



**REED TRUCK MOUNTED CONCRETE BOOM PUMP MODEL XT 36 VENDOR SECTION CONTAINS THE FOLLOWING FIGURES:**

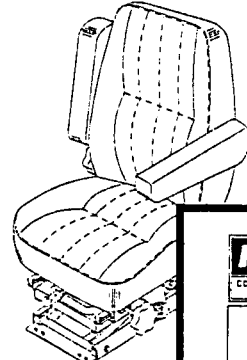
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BOSTROM AIR SUSPENSION SEAT  
TALLADEGA SERIES

VENDR  
FIGURE 02  
PAGE 01



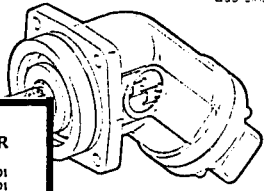


905  
AIR



RENROTH A2F HYDRAULIC PUMP MOTOR


VENDR  
FIGURE 03  
PAGE 01



A2F  
Eurema Series 6.1

MANNESMANN  
REXROTH  
Hydromatik GmbH

**R**



MACK TRUCK MR 690S  
T2070 SEVEN SPEED TRANSMISSION

VENDR  
FIGURE 01  
PAGE 01

THE CUSTOMER SERVICE DEPARTMENT PHONE NUMBER IS (813) 726-2461.

When contacting our regional service offices or Customer Service Department, it is imperative that you provide them with the following information:

- VEHICLE IDENTIFICATION NUMBER (VIN) - This 17 digit number is [XXXXXXXXXX10006754]
- MAKE and YEAR of vehicle
- DATE vehicle was PURCHASED and date of service
- DATE of REPAIR and REPAIR MILEAGE
- BRANCH or DISTRIBUTOR who sold and/or serviced the vehicle
- DESCRIPTION of unresolved service complaint or inquiry
- SUMMARY of ACTION TAKEN to date by the branch or distributor and the regional service office
- NAMES of INDIVIDUALS (if branch) contacted at the branch or distributor and the Mack Trucks, Inc. regional service office




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**MODEL XT 36 TRUCK MOUNTED  
CONCRETE BOOM PUMP  
VENDOR SECTION**

**VENDR**

**FIGURE 00  
PAGE 02**

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### OPERATION



#### Power Take-Off

If the vehicle you are operating is equipped with a Power Take-Off (PTO) unit, be sure you read and understand the following section.

#### **⚠ DANGER**

*Power Take-Off (PTO) units and their related equipment can be very dangerous. Any PTO installation, repair or replacement should include a warning indicator light which indicates PTO engagement. The light must be located close to the PTO control and clearly visible to the operator.*

#### **⚠ DANGER**

*PTO units are driven by the engine or drivetrain components (flywheel, crankshaft, transmission). Do not attempt any work or service on the PTO and related units unless the engine is shut down.*

#### **⚠ DANGER**

*Always keep body parts and loose-fitting clothing out of the range of drivetrain components or personal injury may result.*

#### **⚠ DANGER**

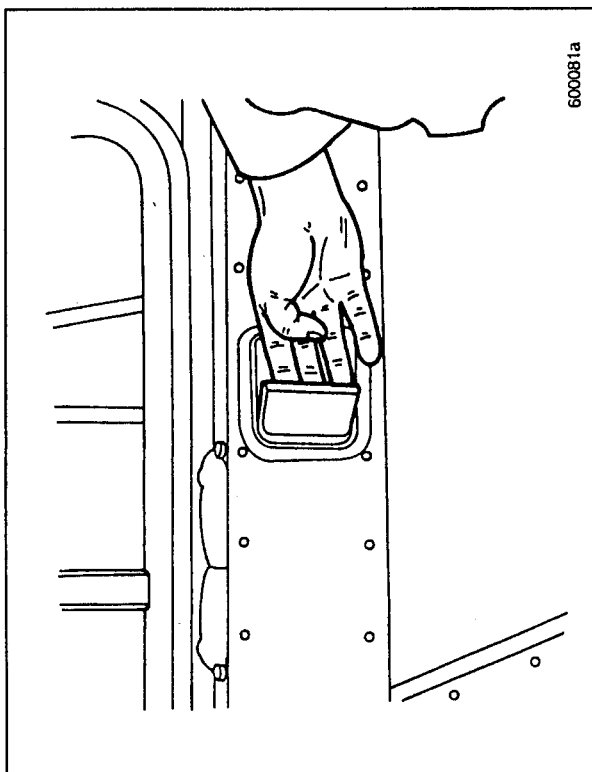
*Be sure you are aware of the PTO's engagement or non-engagement status and the position of the truck's body (dump body controlled by PTO, etc.). Be sure PTO is disengaged when not in use.*

### OPERATION



#### Doors

#### Opening



The inside door handles are of flush-mounted, paddle-type design. To open, put your fingers behind the handle and pull out while exerting some force on the door to open it.

#### Locking

To lock (with door open), press the door handle inward and shut the door.

**OPERATION****PTO Operating Procedures**

The following procedures apply to transmissions with a neutral switch and a transmission rear-case-mounted PTO only.

When engaging PTO:

1. Select LO-split using the splitter switch and select LO range using the range selector. The transmission **MUST** be in LO range and LO-split at all times during PTO operation.
2. Depress the clutch pedal to disengage the clutch.
3. Set parking brakes.
4. Move the main box gearshift lever to the **NEUTRAL** position.
5. Move the dash-mounted compound neutral control valve to the **ON** position, which moves the synchro clutch to a neutral position.
6. Engage the PTO.
7. Move the main box gearshift lever to the desired ratio.
8. Release the clutch pedal to engage the clutch.
9. Operate the PTO-driven load.

When disengaging the PTO:

1. Depress the clutch pedal to disengage the clutch.
2. Move the main box gearshift lever to **NEUTRAL**.
3. Disengage the PTO.
4. Move the dash-mounted compound neutral control valve to the **OFF** position, which moves the synchro clutch back to LO range.
5. Move the gearshift lever to the desired main gear box ratio.
6. Release the parking brakes.
7. Release the clutch pedal to engage the clutch.

**OPERATION**

MACK transmission rear-mounted PTO units fall into one of two categories (depending on how they operate).

**Intermittent Service** — The PTO unit is operated, under load, for less than seven minutes and then allowed to cool before it is operated again.

**Continuous Service** — The PTO unit is operated, under load, for seven minutes or more. Also, units operated for less than seven minutes and not allowed to cool down before operating again, should be considered in continuous service.

Rear-mounted PTO units operating under the continuous service guideline must not be run at more than 70% of the PTO output-rated torque/horsepower.

**V-MAC** — PTO operations controlled through V-MAC differ from vehicles not equipped with V-MAC. See TS725 (V-MAC) or TS780 (V-MAC II) for information regarding the programming of PTO.

**OPERATION****Engine****OPERATION****CAUTION**

Use a Mack-approved winterfront designed for the specific chassis only. The use of winterfronts or shutters for normal operating conditions above freezing requires caution to avoid high intake/exhaust temperatures. The restriction in air flow can cause higher exhaust temperature, power loss, excessive fan usage and a reduction in fuel economy.

**CAUTION**

A Mack-approved exhaust pyrometer must be installed and closely monitored while the engine is in operation when a winterfront is used. DO NOT exceed the maximum temperature listed on the decal. To reduce exhaust temperature, downshift or reduce engine power and open the winterfront.

**CAUTION**

Do not permit load to drive engine above governed speed. Operate in a gear low enough to allow engine to accelerate to (or maintain) governed RPM when applying throttle.

**WARNING**

Misuse or modification of a turbocharger can result in serious injury and property damage. In addition, extreme care must be taken to avoid foreign material induction, excessive exhaust temperatures and lack of lubrication.

**Model Designation**

The MACK engine unit symbol designation system is designed to provide total unit description identification through a combination of prefix letters, numbers, digits and suffix letters, as applicable.

**Prefix Letters and Numbers:**

- E = MACK turbocharged diesel engine
- M = Maxidyne engine (high torque rise)
- 7 = 728 cubic inch displacement
- 9 = 998 cubic inch displacement
- Digits: peak gross horsepower (BHP)

**NOTE**

E7 engines use the Jacobs compression release brake, or the Jacobs Stealth Retarding System™. With either system, the best braking performance is achieved in the 1800 to 2100 RPM range. For optimum retarding power, keep engine RPM as close to 2100 RPM as possible. For additional information, refer to the Jacobs driver's manual supplied with your chassis.

**OPERATION**

When slowing for a stop, leave clutch engaged as long as possible to use the braking effect of the engine. When forward speed has dropped to a little above idling speed, push clutch pedal in and brake to a complete stop.

**Parking Brake**

Spring-type parking brakes are standard on rear axles and bogies. The basic unit of a spring brake system is an air cylinder with heavy springs integrated with the service brake chamber. The spring brake chamber operates so that when there is no pressure in the spring brake section of the air chamber, the spring expands, causing a brake application. When air pressure is applied to the spring section of the air chamber, the heavy spring is compressed, releasing the brakes.

The spring brakes can be applied and released from the cab by using the hand-operated control valve. In the event of an air loss in both the primary and secondary air systems, pressure is automatically exhausted from the spring brake chambers, applying the brakes. The spring brakes will remain applied until enough pressure is available in the system to compress the heavy application springs.

**CAUTION**

*NEVER use the trailer parking brake system alone.  
Use the tractor-trailer parking brake system only.*

**OPERATION****Brakes****Air Brake System**

This truck has been built to meet or exceed all applicable federal standards and regulations.

**Brake Operation** — The air brake system consists of three main elements:

- The compressor, governor and reservoirs supply and store the air pressure.
- The brake application valve controls the brake application pressures.
- The brake chambers perform the work on the brake mechanism.

MACK vehicle design has incorporated into this chassis a dual braking system. It has two complete air circuits: a primary circuit for rear brakes and a secondary circuit for front brakes. Each circuit receives air from separate reservoirs. Although there are two air circuits, they operate as one brake system through the dual-circuit treadle valve. This provides the driver with easy, graduated control when applying and releasing the brakes.

The air pressure in the two air brake circuits is monitored by air pressure gauges on the instrument panel. (See the INSTRUMENT PANEL section for more information.) When air pressure drops below 65 ± 5 psi (448 ± 34 kPa) in either the primary or secondary air system at any time other than vehicle startup, pull to the side of the road and determine problem. If air pressure continues to drop below 40 ± 5 psi in BOTH systems, spring brakes will automatically apply. The Low Air Pressure warning indicator or buzzer will be activated if low air pressure occurs in either circuit.

**CAUTION**

*Avoid sudden stops. Constant, sudden stops may negatively affect the performance of braking and driving parts.*

**OPERATION****Good Driving Habits****Gross Vehicle Weight (GVW) Rating**

Do not overload your chassis. The gross vehicle weight ratings for a given model truck vary with operating conditions, tire size, wheel base, type of wheels, axles, suspension, frame length and overhang. For economy and safety, it is important to observe the GVW rating for your particular truck, which can be found on the Safety Certification Label.

**Observe Instruments**

Glance at instruments frequently. When problems develop, take prompt steps to correct them.

**Stopping the Engine**

After a hard run, allow engine to idle three minutes before shutdown in order to stabilize the temperature of all engine parts. Quick shutdowns can cause engine damage and prevent the turbocharger from being properly lubricated.

**Parking**

Use only the parking brake for parking. Do NOT use the hand control for rear service brakes or trailer brakes (if equipped) for parking. Check brake adjustment frequently to be sure the brakes will lock and hold vehicle when parked. Do NOT use the parking brake for braking vehicle when in motion, except in an emergency. When parking on a grade, use wheel chocks under the rear wheels or turn front wheels to the curb. Do NOT leave diesel engine vehicles in gear; if vehicle should move, the engine may start by heat of compression.

**General Observation**

Make it a habit at stops to walk around your truck looking for fuel, oil and coolant leaks. Also check condition of tires, wheel nuts, springs and lights. Stop trouble before it stops you!

**OPERATION****Anti-Lock Brakes (If Equipped)****Installation of Electrical Equipment on Vehicles Equipped with Anti-Lock Brake System (ABS)**

Connecting electrically powered or electrically controlled equipment to the vehicle may cause interference with the proper operation of other vehicle components. This interference may depend on the operating frequency and the degree to which transient signals are coupled into the vehicle system.

Every user and installer of electrical equipment has the obligation to ensure the proper operation of all electrical systems on the vehicle with respect to conducted or radiated signals by his installation.

Specific attention is directed to the anti-lock brake control system. A vehicle checkout procedure should include operating any added circuitry under the following test conditions:

- Engine running and brake air system pressure in operating range
- Vehicle stationary
- Depress and hold brake pedal in full application pressure mode
- Operate added equipment in all starting, running and shutdown conditions. Listen for any air exhausting from anti-wheel-lock controllers. This indicates an interference condition which must be corrected before the vehicle is released for highway use.

**Operating an ABS-Equipped Vehicle**

- Apply the brakes as normal. If the anti-lock brake system begins to function, maintain brake pressure. DO NOT release the brakes.
- Avoid rapidly pumping the brakes. The anti-lock brake system automatically applies and releases the brakes up to five times per second.
- When towing a trailer(s), especially if only the tractor is equipped with anti-lock brakes, watch the trailer(s) through the mirrors. Adjust brake application pressure as necessary to keep the combination in a straight line. Make sure the trailer(s) follows the tractor properly.

**OPERATION****Cold Weather Starting Tips****NOTE**

Before attempting to start the engine during cold weather, actuate the Engine Stop Control (if so equipped) several times to ensure that the injection pump control rack is free. Condensation in the fuel could cause the control rack to freeze up after extended shutdown in cold weather.

- Save your batteries. Do not overtax batteries and starting motor by cranking for more than 30 seconds without interruption. Allow about two minutes between attempts at starting the truck. This permits starter to cool and batteries to re-energize.
- Use the correct grade of oil in your crankcase for the prevailing winter temperature.
- Water/moisture can accumulate in the fuel system. Water accumulation can freeze in fuel tank, fuel lines and filter. This can be avoided by regularly draining the tanks and filters.

**WARNING**

**Under NO circumstances should gasoline, alcohol, used oil or additives with metallic particles be added to the fuel.**

- Diesel fuel has some bad habits in cold weather. It can gel and clog filters and small passages. When gelling occurs, mix a small percentage of No. 1D fuel (kerosene) with No. 2D (diesel) fuel. Adding kerosene is NOT recommended for general use since there will be a sacrifice in both performance and fuel economy. Refer to the MAINTENANCE AND LUBRICATION manual, TS494, for additional cold weather operating information.

**OPERATION****STARTING YOUR VEHICLE****General Information**

Before you put the key in the ignition switch, set the parking (spring) brake, disengage the clutch (if equipped) and put the transmission in NEUTRAL. Push the Engine Stop Control all the way in (if equipped).

**CAUTION**

*Do not engage the starting motor too soon after an incomplete start of the engine, or the starter may be damaged. Wait at least five seconds before attempting to restart the engine.*

**CAUTION**

*Do not rev the engine at start-up. Turbocharger damage may result. Lubricants need time to establish a film between moving parts.*

**CAUTION**

*If the engine does not start immediately, limit cranking periods to 30 seconds to avoid overheating and damaging the starter.*





### OPERATION

#### Air Starter or Push Button (If Equipped)

#### NOTE

Build up air pressure to a maximum (120 lbs/827 kPa) before shutting down and parking for the night.

#### CAUTION

*Idling engine unnecessarily for long periods of time wastes fuel and fouls injection nozzles. Unburned fuel causes carbon formation and oil dilution. NEVER race an engine during warm-up.*

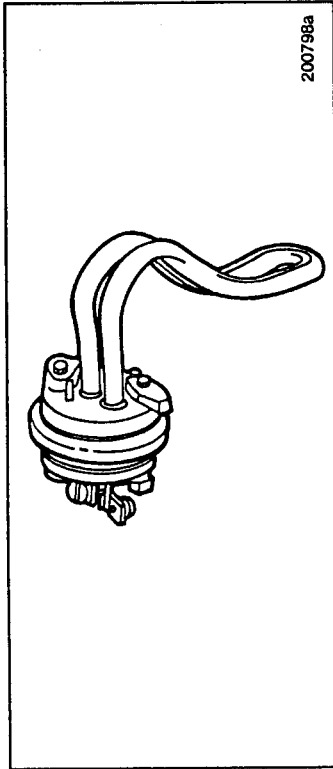
Put the key in the ignition switch. Turn the key clockwise to the first "click" (about two o'clock position) to activate the instruments. Push starter button in and release as soon as engine starts. Keep clutch (if equipped) disengaged until engine runs smoothly. When oil pressure and air pressure approach normal operating ranges, you may put the vehicle into operation.



### OPERATION

#### Engine Block Heater

An engine block heater works by heating the coolant surrounding the combustion chambers. Engine heaters are recommended to help combat the extreme demands of cold weather operating conditions. The engine heater can be plugged in overnight when the temperature drops. Location of the engine heater power receptacle varies according to vehicle design.



#### Engine Heater Benefits

- Eliminates cold weather starting problems.
- Increases engine life significantly by keeping the engine warm and avoiding costly, excessive idling.
- Prevents external water leaks caused by excessive cold.
- Allows the cab to heat more quickly.
- Reduces the temperature at which ether is required.
- Engine heaters may be activated as soon as the engine is stopped.

### OPERATION



### OPERATION



#### E7 Non V-MAC Engines

If your chassis is equipped with a mechanically governed E7 (non V-MAC) engine, use the following procedure:

#### Normal Temperatures

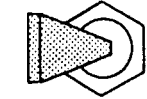
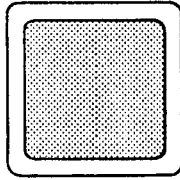
1. Do NOT depress the accelerator.
2. Crank the engine.
3. After the engine has started, set the hand throttle to maintain an engine speed of 1200 RPM.
4. Allow the engine to idle at 1200 RPM and reach normal operating temperature BEFORE moving the vehicle.


If the engine is difficult to start, use the following procedure:

1. With the key switch in the OFF position, fully depress and hold the accelerator pedal to the floor.
2. If equipped with an Engine Stop Control, pull to the OFF position, then return to the run position.
3. Crank the engine.
4. Release the accelerator pedal as soon as the engine starts.

#### Cold Temperatures

1. Fully depress and hold the accelerator pedal to the floor.
2. Push the Charge Air Cooler Bypass switch (if equipped) to the ON position. A dash light will illuminate when the bypass is activated.



ON  OFF

CHARGE AIR COOLER BY-PASS

700144a

3. Crank the engine.
4. Release the accelerator pedal as soon as the engine starts.
5. Set the hand throttle to maintain an engine speed of 1200 RPM.
6. Allow the engine to idle at 1200 RPM and reach normal operating temperature BEFORE moving the vehicle.
7. Move the Charge Air Cooler Bypass switch (if equipped) to the OFF position when the coolant temperature has reached 125°F (52°C).

#### CAUTION

Operating the chassis with the Charge Air Cooler Bypass switch (if equipped) in the ON position may cause severe engine damage.

#### CAUTION

Do NOT use the Charge Air Cooler Bypass switch (if equipped) during warm temperatures or if the engine is already warm.

**OPERATION****Engine Warm-Up**

Engine damage can occur if the engine is not warmed up to a minimum operating temperature of 170°F (77°C) before putting the chassis into full operation.

Heavy-duty diesel engines are designed to operate at optimum efficiency when they are running loaded at (or very near) normal operating temperature where efficient combustion takes place. When the engine is operated unloaded, lightly loaded (stop and go operations, PTO operations, or periods of extended engine idling) or in cold weather conditions, normal operating temperature may not be achieved or maintained. As a result, carbon and/or varnish build-up will occur and lubricating oil will become contaminated with combustion byproducts.

Cold weather operations place added demands on a diesel engine. When operating in cold climates, particularly in stop-and-go operations, PTO operations or periods of extended engine idling, minimum operating temperature must be maintained to prevent engine damage resulting from valve varnishing and carbon build-up. Many accessories, from winterfronts to belly tarps, are available to best equip your truck for cold weather operations. Refer to the MAINTENANCE AND LUBRICATION manual, TS494, supplied with your truck for additional information concerning cold weather accessories.

**Engine Idling**

Idling the engine unnecessarily for long periods of time wastes fuel, fouls injector nozzles and can lead to valve carbon and varnish deposits. Unburned fuel causes carbon formation and oil dilution. Shut engine down when prolonged loading or unloading of cargo is required. When starting a cold engine, or if the vehicle has been parked and the engine coolant has fallen well below normal operating temperature, a fast idle speed of approximately 1200 RPM should be maintained to help the engine warm up more quickly.

**OPERATION****E7 V-MAC Engines**

If your chassis is equipped with an electronically governed E7 (V-MAC) engine, use the following procedure:

**Normal Temperatures**

1. Do NOT depress the accelerator. The pedal must be left in the idle position.
2. Crank the engine.
3. After the engine has started, set the hand throttle to maintain an engine speed of 1200 RPM.
4. Allow the engine to idle at 1200 RPM and reach normal operating temperature BEFORE moving the vehicle.

**Cold Temperatures**

1. Fully depress and hold the accelerator pedal to the floor.
2. Crank the engine.
3. Release the accelerator pedal as soon as the engine starts.
4. Set the Variable Speed Control (VSC) (if equipped) to maintain an engine speed of 1200 RPM.
5. Allow the engine to idle at 1200 RPM and reach normal operating temperature BEFORE moving the vehicle.

**OPERATION****Engine Shutdown System (If Equipped)**

The engine may be protected by a shutdown system that prevents engine failure when a condition such as loss of oil pressure, loss of coolant or engine overheating occurs. If the system detects a condition that will initiate engine shutdown, a warning indicator light will illuminate to alert the driver before the engine actually shuts down. Should shutdown occur, the system can be overridden so the vehicle can be moved to a location where it will not pose a hazard.

**Check Engine Warning Indicator** — During normal operating conditions, the Check Engine warning indicator should illuminate as soon as the key switch is turned on. After the engine is started, it will remain illuminated until engine oil pressure reaches normal idling range. During shutdown, if the system detects a condition that could lead to engine failure, the Check Engine warning indicator illuminates 30 to 45 seconds prior to engine shutdown.

**Lengard Shutdown System**

**Shutdown Override Button (If Equipped)** — During normal operation, to ensure adequate fuel delivery when starting the engine (whether starting a hot or a cold engine), the following starting procedures are recommended (Lengard system only):

1. Depress and hold the Shutdown Override button.
2. Crank the engine.
3. Continue depressing the Shutdown Override button after the engine is started and the Check Engine warning indicator is still illuminated.
4. Release the Shutdown Override button when the Check Engine warning indicator deactivates.

Refer to the **STARTING YOUR VEHICLE** section for complete engine starting procedures.

**OPERATION****Engine Shutdown**

After a hard run, allow the engine to idle approximately three minutes before shutdown. This provides the temperature stabilization of all engine parts and allows the turbocharger RPM to slow gradually. Quick shutdowns can result in mechanical problems for the engine and/or turbocharger.

**CAUTION**

*Operating the engine below normal operating temperature for extended periods of time will allow varnish/carbon deposits to build on the valve stems and guides. Varnish deposits will cause the valves to stick in the guides after the engine has been shut down, and could result in push rod damage when the engine is restarted. If the engine has been operated below normal operating temperature for an extended period of time, and the odor of raw diesel fuel can be detected or unburned fuel can be seen at the exhaust stack, it is recommended that the engine be operated under load until normal operating temperature is achieved before shutting down.*

On chassis equipped with an air starter, make sure that the air pressure gauge reads a maximum of 120 psi before shutting down and parking for the night. This will ensure sufficient air pressure for restarting the engine.

**OPERATION**

**During Shutdown** — If the shutdown system activates, use the following procedures to move the vehicle to a location where it can be parked safely:

1. Push and hold the Shutdown Override button (if equipped).
2. Start the engine.
3. Continue depressing the Shutdown Override button while moving the vehicle to the nearest area where the vehicle can be parked safely.

**Kysor Shutdown Systems**

There are no special starting instructions for the Kysor shutdown system. To override the engine shutdown system so the vehicle can be moved to safety, simply restart the engine in the normal manner. The engine will run for 30 seconds and then shut down again.

**CAUTION**

*Continuously overriding the shutdown system for an extended period will cause severe engine damage.*

**OPERATION****MOVING YOUR VEHICLE****General Information****Braking**

Avoid sudden stops. Constantly making such stops may have a negative effect on the performance of braking and driving parts. When slowing, leave clutch (if equipped) engaged as long as possible to use the braking effect of the engine.

