

**MODEL**

**166**

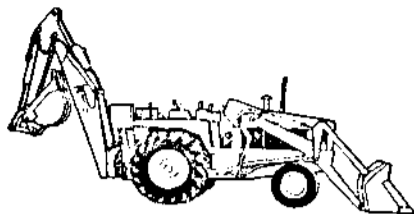
**OPERATOR**

**MANUAL**



**Powers**  
Division of Kohler Company

MODEL No. 166-15



SERIAL No. 1022 D-27

#### WARRANTY

"Manufacturer warrants each new Product made by Manufacturer to be free from defects in material and workmanship, its obligation and liability under this Warranty being expressly limited to repairing or, at Manufacturer's option, replacing free of charge at its factory any part proving defective under normal use and service within 6 months, after date of delivery to a customer as attested by Distributor. Parts claimed to be defective and for which repair or replacement is desired shall be, if requested by Manufacturer, returned transportation prepaid to Manufacturer's factory for inspection. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE, AND THE OBLIGATION AND LIABILITY OF MANUFACTURER UNDER THIS WARRANTY SHALL NOT INCLUDE ANY TRANSPORTATION OR OTHER CHARGES OR THE COST OF INSTALLATION OR ANY LIABILITY FOR DIRECT, INDIRECT OR CONSEQUENTIAL DAMAGES OR DELAY RESULTING FROM THE DEFECT. Any operation beyond rated capacity or the improper use or application of Product or the substitution upon it of parts not approved by Manufacturer or any alteration or repair by others in such manner as, in Manufacturer's judgment, to affect the Product materially and adversely shall void this Warranty. No representative of Manufacturer is authorized to change this Warranty in any way, and no attempt, effort or promise to repair Products of Manufacturer either by Manufacturer or by any representative of Manufacturer at any time shall change or extend this Warranty in any way. This Warranty covers only new and unused Products Manufactured by Manufacturer. Products manufactured by others are covered only by such warranties as are extended to Manufacturer by its suppliers." Distributor agrees to extend only the above Warranty to its customers. In the event Distributor extends to its customers any additional warranty such as by extending the scope or period of warranty or undertaking a warranty of fitness for any particular purpose or any other obligation not encompassed in Manufacturer's Warranty, then Distributor shall be solely responsible therefor and shall have no recourse against Manufacturer with respect thereto.

The degree of performance and the cost of operation of the Model 166 depends largely on the maintenance and care provided by the operator. A thorough knowledge and understanding of the instructions in this manual will enable the operator to attain a maximum of efficiency and a low cost of operation.

When communicating with the manufacturer in regard to the operation, parts or service of the Model 166, the serial number must be supplied.

KOEHRING - PARSONS DIVISION  
200 North 8th Avenue East  
NEWTON, IOWA, 50208  
515 - 792-3711

## DAILY CHECK LIST AT START OF OPERATION

1. Know the level in coolant, lubricating oil, battery acid, and fuel compartments. Make sure all caps and filler plugs are secure.
2. Observe all gauges to assure the readings are correct.
3. Check underneath and around machine for signs of oil, fuel, or coolant leakage.
4. Lubricate all grease fittings as to daily key chart, Page 17
5. Check each power operation by running at slow speed in a safe area. Listen for unusual sounds.
6. Check function of safety devices--lights, emergency brakes, etc.
7. Examine machine for obvious damage or missing parts.
8. Correct or report apparent machine defects.
9. As an operator, you can help prevent accidents and down time that cost you time and money.

- SEE:

- # 700-14

## INDEX

| DESCRIPTION                             | PAGE   |
|---|--------|
| Backhoe Operation . . . . .             | 30     |
| Brake Adjustment . . . . .              | 40     |
| Brake Hand Adjustment . . . . .         | 39     |
| Bucket Adjustment . . . . .             | 38     |
| Capacities (Lubrication) . . . . .      | 15     |
| Cylinder Repairs . . . . .              | 50     |
| Cylinder Torque Chart . . . . .         | 54     |
| Diagnosing Engine . . . . .             | 36     |
| Engine Diagnosing . . . . .             | 36     |
| Engine Operation . . . . .              | 26     |
| Fan Belt Adjustment . . . . .           | 38     |
| Front Wheel Adjustment . . . . .        | 38     |
| Fuels . . . . .                         | 14     |
| General Trouble Shooting . . . . .      | 44     |
| Hand Brake Adjustment . . . . .         | 39     |
| Hydraulic Cylinder Repairs . . . . .    | 50     |
| Hydraulic Oils . . . . .                | 13     |
| Hydraulic System . . . . .              | 48     |
| Hydraulic Trouble Shooting . . . . .    | 49     |
| Instrument Panel . . . . .              | 21     |
| Loader Operation . . . . .              | 28     |
| Lubricants . . . . .                    | 12     |
| Lubricating Capacities . . . . .        | 15     |
| Lubricating Instructions . . . . .      | 15     |
| Oils (Engine) . . . . .                 | 12     |
| Oils (Hydraulic) . . . . .              | 13     |
| Operating Procedures . . . . .          | 31     |
| Operating Tips . . . . .                | 29     |
| Power Shift Shuttle Operation . . . . . | 41     |
| Safety Precautions . . . . .            | 14     |
| Safety Rules . . . . .                  | 14     |
| Serial Numbers . . . . .                | 10     |
| Specifications . . . . .                | 5      |
| Starting Check List . . . . .           | 2      |
| Storage . . . . .                       | 9      |
| Timing . . . . .                        | 39     |
| Torque (Cylinder) Chart . . . . .       | 54     |
| Trouble Shooting . . . . .              | 44, 49 |
| Warranty . . . . .                      | 1      |
| Wheel Cylinders . . . . .               | 40     |
| Wheels (Front) . . . . .                | 38     |

## SAFETY PRECAUTIONS

### AVOID ACCIDENTS

Most accidents, whether they occur in industry, at home, or on the highway, are caused by failure of some individual to follow simple and fundamental safety rules or precautions. For this reason, most accidents can be prevented by recognizing the real cause and doing something about it before the accident occurs.

A CAREFUL OPERATOR IS THE BEST INSURANCE AGAINST AN ACCIDENT.

THE COMPLETE OBSERVANCE OF ONE SIMPLE RULE WOULD PREVENT MANY THOUSAND SERIOUS INJURIES EACH YEAR. THAT RULE IS:

NEVER ATTEMPT TO CLEAN, OIL, OR ADJUST A LOADER BACKHOE WHILE IT IS IN MOTION!

Many hours of lost time and much suffering is caused by the failure to practice simple safety rules.

IT IS TOO LATE TO REMEMBER WHAT SHOULD HAVE BEEN DONE AFTER THE ACCIDENT HAS HAPPENED.

### SAFETY RULES

1. Do not fill fuel tanks when engine is hot or while using a lantern, light with an open flame, or when smoking.
  2. Do not attempt to oil or grease a machine or tractor while it is in operation.
  3. Do not wear loose fitting clothing that may be blown in moving parts.
  4. Keep all shields and guards in place.
  5. Place gear shift lever in neutral position when starting engine or dismounting from loader backhoe.
  6. Loader backhoe should only be operated by those who are responsible and delegated to do so.
  7. Only one person - the operator - should be permitted on loader backhoe when it is in motion.
  8. The rate of travel on hillsides or turns should be regulated so there is no danger of tipping.
  9. Do not remove radiator cap when engine temperature is above 212° F.
  10. Brakes should be properly adjusted.
  11. Do not drive too close to the edge of a ditch or creek.
  12. Never operate your loader backhoe in a closed garage or shed.
  13. Do not tow or push loader backhoe under any circumstances, to start the engine.
  14. Always keep loader backhoe in gear when going down steep grades.
  15. Do not leave the engine running unattended when anyone is adjusting or repairing a driven machine.
  16. Do not attempt to operate loader backhoe unless you are in the operator's seat.
- CAUTION: DO NOT OPERATE MACHINE AT AN ANGLE EXCEEDING TWENTY-FIVE DEGREES (25°) IN ANY PLANE.
17. Provide a first aid kit. Treat all scratches, cuts, etc., with proper antiseptic immediately.
  18. Do not dismount from loader backhoe while it is in motion.
  19. Keep a fire extinguisher handy at all times.
  20. CAUTION: Slowly remove hydraulic reservoir check plug when oil is at operating temperature. This is a pressurized hydraulic system.

## STANDARD EQUIPMENT SPECIFICATIONS

|   | <u>166-15</u>  | <u>166-13</u> |
|---|--|---------------|
| <b><u>ENGINE:</u></b>                             |  |               |
| Make . . . . .                                    | Perkins  | IHC           |
| Model . . . . .                                   | 4.236  | C-200         |
| Maximum H.P. . . . .                              | 78   | 68            |
| Rated R.P.M. (Full Load) . . . . .                | 2400   | 2400          |
| Maximum Torque . . . . .                          | 200  | 175           |
| Number of Cylinders . . . . .                     | 4  | 4             |
| Bore and Stroke . . . . .                         | 3.975 x 5  | 3.813 x 4.390 |
| Firing Order . . . . .                            | 1, 3, 4, 2   |               |
| Cu. In. Displacement . . . . .                    | 236  | 200           |
| Air Cleaner . . . . .                             | Dry  | Dry           |
| Fuel Oil Specification . . . . .                  | A.S.T.M./D.975-66T-Nos. 1-D and 2-D. Federal specification VV-F-800 Grade DF-A, DF-1, and DF-2 (according to operating ambient temperature). |               |
| <br><b><u>FUEL LIFT PUMP:</u></b>                 |  |               |
| Type of Pump . . . . .                            | A.C. Delco, V.P. Series  |               |
| Method of Drive . . . . .                         | Eccentric on Camshaft  |               |
| Delivery Pressure . . . . .                       | 2 3/4 to 4 1/4 lbf/in <sup>2</sup><br>(0,19/0, 30 KFG/CM <sup>2</sup> )  |               |
| Pump to Cylinder Block Gasket Thickness . . . . . | 0.025 In. (0.65 MM)  |               |
| Spring Color Code . . . . .                       | Green  |               |
| <br><b><u>FUEL INJECTION PUMP:</u></b>            |  |               |
| Make . . . . .                                    | C.A.V.   |               |
| Type . . . . .                                    | D.P.A.   |               |
| Pump Rotation . . . . .                           | Clockwise  |               |
| Timing Letters (Mechanical) . . . . .             | "C"  |               |
| Static Timing Position . . . . .                  | PS - 22° B.T.DC.   |               |
| <br><b><u>ELECTRICAL SYSTEM:</u></b>              |  |               |
| Voltage . . . . .                                 | 12   | 12            |
| Alternator Output . . . . .                       | 40   | 40            |
| Ground . . . . .                                  | Negative   | Negative      |
| Battery Amp Hours . . . . .                       | 190  | 95            |
| Number of Batteries . . . . .                     | 2 - 12-V   | 1 - 12 V      |
| Alternator . . . . .                              | Motorola   | Motorola      |
| Model . . . . .                                   | 8AR2008  | 8AR2008       |
| Regulator . . . . .                               | R3-1   | R3-1          |

STANDARD EQUIPMENT SPECIFICATIONS

166-15

166-13

HYDRAULIC SYSTEM:

|                                   |               |                        |
|-----------------------------------|---------------|------------------------|
| Type . . . . .                    | Open Center   | Open Center            |
| Pump . . . . .                    | Triple Gear   | Triple Gear            |
| Loader . . . . .                  | 21 GPM        | 21 GPM                 |
| Swing . . . . .                   | 12 GPM        | 12 GPM                 |
| Backhoe . . . . .                 | 33 GPM        | 33 GPM                 |
| Stabilizers . . . . .             | 12 GPM        | 12 GPM                 |
| Power Steering & Brakes . . . . . | 9 GPM         | 9 GPM                  |
| System Relief Pressure . . . . .  | 2500          | Ldr 2500, Hoe 2000 PSI |
| Filter . . . . .                  | Full Flow-10M | Full Flow-10M          |
| Oil Cooler . . . . .              | Air to Oil    | Air to Oil             |
| Loader Control . . . . .          | Single Lever  | Single Lever           |
| Backhoe Control . . . . .         | Dual Lever    | Dual Lever             |

BRAKES:

|   |                      |                     |
|---|----------------------|---------------------|
| Size . . . . .                                | 16.5 x 5.5           | 16.5 x 5.5          |
| Control . . . . .                             | Full Power           | Full Power          |
| Type . . . . .                                | Rigid Anchor         | Rigid Anchor        |
| Operation . . . . .                           | Ind. or Both         | Ind. or Both        |
| Pressure . . . . .                            | 1650 PSI             | 1650 PSI            |
| Parking Brake . . . . .                       | Band Type            | Band Type           |
| Emergency Brake . . . . .                     | Band Type            | Band Type           |
| Stopping Distance-level<br>concrete . . . . . | 28' Max. from 15 MPH | 28' Max from 15 MPH |
| Emergency Stopping Distance . . . . .         | 84' Max. from 15 MPH | 84' Max from 15 MPH |

GENERAL DIMENSIONS:

|                                       |         |         |
|---------------------------------------|---------|---------|
| Transport Length . . . . .            | 23'-8"  | 22'-0"  |
| Transport Height . . . . .            | 12'-0"  | 9'-9"   |
| Transport Width . . . . .             | 7'-5"   | 7'-5"   |
| Wheel Base . . . . .                  | 85"     | 85"     |
| Ground Clearance . . . . .            | 12"     | 12"     |
| Turning Radius w/Brakes . . . . .     | 13'-4"  | 13'-4"  |
| Turning Radius w/o Brakes . . . . .   | 15'-9"  | 15'-9"  |
| Clearance Radius w/o Brakes . . . . . | 19'-3"  | 19'-3"  |
| Shipping Weight . . . . .             | 13,000# | 12,000# |
| Operating Weight . . . . .            | 13,320# | 12,320# |
| Front Axle Weight . . . . .           | 3,200#  | 3,800#  |
| Rear Axle Weight . . . . .            | 10,120# | 8,520#  |

STANDARD EQUIPMENT SPECIFICATIONS

166-15

166-13

TORQUE CONVERTER:

|                              |              |            |
|------------------------------|--------------|------------|
| Type . . . . .               | Single Stage | 11" Clutch |
| Stall Torque Ratio . . . . . | 2.6:1        | -          |

TRANSMISSION:

|                                 |                    |                |
|---------------------------------|--------------------|----------------|
| Type . . . . .                  | Powershift Shuttle | Mech. Reverser |
| Speeds . . . . .                | 4F - 4R            | 4F - 4 R.      |
| Speed Range Selection . . . . . | Synchromesh        | Synchromesh    |
| Speeds . . . . .                |                    |                |
| 1st                             | 0 - 2.9            | 2.9            |
| 2nd                             | 0 - 6.0            | 6.0            |
| 3rd                             | 0 - 11.0           | 11.0           |
| 4th                             | 0 - 18.6           | 18.6           |

REAR AXLE:

|                           |                   |                   |
|---------------------------|-------------------|-------------------|
| Type . . . . .            | Planetary         | Planetary         |
| Differential . . . . .    | Torque Proportion | Torque Proportion |
| Power Transfer . . . . .  | 27%               | 27%               |
| Wheel End Ratio . . . . . | 3.3:1             | 3.3:1             |
| Tread Width . . . . .     | 70                | 70                |

