

Disassembly

1. Drain fluid from housing. Remove cotter pins (16 & 26), flange nuts (15 & 25), washers (2 & 14), O-rings (18 & 24) and flanges (1 & 17) from mid-mount.
2. Remove capscrews (3) and bearing retaining caps (13 & 23). Mark caps and wire shims to caps to insure correct installation.
3. Use a soft hammer and drive shaft and bearing assembly from housing. One bearing cup (6 or 20) will come out with shaft assembly. Assembly can be removed from either end. Tap remaining bearing cup from housing.
4. Remove old seals (19 & 22) from bore of caps and remove o-rings (5 & 12) from outside of caps.
5. Press bearing cones (7 & 10) from shaft (9).

Assembly and Adjustment

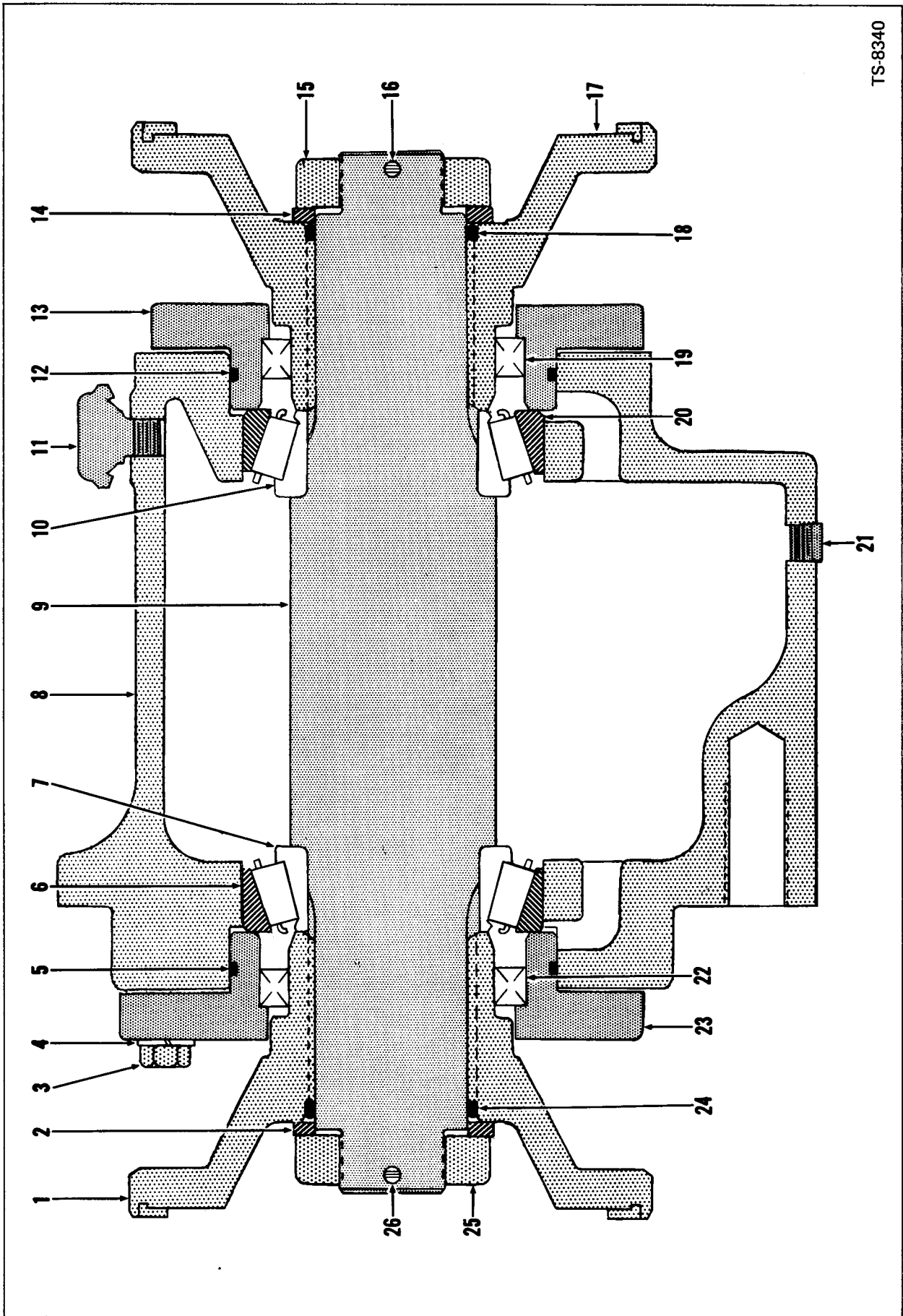
1. Thoroughly clean and inspect all parts.
2. Press new bearings (7 & 10) on shaft (9). Be certain bearings seat tightly against shoulders on shaft. Note position of bearings in diagram.
3. Coat outer diameter of seals (19 & 22) with non-hardening gasket cement and install them in the bearing race retaining caps (13 & 23). These are oil seals; the lip of the seal must point toward the inside of the housing when caps are installed. Coat O-rings (5 & 12) with grease and install them in the groove on the outside of each cap (13 & 23).
4. Place shaft and bearing assembly into housing. Tap bearing cups (6 & 20) into position against bearings. Lubricate bearings with transmission oil.
5. Place the same thickness of shims under the caps as was removed during disassembly. If these shims were lost or damaged start with .030 in. shims under each cap. Install the caps (13 & 23) and capscrews (3) but leave the capscrews loose.
6. With the capscrews loose, measure the rolling resistance of the shaft in inch/lbs. Record this reading.
7. Torque the capscrews to specification and measure the shaft rolling resistance again and record.

Bearing preload is determined by measuring rolling resistance. This value is determined by subtracting the rolling resistance measured with the caps loose from the rolling resistance measured with the caps torqued. Note that all values are measured with the flanges removed.

Example: 5 lb/in caps torqued
-3 lb/in caps loose
2 lb/in rolling resistance due to preload

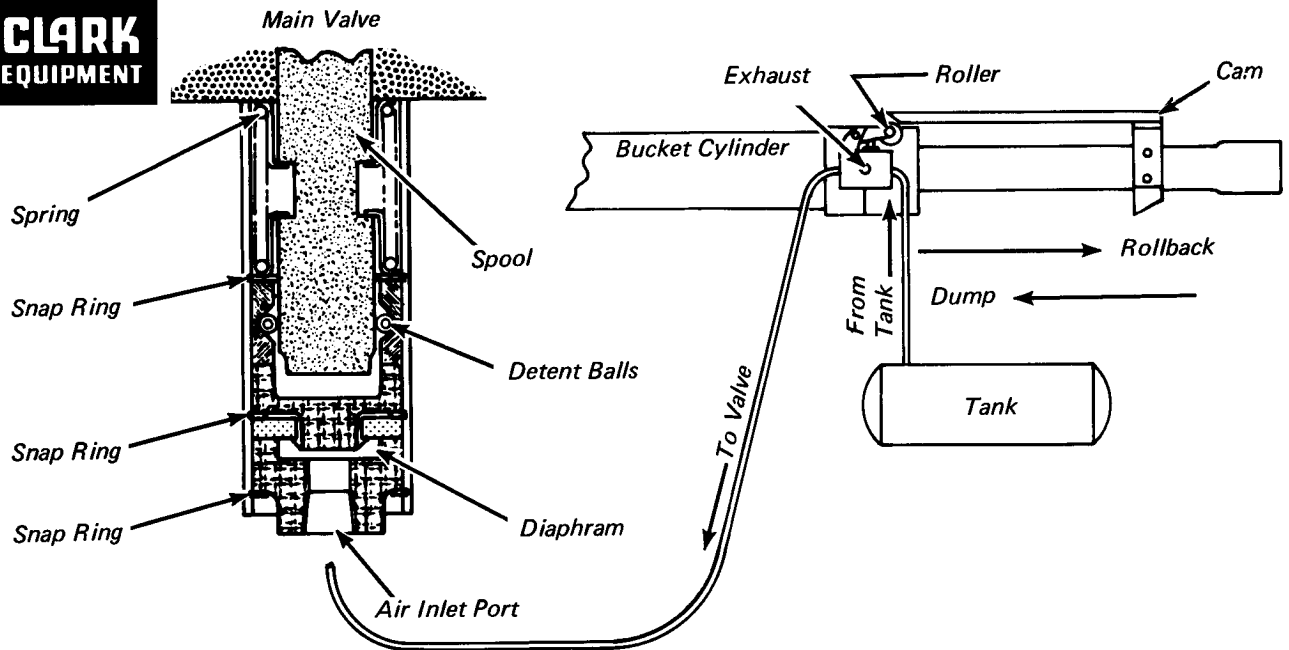
When properly adjusted the mid-mount bearing assembly, with no flanges, should have a rolling resistance due to preload of 0 to 2 lb/in. except for 675 which should be set .000 to .002 end play.

8. Install the flanges (1 & 17) on the splines. Note that the flanges must be aligned (in the same plain). Install the O-rings (18 & 24) and flange nuts (15 & 25). Torque the flange nuts to the same value as specified for the transmission output flange nut. Lock the nuts with cotter pins (16 & 26).
9. Install plugs, breather and fill with transmission fluid.



TS-8340

**CLARK
EQUIPMENT**



NORMALLY CLOSED AIR LEVELER VALVE OPERATION

With roller in the relaxed or "out" position air is blocked at the "in" port and the "out" port is open to the "exhaust" port. The air pressure to the main valve is therefore exhausted to the atmosphere.

With the roller in the compressed or "in" position air is blocked at the "exhaust" port and the "in" port is open to the "out" port. Air pressure is therefore supplied to the main valve.

When no air pressure is supplied to the air inlet port the valve is spring centered and automatically returns to "neutral" and "hold" when lever is released.

When air pressure is supplied to the air inlet port it pushes against the diaphragm thus exerting force against the detent balls and provides a detent in the rollback position.

With bucket in level position the roller is off the cam and the line from tank is blocked at the leveler valve. The line from the leveler valve to the main valve is open to exhaust. There is no detent therefore the valve spool is spring centered and automatically returns to "neutral" and "hold".

As the bucket is rolled back the cam continues to move away from the roller and the spool remains spring centered as above.

As the bucket is dumped the roller is pushed in by the cam. This closes the exhaust port and lets pressure go from the tank to the main valve. There is now a detent and when the lever is pulled to the rollback position it will remain there until the bucket reaches the level position at which time roller comes off cam, closes off air from tank, exhausts air from main valve line and returns valve spool to "neutral" and "hold".

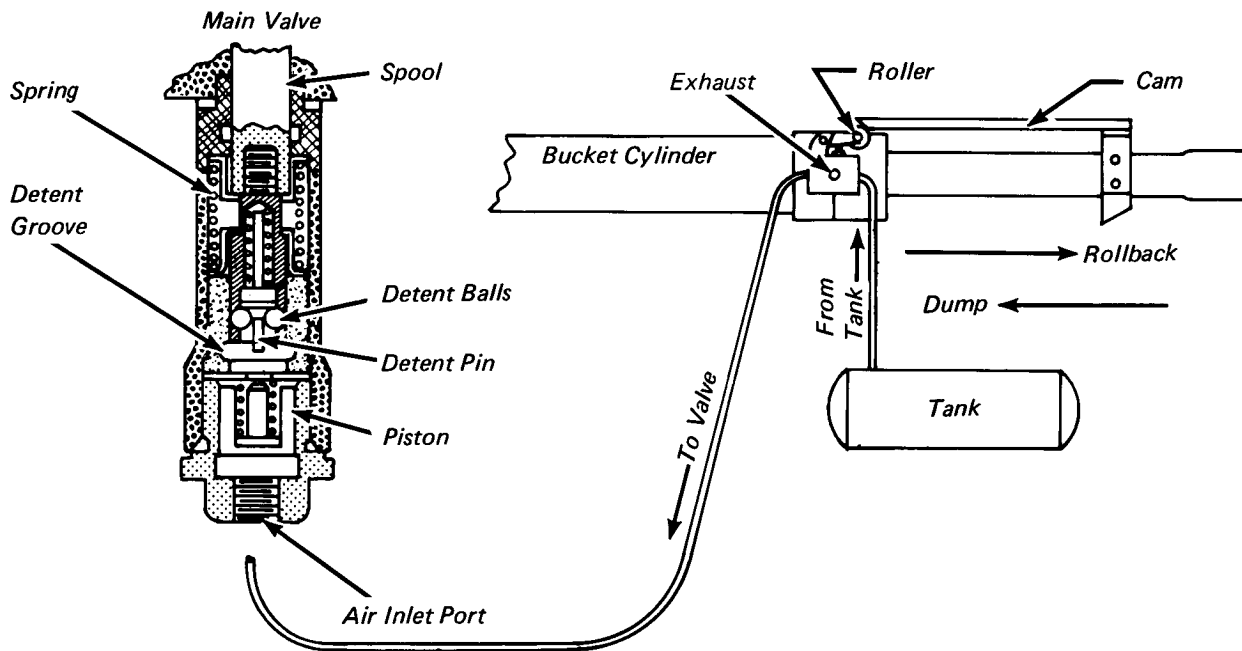
In order for this system to work properly it must be properly adjusted.

- A) The cam should stroke the valve roller in 1/8".
- B) The cam must be positioned square and parallel so the roller is stroked the same distance over the full length of the cam.
- C) There is adjustment in the cam, in the cam bracket and on the roller arm of the valve itself.

- D) Proper adjustment is necessary to insure the proper stroke to completely open one port while completely closing the other.



Normally Open Air Leveler Operation



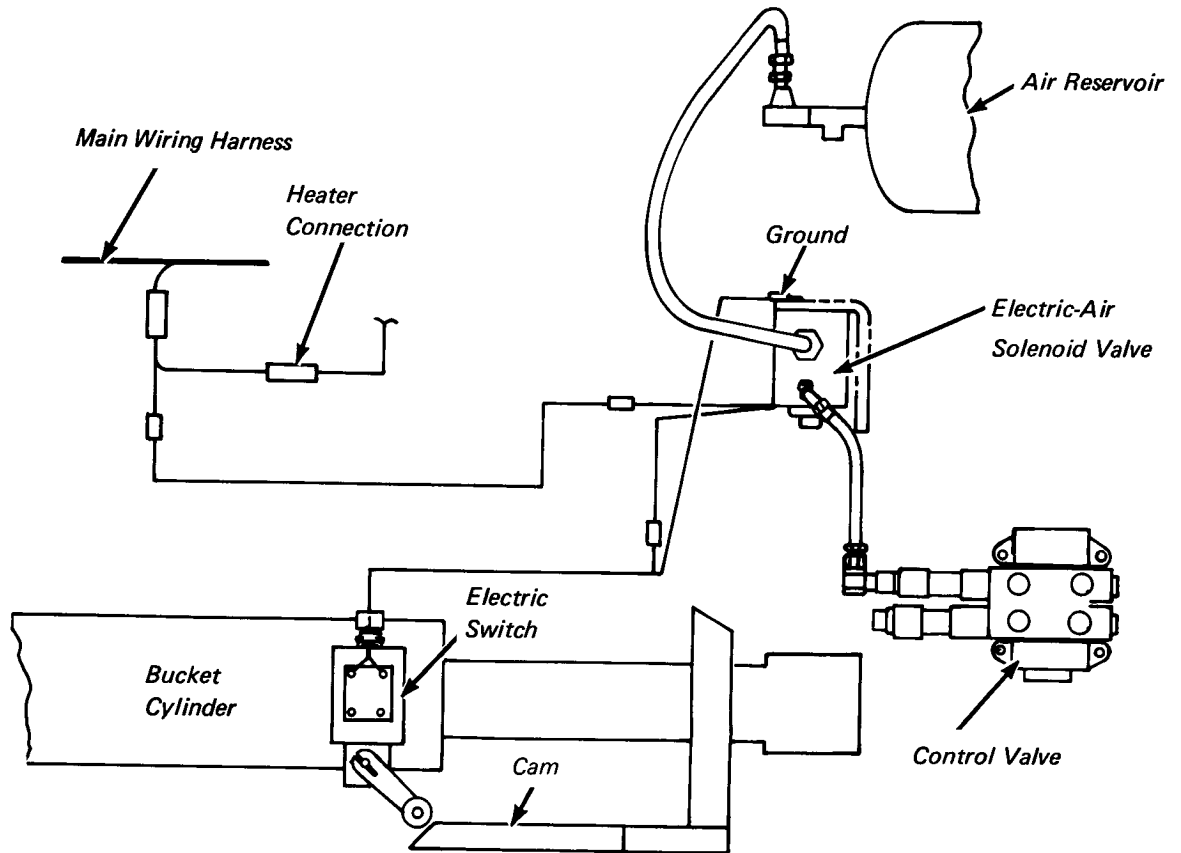
With roller in relaxed or "out" position, air is blocked at the "exhaust" port and the "in" port is open to the "out" port. Air pressure is therefore supplied to the detent housing of the main valve.

With the roller in the compressed or "in" position, air is blocked at the "in" port and the "out" port is open to the exhaust port. The air pressure to the main valve is therefore exhausted to the atmosphere.

As the bucket is dumped, the roller is pushed in by the cam. This blocks the "in" port of the air valve, and opens the "out" port to exhaust. Therefore, air pressure is released from the detent piston area of the valve. When the lever is pulled to roll the bucket back, the detent balls move into the detent groove and are held in place by the spring loaded detent pin. This holds the bucket spool in the roll-back position until the cam moves off the roller. When the cam moves from the roller, air flows to the valve pushing the piston up. The pin in the piston pushes the detent pin releasing tension on the detent balls. This allows the main spool centering spring to pull the spool back to neutral or hold position.

In order for this system to work properly it must be properly adjusted.

- A) The cam should stroke the valve roller in 1/8".
- B) The cam must be positioned square and parallel so the roller is stroked the same distance over the full length of the cam.
- C) There is adjustment in the cam, in the cam bracket and on the roller arm of the valve itself.
- D) Proper adjustment is necessary to insure the proper stroke to completely open one port while completely closing the other.



ELECTRIC-AIR BUCKET LEVELER

The major difference between the Electric-Air Bucket leveler and the straight air bucket leveler is that the air valve on the bucket cylinder has been replaced by an electric switch and an electric-air solenoid valve.

The detent mechanism on the control valve functions exactly the same as described in the two previous write-ups. The electric-air solenoid valve controls the air flow the same as was described for the air valve in the two previous write-ups. The electric switch opens and closes the electric-air solenoid valve as the cam on the bucket cylinder opens and closes the switch.



Service School Topic.....

DATE: 20 August 1976

SST - 15

SUBJECT: Air Conditioning Operation & Troubleshooting
All Model Machines

Ref. Group No. 120

Attached is an air conditioning operation and troubleshooting guide covering Operating Instructions, Service Instructions, Special Safety Instructions, Refrigeration Circuits, and specifics on the Crenlo Air Conditioning Systems.

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OPERATING INSTRUCTIONS**Air Conditioner Operations**

1. Close all windows, doors, and vents tightly.
2. Turn selector switch to "air condition" to start air conditioner.
3. Turn blower switch to "Hi".
4. Set temperature control to "coldest" position.
5. After cab has cooled down, set blower to "Med" or "Lo" to maintain desired comfort.
6. If cab is too cool, adjust thermostat to a "warmer" position to obtain desired comfort.
7. Heater thermostat must be "off" when air conditioner is operating or air conditioner will not cool properly.

Pressurized Operation

(Useful on cooler days, mornings and evenings when air conditioning is not required).

1. Turn selector switch to pressurizer.
2. Turn blower switch to desired speed.

Heater Operation

1. Turn selector switch to "Heater".
2. Turn blower switch to desired speed.
3. Turn heater thermostat to warm or any intermediate position between warm and off to maintain desired comfort.

SERVICE INSTRUCTIONS**In-Season Care**

1. Check compressor drive belts when servicing tractor.
- *2. Check compressor oil level after recharging system and at beginning of each operating season.
3. Keep evaporator and condenser clean with a brush and/or cold water or air hose.
4. Clean fresh air filter when required with light tapping or washing.
5. Check refrigerant hoses occasionally for abrasion and kinks.
6. Check sight glass occasionally to detect any leakage of refrigerant from the system. When compressor clutch engages some bubbles will be observed, however, the sight glass should show a clear liquid shortly after the compressor is running. If bubbles continue to be observed, refrigerant is leaking from the system and the system should be tested for leaks.

*See instructions for checking compressor oil level.

Off-Season Care

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1. Operate air conditioner at least once a month for a short period during off-season to lubricate seal on compressor. Compressor should be warm before starting.

CAUTION: Do not turn air conditioner on if ambient temperature is less than 50° F.

SPECIAL SAFETY PRECAUTIONS

Although there are many refrigerants used in air conditioning and refrigeration systems, in automotive air conditioning only Refrigerant 12 is used.

Refrigerant 12 is odorless and cannot be detected in small quantities. It is colorless and will not stain.

There are, however, a few words of caution concerning the handling of Refrigerant 12 (R 12).

Suitable eye protection should be worn when handling R 12 because of its low evaporation temperature. R 12 evaporates at -21.6° F.

If liquid R 12 strikes the eye, the eyeball may be frozen. Freezing the eye can cause blindness. If liquid R 12 should strike the eye, DO NOT RUB IT. Follow these instructions:

1. Do not rub the eye.
2. Splash large quantities of cool water into the eye to raise the temperature.
3. Tape on a sterile eye patch to avoid the possibility of dirt entering the eye.
4. Rush to a doctor or hospital for immediate professional aid.
5. Do not attempt to treat it yourself.

If liquid R 12 strikes the skin, frostbite may occur. Care must always be exercised when handling refrigerants. Should liquid R 12 strike you anywhere else on the body, follow the same procedures as outlined. Splash on cool water to raise the temperature.

Refrigerant 12 is harmless unless released in a confined space where it could cause drowsiness. We will not be concerned with this since the air conditioner capacity is not great enough to cause any problems.

If R 12 is allowed to come into contact with an open flame or a very hot metal, Phosgene gas will be formed. Phosgene gas is poisonous and can be very dangerous. This gas can make a person very sick when inhaled. Phosgene gas inhaled a little at a time over a period of time can be cumulative and may result in a toxic condition.

The following rules must be followed when handling R 12, or other similar refrigerants.

1. Above 130° F. liquid refrigerant will completely fill a container and hydrostatic pressure will build up rapidly with each degree of temperature rise. To provide for some margin of safety, never heat a refrigerant cylinder above 125° F.
2. Never apply a direct flame to a refrigerant cylinder or container. Never place an electric resistance heater near or in direct contact with a container of refrigerant.

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3. Do not abuse a refrigerant cylinder or container. Use an approved valve wrench for opening and closing valves to avoid damage. Secure all cylinders in an upright position for storage and withdrawal of refrigerant.
4. Do not handle refrigerant without suitable eye protection.
5. Do not overheat the refrigerant container.
6. Do not discharge refrigerant into an enclosed area having an open flame.
7. When purging a system, discharge refrigerant slowly and cover hands with shop towel or gloves.
8. Do not introduce anything but pure Refrigerant 12 and refrigerant oil into the system.

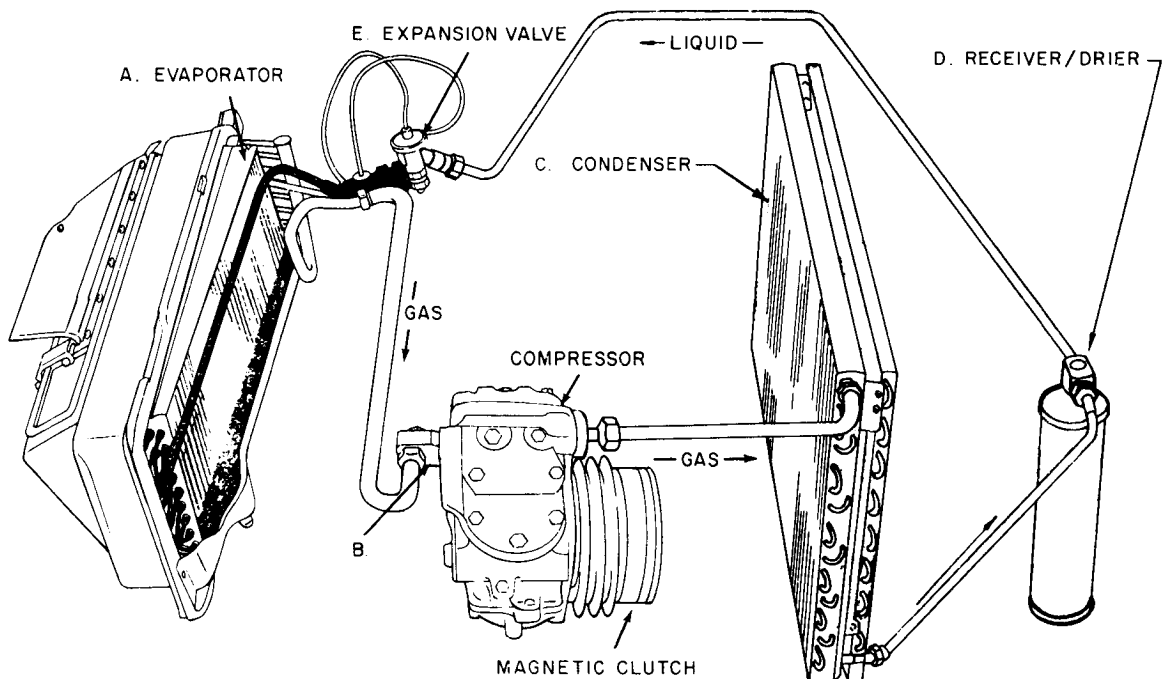
THE REFRIGERATION CIRCUIT

The following unit deals with the basic refrigeration circuit. The temperature of such a unit is maintained by a thermostatically controlled clutch. The clutch is cycled on and off as the thermostat may indicate and thus allows a proper cycle, or defrost period.

Each component will be discussed as will its purpose and placement in the air conditioning circuit.

Though different systems vary in size of hoses for a particular line, they will, in general, be as described here. The state of refrigerant will be given in each hose and component. This is the state of the refrigerant in a normal operating unit. It should again be pointed out that a suitable eye protection is suggested when servicing the air conditioner.

The following functional description of the refrigeration part of the air conditioning system is intended to familiarize the serviceman with the general arrangement and function of the components in the system. A complete understanding of the overall operation of the system is necessary when working on air conditioning.



REFRIGERATION SYSTEM COMPONENTS (TYPICAL)

Note the schematic diagram of refrigeration components. The compressor (B) pumps heat-laden refrigerant from the evaporator (A). It compresses the refrigerant and sends it, under high pressure, to the condenser (C) as a superheated vapor.

Since the high-pressure vapor delivered to the condenser is much hotter than the surrounding air, it gives up its heat to the outside air flowing through the condenser fins.

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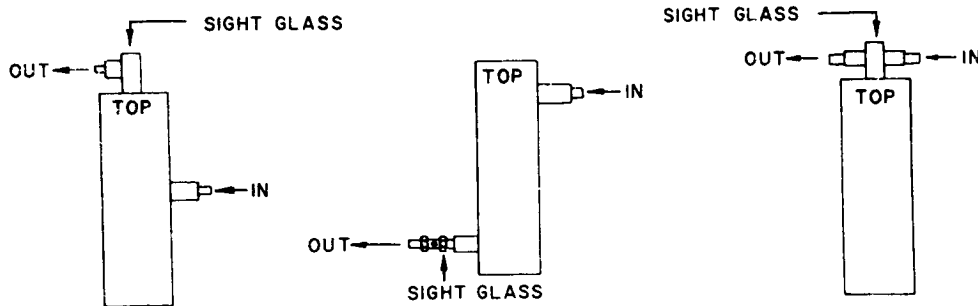
As the refrigerant vapor gives up its heat, it changes to a liquid. The condensed liquid refrigerant is filtered, dried and temporarily stored, under pressure, in the receiver/drier (D) until it is needed by the evaporator.

Liquid refrigerant is metered from the receiver/drier into the evaporator by the thermostatic expansion valve (E), which controls the flow of refrigerant in this part of the system. The pressure of the refrigerant is lowered by the expansion valve and begins to boil, or change to a vapor. In so doing it will pick up heat from the warm air passing through the fins of the evaporator. This heat will be transmitted, via the compressor, to the condenser for dissipation.

The following description deals with the refrigerant and its path of travel in the system through each component and explains the part each plays in affecting heat removal.

Receiver/Drier

Since the receiver/drier assembly is a part of the system that is used to store refrigerant, we will start with it. The receiver/drier or drier as it may be called, is a cylindrical metal can with two fittings and, in most cases, a sight glass. It is located in the high-pressure side of the air-conditioning system and, for the most part, contains 100% liquid refrigerant. It may be divided into two parts: the receiver and the drier.



THREE TYPES OF RECEIVER/DRIER ASSEMBLIES

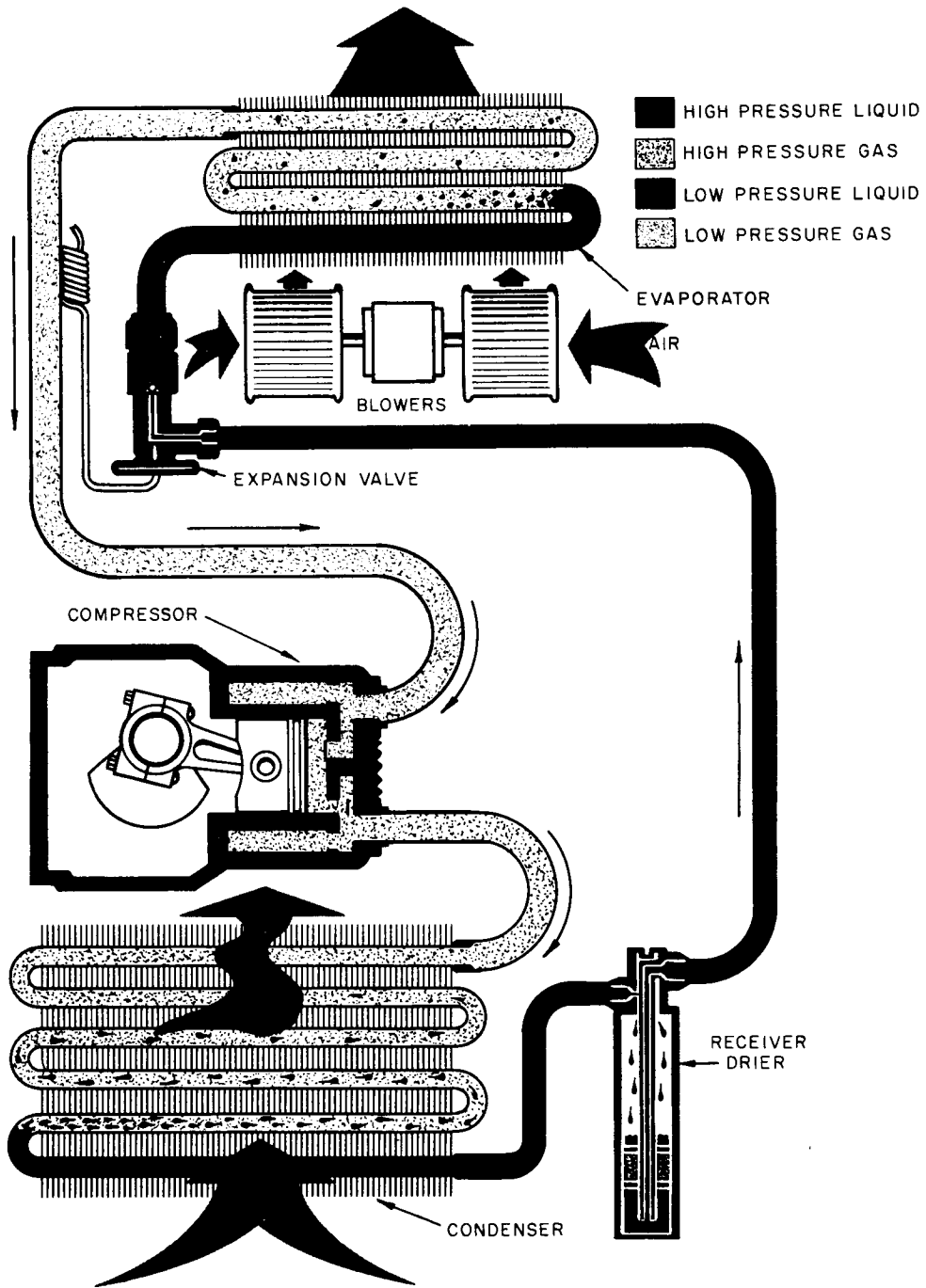
The receiver section of the tank is a storage compartment to accept the proper amount of extra refrigerant the system requires to insure proper operation. It is the function of the receiver to insure that a steady flow of liquid refrigerant may be supplied to the thermostatic expansion valve.

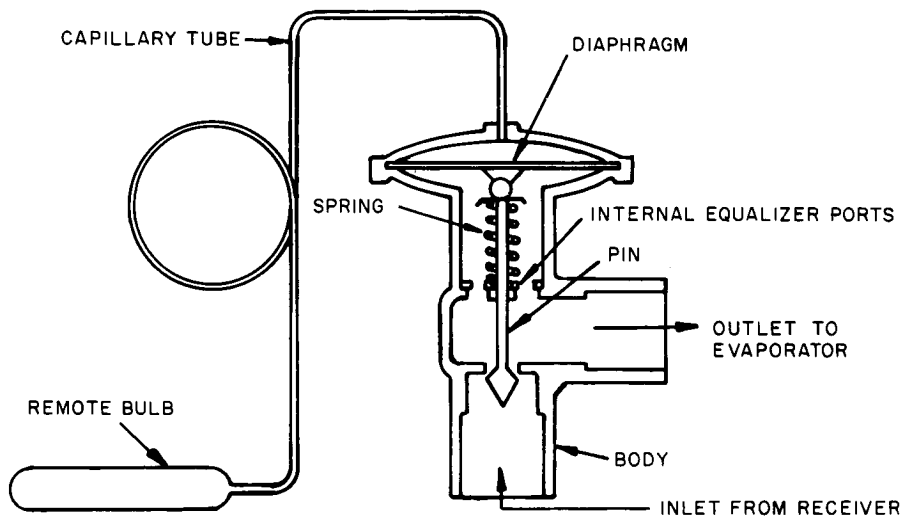
The drier section of the tank is simply a bag of desiccant, such as silica gel, that is capable of absorbing and holding a small quantity of moisture.

A screen is placed in the receiver/drier to catch and hold any trash that may be in the system and prevent its circulation. Though this screen is not serviceable, there are two others in the system that may be cleaned or replaced if necessary.

From the receiver/drier the refrigerant travels to the thermostatic expansion valve via a rubber hose referred to as the liquid line. The state of refrigerant in the liquid line is high-pressure liquid.

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THERMOSTATIC EXPANSION VALVE

Thermostatic Expansion Valve and Evaporator

The thermostatic expansion valve, or TXV, is located at the inlet side of the evaporator. It is the controlling device for the system and separates the high side from the low side. A small restriction, or orifice, in the valve allows only a small amount of liquid refrigerant through, modulating according to evaporator temperature. The largest the orifice can become is about .008" so it can easily be seen that only a small amount of refrigerant can pass even when the valve is wide open.

The state of the refrigeration inside of the TXV and immediately after it is 100% liquid. It is not all liquid long, however. As soon as the liquid pressure is dropped it starts to boil, and in so doing must absorb or take on BTU's of heat. This heat is removed from the air passing over the coils and fins of the evaporator and causes the air to feel cool. Remember, we are removing the heat from the air, not creating cold air.

It is the job of the TXV to meter just the proper amount of refrigerant into the evaporator so that the outlet of the evaporator will be 100% low-pressure vapor, or gas.

If too much refrigerant is metered, a flooding condition is the result and the unit will not cool. It will not cool because the pressure of the refrigerant will be higher and it will not boil away so easily. Also, the evaporator full of liquid refrigerant eliminates a place for the refrigerant to properly vaporize which is necessary in order for it to take on heat. A flooding condition of the evaporator will allow an excess of liquid refrigerant to leave the evaporator and may cause serious damage to the next component, the compressor.

If too little refrigerant is metered into the evaporator, we refer to the system as being starved. Again the unit will not cool because the refrigerant will vaporize, or boil off, long before it passes through the evaporator.

Refrigerant properly metered into the evaporator should allow for 100% liquid just after the TXV, and 100% gas at the outlet, or tailpipe.

The TXV has a sensing tube attached to the tailpipe to sense outlet temperature and thus regulate itself.

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The tailpipe, or hose leaving the evaporator, is usually the largest hose in the system. Condition of the refrigerant in the tailpipe is low-pressure gas, and is directed into the compressor inlet.

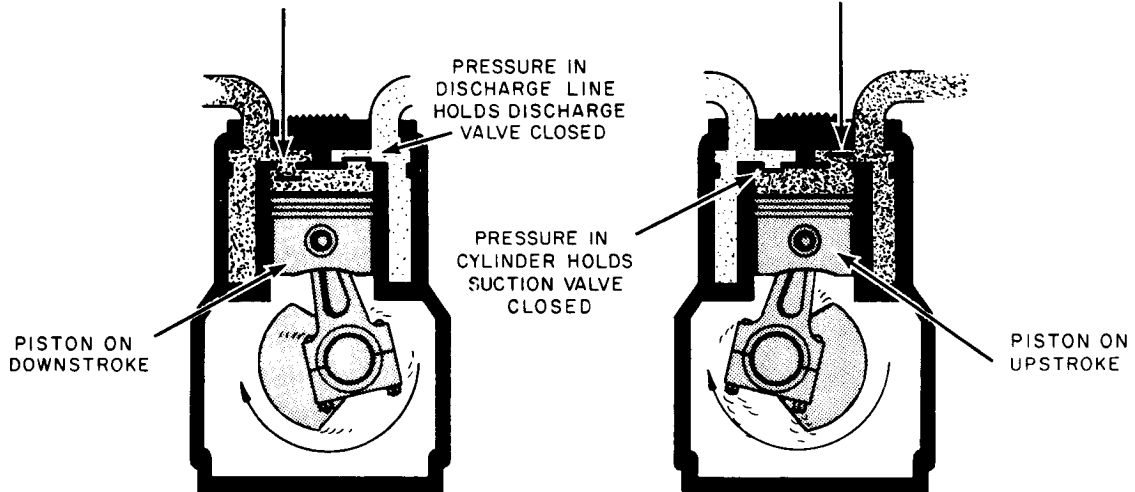
Compressor

The compressor is a pump designed to raise the pressure of the refrigerant. In so doing, the refrigerant will condense more rapidly in the next component, the condenser.

Most of the compressors are two-cylinder units, with the exception of some, which are five- and six-cylinder units.

DOWNSTROKE OF PISTON CREATES VACUUM IN CYLINDER. PRESSURE IN SUCTION LINE FORCES SUCTION VALVE OPEN

PRESSURE IN CYLINDER RAISES DISCHARGE VALVE, GAS FLOWS INTO DISCHARGE PIPE



OPERATING CYCLE OF RECIPROCATING COMPRESSOR

Equipped with a set of suction and discharge valves and valve plates, each piston, working conversely to each other, draws in refrigerant through the suction valve and forces it out through the discharge valve. While the piston is on the downstroke, or intake stroke, the discharge valve is held closed by action of the piston and the higher pressure above it. With the piston on the downstroke the suction reed valve is opened allowing low-pressure gas to enter. When the piston is on the upstroke, or compression stroke, refrigerant is forced through the discharge valve while the suction valve is held closed by the same pressure. While one piston is on the intake stroke, the other is on the compression stroke.

The compressor is the device that separates the low side from the high side of the system. The state of the refrigerant on entering the compressor is low-pressure gas, and on leaving is high-pressure gas.

The compressor is equipped with service valves which are used as an aid in servicing the air-conditioning system. The manifold gage set is connected into the system at the service valve ports and all procedures such as evacuating and charging are carried on through the manifold and gage set.

The hose leaving the compressor contains high-pressure gas and is referred to as the hot gas discharge line. It connects to a condenser inlet, always on the top side of the condenser.

Condenser

The purpose of the condenser is just opposite to that of the evaporator. It is in the condenser that the refrigerant in the gas state is to liquify, or condense. To do so it must give up its heat BTU's.

Ram air, or air passing over the condenser, carries off heat and the gas condenses. This heat which is now removed to cause a change of state from a gas to a liquid is the same heat that was absorbed in the evaporator to cause a change of state from a liquid to a gas.

The state of the refrigerant will be almost 100% gas on entering the condenser. A very small amount of gas might turn to liquid in the hot-gas discharge line, but the amount would be so small that it wouldn't require considering.

We cannot consider that the refrigerant leaving the condenser is 100% liquid though. Since the condenser is capable of handling just so much heat at a given time, a small percentage of the refrigerant may leave the condenser in a gas state. This is of little consequence, however, since the next component is the receiver/drier.

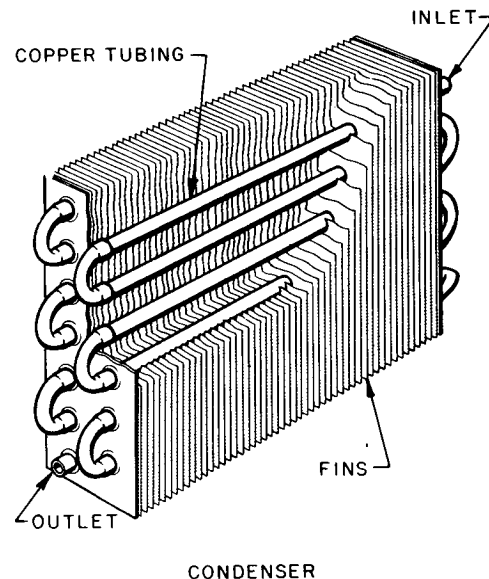
As we mentioned earlier, the inlet of the condenser must be at the top. This will allow condensing refrigerant to drop to the bottom of the condenser where it will be forced, under pressure to the drier through the liquid line.

Though we refer to the condition of the refrigerant in the condenser as liquid and gas, it is under high pressure and care must be exercised when servicing this part.

From the condenser we continue to the receiver/drier through the liquid line where the cycle starts over again.

So, in covering the refrigeration cycle we learn several things about refrigeration: When the pressure of the refrigerant is dropped in the evaporator it boils. In boiling it picks up BTU's of heat. The compressor raises the temperature and pressure of the refrigerant so that it will condense in the condenser where it will give up the same BTU's of heat that it picked up in the evaporator. We learn the direction of the refrigerant flow and the state of it in each part of the system.

This is the basic fundamental air-conditioning circuit from which all of the other automotive circuits are patterned. A good understanding of the simple circuit will make understanding the other circuits much easier.

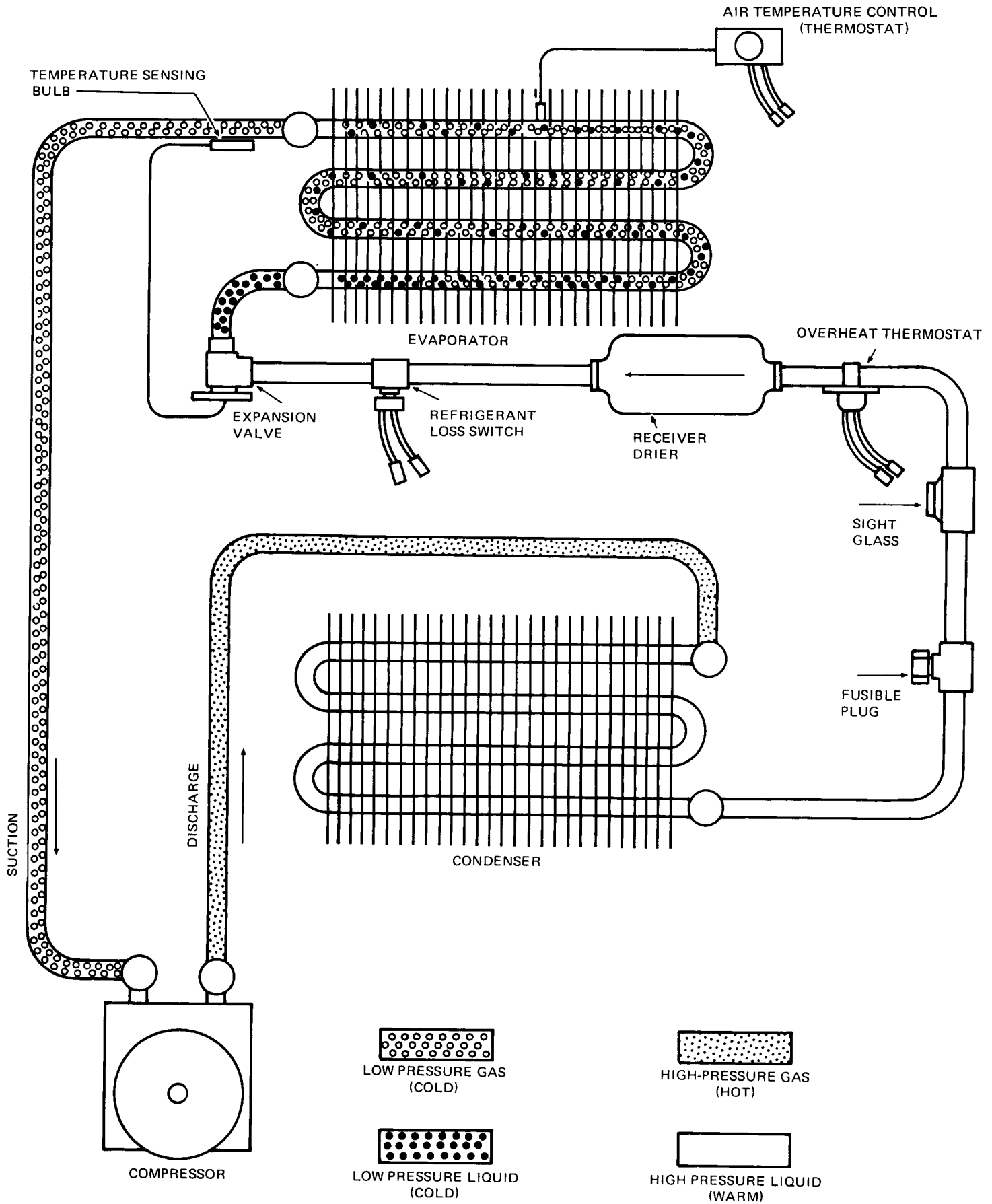


CRENLO AIR CONDITIONING SYSTEM

The Crenlo system uses a few more components than the system just covered. The extra components are installed to shut down the system if problems occur before unreparable damage is done. The following is a list of Crenlo components and their function.

Fusible Plug

The fusible plug is located in the liquid line between the condenser outlet and the receiver-drier. If the temperature of the liquid refrigerant should rise to 208° or higher, the center of the plug will melt allowing the refrigerant to escape. This protects the system from damage due to excessively high head pressures.



Overheat Thermostat

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The overheat thermostat is clamped to the liquid line. Its function is to disengage the clutch if the refrigerant in the liquid line exceeds 155° F. This condition could occur if the condenser air flow is restricted or stopped. If the thermostat does "open", it will not "close" again until the liquid line temperature drops to below 120° F.

Refrigerant Loss Switch

This switch will "open" and thereby disengage the clutch if the refrigerant pressure in the discharge line should drop below 35 psi and will not close unless the pressure rises to 45 psi. This is a safety feature to prevent system damage in the event there is a leak in the system and the refrigerant is lost.

