LOS ANGELES FIRE DEPARTMENT

APPARATUS LOG BOOK

To All Members:

This logbook is to serve as a source of information, a guide to proper maintenance, and a continuing service record for the apparatus indicated.

Members assigned to operate this apparatus are to be familiar with the information contained herein and are responsible for the prescribed maintenance. Records shall be kept by proper entries substantiating performance of required maintenance.

Each logbook has been prepared for a specific apparatus and is not easily replaced. All officers and members are to exercise care with regard to maintenance and condition of the logbook.

For necessary revision or replacement, please refer to the Manual of Operation, Section 7/1-01.90.

WILLIAM R. BAMATTRE
Chief Engineer and General Manager

WRB:deg:logbook.2/96

LOS ANGELES CITY FIRE DEPARTMENT

APPARATUS LOG BOOK

I N S T R U C T I O N S

This logbook is to be maintained in accordance with the Manual of Operation, 7/1-01.72. It is to be kept at a designated place in quarters, properly cared for, and ready for inspection at any time.

If any change is made to the apparatus which will cause the information or instructions to become obsolete or in error, the officer(s) concerned shall notify the Supply and Maintenance Division, in writing.

ANNUAL PERFORMANCE TEST: (Retain permanently.)

PREVENTIVE MAINTENANCE RECORD (F-377): Make entries as indicated in the Preventive Maintenance Instructions. (Retain last six copies.)

APPARATUS STATISTICAL INFORMATION (F-701): Original entries will be made by the Supply and Maintenance Division. Addition or corrections will be made by responsible members. (Retain permanently.)

ASSIGNMENT RECORD (F-702): When apparatus is detailed or transferred, the receiving officer is to check the apparatus and inventory and make entries required. (Retain permanently.)

MAINTENANCE RECORD (F-704): Make entries as indicated by a check mark under date/mileage column and across from "Operation Number". (Retain until filled; one year after date of last entry may be discarded.)

REPAIR RECORD (F-705): Make entries as indicated. If repaired in quarters, enter mechanic's name in "Repaired By" column. If repaired at the Supply and Maintenance Division, enter "Shops". (Retain permanently.)

BATTERY RECORD (F-706): Make entries as indicated. (When filled, may be discarded.)

INVENTORY (F-708): Mechanical tools - list all tools (e.g., wrenches, screwdrivers, pliers, etc.).

TIRE RECORD (F-710): Make entries as indicated. NOTE: All

records on one sheet, not a separate sheet for each tire. (Retain permanently.)

ADDENDUM: This section is to be used for any addendum, updates or changes, that may occur Department wide or specific to this apparatus, tools or equipment.

a:logbook.10/96

1993 SIMON LTI AERIAL LADDER TRUCKS

The Los Angeles City Fire Department purchased six 1993 LTI Ladder Trucks during the 1992/93 budget, costing the tax payers just over $500,000 each.

The LTI story begins with the number one manufacturer of mobile hydraulic (telescoping boom) construction cranes: Grove Manufacturing Company of Shady Grove, Pennsylvania. In 1973, however, simply to create much needed additional production space to meet the ever-growing demand for its crane line, Grove decided to sacrifice its aerial ladder through outright sale. In which Ladder Towers Incorporated was born. Then in 1986 LTI became a part of Simon Engineering which was named Simon Ladder Towers, Incorporated. Simon Engineering corporate offices are based in London, England. Which is a large company broken down into three different divisions. Simon Storage, Simon-Carvers and Simon Access.

Simon Access consists of six different entities, which deal with self-propelled telescopic and articulated machines, scissors lifts, truck mounted cranes, aircraft devices, high-reach articulated and telescopic platforms for industrial, fire and rescue purposes, airport crash, fire and rescue vehicles, airport refuelers, digger derricks and insulated truck mounted

platforms, firefighting extending ladders, platforms, and custom chassis. Simon Access is the division that LTI belongs to. One of the other companies in the Simon Access division along with LTI is Simon Duplex.

Simon Duplex is the company that makes the tractor cabs and chassis of this apparatus. Simon Duplex is located in Dover, Ohio. LTI is located in Ephrata, Pennsylvania. LTI is the company that makes the trailers and aerial ladder assemblies for this apparatus.

Once the tractors are completed by Simon Duplex, they are shipped to LTI where the trailers are mated with the tractors. All the finishing touches and final inspectiLTI and the completed apparatus are shipped out of the LTI plant for our use.

LTI is the largest aerial ladder truck manufacturer in the country. They make 26 different model versions of the aerial ladder assemblies, which range from 75' three section ladders to 182' six section ladders.**1993 SIMON LTI AERIAL LADDER TRUCKS**

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PART I

1993 SIMON - LTI
100' AERIAL LADDER

TABLE OF CONTENTS
GENERAL INFORMATION

NOTE: REFER TO PART III FOR AERIAL LADDER, E.P.U., HYDRAULIC SYSTEMS AND OUTRIGGER INFORMATION

1993 SIMON - LTI

100' AERIAL LADDER

GENERAL INFORMATION

ENGINE

THE CUMMINS DIESEL, MODEL N14-460E, IS A SIX CYLINDER VALVE-IN-HEAD TYPE ENGINE. IT HAS A 5-1/2" BORE AND A 6" STROKE, WITH A TOTAL PISTON DISPLACEMENT OF 855 CUBIC INCHES AND A COMPRESSION RATIO OF 16.5 TO 1.

THE N-14 DEVELOPS ITS HIGHEST TORQUE, 1550 FT LBS, AT 1100 RPM AND HIGHEST HORSEPOWER 460 AT 1600 RPM. THE N-14 IS DESIGNED TO RUN AT LOWER RPM, DRIVING AT LOWER RPM'S IT DELIVERS THE BEST PERFORMANCE, LONGEST ENGINE LIFE, AND BEST FUEL ECONOMY. THE N-14 ALSO DELIVERS GREATER TORQUE & PULLING POWER AT LOW RPM. THE ENGINE CAN RUN AN ADDITIONAL SEVEN PERCENT HIGHER THAN ITS MAXIMUM OPERATING RANGE.

"CAUTION" WHEN THE ENGINE IS COLD, THIS ADDITIONAL RPM COULD BE VERY HARMFUL DUE TO MINIMAL LUBRICATION AND DUE CAUTION SHOULD BE EXERCISED.

CELECT. THE CELECT SYSTEM IS AN ELECTRONICALLY CONTROLLED FUEL INJECTION SYSTEM THAT OPTIMIZES FUEL ECONOMY, AND REDUCES EXHAUST EMISSIONS. IT DOES THIS BY CONTROLLING THE TORQUE AND HORSEPOWER CURVE, AIR FUEL CONTROL (AFC) FUNCTION, ENGINE HIGH SPEED, LOW IDLE, AND ROAD SPEED.

THE SYSTEM PROVIDES ADDITIONAL ELECTRONIC FEATURES THAT ENHANCE ENGINE AND VEHICLE PERFORMANCE AND CONTROL.

CELECT (CONT'D)

THE FEATURES INCLUDE GEAR DOWN PROTECTION, PROGRESSIVE SHIFTING, AUTOMOTIVE/VARIABLE SPEED GOVERNOR, LOW IDLE ADJUSTMENT, AND ENGINE PROTECTION SHUT DOWN.

ELECTRONIC CONTROL MODULE (ECM). THE CUMMINS CELECT ENGINE IS ELECTRONICALLY CONTROLLED. MANY OF ITS FUNCTIONS ARE CONTROLLED BY SENSORS AND SWITCHES. THESE SWITCHES AND SENSORS FEED INFORMATION TO A CENTRAL POINT. THIS POINT IS THE ELECTRONIC CONTROL MODULE OR ECM.

THE CELECT ECM RECEIVES INFORMATION FROM MANY DIFFERENT SENSORS. SOME OF THESE SENSORS INCLUDE THE ENGINE POSITION SENSOR, VEHICLE SPEED SENSOR, AND THROTTLE POSITION SENSOR. THE ENGINE POSITION SENSOR PROVIDES ENGINE SPEED AND POSITION INFORMATION. THE VEHICLE SPEED SENSOR IS LOCATED IN THE TRANSMISSION HOUSING. THE UNIT SENSES THE SPEED OF THE OUTPUT SHAFT OF THE TRANSMISSION. FROM THIS INFORMATION, THE ECM COMPUTES VEHICLE SPEED. ANOTHER SENSOR IS THE THROTTLE POSITION SENSOR; WHICH IS LOCATED IN THE THROTTLE FOOT PEDAL ASSEMBLY. WHEN THE FOOT PEDAL IS AT THE TOP OF ITS TRAVEL, THE ENGINE BRAKE CAN BE ACTIVATED. WHEN THE THROTTLE IS DEPRESSED, THE SENSOR DEACTIVATES THE ENGINE "C" BRAKE.

THE ECM PROCESSES THE INFORMATION THAT IT RECEIVES FROM THE SENSORS, AND CONTROLS OPENING AND CLOSING OF THE INJECTOR SOLENOID. THIS ACTION CONTROLS THE AMOUNT OF FUEL METERED TO EACH INJECTOR, AND THE PRECISE TIME OF INJECTION FOR EACH INJECTOR. THIS WILL PRODUCE THE CORRECT HORSE-POWER AND TORQUE FOR THE ENGINE.

ANOTHER SYSTEM THAT THE ECM IS CONNECTED TO IS THE DIAGNOSTIC SYSTEM. THIS SYSTEM IS CAPABLE OF READING ANY FAULT CODES RECORDED IN THE ECM.

ELECTRONIC CONTROL MODULE (ECM) (CONT'D)

THE DIAGNOSTIC SWITCH IS AN ON/OFF TYPE SWITCH LOCATED IN THE CIRCUIT BREAKER PANEL IN FRONT OF THE APPARATUS OPERATOR'S SEAT. THIS SWITCH IS TURNED ON WHEN A MECHANIC WANTS TO READ ANY FAULT CODES. IT MUST REMAIN OFF AT ALL OTHER TIMES.

ENGINE PROTECTION SYSTEM. THE CELECT ENGINES ARE EQUIPPED WITH AN ENGINE PROTECTION SYSTEM. THE SYSTEM MONITORS CRITICAL ENGINE TEMPERATURES AND PRESSURES, AND WILL LOG DIAGNOSTIC FAULTS WHEN AN OVER OR UNDER NORMAL OPERATING CONDITION OCCURS. IF AN OUT-OF-RANGE CONDITION EXISTS, AND ENGINE DERATE ACTION IS TO BE INITIATED, THE OPERATOR WILL BE ALERTED BY A WARNING LIGHT ON THE DASH. THE WARNING LIGHT WILL BLINK OR FLASH WHEN OUT-OF-RANGE CONDITIONS CONTINUE TO GET WORSE. THE OPERATOR MUST PULL TO THE SIDE OF THE ROAD, WHEN IT IS SAFE TO DO SO, TO REDUCE THE POSSIBILITY OF ENGINE DAMAGE.

NOTE: ENGINE POWER AND SPEED WILL BE GRADUALLY REDUCED, DEPENDING ON THE LEVEL OF SEVERITY OF THE OBSERVED CONDITION. THE ENGINE PROTECTION SYSTEM WILL NOT SHUT DOWN THE ENGINE UNLESS THE ENGINE PROTECTION SHUTDOWN FEATURE HAS BEEN SELECTED.

ENGINE LUBRICATION SYSTEM. LUBRICATION IS PROVIDED BY A FORCE FED WET SUMP SYSTEM. THE OIL SUMP IS INTEGRAL WITH THE LOWER CASE AND HOLDS 38 QUARTS OF OIL. AN OIL COOLER OF THE HEAT EXCHANGER TYPE IS LOCATED ON THE RIGHT SIDE OF THE ENGINE BLOCK.

LUBE OIL IS SUPPLIED UNDER PRESSURE BY A GEAR PUMP WHICH SHOULD MAINTAIN AT 2100 RPM 45 PSI OF OIL PRESSURE AND SHOULD SHOW 10 PSI MINIMUM AT IDLE. TOTAL OIL SYSTEM CAPACITY INCLUDING OIL FILTER IS 44 QUARTS.

ENGINE LUBRICATION SYSTEM (CONT'D)

NOTE: THE TOTAL SYSTEM CAPACITY IS 44 QUARTS AND THE LOWER CASE CAPACITY IS 38 QUARTS. THERE IS A DIFFERENCE OF 6 QUARTS IN THE LUBRICATING OIL SYSTEM. SOME OF THIS OIL IS IN THE OIL FILTER, OIL PUMP, MAIN OIL RIFLE, OIL MANIFOLD COLLECTOR, AND OTHER RELATED ENGINE LUBRICATING OIL SYSTEMS.

ENGINE BRAKE SYSTEM. THE CUMMINS BRAKE OR "C-BRAKE" IS VERY SIMILAR TO THE JAKE BRAKE SYSTEM USED ON MANY OF THE DEPARTMENT'S HEAVY APPARATUS. THE C-BRAKE IS A HYDRAULIC ENGINE ATTACHMENT THAT WHEN ENERGIZED, ALTERS THE ENGINE EXHAUST VALVE OPERATION WHICH CONVERTS THE DIESEL ENGINE INTO AN AIR COMPRESSOR. THIS IS ACCOMPLISHED BY PREMATURELY OPENING THE EXHAUST VALVES NEAR THE TOP OF THE COMPRESSION STROKE RELEASING THE COMPRESSION PRESSURE OUT THE EXHAUST VALVES.

THE C-BRAKE IS EQUIPPED WITH TWO DASH MOUNTED SWITCHES, AN ON/OFF SWITCH, AND A THREE POSITION SWITCH THAT CONTROLS THE MOUNT OF RETARDING POWER (DYNAMIC BRAKING) THAT IS DESIRED.

POSITION 1 - FOR MINIMUM RETARDING
POSITION 2 - FOR MODERATE RETARDING
POSITION 3 - FOR MAXIMUM RETARDING

DEACTIVATION OF THE C-BRAKE WILL OCCUR WHEN:

- THE THROTTLE PEDAL IS DEPRESSED.
- AT LOW ENGINE SPEEDS AND ROAD SPEEDS.

"CAUTION" ALL SAFETY REQUIREMENTS THAT HAVE BEEN ADHERED TO WITH THE JAKE BRAKE SYSTEM SHALL APPLY TO THE C-BRAKE

SYSTEM. THE BRAKE SHALL NOT BE USED DURING AERIAL OPERATION OR ON WET STREETS, ETC.

FOR ADDITIONAL INFORMATION SEE LAFD TRAINING BULLETIN NO. 48.

FUEL SYSTEM

A FUEL TANK WITH A CAPACITY OF 50 GALLONS IS PROVIDED. TO INSURE CORRECT FUEL TEMPERATURE, AND TO MINIMIZE CONDENSATION FROM FORMING INSIDE THE FUEL TANK, A FULL FUEL TANK SHOULD BE MAINTAINED FULL WHENEVER POSSIBLE.

THE FUEL PUMP IS EQUIPPED WITH A FUEL SOLENOID VALVE THAT IS OPERATED BY THE SWITCH WHICH IS LABELED "IGNITION" ON THE DRIVER'S INSTRUMENT PANEL. THE FUEL SOLENOID VALVE IS THE VALVE THAT ACTUALLY STARTS AND STOPS THE ENGINE. WHEN THE VALVE IS ELECTRICALLY ENERGIZED (IGNITION SWITCH TURNED ON) THE VALVE OPENS, ALLOWING FUEL TO FLOW TO THE FUEL PUMP, WHICH IN TURN ALLOWS THE ENGINE TO START AND RUN. WHEN THE ELECTRICITY TO THE FUEL SOLENOID VALVE IS TURNED OFF (IGNITION SWITCH TURNED OFF) THE VALVE CLOSES, SHUTTING OFF THE FLOW OF FUEL TO THE FUEL PUMP, AND THE ENGINE SHUTS OFF.

ON RARE INSTANCES, A SITUATION MAY OCCUR WHERE THE IGNITION SWITCH ON THE DASH MAY BURN OUT, THE WIRE TO THE FUEL SOLENOID VALVE MAY BREAK, THE FUEL SOLENOID VALVE ITSELF MAY BURN OUT OR THE BATTERY VOLTAGE DROPS BELOW 9 VOLTS. IN EACH OF THESE CASES, THE ELECTRICITY TO THE FUEL SOLENOID VALVE WILL BE CUT OFF, CAUSING THE VALVE TO CLOSE AND THE ENGINE PROTECTION SYSTEM TO TAKE OVER. ENGINE POWER AND SPEED WILL GRADUALLY BE REDUCED WHEN THIS OCCURS, PULL OVER SAFELY AND NOTIFY THE DEPARTMENT SHOPS.

FUEL FILTER/WATER SEPARATOR. THE FUEL SYSTEM IS EQUIPPED WITH A **"RACOR 490RP30"** FUEL FILTER/WATER SEPARATOR. IT IS LOCATED IN THE RIGHT SIDE FRAME RAIL NEXT TO THE TRANSMISSION.

ALONG WITH THE RACOR FUEL FILTER/WATER SEPARATOR, THERE IS ALSO A CANISTER TYPE FUEL FILTER PLUMBED IN THE FUEL SYSTEM.

FUEL FILTER/WATER SEPARATOR (CONT'D)
THE CANISTER TYPE FUEL FILTER IS LOCATED BEHIND THE FRAME RAIL JUST BELOW THE RACOR 490RP30. THIS FILTER WILL BE CHANGED AT ANNUAL LADDER TEST.

SERVICE. FREQUENCY OF WATER DRAINING OR ELEMENT REPLACEMENT IS DETERMINED BY CONTAMINATION LEVEL IN THE FUEL. INSPECT THE COLLECTION BOWL DAILY, DRAIN AS NECESSARY. FILTER REPLACEMENT IS DONE ANNUALLY AT LADDER TEST.

1. OPEN THE DRAIN AND OPERATE THE PRIMING PUMP TO DRAIN OFF CONTAMINANTS (PRIMING PUMP IS LOCATED AT THE TOP OF THE FUEL FILTER/WATER SEPARATOR HOUSING).
2. TIGHTEN DRAIN (CLOCKWISE), RUN ENGINE AND CHECK FOR LEAKS.

IN THE EVENT THAT FILTER REPLACEMENT IS DONE IN THE FIELD, FOLLOW THESE STEPS FOR ELEMENT REPLACEMENT. TO REPLACE ELEMENT:

1. DRAIN OFF SOME FUEL BY LOOSENING THE VENT PLUG AND OPENING THE DRAIN VALVE (THE VENT PLUG IS LOCATED AT THE TOP RIGHT CORNER OF THE FUEL FILTER/WATER SEPARATOR HOUSING).
2. REMOVE FILTER ELEMENT FROM MOUNTING HEAD WITH BOWL CONNECTED.
3. REMOVE BOWL FROM FILTER ELEMENT. CLEAN BOWL AND O-RING GLAND.
4. LUBRICATE O-RING WITH CLEAN DIESEL FUEL OR MOTOR OIL AND PLACE IN BOWL GLAND.

5. SPIN BOWL ONTO NEW FILTER ELEMENT SNUGLY BY HAND.
   "CAUTION" DO NOT USE TOOLS TO TIGHTEN
6. LUBRICATE FILTER TOP SEAL WITH CLEAN DIESEL FUEL OR MOTOR OIL.
7. WITH THE VENT PLUG STILL LOOSENED, OPERATE THE PRIMING PUMP UNTIL FUEL PURGES AT THE VENT PLUG. MAKE SURE FILTER IS COMPLETELY FULL OF FUEL, THEN CLOSE VENT PLUG.
8. START ENGINE AND CHECK THAT THERE ARE NO LEAKS.

SERVICE (CONT'D)

WARNING! IF THE WATER AND/OR CONTAMINANTS ACCUMULATED IN THE SEPARATOR BOWL REACHES A PREDETERMINED LEVEL, A WARNING LIGHT WILL AUTOMATICALLY DISPLAY AND AN AUDIBLE BUZZER WILL SOUND. THIS WARNING DEVICE IS LOCATED ON THE CENTER CONSOLE. THIS WARNING LIGHT AND BUZZER INDICATES THAT THE FUEL FILTER/WATER SEPARATOR BOWL MUST BE DRAINED "AS SOON AS POSSIBLE".

IF THE WATER IS NOT DRAINED OUT OF THE BOWL, IT COULD ENTER THE ENGINE CAUSING THE ENGINE TO STALL AND POSSIBLY CAUSE SERIOUS DAMAGE TO THE ENGINE. IT IS FOR THIS REASONS THAT IT IS ESSENTIAL THAT THE SEPARATOR BOWL ON THE FILTER UNIT BE CHECKED AND DRAINED WEEKLY.

ELECTRICAL

A DIESEL ENGINE DOES NOT HAVE COILS, PLUGS, OR POINTS TO BE SERVICED. THE IGNITION SWITCH ON THE DASH OPENS THE FUEL VALVE PERMITTING FUEL TO FLOW TO THE INJECTORS. TURNING THE IGNITION SWITCH TO **"OFF"** CLOSES THE SOLENOID VALVE. THIS DEPRIVES THE ENGINE OF FUEL AND STOPS THE ENGINE IMMEDIATELY.

STARTER MOTOR. A LARGE HEAVY-DUTY, 12 VOLT STARTER MOTOR IS PROVIDED.

DUE TO THE HEAVY CURRENT DRAW AND THE DANGER OF OVERHEATING, DO NOT CRANK THE ENGINE FOR MORE THAN 30 SECONDS AT A TIME AND HESITATE ABOUT 30 SECONDS BEFORE MAKING ANOTHER ATTEMPT. FREQUENTLY INSPECT THE EXTERNAL CONNECTIONS AND WIRING FOR LOOSENESS AND CORROSION. BE CERTAIN THAT MOUNTING BOLTS ARE PROPERLY TIGHTENED.

STARTER MOTOR (CONT'D)

"CAUTION" DUE TO THE NATURE OF THIS N-14 ENGINE, IT MAY TAKE MORE THAN FIVE SECONDS OF ENGINE CRANKING TO START. BECAUSE OF THE SOUND INSULATION THE TILLER CAB PROVIDES, THE APPARATUS OPERATOR SHOULD NOTIFY THE TILLERMEN ONCE THE ENGINE HAS STARTED. MEMBERS SHOULD NOT RELEASE THE STARTER BUTTONS UNTIL THE ENGINE HAS STARTED. THE APPARATUS OPERATOR SHOULD BE THE FIRST TO BREAK THE ELECTRICAL CONNECTION. PREMATURE RELEASE OF THE STARTER BUTTON BEFORE THE ENGINE HAS STARTED MAY CAUSE STARTER BENDIX DRIVE DAMAGE.

BATTERIES. "SIX BATTERY SYSTEM" EVOLVED FROM THE NEED OF AN ELECTRICAL SYSTEM WHICH WAS CAPABLE OF MAINTAINING THE **800 Mhz** RADIO, AND THE MOBIL DATA TERMINAL (**MDT**), WHILE HAVING ENOUGH AMPERES TO SUPPLY THE REST OF A VEHICLE'S ELECTRICAL REQUIREMENTS.

THIS SYSTEM HAS BEEN INSTALLED IN ALL 93 LTI'S AND CONSISTS OF SIX (TWO SETS OF THREE), LEAD ACID 12 VOLT BATTERIES. EACH BATTERY IS RATED AT 950 COLD CRANK AMPERES AT 0 DEGREES F. DIESEL ENGINES DRAW APPROXIMATELY TWO AMPERES PER CUBIC INCH WHEN STARTING (I.E., A 1993 CUMMINS DIESEL ENGINE WITH 855 CUBIC

INCHES TAKE ABOUT 1710 AMPERES TO START).

THE BATTERIES ARE CONNECTED IN PARALLEL TO THE REST OF THE ELECTRICAL SYSTEM. THIS CONFIGURATION ALLOWS THE ALTERNATOR OR THE ON-BOARD BATTERY CHARGER TO CHARGE ALL BATTERIES SIMULTANEOUSLY.

THE COMBINED USE OF THE **800 Mhz** RADIO, AND THE **MDT** UNITS, CAUSES A CONSTANT EIGHT AMPERES PER HOUR DRAW ON THE BATTERY SYSTEM. DUE TO THIS CONSTANT DRAIN, AN AUTOMATIC ON-BOARD (45 AMP) BATTERY CHARGER HAS BEEN INSTALLED ON EACH APPARATUS.

BATTERIES (CONT'D)
THIS CHARGER IS CONNECTED TO THE "ENGINE BLOCK" HEATER RECEPTACLE (110 VOLT AC POWER). WHEN THE BATTERIES ARE AT FULL CHARGE, THE CHARGER WILL AUTOMATICALLY SHUT OFF.

HEAVY APPARATUS MUST BE PLUGGED IN WHEN THE VEHICLE IS IN QUARTERS.

NOTE: WHEN THE APPARATUS IS OUT OF SERVICE FOR AN EXTENDED PERIOD OF TIME (OVER TEN HOURS) OR THE ON-BOARD BATTERY CHARGER CANNOT BE PLUGGED IN, THE RADIO "CUTOFF SWITCH" MUST BE TURNED OFF TO AVOID RUNNING DOWN THE BATTERIES. THIS SWITCH IS LOCATED UNDER THE CAPTAIN'S SEAT.

IN ACTUAL PRACTICE, EXCEPT UNDER EXTREMELY UNUSUAL CONDITIONS, THE BATTERIES ON THIS APPARATUS SHOULD NEVER BECOME FULLY DISCHARGED.

IF THE ENGINE IS ALLOWED TO OPERATE AT SLIGHTLY ABOVE IDLE SPEED, THE GENERATING SYSTEM SHOULD ADEQUATELY HANDLE ALL ELECTRICAL NEEDS AND MAINTAIN THE BATTERY IN A CHARGED

CONDITION.

WHEN CHECKING THE SPECIFIC GRAVITY OF BATTERIES, IF A **"FULL CHARGE"** CANNOT BE MAINTAINED, OR IF THE BATTERY OVERCHARGES AND THE LIQUID HAS BEEN BOILING, NOTIFY THE DEPARTMENT SHOPS SO THAT THE CHARGING SYSTEM CAN BE INSPECTED.

ON-BOARD BATTERY CHARGER OPERATION. THE ON-BOARD BATTERY CHARGER WILL ONLY FUNCTION WHEN THE 110 VOLT POWER CORD IS PLUGGED INTO THE ELECTRICAL RECEPTACLE IN DRIVERS SIDE STEP WELL.

ON-BOARD BATTERY CHARGER OPERATION (CONT'D)

TO OPERATE SYSTEM:

1. CONNECT 110 POWER CORD INTO APPARATUS ELECTRICAL RECEPTACLE.
2. TURN CHARGER SWITCH TO "ON" POSITION AT RECEPTACLE.
3. IT IS NOT NECESSARY TO TURN THE RADIO OFF WHEN CHARGING BATTERIES.

THIS CHARGER IS SELF REGULATED, THEREFORE, THE AMPERAGE WILL DECREASE AUTOMATICALLY WHEN THE BATTERIES BEGIN TO CHARGE. UNDER NORMAL OPERATING CONDITION, THE BATTERY CHARGER WILL NOT OVERCHARGE THE BATTERIES.