TIRES:

|                 |           |           |
|-----------------|-----------|-----------|
| Front . . . . . | 11L-16    | 11L-16    |
| Rear . . . . .  | 16.9 x 24 | 16.9 x 24 |

FRONT AXLE:

|                                |          |          |
|--------------------------------|----------|----------|
| Type . . . . .                 | Str. Bar | Str. Bar |
| Static Load Capacity . . . . . | 30,000#  | 24,000#  |
| Working Capacity . . . . .     | 7,500#   | 6,000#   |
| Tread Width . . . . .          | 72-1/2   | 72-1/2   |

STEERING:

|                    |             |             |
|--------------------|-------------|-------------|
| Type . . . . .     | Hydrostatic | Hydrostatic |
| Pump . . . . .     | Gear        | Gear        |
| Pressure . . . . . | 2000        | 2000        |
| Volume . . . . .   | 9 GPM       | 9 GPM       |

CAPACITIES:

|                                  |          |          |
|----------------------------------|----------|----------|
| Fuel Tank . . . . .              | 22 Gal.  | 22 Gal.  |
| Cooling System . . . . .         | 21 Qts.  | 21 Qts.  |
| Transmission F-R . . . . .       | 8 Qts.   | 1.5 Qts. |
| Transmission - 4 Speed . . . . . | 3.5 Qts. | 3.5 Qts. |
| Differential . . . . .           | 11 Qts.  | 11 Qts.  |
| Wheel Ends - each . . . . .      | 2 Qts.   | 2 Qts.   |
| Engine Crank Case . . . . .      | 7 Qts.   | 6 Qts.   |
| Hydraulic System . . . . .       | 33 Gal.  | 33 Gal.  |

STANDARD EQUIPMENT SPECIFICATIONS

|   | <u>166-15</u>  | <u>166-13</u>  |
|---|----------------|----------------|
| <b>LOADER:</b>                                    |                |                |
| Size . . . . .                                    | 1 Cu. Yd.      | 1 Cu. Yd.      |
| Bucket Width . . . . .                            | 80"            | 80"            |
| Lift to Full Height . . . . .                     | 4900#          | 4900#          |
| Breakout Force (IEMC) . . . . .                   | 9200#          | 9200#          |
| Max. Breakout (18" behind cutting edge) . . . . . | 15,600#        | 15,600#        |
| Carrying Capacity . . . . .                       | 5,000#         | 4,000#         |
| Rollback at Ground . . . . .                      | 40°            | 40°            |
| Dump Angle . . . . .                              | 45°            | 45°            |
| Height to Hinge Pin . . . . .                     | 10'-1"         | 10'-1"         |
| Dump Clearance @ 45° . . . . .                    | 102"           | 102"           |
| Dump Reach . . . . .                              | 34"            | 34"            |
| Reach at Ground . . . . .                         | 74 3/4"        | 74 3/4"        |
| Digging Depth Below Surface . . . . .             | 4"             | 4"             |
| Raise Time . . . . .                              | 5 Sec.         | 5 Sec.         |
| Lower Time . . . . .                              | 4.5 Sec.       | 4.5 Sec.       |
| Dump Time . . . . .                               | 2 Sec.         | 2 Sec.         |
| <b>BACKHOE:</b>                                   |                |                |
| Maximum Digging Depth . . . . .                   | 16'-0"         | 13'-0"         |
| Maximum IEMC Depth . . . . .                      | 15'-5"         | 12'-8"         |
| Digging Force Bucket Cyl. . . . .                 | 13,000#        | 8,500#         |
| Digging Force-Crowd Cyl. . . . .                  | 10,000#        | 5,000#         |
| Lift-Boom Cylinder (Max.) . . . . .               | 2,000#         | 1,700#         |
| Lift-Crowd Cylinder (Max.) . . . . .              | 4,000#         | 2,500#         |
| Bucket Capacity - 24" . . . . .                   | 9 Cu. Ft.      | 7.5 Cu. Ft.    |
| Reach from Rear Axle . . . . .                    | 22'-6"         | 18'-7"         |
| Reach from Center Line Pivot . . . . .            | 19'-2"         | 15'-2 1/2"     |
| Dump Height . . . . .                             | 11'-2"         | 9'-0"          |
| Swing Arc . . . . .                               | 190°           | 190°           |
| Stabilizer Spread . . . . .                       | 12'-6"         | 12'-6"         |
| Stabilizer Max. Grade to Level . . . . .          | 13°            | 13°            |
| Stabilizer Reach Below Grade . . . . .            | 20"            | 20"            |
| Bucket Rotation . . . . .                         | 183°           | 183°           |
| <b>CYLINDER SIZES AND NUMBER:</b>                 |                |                |
| Loader Lift (2) . . . . .                         | 3 x 31 1/2     | 3 x 31 1/2     |
| Loader Bucket (2) . . . . .                       | 2 1/2 x 31 1/4 | 2 1/2 x 31 1/4 |
| Swing (2) . . . . .                               | 3 1/2 x 10 3/8 | 3 1/2 x 10 3/8 |
| Stabilizer (2) . . . . .                          | 4 x 21 7/8     | 4 x 21 7/8     |
| Backhoe Boom (1) . . . . .                        | 5 x 32         | 4 x 33         |
| Backhoe Crowd (1) . . . . .                       | 5 x 29         | 4 x 29 1/8     |
| Backhoe Bucket (1) . . . . .                      | 4 x 32 3/4     | 3 1/2 x 30     |

### LOADER BACKHOE STORAGE

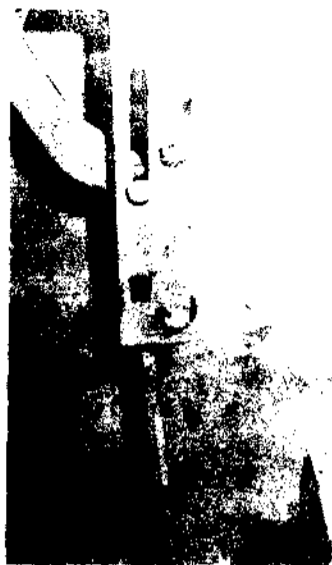
IF LOADER BACKHOE IS STORED FOR ANY LENGTH OF TIME, A FEW PRECAUTIONARY MEASURES ARE HELPFUL IN PRESERVING VARIOUS PARTS, ALSO IN AVOIDING FUTURE DIFFICULTY.

1. Store loader backhoe under cover. If impossible to place loader backhoe under cover be sure to cover the air stack and exhaust pipe
2. Drain radiator and engine block.
3. To avoid gum content collections, drain fuel tank.
4. Leave radiator and fuel caps slightly loose to protect gaskets
5. Block loader backhoe up to remove weight from tires and to keep tires from contact with moist floor.
6. Remove battery and store in a cool dry place. Keep battery fully charged.
7. Remove nozzles and pour a small amount of motor oil on top of pistons, crank engine over a few times and replace nozzles.
8. Disconnect the fuel line from the main tank and connect it to a clean container of a mixture of rust preventive and perfection kerosene. Mix to a consistency of regular fuel. Operate engine until the entire filtering system and the injection pump are filled with the rust preventive mixture.
9. Lubricate all grease fittings.
10. Oil control cables and control lever pivot points.
11. Retract all cylinders where possible--- if not, cover rods with film of heavy oil.
12. Release hand brake.
13. When loader backhoe is removed from storage it should be serviced throughout, including draining and refilling the engine oil sump with fresh clean oil.

### TROUBLE SHOOTING

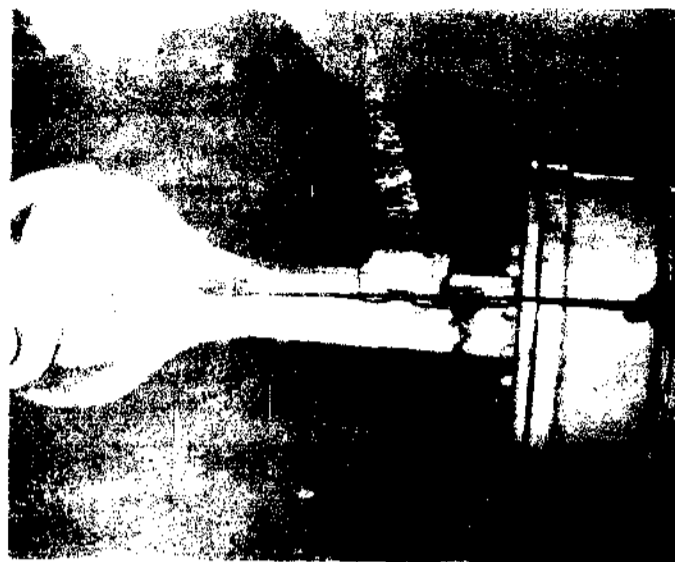
The following suggestions are listed for your assistance. You can make simple adjustments on your loader backhoe that will improve its operation and save you the time and expense of engaging a serviceman.

Always make one adjustment at a time and if the adjustment made does not improve the condition, return to the original setting before proceeding on next adjustment.

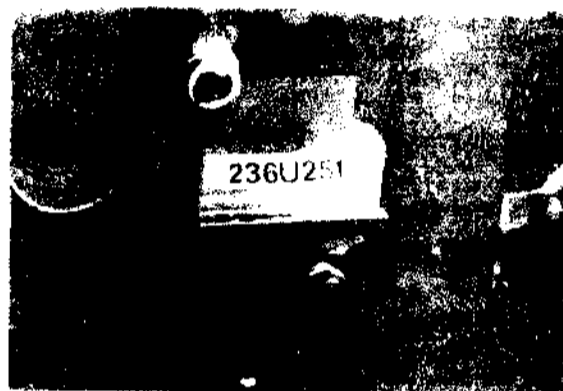


BACKUP

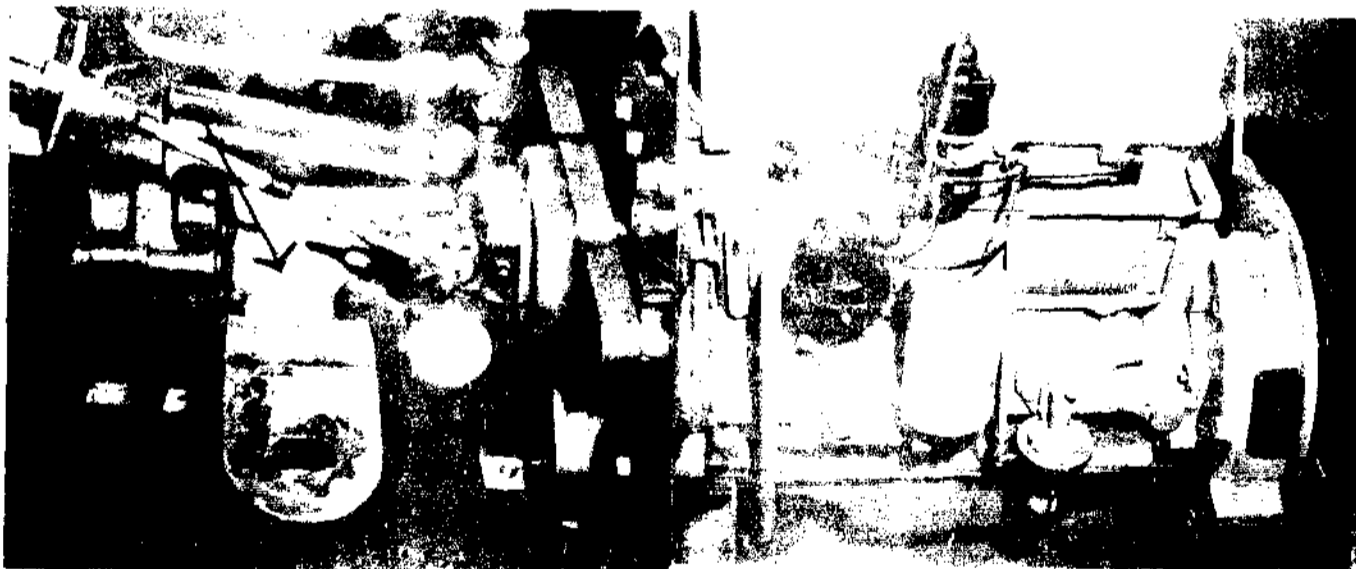
PARSONS



GEAR AXLE



PERKINS DIESEL



FRONT

PERKINS ENGINE

# LUBRICATION

## LUBRICANTS

### MOTOR OIL

#### ENGINE CRANKCASE OIL

Motor oils are designated by code letters as follows: SA, SB, SC, SD, CA, CB, CC, CD.

The letters denote the type of service for which the unit is used.

SA - for utility gasoline and diesel engine service. Service typical of engines operated under such mild conditions that protection afforded by compounded oils is not required. This classification has no performance requirements.

SB - for minimum duty gasoline engine service. Service typical of engines operated such mild conditions that only minimum protection afforded by compounding is desired. Oils designed for this service have been used since the 1930's and provide only anti-scuff capability, and resistance to oil oxidation and bearing corrosion.

SC - for 1964 gasoline engine warranty service. Service typical of gasoline engines in 1964 through 1967 models of passenger cars and trucks operating under engine manufacturers' warranties in effect during those model years. Oils designed for this service provide control of high and low temperature deposits, wear, rust and corrosion in gasoline engines.

SD - for 1968 gasoline engine warranty service. Service typical of gasoline engines in passenger cars and trucks beginning with 1968 models and operating under engine manufacturers' warranties. Oils designed for this service provide more protection from high and low temperature engine deposits, wear, rust and corrosion in gasoline engines than oils which are satisfactory for API Service Classification SC and may be used when API Service Classification SC is recommended.

CA - for light duty diesel engine service. Service typical of diesel engines operated in mild to moderate duty with high quality fuels. Occasionally has included gasoline engines in mild service. Oils designed for this service were widely used in the late 1940's and 1950's. These oils provide protection from bearing corrosion and from high temperature deposits in normally aspirated diesel engines when using fuels of such quality that they impose no unusual requirements for wear and deposit protection.

CB - for moderate duty diesel engine service. Service typical of diesel engines operated in mild to moderate duty, but with lower quality fuels which necessitates more protection from wear and deposits. Occasionally has included gasolines in mild service. Oils designed for this service were introduced in 1949. Such oils provide necessary protection from bearing corrosion and from high temperature deposits in normally aspirated diesel engines with higher sulfur fuels.

CC - for moderate duty diesel and gasoline engine service. Typical of lightly supercharged diesel engines operated in moderate to severe duty and has included certain heavy-duty, gasoline engines. Oils designed for this service were introduced in 1961 and used in many trucks and in industrial and construction equipment and farm tractors. These oils provide protection from high temperature deposits in lightly supercharged diesels and also from rust, corrosion and low temperature deposits in gasoline engines.

CD - for severe duty diesel engine service. Service typical of supercharged diesel engines in high-speed, high output duty requiring highly effective control of wear and deposits. Oils designed for this service were introduced in 1955, and provide protection from bearing corrosion and from high temperature deposits in supercharged diesel engines when using fuels of a wide quality range.