**CAUTION**

*When using the braking effect of the engine, final gear selection is critical. If gear selection is too high the vehicle will buck, which could cause loss of control.*

E7 engines use the Jacobs compression release engine brake, or the Jacobs Stealth Retarding System™. With either system, the best braking performance is achieved in the 1800 to 2100 RPM range. For optimum retarding power, keep engine RPM as close to 2100 RPM as possible. For additional information, refer to the Jacobs driver's manual supplied with your chassis.

**Shifting**

Operate in a gear low enough to allow engine to accelerate to, or maintain, governed RPM when applying full throttle. Allowing the engine to lug causes excessive strain on engine which could damage pistons, rings, cylinder walls, or bearings. However, you should not overspeed the engine either.

**CAUTION**

*Do not permit a load to drive the engine above governed speed. Use lower gears when descending steep grades, and watch the tachometer. Over-speeding will cause severe drivetrain damage and eventually destroy the engine.*



### OPERATION

#### Clutch (If Equipped)

To avoid shock damage, release the clutch pedal smoothly without shock-loading the driveline, especially on grades while carrying heavy loads. Do not ride the clutch pedal. Premature wear of clutch facing and release bearing may result.

#### CAUTION

*Always use the lowest drive gear combination to start vehicle moving to avoid premature clutch failure.*

#### General Instructions

1. To move the vehicle, begin by starting the engine and waiting until it reaches its operating range.
2. Disengage the clutch (if equipped) by pushing the pedal to the floor.
3. Shift transmission into first or LO gear (see Transmission Shifting Instructions for how to shift your particular transmission and in what gear to start).
4. Release the parking brake.

#### CAUTION

*If the Spring Brake Warning indicator is on, do NOT attempt to move the vehicle because driveline damage may result.*



### OPERATION

#### ⚠ DANGER

*Select the proper gear ratio BEFORE descending a grade to avoid a runaway vehicle and to stay within safe and legal speed limits. Do NOT coast down hills. Gear ratios should be selected to allow engine operation between peak torque and rated speed.*

#### CAUTION

*Running the engine at an RPM that is too low for the load or grade of the road can cause damage to the drivetrain.*

Shifting at the proper time will save both fuel and unnecessary repair bills, but remember that once your engine falls below the peak torque, both the torque and horsepower drop off very rapidly. Before this happens, downshift to the next lower gear.

On vehicles with transmissions having extreme reduction gearing coupled with high rear-axle loads, a torque-limiting device will be used. This device limits the amount of fuel that can be delivered to the engine by the injection pump and prevents overloading of the drivetrain components while in extreme reduction gears.

Use the same gear going downhill as you would going uphill. This will save your brakes and prevent damage to the engine from over-speeding.

#### Engine Temperature

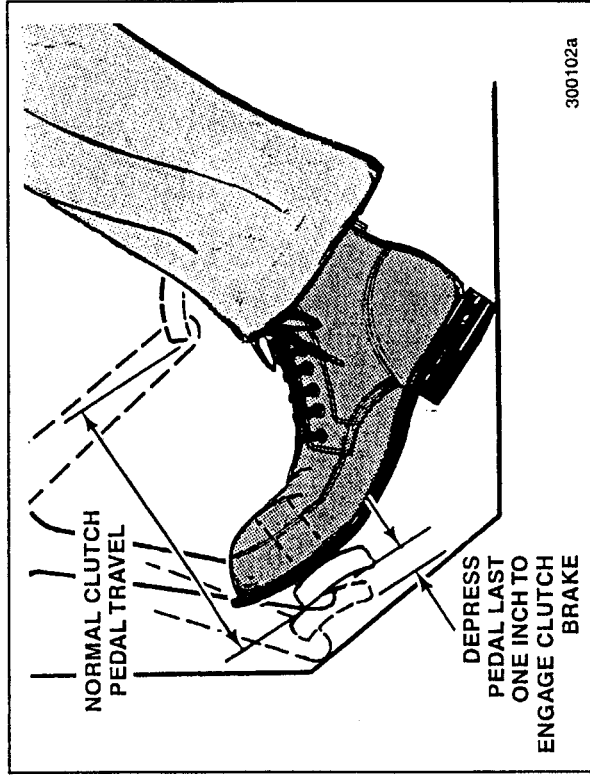
Before entering high-speed traffic conditions, allow the engine to reach normal operating temperature. Normal operating range may be between 170°F and 225°F (77°C and 107°C) depending on weather and road conditions.



### OPERATION

#### Clutch Brake Operation (If Equipped)

The clutch brake is designed to stop the rotation of the transmission input shaft while the truck is standing still, to make shifting into first or reverse gears easier.



With the vehicle standing still, push in the clutch pedal. Apply the clutch brake by pushing the clutch pedal all the way to the floor (the clutch brake is applied when the clutch pedal is fully depressed, the last one inch of travel past normal pedal travel).

### NOTE

When the clutch is engaged, a slight but definite resistance to clutch pedal downward travel will be felt in the last one inch.

### OPERATION



- Engage clutch (if equipped) smoothly by releasing the clutch pedal. At the same time, apply the accelerator enough for the engine to move the load.

### CAUTION

*Never allow your foot to ride the clutch pedal when clutch is engaged. This will cause premature failure and short clutch facing life.*

- As vehicle gains speed, continue shifting until transmission is in the highest gear possible with engine in operating range.

### NOTE

Engine must be warmed up to operating temperature before attempting to move in either REVERSE or LO-LO range when the vehicle is equipped with a torque-limiting device.

### OPERATION



#### Transmission Shifting Instructions

#### CAUTION

Maximum safe oil temperature is 235°F (113°C) for manual transmissions. Continued operation with oil above this temperature will cause rapid deterioration of the oil's lubricating properties and is NOT recommended.

#### CAUTION

The vehicle must be completely stopped before attempting to shift from REVERSE to any forward speed, or vice versa, to avoid transmission damage.

### OPERATION



Shift the transmission into first or reverse gear, engage the clutch and accelerate. The clutch brake is only to be used when the vehicle is stopped and being shifted into first or reverse gears. It is not designed to be used as an upshifting aid.

#### CAUTION

Clutch brake damage may result if used while the vehicle is in motion. The clutch brake must NOT be used when making a downshift or an upshift.

#### Double-Clutching

As with all nonsynchronized transmissions, double-clutching is necessary on downshifts as well as upshifts. It is advisable to use the torque-limiting clutch brake to engage first and REVERSE gears and to double-clutch for gear ratio changes.

Double-clutching is a way to bring the speed of transmission gears into synchronization so that the shift can be made without clash. The engine is used to speed up the countershaft for a downshift and to slow it down for an upshift.

1. Depress clutch pedal and shift to NEUTRAL.
2. Let up clutch pedal and accelerate engine (when making downshift) or allow engine to slow down (upshift) until engine speed approximately corresponds to road speed of gear to be selected.
3. Depress clutch pedal and complete shift to desired gear. Release the clutch pedal.

#### T2070-T2070C-T2070F TRANSMISSION RATIOS

Gear (Main Box)	Ratios	
	LO	HI
1	14.16	5.24
2	8.25	3.05
3	(4.67)	1.73
4	(2.70)	1.00
5	(1.62)	0.60
5 (T2070C)	(1.81)	0.67
Reverse	14.53	5.38

( ) The ratios in parentheses are not practical to use.

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### OPERATION



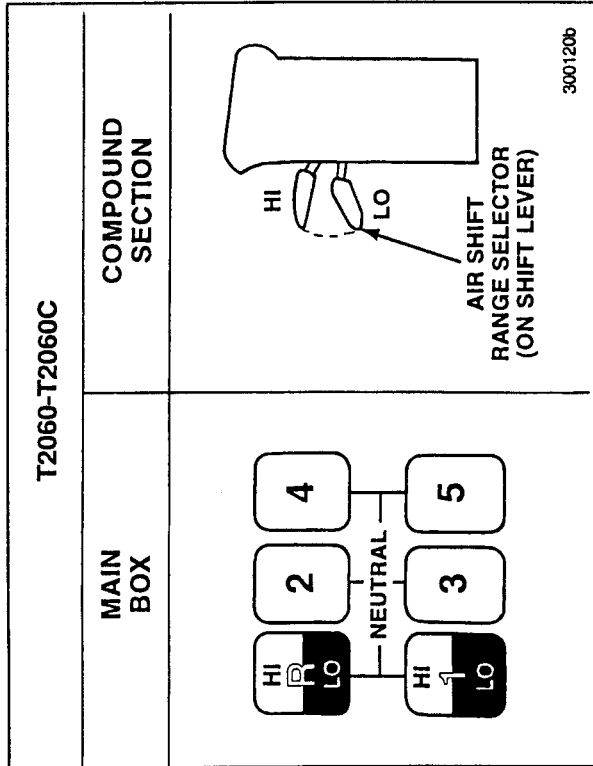
#### MACK T2070-T2070C-T2070F

The T2070-T2070C-T2070F are nonsynchronized transmissions. These transmissions feature a LO and HI auxiliary compound section controlled by an air-shift range selector located on the shift lever. The LO range provides two low ratios. In HI range there are five forward gears that can be shifted in the standard manner, but remember to double-clutch whether moving up or down through the gears. For normal highway usage, start in HI range, first gear and shift through second, third, fourth, and fifth. The two gears in LO range are designed for off-highway use and in slow-moving applications (curb pouring, material spreading, heavy load/steep grade operation). REVERSE can be used in LO or HI range.

**Upshift** — Begin in first gear, LO range (commonly called LO-LO as shown on the shift pattern diagram). Double-clutch and upshift to second gear, LO range (called LO) in the normal manner. When ready to upshift again, depress the clutch pedal and release the accelerator pedal. Move the shift lever to NEUTRAL, then flip the air-shift range selector to HI range, double-clutch and move the shift lever back to first gear. This is first gear HI range, which provides the next higher ratio. Release the clutch pedal and apply the accelerator to reach the top of the operating range. Shift through second, third, fourth, and fifth (HI range), being sure to double-clutch from one gear to the next.

**Downshift** — Downshift in reverse order from fifth through first gear (HI range), double-clutching through each gear. The next downshift will be to second gear, LO range (called LO). Proceed to depress the clutch pedal and release the accelerator pedal. Move the shift lever to NEUTRAL, then flip the air-shift range selector to LO range, double-clutch and move the shift lever to second gear. This is second gear, LO range, which provides the next lower ratio. When ready for the lowest ratio available (called LO-LO), double-clutch and downshift to first gear, LO range.

### OPERATION



T2060-T2060C TRANSMISSION RATIOS

Gear (Main Box)	Ratios	
	LO	HI
1	9.02	5.24
2	(5.25)	3.05
3	(2.98)	1.73
4	(1.72)	1.00
5 (T2060)	(1.03)	0.60
5 (T2060C)	(1.16)	0.67
Reverse	9.25	5.38

( ) The ratios in parentheses are not practical to use.

300121b

### OPERATION



#### Axles

#### Rear Axle

Mack Trucks, Inc. provides axle housings in three capacity classifications. They are medium duty, heavy duty and extra-heavy duty. To deliver the appropriate amount of torque to the driving wheels, Mack Trucks, Inc. offers single-reduction and dual-reduction carriers in a large variety of ratios for single axle applications. When required, a large variety of four-wheel-drive, two-axle bogies are also available with top-mounted, dual-reduction carriers for straight line through drive. The bogie carriers are also available in a large number of ratios.

All four-wheel-drive bogie tandem carriers are available with the MACK inter-axle power divider third differential, with or without a driver-controlled lockout.

MACK rear axles are designed so the entire load is carried by the axle housing through the wheel bearings mounted on the housing spindle. The rear axle shafts can be either free-splined, both ends, or integral flange type. Both types of axle shafts may be removed without removing or disturbing the rear wheels.

To avoid excessive tire wear, good maintenance must be practiced in the matching of tires on bogies without a compensating inter-axle power divider.

### CAUTION

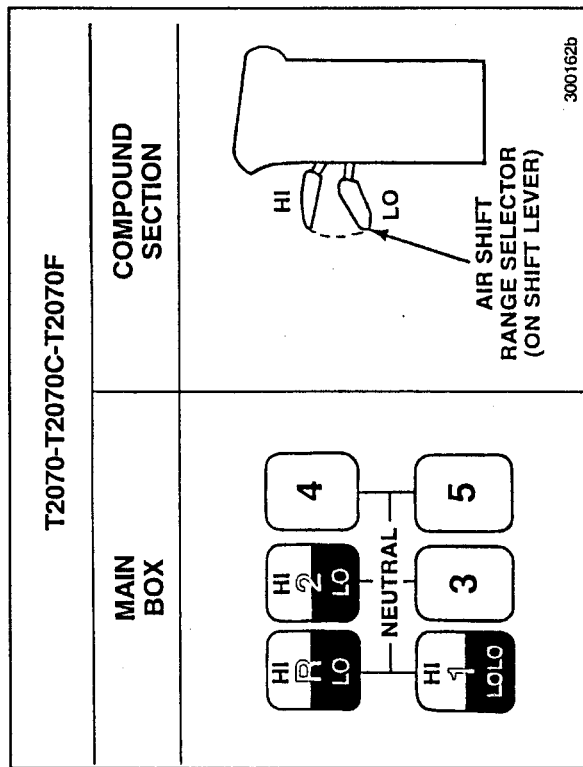
Maximum safe oil temperature is 235° F (113° C).  
Continued operation with oil above this temperature will cause rapid deterioration of the oil's lubricating properties and is NOT recommended.

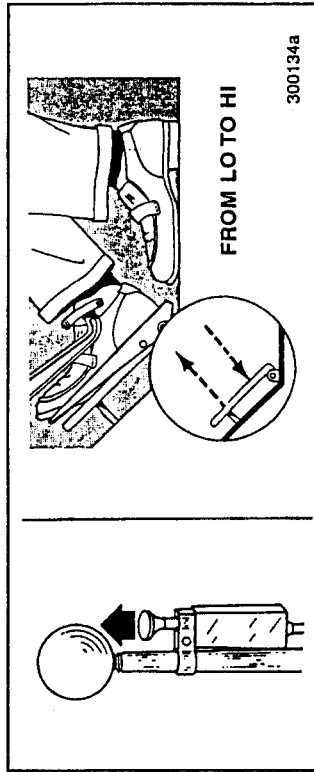
### OPERATION



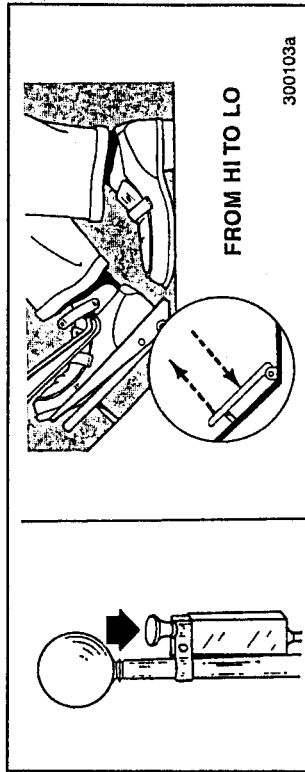
### CAUTION

Do not overspeed the engine when downshifting the transmission. Damage to the drivetrain components can result. Do NOT preselect the air-shift range selector. Shift the auxiliary compound section only with the clutch pedal depressed and/or the shift lever in NEUTRAL. To avoid transmission damage, do NOT change range while moving in reverse gear.



**OPERATION**

**To shift from LO to HI speed** — Hold accelerator down and pull axle shifter button up. Ride with accelerator down until you want to complete shift. Release accelerator, pause until shift is completed, then depress accelerator to maintain road speed.



**To shift from HI to LO speed** — Push axle shifter button down and hold accelerator down until you want to shift. Disengage and re-engage clutch as quickly as possible while holding accelerator down, or release and depress accelerator as quickly as possible without declutching.

**OPERATION****Two-Speed Rear Axle**

The dual-reduction rear axle carrier employs selective fast and slow gear reductions. Electric shift (button on the transmission shifter lever) provides either fast or slow ratio by selecting these gearsets. The transmission is shifted in the usual manner and the two-speed axle is shifted in the usual manner. The two-speed axle is shifted as follows:

**Split Shifting** — To shift to higher transmission gear and LO axle speed at the same time:

1. Shift transmission to higher gear in the usual way.
2. Push the axle shifter button down just before re-engaging the clutch.
3. Re-engage clutch and depress the accelerator to maintain road speed.

To shift to lower transmission gear and HI axle speed at the same time:

1. Hold accelerator down and pull axle shifter up.
2. Shift transmission to lower gear in the usual way, then depress accelerator to maintain road speed.

**CAUTION**

*Always keep accelerator down when shifter button is moved, except when split shifting to LO axle speed. Vehicle must be brought to a full stop before shifting from forward to REVERSE, and vice versa.*



### OPERATION

Decouple the engine (if equipped with an automatic transmission, shift to NEUTRAL) and move the lockout switch to the engaged position. Re-engage clutch and drive through the slippery area.

### NOTE

An electric buzzer in the cab sounds continuously as long as the lockout is engaged. This is to remind the driver to release the lock as soon as normal traction is regained.

When driving conditions permit returning to normal, unlock power-divider drive, move the lockout switch back to the OUT (disengaged) position, and let up momentarily on the accelerator pedal to powershift out of locked position. Then drive as usual.

### CAUTION

To avoid clash at the lockout sliding clutch and outer cam, under NO circumstances should the air-shift mechanism be activated while the drive wheels are actually slipping or spinning.

### OPERATION



#### Inter-Axle Power Divider (If Equipped)

A driver-controlled, air-shifted lockout is available so the MACK power divider can be rendered inoperative for short periods of poor traction, and then unlocked when normal traction returns. When the MACK sliding clutch lockout is engaged with mating teeth of the outer cam, both axles are locked together in positive through-drive for maximum traction with no differential action taking place between axles.

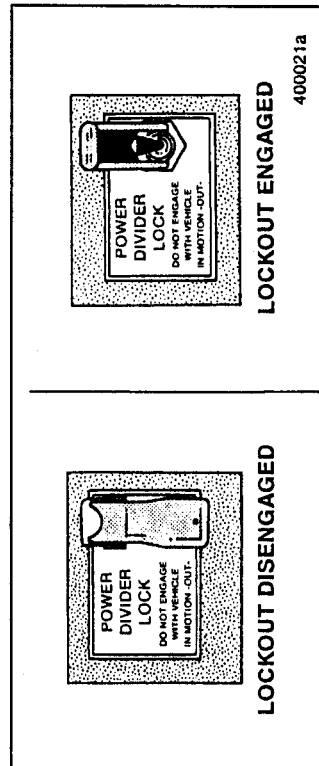
Normally, the driver-controlled, inter-axle power divider lockout control switch is in the OUT or unlocked position. On rare occasions, it is necessary to provide positive through-drive to both bogie axles for poor traction situations.

### CAUTION

Stop the vehicle before actuating the air-shift range selector.

### NOTE

The lockout should NOT be used on dry, hard surfaces.





### MAINTENANCE AND LUBRICATION

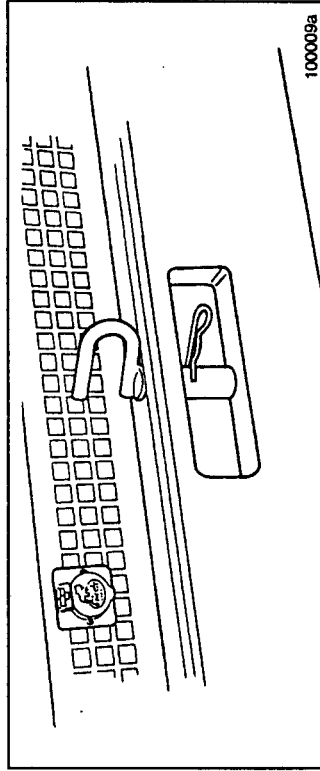
#### TOWING

There is one center-mounted tow pin located in the front bumper. The device meets the requirements set forth by The Maintenance Council (TMC) of the American Trucking Association. The tow pin may be used for towing a disabled vehicle from the immediate location.

If it is necessary to remove the tow pin, remove the retainer clip first. Once the retainer clip is pulled, the tow pin can be lifted out of the bumper hole.

#### CAUTION

*Do NOT lift and tow vehicle by tow pins, hooks, eyes, etc. If mired in heavy mud, snow, etc., use a suitable sling-type towing arrangement to move the truck.*



### MAINTENANCE AND LUBRICATION

#### MAINTENANCE INTRODUCTION

Preventive maintenance is vital to the life of your new MR. This section of the Operator's Handbook covers items of importance concerning the proper care of your new truck. A well-run maintenance and lubrication program is the best way of ensuring a long and productive life for your truck, as well as increased profitability and reduced maintenance costs for your business.

The operator plays an important role in the proper care of this equipment. By performing daily checks and observing the equipment while it is in operation, minor defects can be caught and corrected before they become major problems. Make sure any problems are corrected before putting the equipment into operation.

The service manager at your Mack Sales, Parts and Service Center knows your truck the best. Your satisfaction is his main concern. If you have any questions concerning the proper care, maintenance and lubrication of your MR, or if you need help in developing a preventive maintenance program, he will be glad to help.

#### NOTE

This handbook contains some maintenance information. Refer to TS494 for complete maintenance and lubrication procedures.



### MAINTENANCE AND LUBRICATION

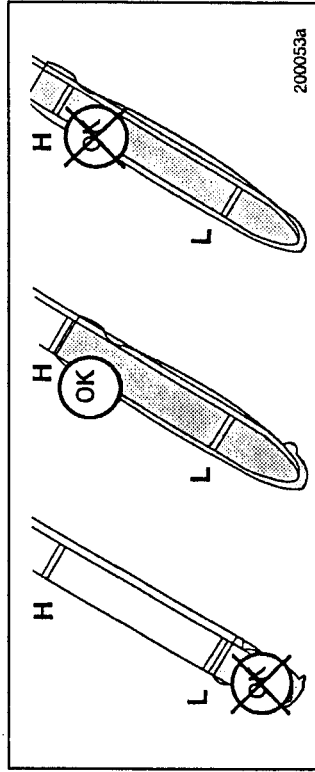
#### ENGINE

##### Oil Level Check

As the operator of this vehicle, it is important for you to perform the daily inspections necessary to keep your truck in good shape. Maintaining the proper oil level in your engine crankcase cannot be overemphasized.

Before checking the oil, remember these important points:

- Measurement of the oil level must be taken on level ground.
- If the engine has been running, allow about 15 minutes after shutdown for oil to drain down to the oil pan.
- The level must be close to the FULL line (at least between the ADD and FULL lines) on the dipstick, but must NOT exceed the FULL line (refer to illustration below).



### MAINTENANCE AND LUBRICATION

#### NOTE

Use of tow pins, hooks, eyes, etc., is NOT intended for long-term wrecker pull of disabled vehicles.

#### CAUTION

*Failure to disconnect the driveline before towing or pushing the vehicle can cause serious transmission damage.*

Before towing or pushing the vehicle, the driveline should be disconnected or the drive wheels should be lifted off the ground.



### MAINTENANCE AND LUBRICATION

When a winterfront is installed, a MACK-approved exhaust pyrometer must also be installed and closely monitored while the engine is in operation.

#### **CAUTION**

*DO NOT exceed the maximum exhaust temperature listed on the pyrometer decal. To reduce exhaust temperature, open the winterfront, downshift or reduce engine power.*



### MAINTENANCE AND LUBRICATION

#### COOLING SYSTEM

The cooling system is a pressurized system. The coolant is circulated by a centrifugal pump. It is a typical system in most respects, but there are a few things to keep in mind when checking or working on the cooling system.

#### **WARNING**

*Avoid injury when checking coolant in a hot engine. Wait for the engine to cool prior to checking the level, whenever possible.*

#### Winterfronts

A MACK-approved winterfront, although not recommended for normal operation, may be used during cold weather to aid the engine in reaching and maintaining engine coolant temperatures within the normal operating range.

#### **CAUTION**

*Use only a MACK-approved winterfront designed for the specific chassis. Restricted air flow through the charge air cooler can cause higher exhaust temperatures, power loss, excessive fan usage, reduced fuel economy and possible engine damage. The use of any other type of device, such as a radiator cover, cardboard or similar material, is not approved by Mack Trucks, Inc.*

#### **NOTE**

The minimum operating temperature is 170°F (77°C).