CIRCUIT PROTECTION. CIRCUIT BREAKERS ARE PROVIDED IN THE ELECTRICAL SYSTEM CIRCUITS FOR PROTECTION IN THE EVENT AN ELECTRICAL SHORT DEVELOPS.

IF A SHORT OCCURS, THE HEAT IN THE CIRCUIT BREAKER CAUSES THE POINTS WITHIN THE BREAKER TO OPEN; AS THE CIRCUIT BREAKER COOLS THE POINTS WILL CLOSE; BUT UNLESS THE SHORT HAS BEEN ELIMINATED, THEY WILL OPEN AGAIN.

THIS OPENING AND CLOSING OF THE POINTS WILL CAUSE A **"CLICKING"** SOUND WHICH WILL CONTINUE UNTIL THE SWITCH CONTROLLING THE FAULTY CIRCUIT HAS BEEN TURNED OFF OR THE SHORT ITSELF HAS BEEN REPAIRED.

IN THE FUSE PROTECTED CIRCUITS AN OVERLOAD WILL CAUSE A FUSE TO BLOW THUS BREAKING THE CIRCUIT.

IF A CIRCUIT SHORTS OUT, THE DEPARTMENT SHOPS SHALL BE NOTIFIED, EVEN THOUGH THE SHORT HAS BEEN ISOLATED AND ELIMINATED.

WARNING DEVICES, FRONT CAB. THERE ARE SEVERAL WARNING DEVICES

LOCATED INSIDE THE FRONT CAB OF THE LTI. THE SYSTEMS ARE:

WARNING DEVICES, FRONT CAB (CONT'D)

1. LOW AIR SYSTEM PRESSURE. A WARNING BUZZER WILL SOUND AND A RED LIGHT WILL ILLUMINATE WHEN AIR SYSTEM PRESSURE IS 60 PSI OR LOWER.

2. LOW OIL PRESSURE. A WARNING BUZZER WILL SOUND AND A RED LIGHT WILL ILLUMINATE WHEN ENGINE OIL PRESSURE IS BELOW 3 PSI.

3. HIGH WATER TEMPERATURE. A WARNING BUZZER WILL SOUND AND A RED LIGHT WILL ILLUMINATE WHEN ENGINE WATER TEMPERATURE REACHES 220°F.

4. FUEL FILTER-WATER SEPARATOR. A WARNING BUZZER WILL SOUND AND A RED LIGHT WILL ILLUMINATE WHEN WATER IS SENSED IN THE COLLECTION BOWL.

5. TRANSMISSION OIL TEMPERATURE. A RED WARNING LIGHT WILL ILLUMINATE WHEN TRANSMISSION TEMPERATURE REACHES 250°F. NO WARNING BUZZER WILL SOUND.

6. JACKKNIFE WARNING SYSTEM. A BUZZER WILL SOUND AND A RED LIGHT WILL ILLUMINATE WHEN THE TRACTOR AND TRAILER ARE AT A 62° ANGLE. THE SAME BUZZER AND LIGHT WILL ACTIVATE WHEN THE TRACTOR AND TRAILER ARE AT A 90° ANGLE WARNING THE OPERATOR OF POSSIBLE SELF COLLISION. THE OPERATOR SHALL STOP IMMEDIATELY WHEN THE ALARM SOUNDS.

7. AUDIBLE WARNING SYSTEM. AN AUDIBLE ALARM (BUZZER), WITH RED INDICATING LIGHT, THAT ALLOWS THE TILLERMAN TO SIGNAL AND/OR WARN THE OPERATOR AND/OR THE OPERATOR TO SIGNAL THE TILLERMAN.

WARNING DEVICES, TILLER CAB. THE TILLER CAB IS EQUIPPED WITH TWO OF THE SAME WARNING DEVICES THAT ARE FOUND IN THE FRONT CAB. THE SYSTEMS ARE.

1. THE JACKKNIFE WARNING SYSTEM.
2. THE AUDIBLE WARNING SYSTEM.

ALTERNATOR SYSTEM. THIS SYSTEM CONSISTS OF AN ALTERNATOR, REGULATOR ASSEMBLY, AND EXTERNAL RECTIFIER. THE ALTERNATOR PRODUCES ITS MAXIMUM CAPACITY OF 250 AMPERES AT 14.2 VOLTS (RECTIFIED OUTPUT) AT COMPARATIVELY LOW ENGINE SPEEDS.

THE RECTIFIER CHANGES THE AC OUTPUT OF THE ALTERNATOR TO DC. ONCE CONVERTED TO DC THE OUTPUT CURRENT GOES TO THE BATTERY.

THE ALTERNATOR BEARINGS ARE LUBED AND SEALED AT THE FACTORY AND REQUIRES NO ADDITIONAL LUBRICATION.

IF THE VOLTMETER FAILS TO SHOW A CHARGE WHEN IT SHOULD, CHECK ALL CONNECTIONS FOR TIGHTNESS AND WIRING FOR BREAKS. IF THIS FAILS TO REMEDY THE PROBLEM, NOTIFY THE DEPARTMENT SHOPS.

AIR CONDITIONING UNIT

AIR CONDITIONING UNIT IS LOCATED INSIDE THE CAB. THERE ARE TWO A/C UNITS. EACH UNIT HAS A DRIP PAN FOR CONDENSATION. WHEN THE DRIP PAN FILLS WITH CONDENSATION (WATER), THE WATER WILL OVERFLOW INTO THE OVERFLOW TANK.

THE OVERFLOW TANK HAS A PUMP THAT WILL AUTOMATICALLY TURN ON AND PUMP THE WATER OUT OF A DRAIN HOSE. THE DRAIN HOSE TERMINATES BEHIND THE LEFT FRONT TIRE. WHEN THE AIR CONDITIONING UNIT IS IN USE IT IS NORMAL FOR WATER TO DRAIN FROM THIS HOSE.

AIR CONDITIONING UNIT (CONT'D)

IF THE HOSE GETS CLOGGED, CONDENSATION WILL OVERFILL THE DRIP PAN AND WATER WILL BEGIN TO LEAK FROM THE BOTTOM OF THE A/C UNIT.

NOTE: NOTIFY THE DEPARTMENT SHOPS IF EXCESSIVE WATER STARTS TO LEAK INTO THE CAB AREA. WHEN DRIVING OVER ROUGH TERRAIN SOME WATER CAN SPLASH OVER THE DRIP PAN AND LEAK OUT OF THE BOTTOM OF THE UNIT. WHEN IN USE IT IS NORMAL FOR SOME WATER TO LEAK INTO THE CAB AREA. DUE TO SWEAT COMING FROM THE EVAPORATOR.

THERE IS ALSO ONE AIR FILTER IN EACH UNIT. THE AIR FILTER IS DESIGNED TO KEEP DIRT OUT OF THE EVAPORATOR. THE FILTER IS MADE OF A NYLON FIBROUS MATERIAL. BOTH FILTERS NEED A VISUAL CHECK FOR DIRT PERIODICALLY. A DIRTY AIR FILTER MAY RESULT IN WARM AIR COMING FROM THE A/C UNIT. NOTIFY THE DEPARTMENT SHOPS TO HAVE THE FILTER CLEANED AND SERVICED.

TO PROLONG LIFE AND PREVENT PREMATURE FAILURE OF THE A/C COMPRESSOR SEALS, RUN THE A/C UNITS AT LEAST ONCE A WEEK FOR TEN MINUTES.

TILLER CAB HEATER UNIT

THE TILLER CAB HEATER IS A DIESEL-FIRED 6,000 BTU AIR HEATER. THE HEATER PROVIDES HOT AIR TO THE INTERIOR OF THE TILLER CAB. SINCE THE HEATER RUNS ON DIESEL FUEL AND 12 VOLT POWER, IT IS ABLE TO PERFORM THIS COMPLETELY INDEPENDENT OF THE APPARATUS ENGINE.

THE HEATER IS OPERATED BY AN ON/OFF SWITCH WHILE THE DESIRED

TEMPERATURE IS MAINTAINED BY A THERMOSTAT THAT AUTOMATICALLY CYCLES THE HEATER ON OR OFF AS REQUIRED.

TILLER CAB HEATER UNIT (CONT'D)

TEMPERATURE AND OVERHEAT LIMIT SWITCHES, AND A SPECIALLY DESIGNED HEAT EXCHANGER ARE AMONG THE SAFETY FEATURES WHICH MAKE THIS HEATER A SAFE AND DEPENDABLE UNIT. THE AVERAGE FUEL CONSUMPTION IS ABOUT .05 GALLON PER HOUR OF USE.

"CAUTION"

- THE HEATER MUST BE SWITCHED OFF WHILE FILLING THE HEATER UNIT DIESEL FUEL TANK. **NOTE:** FILL OUTSIDE OF QUARTERS

- THE HEATER EXHAUST IS VERY HOT, KEEP ALL OBJECTS AWAY A MINIMUM OF 6".

- THE HEATER EXHAUST IS LOCATED IN FRONT OF THE FORWARD RIGHT VENT. TO PREVENT CARBON MONOXIDE FROM ENTERING THE TILLER CAB, KEEP RIGHT VENT CLOSED WHILE HEATER IS IN OPERATION.

- DO NOT RUN THE HEATER IN ENCLOSED AREAS. EXAMPLE: INSIDE STATION APPARATUS FLOOR AND INSIDE GARAGES.

- RUN THE HEATER AT LEAST ONCE A MONTH (INCLUDING DURING THE SUMMER) TO PREVENT THE FUEL PUMP BEARING FROM DRYING OUT.

COOLING SYSTEM

"CAUTION" TO HELP AVOID THE DANGER OF BEING BURNED, DO NOT REMOVE THE RADIATOR CAP WHILE THE ENGINE AND RADIATOR ARE STILL HOT. SCALDING FLUID AND STEAM CAN BE BLOWN OUT UNDER PRESSURE IF THE CAP IS TAKEN OFF TOO SOON.

COOLING SYSTEM (CONT'D)

THE IMPORTANCE OF A PROPERLY CONDITIONED OR INHIBITED COOLANT LIQUID CANNOT BE OVERSTRESSED. A COOLANT WHICH HAS INSUFFICIENT INHIBITORS INVITES THE FORMATION OF RUST AND SCALE WITHIN THE COOLING SYSTEM. RUST, SCALE AND MINERAL DEPOSITS CAN COAT THE WALLS OF THE CYLINDER BLOCK WATER JACKETS AND THE OUTSIDE WALLS OF THE CYLINDER LINERS. AS THESE DEPOSITS BUILD UP, THEY INSULATE THE METAL AND REDUCE THE RATE OF HEAT TRANSFER.

AN ENGINE AFFECTED IN THIS MANNER OVERHEATS GRADUALLY - OVER A PERIOD OF WEEKS OR MONTHS. LINER SCUFFING, SCORING, PISTON SEIZURE AND CYLINDER HEAD CRACKING ARE THE INEVITABLE RESULTS.

AN IMPROPERLY INHIBITED COOLANT CAN ALSO BECOME CORROSIVE ENOUGH TO "EAT AWAY" COOLANT PASSAGES AND SEAL RING GROOVES AND CAUSE COOLANT LEAKS TO DEVELOP.

AN IMPROPERLY INHIBITED COOLANT CAN ALSO CONTRIBUTE TO CAVITATION EROSION. CAVITATION EROSION IS CAUSED BY THE COLLAPSE OF BUBBLES (VAPOR POCKETS) FORMED AT THE COOLANT SIDE OF AN ENGINE COMPONENT.

THE COLLAPSE RESULTS FROM A PRESSURE DIFFERENTIAL IN THE LIQUID CAUSED BY THE VIBRATION OF THE ENGINE PART. AS BUBBLES COLLAPSE, THEY FORM PIN POINTS OF VERY HIGH PRESSURE. OVER A PERIOD OF TIME, THE RAPID SUCCESSION OF MILLIONS OF TINY BUBBLES COLLAPSING CAN WEAR AWAY (ERODE) INTERNAL ENGINE SURFACES.

WHEN CHECKING COOLANT LEVEL, IT IS MOST IMPORTANT TO VISUALLY INSPECT THE CONDITION OF THE COOLANT. IF RUST IS NOTED OR A CLEAR WATER CONDITION IS EVIDENT, INFORM THE DEPARTMENT SHOPS IMMEDIATELY FOR SCHEDULING OF A COOLING SYSTEM INSPECTION. THE WATER PUMP IS MOUNTED ON THE FRONT OF THE ENGINE. IT HAS A PACKLESS SEAL AND REQUIRES NO LUBRICATION.

COOLING SYSTEM (CONT'D)

WHEN CHECKING THE WATER PUMP, CHECK THE WEEP HOLE FOR LEAKS. IF A LEAK HAS DEVELOPED, THE WATER PUMP SEAL IS WORN OUT. NOTIFY THE DEPARTMENT SHOPS FOR SERVICE (**NOTE:** WEEP HOLE IS LOCATED ON BOTTOM HALF OF WATER PUMP).

THE COOLING SYSTEM IS EQUIPPED WITH A COOLING SYSTEM CONDITIONER WHICH IS DESIGNED TO FILTER THE COOLANT, PROVIDE ELECTROLYTIC PROTECTION AND ACT AS A RUST INHIBITOR.

A PORTION OF THE COOLANT IS CIRCULATED THROUGH THE CONDITIONER AT ALL TIMES WHEN THE ENGINE IS OPERATING. THE DEPARTMENT SHOPS WILL REPLACE THE FILTER AS REQUIRED. THE FILTER IS LOCATED ON THE RIGHT SIDE OF THE ENGINE BLOCK NEXT TO THE OIL FILTER.

THE COOLANT TRAVELS TO THE BLOCK, INTO THE HEAD WATER JACKETS, THEN BACK TO THE RADIATOR WHEN OPERATING TEMPERATURE IS REACHED AND THE THERMOSTAT OPENS. PRIOR TO REACHING OPERATING TEMPERATURE, THE THERMOSTAT ROUTES THE WATER FROM THE THERMOSTAT HOUSING BACK TO THE WATER PUMP, AND IT IS RECIRCULATED WITHOUT PASSING THROUGH THE RADIATOR.

THE FAN IS BOLTED DIRECTLY TO THE HUB AND CONTINUOUSLY TURNS WHILE THE ENGINE IS RUNNING, THE FAN IS DRIVEN BY THREE VEE BELTS, AND THE WATER PUMP IS DRIVEN BY A POLY VEE BELT. IF POSSIBLE, DO NOT PERMIT ENGINE WATER TEMPERATURE TO EXCEED 200°F. CARE MUST BE TAKEN TO KEEP ALL FOREIGN OBJECTS CLEAR OF FAN AT

ALL TIMES WHILE ENGINE IS RUNNING.

THE THERMOSTAT IS OF THE MODULATING TYPE THAT DELIVERS THE WATER TO A BYPASS LINE SO THAT THE WATER CIRCULATES IN THE ENGINE THROUGH THE OIL COOLER UNTIL THE TEMPERATURE REACHES ABOUT 170°. DURING THIS TIME THE WATER IS NOT CIRCULATING THROUGH THE RADIATOR. WHEN THE THERMOSTAT OPENS, THE WATER THEN CIRCULATES FROM THE TOP TO THE BOTTOM OF THE RADIATOR.

COOLANT RECOVERY TANK. THE COOLANT SYSTEM CAN BE MAINTAINED FULL WITHOUT TILTING THE CAB. THE COOLANT RECOVERY TANK IS LOCATED INSIDE THE CAB UNDER THE ENGINE COVER. LIFT THE ACCESS PANEL DOOR TO ADD WATER TO THE RECOVERY TANK DEPENDING ON THE ENGINE TEMPERATURE AND WATER LEVEL.

DEAERATION TANK. THE DEAERATION TANK PURGES AIR WHICH COULD BECOME TRAPPED IN THE COOLING SYSTEM FROM CIRCULATING THROUGH THE SYSTEM. AIR IN THE SYSTEM CAN CAUSE HOT SPOTS AND CAVITATION, RESULTING IN ELECTROLYSIS WHICH SUBSTANTIALLY DECREASES WATER PUMP AND CYLINDER LINER LIFE.

ENGINE HEATER. THE COOLING SYSTEM IS EQUIPPED WITH 110 VOLT ENGINE HEATER OF THE DIRECT IMMERSION TYPE. IT WILL KEEP THE ENGINE TEMPERATURE BETWEEN 120°F AND 140°F WHEN PLUGGED INTO A 110 VOLT WALL PLUG. THIS UNIT SHALL BE CONNECTED WHENEVER THE APPARATUS IS HOUSED IN QUARTERS.

RADIATOR CAP. THE CAP IS A PRESSURE RELIEF TYPE WITH A SEVEN POUND RATING. THIS CAP ALLOWS WATER TEMPERATURE TO RISE TO 233°F BEFORE BOILING.

AIR CLEANER

THE DRY TYPE AIR CLEANER IS DESIGNED TO REMOVE FOREIGN MATTER FROM THE AIR, PASS THE REQUIRED VOLUME OF AIR FOR PROPER COMBUSTION, AND MAINTAIN EFFICIENT OPERATION FOR A REASONABLE PERIOD OF TIME BEFORE REQUIRING SERVICE.

THE IMPORTANCE OF KEEPING DUST AND GRIT-LADEN AIR OUT OF AN ENGINE CANNOT BE OVER-EMPHASIZED SINCE CLEAN AIR IS ESSENTIAL TO SATISFACTORY ENGINE OPERATION AND LONG ENGINE LIFE.

AIR CLEANER (CONT'D)

THE AIR CLEANER MUST BE ABLE TO REMOVE FINE MATERIALS SUCH AS DUST AND BLOWN SAND, AS WELL AS COARSE MATERIALS SUCH AS ASHES AND AIR-BORNE FIRE DEBRIS FROM THE AIR.

IT MUST ALSO HAVE A RESERVOIR CAPACITY LARGE ENOUGH TO RETAIN THE MATERIAL SEPARATED FROM THE AIR TO PERMIT OPERATION FOR A REASONABLE PERIOD BEFORE CLEANING AND SERVING ARE REQUIRED.

DUST AND DIRT ENTERING AN ENGINE WILL CAUSE RAPID WEAR OF PISTON RINGS, CYLINDER LINERS, PISTONS AND THE EXHAUST VALVE MECHANISM WITH A RESULT IN LOSS OF POWER AND HIGH LUBRICATING OIL CONSUMPTION.

ALSO DUST AND DIRT WHICH IS ALLOWED TO BUILD UP IN THE AIR CLEANER PASSAGES WILL EVENTUALLY RESTRICT THE AIR SUPPLY TO THE ENGINE AND RESULT IN HEAVY CARBON DEPOSITS ON PISTONS AND VALVES DUE TO INCOMPLETE COMBUSTION.

CLEANING THE FILTER IS NOT RECOMMENDED. NUMEROUS LABORATORY AND FILED TESTS HAVE SHOWN THAT SHAKING, WASHING, RAPPING, OR BLOWING OUT WITH COMPRESSED AIR CAN CAUSE CRACKS OR RUPTURES IN PAPER FILTER CARTRIDGES (PAMIC OR OTHERS) WHICH WOULD PERMIT WEAR CAUSING DIRT PARTICLES TO ENTER THE ENGINE. ATTEMPTING TO

CLEAN THE CARTRIDGES INTRODUCES A HUMAN ELEMENT WHICH IS UNRELIABLE.

SOMETIMES THE CARTRIDGES ARE CLEANED ONCE TOO OFTEN AND ARE REINSTALLED WITH RUPTURED TUBES. A DUSTED OUT ENGINE IS GENERALLY THE RESULT. THE FARR COMPANY FEELS THAT THE LONG SERVICE LIFE OF THE CARTRIDGE TOGETHER WITH THE HIGH COST OF THE ENGINE DOES NOT JUSTIFY THE GAMBLE ASSUMED IN ATTEMPTING TO CLEAN THE CARTRIDGES. THE AIR CLEANER ELEMENT WILL BE REPLACED OR SERVICED AT ANNUAL PUMP TEST OR SOONER, IF NECESSARY.

AIR CLEANER (CONT'D)

NOTE: WHEN WASHING THE APPARATUS WITH A WATER HOSE, DO NOT DIRECT THE STREAM AT THE FILTER INTAKE. THIS CAN RUIN THE FILTER ELEMENT AS WELL AS ALLOWING WATER TO ENTER INTO THE ENGINE, WHICH CAN CAUSE SEVERE ENGINE DAMAGE. AT NO TIME MOUNT ANY TYPE OF TOOL OR HOLDER TO ANY PART OF THE AIR CLEANER FILTER HOUSING OR AIR INTAKE TUBING. THIS WILL CAUSE LEAKS IN THE AIR INTAKE SYSTEM WHICH WILL CAUSE UNFILTERED AIR TO ENTER THE ENGINE.

AIR CLEANER LOCATION AND ACCESS. THE AIR CLEANER IS LOCATED DIRECTLY BEHIND THE ENGINE. ACCESS IS GAINED BY TILTING THE CAB FORWARD.

AIR CLEANER SERVICE GAUGE IS LOCATED ON THE DASH. MAXIMUM INLET RESTRICTION FOR A CLEAN AIR FILTER IS 10" OF H2O. IF, FOR SOME REASON, THE DASH MOUNTED AIR CLEANER SERVICE GAUGE READS 25" OF H2O, CHECK FOR RESTRICTIONS (ASHES, TREE LEAVES, PAPER, ETC.) AT THE FILTER INTAKE SCREEN. THIS SCREEN IS LOCATED ON THE OUTSIDE OF THE APPARATUS ON THE LEFT SIDE. IF THE SCREEN APPEARS CLEAN, CALL THE DEPARTMENT SHOPS FOR SERVICE.

TURBOCHARGER

THE TURBOCHARGER FORCES ADDITIONAL AIR INTO THE ENGINE SO IT CAN BURN MORE FUEL, DEVELOP MORE HORSEPOWER AND MAINTAIN ENGINE EFFICIENCY (BALANCED FUEL TO AIR RATIO) AT ALTITUDES ABOVE SEA LEVEL.

THE TURBOCHARGER CONSISTS OF A TURBINE WHEEL AND A CENTRIFUGAL BLOWER, OR COMPRESSOR WHEEL, SEPARATELY ENCASED BUT MOUNTED ON AND ROTATING WITH A COMMON SHAFT.

TURBOCHARGER (CONT'D)

THE POWER TO DRIVE THE TURBINE WHEEL, WHICH IN TURN DRIVES THE COMPRESSOR, IS OBTAINED FROM ENERGY OF WASTE ENGINE EXHAUST GASES. ROTATION SPEED OF THE TURBINE CHANGES AS THE ENERGY LEVEL OF GAS CHANGES AND CAN REACH AS HIGH AS 60,000 RPM; THEREFORE, THE ENGINE IS SUPPLIED WITH ENOUGH AIR TO BURN FUEL FOR ITS LOAD REQUIREMENTS. THE TURBOCHARGER IS COOLED AND LUBRICATED BY ENGINE LUBRICATING OIL.

TURBOCHARGER MAINTENANCE. THE TURBOCHARGER DOES NOT NEED ANY SPECIAL MAINTENANCE AS ITS LUBRICATING AND COOLING IS FURNISHED BY THE OILING SYSTEM OF THE ENGINE. CERTAIN PRACTICES AND CAUTIONS ARE NECESSARY FOR LONG, DEPENDABLE SERVICE.

1. A PERIODIC CHECK OF THE AIR CLEANER IS VERY ESSENTIAL AS A CLOGGED AIR CLEANER ELEMENT WILL RESULT IN HIGH EXHAUST TEMPERATURES WHICH, IN TURN, WILL DAMAGE THE TURBINE, BEARINGS AND SHAFT. A CLOGGED OR RESTRICTED AIR CLEANER WILL ALSO CAUSE THE ENGINE TO RUN OVER-RICH, WASHING THE

CYLINDERS AND PISTONS OF LUBRICATING OIL, CAUSING PREMATURE WEAR. THIS CONDITION WILL CAUSE THE ENGINE TO SMOKE EXCESSIVELY.

2. A BI-MONTHLY INSPECTION OF THE CONNECTIONS, CLAMPS AND COUPLINGS BETWEEN THE AIR CLEANER AND TURBOCHARGER IS IMPORTANT AS UNFILTERED AIR CAN CAUSE EXCESSIVE WEAR AND DAMAGE TO THE COMPRESSOR SECTION OF THE TURBOCHARGER. CALL THE DEPARTMENT SHOPS IMMEDIATELY IF A DEFECT IN THE SYSTEM IS NOTED. MAKE A TEMPORARY REPAIR UNTIL A PERMANENT REPAIR OR REPLACEMENT TO THE DEFECTIVE COMPONENT IS MADE.

3. **DO NOT OVER-REV THE ENGINE ON COLD STARTS.** OIL LAG OR OIL STARVATION TO THE TURBO WILL CAUSE PREMATURE WEAR ON THE BEARINGS.

TURBOCHARGER MAINTENANCE (CONT'D)

4. ENGINE OIL AND OIL FILTERS MUST BE CHANGED AT RECOMMENDED INTERVALS. ACIDS AND ABRASIVE CONTAMINANTS CAN DAMAGE THE TURBO AS WELL AS OTHER IMPORTANT ENGINE COMPONENTS. USE ONLY THE TYPE AND GRADE OF OIL RECOMMENDED FOR THIS ENGINE.

5. IT IS "IMPORTANT" TO IDLE AN ENGINE THREE TO FIVE MINUTES BEFORE SHUTTING DOWN AFTER HEAVY OR PROLONGED USE (I.E., WHEN DRIVING TO AN INCIDENT EMERGENCY AFTER PARKING APPARATUS, IDLE ENGINE THREE TO FIVE MINUTES TO ALLOW ENGINE TO COOL DOWN). THIS WILL ALLOW LUBRICATING OIL AND WATER TO CARRY HEAT AWAY FROM THE COMBUSTION CHAMBER, BEARINGS, SHAFTS, ETC. THIS IS ESPECIALLY IMPORTANT WITH TURBOCHARGED ENGINES.

CHARGE AIR SYSTEM IS AN AIR TO AIR RADIATOR LOCATED IN FRONT OF THE ENGINE COOLANT RADIATOR. IT IS CONNECTED BETWEEN THE COMPRESSOR SIDE OF THE TURBOCHARGER AND THE INTAKE SIDE OF THE

ENGINE. THE AIR TO AIR RADIATOR IS APPROXIMATELY THE SAME SIZE AS THE ENGINE COOLANT RADIATOR. THE 1993 LTI DOES NOT HAVE AN INTERCOOLER OR AFTERCOOLER

HOW IT WORKS. THE AIR TO AIR RADIATOR WORKS THE SAME WAY AS A STANDARD ENGINE COOLANT RADIATOR. THE TURBOCHARGER FORCES HOT COMPRESSED AIR THROUGH THE AIR TO AIR RADIATOR, THEN INTO THE INTAKE MANIFOLD. THIS COOLING PROCESS PROVIDES DENSE AND COOLER AIR. ONCE THE AIR HAS BEEN COOLED AND IS MORE DENSE THE AIR IS NOW MORE EFFICIENT.