Only CC diesel medium service oils as classified by the American Petroleum Institute (API) or oils meeting Military Specifications MIL-L-2104B are specified for use in the engine crankcase

Unless the oil has the proper additives, fuels with a high sulphur content cause excessive piston ring and cylinder liner wear, excessive oil consumption and piston ring sticking.

If a fuel with more than .5% sulphur content must be used the oil change intervals should be shortened.

The fact that the oil has the ability to carry contaminants in suspension rather than deposit them in the engine, causes the oil to discolor rapidly. Thus, the color of the oil cannot be used to determine when to change. (follow intervals given in the Lubrication and Service Guide.).

## HYDRAULIC OIL AND LUBRICANT

### LUBRICATION:

Use molly grease for all grease fittings. Grease fittings are located on all pivot points and hydraulic cylinder ends.

### HYDRAULIC OIL

#### WHAT MAKES A GOOD HYDRAULIC OIL?

A hydraulic oil for use in construction equipment should have the following characteristics:

1. Proper Viscosity  
This includes the correct viscosity at operating temperature, resistance to excessive thinning out under high temperature operation and freedom from sluggishness at low temperature. These characteristics describe an oil carefully refined from good base stock and having a high viscosity index and low pour point.
2. Ability to Resist Oxidation  
The oil in a high output hydraulic system commonly becomes quite hot and this heat tends to oxidize the oil. Only high quality oil inhibited against oxidation should be used.
3. Protection Against Rusting and Corrosion.  
Good hydraulic oils contain additives which extend this protection to all parts of the system.
4. Protection Against Wear  
The operating conditions encountered by the oils in the high pressure, high output hydraulic systems on many modern earthmoving machinery requires the presence of additives in the oil to minimize the wear on all moving parts, particularly pump parts.
5. Anti-Foam Characteristics.  
Hydraulic oils must resist foaming, which can be fatal to pumps and which interferes with the efficient operation of valves and cylinders. This quality is provided by special anti-foam agents in the oil.

### SELECTING HYDRAULIC OIL

Fortunately most engine crankcase oil exhibits all five of the foregoing essential characteristics of a good hydraulic oil. Therefore, these oils may be used both in the engine and in the hydraulic system. The simplification of inventory, increased efficiency in operation and elimination of misapplication are obvious.

### A.P.I. CLASSIFICATION

Any reputable brand of engine oil suitable for A.P.I. service classification of the proper viscosity may be used.

### VISCOSITY.

Use oil for loader backhoe operation.

CAUTION: KEEP HYDRAULIC OILS AND HYDRAULIC SYSTEMS CLEAN.

In the maintenance of hydraulic systems, three items are of extreme importance.

1. Keeping the oil and system clean.
2. Choice of the correct viscosity.
3. Selection of the proper type oil.

Other maintenance items of importance are:

1. Checking oil level frequently and maintaining at proper level.
2. Proper servicing of hydraulic oil filter.
3. Keeping air breathers clean and open.
4. Seasonal draining and flushing of system.

The most important reason to change oil is due to contamination---by acids, condensation of water vapor, dirt, dust from breather, rust, wear, metals and carbon from over-heat above 235° F.

It is extremely important that hydraulic systems be properly maintained and all connections kept tight and free from leaks if they are to function properly.

NOTE: The hydraulic system is pressurized. Release the pressure from hydraulic reservoir before doing any service work requiring disconnecting of lines or removing of plugs. Loosen hydraulic reservoir dipstick until pressure is released.

### FUEL SPECIFICATIONS

FOR ECONOMY AND PERFORMANCE USE FUELS SPECIFIED FOR YOUR ENGINE

Fuels used in the Perkins Diesel engine must have certain qualities in order to ignite and burn at the proper temperature and the proper rate. Experience has shown that the fuel best suited, closely follows these specifications.

Gravity (API) 30-35  
Viscosity Saybolt Universal at 100° F. 35-40  
Flash F° minimum 150° F.  
Diesel Index 48.5 - 65.5  
Cetane Number 46 - 60  
Pour Point 0° F.  
98% Recovery 700° F.  
Sediment and Water trace  
Ash Maximum .02 of 1% maximum  
Conradson carbon maximum .03 of 1% maximum  
Sulphur maximum 1/2 of 1% maximum

## NUMBER 2 HIGH SPEED DIESEL FUELS GENERALLY MEET THE ABOVE SPECIFICATIONS

Some of the more desirable high speed diesel fuels do not have a low enough pour point for below zero operation and cause filter plugging which, in turn, causes hard starting. In this event, a winter grade fuel of the same type should be obtained.:

Pour point of fuel must be at least 10° F. below prevailing atmospheric temperature for satisfactory fuel flow through lines and filters.

API gravity of fuel varies with its specific gravity. Low API fuels are desirable because they have high specific gravity and more heat units per gallon. However, the higher the API gravity, the better ignition quality of fuel will be.

Ignition quality of fuel is expressed as a "cetane number". Higher cetane number---higher quality of fuel. Higher cetane fuel shortens ignition delay period to facilitate starting and improve combustion. Diesel index number, which is a close approximation of the cetane number, is a field method to represent ignition quality.

Distillation 90% point and the end point are important. High volatility is required to enable complete vaporization of fuel, clean combustion and low residue formation.

Flash point of fuel has no quality significance, but is important with respect to safety in fuel storage and handling.

It is important fuel be within specified limits for ash, carbon, water and sediment content, etc., to prevent excessive wear and damage to engine parts.

It is also important fuel has lubricating properties so fuel injection pump and fuel injection nozzles are adequately lubricated.

NOTE: Sulphur content of diesel fuel should be as low as possible; fuel should not contain sulphur content of more than 1/2 of 1%.

## HANDLING OF FUELS

### HANDLING OF FUEL

No fuel is satisfactory for use if it is dirty or contains water. A few small pieces of dirt or small amount of water can cause costly damage to the fuel injection pump, which is built of closely fitted precision parts.

### FUEL STORAGE DIESEL

The importance of proper fuel storage cannot be too strongly stressed. Storage tanks, drums or portable service tanks must be free from rust scale, sediment, or any other foreign matter which will contaminate the fuel. Contaminated fuel will clog the fuel filters and eventually damage the fuel injection pump and fuel nozzles.

The most practical fuel storage seems to be elevated tank with an open sided roof, high enough for air to circulate tank. This protects the fuel tank from rain or snow, and hot sun rays.

The fuel storage tank should be installed so that one end of tank is slightly lower, and equipped with a drain valve at the lower end for draining off the sediment and water. The tank should also be provided with a hose, equipped with a self closing nozzle to prevent the entrance of dirt.

A portable storage tank provides the best method of storing fuel on the job. Since all storage tanks are subject to condensation, it is very important that sediment

sump be provided in the bottom of the tank so that water and sediment can be drained daily.

A portable storage tank should be provided with a pump, so the fuel can be pumped into the tractor fuel tank with a minimum of handling. Draining fuel from supply tank into buckets or other containers, then pouring it into the tractor fuel tank is not considered a good method of handling fuel.

Fuel should be allowed to settle as long as possible in a storage container, before it is used in the fuel tank of the tractor. This will allow the sediment and water to settle to the bottom of the storage container and permitting cleaner fuel to be used in the tractor fuel tank.

Where conditions are such that drums must be used to supply fuel, it is advisable to have enough drums to allow sufficient time for the fuel to settle before being used. It is also advisable to use a pump and drain the fuel from the drum or container, rather than drain it from the bottom of the fuel container.

The fuel thus left in a number of drums can be collected into one drum and used after the usual time allowed for settling. In this manner the sediment and foreign matter will be disposed of and no fuel will be wasted.

Whenever drums are used for fuel storage, they should be covered or placed under shelter so that the fuel will not become contaminated by water, which will enter through the filter plugs when it rains, even though the plugs are tight.

The fuel tank of the tractor should be filled at the end of the day's run. This will reduce the water content of the fuel, as a full tank is less subject to condensation.

**IMPORTANT:** The lubricant distributors and/or suppliers are to be held responsible for the results obtained from their products. Procure lubricants from distributors and/or suppliers of unquestioned integrity, supplying known and tested products.

Do not jeopardize your equipment with inferior lubricants. No specific brands of oil are recommended. Use only products qualified under the following oil viscosity and classifications and recommended by reputable oil companies.

### LUBRICATING INSTRUCTIONS

Correct lubrication is an essential part of preventative maintenance to minimize wear on working parts and insure against premature failures. By maintaining correct lubrication, the possibility of mechanical failures which might tie up the equipment is reduced to a minimum.

Too much emphasis cannot be placed on the benefits derived by properly using the best grade of lubricant.

All greasing and oiling points are indicated on the lubrication chart and marked with a number. By referring to the like numbers in the lubricating instructions, the intervals of time between lubricating, recommended lubricants and special lubrication instructions are noted. The instructions are based on continuous operation.

For intermittent service, the period between lubrication should be adjusted accordingly.

When using the grease gun, be sure to inject enough grease to force out the accumulation of dirty grease. The grease used should be of such consistency that it will not run in summer or require heat to melt in winter.

It should be the best obtainable grade with a mineral oil base suitable for use in a pressure gun.

Do not use a grease that will gum or harden in the grooves of bearings.

For gear cases, use a high grade gear lubricant. All gears not running in oil should be dressed when necessary with a heavy adhesive base grease.

All active linkage not fitted with grease fittings should be lubricated for ease of operation and to prevent excess wear.

#### GREASE RATING:

Molybdenum disulfide MoS<sub>2</sub> is a soft, grayblack compound derived from the mineral molybdenite. Its lubricity stems from a lamellar structure which resists compressive forces but shears readily. It allows sliding of one layer over the other, resulting in low coefficient of friction.

It is recommended to use a moly grease with lithium base and a 3% minimum moly fortified.

| LUBRICANT                           | CAPACITY  | DESCRIPTION, INTERVALS & INSTRUCTIONS  |
|-------------------------------------|-----------|--|
| EP-90 below 80°<br>EP-140 above 80° | 11 Quarts | <u>DRIVE AXLE AND DIFFERENTIAL:</u><br>Check lubricant level every 100 hours.<br>Add oil if necessary. Change every 800 hours.<br>Completely drain the lubricant while unit is warm. |
| EP-90 below 80°<br>EP-140 above 80° | 2 Quarts  | <u>PLANETARY DRIVE:</u><br>Check oil level at plug every 100 hours. Check or fill through plug hole with wheel at 3:00 or 9:00 position Photo Page 18                                |



**AIR FILTER:**

Air drawn into the engine through the induction manifold is filtered by a dry element type air cleaner. The time period for cleaning air filter or renewing the paper element depends on operating conditions. Under extremely dusty conditions, the time limits recommended should be decreased. Periodically the filter should be dismantled and any dirt removed. Replace with new element every 400 hours. Photo Page 19

**LUBRICATING OIL FILTER:**

The oil filter should be cleaned and a new element installed every 200 hours.

**FUEL OIL FILTERS:**

The fuel oil filters should be removed and new elements installed every 400 hours of operation, or more often if necessary depending upon the cleanliness of the fuel oil.

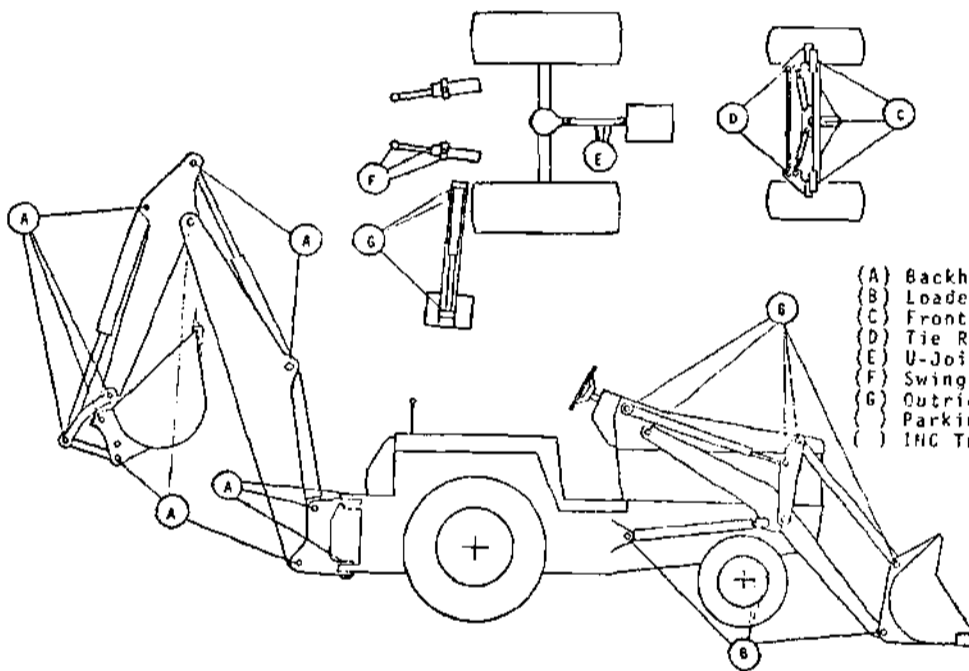
SAE-10SD below 32°  
SAE-20SD above 32°

33  
U.S. Gallons

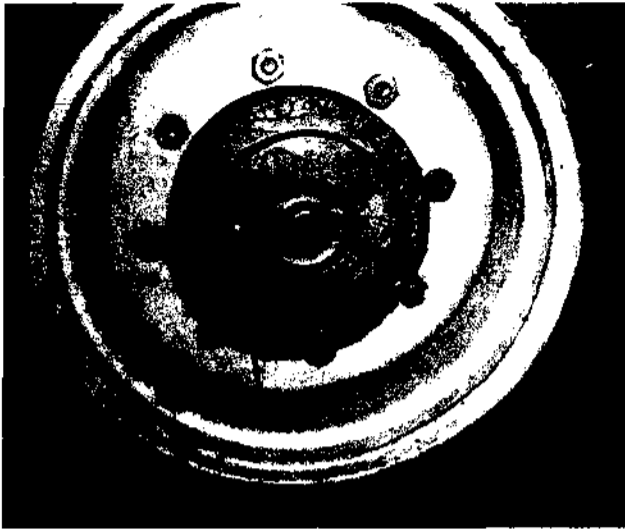
**HYDRAULIC SYSTEM:**

Check the hydraulic oil daily. Keep oil level at the "full" mark on the dipstick. Change oil every 800 hours of operation. Change filter every 400 hours. Photo Page 19

**NOTE:** THE HYDRAULIC SYSTEM IS PRESSURIZED. RELEASE THE PRESSURE FROM HYDRAULIC RESERVOIR BEFORE DOING ANY SERVICE WORK REQUIRING DISCONNECTING OF LINES OR REMOVING OF PLUGS. LOOSEN HYDRAULIC RESERVOIR DIPSTICK UNTIL PRESSURE IS RELEASED.