Maximum Ambient Air Temperature		
Above 60°F (15.5°C)	60°F (15.5°C)	40°F (4.40°C)
MACK-Approved Winterfront	Available*	Recommended
MACK-Approved Belly Tarp	Not Recommended	Available*

\* Make sure that engine oil, coolant, transmission and pyrometer temperatures remain in normal operating range.

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#### **CAUTION**

*Winter treatments are NOT RECOMMENDED for vehicles which only operate intermittently in cold climates.*

#### **CAUTION**

*Never operate a viscous fan with a closed or partially closed winterfront.*



### MAINTENANCE AND LUBRICATION

#### Draining

Whenever repairs are to be made which would require disconnection of coolant hoses, etc., the cooling system should be completely drained. Carefully remove the filler cap and open all coolant drain cocks.

#### Protecting Coolant System

#### CAUTION

*The concentration of ethylene glycol or propylene glycol in the cooling system must be checked with a refractometer prior to traveling or operating in areas where subfreezing temperatures may be encountered. When adding antifreeze to the system, run the engine for 20 minutes before checking with a hydrometer.*

#### NOTE

Your chassis is currently supplied from the factory with engine coolant protection to  $-10^{\circ}\text{F}$  ( $-23^{\circ}\text{C}$ ). Optional coolant protection to  $-40^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$ ) is also available.

Ethylene glycol or propylene glycol-based antifreezes are both approved for all MACK engines. All ethylene glycol and propylene glycol coolants must be low-silicate antifreezes which meet ASTM4985 test (GM6038M SPEC) criteria. These antifreezes are sometimes referred to as heavy-duty diesel coolants. Passenger car coolants do NOT meet this specification.

Be sure to maintain the required level of antifreeze protection for anticipated winter temperatures in your area of operation. A 40% to 60% concentration of antifreeze is required for E7 and E9 engines, regardless of application, geographic location or ambient air temperature.



### MAINTENANCE AND LUBRICATION

#### ON/OFF FAN CLUTCH

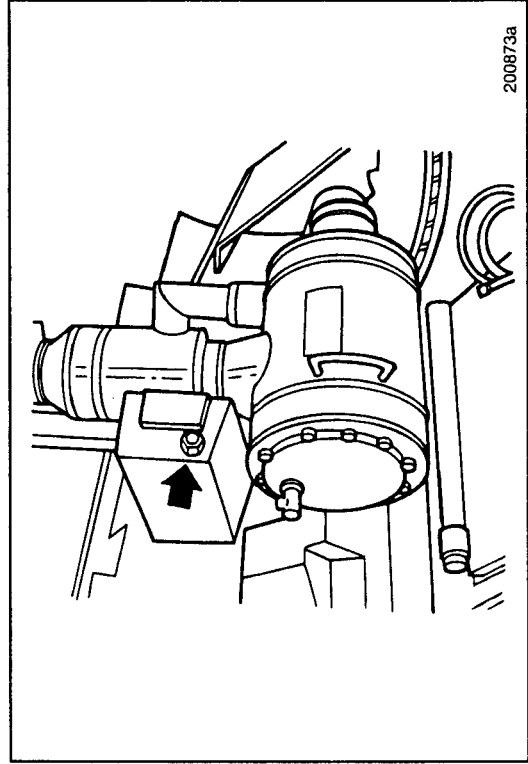
An ON/OFF fan clutch can help prevent excessive cooling during extremely cold weather operations. Whereas viscous fans often rotate continuously during cold weather, an ON/OFF fan clutch keeps the fan in the OFF position, thus reducing unnecessary air movement and helping to maintain adequate engine operating temperatures.

#### COOLANT LEVEL CHECK

#### WARNING

Turn the radiator cap counterclockwise to the first stop but do NOT depress. After the pressure has completely dissipated, press the cap downward and continue turning to remove.

The MR model chassis has an expansion tank located on the left-hand side of the chassis, mounted on the air cleaner assembly support bracket. Coolant should be visible in the sight glass located on the side of the tank.





**MAINTENANCE AND LUBRICATION****CAUTION**

Do NOT exceed a 60% concentration of antifreeze to water. A higher percentage of antifreeze will not increase protection. Concentrations over 60% adversely affect freeze protection and heat transfer rates.

**NOTE**

Propylene glycol should be checked with a refractometer.

**NOTE**

ALWAYS mix the water/antifreeze solution before pouring it into the cooling system.

**NOTE**

Piping arrangement may cause capacity variation depending on the type of cooling system and optional external cooling devices which may be attached. Therefore, it is difficult to tell exactly how much coolant it will take to fill any one particular system. As a general rule, fill to one inch below the bottom of the radiator filler neck.

**MAINTENANCE AND LUBRICATION****CAUTION**

Do NOT use coolant solutions which contain anti-leak additives in trucks equipped with coolant filters or conditioners.

**CAUTION**

Do NOT use soluble oil-type coolants in any MACK cooling system.

**Refilling**

Close all drain cocks and fill with the proper coolant mixture. Run engine with the radiator cap off until operating temperature is reached and the thermostat opens. Recheck level and add coolant, if required. Run the engine long enough to be sure the system is free of air and has the correct amount of coolant.

**Cooling System Maintenance**

The cooling system must be maintained by performing regularly scheduled maintenance as outlined in the MAINTENANCE AND LUBRICATION manual, TS494. Cold weather operations, however, place added demands on the cooling system. Prevent potential cold weather problems by performing a quick check of the cooling system as outlined below:

- Make a general check for cooling system leaks.
- Inspect hoses and clamps for leaks and condition. Tighten hose clamps to specifications (as required).
- Check coolant level. Add fresh coolant (in specified concentration) as necessary.
- Check and record degree of antifreeze concentration. Add antifreeze as necessary to obtain required protection level.



### MAINTENANCE AND LUBRICATION

#### BATTERY

##### Jump-Starting Engine

If you encounter a situation in which it is necessary to jump-start an engine, use the following procedures.

#### WARNING

Batteries which are to be linked together must be of the same voltage (12 to 12, 24 to 24). Batteries produce explosive gasses. Keep sparks, flames, cigarettes, etc., away from batteries at all times. Protect your eyes by wearing safety goggles. Be sure vehicles are NOT touching each other.

1. Connect positive (+) cable to positive (+) post of discharged battery.
2. Connect the other end of the same cable to the positive (+) post of the booster battery.
3. Connect the second cable, negative (-) side, to the other post of the booster battery.
4. Make the final connection on the engine block of the stalled vehicle AWAY FROM THE BATTERY, and stand back.
5. Start the vehicle with the booster batteries and then start the stalled vehicle. Shut down the vehicle with the booster batteries and remove the cables in the reverse order of connection.

#### WARNING

Do NOT connect the final negative (-) connection to the frame of the stalled vehicle. This would cause all current to flow through the master ground circuit breaker resulting in overload.



### MAINTENANCE AND LUBRICATION

#### ELECTRICAL

##### Circuit Protection

The circuit protection panel is located to the left of the passenger seat (on the engine tunnel). Remove the fasteners and the circuit board will be exposed.

Fuses are standard equipment for all circuits except the headlamps and windshield wipers. Circuit breakers are available as optional equipment.

#### CAUTION

For proper installation of electrical accessories, all wiring should meet SAE requirements and be routed through the circuit protection panel with proper amperage fuses or Type II circuit breakers. (Headlights and wipers will be on Type I, cycling-type circuit breakers.)

Some vehicles may be equipped with daytime running lights. For the daytime running lights to be operational, a DRL module must be installed in the relay socket marked either "DRL MOD" or "Running Lamps" on the electrical equipment panel. Do NOT install a standard relay into the daytime running light relay socket (marked either "DRL MOD" or "Running Lamps") or a short circuit in the headlight high beam circuit will result.

The headlight circuits are protected by SAE Type I (automatic reset-cycling) circuit breakers that automatically interrupt then restore the flow of current through the circuit in the event of an overload. This cycling will continue until the cause of the overload is repaired.

SAE Type II (automatic reset, non-cycling) circuit breakers (if equipped) provide a complete circuit disconnect until the overload is corrected. The power to the affected circuit breaker must be shut off before the circuit breaker will reset itself.

The circuit protection panel also provides access to battery, ignition and ground terminals for non-factory installed electronic equipment. (On V-MAC chassis, there are two serial link terminals for easy local connection of a trip recording device.)

### MAINTENANCE AND LUBRICATION



#### Bulb Chart

Light (Some lights may not be available on certain models)	Quantity (Varies with model)	CP/Watt	Trade No.
ABC Gauge Panel Cluster Lights	26	1.0CP	#161
Gauge Panel D	2	1.0CP	#161
Dome and Door Courtesy Light	2/3	12.0CP	#561
Map Light	1	3.0CP	#1816
Heater and Air Conditioner	1	1.0CP	#184
Clearance & Cab ID Marker (Standard)	5/7	3.0CP	#168
Clearance & Cab ID Marker (Premium)	5	4.0CP	#904
Side Turn Indicator	2	32.0CP	#570
Hook-Up Light	1	35W/600CP	#4406
Fog Light	2	55W	#H3
Headlight, Incandescent (Round)	2	60W/50W	#6015
Headlight, Halogen (Round)	2	65W/35W	#H6024
Headlight, Halogen (Rectangular)	2	65W/45W	#9004
Rear Tail Light Backup	2	32.0CP	#1156
Rear Stop, Tail and Turn Light	2	32.0/3.0CP	#1157
Front Turn Light	2	32.0/3.0CP	#3057

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To prevent corrosion of the lamp socket terminals, particularly with the clearance and marker lamps, apply a coating of electrical sealing grease, such as Lubriplate DS-EX, to the socket and terminal assemblies.

### CAUTION

Do not use electrical grease on any V-MAC connectors.

**METRIC CONVERSIONS**

<b>U.S. to SI Conversions</b>	
1 inch	= 25.4 millimeters
1 mile	= 1.61 kilometers
1 pint (U.S. liquid)	= .473 liter
1 quart (U.S. liquid)	= .946 liter
1 cubic inch	= .01639 liter
1 pound-foot	= 1.3558 Newton meters
1 horsepower	= .746 kilowatt
1 pound/square inch	= 6.895 kilopascals
degrees Fahrenheit	= (1.8 x degrees Celsius) + 32
1 gallon (U.S. liquid)	= .83267 Imperial gallon
<b>SI to U.S. Conversions</b>	
1 millimeter	= .03937 inch
1 kilometer	= .6214 mile
1 liter	= 2.1134 pints (U.S. liquid)
1 liter	= 1.0567 quarts (U.S. liquid)
1 liter	= 61.024 cubic inches (U.S. liquid)
1 Newton meter	= .7376 pound-foot
1 kilowatt	= 1.34 horsepower
1 kilopascal	= .145 pound/square inch
degrees Celsius	= .556 x (degrees Fahrenheit - 32)
1 Imperial gallon	= 1.2009 gallons (U.S. liquid)

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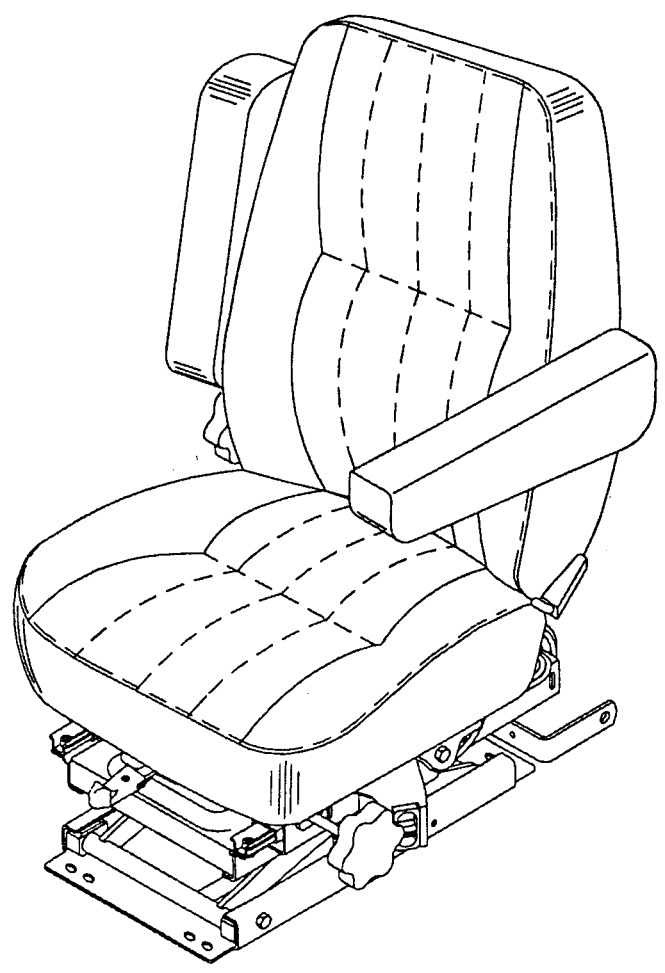
**METRIC CONVERSIONS****NOTE**

Use all tools on the fasteners they were made to be used on. Use metric tools on SI metric units only. Never try to use metric tools on U.S. pound-inch units or U.S. pound-inch tools on SI metric units.

**CAUTION**

Potential external/internal thread mismatch condition(s) may occur with certain metric thread-inch thread fastener combinations, and with fastener combinations involving incompatible metric fastener systems. A given thread mismatch condition can result in thread stripping and/or assembly weakness leading to potential service failure, thereby rendering a vehicle non-operational and/or unsafe for operation. The specific external/internal thread combinations from which such problems can result are identified and set forth in TS494.

**Bostrom**<sup>®</sup>  
S E A T I N G



**TALLADEGA**<sup>TM</sup>  
SERIES  
905L/905/910  
AIR SUSPENSION SEATS

# REED

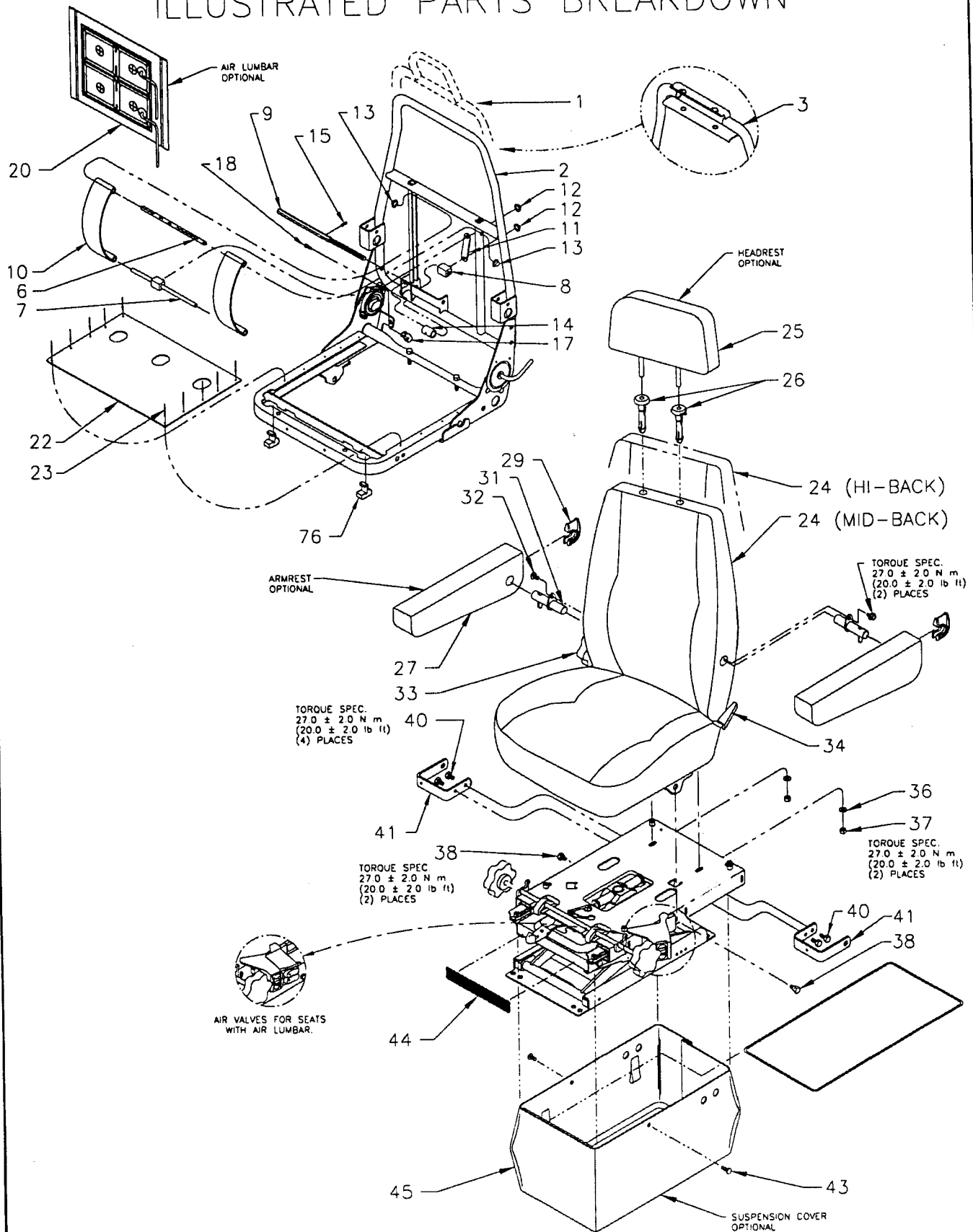
CONCRETE PLACING  
EQUIPMENT

## BOSTROM AIR SUSPENSION SEAT TALLADEGA SERIES

VENDR

FIGURE 02  
PAGE 02

### ILLUSTRATED PARTS BREAKDOWN



REVISION:

**PARTS REPLACEMENT LIST  
LOW PROFILE SUSPENSION SEAT****ORDERING INSTRUCTIONS:** Order by Part Number, NOT Reference Number.**HOW TO USE:** Find the corresponding part that you wish to replace on the exploded view illustration and note its reference number. Refer to list below and record part number, quantity required and description. Order cover pad kits or armrests by color and material.**ORDER FROM:** Your truck dealer or Bostrom Authorized Distributor for your area.

REF NO	PART NO	DESCRIPTION	QTY	REF NO	PART NO	DESCRIPTION	QTY
1	6200906-001	Frame Assy. - High Back		35	6222007-001	Kit Fastener Mounting	
2	6200908-001	Frame Assy. - Mid Back		36	*	Washer Flat	2
3	6201118-001	Frame w/Headrest		37	*	Nut M8 x 1.25	2
4	6201316-001	Frame w/Air Lumbar		38	*	Shoulder Bolt M8	2
5	6222137-001	Lumbar Kit		39	6222005-001	ICP Bracket Kit	
6	*	Lumbar Support Shaft	1	40	*	Bolts	4
7	*	Lumbar Slide Shaft	1	41	*	ICP Bracket	2
8	*	Lumbar Adj. Block	1	42	**	Suspension Cover Kit	
9	*	Lumbar Adj. Shaft	1	43	*	Fastener	2
10	*	Lumbar Spring	2	44	*	Velcro	1
11	*	Lumbar Linkage	1	45	*	Suspension Cover	1
12	*	Push Nut 5/16"	2	46	6222155-001	Air Valve Kit	
13	*	Push Nut 3/8"	2	47	*	Valve Mounting Pod	1
14	*	Spacer	1	48	*	Air Valve	1
15	*	Roll Pin	1	49	*	Wire Tie 3"	3
16	6107030-001	Back Restriction Kit		50	*	Wire Tie 6"	1
17	*	Stop Block	1	51	*	Air Line	
18	*	Screw 10-32	1	52	6222133-001	Isolator Spring Kit	
19	6222141-001	Lumbar Kit (Air)		53	*	Rubber Bumper	2
20	*	Lumbar Bladder	1	54	*	Isolator Spring	2
21	6222157-001	Pan - Support Kit		55	*	Shoulder Bolt M10 x 1.50	1
22	*	Pan	1	56	*	Pivot Block Assy.	1
23	*	Rivets	10	57	*	Latch Spring	2
24	**	Upper or Cover Pad Kit		58	*	Split Poly Loom	2
25	**	Headrest		59	*	Spacer	1
26	6201133-001	Grommet	2	60	*	Latch Bar	1
27	**	Armrest Assy.		61	6222134-001	Control Handle Kit	
28	6222159-001	Kit Armrest Insert		62	*	Control Handle Assy.	1
29	*	Insert	1	63	*	Detent Pin Assy.	1
30	6222160-001	Kit Armrest Bracket		64	*	Spring Lockout	1
31	*	Screw 5/16 x 1/2 Hex Tap	1	65	*	Hex Head - Shoulder	1
32	*	Armrest Shaft	1	66	*	Washer	1
33	6200413-002	Lumbar Knob	1	67	*	Isolator Knob	1
34	6103653-003	Recliner Handle	1	68	*	Pop Rivet	1

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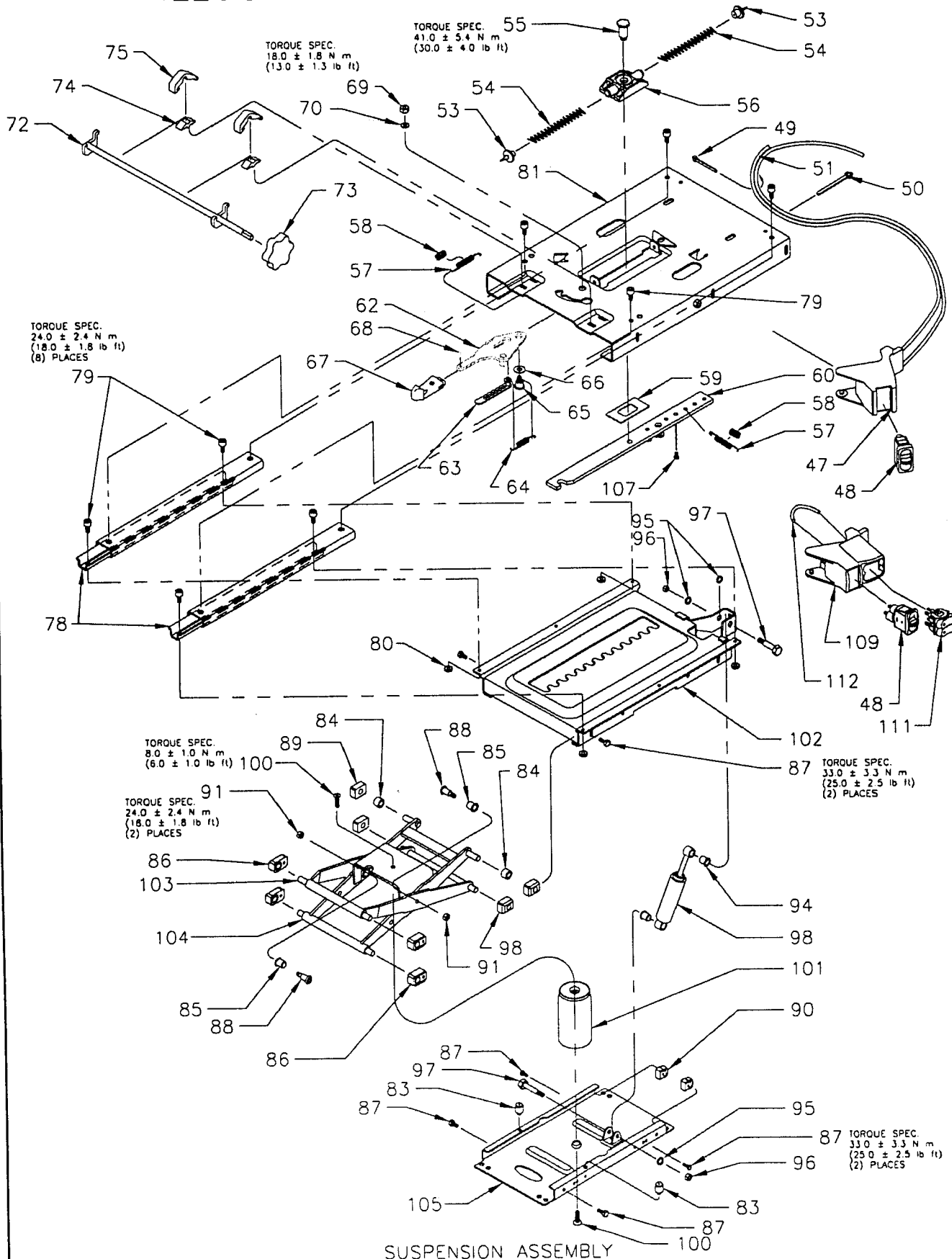
CONCRETE PLACING  
EQUIPMENT

## BOSTROM AIR SUSPENSION SEAT TALLADEGA SERIES

VENDR

FIGURE 02  
PAGE 04

### ILLUSTRATED PARTS BREAKDOWN



REVISION:



**BOSTROM AIR SUSPENSION SEAT  
TALLADEGA SERIES****PARTS REPLACEMENT LIST  
LOW PROFILE SUSPENSION SEAT  
CONTINUED**

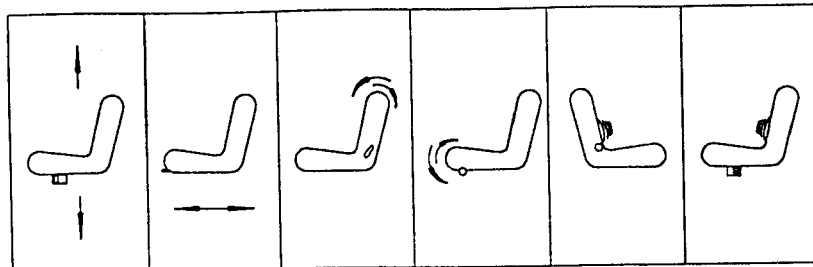
REF NO	PART NO	DESCRIPTION	QTY	REF NO	PART NO	DESCRIPTION	QTY
69	*	Hex Nut M8 x 1.25 LK	1	92	6222078-001	Low Profile Damper Kit	
70	*	Washer	1	93	6222079-001	Heavy Duty Damper Kit	
71	6222135-001	Seat Tilt Replacement		94	*	Bearing Multilube	2
72	*	Tilt Rod Weldment	1	95	*	Washer Flat	2
73	*	Tilt Knob	1	96	*	Hex Nut	2
74	*	Bracket Tilt Rod	2	97	*	Bolt	2
75	*	Bracket Tilt Rod	2	98	*	Standard Damper	1
76	*	Slide Block Seat Tilt	2	99	6222084-001	Air Spring Kit	
77	6222165-001	Slide Rail Kit		100	*	Screw	2
78	*	Slide Rail	2	101	*	Air Spring Assy.	1
79	*	Screws	8	102	6201571-001	Upper Plate Weldment	1
80	*	Nuts	4	103	6065662-002	Outer Lever Assy.	1
81	6200641-004	Isolator Assy.		104	6106528-002	Inner Lever Assy.	1
82	6222076-001	Susp. Hardware Kit		105	6111111-001	Base Assy.	1
83	*	Rubber Bumper	2	106	6222138-001	Fore/Aft Restriction	
84	*	Spacer Roller	2	107	*	Restrictor Screw	1
85	*	Bearing Multilube	2	108	6222163-001	Air Valve Kit Assy.	
86	*	Bearing Block	4	109	*	Pod	1
87	*	Screw Cap M8 x 20mm	6	110	*	Air Lumbar Valve	1
88	*	Bolt Shoulder M8 x 1.25	2	111	*	Air Valve	1
89	*	Block Slide	4	112	*	Jumper Loop	1
90	*	Stop Block Assy.	2				
91	*	Nut Hex M8 x 1.25 LK	2				

\* EXCEPT AS NOTED, KITS CONTAIN ALL ITEMS DENOTED BY ASTERISK LISTED BELOW EACH KIT PART NUMBER.