"MAINTENANCE" IS TO CHECK FOR CRACKS, LEAKS, AND LOOSE CONNECTIONS (BI-MONTHLY).

AIR SYSTEM

AIR OUTLET FROM THE AIR BRAKE SYSTEM IS MOUNTED ON THE LEFT SIDE NEAR THE REAR DUELS. THIS OUTLET IS FOR ADDING AIR TO THE TIRES OR CHARGING THE COMPRESSED AIR WATER EXTINGUISHER CARRIED ON THE APPARATUS. **UNDER NO CONDITION SHALL IT BE USED FOR OPERATING A PAINT SPRAY GUN OR HAVE AN AIR BOTTLE CONNECTED TO IT.** THE SHUTOFF IN THE LINE SHALL BE CLOSED WHEN NOT IN USE.

NOTE: DO NOT CONNECT ENGINE HOUSE COMPRESSOR TO APPARATUS AIR OUTLET FITTING AS THE ONE-WAY CHECK VALVE WILL PREVENT AIR FROM ENTERING THE APPARATUS AIR SYSTEM.

AIR STORAGE TANKS. THE AIR RESERVOIR SYSTEM CONSISTS OF SIX TANKS. ONE OF THE TANKS IS THE PRIMARY TANK AND IS SEPARATED FROM THE OTHERS BY A REGULATING VALVE.

THIS VALVE ALLOWS THE PRIMARY TANK TO FILL TO 90 PSI BEFORE THE SECONDARY TANKS ARE FILLED, THUS PROVIDING A RAPID BUILDUP OF AIR PRESSURE IN THE PRIMARY TANK FOR IMMEDIATE USE.

AUTOMATIC BLEEDER VALVE IS LOCATED ON THE PRIMARY TANK, CAREFULLY OPERATE THE SCHRADER VALVE WEEKLY TO INSURE IT IS FUNCTIONING CORRECTLY.

AIR RESERVOIR GAUGE. THERE ARE TWO AIR RESERVOIR GAUGES LOCATED ON THE DASH, THE LEFT GAUGE INDICATES THE AMOUNT OF AIR IN THE PRIMARY TANK. WITH THE ENGINE RUNNING THE PRIMARY TANK WILL FILL FIRST.

WHEN THE (PRIMARY SYSTEM) HAS REACHED 90 PSI, THE APPARATUS MAY BE MOVED. HOWEVER, ONLY THE REAR BRAKES WILL HAVE FULL BRAKING PRESSURE UNTIL THE (SECONDARY SYSTEM) HAS REACHED 90 PSI.

AIR RESERVOIR GAUGE (CONT'D)
ALL OF THE AUXILIARY AIR-POWERED EQUIPMENT IS SUPPLIED FROM THE SECONDARY SYSTEM. UNTIL THE SECONDARY SYSTEM HAS REACHED 90 PSI, THE AUXILIARY EQUIPMENT WILL NOT FUNCTION CORRECTLY. ONLY THE BRAKE SYSTEM IS SUPPLIED VIA THE PRIMARY SYSTEM.

THE PRIMARY SYSTEM WILL ALWAYS FILL BEFORE THE SECONDARY SYSTEM, HOWEVER, SOME BLEEDING MAY OCCUR AS THE PRIMARY SYSTEM IS FILLED.

LOW AIR PRESSURE WARNING SYSTEM. THE LOW PRESSURE INDICATOR SWITCH CAUSES THE LOW AIR PRESSURE BUZZER AND LIGHT AT THE DRIVER'S INSTRUMENT PANEL TO WARN DRIVER OF LOW AIR PRESSURE IN THE SYSTEM. THE BUZZER WILL SOUND WHEREVER THE RESERVOIR PRESSURE FALLS BELOW 60 PSI AND THE IGNITION SWITCH IS ON.

AIR BRAKES

BRAKING SYSTEM COMPONENTS. THE AIR BRAKE SYSTEM CONSISTS OF AN AIR COMPRESSOR, AIR DRYER, AIR RESERVOIR TANKS, AIR PRESSURE GOVERNOR, BRAKE APPLICATION VALVE, REAR AXLE RELAY VALVE, LOW AIR
PRESSURE INDICATOR SWITCH, QUICK RELEASE VALVES, SAFETY VALVE, CHECK VALVES AND BRAKE CHAMBERS AT EACH WHEEL.

DUAL BRAKE SYSTEM IS ALSO REFERRED TO AS A SPLIT BRAKE SYSTEM. THE HEART OF THE SYSTEM IS THE BENDIX-WESTINGHOUSE E-8 BRAKE APPLICATION VALVE.

TWO SEPARATE SUPPLY AND DELIVERY AIR CIRCUITS ARE UTILIZED FOR SERVICE AND EMERGENCY BRAKING. THE E-8 BRAKE VALVE PROVIDES A GRADUATED CONTROL FOR APPLYING AND RELEASING THE APPARATUS

BRAKES.

DUAL BRAKE SYSTEM (CONT'D)

THE CIRCUITS IN THE E-8 DUAL BRAKE VALVE ARE IDENTIFIED AS FOLLOWS: THE PRIMARY CIRCUIT PORTION IS THAT PORTION OF THE VALVE BETWEEN THE SPRING SEAT WHICH CONTACTS THE PLUNGER, THE RELAY PISTON AND THE EXHAUST CAVITY.

THE PRIMARY CIRCUIT PORTION OF THE VALVE IS SIMILAR IN OPERATION TO A STANDARD, SINGLE-CIRCUIT AIR BRAKE VALVE AND, UNDER NORMAL OPERATING CONDITIONS, THE SECONDARY CIRCUIT PORTION IS SIMILAR IN OPERATION TO A RELAY VALVE.

BOTH PRIMARY AND SECONDARY CIRCUIT PORTION OF THE E-8 DUAL BRAKE VALVE USE A COMMON EXHAUST PROTECTED BY AN EXHAUST CHECK VALVE.

BRAKE OPERATION

APPLYING: NORMAL OPERATION - PRIMARY CIRCUIT PORTION. WHEN THE BRAKE PEDAL IS DEPRESSED, THE PLUNGER EXERTS FORCE ON THE SPRING SEAT, RUBBER GRADUATING SPRING, AND PRIMARY PISTON. THE PRIMARY PISTON WHICH CONTAINS THE EXHAUST VALVE SEAT, CLOSES THE PRIMARY EXHAUST VALVE. AS THE EXHAUST VALVE CLOSES, THE PRIMARY INLET VALVE IS MOVED OFF ITS SEAT ALLOWING PRIMARY AIR PRESSURE TO EXIT THE PRIMARY DELIVERY PORT.

APPLYING: NORMAL OPERATION - SECONDARY CIRCUIT PORTION. WHEN THE PRIMARY INLET VALVE IS MOVED OFF ITS SEAT, AIR IS PERMITTED TO PASS THROUGH THE BLEED PASSAGE AND ENTERS THE RELAY CAVITY. THE AIR PRESSURE MOVES THE RELAY PISTON. THE RELAY PISTON WHICH CONTAINS THE EXHAUST SEAT CLOSES THE SECONDARY EXHAUST VALVE.

AS THE SECONDARY EXHAUST VALVE CLOSES, THE SECONDARY INLET VALVE IS MOVED OFF ITS SEAT ALLOWING SECONDARY AIR PRESSURE TO EXIT THE SECONDARY DELIVERY PORT.

APPLYING: NORMAL OPERATION - SECONDARY CIRCUIT PORTION (CONT'D) BECAUSE OF THE SMALL VOLUME OF AIR REQUIRED TO MOVE THE RELAY PISTON, THE ACTION OF THE SECONDARY CIRCUIT PORTION OF THE VALVE IS ALMOST SIMULTANEOUS WITH THE PRIMARY CIRCUIT PORTION.

APPLYING: LOSS OF AIR IN PRIMARY CIRCUIT. SHOULD AIR BE LOST IN THE PRIMARY CIRCUIT, THE FUNCTION WILL BE AS FOLLOWS:

AS THE BRAKE PEDAL IS DEPRESSED AND NO AIR PRESSURE IS PRESENT IN THE PRIMARY CIRCUIT SUPPLY AND DELIVERY PORTS, THE PRIMARY PISTON WILL MECHANICALLY MOVE THE RELAY PISTON ALLOWING THE PISTON TO CLOSE THE SECONDARY EXHAUST VALVE AND OPEN THE SECONDARY INLET VALVE AND ALLOW AIR PRESSURE TO EXIT THE SECONDARY DELIVERY PORT.

APPLYING: LOSS OF AIR IN SECONDARY CIRCUIT. SHOULD AIR BE LOST IN THE SECONDARY CIRCUIT, THE PRIMARY CIRCUIT PORTION WILL CONTINUE TO FUNCTION AS DESCRIBED ABOVE UNDER "NORMAL OPERATION: PRIMARY CIRCUIT PORTION".

BALANCED: PRIMARY CIRCUIT PORTION. WHEN AIR PRESSURE DELIVERED TO THE BRAKE ACTUATORS AND AIR PRESSURE IN THE CAVITY ON THE DELIVERY SIDE OF THE PRIMARY PISTON EQUALS THE MECHANICAL FORCE OF THE BRAKE PEDAL APPLICATION, THE PRIMARY PISTON WILL MOVE AND THE PRIMARY INLET VALVE WILL CLOSE, STOPPING THE FURTHER FLOW OF AIR FROM THE PRIMARY SUPPLY LINE THOROUGH THE VALVE. THE EXHAUST VALVE REMAINS CLOSED PREVENTING ANY ESCAPE OF AIR THOUGHT THE EXHAUST PORT.

SPRING BRAKES. THE APPLICATION OF THE SPRING BRAKE IS AT THE REAR WHEELS (DRIVE) AND TRAILER WHEELS. THE BRAKE CHAMBER CONSISTS OF A SERVICE BRAKE DIAPHRAGM FOR AUXILIARY OR SAFETY BRAKING.

SPRING BRAKES (CONT'D)

IT IS IMPORTANT TO UNDERSTAND THAT SPRING BRAKES OF THIS TYPE ARE NOT APPLIED BY AIR PRESSURE BUT BY THE ABSENCE OF AIR. THE SPRING LOADED PISTON IS CAGED BY THE PRESSURE FROM THE MAIN SYSTEM.

APPLICATION. TO APPLY THE SPRING BRAKES, PULL THE YELLOW BUTTON (MAXI BRAKE) ON THE CENTER CONSOLE. BY PULLING MAXI BRAKE, YOU RELEASE AIR PRESSURE IN THE SPRING BRAKE CHAMBERS, THUS ALLOWING SPRING PRESSURE TO APPLY THE BRAKES. TO RELEASE THE SPRING BRAKES, PUSH THE MAXI BRAKE UNTIL AIR PRESSURE COMPRESSES MECHANICAL SPRING TENSION, RELEASING BRAKES.

THERE ARE THREE PRIMARY USES FOR SPRING BRAKES:

1. AS AN EMERGENCY BRAKE:
   RENDERS THE SERVICE BRAKES UNSAFE.

2. AS A PARKING BRAKE: ONCE APPLIED, SPRING BRAKES CANNOT BE RELEASED UNLESS ADEQUATE AIR PRESSURE IS AVAILABLE FROM THE VEHICLE'S AIR SYSTEM. SPRING BRAKES WILL HOLD A VEHICLE FIRMLY IN PLACE UNTIL THE AIR PRESSURE RISES TO A SAFE OPERATING LEVEL.

3. AS A HILL HOLDER: DURING ROUTINE DRIVING ON A SEVERE GRADE APPLY THE SPRING BRAKE (MAXI BRAKE). IF NECESSARY, ACCELERATE THE ENGINE TO THE TRANSMISSION STALL SPEED, AND THEN RELEASE THE SPRING BRAKE. THIS SHOULD ELIMINATE ANY ROLLBACK WHICH COULD DAMAGE THE DRIVELINE.

TOWING. IN THE EVENT THAT THE SPRING BRAKES CANNOT BE RELEASED AND THE APPARATUS MUST BE TOWED, REMOVE THE RELEASE BOLT THAT IS STORED ON THE OUTSIDE OF THE SERVICE CHAMBER.

TOWING (CONT'D)

REMOVE THE TWO SELF TAPPING SCREWS HOLDING THE STOP WASHER, BEHIND THE STOPWASHER IS A RUBBER (SNAP PLUG). REMOVE THE SNAP PLUG AND REINSTALL THE STOP WASHER, INSERT THE RELEASE BOLT, TIGHTEN THE RELEASE BOLT ENOUGH TO MECHANICALLY RELEASE THE COMPRESSION SPRING. THIS WILL RELEASE THE SPRING BRAKES SO THAT THE APPARATUS CAN BE TOWED OR MOVED.

WARNING! DO NOT RELEASE SPRING BRAKES UNLESS VEHICLE IS PROPERLY BLOCKED SO THAT IT WILL NOT MOVE.

SELF ADJUSTING BRAKES.

ADJUSTER TRAVEL MUST STILL BE CHECKED AS PER THE F-377 MAINTENANCE SCHEDULE.

IF SLACK ADJUSTER TRAVEL GOES BEYOND ITS MAXIMUM ALLOWABLE TRAVEL, THE FOLLOWING STEPS WILL GENERALLY CORRECT THE CONDITION:

1. START THE ENGINE AND ALLOW THE AIR SYSTEM TO BUILD TO IS MAXIMUM PRESSURE (120 PSI).

2. DEPRESS THE BRAKE PEDAL TO FULL APPLICATION TRAVEL, HOLD FOR ONE SECOND, THEN RELEASE. REPEAT THE PROCEDURE. FOUR OR MORE APPLICATIONS WILL BE SUFFICIENT TO BRING THE AUTOMATIC SLACK ADJUSTER BACK TO SPECIFIED LIMITS.

3. SHUT THE ENGINE OFF.

4. RECHECK THE SLACK ADJUSTER TRAVEL. IF STILL INCORRECT, CALL THE DEPARTMENT SHOPS FOR NEEDED REPAIR.

AIR DRYER

MOISTURE EJECTION SYSTEM. THE BENDIX-WESTINGHOUSE #AD9 AIR DRYER IS A DESICCANT TYPE, IN-LINE FILTRATION SYSTEM THAT REMOVES BOTH LIQUID AND WATER VAPOR FROM THE COMPRESSOR DISCHARGE BEFORE IT REACHES THE AIR BRAKE RESERVOIR. THE AIR DRYER UTILIZES A REPLACEABLE DESICCANT MATERIAL WHICH HAS THE UNIQUE ABILITY TO STRIP WATER VAPOR FROM MOISTURE LADEN AIR. THE DESICCANT MATERIAL IS GENERATIVE IN THAT ITS ABSORPTIVE PROPERTIES ARE RENEWED EACH TIME THE COMPRESSOR IS UNLOADED. THE AIR DRYER END COVER IS EQUIPPED WITH AN AUTOMATIC DRAIN VALVE, CONTROLLED BY THE AIR SYSTEM GOVERNOR AND IS EQUIPPED WITH AN INTEGRAL HEATING ELEMENT. ANNUAL SERVICE IS TO BE PERFORMED BY THE DEPARTMENT'S SHOP.

THE DESICCANT BEADS, WHICH ARE REFERRED TO AS THE "DRYING BED", ARE A DRYING SUBSTANCE THAT HAVE THE UNIQUE PROPERTY OF EXPOSING A TREMENDOUS SURFACE AREA IN PROPORTION TO THEIR BULK.

ONE POUND OF THE MILLION DESICCANT BEADS HAS ABOUT TWO MILLION SQUARE FEET OF ADSORPTIVE AREA MADE UP OF A LARGE NUMBER OF SUBMICROSCOPIC CAVITIES IN EACH BEAD. EACH DESICCANT BEAD ABSORBS MOISTURE. THE HEATER AND THERMOSTAT ASSEMBLY PREVENT FREEZE-UP IN THE PURGE DRAIN VALVE WHEN THE DRYER IS USED IN SEVERE WINTER CONDITIONS.

AIR DRYER OPERATION CAN BEST BE DESCRIBED BY SEPARATING THE OPERATION INTO TWO CYCLES; THE CHARGE CYCLE AND THE PURGE CYCLE.

CHARGE CYCLE - COMPRESSOR IN COMPRESSING CYCLE: WITH THE COMPRESSOR IN ITS "LOADED" OR COMPRESSING CYCLE, AIR FROM THE COMPRESSOR ENTERS THE AIR DRYER THROUGH THE DISCHARGE LINE.

CHARGE CYCLE - COMPRESSOR IN COMPRESSING CYCLE (CONT'D)
WHEN THE AIR, ALONG WITH THE WATER AND CONTAMINANTS, ENTERS THE AIR DRYER, THE VELOCITY OR SPEED OF THE AIR REDUCES SUBSTANTIALLY AND MUCH OF THE ENTRAINED LIQUID DROPS TO THE BOTTOM OR SUMP OF THE AIR DRYER. THE INITIAL FLOW IS TOWARD THE BOTTOM OF THE DRYER, BUT AIR FLOW DIRECTION CHANGES 180° AT THE BOTTOM OF THE AIR DRYER, DROPPING SOME WATER AND OIL

THE AIR NOW PASSES THROUGH THE OIL FILTER WHICH REMOVES SOME OIL AND FOREIGN MATERIAL BUT DOES NOT REMOVE WATER VAPOR. AT THIS POINT, THE AIR REMAINS SATURATED WITH WATER. THE FILTERED AIR AND VAPORS PENETRATE THE DESICCANT DRYING BED AND THE ADSORPTION PROCESS BEGINS. WATER VAPOR IS REMOVED FROM THE AIR BY THE DESICCANT.

THE UNSATURATED "DRY AIR" PASSES THROUGH THE BALL CHECK VALVE AND PURGE ORIFICE INTO THE PURGE VOLUME. FROM THE PURGE VOLUME, AIR FLOWS THROUGH A CHECK VALVE AND INTO THE FIRST RESERVOIR.

PURGE CYCLE. WHEN DESIRED SYSTEM PRESSURE IS REACHED, THE GOVERNOR CUTS OUT, PRESSURIZING THE UNLOADER CAVITY OF THE COMPRESSOR WHICH UNLOADS THE COMPRESSOR (NON-COMPRESSING CYCLE). THE LINE CONNECTING THE GOVERNOR UNLOADER PORT TO THE END COVER PURGE VALVE PORT (BOTTOM OF THE AIR DRYER) IS ALSO PRESSURIZED, OPENING THE EXHAUST OF THE PURGE VALVE TO ATMOSPHERE. WITH THE EXHAUST TO THE PURGE VALVE OPEN, CONTAMINANTS IN THE DISCHARGE LINE AND DRYER SUMP ARE PURGED OR FORCED PAST THE OPEN EXHAUST OUT TO ATMOSPHERE.

THE REVERSE AIR FLOWS ACROSS THE DESICCANT STARTS THE REMOVAL PROCESS OF MOISTURE FROM THE DESICCANT SURFACE. DRY AIR FLOWING FROM THE PURGE VOLUME THROUGH THE PURGE ORIFICE AND ACROSS THE

DRYING BED FURTHER DRIES THE DESICCANT.

PURGE CYCLE (CONT'D)

THE COMBINATION OF THESE REVERSE FLOWS, STRIPS THE WATER VAPOR FROM THE DESICCANT (DRYING BED). THIS NORMALLY TAKES BETWEEN 12-15 SECONDS. THE DESICCANT BECOMES ACTIVATED FROM THIS CYCLE AND

IS NOW READY FOR ANOTHER CHARGE CYCLE, WHICH OCCURS WHEN THE COMPRESSOR RETURNS TO THE COMPRESSING CYCLE.

ROCKWELL DURA-MASTER DISC BRAKES

DISC BRAKE WEAR INSPECTION

BRAKE PAD INSPECTION PROCEDURE

THE FOLLOWING INSPECTION MUST BE DONE WEEKLY.

VISUALLY CHECK THE WEAR ON THE INBOARD AND OUTBOARD DISC BRAKE LINING ON ALL SIX CALIPERS WEEKLY. (THIS IS THE MOST ACCURATE METHOD). IT WILL BE NECESSARY TO UTILIZE A MIRROR, FLASHLIGHT OR DROP LIGHT AND A CREEPER. WHEN THE INBOARD OR THE OUTBOARD PAD WEARS DOWN TO 1/4" OF PAD THICKNESS (USE THICKNESS OF THE BACKING PLATE AS A INDICATOR) NOTIFY THE DEPARTMENT SHOPS FOR INSPECTION OF THE BRAKE PADS. THE DEPARTMENT SHOPS WILL THEN SCHEDULE TO HAVE THE BRAKES SERVICED. A 1/4" OF PAD THICKNESS WILL ALLOW ADEQUATE WEAR TIME FOR THE DEPARTMENT SHOPS TO SCHEDULE BRAKE PAD REPLACEMENT.

REPORTS FROM THE FIELD AND THE SHOPS INDICATE THAT THE INBOARD AND OUTBOARD DISC BRAKE LINING DO NOT WEAR AT AN EVEN RATE. THEREFORE, WHEN OBSERVING THE LINING WEAR INDICATOR, WE ARE, IN REALITY, CHECKING THE WEAR ON THE OUTBOARD PAD ONLY. MAKE THE BASIC CHECK BY VISUALLY CHECKING THE POSITION OF THE CALIPER ON THE STATIONARY SLIDE PINS AT THE INBOARD SIDE OF THE BRAKES. CHANGE SHOE AND LINING (PAD) ASSEMBLIES WHEN THE CALIPER HAS MOVED INWARD ENOUGH TO ALLOW 1/8" OF THE SLIDE PIN STILL SHOWING BEYOND THE CALIPER PIN BOSS (SEE FIGURE 1). THIS METHOD IS USED AS A INDICATION ONLY AND THE BEST METHOD IS A VISUAL CHECK OF THE BRAKE PADS.

DISC ROTOR INSPECTION WITH AXLE JACKED UP AND SPRING BRAKE (MAXI BRAKE) OFF. **"CAUTION"** TO PREVENT APPARATUS FROM ROLLING PLACE CHOCK BLOCKS IN THE FRONT AND REAR OF A TIRE THAT IS NOT JACKED

UP.

DISC ROTOR INSPECTION (CONT'D)

ROTATE WHEEL SLOWLY AND INSPECT BOTH THE INBOARD AND OUTBOARD BRAKING (FRICTION) SURFACES OF THE DISC (ROTOR) FOR CRACKS, HEAT CHECKING, GROOVING OR SCORING AND HEAT SPOTTING OR BLUING. ALSO, CHECK THE LATERAL RUNOUTS OF THE DISC. DISCS THAT ARE DAMAGED MUST BE REPLACED, REFER TO THE FOLLOWING ITEMS (USE FLASHLIGHT AND MIRROR FOR CHECKING OUTBOARD SIDE OF ROTOR).

"CAUTION" FAILURE TO REPLACE A DAMAGED DISC WILL INHIBIT THE BRAKE FROM FUNCTIONING PROPERLY WHEN BRAKING IS REQUIRED. A HAZARDOUS CONDITION MAY EXIST.

CRACKED ROTOR. CHECK BOTH FRICTION SURFACES AND OUTER DIAMETER OF THE DISC FOR CRACKS THAT EXTEND PARTIALLY OR COMPLETELY THROUGH ANY SECTION OF THE DISC. IF CRACKS ARE FOUND, THE DISC **MUST BE DISCARDED. LIGHT HEAT CHECKING (VERY FINE HAIRLINE CRACK ACROSS THE DISK FRICTION SURFACES)** IS TYPICAL OF NORMAL OPERATION. HOWEVER, IF HEAT CHECKS INCREASE IN SIZE AND DEVELOP INTO CRACKS THAT EXTEND PARTIALLY OR COMPLETELY THROUGH THE DISK OR IF THE HEAT CHECKS EXTEND TO THE OUTER CIRCUMFERENCE OF THE ROTOR THE DISK **MUST BE DISCARDED.** NOTIFY THE DEPARTMENT SHOPS.

"CAUTION" DURING BRAKING OPERATION, THE APPARATUS CAN DEVELOP A STEERING WHEEL SIDE-TO-SIDE MOTION OR CHATTER, THIS MAY INDICATE A WARPED OR CRACKED ROTOR AND MUST BE SERVICED.

BRAKE DESIGN. A CLOSE INSPECTION OF THE ROCKWELL DURA-MASTER DISC BRAKE SYSTEM WILL REVEAL THAT THE BRAKE PADS ARE OF DIFFERENT THICKNESSES; THE INNER PAD BEING THE THICKER (7/8" WHEN NEW) AND THE OUTER PAD THE THINNER (9/16" WHEN NEW). THE ROTOR COMPENSATES FOR THIS DIFFERENCE BY BEING THICKER ON THE OUTBOARD SIDE AND THINNER ON THE INBOARD SIDE.

BRAKE DESIGN (CONT'D)

"IMPORTANT" WITHOUT THE ABOVE KNOWLEDGE, THE AVERAGE OBSERVER WILL ASSUME THAT A "BRAKE WEAR IMBALANCE CONDITION EXITS" WHEN, IN REALITY, THERE IS NO PROBLEM. THE FRONT BRAKE PADS, INNER AND OUTER, ARE IDENTICAL TO THE REAR BRAKE PADS.

HOW THE BRAKE FUNCTIONS. WHEN THE BRAKES ARE APPLIED, THE PUSH ROD OF THE AIR CHAMBER PUSHES THE AUTOMATIC SLACK ADJUSTER WHICH IS MOUNTED TO THE POWERSHAFT OF THE BRAKE. THE MOVEMENT OF THE SLACK ADJUSTER ROTATES THE POWERSHAFT WHICH CAUSES THE POWERSHAFT NUT TO SLIDE OUT ALONG THE POWERSHAFT. THE NUT PUSHES THE PISTON AND THE INBOARD LINING (PAD) AGAINST THE DISC (ROTOR). THE FORCE OF THE INBOARD LINING ON THE DISC PULLS THE CALIPER IN ALONG THE SLIDE PINS. THE MOVEMENT OF THE CALIPER PUTS THE OUTBOARD PAD INTO CONTACT WITH THE DISC. THE RESULT IS CLAMPING FORCE ON BOTH SIDES OF THE DISC.

"EXTREME CAUTION" AND JUDGEMENT MUST BE TAKEN WHENEVER DRAG IS APPLIED. EXCESSIVE DRAG WILL OVERHEAT THE BRAKE ROTORS POSSIBLY BURNING OUT THE BRAKE PADS, OR GLAZING THE PADS, CAUSING BRAKE FAILURE.

STEERING

TRACTOR STEERING. THE FRONT AXLE IS EQUIPPED WITH THE ROSS HYDROPOWER INTEGRAL POWER STEERING GEAR. INTEGRAL HYDRAULIC POWER STEERING SYSTEM IMPLIES THAT THE GEAR BOX CONTAINS A MANUAL STEERING MECHANISM, A HYDRAULIC CONTROL VALVE, AND A HYDRAULIC POWER CYLINDER ALL IN A SINGLE, COMPACT ASSEMBLY.