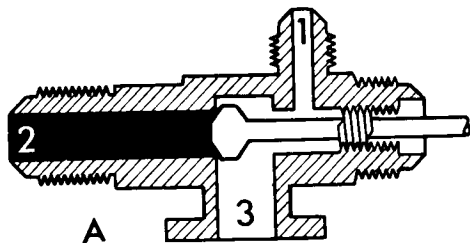
SERVICE AND TROUBLESHOOTING

SERVICE VALVES

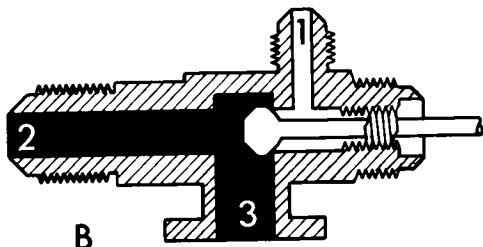
It is necessary, from time to time, for the serviceman to "enter" the air conditioning system for certain diagnostic services and procedures which require the recording of pressures within the system. The service valve is a device, usually located on the compressor, that enables the serviceman to enter the refrigeration system by mechanical means.

Most units are equipped with two service valves. Since all valves are the same, we will be concerned here with the operation of one valve in the system.

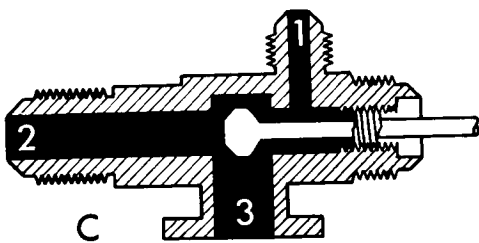
- 1 - TO SERVICE PORT
- 2 - TO HOSE
- 3 - TO COMPRESSOR



A FRONT SEATED



B BACK SEATED



C MID-POSITIONED (CRACKED)

SERVICE VALVES

The hand shutoff type of valve is a three-position valve that may be used for one of three functions.

- A Shut off refrigerant flow. Gage port out of the system.
- B Normal refrigerant operation. Gage port out of the system.
- C Normal refrigerant operation. Gage port in the system.

We will discuss each position and determine at what points refrigerant will be allowed to flow under each position.

SHUT OFF REFRIGERANT FLOW. GAGE PORT OUT OF SYSTEM.

In this position we refer to the service valve as being in the front seated position.

Refer to illustration A. You can see that the refrigerant is trapped in the hose end of the service valve. The gage port fitting is toward the atmosphere. By following the path through the valve you can see that the gage port only connects to the compressor. If the compressor were run with the service valve in this position and the gage port capped, serious damage would occur in the compressor. There would be no area to pump out.

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Never operate a compressor with the service valves in this position unless to perform such tests as may be determined to be necessary.

Normal Refrigerant Operation – Gage Port Out Of The System

The service valve in this position is referred to as in the back seated position. As shown in Figure B, the compressor and hose outlet are connected and refrigerant is free to flow if the compressor is started. With the service valve in this position, the gage port is closed off and pressure readings may not be taken. All of the service valves should be in this position when the system is operating normally.

Normal Refrigerant Operation – Gage Port In The System

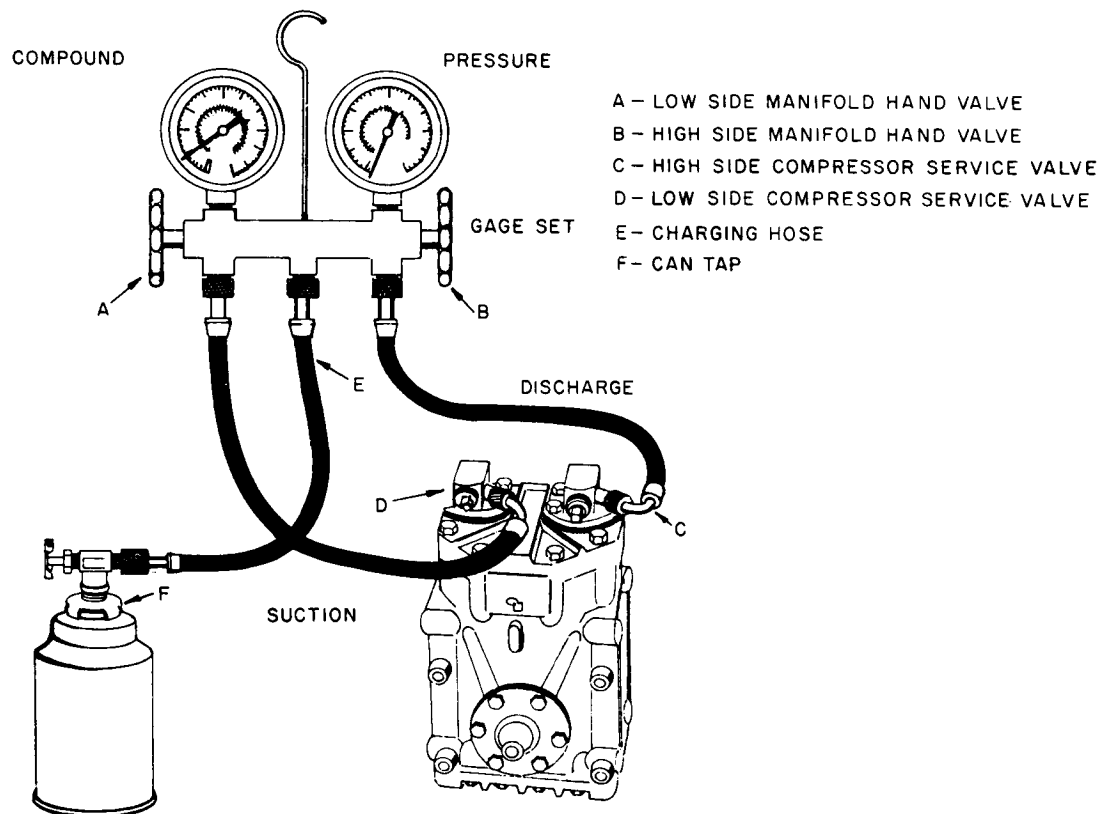
The service valve in this position is referred to as in the cracked, or mid position. It is in this position that the system can be operated and the pressures recorded through the gage port openings, Figure C.

It must be remembered, however, that the valves must always be back seated before attempting to remove the gage hose from the service valves. To fail to do so will result in a loss of refrigerant. Figure C illustrates the presence of refrigerant at all outlets of the service valve in the cracked position.

The Manifold

The gages are connected into the air-conditioning system through a manifold. The manifold is a device having fittings for the gages and hoses with provisions for controlling flow of refrigerant through the manifold.

The gages are attached to the manifold by use of 1/8" pipe connections. The manifold is connected to the compressor service valves by use of rubber hoses about 36" long with 1/4" female flare fittings on each end. The hoses are connected to the manifold by use of 1/8" male pipe with 1/4" male flare adapters.



The low side hose and fitting is fastened directly below the low side gage; the high side hose and fitting below the high side gage.

The center port of the manifold set is used for charging or evacuation procedures, or any other service that may be necessary.

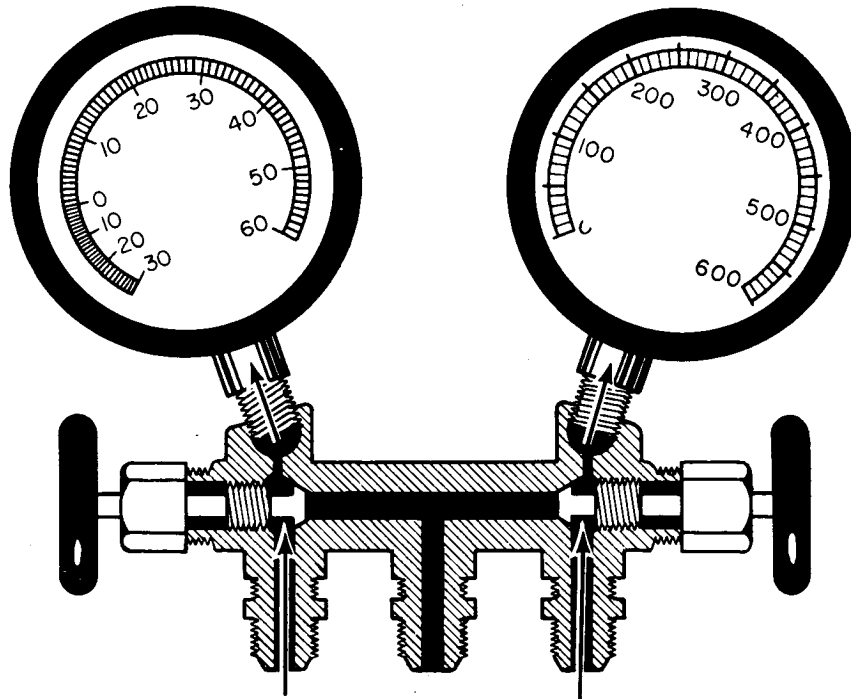
Both the high and low side of the manifold have hand shutoff valves. When the hand valve is turned all the way in, in a clockwise direction, the manifold is closed. The pressures on that side of the system will, however, be recorded on the gage above the hose.

Cracking the hand valve, in the counterclockwise direction, opens the system to the middle service port of the manifold set. This is desirable only when it is necessary to let refrigerant out or into the system.

If the hand valve on the low side of the manifold is cracked, the action takes place between the low side and the center port only. The low side gage is recording low side pressure only. The high side remains closed: pressures read on the high side indicate high side pressures only.

The manifold gage set is used to perform nearly all air-conditioning test and service procedures.

The illustration below shows manifold hand valves in the closed, or off position. Pressure can still be recorded on each gage.



TO LEAK TEST THE SYSTEM USING HALIDE LEAK DETECTOR

The halide leak detector, a propane torch, is the most popular leak detector with the refrigeration serviceman because of its low initial cost and low cost upkeep. About the only maintenance required, other than propellant replacement, is an occasional reactor plate replacement.

CLARK

To check the sensitivity of the reactor plate, pass the pickup hose over a recently opened and empty can of refrigerant, or crack open a service valve. The flame should have a violet reaction. If little or no color change occurs, replace the reactor plate.

When leak testing, all joints and fittings should be free of oil to eliminate the possibility of a false reading caused by refrigerant absorption in the oil. Cigarette smoke, purging of another unit nearby, as well as vapors in the surrounding air may also give a false reading on the detector.

CAUTION: A halide leak detector must only be used in a well-ventilated area. It must never be used in spaces where explosive gases are present. When refrigerant comes into contact with an open flame, phosgene gas is formed. Never inhale the vapors or fumes from the halide leak detector, they may be poisonous.

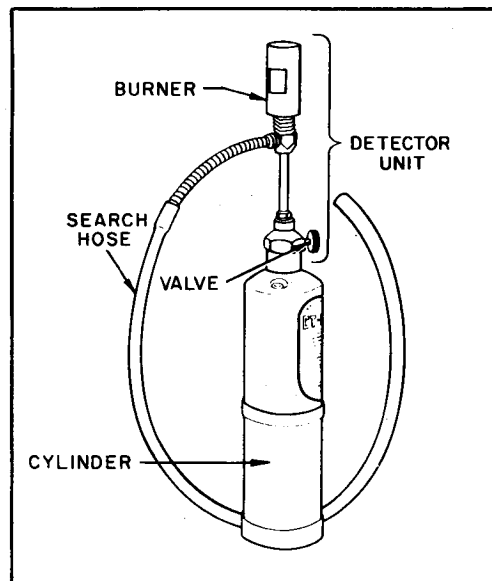


FIG. 6-1 LEAK DETECTOR (TORCH)

Tools

Service valve wrench, suitable hand wrenches, eye protection, manifold gage set, halide leak detector.

PROCEDURE

Prepare System

1. Connect manifold gage set into the system.
2. Place high and low side manifold hand valve in the closed position.
3. Place high and low side compressor service valve in the cracked position.
4. Determine presence of refrigerant in the system. A minimum of 50 psi is needed for leak detection.
5. If there is insufficient charge of refrigerant in the system, continue with the next step, "Add Refrigerant for Leak Test Pressure". If sufficient, skip the next step and proceed with "Prepare Leak Detector".

Add Refrigerant For Leak Test Pressure

1. Open high and low side hand valves to purge hoses of air, and then close.
2. Attach center manifold hose to refrigerant container.
3. Open refrigerant container service valve.
4. Open high side manifold hand valve until a pressure of 50 psi is reached on the low side gage, then close high side hand valve.

5. Close refrigerant container service valve and remove hose.

Prepare Leak Detector

1. Open valve and light the gas. Adjust for low flame which burns 1/2" above the reactor plate.
2. Let it burn until the reactor plate, a copper element, turns to a cherry red color.
3. Lower flame until it is about 1/4" above or even with the reactor plate.

Check For Leaks In The Air Conditioning System

1. Move the search hose under all joints and connections in the system. Seals and control devices must not be overlooked.
2. Disconnect any vacuum control hoses connected to the system and check their ports for refrigerant vapors.

Reaction Of Halide Leak Detector In Presence Of Refrigerant

Watch for a color change in the flame above the reactor plate.

Pale blue – no refrigerant loss

Pale yellow at edges of flame – very small refrigerant loss

Yellow – small amount of refrigerant loss

Purplish-blue – large amount of refrigerant loss

Violet – heavy amount of refrigerant loss, may be great enough to extinguish flame

Repair System

1. After leak is located, purge system of refrigerant. (Best to check entire system for leaks before purging.)
2. Repair as indicated and check compressor oil.
3. Add oil if required; add refrigerant and recheck for leaks.
4. If no leaks are found, the system may be evacuated and charged.

To Evacuate The System Using A Vacuum Pump

It is necessary to evacuate the air conditioning system any time the system has been serviced to the extent that it has been purged of refrigerant. Evacuation is necessary to rid the system of all air and moisture that may have been allowed to enter the unit. At or near sea level, a good vacuum pump is one that is capable of pulling 29" Hg or better. For each 1000 feet of elevation, the reading will be about 1 inch higher.

As we lower the pressure in the air conditioning system, we lower the boiling temperature of the water (moisture) that may be present. Then we are able to pull this water, in the form of vapor, out of the system. The following chart shows at what temperature the water turns to vapor.

27.99	100
28.89	80
29.40	60
29.71	40
29.82	20
29.88	0

Tools

Service valve wrench, hand wrenches, manifold and gage set, vacuum pump, and eye protection.

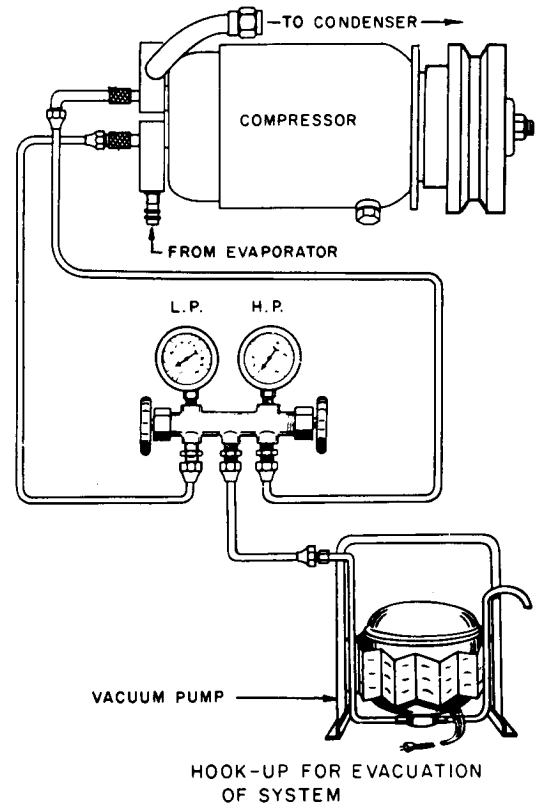
PROCEDURE

Prepare System

1. Connect manifold gage set into the system.
2. Place high and low side compressor service valves in the cracked position.
3. Place high and low manifold hand valves in the closed position.
4. Remove protective caps from the inlet and exhaust of the vacuum pump. Make sure the port cap is removed from the exhaust port to avoid damage to the vacuum pump.
5. Connect the center manifold hose to the inlet of the vacuum pump.

Evacuate System

1. Start vacuum pump.
2. Open low side manifold hand valve and observe compound gage needle. It should pull down into a slight vacuum.
3. After about 5 minutes the compound gage should be below 20" Hg and the high side gage should be slightly below the zero index of the gage.
4. If the high side needle does not drop below zero, unless restricted by a stop, system blockage is indicated.
5. If system is blocked, discontinue evacuation. Repair or remove obstruction. If system is clear, continue.
6. Continue to operate the vacuum pump for 15 minutes and observe gages. The system should now be in about 24-26" Hg minimum if there is no leak.
7. If the system is not down to 24-26" Hg, close low side hand valve and observe the compound gage.



8. If the compound gage rises, indicating a loss of vacuum, there is a leak which must be repaired before continuing with evacuation.
9. If no leak is evident, continue pump-down.

Complete Evacuation

1. Pump for a minimum of 30 minutes at a minimum of 28.5 Hg, longer if time permits.
2. After pump-down, close low side manifold hand valve.
3. Shut off vacuum pump, disconnect manifold hose and replace protective caps.

Check System For Irregularities

1. Note the compound gage. It should read about 29" Hg at sea level.
2. The compound gage should not rise at a rate faster than 1" in five minutes.
3. If the system fails to meet this requirement, although not indicated previously, a partial charge must be installed and the system must be leak checked.
4. After the leak is detected and repaired, the system must be purged of refrigerant and completely evacuated.
5. If the system holds vacuum as specified, continue with the charging procedure.

TO CHECK COMPRESSOR OIL LEVEL OR REMOVE COMPRESSOR FROM SYSTEM

The following procedure may be followed when it becomes necessary to check the compressor oil level, or when servicing the compressor without losing refrigerant from the system.

Tools

Service valve wrench, hand wrenches, eye protection, manifold gage set, oil dipstick.

Material

Refrigeration oil

PROCEDURE

Prepare System

1. With manifold gage set connected into the system, set both hand valves in the closed position.
2. Set both compressor service valves in the cracked position.
3. Stabilize system by running engine at about 1200 rpm with air conditioner controls turned on maximum cooling for about 10 minutes.

Isolate The Compressor

1. Return engine to idle speed.
2. Use dipstick and measure oil.
3. Compare with chart on next page to determine proper oil level.

CLARK

Compressor Position	Oil Height	Remarks
Vertical	1-5/16"	Factory charge of 11 fluid oz.
Horizontal	1-9/16"	Factory charge of 11 fluid oz.
Vertical	7/8"	Min. recommended height*
Vertical	1-3/8"	Max. recommended height*
Horizontal	7/8"	Min. recommended height*
Horizontal	1-5/8"	Max. recommended height*

*After connection to system and run

4. Fill with refrigeration oil as necessary to bring level to proper height.

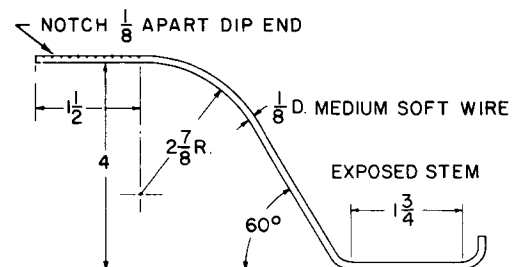
Return Compressor To System

1. If compressor was removed, replace service valve gaskets with new ones or replace oil check plug.
2. Purge air from compressor as follows:
 - a. Open high side manifold hand valve.
 - b. Crack low side compressor service valve off front-seated position.
 - c. Low side refrigerant pressure will force air out of compressor through high side manifold set.
 - d. After a few seconds of purging, close high side manifold hand valve.
3. Mid-position the low side compressor service valve.
4. Mid-position the high side compressor service valve.
5. With gage set hooked up, check refrigerant charge.
6. Add refrigerant as necessary.

Return System To Service

1. Back seat high and low side compressor service valves.
2. Remove service hoses and replace protective caps.

NOTE: An oil dipstick, such as the one shown here, may be made from a piece of medium soft wire, such as a black coat hanger. A black wire should be used so the refrigeration oil level can be more easily seen on the stick.



TO CHARGE SYSTEM

CLARK

Caution

Above 130° F., liquid refrigerant will completely fill a container and hydrostatic pressure will build up rapidly with each degree of temperature added. Never heat a refrigerant container above 125° F. It should never be necessary to heat a refrigerant container. But, if heating is necessary, it should be done with warm water. Never apply a direct flame or an electric resistance heater to a refrigerant container. Do not abuse a refrigerant container. Use only approved wrenches to open and close valves. Store in an upright position.

Do not handle refrigerant without suitable eye protection and do not discharge refrigerant into an enclosed area having an open flame.

With the refrigerant can or tank inverted, vapor will rise to the top of the container and liquid refrigerant will be forced into the charging hoses. Do not invert the refrigerant container with low side pressures in excess of 40 psi. Regulating the valve on the container or the manifold hand valve will insure a pressure of 40 psi, or below. Liquid refrigerant entering the compressor low side can cause serious damage to internal parts such as pistons, reed valves, head and head gaskets.

If ambient temperature is lower than 80° F., do not invert the refrigerant container. Engine and air conditioning system should be at operating temperature.

Tools

Service valve wrench, hand wrenches, eye protection, manifold gage set, can tap.

Material

Refrigerant 12

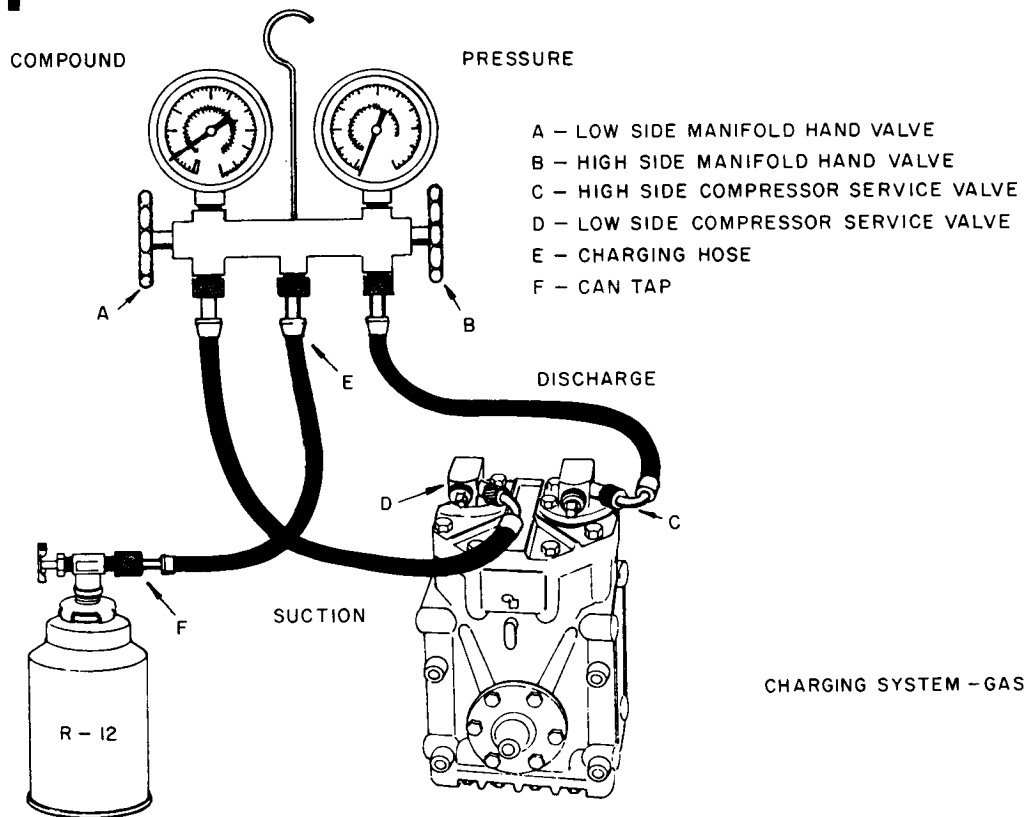
PROCEDURE

Prepare System

1. Connect manifold gage set into the system. Set both hand valves in the closed position.
2. Set compressor high and low side service valves in the cracked position.
3. Place system under a vacuum after adequate pump-down.

Install Can Tap To Can Of Refrigerant

1. Set can tap in the counterclockwise position.
2. Attach valve to refrigerant container and secure locking nut if so equipped.
3. Connect center manifold hose to can tap port.
4. Pierce can by turning shutoff valve in the clockwise position.



Purge Line Of Air

1. With can pierced, back can tap valve out in a counterclockwise position.
2. Center hose is now charged with refrigerant and air. Do not crack high or low side manifold hand valve.
3. Loosen center hose connector at manifold set until a hiss can be heard. Allow gas to escape for a few seconds, and then tighten fingertight.

Check System For Blockage

1. Open high side gage manifold hand valve; observe low side gage pressure. Close high side hand valve.
2. If low side gage does not come out of a vacuum and into a pressure, system blockage is indicated.
3. Correct blockage, if indicated, evacuate and proceed with the following step.

Charge System

1. Start engine and adjust speed to about 1250 rpm.
2. Insure that both manifold hand valves are closed.
3. Adjust controls for maximum cooling, blower on high speed.
4. Open low side gage manifold hand valve to allow refrigerant, in the gas state, to enter the system.

5. After the pressure on the low side has dropped below 40 psi, the can may be inverted for more rapid removal of refrigerant.
6. To determine when can is empty, tap it on the bottom. A hollow ring should be heard when empty.
7. Repeat with additional cans of refrigerant as required to completely charge the system.

NOTE: If system capacity is not known, charge unit until the sight glass is clear, then add 1/4 pound or until pressure readings are between 150-250 PSI on the high side of the gauge.

Complete System Charge

1. Close low side manifold hand valve.
2. Remove can tap from center hose.
3. Hold performance test if indicated.
4. Back seat the compressor service valves and remove the manifold gage set.
5. Replace all protective caps and covers.

Physical Checkout Of Air Conditioner Operation

1. With the air conditioner operating, feel all the lines and make sure that they are hot, warm, or cold where they should be. (Remember, from the discharge side of the compressor along the high pressure line, through the condenser, the receiver-drier tank and up to the expansion valve, everything should be hot or warm to the touch. The expansion valve, evaporator and all of the lines on the low pressure side leading back to the compressor should be cool to the touch. Any deviation from the above conditions indicates a malfunction in the system.
2. A stoppage or severe restriction is pinpointed in this manner. Malfunctions or stoppages in the system are apt to be indicated by extreme cold or frosted areas. (e.g. cold receiver-drier tank frosted part way up indicates a stoppage or serious restriction in the tank).

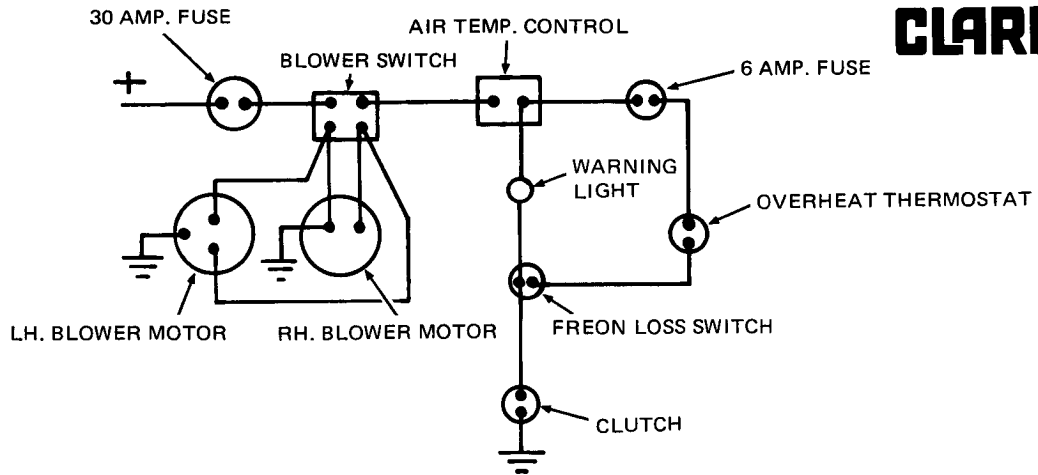
TROUBLESHOOTING PROCEDURES

Compressor clutch and related electrical controls

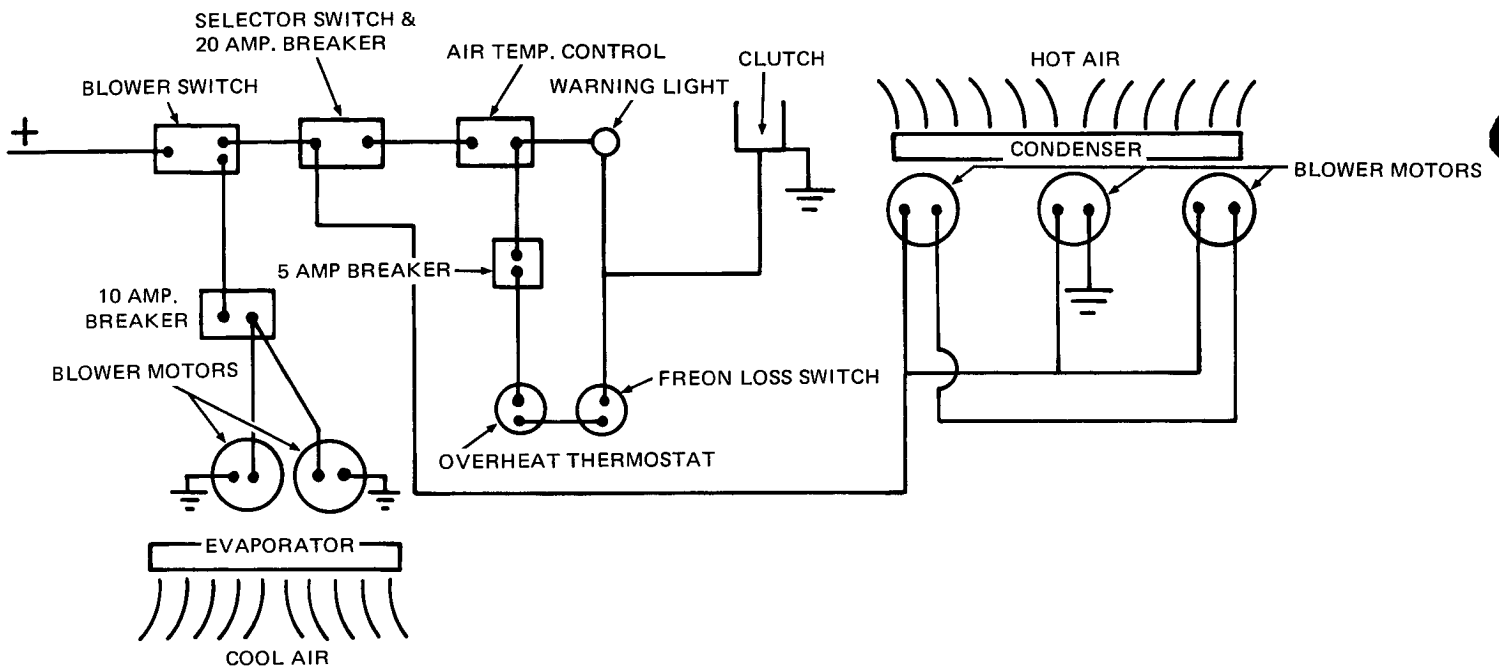
1. Turn tractor ignition "on" but do not start engine.
2. Turn selector switch to "air condition". Turn blower switch to "press". Condenser fans should stop and evaporator blower should continue running. The "blower" switch should change the speed of the evaporator blower only under either "air-condition" or "press".
3. With blower on, turn selector switch back to "air condition". Turn air conditioner thermostat to coldest setting and then back to its warmest setting. As you do this, you should be able to hear the clutch "click" as it engages and disengages.
4. Clutch — If clutch does not react in Step 3, connect a 12-volt battery (if it is a 12-volt system) 24-volt (if it is a 24-volt system) directly to the clutch. If the clutch does not engage, it is faulty and must be replaced. If the clutch does engage, proceed to Step 5.

CLARK

5. Clutch Circuit — Check all violet colored wiring for breaks and loose connections. Repeat Step 3. If clutch does not react, set temperature control back to its coldest setting, leave it there, and proceed to Step 6.
6. Overheat Thermostat — The overheat thermostat can be checked by removing the two violet wires from the thermostat lead wires. Connect the two violet wires together. If the clutch engages, the overheat thermostat is faulty and must be replaced. If the clutch does not engage, proceed to Step 7.
7. Freon-Loss Switch — The freon-loss switch is checked by removing the two violet wires from the switch terminals. Connect the two violet wires together. If the clutch engages, the switch might be faulty or the system might be low on refrigerant (Check sight glass). Check the pressure in the discharge line by attaching a gage to the compressor discharge service valve. If the pressure is over 45 psi, and the clutch engages when the wires are connected, the Freon-loss switch is definitely faulty and must be replaced. If the discharge line pressure is over 45 psi, and the clutch did not engage when the violet wires were connected together, proceed to Step 8.
8. Temperature Control — If you proceeded to this point, the temperature control is probably faulty. This can be checked by removing the two violet wires from the terminals and connecting the wires together. If the clutch engages, the control is faulty and must be replaced. (The control should still be set at its coldest position from Step 5).



45B AIR CONDITIONING -
HEATER WIRING SCHEMATIC
(CRENLO CAB)



75B, 125B, 475B AIR CONDITIONING -
HEATER WIRING SCHEMATIC
(CRENLO CAB)

TROUBLESHOOTING TIPS – AIR CONDITIONER

Complaint: Draft

Possible Causes:

Poor air distribution

Cab temperature too cold

Corrective Action:

Adjust air louvers in air discharge chamber.

Adjust thermostat to warmer position. Set blower to "Med" or "Lo". Check to see that expansion valve sensing bulb is clamped to evaporator outlet.

Complaint: Inadequate air flow

Possible Causes:

Air flow restricted

Faulty evaporator blower motor

Corrective Action:

Check air passages for obstructions and evaporator for excessive dirt deposits.

Check evaporator motor and blower.

Complaint: Water leaking or dripping from conditioner compartment

Possible Causes:

Drip pan or drain tube clogged or kinked

Corrective Action:

Clean pan and outlet. Check drain tubes.

Complaint: Hissing Noise at expansion valve

Possible Causes:

Shortage of refrigerant (Check sight glass for bubbles)

Restriction in system

Corrective Action:

Check for leaks in system.

Check filter screen at entrance to expansion valve. Check for kinks in hoses. Check receiver for uniformity of temperature.



Complaint: Partial frosting and sweating of lines combined with poor cooling.

Possible Causes:

Compressor belt slipping

Shortage of refrigerant

Restricted or clogged liquid line

Expansion valve malfunctioning

Corrective Action:

Adjust belt tension.

Check sight glass, add refrigerant per instructions.

Check receiver-drier

Replace expansion valve.

Complaint: Failure to cool.

Possible Causes:

Lost refrigerant (completely)

Broken compressor drive belt

Clutch not engaging

Expansion valve not functioning

Corrective Action:

Locate leak and repair. Check compressor oil level, replace refrigerant.

Install new belt.

Check clutch, freon loss switch, overheat thermostat, temperature control and wiring.

Replace expansion valve.

Blockage in system

Locate block and repair.

Complaint: Gage reading on high side above 250 PSI. (under normal summer conditions)

Possible Causes:

Excessive refrigerant or air in system

Blocked air circulation through condenser

Condenser fan malfunctioning

Restricted discharge line

Corrective Action:

Discharge system or evacuate and recharge system.

Clean condenser with brush, compressed air, or cold water.

Check condenser motor, fans, and shaft bearing.

Check hose for kinks.

Complaint: Gage reading below 140 PSI on high side. (under normal summer conditions)

Possible Causes:

Shortage of refrigerant

Faulty compressor

Compressor belt slipping

Corrective Action:

Check for leaks and recharge.

Replace compressor unit.

Adjust belt tension.



CLARK

Complaint: High gage reading on low side of system.

Possible Causes:

Compressor belt slipping

Over feeding of expansion valve

Faulty compressor

Corrective Action:

Adjust belt tension

Check expansion valve for poor bulb contact to evaporator outlet.

Replace compressor unit.

Complaint: Gage reading below 5 PSI on low pressure side. (under normal summer conditions)

Possible Causes:

Shortage of refrigerant

Restriction in suction line, receiver tank, or expansion valve screen

Evaporator dirty or iced-up

Corrective Action:

Check and repair leaks and recharge system.

Check lines for kinks. Check over-all temperature of receiver tank. Check expansion valve.

Check evaporator for foreign matter. If iced-up, check temperature control.

High Compressor Out Pressure
Indicates:

1. Air in system or overcharge of refrigerant.
2. Blocked air circulation through condenser.
3. Stuck expansion valve.
4. Restricted discharge line.
5. Faulty condenser motor or fans.

Low Compressor Out Pressure
Indicates:

1. Faulty compressor.
2. Shortage of refrigerant.
3. Expansion valve not closing.
4. Compressor belt slipping.

Shortage of Refrigerant
Indications:

1. Hissing noise at expansion valve.
2. Sight glass shows foam or bubbles.
3. High evaporator coil temperature.
4. Low head pressure.
5. No moisture forming on evaporator.
6. Rapidly cycling compressor clutch.

Poor Or No Refrigeration Causes:

1. Shortage of refrigerant.
2. Expansion valve screen clogged with foreign material.
3. Faulty thermo-bulb on expansion valve.
4. Faulty compressor.
5. Heavily frosted evaporator coil. (Air flow blocked.)
6. Partially stopped receiver-drier, liquid line or suction line.
7. Compressor belt slipping or broken.
8. Faulty compressor clutch.

Needle Stuck Open in Expansion
Valve Indications:

1. Frost or excessive sweating on suction line.
2. Low head pressure.
3. High suction pressure.

WARNING LIGHT REACTION AND DIAGRAM

WARNING LIGHT REACTION	POSSIBLE CAUSES	THINGS TO OBSERVE WHEN INVESTIGATING	THINGS TO CHECK OR DO TO CORRECT THE PROBLEM
Warning light comes on and stays on constantly.	<ol style="list-style-type: none"> 1. Outside Temp. below 48° F. 2. Refrigerant is lost or extremely low. 	<ol style="list-style-type: none"> 1. Is outside Temp. below 48° F? 2. Fusible plug blown? Sight glass cannot be checked because compressor will not start. 	<ol style="list-style-type: none"> 1. Wait until day gets warmer. If light stays on, there is a malfunction in the system. 2. If fusible plug is blown, check entire system for malfunction, especially clutch overheat thermostat, condenser fans, core. If plug is not blown, jump refrigerant loss switch. If clutch engages, system is low on refrigerant or refrigerant loss switch failed. If system pressure is below 45 psi, system is low on refrigerant. If pressure is above 45 psi, switch is failed.
	<ol style="list-style-type: none"> 3. Burned out clutch field or faulty field. 	<ol style="list-style-type: none"> 3. Discolored clutch. Melted epoxy running out of clutch. Drive belt heat cracked. Clutch fuse will be blown. 	<ol style="list-style-type: none"> 3. Replace clutch. Drive belt <u>must</u> be cut or removed until repairs are made.
	<ol style="list-style-type: none"> 4. Short circuit in control circuit or failure of a switch in circuit. (Violet wiring) 	<ol style="list-style-type: none"> 4. Clutch fuse might be blown. Violet wire might be pinched or frayed. 	<ol style="list-style-type: none"> 4. Check all violet wiring for short circuits. Check all switches in circuit for failure. Check for good electrical connections in circuits.
Warning light comes on and cycles on and off.	<ol style="list-style-type: none"> 1. Condenser is overheating. 	<ol style="list-style-type: none"> 1. Condenser core dirty or covered with chaff. Condenser motors not operating. 	<ol style="list-style-type: none"> 1. Clean condenser core or correct condenser fan failure. (motor, switch, wiring)

WARNING LIGHT REACTION AND DIAGNOSIS – CONTINUED

WARNING LIGHT REACTION	POSSIBLE CAUSES	THINGS TO OBSERVE WHEN INVESTIGATING	THINGS TO CHECK OR DO TO CORRECT THE PROBLEM
Warning light comes on and cycles on and off.	2. Severe restriction in high side between compressor and refrigerant loss switch.	2. Change in temp. at point of restriction. Likely to be at condenser or receiver-drier. High side pressure will be excessively high.	2. Replace restricted component or remove restriction if possible.

Service School Topic.....

DATE: 1 October 1980

SST-16A

SUBJECT: Lease AFEX Incorporated, Fire Suppression System
used by Clark Equipment Company.

DESCRIPTION: (See Figure 1)

This system is an automatic heat-sensing fire suppression system designed to work with a high degree of reliability on mobile equipment in most types of weather, temperature, and operating conditions. It is available as an option on some models.

The system consists of a thirty (30) pound dry chemical extinguisher which is pressurized by a gas cartridge containing either CO₂ or, for low temperature operation, nitrogen (N₂). The multipurpose dry chemical is distributed through hinge covered nozzles (maximum of six [6]) by steel tubing fitted with vibration resistant connectors. The sensors are normally open point thermal type and have a closing temperature of 300°F., reopening at 255°F. They are shock resistant and vibration resistant. The sensors are wired in parallel using 250°C (482°F) rated trunk wire. Closing of any one of the sensors can cause the system to operate. A self-contained battery provides independent power for operation. (In the low temperature unit, the equipment battery is used instead.)

The triggering mechanism is actuated by a squib* device. The gases from the squib discharge power to a piston and puncture pin down which ruptures a disc-seal in the neck of the gas cartridge. The pressurizing gas is fed into the extinguisher through a gas tube which is perforated and runs vertically the height of the powder. The gas, in passing through the powder, agitates it, even when severely compacted, insuring total discharge. There is also a manual over-ride rod or lever for mechanical operation.

NOTE: Some suppression systems are equipped with a manual electrical switch for manual operation. To reduce the chance of accidentally setting off the system, this switch (located on the control box) may be removed. Disconnect the wire leads and tape the ends with electrical tape then remove the switch.

OPERATION

When any one of the sensors is heated to 300°F., it closes the self-contained circuit, causing the squib to discharge. The resultant gases force the piston downward driving the piercing rod through the seal in the neck of the pressuring bottle.

The pressurizing gas is then carried by a 1/4" hose to the gas tube fitting on the upper side of the extinguisher shell. The gases pass through the perforations in the gas tube, which is buried the full height of the dry chemical powder, causing vigorous agitation of the powder, "fluidizing" the powder even when severely compacted.

An aluminum "blow-out" disc in the discharge outlet at the bottom of the extinguisher ruptures at 200 PSI, allowing the powder to be forced through the distribution tubing to the nozzles. This disc prevents moisture from entering the extinguisher and "cementing" the powder.

*A small electric device used to ignite a charge.

EXTINGUISHER

CONTROL BOX

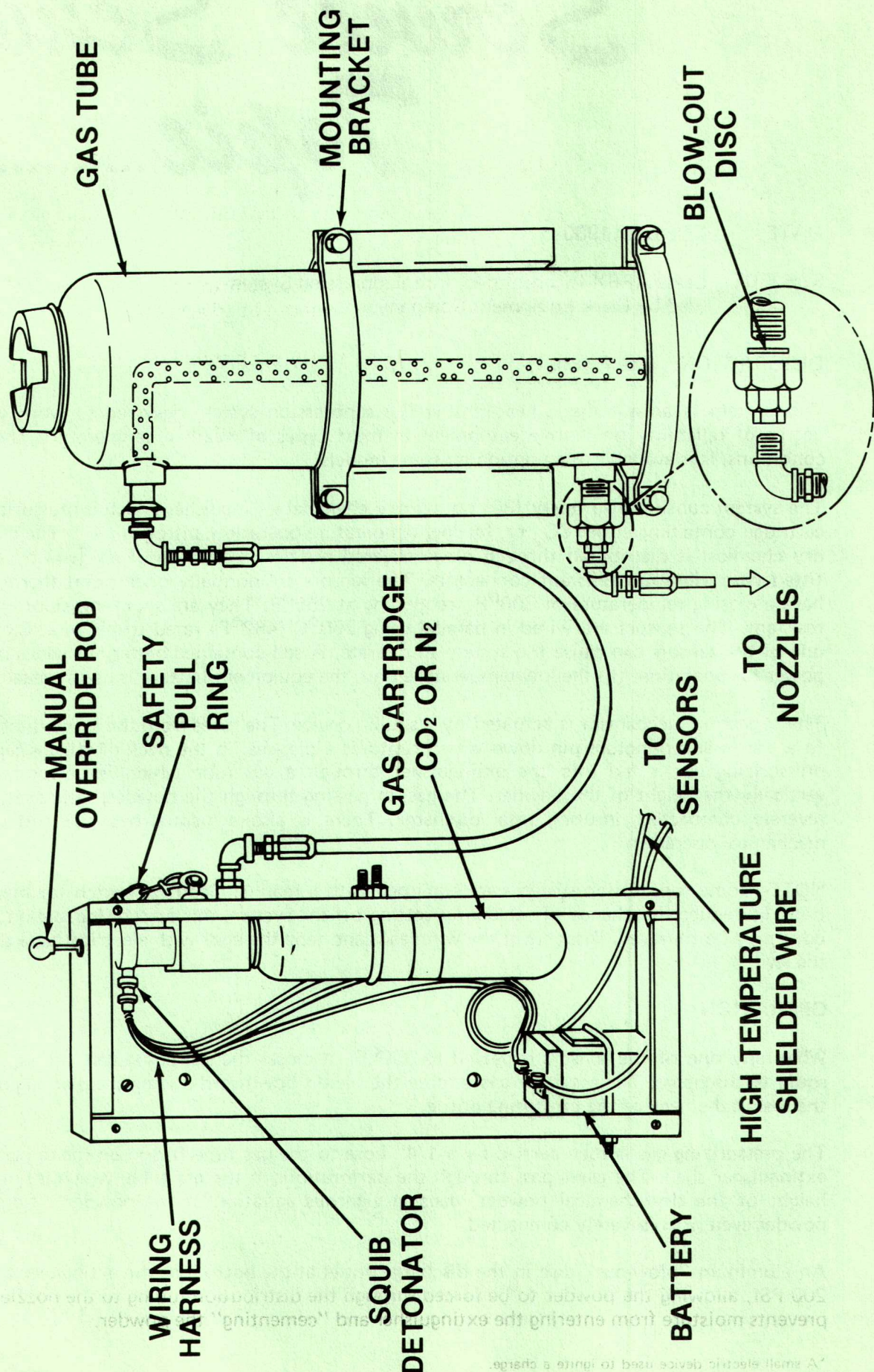


Figure 1

The nozzles have hinged covers which prevent oil, dust, or other debris from clogging the nozzle openings. They are semi-directional and will throw powder in a cone shaped cloud 8-10 feet away. The turbulence of this discharge is such that the powder is distributed throughout a predetermined area, totally blanketing these areas of the machine. The system is permanent and in the event of a fire, will generally only require recharging and a new squib charge to be fully operative again. With its own battery powered electrical system, it is not dependent on the machine battery for operation, and provides 24 hour protection whether the operator is present or not. A mechanical over-ride rod or lever is provided for emergency operation.

If a fire occurs, temperatures of 300° F. will cause the system to operate automatically. In the event of emergency or at the operator's choice, the system can be triggered manually by:

An over-ride rod or lever that is attached to the top of the piston. Pull the safety pin and press sharply down to operate the system.

When a fire occurs, activate the system *immediately*. Do not wait for the system to trigger automatically.

INSTALLATION (Refer to figure 2)

One "AFEX" system will normally suppress fire in a 400-500 cubic feet area of enclosed engine-transmission space. With five (5) nozzles excellent distribution of dry chemical is obtained. Two (2) or three (3) nozzles are generally used to cover the engine space and one (1) or two (2) to cover the transmission-pump-filter space. Also, if the machine is equipped with an exposed brake, one nozzle should be directed to cover it.