\*\* SEE YOUR DEALER OR BOSTROM AUTHORIZED DISTRIBUTOR FOR UPPER, ARMREST, SUSPENSION COVER OR COVER PAD KIT PART NUMBERS APPROPRIATE FOR YOUR SEAT.

**COMFORT ADJUSTMENTS**

After installation the following comfort adjustments can be made to ensure the best performance.



A B C D E F

**E - LUMBAR ADJUSTMENT**  
Rotate knob forward to increase or rearward to decrease the support in the lumbar area.

**C - BACK ANGLE ADJUSTMENT**  
Lean forward slightly to remove pressure from seat back, hold handle rearward to adjust to any position within range.

**F - OPTIONAL AIR LUMBAR ADJUSTMENT (UPPER AND LOWER)**  
To increase lumbar support press control valve forward. To decrease lumbar support press control valve rearward.

**B - FORE AND AFT SEAT POSITION ADJUSTMENT FORE AND AFT ISOLATION**  
Hold lever to left to adjust seat position forward or backward. Isolation is provided when lever is in center (straight forward) position. To lock out move lever to right.

**D - SEAT CUSHION TILT ADJUSTMENT**  
Rotate seat tilt knob to decrease or increase seat tilt.

**A - WEIGHT AND HEIGHT ADJUSTMENT**  
To raise seat, push the air valve lever upwards. To lower seat, push the air valve lever downwards. When adjusted properly and under normal driving conditions. The seat should not top nor bottom against the end limits of the vertical travel. Adjusted height position should aid drivers visibility and vehicle control.

**REMOVAL / REASSEMBLY****Air Spring Assembly (101)  
Removal/Reassembly**

Remove complete seat assembly from vehicle.

1. Fill air spring assembly (101) so that seat is at maximum height (see comfort adjustments).
2. Block suspension up with a spacer placed between the base riser (105) and the upper frame (102).
3. Release air pressure from air spring so that seat is supported by spacer (see comfort adjustments).
4. Disconnect air line (51) from air spring assembly (101) by loosening air fitting and pulling air line out of fitting.
5. Remove top and bottom screw from air spring (101) and remove air spring assembly from suspension assembly.
6. Position air spring so that fitting at bottom of air spring (101) is toward the front of the seat. Install screw (100) into bottom of air spring (101).
7. Torque screw (100) at bottom of air spring assembly (101) to 10.0 +/- 1.0 ft.-lbs.
8. Install screw (100) at top of air spring assembly (101) and torque to 6.0 +/- 1.0 ft.-lbs.
9. Reconnect air line (51) to fitting in air spring assembly (101) by pushing air line into fitting and tightening fitting.
10. Fill air spring assembly (101) (see comfort adjustment) and remove spacer block.

**Damper Replacement (98)**

Seat need not be removed from truck.

1. Be sure suspension is at maximum height. Add air if needed (see comfort adjustment).
2. Move channel assembly (81) to full forward position to gain working room.
3. Remove shoulder bolts (97) and hex nuts (96).
4. Remove damper assembly.
5. Install new damper with flanges of bearings to the outside of the suspension. Add thrust washers (95) and install shoulder bolts (97) and hex nuts (96).

**Slide Rail (77) Replacement**

1. Remove seat/back assembly (24). NOTE: See Seat/Back Assembly Removal/Reassembly procedure.
2. Once seat/back is removed, slide channel assembly (81) to the rear. Remove front screws (79) and nuts (80). Carefully, move channel assembly (81) to the front. Remove screws (79) and nuts (80).
3. Remove top screws (79).
4. Remove and install one slide rail (78) at a time.
5. Install new screws (79) and nuts (80).
6. Reassemble seat/back assembly (24).

**REMOVAL / REASSEMBLY****Suspension Rebuild Bearing/Slide  
Block Replacement**

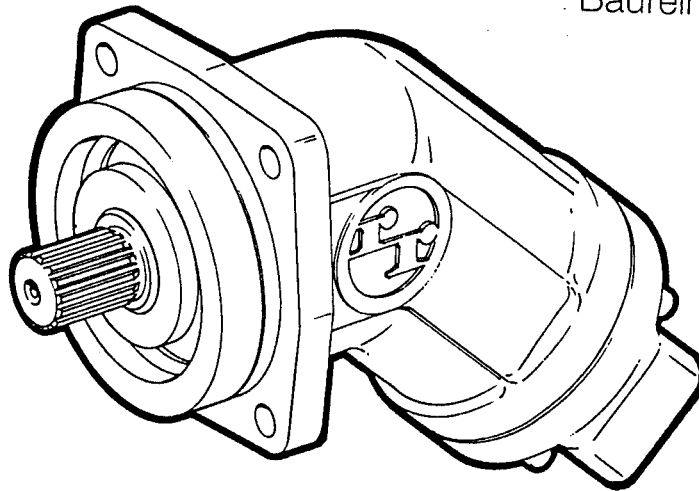
1. Bleed all air from supply line. Disconnect air supply line to seat. Using air valve, exhaust all air from air spring. Remove complete seat assembly from vehicle.
2. Remove seat/back assembly (24) from suspension per procedures shown.
3. If seat assembly has a suspension cover (45), remove along with fasteners (43), after removing ICP bracket (41) and cap screws (40).
4. Block suspension up with a spacer placed between the base riser (105) and the upper frame (102).
5. Disconnect air line (51) from air spring assembly (101) by loosening air fitting and pulling air line (51) out of fitting.
6. Remove top and bottom screw from air spring (101) and remove air spring assembly from suspension assembly.
7. Remove damper assembly (98) by removing shoulder bolts (97) nuts (96) and washers (95) (see procedure for damper replacement).
8. Remove cap screws (87) from upper front bearing blocks (86) and lower rear stop block assemblies (90).
9. Remove upper plate weldment (102) by lifting and sliding it forward until bearing blocks (86) can be removed from cutouts in channels on upper frame (102). Then slide channel rearward until slide blocks (89) can be removed. Be careful not to pinch fingers in lever assembly.
10. Remove cap screws (87) from lower front bearing blocks (86) and slide lever assemblies (103 and 104) forward until bearing blocks (87) are removed from channel on base (105). Then slide lever assemblies rearward until slide blocks (89) are removed from channel. Be careful not to pinch fingers in lever assemblies.
11. Remove shoulder bolts (88) and nuts (91) from pivots of lever assemblies (103 and 104) and inspect. Replace if worn.
12. Replace bearings (85) at pivots on lever assembly (104) by pushing the old out and pressing in new. Flange of bearings (85) should be on outside of lever assembly (104).
13. Reassemble reverse order. Torque pivot shoulder bolts (88) to 20.0 +/- 2 ft.-lbs.
14. Put new bearing blocks (86) and slide blocks (89) on levers with beveled surfaces outward and slide levers with blocks into channel on base riser (105). Torque screws (87) to 30.0 +/- 3.0 ft.-lbs.
15. After putting bearing blocks (86), spacers (85) and slide blocks (89) on levers, slide upper frame assembly (102) over blocks. Line up screws (88) with bearing blocks (86) and torque screws (87) to 30.0 +/- 3.0 ft.-lbs.
16. Manually move suspension up and down to make sure there are no clearance problems. Be careful not to pinch fingers in linkage.
17. Block up suspension and reinstall air spring assembly (101). Torque upper screw (100) to 6.0 +/- 1.0 ft.-lbs. and lower screw (100) to 10.0 +/- 1.0 ft.-lbs. (see procedure shown for air spring reassembly).
18. Reinstall damper assembly (98) with washer (95) and nuts (96) (see procedure for damper replacement).
19. Reinstall suspension cover (45) and ICP brackets (41) if removed (see step #3).
20. Install assembly (24).

**Seat/Back Assembly (24)  
Removal/Reassembly**

1. Adjust the seat upper to most rearward position and remove two nuts (37) and flat washers (36) from underside of channel assembly (81).
2. Remove two shoulder bolts (38) from channel assembly (81).
3. Reverse procedure to reassemble.

**A2F**

Baureihe/Series 6.1

**NOTE**

Pretested and preassembled Original-Hydrumatik-subassemblies make quick and successful repairs possible.

Should it be necessary to carry out repairs with individual components, our experience shows that only Original-Hydrumatik-seals, retaining rings, and bearings should be used. Basically, these should be changed when ever a unit is stripped down, as useful life still remaining cannot be visually determined. In addition, it would be dissapointing to spoil a well done repair by including marginally cheaper components.

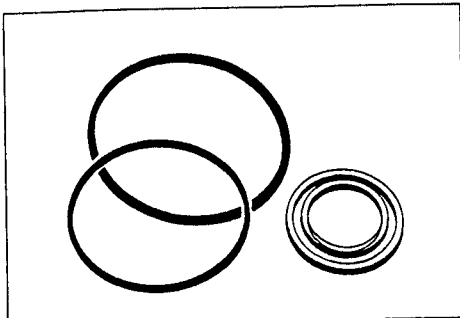
Giving us the unit type and fabrication number when ordering components will mean that you receive them quickly.

Repairs are simple, but we recommend you take advantage of our training in order to acquire the necessary special knowledge. This applies also to specialists whom we are always pleased to meet again to explain the repair of newly developed products.

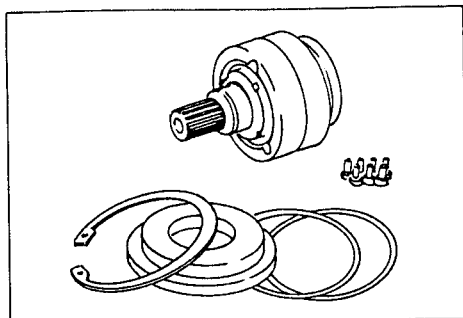
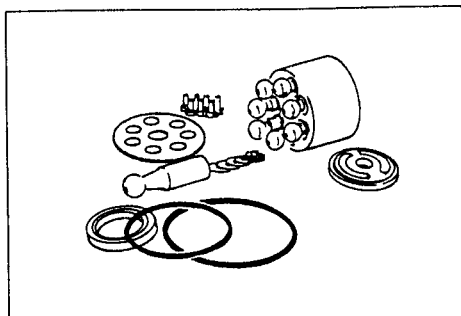
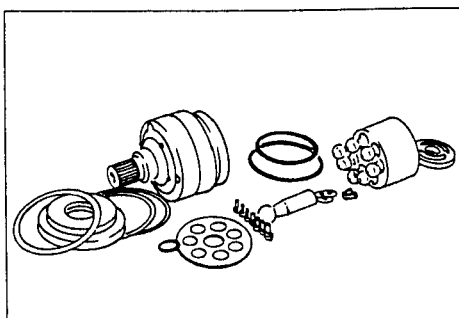
**MANNESMANN  
REXROTH**

Hydrumatik GmbH

**R**



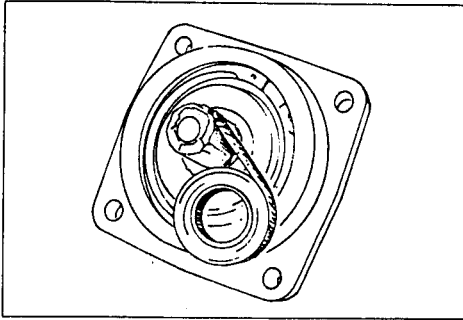
External seals

Rotary group, mechanical part; with sealkit,  
completely adjusted.Rotary group, hydraulic part; with sealkit,  
completely adjusted.Rotary group, complete; with sealkit, completely  
adjusted.

## C O N T E N T S

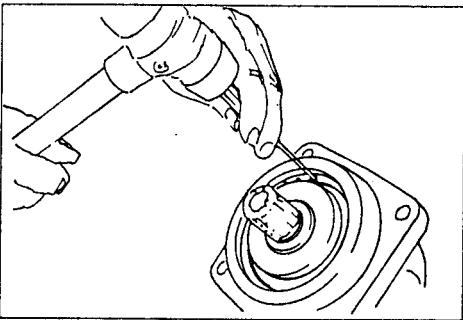
Seal sets/Sub-assemblies  
Notes/Section  
Drive Shaft/Seal  
Cover Plate/Seals  
Removal of rotary group  
Examination (notes)  
Installing rotary group  
Special equipment/Torques

### Shaft seals



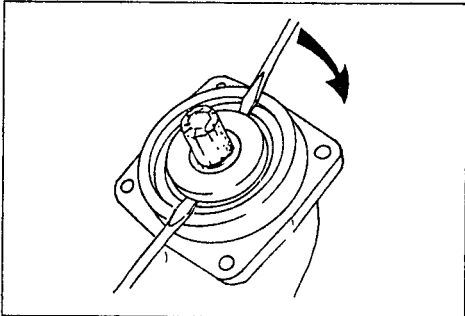
1

Remove protective cover. If keyed shaft, remove key.



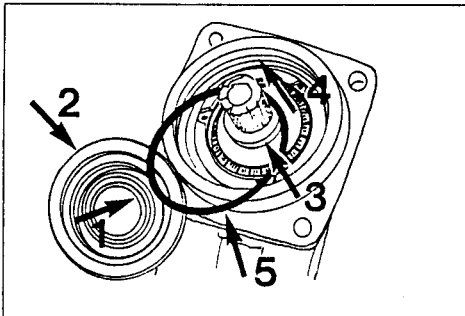
2

Free circlip and remove.



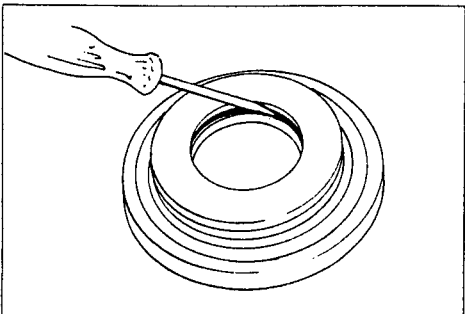
3

Prise off front cover.



4

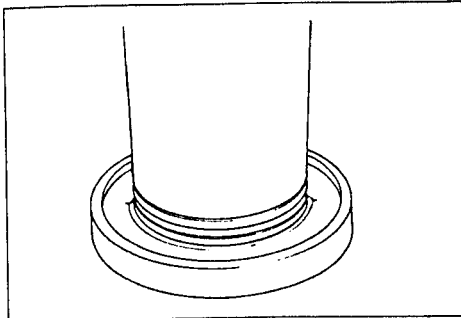
Visual check  
Shaft seal (1), Cover (2), drive shaft (3),  
housing (4), O-ring (5).



5

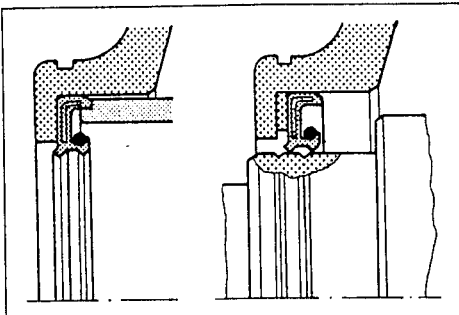
Remove old shaft seal.

### Shaft seals



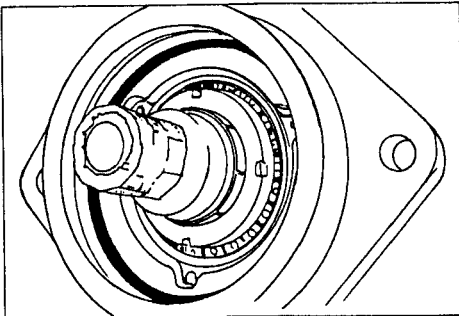
6

Press in the shaft seal ring to the correct position with a suitable sleeve.



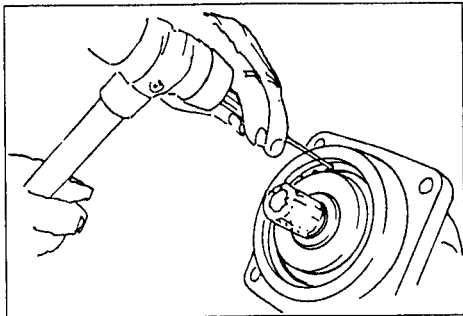
7

If the shaft is deeply grooved, insert shim behind seal.



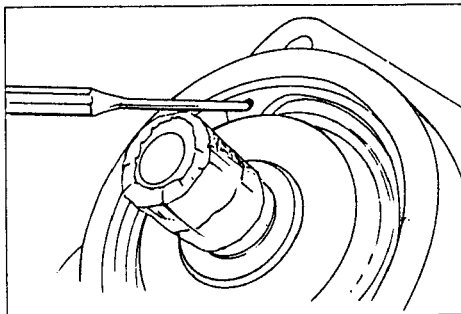
8

Fit new O-ring, ensure it is a snug fit. Grease O-ring and lips of shaft seal.



9

Fit circlip using a punch.

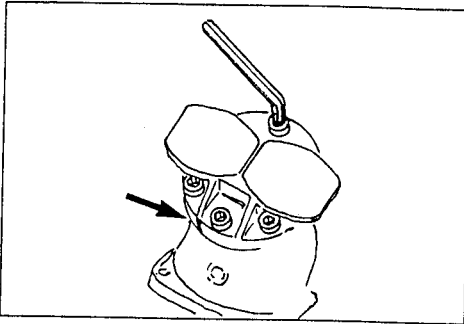


10

Check that circlip is well seated.

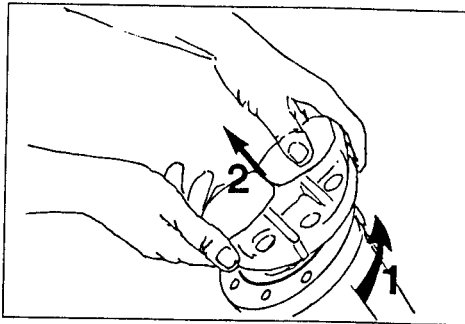


Cover plate/seals



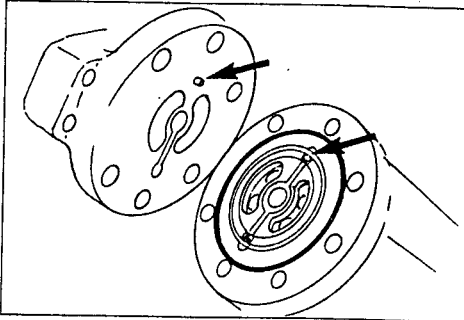
11

Mark position of cover plate (arrowed). Remove screws.



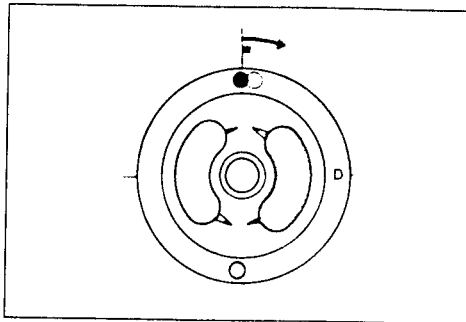
12

Swivel port plate on locating pin and lift off.



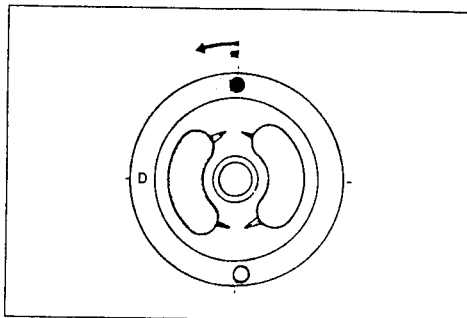
13

Note position of locating pin. (arrow).



14

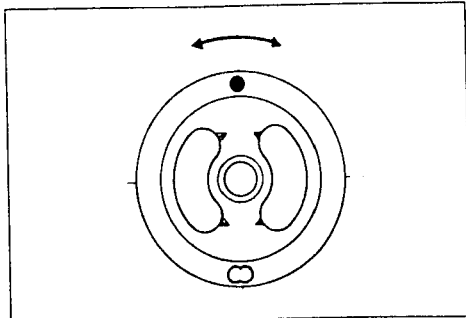
Pump, clockwise rotation. (Viewed on spherical surface.)



15

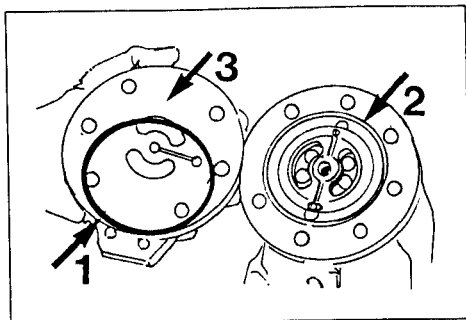
Pump, anti-clockwise rotation. (Viewed on spherical surface.)

Cover plate/seals



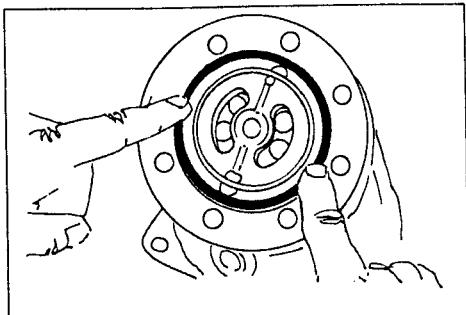
16

Motor, bi-directional. (Viewed on spherical surface.)



