **PAGE**

E **PAGE**

F

F continued **PAGE**

G

H

H continued **PAGE**

I

I continued **PAGE**

L continued **PAGE**

L continued **PAGE**

M

N

O **PAGE**

P **PAGE**

Q

R

R continued **PAGE**

R continued **PAGE**

S

S continued **PAGE**

T **PAGE**

T continued **PAGE**

U

V

V continued **PAGE**

W

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
0407004

DISTRIBUTION: To be distributed in accordance with the initial distribution for IDN: 256764, requirements for TM 5-5420-279-10.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS FOR USE OF THIS FORM, SEE AR 25-30; THE PROPONENT AGENCY IS OAASA	Use Part II (*reverse*) for Repair Parts and Special Tools List (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM)	DATE

To: (*Forward to proponent of publication or form*) (*include ZIP Code*)	**From**: (*Activity and location) (Include ZIP Code*)
AMSTA-LC-CI/TECH PUBS. TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	125 Transport Company ATTN: Motor SGT (SGT Wilson) Ft. Riley, KA 78665-4000

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM MUMBER	DATE	TITLE
TM 9-2320-302-20	28 May 2001	Unit Maintenance Manual for the M915A3 Tractor Truck

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASONS
	0035 00-01	Intial setup				**Item number for Oil, Lubricating is not correct.**

**Referance to line numbers within the paragraph or subparagraph*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Johnny Wilson, E5, MOTOR SGT	DSN 867-7967	

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS FOR USE OF THIS FORM, SEE AR 25-30; THE PROPONENT AGENCY IS OAASA	**Use Part II (*reverse*) for Repair Parts and Special Tools List (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM)**	DATE
To: (*Forward to proponent of publication or form*) (*include ZIP Code*)	**From**: (*Activity and location) (Include ZIP Code*)	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM MUMBER	DATE	TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASONS

**Referance to line numbers within the paragraph or subparagraph*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (*Forward to proponent of publication or form*) (*include ZIP Code*)	**FROM**: (*Activity and location) (Include ZIP Code*)	**DATE**

PART II – FOR REPAIR PARTS AND SPECIAL TOOLS LIST AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM MUMBER	DATE	TITLE

Page NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERANCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (**Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)**

TYPED NAME, GRADE OR TITLE	**TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION**	**SIGNATURE**

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS FOR USE OF THIS FORM, SEE AR 25-30; THE PROPONENT AGENCY IS OAASA	**Use Part II (*reverse*) for Repair Parts and Special Tools List (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM)**	DATE
To: (*Forward to proponent of publication or form*) (*include ZIP Code*)	**From**: (*Activity and location) (Include ZIP Code*)	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM MUMBER	DATE	TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASONS

**Referance to line numbers within the paragraph or subparagraph*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (*Forward to proponent of publication or form*) (*include ZIP Code*)	**FROM**: (*Activity and location) (Include ZIP Code*)	**DATE**

PART II – FOR REPAIR PARTS AND SPECIAL TOOLS LIST AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM MUMBER	DATE	TITLE

Page NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERANCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (**Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)**

TYPED NAME, GRADE OR TITLE	**TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION**	**SIGNATURE**

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS FOR USE OF THIS FORM, SEE AR 25-30; THE PROPONENT AGENCY IS OAASA	**Use Part II (*reverse*) for Repair Parts and Special Tools List (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM)**	DATE
To: (*Forward to proponent of publication or form*) (*include ZIP Code*)	**From**: (*Activity and location) (Include ZIP Code*)	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM MUMBER	DATE	TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASONS

**Referance to line numbers within the paragraph or subparagraph*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (*Forward to proponent of publication or form*) (*include ZIP Code*)	**FROM**: (*Activity and location) (Include ZIP Code*)	**DATE**

PART II – FOR REPAIR PARTS AND SPECIAL TOOLS LIST AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM MUMBER	DATE	TITLE

Page NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERANCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (**Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)**

TYPED NAME, GRADE OR TITLE	**TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION**	**SIGNATURE**

THE METRIC SYSTEM AND EQUIVALENTS

Linear Measure

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

Weights

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Pounds
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

Liquid Measure

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

Square Measure

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.0386 Sq Miles

Cubic Measure

1 Cu Centimeter = 1,000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

Temperature

5/9 (°F - 32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5 C° +32 = F°

APPROXIMATE CONVERSION FACTORS

To Change	To	Multiply By
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Sq Inches	Sq Centimeters	6.451
Sq Feet	Sq Meters	0.093
Sq Yards	Sq Meters	0.836
Sq Miles	Sq Kilometers	2.590
Acres	Sq Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Sq Inch	Kilopascals	6.895
Bar	Pounds per Sq Inch	14.5
Bar	Kilopascals	100
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

To Change	To	Multiply By
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Sq Centimeters	Sq Inches	0.155
Sq Meters	Sq Feet	10.764
Sq Meters	Sq Yards	1.196
Sq Kilometers	Sq Miles	0.386
Sq Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Sq Inch	0.145
Pounds per Sq Inch	Bar	0.069
Kilopascals	Bar	0.01
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621

PIN: 080577-000