The control panel and extinguisher should be located as close to the operator as possible. Mounting inside the cab, if possible, will give maximum protection from falling rock and debris. However, in many cases, the cab is too crowded for this type location. The system is not affected by weather; outside mounting is therefore acceptable. However, easy access for the operator to the manual-over-ride on the control box should be maintained.

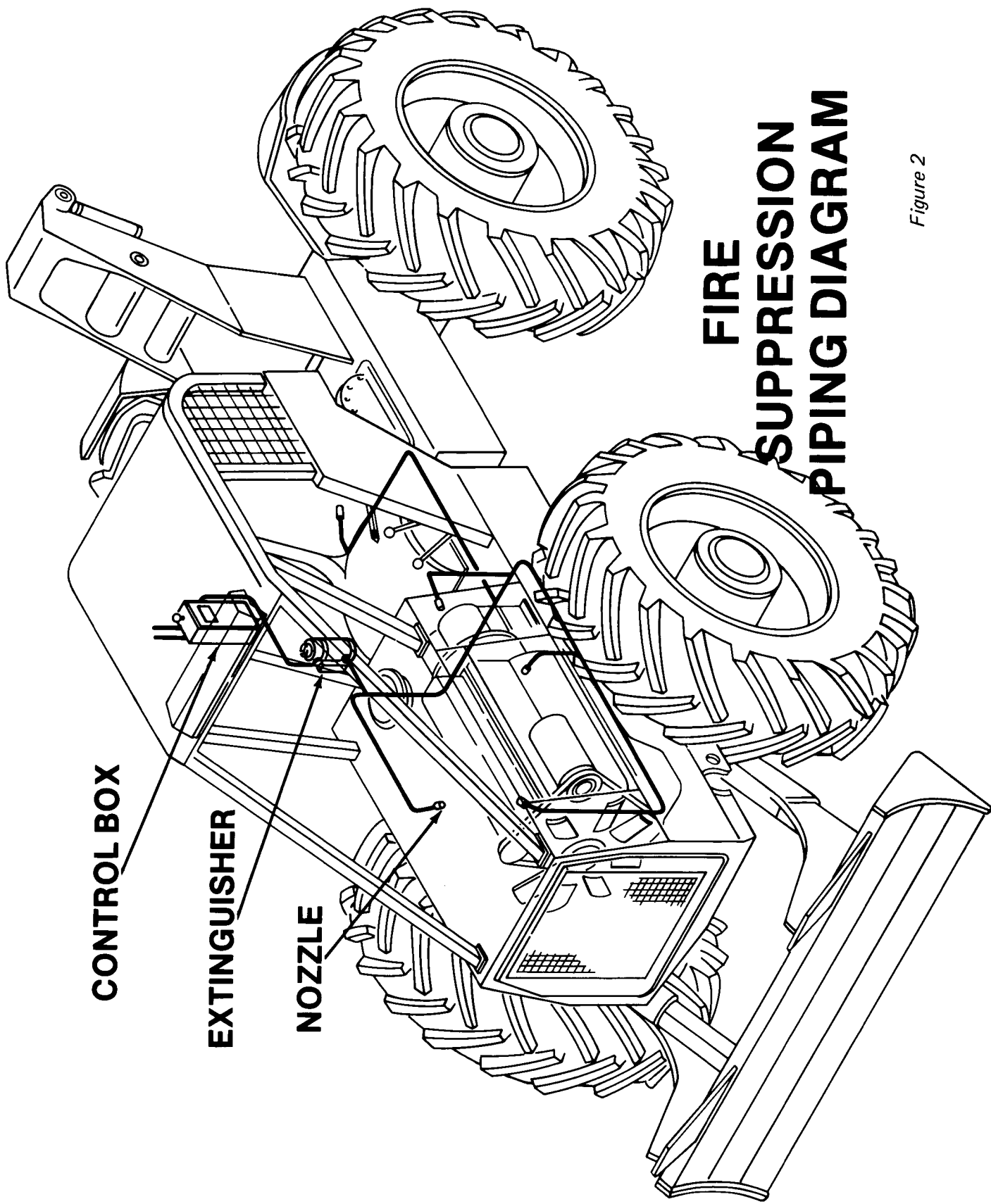
NOZZLES

Using the vibration resistant fittings and steel tubing supplied, the distribution piping system is installed and the nozzles fitted so that they cover the major fire hazards. These include engine, exhaust manifold, blower, or turbo-charger, fuel pump, hydraulic pump, filters, battery, converter, driveline brakes, and wherever hydraulic or fuel lines are close to the manifold or turbocharger.

Special conditions may exist where more than one system will be needed to provide adequate protection. These would include machines with large engine spaces (dual engine), over 400-500 cubic feet of space to be covered. Any number of systems may be installed and wired to discharge simultaneously or separately. On large machines, the systems fire simultaneously for total flooding, to prevent the fire from spreading from the affected area to non involved areas.

SENSORS (Reference Figure 3)

Sensors should be located so they are exposed to the most likely fire hazards. They also should be located as high as possible to catch the heat rise when fire starts. The transmission/converter, around pumps, heat deflector, belly pan, fuel pump, battery box, brakes, are areas that should be protected.



CONTROL BOX

EXTINGUISHER

NOZZLE

FIRE SUPPRESSION PIPING DIAGRAM

Figure 2

FIRE SUPPRESSION ELECTRICAL SYSTEM

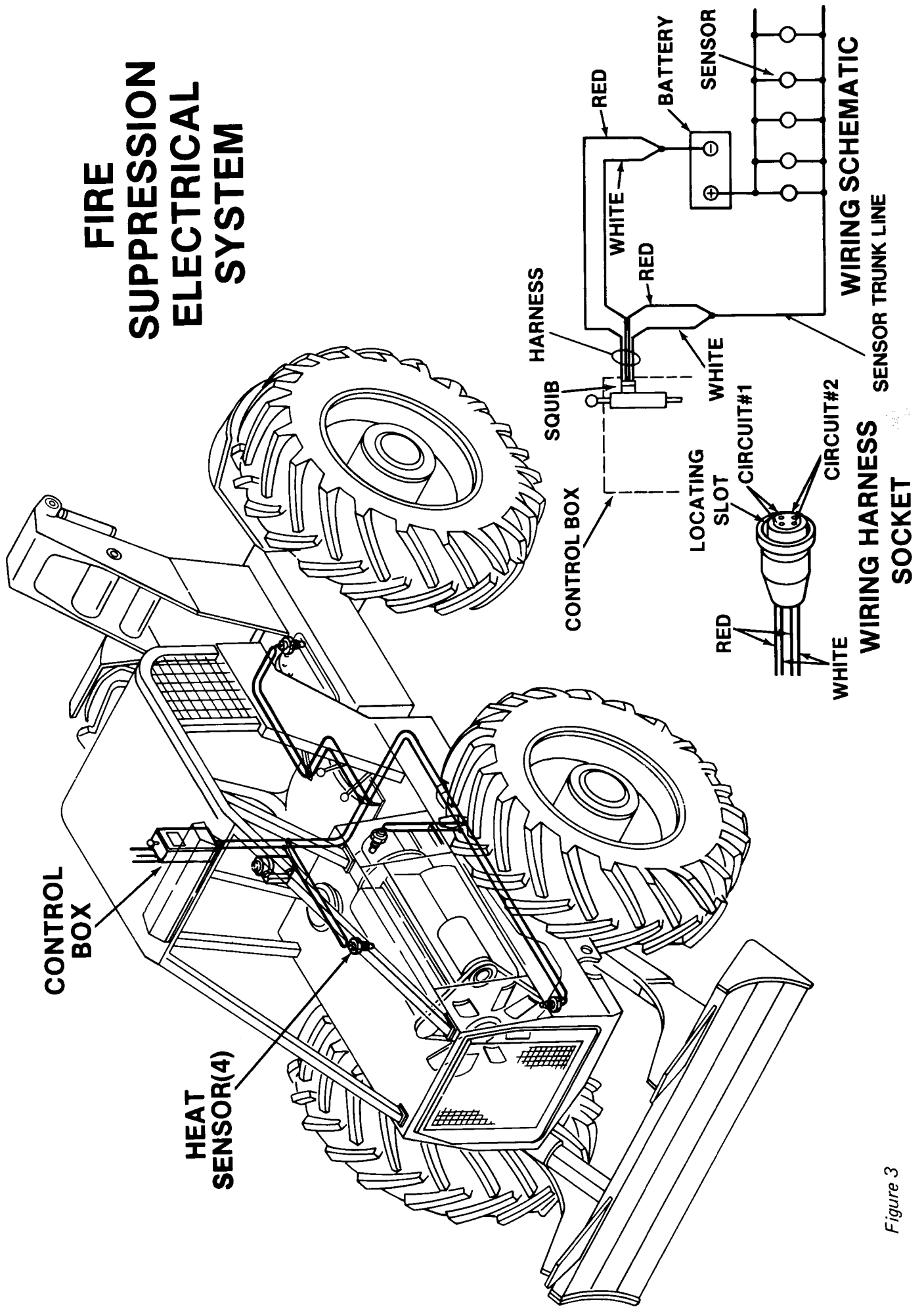


Figure 3

FIELD INSTALLATION

IMPORTANT: Installation in accordance with these instructions is essential for proper operation of the system.

PIPING

1. Remove extinguisher from bracket by unbolting the two "U" straps. Mount the bracket on the canopy using back-up straps and 3/8" bolts. (See Fig. 2 – Piping Diagram drawing)

NOTE: The Bracket Must Be Mounted So Extinguisher Is In Vertical Position.

2. Mount the control box on the side of canopy using back-up plates and 3/8" bolts.
3. Remount extinguisher with lower outlet facing forward.
4. Connect control box outlet to extinguisher inlet using 1/4" I.D. single braid hydraulic hose.
5. 1/2" and 3/4" tubing for piping is supplied as part of package. Flareless and vibration resistant fittings are also furnished. To install fittings simply cut tubing to required length and deburr ends. Slip fitting nut over tube end and bottom tube in fitting. Tighten fitting nut until it bottoms. This will give a leak tight joint. Fittings will also stand some misalignment and will sustain continued vibration without failing. Install piping and hose as required for adequate coverage. Bend tubing as required using a tubing bender. This will prevent kinking of the tubing.

NOTE: Feed Lines Must Enter Tee's At the Center (or Branch) And Not At End (or Leg).

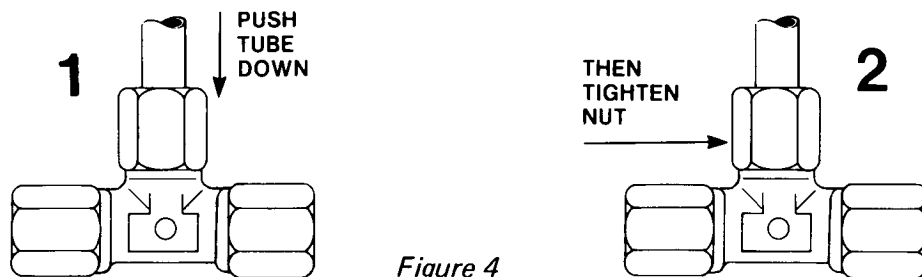


Figure 4

NOZZLES

1. Care must be taken to install nozzles for maximum sweep and best discharge direction. Spring cap will initially spray some powder down and behind nozzle until fully open. Nozzles are drilled with three openings to create fog or cloud of powder and will spray out up to 10 feet. Nozzle location may be varied to suit particular conditions or to cover areas determined to be of highest hazards. Normally nozzles will be mounted so as to spray slightly in toward center of machine as well as slightly up or down vertically depending on location.

SENSORS

1. Install sensors near fire hazard areas.

2. On old flat sensors: (See Figure 5)

Use 1/8" x 1" flat bar cut approximately 7" to 12" long to mount sensors. Drill 3/4" hole in one end and 7/16" hole in other. Thread sensor wires through 3/4" hole and carefully pull sensor head through hole so flanges are flush with flat bar. Then drill two (2) 1/8" mounting holes and attach sensor.

3. On new cylinder shaped sensors: (See Figure 5)

Use bracket provided with kit.

4. Using any convenient bolt, (except around exhaust manifold) bolt down bracket.

A) On old style sensors, bend as necessary so sensor is positioned with silver side down and flat.

B) New style should be installed so that cylinder section is exposed to free moving air.

5. Mount other sensors and connect with high temperature wire in parallel circuit as shown in Figure 3.

6. Sensors must be adequate distance (6" to 11") from turbo-charger and exhaust manifold as high operating temperature could trigger system accidentally.

7. Connect to battery (\pm) terminal as shown in wiring schematic.

NOTE: Before releasing any machine with a newly installed fire suppression system, the system must be thoroughly checked out for proper installation. To check out a system, the "Field Inspection Procedure" may be followed.

FIELD INSPECTION PROCEDURE

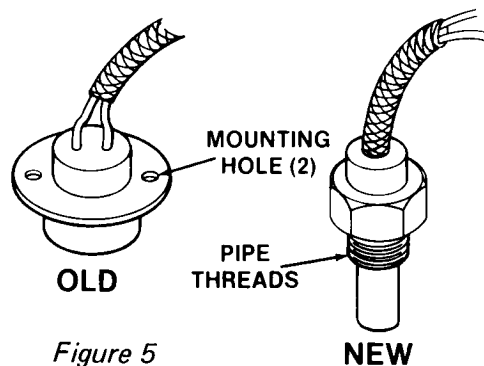
NOTE: When checking the suppression system, be sure to have a hand fire extinguisher handy.

1. Remove battery box cover.
 - a. Inspect for damaged or missing parts, frayed lines.
 - b. Disconnect the wiring harness from the squib detonator.
 - 1) This is to disarm the system and prevent accidental discharge.
2. Remove squib and check if it has not been discharged. The red seal will be intact.
3. Remove the gas cartridge by turning it counter clockwise. If the cartridge has not been discharged (the seal intact), the bottle should be weighed. The normal charged weight of each bottle is stamped in ounces near the top. If there is more than 1 ounce (28 grams) difference between the stamped and actual weight, the bottle should be recharged or replaced to insure a proper charge at all times.
4. Pull safety chain and pin from manual over-ride rod and operate rod to insure that it functions smoothly. Lubricate pin and cylinder with a few drops of light machine oil, or remove and clean if needed.

NOTE: Reinstall safety pin.

Safety ring and over-ride rod must be in place for system to operate automatically.

5. Check the 12 volt dry cell battery (if equipped) with volt meter. It should read no lower than 11.5 volts. (Replace if necessary)
6. To check system for shorts using a test light: (Reference figure 3)
 - a. With test light leads plugged into circuit #1, light should not come on.
 - b. Repeat step a. for circuit #2.
 - c. If the light comes on, it indicates there is a short somewhere in the system or one of the sensors has closed and not reopened.
 - d. Repair wiring or replace parts as needed.
7. To check heat sensors:
 - a. Plug test light into circuit #1 or #2. (Reference figure #3)
 - b. Using propane torch, cigarette lighter, or any low flame heat source, hold flame under the sensor until the test light comes on. (Approximately 15-20 seconds)
 - c. Remove flame from sensor and wait for test light to go out. (2-3 minutes)
 - d. Check all sensors on the machine in this manner.
 - e. If light fails to come on, sensor is faulty or wiring is damaged. Repair or replace as necessary.
8. If machine is equipped with the old style sensors, it is advisable to replace them with the new style sensors and brackets if service is necessary.



9. Piping and Nozzles.

- a. Inspect the tubing for crimped or damaged tubes, loose clips, and loose fittings.

- b. Check each nozzle to insure that the dust flap opens and closes properly and that there is no mud, grease, or other material plugging the holes. (If there is grease in the nozzle, this indicates that it is probably mistaken for a grease fitting and the tubing is probably full of grease and will have to be thoroughly cleaned.)
10. Check that extinguisher is full of dry chemical.
11. Take union apart and check that bursting disc is intact and installed correctly. Reconnect the union.
12. Screw harness onto squib.
13. Screw gas cartridge into holder, first checking to be sure piercing rod is pushed up fully and safety pin is installed.
14. Close control box.

REMEMBER . . . GOOD HOUSEKEEPING IS THE BEST FIRE PROTECTION YOU CAN HAVE! Clean machine periodically with steam cleaner or high pressure washer, wipe off oil spills and accumulations of grease. These are fuel for fires.

MAINTENANCE INSTRUCTIONS

IMPORTANT: Proper maintenance of this system is necessary to insure its optimum performance.

1. Check periodically to be sure all wiring and tubing is intact.
2. Replace battery every twelve (12) months.
3. Each three (3) months, conduct inspection and check as in "Field Inspection Procedure". *Be sure to first disconnect harness connector from squib then remove gas cartridge.*

AFTER FIRE INSTRUCTIONS

This procedure should be completed as soon as possible after any fire.

1. Check entire machine for any remaining fire or smoldering embers. Wash down as soon as possible. Remove any debris remaining and clean machine completely.
2. Disconnect 1/4" hose from extinguisher shell. Loosen union at bottom of extinguisher. Unbolt bracket and remove extinguisher from bracket.
3. All lines must be blown out with compressed air.
4. Replace bursting disc in union with flat side of disc facing in.
5. Remove top of extinguisher, clean threads, lubricate "o" ring, and refill with Ansul Foray powder or equal (ABC Dry Chemical). Replace top and set extinguisher back in bracket. Tighten bracket clamp, and union.
6. Check all nozzles and sensors for any damage. Replace if needed. Conduct check for operation as in "Field Inspection Procedure".

7. Replace squib charge. Use caution when handling squib charge. Remove plastic cap and shunt spring from new squib. Connect harness.
8. Replace gas cartridge and tighten "U" bolt.

"SPECIAL INSTRUCTIONS"

The AFEX system can be activated by both arc and oxyacetylene welding equipment. Before using any such welding equipment in the vicinity of the system, disconnect the squib and have a hand fire extinguisher close by in case of fire.

"NOTICE"

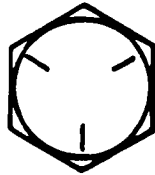
The Lease AFEX Fire Suppression System is, as the name implies, merely a system designed to suppress a fire and other means may be required to completely extinguish the fire. FURTHERMORE, THE INSTALLATION OF THIS SYSTEM IN NO WAY WARRANTS, GUARANTEES, OR IMPLIES ABSOLUTE PROTECTION AGAINST DAMAGE CAUSED BY FIRE. NO OBLIGATION OF ANY KIND IS ASSUMED FOR FIRE DAMAGE OR LOSS OR ANY OTHER LOSS OR INJURY TO PERSON OR PROPERTY RESULTING FROM FIRE OR INSTALLATION OF THIS SYSTEM. The operator is cautioned to initially check for proper installation and to maintain periodic checks according to instructions furnished with the system. The obligation of Clark and the manufacturer is limited to replacing any parts at no expense which are found to have manufacturing defects within a period of six months from date of purchase of the system.

THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL CLARK BE RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

BOLT TORQUE CHART, GENERAL

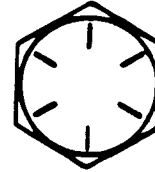
Note: Use this chart only if the torque is not shown on the BOLT TORQUE CHART, APPLICATION.

Grade 5 Identification, 3 Radial
Dashes 120° Apart on Head of Bolt



TS-34049

Grade 8 Identification, 6 Radial
Dashes 60° Apart on Head of Bolt



TS-34050

Thread Diameter		GRADE 5			GRADE 8			Socket Head and 12 Point Head Cap Screws		
		Part Number Prefixes Coarse Thread 1C, 15C, 61D Fine Thread 2C, 16C, 62D			Part Number Prefixes Coarse Thread 17C, 23C, 63D Fine Thread 18C, 24C, 64D			Part Number Prefixes Coarse Thread 25C, 73G, 93G Fine Thread 26C, 74G, 94G		
Fraction	Decimal	lbf-ft	N-m	kgf-m	lbf-ft	N-m	kgf-m	lbf-ft	N-m	kgf-m
1/4	0.2500	7	9.5	0.9	9-10	12.2-13.6	1.2-1.4	11-12	14.9-16.3	1.5-1.7
5/16	0.3125	15-16	20.3-21.7	2.1-2.2	18-20	24.4-27.1	2.5-2.8	23-25	31.2-33.9	3.2-3.5
3/8	0.3750	25-28	33.9-38.0	3.5-3.9	35-40	47.5-54.2	4.8-5.5	45-50	61.0-67.8	6.2-6.9
7/16	0.4375	40-45	54.2-61.0	5.5-6.2	60-65	81.3-88.1	8.3-9.0	70-75	94.9-101.7	9.7-10.4
1/2	0.5000	65-70	88.1-94.9	9.0-9.7	90-100	122.0-135.6	12.4-13.8	110-120	149.1-162.7	15.2-16.6
9/16	0.5625	90-100	122.0-135.6	12.4-13.8	125-140	169.5-189.8	17.3-19.4	150-165	203.4-223.7	20.7-22.8
5/8	0.6250	125-140	169.5-189.8	17.3-19.4	175-190	237.3-257.6	24.2-26.3	210-230	284.7-311.8	29.0-31.8
3/4	0.7500	220-245	298.3-332.2	30.4-33.9	300-330	406.7-447.4	41.5-45.6	360-400	488.1-542.3	49.8-55.3
7/8	0.8750	330-360	447.4-488.1	45.6-49.8	475-525	644.0-711.8	65.7-72.6	600-650	813.5-881.3	83.0-89.9
1	1.0000	475-525	644.0-711.8	65.7-72.6	725-800	983.0-1084.7	100.2-110.6	900-1000	1220.2-1355.8	124.4-138.3
1-1/8	1.1250	650-720	881.3-976.2	89.9-99.5	1050-1175	1423.6-1593.1	145.2-162.4	1300-1450	1762.6-1965.9	179.7-200.5
1-1/4	1.2500	900-1000	1220.2-1355.8	124.4-138.3	1475-1625	1999.8-2203.2	203.9-224.7	1850-2000	2508.3-2711.6	255.8-276.5
1-3/8	1.3750	1200-1350	1627.0-1830.4	165.9-186.6	2000-2200	2711.6-2982.8	276.5-304.2	2450-2700	3321.8-3660.7	338.7-373.3
1-1/2	1.5000	1500-1650	2033.7-2237.1	207.4-228.1	2600-2850	3525.1-3864.0	359.5-394.0	3150-3450	4270.8-4677.6	435.5-477.0
1-5/8	1.6250	2000-2200	2711.6-2982.8	276.5-304.2	3450-3800	4677.6-5152.1	477.0-525.4	4150-4600	5626.6-6236.8	573.8-636.0
1-3/4	1.7500	2500-2750	3389.5-3728.5	345.6-380.2	4300-4800	5830.0-6507.9	594.5-663.6	5100-5700	6914.7-7728.2	705.1-788.1
1-7/8	1.8750	3150-3500	4270.8-4745.4	435.5-483.9	5500-6100	7457.0-8270.5	760.4-843.4	6500-7200	8812.8-9761.9	898.7-995.4
2	2.0000	3800-4200	5152.1-5964.4	525.4-580.7	6500-7200	8812.8-9761.9	898.6-995.4	7800-8600	10575.4-11660.0	1078.4-1189.0

Note: The torque values shown are for fasteners coated with zinc phosphate and oil, and used with hardened plain or zinc phosphate and oil coated washers.

CLARK

Service gram

August 5, 1959

SG-125

Subject: Cleaning Parts Prior to Use in
 Overhaul and Repair Operations

Field investigation has disclosed that in many cases component parts are being drawn from Distributor parts stocks and utilized in overhaul and repair operations without cleaning prior to use.

It is an absolute necessity that all parts be properly cleaned prior to use. Many parts are coated with a rust preventive which is not compatible with lubricants used in the machines of which they will become part of. All metallic parts (except bearings) should be washed thoroughly in a solvent type cleaner and dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil or lapping compound. When laying out parts prior to incorporation in an assembly they should be placed on a clean surface and covered with clean paper or cloth.

Please arrange to caution all personnel involved in overhaul and repair operations with regard to this subject.

CLARK

Service gram

10 December 1975

MICHIGAN SG-376B
Group Ref. No. 1500

(This bulletin supersedes Service Gram SG-376A, dated 21 March 1973.
REASON: Updated to provide latest part number data).

SUBJECT: Heater Assemblies
1510660 (12 Volt) and 1510661 (24 Volt)

(This Service Gram voids and supersedes Service Gram SG-304A dated 26 June 1970, SG-391A dated 26 May 1970 and SG-332A date 5 Jan. 1970.
REASON: To update data and include usage of new, improved heater assemblies).

New and improved heater assemblies are now in use for installation in Series III & IIIA machines as outlined herein. The new heaters incorporate the use of Leece-Neville motors and offset aluminum blower wheels replacing the previously used Tenna motors and metal tap-type blower wheels. The new assemblies are easily identified by viewing the motor end of the blower assembly as shown in illustrations below (blower assemblies removed from heater case for photo purposes). Figure 1 illustrates the old style and Figure 2 illustrates the new style.

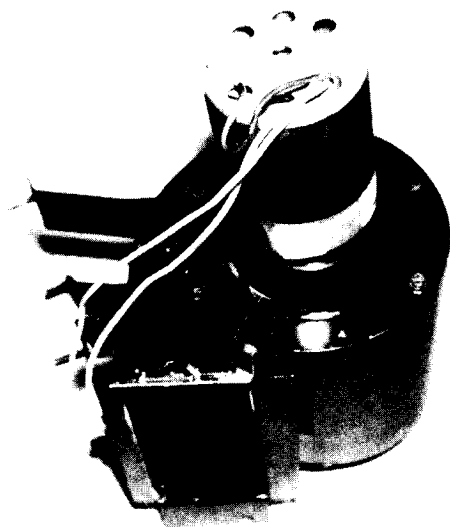


Figure 1 Old Style

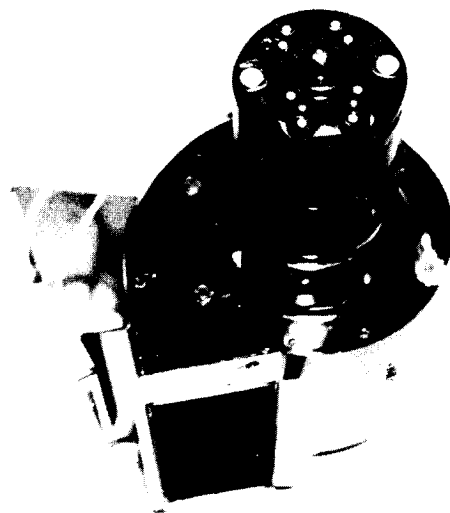


Figure 2 New Style

As a result of the above described changes, the following part number supersedences apply:

Heater Assemblies

12V - 1510660 supersedes 1505845
24V - 1510661 supersedes 1505844

Blower Assemblies

12V - 948957 supersedes 948333
24V - 948958 supersedes 948334

When replacing the following listed components of old style heater assemblies, complete blower assemblies must be used as shown for respective 12 Volt and 24 Volt applications. To install the new blower assemblies in old style heaters, two (2) additional holes must be drilled in the heater case to accomodate the two added studs on the blower assemblies. Templates are supplied with the new blower assemblies for this purpose.

947922	12 Volt Motor)	
948977	12 Volt Motor)	12V - 948957 Blower Assy.
947923	24 Volt Motor)	Use -
947947	Blower Wheel)	24V - 948958 Blower Assy.
948992	Blower Wheel)	
947979	Blower Housing)	

The new heater assemblies may be installed in Series III and IIIA machines by using parts listed below and installing same in accordance with instructions given herein.

PARTS REQUIRED PER MACHINE:

55-III & 75-III G. M. Heater Installation

1	-	1510660	Heater Assembly
5	-	23C-612	Bolt, Heater to Seat Support Plate
5	-	4E-06	Lockwasher
5	-	656672	Washer
1	-	1508863	Wire Assembly
1	-	611074	Fuse 20 Amp
4	-	23C-412	Bolt, Adapter to Seat Support Plate
4	-	4E-04	Lockwasher
4	-	655629	Washer
1	-	1529688	Hose (Bulk cut 20 ft.)
2	-	30H-50	Clip
1	-	19F-6	Reducing Bushing
1	-	552433	Valve - Heater Shut-Off
1	-	666867	Nipple - Straight
4	-	521874	Clamp
*1	-	1538822	Suction Tube - Steer Pump

*Before installing heater, replace steer pump suction tube with 1538822.

55-IIIA Cummins & G. M. Heater Installation

1	- 1510660	Heater Assembly
5	- 23C-612	Bolt, Heater to Seat Support Plate
5	- 4E-06	Lockwasher
5	- 656672	Washer
1	- 1511475	Wire Assembly
1	- 611074	Fuse 20 Amp
4	- 23C-412	Bolt, Adapter to Seat Support Plate
4	- 4E-04	Lockwasher
4	- 655629	Washer
1	- 1529688	Hose (Bulk cut 20 ft.)
6	- 1539058	Cable Tie
1	- 19F-6	Reducing Bushing
1	- 552433	Valve, Heater Shut-off
1	- 666842	Nipple 90°
4	- 521874	Clamp

75-IIIA Cummins Heater Installation

1	- 1510660	Heater Assembly
5	- 23C-612	Bolt, Heater to Seat Support Plate
5	- 4E-06	Lockwasher
5	- 656672	Washer
1	- 1508863	Wire Assembly
1	- 611074	Fuse 20 Amp
4	- 23C-412	Bolt, Adpater to Seat Support Plate
4	- 4E-04	Lockwasher
4	- 655629	Washer
1	- 1529688	Hose (Bulk cut 20 ft.)
2	- 31H-46	Clip
1	- 19F-6	Reducing Bushing
1	- 552433	Valve, Heater Shut-off
1	- 356622	Reducing Bushing
1	- 666854	Nipple 45°
4	- 521847	Clamp

75-IIIA G. M. Heater Installation

1	- 1510660	Heater Assembly
5	- 23C-612	Bolt, Heater to Seat Support Plate
5	- 4E-06	Lockwasher
5	- 656672	Washer
1	- 1508863	Wire Assembly
1	- 611074	Fuse 20 Amp
4	- 23C-412	Bolt, Adapter to Seat Support Plate
4	- 4E-04	Lockwasher
4	- 655629	Washer
1	- 1529688	Hose (Bulk cut 22 ft.)
2	- 31H-46	Clip
1	- 19F-6	Reducing Bushing
1	- 552433	Valve, Heater Shut-off
1	- 356622	Reducing Bushing
1	- 666854	Nipple 45°
4	- 521874	Clamp

85-IIIA Cummins Heater Installation

1	-	1510661	Heater Assembly
5	-	23C-612	Bolt, Heater to Seat Support Plate
5	-	4E-06	Lockwasher
5	-	656672	Washer
4	-	23C-412	Bolt, Adapter to Seat Support Plate
4	-	4E-04	Lockwasher
4	-	656629	Washer
1	-	1511475	Wire Assembly
1	-	635583	Fuse 15 Amp
1	-	1529688	Hose (Bulk cut 20 ft.)
6	-	1539058	Cable Tie
1	-	356618	Reducing Bushing
1	-	552433	Valve, Heater Shut-off
1	-	356617	Reducing Bushing
1	-	666854	Nipple 45°
4	-	521874	Clamp

85-IIIA G. M. Heater Installation

1	-	1510661	Heater Assembly
5	-	23C-612	Bolt, Heater to Seat Support Plate
5	-	4E-06	Lockwasher
5	-	656672	Washer
4	-	23C-412	Bolt, Adapter to Seat Support Plate
4	-	4E-04	Lockwasher
4	-	656629	Washer
1	-	1508863	Wire Assembly
1	-	635583	Fuse 15 Amp
1	-	1529688	Hose (Bulk cut 24 ft.)
2	-	546169	Tapped Block
2	-	31H-46	Clip
2	-	24C-616	Bolt
2	-	4E-06	Lockwasher
4	-	521874	Clamp
1	-	552433	Valve, Heater Shut-off
1	-	666842	Nipple 90°

125-IIIA Cummins Heater Installation

1	-	1510661	Heater Assembly
5	-	23C-612	Bolt, Heater to Seat Support Plate
5	-	4E-06	Lockwasher
5	-	656672	Washer
1	-	1508863	Wire Assembly
1	-	635583	Fuse 15 Amp
4	-	23C-412	Bolt, Adapter to Seat Support Plate
4	-	4E-04	Lockwasher
4	-	655629	Washer
1	-	1529688	Hose (Bulk cut 22 ft.)
3	-	30H-50	Clip
1	-	552433	Valve, Heater Shut-off
1	-	356617	Reducing Bushing
1	-	666854	Nipple 45°
4	-	521874	Clamp

125-IIIA, 175-IIIA, 280-IIIA G. M. Heater Installation

1	- 1510661	Heater Assembly
5	- 23C-612	Heater to Seat Support Plate
5	- 4E-06	Lockwasher
5	- 656672	Washer
1	- 1508863	Wire Assembly
1	- 635583	Fuse 15 Amp
4	- 23C-412	Bolt, Adapter to Seat Support Plate
4	- 4E-04	Lockwasher
4	- 655629	Washer
1	- 1529688	Hose (Bulk cut 24 ft.)
2	- 31H-46	Clip
1	- 19F-6	Reducing Bushing
1	- 552433	Valve, Heater Shut-off
1	- 666867	Nipple, Straight
4	- 521874	Clamp

175B, 275-IIIA, 275B, 280-IIIA Cummins Heater Installation

1	- 1510661	Heater Assembly
5	- 23C-612	Bolt, Heater to Seat Support Plate
5	- 4E-06	Lockwasher
5	- 656672	Washer
1	- 1508863	Wire Assembly
1	- 635583	Fuse 15 Amp
4	- 23C-412	Bolt, Adapter to Seat Support Plate
4	- 4E-04	Lockwasher
4	- 655629	Washer
1	- 1529688	Hose (Bulk cut 30 ft.)
5	- 30H-50	Clip
1	- 552433	Valve, Heater Shut-off
2	- 356617	Reducing Bushing
1	- 666854	Nipple 45°
4	- 521874	Clamp
1	- 568182	Restrictor

380-IIIA Cummins Heater Installation

1	- 1510661	Heater Assembly
5	- 23C-612	Bolt, Heater to Seat Support Plate
5	- 4E-06	Lockwasher
5	- 656672	Washer
1	- 1511475	Wire Assembly
1	- 635583	Fuse 15 Amp
4	- 23C-412	Bolt, Adapter to Seat Support Plate
4	- 4E-04	Lockwasher
4	- 655629	Washer
1	- 1529688	Hose (Bulk cut 30 ft.)
1	- 30H-50	Clip
4	- 31H-46	Clip
1	- 356618	Reducing Bushing
1	- 552433	Valve, Heater Shut-off
1	- 356622	Reducing Bushing
1	- 666854	Nipple 45°
4	- 521874	Clamp

380-IIIA Cummins Heater Installation (Cont'd.)

1	- 1509913	Bracket
2	- 24C-616	Bolt
1	- 4E-06	Lockwasher
1	- 18D-06	Locknut
1	- 522906	Tapped Block

475-IIIA Cummins Heater Installation

1	- 1510661	Heater Assembly
5	- 23C-612	Bolt, Heater to Seat Support Plate
5	- 4E-06	Lockwasher
5	- 656672	Washer
1	- 1511477	Wire Assembly
1	- 635583	Fuse 15 Amp
4	- 23C-412	Bolt, Adapter to Seat Support Plate
4	- 4E-04	Lockwasher
4	- 655629	Washer
1	- 1529688	Hose (Bulk cut 30 ft.)
6	- 31H-46	Clip
1	- 356618	Reducing Bushing
1	- 552433	Valve, Heater Shut-off
1	- 356622	Reducing Bushing
1	- 666854	Nipple 45°
4	- 521874	Clamp
1	- 1509913	Bracket
5	- 24C-616	Bolt
4	- 4E-06	Lockwasher
1	- 18D-06	Locknut
4	- 522906	Tapped Block

INSTALLATION PROCEDURE:

When installing a new heater kit (Part No. 1510660 on 55-III, 75-III, 55-IIIA and 75-IIIA or Part No. 1510661 on all other Series IIIA models) it may be necessary to rework the cockpit. To determine if cockpit is in need of reworking, compare section of cockpit shown in rework drawings (Figure 3 for 55-III and 75-III or Figure 4 for all Series IIIA machines) to cockpit of machine in which heater is to be installed. If cockpit does not match drawing, remove seat support and rework as shown. Install heater as follows:

1. Remove seat and seat support plate.
2. Refer to Figure 5 and install heater as shown. Heater has 5/8" movement fore and aft for outside air control.
3. Install plastic air deflector as shown.
4. Install air hose mounting adapter as shown.
5. Install air hose as shown.

6. Reinstall seat and seat support plate using original hardware.
7. Bolt heater to seat support plate as shown.

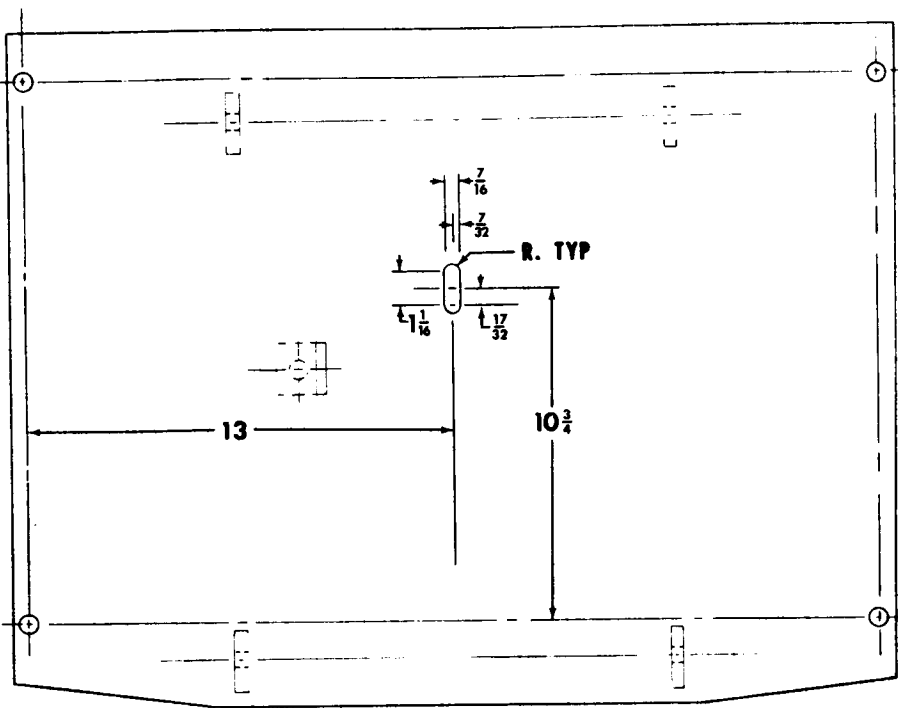
Connect Heater Wiring :

1. Thread heater wire next to cockpit wiring harness and fasten to harness with PVC tape below cockpit as shown in Figure 5.
2. Thread rest of wire through existing clips or fasten to harness with PVC tape as shown in Figure 5.
3. Connect heater wire to ignition switch as shown in Figure 6 using a 611074 20 amp fuse on all 12 volt installations and a 635583 15 amp fuse on all 24 volt installations.

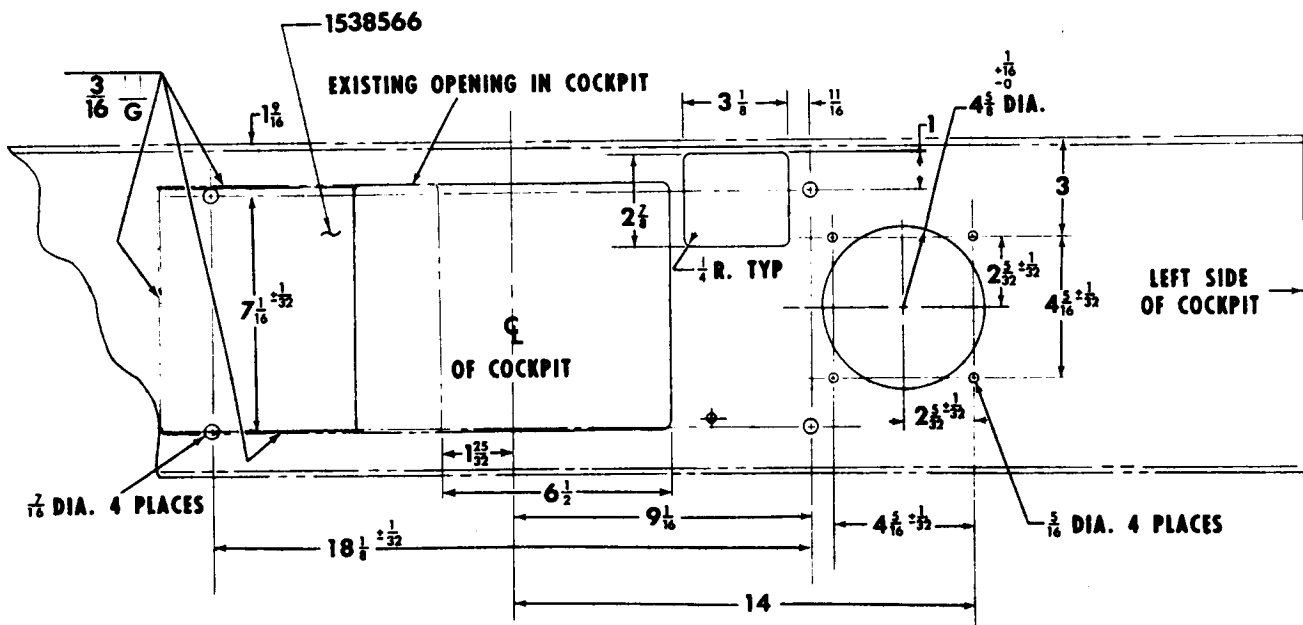
Connect Heater Plumbing:

1. Refer to plumbing diagram covering applicable model machine and connect heater supply and return hoses (1529688 cut to length as required) using specified hardware.

NOTE: Use AWS-E-7018 electrode on models requiring welding of tapped block to frame. Weld as shown on appropriate plumbing diagram.

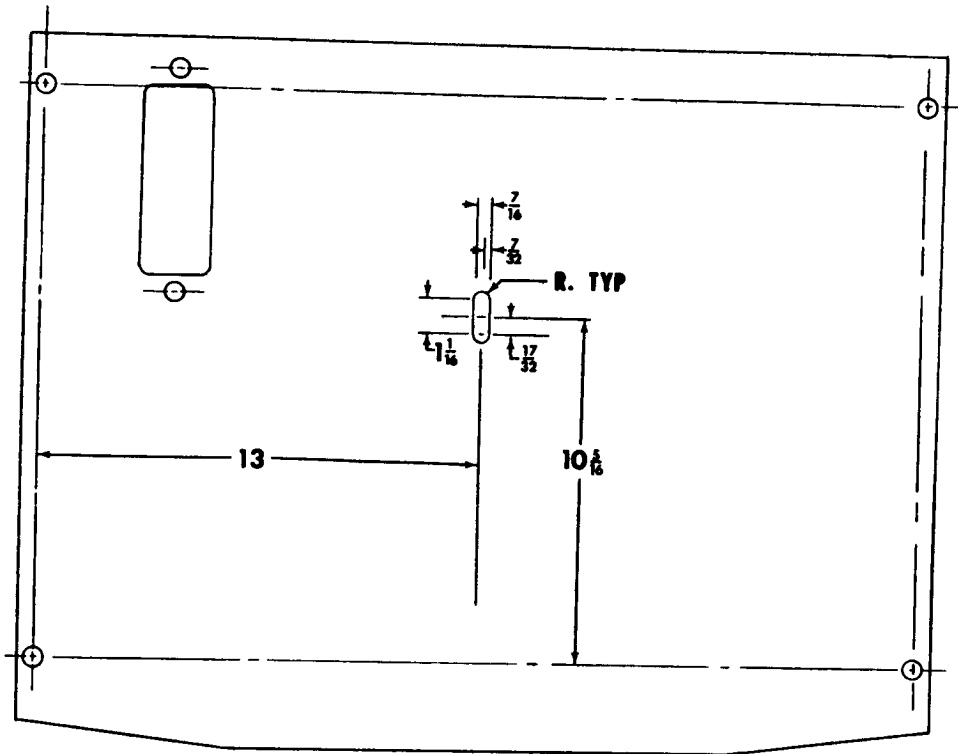


SEAT SUPPORT PLATE

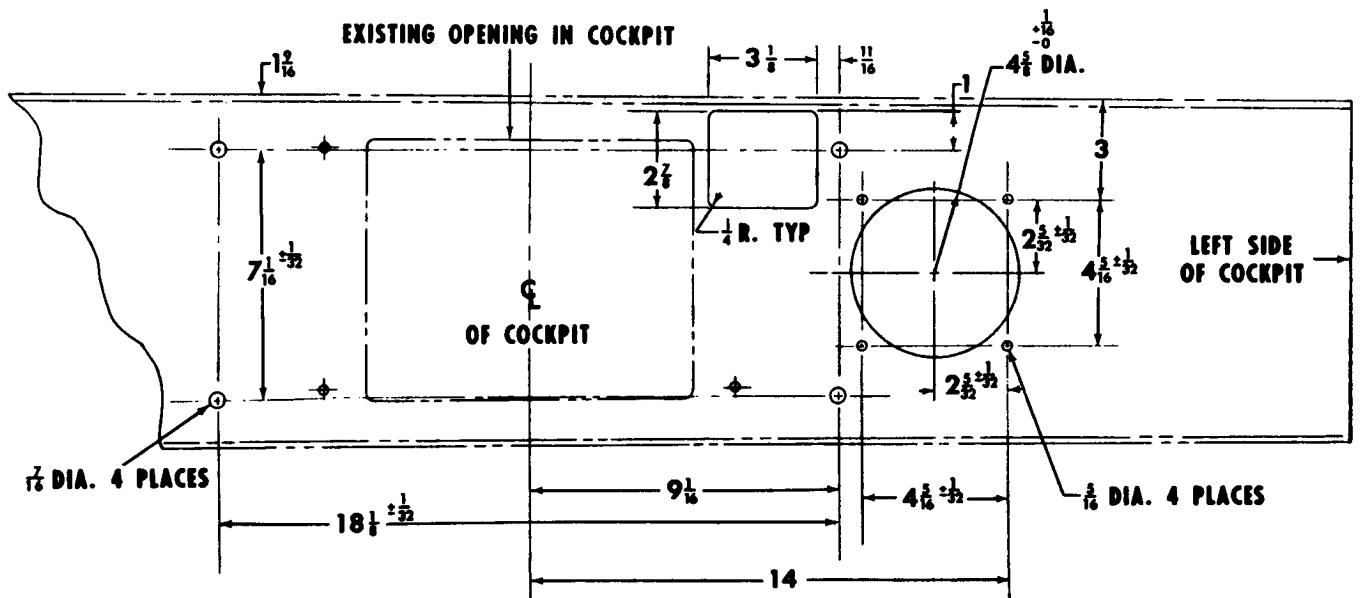


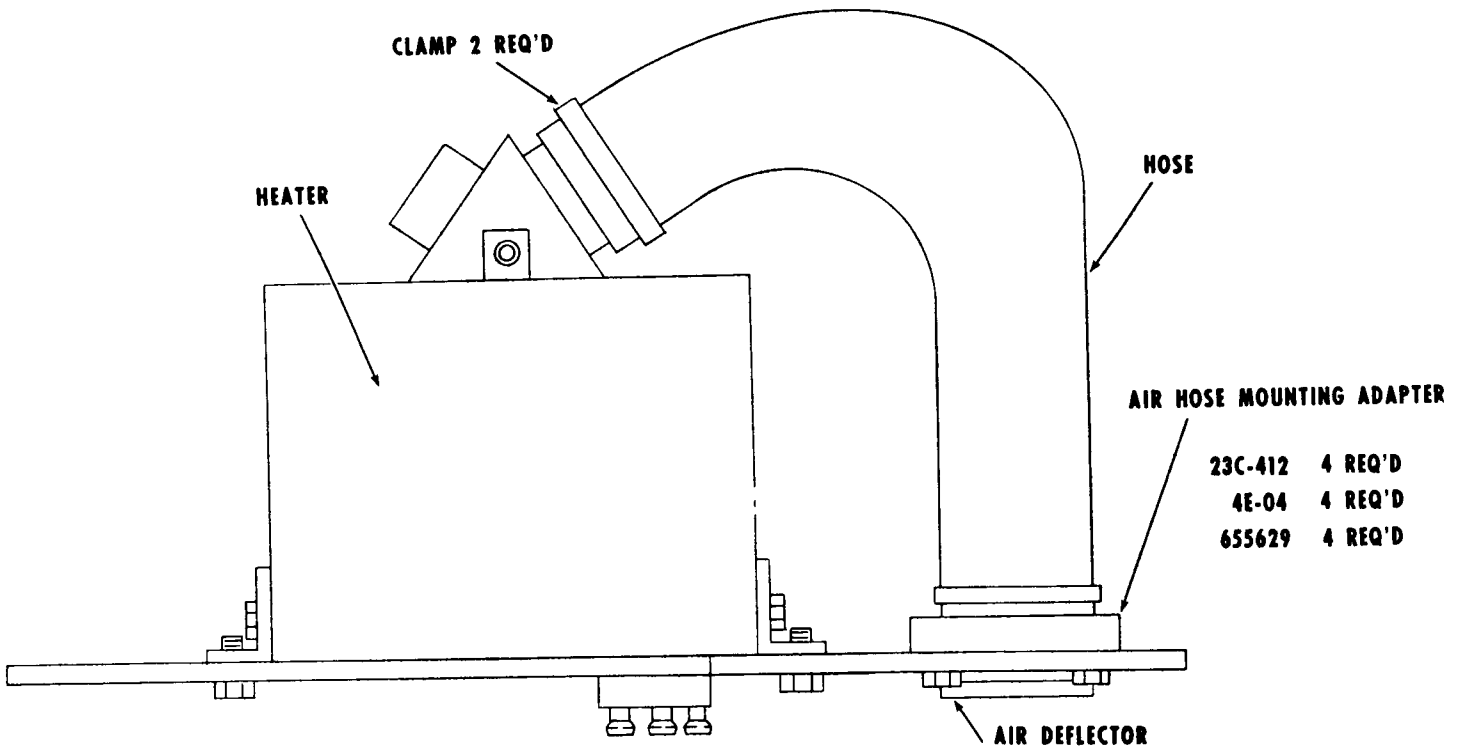
COCKPIT REWORK DIAGRAM
FIGURE 3.