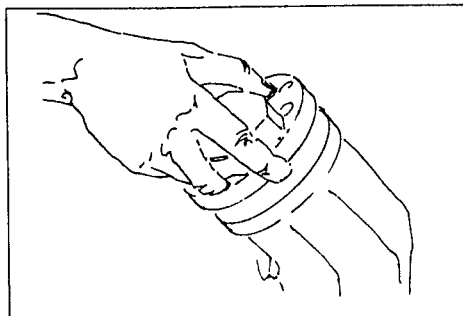
17

Visual check  
O-ring (1), Groove (2), Plate (3).



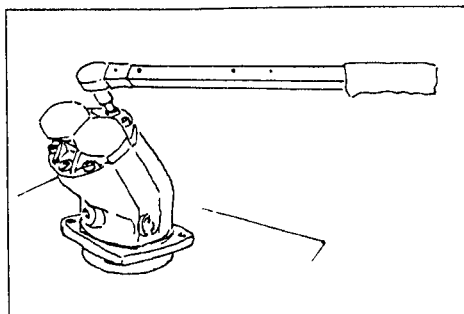
18

Lightly grease and fit O-ring.



19

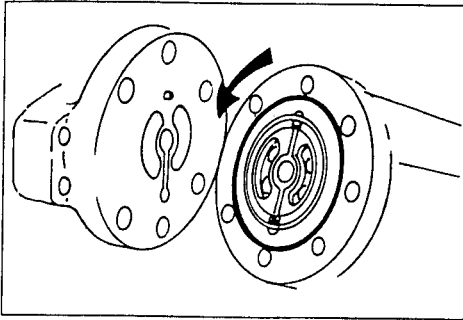
Assemble port plate to original mark (11), noting position of port plate (14-16). See notes fitting control plate.



20

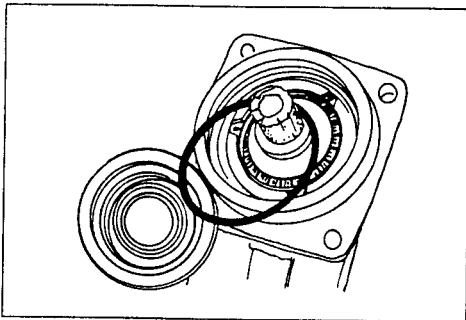
Tighten screws using torque wrench. See p. 14 for setting.

## Removal of rotary group



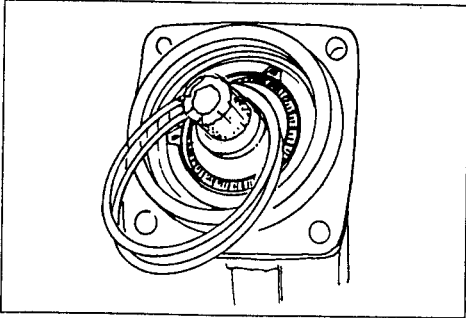
21

Remove cover plate (page 6). Rotate control plate to remove.



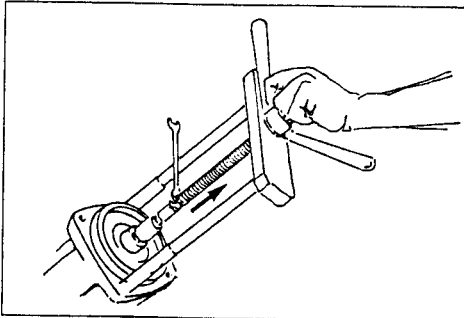
22

Remove front cover (page 4).



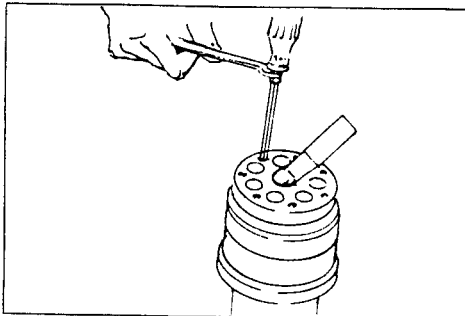
23

Remove shim(s).



24

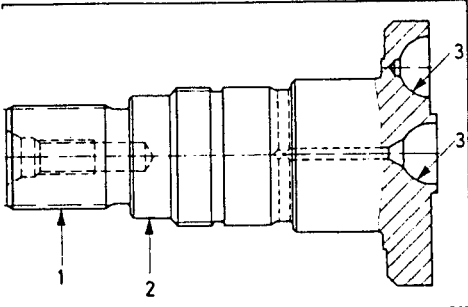
Remove rotary group with extractor. (See fig. 50).



25

Remove retaining plate. The screws are held by loctite.

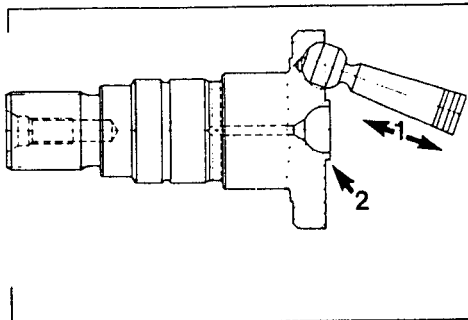
## Examination notes



26

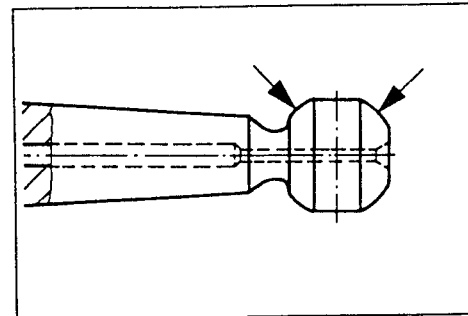
## Drive shaft

- 1.) Free of corrosion or erosion, no damage to splines or keyway.
- 2.) No trace of wear, free of scratches (p. 7).
- 3.) Cups free of scratches and no pitting.



27

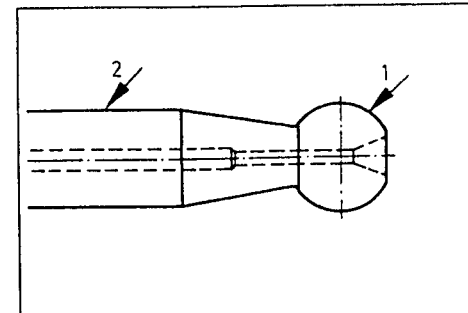
- 1.) Axial play of piston.
- 2.) Spigot.



28

## Piston

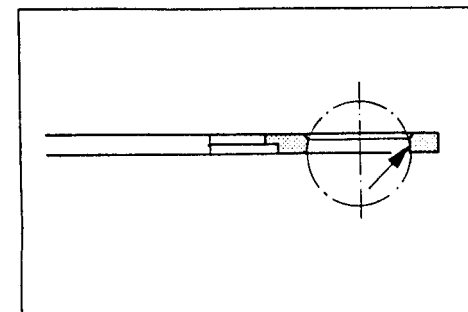
Free of scratches, no pitting (do not dismantle - tilt).



29

## Centre pin

- 1.) Free of scratches, no pitting (do not dismantle - tilt).
- 2.) Free of scratches.

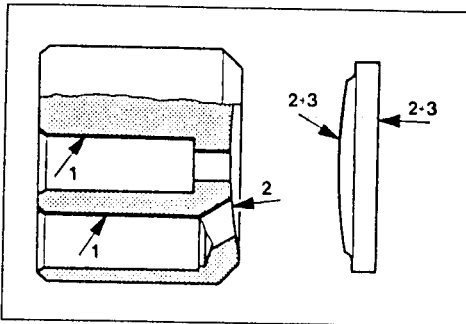


30

## Retaining plate

Free of scratches, no wear.

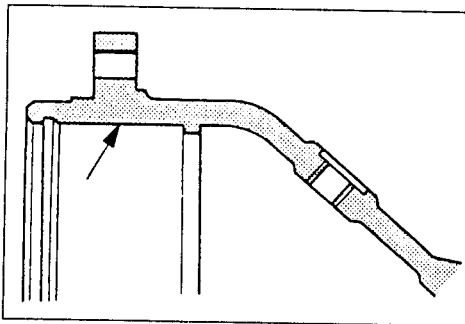
## Examination notes



31

Cylinder block/Control plate

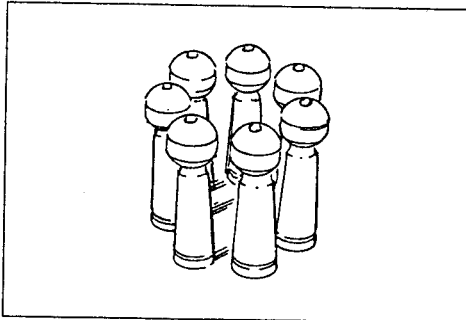
- 1.) Bores unscratched, and not worn.
- 2.) Faces, smooth and even, no cracks or scratches.
- 3.) Min. hardness 700 HV 10.



32

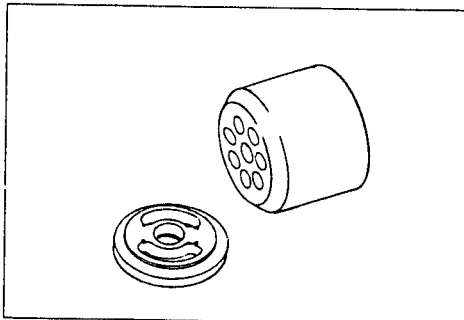
Housing

No damage or wear where bearings fit.



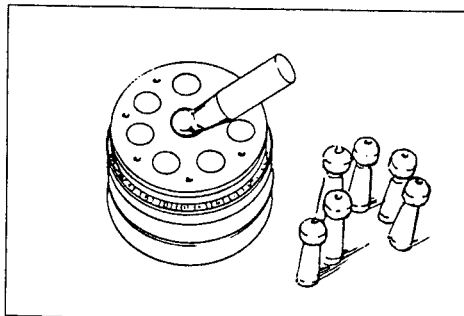
33

Only exchange piston as a complete set. When changing other components, re-calibration is required.



34

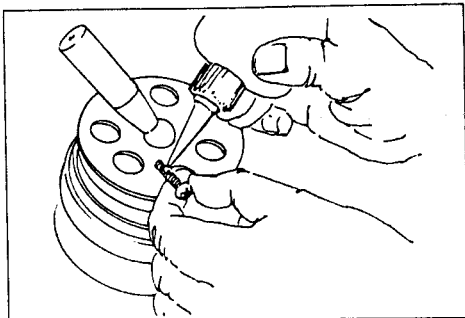
Exchange cylinder block and control plate as a pair.



35

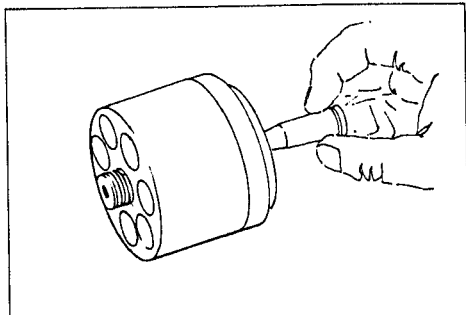
Insert centre pin with retaining ring. Correctly fit retaining plate.

### Installing rotary group



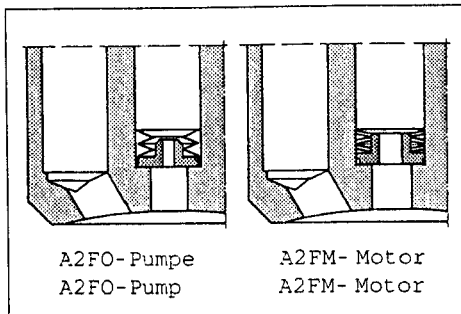
36

Apply loctite sparingly to screws only.



37

Heavily grease and fit spring pad and Belleville washers (using screwdriver).



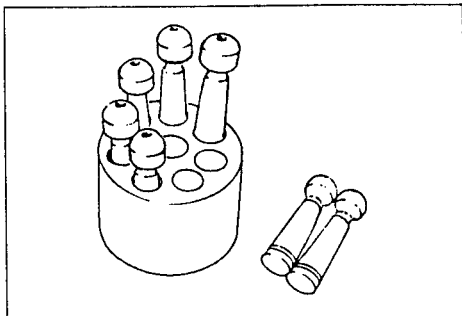
38

Make sure all parts are fitted in correctly!

Note:

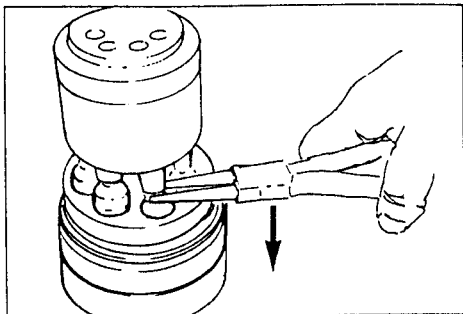
A2FO - Pump- 4 Belleville washers/ Spring pad

A2FM - Motor- 6 Belleville washers/ Spring pad



39

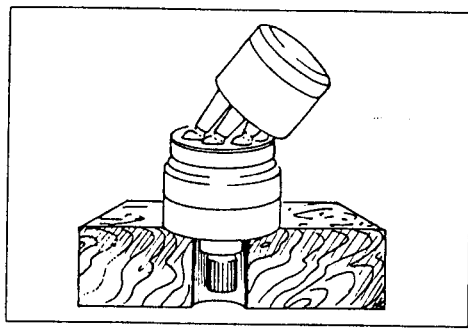
Fit pistons in bores.



40

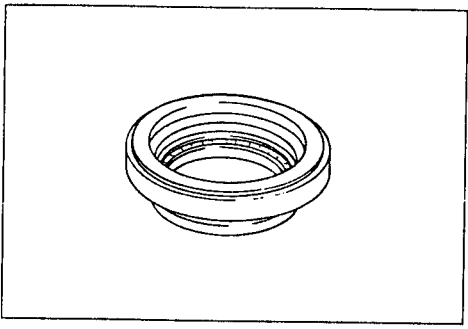
Press pistons firmly into cups with cylinder block held in central position.

Installing rotary group



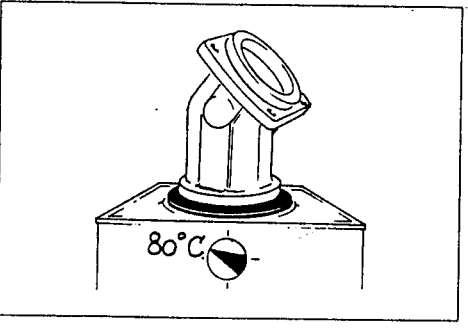
41

Swivel cylinder block to max. If fouling occurs fig. 40.



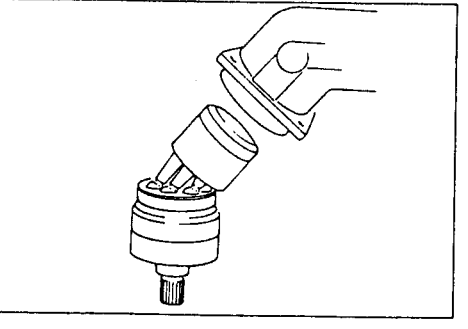
42

Is new shaft seal fitted? (comparisons fig 7).



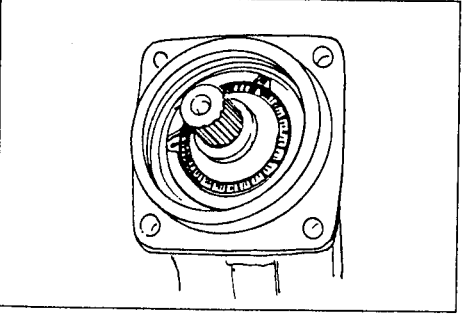
43

Heat the housing to 80°C.



44

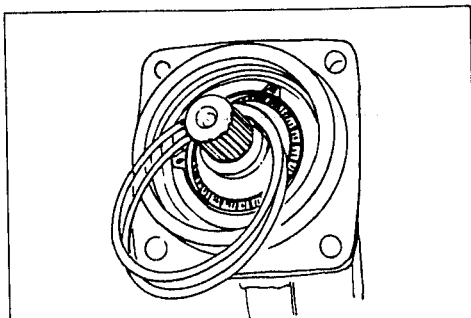
Fit pre-heated housing up to stop.



45

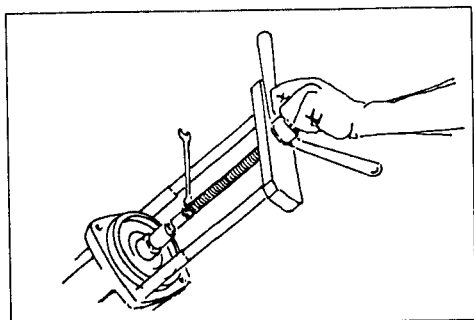
Re-position.

## Installing rotary group



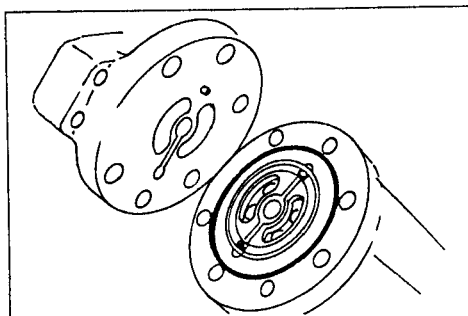
46

Insert shims and assemble to figs. 7 - 10.



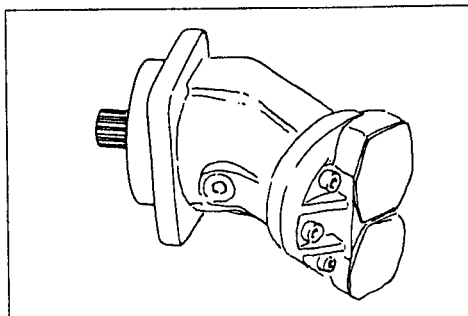
47

Pull the rotary group against the cover plate.  
Check that the cover plate cannot move!



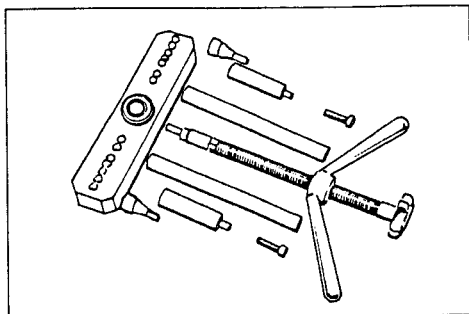
48

Completely assemble to figs. 18 - 20.



49

Seal connections to protect against dust.  
Corrosion protection (internal/external).  
Assembly complete.



50

Extractor for rotary group (fig. 24).



Tightening torques

Anziehdrehmomente für Schafschrauben  
(Metrisches ISO-Regelgewinde)

Die nebenstehenden Werte für Anziehdrehmomente gelten nur für Schafschrauben mit metrischem ISO-Regelgewinde und Kopfaufmaß nach DIN 912, DIN 931 und DIN 933. Außerdem gelten diese Werte nur für leicht- oder nicht geölte, unbehandelte Oberflächen, sowie nur bei Verwendung von Drehmoment- und Kraftbegrenzungsschlüsseln.

Gewindegröße	Festigkeitsklassen		
	8.8	10.9	12.9
M 3	1.1	1.6	1.9
M 4	2.9	4.1	4.9
M 5	6	8.5	10
M 6	10	14	17
M 8	25	36	41
M 10	49	69	83
M 12	86	120	145
M 14	135	190	230
M 16	210	295	355
M 18	290	405	485
M 20	410	580	690
M 22	550	780	930
M 24	710	1000	1200
M 27	1050	1500	1800
M 30	1450	2000	2400

Tightening torques for shaft bolts  
(Metric ISO Standard Thread)

The values for tightening torques shown in the table are valid only for shaft bolts with metric ISO-standard threads and head support surface dimensions in accordance with DIN 912, DIN 931 and DIN 933. These values are also valid only for light or unoiled, untreated surface as well as for use only with torque-indicating wrenches and force limiting tools.

Thread Size	Strength Classes		
	8.8	10.9	12.9
M 3	0.8	1.2	1.4
M 4	2.1	3.0	3.6
M 5	4.4	6.3	7.4
M 6	7.4	10.3	12.5
M 8	18.4	25.8	30.2
M 10	36.1	50.9	61.2
M 12	63.4	88.4	106.9
M 14	99.5	140.0	169.5
M 16	154.8	217.4	261.6
M 18	213.7	298.5	357.4
M 20	302.2	427.5	508.5
M 22	405.4	574.9	685.4
M 24	523.5	737.0	884.4
M 27	773.9	1105.5	1326.6
M 30	1068.7	1474.0	1768.8

Anziehdrehmomente für Verschlusschrauben VSTI  
(Metrisches Feingewinde)

Gewindegröße	Bezeichnung	Anziehdrehmoment (Nm)
M 8 x 1	VSTI 8 x 1 -ED/SA	= 5
M 10 x 1	VSTI 10 x 1 -ED	= 10
M 12 x 1,5	VSTI 12 x 1,5 -ED	= 20
M 14 x 1,5	VSTI 14 x 1,5 -ED	= 30
M 16 x 1,5	VSTI 16 x 1,5 -ED/SA	= 30
M 18 x 1,5	VSTI 18 x 1,5 -ED/SA	= 40
M 20 x 1,5	VSTI 20 x 1,5 -ED/SA	= 50
M 22 x 1,5	VSTI 22 x 1,5 -ED	= 60
M 26 x 1,5	VSTI 16 x 1,5 -ED/SA	= 70
M 27 x 2	VSTI 27 x 2 -ED	= 90
M 30 x 1,5	VSTI 30 x 1,5 -ED/SA	= 100
M 33 x 2	VSTI 33 x 2 -ED/SA	= 120
M 42 x 2	VSTI 42 x 2 -ED/SA	= 200
M 48 x 2	VSTI 48 x 2 -ED	= 300

Tightening torques for locking screws VSTI  
(Metric ISO fine thread)

Thread Size	Designation	Tightening Torque (lb.ft)
M 8 x 1	VSTI 8 x 1 -ED/SA	= 4
M 10 x 1	VSTI 10 x 1 -ED	= 7
M 12 x 1,5	VSTI 12 x 1,5 -ED	= 15
M 14 x 1,5	VSTI 14 x 1,5 -ED	= 22
M 16 x 1,5	VSTI 16 x 1,5 -ED/SA	= 22
M 18 x 1,5	VSTI 18 x 1,5 -ED/SA	= 29
M 20 x 1,5	VSTI 20 x 1,5 -ED/SA	= 37
M 22 x 1,5	VSTI 22 x 1,5 -ED	= 44
M 26 x 1,5	VSTI 16 x 1,5 -ED/SA	= 51
M 27 x 2	VSTI 27 x 2 -ED	= 66
M 30 x 1,5	VSTI 30 x 1,5 -ED/SA	= 74
M 33 x 2	VSTI 33 x 2 -ED/SA	= 88
M 42 x 2	VSTI 42 x 2 -ED/SA	= 147
M 48 x 2	VSTI 48 x 2 -ED	= 220

Anziehdrehmomente für Seal-Lock Bundmuttern  
(Metrisches ISO-Regelgewinde)

Die nebenstehenden Werte für Anziehdrehmomente gelten nur für Seal-Lock Bundmuttern der Festigkeitsklasse 8.8 mit metrischem ISO-Regelgewinde.

Gewindegröße	Festigkeitsklassen		
	8.8	10.9	12.9
M 6	10	/	/
M 8	22	/	/
M 10	40	/	/
M 12	69	/	/
M 14	110	/	/
M 16	170	/	/

Tightening torques for seal-lock nuts  
(Metric ISO-Standard Thread)

The values for tightening torques shown in the table are valid only for seal-lock nuts of the strength class 8.8 and with metric ISO-standard thread.

Thread size	Strength Classes		
	8.8	10.9	12.9
M 6	7.4	/	/
M 8	16.2	/	/
M 10	29.5	/	/
M 12	50.9	/	/
M 14	81.1	/	/
M 16	125.3	/	/

Anziehdrehmomente für Linsenschrauben mit Kreuzschlitz DIN 7985  
(Metrisches ISO-Regelgewinde)

Die nebenstehenden Werte für Anziehdrehmomente gelten nur für Linsenschrauben mit Kreuzschlitz DIN 7985 der Festigkeitsklasse 8.8 mit metrischem ISO-Regelgewinde.