THE EASE OF OPERATION AND INCREASED MANEUVERABILITY AFFORDED BY

THE POWER STEERING UNIT IS QUICKLY APPRECIATED BY THE DRIVER.

TRACTOR STEERING (CONT'D)
HOWEVER, THE DRIVER MUST GUARD AGAINST THE TENDENCY TO FORGET THAT ALTHOUGH THE APPARATUS WILL HANDLE ALMOST AS EASILY AS A PASSENGER CAR, THIS IS STILL A HEAVY APPARATUS AND MUST BE HANDLED ACCORDINGLY.

THE POWER STEERING UNIT IS SO DESIGNED AS TO RETAIN THE TENDENCY OF THE FRONT WHEELS TO RETURN TO THE NORMAL STRAIGHT-AHEAD POSITION AFTER COMPLETING A TURN. HOWEVER, DO NOT RELY UPON THE STEERING TO RETURN TO CENTER AUTOMATICALLY. IT IS ALWAYS WISE TO STEER - BOTH TURNING AND STRAIGHTENING - WITH BOTH HANDS ON THE WHEEL.

THE POWER STEERING UNIT IS INSTALLED AS AN ADDITION TO THE STEERING ASSEMBLY AND FAILURE OF THIS UNIT WILL NOT RESULT IN LOSS OF CONTROL OVER THE APPARATUS AS IT MERELY REVERTS TO FULL MANUAL STEERING.

ROTARY CONTROL VALVE COMBINES SIMPLICITY OF CONSTRUCTION WITH DESIRABLE PERFORMANCE CHARACTERISTICS. THE SPEED AT WHICH THE DRIVER CAN TURN THE STEERING WHEEL WITH POWER ASSIST IS DEPENDENT UPON THE PUMP FLOW (MEASURED GALLONS PER MINUTE-GPM) DIRECTED TO A CYLINDER CAVITY.

THE PRESSURE (MEASURE IN POUNDS PER SQUARE INCH-PSI) REQUIRED FOR THE GEAR TO STEER THE VEHICLE IS CREATED BY THE POWER STEERING PUMP TO OVERCOME RESISTANCE AT THE STEERED WHEELS. THE CONTROL VALVE SENSES THESE REQUIREMENTS AND DIRECTS FLUID INTO THE CYLINDER CAVITY AT THE PROPER FLOW RATE AND PRESSURE.

TILLER STEERING. THE TILLER AXLE IS EQUIPPED WITH A ROSS

INTEGRAL POWER STEERING GEAR. OIL IS SUPPLIED BY THE SAME PUMP THAT SUPPLIES THE OIL FOR THE TRACTOR STEERING.

TILLER STEERING (CONT'D)
WHEN THE TILLER STEERING WHEEL IS TURNED, A VALVE OPENS WHICH ADMITS OIL UNDER PRESSURE TO ONE END OF THE PISTON, FORCING THE PISTON TO MOVE WITHIN THE CYLINDER. THE TIE ROD IS MOVED AS A RESULT OF THE PISTON TRAVEL, THUS TURNING THE TILLER WHEELS AS REQUIRED.

WHAT HAPPENS DURING A STEERING MANEUVER. WHEN THE DRIVER TURNS THE STEERING WHEEL, FORCE IS TRANSMITTED FROM THE WHEEL TO THE STEERING GEAR INPUT SHAFT. A TORSION BAR, PINNED AT ITS ONE END TO THE INPUT SHAFT AND AT ITS OTHER END TO THE WORM SHAFT, TURNS WITH THE INPUT SHAFT AND EXERTS A ROTATIONAL FORCE ON THE WORM SHAFT. IN RESPONSE TO THIS ROTATIONAL FORCE, THE WORM SHAFT, ACTING THROUGH THE RECIRCULATING BALL MECHANISM, TRIES TO MOVE THE RACK PISTON AXIALLY THROUGH THE GEAR HOUSING CYLINDER BORE.

THE RACK PISTON'S AXIAL MOVEMENT IS RESISTED BY ITS ENGAGEMENT TO THE SECTOR SHAFT, WHICH IS CONNECTED BY LINKAGE TO THE STEERED WHEELS. BECAUSE OF THIS RESISTANCE, THE TORSION BAR IS TWISTED BY THE INPUT SHAFT, THEREBY ACTUATING THE CONTROL VALVE. PRESSURIZED FLUID, DIRECTED BY THE CONTROL VALVE, ASSISTS IN MOVING THE RACK PISTON AXIALLY THROUGH THE CYLINDER BORE. THE RACK PISTON THEN TURNS THE SECTOR SHAFT TO STEER THE VEHICLE.

TRANSMISSION

THIS VEHICLE IS EQUIPPED WITH AN ALLISON AUTOMATIC TRANSMISSION, MODEL HD 754CR. IT HAS FIVE SPEEDS FORWARD AND ONE REVERSE. THE TRANSMISSION IS EQUIPPED WITH A TORQUE CONVERTER WITH A

RATIO OF 2.2:1. THE TORQUE CONVERTER OFFERS VARIABLE RATIOS IN GEAR.

THIS TRANSMISSION TORQUE CONVERTER COMBINATION IS SELECTED TO ENABLE THIS VEHICLE, FULLY LADEN, TO START ON ANY HILL WITHIN THE CITY.

TRANSMISSION (CONT'D)
WHEN STARTING ON SEVERE GRADES, THE ENGINE SHOULD BE ACCELERATED UNTIL THE CONVERTER IS IN A STALL CONDITION BEFORE THE FOOT OR MAXI BRAKES ARE RELEASED. THIS WILL ALLOW SMOOTH ACCELERATION, ELIMINATING ANY ROLLBACK WHICH COULD DAMAGE THE DRIVELINE COMPONENTS.

TORQUE CONVERTER. THE TORQUE CONVERTER IS A SINGLE-STAGE, THREE ELEMENT UNIT CONSISTING OF PUMP, STATOR AND TURBINE. THE CONVERTER PROVIDES MAXIMUM TORQUE WHEN LOAD CONDITIONS DEMAND. OIL FOR CONVERTER CHARGING PRESSURE COMES FROM THE SUMP AND IS SUPPLIED BY THE TRANSMISSION OIL PUMP.

LOCKUP CLUTCH. THE LOCKUP CLUTCH CONSISTS OF A SINGLE CLUTCH PLATE, BACK PLATE AND PISTON LOCATED BETWEEN THE CONVERTER TURBINE ASSEMBLY AND THE TRANSMISSION FLYWHEEL ASSEMBLY (OR CONVERTER DRIVE HOUSING). THE LOCKUP CLUTCH PLATE IS SPLINED TO THE HUB OF THE CONVERTER TURBINE ASSEMBLY. WHEN THE LOCKUP CLUTCH IS APPLIED, THE TURBINE AND THE CONVERTER PUMP ARE LOCKED TOGETHER AND ROTATE AS A UNIT.

ENGINE OUTPUT IS THEN DIRECTED TO THE TRANSMISSION GEARING AT A SPEED RATIO OF 1:1, BYPASSING THE TORQUE CONVERTER. LOCKUP OCCURS IN ALL FORWARD GEARS, BUT NOT IN REVERSE OR NEUTRAL.

TORQUE CONVERTER OPERATION. THE TORQUE CONVERTER SERVES TWO PRIMARY FUNCTIONS. FIRST, IT ACTS AS A FLUID COUPLING TO

SMOOTHLY CONNECT ENGINE POWER THROUGH THE TRANSMISSION OIL TO THE TRANSMISSION GEAR TRAIN. SECOND, IT MULTIPLIES THE TORQUE, OR TWISTING EFFORT, OF THE ENGINE WHEN ADDITIONAL PERFORMANCE IS DESIRED.

THE TORQUE CONVERTER CONSISTS OF THREE BASIC ELEMENTS; THE PUMP (DRIVING MEMBER), THE TURBINE (DRIVEN OR OUTPUT MEMBER), AND THE STATOR (REACTION MEMBER).

TORQUE CONVERTER OPERATION (CONT'D)

THE CONVERTER PUMP COVER IS BOLTED DIRECTLY TO THE ENGINE FLEXPLATE WHICH IS BOLTED DIRECTLY TO THE ENGINE CRANKSHAFT.

THE CONVERTER PUMP IS, THEREFORE, MECHANICALLY CONNECTED TO THE ENGINE AND TURNS AT ENGINE SPEED WHENEVER THE ENGINE IS OPERATING.

WHEN THE ENGINE IS RUNNING AND THE CONVERTER PUMP IS SPINNING, IT ACTS AS A CENTRIFUGAL PUMP, PICKING UP OIL AT ITS CENTER AND DISCHARGING THIS OIL AT ITS RIM BETWEEN THE BLADES. THE SHAPE OF THE CONVERTER PUMP SHELLS AND BLADES CAUSES THE OIL TO LEAVE THE PUMP SPINNING IN A CLOCKWISE DIRECTION TOWARD THE BLADES OF THE TURBINE. AS THE OIL STRIKES THE TURBINE BLADES, IT IMPARTS A FORCE TO THE TURBINE CAUSING IT TO TURN. WHEN THE ENGINE IS IDLING AND THE CONVERTER PUMP IS NOT SPINNING FAST, THE FORCE OF THE OIL LEAVING THE PUMP IS NOT GREAT ENOUGH TO TURN THE TURBINE WITH ANY EFFICIENCY.

THIS ALLOWS THE VEHICLE TO STAND IN GEAR WITH THE ENGINE IDLING. AS THE THROTTLE IS OPENED AND THE PUMP SPEED INCREASES, THE FORCE OF THE OIL INCREASES AND ENGINE POWER IS MORE EFFICIENTLY TRANSMITTED TO THE TURBINE MEMBER AND THE GEAR TRAIN.

PLANETARY GEARING. THE PLANETARY GEAR TRAIN IS MADE UP OF FOUR CONSTANT MESH, STRAIGHT SPUR GEAR PLANETARY SETS.

THE FORWARD SET IS ARRANGED FOR DIRECT DRIVE AND IS CALLED THE SPLITTER PLANETARY. THE THREE REAR SET ARE INTERMEDIATE-RANGE, LOW-RANGE, AND REVERSE-RANGE PLANETARY. BY THE ENGAGEMENT OF THE CLUTCHES IN VARIOUS COMBINATIONS, THE PLANETARY SETS ACT SINGLY OR TOGETHER TO PROVIDE FIVE FORWARD SPEEDS AND ONE REVERSE.

CLUTCHES. THE CLUTCHES DIRECT THE FLOW OF TORQUE THROUGH TRANSMISSION IN ACCORDANCE WITH THE GEAR SELECTED. ALL CLUTCHES ARE HYDRAULICALLY APPLIED. THE FRICTION SURFACES ARE SINTERED BRONZE AGAINST STEEL. ANY WEAR IS AUTOMATICALLY COMPENSATED, THUS NO ADJUSTMENT IS EVER NECESSARY EXCEPT WHEN REBUILDING THE TRANSMISSION.

HYDRAULIC SYSTEM. A SINGLE, PRESSURIZED HYDRAULIC SYSTEM SERVES THE CONVERTER AND TRANSMISSION. OIL FOR THE HYDRAULIC OPERATION, LUBRICATION, AND COOLING COMES FROM SUMP AND IS SUPPLIED BY THE SAME PUMP.

ALTHOUGH YOUR ALLISON TRANSMISSION IS RUGGED IN DESIGN, CERTAIN PRECAUTIONS AND PROCEDURES MUST BE FOLLOWED TO INSURE LONG, TROUBLE-FREE SERVICE.

TRANSMISSION OPERATIONS

TRANSMISSION OPERATIONS. THE TRANSMISSION SHOULD OPERATE AT APPROXIMATELY 50 PSI WITH NORMAL OIL TEMPERATURE OF APPROXIMATELY 160-220°F. OIL TEMPERATURE WILL RISE CONSIDERABLE WHEN THE VEHICLE IS DRIVEN IN CONVERTER IN A HIGH RANGE OR WHEN

THE DEGREE OF HILL IS EXCESSIVE.

MAKE SURE THE RIGHT RANGE IS SELECTED FOR THE HILL. IF THE TRANSMISSION OIL TEMPERATURE EXCEEDS 250°, STOP THE VEHICLE, SHIFT TO NEUTRAL AND CAUSE THE ENGINE TO RUN AT 1000 TO 1200 RPM. THIS SHOULD IMMEDIATELY COOL THE OIL TO NORMAL. IF NOT, NOTIFY THE SHOPS. THE TRANSMISSION ALSO HAS A NEAT EXCHANGER WHICH IS LOCATED IN FRONT OF THE COOLANT RADIATOR AND THE AIR TO AIR RADIATOR.

TRANSMISSION OPERATIONS (CONT'D)

"CAUTION" THE TRANSMISSION CAN BE DOWNSHIFTED OR UPSHIFTED, EVEN AT FULL THROTTLE, AND ALTHOUGH THERE IS NO SPEED LIMITATION ON UPSHIFTING, THERE IS ON DOWNSHIFTING AND REVERSE. GOOD DRIVING PRACTICE INDICATES THAT DOWNSHIFTING SHOULD BE AVOIDED WHEN THE VEHICLE IS ABOVE THE MAXIMUM SPEED ATTAINABLE IN THE NEXT LOWER GEAR. HOWEVER, PROTECTION AGAINST IMPROPER DOWNSHIFTS AND REVERSE SHIFTS IS INHERENT IN THE DESIGN OF THE HYDRAULIC SYSTEM. IF A DOWNSHIFT OR REVERSE SHIFT IS MADE AT TOO HIGH A SPEED, THE HYDRAULIC SYSTEM AUTOMATICALLY PREVENTS THE SHIFT FROM TAKING EFFECT UNTIL A SAFE, LOWER SPEED IS REACHED. IT WILL AUTOMATICALLY DOWNSHIFT WHEN THE CORRECT SPEED IS REACHED.

TOWING OR PUSHING. NOTE: THE ENGINE CANNOT BE STARTER BY TOWING OR PUSHING. BEFORE TOWING OR PUSHING BEYOND A FEW BLOCKS, THE DRIVELINE MUST BE DISCONNECTED.

COASTING IN NEUTRAL. UNDER NO CIRCUMSTANCES SHOULD YOU ALLOW YOUR APPARATUS TO COAST IN NEUTRAL. WHEN COASTING IN NEUTRAL OR BEING TOWED WITH THE DRIVE SHAFT CONNECTED, THE REAR WHEELS

BECOME THE DRIVING FORCE, CAUSING THE PLANETARY GEARS IN THE TRANSMISSION TO OVERDRIVE.

SINCE THE MULTIPLE CLUTCH SETS ARE NOT APPLIED IN NEUTRAL AND ARE SPACED VERY CLOSE TOGETHER, THEY WILL SOON BE DESTROYED BY HEAT AND LACK OF LUBRICATION. COASTING IN NEUTRAL DOES NOT ALLOW THE ENGINE TO HELP SLOW YOUR APPARATUS.

USING THE ENGINE TO HELP BRAKING. DOWNSHIFTING SHOULD BE AVOIDED WHEN THE APPARATUS ENGINE RPM IS ABOVE THE MAXIMUM SPEED ATTAINABLE IN THE NEXT LOWER GEAR.

USING THE ENGINE TO HELP BRAKING (CONT'D)
USE THE SERVICE BRAKE TO SLOW THE VEHICLE TO AN ACCEPTABLE SPEED WHERE THE TRANSMISSION MAY BE DOWNSHIFTED SAFELY. USE TRANSMISSION FOR BRAKING AS YOU WOULD USE A MANUAL SHIFT.

ENGINE STALL TEST. IF THE ENGINE MUST BE STALL TESTED, THAT IS, TO ENGAGE THE TRANSMISSION IN DRIVE 1 - 5 RANGE WITH THE BRAKE APPLIED, WHEELS CHOCKED AND THEN OPENING THE THROTTLE FULL TO CHECK FOR ENGINE OR TRANSMISSION MALFUNCTION; 30 SECONDS IS THE MAXIMUM TIME ALLOWED FOR THIS TEST. PROLONGED OPERATION OF THIS TYPE WILL CAUSE THE TRANSMISSION OIL TEMPERATURE TO BECOME EXCESSIVE ENOUGH TO CAUSE SEVERE INTERNAL DAMAGE. IF STALL TEST MUST BE REPEATED, SHIFT TO NEUTRAL AND ACCELERATE THE ENGINE TO 1200 RPM AND RUN UNTIL TEMPERATURE LOWERS TO OPERATIONAL LEVEL, 160 - 220.

MAXIMUM TRANSMISSION OPERATING TEMPERATURE. IF TRANSMISSION OVERHEATS DURING NORMAL OPERATION, CHECK THE OIL LEVEL IN THE TRANSMISSION (REFER TO OIL CHECK PROCEDURE). ADD OIL IF NECESSARY. DO NOT CONTINUE OPERATION IF TRANSMISSION TEMPERATURE RISES ABOVE 250°; CALL THE SHOPS FOR ASSISTANCE IN LOCATING THE OVERHEATING PROBLEM.

SHIFT CHARACTERISTICS. SINCE THE BASIC DESIGN OF THE ALLISON AUTOMATIC TRANSMISSION USED IN THIS FIRE APPARATUS HAS BEEN ADJUSTED FOR OPTIMUM FULL THROTTLE SHIFTS; THE LIGHT THROTTLE SHIFTS MAY SEEM HARSH OR SLIGHTLY SEVERE. THIS CONDITION IS NORMAL.

IF, HOWEVER, OVER A PERIOD OF TIME THE SHIFT PATTERN CHANGES FROM ITS NORMAL OPERATION, CONTACT THE SHOPS IMMEDIATELY FOR AN INSPECTION OF THE CONDITION.

NOTE: FULL THROTTLE UP-SHIFTS SHOULD OCCUR AT APPROXIMATELY 1900-2000 RPM IN EACH GEAR.

TRANSMISSION PREVENTIVE MAINTENANCE

CHECKING OIL LEVEL

COLD CHECK. THE PURPOSE OF THE COLD CHECK (ENGINE NOT RUNNING) IS TO MAKE SURE THERE IS SUFFICIENT OIL IN THE TRANSMISSION TO SAFELY START THE ENGINE - ESPECIALLY OF THE EQUIPMENT HAS BEEN STANDING IDLE FOR SOME TIME. THE OIL LEVEL MUST REACH THE FULL MARK ON THE DIPSTICK. BEFORE OPERATING THE VEHICLE.

HOT CHECK. CHECK OIL LEVEL WITH THE ENGINE RUNNING AT 1000 RPM, TRANSMISSION IN NEUTRAL AND WITH THE OIL AT NORMAL OPERATING TEMPERATURE (160 - 220°).

INSPECTING TRANSMISSION FLUID

INTERVALS. THE TYPE OF SERVICE AND OPERATING CONDITIONS WILL DETERMINE THE FREQUENCY OF REGULAR INSPECTION. HOWEVER, CHECK THE TRANSMISSION SYSTEM OIL LEVEL WEEKLY. AT THE SAME TIME,

CHECK FOR OIL LEAKS.

KEEPING THE OIL CLEAN. BECAUSE THE HYDRAULIC SYSTEM IS THE BASIC MEANS OF POWER TRANSFER AND CONTROL OF THE TRANSMISSION, IT IS ESPECIALLY IMPORTANT THAT THE OIL BE KEPT CLEAN. THE AREA AROUND THE OIL FILTER HOLE SHOULD BE KEPT CLEAN AND THE **OIL CONTAINERS MUST BE KEPT FREE FROM WATER, DIRT, MUD, OR OTHER HARMFUL MATTER.**

WATER OR DIRT IN OIL. AT EACH OIL CHANGE, EXAMINE THE OIL THAT IS DRAINED FOR EVIDENCE OF DIRT OR WATER. A NORMAL AMOUNT OF CONDENSATION WILL EMULSIFY IN THE OIL DURING THE OPERATION OF THE TRANSMISSION. HOWEVER, IF THERE IS EVIDENCE OF WATER, CHECK THE COOLER (HEAT EXCHANGER) FOR LEAKAGE BETWEEN THE WATER AND OIL AREA.

WATER OR DIRT IN OIL (CONT'D)
OIL IN THE WATER SIDE OF THE COOLER (VEHICLE RADIATOR) IS ANOTHER SIGN OF LEAKAGE. HOWEVER, THIS MAY INDICATE LEAKAGE OF OIL FROM THE ENGINE INTO THE COOLING SYSTEM.

DRIVELINE. THE DRIVESHAFT IS A SPICER 1810 SERIES RATED AT 24,000 LBS. THE DRIVESHAFT IS BOTH A SOLID AND A TUBULAR TYPE. THE TORSIONAL STRESS IN THE SHAFT IS ITS MAXIMUM AT THE OUTSIDE OF THE SHAFT. THE SLIPJOINT ALLOWS THE SHAFT TO CONTRACT AND EXPAND. THIS GIVES FREEDOM OF MOVEMENT IN A HORIZONTAL DIRECTION AND YET IS CAPABLE OF TRANSMITTING ROTARY MOTION. THE TWO UNIVERSAL JOINTS ARE THE COUPLING THAT PERMITS THE TRANSMISSION TO DRIVE THE DRIVELINE AND THE DRIVELINE TO DRIVE THE DIFFERENTIAL AT DIFFERENT ANGLES.

DIFFERENTIAL (REAR AXLE). THE REAR AXLE IS A ROCKWELL RS-23-180 SERIES AXLE. THE MANUFACTURER CERTIFIED RATING IS 24,00 LBS THE GEAR RATIO IS 4.10:1. THE PURPOSE OF THE DIFFERENTIAL IS TO

PROVIDE FOR DIFFERENCES IN SPEED OF ROTATION OF WHEELS AS THE APPARATUS ROUNDS A CORNER OR TRAVELS OVER UNEVEN GROUND. THE DIFFERENTIAL IS A FULL FLOATING TYPE WHICH IN SHORT MEANS THAT THE AXLE SHAFT TRANSMITS THE TURNING TORQUE WHILE THE HOUSING TAKES THE STRESS CAUSED BY TURNING, SKIDDING AND WOBBLING OF THE WHEELS.

PART II

1993 SIMON - LTI
100' AERIAL LADDER

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DRIVING AND OPERATION

PART II

1993 SIMON - LTI
100' AERIAL LADDER

DRIVING AND OPERATION

STARTING AND DRIVING PROCEDURES

RECOMMENDED ENGINE STARTING PROCEDURES:

1. SHIFT SELECTOR INTO NEUTRAL POSITION.

2. BATTERY MASTER SWITCH "ON".

3. IGNITION SWITCH "ON".

4. WARNING LIGHT MASTER SWITCH "OFF".

5. HEADLIGHT SWITCH "OFF".

6. AIR CONDITIONER/HEATER OFF.

   NOTE: ANYTHING THAT WILL CAUSE A DRAW TO THE ELECTRICAL SYSTEM TURN "OFF" BEFORE STARTING.

7. WITH FOOT OFF THE THROTTLE, DEPRESS STARTER BUTTON ON DASH WITH TILLERPERSON COOPERATING UNTIL ENGINE STARTS.

AFTER THE ENGINE STARTS, CHECK THE ENGINE OIL PRESSURE, WATER TEMPERATURE, AIR PRESSURE, AND ALTERNATOR OUTPUT.

NOTE: **IF ENGINE PREHEATER IS NOT WORKING**, ALLOW THE ENGINE TO WARM UP BEFORE DRIVING **(EXCEPT EMERGENCY OPERATIONS).** DRIVING A COLD ENGINE CAN CAUSE PREMATURE WEAR AND DAMAGE THE ENGINE.

IF ENGINE FAILS TO START WITHIN 30 SECONDS, WAIT 30 SECONDS FOR THE STARTER TO COOL. IF IT FAILS TO START AGAIN, CHECK FUEL LINES AND FUEL SHUTOFF VALVE TO BE SURE FUEL IS NOT SHUT OFF.

NOTE: WHILE DRIVING, IT'S IMPORTANT TO OCCASIONALLY CHECK THE GAGES FOR PROPER TEMPERATURE AND PRESSURE. IT IS ALSO IMPORTANT TO BE AWARE OF YOUR SURROUNDINGS BY CHECKING YOUR MIRRORS AND KNOWING WHAT IS BESIDE AND BEHIND YOU.

SHIFTING GEARS

THE ALLISON HT740 AUTOMATIC TRANSMISSION INSTALLED IN THIS APPARATUS HAS FIVE FORWARD SPEEDS, A REVERSE AND NEUTRAL. THE SHIFTING LEVER LOCATED IN THE CAB IS DIVIDED INTO SEVEN POSITIONS AND MOVEMENT OF THE SELECTOR LEVER DETERMINES THE GEAR IN WHICH THE START WILL BE MADE AND ALSO THE HIGHEST GEAR TO SHIFT WILL BE MADE. THE FOLLOWING IS TO BE USED AS A GUIDE ONLY:

(R) USE FOR BACKING THE VEHICLE. THE REVERSE WARNING SIGNAL BEEPER IS ACTIVATED WHEN THE RANGE SELECTOR IS IN THIS POSITION. REVERSE HAS ONLY ONE GEAR. REVERSE OPERATIONAL PROVIDES THE GREATEST TRACTIVE ADVANTAGE. **"IMPORTANT"** THE APPARATUS SHOULD BE COMPLETELY STOPPED BEFORE SHIFTING FROM A FORWARD GEAR TO REVERSE OR FROM REVERSE TO FORWARD.

(N) USE THIS POSITION TO START THE ENGINE. IF THE ENGINE STARTS IN ANY OTHER POSITION, THE NEUTRAL START SWITCH

IS MALFUNCTIONING. THIS POSITION IS ALSO USED DURING STATIONARY OPERATION OF THE POWER TAKE OFF (AERIAL OPERATION). USE THIS POSITION WHEN THE VEHICLE WILL BE LEFT UNATTENDED. ALWAYS APPLY THE MAXI BRAKES.

SHIFTING GEARS (CONT'D)

(1) THIS IS LOW GEAR, USE THIS WHEN PULLING STEEP GRADES. THIS POSITION ALSO PROVIDES MAXIMUM ENGINE BRAKING POWER. MAXIMUM SPEED IN THIS GEAR IS 17 MPH AT 2100 RPM.

(1-2) NORMALLY USE WHEN STARTING OUT. MAXIMUM SPEED IS 33 MPH AT 2100 RPM.

(1-3) MAXIMUM SPEED IS 42 MPH AT 2100 RPM

(1-4) MAXIMUM SPEED IS 53 MPH AT 2100 RPM

(1-5) MAXIMUM SPEED IS 65 MPH AT 2100 RPM

ALTHOUGH THIS TRANSMISSION IS A TRUE AUTOMATIC, IT WILL GIVE MUCH BETTER PERFORMANCE, SMOOTHER OPERATION, AND MORE LONGEVITY IF THEY ARE OPERATED AS IF THEY WERE A "CLUTCHLESS" MANUAL SHIFT TRANSMISSION. SELECT THE RANGE WHICH IS CONSISTENT WITH TRAFFIC AND ROAD CONDITIONS. SELECTION OF THE CORRECT GEAR RANGE PROVIDES BETTER CONTROL; IT ALSO AVOIDS UNDUE "GEAR HUNTING" BY THE TRANSMISSION, ESPECIALLY AT LIGHT OR PART THROTTLE OPERATION (THIS OCCURS WHEN THE GEAR SELECTOR IS IN TOO HIGH A GEAR FOR THE CONDITIONS ENCOUNTERED).