TS-9246



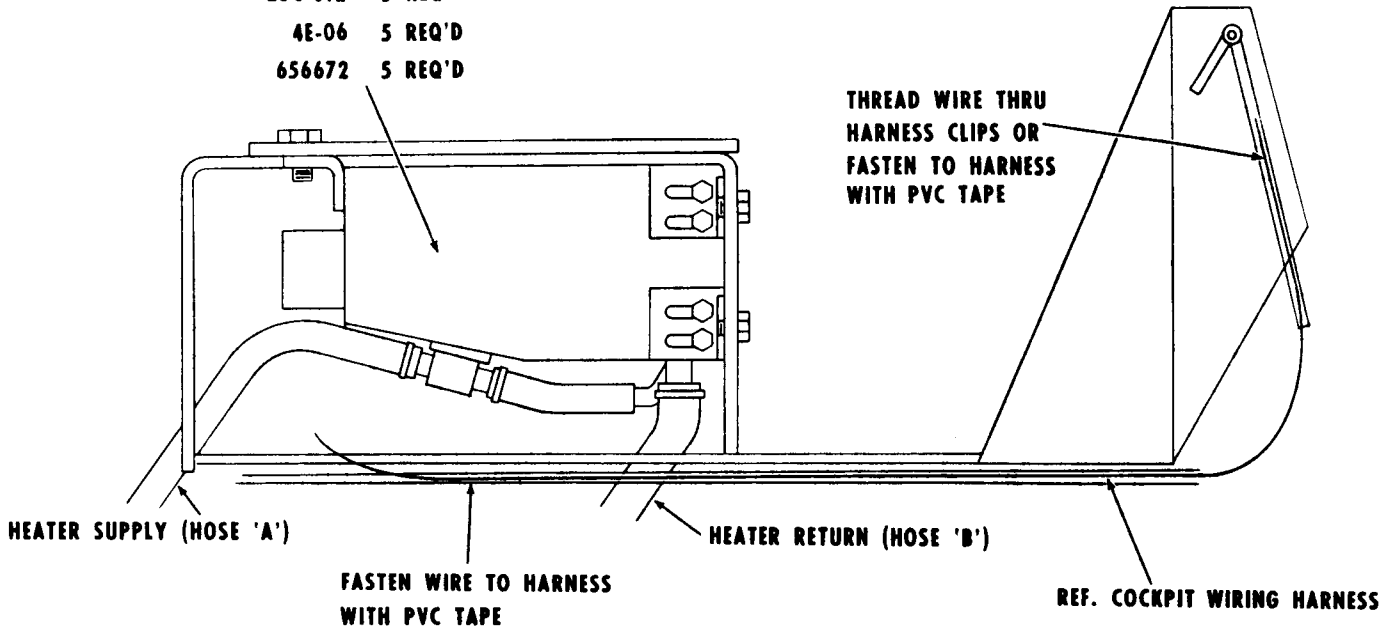
SEAT SUPPORT PLATE





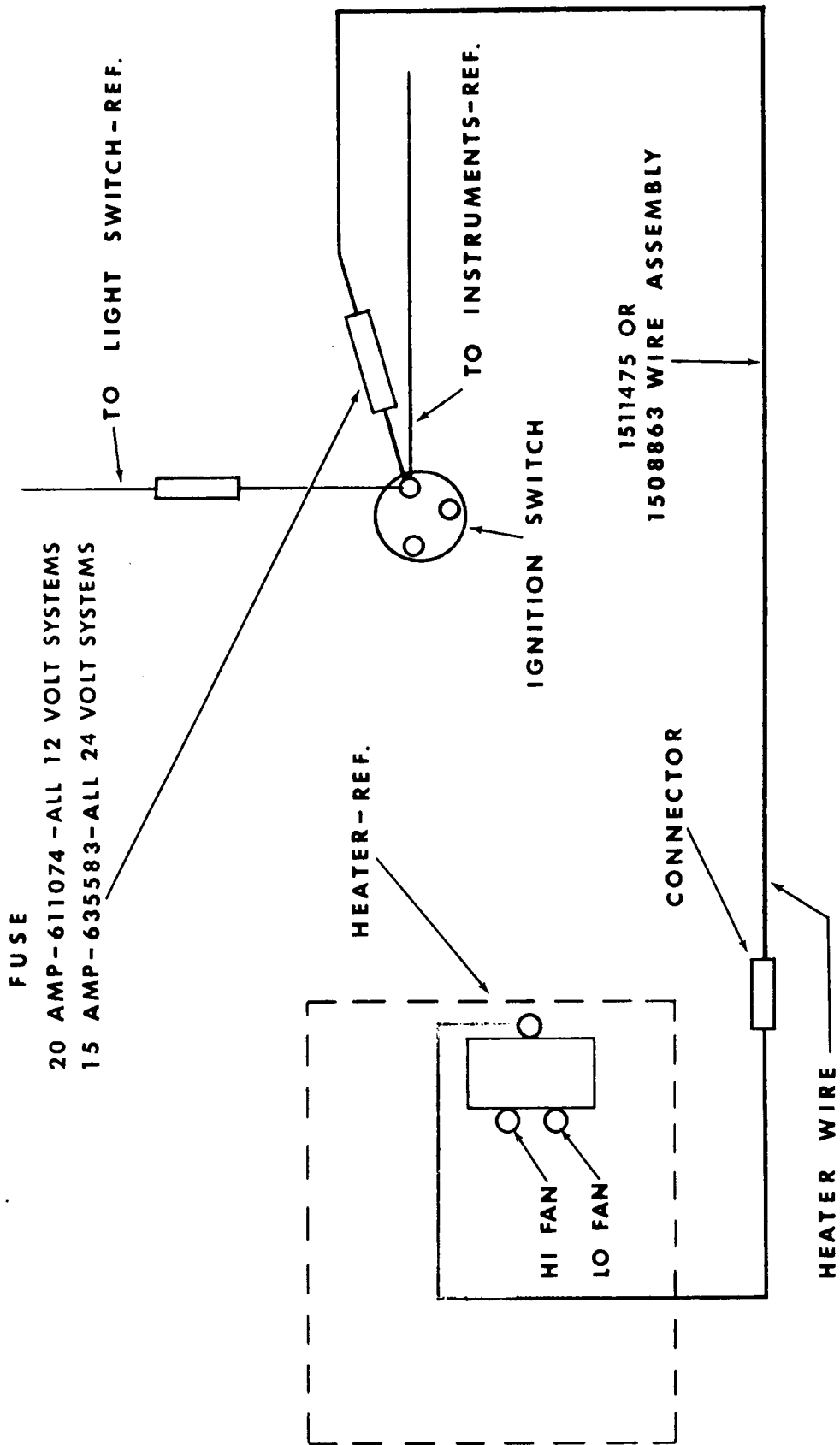
HEATER ASSEMBLY

- 23C-612 5 REQ'D
- 4E-06 5 REQ'D
- 656672 5 REQ'D

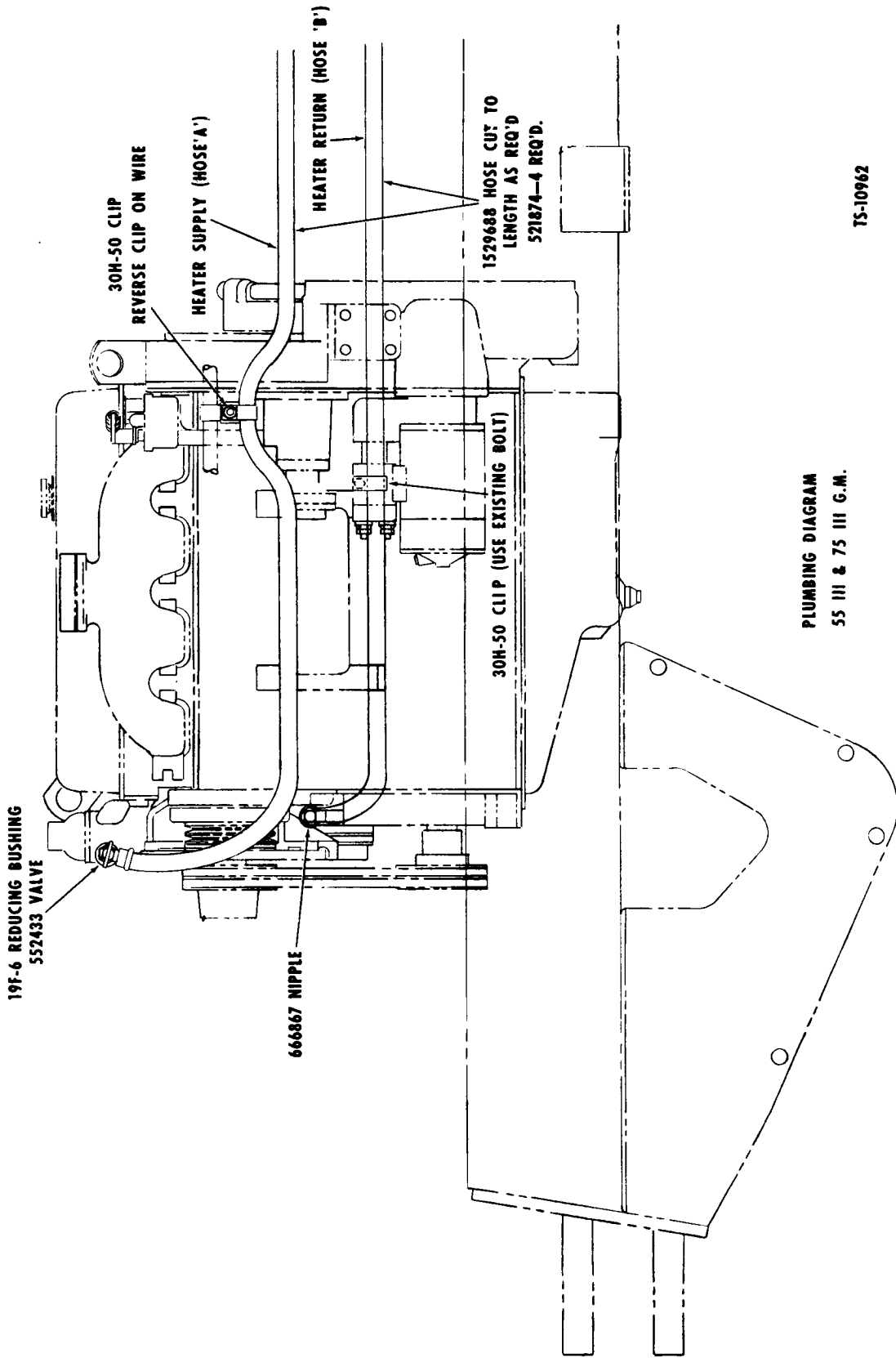


**HEATER INSTALLATION
FIGURE 5.**

TS-9136



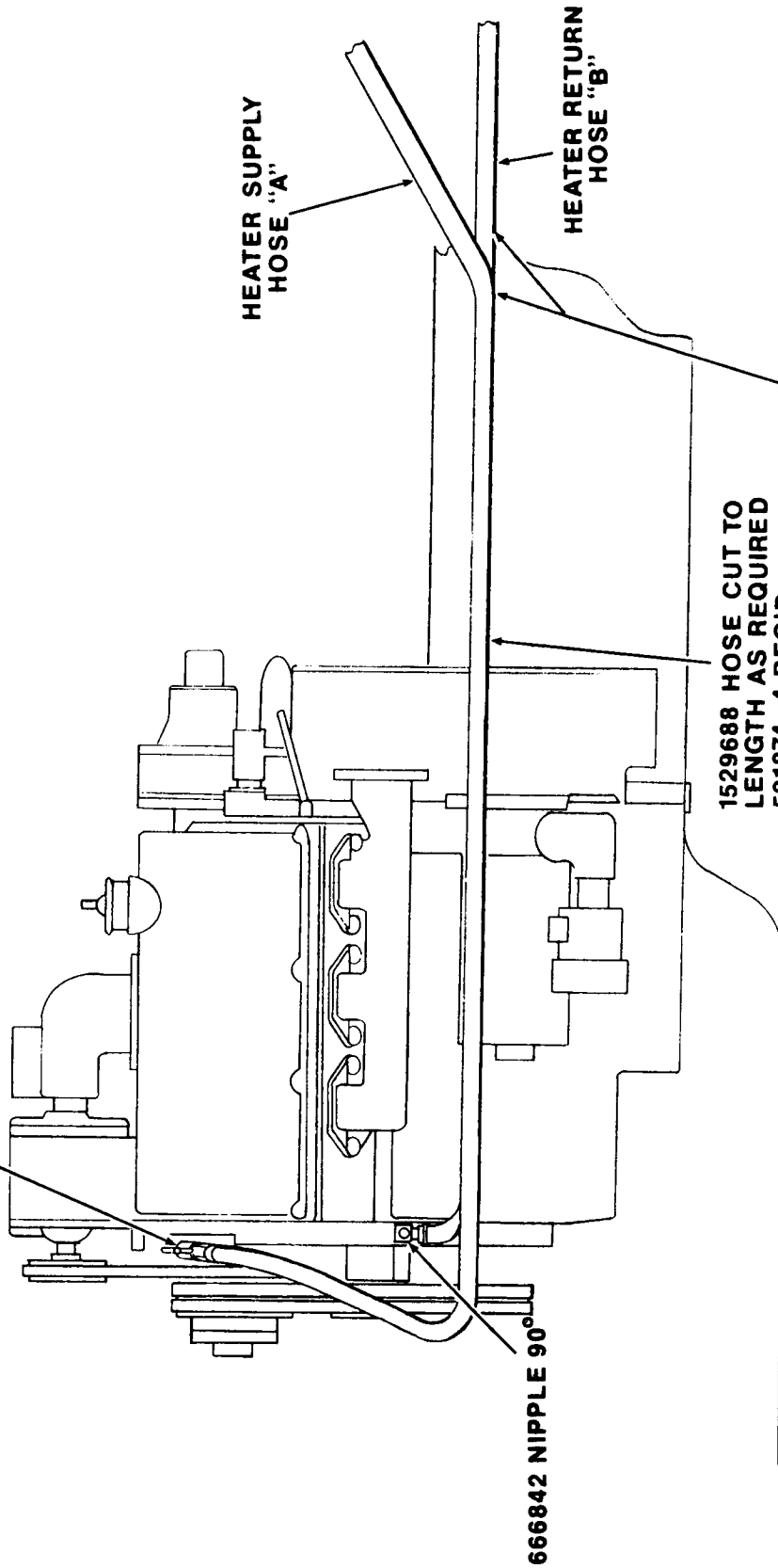
WIRING DIAGRAM
FIGURE 6.



PLUMBING DIAGRAM
55 III & 75 III G.M.

TS-10962

19F-6 REDUCING BUSHING
552433 VALVE



HEATER SUPPLY
HOSE "A"

HEATER RETURN
HOSE "B"

1529688 HOSE CUT TO
LENGTH AS REQUIRED
521874 4 REQ'D.

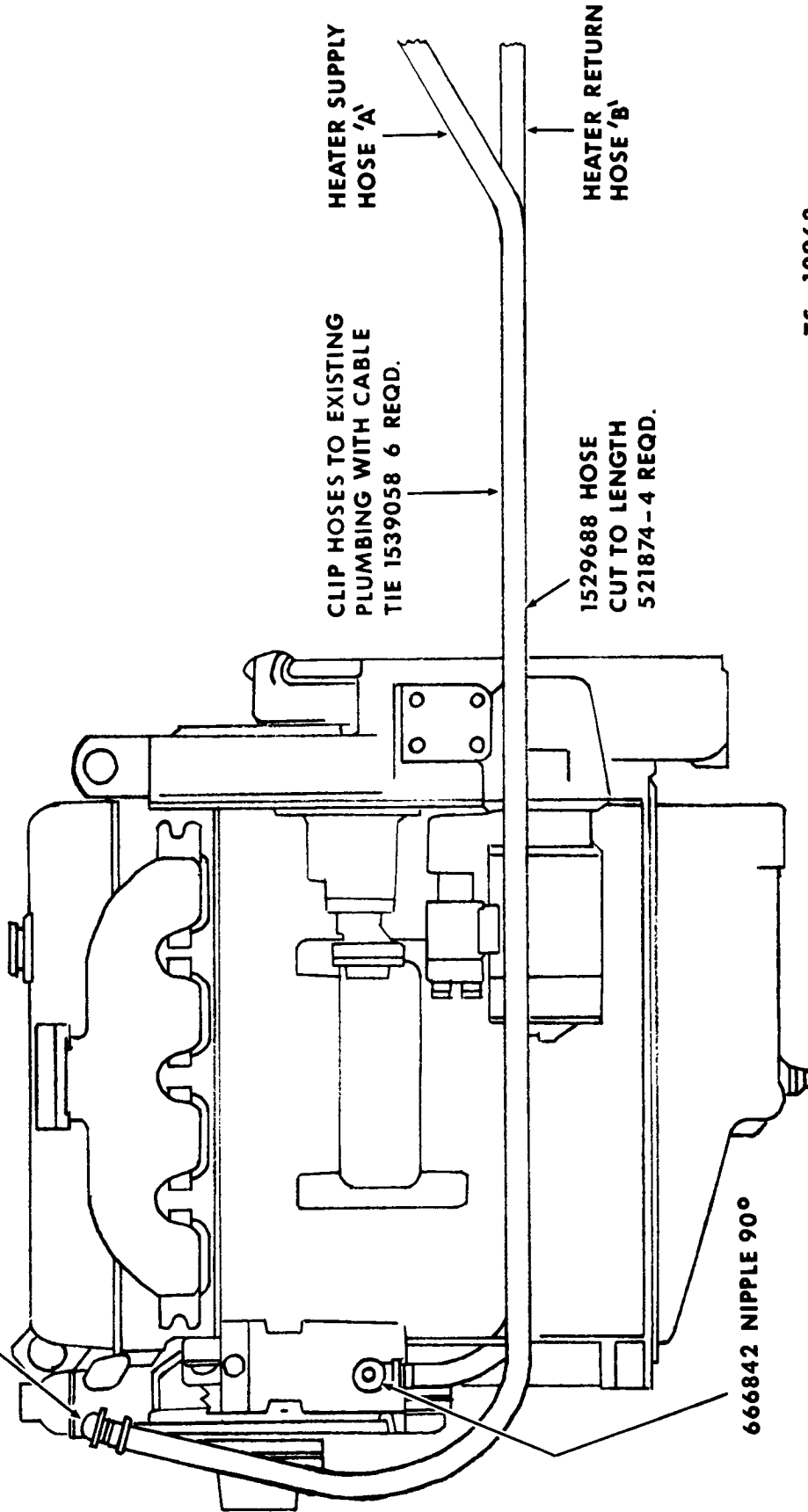
CLIP HOSES TO EXISTING
PLUMBING WITH CABLE TIE
1539058 6 REQ'D.

666842 NIPPLE 90°

PLUMBING DIAGRAM
MODEL 55-III A CUMMINS

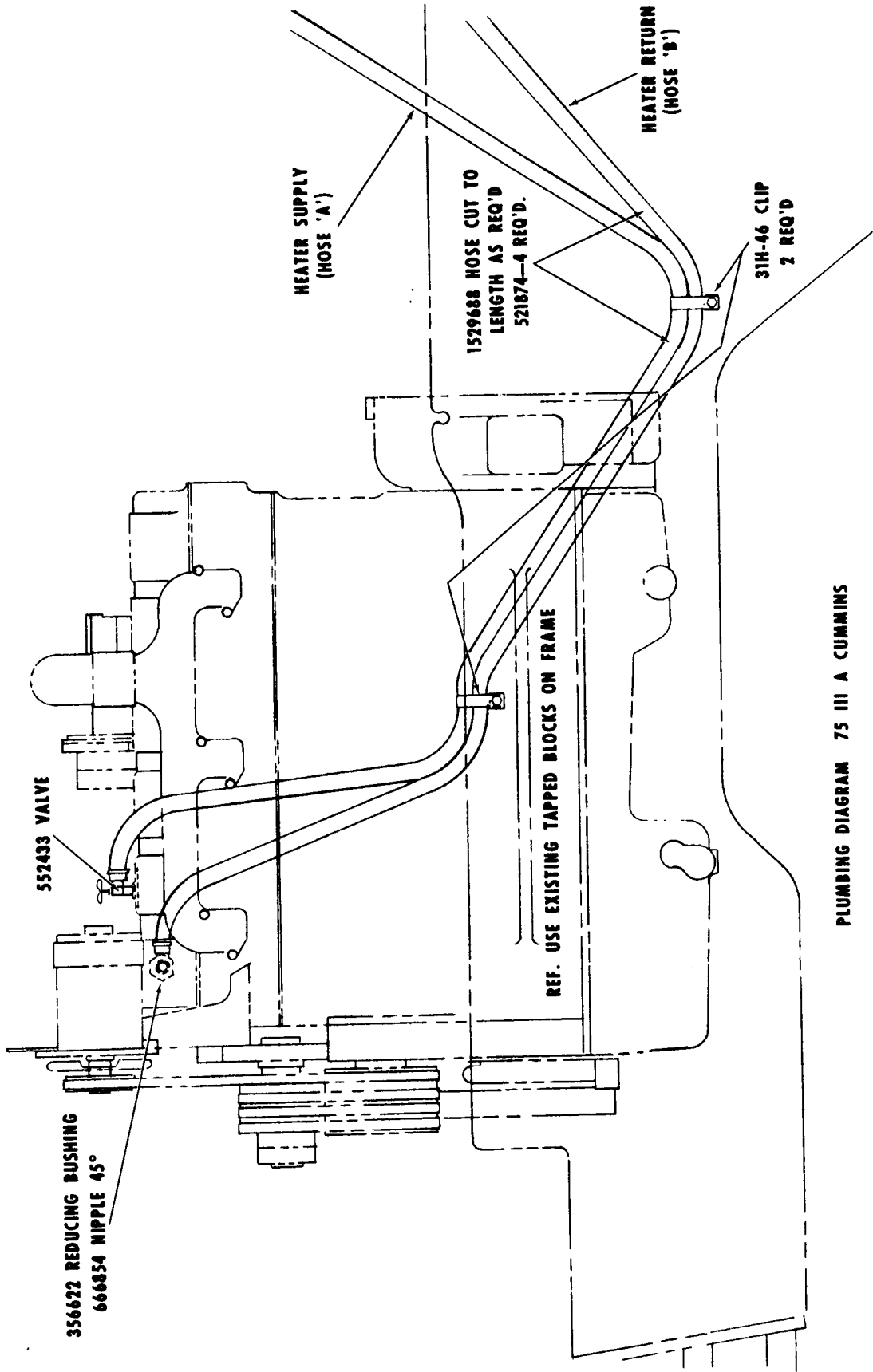
TS-10996

19 F-6 REDUCING BUSHING
552433 VALVE

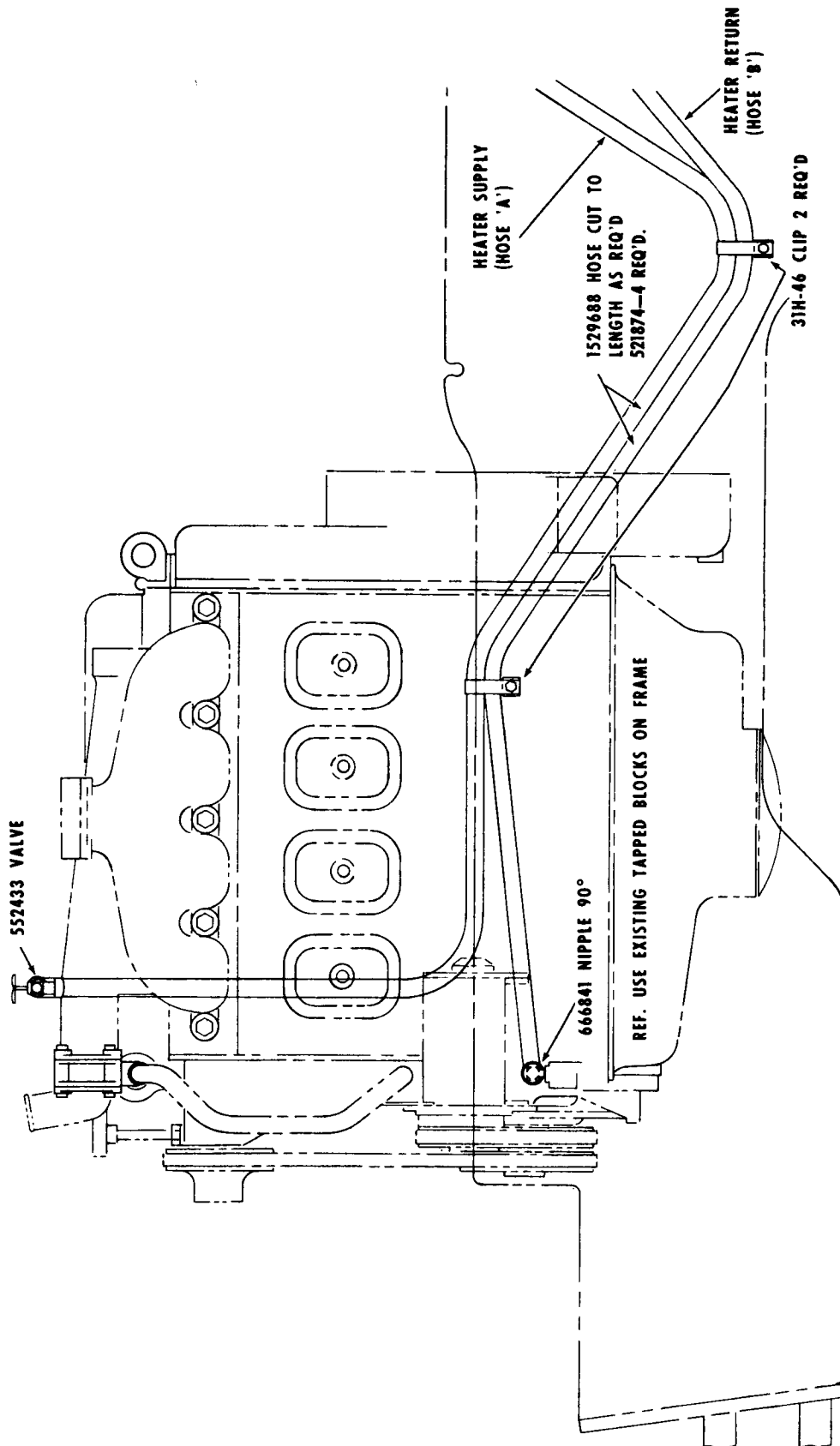


TS-10963

PLUMBING DIAGRAM 55 III A G.M.

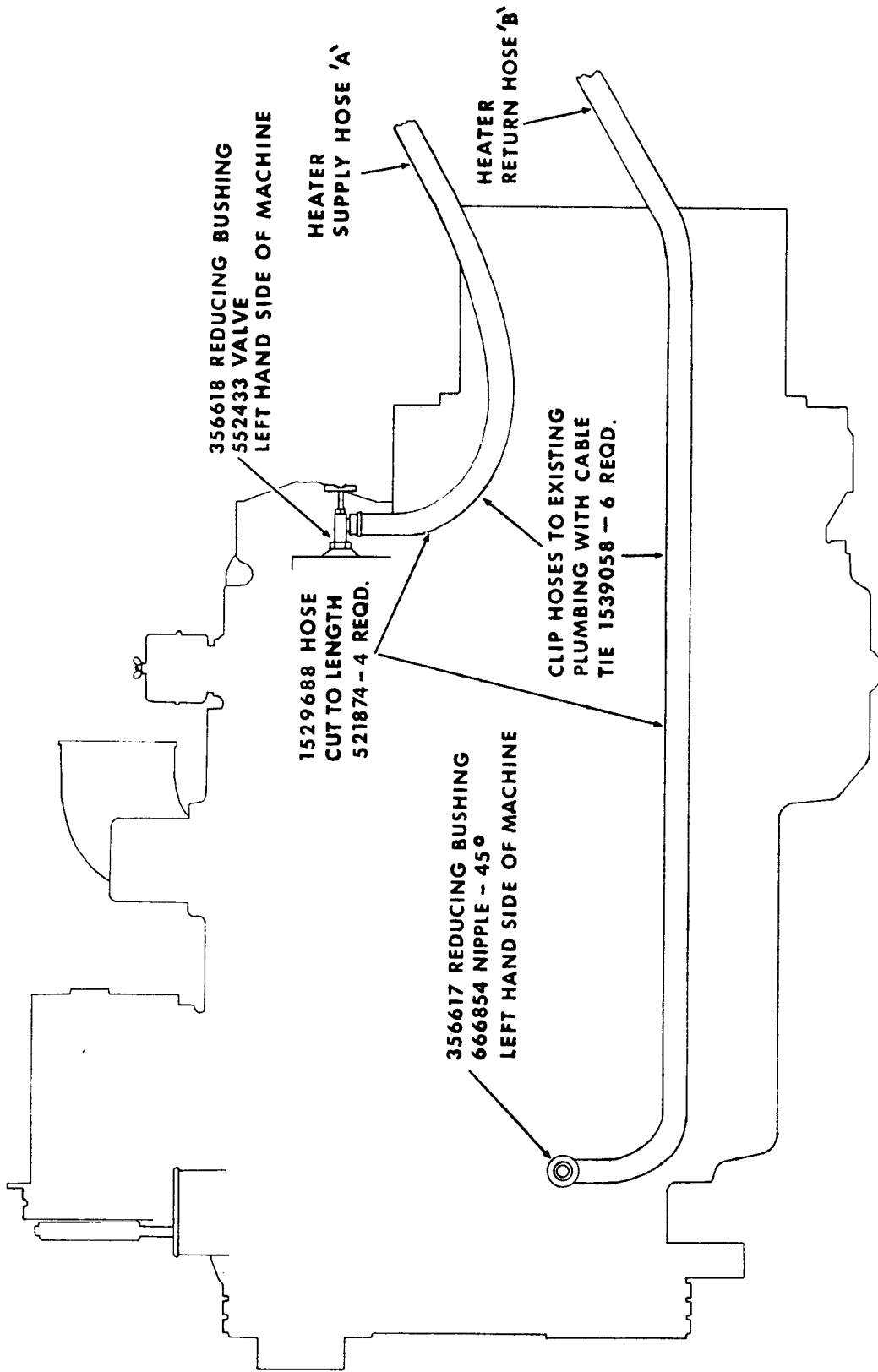


PLUMBING DIAGRAM 75 III A CUMMINS



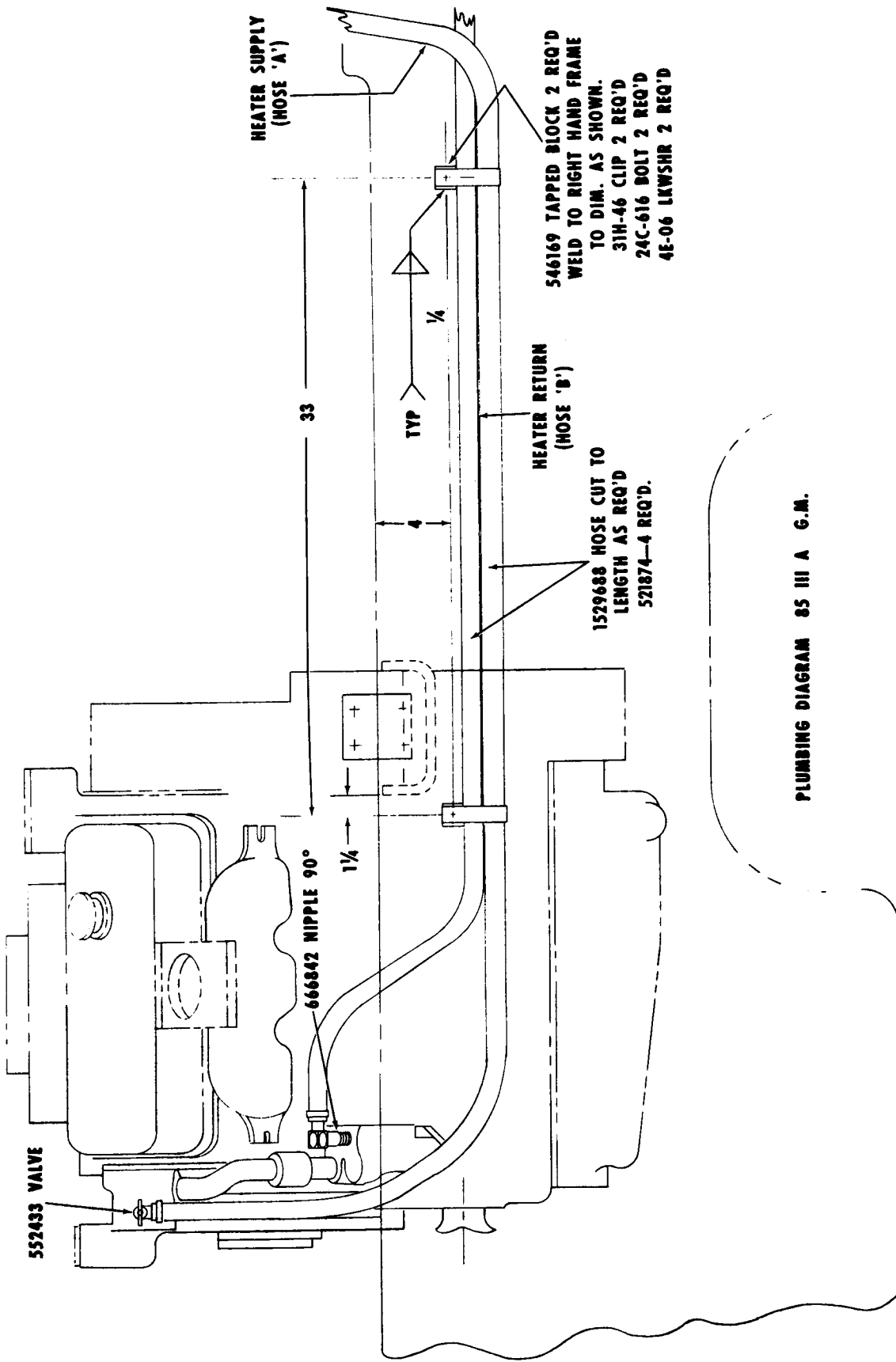
PLUMBING DIAGRAM 75 III A G.M.

TS-10965

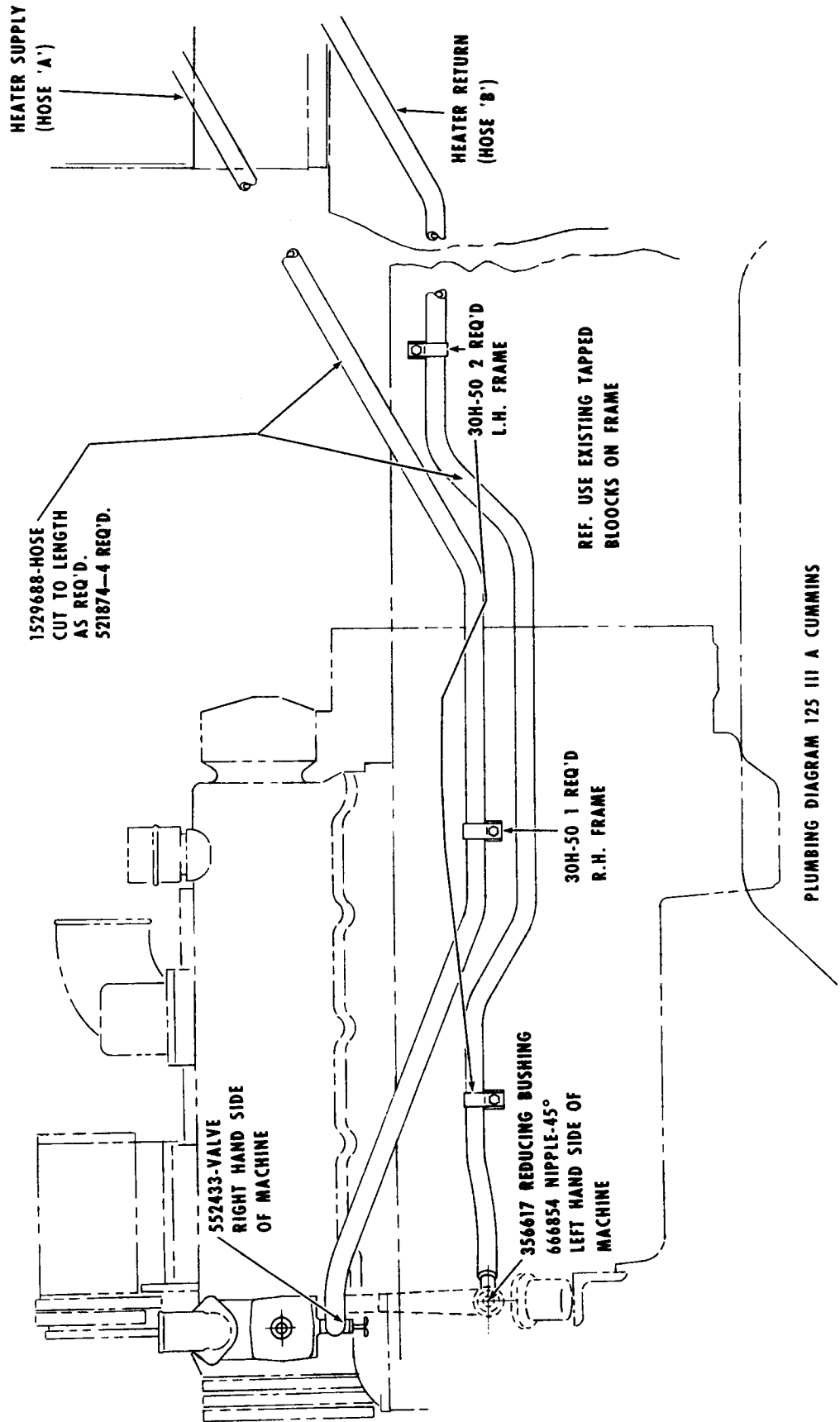


PLUMBING DIAGRAM 85 III A CUMMINS

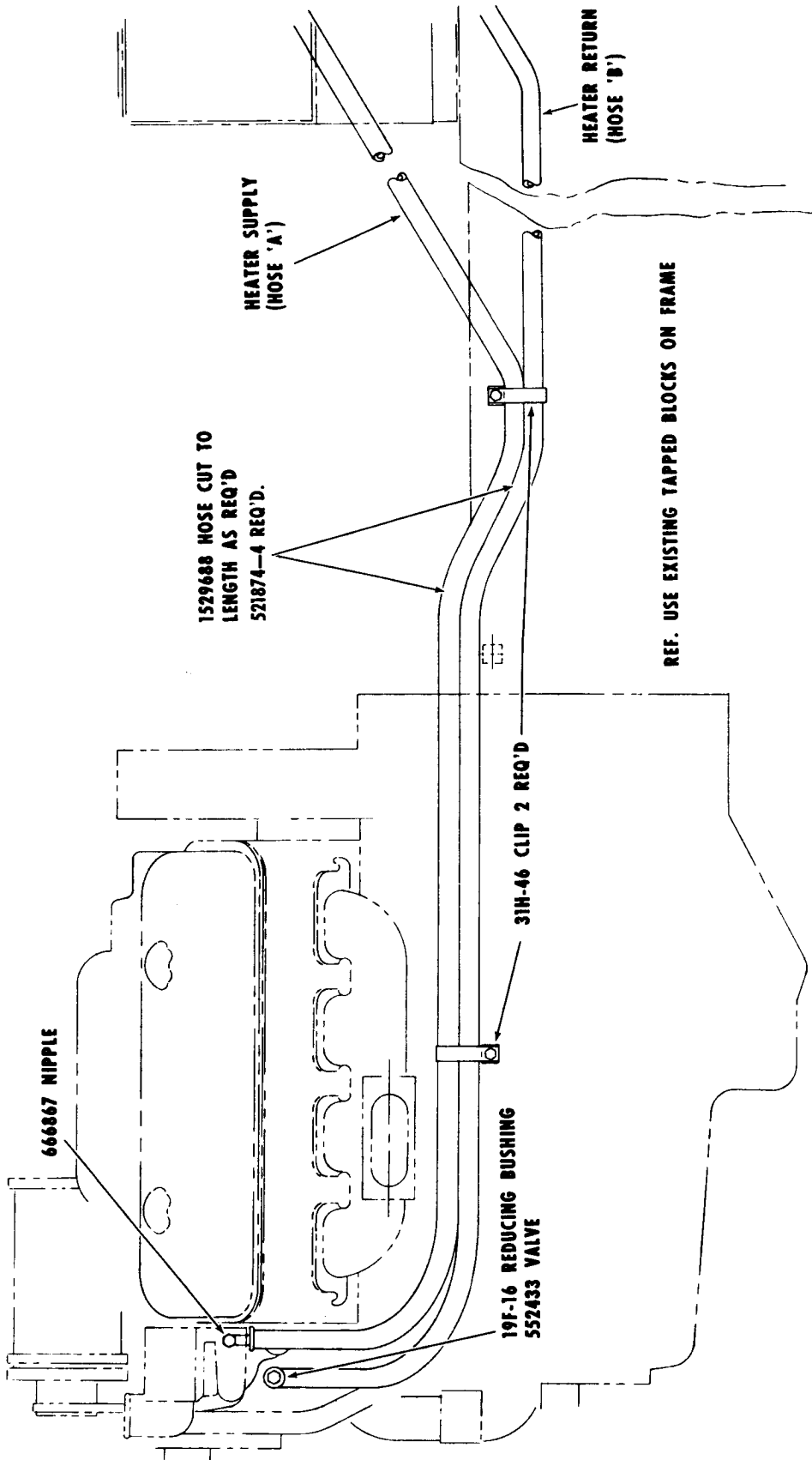
TS-10966



TS-10967



75-10968

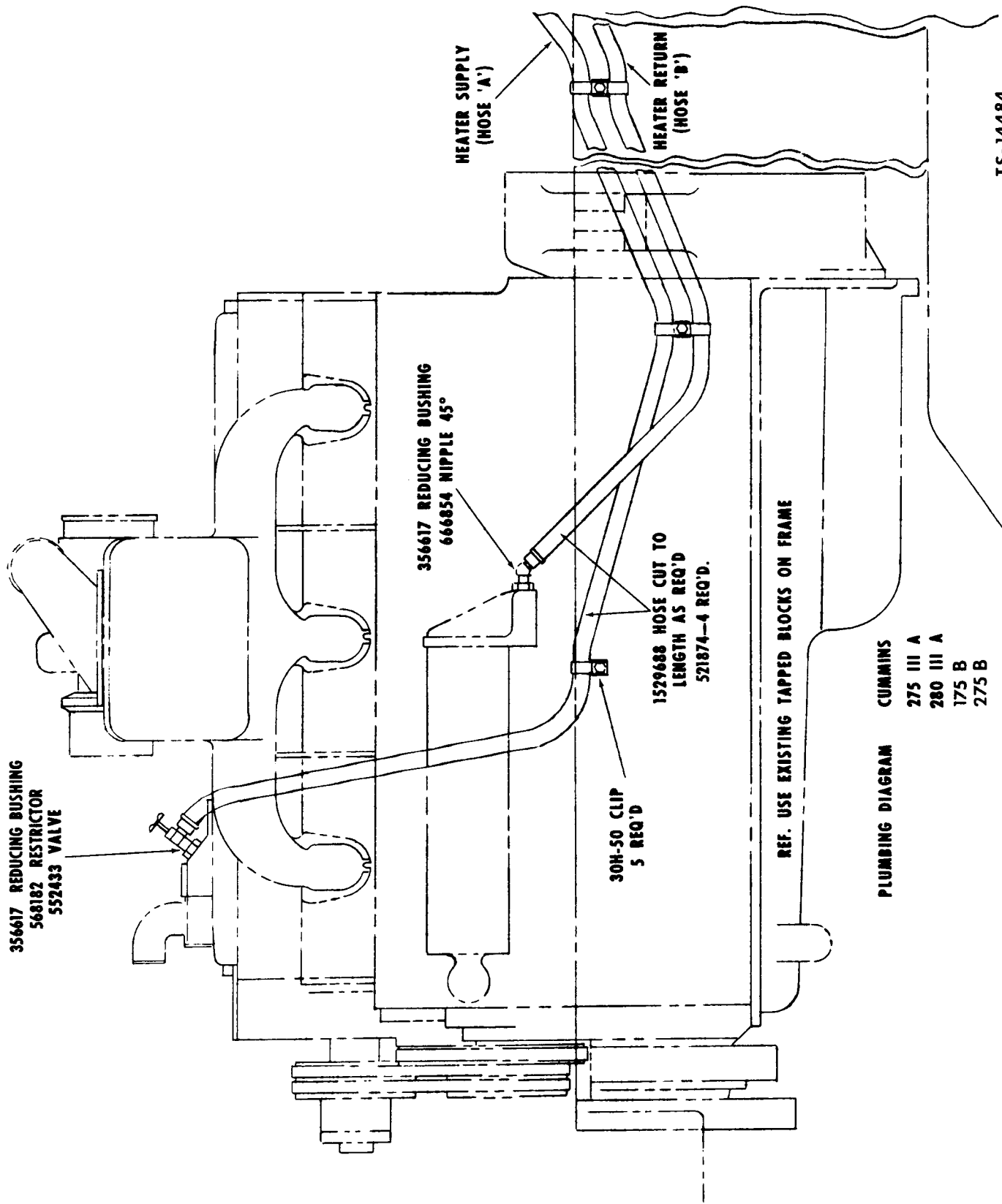


REF. USE EXISTING TAPPED BLOCKS ON FRAME

PLUMBING DIAGRAM

- 125 III A G.M.
- 175 III A G.M.
- 280 III A G.M.