Gewindegröße	Festigkeitsklassen		
	8.8	10.9	12.9
M 3	1.1	/	/
M 4	2.9	/	/
M 5	6	/	/
M 6	10	/	/
M 8	25	/	/
M 10	49	/	/

Tightening torques for cross-slotted lens head screws  
DIN 7985  
(Metric ISO-Standard Thread)

The values for tightening torques shown in the table are valid only for cross-slotted lens head screws DIN 7985 of the strength class 8.8 and with metric ISO-standard thread.

Thread size	Strength Classes		
	8.8	10.9	12.9
M 3	0.8	/	/
M 4	2.1	/	/
M 5	4.4	/	/
M 6	7.4	/	/
M 8	18.4	/	/
M 10	36.1	/	/

**General advice**

- Make yourself familiar with the equipment of the machine.
- Only operate the machine if you are completely familiar with the operating and control elements as well as the functioning of the machine.
- Use your safety equipment like helmet, safety shoes and hearing protection.
- Make yourself familiar with your working field.
- Only operate the machine for its intended purpose.

Please observe the guidelines of the Professional Association and the machine manufacturer.

**Before starting**

- Observe the operating instructions before starting.
- Check the machine for remarkable faults.
- Do not operate the machine with defective instruments, warning lights or control elements.
- All safety devices must be in a secure position.
- Do not carry with you movable objects or secure them to the machine.
- Keep oily and inflammable material away from the machine.
- Before entering the driver's cabin, check if persons or obstacles are beside or beneath the machine.
- Be careful when entering the driver's cabin, use stairs and handles.
- Adjust your seat before starting.

**Start**

- When starting all operating levers must be in "neutral position".
- Only start the machine from the driver's seat.
- Check the indicating instruments after start to assure that all functions are in order.
- Do not leave the machine unobserved when the motor is running.
- When starting with battery connection cables connect plus with plus and minus with minus. Always connect mass cable (minus) at last and cut off at first.

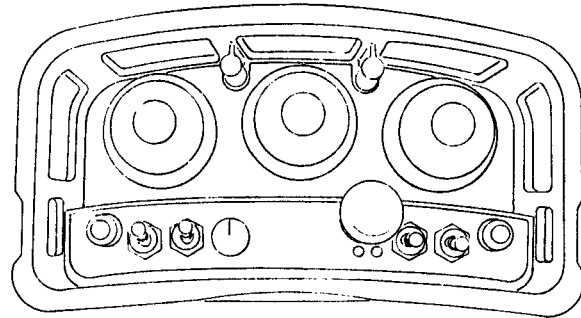
**Attention**

- Exhaust gas is dangerous. Assure sufficient fresh air when starting in closed rooms!

**Hydraulic equipment**

1. Hydraulic equipment is standing under high pressure. High pressure fluids (fuel, hydraulic oil) which escape under high pressure can penetrate the skin and cause heavy injuries. Therefore immediately consult a doctor as otherwise heavy infections can be caused.
2. When searching leakages use appropriate auxiliary devices because of the danger of accidents.
3. Before working at the hydraulic equipment, lower pressure to zero and lower working arms of the machine.
4. When working at the hydraulic equipment, absolutely stop motor and secure tractor against rolling away (parking brake, shim)!
5. When connecting hydraulic cylinders and motor pay attention to correct connection of hydraulic flexible hoses.
6. In case of exchanging the ports, the functions are vice versa (f. ex. lift-up/lower) - danger of accidents!
7. Check hydraulic flexible hoses regularly and replace them in case of damage or wear! The new hose pipes must comply with the technical requirements of the machine manufacturer!

- ⚠ Orderly disposal or recycling of oil, fuel and filters!

NBB  
NACHRICHTEN  
TECHNIK

S/N :

## 1. STANDARD SPECIFICATION

- Portable transmitter with two replaceable 7,2 volt NiCd batteries, halter and waist straps
- Receiver with NBB adapter plate for fastening purposes (Only PNN-BUS-3)
- Receiver with 4 fastening angles (PNN-BUS-5)
- Multi-pole connecting cable for the receiver, to your specifications
- Automatic battery charger with charging adapter (rapid charging in three hours)

The actual delivery specification is as detailed on the confirmation of order or the delivery note accompanying the goods!

## 2. SAFETY PRECAUTIONS

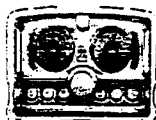
Even if you are accustomed to working with radio control systems, read these operating instructions without fail before using this equipment. Only this document contains the latest information relating to your NBB radio control system.

Please refer to the accompanying registration documents for the explanatory notes on obtained an operating permit. Observe all applicable work-safety and accident prevention regulations without fail. Only fully trained, authorized personnel may use the NBB radio control equipment. Components, etc. built into the NBB equipment for safety purposes must be regularly inspected. (See point 6 of this instruction)

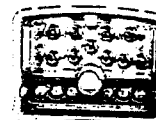
If the NBB radio control unit develops a fault, it must be shut down immediately. The transmitter should be switched off with the EMERGENCY-OFF switch. The connecting cable must be disconnected from the crane connecting socket (terminal) on the receiver. The repair of the equipment must not be carried out other than by NBB or an NBB authorized technician.

Failure to observe these recommendations will put both you yourself and others at risk. Under these circumstances, NBB rescinds the guarantee and any other form of liability. This radio control unit is designed exclusively for the control of construction machines and industrial plants. Only under these conditions are the safety systems (EMERGENCY-OFF, zero setting) fully effective. No other form of use is permitted. Any non-observance of this condition will relieve NBB of all liability.

Nano, Nano-S-A2-HC



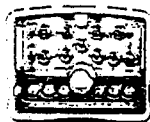
Nano-Vario



Nano, Nano-S-A2-HC



Nano-Vario



**3. TRANSMITTER**

To make the unit ready for use, insert the battery into the battery compartment. To remove the battery, depress the pin and push out the battery. The power supply to the transmitter is activated with the EMERGENCY-OFF switch (when depressed, the EMERGENCY-OFF switch can also be secured by removing the key cap). The green LED on the transmitter control panel must flash regularly. Commands can now be input by means of the controls. The operating period with a charged battery is approximately 8 hours with the transmitter in continuous use. When the red 'Battery' indicator lamp lights up, the battery is nearing exhaustion. The transmitter can be operated for approximately 15 minutes more in this condition. During this time, bring the crane to a safe position and install a new battery.

Removal of the battery interrupts the radio link. As a result, the master switch for the crane must be switched on again.

Charge the discharged battery with the charger supplied.

**4. BATTERY CHARGER**

The red indicator lamp indicates that the battery charger is ready for use. Place the battery in the charging well; it will now be charged. When the red LED goes out, the charging process is concluded. No harm will come to the battery if it is left in the charger beyond the required charging time.

**Do not use the charger other than in dry rooms having a min-max temperature range of 0-40°C. A charged battery is a concentrated energy source. Never store a charged battery in a toolbox or similar where it could be short-circuited by metal components (even a key in your trouser pocket can cause a short circuit).**

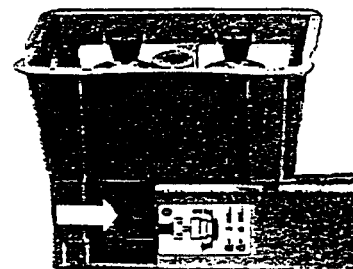
**5. RECEIVER (PNN-BUS-3 and PNN-BUS-5)**

The receiver is connected to the crane with the multi-pole connecting cable supplied. Please observe the instructions issued by the crane manufacturer. The power supply to the receiver is generally effected by way of the connecting cable.

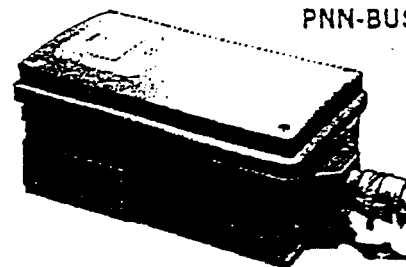
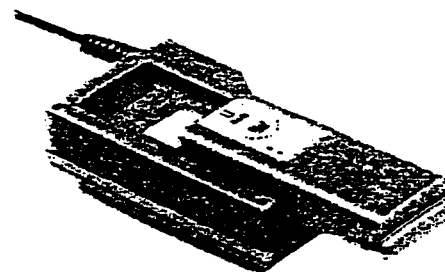
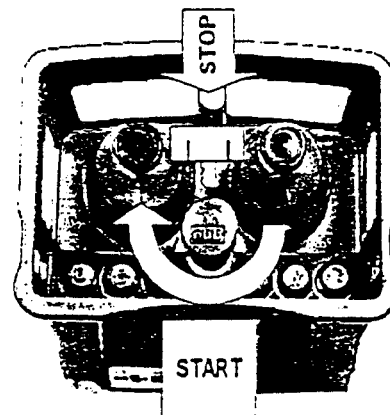
- In general, an earth lead is required in the case of cranes which have not previously been operated under radio control. Failing this, the receiver electronic circuit will not receive any power supply.

Take care to ensure that the operating voltage of the receiver complies with the electrical specifications of the crane.

The applicable operating voltage is specified in the supplement.

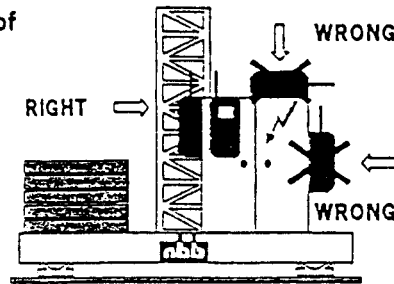


Depress the pin and push out the battery



PNN-BUS-3

- Never expose the receiver to a high pressure cleaning jet. This also applies to the transmitter.
- The receiver should always be fixed vertical at the outside panel of the switching cabinet. The antenna should reach over the top of the panel.



### 6. OPERATING THE SYSTEM

Safety equipment in the NBB radio control system:

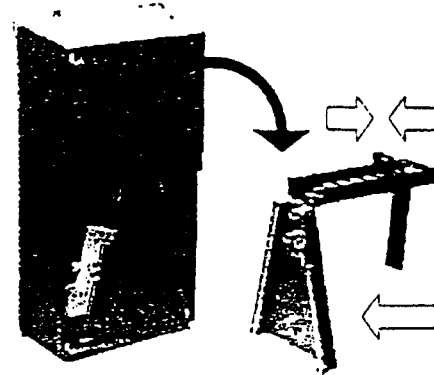
- In the transmitter:**
  - EMERGENCY-OFF switch with automatic disconnection from the power supply
  - Automatic zeroing
- In the receiver:**
  - Duplicated 2-channel evaluation of the EMERGENCY-OFF signal
  - Automatic zeroing when switched on again after radio signal interruption
  - Inhibition of radio control commands at the relay level if EMERGENCY-OFF circuit defective.

To ensure troublefree operation, observe the following operating instructions precisely. Subject to the transmitter being in operating condition, the crane's master switch can only be switched on provided no command transmitter is actuated. The necessary command for this purpose is initiated by the 'ON/HOOTER' button. This activates a warning signal on the crane. After the crane has been switched on, this button serves for the subsequent activation of the hooter as required by safety at work regulations.

If the NBB radio control unit remains unused for a prolonged period, we strongly recommend that the battery be charged from time to time (approximately every four weeks). This will prevent it from becoming discharged and will prolong its working life. If an extended period of disuse is intended, we recommend that the battery be removed from the transmitter.

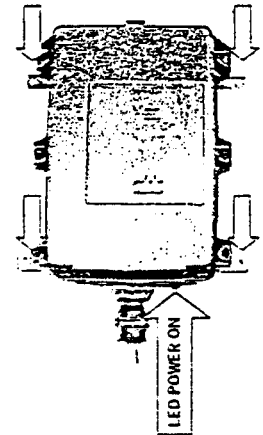
Changing the frequency:

To change the frequency, hold down the 'ON/HOOTER' button while simultaneously operating the 'FREQUENCY CHANGE' button until the hooter sounds. (Please observe the accompanying registration conditions, see page 5, point 9).

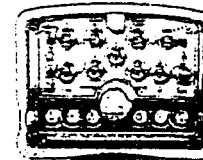


Mounting-possibilities of the PNN-BUS-3 or of the PNN-BUS-5.

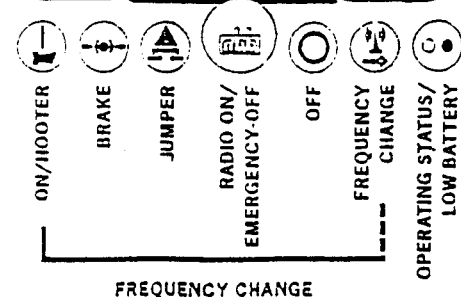
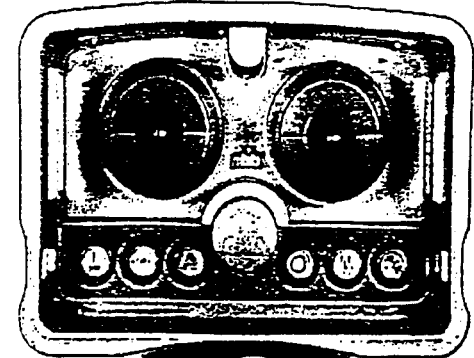
PNN-BUS-5



Nano-Vario



Nano / Nano-S-A2-HC



**NBB NANO-S-A2-HC  
RADIO REMOTE CONTROL**

**TEACH-IN: Individual Setting of Analog Channels (Basic Setting) at Nano Transmitter \*.**  
The output signals of the analog channels can be individually programmed from the transmitter.

**Activate  
programming mode**



**Select  
analog function**



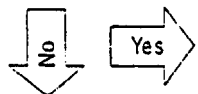
**Save  
"contact point"**



**Save  
maximum  
speed**



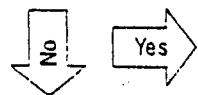
**Program opposite  
direction ?**



**End  
programming mode**

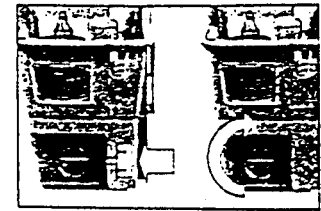


**Programming  
of next function ?**

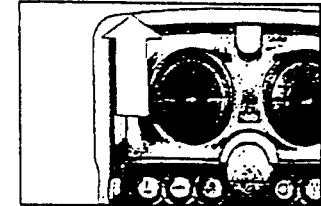


The control is ready to operate.

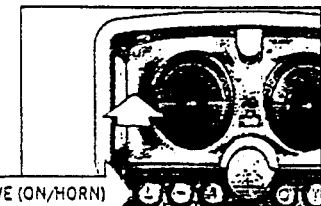
Mounting the key cap on the rotary switch opposite the battery compartment and then turning this switch activates the programming mode.



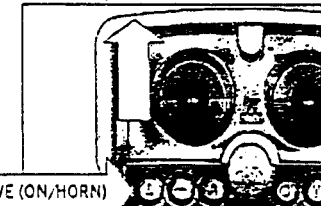
To determine which analog function is to be programmed, it is sufficient to briefly turn the appropriate master switch fully in the direction of this function.



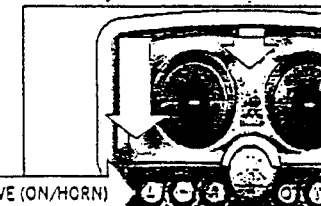
The master switch is now turned until the required "contact point" (less than 50% of the master switch turning range) is reached. To save this value, the "SAVE" ("ON/HORN") key must be pressed at this position.



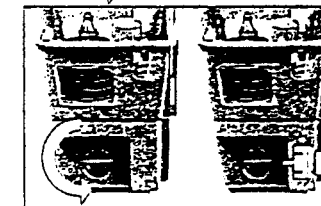
The upper initial value is saved by turning the master switch (further than 50% of the master switch turning range) until the maximum speed of the function is reached, and then pressing again the "SAVE" ("ON/HORN") key.



The opposite direction of this function can then be programmed the same way immediately afterwards.



If the rotary switch is reset, the programming mode is left and working with this function can commence. Removing the key cap secures the transmitter against inadvertent teaching.



When programming several analog channels consecutively, the programming function must be left after saving a function, in order to release the next channel for programming, after turning the programming switch back on by briefly turning the master switch to the full.

**Please note:**

**No frequency change is possible in the programming mode!**

\*Please refer to the scope of supply of your facility.

**NBB NANO-S-A2-HC  
RADIO REMOTE CONTROL****TEACH-IN: Individual Setting of Analog Channels (Basic Setting) at Nano Transmitter with Potentiometer Control\*.**

The output signals of the analog channels can be individually programmed from the transmitter.

**Activate  
programming mode**



**Select  
analog function**



**Save  
"contact point"**



**Save  
maximum  
speed**



**End  
programming mode**

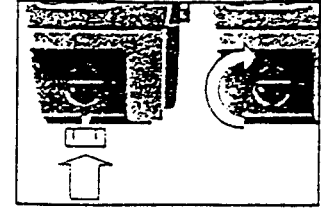


**Programming  
'next function?'**

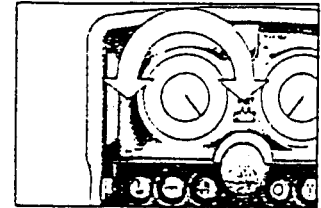


**The control is ready to operate.**

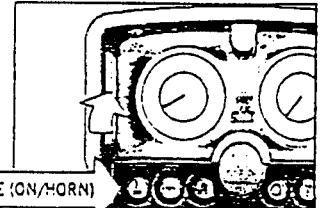
Mounting the key cap on the rotary switch opposite the battery compartment and then turning this switch activates the programming mode.



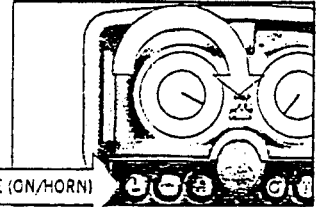
To determine which analog function is to be programmed, it is sufficient to briefly turn the appropriate potentiometer fully in the direction of this function and then back again.



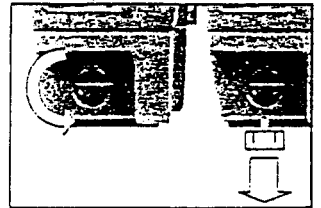
The potentiometer is now turned until the required "contact point" (less than 50% of the potentiometer turning range) is reached. To save this value, the "SAVE" ("ON/HORN") key must be pressed at this position.



The upper initial value is saved by turning the potentiometer (more than 50% of the potentiometer turning range) until the maximum speed of the function is reached, and then pressing again the "SAVE" ("ON/HORN") key.



If the rotary switch is reset, the programming mode is left and working with this function can commence. Removing the key cap secures the transmitter against inadvertent teaching.



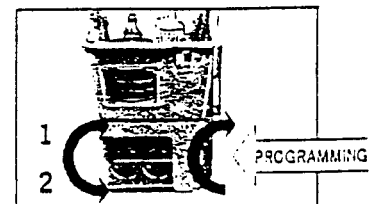
When programming several analog channels consecutively, the programming function must be left after saving a function, in order to release the next channel for programming, after turning the programming switch back on by briefly turning the master switch to the full.

**Please note:**

**No frequency change is possible in the programming mode!**

**Saving two different basis settings (optional)\***

If required, the unit can be supplied with two saving options for the basic setting. These can be selected using an additional key switch or rotary switch once saved. For both settings, the individual analog functions must be programmed separately.



\*Please refer to the scope of supply of your facility.

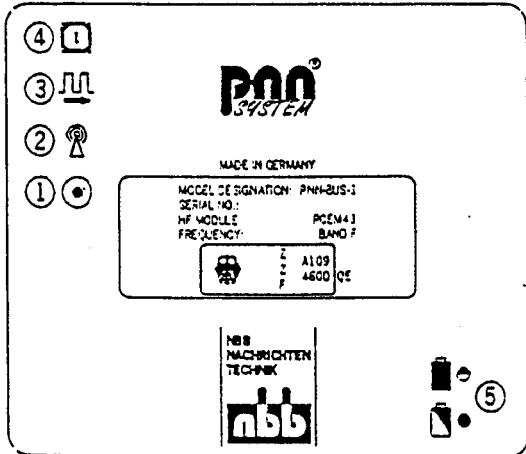
**7. FUNCTION CHECKS**

Regular function checks of the NBB radio control unit are essential to ensure that operating safety is maintained. In the case of a single-shift daily operation, we recommend that the checks be carried out once a week. They can be performed with the aid of the indicator lamps on the receiver. For this purpose, the transmitter must be in operating condition.

- First, connect only the receiver - the transmitter remains switched off.
- Switch on the transmitter by releasing the EMERGENCY-OFF button.
- Now test the command functions (always starting at the lowest stage) and check that the crane responds correctly. In particular, make sure that the danger area is clear of all personnel. **Failure to do so may result in an ACCIDENT.**
- **EMERGENCY-OFF check.** Press the EMERGENCY-OFF button on the transmitter until it locks. The crane's master contactor must drop out after a maximum of 1/2 second.

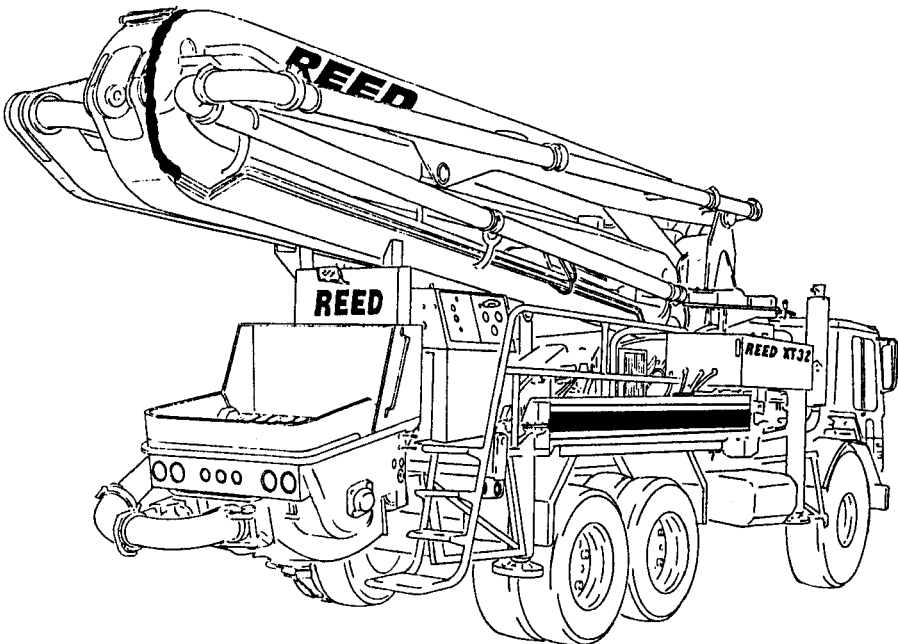
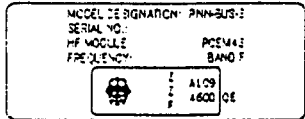
**Checking the LEDs of the receiver**

- **LED 1: POWER ON.** If the LED does not light up, check the power supply. If the power supply lead is in satisfactory condition, notify your service centre.
- **LED 2: HF AVAILABLE.** Remains lit continuously when the transmitter is switched on.  
(not significant in the case of scanner operation).
- **LED 3:** Flashes at regular intervals during fault-free operation. Irregular flashing means that the HF channel is probably disrupted. In this case, select an alternative channel.
- **LED 4:** If this LED flashes, the HF channel is disrupted.
- **LED 5 (Battery operation):** state of charge of the battery.



**8. RATING PLATES**

Rating plates contain the serial number, model designation, type of HF module and frequency. In the event of a query, please give the serial number without fail.





## 9. REGISTRATION

Explanatory notes on obtaining an operating permit for your NBB radio control system will be found in the accompanying registration documents.

## 10. MAINTENANCE

The NBB radio control unit is largely maintenance-free. Nevertheless, please observe the following points:

- The EMERGENCY-OFF button must operate freely.
- Keep the unit clean of any contamination from building materials.
- If any electrical welding is carried out on the crane, disconnect the control cable from the receiver, otherwise the receiver electronics may be damaged.