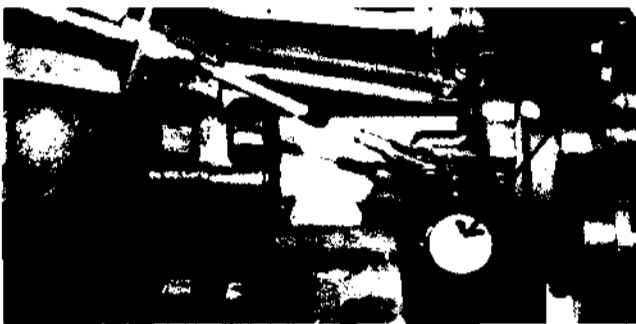
- (A) Backhoe . . . . . Total 12
- (B) Loader (9 Ea. Side) . . . Total 18
- (C) Front Pivot Pins . . . Total 3
- (D) Tie Rod Ends . . . . . Total 2
- (E) U-Joine. . . . . Total 3
- (F) Swing Cyl. (3 Ea.) . . . Total 6
- (G) Outriggers (3 Ea.) . . . Total 6
- ( ) Parking Brake Cable. . . Total 2
- ( ) IHC Trans. Shift Lever Total 2



OUTSIDE PLANETARY AXLE

Fill or Check Planetary Axle with plug at 3 or 9 o'clock position.

POWER SHIFT



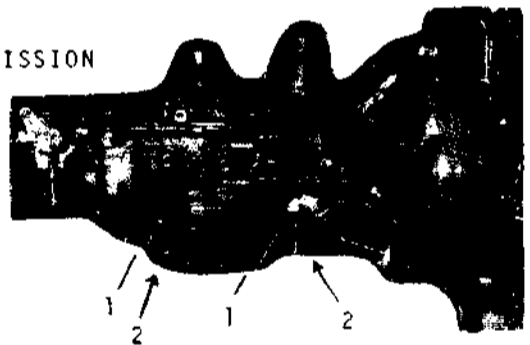
Fill and check (dip stick) cap

FOUR SPEED TRANSMISSION with POWER SHIFT (Right Side)



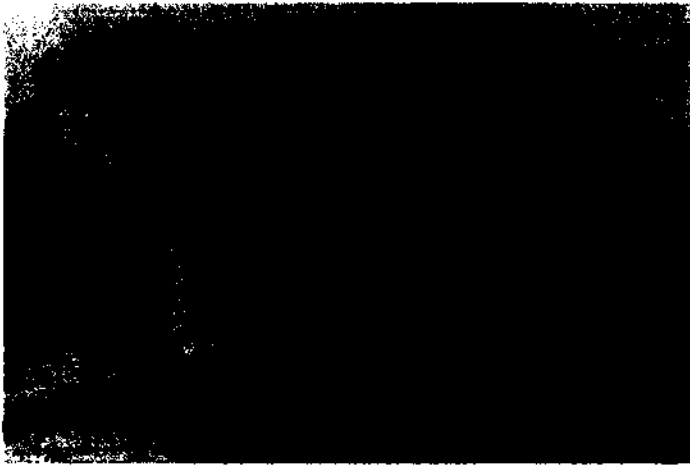
1. Check & fill plug
2. Drain plug
3. Drain plug

FOUR SPEED MECHANICAL REVERSING TRANSMISSION



1. Check & fill plugs
2. Drain plugs

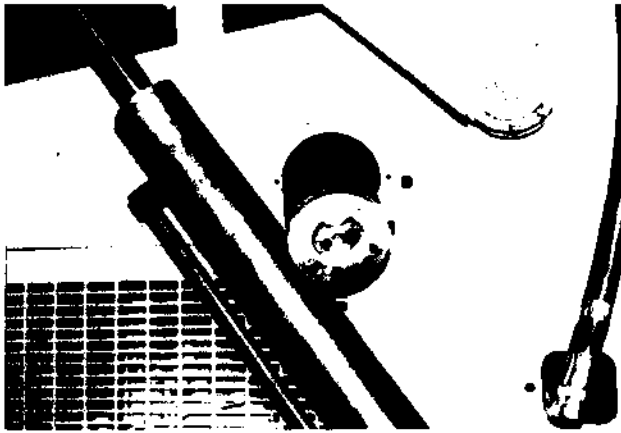
# INSTRUMENTS



To check the hydraulic oil level it is advisable to have the hoe and the loader in the approximate positions shown on the left. These positions best equalize the oil throughout the machine and assure an adequate oil level.

#### OIL FILTER:

Replace element every 400 hours. Remove the top cover from the left hand side of the oil reservoir to expose element.



#### AIR FILTER:

Replace element every 400 hours. To replace the filter element raise the loader arm until the cover on the left side of engine side panel is fully exposed. Remove the cover to replace element.



THE TRIPLE GEAR HYDRAULIC PUMP

THE INSTRUMENT PANEL IS LOCATED ON THE FENDER TO THE RIGHT OF THE OPERATOR

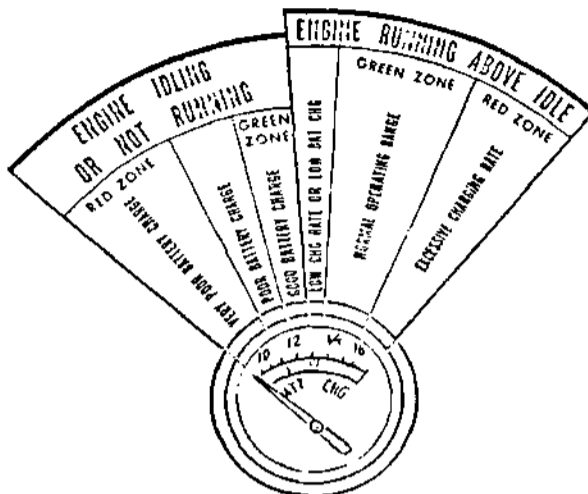
Photo Page 24

1. OIL PRESSURE GAUGE:

The oil pressure gauge registers the pressure of lubricating oil in the engine. As soon as the engine is started, the oil pressure gauge should start to register. If the oil pressure gauge does not register at least 30 PSI. at 2400 RPM, the engine should be stopped and the cause of the low oil pressure determined and corrected before the engine is started again. The oil pressure at normal operating speed should be 40 - 60 PSI.

2. VOLTMETER:

The Voltmeter indicates the rate at which the battery is being charged or discharged. Normally the Voltmeter will show a slight charge when the engine is first started, then gradually diminish to zero as the battery charge is replenished. If the battery is in a discharged condition, the Voltmeter should indicate a good rate of charge until the battery approaches a fully charged condition. It registers from -10 to +16 volts.



3. HYDRAULIC OIL TEMPERATURE:

The hydraulic oil temperature gauge indicates the operating temperature of the hydraulic system. The temperature should be from 100° to 200°.

4. TRANSMISSION OIL TEMPERATURE GAUGE:

The transmission oil temperature gauge registers the temperature of the oil in transmission and torque converter. Normal operation is between 100° and 250°. If the temperature reads in the red zone of the gauge, chances are the unit is being operated in too high a gear for that operation, causing excessive converter slippage. (There is no temperature gauge on mechanical transmission.) NOTE: Temperatures in excess of 250° could also be the first indication of converter slippage, or clutch slippage due to low pressure or excessive wear

5. WATER TEMPERATURE GAUGE:

The water temperature gauge indicates the engine operating temperature. Normal operating temperature is from 165° to 195°. Engine temperature will vary in accordance with the air temperatures and climate conditions.

6. TACH-HOUR METER:

The Tach-Hour meter records the accumulated hours of operation. Use this gauge to determine when periodic services are required. On the diesel unit, the hour meter records any time the ignition switch is on. When shutting off the diesel, also turn off the ignition switch. The tach-hour meter also shows the engine speed in hundreds of RPM.

FUEL GAUGE:

The fuel gauge is located on top of fuel tank.

CONTROL PANEL IN FRONT OF OPERATOR Photo Page 24

1. FUEL SHUT OFF KNOB:

Fuel shut off knob is located in the lower left hand corner of control panel. This knob must be pushed in before engine can start. Pulling out will shut fuel off stopping the engine.

2. FORWARD & REVERSE LEVER:

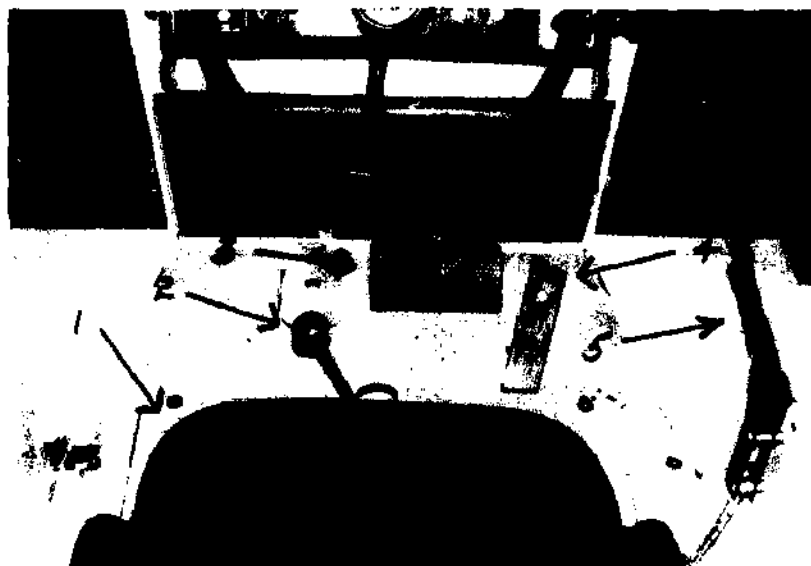
It is located to the left of the steering wheel. It controls the forward and reverse movement of the unit. It has three positions: UP - Forward position. CENTER - Neutral position. DOWN - Reverse position.

Before shifting directional lever in either forward or reverse position, the unit should be brought to a complete stop.

Units with mechanical transmission, the Forward and Reverse Lever is located on the floor board, back and to the left of the Brake Pedal.

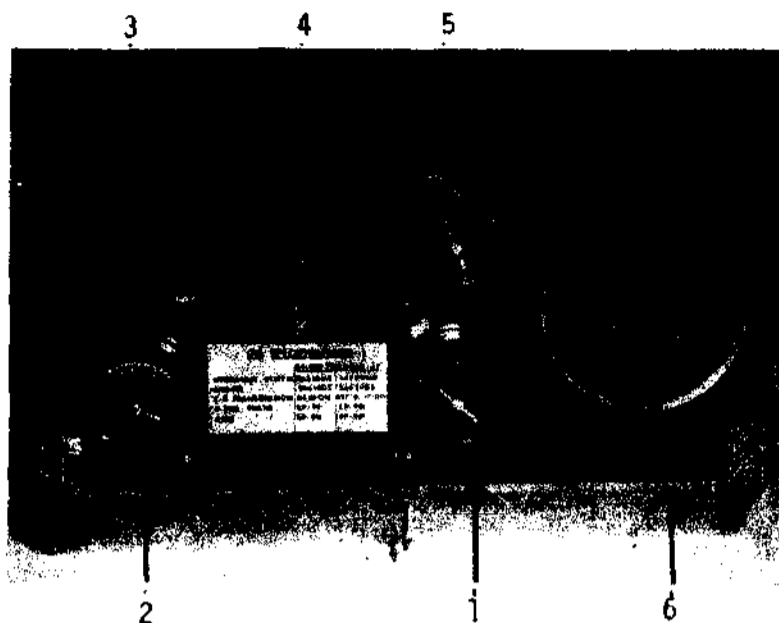
3. IGNITION SWITCH:  
The ignition switch is used to control the current to the instruments and to the starting motor.
4. LIGHT SWITCH:  
The light switch is located in the upper left hand corner of control panel. There are four positions on the light switch. The positions are:
  - 1 - Off
  - 2 - Instruments and Head Lights
  - 3 - Rear Work Lights
  - 4 - Optional Front Work Lights
5. INSTRUMENT PANEL LIGHT:
6. HORN BUTTON:
7. DIRECTIONAL AND FOUR-WAY FLASHER SWITCH:  
The flashing light switch is located in the upper right hand corner of the control panel. It has four positions:
  - 1 - Off
  - 2 - Left Hand Flasher
  - 3 - Both Flashers
  - 4 - Right Hand FlasherThe flashers and the horn will work without the ignition switch being turned on. The horn is located to the left of the flasher light switch.
8. LOADER CONTROL LEVER:  
The control lever for the loader is located on the right hand side of the control panel. The lever will control both the boom hydraulic circuit and the bucket hydraulic circuit. The decal on the control panel shows the position for operating the loader.
9. STEERING WHEEL:
10. TRANSMISSION GEAR SHIFTING PATTERN:  
The diagram to the left side of the loader control lever shows the four gear positions in the transmission. Before shifting into any gear, place the forward and reverse lever in neutral position. Always stop the motion of the unit before shifting into low gear. 2nd, 3rd, and 4th speeds are synchronized and may be shifted on the go.
1. OPERATOR'S SEAT:  
The operator's seat is a dual purpose type. It serves as an operator's seat during loader operation and as a backhoe operator's seat during backhoe operation. To position for use during backhoe operation, stand up and rotate seat 180°. The seat may be adjusted forward or reverse by pushing back on lever on right hand side of seat. It can be adjusted up or down by removing capscrew and repositioning in one of three holes in seat support assembly. Photo Page 23
2. GEAR SHIFT LEVER:  
The transmission shift lever is located on the floor board and is used to select the forward travel speeds to meet the varying working conditions. When used in conjunction with the directional reverse lever, it provides four forward speeds and four reverse speeds.
3. BRAKES:  
The brake consists of one pedal with a tilting brake pad, giving the operator individual rear wheel brakes when he depresses one side or the other of the tilting brake pad, or the tilting pad can be operated simultaneously giving both rear wheel brakes. For transport operation, insert a pin in the hole provided in the pedal to insure that both brakes will operate regardless of how the pedal is pressed.
4. ACCELERATOR PEDAL: (FOOT OPERATED)  
Set hand throttle at desired engine R.P.M. Use foot accelerator to increase R.P.M., above hand throttle setting. Foot accelerator will increase engine R.P.M. only above hand throttle setting.
5. HAND BRAKE LEVER:  
The hand brake lever is located to the right hand side of the operator and mounted on the side of the fender. The handbrake is used to brake the unit when parked. To tighten cable, screw knob on lever clockwise. In event of hydraulic brake failure, hand brake can be used.