TS-10969



356617 REDUCING BUSHING
568182 RESTRICTOR
552433 VALVE

356617 REDUCING BUSHING
666854 NIPPLE 45°

30H-50 CLIP
5 REQ'D

152988 HOSE CUT TO
LENGTH AS REQ'D
521874-4 REQ'D.

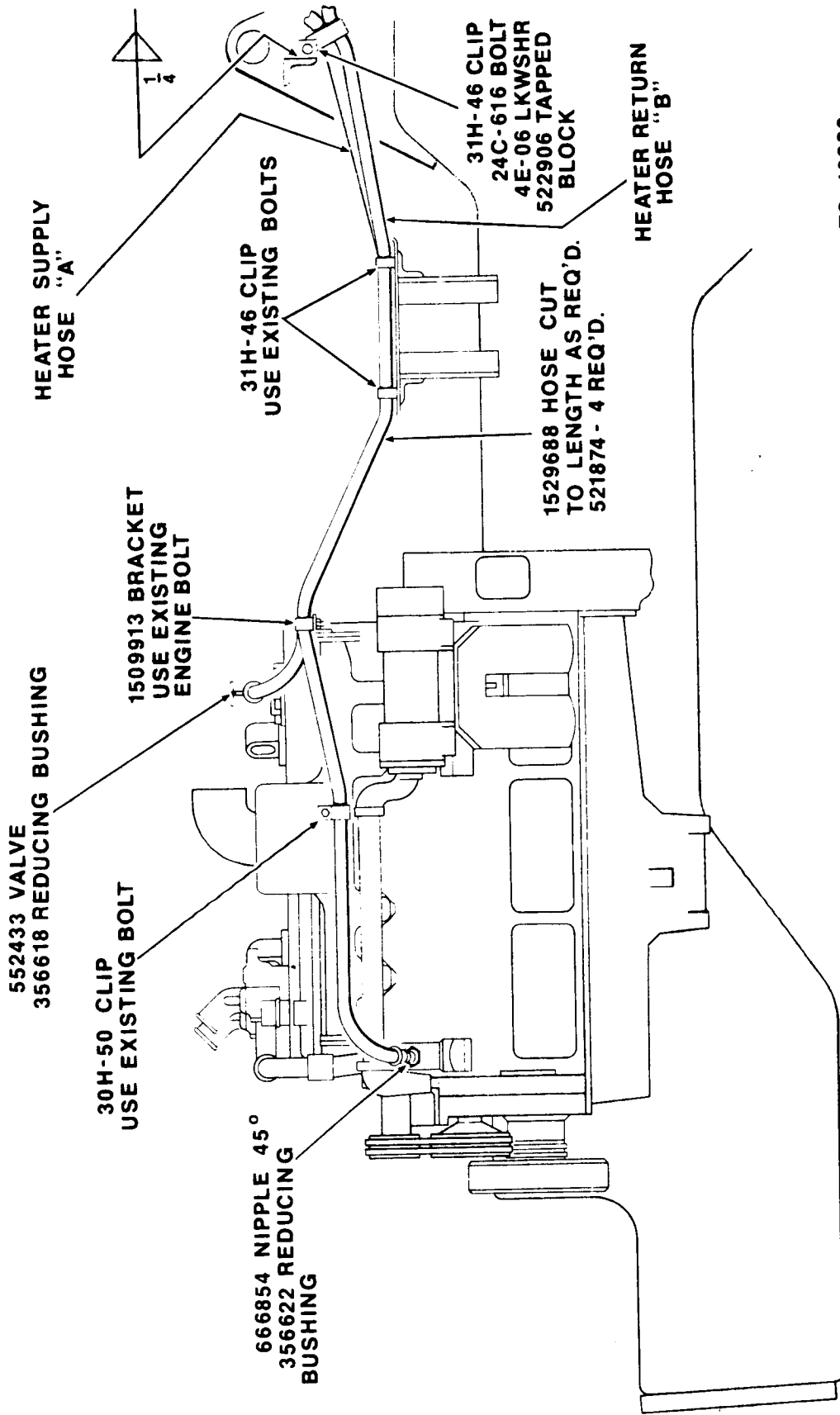
HEATER SUPPLY
(HOSE 'A')

HEATER RETURN
(HOSE 'B')

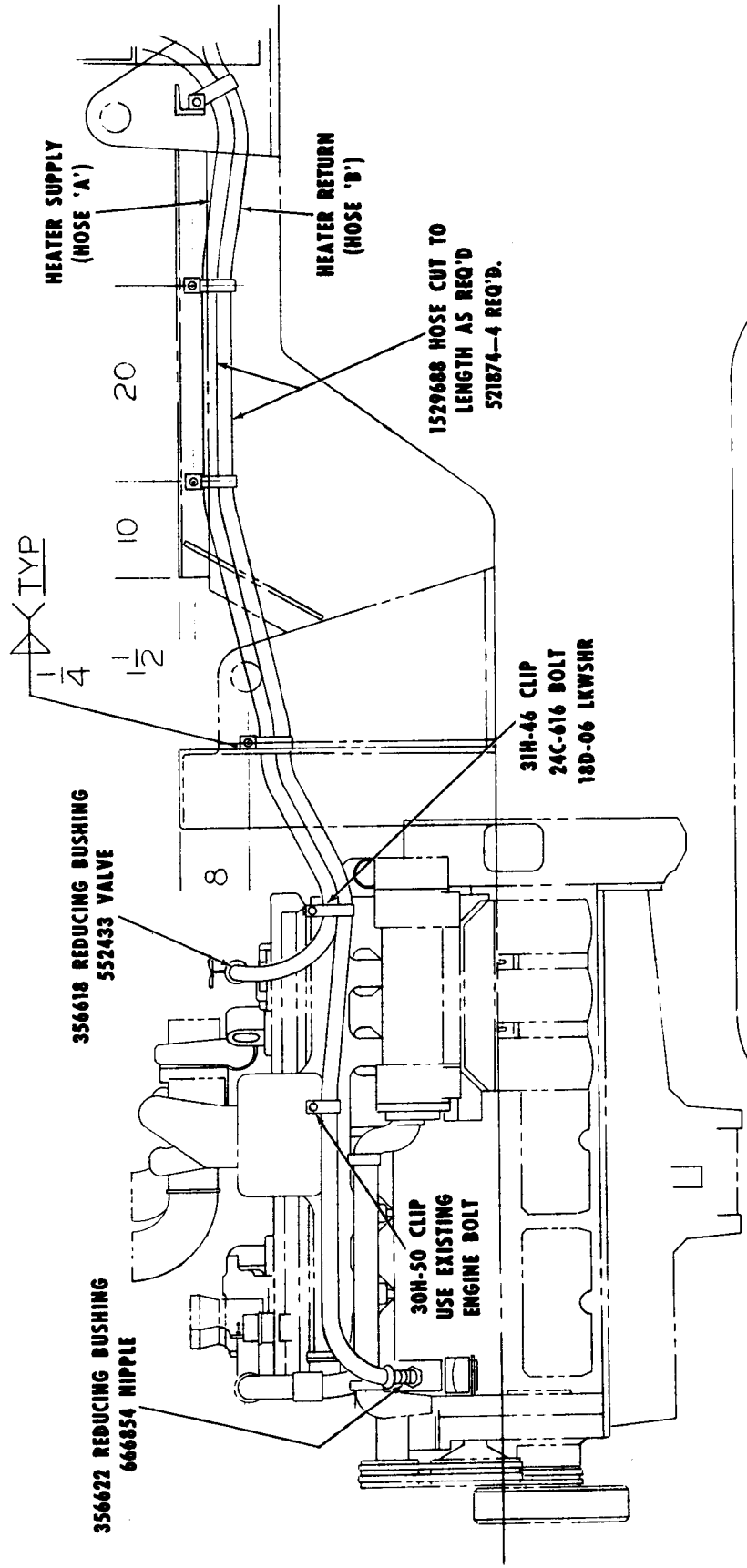
REF. USE EXISTING TAPPED BLOCKS ON FRAME

PLUMBING DIAGRAM CUMMINS

275 III A	CUMMINS
280 III A	
175 B	
275 B	



PLUMBING DIAGRAM 380 I11A CUMMINS



PLUMBING DIAGRAM 475 III A CUMMINS

11 September 1974

MICHIGAN SG-512
Group Ref. No. 1500

SUBJECT: Replacement of Heater Fan Switch on Heater
Assemblies 1510660 (12 Volt) & 1510661 (24 Volt)
Series III & IIIA Tractor Shovels and Dozers

A new improved heater fan switch has been designed for use on subject heater assemblies. The new switch features a mounting bracket assembly with a built in switch guard, designed to alleviate the possibility of switch toggle breakage. The new switch may be installed, if desired, on subject heater assemblies currently in the field by ordering parts listed below and installing them in accordance with the following instructions.

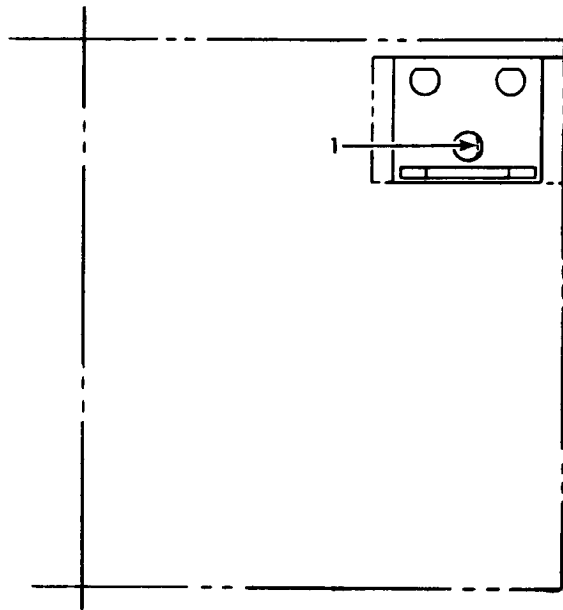
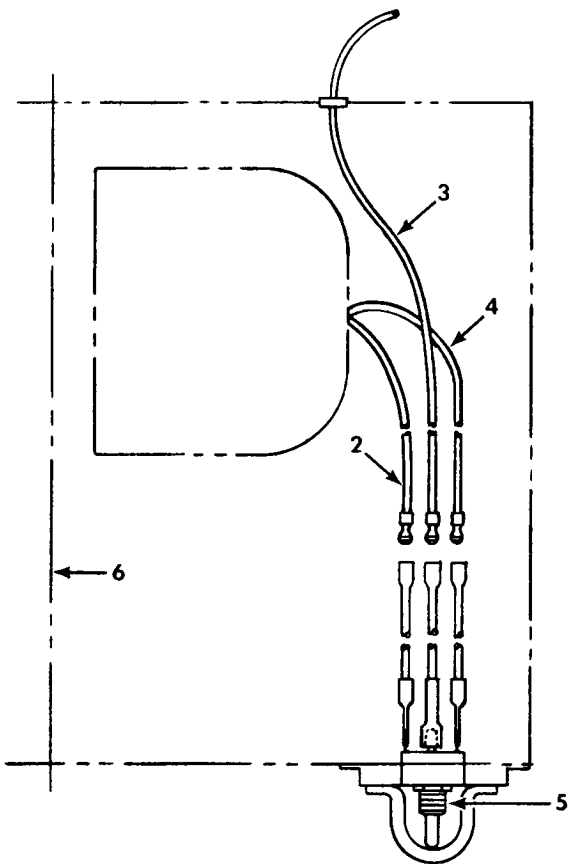
PARTS REQUIRED (Per machine):

1 - 2507065 Switch & Mounting Bracket Assy

INSTALLATION:

1. Remove four screws at top of heater assembly and retain for re-use.
2. Remove top of heater assembly.
3. Remove switch knobs.
4. Remove all switches from switch panel and disconnect wires from lower (fan) switch.
5. Place new switch panel over existing panel.
6. Install the two upper switches and secure in place with existing nuts.
7. Before installing the lower (fan) switch, file off flat surface on current switch panel to match the hole on the new panel as shown in Figure 1.
8. Insert new lower (fan) switch thru hole from back side of panel and fasten in place with nut furnished.
9. Connect wires to fan switch as shown in Figure 1.
10. Reinstall top of heater assembly and fasten in place with four screws retained for this purpose in Step 1.

R/N 96973



TS-13823

Figure 1

- | | |
|------------------------|--------------------------|
| 1. Remove Flat Surface | 4. Red Wire |
| 2. Orange Wire | 5. 2507065 Switch Assy |
| 3. Black Wire | 6. Center Line of Heater |

CLARK

Service gram

24 July 1974

MICHIGAN SG-522
Group Ref. No. 2500

SUBJECT: Identification of Cantilever ROPS
Components Used on MICHIGAN
Tractor Shovels and Dozers

Requests have been received from the field for a means of identification for the various Cantilever ROPS components by individual component size. The purpose of this bulletin is to provide the necessary data to accomplish such identification.

The following reference drawing (Figure 1) and chart provide the information for identification of strut pins, canopy pins and struts by location & usage, part number and size for each of the various models which use the Cantilever ROPS. Since a number of the components are used on several of the different models, this bulletin can also be used as an index of interchangeability.

Refer to Figure 1 for the location of the individual ROPS components. Then match the reference numbers in Figure 1 to the reference numbers at the top of the chart for usage and identification by size and part number.

Model No.	1. Canopy P/N	2. Adjustment Bushing P/N	3. Strut Pin P/N	3A. Strut Pin Length	4. Canopy Pin P/N	4A. Canopy Pin Length	5. Strut P/N	5A. Strut Length
45B	1511935	1519894	1537103	5.3 in. (134,6)	1537103	5.3 in. (134,6)	2500257	80.4 in. (2042,2)
55-IIIA	1511935	1519894	1537103	5.3 in. (134,6)	1537103	5.3 in. (134,6)	1510966	88.8 in. (2255,5)
*75B	2501237	1519894	1537103	5.3 in. (134,6)	1537103	5.3 in. (134,6)	2501234	97.8 in. (2484,1)
75B	1511935	1519894	1537103	5.3 in. (134,6)	1537103	5.3 in. (134,6)	1512505	95.2 in. (2418,1)
125-IIIA	1517047	1519894	1537103	5.3 in. (134,6)	1509937	6.4 in. (162,6)	1512505	95.2 in. (2418,1)
125B	2502802	1519894	1537103	5.3 in. (134,6)	1509937	6.4 in. (162,6)	2502799	52.1 in. (1323,3)
175B	1547690	1519894	1516040	4.5 in. (114,3)	1537424	6.8 in. (172,7)	1547680	105.9 in. (2689,9)
275B	1547690	1519894	1516040	4.5 in. (114,3)	1537424	6.8 in. (172,7)	1547680	105.9 in. (2689,9)
475B	1519354	1519893	1509937	6.4 in. (162,6)	1510703	7.5 in. (190,5)	1510717	80.9 in. (2054,9)
280-IIIA	1547690	1519894	1516040	4.5 in. (114,3)	1537424	6.8 in. (172,7)	1547680	105.9 in. (2689,9)
380-IIIA	1510699	1519893	1509937	6.4 in. (162,6)	1510703	7.5 in. (190,5)	1510734	80.9 in. (2054,9)

*Applies to Serial Ranges 443A, 447A & 4198A

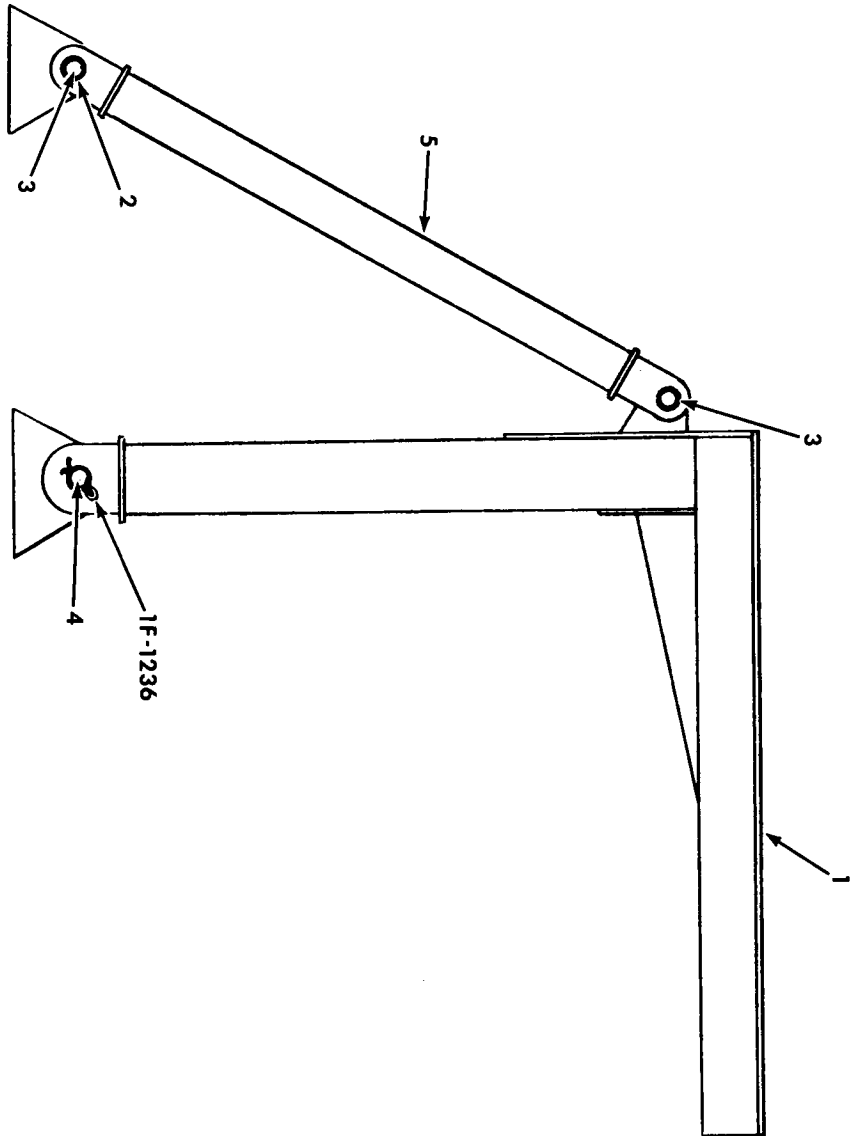


Figure 1

TS-13908

CLARK

Service gram

23 April 1975

MICHIGAN SG-541
Group Ref. No. 1500

SUBJECT: Bellyguard Kits for Machines with
Trunnion Mounted Boom Cylinders
Model 55-111A, 75B, 125B, 175B & 275B

Bellyguard Kits are available for installation on subject model machines. It is recommended that front frame bellyguard installations be performed for the purpose of alleviating the possibility of boom cylinder rods being bent when the bottom of the boom cylinder barrel contacts rocks or other material encountered on applications where severely rough operating terrain is common.

Orders for Bellyguard Kits must be sent to:

Clark Equipment Company
Sales Order Department
P. O. Box 547
Benton Harbor, Michigan 49022

DO NOT place orders for Bellyguard Kits with the Central Parts Division.

Bellyguard Kit Numbers for the respective models of tractor shovels are as follows:

1516357 Model 55-111A & 75B, S/N range 428A & 435A
2504392 Model 75B, S/N range 443A & 447A
2505307 Model 125B
1517068 Model 175B
1512597 Model 275B

Installation drawings will be furnished with the respective Bellyguard Kits.

CLARK

Service gram

12 November 1975

MICHIGAN SG-566
Group Ref. No. 900
1500

SUBJECT: Identification of Palm ROPS/Cabs
Model 175B, 275B & 280-111A

Bolt on design ROPS/Cabs for subject model machines are now being supplied to Clark by Palm Industries under the following Clark part numbers:

Model 175B	- P/N 2514193
275B	- P/N 2514191
280-111A	- P/N 2514191

While the above cabs are similar in appearance, they may be identified by the three (3) methods described below.

1. Markings on the outside of shipping crates show the cab part number and one of the following statements:
 - A. For use on 175B only
 - B. For use on 275B - 280-111A only
2. Certification tag inside of ROPS/Cab is marked with the cab part number and for machine used.
3. As a last resort, a visual check of the rear legs may be used to determine model application. To perform this check, the ROPS/Cab must be tilted to enable the inspector to look inside rear clevis.
 - A. The 175B ROPS/Cab has a 4 x 4 square tube which runs halfway up the inside of the outside 5 x 5 square tube. The end of the 4 x 4 tube is visible with the aid of a light source.
 - B. The 275B - 280-111A ROPS/Cab has a 4 x 4 square tube which extends the entire inside length of the outside 5 x 5 tube, therefore no inside tube end will be visible.

CAUTION: THE ABOVE ROPS/CABS MUST NOT BE INTERCHANGED UNDER ANY CIRCUMSTANCES. INTERCHANGING OF THE ABOVE CABS COULD BE DISASTROUS IN THE EVENT OF A ROLLOVER ACCIDENT.

CLARK

Service gram

21 April 1976

MICHIGAN SG-593
Group Ref. No. 2500

SUBJECT: Machine Serial Number Plate

The machine serial number plates shown in Figure 1 are examples of a few of the plates used to identify Clark products. The lower portion of each serial number plates shows the country of origin.

It has been brought to our attention that in some instances the country of origin portion of this plate has been removed or destroyed (Figure 2). U.S. Customs laws make it unlawful for any person other than the ultimate user to remove or destroy the country of origin identification.

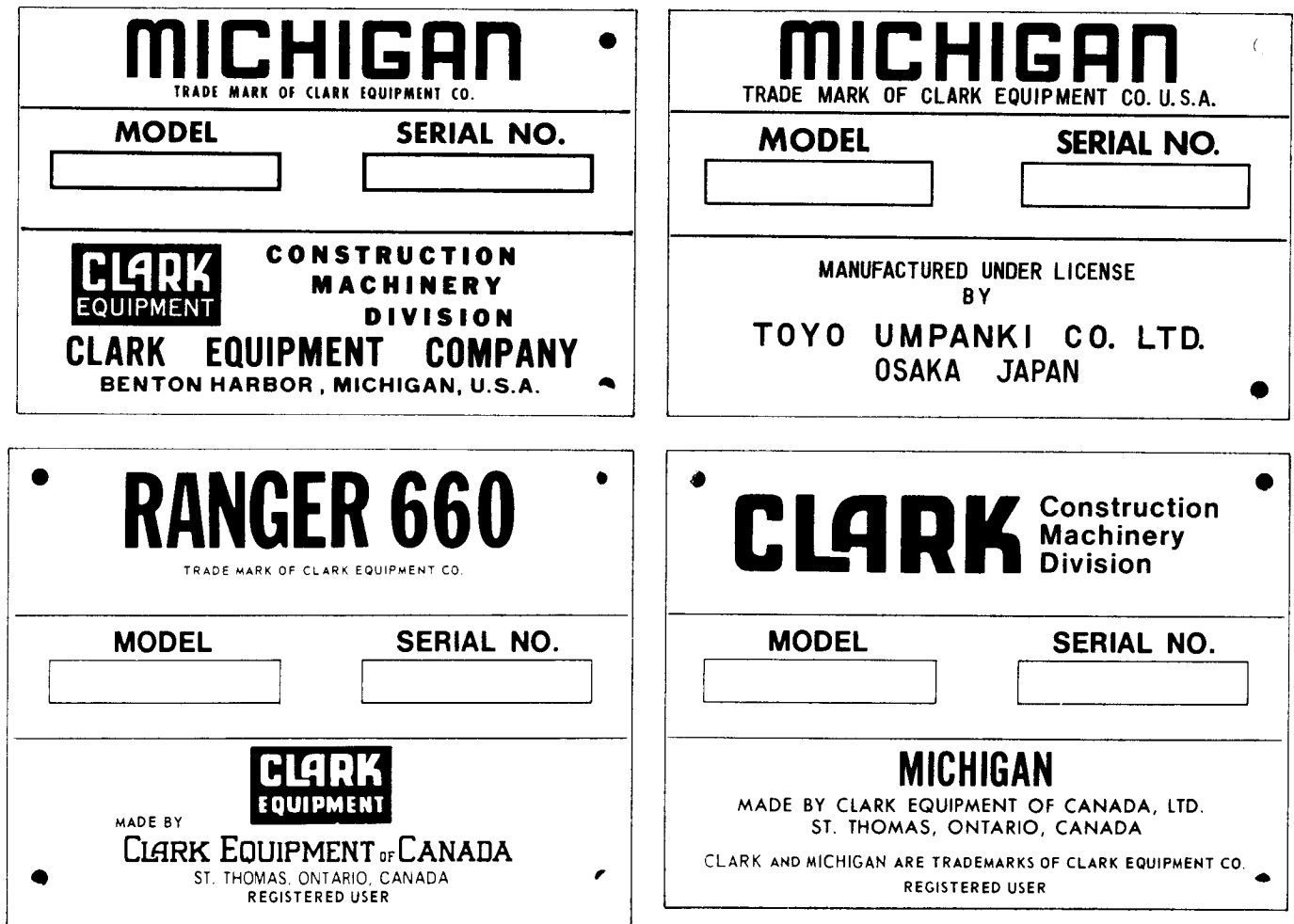
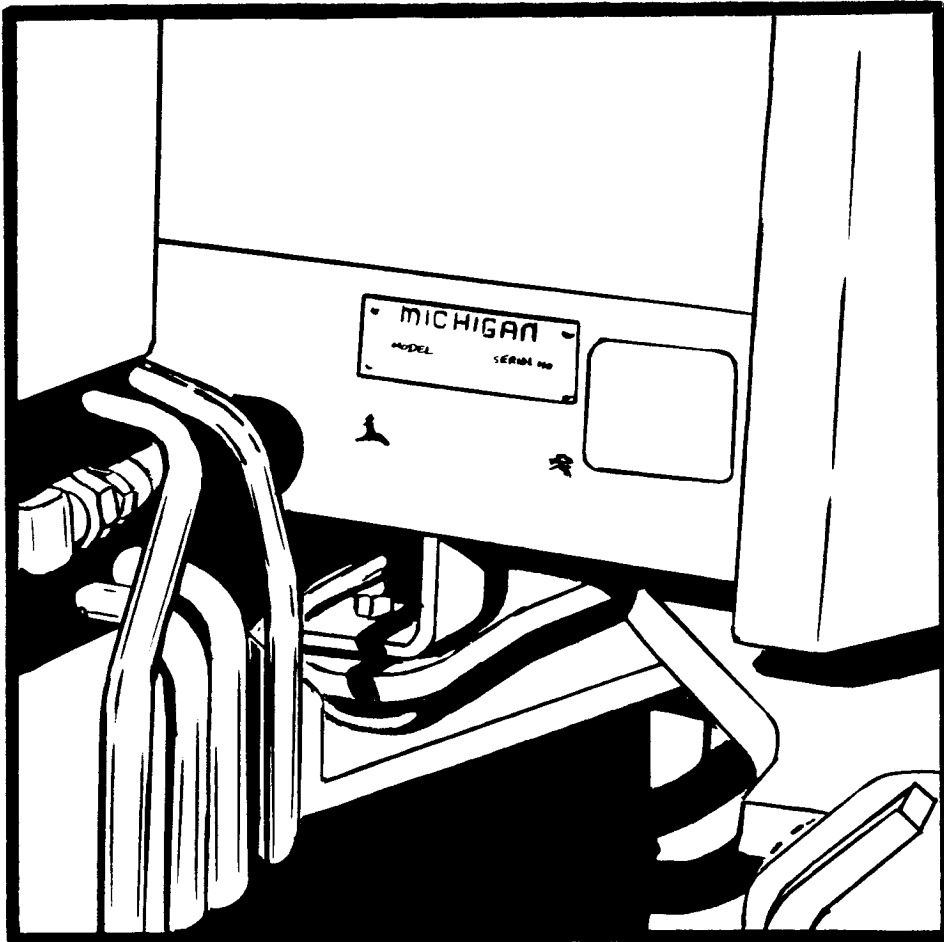


Figure 1

TS-14567



TS-14565

Figure 2

23 June 1976

MICHIGAN SG-605
Group Ref. No. 2500

SUBJECT: Welded Component Warning

All replacement parts furnished by the Central Parts Division requiring installation by welding will be tagged with the decal shown in Figure 1.



Fig. 1

In the event the instructions were not furnished, were lost or are not understood, you may be contacted by the customer.

If you are unable to provide the information or assistance requested, contact the Service Department of Clark Equipment Company at Benton Harbor, Mich.

CLARK

Service gram

3 November 1976

MICHIGAN SG-621
Group Ref. No. 2500

SUBJECT: Product Identification

To promote the visual identification of Clark the current yellow paint and black decals should be used whenever a machine is repainted. Applying this new identity to older machines of "THE MICHIGAN LINE" will expand and strengthen the image of Clark.

The new Clark yellow paint is available from Central Parts in one gallon cans; order part number 5260034.

Part numbers of the new decals are shown on the following list, along with the old decal they replace. In some cases it will be necessary to cut off a portion of the new decal before using that decal on an older machine. For example, the Model 55A-II will now be a 55. Use the 55B decal and cut off the "B".

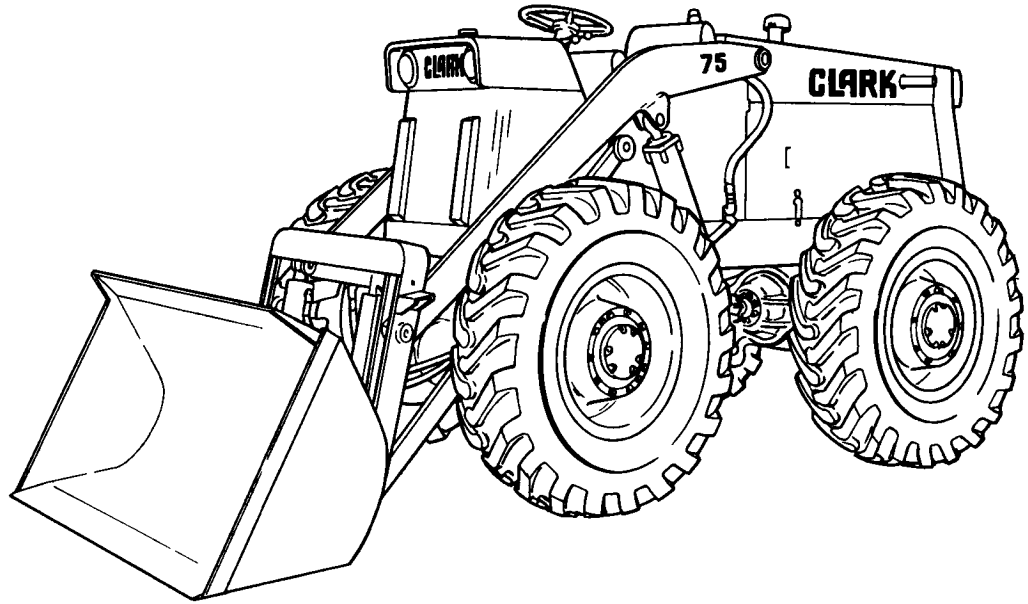
<u>OLD PART NO.</u>	<u>DESCRIPTION</u>	<u>NEW PART NO.</u>	<u>DESCRIPTION</u>	<u>REMARKS</u>
516812	Model 85A	3301782	85	
519881	Model 275A	2513638	275B	Remove "B"
526593	Model 55A	2513634	55B	Remove "B"
547812	Model 55A-II	2513634	55B	Remove "B"
547813	Model 75A-II	2513635	75B	Remove "B"
547814	85A-II	3301782	85	
547815	Model 125A-II	2513636	125B	Remove "B"
547816	Model 175A-II	2513637	175B	Remove "B"
547817	Model 275A-II	2513638	275B	Remove "B"
547852	MICHIGAN	2513351	Clark	
548388	Model 180	3587498	180	
548389	Model 280	2513641	280	
548390	Model 380-II	2513642	380	
549868	280-III	2513641	280	
551798	Model 75A	2513635	75B	Remove "B"
551801	Model 125A	2513636	125B	Remove "B"
551802	Model 175A	2513637	175B	Remove "B"
559283	110-III	1583570	110-9	Remove "9"
565972	175-III	2513637	175B	Remove "B"
566480	275-III	2513638	275B	Remove "B"
571099	75-III	2513635	75B	Remove "B"
571100	85-III	3301782	85	
572153	175	2513637	175B	Remove "B"

<u>OLD PART NO.</u>	<u>DESCRIPTION</u>	<u>NEW PART NO.</u>	<u>DESCRIPTION</u>	<u>REMARKS</u>
572154	275	2513638	275B	Remove "B"
584567	MICHIGAN	2513352	Clark	
584568	Model 110	1583570	110-9	Remove "9"
584569	210	1583632	210	
585657	Model 35A	2514246	35	
588019	180	3587498	180	
1501808	35	2514246	35	
1501809	45	2513633	45B	Remove "B"
1504793	35	2514246	35	
1513371	475B	2513639	475B	
1513931	175B	2513637	175B	
1513932	275B	2513638	275B	
1513993	55	2513634	55B	Remove "B"
1513994	75B	2513635	75B	
1513995	85	3301782	85	
1514252	125	2513636	125B	Remove "B"
1516289	MICHIGAN	2513736	Clark	
1520838	475	2513639	475B	Remove "B"
1522324	280	2513641	280	
1522325	75	2513635	75B	Remove "B"
1535762	380	2513642	380	
1545671	110-14	1583570	110-9	Remove "9"
1545672	210-H	1583571	210-H	
2501172	45B	2513633	45B	

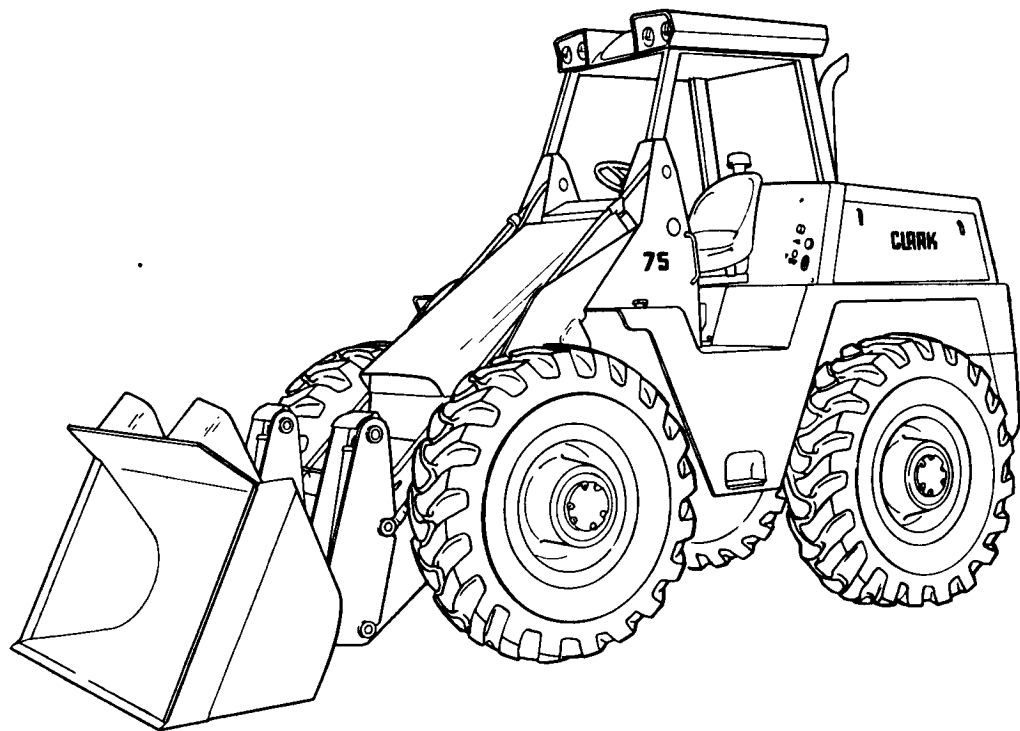
The following decals are no longer available.

<u>PART NO.</u>	<u>DESCRIPTION</u>
547851	CLARK EQUIPMENT
1517621	Racing Stripe
567755	CLARK EQUIPMENT
572200	All Wheel Steer
519880	Model 375A
548391	Model 480
549096	Pointer
569331	Bucket Indicator
1501805	MICHIGAN

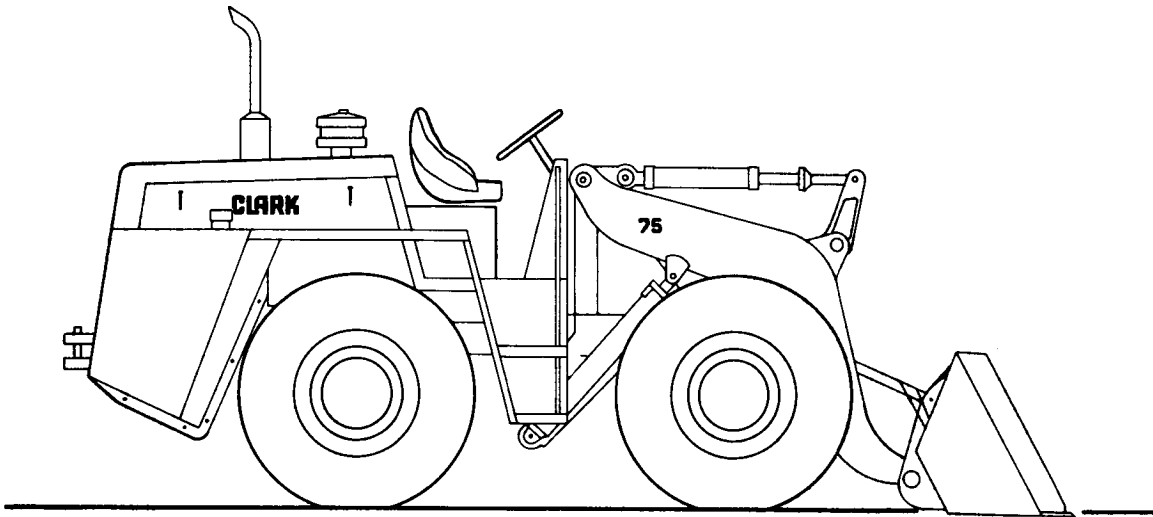
Typical location of the new decals are shown in the following illustrations. This depicts the machine as originally manufactured and not as may be required to meet current safety regulations.



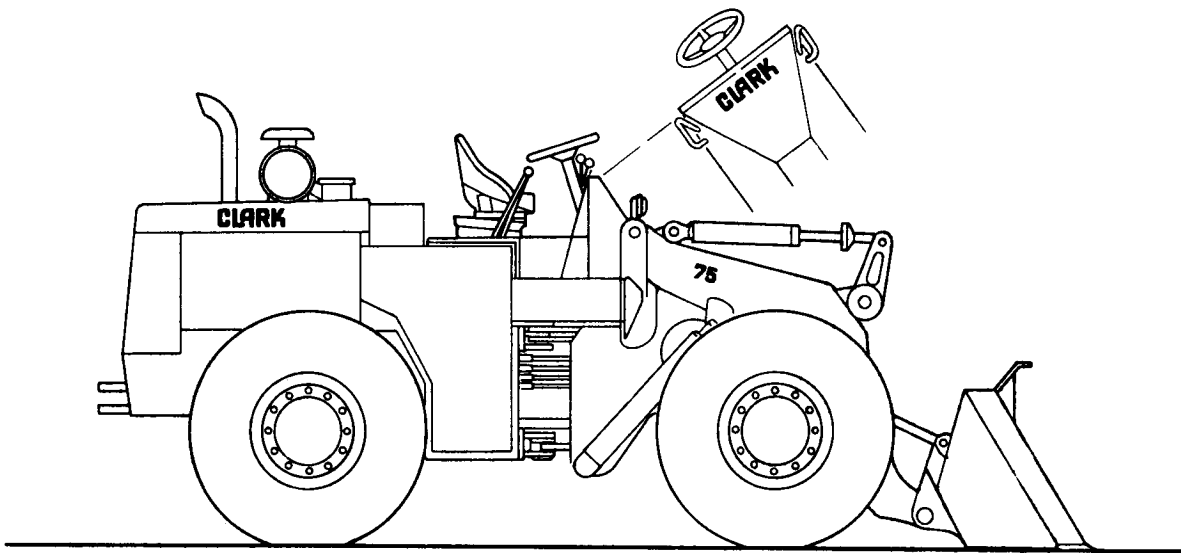
Series I Tractor Shovel



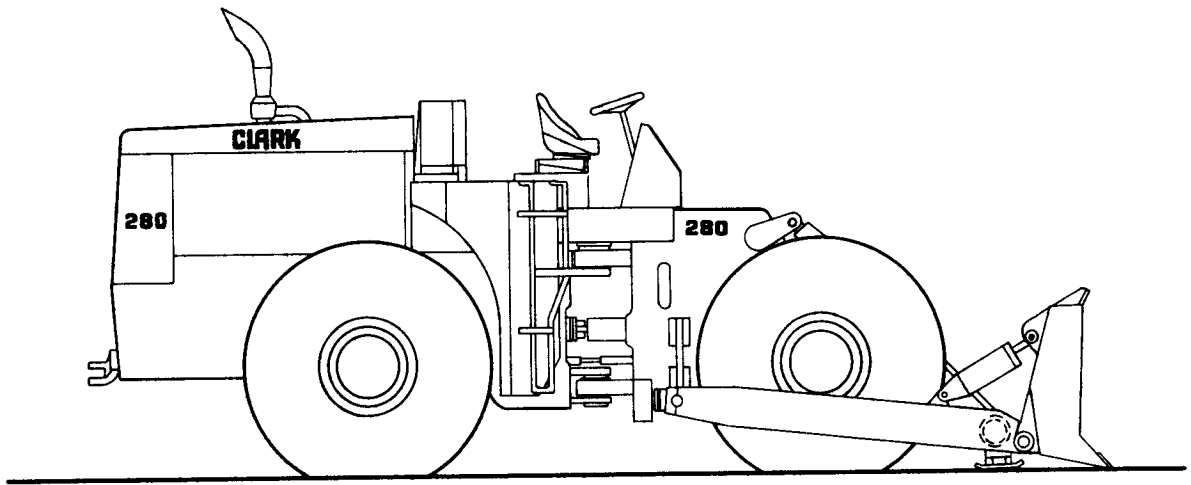
Series II Tractor Shovel



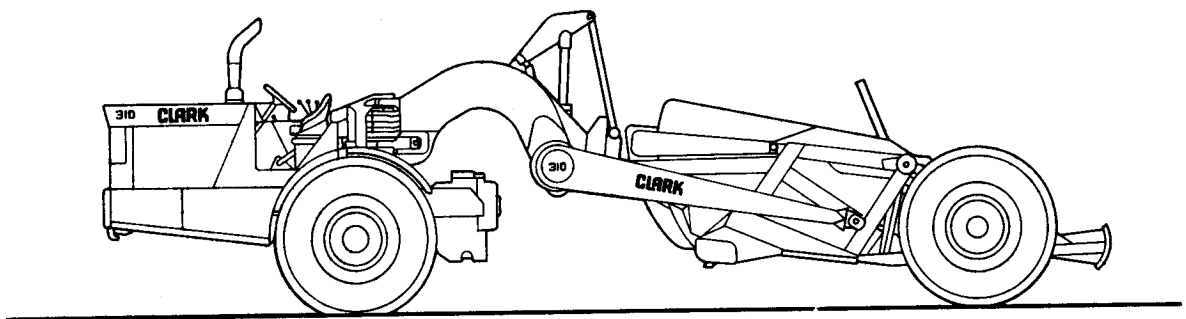
Series III Tractor Shovel



Series IIIA Tractor Shovel



Typical Dozer



Typical Scraper

CLARK

Service gram

26 January 1977

MICHIGAN SG-631

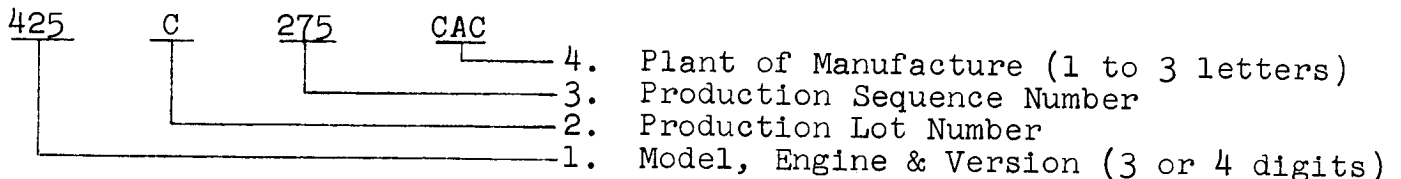
Group Ref. No. 2500

SUBJECT: Machine Serial Numbers

Clark Equipment Company is a world-wide company with manufacturing facilities in many countries. To aid in production scheduling, certain machine models are produced in only one country and other machine models are built in several countries and exported to meet our world market requirements.

At the time of manufacture, every machine is assigned a serial number to identify that machine from all others built by Clark.

The following breakdown explains the serial numbering system.



It is very important that the complete serial number be used in all correspondence with the Service Department and all orders for parts or literature. There have been instances where correspondence with the Service Department has included only the first three modules of the serial number. It is very likely that there are three or more machine around with the first three modules identical as shown in the following example.

425C275C
425C275CAC
425C275FSC

THE FOURTH MODULE MUST ALWAYS BE USED

Always use the complete serial number on all Delivery & Inspection Reports, parts orders, warranty requests, correspondence, service reports and literature orders.

CLARK

Service gram

6 April 1977

MICHIGAN SG-648

Group No. 2500

SUBJECT: Preparation for Warm Weather Operation – All Models

Contact your customers with suggestions for machine service NOW to avoid loss of time during the peak production months ahead.

Every machine needs some preparation for the hot summer weather and longer days.

Machines that have been idle during the winter will have different needs from the machines that have been working all year.

Some will need only oil and filters changed or a new hourmeter...others will require a brake job or new cutting edge and bucket teeth or maybe that leaky torque converter should be re-sealed.

★ ★

*Think about selling your service...
and Clark-approved parts.*

★ ★

*Encourage the use of the Clark Preventive
Maintenance Guide to help customers
schedule service and keep records.*

★ ★

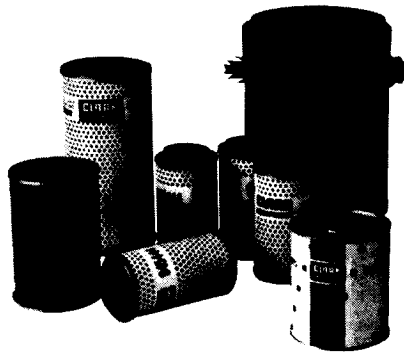
*Most customers will appreciate your
concern for their machine productivity.*

★ ★

Here are some ideas for selling parts and service: ►

1. COOLING SYSTEM

- Drain
- Flush
- Refill
- Test the thermostat.
- Inspect the pressure cap.
- Radiator — does it leak?
- Water pump — noisy?
- Pump drive belts — loose?
- Coolant hoses — leaky?