## 11. GUARANTEE

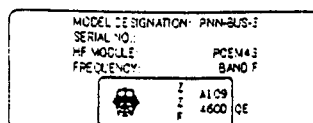
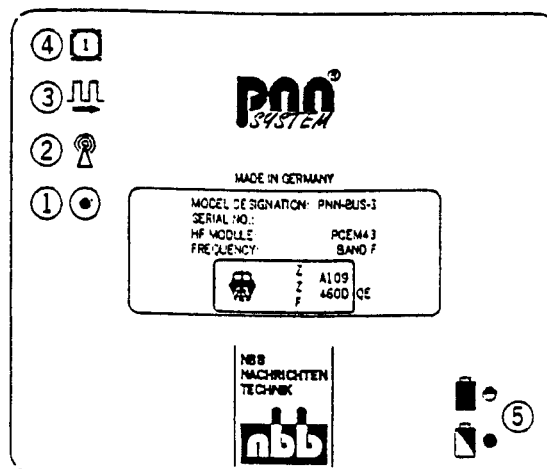
All NBB radio control units (transmitter, receiver, battery charger) are guaranteed to operate satisfactorily for a period of six months from the date of sale. The terms of the guarantee include parts and labour. Transport costs are the buyer's responsibility. The following are excluded from the guarantee: wearing parts, relays and batteries. The guarantee does not cover damage, accidental damage, negligence, improper use, non-adherence to operating conditions, the non-observance of operating, testing and servicing instructions, or repairs or modifications to the unit not authorized by NBB.

NBB will not be liable for consequential damage. It reserves the right to effect repairs or replacements at its own discretion.

## 12. ACTION IN THE EVENT OF A FAULT

Do not continue to work with a defective NBB radio control unit. Even a minor defect in the first instance may eventually lead to a major fault!

Do not try to repair the NBB radio control unit yourself. In the event of a fault, please notify your dealer or contact us!



# REED

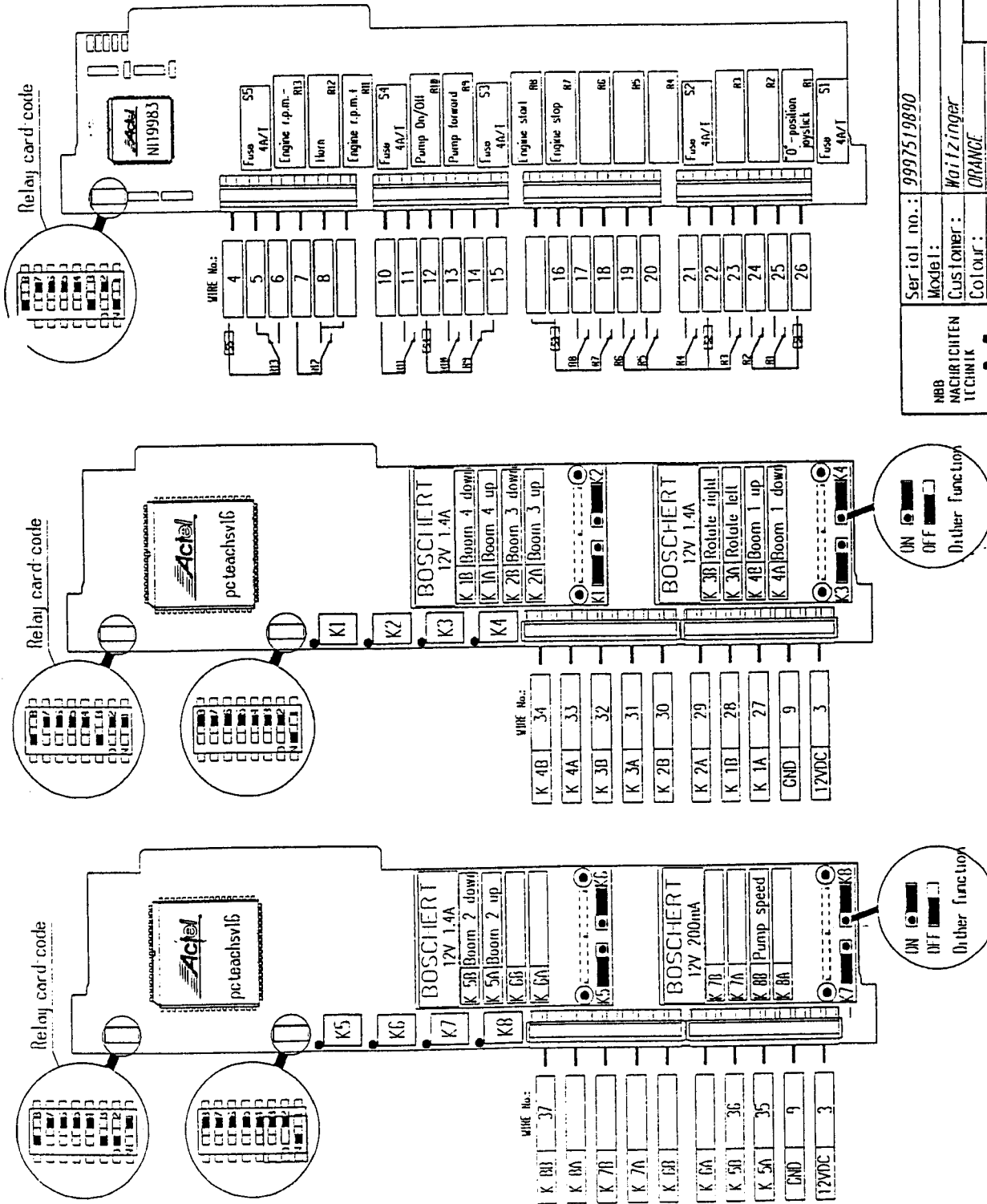
CONCRETE PLACING  
EQUIPMENT

## NBB NANO-S-A2-HC RADIO REMOTE CONTROL

VENDR

FIGURE 04  
PAGE 08

RECEIVER  
WIRING DIAGRAM



Serial no.: 9997519890  
Model: Walzinger  
Customer: CRANCE



3 Module Boschert 12V 1.4A  
limitat von 50Hz auf 100Hz/Other

REVISION:

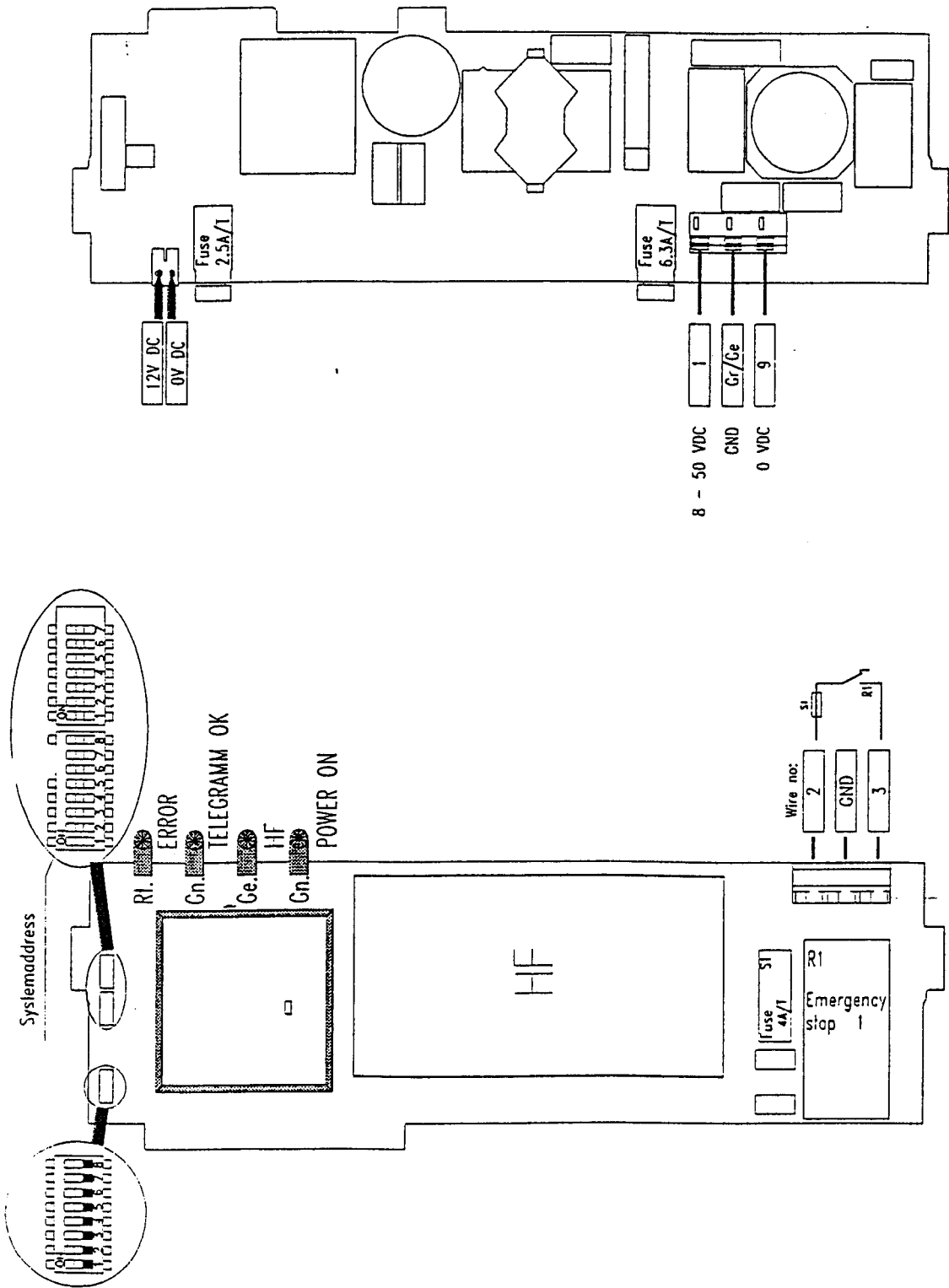
# REED


CONCRETE PLACING  
EQUIPMENT

## NBB NANO-S-A2-HC RADIO REMOTE CONTROL

VENDR

FIGURE 04  
PAGE 09



	Serial no.:	9997519890
	Model:	Concrete-Pump
	Customer:	Waltzinger
	Colour:	
	Date:	05/1997
	Name:	
Scale:		
		RECEIVER WIRING DIAGRAM

REVISION:

**CONTROL CABLE CONNECTING PLAN**

Serial no.: 9997519890  
Relay board code: 1. 3. 8

RECEIVER		CONTROL CABLE		CRANE
Terminal strip no. :	Function:	Wire-No.:	Terminal strip or plug socket:	
1	Power supply 12VDC	1	→	
9	Power supply 0VDC GND	9	→	
2	Common	2	→	
3	Emergency stop	3	→	
4	Common	4	→	
5	Engine r.p.m. „-“	5	→	
6	Engine r.p.m. „-“	6	→	
7	Common	7	→	
8	Horn	8	→	
10	Common	10	→	
11	Engine r.p.m. +	11	→	
12	Common	12	→	
13	Pump on/off	13	→	
14	Pump for.	14	→	
15	Pump rev.	15	→	
16	Common	16	→	
17	Engine start	17	→	
18	Engine stop	18	→	
19		19	→	
20		20	→	
21		21	→	
22	Common	22	→	
23		23	→	
24		24	→	
25	„0“-position joystick	25	→	
26	Common	26	→	

REVISION:

## NBB NANO-S-A2-HC RADIO REMOTE CONTROL

Serial no.: 9997519890

Crane model:

Relay board code: 3, 8

### RECEIVER

### CONTROL CABLE

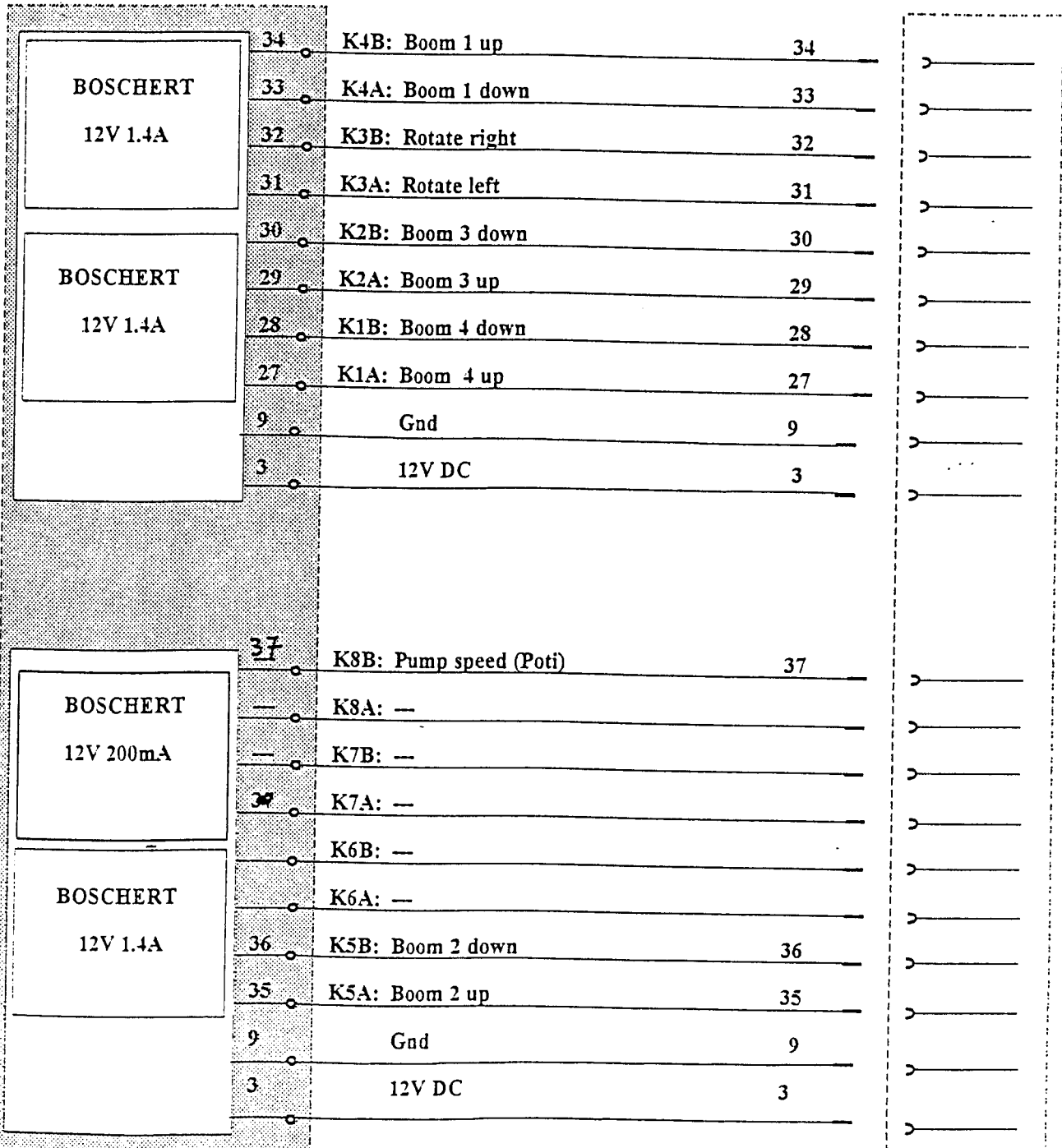
### CRANE

Terminal strip no.:

Function:

Wire-No.:

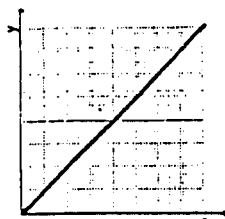
Terminal strip  
or plug socket:



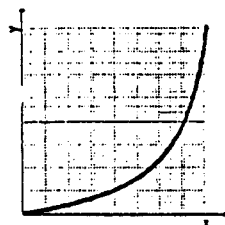
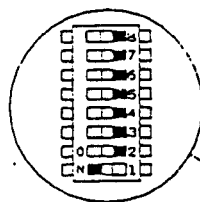
# TECHNICAL SUPPLEMENT

## NANO: Board E-AN04A2V1/1 TEACH-IN\*

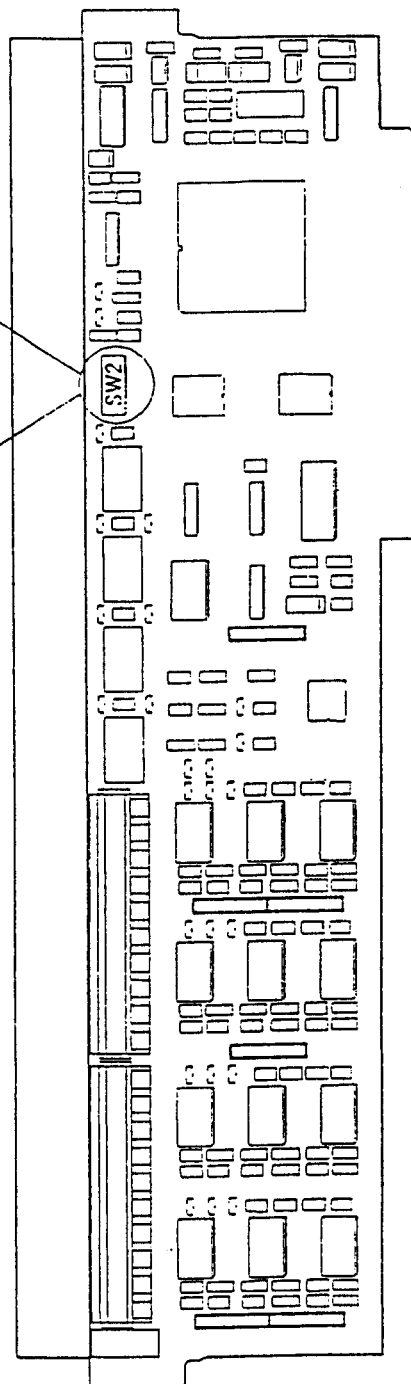
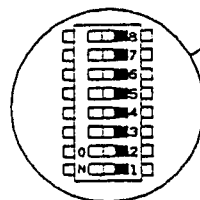
DIL switch (SW2) for setting various transmission characteristics:



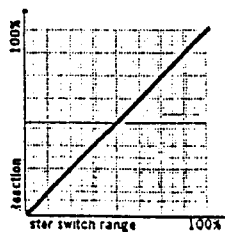
Setting for linear characteristic



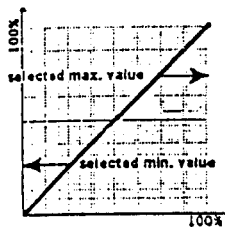
Setting for non-linear characteristic



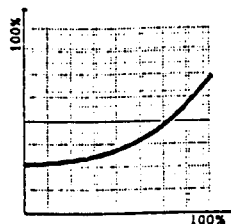
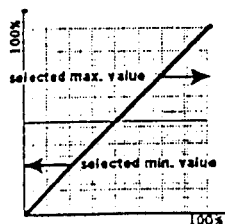
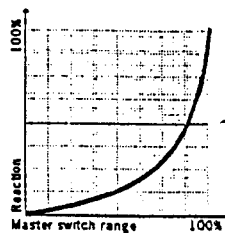
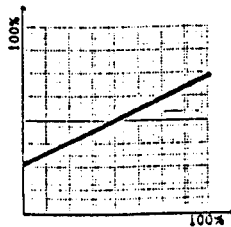
Characteristics linear or non-linear



Characteristics in Teach-In mode



Characteristics after Teach-In mode



\*Please refer to the scope of supply of your facility.

**Teaching of the function "PUMP SPEED":**

In case of teaching the function "PUMP SPEED" the rotary switch has to be set from minimum to maximum and back in order to release this function for programming. This function is to be programmed at last.

**Teaching of the additional functions:**

Before the programming-mode is activated the rotary switch for the function "PUMP SPEED" has to be set to less than 50% (best minimum or left-hand position).

Apart from that the programming is according to the advice in the operating instructions.

# TECHNICAL DATA

Operating ambient temperature	-20 to +65 °C
Insulation class - Protection	IP 65

**TRANSMITTER***Nano, Nano-Vario, Nano-S-A2-HC*

Transmission frequency range	400 - 477 MHz, 25 mW FM
------------------------------	-------------------------

The use of synthesizer technology permits frequencies to be selected in accordance with the appropriate waveband for the country of use.

Low frequency modulation	FSK signal to CCITT V.23
Data repetition rate	about 60 ms
Baud rate	1200 baud (bits per sec.)
Range	300 up to 1000 m
Power input	about 60 mA
RF output	25 mW

	Weight (without battery)	Size (L x W x H)
Pocket	0,4 kg	8,7 x 3,5 x 18,2 cm
Nano	0,8 kg	17,5 x 12,6 x 12,2 cm
MOL	1,5 kg	28,3 x 14,4 x 16,7 cm

# TECHNICAL DATA

**RECEIVER**

*PNN-BUS-3 PNN-BUS-5*

Reception frequency range 400 - 477 MHz

Data security:  
 Generates a CRC code with a Hamming distance = 4. Generates a neutral position  
 Addressing of each transmitter with its own, unique combination  
 (32768 possible combinations). Parity - Bit parameters with addressing.

Data reception security:  
 2 diversitary evaluators (1 hardware evaluator, 1 software - controlled evaluator).  
 CRC. EMERGENCY OFF and neutral position bits. Restart inhibitor if EMERGENCY OFF  
 relay defective.

Contact loading for EMERGENCY OFF and commands.

max. switching voltage	250 V
max. switching current	6 A
max. switching power	1000 VA

	Weight	Size (L x W x H)
PNN-BUS-3	3,0 kg	30,6 x 18,1 x 13 cm
PNN-BUS-5	4,7 kg	36,4 x 28,3 x 15,2 cm

**BATTERY**

Pocket / Nano	7,2V / 0,6 Ah
MOL	9,6V / 0,6 Ah

**CHARGING UNIT**

Operating voltage	80V - 270V AC
	8V - 50V DC



# SAUER SUNDSTRAND

## Contents

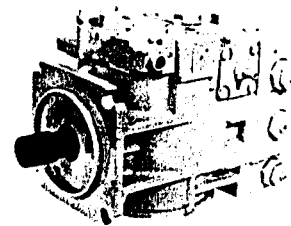
## Series 90

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- 1.2 Safety Precautions

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  - 2.1.1 Variable Displacement Pumps
- 2.2 The System Circuit
- 2.3 Common Features of Pumps and Motors
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  - 2.3.2 Speed Sensors
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  - 2.4.3 Charge Check Valves
  - 2.4.4 Multi-Function Valves
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### 3. Technical Specifications

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- 3.2 Circuit Diagrams
- 3.3 Hydraulic Parameters
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### 4. Pressure Measurement

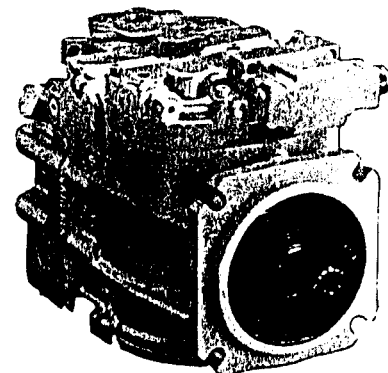
- 4.1 Required Tools
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- 7.8 System Response is Sluggish



**Series 90 Introduction 1**

## 1. Introduction

### 1.1 Use of This Manual

This manual includes information for the normal operation, maintenance, and servicing of the Series 90 family of hydrostatic pumps and motors. The manual includes the description of the units and their individual components, troubleshooting information, adjustment instructions, and minor repair procedures. Unit warranty obligations should not be affected if maintenance, adjustment, and minor repairs are performed according to the procedures described in this manual.

Many service and adjustment activities can be performed without removing the unit from the vehicle or machine. However, adequate access to the unit must

be available, and the unit must be thoroughly cleaned before beginning maintenance, adjustment, or repair activities. Since dirt and contamination are the greatest enemies of any type of hydraulic equipment, cleanliness requirements must be strictly adhered to. This is especially important when changing the system filter and during adjustment and repair activities.

A worldwide network of Sauer-Sundstrand Authorized Service Centers is available should repairs be needed. Contact any Sauer-Sundstrand Authorized Service Center for details. A list of all Service Centers can be found in bulletin BLN-2-40527, or in brochure SAW (Ident. No. 698266).

### 1.2 Safety Precautions

Observe the following safety precautions when using and servicing hydrostatic products.