THERE IS NO SPEED LIMITATION ON UPSHIFTING, BUT THERE IS ON DOWNSHIFTING. DO NOT DOWNSHIFT WHEN THE VEHICLE IS ABOVE THE MAXIMUM SPEED ATTAINABLE IN THE NEXT LOWER GEAR. USE THE BRAKE TO HELP SLOW THE APPARATUS TO AN ACCEPTABLE SPEED WHERE THE TRANSMISSION MAY BE DOWNSHIFTED SAFELY. IT GENERALLY SMOOTHS

OUT THE DOWN-SHIFT IF THE THROTTLE IS DEPRESSED OR "ADVANCED" SLIGHTLY, BEFORE MOVING THE GEAR SELECTOR INTO THE NEW RANGE.

SHIFTING GEARS (CONT'D)

THE DRIVER SHOULD MANUALLY SHIFT UP THROUGH THE GEARS WHEN ACCELERATING; KEEPING THE OPERATING RANGE BETWEEN 1550-2100 RPM. DOWNSHIFT WHEN DECELERATING, TO MAKE USE OF ENGINE BRAKING EFFECT AND THE SUPPLEMENTAL BRAKING SYSTEMS (C-BRAKE).

AUTOMATIC TRANSMISSION USED BY THE LAFD ARE ADJUSTED FOR OPTIMUM FULL THROTTLE SHIFTS. THE LIGHT THROTTLE SHIFTS MAY SEEM TO BE HARSH OR SLIGHTLY SEVERE. THIS CONDITION IS CONSIDERED TO BE NORMAL. IF, OVER A PERIOD OF TIME, THE SHIFT PATTERN CHANGES FROM ITS SEEMINGLY NORMAL OPERATION, IMMEDIATELY CONTACT THE SHOPS FOR AN INSPECTION OF THE TRANSMISSION.

ENGINE SHUTDOWN. IT'S IMPORTANT TO IDLE AN ENGINE THREE TO FIVE MINUTES BEFORE SHUTTING DOWN AFTER HEAVY OR PROLONGED USE (I.E., WHEN DRIVING TO AN INCIDENT EMERGENCY AFTER PARKING APPARATUS, IDLE ENGINE THREE TO FIVE MINUTES TO ALLOW ENGINE TO COOL DOWN). THIS WILL ALLOW LUBRICATING OIL AND WATER TO CARRY HEAT AWAY FROM THE COMBUSTION CHAMBER, BEARINGS, SHAFTS, ETC. THIS IS ESPECIALLY IMPORTANT WITH TURBOCHARGED ENGINES. THE TURBOCHARGER CONTAINS BEARINGS AND SEALS THAT ARE SUBJECT TO HIGH HEAT OF COMBUSTION EXHAUST GASES. TURBO CHARGED ENGINES MUST NOT BE SHUT DOWN IF EXCESSIVELY HOT (OVER 200°F). THE TRANSFER OF HEAT WILL CAUSE THE BEARINGS TO SEIZE.

HOT ENGINE SHUTDOWN. LET ENGINE RUN FOR 3-5 MINUTES AT 900-1100 RPM OR UNTIL TEMPERATURE RETURNS TO NORMAL, AND THEN RUN AT IDLE FOR ABOUT 30 SECONDS BEFORE SHUT DOWN. WHILE THE ENGINE IS RUNNING, THIS HEAT IS CARRIED AWAY BY OIL CIRCULATION, BUT IF

THE ENGINE IS STOPPED SUDDENLY, THE TURBOCHARGER TEMPERATURE MAY RISE AS MUCH AS 100°F ABOVE ENGINE TEMPERATURE. THIS EXTREME HEAT MAY RESULT IN SEIZED BEARINGS OR DAMAGED OIL SEALS IN THE TURBOCHARGER.

HOT ENGINE SHUTDOWN (CONT'D)

"IMPORTANT" WHEN SHUTTING DOWN THE ENGINE, DO NOT SWITCH BATTERY MASTER SWITCH TO "OFF" WHILE ENGINE IS STILL IN OPERATION. THIS CAN DAMAGE THE VOLTAGE REGULATOR AND DESTROY THE ALTERNATOR DIODES. SWITCHING THE BATTERY MASTER SWITCH TO "OFF" IS YOUR LAST OPERATION BEFORE YOU GET OUT OF THE CAB AND PLUG IN YOUR PREHEAT PLUG.

BRAKING. OPERATING THE BRAKES OF AN AIR BRAKED-EQUIPPED VEHICLE IS EXTREMELY SIMPLE. THE EFFORT REQUIRED TO DEPRESS THE BRAKE PEDAL IS ONLY SLIGHTLY MORE THAN DEPRESSING THE AVERAGE ACCELERATOR. IN CASE OF AN EMERGENCY, THERE IS PRACTICALLY AN UNLIMITED SUPPLY OF BRAKING POWER AVAILABLE.

HOWEVER, IT MUST BE REMEMBERED THAT THIS IS A POWERFUL AND HEAVY VEHICLE AND THE DRIVER MUST STILL USE ALL HIS KNOWLEDGE OF THE SPEED, LOAD, AND ROAD TRAFFIC CONDITIONS WHEN BRINGING HIS VEHICLE TO A STOP.

"CAUTION" DO NOT MOVE THE VEHICLE WITH LESS THAN 90 POUNDS OF RESERVOIR PRESSURE.

THE BEST POSSIBLE STOP WILL BE MADE WHEN THE FIRST BRAKE APPLICATION IS AS HARD AS THE SPEED, CONDITION OF THE ROAD, AND PASSENGER COMFORT PERMIT, THEN GRADUATED OFF AS THE SPEED IS REDUCED SO THAT, AT THE END OF THE STOP, LITTLE PRESSURE REMAINS IN THE BRAKE CHAMBER. NEVER APPLY THE BRAKES LIGHTLY AT FIRST AND THEN INCREASE THE PRESSURE AS THE SPEED DIMINISHES. THIS

STOP NOT ONLY REQUIRES MORE TIME, BUT THE HIGH PRESSURE AT THE END WILL PRODUCE A SEVERE FINAL STOP.

DO NOT "FAN" THE BRAKE PEDAL. ON AND OFF APPLICATION OF THE BRAKE DOES NOT INCREASE THE BRAKING EFFICIENCY -- IT ONLY LOWERS THE RESERVOIR AND LINE PRESSURE.

ENGINE OPERATION. A GASOLINE ENGINE DECREASES FUEL INTAKE AS RPM DECREASES BECAUSE OF VACUUM LOSS, WHICH CONTROLS CARBURETOR OPERATION. THE DIESEL ENGINE CAN EASILY BE OVERFUELED, (LUGGING) WHEN CLIMBING A GRADE WHERE ROAD SPEED DECREASES, THE THROTTLE SETTING STAYS THE SAME AND THE TRANSMISSION IS LEFT IN THE SAME GEAR. THE RESULTS ARE LOSS OF POWER, SMOKING, AND OVERHEATING. THIS CONDITION CAN ALSO RESULT IN EXCESSIVE CARBON BUILD-UP ON THE TURBOCHARGER TURBINE WHEEL, CARBON BUILD-UP IN THE ENGINE AND AN INCREASE IN THE CONTAMINANTS IN THE ENGINE OIL.

ENGINE TEMPERATURE. THIS GAUGE INDICATES ENGINE COOLANT TEMPERATURE. OPERATING RANGE IS BETWEEN 160° AND 190°. THE **"RED"** WARNING LIGHT IS SET TO GO ON AT 220°F.

UNNECESSARY ENGINE IDLING. EXCESSIVE IDLING CREATES TWO SERIOUS PROBLEMS. FIRST, IT WASTES FUEL, A DIESEL ENGINE WILL BURN ABOUT ONE-HALF GALLON PER HOUR. SECOND, EXCESSIVE IDLING CAUSES ENGINES TO OPERATE AT DANGEROUSLY LOW TEMPERATURES. THE INCOMPLETE COMBUSTION OF FUEL IN A COLD ENGINE WILL CAUSE PLUGGED FUEL INJECTORS, CRANKCASE DILUTION, FORMATION OF LACQUER OR GUMMY DEPOSITS ON THE VALVES, PISTON, AND RINGS AND RAPID ACCUMULATION OF SLUDGE IN THE ENGINE.

NOTE: WHEN PROLONGED ENGINE IDLING IS NECESSARY, SET THE THROTTLE AT 900 TO 1100 RPM. THIS WILL BRING THE OPERATING TEMPERATURE UP TO A SAFE LEVEL.

DIESEL DRIVING HINTS. IMPROPER DOWNHILL DRIVING CAN BE DEVASTATING TO ENGINE PARTS. WHEN DESCENDING, THE DRIVER WILL OFTEN DOWNSHIFT TO CONTROL SPEED AND TO AVOID EXCESSIVE USE OF THE BRAKES. WHAT ACTUALLY HAPPENS IS THAT THE LOAD IS PUSHING THE VEHICLE DOWNHILL AND THE GOVERNOR CANNOT CONTROL THE ENGINE SPEED. THE WHEELS ARE TURNING THE DRIVESHAFT AND THE ENGINE.

DIESEL DRIVING HINTS (CONT'D)
WHEN THE ENGINE ROTATION EXCEEDS 200 TO 300 RPM ABOVE RATED SPEED, IT COULD RESULT IN THE VALVES HITTING THE PISTON (VALVE FLOAT), INCREASED OIL CONSUMPTION, INJECTOR PLUNGER SEIZURE OR POSSIBLE ENGINE DAMAGE REQUIRING MAJOR REPAIRS. DRIVERS SHOULD SELECT A LOWER GEAR WHEN DESCENDING, REMAIN IN THAT GEAR AT ALL TIMES, AND USE A COMBINATION OF BRAKES AND GEARS TO PREVENT OVERSPEEDING THE ENGINE.

TACH. A DIESEL ENGINE MUST BE DRIVEN BY THE TACH. DURING NORMAL DRIVING CONDITIONS, THE 460E SHOULD BE MAINTAINED BETWEEN 1500-2100 RPM. THE DIESEL ENGINE SHOULD NEVER BE LUGGED. LUGGING AN ENGINE IS RUNNING IT IN A GEAR THAT WILL NOT PROVIDE IMMEDIATE ACCELERATION WHEN THE THROTTLE PEDAL IS DEPRESSED. THIS DEFINITION APPLIES TO ALL GEARS AND AT ALL ENGINE SPEEDS. THE THREE RESULTS OF LUGGING ARE: LOSS OF POWER, SMOKING AND OVERHEATING.

OIL PRESSURE GAUGE. WITH ENGINE AT NORMAL OPERATING TEMPERATURE, THE OIL PRESSURE SHOULD BE 35 PSI MINIMUM AT 1200 RPM AND 40 TO 50 PSI AT 2100 RPM.

ENGINE TUNE UP. THERE IS NO SCHEDULED INTERVAL FOR PERFORMING AN ENGINE TUNE UP. AS LONG AS THE ENGINE PERFORMANCE IS SATISFACTORY, NO TUNE UP SHOULD BE NEEDED. MINOR ADJUSTMENTS

AND FUEL FILTER CHANGE WILL BE DONE AT THE DEPARTMENT SHOPS ANNUALLY AT AERIAL LADDER TEST.

DIESEL RUNAWAY IS USUALLY CAUSED BY A WORN OUT OIL SEAL IN THE TURBOCHARGER DUE TO EXCESSIVE HEAT OR A BROKEN SHAFT. THE ENGINE OIL THEN PASSES BY THE WORN OIL SEAL, AND THEN THE TURBOCHARGER FORCES OIL INTO THE ENGINE. THE ENGINE RPM AT THIS TIME WILL NOT BE GOVERNED AND OVER REVVING OF THE ENGINE CAN OCCUR.

DIESEL RUNAWAY (CONT'D)

DIESEL RUNAWAY IS NOT COMMON IN NORMAL DAY TO DAY COMMERCIAL USE BECAUSE THE ENGINE AND TURBOCHARGER MAINTAINS NORMAL OPERATING TEMPERATURES DURING LONG CONTINUOUS DRIVING.

IN THE FIRE SERVICE, "EMERGENCY DRIVING" CAUSES THE ENGINE AND TURBOCHARGER TO WORK HARDER THAN NORMAL DRIVING. WHEN THE ENGINE IS SHUTDOWN TO SOON AFTER AN EMERGENCY RUN, THERE IS EXCESSIVE HEAT ON THE TURBOCHARGER BEARINGS AND SEALS. THE DEPARTMENT SHOPS ARE CHANGING THE TURBOCHARGERS AT SCHEDULED INTERVALS EVERY 40,000 MILES TO HELP PREVENT DIESEL RUNAWAY. IN THE EVENT A DIESEL RUNAWAY OCCURS THERE ARE GENERAL GUIDELINES TO FOLLOW. UNDERSTAND THIS COULD HAPPEN AT ANY TIME, WHILE DRIVING, STOPPED WITH THE ENGINE RUNNING, OR WHILE IN AN AERIAL OPERATION WITH PTO ENGAGED. IF WE CAN IDENTIFY THE PROBLEM AS SOON AS POSSIBLE, WE CAN POSSIBLY MINIMIZE FURTHER DAMAGE.

IF THE **APPARATUS IS STOPPED** OR COMES TO A COMPLETE STOP & THE ENGINE IS OVER REVVING, ATTEMPT TO STALL THE ENGINE BY FOLLOWING THESE GUIDELINES.

1. APPLY THE MAXI BRAKES.

2. TURN OFF THE IGNITION SWITCH (IF THE IGNITION SWITCH DOES NOT SHUT DOWN THE ENGINE, A DIESEL RUNAWAY POSSIBLY HAS OCCURRED).

3. IF THIS PROCEDURE IS NOT EFFECTIVE, SHIFT TO NEUTRAL, TURN OFF THE IGNITION SWITCH, AND KEEP CLEAR OF THE ENGINE. AFTER THE ENGINE CONSUMES ALL OF THE OIL IN THE CRANKCASE, THE ENGINE WILL EVENTUALLY FREEZE UP AND STOP.

DURING AERIAL OPERATION, IF A DIESEL RUNAWAY OCCURS THIS PRESENTS ANOTHER PROBLEM. FOLLOW THESE GUIDELINES.

DIESEL RUNAWAY (CONT'D)

1. TURN OFF THE IGNITION SWITCH (IF THE IGNITION SWITCH DOES NOT SHUT DOWN THE ENGINE, A DIESEL RUNAWAY POSSIBLY HAS OCCURRED).

2. NOTIFY I.C. THAT A RUNAWAY HAS OCCURRED.

3. NOTIFY COMPANIES YOUR AERIAL LADDER IS OUT OF SERVICE.

NOTE: IF THIS DOES NOT SHUT DOWN THE ENGINE, KEEP CLEAR OF THE ENGINE. AFTER THE ENGINE CONSUMES ALL OF THE OIL IN THE CRANKCASE, THE ENGINE WILL EVENTUALLY FREEZE UP AND STOP.

REMEMBER: THESE ARE ONLY GUIDELINES AND IF A DIESEL RUNAWAY OCCURS, SAFETY TO FIRE DEPARTMENT PERSONNEL AND TO THE PUBLIC ARE MOST IMPORTANT.

PREVENTATIVE MAINTENANCE. DIESEL RUNAWAY IS USUALLY CAUSED BY OVER HEATING OF THE BEARINGS AND SEALS IN THE TURBOCHARGER (REFER TO ENGINE SHUT DOWN).

SYMPTOMS LEADING TO DIESEL RUNAWAY:

- EXCESSIVE OIL CONSUMPTION.
- EXHAUST SMOKE IS UNUSUALLY BLACK.
- OIL LEAKING AROUND THE TURBO SEALS.
- INCREASE IN RPM WITHOUT APPLYING THROTTLE.

ENGINE BRAKING SYSTEM "C-BRAKE" THE CUMMINS ENGINE BRAKE IS REFERRED TO AS A C-BRAKE. THE C-BRAKE OPERATES IN THE SAME MANNER AS THE JAKE BRAKE.

ENGINE BRAKING SYSTEM "C-BRAKE" (CONT'D)

AN ENGINE BRAKE IS A DEVICE WHICH USES THE ENERGY OF THE ENGINE COMPRESSION TO PROVIDE VEHICLE RETARDATION. ENGINE BRAKES PROVIDE THE MAXIMUM RETARDING POWER AT RATED SPEED; THEREFORE, GEAR SELECTION IS IMPORTANT. THE ENGINE BRAKE CONVERTS THE ENGINE TO AN ENERGY ABSORBING DEVICE TO REDUCE VEHICLE SPEED. THIS IS ACCOMPLISHED BY A HYDRAULIC CIRCUIT THAT OPENS THE EXHAUST VALVES NEAR THE END OF THE COMPRESSION STROKE.

C-BRAKE CONTROL CONSISTS OF THE FOLLOWING:

- A THREE POSITION SELECTOR SWITCH.
- AN ON/OFF SWITCH TO ACTIVATE OR DEACTIVATE THE SYSTEM.
- A THROTTLE SENSOR.

ADVANTAGES FOR APPARATUS EQUIPPED WITH C-BRAKES INCLUDE INCREASED PERFORMANCE, SAFETY, VERSATILITY, AND COST-EFFECTIVENESS. SIGNIFICANT REDUCTION IN BRAKE WEAR CAN BE ANTICIPATED THROUGH THE PROPER TRAINING AND USE OF C-BRAKES ON APPARATUS SO EQUIPPED.

FAMILIARIZATION WITH THE OPERATIONAL CHARACTERISTICS AND PRECAUTIONS IS NECESSARY BY ALL MEMBERS FOR THE DEPARTMENT TO FULLY BENEFIT FROM THE C-BRAKES' CAPABILITIES.

THEORY OF OPERATION. DIESEL ENGINES HAVE SUBSTANTIALLY LESS RETARDING EFFECT UPON VEHICLES THAN A GASOLINE ENGINES. THIS IS DUE TO LACK OF RESTRICTION IN THE DIESEL INTAKE MANIFOLD. THE GASOLINE ENGINE HAS A BUTTERFLY VALVE IN THE CARBURETOR WHICH CREATES A VACUUM AND SUBSEQUENT ENGINE BRAKING.

THE C-BRAKE IS A HYDRAULIC ENGINE ATTACHMENT THAT, WHEN ENERGIZED, ALTERS THE ENGINE EXHAUST VALVE OPERATION WHICH CONVERTS THE DIESEL ENGINE INTO AN AIR COMPRESSOR.

THEORY OF OPERATION (CONT'D)

THIS IS ACCOMPLISHED BY PREMATURELY OPENING THE EXHAUST VALVES NEAR THE TOP OF THE COMPRESSION STROKE RELEASING THE COMPRESSION PRESSURE TO EXHAUST. THE RESULT IS AN ENGINE RETARDING EFFORT TO THE DRIVE WHEELS.

THE ENGINE BRAKE MAY BE USED FOR DESCENDING GRADES, DRIVING IN CITY TRAFFIC, OR WHEN APPROACHING STOP LIGHTS AND, IN GENERAL, WHENEVER VEHICLE RETARDING IS REQUIRED. THE C-BRAKE IS A VERY EFFECTIVE TOOL AND CAN REDUCE BRAKE WEAR IF USED PROPERLY.

THERE IS NO TIME LIMIT WITH RESPECT TO THE OPERATION OF YOUR C-BRAKE. THE ENGINE'S COOLING SYSTEM WILL CONTINUALLY ABSORB AND DISSIPATE THE HEAT GENERATED BY ITS CONTINUAL USE.

THE ENGINE BRAKE REACTS QUICKLY, IT WILL ACTIVATE OR DEACTIVATE IN LESS THAN 1/4 OF A SECOND.

ALL OF THESE SWITCHES SEND SIGNALS TO THE ECM. THE ECM THEN

ELECTRONICALLY ENABLES OR DISABLES THE C-BRAKE THROUGH THE "BRAKE ENABLE" RELAY.

NOTE: C-BRAKE CANNOT BE ENABLED:

- WHEN ENGINE RPM GOES BELOW 850 RPM OR,
- WHEN AN ELECTRONIC PROBLEM IS DIAGNOSED.

C-BRAKE OPERATING INSTRUCTIONS

1. START ENGINE.
2. ENGINE SHOULD BE FAIRLY WARM BEFORE ENGAGING C-BRAKE. ENGINE PREHEATER WATER TEMPERATURE IS SUFFICIENT.
3. TURN ON THE C-BRAKE "ON/OFF" SWITCH LOCATED ON GEAR SHIFT LEVER.

C-BRAKE OPERATING INSTRUCTIONS (CONT'D)

THE THREE-POSITION SELECTOR SWITCH ALLOWS THE OPERATOR TO CHOOSE THE DESIRED BRAKING LEVEL:

POSITION NO. 1	MINIMUM ENGINE RETARDING ACTIVATES TWO CYLINDERS
POSITION NO. 2	MODERATE ENGINE RETARDING ACTIVATES FOUR CYLINDERS
POSITION NO. 3	MAXIMUM ENGINE RETARDING ACTIVATES SIX CYLINDERS

SELECTOR SWITCH POSITION CAN BE CHANGED AT THE DISCRETION OF THE OPERATOR, AT ANY TIME, WITHOUT THE FEAR OF DAMAGING ANY OF THE ENGINE COMPONENTS.

C-BRAKE "CAUTIONS"

WET STREET OPERATION. DO NOT ENGAGE THE C-BRAKE ON WET STREETS. THE ADDITIONAL BRAKING EFFORT ON THE DRIVE WHEELS (DUALS) CAN CAUSE THEM TO LOCK UP WHICH COULD RESULT IN AN UNCONTROLLABLE SKID.

DO NOT ENGAGE THE C-BRAKE DURING AERIAL OPERATIONS. THIS PRACTICE CAUSES UNDESIRABLE RETARDATION, POSSIBLE ENGINE AND COMPONENT DAMAGE, AND ENGINE STALLING.

USAGE GUIDE. LIGHT TRAFFIC CONDITION MINIMUM C-BRAKE SWITCH SETTING.

MINIMUM TRAFFIC CONDITION. MINIMUM TO MODERATE C-BRAKE SWITCH SETTING.

HEAVY TRAFFIC CONDITION AND EMERGENCY RESPONSES. MAXIMUM C-BRAKE
SWITCH SETTING.

CHARGING SYSTEM QUICK CHECK

ENGINE MODE	VOLTMETER READING	CONDITION
BATTERY SWITCH ON IGNITION SWITCH ON ENGINE NOT RUNNING NO ELECTRICAL LOAD	12.2 - 12.8	
SAME CONDITION AS ABOVE	BELOW 12	
ENGINE RUNNING (1 MIN. OR MORE) APPROX. 1000 RPM NO LOAD	13.8 - 14.2	CHECK ALTERNATOR

SAME AS ABOVE	BELOW 13.8	
ENGINE RUNNING (1 MIN. OR MORE)		
APPROX. 1000 RPM	13.5 - 14.2	CHARGING SYSTEM
FULL LOAD (ALL LIGHTS ON)		
SAME AS ABOVE	BELOW 13.5	BELT TENSION. CHECK BATTERY CONDITION.

THE ABOVE INFORMATION DOES NOT SUPERSEDE THE STANDARD BATTERY MAINTENANCE PROGRAM AS RECOMMENDED IN THE F-377, BUT IS INTENDED TO BE FOLLOWED ONLY AS A QUICK DAILY CHECK TO MAKE SURE THE CHARGING SYSTEM IS FUNCTIONING IN A NORMAL MANNER. KEEP THE BATTERIES AT FULL CHARGE AT ALL TIMES.

BATTERY CHARGER. WHEN USING THE ON-BOARD CHARGER OR THE HOUSE CHARGER DO NOT REMOVE BATTERY FILL CAPS (WHERE APPLICABLE). THE DESIGN OF THE CAPS IS SUCH THAT GASES PRODUCED DURING CHARGING WILL ESCAPE INTO THE ATMOSPHERE WHILE KEEPING LIQUID LOSS TO A MINIMUM. CHARGING THE BATTERIES WITH THE CAPS OFF GREATLY INCREASES LIQUID LOSS, AS WELL AS ADDING TO BATTERY CABLE AND COMPARTMENT CORROSION.

BATTERY GASES

"CAUTION" THE GASES HYDROGEN AND OXYGEN EMITTED FROM A CHARGING BATTERY CAN EXPLODE WITH GREAT FORCE IF A SPARK OR FLAME IS BROUGHT TOO CLOSE DURING CHARGING. WHENEVER A CABLE IS REMOVED AT THE BATTERY, OR THE

BATTERY IS REPLACED, THE BATTERY MASTER SWITCH MUST BE IN THE "OFF" POSITION. REMOVING A CABLE WITH ANY ELECTRICAL COMPONENT ON MAY CAUSE A SPARK AT THE CABLE TERMINAL END.

BATTERY WEEKLY CHECKS. ANYTIME BEFORE REMOVING THE VENT CAPS TO SERVICE OR WORK ON THE BATTERIES, THE FOLLOWING STEPS MUST BE TAKEN.

- TURN OFF RADIO "CUT OFF SWITCH".
- TURN OFF BATTERY CHARGER TOGGLE SWITCH.
- UNPLUG 110 VOLT ENGINE HEATER CORD.
- WEAR SAFETY GLASSES WHILE CHECKING HYDROMETER READING OR ADDING WATER.

VOLTMETER WILL ALLOW YOU TO KNOW THE BATTERY AND CHARGING SYSTEM CONDITION. FOLLOW THE GUIDE ON THE PREVIOUS PAGE FOR CHECKING BATTERY AND ALTERNATOR.

DIRECTIONAL SIGNALS, OR TURN INDICATORS, ARE PROVIDED AS A USEFUL AID IN SIGNALING FOR A TURN. BE SURE THAT THEY ARE FUNCTIONING PROPERLY AND CAN BE SEEN CLEARLY UNDER ALL LIGHTING CONDITIONS. THEY SHOULD ALWAYS BE USED WHEN MAKING TURNS OR CHANGING LANES.

ELECTRICAL WINDSHIELD WIPER SYSTEM HAS TWO (2) SPEEDS, WITH AN INTERMITTENT FEATURE. IT ALSO HAS A "WET ARM" WINDSHIELD WASHER FEATURE.

EXTERIOR FINISH APPLIED TO THIS APPARATUS IS DUPONT IMRON POLYURETHANE ENAMEL. THIS FINISH IS VERY DURABLE BUT REQUIRES THAT NO TYPE OF ABRASIVE POLISH OR CLEANER BE USED ON IT.

WASH PAINTED SURFACES WITH A MILD DETERGENT AND, IF POLISHING IS NECESSARY, USE (WAX, AUTO SOFT PASTE) STOREROOM ITEM 932-5408 OR EQUIVALENT.