2. AIR SYSTEM

- Inspect engine air filters.
- Condition of tubes / hoses.
- Brake air filter.
- Brake air dryer — dessicant



3. LUBRICATION SYSTEM

- Engine oil filter — dipstick.
- Trans / converter oil level.
- Automatic central lube system (reservoir filled?)
- Axles — level plugs — seals

Differentials	<input type="checkbox"/>	<input type="checkbox"/>
	FRONT	REAR
Planetaries	<input type="checkbox"/>	<input type="checkbox"/>
	RH LH	RH LH



4. FUEL SYSTEM

- Fuel filters — tank
- Fuel pump — lines
- (Look for leaks.)

5. ELECTRICAL SYSTEM

- Inspect batteries
- electrolyte
- specific gravity
- Examine cables, clamps,
- wiring
- (Clean, tighten or replace.)

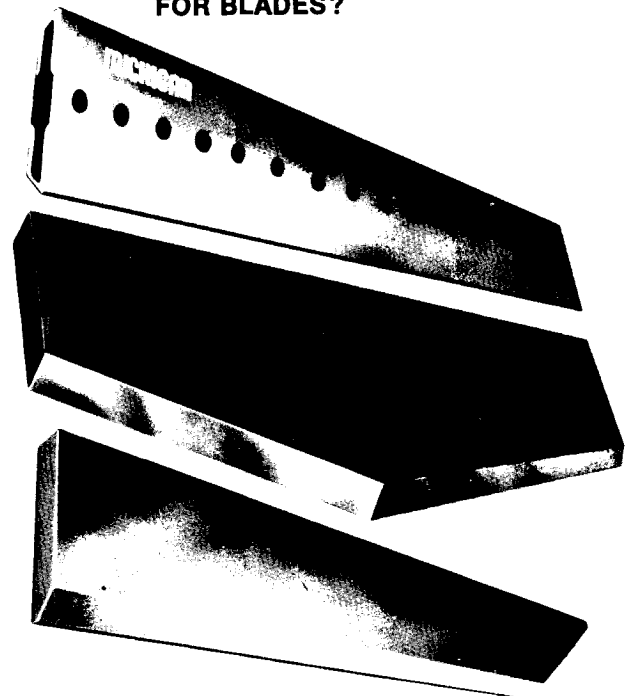
6. HYDRAULIC SYSTEM

- Filters
- Hoses
- Reservoir

7. BUCKET

- Bucket cutting edge
- Blade teeth condition

HOW ARE YOU FIXED FOR BLADES?



8. MID MOUNT

- Oil level plug
- Prop shafts
- Hinge pin

9. WHEELS

(Mark X in one)

YES NO

- Will the tires last?
- Are the planet cover seals leaking?
- Is everything tight enough?

(lugs, lugnuts, rims)

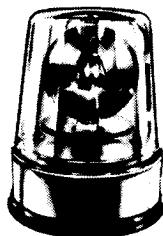
10. BRAKES

- Check and adjust.

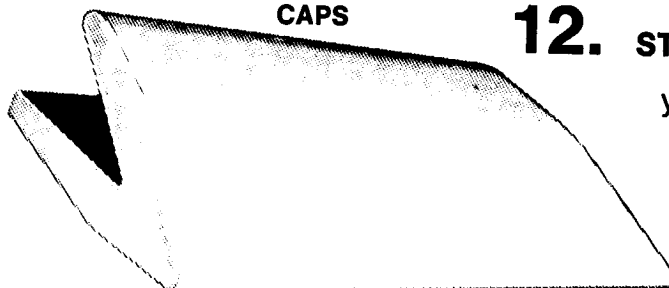
(It runs good and looks good but will it stop?)

11. CAB ACCESSORIES

- Air conditioner
- Fans, fan motors
- Windshields
- Wipers
- Washers
- Control panels, controls



WEAR CAPS

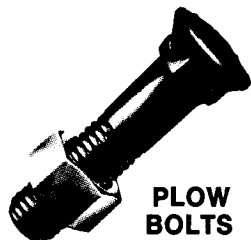


12. STEAM CLEAN

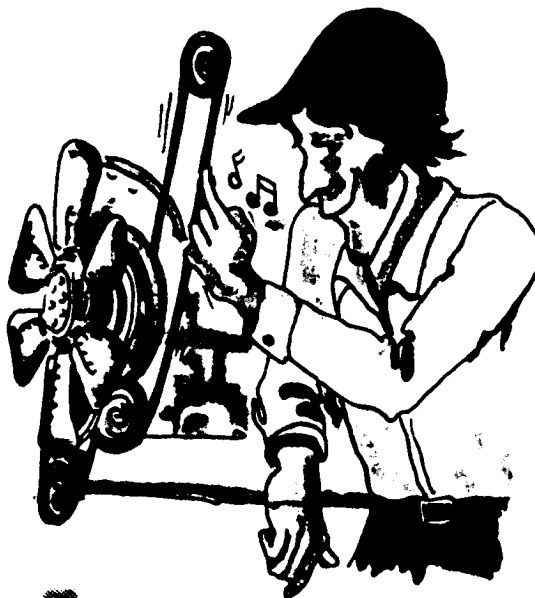
your machine
if it's a
SHAME
to be
SEEN



MAKE BELT TIGHTENING
PART OF
SPRING TUNE-UP

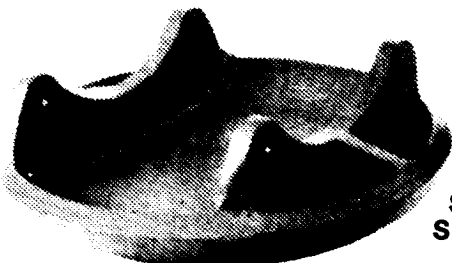


PLOW BOLTS

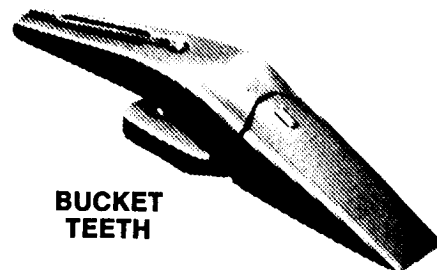


HAVE YOU
HAD YOUR
SEMI-ANNUAL
CHECK-UP?

CLEAN / REPAIR / REPLACE



SKID SHOES



BUCKET TEETH

**GOOD
CUSTOMER
HANDOUTS
HELP KEEP
GOOD CUSTOMERS**

CLARK Construction Machinery
Group

**Parts Catalog
of
Accessories
& Attachments**

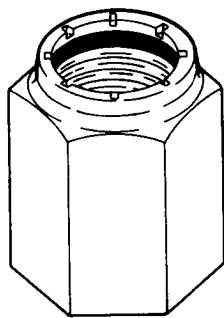


11 May 1977

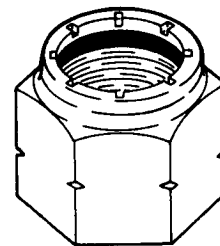
MICHIGAN SG-651
Group Ref. No. 2500

SUBJECT: Change from 68D Series Locknut
to 60D Series Locknut

The 60D series locknuts have replaced the 68D series locknuts in general use. This type of locknut is used for fastening axles, cylinder caps, engines and transmissions. The main visual difference in the two types of locknuts is the height. See Figure 1.



68D



60D

TS-14955

Figure 1

The 60D series locknut is a nut of standard height. It is of good quality and is heat treated. The 68D series locknut is softer. Because the 68D series nut is softer, it is of greater height than the 60D series. If a 60D series nut is used in place of a 68D series nut, it may be necessary to use a shorter bolt so the bolt will not hit bottom while it is being tightened.

CLARK

Service gram

22 June 1977

MICHIGAN SG-661
Group Ref. No. 1500

SUBJECT: Optional T-Handle Door Catch Field Installation
Models 175B, 275B, 280-IIIA

Engineering has made an optional improvement change in Tractor Shovels with Crown cabs to provide a T-handle door catch for field installation in Models 175B, 275B and 280-IIIA.

PARTS NEEDED PER MACHINE:

- 2 - 2513450 Latch Strike Assembly
 - includes { 1 - Nut Retainer
 - { 1 - Latch Striker Plate
 - { 1 - Cage Nut
- 2 - 85G-1032 Machine Screw
- 2 - 949596 Rubber Bumper
- 2 - 12D-10 Hex Nut
- 2 - 2512192 Latch Plate Reinforcement
- 4 - 23C-616 Bolt for Latch Strike Assy
- 4 - 17D-3 Locknut
- 2 - 2512199 T-Handle
- 4 - 2512195 Door Reinforcement Plate
- 2 - 2512218 Eslok Nut for T-Handle
- 8 - 47G-432 Hexhead Machine Screw
- 8 - 17D-1 Locknut

FIELD REWORK PROCEDURE

1. Remove existing door catch assembly, strike plate assembly and mounting hardware.
2. Drill mounting holes for new latch strike assembly.
3. Install new T-handle door catch in existing holes of cab door.
4. Install new latch strike assembly with attaching hardware. Refer to Figure 1.

ERN-09776

85G-1032 2 REQD
949596 2 REQD
12D-10 2 REQD

23C-616 4 REQD
17D-3 4 REQD

2513450 2 REQD

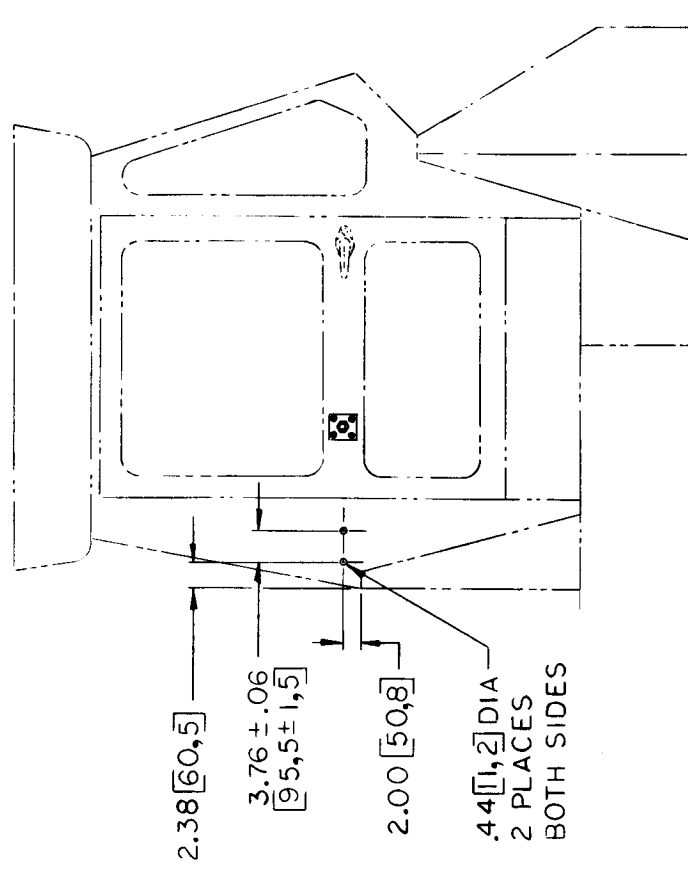
2512192 2 REQD

2512199 2 REQD
2512218 2 REQD

47G-432 8 REQD
17D-1 8 REQD

2512195 4 REQD

NOTE: THIS KIT MAY BE INSTALLED ONLY ON
TRACTOR SHOVELS WITH CROWN CABS



RH SIDE VIEW OF CAB

TS-14995

Figure 1

CLARK

Service gram

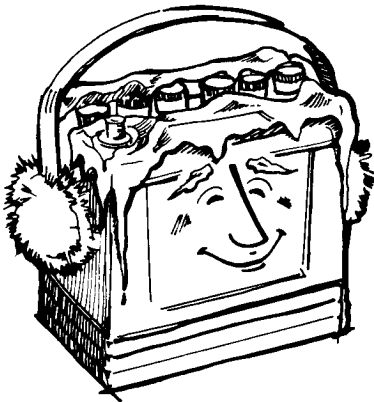
28 September 1977

MICHIGAN SG-669
Group Ref. No. 2500

SUBJECT: Preparation for Cold Weather
All Models

THINK SERVICE - Cold weather brings out the little gremlins that slip in unnoticed during warm weather and begin their pranks when the temperature drops.

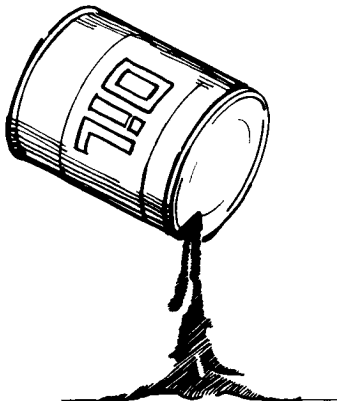
KEEP BATTERIES FULLY CHARGED - Replace batteries when required. REMEMBER-----A fully charged battery has only 40% cranking ability at 0°F. (-18°C.). Add distilled water as required.



A fully charged battery will not freeze under normal conditions. Dead batteries, or those with a low specific gravity reading are susceptible to freezing and damage. KEEP THE BATTERIES PROTECTED. Use CLARK BATTERY SAVER!



USE THE RIGHT LUBRICANTS - Watch the viscosity of your lubricants. Use the viscosity recommended for the ambient temperature in your area.



Summer weight lubricants will become stiff during cold weather. Stiff lubricants can cause starting difficulty.

CHANGE THOSE FILTERS - Clean filters mean clean oil, and clean oil means better performance. Dirty oil can cause costly repairs and downtime.



Use your CLARK PREVENTIVE MAINTENANCE GUIDE. Be sure to change filter element at the recommended intervals. Clean re-usable filters and strainers at the regular specified intervals.

PROTECT YOUR COOLING SYSTEM - Keep your cooling system clean and well protected with permanent type (Ethelene glycol) anti-freeze. A 50% coolant solution (one half anti-freeze to one half clean soft water) will protect the cooling system to -35°F . (-37°C .). Check, adjust and replace fan belts when needed.



REMEMBER-----Water freezes at 32°F . (0°C .). Make sure that your radiator and cooling system are well protected against freezing during cold weather.

Every 1000 Operating Hours - Drain, clean, flush and refill your machine's cooling system.

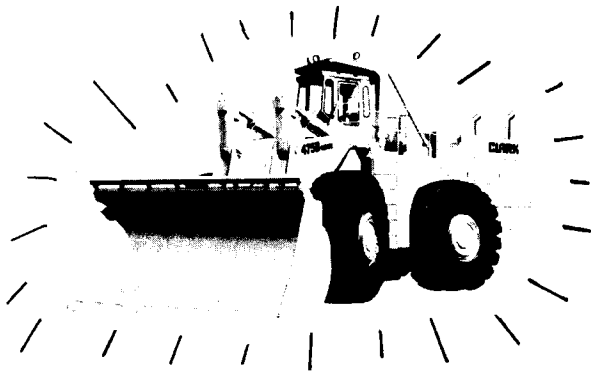
COLD WEATHER STARTING - Keep your electrical system in good working order. Look for corroded terminals or frayed insulation. Put these power thieves out of business as soon as you find them. If your machine has a "Quick Start" cold weather starting aid, make sure that the cylinder has a full charge of ether. Make sure that the system does not leak and the valve works properly. If your machine does not have an ether injection system or a pre-heater, a pressurized can of ether can be used as a starting aid.



Spray a little ether into the air cleaner intake while cranking the engine.

REMEMBER-----Use ether in small amounts. Too much ether can cause damage to your engine.

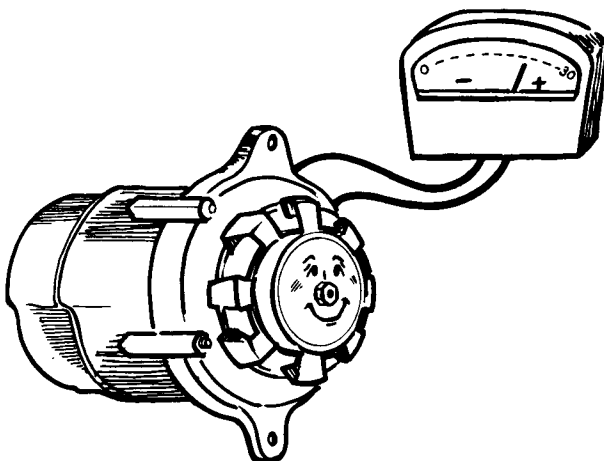
KEEP IT CLEAN - A clean machine is a safer machine. It is especially important to keep your machine clean during the winter. Dirt, salt and water can combine to cause corrosion. Steam clean the machine regularly. If steam is not available, use a mineral spirit spray that will not harm electrical components.



Use a little touch-up paint as needed. Protect your machine from rust.



CHECK ALTERNATOR OUTPUT - During the cold winter weather your machine will use more electricity. It is especially important to make sure you are getting maximum output from your alternator.



Winter weather means using the heater, defroster and wipers. This means you will need efficient performance from your alternator.

CHECK YOUR COLD WEATHER ACCESSORIES - Inspect your heater, defroster, fittings, lines, and windshield wipers. Make sure they are in good working order. Check the cab for drafts from glass and moldings. Replace glass and moldings as needed.

SERVICE THE AIR SYSTEM - Keep the air system free of condensation. If your air system is fitted with an air dryer or alcohol evaporator, make sure it is in good working order. Drain all condensation from system and components.

INSPECT ALL SAFETY SYSTEMS AND DEVICES - Check the condition and operation of the brake system. Check the condition of the ROPS and seat belt. Make sure that they are in good condition.

KEEP IT SERVICED SYSTEMATICALLY

SCHEDULE REPAIRS - This is the time to schedule repair and overhaul operations. Torque converter overhaul, replacement of leaking wheel seals and other repair operations should be scheduled during the "off season" so the machine will be ready for spring.

WINTER STORAGE - If you put your machine in winter storage, make sure you disconnect the ground cable from the battery. All machines in storage should be checked out according to the list below every 30 days.

1. Start and run the engine at least 15 minutes.
2. Operate the transmission in each speed range, both forward and reverse.
3. Move the machine around to rotate the planetary hubs several times so that the internal axle parts receive proper lubrication.
4. Cycle all hydraulic components several times to make sure that oil flows through the complete system.

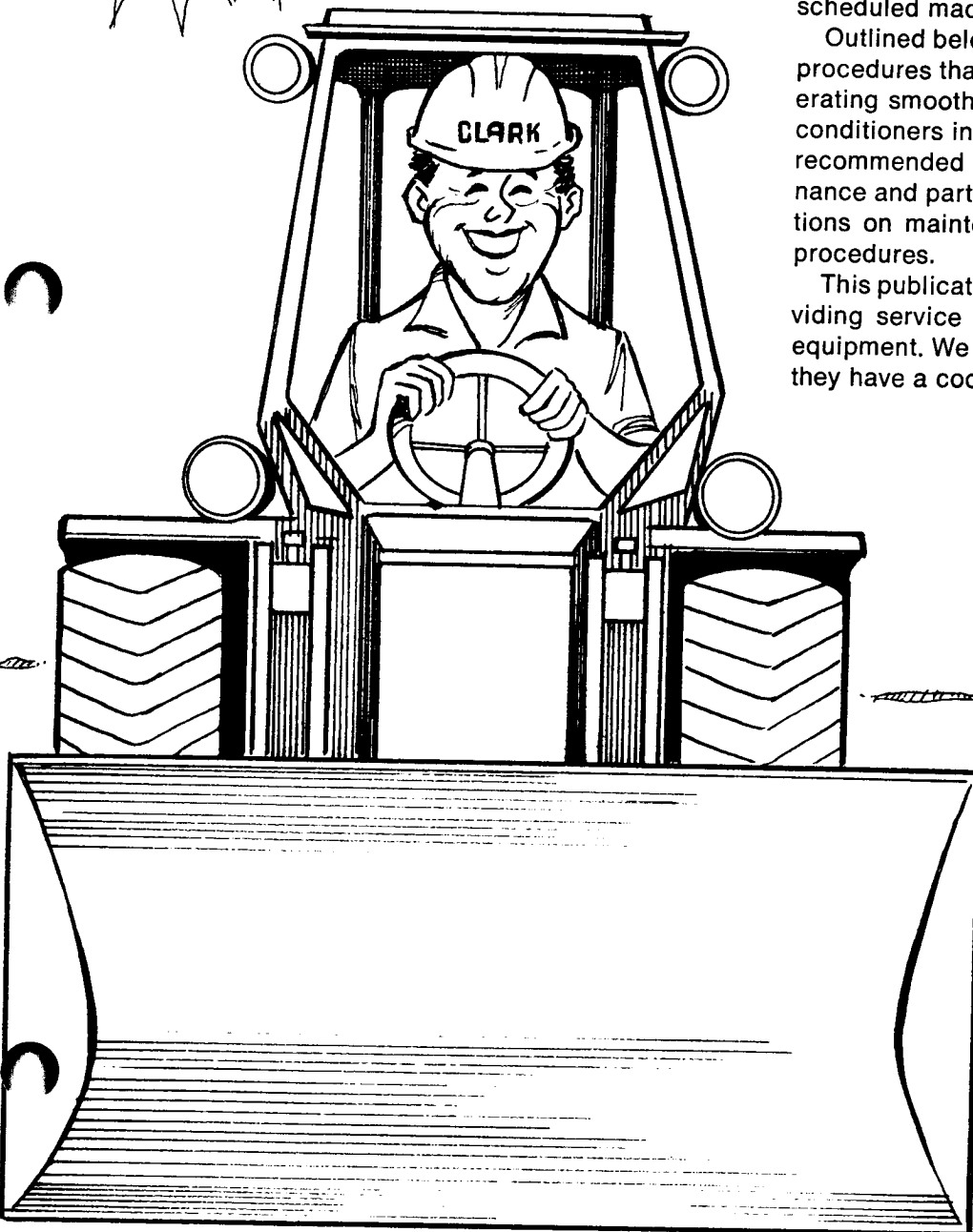
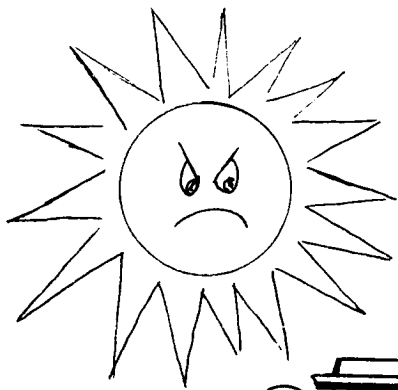
PASS THESE HINTS ALONG TO YOUR CUSTOMERS. THEY WILL APPRECIATE YOUR CONCERN.

NOW IS THE TIME TO SELL YOUR SERVICE AND CLARK APPROVED PARTS.

19 May 1978

AIR CONDITIONING — Getting Ready for Summer

Michigan SG-693
Group Ref. No. 1500



Air conditioning has become a very popular construction equipment option. By providing optimum operator comfort, air conditioning can make a significant contribution to overall efficiency and productivity. For that reason, it is important that the total air conditioning system be checked thoroughly before the spring and summer season begins. Thereafter, the same basic checks and maintenance procedure should be made a part of regular scheduled machine service.

Outlined below are the basic checks and maintenance procedures that will keep an air conditioning system operating smoothly. Because Clark installs a variety of air conditioners in various types of equipment, it is strongly recommended that the manufacturer's service, maintenance and parts books be consulted for specific instructions on maintenance, particularly on trouble-shooting procedures.

This publication contains the basic information on providing service to your customers with air conditioned equipment. We suggest you contact them and make sure they have a cool, comfortable summer.





CHECKS BEFORE OPERATION

VISUAL CHECK REVEALS:

- Broken drive belt
- Frayed or worn drive belt

- Loose/sagging belt
- Loose/missing hose clamps
- Frayed/bulged/cut hose

- Loose/missing capscrews or bolts — compressor and/or compressor clutch, coil assembly, evaporator assembly
- Loose/missing mounting capscrews or bolts, braces — compressor, coil, evaporator

- Oil leaks — compressor
- Damaged fins/dirty coil
- Damaged/loose hose fittings and connections — coil, condenser, evaporator
- Damaged/broken/missing wiring, poor ground

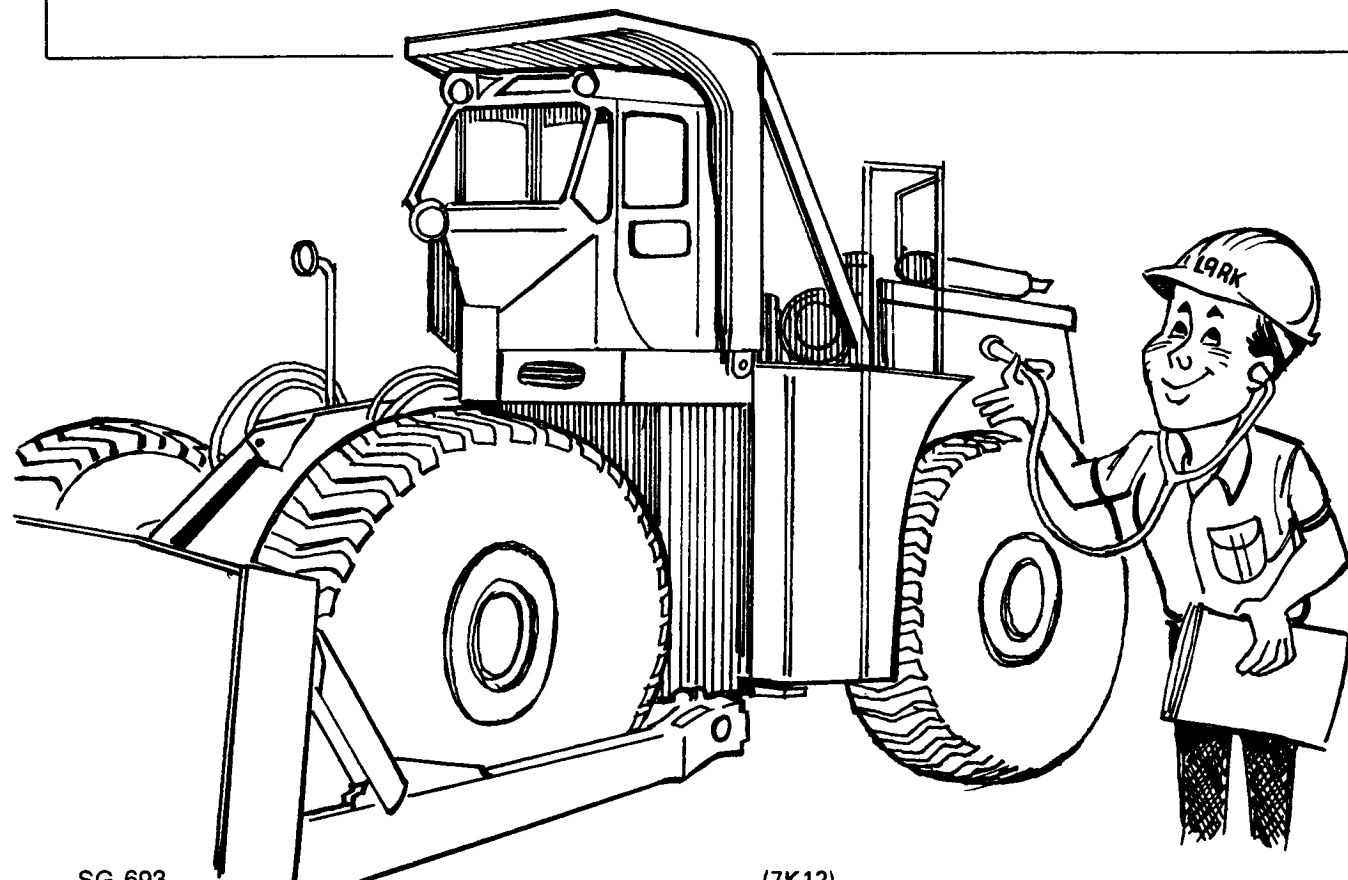
CORRECTION

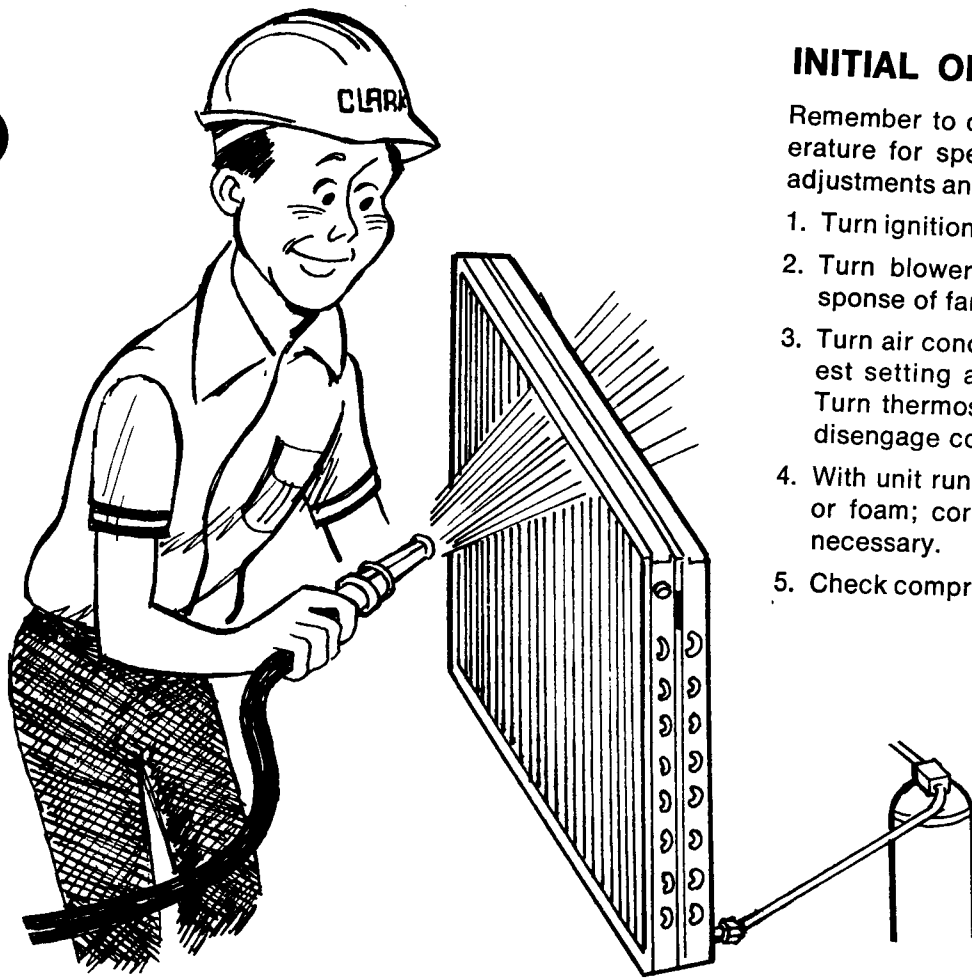
- Replace with proper belt
- Replace with proper belt; check pulley alignment
- Check tension; adjust
- Tighten; replace
- Replace if necessary; reroute away from hot areas, sharp edges
- Tighten securely; replace

- Tighten; replace

- Check seals, gaskets; replace
- Repair/straighten; clean thoroughly
- Replace; check all connections

- Replace; check all connections





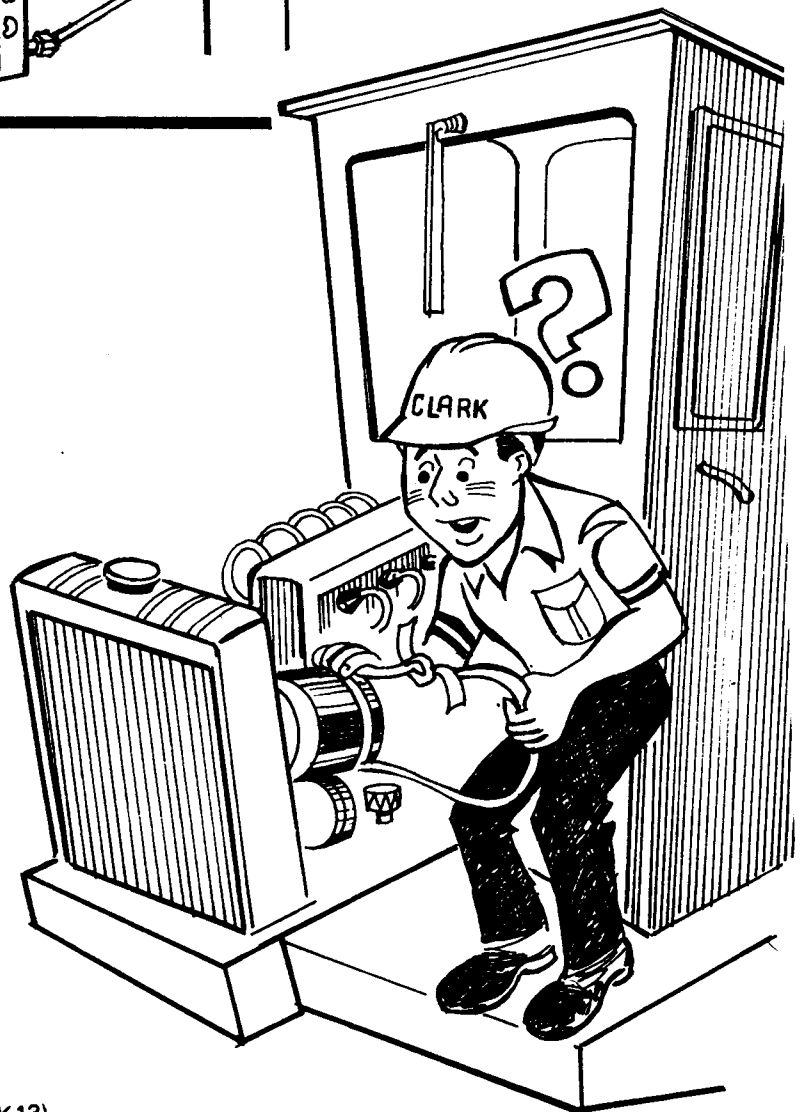
INITIAL OPERATION

Remember to check applicable manufacturer's literature for specific trouble shooting procedures, adjustments and test values.

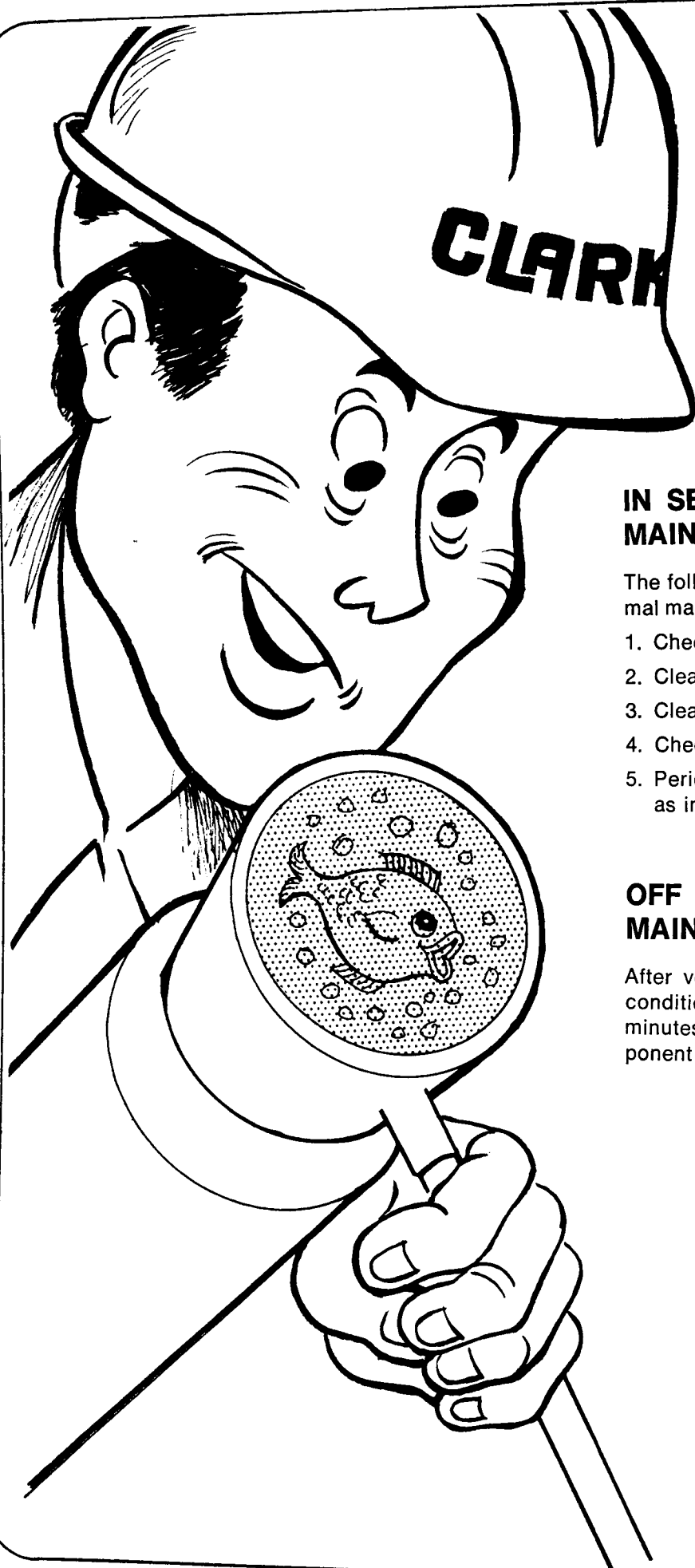
1. Turn ignition ON; start machine.
2. Turn blower ON; if multiple speed, check response of fan speed to switch position changes.
3. Turn air conditioner ON; set thermostat on coldest setting and check compressor operation. Turn thermostat OFF; clutch should kick out to disengage compressor.
4. With unit running, check sight glass for bubbles or foam; correct leakage or add refrigerant, if necessary.
5. Check compressor oil level.

TESTING

1. Turn ignition ON; set blower fan on HI and thermostat on coldest setting. Compressor clutch should engage, condenser and evaporator fan(s) should run at high speed and discharge air should be cool after a few seconds.
2. Allow unit to operate about 20 minutes; check for bubbles or foam in sight glass. Check to make sure condensate is draining from drain hose.
3. Turn thermostat OFF; clutch should disengage and discharge air should become warmer.
4. Turn blower switch to lower speeds and observe reaction; fan(s) speed should match setting.
5. During whole period of operation, note any unusual noise or vibration; locate source and correct.



Work Safely!



IN SEASON MAINTENANCE

The following checks should be integrated in the normal machine maintenance program.

1. Check compressor drive belts
2. Clean evaporator and condenser coil
3. Clean air filter
4. Check all hose and connections
5. Periodically check sight gauge for bubbles or foam as indication of leakage or refrigerant loss.

OFF SEASON MAINTENANCE

After vehicle is thoroughly warmed up, operate air conditioner at least once each 30 days for about 10 minutes. This will thoroughly lubricate seals and component parts to prevent damage.

CLARK

Service gram

31 July 1978

MICHIGAN SG-710
Group Ref. No. 1500

SUBJECT: Air Conditioners - Model 35C, 45B, 45C, 55B,
75B, 125B, 175B, 275B, 475B, 675B, 280111A & 380111A

Air conditioners are available as optional equipment on all current models of Clark tractor shovels and dozers except the Model 675B. Air conditioning is standard equipment on Model 675B tractor shovels. The following chart gives information on model, part number and service. Air conditioning units serviced by Clark are covered in the machine parts manual/microfiche.

<u>MODEL</u>	<u>SERVICED BY</u>
35C	Clark *NOTE
45B	Clark *NOTE
45C	Clark *NOTE
55B	Frigiking - Part Number 91-09234
75B	Clark *NOTE
125B	Clark *NOTE
175B	Frigiking - Part Number 91-12696
275B	Frigiking - Part Number 91-12696
475B	Clark *NOTE
675B	Clark *NOTE
280111A	Frigiking - Part Number 91-12696
380111A	Frigiking - Part Number 91-12696

*NOTE: See the Applicable Clark Parts Manual/Microfiche

For service on Frigiking units, contact:

Frigiking
10858 Harry Hines Blvd.
Dallas, TX 75220

Phone ----- (214) 357-6361

Service Manager ----- Don Park
Parts Manager ----- Lloyd Woodlee

18 October 1978

MICHIGAN SG-723
Group Ref. No. 2500

SUBJECT: Adjustment of Bucket Leveler and Boom
Kickout - All Series B or C Tractor Shovels

Correct adjustment of the boom kickout and bucket leveler limit switches is necessary for satisfactory operation of the boom and bucket system. Use the following procedures to check the limit switches and other parts in relation to the limit switches for correct adjustment. These procedures can be used on all tractor shovels with a model number suffix of B or C.

Bucket Leveler: (See Figure 1.)

Caution: Make sure that the leveler cam is parallel to the bucket cylinder rod at all times.

1. Put the bucket on the ground in a level position.
2. Look at the roller on the limit switch. The roller must be off the leveler cam, but almost in contact with the cam.
3. Adjust the stroke of the roller arm by loosening the bolts (item 1) for mounting the cam and moving the cam. The minimum stroke of the roller arm is .125 (3,2). Maximum stroke of the roller arm is .5625 (14,3).
4. Check the bucket leveler for correct operation. Raise the bucket to several different heights and cycle the bucket slowly at each of these heights. Each time the bucket rotates back from the DUMP position, the bucket should stop when it is in a level position.

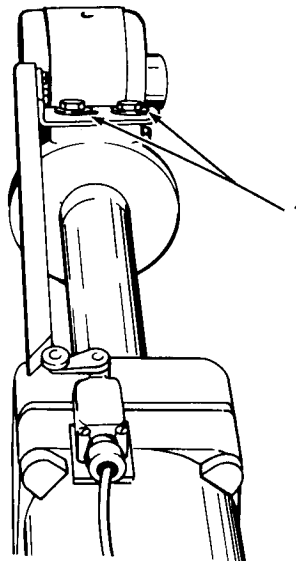


Figure 1.

TS-11065

Boom Kickout:

1. Put the bucket on the ground in a level position.
2. Adjust the roller arm for .12 (3,0) clearance between the roller and the cam. See Figure 3.
3. Adjust the boom kickout height by raising or lowering the bracket for the kickout switch in the mounting slots. See Figure 2. Lower the bracket to raise the the boom kickout height. Raise the bracket to lower the boom kickout height.

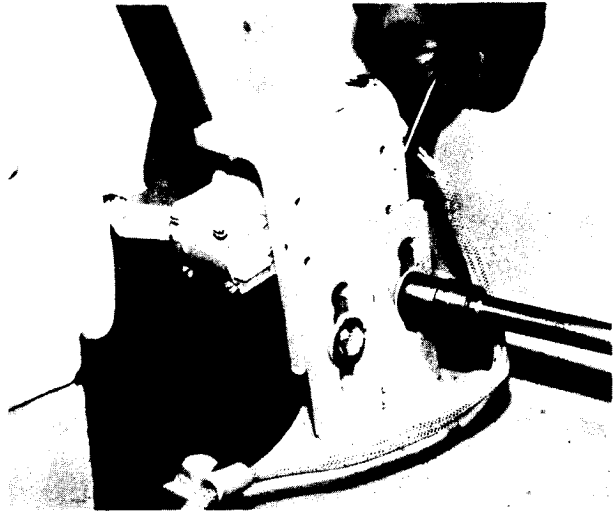
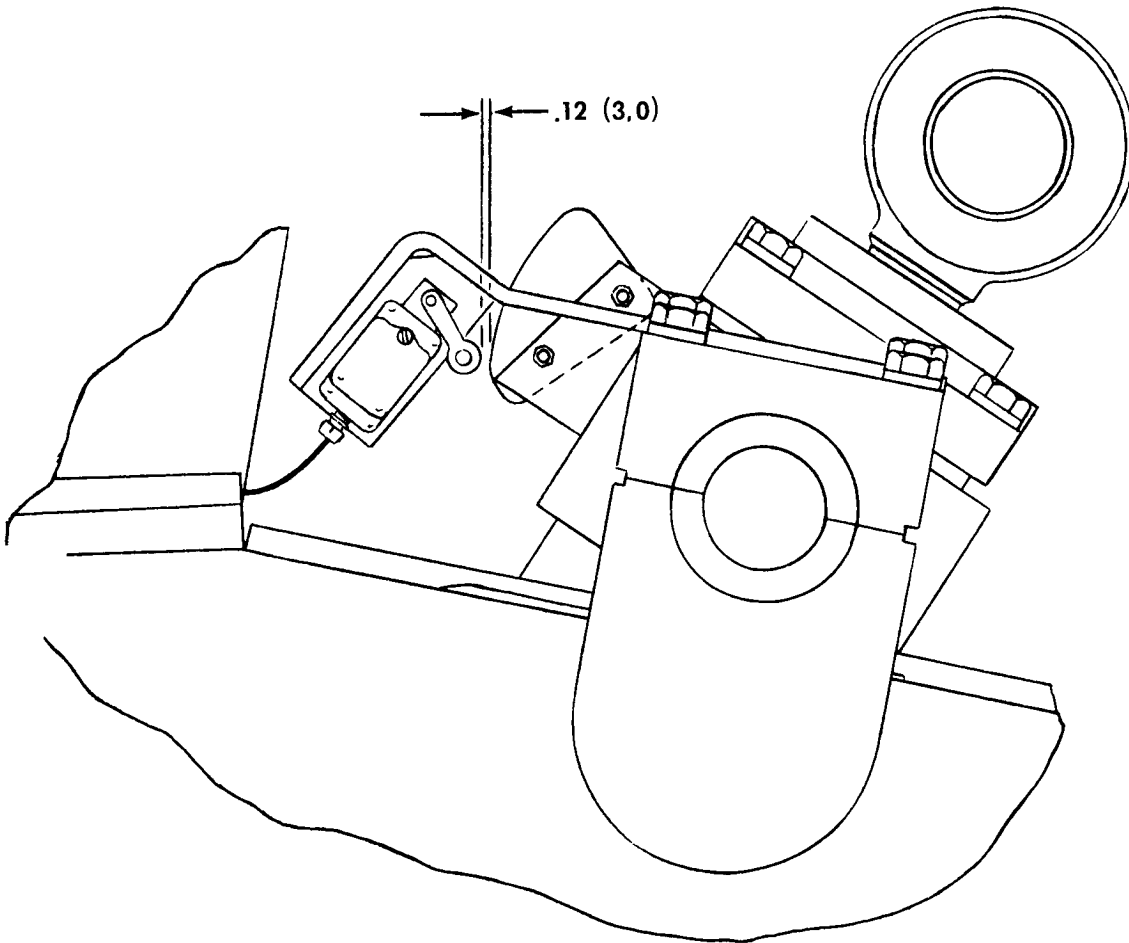


Figure 2. TS-15311



TS-15317

Figure 3.

25 October 1978

MICHIGAN SG-728
Group Ref. No. 1500

SUBJECT: Adjustment of Windshield Wipers
All Tractor Shovels and Dozers

Correct adjustment of windshield wiper arms is necessary for maximum efficiency of the windshield wipers. Incorrect adjustment of the wiper arm can cause poor wiper efficiency or failure of wiper motors and wiper gear teeth. If you have a machine with an enclosed cab with windshield wipers, make sure that the wiper arms are adjusted correctly. Use the following procedure for correct adjustment each time you install a windshield wiper arm and blade.

ADJUSTMENT PROCEDURE:

1. Energize the wiper motor and operate for several cycles, then stop the motor.
2. Put the wiper arm on the pivot shaft so that the clevis for the blade is at least 1.5 in (38,1 mm) from the nearest molding, cowl or other obstruction. Install the wiper blade.
3. Flush the windshield with water and operate the wiper motor at high speed. Check the point where the blade changes direction. At both ends of the wiper stroke, you must have a minimum clearance of 1.0 in (25,4 mm). See Figure 1.