#### Loss of Hydrostatic Braking Ability

**WARNING**

When Series 90 units are used in vehicular hydrostatic drive systems, the loss of hydrostatic drive line power in any mode of operation (e.g. acceleration, deceleration or "neutral" mode) may cause a loss of hydrostatic braking capacity. A braking system which is independent of the hydrostatic transmission must, therefore, be provided which is adequate to stop and hold the system should the condition develop.

#### Disable Work Function

**WARNING**

Certain service procedures may require the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing them in order to prevent injury to the technician and bystanders.

#### Fluid Under High Pressure

**WARNING**

Use caution when dealing with hydraulic fluid under pressure. Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury. This fluid may also be hot enough to burn. Serious infection or reactions can develop if proper medical treatment is not administered immediately.

#### Flammable Cleaning Solvents

**WARNING**

Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

**Series 90****Functional Description****2**

## 2. Functional Description

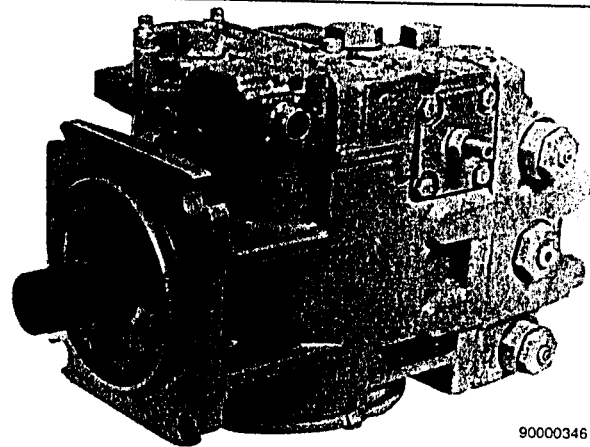
This section describes the operation of pumps, motors, and their various serviceable features. It is a useful reference for readers unfamiliar with the functioning of a specific system.

### 2.1 General Description and Cross Sectional Views

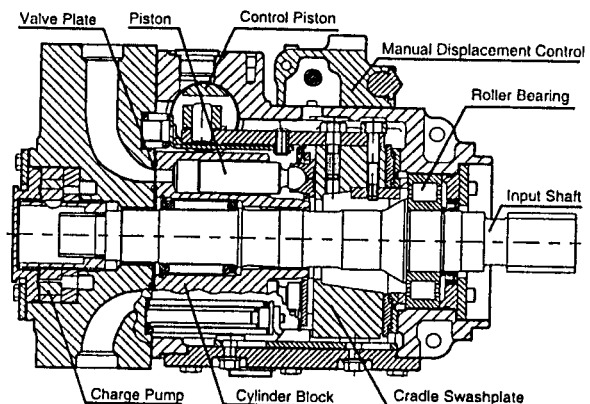
#### 2.1.1 Variable Displacement Pumps

The Variable Displacement Pump (PV) is designed to convert an input torque into hydraulic power. The input shaft turns the pump cylinder which contains a ring of pistons. The pistons run against a tilted plate, called the swashplate. This causes the pistons to compress the hydraulic fluid which imparts the input energy into the hydraulic fluid. The high pressure fluid is then ported out to provide power to a remote function.

The swashplate angle can be varied by the control piston. Altering the swashplate angle varies the displacement of fluid in a given revolution of the input shaft. A larger angle causes greater displacement which yields greater output torque for a given input. A smaller angle reduces the displacement per revolution and yields greater speed for a given input.



Series 90 Variable Displacement Pump (PV)

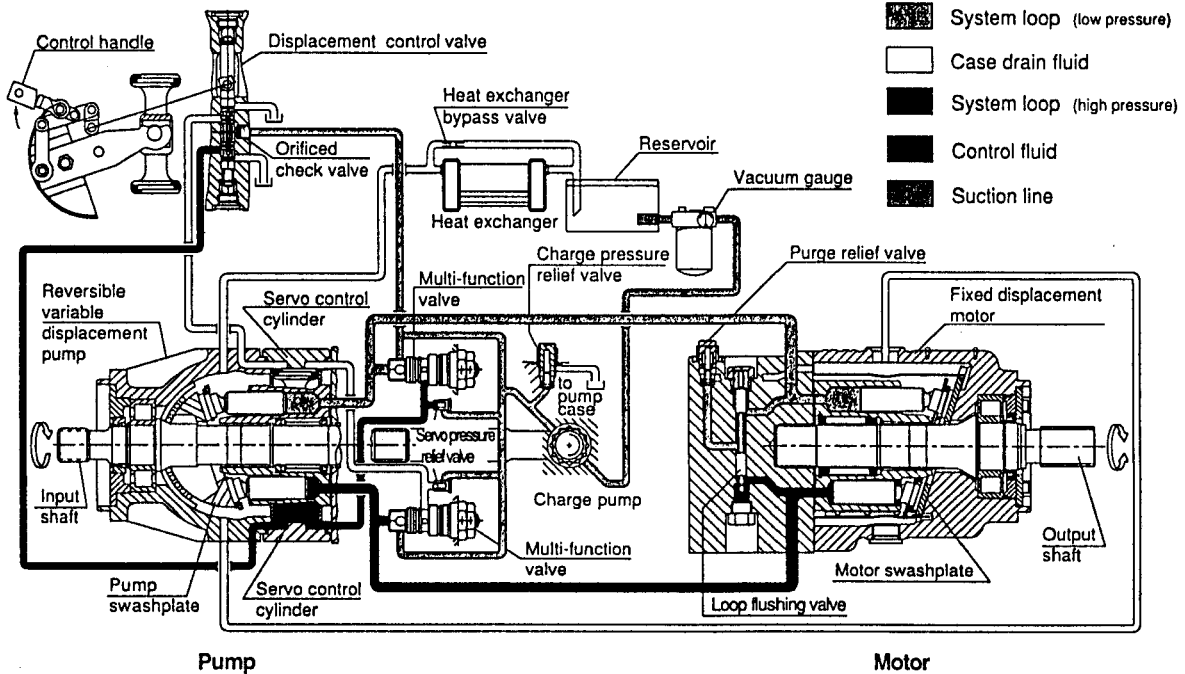


Series 90 PV Cross Section



### Series 90 Functional Description 2

#### 2.2 The System Circuit



Circuit Diagram for Series 90 PV and Series 90 MF

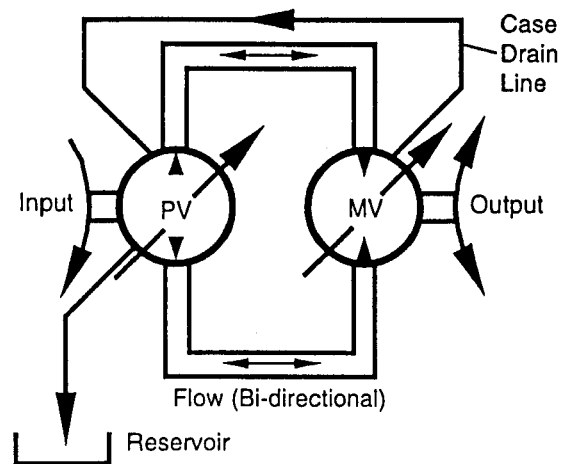
90000800

#### The Basic Closed Circuit

The main ports of the pump are connected by hydraulic lines to the main ports of the motor. Fluid flows, in either direction, from the pump to the motor then back to the pump in this closed circuit. Either of the hydraulic lines can be under high pressure. The position of the pump swashplate determines which line is high pressure as well as the direction of fluid flow.

#### Case Drain and Heat Exchanger

The pump and motor require case drain lines to remove hot fluid from the system. The motor should be drained from its topmost drain port to ensure the case remains full of fluid. The motor case drain can then be connected to the lower drain port on the pump housing and out the top most port. A heat exchanger, with a bypass valve, is required to cool the case drain fluid before it returns to the reservoir.



Basic Closed Circuit

90000803

SAUER  SUNDSTRAND

Series 90

Functional Description

2

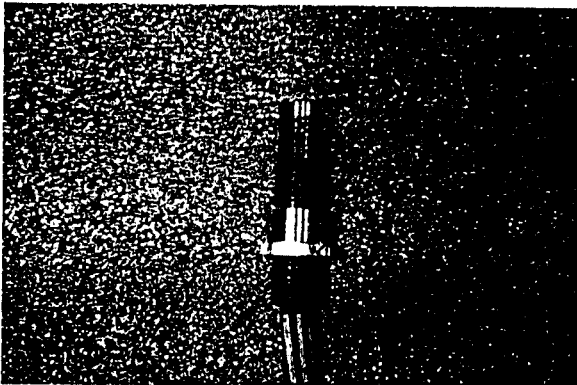
## 2.3 Common Features of Pumps and Motors

### 2.3.1 End Caps and Shafts

Series 90 pumps and motors can be supplied with a variety of end caps and shafts to allow for almost any configuration. For pumps, end caps are available with system ports on either side ("side ports") or both ports on one side ("twin ports"). Motors have end caps with ports on the face of the end cap ("axial ports") or both ports on one side ("twin ports"). See the Series 90 Technical Information manuals (BLN-10029 and BLN-10030) or the Series 90 Price Book (BLN-2-40588) for information on available options. **Removing the end cap will void the warranty on a Series 90 pump or motor.**

### 2.3.2 Speed Sensors

An optional speed sensor can be installed on Series 90 pumps and motors to provide unit speed information. The sensor reads a magnetic ring wrapped about the unit's cylinder. See Sec. 4 to locate the speed sensor port. See Sec. 8.4 and 9.6 to adjust and install the sensor.



Speed Sensor

90000810

SAUER  SUNDSTRAND**Series 90 Functional Description**

2

**2.4 Pump Features****2.4.1 Charge Pump**

The charge pump is necessary to supply cool fluid to the system, to maintain positive pressure in the main system loop, to provide pressure to operate the control system, and to make up for internal leakage. Charge pressure must be at its specified pressure under all conditions of driving and braking to prevent damage to the transmission.

The charge pump is a fixed-displacement, gerotor type pump installed in the variable displacement pump and driven off the main pump shaft. Charge pressure is limited by a relief valve (Sec. 2.4.2).

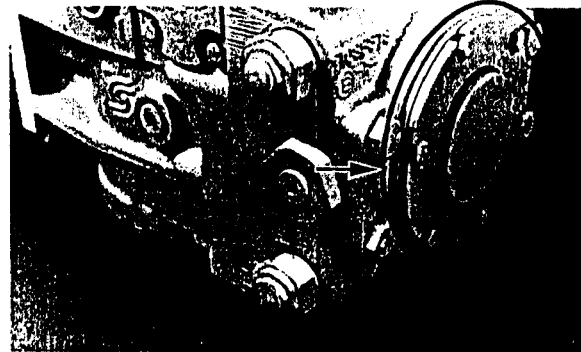
The standard charge pump will be satisfactory for most applications. However, if the charge pump sizes available for the given main pump size are not adequate, a gear pump may be mounted to the auxiliary mounting pad (Sec. 2.4.8) and supply the required additional charge flow. For repairs to the charge pump see Sec. 9.2.4.

**2.4.2 Charge Relief Valve**

The charge relief valve on the pump serves to maintain charge pressure at a designated level. A direct-acting poppet valve relieves charge pressure whenever it surpasses a certain level. This level is nominally set referencing case pressure at 1775 rpm. This nominal setting assumes the pump is in neutral (zero flow); in forward or reverse charge pressure will be lower. The charge relief valve setting is specified on the model code of the pump (Sec. 8.1.1). For repairs to the pump charge relief valve see Sec. 9.2.3.

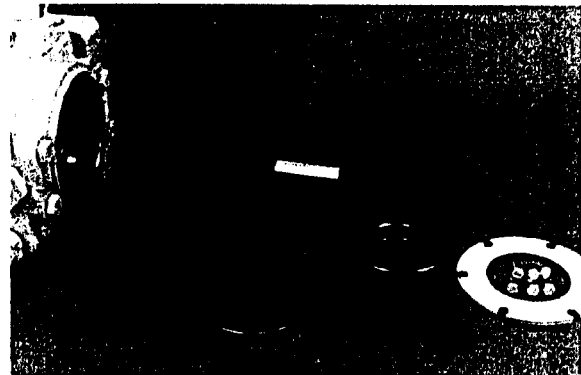
**2.4.3 System Check Valves**

The system check valves allow pressurized flow from the charge pump to enter the low pressure side of the loop whenever system pressure dips below a certain level. This is needed as the pump will generally lose system pressure due to leakage and other factors. Since the pump can operate in either direction, two system check valves are used to direct the charge supply into the low pressure lines. The system check valves are poppet valves located in the multi-function valve assembly (next section).



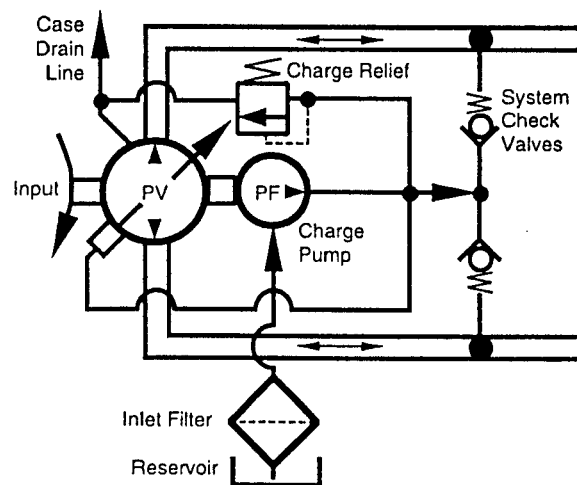
PV with Charge Pump

90000243



Charge Pump Components

90000349



Pump Charge System

90000804



### Series 90

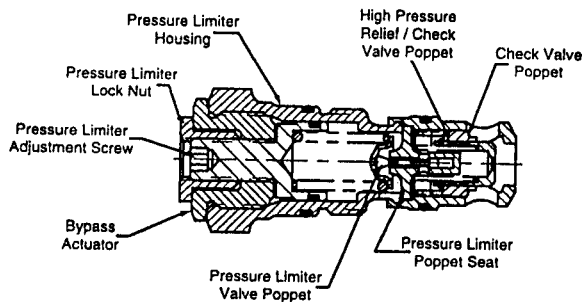
### Functional Description

2



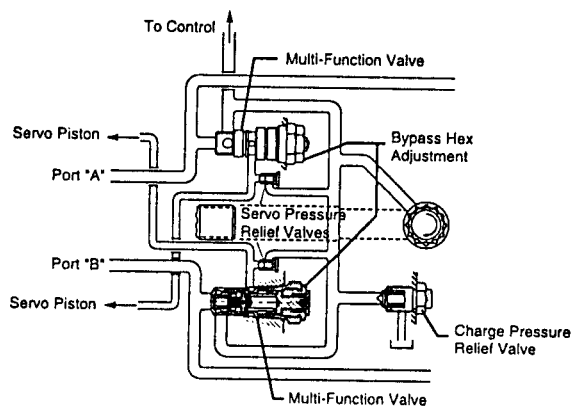
90000243

PV showing location of Multi-Function Valves



90000808

Cross Section of Multi-Function Valve



90000801

Circuit Diagram Showing Pressure Control Mechanisms

#### 2.4.4 Multi-Function Valves

All Series 90 pumps include two multi-function valves. The multi-function valve incorporates the system check valve, the pressure limiter valve, the high pressure relief valve, and the bypass valve in a replaceable cartridge. These functions are described separately. There are two multi-function valve cartridges in each Series 90 pump to handle functions in either direction. See Secs. 8.1.2 and 9.2.1 for adjustments and repairs.

*NOTE: Some multi-function valves do not include a pressure limiter valve.*

#### 2.4.5 Pressure Limiter and High Pressure Relief Valves

Series 90 pumps are designed with a sequenced pressure limiting system and high pressure relief valves. When the preset pressure is reached, the pressure limiter system acts to rapidly destroke the pump so as to limit the system pressure. For unusually rapid load application, the high pressure relief valve acts to immediately limit system pressure by cross-porting system flow to the low pressure side of the loop. The pressure limiter valve acts as the pilot for the high pressure relief valve spool. The high pressure relief valve is sequenced to operate at approximately 35 bar (500 psi) above the level that initiates the pressure limiter valve.

Both the pressure limiter sensing valves and relief valves are built into the multi-function valves (see above).

*NOTE: For some applications, such as dual path vehicles, the pressure limiter function may be defeated so that only the high pressure relief valve function remains.*

#### 2.4.6 Bypass Valves

The bypass valves ("tow") can be operated when it is desired to move the vehicle or mechanical function when the pump is not running. The valve is opened by manually resetting the valve position (Sec. 8.1.3).

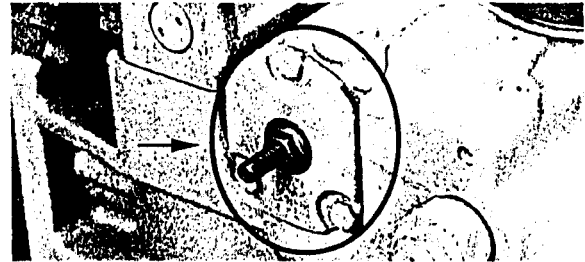
The bypass valves are built into the multi-function valves (see above).

SAUER  SUNDSTRAND**Series 90 Functional Description 2****2.4.7 Displacement Limiters**

Series 90 pumps sizes 042 - 250 are designed for optional mechanical displacement (stroke) limiters. The maximum displacement of the pump can be limited in either direction.

The setting can be set as low as 0° in either direction.

For instructions on adjustment see Sec. 8.1.5.



PV with Displacement Limiters

**2.4.8 Auxiliary Mounting Pads**

Auxiliary mounting pads are available on all Series 90 pumps. SAE A through E and H mounts are available (availability varies by pump size). This pad is used for mounting auxiliary hydraulic pumps and for mounting additional Series 90 pumps to make tandem pumps. The pads allow for full through-torque capability.



PV with Auxillary Mounting Pad

**2.4.9 Filtration Options**

All Series 90 pumps are available with provisions for either suction or charge pressure filtration (integral or remote mounted) to filter the fluid entering the charge circuit. (See Sec. 6 for more information.)

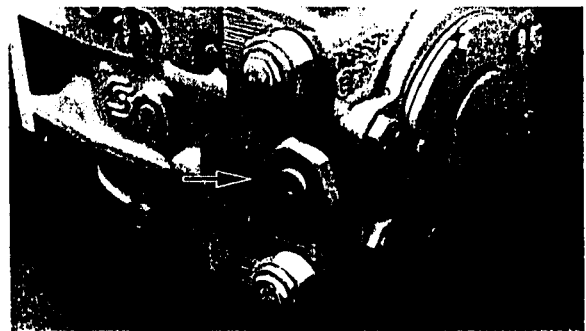
**Suction Filtration**

The suction filter is placed in the circuit between the reservoir and the inlet to the charge pump. When suction filtration is used, a reducer fitting is placed in the charge pressure gauge port (M3). Filtration devices of this type are provided by the user.

**Charge Pressure Filtration**

The pressure filter may be integrally mounted directly on the pump or a filter may be remotely mounted for ease of servicing.

A 200 mesh screen, located in the reservoir or the charge inlet line, is recommended when using this filtration option. A non-bypass filter is preferred on all types of filtration.

PV with Suction Filtration  
(No filtration device attached)PV with Integral Charge Pressure Filtration (left)  
PV with Remote Charge Pressure Filtration (right,  
filter attached remotely)

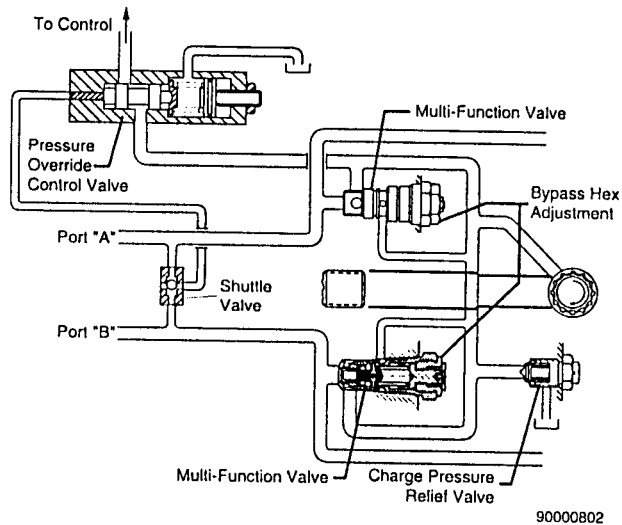


SAUER  SUNDSTRAND

Series 90

Functional Description

2



Pressure Override - 180 Frame Size Only

#### 2.4.10 Pressure Override (POR) - 180 Frame Size Only

The pressure override valve (POR) modulates the control pressure to the displacement control to maintain a pump displacement which will produce a system pressure level less than or equal to the POR setting. For unusually rapid load application, the high pressure relief valve function of the multifunction valves is available to also limit the pressure level.

The pressure override consists of a three-way normally open valve which operates in series with the pump displacement control. Control supply pressure is normally ported through the pressure override valve to the displacement control valve for controlling the pump's displacement. If the system demands a pressure above the override setting, the POR valve will override the control by reducing the control pressure supplied to the displacement control. As the control pressure reduces, the internal forces tending to rotate the swashplate overcome the force of the servo pistons and allow the pump's displacement to decrease.

**Series 90 Functional Description****2****2.5 Pump Control Options****2.5.1 Manual Displacement Control (MDC)**

The manual displacement control converts a mechanical input signal to a hydraulic signal using a spring-centered four-way servo valve. This valve ports hydraulic pressure to either side of a dual-acting servo piston. The servo piston rotates the cradle swashplate through an angular rotation of  $\pm 17^\circ$ , thus varying the pump's displacement from full displacement in one direction to full displacement in the opposite direction. The MDC is designed so the angular position of the pump swashplate is proportional to the rotation of the control input shaft. For adjustments see 8.2.1; for repairs see 9.3.2, 9.3.8.

**Non-Linear MDC**

The non-linear manual displacement control (photo in Sec. 8.2.2) operates in the same manner as the regular MDC except that it is designed so the change in the angular position of the pump swashplate *progressively* increases as the control input shaft is rotated toward its maximum displacement position. For adjustments see Sec. 8.2.2; for repairs see 9.3.2.

**Solenoid Override Valve**

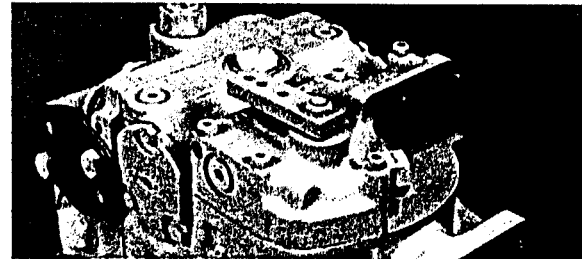
A solenoid override valve option (not shown here) is available for MDC. This safety feature will return the swashplate to zero displacement position when activated. The valve may be set in either a normally open or normally closed mode. For repairs see 9.3.3, 9.3.4.

**Neutral Start Switch (NSS)**

The neutral start switch is an optional feature available with MDC. When connected properly with the vehicle's electrical system, the neutral start switch ensures that the prime mover can be started only when the control is in a neutral position. For adjustments see Sec. 8.2.3.

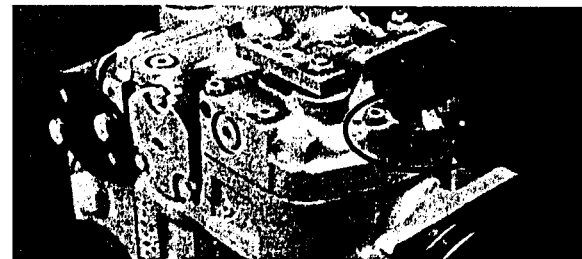
**2.5.2 Hydraulic Displacement Control (HDC)**

The hydraulic displacement control uses a hydraulic input signal to operate a spring-centered four-way servo valve. This valve ports hydraulic pressure to either side of a dual-acting servo piston. The servo piston rotates the cradle swashplate through an angular rotation of  $\pm 17^\circ$ , thus varying the pump's displacement from full displacement in one direction to full displacement in the opposite direction. The HDC is designed so the angular position of the pump swashplate is proportional to input pressure. For adjustments see 8.2.4; for repairs see 9.3.5, 9.3.8.



90000237

PV with Manual Displacement Control



90000239

PV with Manual Displacement Control and Neutral Start Switch



90000240

PV with Hydraulic Displacement Control