LUBRICATION AND MAINTENANCE. TO INSURE TROUBLE FREE OPERATION OF YOUR SIMON-LTI FIRE APPARATUS, IT IS OF THE UTMOST IMPORTANCE THAT THE F-377 PREVENTIVE MAINTENANCE SCHEDULE BE STRICTLY ADHERED TO.

IN CONJUNCTION WITH THE F-377, THE FOLLOWING LUBRICATION CHART AND SERVICE INFORMATION SHOULD BE USEFUL IN MAINTAINING THIS APPARATUS (PAGE ____).

PART III

1993 SIMON - LTI
100' AERIAL LADDER

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AERIAL LADDER SYSTEM

AERIAL LADDER COMPONENTS

PART III

1993 SIMON - LTI
100' AERIAL LADDER

AERIAL LADDER OPERATION

THE AERIAL LADDER IS ONLY GOOD OR AS SAFE AS THE OPERATOR IS COMPETENT. ALLOW ONLY "QUALIFIED OPERATORS" WITH GOOD FIRE SERVICE BACKGROUND AND A COOL-HEADED NATURE TO OPERATE AN AERIAL LADDER. IT IS BEST TO HAVE REGULAR OPERATORS ASSIGNED AND ADEQUATE RELIEF OPERATORS QUALIFIED.

QUALIFIED OPERATORS

- AN UNTRAINED OPERATOR SUBJECTS MEMBERS TO SERIOUS INJURY OR DEATH.

- YOU MUST NOT OPERATE THIS APPARATUS UNTIL YOU HAVE BEEN PROPERLY TRAINED.

- YOU MUST NOT OPERATE THIS APPARATUS UNTIL YOU HAVE READ AND THOROUGHLY UNDERSTAND APPLICABLE SECTIONS OF THIS LOG BOOK AND APPLICABLE SECTIONS FROM THE FOLLOWING: MANUAL OF OPERATIONS, AOTM, DRIVER'S TRAINING MANUAL, TRAINING BULLETINS, AND SIMON QS SERIES OPERATION MANUAL.

AERIAL LADDER COMPONENTS

AERIAL CONTROL LEVERS ARE MECHANICALLY LINKED TO THE SPOOL VALVE. WHEN THE CONTROL LEVER IS MOVED, THE SPOOL IS LIFTED PROPORTIONALLY TO THE CONTROL LEVER MOVEMENT. THE LADDER SPEED IS DIRECTLY PROPORTIONAL TO THE CONTROL LEVER MOVEMENT.

HOIST CONTROL LEVER PERMITS RAISING AND LOWERING OF THE LADDER WITH DUAL, DOUBLE-ACTING HYDRAULIC CYLINDERS WITH INTEGRAL HOLDING VALVES. THIS LEVER PROVIDES LADDER TRAVEL OF -4° T0 75° FROM HORIZONTAL. LADDER SHOULD HOIST FROM BEDDED POSITION TO 75° INCLINATION IN 30 SECONDS OR LESS. FROM THE POSITION THE LADDER SHOULD BE BEDDED IN 40 SECONDS OR LESS.

HOIST CONTROL LEVER (CONT'D)

THE HOIST CONTROL LEVER IN THE LOWER POSITION IS USED TO POWER LADDER INTO CRADLE (800 PSI). THIS WILL AID IN PREVENTING AERIAL LADDER BOUNCE DURING TRAVEL.

ROTATION CONTROL LEVER PERMITS ROTATION OF THE LADDER. AN ANTIFRICTION BALL BEARING AND RING GEAR ATTACH AERIAL LADDER TO TRAILER, PROVIDING 360° CONTINUOUS ROTATION. A HYDRAULIC MOTOR POWERS THE PLANETARY GEAR REDUCTION. WHEN THE LEVER IS IN THE NEUTRAL POSITION A DISC-TYPE BRAKE APPLIES AUTOMATICALLY. AT A 30° INCLINATION OR HIGHER THE LADDER SHOULD ROTATE 360° IN 90 SECONDS OR LESS.

EXTENSION CONTROL LEVER PERMITS EXTENSION AND RETRACTION OF THE LADDER WITH DUAL, EXTENSION/RETRACTION CYLINDERS AND CABLE-DRIVE COMBINATION. AT 0° (ZERO DEGREES) INCLINATION, THE LADDER SHOULD FULLY EXTEND OR RETRACT IN 45 SECONDS. AT 75° INCLINATION, THE LADDER SHOULD FULLY EXTEND IN 30 SECONDS OR LESS.

BLOCKING VALVE SOLENOID IS NEEDED IN THE EVENT OF AN ELECTRICAL FAILURE. IT IS LOCATED AT THE BACK WALL OF THE TURNTABLE WELDMENT, JUST FORWARD OF THE TURNTABLE STEP. TO ACTUATE THE VALVE, PUSH KNOB IN AND TURN SLIGHTLY TO THE LEFT. FLUID FLOW IS NOW PASSED THROUGH THE AERIAL MAIN CONTROL VALVE TO THE AERIAL CONTROL SPOOL VALVES. AERIAL CONTROL LEVERS WILL NOW OPERATE IF IT WAS AN ELECTRICAL FAILURE.

BLOCKING VALVE SOLENOID (CONT'D)

THE EPU NEEDS TO BE ACTIVATED, IF THERE WAS ALSO A HYDRAULIC FAILURE. WHEN OPERATION OF AERIAL CONTROL LEVERS ARE COMPLETE, PUSH AND TURN SOLENOID KNOB TO THE RIGHT TO RE-ENGAGE VALVE FOR OUTRIGGER OPERATION.

"DANGER" WHEN BLOCKING VALVE SOLENOID, ALL ACTIVATED SAFETY SYSTEMS ARE DEACTIVATED, AND CONTROLS ARE ALIVE, E.G.:

1. **AERIAL DEADMAN SWITCH - NOT NECESSARY FOR MOVEMENT**
2. **SHORT JACK - INTERLOCK OVERRIDE NOT NECESSARY**
3. **AERIAL USE IS PERMISSIBLE WITH OUTRIGGERS STOWED**

CONSTRUCTION FOR THE LTI QS-100 IS A 4 SECTION, ALL RECTANGULAR TUBULAR STEEL, WELDED CONSTRUCTION, 250 POUND TIP LOAD, PEDESTAL WITH CONTROLS AND INDICATORS, HYDRAULIC AND CABLE EXTENSION, MINIMUM 15" HANDRAILS, 1-1/2" DIAMETER K-BRACED RUNGS, SPACED 14" ON CENTER WITH REPLACEABLE RUBBER COVERS. RETRACTED LENGTH IS 31.8'. EXTENDED LENGTH IS 94.5'. ELEVATED HEIGHT (TOP RUNG PERPENDICULAR TO GROUND) IS 100'.

"DEAD-MAN" IS A FOOT OPERATED POWER SWITCH INSTALLED ON THE TURNTABLE AT THE PEDESTAL. THE OPERATOR MUST DEPRESS AND HOLD THE SWITCH IN THE ON POSITION TO OPEN THE AERIAL MAIN CONTROL VALVE OR ACTIVATE THE FAST IDLE (IF FAST IDLE SWITCH IS ON). SHOULD THE OPERATOR BECOME IMMOBILIZED RELEASING THE "DEAD-MAN", THE AERIAL WOULD IMMEDIATELY BECOME INOPERABLE, EVEN IF AERIAL CONTROL LEVERS ARE NOT IN THE NEUTRAL POSITION (SEE BLOCKING VALVE SOLENOID).

EXTENSION GAUGE IS OPERATED BY A SMALL WIRE THAT EXTENDS AND RETRACTS WITH THE AERIAL LADDER. THE GAUGE DISPLAYS LADDER EXTENSION IN FEET. USED IN CONJUNCTION WITH THE LOAD CHART AND INCLINOMETER, THE LADDER LENGTH SHOWN ENABLES THE OPERATOR TO DETERMINE THE RATED CAPACITY AT THE GIVEN LENGTH AND INCLINATION.

FAST IDLE SWITCH IS A SWITCH THAT GETS ELECTRICAL POWER THROUGH THE AERIAL SWITCH IN THE CAB. A FAST IDLE SWITCH IS INSTALLED AT EACH OUTRIGGER CONTROL BOX AND ON THE PEDESTAL. ACTUATING THE SWITCH AT THE OUTRIGGER CONTROL BOX INCREASES ENGINE TO THE PRESET "FAST-IDLE". ACTUATING THE SWITCH AT THE PEDESTAL OPENS THE CIRCUIT SO THAT WHEN THE "DEAD-MAN" SWITCH IS DEPRESSED THE ENGINE INCREASES TO THE PRESET "FAST IDLE". THESE CONTROLS ARE USED TO MAINTAIN HIGHER RPM VALUES FOR FASTER AERIAL LADDER AND OUTRIGGER MOVEMENT, LIGHTS AND AUXILIARY EQUIPMENT. THE PRESET "FAST IDLE" IS 1500 TO 1600 RPM.

HYDRAULIC SYSTEM PRESSURE GAUGE READS 0 (ZERO) TO 5000 PSI. THE GAUGE REGISTERS "WORKING PRESSURE" IN THE HYDRAULIC SYSTEM. WITH ALL CONTROLS IN NEUTRAL, THE GAUGE REGISTERS STATIC PRESSURE IN THE SYSTEM. WHEN A CONTROL LEVER IS ACTUATED, THE GAUGE REGISTERS PRESSURE DEVELOPED TO PERFORM THAT SPECIFIC FUNCTION. PRESSURE TO HOIST SHOULD NOT EXCEED 2800 PSI. PRESSURE TO ROTATE SHOULD NOT EXCEED 1500 PSI. PRESSURE TO EXTEND/RETRACT SHOULD NOT EXCEED 2000 PSI.

INCLINOMETER IS A FLOATING BALL-TYPE ANGLE INDICTOR CALIBRATED FROM -20° TO 80°. USED IN CONJUNCTION WITH THE AERIAL LADDER LOAD CHART AND THE EXTENSION METER, THE INCLINOMETER ENABLES THE OPERATOR TO DETERMINE THE RATED CAPACITY AT THE GIVEN ANGLE AND LENGTH. WHEN USED TO DETERMINE THE STREET GRADE 3.5° TO 8.0° REDUCE CAPACITIES OF AERIAL LADDER BY 50%, MORE THAN 8.0° THE OPERATION OF AERIAL LADDER IS PROHIBITED.

INTERCOM SYSTEM IS A TWO-WAY COMMUNICATION SYSTEM CONSISTING OF A MASTER STATION AT THE PEDESTAL WITH VOLUME, SQUELCH AND PUSH TO TALK CONTROLS. A "HANDS FREE" STATION ON THE FLY SECTION

HAS NO CONTROLS TO OPERATE WHEN COMMUNICATING OR LISTENING TO THE MASTER STATION ON THE PEDESTAL.

INTERLOCK OVERRIDE SWITCH. A COVERED INTERLOCK OVERRIDE SWITCH ALLOWS THE AERIAL TO BE OPERATED WITHOUT THE OUTRIGGERS BEING "FULLY DEPLOYED" (SEE EMERGENCY SYSTEMS).

OUTRIGGER "NOT DEPLOYED" LIGHT IS A RED LIGHT THAT WHEN ILLUMINATED INDICATES THAT AN OUTRIGGER HAS NOT BEEN FULLY DEPLOYED, AND THAT A "SHORT-JACK" CONDITION IS EXISTING.

RUNG ALIGNMENT INDICATOR IS AN AMBER LIGHT THAT ILLUMINATES WHEN THE RUNGS OF ALL LADDER SECTIONS ARE PROPERLY ALIGNED FOR CLIMBING.

STABILITY/SPOT. BEST STABILITY IS OVER THE TILLER CAB TO 45° TO EITHER SIDE OF CENTER. GREATEST REACH IS ATTAINED OVER THE SIDE, 90° FROM CENTER.

SPOTTING WITH A JACKKNIFE CAN BETTER YOUR POSITION FOR GOING UNDER OR OVER OBSTRUCTIONS, INCREASE AERIAL LADDER REACH AND IMPROVE CLIMBING ANGLE.

AERIAL LADDER SAFETY

ELECTROCUTION CAN CAUSE SERIOUS INJURY OR DEATH. KEEP SAFE DISTANCES FROM ELECTRICAL POWER LINES AND A "CHARGED" APPARATUS. WHEN OPERATING CLOSE TO POWER LINES, BE SURE TO ALLOW FOR LADDER SWAY, BOUNCE, AND SAG. ALSO, BE PREPARED FOR EFFECTS OF WIND, FIRE AND HOSE STREAMS ON THE POWER LINES. IF THE AERIAL SHOULD CONTACT POWER LINES, ALL MEMBERS SHOULD REMAIN FULLY ON OR FULLY OFF THE APPARATUS UNTIL POWER IS SHUT OFF OR AERIAL IS FREED.

NEVER OPERATE THE AERIAL LADDER ON THE SAME SIDE AS "SHORT-JACK" OUTRIGGER (SEE EMERGENCY SYSTEMS).

LEARN AERIAL LADDER LOAD CHART. THE AERIAL LADDER LOAD CHART IS INSTALLED ON PEDESTAL. IT IS THE OPERATOR'S RESPONSIBILITY TO STUDY AND LEARN THE LOAD LIMITATIONS. HOWEVER, NEVER RELY ON MEMORY. ALWAYS REFER TO YOUR AERIAL LADDER LOAD CHART WHILE OPERATING THE AERIAL.

STREET GRADES FROM 6% TO 14% (3.5° TO 8.0° ON INCLINOMETER) REDUCE CAPACITIES OF AERIAL LADDER BY 50%. STREET GRADES IN EXCESS OF 14% (>8.0° ON INCLINOMETER) OPERATION OF AERIAL LADDER IS PROHIBITED.

APPARATUS LEVELING INDICATOR SHOWS BUBBLE IN YELLOW (3.5° TO 8.0°) REDUCE CAPACITIES OF AERIAL LADDER BY 50%. APPARATUS LEVELING INDICATOR SHOWS BUBBLE IN RED (>8.0°) OPERATION OF AERIAL LADDER IS PROHIBITED.

NOTIFY MEMBERS ON TURNTABLE BEFORE ROTATING. THE TURNTABLE TO

THE GROUND IS OVER 9'.

NEVER SUPPORT THE AERIAL. THE AERIAL IS DESIGNED WITH ITS MAXIMUM STRENGTH AVAILABLE IN THE UNSUPPORTED CONFIGURATION. "REVERSE LOADING" INTRODUCES COMPONENT STRESS, RESULTING IN REDUCED LOAD CAPACITIES. POSITION LADDER APPROXIMATELY 6" TO 12" ABOVE THE OBJECTIVE.

AERIAL LADDER SAFETY (CONT'D)

POSITION THE AERIAL. THEN CLIMB. NEVER ALLOW CLIMBING OPERATIONS DURING ANY LADDER FUNCTIONS. DO NOT PERMIT MEMBERS TO CLIMB THE AERIAL UNTIL THE RUNGS OF ALL SECTIONS ARE ALIGNED FOR CLIMBING. NEVER PERMIT MEMBERS TO CLIMB AN AERIAL LADDER UNTIL THE OPERATOR INDICATES THAT THE LADDER IS SET FOR CLIMBING.

EVENLY DISTRIBUTE WEIGHT ON LADDER. MEMBERS ON LADDER SHOULD MAINTAIN A DISTANCE OF 10' APART. LOAD DISTRIBUTION (DISTANCE AND WEIGHT) SHALL NOT EXCEED RATED CAPACITIES SHOWN ON AERIAL LADDER LOAD CHART.

RIDING OR LADDER PIPE OPERATION, MEMBER MUST BE STRAPPED IN WITH SAFETY STRAP TO BOTH "D" RINGS AND USING FOOT RESTS AT END OF FLY SECTION. NEVER USE LEG LOCK ON AERIAL. ARMS AND LEGS CAUGHT BETWEEN MOVING LADDER SECTIONS WILL BE SERIOUSLY MANGLED OR SEVERED.

NEVER PUSH OR PULL SIDEWAYS OR USE AS A RAM. THE AERIAL IS NOT STRUCTURALLY DESIGNED FOR SIDE LOADING OR OPPOSING PRESSURE AGAINST THE EXTENSION RAMS.

ON WINDS OVER 30 MPH, DO NOT EXTEND LADDER.

NEVER MOVE APPARATUS UNLESS LADDER IS RETRACTED AND BEDDED.

ELECTRICAL SYSTEM

AERIAL POWER SWITCH WHEN TURNED ON, PROVIDES PRIMARY AERIAL SYSTEMS AND ACCESSORIES WITH ELECTRICAL POWER. ELECTRICAL POWER IS SUPPLIED BY THE TRACTOR'S ELECTRICAL SYSTEM. THE AERIAL ELECTRICAL SYSTEM IS A SINGLE WIRE, NEGATIVE GROUND RETURN TYPE, UTILIZING THE APPARATUS FRAME AS GROUND. POWER FROM THE TRACTOR'S SYSTEM IS TRANSFERRED TO THE AERIAL THROUGH THE ELECTRICAL SWIVEL COUPLING. THE COUPLING CONSISTS OF NUMEROUS SETS OF BRUSHES AND BRUSH HOLDER ASSEMBLIES, COLLECTOR RINGS, AND CONNECTORS, WHICH PERMIT UNINTERRUPTED CURRENT FLOW TO THE AERIAL CIRCUITS THROUGH 360° OF AERIAL ROTATION.

POWER TAKE-OFF (PTO) SWITCH IS AN ELECTRIC SWITCH THAT ENERGIZES A SOLENOID WHICH ALLOWS TRANSMISSION FLUID TO THE PTO. THE SWITCH WILL NOT BE ENERGIZED UNTIL THE TRANSMISSION IS IN THE NEUTRAL POSITION, AND THE PARKING BRAKE SET.

POWER TAKE-OFF ENGAGED INDICATOR LIGHT. A PRESSURE SWITCH MOUNTED ON THE PTO SENSES PRESSURE INSIDE THE PTO AND ENERGIZES A LIGHT ADJACENT TO THE PTO SWITCH.

EMERGENCY POWER (EPU) SWITCH IS SPRING-LOADED AND MOUNTED AT EACH OUTRIGGER CONTROL BOX. ACTIVATING AND HOLDING THE SWITCH IN THE ON POSITION ACTIVATES THE EMERGENCY POWER UNIT DURING ELECTRICAL OR HYDRAULIC FAILURE. THE ELECTRIC SWITCH IS WIRED TO WORK EVEN WITH THE BATTERY SWITCH OFF (SEE EMERGENCY SYSTEMS).

HYDRAULIC SYSTEM

VARIABLE DISPLACEMENT PUMP OPERATES ON WHAT COULD BE DEFINED AS A SUPPLY AND DEMAND PRINCIPLE. PRESSURE WILL INCREASE IN THE CIRCUIT TO THAT REQUIRED FOR MOVING THE ACTUATOR(S) AND PERFORMING ELEMENTS, INTEGRAL OF THE PUMP, AND WILL NOT ALLOW PRESSURE TO BUILD UP BEYOND THE CIRCUIT'S OPERATING REQUIREMENT. AS THE CONTROL IS RETURNED TO NEUTRAL OR LOAD DECREASES, PRESSURE DECREASES. WITH THE PUMP OPERATING AND ALL FUNCTION CONTROLS IN NEUTRAL, THE OIL MERELY CIRCULATES WITHIN THE PUMP CAVITY UNDER NEGLIGIBLE PRESSURE. WHEN A LOAD OR RESTRICTION IS INTRODUCED INTO THE SYSTEM (MOVING A CONTROL), PRESSURE DEVELOPS IMMEDIATELY IN THE SELECTED CIRCUIT. PRESSURE WILL CONTINUE TO INCREASE UNTIL THE CONTROL IS RETURNED TO, OR REVERSED TOWARD NEUTRAL, OR UNTIL PRESSURE REACHES THE LIMIT OF THE CIRCUIT'S PRESSURE CONTROL VALVES. RELIEF VALVES ALSO PROTECT COMPONENTS FROM DAMAGE DUE TO EXCESSIVE PRESSURE BUILD-UP. VARIABLE DISPLACEMENT TYPE PUMP WILL CREATE 2800 PSI AND APPROXIMATELY 20 GPM.

POWER TAKE-OFF UNIT (PTO) IS MOUNTED ON THE TRANSMISSION. TRANSMISSION FLUID GOES TO THE PTO WHEN THE POWER TAKE-OFF SWITCH IS TURNED ON.

A CLUTCH WITHIN THE PTO ENGAGES THE SHAFT WHICH TRANSFERS POWER TO THE HYDRAULIC PUMP. THE PRIMARY POWER IS SUPPLIED BY THE ENGINE WHICH DRIVES THE MECHANICALLY-COUPLED "CHELSEA HOT-SHIFT" HEAVY DUTY PTO. THE PTO TRANSMITS THE MECHANICAL FORCE DEVELOPED BY THE ENGINE TO DRIVE THE MAIN HYDRAULIC PUMP.

HYDRAULIC OIL RESERVOIR IS ALL STEEL, WELDED CONSTRUCTION WITH

REMOVABLE CLEAN-OUT ACCESS; INTEGRAL BAFFLES, FILTER, AND STRAINER; GATED SUCTION, DRAIN VALVES AND MAGNETIC DRAIN PLUGS. CAPACITY IS 40 GALLONS.

HYDRAULIC SYSTEM FILTERS ARE PRESSURE TYPE WITH BYPASS IN SUPPLY LINE AND BYPASS-TYPE IN RETURN LINE (INSIDE RESERVOIR).

AERIAL MAIN CONTROL VALVE OPENS TO LET HYDRAULIC FLUID TO THE AERIAL CONTROL SPOOL VALVES. THE AERIAL MAIN CONTROL VALVE OPENS WHEN THE "DEAD-MAN" IS DEPRESSED OR THE EMERGENCY BLOCKING VALVE SOLENOID IS ACTUATED.

AERIAL CONTROL SPOOL VALVES OPERATE HOISTING CYLINDERS, ROTATION MOTOR, AND EXTENSION CYLINDERS. THE THREE AERIAL CONTROL SPOOL VALVES ARE MECHANICALLY LINKED TO THE AERIAL CONTROL LEVERS.

OUTRIGGER COMPONENTS

CONSTRUCTION FOR OUTRIGGERS ARE DOUBLE-BOX HORIZONTAL BEAMS AND VERTICAL JACKS, POWERED BY DOUBLE-ACTING HYDRAULIC CYLINDERS WITH INTEGRAL HOLDING VALVES AND MANUAL PIN LOCKS. OUTRIGGERS SHOULD OPERATE FROM STOWED TO DEPLOYED IN 90 SECONDS OR LESS.

CHOCK BLOCKS ARE USED TO PROVIDE ADDITIONAL FRICTION TO PREVENT MOVEMENT (WALKING) OF THE APPARATUS ON ITS OUTRIGGERS. THE CHOCK BLOCK SHOULD BE POSITIONED IN FRONT AND BEHIND BOTH FRONT TIRES. IF ON HILL, PLACE ON DOWNHILL SIDE OF FRONT AND TILLER TIRES.

AUXILIARY JACK PADS ARE PORTABLE, OVERSIZED METAL PLATES THAT GIVE GREATER SURFACE BEARING AREA FOR THE JACKS. THE AUXILIARY JACK PAD SHOULD BE CENTERED UNDER JACK AND HANDLE SHOULD BE POSITIONED TO PREVENT MEMBERS FROM TRIPPING OR HOSE FROM CATCHING ON HANDLE.

OUTRIGGER CONTROL BOXES ARE MOUNTED ON EACH SIDE OF THE TRAILER, SO THE OUTRIGGER OPERATION CAN BE DONE ON THE OBJECTIVE SIDE.

FAST IDLE SWITCH GETS ELECTRICAL POWER THROUGH THE AERIAL SWITCH IN THE CAB. A FAST IDLE SWITCH IS INSTALLED AT EACH OUTRIGGER CONTROL BOX AND ON THE PEDESTAL. ACTUATING THE SWITCH AT THE OUTRIGGER CONTROL BOX INCREASES THE ENGINE TO THE PRESET "FAST IDLE". FAST IDLE SWITCH AT OUTRIGGER CONTROL BOX, MUST BE TURNED OFF, OR HIGH IDLE IS MAINTAINED THROUGHOUT AERIAL OPERATIONS. ACTUATING THE SWITCH AT THE PEDESTAL OPENS THE CIRCUIT SO THAT WHEN THE "DEAD-MAN" SWITCH IS DEPRESSED THE ENGINE IS INCREASED TO THE PRESET "FAST IDLE". THESE CONTROLS

ARE USED TO MAINTAIN HIGHER RPM VALUES FOR FASTER AERIAL LADDER AND OUTRIGGER MOVEMENT, LIGHTS AND AUXILIARY EQUIPMENT. THE PRESET "FAST IDLE" IS 1500 TO 1600 RPM.

OUTRIGGER CONTROL SWITCHES ARE ELECTRIC OVER HYDRAULIC CONTROL SYSTEM FOR NORMAL OUTRIGGER OPERATION. SWITCHES ARE SPRING LOADED.

OUTRIGGER CONTROL SWITCHES (CONT'D)

BEAM CONTROL SWITCHES OPERATE HORIZONTALLY WITH THE OUT POSITION TOWARD THE OUTSIDE OF THE BOX AND THE IN POSITION TOWARD THE CENTER OF THE BOX. THE BEAM CONTROL SWITCHES MAY BE OPERATED SIMULTANEOUSLY, BUT THIS IS NOT RECOMMENDED (SEE NOTE). JACK CONTROL SWITCHES OPERATE VERTICALLY. JACK CONTROL SWITCHES OPERATE ONLY AFTER BEAMS ARE FULLY EXTENDED OR INTERLOCK OVERRIDE SWITCH IS USED TO SHORT JACK (SEE EMERGENCY SYSTEMS). JACK CONTROL SWITCHES MAY BE OPERATED SIMULTANEOUSLY, BUT HIS IS NOT RECOMMENDED (SEE NOTE). FOR EMERGENCY RESPONSE THE BEAM IN AND JACK UP CAN BE OPERATED SIMULTANEOUSLY AFTER JACK PRESSURE IS RELEASED.

NOTE: BEAM CONTROL AND JACK CONTROL SWITCHES SHALL BE OPERATED AS A SINGLE FUNCTION TO WATCH EACH BEAM AND JACK EXTEND AND/OR RETRACT.

FULLY DEPLOYED INDICATOR LIGHTS ARE WORKING IN CONJUNCTION WITH THE INTERLOCK OVERRIDE SYSTEM. EACH OUTRIGGER HAS LIMIT AND PROXIMITY TYPE SWITCHES WHICH MUST BE ACTIVATED BEFORE THE AERIAL CAN BE OPERATED. SWITCHES ACTIVATE WHEN CYLINDERS ARE IN THEIR FULL TRAVEL POSITION.