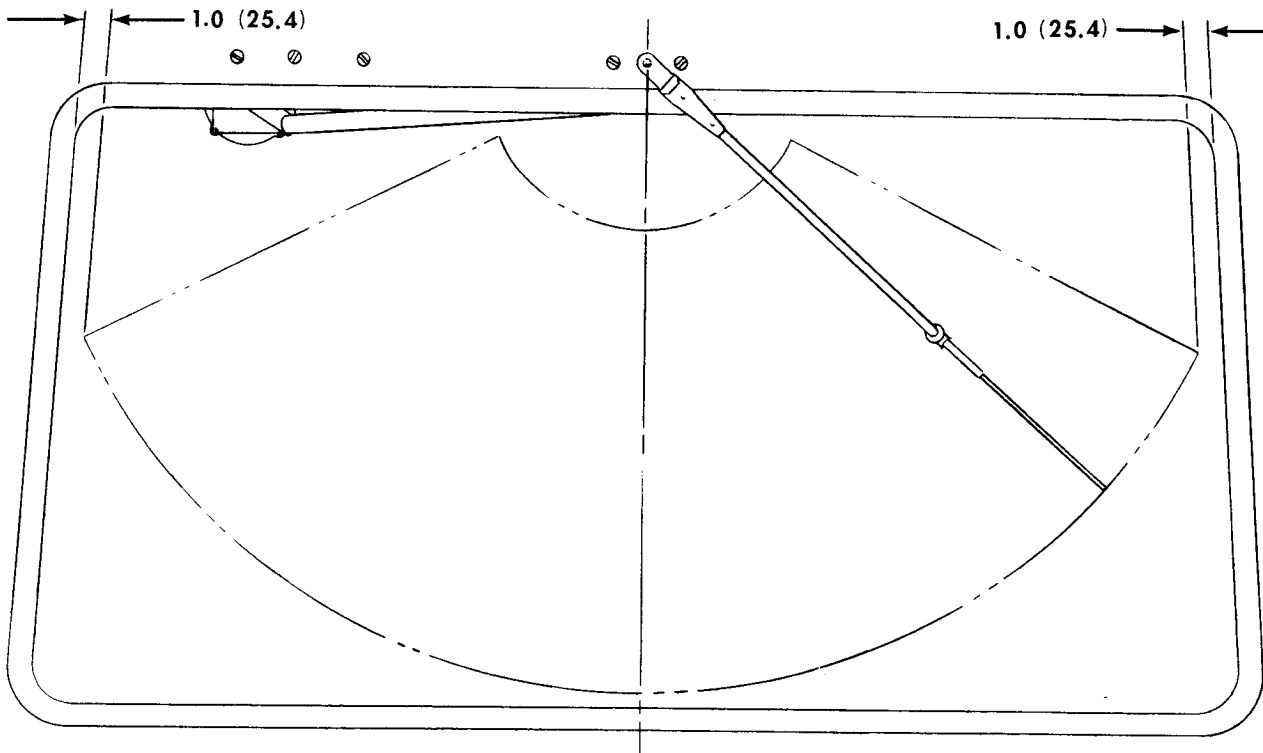


Figure 1.

TS-15318

CLARK

Service gram

14 September 1979

MICHIGAN SG-764
Group Ref. No. 1500

SUBJECT: Windshield Wiper Motors (American Bosch)
All Models of Tractor Shovels and Dozers

There have been reports of the driven gear in some windshield wiper motors being destroyed because of the wiper blade running up on the window molding or force being applied when either cleaning the windshield or installing the windshield wiper arm.

These wiper motors are of the permanent magnet type and have locked armatures in the off position.

Be sure to use the correct blade and arm combination when replacement is necessary. A blade and arm combination that is not correct could cause the wiper blade to run up on the window molding.

When installing the wiper arm to the motor, do not let the arm move while tightening the nut. Hold the wiper arm in one position while tightening the nut (See Figure 1). Tighten the wiper arm mounting nut to a torque of 6 LBF-FT (8,1 N m, 0,8 kgf m).

When pulling the wiper arm away from the windshield for cleaning purposes, do not move the arm or pull it too far away from the windshield. Moving the arm or pulling it too far will cause either the driven gear to be destroyed or the wiper arm to be bent.



TS-33633

Figure 1

CLARK

Service gram

21 January 1980

MICHIGAN SG-780
Group Ref. No. 2500

SUBJECT: Mounting Bolt Torque Checks
All Models of Tractor Shovels and Dozers

Proper bolt tightness is very important on new machines as well as used machines for both reliability and safety.

Bolt torque checks in the first 4 to 12 hours of operation after a new machine is put to work or whenever components are removed for repair is an important preventive maintenance activity.

Bolt torque values should be physically rechecked in the following areas:

1. Wheel mounting bolts
2. Axle mounting bolts
3. Differential carrier and planet carrier bolts
4. Engine mounting bolts
5. All propshaft bolts
6. Transmission mounting bolts

Visual checks should also be made at this time to make sure that sheet metal, cab, boom and bucket, etc., mounting bolts are tight and that no other components are loose or damaged.

Any mounting bolts that are loose, missing or improperly installed should be taken care of immediately.

CLARK

Service gram

November 1980

MICHIGAN SG-830A
Group Ref. No. 2500

(This bulletin replaces SG-830, dated October 1980. REASON: Information Revision)

SUBJECT: 175B Lot 4 Changes
S/N Cummins 438D
GM 427D

The list below consists of changes made on the 175B Lot 4 Tractor Shovels that are different from the present 175B Lot 3 Tractor Shovels. The following changes have been made:

SPECIFICATIONS

(Specifications not listed are the same as the present 175B Lot 3 specifications)

Fluid Specification:

Transmission and Converter Hydraulic: -30°F (-34°C) and above:
Clark Transmission and Converter Fluid Part No. 962669 (5 Gallon can)
or 962672 (55 Gallon Drum)

DO NOT USE MOTOR OIL IN THESE TRANSMISSIONS

Capacities (Approximate) U.S. Measure – Metric Measure (Liters)	175B Cummins	175B GM
Engine Crankcase and System	9 gal (34,1 L)	6 gal (22,7 L)
Cooling System	20 gal (75,7 L)	22 gal (83,3 L)
Front Drive Axle Differential	9 gal (34,1 L)	9 gal (34,1 L)
Front Drive Axle Planetary Hubs (ea.)	3.25 gal (12,3 L)	3.25 gal (12,3 L)
Fuel Tank	114 gal (431,5 L)	114 gal (431,5 L)
Hydraulic System (total)	118 gal (446,6 L)	118 gal (446,6 L)
Rear Drive Axle Differential	9 gal (34,1 L)	9 gal (34,1 L)
Rear Drive Axle Planetary Hubs (ea.)	3.25 gal (12,3 L)	3.25 gal (12,3 L)
Torque Converter and Transmission	12.5 gal (47,3 L)	12.5 gal (47,3 L)
Mid-Mount Bearing	2 qts (1,9 L)	2 qts (1,9 L)

Pressures*	175B Cummins	175B GM
Engine Oil:		
Low idle (minimum)	15 psi (103 kPa)	11 psi (76 kPa)
Air Compressor	95-110 psi (655-758 kPa)	95-110 psi (655-758 kPa)
Main Hydraulic System – (At maximum rpm with one set of cylinders against stops)	2125-2325 psi (14644-16023 kPa)	2125-2325 psi (14644-16023 kPa)
Steering Hydraulic System – (At maximum rpm with tractor halves against stops)	1800 ± 50 psi (12411 ± 345 kPa)	1800 ± 50 psi (12411 ± 345 kPa)
Transmission Clutches – (At idle rpm in all speed ranges both forward and reverse)	240-280 psi (1655-1930 kPa)	240-280 psi (1655-1930 kPa)

**NOTE: All hydraulic pressure checks should be made with converter oil at operating temperature, approximately 180^oF to 200^oF (82^oC to 94^oC) and hydraulic system oil at least 150^oF (65^oC).*

Engine Specifications

Engine (make)	Cummins	Detroit Diesel
Model	NT-855-C310	8V71-N65
No. of Cylinders	6	8
Bore in (mm)	5.50 (139,7)	4.25 (108,0)
Stroke in (mm)	6.00 (152,4)	5.00 (127,0)
Displacement cu in (liters)	855 (14,0)	567.4 (9,3)
Maximum Torque ft lbs (kg·m) @ RPM	(123,1) 1500	(110,5) 1600
Flywheel Horsepower	279	304
Governor RPM	2100	2100
Low Idle RPM	700-775	700-775
High Idle RPM	2200-2300	2200-2300

**NOTE: Stall rpm is the maximum obtainable rpm with converter oil at operating temperature 180° F to 200° F (82° C to 94° C) parking brake applied, wheels blocked, directional and speed range levers in FORWARD-HI and bucket held in full close position. Stall rpm is applicable to altitude of 600 ft and ambient temperature of 70° F (21° C). Due to the many combinations of altitude and temperature possible in the field, space does not permit publishing here all the corrections necessary to stall rpm indicated to accommodate such variations. It is suggested the engine manufacturer's distributor be contacted to determine the correction necessary for altitude and temperature in your application.*

Batteries – Cummins and GM

Clark Part No. 2511022 or 5294985

No. and Voltage 4 – 12 V

System – 24 volt

Ground – Negative

Specific Gravity – 1.230 – 1.260

Transmission – A modulated transmission is now standard equipment***Front Axle** – A completely new, larger front axle is now used.**Rear Axle** – The rear axle will have a planetary flange change so that 29.5 wheels and tires may be used. 29.5-25 L-4 tires will be available. The 29.5 tires will reduce rear axle oscillation from 11-1/2 degrees to 8 degrees.

The overall track of the machine will increase from 90 in (22,86 mm) to 92 in (23,37 mm).

Propshafts – U-joints and flanges on propshafts will change from 7C to 8-1/2C to give a stronger and more reliable U-joint.**Engine** – Cummins powered machines have the Cummins series NT-855 low profile engine with an improved muffler system.**Center Hinge** – A double steep angle bearing has been added to the center hinge pin assembly. This bearing is like the double steep angle bearings added to other tractor shovels previously.**Main Valve** – A dampening kit that is part of the main hydraulic valve will now be standard equipment. The dampener will give smoother operation with increased 'metering'.**Pilot Valve** – The pilot control valve now has electric detents to give a more positive control and response to the main valve assembly.**Control Valve Linkage** – The hydraulic control valve linkage has been redesigned to give better metering and a more positive feel of the controls.**Hydraulic Fluid Reservoir** – A sight glass replacing the dipstick presently used has been added to the hydraulic reservoir for easier fluid level checking. The hydraulic reservoir capacity has been decreased from 122 gal (461,8 L) to 98 gal (371,0 L) to reduce maintenance expenses.**Hydraulic Reservoir Suction Filters** – The suction filters have been removed from the hydraulic reservoir to permit the use of 2 pick-up tubes. The steering system suction tube will now be lower than the main hydraulic system tube to prevent steering system loss if the main hydraulic system develops a severe leak.

Hydraulic System Test Ports – Hydraulic system quick connect test ports have been installed in easy to reach panels in the engine compartment and to the center hinge area.

Hydraulic System Fittings – All fittings in the hydraulic system have been changed to forged fittings, for a stronger more dependable fitting.

Bucket Cylinders – Bucket cylinders have the new modular bearings and U-cup seals. These cylinders also have bolt-on threaded pistons and heavier cap bolts to decrease leakage.

Gauges and Wiring Harness – New gauges and wiring harnesses are now used to improve reading of the gauges and to have a more trouble-free electrical system.

Engine and Transmission Mounts – Rubber mounts are now used on the engine and transmission to decrease vibration and increase sound suppression.

Air Horn – A straight type air horn is now used.

Quick Start – A quick start system is now standard equipment to give easier starting in cold weather.

ROPS Cab – A new intergral Palm ROPS Cab will be available to increase operator comfort and ease of operation. The cab and machine will be equipped so as to meet the 90 DBA sound level requirements at the operator's level.

Air Compressor to Air Dryer Tube – The air compressor to air dryer tube will be coiled to give more cooling area for the air.

Transmission Filters -- The transmission filters have been moved to the rear frame behind the axle cradle support for easier service accessibility.

Rear Brake Reservoir – The rear brake reservoir is now under the hood in the engine compartment for easier servicing.

Batteries – Larger maintenance free batteries are now standard equipment.

Air Dryer – A Stratoflex Air Dryer is now standard equipment to give increased reliability to the air system.

Complete specifications and operator information are included in Operators Manual No. 3005. Parts information is available in Parts Manual No. 3243.

November 1980

MICHIGAN SG-850
Group Ref. No. 2500

SUBJECT: Weld Specification Revision
All Models of Tractor Shovels and Dozers

The welding qualification procedure has been revised. See Figure 1 for the latest procedure information.

PROCEDURE

REMOVE ALL OLD WELD USING CARBON ARC (AIR-ARC), GRINDER, OR PNEUMATIC CHIPPER WHEN REQUIRED. OXY-ACETYLENE TORCHES SHOULD NOT BE USED.

IF A CARBON ARC IS USED, THE AREA TO BE REWELDED SHOULD BE GROUND TO REMOVE CARBON DEPOSITS.

CLEAN AREA OF REPAIR REMOVING ALL GREASE, OIL, RUST AND SCALE FROM SURFACES TO BE JOINED.

DISCONNECT BATTERY GROUND CABLE WHEN WELDING ON MACHINE.

LOCATE PART AND WELD USING METAL ARC PROCESS IN ACCORDANCE WITH DRAWING SPECIFICATIONS.

NOTE:

WELDER SHALL BE QUALIFIED FOR THE TYPE OF WELD BEING MADE IN ACCORDANCE WITH AWS D14.3 (LATEST ISSUE)
QUALITY AND WORKMANSHIP OF WELD SHALL BE IN ACCORDANCE WITH AWS D14.3 (LATEST ISSUE)



WARNING:

FAULTY WELDING OR IMPROPER INSTALLATION COULD CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

March 1983

SERVICE GRAM

*(This bulletin replaces SG-878B, dated November 1981. REASON: Part numbers added)

SUBJECT: Propeller Shaft Revision
Model 175B Wheel Loaders with S/N:
Cummins 438A, 438B, 438C
Detroit Diesel 427A, 427B, 427C

CLARK SG-878C
Group Ref. No. 1600

Heavy duty propeller shafts can be installed on machines with serial numbers listed above, replacing the existing propeller shafts.

The new propeller shafts have larger size u-joints.

These propeller shafts can be installed on the mid-mount bearing to front axle, transmission to mid-mount bearing and the transmission to rear axle.

NOTE: *Only the mid-mount bearing to front axle propshaft and flanges may be changed if desired.*

To make this change, order the parts from the parts list below and follow the installation instructions.

PARTS LIST FOR ONE MACHINE:

2 - 1F740	Cotter Pin
1 - 127862	Flange (Front Axle)
2 - 240227	Flange (Mid-Mount Bearing)
2 - 25K60116	O-ring
2 - 222179	Washer
2 - 222960	Nut
2 - 233078	Flange (Transmission Output)
2 - 25K60128	O-ring
2 - 231916	Washer
2 - 215634	Nut
1 - 114259	Flange (Rear Axle)
1 - 2531124	Propeller Shaft (Transmission to rear axle)
24 - 18C840	Bolt
3 - 2538243	Spacer
*1 - 2531125	Propshaft (Transmission to mid-mount)
*1 - 2531126	Propshaft (Mid-mount to front axle)
*6 - 944688	Grease fitting

INSTALLATION:

1. Put the machine on a level surface.
2. Put the machine in the 'SERVICE' position: Steering frame lock connected, bucket on the ground, parking brake applied, engine stopped, ignition key removed, red warning flag on Steering wheel, wheels blocked.

(10K21)

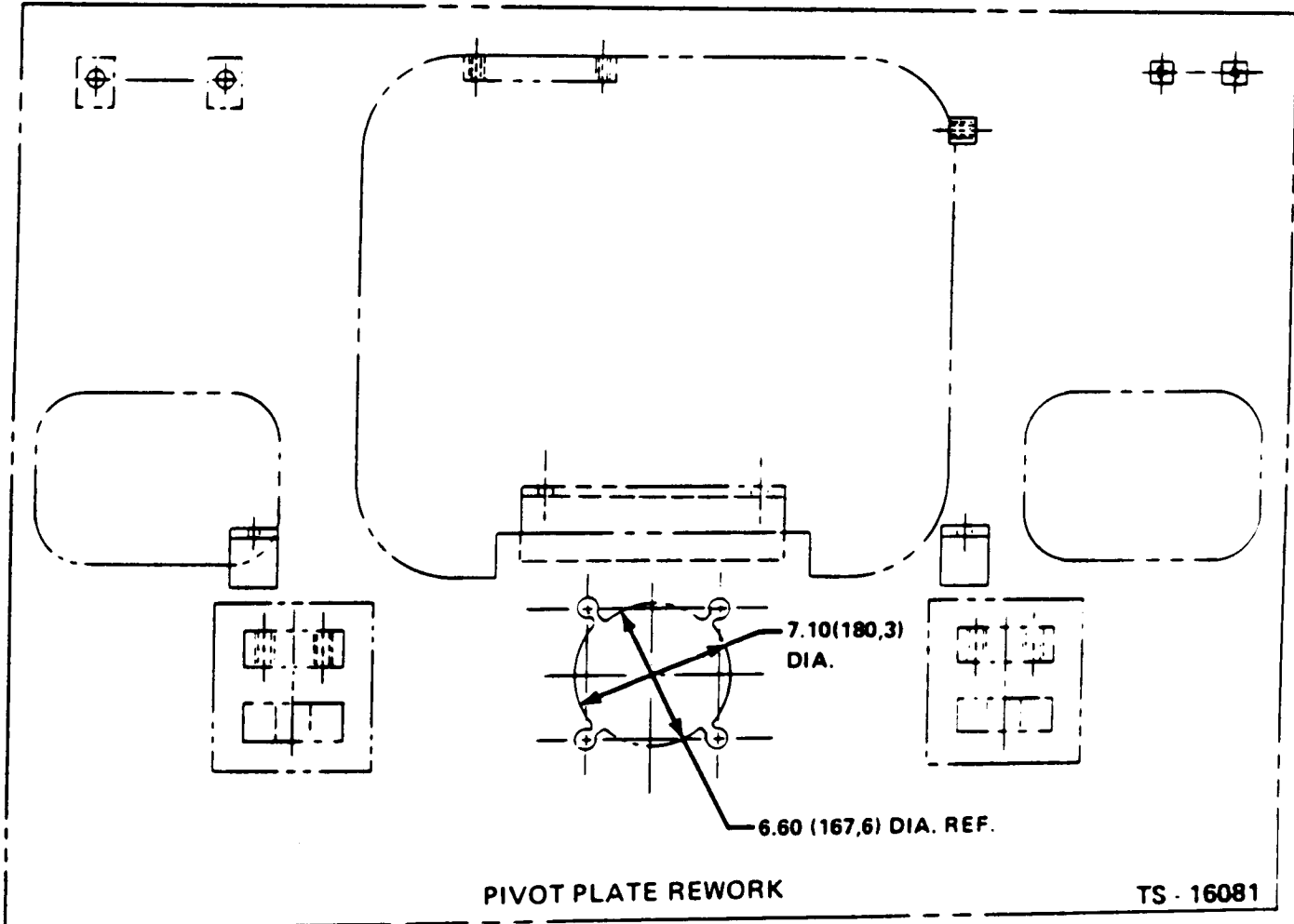
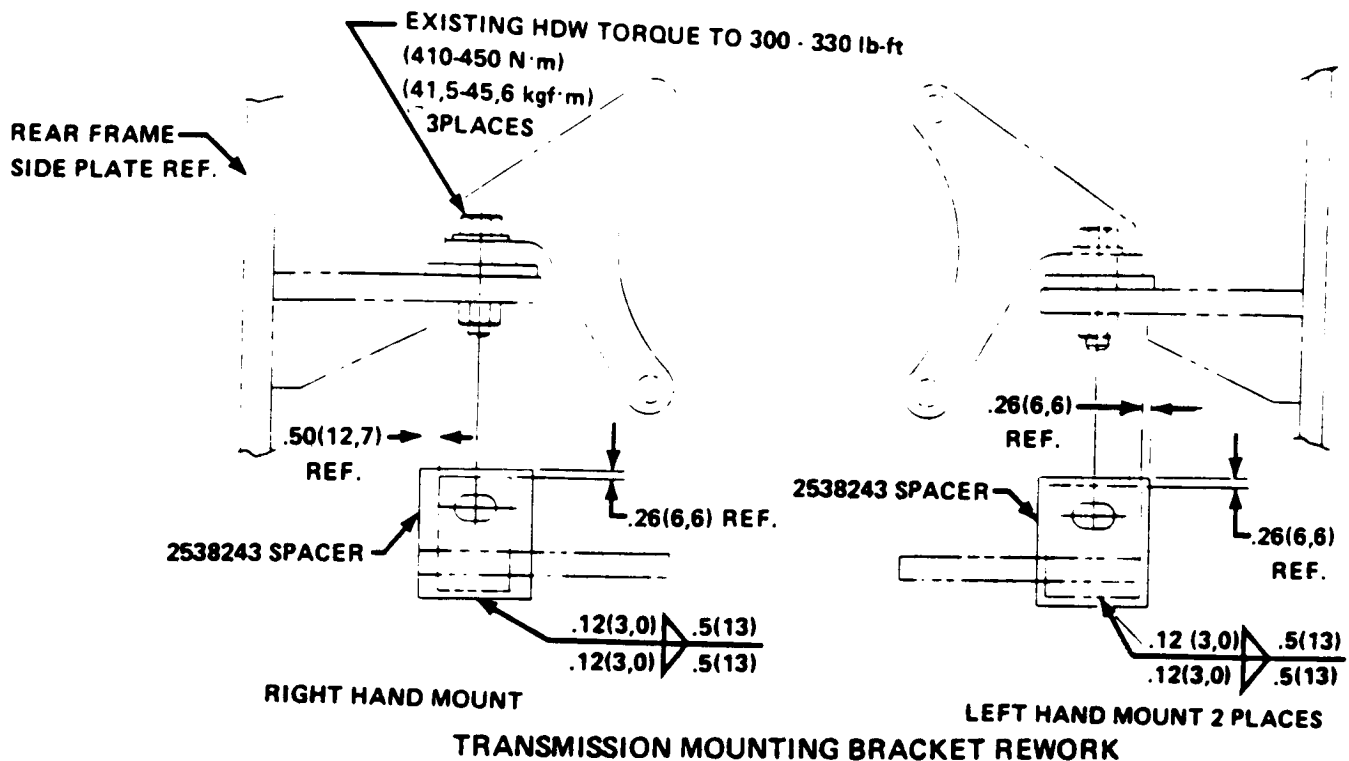


Figure 1
- 3 -
(10K23)

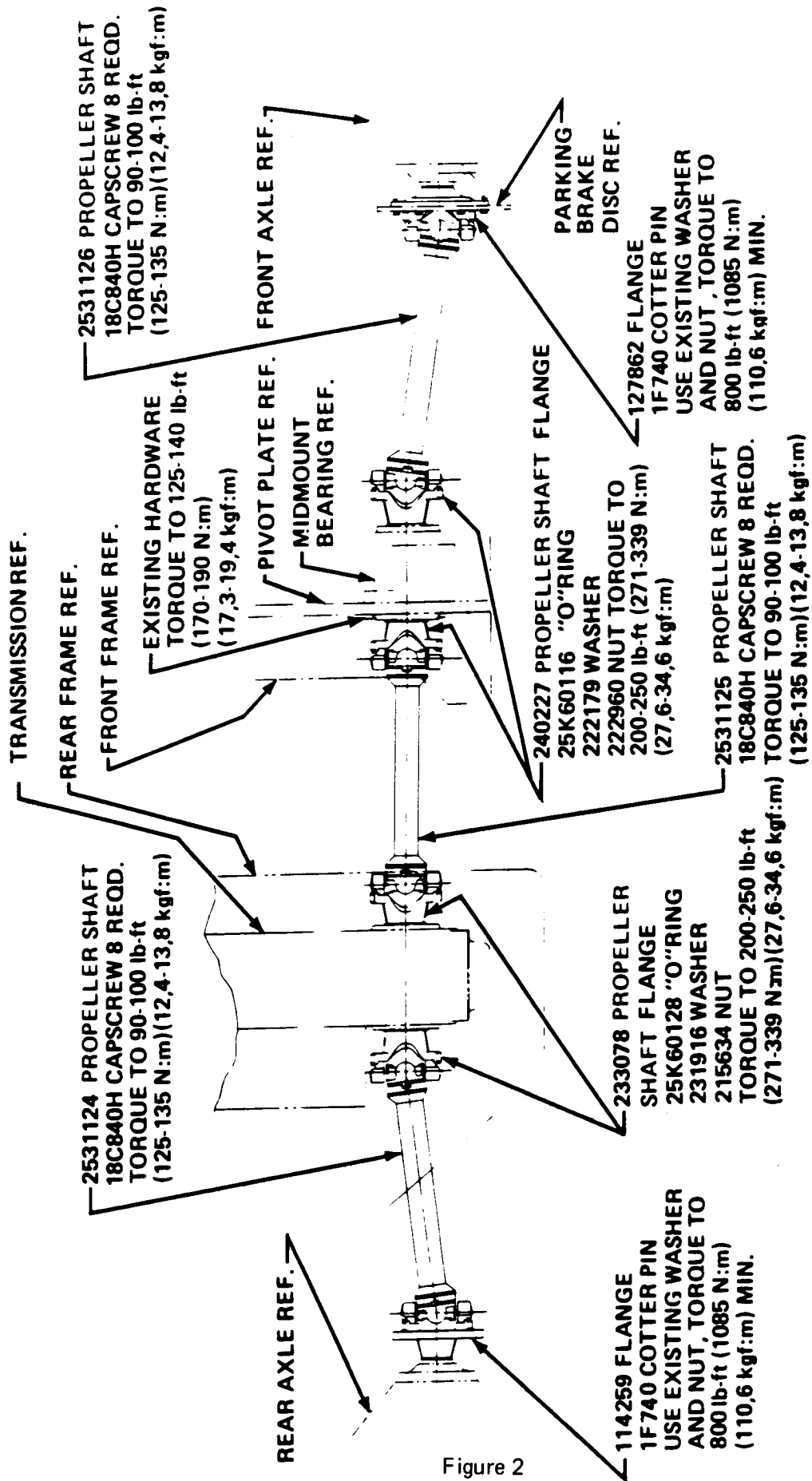


Figure 2
- 4 -
(10K24)

CLARK

Service gram

February 1982

MICHIGAN SG - 886A
Group Ref. No. 1400

(This bulletin replaces SG-886, dated August 1981. REASON: Information Revision).

SUBJECT: Fluid Analysis
All Models of Wheel Loaders and Dozers

An analysis of lubricating fluids is an effective method to determine the condition of both fluid and equipment. Clark emphasizes that trends be used to establish these conditions.

A small amount of contamination is normal and even present in new fluid. With time, more contamination will enter the system from the outside. For this reason, it is very important that only Clark branded fluid filters are used.

Any other unapproved filters may not meet the specifications required to keep the system clean and may result in the decreased life of pumps, valves, cylinders, etc. Clark branded filters meet the requirements needed to keep the system clean.

FLUID ANALYSIS:

A series of fluid samples will give an ongoing indication of the condition of each system. One or two fluid samples are not enough. Once a fluid analysis trend has been established any large change from this trend will indicate an abnormal condition.

Each fluid analysis trend will change among different machines depending upon the working application and environment under which each machine is operating. This would cause differences in the amount of wear from machine to machine. For this reason, Clark does not give exact wear limits, but does list average wear limits for each separate system.

The actual levels of wear metal contamination should be compared to the normal levels for that particular machine. It is the difference from the normal level that is important in finding the abnormal condition.

TRANSMISSION:

Clutch material is different according to model application. Model 35,45,55,75 and 125 Wheel Loaders use graphitic bronze clutch plates.

Model 175,275,475 and 675 Wheel Loaders and 280 and 380 Wheel Dozers use graphitic clutch plates EXCEPT that 275 and 280 machines have graphitic bronze clutch plates in 3rd and 4th gears only.

WEAR METALS	NORMAL RANGE	WARNING LIMIT
Iron	Under 75 PPM	Over 75 PPM
Lead	Under 75 PPM	Over 75 PPM
*Copper	Under 300 PPM	Over 300 PPM
*Machines with modulated transmissions tend to have a higher level of copper than machines equipped with non-modulated transmissions.		
Dirt (shown as Silicon on report)	0 to 15 PPM	Over 15 PPM
All other wear metals	0 to 10 PPM	Over 10 PPM

HYDRAULIC SYSTEM:

NOTE: Clark recommends that a particle count be used along with a spectro chemical analysis to more accurately find the contamination level in the system.

WEAR METALS	NORMAL RANGE	WARNING LIMIT
All Wear Metals	0 to 10 PPM	Over 10 PPM
Dirt (shown as Silicon on report)	0 to 15 PPM	Over 15 PPM

PARTICLE COUNT:

A particle count gives the number and size of the particles (contamination) suspended in the fluid. The particles are measured in micron size in five different ranges. This information will give an indication of the cleanliness of the hydraulic system to make sure that the filters are keeping the system as clean as they should. If the analysis report shows a large amount of particles in the system, the filters must be changed and an auxiliary fine filtration system should be used if available. A typical particle count per 100ml of fluid for machines using a Clark 10 micron filter is as follows:

PARTICLE SIZE (Normal Range)	CONDEMNATION LIMIT (Used Fluid)
up to $\frac{> 10m}{100,000}$	Over $\frac{> 10m}{250,000}$
up to $\frac{> 20m}{7,500}$	Over $\frac{> 20m}{20,000}$
up to $\frac{> 30m}{1,500}$	Over $\frac{> 30m}{4,000}$
up to $\frac{> 40m}{500}$	Over $\frac{> 40m}{1,500}$

Dirt in the hydraulic system can ruin a pump very fast and cause valves to stick and operate roughly. For example: A system with a contamination level of 100,000 particles greater than 10 microns in size (per 100ml of fluid). At this level a pump life of 5000 hours may be expected. If the contamination increases to 250,000 particles greater than 10 microns in size (the system now contains more dirt) a pump life of only 1000 hours could result. The pump life has decreased 5 times even though the number of particles has increased only 2 1/2 times.

CLARK

Service gram

June 1981

MICHIGAN SG-882
Group Ref. No. 1500

SUBJECT: Cab Door Replacement
Model 175B and 275B Wheel Loaders
Model 280 Wheel Dozer
With Cab Assembly Part Numbers 2526105 or 2526106

Improved door assemblies are available for installation on cabs with the above part numbers.

The part number for the right hand door is 963995 and the left hand door 963996.

NOTE: These are door assemblies only. Windows, moldings and hardware will have to be removed from the existing door assembly and installed into the new door assembly.

The doors are available from Clark Central Parts Division, 7300 S. Cicero Ave., Chicago, IL 60629

AXLES:

Clark axles contain 'SCL' oil installed at the factory. This oil has excellent break-in ability. Due to the 'SCL' oil, iron, lead and silicon levels will be high on the analysis report and remain high until the oil is removed or diluted.

WEAR METALS	NORMAL RANGE	WARNING LIMIT
* Iron	Under 500 PPM	Over 500 PPM
* Lead	Under 1000 PPM	Over 1000 PPM
* Silicon	Under 150 PPM	Over 150 PPM
* All other wear metals	0 to 10 PPM	Over 10 PPM

*With factory installed oil. Clark recommends that the oil be removed from the axle and flushed with a light weight flushing oil after the first 1000 hours of operation in order to remove all of the break-in particles.

ENGINES:

Engine manufacturers do not recommend the use of spectro-chemical analysis alone as an acceptable method of finding fluid change intervals. Tests for fuel dilution, water, total solids, viscosity, and neutralization number should be done, also. The 'CODI' program offers all of these tests. If the 'CODI' program shows that the fluid drain interval can be extended beyond the engine manufacturer's recommended interval the engine manufacturer must approve the extended interval to validate the engine warranty. Check the engine manufacturer's lubrication instructions for more information.

The figures for each engine listed on the following chart give very general guideline data that will change with each service requirement. Base line wear metal content must be found by continued used oil checks of each engine. At least three engines operating at the same location under the same conditions should be checked before any baseline figures are found.

WEAR METALS		
SYSTEM	NORMAL RANGE	WARNING LIMIT
New Engines	Wear metal levels may appear high on brand new engines do to break-in wear. This is typical. Normal wear levels should be reached after 200 - 300 hours of operation.	
Cummins Engines	Cummins does not publish wear metal limits but recommends that each person using spectro-chemical analysis look for results that change greatly from normal levels (levels that have been found from analyzing several oil samples over a length of time).	
	PHYSICAL PROPERTIES	CONDEMNATION LIMIT
	Fuel Dilution	5.0% maximum
	Total Solids	6.0% by volume maximum
	Water content	0.2% maximum
	TBN	2.0 minimum
	Viscosity	±1 SAE Grade from new oil

		NORMAL RANGE (PPM) up to	WARNING LIMIT (PPM)
Detroit Diesel Engines (Series 53,71,92)	WEAR METALS		
	Iron	65	150
	Copper	15	25
	Lead	20	25
	Tin	30	40
	Chromium	15	20
	Dirt (Silicon)	35	40
	PHYSICAL PROPERTIES	CONDEMNATION LIMIT	
	Fuel Dilution	2.5% by volume maximum	
	Total Solids	5.0% by volume maximum	
	Water Content	0.2% maximum	
	Viscosity	±1 SAE grade from new oil	
	TBN	1.0 minimum	

ANALYZING THE FLUID:

Clark strongly recommends Analysts Inc. for fluid analysis. They offer two analysis program options:

- (1) 'CM' (Controlled Maintenance Program)
- (2) 'CODI' (Correct Oil Drain Intervals Program)

The 'CM' program is used to check the condition of the customer's equipment and to help in finding the 'Correct Maintenance' schedule to fit his particular operation. Tests for fuel dilution (engine only), water and total solids are done to find the amounts of outside contamination of the fluid as well as a spectro-chemical analysis for twenty metallic elements to find the amount of machine wear, dirt content, coolant additives and fluid additives.

In the 'CODI' program the same tests are made as in the 'CM' program with the additional physical properties tests of viscosity and neutralization number. With 'CODI' the 'Correct Oil Drain Interval' is found by unit as necessary. A particle count is offered in addition to 'CODI' for the hydraulic system to check fluid cleanliness.

When the used fluid has been analyzed, the analysts will give their best judgment on the condition of the system. The customer is then responsible to take any required action.

There are many well qualified fluid analysis laboratories throughout the world, but not all are equipped to do the hydraulic fluid particle count analysis. This test is very important to find fluid cleanliness. Analysts, Inc. has the capability to make this test at all of their North American locations. There are four North American laboratory locations:

(1) ANALYSTS, INC.
Box 181
Piscataway, N.J. 08854
Ph. (201) 985-8282

(2) ANALYSTS, INC.
Box 4002
Schaumburg, Ill 60194
Ph. (312) 884-7877

(3) ANALYSTS, INC.
Box 23200
Oakland, CA. 94623
Ph. (415) 536-5914

(4) ANALYSTS, INC.
Box 4352
Houston, TX 77210
Ph. (713) 494-3042

BENEFITS OF FLUID ANALYSIS:

1. Gives the history of each lubricated system on the machine.
2. Machine not correctly maintained is found.
3. Finds contamination
4. Warns of high wear rates
5. Checks fluid additive package
6. Small problems are found before they increase.
7. Parts that could fail are found.
8. May be used to extend the hydraulic fluid drain intervals.
9. Repairs can be made before a breakdown.
10. Overall maintenance costs are reduced.
11. Overall machine life is extended.

December 1981

MICHIGAN SG - 902
Group Ref. No. 1500

SUBJECT: Cab Door Reinforcement
Model 175B and 275B Wheel Loaders
Model 280 Wheel Dozer
With Cab Assembly Part Numbers 2526105 or 2526106

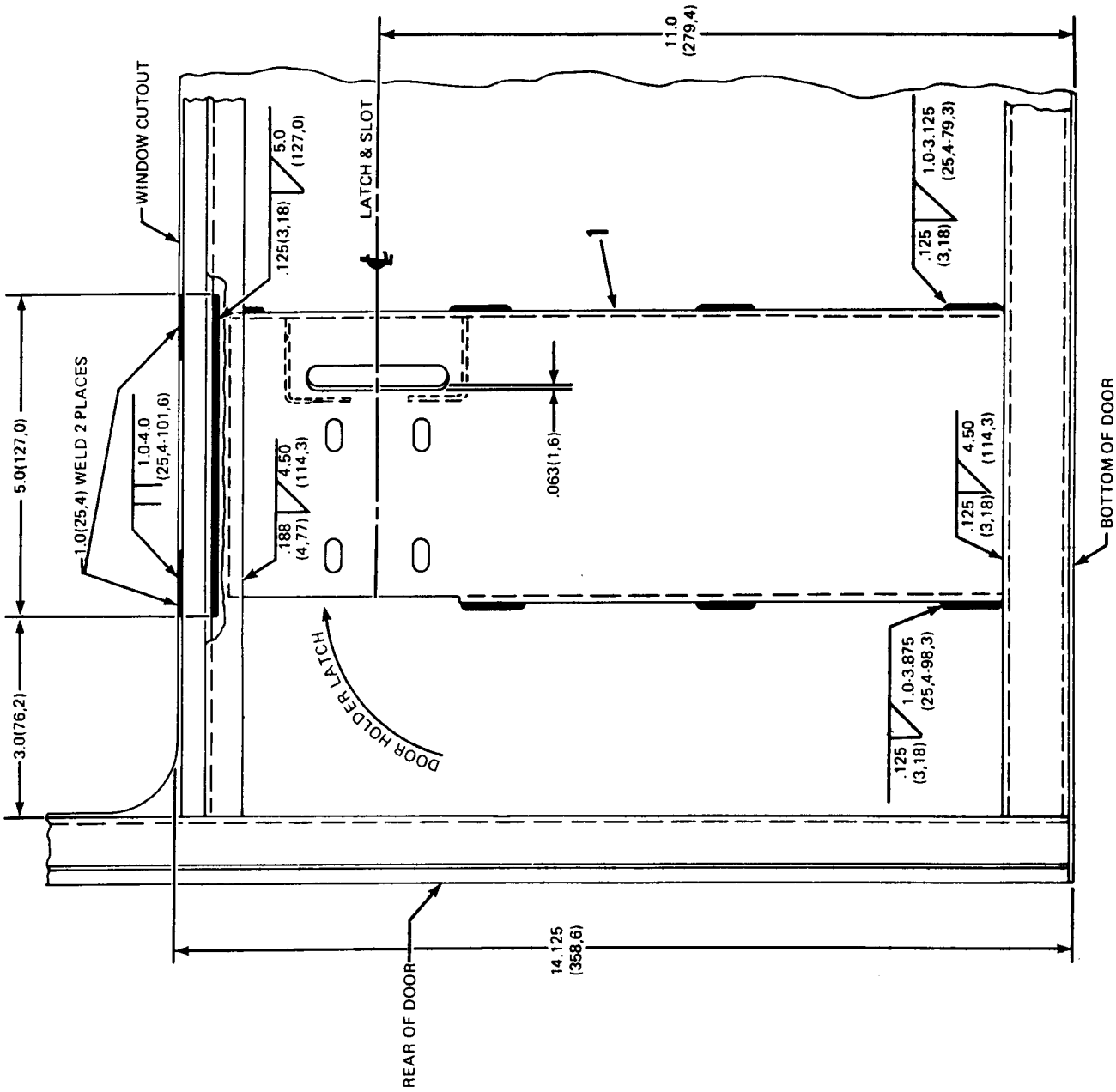
Cab door reinforcements can be installed into each door assembly on machines with cab part numbers listed above.

The reinforcement installation will improve cab door durability.

To make this change, follow the installation instructions listed below.

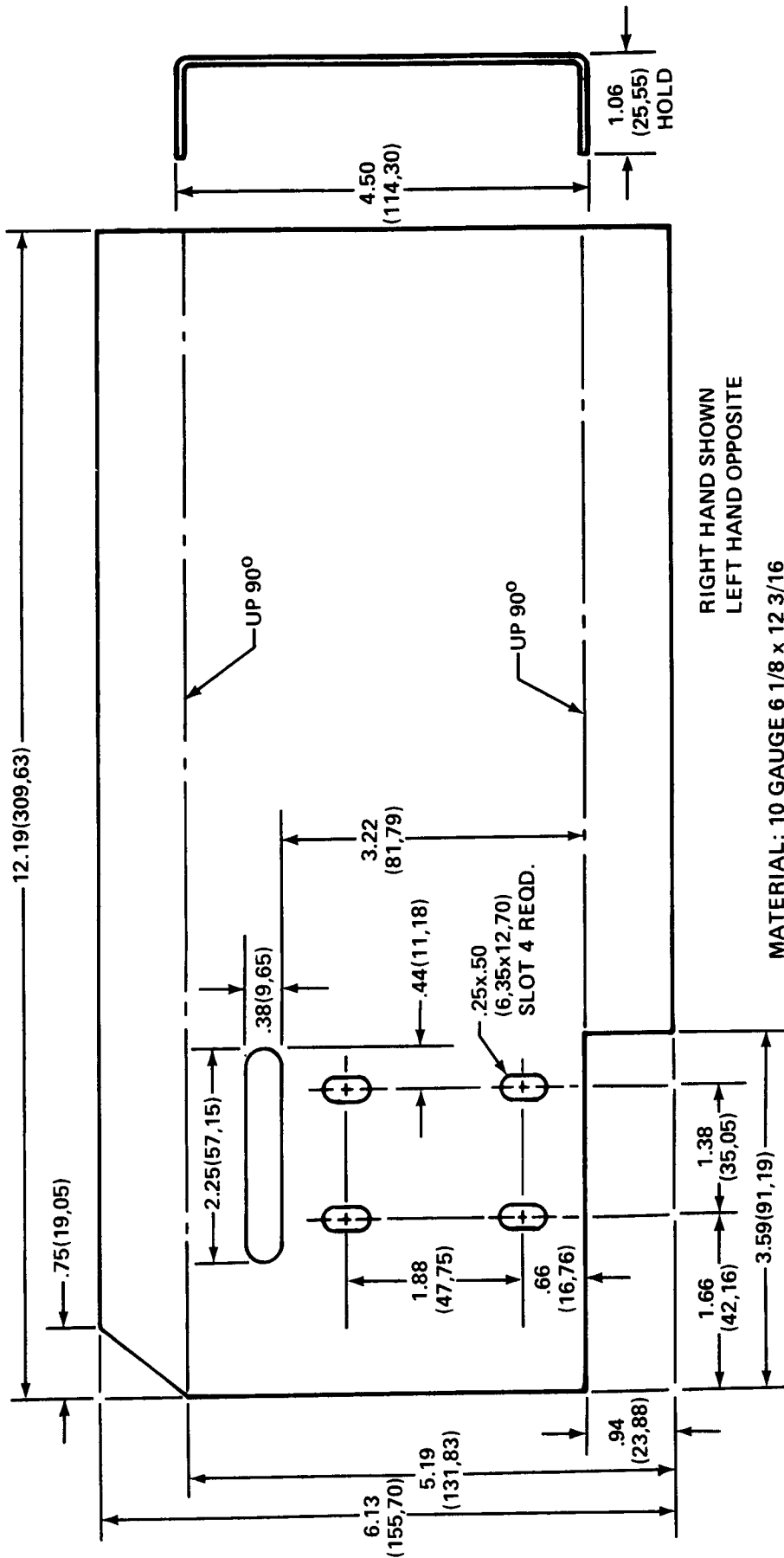
INSTALLATION:

1. Put the machine on a level surface.
2. Put the machine in the 'SERVICE' position: Bucket or blade on the ground, parking brake applied, engine stopped, ignition key removed, red warning flag on steering wheel, safety link connected, wheels blocked.
3. Remove each door assembly from the cab. Remove each door window, weatherstrip, inside door panel, carpet panel and door holder latch.
4. Remove the existing door holder bracket from each door assembly. Discard the bracket.
5. See Figure 1 and reinforce the 'Z' stiffener in each door assembly with additional weld as shown. These are shown with the 3in. (76,2mm) and 5in. (127,0mm) measurements on the top of the door assembly. Apply 2 - 1in. (25,4mm) welds at the window cutout area as shown.
6. See Figure 2 for the necessary information on making the new door holder brackets.
7. See Figure 1 and install 1 - new door holder bracket (Item 1) into each door assembly as shown. **NOTE:** *The slot in the bracket must be .0625 in. (16,0mm) toward the rear over the slot in the door panel.* Tack weld the bracket to the door panel as shown. Check for proper clearance of the door holder striker in the slots of the bracket.
8. See Figure 1 and weld the bracket (Item 1) to the door panel as shown. **NOTE:** *To reduce the possibility of warpage, use a backup plate on the door panel.* Clamp the bracket to the plate.
9. Clean each door and paint it. Install the existing door window, weatherstrip, inside door panel, carpet panel and door holder latch into each door assembly. **NOTE:** *See Figure 1 and move the door latch sideways to fit under the bracket, if necessary (See note with arrow on Figure 1).* Install the door assemblies onto the cab.
10. Remove warning flag from steering wheel. Disconnect safety link. Remove blocks from wheels.



TS-16221

LEFT SIDE DOOR SHOWN



RIGHT HAND SHOWN
LEFT HAND OPPOSITE

MATERIAL: 10 GAUGE 6 1/8 x 12 3/16
MILD STEEL

TS-16197

January 1982

MICHIGAN SG - 911
Group Ref. No. 1500

**SUBJECT: Heater and Air Conditioning System
Troubleshooting Guide**

**Model 75B & 75C, 125B & 125C, 175B & 175C, 275B & 275C, 475B & 475C, 675B & 675C
Wheel Loaders and 280B and 380B Wheel Dozers with Rear of Cab Mounted Heater.**

Proper heating and air conditioning maintenance is very important for both safe and efficient system operation.

The components listed below are the items that have been found to cause the most problems in the system. Follow the information in this bulletin for the correct troubleshooting procedure and component installation information.

A more detailed troubleshooting guide will be available at a later date.

CAB BLOWER MOTOR AND RESISTOR TROUBLESHOOTING

The blower motor is protected by a circuit breaker in the cab and a thermal disconnect located in the fan shroud. The thermal disconnect only protects the motor at low or medium speeds. If low and/or medium speed will not operate but high speed does operate, the resistor assembly with the thermal disconnect is not operating correctly and must be replaced.

If any problems with the blower motor occurs, check the circuit breaker, blower switch, resistor assembly, the blower motor itself and all wires and connections in the circuit.