1. Operator's Seat
2. Gear Shift Lever
3. Brakes
4. Accelerator Pedal  
(Foot Operated)
5. Hand Brake Lever.

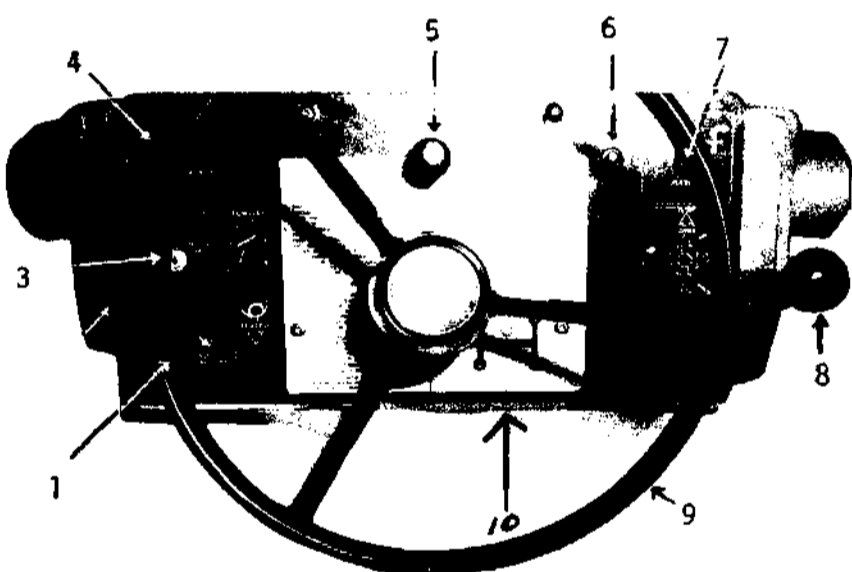


### INSTRUMENT PANEL

- 1 - Oil Pressure Gauge
- 2 - Voltmeter
- 3 - Hydraulic Oil Temp.
- 4 - Trans. Oil Temp. Gauge
- 5 - Water Temperature
- 6 - Tack Hour Meter



### CONTROL PANEL



- 1-Fuel Shut-off Knob
- 2-Fwd. & Rev. Lever
- 3-Ignition Switch
- 4-Light Switch
- 5-Instr. Panel Light
- 6-Horn Button
- 7-Direction & 4-Way Flasher Switch
- 8-Loader Control Lever
- 9-Steering Wheel
- 10-Transmission Gear Shifting Pattern

# OPERATION

## OPERATION

Complete instructions for safe and efficient operation are given on the control panel in front of the operator. By following these directions carefully, you can be sure that you are taking full advantage of the time and labor-saving features built into your loader backhoe.

### OPERATING THE ENGINE

#### PRE-STARTING INSPECTION:

Perform the following checks and services before starting the engine for the first time each day:

1. Check the engine crankcase oil level. See Page
2. Check the radiator coolant level. See Page
3. Inspect air cleaner. See Page 19
4. Check the fuel sediment bowl on gas engines.
5. Make sure the fuel shut-off valve at fuel tank is open.

#### STARTING THE ENGINE:

1. The 166 is equipped with a starter safety switch, so directional shift lever must be in neutral position when starting the engine. Clutch pedal must be depressed on gas engines.
2. (Gasoline Engines) Place hand throttle in slow idle position. (Diesel Engines) Place hand throttle in halfway open position.
3. (Gasoline Engines) Pull out choke knob full distance. (If engine is warm, start engine without choking.)
4. At temperatures below 32° F, use cold weather starting aids, if so equipped (see "Cold Weather Starting Aids")
5. Turn starter switch clockwise to start engine. (Do not crank engine for more than 30 seconds at a time. To do so may overheat the starter. Wait a minute or two before trying again.)
6. (Gasoline Engines) Push choke in as necessary for smooth engine operation.
7. As soon as engine starts, release starter switch and adjust engine speed to approximately half throttle. If engine oil pressure gauge does not register at least 30 PSI. after the engine has been running for ten seconds, the engine should be shut off at once and the cause of difficulty determined.
8. Release clutch pedal. In cold weather, warm engine and transmission five minutes by operating engine at half throttle. Do not allow engine to operate at slow idle speed during engine warm-up. Observe gauges. (Gas Engine)

NOTE: IF ENGINE FAILS TO START, REFER TO TROUBLE SHOOTING CHARTS.

CAUTION: Never attempt to start a unit with reverser by towing or pushing, as reverser clutches may be damaged. On units without reverser, never tow at a speed faster than normal for the gear the unit is being started in. Tow the unit for starting only in 4th gear.

#### COLD WEATHER STARTING AIDS

To assist in cold weather starting, several aids are available. They are effective at low temperatures only when the engine is otherwise operating satisfactorily. They will not correct such deficiencies as low battery charge, crankcase oil of too heavy viscosity, or high electrical resistance, any of which may prevent the engine from starting.

#### AUXILIARY BATTERIES:

Starting the engine in cold weather can be made easier by connecting an auxiliary 12-volt battery on parallel with the 12-volt battery or batteries on the loader backhoe.

Use jumper cables to connect the positive (+) terminal of the booster battery to the positive (+) terminal of the loader backhoe battery and the negative (-) terminal of the booster battery to the negative (-) terminal of the loader backhoe battery.

CAUTION: The batteries on your loader-backhoe are NEGATIVE grounded only. Reversed polarity in battery or alternator connections will result in damage to electrical system.

Check Electrolyte level of Battery every fifty (50) hours of operation. Always use distilled water.

#### DIESEL STARTING FLUID ADAPTER:

Your diesel loader backhoe may be equipped with a "quick start". This attachment is used to inject atomized starting fluid into the engine air intake system when starting the engine at temperatures below 20° F. The "quick start" knob is located directly above the directional reverser lever.

CAUTION: Starting fluid is highly inflammable.

To avoid damage, turn engine with starter one or two revolutions before injecting starting fluid. Inject starting fluid only while engine is turning. Inject fluid intermittently, not continuously.

Do not puncture or incinerate starting fluid containers.

#### WARM-UP PERIOD:

Before putting your unit under full load or into high gear, be sure it is warmed up sufficiently. Oil will then circulate freely, preventing excessive wear on piston rings, cylinders and bearings. Do not race engine or idle it during warm-up period.

#### ENGINE IDLING:

Avoid unnecessary engine idling. Prolonged engine idling may cause the engine coolant temperature to fall below its normal range. This in turn causes crankcase oil dilution, due to incomplete fuel combustion, and permits formation of lacquer or gummy deposits on valves, pistons, and piston rings. It also promotes rapid accumulation of engine sludge.

#### ENGINE SPEEDS:

The engine is designed to operate under load at speeds ranging from 1800 to 2400 RPM. These are variable governed speeds, and the engine can be operated at any speed between the two extremes to meet various working conditions. Maximum continuous power at full load is obtained at 2400 RPM.

#### STOPPING THE ENGINE:

**MECHANICAL TRANSMISSION:** Move the gear shift lever into any gear position. Then place the directional shift lever in neutral.

Allow engine to run at 1500 RMP for a short time. This permits engine to cool gradually. Sudden cooling of a hot engine causes extreme contraction of parts and may damage engine.

Turn starter switch to vertical (OFF) position.

**IMPORTANT:** Key starter switch should be in vertical (OFF) position at all times when engine is stopped. Failure to do so will run down batteries and may cause overheating of ignition resistor (gasoline engine).

#### BREAK-IN PERIOD

Operate the unit at normal load for the first 100 hours of operation. Avoid light loads or excessive engine idling. Check periodically to be sure that an adequate supply of oil is maintained in the crankcase. If it becomes necessary to add oil during the first 50 hours, use oil of the type recommended. At the end of this 50 hour period, drain the oil, replace the filter element,

and fill the crankcase with oil as recommended. Thereafter, drain and refill crankcase at the end of each 100 hours of operation.

At the end of the first 10 hours of operation, retighten all wheel retainers. Check tightness of retainers frequently for the first 100 hours of operation. Also, check steering cylinder, tie rod, front wheel bearing adjustment, lower swing cylinder trunnions, and rear axle mounting bolts.

After the first 100 hours, retighten the front axle tie rod and steering drag link end nuts to 50 - 60 ft.-lbs.

At the end of the first 50 hours of operation, change the transmission-hydraulic system oil filter. Change the loader return oil filter after the first 200 hours.

#### SELECTING TRAVEL SPEEDS

The loader-backhoe has four forward gears and four reverse gears. These gears, together with the engine speeds that may be selected, allow the operator to balance load and speed for maximum economy and give him flexibility to meet varying work conditions. For example, for a given travel speed the operator may choose to work in a low gear at high engine speed or in a higher gear at a lower engine speed. Engine working speeds may be varied anywhere between 1800 and 2400 RPM.

Decals on the control panel show range and gear positions, permitting selection of the proper speed for the work to be performed.

#### SHIFTING FROM NEUTRAL

1. Fully depress clutch pedal. (Gas Engine)
2. Move gear shift lever from neutral into gear desired. Then move directional lever forward. Gradually release clutch pedal. Machine will move forward.

#### SHIFTING TO ANOTHER RANGE

To shift to another gear lower, fully stop the unit and disengage the clutch before attempting to change the gears. 2nd, 3rd, and 4th are synchro-mesh and can be shifted up on the go.

#### HIGH SPEED DRIVING

Use high speed (4th) gear to save time in transporting over highways and other smooth roads. But---BE CAREFUL! Fast driving is the cause of many accidents. On rough ground, gear down for safety.

#### PARKING THE LOADER BACKHOE

1. Completely stop the unit.
2. Move the gear shift lever into any gear position.
3. Move the range shift lever to neutral.
4. Lower all equipment and engage hand brake.

## TOWING THE LOADER BACKHOE

When towing the loader backhoe, move both the directional shift lever and the gear shift lever to the neutral position. This will prevent undue wear on transmission parts during towing.

### CAUTION:

NEVER TOW THE UNIT AT A SPEED GREATER THAN 35 MILES PER HOUR

## LOADER AND BACKHOE

### OPERATION

It is most important to study these instructions carefully before operating your loader backhoe. These are basic instructions to acquaint you with the controls for most efficient operation of your loader backhoe. Run the engine no greater than you can operate the loader backhoe without metering the controls.

**CAUTION:** In cold weather, always allow the loader backhoe to warm up in a medium engine RPM. Damage to the pump can result if this is not allowed.

### GENERAL

This section tells you how to operate your Parsons loader and backhoe properly and points out facts you should know if you are to use this heavy duty machine to the best advantage. The instructions here are basic. Actual digging experience is the best teacher. Develop a "feel" for the loader backhoe and use it to the limit of its capacity when necessary, but don't abuse it. Apply pressure smoothly--don't "bang" the control levers. Anchor the loader backhoe firmly before digging. Never operate your loader backhoe without having serviced it and checked operating instructions.

### LOADER

#### OPERATING CONTROLS:

The control handle for the loader is located on the R. H. side of the instrument panel. Its position in relation to the operator is to the right and up slightly. The handle will control both the boom hydraulic circuit and bucket hydraulic circuit.

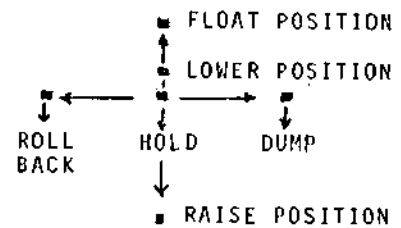
#### c. RAISE LEVEL:

The loader bucket will self-level as boom is raised to maximum height position. This is accomplished through the mechanical design of the loader boom and bucket linkage.

#### LOADER CONTROL:

a. HOLD, RAISE AND LOWER operations are similar to a standard loader boom circuit. When one is holding control lever in raise position or in the lower position and then release the handle, it will automatically return to the hold position. The loader boom will stop and remain in position it was in when control lever was released.

b. FLOAT: Moving the control handle to the forward detent position will allow the boom to float for finish grade operations. The control lever will not automatically return to hold position from the float position.



**CAUTION:** IF TRANSMISSION TEMPERATURE GAUGE READS IN THE "RED" ZONE, SHIFT INTO LOW GEAR.

#### BUCKET OPERATION:

- a. In loading from a bank or stockpile, position the bucket so that it is level with the ground. The bucket must not be rolled back - thus riding the bucket on the heel wasting power and preventing bucket from entering the ground.
- b. When the bucket has entered the material far enough to get bucket full - roll the bucket completely back, taking advantage of maximum breakaway.  
  
With the bucket completely rolled back, start the lift. Stop the forward travel of the tractor.
- c. With the bucket completely loaded, the operator backs away naturally and quickly only far enough to allow him to turn and move up to the truck to be loaded.
- d. Move the tractor forward into the stockpile with the directional reverser engaged. As the cutting edge penetrates the material, raise the lift arm slightly. Use the forward gear which will provide penetration without excessive engine lug or wheel slippage.

#### NOTE:

The mechanical raise leveling of the bucket is designed into the loader to prevent spilling the material. This combined with the directional reverse clutch provides a fast cycle.

#### OPERATING TIPS

##### Stripping and stockpiling:

1. In stripping top soil, start with bucket in a level position and maintain a level cut. If an error is made, reposition the loader backhoe for a level attitude and start the cut over.
2. To start the cut place the bucket in an approximately 5° angle. With the LIFT-LOWER lever in the center or hold position, move the loader backhoe forward. In hard to penetrate material, a slight down pressure on the lift arms may be necessary.
3. As the loader backhoe moves forward the depth of cut can be adjusted by a slight lift on the lift arms or by slightly rolling the bucket back. Cut only as much as the loader backhoe can handle.
4. When the bucket is full and pushing a good load, completely roll the bucket while still traveling forward. When traveling to the stockpile or truck, the bucket should be carried approximately 1 to 2 feet above the ground.

A few minutes sizing up the job will be time well spent. Where the top soils are deep the operator should begin by cutting off layers at a time. The depth of each cut is determined by the soil and the size of the bucket. Start each cut with the loader backhoe in a relatively level position.

##### Rough finishing, backfilling and grading:

Rough finishing on housing projects is a job often required of this unit. Tilt the bucket forward until the bottom of the bucket is at a 45° angle. This will allow the dirt to be drifted ahead of the bucket filling the low spots. The LIFT-LOWER lever is used to

raise and lower the lift arms in the grading operation.

Some operators prefer a final finish by back-dragging for a clean job. This is done with the loader control in the float position. This is not recommended procedure in rock and abrasive material.

Backfilling is effectively accomplished. Here the bucket is positioned level with the ground, thus pushing a large amount of material toward the wall or foundation to be back-filled.

As the bucket reaches the edge of the trench, the operator dumps the bucket and raises the lift arms slightly. Caution should be used never to contact the wall or foundation with the bucket.

Loaders are also effectively used for back-filling trenches over sewer tile and culverts.

After construction is completed, the loader backhoe is an ideal combination to clean up and remove debris that has accumulated around the job.

##### Transporting:

When transporting the 166 unit, carry the loader bucket approximately 20" from the ground. This will provide adequate ground clearance and the operator good visibility.

Be sure to lock boom in position, using the swing lock pin.

CAUTION: Do not allow the loader backhoe to "coast" or free wheel down grades with shuttle control lever in neutral position.

A machine of this size can pick up several miles per hour in speed if allowed to coast or free wheel down a slope or long grade creating an unsafe condition.

#### Fuel Tank:

The loader backhoe is equipped with a large capacity 22 gallon fuel tank located at the rear of the engine. Fill the fuel tank at the end of each day's operation. This will help prevent condensation and moisture from collecting in the fuel system. Excessive moisture in the fuel system clogs fuel filters and may damage fuel injection components.

**CAUTION:** Do not fill the fuel tank while the engine is running, or when smoking.

The 166 unit is equipped with a hydraulic operated shuttle clutch and cannot be towed to start the engine since there is no hydraulic pressure available to engage the clutch when the engine is not running. Attempting to start the engine by towing could cause damage to the transmission components.

If the tractor must be towed from one location to another the transmission and directional lever must be placed in the neutral position.

If this unit must be towed for long distance the drive shaft that connects the transmission to the differential must be disconnected.