WHEN ALL SWITCHES ARE ACTIVATED FOR A PARTICULAR OUTRIGGER, ITS

GREEN LIGHT, AT THE OUTRIGGER CONTROL BOX, WILL LIGHT AT 800 LBS. ALTHOUGH THE PARAMETERS NEEDED TO ACTIVATE THE LIGHT ARE MET, THE OUTRIGGER MAY NOT BE "FULLY DEPLOYED".

FULLY DEPLOYED OUTRIGGERS MEET THE FOLLOWING CRITERIA:

1. BOTH BEAMS ARE EXTENDED TO FULL TRAVEL.
2. JACKS EXTENDED, AS NECESSARY (SEE APPARATUS LEVELING INDICATOR).
3. JACKS MUST BE IN CONTACT WITH A SOLID, LOAD-BEARING SURFACE.
4. OUTRIGGER PADS DONE PROPERLY.
5. MANUAL LOCKING PINS INSERTED PROPERLY.

APPARATUS LEVELING INDICATORS ARE MOUNTED ON BOTH SIDES OF THE TRAILER. USE THIS INDICATOR TO LOWER THE LOW SIDE JACK FIRST AND TO LEVEL THE TURNTABLE AND/OR REDUCE YOUR AERIAL LADDER CAPACITIES. DUALS MUST REMAIN IN CONTACT WITH THE GROUND. BUBBLE IN GREEN IS NO REDUCTION. BUBBLE IN YELLOW (3.5° TO 8.0°) REDUCE CAPACITIES OF AERIAL LADDER BY 50%. BUBBLE IN RED (>8.0°) OPERATION OF AERIAL LADDER IS PROHIBITED.

INTERLOCK OVERRIDE SWITCH. A COVERED INTERLOCK OVERRIDE SWITCH ALLOWS THE JACK CYLINDER TO BE LOWERED TO THE GROUND WITHOUT THE BEAM CYLINDER BEING IN ITS FULLY EXTENDED POSITION. THIS IS IDENTIFIED AS A "SHORT-JACK" CONDITION WHICH WILL REDUCE THE SAFE MOVEMENT OF THE AERIAL (SEE EMERGENCY SYSTEMS).

EMERGENCY POWER (EPU) SWITCH IS SPRING-LOADED AND MOUNTED AT EACH OUTRIGGER CONTROL BOX. ACTIVATING AND HOLDING THE SWITCH IN THE ON POSITION ACTIVATES THE EMERGENCY POWER UNIT DURING

ELECTRICAL OR HYDRAULIC FAILURE. THIS ELECTRIC SWITCH IS WIRED TO WORK EVEN WITH BATTERY SWITCH OFF (SEE EMERGENCY SYSTEMS).

OUTRIGGER "NOT DEPLOYED" INDICATOR. A RED LIGHT LOCATED AT THE PEDESTAL INDICATES THAT AN OUTRIGGER HAS NOT BEEN FULLY DEPLOYED, AND THAT A "SHORT-JACK" CONDITION IS EXISTING.

OUTRIGGERS SAFETY

KEEP AWAY FROM AREAS OF UNCERTAIN FOOTING. NEVER SET OUTRIGGERS OVER STORM DRAIN OR A MANHOLE COVER. OUTRIGGER BEAMS SHOULD NOT "BRIDGE" STREET OR CURB. THE AUXILIARY JACK PADS ARE INTENDED FOR USE "EVERY TIME" THE OUTRIGGERS ARE DEPLOYED.

ALWAYS EXTEND AND SET OUTRIGGERS BEFORE ATTEMPTING ANY AERIAL LADDER OPERATION. CAPACITIES ARE BASED ON ALL WEIGHT BEING REMOVED FROM THE VEHICLE SPRINGS, WITH THE LOAD FORCES BEING ABSORBED BY THE AERIAL TORQUE BOX AND CHASSIS FRAME. BOTH OUTRIGGERS MUST BE "FULLY DEPLOYED" BEFORE AERIAL IS ROTATED THROUGH 360° (SEE EMERGENCY SYSTEMS FOR "SHORT-JACKING" AND LIMITED ROTATION).

APPARATUS LEVELING INDICATOR SHOWS BUBBLE IN YELLOW (3.5° TO 8.0°) REDUCE CAPACITIES OF AERIAL LADDER BY 50%. SHOWS BUBBLE IN RED (>8.0°) OPERATION OF AERIAL LADDER IS PROHIBITED.

DUALS MUST REMAIN IN CONTACT WITH THE GROUND. IF LEVELING CANNOT BE ACCOMPLISHED WITH DUALS IN CONTACT WITH THE GROUND, FOLLOW APPARATUS LEVELING INDICATOR GUIDELINES.

OUTRIGGER SYSTEM SHOULD NORMALLY ACTIVATE WHEN THE AERIAL LADDER IS BEDDED, TRANSMISSION IN NEUTRAL, PARKING BRAKE IS ON, AERIAL AND PTO SWITCHES ON.

ALWAYS COMPLETELY STOW OUTRIGGERS BEFORE MOVING APPARATUS. ENSURE THAT MEMBERS ARE CLEAR FROM APPARATUS TO AVOID INJURY WHEN OPERATOR INITIATES STOWING OF OUTRIGGERS. THE DISTANCE FROM THE GROUND TO THE APPARATUS WILL BE REDUCED RAPIDLY.

RELEASE JACK PRESSURE ONE SIDE AT A TIME.

STANDARD OPERATION

CAB OPERATION

THE FOLLOWING IS A GUIDELINE FOR STANDARD OPERATION. THE EXACT SEQUENCE LISTED MAY NOT PRODUCE THE DESIRED RESULTS.

BEFORE OPERATIONS

- APPARATUS RUNNING
- EMERGENCY LIGHTS ON
- PARKING BRAKES ON
- TILLERMAN HORN SIGNAL
- CHECK PARKING BRAKE INDICATOR LIGHT
- TRANSMISSION IN NEUTRAL
- AERIAL SWITCH ON
- PTO SWITCH ON
- CHECK PTO ENGAGED INDICATOR LIGHT
- A/C OFF - BECAUSE OF VOLTAGE DRAW

AFTER OPERATIONS

- PTO SWITCH OFF
- CHECK PTO ENGAGED INDICATOR LIGHT
- AERIAL SWITCH OFF
- C-BRAKE ON (IF APPROPRIATE)
- APPARATUS READY FOR TRAVEL

"CAUTION" IF AT ANYTIME THE ROAD TRANSMISSION IS SHIFTED INTO GEAR WHILE PERFORMING AERIAL OPERATIONS, THE CHELSEA HOT START WILL AUTOMATICALLY DISENGAGE THE PTO.

OUTRIGGER OPERATION

THE FOLLOWING IS A GUIDELINE FOR STANDARD OPERATION. THE EXACT

SEQUENCE LISTED MAY NOT PRODUCE THE DESIRED RESULTS. THE SAFETY AND COMPONENTS SECTION OF THIS OPERATION SHOULD BE REVIEWED BEFORE OPERATION.

DEPLOYING THE OUTRIGGERS

- CAB OPERATION
- CHOCK BLOCKS PLACED IN FRONT AND BEHIND BOTH FRONT TIRES. IF ON HILL, PLACE ON DOWNHILL SIDE OF FRONT AND TILLER TIRES
- AUXILIARY JACK PADS PLACED ON GROUND JACKS BENEATH IF NOT ATTACHED (IF SO EQUIPPED)
- FAST IDLE SWITCH ON
- EXTEND OUT BEAMS (SEE EMERGENCY SYSTEMS FOR SHORT JACK)
- ENSURE CLEAR PATH OF TRAVEL BEFORE EXTENDING
- AUXILIARY JACK PADS SHOULD BE PLACED ON JACK, IF APPLICABLE, AND HANDLE SHOULD BE POSITIONED TO PREVENT MEMBERS FROM TRIPPING OR HOSE FROM CATCHING ON HANDLE
- READ AERIAL LEVEL INDICATOR
- EXTEND DOWN LOW SIDE JACK UNTIL BUBBLE IN THE AERIAL LEVELING INDICATOR MOVES JUST PASSED LEVEL (1/8"). THE FULLY DEPLOYED LIGHT SHOULD BE ILLUMINATED FOR THAT SIDE AND THE WEIGHT BE REMOVED FROM THE TRACTOR'S REAR SPRING BY TAKING THE BULGE OUT OF THE DUALS, BUT NOT OFF THE GROUND.
- EXTEND DOWN THE OTHER JACK UNTIL BUBBLE IN THE AERIAL LEVELING INDICATOR SHOWS LEVEL. THE FULLY DEPLOYED LIGHT SHOULD BE ILLUMINATED FOR THAT SIDE AND THE WEIGHT BE REMOVED FROM THE TRACTOR'S REAR SPRING BY TAKING THE BULGE OUT OF THE DUALS, BUT NOT OFF THE GROUND.
- FAST IDLE SWITCH OFF
- CHOSE A HOLE THAT IS A MINIMUM 1/4" BELOW JACK SKIRT
- FULLY INSERT MANUAL LOCKING PIN AND THEN BACK PIN OUT 1/2"

THE FOLLOWING IS A GUIDELINE FOR STANDARD OPERATION. THE EXACT SEQUENCE LISTED MAY NOT PRODUCE THE DESIRED RESULTS. THE SAFETY AND COMPONENTS SECTION OF THIS OPERATION SHOULD BE REVIEWED

BEFORE OPERATION.

STOWING THE OUTRIGGERS

TO STOW OUTRIGGERS, ENSURE THAT MEMBERS ARE CLEAR FROM THE APPARATUS BEFORE INITIATING ANY STOWING OPERATIONS. THE DISTANCE FROM GROUND TO THE APPARATUS WILL BE REDUCED RAPIDLY.

STOWING THE OUTRIGGERS (CONT'D)

- REMOVE MANUAL LOCKING PIN AND PLACE IN PIN HOLDER.
- FAST IDLE SWITCH ON. HIGH IDLE ON RETRACTION DOES NOT INCREASE SPEED.
- RETRACT UP THE JACKS (LAST JACK DOWN, FIRST JACK UP).
- RETRACT IN THE BEAMS, ONE BEAM AT A TIME.
- FAST IDLE SWITCH OFF.
- STOW AUXILIARY JACK PADS.
- STOW CHOCK BLOCKS.
- PTO AND AERIAL SWITCH OFF.

AERIAL LADDER OPERATION

THE FOLLOWING IS A GUIDELINE FOR STANDARD OPERATION. THE EXACT SEQUENCE LISTED MAY NOT PRODUCE THE DESIRED RESULTS. THE SAFETY AND COMPONENTS SECTION OF THIS OPERATION SHOULD BE REVIEWED BEFORE OPERATION.

RAISING THE AERIAL LADDER

- CAB OPERATION
- CHOCK BLOCKS PLACED IN FRONT AND BEHIND BOTH FRONT TIRES. IF ON HILL, PLACE ON DOWNHILL SIDE OF FRONT AND TILLER TIRES.
- AUXILIARY JACK PADS DOWN
- FULLY DEPLOY OUTRIGGERS

- OPEN AERIAL CONTROL PEDESTAL
- TURN ON INTERCOM UNIT
- FAST IDLE SWITCH ON
- "DEAD-MAN" PEDAL DEPRESSED
- RAISE LADDER UNTIL LADDER REACHES DESIRED ANGLE ENSURING THAT AREA ABOVE LADDER IS CLEAR OF ALL OBSTRUCTION.
- ROTATE LADDER UNTIL LADDER REACHES DESIRED POSITION ENSURING THAT ROTATION PATH IS CLEAR OF OBSTRUCTIONS AND MEMBERS.
- EXTEND LADDER UNTIL LADDER REACHES DESIRED LENGTH ENSURING PATH AND RUNGS ARE CLEAR OF OBSTRUCTIONS AND MEMBERS.
- CHECK RUNG ALIGNMENT INDICATOR LIGHT
- LOWER OR RAISE LADDER UNTIL LADDER IS APPROXIMATELY 6" TO 12" ABOVE OBJECTIVE IN AN UNSUPPORTED POSITION.

RAISING THE AERIAL LADDER (CONT'D)

- RELEASE "DEAD-MAN" PEDAL

"CAUTION" DURING AERIAL OPERATIONS, IF THE DEAD-MAN PEDAL IS EVER INADVERTINGLY RELEASED, RETURN CONTROL LEVERS TO THEIR NEUTRAL POSITION. FAILURE TO DO SO, PRIOR TO REDEPRESSING THE DEAD-MAN PEDAL, WILL CAUSE A HYDRAULIC PRESSURE SURGE RESULTING IN MOMENTARY LOSS OF CONTROL OF AERIAL LADDER.

NOTE: LOAD GAUGE ON CONTROL CONSOLE

PROVIDES THE OPERATOR WITH AN INDICATION THAT THE LIFT CYLINDER PRESSURE ON THE RAISED SIDE IS BELOW A MINIMUM PRE-SET VALUE.

THIS WILL INDICATE TO THE OPERATOR THE PRESENCE OF A LARGE REACTION FORCE OR THAT HE IS POWERING THE LADDER INTO AN

OBSTRUCTION.

THE LOAD GAUGE WILL HAVE ZONE MARKINGS. WHEN THE LADDER HAS FORWARD LOAD, THE GAUGE WILL READ IN THE GREEN ZONE. WHEN THE LADDER HAS REARWARD LOAD (OR IS APPROACHING REARWARD LOAD) THE GAUGE WILL READ IN THE ORANGE ZONE. READINGS IN THE ORANGE ZONE WILL OCCUR WHEN:

1. THE LADDER IS POWERED INTO AN OBSTRUCTION, ROOF, WINDOW PARAPET, ETC. THIS WILL INDICATE A POTENTIAL RESERVE LOAD PROBLEM.

2. EXTREMELY HIGH NOZZLE REACTION FORCES OR STRONG WINDS THAT ARE ATTEMPTING TO PUSH THE LADDER BACKWARDS.

3. DURING NORMAL BEDDING OF THE LADDER IN THE CRADLE.

READINGS SHOULD NORMALLY BE IN THE GREEN WHEN OPERATING UNSUPPORTED OR WHEN FLOWING NORMAL LADDER PIPE FLOWS.

RAISING THE AERIAL LADDER (CONT'D)

THE FOLLOWING IS A GUIDELINE FOR STANDARD OPERATION. THE EXACT SEQUENCE LISTED MAY NOT PRODUCE THE DESIRED RESULTS. THE SAFETY AND COMPONENTS SECTION OF THIS OPERATION SHOULD BE REVIEWED BEFORE OPERATION.

LOWERING THE AERIAL

- "DEAD-MAN" PEDAL DEPRESSED
- RETRACT LADDER FULLY ENSURING RUNGS ARE CLEAR OF OBSTRUCTIONS AND MEMBERS
- ROTATE LADDER TO BE BEDDED, ENSURING THAT ROTATION PATH IS CLEAR OF OBSTRUCTION AND MEMBERS
- LOWER LADDER TO TILLER CAB ROOF, ENSURE THAT LADDER IS FULLY RETRACTED, VISUAL TO ALIGNMENT OF RED MARKS ON MAIN AND 3RD FLY SECTION (FULL RETRACTION) AND OR EXTENSION GAUGE AT 30' MARK. LADDER IS ROTATED TO CORRECT POSITION, LADDER PIPE AND ALL OBSTRUCTIONS ARE CLEAR.
- BED LADDER AND HOLD HOIST CONTROL IN THE "LOWER" POSITION TO "POWER" LADDER INTO CRADLE.
- FAST IDLE SWITCH OFF
- TURN OFF INTERCOM UNIT
- CLOSE AERIAL CONTROL PEDESTAL
- STOW OUTRIGGERS
- AUXILIARY JACK PADS UP
- CHOCK BLOCKS UP
- AERIAL SWITCH AND PTO SWITCH OFF

EMERGENCY SYSTEMS

SHORT JACK

INTERLOCK OVERRIDE SYSTEM IS DESIGNED TO ALLOW USE OF THE AERIAL IN SITUATIONS WHERE LIVES COULD BE AT RISK AND NO OTHER OPTIONS ARE AVAILABLE. THE SYSTEM ALLOWS AN OUTRIGGER TO BE "SHORT JACKED". SHORT JACK IS WHEN THE OFF SIDE BEAM EXTENDS AS FAR AS POSSIBLE BUT STILL NOT FULLY EXTENDED DUE TO EMERGENCY SITUATION. WHEN THE OFF SIDE OUTRIGGER IS "SHORT JACKED", IN ORDER TO ACTUATE AERIAL OR JACK CONTROLS, THE INTERLOCK OVERRIDE SWITCH IS ACTUATED THROUGHOUT THE USE OF THE AERIAL CONTROL LEVERS OR JACK CONTROL WITCH. THIS IS DESIGNED TO MAKE EACH MOVEMENT OF THE AERIAL OR JACK DELIBERATE AND THOUGHT OUT. THE INTERLOCK OVERRIDE SWITCH CAN BE RELEASED WHEN MOVEMENTS ARE COMPLETE.

USE OF THE AERIAL LADDER WHILE IN AN OVERRIDE SITUATION SHALL BE LIMITED TO THE SIDE OF THE "FULLY DEPLOYED" OUTRIGGER.

MANUAL OVERRIDES

AERIAL CONTROLS CAN BE OPERATED WHEN ELECTRICAL FAILURE OCCURS BY ACTUATING THE BLOCKING VALVE SOLENOID ON THE AERIAL MAIN CONTROL VALVE (HYDRAULIC FAILURE, SEE EMERGENCY POWER UNIT).

OUTRIGGER CONTROLS CAN BE OPERATED WHEN ELECTRICAL FAILURE OCCURS BY ACTUATING THE APPLICABLE BUTTON ON THE OUTRIGGER VALVE BANK AND PULLING ON THE 4-WAY SOLENOID MANUAL CONTROL HANDLE (HYDRAULIC FAILURE, SEE EMERGENCY POWER UNIT).

EMERGENCY POWER UNIT (EPU)

THE EPU IS A 12 VOLT DC ELECTRIC MOTOR AND A 1.5 GPM AT 2000 PSI

PUMP. EPU OPERATION IS INDEPENDENT OF AERIAL ELECTRICAL SYSTEM AND THE PTO SWITCH SHOULD BE TURNED OFF. WHEN THE EPU IS ACTIVATED IT WILL MOVE THE AERIAL OR OUTRIGGERS IN THE EVENT OF A MAIN SYSTEM FAILURE. THE SYSTEM IS CAPABLE OF ALL FUNCTIONS IN A NO-LOAD CONDITION. BECAUSE OF THE SHORT CONTINUOUS USE TIME LIMIT, IT IS IMPORTANT THAT ONLY REQUIRED FUNCTIONS BE USED TO MOVE PERSONNEL AND EQUIPMENT TO SAFETY.

EMERGENCY POWER UNIT (EPU) (CONT'D)

FUNCTION SHOULD THEN BE LIMITED TO THOSE ASSOCIATED WITH BEDDING THE AERIAL AND STOWING THE OUTRIGGERS TO ALLOW TRUCK MOVEMENT IN A SITUATION OF IMPENDING DANGER. THE EPU IS RATED FOR A MAXIMUM OF THREE MINUTES CONTINUOUS OPERATION. THE EPU CAN BE USED OVER A LONG PERIOD OF TIME AT A 7% DUTY CYCLE, WHICH IS APPROXIMATELY 21 SECONDS IN EVERY 5 MINUTES. ACTUAL OPERATING TIME IS DEPENDED ON BATTERIES; STATE OF CHARGE AND HYDRAULIC PRESSURE IN CONTROL BEING MOVED. AN EPU SWITCH IS AT EACH OUTRIGGER CONTROL BOX. ACTUATE EPU SWITCH TO ON POSITION AND HOLD FOR EMERGENCY POWER THEN RELEASE. THIS ELECTRIC SWITCH IS WIRED TO WORK EVEN WITH THE BATTERY SWITCH OFF.

HYDRAULIC AND ELECTRICAL FAILURE AND THE EPU

IN CASE OF ELECTRICAL SYSTEM MALFUNCTION AND THE CHASSIS ENGINE CEASES TO RUN, THERE WILL BE NO HYDRAULIC PRESSURE OR ELECTRICAL POWER TO THE APPROPRIATE CIRCUITS TO RETRACT THE AERIAL AND OUTRIGGERS.

IN THIS EXTREME CASE BOTH AERIAL LADDER AND OUTRIGGERS CAN BE RETRACTED AND BEDDED SO THE APPARATUS CAN BE MOVED. THIS CAN BE ACCOMPLISHED BECAUSE THE EMERGENCY POWER UNIT IS WIRED DIRECTLY TO THE BATTERIES. AS LONG AS THERE IS SUFFICIENT ENERGY STORED IN THE BATTERIES TO POWER THE EPU, THESE EMERGENCY FUNCTIONS CAN

BE ACCOMPLISHED.

TO ACCOMPLISH THIS, THE FOLLOWING STEPS MUST BE FOLLOWED TO RETRACT AND BED THE AERIAL:

1. ACTIVATE THE BLOCKING SOLENOID MOUNTED FORWARD OF THE TURNTABLE REAR STEP. A SLIGHT PUSH AND TURN TO THE LEFT OF THE CONTROL KNOB WILL ALLOW HYDRAULIC FLUID TO FLOW TO THE AERIAL FUNCTION CONTROLS.

   NOTE: STEPS 2 AND 3 MUST BE DONE SIMULTANEOUSLY.

HYDRAULIC AND ELECTRICAL FAILURE AND THE EPU (CONT'D)

2. ACTIVATE THE EMERGENCY POWER UNIT SWITCH LOCATED AT EACH OUTRIGGER CONTROL PANEL. THE SYSTEM IS CAPABLE OF ALL FUNCTIONS IN A NO-LOAD CONDITION, HOWEVER, BECAUSE OF THE SHORT CONTINUOUS USE TIME LIMIT (APPROXIMATELY THREE MINUTES, DEPENDING ON THE CIRCUIT BEING ACTIVATED) FUNCTION SHOULD BE LIMITED TO THOSE ASSOCIATED WITH WRAP-UP OF THE AERIAL AND OUTRIGGER OPERATIONS.

3. OPERATE APPROPRIATE CONTROLS TO BED THE AERIAL LADDER.

4. AFTER AERIAL IS BEDDED, RETURN THE BLOCKING SOLENOID LOCATED FORWARD OF THE TURNTABLE REAR STEP TO ITS ORIGINAL POSITION WITH A SLIGHT PUSH AND TURN TO THE RIGHT.

TO RETRACT THE OUTRIGGERS

1. OPEN THE CABINET THAT HOUSE THE OUTRIGGER OVERRIDE CONTROLS LOCATED TO THE REAR OF THE LEFT OUTRIGGER CONTROL PANEL.

2. PULL THE RED HANDLE AND HOLD THE BLOCKING SOLENOID VALVE, SHUTTING OFF HYDRAULIC FLUID TO THE AERIAL SYSTEM AND DIRECTING FLOW TO THE OUTRIGGER VALVE BANK.

   NOTE: STEPS 3 AND 4 MUST BE DONE SIMULTANEOUSLY.

3. ACTIVATE THE EMERGENCY POWER UNIT LOCATED IN THE LEFT SIDE OUTRIGGER CONTROL PANEL.

4. BY ACTIVATING THE APPROPRIATE BUTTON ON THE OUTRIGGER VALVE BANK, THE VALVE SPOOL IS PHYSICALLY SHIFTED FOR THE CORRESPONDING CIRCUIT. A PLACARD ADJACENT TO THE VALVE

BANK DENOTES "BUTTON" FUNCTION.

HEAVY APPARATUS
PREVENTIVE MAINTENANCE

DAILY SCHEDULE

Daily checks shall be conducted by operators of apparatus or members responsible as soon as practicable following relief.

1.	Fuel supply	Maintain to capacity.
2.	Oil, crankcase	Maintain to factory specification capacity.
3.	Water, radiator & recovery tank	Maintain to capacity (check for rust).
4.	Brake air reservoir pressure	Is storage over required minimum? Check for leaks.
5.	Tires	Look for cuts, bruises, proper inflation: Clean out rocks, dirt, etc.
6.	Signal & lighting	Check and operate all lights, system including signal devices, that they operate (includes horn, siren, bells, outrigger sounding devices, etc.).
7.	Electrical system	Check power to radio and adequate alternator output.
8.	Engine	Look for excessive oil or water leaks. Check belts for wear and tension.
9.	Running Gear	Look for condition/tightness of bolts, nuts, fittings, shafts, cables, etc.
10.	Seat belts	Look for cuts. Check operation of buckles and general condition of belts.

11.	Fuel Filter	Check Raco fuel filter/water separator for water or debris in filter. Drain as needed.
12.	Portable Radio	Check battery and operation.

NOTE: Notify the Shops of needed repairs, and be guided by their advice.

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HEAVY APPARATUS
PREVENTIVE MAINTENANCE

WEEKLY SCHEDULE

1.	Air Tank	Apparatus with or without air dryer system must be drained of condensate and oil. Notify Shops of any abnormal amounts of oil in system.
2.	Air conditioning unit	Check belts and look for leaks in system. Operate A/C unit at least once a week for ten minutes.
3.	Tires	Check pressure by gauge. Check and tighten wheel lugs. Wheel covers removed and rims checked at annual Pump Test and Aerial Ladder Test.
4.	Batteries	Maintain proper level of electrolyte. Take specific gravity reading of electrolyte. Charge if needed. Check all battery connections for corrosion and tightness.
5.	Water filter	Inspect for proper fluid color, level and leaks.

6.	Power steering	Inspect reservoir for proper oil level.
7.	Exhaust system	Inspect under vehicle for leaks, condition (rust or breakage) and for proper mounting.
8.	Springs, suspension	Inspect springs for broken or missing leafs, and frame clamps, U-bolts, shackles, etc. Inspect shocks for proper mounting and condition. Inspect frame rails and frame members for breaks, cracks, bad welds, loose rivets and bent sections.
9.	Transmission Fluid	Refer to logbook, Part I for instructions.
10.	Windshield wipers	Check blades for wear. Inspect hose for cracks and leaks. Wipers shall not be operated on a dry windshield or with defective blades. Inspect tiller cab windshield wipers.
11.	Engine Water Pump	Check weep hole for signs of leakage.

WEEKLY SCHEDULE (CONT'D)

12.	Power Equipment	Operate and check all light power equipment, i.e., blowers, jaws, saws, etc.
13.	Rubber Gauntlet Gloves	Check gauntlet gloves.
14.	Radio	Check other radio frequencies on apparatus and portable radios.
15.	Brakes	Check pad thickness on rockwell disc brakes - minimum 1/4" notify shops.
16.	Emergency Power Unit	Run emergency power unit, circulate fluid, check operation and check for leaks.
17.	Aerial Swing Drive	Check fluid level once a week. (SAE 90) pipe plug (inspection hole) is located near the top of swing drive.
18.	Aerial Ladder	Check oil reservoir, add oil as needed. Operate and test aerial and outrigger jacks. Inspect drive pinion bearing gear teeth for wear alignment and lubricaiton. Inspect aerial control console and communication system for aerial. Inspect collector rings under turntable for corrosion and brushes for wear. Inspect hoses, lines, etc., under turntable.
19.	Tiller Cab	Inspect door hinges and door latch.
20.	Fuel Filter/ Water Separator	Drain water and sediment.