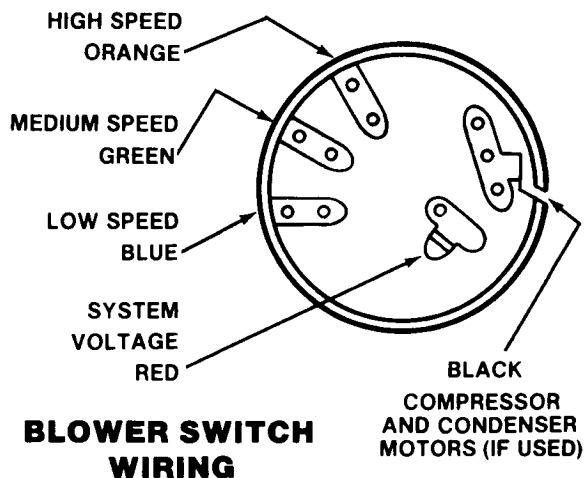
The electrified circuit of the blower motor is made up of four basic parts:

1. **CIRCUIT BREAKER**

A 15 amp circuit breaker is used without air conditioning. A 25 or 35 amp circuit breaker is used with air conditioning. If an overload condition occurs, the circuit breaker will become activated and the top of the circuit breaker will pop up which can be seen by the operator. Activate the circuit breaker by pushing the top back in. **DO NOT HOLD IN.**

2. **BLOWER SWITCH**

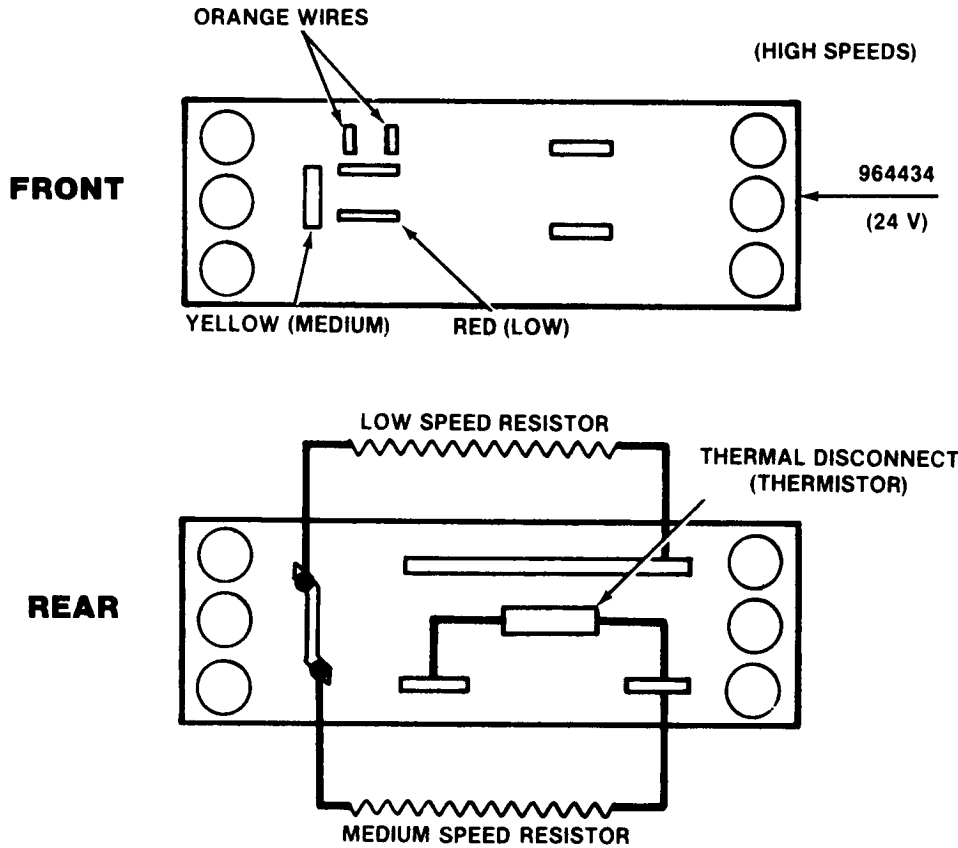
The blower switch is a rotary sealed switch which has the capacity of handling the blower motor current load. The switch is labeled with abbreviations of colors for each connection - orange, green, blue, red and black. **NOTE: These colors may not always match the color of the wires connected to them. These colors will represent each speed as shown below:**



BLOWER SWITCH MARKINGS		WIRE COLOR
Orange (Org)	High speed blower	Orange
Green (Grn)	Medium speed blower	Yellow
Blue (Blu)	Low speed blower	Red
Red (Red)	Power terminal or common	Red/White
Black (Blk)	A/C clutch or A/C condenser motors	

3. RESISTOR

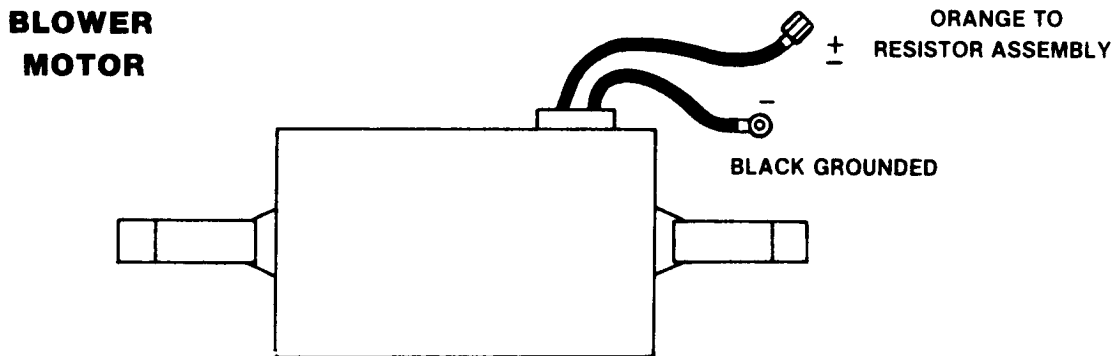
The resistor is located in the right hand blower fan housing (as viewed from the rear of the cab with the heater cover removed). The resistor is wired as shown below. **NOTE:** *If low and/or medium speed will not operate but high speed does operate, the resistor assembly with the thermal disconnect is not operating correctly and must be replaced.*



4. BLOWER MOTOR

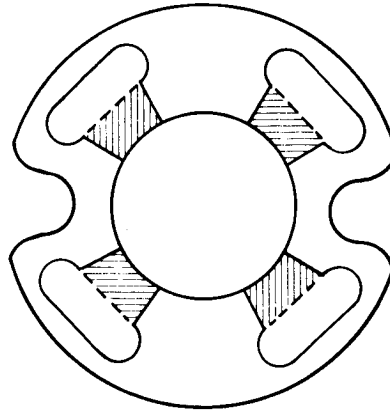
The blower motor may have an arrow stamped on the end to indicate correct rotation, CWLE (Clockwise Lead End), CCWLE (Counterclockwise Lead End). **NOTE:** *Some motors have been found to have the orange and black wires crossed inside the motor. Check the rotation of the motor before installation by connecting it to an auxiliary battery.*

If the direction of the motor is not correct, the wire ends must be reversed. If the motor is run in the reverse direction for too long, it will greatly decrease the motor life.



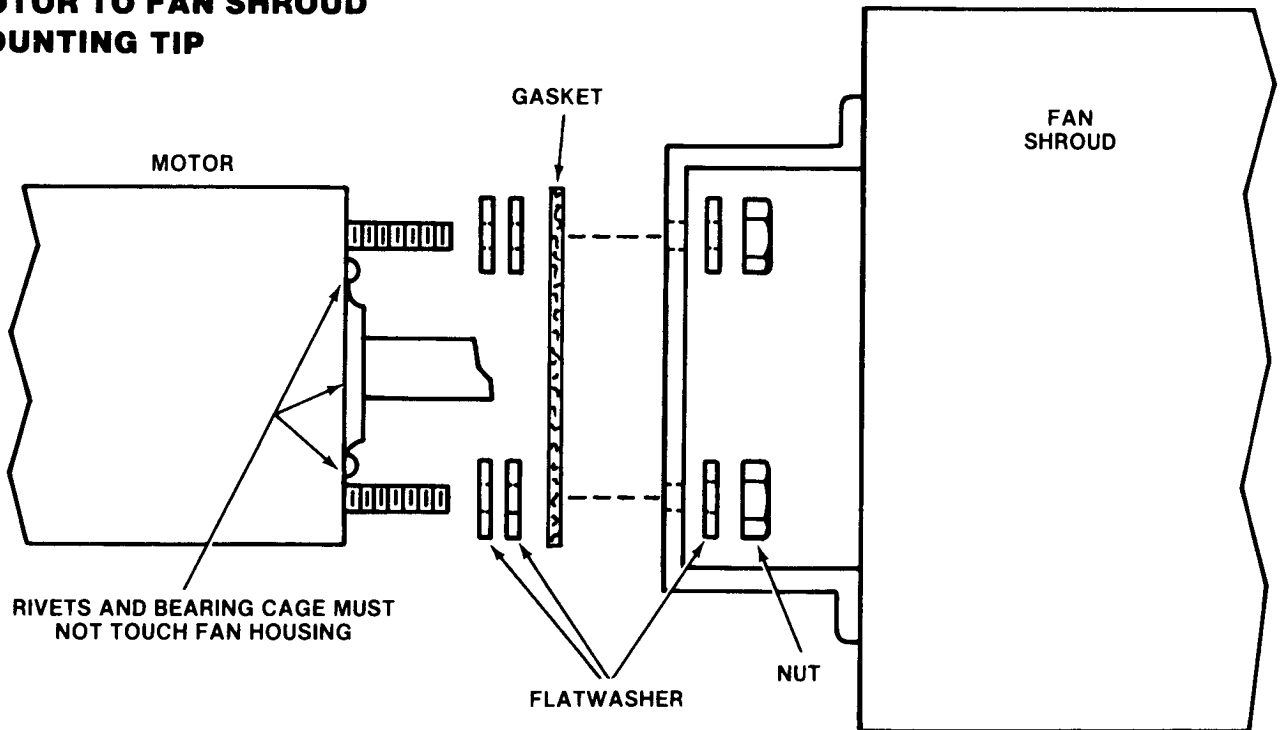
5. BLOWER MOTOR GASKET REWORK

When a new blower motor is installed, the existing motor gasket must be reworked. See the gasket illustration below and remove the shaded area of the gasket as shown. This will increase the cooling vents of the motor. **NOTE:** The gasket must be placed on the motor so that the motor vent holes are open.



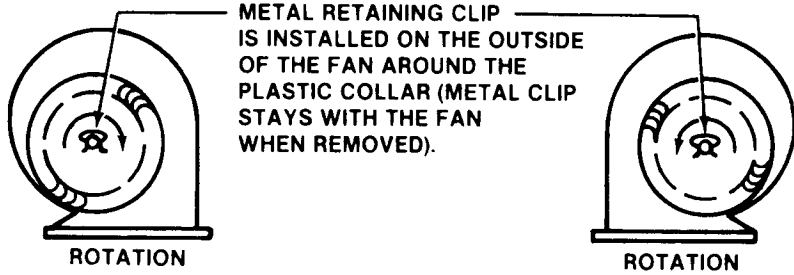
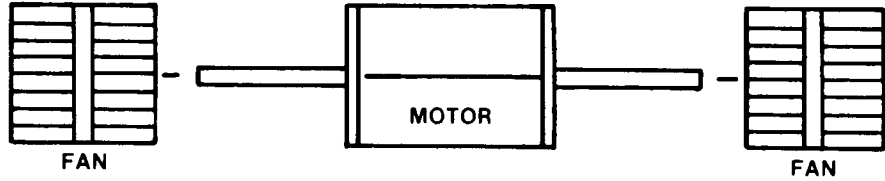
6. BLOWER MOTOR TO FAN HOUSING MOUNTING

MOTOR TO FAN SHROUD MOUNTING TIP

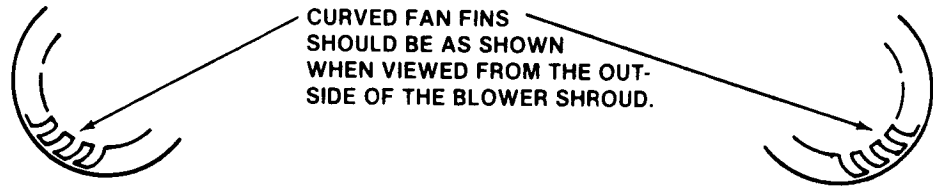


When installing a new blower motor, use flatwashers as necessary to shim the motor from the fan housing. Using these washers as shims will prevent distortion of the blower motor and keep the shaft bearings from binding. These two conditions could cause the blower motor life to become greatly reduced.

MOTOR AND FAN ASSEMBLY TIPS (SINGLE MOTOR ONLY)



METAL RETAINING CLIP IS INSTALLED ON THE OUTSIDE OF THE FAN AROUND THE PLASTIC COLLAR (METAL CLIP STAYS WITH THE FAN WHEN REMOVED).

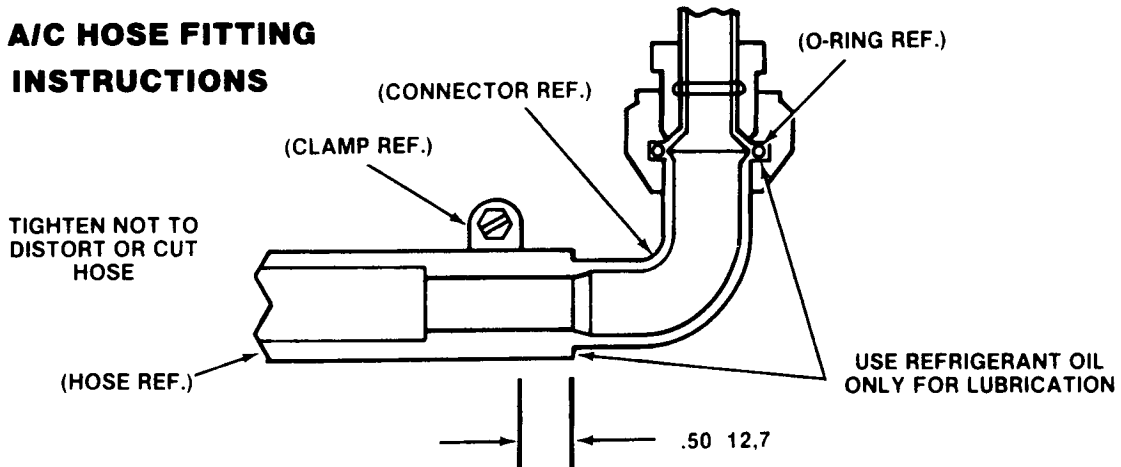


CURVED FAN FINS SHOULD BE AS SHOWN WHEN VIEWED FROM THE OUTSIDE OF THE BLOWER SHROUD.

AIR CONDITIONING HOSE FITTING INSTRUCTIONS

FITTING SIZE	TORQUE REQUIRED	FITTING SIZE	TORQUE REQUIRED
.438(11,2)	5-7 lbf•ft (6,8-9,5 N•m) (0,7-1,0 kgf•m)	.75(19,0)	15-20 lbf•ft (20,3-27,1 N•m) (2,0-2,8 kgf•m)
.625(15,7)	11-13 lbf•ft (14,9-17,6 N•m) (1,5-1,8 kgf•m)	.875(22,1)	21-27 lbf•ft (28,5-36,6 N•m) (2,9-3,7 kgf•m)
.688(17,5)	11-13 lbf•ft (14,9-17,6 N•m) (1,5-1,8 kgf•m)	1.06(26,9)	28-33 lbf•ft (37,9-44,7 N•m) (3,9-4,6 kgf•m)

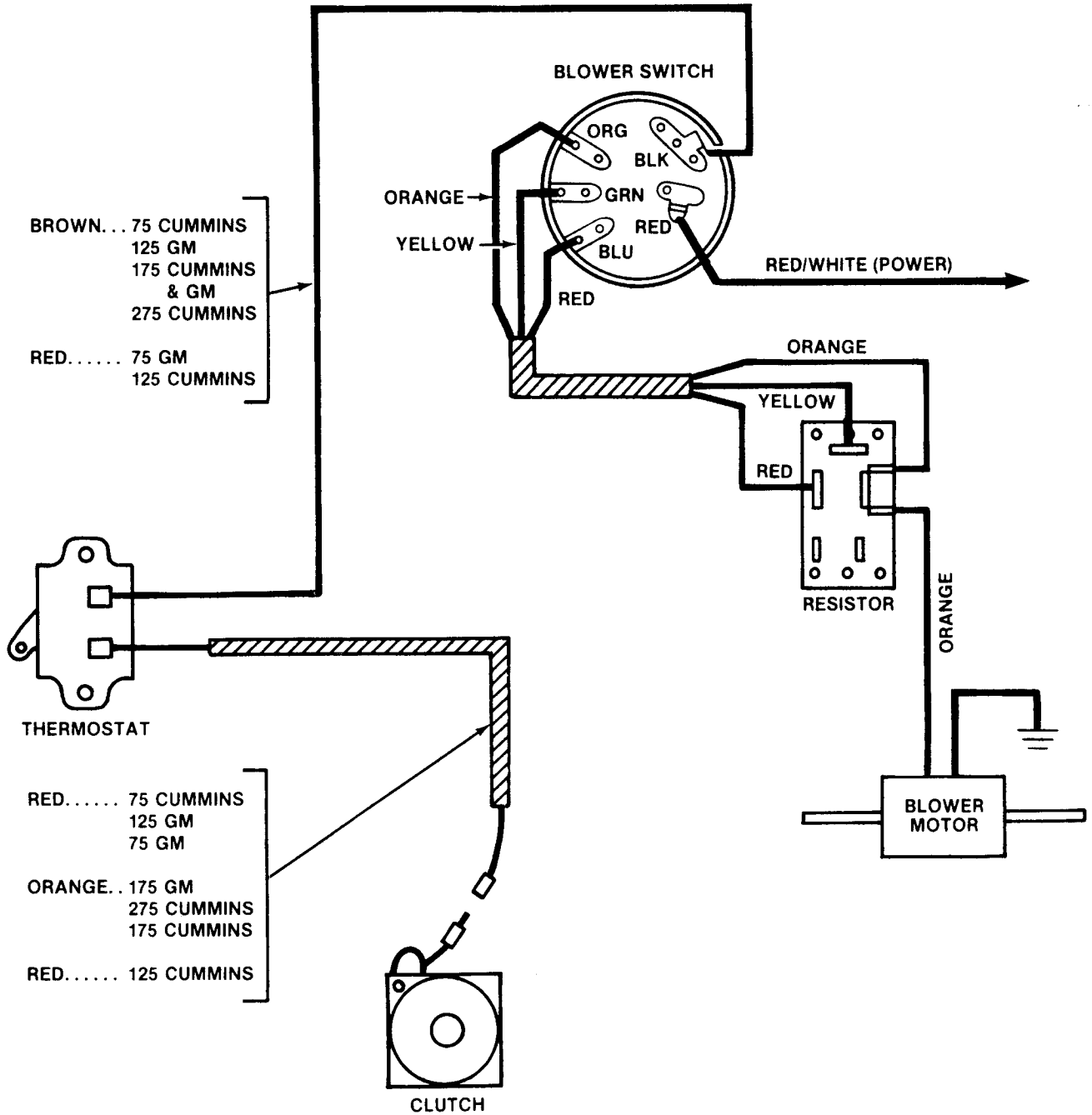
A/C HOSE FITTING INSTRUCTIONS



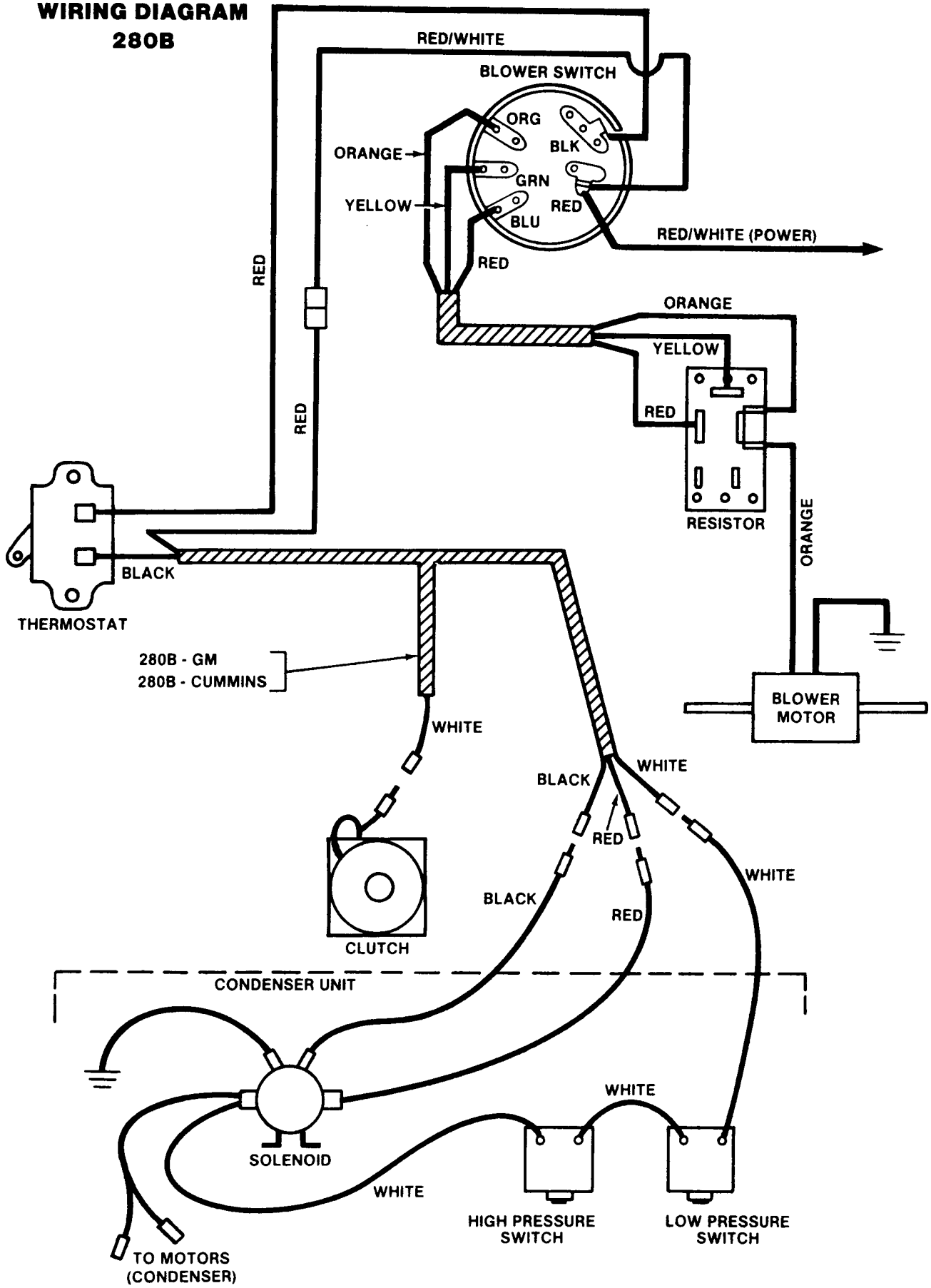
IMPORTANT: Use a sharp knife to cut bulk hose to the required length. DO NOT use an abrasive wheel cutting machine as this will cause a large amount of hose fragments to be left in the hose.

WIRING DIAGRAMS

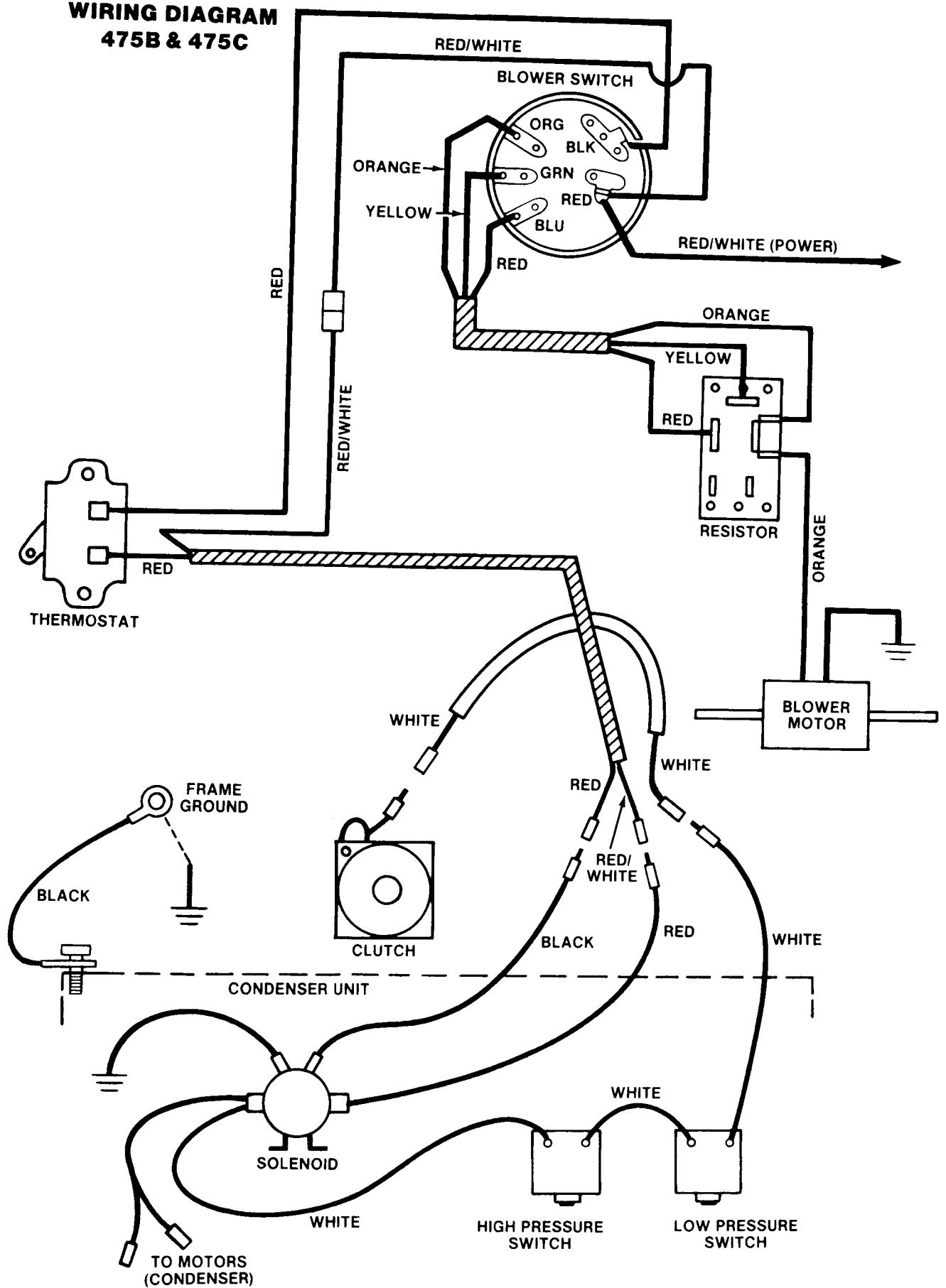
75B & 75C, 125B & 125C, 175B & 175C, 275B & 275C



**WIRING DIAGRAM
280B**

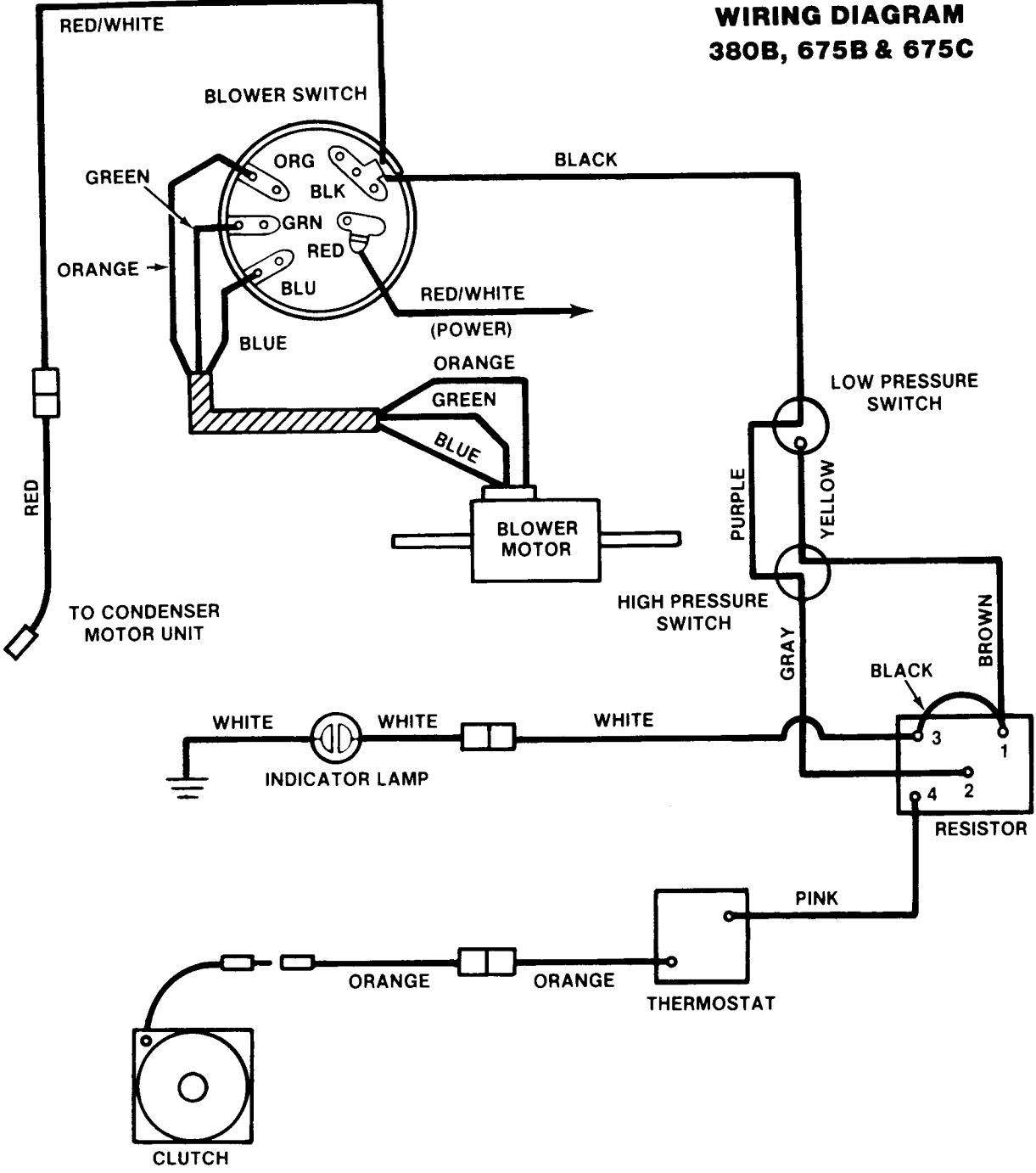


**WIRING DIAGRAM
475B & 475C**



WIRING DIAGRAM

380B, 675B & 675C



June 1985

CLARK

(THIS BULLETIN REPLACES CLARK SG-920A)
DATED FEBRUARY 1983.

SERVICE GRAM

REASON: Improved Heater Motor

SUBJECT: Heater Motor Revision For Model 75B,
75C, 125B, 125C, 175B, 175C, 275B, 275C,
475B and 475C Wheel Loaders and 280IIIA
And 280B Wheel Dozers With Hupp Heaters.

CLARK SG-920B
Group Ref. No. 1500

An improved heater motor assembly 966341 with ball bearings can be installed on the machines listed above, replacing the existing heater motor 964560.

The new heater motor is ball bearing constructed and will operate at a lower temperature, which will increase motor durability.

Once the new heater motor assembly 966341 is installed, you can service the heater motor only by ordering 966290.

To make this change, order the parts from the list below and follow the installation instructions.

PARTS LIST FOR ONE MACHINE:

Qty.	Part Number	Description
1	966341	Heater motor assembly — 24V

INSTALLATION:

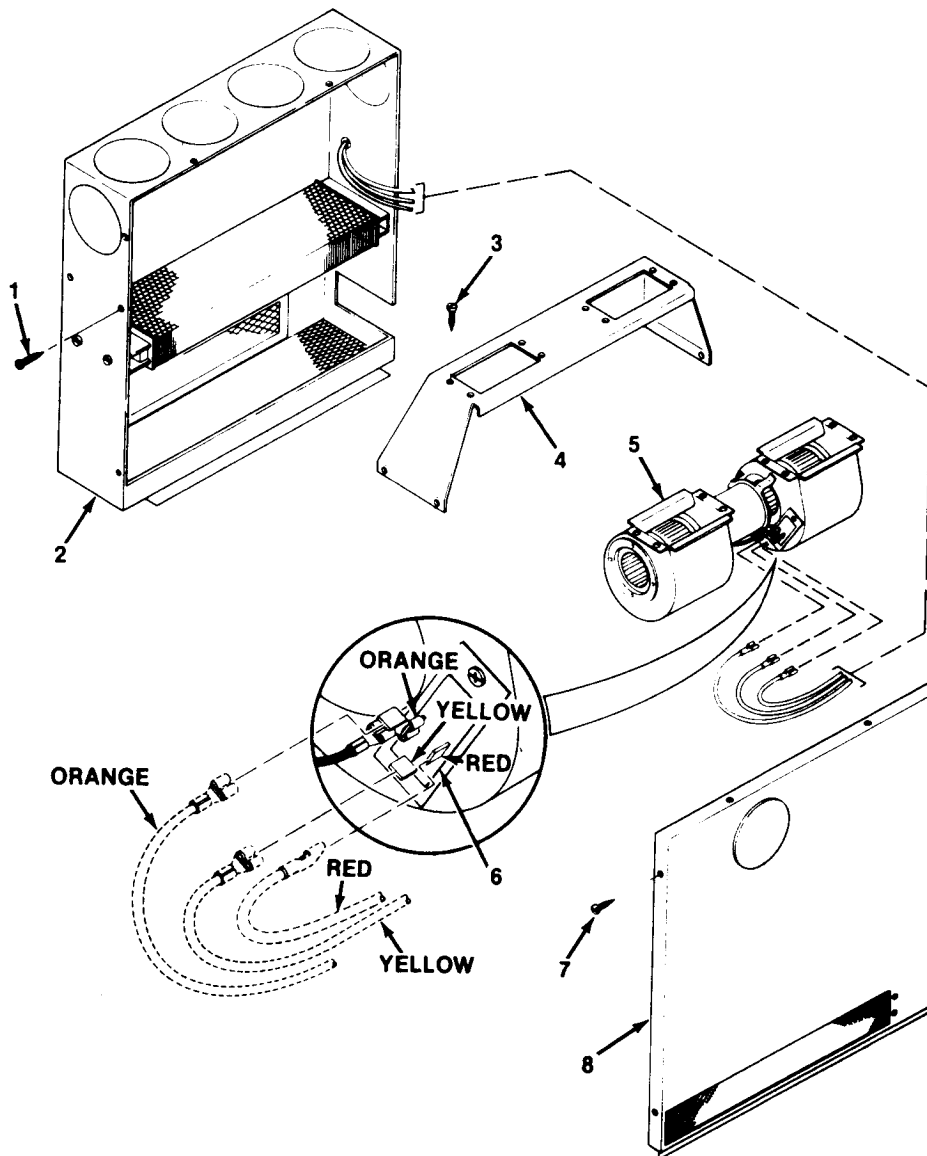
1. Put the machine on a level surface.
2. Put the machine in the "SERVICE" position: Connect the steering frame lock, bucket on the ground, parking brake applied, engine stopped, ignition key removed, red warning flag on the steering wheel, and the wheels blocked. Disconnect the negative battery cable from the batteries or turn off the battery disconnect switch.

(See Figure 1 for Steps 3 thru 9 and 12).

3. Remove the cab cover and filter. Remove the screws (7) in the cover (8) and then remove the cover (8) from the housing (2).
4. Disconnect the red, yellow and orange wires from the resistor assembly (6).
5. Remove the screws (1) and then remove the blower assembly (5) and mounting bracket (4) as an assembly from the housing (2).
6. Remove the screws (3) from the mounting bracket (4) and remove the mounting bracket (4) from the blower assembly (5). Discard the existing blower assembly (5).
7. Using the screws (3), install the mounting bracket (4) on the new blower motor assembly (5).

(11118)

8. Using the screws (1), install the blower assembly (5) and mounting bracket (4) as an assembly in the housing (2).
9. Connect the wires to the resistor (6), making sure the correct wires are connected to the correct terminals as shown.
10. Make sure all connections are tight. Connect the negative battery cable to the batteries or turn the battery disconnect switch on. Turn the ignition switch to the "ACC" (accessory) position. Turn the blower switch to the "ON" position and check the blower motor for proper operation at all speeds.
11. Turn the ignition switch and the blower switch to the "OFF" position.
12. Using the screws (7), install the cover (8) on the housing (2). Install the filter and cab cover.
13. Take the machine out of the "SERVICE" position.



TS-17865

CLARK

Service gram

October 1982

MICHIGAN SG - 934B
Group Ref. No. 2500

(This bulletin replaces MICHIGAN SG - 934, dated July 1982.)

* REASON: Information revision)

SUBJECT: Improved O-rings
All Models of Wheel Loaders and Dozers

An improved Viton type o-ring can be used to replace the Buna-N type o-rings presently used in the main, steering and transmission hydraulic systems on all 'B' Model and 'C' Model Wheel Loaders and all 'B' Model Wheel Dozers.

* The Viton o-rings will withstand higher hydraulic system temperatures.

Whenever o-ring replacement is necessary, it is recommended that VITON O-RINGS be installed use the chart below for the correct application.

FLANGE SIZE	PRESENT BUNA-N TYPE O-RING	NEW VITON TYPE O-RING
.5 in. (1,3mm)	58K210	77K210
.75 in. (19,0mm)	58K214	77K214
1.00 in. (25,4mm)	58K219	77K219
1.25 in. (31,7mm)	58K222	77K222
1.50 in. (38,1mm)	58K225	77K225
2.00 in. (50,8mm)	58K228	77K228
2.50 in. (63,5mm)	58K232	77K232
3.00 in. (76,2mm)	58K237	77K237
3.50 in. (88,9mm)	25K40328	77K241
4.00 in. (101,6mm)	25K40412	77K245
*RECOMENDED TEMPERATURE RANGE	-30°F to 250°F (-34.4°C to 121.1°C)	-20°F to 400°F (-28.9°C to 204.4°C)

CLARK

Service gram

August 1982

MICHIGAN SG - 944
Group Ref. No. 2500

**SUBJECT: T-Bolt Clamp Adjustment
All Wheel Loaders and Dozers**

Reports from the field shown that the T-Bolt clamps being used are not being adjusted properly.

Improper adjustment can cause failure of the clamp if it is over tightened or allow the connection to leak if it is too loose.

To properly adjust the clamp follow these steps.

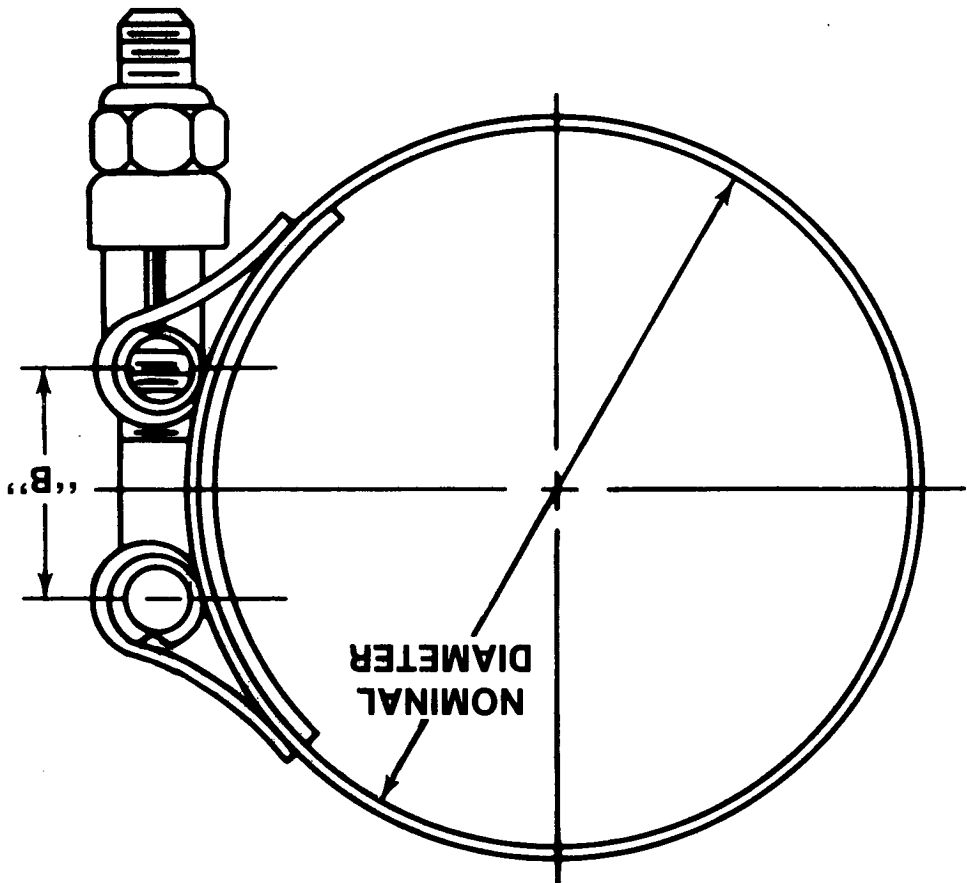
INSTRUCTIONS:

1. Measure the nominal O.D. of the hose. The I.D. of the clamp to be used must be the same size. See Figure 1 for clamp part numbers and sizes.
2. Install the clamp on the hose.
3. See Figure 1 and tighten the clamp to the correct 'B' dimension.

NOTE: *This dimension will use one half of the available adjustment and allow for future adjustments if needed.*

Part No.	Nom. I.D.	'B'
43H-1125 thru 43H-1244	1.250 in. thru 2.438 in. (31.75 mm thru 61.93 mm)	.60 in. (15.24 mm)
43H-1250 thru 43H-1694	2.50 in. thru 6.938 in. (63.50 mm thru 176.48 mm)	.80 in. (20.32 mm)
43H-1700 and up	7.00 in. and up (177.80 mm and up)	1.00 in. (25.4 mm)

TS-21569



March 1983

SERVICE GRAM

(This bulletin replaces SG-844, dated February 1981 and SG-955 dated November 1982. REASON: To clarify usage by determining machine voltage and type of heater).

SUBJECT: Heater Motor Replacement
964950 (12 volt) 963283 (24 volt)
All machines with under the seat
'Kysor' heater

CLARK SG - 973
Group Ref. No. 1500

New heater motors are available for use on machines listed above.

The new motors are more durable and reliable.

To make this change, order parts from the list below and follow the installation instructions.

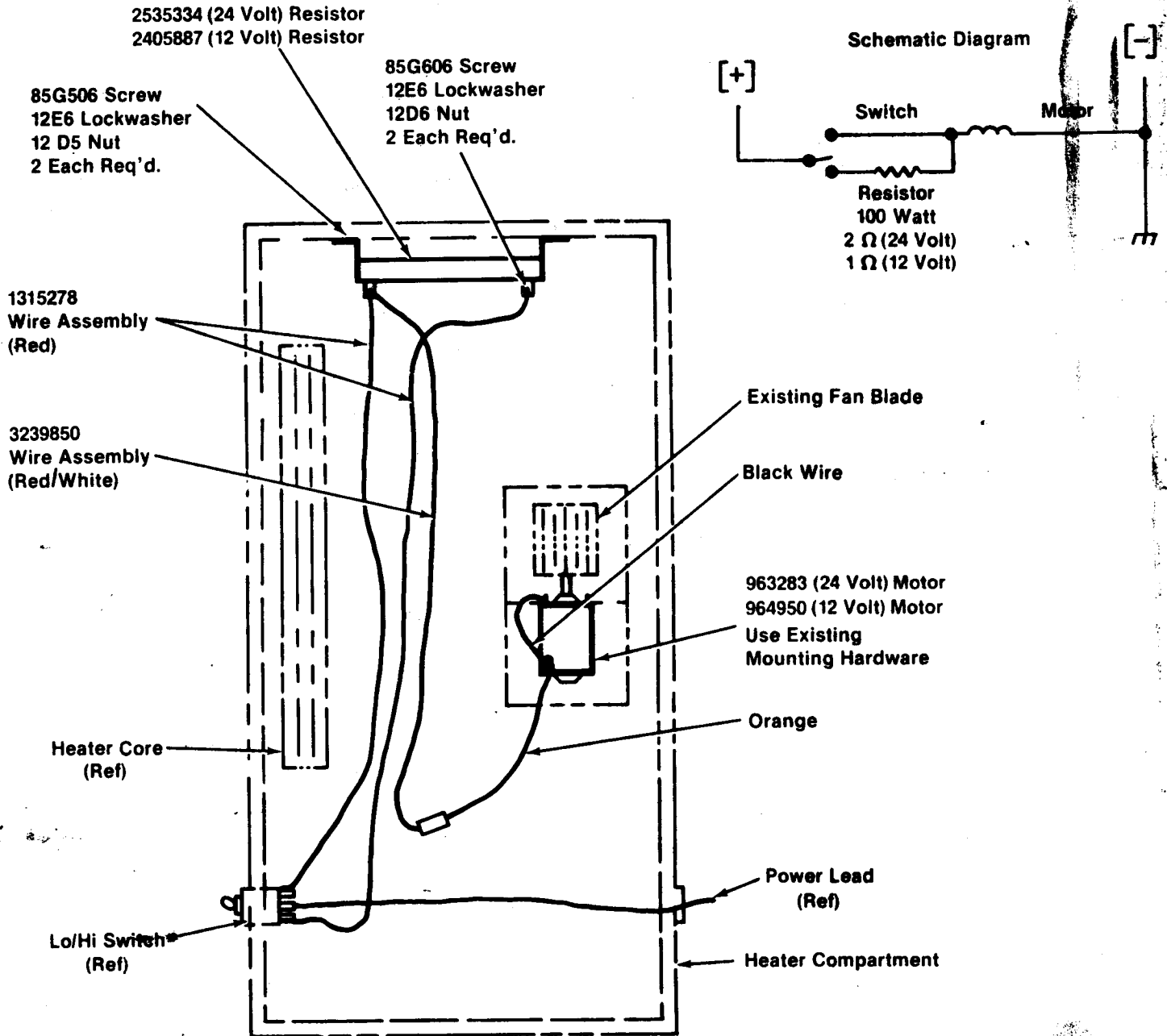
1 - 964950	Motor (12 volt)	4 - 12E6	Lockwasher
1 - 2405887	Resistor (12 volt)	2 - 85G608	Screw
1 - 963283	Motor (24 volt)	2 - 12D6	Nut
1 - 2535334	Resistor (24 volt)	1 - 614136	Terminal
2 - 1315278	Wire	2 - 614142	Sleeve
2 - 85G506	Screw	1 - 1513575	Terminal
2 - 12D5	Nut	1 - 3239850	Wire

INSTALLATION:

1. Put the machine on a level surface.
2. Put the machine in the "SERVICE" position: Bucket on the ground, parking brake applied, engine stopped, ignition key removed, red warning flag on steering wheel, steering frame lock connected, wheels blocked.
3. Disconnect the negative battery cable from the batteries.
4. Remove mounting hardware and motor. Keep mounting hardware and fan, discard motor and existing wires on LO and HI terminals of switch.
5. Install new motor using existing fan and mounting hardware.
6. Locate the resistor so it is not in the way of heater or hoses. Drill two .156 in (3,96 mm) dia. holes on 7.38 in (187,5 mm) centers and install.
7. Attach one end of red wires 1315278 to the LO/HI switch and the other ends to the resistor. Attach ring end of red/white wire 3239850 to one of the terminals on the resistor.
8. Cut orange wire on motor to the correct length so it will connect to new red/white wire and install pin terminal 1513575 and connect wires. Cut black wire on motor to the correct length needed to attach to one of the motor mounting screws, install ring terminal 614136 and shrink sleeve 614142 and attach to motor mounting screw.

(12123)

9. Make sure all connections are tight. Connect the negative battery cable to the batteries.
10. Check the heater assembly for proper operation.
11. Remove warning flag from steering wheel. Disconnect the steering frame lock. Remove blocks from wheels.



TS-16458

Figure 1
 - 2 -
 (12124)