PARSONS DIVISION does not recommend towing as it is an unsafe practice. The loader backhoe should be driven from one location to another or transported by truck or trailer.

#### BACKHOE

For the best overall backhoe operation, it is recommended that the engine speed be run between 1800 and 2200 RPM.

#### BACKHOE DUAL LEVER CONTROL:

The 166 has dual lever control as standard equipment. This control makes it possible to operate four circuits with only two levers. Each lever operates two circuits. Moving the lever forward and back operates one circuit. Moving the lever from side to side operates the other circuit. If the lever is moved forward or back and to the side at the same time, then two circuits can be actuated simultaneously.

#### STABILIZER CONTROLS:

Stabilizers are controlled by the short handle control lever on left of the control valve bank. Pushing forward will lower stabilizer, pulling back will raise stabilizer.

#### BOOM AND SWING CONTROL:

The boom control handle will operate boom cylinder to raise and lower the boom. Pulling back on the boom control handle will raise boom. Pushing forward will lower the boom in the normal manner.

#### DOWN PRESSURE:

When in the normal lowering position once the bottom of an excavation is reached, pump pressure may work against the full piston area giving maximum down pressure to the backhoe boom.

The swing control lever is the same lever that operates boom circuit. To swing backhoe to the left side, push control handle to left. To swing backhoe to the right side, push control handle to right.

L.H. and R.H. side of Loader Backhoe for backhoe operation is established when operator is positioned facing backhoe from operator's seat.

#### SWING SYSTEM:

The swing system is provided with hydraulic cushion stops for gentle stop of the boom swinging arc. There are also mechanical stops at either side of the swing arc. However, the operator should avoid working in the extreme left or right, thus using the swing cushion at a minimum.

The swing cushion was designed into the swing circuit as an aid in assisting the operator to prevent striking mechanical stops with force.

As the operator swings backhoe to either left or right side, at a point just before backhoe boom strikes mechanical stop, the operator will notice that the backhoe swing speed will become very slow and, if travel of boom in swing arc continues boom will strike mechanical stops very gently, thus preventing structural damage to machine. This is proper operation of the cushion valves.

**NOTE:** When the oil is cold in hydraulic system the operator will notice it is difficult to swing through the swing cushion valves. However, when the oil reaches operating temperature the swing cushion valves can be swung through slowly if needed.

The operator should practice swinging the boom to the left and right and gently releasing swing control lever to stop boom in desired position. When swinging boom to the left or right and then moving swing control lever to the neutral position a slight carry over of boom will be noticed.

depending on the speed that boom is being swung. This is the circuit relief valves releasing oil to protect the machine from unnecessary strain.

**DIPPERSTICK & BUCKET CONTROL:**

To activate dipperstick, pull control handle back to move dipperstick in. To move dipperstick out, push forward on control lever.

To operate bucket, push control lever toward left to roll bucket in; use control lever to right to roll bucket out.

OPERATING PROCEDURE

BACKHOE CONTROLS

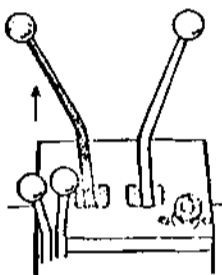
OPERATING PROCEDURES:

It is not a difficult task to become an efficient operator of a backhoe. A special valve operating guide is mounted immediately in front of valve operating control handles to assist you in becoming familiar with the controls.

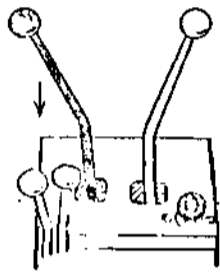
The speed of operation of the backhoe is greatly dependent upon the RPM of engine. The operator may control the speed of the backhoe within limits by regulating the

loader backhoe engine speed. However, enough engine RPM must be maintained to provide ample horsepower to prevent lugging. It is recommended to operate the engine between 1800 and 2200 RPM.

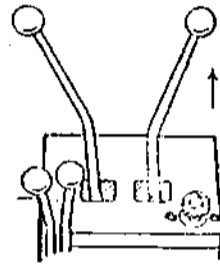
Before attempting to dig a trench, drive the unit into an open lot and operate each of the controls several times.



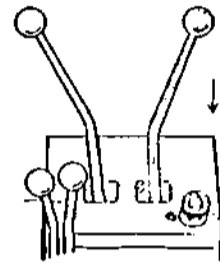
LOWER BOOM



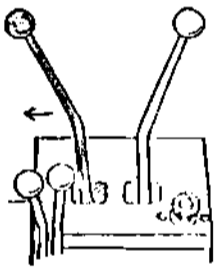
RAISE BOOM



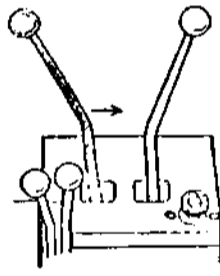
DIPPERSTICK EXTENDED



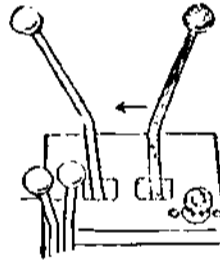
DIPPERSTICK RETRACTED



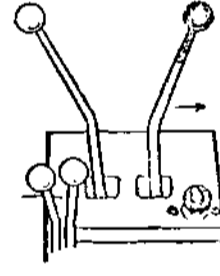
BOOM SWING LEFT



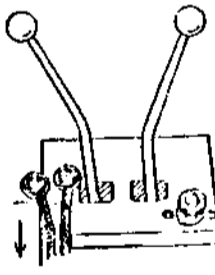
BOOM SWING RIGHT



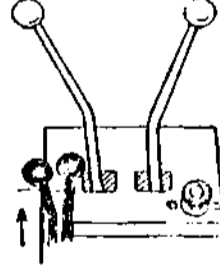
BUCKET ROLL UNDER



BUCKET ROLL OUT



STABILIZER UP POSITION



STABILIZER DOWN POSITION

## STABILIZER UP POSITION

### OPERATING BACKHOE:

Drive the loader backhoe into position. Although the backhoe will swing 90° to either side of center and can be operated anywhere within the arc, best results are obtained by digging near the center of swing arc so that spoil can be dumped on either side.

Lower the stabilizers until they penetrate the ground. Lift some of the weight from the drive wheels of the loader backhoe.

The stabilizers are independently controlled and the loader backhoe may be leveled on stops up to 15° so the backhoe will dig a vertical ditch.

### DIGGING:

When breaking ground to open a new trench, set the dipperstick with bucket teeth striking ground approximately two feet behind vertical position of dipperstick. Have the bucket positioned with a good penetration angle. Without changing position of boom, or bucket, bring the bucket forward with the dipper control.

On each succeeding bucket full, lower boom three to six inches and proceed as before. The bucket should be positioned so that the bucket teeth provide a shaving action without the heel of the bucket dragging on the ground. If the bucket becomes stalled and the main relief valve by-passes, roll the bucket or lift boom slightly and continue. Under some conditions only changing the pitch of the bucket teeth angle will allow you to continue to load bucket. **DO NOT HOLD DIPPER CONTROL VALVE OPEN WHEN THE BUCKET STALLS.**

Rolling the bucket into the ground by pulling the bucket control give extra digging power when needed. It is also used to dig trenches with vertical ends and for loading in trucks.

## STABILIZER DOWN POSITION

For added stability the loader bucket can be filled with earth and completely rolled back to retain the load. Lower the loader to ground level. This adds counterbalance with the weight of the dirt in the loader bucket. When desired, the loader bucket can be left empty for normal digging.

### TRENCHING (DIPPER DIGGING)

Much of the work done by hydraulic backhoes is in the form of digging a trench. In digging of this type, the bucket should be filled by using the dipper. This method will lend itself to faster digging and efficient operation. Also, this will provide the easiest method of obtaining a flat bottom trench.

When the desired depth is reached, raise stabilizer and move tractor forward. The distance to move depends on the depth of trench.

Move forward a greater distance for shallow trenches.

### BUCKET POSITIONS FOR DIPPER DIGGING:

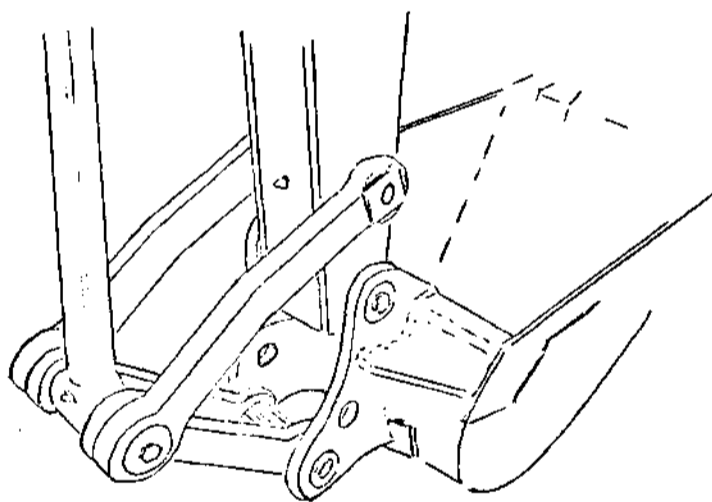
Position the bucket at ground contact for good penetration, approximately 2 to 3 feet behind the vertical position of the dipperstick.

Using the dipper, bring the bucket and dipperstick in. Through the center of the digging arc, the cutting edge of the teeth should be nearly flat with bottom of excavation. It may be necessary to adjust bucket angle slightly, simultaneously while the dipper is coming through.

When the bucket is full, roll the bucket in only enough to retain the load. Raise the bottom and bucket up out of the hole.

After a little practice the operator will be able to raise the boom and swing to the spoil pile at the same time. This gives smooth operation and short cycle time. The operator must judge the length of the pass to fill the bucket. Penetration will depend on type and condition of soil. As soon as the bucket is full roll the bucket in and hoist with boom. No work is accomplished by dragging a full bucket through. To insure a full bucket each time, make a shallow cut. This will allow a clean, smooth, uninterrupted pass.

### BUCKET LINKAGE ADJUSTMENTS:



The 166 has two position adjustments on the backhoe bucket to help the customer adjust the machine to the type digging he is doing.

With the dipperstick positioned in the upper bucket bracket hole the backhoe will attain its maximum digging depth and maximum bucket roll with the dipperstick. Positioned in the lower hole the bucket will achieve maximum digging power. This is the most commonly used position.

#### BACKHOE OPERATION:

Before starting operation, always check the loader backhoe for oils, coolant and proper operation of gauges. Check hydraulic oil to prevent pump damage caused by cavitation.

Start engine and allow engine and hydraulic oil to warm up at approximately 1/2 throttle for four or five minutes.

#### STABILIZERS:

Increase engine speed to approximately 2000 R.P.M. Actuate the stabilizer control levers and lower stabilizers until the drive wheels are one inch off of the ground.

DO NOT operate backhoe unless the stabilizers are down.

#### USING LOADER BUCKET FOR ADDITIONAL STABILITY:

The loader bucket can be used for additional stability by placing the flat bottom of bucket on the ground. It IS NOT recommended to loft the front of the loader backhoe off the ground for backhoe operation.

#### FAMILIARIZATION OF CONTROLS:

The operator should operate all controls and put the backhoe through a complete work cycle. This will aid the operator in becoming familiar with controls and enable him to operate the backhoe easily and smoothly at normal engine operating RPM's.

THE FOLLOWING PAGES ARE SUGGESTIONS TO HELP THE OPERATOR GET MAXIMUM EFFICIENCY AND PRODUCTION FROM HIS BACKHOE.

#### FOR SMOOTH OPERATION:

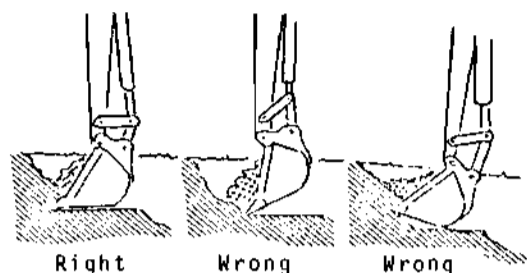
The backhoe valve bank is a parallel circuit type, therefore, hydraulic pressure is available for one or all circuits at any given time. For best overall and smoothest operation, two or more circuits should be open at a time.

Example: While swinging back to trench from spoil pile dipper out, roll bucket to dig position and lower boom at the same time.

#### TRENCHING (DIPPER DIGGING):

Much of the work done by hydraulic backhoes is in the form of digging a trench. In digging of this type, the bucket should be filled by using the dipper. This method will lend itself to faster digging and efficient operation. Also this will provide the easiest method of obtaining a flat bottom trench.

See illustration for starting and each following pass for dipper digging.



When the desired depth is reached, raise stabilizer and move tractor forward. The distance to move depends on the depth of trench.

Move forward a greater distance for shallow trenches

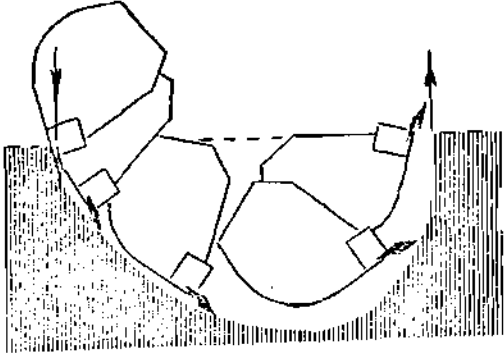
See illustration for correct bucket position during dipper digging. Use the next four steps to perform this operation.

1. Position the bucket at ground contact for good penetration, approximately 2 to 3 feet behind the vertical position of the dipperstick.
2. Using the dipper, bring the bucket and dipperstick in. Through the center of the digging arc the cutting edge of the teeth should be nearly flat with bottom of excavation. It may be necessary to adjust bucket angle slightly, simultaneously while the dipper is coming through.
3. When the bucket is full, roll the bucket in only enough to retain the load.
4. Raise the boom and bucket up out of the hole.

After a little practice the operator will be able to raise the boom and swing to the spoil pile at the same time. This gives a smooth operation and short cycle time. The operator must judge the length of the pass to fill the bucket. Penetration will depend on type and condition of soil. As soon as the bucket is full, roll the bucket and hoist the boom. No work is accomplished by dragging a full bucket through. To insure a full bucket each time make a shallow cut. This will allow a clean, smooth, uninterrupted pass.

## VERTICAL WALL AND BELL HOLE: (BUCKET DIGGING)

On many jobs bucket digging is the most effective method, or a required procedure. This method is necessary for jobs requiring vertical walls, or can be effectively used in some soil conditions.



1. Position the bucket on the ground with the bucket positioned for maximum penetration. Force the bucket into the ground with down pressure. DO NOT LIFT THE LOADER BACKHOE UP OFF THE STABILIZER.
2. With the bucket in the ground, use the dipper and force the bucket further into the dirt.
3. Simultaneously roll the bucket in, with the dipper keeping the bucket forced into the dirt.
4. When the bucket is full, raise the boom and bucket out of the hole. DO NOT ROLL THE BUCKET MORE THAN NECESSARY TO RETAIN THE LOAD.

Continue down pressure on the boom will often aid in filling the bucket.

In any digging, do not pull the dipperstick in to the boom more than necessary to clear the trench or hole. The bucket should be lifted out of the hole with the boom cylinder. This will eliminate the need for extending the dipperstick any more than necessary to dump the bucket.