21.	Aerial Trunnion	Lubricate once a week at zerk fittings.

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ADDITIONAL WEEKLY SCHEDULE FOR AERIALS

1. Service hydraulic oil reservoir, add oil as needed.

2. Operate Aerial: Test operation of outrigger jacks, spring locks and aerial. Request repair or service if needed.

3. Inspect rotation pinion and ring gear under turntable for wear and lubrication, lubricate or report as required.

4. Inspect collector rings under turntable for corrosion, brushes for wear and wires for secure connections and good conditions.

5. Inspect hoses, lines, etc., under turntable for chafing, wear, leaks, etc.

6. Tiller Bucket: Inspect hinges, locks and springs for condition, operation and lubrication.

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HEAVY APPARATUS
PREVENTIVE MAINTENANCE

MONTHLY SCHEDULE

1. Check connections, clamps, couplings for air cleaner and turbo changer.

2. Any joint not equipped with a lubrication fitting; and of a design requiring lubrication, shall be lubricated monthly with a light coat of engine oil.

3. Tiller Cab Heater Unit - Run the heater at least once a month (including the summer months) to prevent the fuel pump bearings from drying out.

4. Invert dry chemical extinguisher to keep contents from settling.

5. Weigh CO2 extinguisher to check content amount.

6. Check life line as per instruction.

7. Check rescue suspension harness.

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INSTRUCTIONS FOR FILLING OUT AND FORWARDING
BI-MONTHLY PREVENTIVE MAINTENANCE RECORD
(F-377)

Proper maintenance of apparatus is dependent on an orderly procedure and an established inspection routine.

The following maintenance operations are to be performed every other month for applicable apparatus in accordance with the following schedules. These are minimum requirements. All of these preventive maintenance checks are to be performed during the last week of every odd month for heavy apparatus, (January, March, May, etc.). Fill out two copies of the F-377. Retain the copy for the log book and forward the original copy, through channels, to your Battalion Commander.

The Preventive Maintenance Form F-377 applies to all light and heavy apparatus and trailers (active, reserve and standby) that are serviced by field personnel. All preventive maintenance items are to be inspected for each apparatus where applicable. Items on the Preventative Maintenance Schedule marked by an asterisk shall pertain only to heavy apparatus. All other items pertain to all apparatus.

Items that are in good condition and not in need of service, repair, etc., shall be marked O.K. in designated column. Items requiring attention shall be indicated by a brief statement of the trouble in the repair comments column. EXAMPLE: Adjust brakes, Left front wheel bearing loose, Radiator leak, Right front tire tread 1/4", etc. (see example F-377, /page 13). All repairs will be reported as directed in Vol. 4, 8/3-40.40 and 40.50 (this includes brake adjustment, clutch adjustment, emergency lighting, steering, warning devices, etc.).

Members calling in needed repairs shall log, on the F-377, the name of the person contacted, instructions received, and the date.

If a reserve apparatus has had limited use within the two-month period, it is not necessary to fill out the entire F-377. Fill out only the checks that you feel are necessary and those listed in Vol. 3, 7/1-48.84 and 48.86, of the Manual of Operations. However, the entire F-377 shall be completed on these apparatus at each six-month oil change.

The F-377 will be reviewed at the Battalion level, with the determination made that needed repairs have been properly reported.

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PREVENTIVE MAINTENANCE
BI-MONTHLY SCHEDULE

1. AIR CLEANER: (Engine cool and shutdown)
   Service, clean or replace as recommended. Examine hose, ducts, pipe, etc., between air cleaner and carburetor for breaks, wear

and secure mounting.

2. AIR COMPRESSOR: * (Engine cool and shutdown)
Service air cleaner, inspect for secure mounting and leaks.

3. ALTERNATOR OR GENERATOR: (Engine cool and shutdown)
Inspect for secure mounting, loose wire connections and worn or chafted insulation on wiring. Lubricate idler (lower) pulley when so equipped. External rectifiers will be carefully cleaned of dirt, etc., with a dry cloth.

4. BRAKES, AIR: * (Engine shutdown)
Visually inspect all mechanical components; inspect for worn clevis pins, missing cotter pins or possible road damage to air lines and brake chambers.

4A. BRAKES, HYDRAULIC: (Engine shutdown)
Light apparatus inspect master cylinder for proper fluid level and leaks. Inspect lines and hose for leaks. Test brakes for need of adjustment. After vehicle has been idle for several minutes, push the brake pedal down as far as it will go. If the pedal travels more than halfway between the released position and the floor, call Shops for an adjustment. Upon completion of the above, test for fluid by-passing in master cylinder by applying brake with about 30% of normal pressure for a period of 1-1/2 to 2 minutes. If pedal depresses to floor, request inspection by mechanic.

5. CARBURETOR: (Engine cool and shutdown)
Inspect for proper choke operation and lube choke cable if needed. Inspect all accessible carburetor linkage for wear, binding and lack of lubrication. Lubricate as needed. Inspect carburetor for loose mounting.

6. COMPRESSION RELEASE ARM, SHAFT AND PINS: * (Diesels)
Apply light coating of SAE-30 engine oil.

7. COOLING SYSTEM: (Engine cool and shutdown)
Visually examine radiator for white or green corrosive spots and for mud, foreign material, etc., in cooling fins. Using compressed air, blow mud, etc. from engine compartment side of radiator to outside of radiator. Do not strike or damage fins of radiator when blowing through core. Examine all accessible water

hoses. Hoses should have a live rubber feel; if dried out or spongy, request replacement. If hose is collapsed (out of shape and flat), request replacement. Inspect radiator cap and cap gasket for proper seating and sealing on radiator fill neck.

7. COOLING SYSTEM: (cont'd)
Light apparatus equipped with coolant recovery systems, maintain coolant level at the "cold full" mark when system is cool and coolant is at ambient temperature.

7A. COOLING SYSTEM COOLANT:
The condition of cooling system coolant is of utmost importance to the protection of internal engine components.

Using the NALCOOL test strips provided and following the enclosed instructions, test a sample of the coolant. Record the test results on the F-377. (Depleted, Danger, Satisfactory) If the test results are not within proper limits, notify the Shops and request that coolant additive be sent to the station location for addition to the apparatus cooling system.

If rust, scale, oil film, or other impurities are evident in the coolant, notify the Shops of such condition and be guided by their instruction.

8. CLUTCH ADJUSTMENT: (Engine shutdown)
Heavy apparatus, see Diagram "B". Light apparatus equipped with clutch, use hand to test for free travel. Press on clutch pedal with hand (not with foot) and note distance pedal moves before clutch starts to disengage. Distance should be 3/4" to 1" of free travel. Less than 3/4" of free travel indicates an adjustment is necessary.

9. DIFFERENTIAL: (Engine cool and shutoff)
Maintain to level of fill plug on right side of differential housing.

10. DISTRIBUTOR: (Engine cool and shutoff)
Clean outside with a dry cloth. If necessary, cloth may be moistened with kerosene. Inspect wires for loose connections, brittleness, poor insulation and oil, liquid, or other damage. Clean ignition coils at this time by same method. also, inspect coil wires the same as distributor wiring. Examine external bakelite parts for cracks or breaks.

11. DRIVE BELTS: (Engine cool and shutoff)
All belts (fan, alternator, compressor and power steering) shall be checked for wear and tension. If belt tension is loose enough to allow 1/2" or more deflection, measured at point midway between pulleys, call Shops for adjustment.

12. DRIVE LINE: * (Engine cool and shutdown)
Block one or more wheels fore and aft to prevent vehicle from rolling. Release all brakes. Visually inspect drive line tubes for damage and/or bent shaft or tube. Inspect for looseness by positioning yourself on creeper with shoulders directly under one end of shaft.

12. DRIVE LINE: (cont'd)
Take hold of shaft as close to end as possible with both hands and try to move shaft up and down. Repeat same test at other end of shaft.This test will also show loose pinion bearings. On vehicles having more than one shaft, test all shafts.

13. DRY VACUUM TESTS: * (Engine running)
To determine the condition of the priming pump, fittings, connections, and piping joints integral to the pumping system, initiate a dry vacuum test. With all openings closed, engage priming pump. Study suction gauge to determine maximum vacuum developed, which sould be at least 20" of mercury. Stop the primer and attempt to hold vacuum in the pump. Check for leaks.

14. ENGINE MOUNTS: (Engine cool and shutdown)
Examine engine mounts for looseness and damage to rubber insulators.

15. FUEL PUMP: (Engine cool and shutdown)
Examine for signs of loose mounting and examine flexible fuel lines for hard or spongy condition. A good hose will have a firm but not hard feel to the finger. Check all lines, solid and flexible, for leaks and secure mounting.

16. RADIO:
Examine all accessible components for secure mounting. Examine visible wiring for damage and proper anchorage.

17. STARTER: (Engine cool and shutdown)
Examine starter of secure mounting, secure connections, and

frayed or bad order wiring. Examine all accessible solenoids for proper mounting, loose connections and wire, or insulation damage.

18. STEERING COLUMN:
Visually inspect outer housing for cracks or breaks. Test for loose mounting by standing on running board or floor and taking a firm grip with one hand on column at the highest point possible; then push away from you and then pull toward you. Any movement of column indicates loose mounting and should be reported as needing repair.

19. STEERING GEAR AND CONNECTIONS: (Engine shutdown)
Position front wheels straight ahead with all weight of vehicle on tires. Have assistant sit in driver's seat and take hold of wheel and with short, fast motions, approximately 6" to 8" on wheel, move wheel back and forth. You can determine if looseness exists by looking at, or placing finger on, connections, joints, etc. The following list of steering parts can be tested for excessive play by the above method: Tie rods, drag link, Pitman arm, Pitman arm shaft and nut, and loose steering box to frame mounting.

19. STEERING GEAR AND CONNECTIONS: (cont'd)
On vehicles equipped with power steering, if play is observed at drag link end where power steering is located, a second test is necessary. Second test is made same as first test with two additional operations: (1) Start engine. (2) Inspect the one connection only where valve is mounted.

Report repair needed if play exists in any area listed. Use care to avoid injury to fingers. Aerials: Inspect tiller steering.

20. STEERING WHEEL:
Inspect for breaks or cracks. Test for looseness by standing on floorboard or sitting in seat, take hold of wheel with both hands, one on each side of wheel, pull up and then push down. (Pressure is in same direction with both hands.) Have assistant look for movement of steering wheel up and down on column. Then, with hand in same position on wheel, pull up with one hand; push down with the other hand. Repeat two or three times. (Pressure of hands is in opposite directions.) Have assistant look for

movement of steering wheel on column. Report any looseness.

21. TIRES:
Measure tread depth at the center of the tire tread with the approved tire tread depth gauge. This is an accurate measuring device calibrated in increments of 1/32". A reading on the gauge where the black line under the number four (4) is visible above the top of the plastic collar would indicate a tread depth of 1/8" or less and should be reported on the F-377 as needing replacement. Other methods of determining tire tread depth should be avoided. (Refer to Tire Replacement Policy and Criteria in the log book "Tire" Section.)

22. TRANSMISSION, MAIN PUMP: *
Check oil and maintain to proper level.

23. TRANSMISSION, ROAD:

A. MANUAL
Check oil and maintain to level of fill plug.

B. AUTOMATIC
Check fluid and maintain full as required (see log book lubrication guide). Check fluid condition for evidence of fluid or transmission deterioration. The fluid should not exhibit a strong burnt odor, dark color, or suspended debris. The fluid should appear bright red. A comparison to new fluid may be helpful.

24. WHEEL BEARINGS: (Engine shutdown)
Place blocks fore and aft of one wheel to prevent vehicle from rolling, then release brakes. Raise one wheel. Position raised wheel so that valve stem is approximately midway between top and bottom of wheel and one of the large stamped openings at the outer diameter of wheel is at its lowest point near the floor. Take a 4' crowbar, place a 2' length of 1-1/2" salvage hose on bottom part of bar (chisel end) to prevent paint damage and place chisel end in large stamped hole of wheel that is closest to floor. Move top of bar toward top of wheel until slight pressure

is produced. Have assistant look at wheel and spindle.

Increase pressure slightly at top of bar (work bar up and down at top). While moving bar, be sure to keep lower end (chisel point of bar) firmly in position. This test will show looseness in wheel bearings, spindle pins and wheel mounting. Perform test on all wheels, front and rear. Wheels on side opposite wheels being raised for test must be blocked to prevent vehicle from moving. WORK SAFELY!

Light Apparatus

Check front and rear wheel bearings. Place blocks fore an aft of one wheel to prevent vehicle from rolling, then release brakes. Raise one wheel. Check bearing play by grasping tire at top and bottom and pulling back and forth, or by using a pry bar under the tire. If movement is excessive, notify Shops.

25. WIRING:
Examine all wiring, rods, linkage, piping and accessories in engine compartment (not specifically mentioned in P.M. sheet) for looseness, wear, interference or need for repair.

26. Current odometer reading.

26A. Current engine hour reading.

26B. Current pump hour reading.

REVISED DISC BRAKE WEAR INSPECTION

The following inspection must be done every Monday.

Reports from the field and the Shops indicate that the inboard and outboard disc brake lining do not wear at an even rate. Therefore, when observing the lining wear indicator, we are, in reality, checking the wear on the outboard pad only. Make the basic check by visually checking the position of the caliper on the stationary slide pins at the inboard side of the brakes (see Figure 1). Change shoe and lining (pad) assemblies when the caliper has moved inward enough to allow 4/32" of the slide pin still showing beyond the caliper pin boss (see Figure 1).

To visually check the wear on the inboard pad, it will be necessary to utilize a mirror, flashlight or drop light and a creeper (see Figure 2). When either the inboard or outboard pad has worn to a thickness of 1/4", notify the Shops to have the pads inspected by a mechanic.

DISC ROTOR INSPECTION WITH AXLE JACKED UP AND SPRING BRAKE (MAXI BRAKE) OFF

Rotate wheel slowly and inspect both the inboard and outboard braking (friction surfaces of the disc (rotor) for cracks, heat checking, grooving or scoring and heat spotting or bluing. Also check the lateral runouts of the disc. Discs that are damaged MUST BE REPLACED, refer to the following items. (Use flashlight and mirror for checking outboard side of rotor.)

CAUTION: FAILURE TO REPLACE A DAMAGED DISC WILL INHIBIT THE BRAKE FROM FUNCTIONING PROPERLY WHEN BRAKING IS REQUIRED. A HAZARDOUS CONDITION MAY EXIST.

Cracked Rotor: Check both friction surfaces and outer diameter of the disc for cracks that extend partially or completely through any section of the disc. If cracks are found, the disc MUST BE DISCARDED.

Light heat checking (very fine hairline crack across the disc friction surfaces) is typical of normal (average) operation. However, if heat checks increase in size and develop into cracks that extend partially or completely through the disc, the disc MUST BE DISCARDED.

BRAKE DESIGN

A close inspection of your Rockwell Dura-Master disc brake system will reveal that the rear brake pads are of different thickness; the inner pad being the thicker (7/8" when new) and the outer pad the thinner (9/16" when new). The rotor compensates for this difference by being thicker on the outboard side and thinner on the inboard side.

BRAKE DESIGN (cont'd)

Without the above knowledge, the average observer will assume that a brake wear balance condition exists when, in reality, there is no problem. The front brake pads, inner and outer, are identical (both 5/8" when new) and normally appear to be wearing at the same rate.

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ROCKWELL INTERNATIONAL

This information pertains to Rockwell disc brake adjustment and check procedure (with self adjusters).

ADJUSTMENT

1. Set chock blocks.

2. Start the engine and allow the air system to build to its maximum pressure, approximate 120 PSI.

3. Release spring brake.

4. Depress the brake pedal to FULL application travel, hold for one second, then release. Repeat the procedure. Four (4) or more applications will be sufficient to bring the automatic slack adjuster back to specified limits.

5. Shut the engine off.

BRAKE ADJUSTMENT CHECK

NOTE: THE FOLLOWING OPERATION REQUIRES TWO (2) PEOPLE.

1. Check and note distance "A" at brake chamber.

2. Have your assistant depress brake pedal, check and note distance at "B".

3. Release brake.

4. Repeat procedure at each wheel.

5. The difference between "A" and "B" should be within the allowable maximum push rod travel "C".

6. If push rod travel goes beyond its maximum allowable travel, call the Shops for further instructions.

7. Apply spring brake and remove chock blocks.

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TIRE REPLACEMENT CRITERIA, INCLUDING RECAPS

1. TREAD WEAR

Tires shall be replaced when tread is worn as follows: Tread wear depth of 4/32" or when worn to the tread wear bar indicator (raised rubber portion, 1/2" wide x 3/32" high, located at the bottom of each tread groove, approximately 6" to 20" apart, around the circumference of the tire), where applicable.

2. TREAD SEPARATION

All tires showing evidence of the tread separating from the tire carcass must be replaced as soon as possible. This condition is almost always associated with poor quality recapped tires.

3. BULGING AND OUT-OF-ROUND TIRES (ALL)

Tires showing the above conditions must be replaced as soon as possible. If a problem is suspected, jack up the axle, spin the wheel by hand, and observe any abnormalities. If the condition of the tire is questionable, call the Shops for additional advice. Check the wheel bearing adjustment while the wheel is off the ground; a loose bearing can cause wheel wobble.

4. GENERAL TIRE INFORMATION

A. Overinflation

Imposes excessive strain on the tire cords, weakening their resistance to impact. This could cause tire rupture and blowouts.

B. Underinflation

Is the principal enemy of tire life and one of the

primary causes of tire failure. Increased flexing due to underinflation causes heating, reduced strength, breakdown, and possible separation of the tire components. Low inflation also increases the rolling resistance which increases fuel costs and reduces tread life.

Inflation pressures should be checked when tires are cold.

NEVER bleed air from tires when hot to relieve normal pressure buildup. Generally speaking, tires on the steering axle will require more inflation than tires run as dual because of the higher individual tire loads.

C. Unequal Inflation

An underinflated tire on a dual assembly shifts its share of the load to its mate, which then becomes overloaded and may fail prematurely.

a:tires:lti

LOS ANGELES FIRE DEPARTMENT

TIRE CHANGING POLICY

1. NEVER MIX DIFFERENT TIRE SIZES OR TIRE CONSTRUCTIONS (BIAS, RADIAL) ON THE SAME AXLE

   Radial tires deflect more under a given load than bias ply tires. Therefore, if radial and bias ply tires are mixed in dual installations on the same apparatus, the bias ply tires will bear the greater part of the load and may operate in an overloaded condition that could lead to reduced tread life and early tire failure. Radial tires also have somewhat different handling characteristics than their bias counterparts and, therefore, may affect vehicle "feel" and stability.

2. NEVER MIX TUBE TYPE AND TUBELESS TIRES ON THE SAME AXLE

   Tube type tires generally run hotter than tubeless tires

under high speed conditions. The differential of air pressure between the two types, when hot, can cause unequal load characteristics, especially on duals.

3. NEVER INSTALL RECAPS (RETREADS) ON ANY STEERING AXLE

4. MATCHING AND SPACING OF DUALS

If the tires on a dual assembly are not closely matched in size, the smaller tire suffers from fast, irregular wear as it scuffs against the road. The larger tire is often subjected to an overloading and excessive flexing which may lead to overheating, internal damage and possible blowout.

Problems are likely to result if tires on a dual assembly differ by more than 1/2" in diameter.

If a slight mismatch does occur, the smaller of the two tires should be installed on the inside. The most accurate way to measure an inflated tire is to measure the circumference with a steel tape.

Tire spacing between duals is also important. If too close, sidewalls will rub together when the vehicle is heavily loaded. If too far apart, the outside tire will suffer from excessive scuffing when the vehicle makes a turn.

It is very important for the A/O or Engineer to measure the wheel offset whenever a wheel change is made. The wrong offset on the front could cause the tire to rub on the brake and power steering hose when turning. A worn hose could possibly prove disastrous.

5. INFORMATION REQUIRED

When calling for apparatus tire replacement, the following information may be required to determine the closest replacement match:

A. Apparatus make

B. Shop number

C. Tire size

D. Tire location

E. Tube type or tubeless

F. Tread design

G. Tread groove depth (for match)

H. Circumference or height

I. Wheel type and offset

J. Inner or outer

K. Finish on rim

a:tires:lti

TIRE INFLATION

Many LAFD personnel wonder why the tires on their apparatus have maximum pressures and maximum loads stamped on their tires, yet the Department specifies a completely different pressure. The Department of Transportation (DOT) requires maximum loads and pressures to be stamped on all tires. The pressures that we use are calculated using the manufacturer's weight/load specifications (see tire inflation table). After each axle is weighed, the axle weight is divided by the number of wheels on that axle. A chart from the manufacturer shows the proper pressure for each tire. These pressures are based on the strength of the tire, wear of the tire (over and under inflation), load, and the foot print pattern of the tire on the surface of the road. The more tire pattern on the surface of the road, equates to better handling of the apparatus.

The 1993 LTI pressures are as follows:

Front Tires	110 PSI
Rear Tires	90 PSI
Trailer Tires	110 PSI

The 1993 LTI tire sizes are as follows:

Front Tires	385/65R22.5
Rear Tires	12R-22.5
Trailer Tires	425/65R22.5

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TIRE INFLATION TABLE

Procedure to follow in determining the correct air pressure for LAFD apparatus.

1. Weight each axle.

2. Divide axle weight by the number of tires on axle. If tires are duals, add 10% to weight carried by each tire.

3. Find tire size and ply from chart, read across on chart to weight carried on tire, the column that the weight is in is the correct tire pressure.

   Example: No.1

15,320	lbs on rear axle
÷ 4	number of tires on axle
3,840	lbs on each tire
380	10% allowance for duals
4,220	

   From chart:

   A 10:00 X 20 tire carrying 4,220 lbs of weight requires 60 lbs of air pressure.

   Example: No. 2

9,120	lbs on front axle
÷ 2	number of tires on axle
4,560	lbs on each tire

   Front chart:

   A 10:00 X 20 tire carrying 4,560 lbs of weight requires 70 lbs of air pressure.

   Operate tires only within the area for which load ratings are shown.

   Listed below are four places that apparatus can be weighed:

   1630 North Main Street, Los Angeles
   12455 Wicks Street, Sun Valley

9430 San Fernando Road, Pacoima
1400 North Gaffey, San Pedro

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ELECTRICAL ROUTINE

BATTERIES

Routine maintenance for batteries on all apparatus equipped with two (2) or four (4) and six (6) battery systems is as follows:

1. Daily — Check changing system with engine running.

2. Weekly — Check the level of electrolyte, add water if needed. First day of the week, take gravity reading of all cells. If needed, charge with onboard battery charger.

   NOTE: Take hydrometer reading before adding water.

   Check cables for corrosion. Clean if necessary to assure good connection. Wire brush or emery cloth can be used to clean terminals.

CHARGING SYSTEM QUICK CHECK

ENGINE MODE	VOLTMETER READING	CONDITION
BATTERY SWITCH ON IGNITION SWITCH ON ENGINE NOT RUNNING NO ELECTRICAL LOAD	12.2 - 12.8	BATTERIES OK
SAME CONDITION AS ABOVE	BELOW 12	RECHARGE BATT.
ENGINE RUNNING (1 MINUTE OR MORE) APPROXIMATELY 1000 RPM	13.8 - 14.2	CHARGING SYSTEM

NO LOAD		OK
SAME AS ABOVE	BELOW 13.8	CHECK ALTERNATOR BELT TENSION - ALTERNATOR B.O.
ENGINE RUNNING (1 MINUTE OR MORE) APPROXIMATELY 1000 RPM FULL LOAD (ALL LIGHTS ON)	13.8 - 14.2	CHARGING SYSTEM OK
SAME AS ABOVE	BELOW 13.5	CHECK ALTERNATOR BELT TENSION.
CHECK		BATTERY CONDITION. ALTERNATOR B.O.

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CHARGING SYSTEM QUICK CHECK

The above information does not supersede the standard battery maintenance program as recommended int he F-377, but is intended to be followed only as a quick daily check to make sure the charging system is functioning in a normal manner. Keep batteries at full charge at all times.

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BOOSTER, JUMPER OR HOT-SHOT STARTING

When both battery systems have too low a charge to start the engine, a 12-volt booster battery may be used. Always connect this battery in a parallel with the front battery, positive to positive, negative to negative. To prevent a battery explosion, the following steps must be taken:

1. Wear safety glasses.

2. Connect positive (+) cable of jumper battery to the positive (+) post of the vehicle battery.

3. Connect negative (-) cable of the jumper battery to any good grounding point on the engine, such as the alternator bracket, cylinder head bolt, etc. Be at least 1' from the top of the battery.

4. Start the engine.

5. ALWAYS remove the negative (-) ground cable first.

6. Remove the positive (+) cable.

7. Determine need for jump start and call Shops for repair or assistance.

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ELECTRICAL SPECIFICATION

This sheet is to be used to record the light bulb numbers that are installed in each apparatus or vehicle. Insert this page in the battery section of the logbook. Listed below are only those lights that are common to most vehicles. Blank space is provided for additional lights.

BULBS	NUMBER		CATALOG CODE	
Head lamps				
Tail lamps				
Stop				
Turn Signals				
Back-up				
Emergency Lights:				
1.				
2.				
3.				
4.				
5.				
Dash				
Turn Indicators				
Map				
Hi-beam				
Oil Pressure				
Alternator				
Spot Light				

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OTHER BI-MONTHLY LUBRICATION

OPERATION NUMBER	LUBE TYPE	PICTURE NO.	COMPONENT SYSTEM	FREQUENCY
1	ENGINE OIL		DOOR HINGES LOCKS/LINKAGE	BI-MONTHLY
2	SAE 90W		SWING DRIVE PLANETARY GEAR	BI-MONTHLY SEE PAGE NO.
3	LUBRI PLATE		SECTION 2 MAIN RAILS	BI-MONTHLY
4	LUBRI PLATE		SECTION 3 MAIN RAILS	BI-MONTHLY
5	LUBRI PLATE		EXT./RETR. CYL GUIDE TRACKS (BASE)	BI-MONTHLY
6	LUBRI PLATE		FLY SECTION MAIN RAILS	BI-MONTHLY
7	ENGINE OIL		TILLER CAB DOOR SLIDES/ LOCKS	BI-MONTHLY
8	ENGINE OIL		COMPARTMENT DOORS/HINGES/ LOCKS/LINKAGE	BI-MONTHLY
9	LUBRI PLATE		GROUND JACKS UNDERSIDE OF HORIZONTAL ARMS	BI-MONTHLY
10	LUBED BY S&M		LADDER EXT./ RETR. CABLES	ANNUALLY

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APPARATUS EQUIPMENT LIST

The following items are part of the apparatus and shall be transferred with the apparatus each time it is reassigned.

These items shall not be included on the sub-divisions official printout.

Replacement due to loss - Follow procedure outlined in Vol. 4 8/5-42.60 (Do not use work order number on DS-70.)

Exchange or repair - Refer to Vol. 4 8/3-16.21.

STOCK CODE NUMBER	DESCRIPTION	QUANTITY

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