When dumping the bucket, do not roll it back more than necessary to unload and when possible, only back to the position of the next pass.

When deep excavations with the wide buckets are to be made, the dipperstick must be extended when dumping the bucket to move the spoil out and away from hole or trench.

When digging excavations which requires straight walls, such as graves, on the far end roll dipper out as you force down. Have the bucket installed in the proper hole for the necessary rotation.

The bucket must be positioned to "cut" the wall straight with the teeth and blade. As the earth is cut it can be loaded in the bucket in the bottom of the hole. The far end wall must be maintained vertical as the hole is dug. The far corner should be the deepest part of the hole while digging. On the closest wall to the unit, lift the boom and dipper in, at the same time. The bucket must again be positioned to cut and fill in this operation. The side walls are relatively easy to cut straight with the bucket side-cutters. Be sure to keep the side wall straight as the hole is dug. To correct an error in the side wall after the hole is completed is costly and time consuming. KEEP ALL CORNERS SQUARE AS THE HOLE IS DUG. Remember, precision digging is not high speed work. Accuracy and a full bucket each cycle, is the most efficient operation. When vertical walls are necessary be sure to level the unit.

## LIFTING OPERATIONS:

Lift with the boom cylinder first, with the dipperstick in close to the boom, or nearly vertical. Use the dipper to push out for lifting loads higher. Swing carefully to position load. Lower load with dipper, when possible, until dipperstick is vertical.

## WALKING THE BACKHOE:

The 166 loader backhoe can best be moved forward when trenching by positioning the transmission in first gear and using the directional reverser. The backhoe operator can conveniently reach both the steering wheel and the directional reverser lever and reposition the loader backhoe with precision control from the backhoe seat.

The unit can be pushed forward with the dipperstick while digging. Lift the loader bucket. Lift both stabilizers. Set the bucket in the ground with the dipperstick approximately one foot back of the vertical position. Apply a reasonable amount of down pressure and dipper out. This will roll the loader backhoe forward a few feet for continued digging.

## TRANSPORTING:

When moving the unit from job-to-job, swing the boom directly behind the loader backhoe. Raise the boom to full height, completely bring the dipperstick in with the dipper and stop just before contact of the bucket and the boom. Roll the bucket in. Do not force the bucket into the boom member. Completely lift both stabilizers. With the boom centered and fully raised install the swing pin to eliminate the backhoe from swinging from side to side.

# SERVICE AND MAINTENANCE

## INFORMATION

The Parsons Industrial 166 Loader Backhoe is constructed for rugged, heavy-duty industrial and commercial applications. They are specifically engineered for maximum ease of operation to move the greatest amount of material in the shortest possible time.

This Operators Manual covers the maintenance, lubrication, and operational information for the 166 unit.

The 166 Industrial Loader Backhoe is an integral unit, powered by a 4 cylinder, 4 cycle, open combustion chamber, direct injection engine with 236 cubic inch displacement.

Drive power is from the engine through a torque converter having 2.6 to 1 torque multiplication factor, to a four speed, full reversing type transmission, to the rear axle assembly. Universal slip-joint drive shaft assembly is used between transmission and rear axle.

The loader backhoe has four shift ranges in both forward and reverse. Effortless hydraulic power steering is provided.

Service brakes are full power hydraulic actuated by a master cylinder. Parking brake is the external band type operating on a drum mounted on the companion flange of the transmission.

Hydraulic power for the loader backhoe, brakes and steering, is supplied through a stage crankshaft driven gear type pump. This pump supplies a total of 42 G.P.M.

The phrases Right-Hand and Left-Hand are used throughout this manual to indicate direction in relation to the operator. Always determine R.H. and L.H. from a position in the operator's seat facing the direction of forward travel or operation.

All parts orders and all correspondence relative to the 166 unit should be accompanied by the tractor, engine, backhoe, loader, transmission, or axle serial numbers. This will properly identify the particular unit and will assure obtaining correct replacement parts. Photo Page 10

## DIAGNOSING ENGINE DIFFICULTY

### **HARD STARTING:**

- Cold air temperatures
- Insufficient fuel
- Air traps in fuel
- Incorrect timing
- Loss of compression
- Dirty nozzles
- Battery charge low
- Valve clearance incorrect
- Fuel transfer pump faulty
- Fuel injection pump faulty
- Fuel injection pump out of time

### **ENGINE OVERHEATING:**

- Low water level in cooling system
- Radiator clogged
- Fan belt slipping
- Collapsed radiator hose
- Thermostat stuck
- Engine overloaded
- Diluted lubricating oil
- Radiator fins dirty
- Water pump impeller vanes broken

### **EXCESSIVE EXHAUST SMOKE:**

- Engine overloaded
- Dirty air cleaner
- Too much fuel to engine
- Faulty fuel nozzles
- Oil consumption

### **LOSS OF POWER:**

- Insufficient fuel
- Air in fuel line
- Restriction in fuel line
- Clogged fuel filters
- Transfer pump defective
- Late injection pump timing
- Loss of compression
- Clogged air cleaner
- Sticking valves
- Valve clearance incorrect
- Faulty nozzles
- High idle RPM too slow

### **IRREGULAR OPERATION**

- Governor control linkage binding
- Compression pressure uneven
- Valves not seating properly
- Faulty fuel nozzles
- Low fuel pressure
- Low operating temperature
- Fuel injection pump out of time

### **ENGINE KNOCKING**

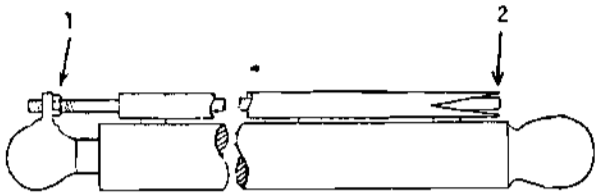
- Engine overloaded
- Incorrect fuel
- Incorrect timing
- Engine RPM too slow

ALL ADJUSTMENTS ON THE FUEL SYSTEM MUST BE MADE BY A COMPETENT MECHANIC

### ADJUSTMENT BUCKET INDICATOR:

An adjustment is provided on indicator rod to maintain alignment between casing and indicator rod (#1). The ends of both should be flush when bucket is level (#2).

To adjust, loosen jam nut on indicator rod (#1) and turn rod to proper alignment when viewed from operator's seat. Lock jam nut.

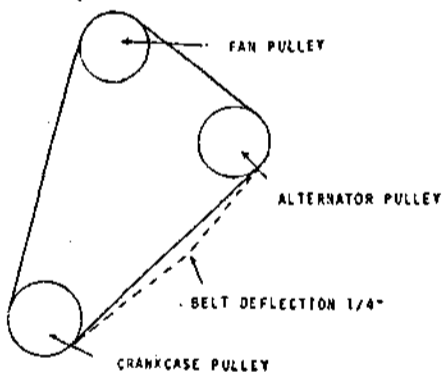


### FAN ADJUSTMENT BELT:

The fan belt adjustment must be checked periodically and the proper adjustment maintained at all times. If the belt is allowed to become loose enough to slip on the pulleys, it will greatly affect the cooling system causing the engine to run hot due to insufficient air flow and circulation of the coolant. The fan belt must not be over-tightened as it will reduce the life of alternator bearings, fan and pump shaft bearing and fan belt.

Adjust fan belt to give 1/4" belt deflection midway between the alternator and crankshaft pulleys. Belt deflection obtained by a 5 lb. force on a spring scale attached to belt.

To adjust fan belts, loosen capscrew on alternator brace and lower pivot point, move alternator toward or away from engine until the above deflection is obtained and retighten capscrew and pivot bolt.



### BACKHOE CONTROL ADJUSTMENT:

Adjust the stabilizer control levers to stand vertical. Adjust the boom and dipper control link rods until the dual control levers are parallel with mounting plate. Adjust the swing and bucket control lever link until the levers are equally positioned and a 1/2" distance is obtained between the levers at the bend. Note: All connecting links must be turned to align all connecting pin holes. This will allow links to pivot on spools and reduce binding. After adjustment is made, tighten all jam nuts.

### LOADER CONTROL:

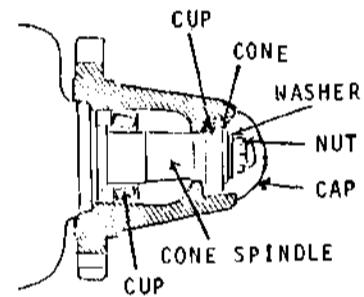
Adjust link to the loader boom control valve spool to position control lever 90° from face of instrument panel.

Adjust link to the loader bucket control valve spool until the control lever is 1 1/4" from steering wheel when lever is pulled to maximum travel toward steering wheel.

### FRONT WHEEL TREAD AND TOE IN ADJUSTMENTS:

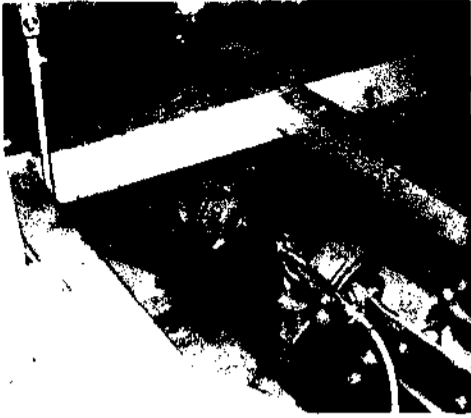
Loosen nuts on each end of tie rod and turn tube. The L.H. end has left hand threads and the right hand end has right hand threads. With wheels in straight ahead position, turn tube until the tie-in is 1/8" narrower at front than at rear of wheels at hub height. Tighten nuts back against tube.

### FRONT WHEELS:



Remove, clean and repack bearings with No. 2 wheel bearing grease every 500 hours of operation. Service more often if used in extremely wet or muddy conditions. Always replace seal when repacking bearings. Adjust wheel bearings periodically.

Tighten nut end and at the same time turning wheel in one direction and then in the other until there is a slight bind to be sure all bearing surfaces are in contact. Then back off adjusting nut 1/6 to 1/4 turn allowing the wheel to rotate freely. Secure nut at this position with cotter pin.



#### HAND BRAKE ADJUSTMENTS:

To adjust hand brake, place hand brake lever in up position. Screw knurl knob on handle either in or out until pin is in midway slotted area on handle. Push handle down. Remove yoke from brake drum housing at rear of transmission. The adjustment on yoke is to take up excessive slack in cable. Install pin through yoke. Install cotter key.

To make final adjustment of hand brake, screw in knurl knob on end of handle to tighten brake and loosen knurl knob to loosen brake adjustment as needed.

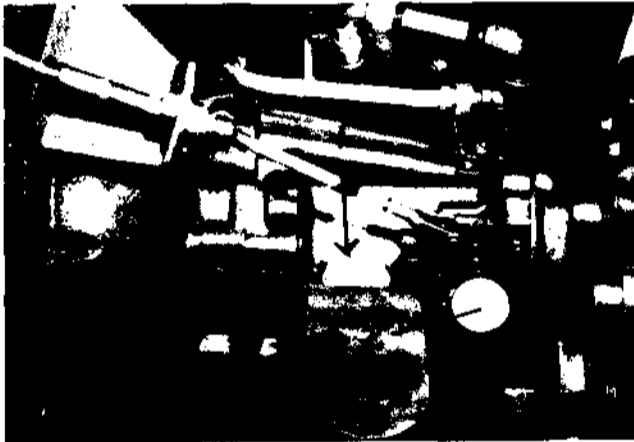
#### TIMING CAV INJECTION PUMP TO ENGINE:

The CAV injection pump is internally timed and the inspection window cover must not be removed. **NOTE:** If window cover is removed the injection pump will not be under warranty.

#### TIMING

To time pump correctly to the engine, align the timing marks on the injection pump flange to the relating mark on the pump mounting cover.

1. Timing Mark
2. CAV Injection Pump S/N
3. Fuel Filters
4. Engine Oil Filter



#### 166-13,-15 4-SPEED MECHANICAL TRANSMISSION (See Photo Page)

Check transmission oil every 100 hours. Change oil every 800 hours. Remove the magnetic drain plug and wipe all metallic accumulations from the plug. Change the oil while oil is warm from operation.

Fill with SAE-90W oil. Maintain oil level to check plug located at the center right side of transmission.

Service the Mechanical Reverser Transmission the same as above, 166-13 ONLY.

Check oil at filler cap bayonet every 10 hours. Change oil every 800 hours. Fill with ATF-B-10100.

1. Serial Number Plate
2. Oil fill and check point.

## WHEEL CYLINDERS

The wheel cylinder has two (2) opposite pistons. Each piston transfers hydraulic pressure into equal mechanical force, expanding the brake shoes to which it is connected, into contact with the brake drum.

### WHEEL CYLINDER INSPECTION:

After dismantling wheel cylinder, inspect for the following:

1. Cylinder walls must be smooth and not pitted or scratched, and be free from burrs. Remove light pits, scratches, or burrs with a hone. If cylinder does not clean up with light honing, cylinder must be replaced.
2. Occasionally grease retainers become worn allowing grease from wheel bearing to leak through in the brake drum. When grease comes into contact with the end closures, they become soft and enlarge, preventing them from protecting the cylinder from foreign matter. If this occurs, replace defective parts.

### NOTE:

A brake adjustment should be made after a wheel cylinder is removed for reconditioning as previous adjustment is lost when shoes are moved out for wheel cylinder removal. Refer to Brake Adjustments. It will also be necessary to bleed the brakes, as air will have entered the system when the wheel cylinder is removed.

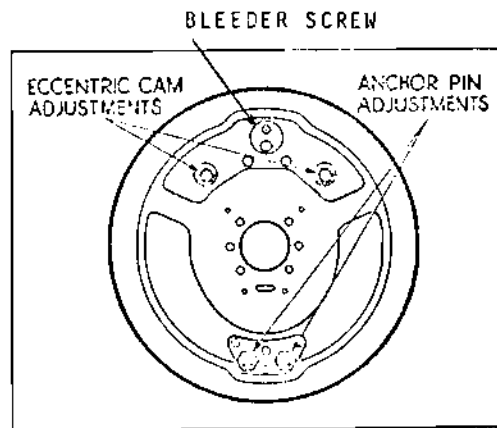
### BLEEDING BRAKES:

Since the operation of the hydraulic brake system requires a solid column of fluid without air bubbles at all points, in the brake pressure system, it becomes necessary, under certain condition, to bleed fluid from system in order to expel air bubbles which have become mixed with the fluid. The necessity of bleeding is indicated by a soft or spongy pedal.

Loosen bleeder screw located on the inside top of rear wheel and depress brake pedal slowly. Tighten bleeder screw and allow pedal to return to "off" position. Repeat this operation until air free fluid flows from bleeder screw.

Repeat procedure for other rear wheel.

Fluid withdrawn from system during bleeding operation should NOT be used again.



### MINOR BRAKE SHOE ADJUSTMENT:

When brake lining becomes worn allowing the brake pedal too much travel, it is necessary to adjust brake lining in closer relation with brake drums. This adjustment changes the toe adjustment only. The anchor adjustments are not moved. The adjustments are made at the outside of the brake backing plate by two eccentric cams.

1. Raise wheel off ground by using the outriggers. Block under the main frame at the rear of axle housing.
2. Rotate the shoe adjusting cam in the direction of axle until lining drags on drum.
3. Back off on cam until wheel turns free. Adjust both cams at the rear wheels in same manner.

## OPERATION OF POWERSHIFT SHUTTLE TRANSMISSION:

Change oil in the transmission and final drive yearly or every 800 hours of operation. Remove the magnetic drain plugs and wipe all metallic accumulations from them. Change the oil while the fluid is warm from operation. Remove the oil pump intake tube screen after the transmission and final drive has been drained. Clean it in solvent. Be sure the screen is unclogged before reinstalling it. Reinstall the transmission and final drive drain plugs and refill the compartment.

When the shuttle transmission is properly filled with oil, and the engine is operating, the following conditions exist in all gear ranges.

1. The oil pump operating at engine RPM supplies oil to the main line circuits where pressure is controlled at 120 to 140 P.S.I.
2. Controlled main line pressure is passed by the regulator valve through external passages to the converter and through internal passages to bushings for lubrication.
3. Charging pressure of 50 to 60 P.S.I. is insured by a safety check and charging pressure control valve.
4. Converter charge pressure of 15 to 25 P.S.I. is controlled by the converter regulator valve.
5. Oil flows from the converter regulator valve through external plumbing to the cooler.
6. All excess oil at the charging pressure and safety check valve is passed by the spring loaded ball in the valve through external plumbing to the sump.

### 166-15 ONLY

#### CHECKING OIL PRESSURE

##### FORWARD AND REVERSE CLUTCH CIRCUITS

Checking reversing gear oil pressure to forward and reverse clutches can be helpful in determining if pump is developing sufficient pressure to actuate clutches and to supply oil to torque converter charging circuit. Main line regulator which controls oil pressure for forward and reverse clutch circuits is located in bore of rotary control valve.

To check pressure, fasten pressure gauge, which will read up to 300 P.S.I. to 3/8 NPT opening at top rear of case above control valve.

Start engine and bring unit up to OPERATING temperature. Check oil for proper level.

Lock tractor brakes. With engine OPERATING at high no-LOAD SPEED and control lever in

neutral, gauge should read 120 to 140 P.S.I. When control lever is shifted from neutral to forward or reverse positions, little pressure change should be noted. Excessive pressure drop in forward or reverse positions indicates clutch leakage. See Trouble Shooting. Shims may be added behind valve spring in bore of rotary control valve to raise pressure.

#### CONVERTER CHARGING CIRCUIT:

Converter charging circuit oil pressure is regulated to 50 - 60 P.S.I. by charging pressure control and safety check valve fastened in the oil lines on top of unit. To check the pressure in the converter charging circuit, first check forward and reverse clutch circuit for proper operation and correct if required. Remove tee to adapter oil line and substitute line in its place which has a pressure gauge connected in it. Gauge should read 50-60 P.S.I. with engine operating at high no-load speed. If it does not, disassemble converter charging and check valve and examine the components. See Trouble Shooting.

#### CONVERTER REGULATOR:

Oil leaving converter is regulated by a converter regulator valve which is set to open at 15 - 25 P.S.I. To check converter regulator valve, first check forward and reverse circuit and converter charging circuit for proper operation and correct if required.

Remove pipe plug directly in front of reversing gear-to-oil filter tube and insert pressure gauge. Gauge should read 15 - 25 P.S.I. at high no-load speed. If it does not, remove reversing gear, and disassemble and inspect converter regulator valve. See Trouble Shooting.

#### PERFORMANCE TEST:

Before a performance test is made, the following items should be checked: Engine high no-load speed in both control lever positions, control linkages for freeness and proper operation, reversing gear for proper amount and type of oil, general condition of engine and brake adjustment.

Start the engine and bring the transmission up to operating temperature. Shift transmission into 4th gear, lock brakes and operate engine at high no-load speed. Place forward and reverse levers in forward position. Engine speed should be between 2250 and 2350 R.P.M. If engine speed exceeds 2400 R.P.M. converter or reversing gear is at fault. If engine speed is low, engine may be at fault or excessive friction is present in drive train. Repeat test in reverse. Check to see if input shaft coupling is turning while tests are being made as

difficulty may be in transmission or final drive. Refer to Trouble Shooting to determine causes of unit malfunction.

#### OPERATION OF FORWARD AND REVERSE UNIT:

When the forward and reverse unit is properly filled with oil and the engine is operating the following conditions exist in all gear ranges:

1. The oil pump operating at engine R.P.M. supplies oil to the main line circuits where pressure is controlled at 120 to 140 P.S.I.
2. Controlled main line pressure is passed by the regulator valve through external passages to the converter and through internal passages to bushings for lubrication.
3. Charging pressure of 50 to 60 P.S.I. is insured by a safety check and charging pressure control valve.
4. Converter charge pressure of 15 to 25 P.S.I. is controlled by the converter regulator valve.
5. Oil flows from the converter regulator valve through external plumbing to the cooler.
6. All excess oil in the charging pressure and safety check valve is passed by the spring loaded ball in the valve through external plumbing to the sump.

#### FORWARD:

Move the forward and reverse transmission shift lever to the extreme forward position where the spring loaded ball enters the chamfered hole in the side of the lever and properly locates in the "forward" position. With the shift lever so located, oil at regulated pressure flows from rotary control valve through porting in the case, output shaft, and drive gear into the forward clutch cylinder, actuating the forward clutch piston. The resulting movement of the forward clutch piston and the lever action of the clutch spring forces the forward clutch discs together. As the inner discs of the forward clutch are secured to the forward clutch hub by their internal teeth and the outer discs are secured to the ring gear, the application of the forward clutch piston locks the input shaft to the ring gear. This in turn prevents rotation of the planetary pinions about their own axes and thus locks the input shaft, ring gear and output shaft together, causing them to rotate as a solid concentric coupling. In this way the input shaft speed and direction of rotation are transmitted directly to the forward and reverse unit output shaft.

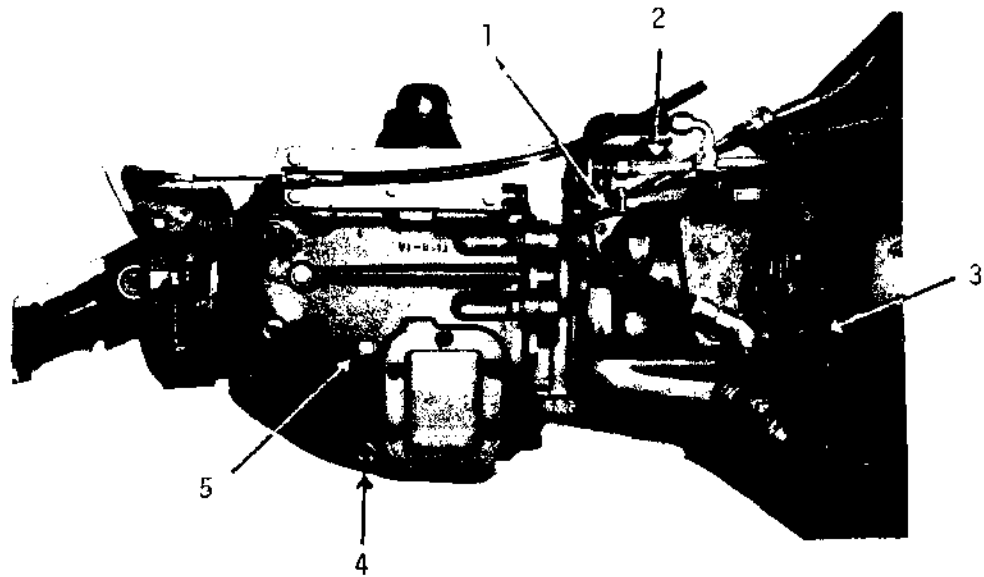
#### REVERSE:

Move the forward and reverse transmission shift lever to the extreme rearward position where the spring-loaded ball enters the chamfered hole in the side of the shift lever and properly locates it in the "reverse" position. With the shift lever so located, oil at regulated pressure flows from the control valve into porting in the transmission case, thence to the front adapter and into the reverse clutch cavity. The resulting movement of the reverse clutch piston and the reverse clutch pressure plate locks the reverse clutch disc to the transmission case. The stationary reverse clutch plates and the inner clutch discs, through their splined connectors, prevent rotation of the ring gear. With the ring gear held and the sun gear on the input shaft operating at input speed, the pinions of the compound planetary gear set are free to rotate about their own axes and reverse the direction of rotation of the pinion carrier and output shaft.

#### NEUTRAL:

Move the forward and reverse transmission shift lever to the center position where the spring-loaded ball enters the chamfered hole in the side of the shift lever and properly locates it in neutral position. With the lever so located, flow of pressurized oil to the clutches is blocked at the rotary control valve. The clutches are also vented by the rotary control valve into the sump of the case. Thus, free running open clutches and complete interruption of power through the transmission is insured.

1. Install gauge to check  
Forward and Reverse Circuit . . . . P.S.I. 120 to 140
2. Install gauge in line to check  
Converter Charging Pressure . . . . P.S.I. 50 to 60



3. Install gauge to check  
Converter Regulator Pressure. . . . P.S.I. 15 to 25
4. Remove Plug to drain oil from transmission.
5. Remove Plug to check  
Oil Level in Transmission . . . . . 10 Hours.

TROUBLE SHOOTING

| TROUBLE   | POSSIBLE CAUSE  | REMEDY   |
|---|---|--|
| Noisy Operation -<br>All Gears                        | Misalignment of converter housing or<br>converter                             | Realign converter and<br>housing                                 |
| Noisy Operation -<br>Neutral Only                     | Worn bushing in pump assembly   | Inspect pump and replace<br>parts as required                    |
|   | Worn sprags or sprag races in<br>converter                                    | Replace converter  |
|   | Oil level low   | Fill to correct oil<br>level                                     |
| Noisy Operation -<br>Reverse                          | Worn or rough planetary gears in<br>reversing gear                            | Disassemble and repair<br>unit.                                  |
| Overheating   | Oil level low   | Fill to correct oil<br>level                                     |
|   | Obstruction in oil lines or heat<br>exchanger                                 | Remove obstruction or<br>replace heat exchanger                  |
|   | Pump pressure low   | Pressure regulator<br>valve defective or pump<br>damaged or worn |
|   | Converter sprag clutch worn and<br>slipping                                   | Replace converter  |
|   | Overloading   | Shift down one gear  |
|   | Heat exchanger fins clogged with<br>dirt                                      | Blow dirt from heat ex-<br>changer with compressed<br>air        |
|   | Air fan belt loose  | Adjust fan belt  |
| Inoperative in either<br>direction                    | Pump gears siezed, converter drive<br>lugs sheared, or not engaged in<br>pump | Replace converter or<br>pump parts as required                   |
|   | Oil level low   | Fill to correct oil<br>level                                     |
| Inoperative in Forward                                | Worn or broken sealing ring on<br>drive shaft                                 | Replace drive shaft<br>sealing rings                             |
|   | Forward clutch plates worn or<br>broken                                       | Disassemble and repair<br>forward clutch                         |
|   | Worn or damaged output shaft<br>bushings                                      | Replace bushings   |
|   | Forward clutch piston sealing<br>rings defective                              | Replace rings  |
| Inoperative in Reverse                                | Reverse clutch plates worn or<br>broken                                       | Disassemble and repair<br>reverse clutch                         |
|   | Reverse clutch piston sealing<br>ring defective                               | Replace rings  |
| Forward and Reverse<br>Clutch Circuit<br>Pressure Low | Oil level low   | Fill to correct oil<br>level                                     |
|   | Pump damaged or worn  | Disassemble and repair<br>pump                                   |
|   | Regulator valve spring weak or<br>broken, or valve stuck open                 | Disassemble and replace<br>parts as required                     |
|   | Pump intake clogged   | Remove obstruction   |
| Converter Charging<br>Circuit Pressure<br>Low         | Forward and reverse clutch<br>circuit pressure low                            | See this heading under<br>Trouble Shooting                       |
|   | Converter charge and check<br>valve spring defective                          | Replace spring   |
| Converter Regulator<br>Pressure Low                   | Converter charging circuit<br>pressure low                                    | See this heading under<br>Trouble Shooting                       |
|   | Regulator valve spring weak<br>or valves stuck open                           | Disassemble and repair<br>as required                            |

TROUBLE SHOOTING

| TROUBLE                                   | POSSIBLE CAUSE   | REMEDY                             |
|---|--|------------------------------------|
| Forward and Reverse Clutch                | Defective regulator valve spring or valve stuck closed | Disassemble and repair as required |
|   | Clogged passageway                                     | Remove obstruction                 |
| Converting Charging Circuit Pressure High | Defective valve spring                                 | Replace spring                     |
|   | Obstruction in oil line                                | Remove obstruction                 |
| Converter Regulator Pressure High         | Defective valve spring                                 | Replace spring                     |
|   | Obstruction in oil line                                | Remove obstruction                 |

TROUBLE CHART

The following chart will serve as a guide for trouble diagnosis in the transmission

NOISY OPERATION

|                       | POSSIBLE CAUSE  | CORRECTIVE MEASURE                             |
|-----------------------|---|--|
| ALL GEARS             | Misalignment of converter housing or converter with transmission or engine                | Align converter assembly and housing           |
|                       | Worn universal joints   | Inspect and service as necessary               |
|                       | Rough or worn main drive bearing in four speed transmission                               | Inspect and replace bearings as necessary      |
|                       | Worn or rough gears in four speed transmission  | Replace gears as necessary                     |
| NEUTRAL ONLY          | Worn bushings in pump assembly  | Inspect pump assembly and replace if necessary |
|                       | Worn sprag or sprag races in converter assembly   | Replace converter assembly                     |
|                       | Oil level low in forward and reversing unit   | Fill to correct oil level                      |
| FORWARD - LOW ONLY    | Worn or rough low speed main shaft gear in four speed transmission.                       | Replace gear                                   |
|                       | Worn or rough low speed gear member of countershaft gear in four speed transmission       | Replace countershaft gear                      |
| FORWARD - SECOND ONLY | Worn second speed main shaft gear or countershaft gear in four speed transmission         | Replace gears as necessary                     |
| FORWARD - THIRD ONLY  | Worn or rough third speed main shaft gear or countershaft gear in four speed transmission | Replace gears as necessary                     |
| FORWARD - FOURTH ONLY | Worn or rough main drive gear or countershaft gear in four speed transmission             | Replace gears as necessary                     |

NOTE: If noise occurs in all ranges of reverse only, the trouble will probably be in the planetary gear of the forward and reversing unit. Always check this possibility before disassembling.

|                       | POSSIBLE CAUSE  | CORRECTIVE MEASURE                   |
|-----------------------|---|--------------------------------------|
| REVERSE - LOW ONLY    | Worn or rough planetary gears in forward and reversing unit                               | Replace planetary gears as necessary |
|                       | Worn or rough low speed main shaft gear or low speed member of countershaft gear          | Replace gears as necessary           |
| REVERSE - SECOND ONLY | Worn or rough planetary gears in forward and reversing unit                               | Replace gears as necessary           |
|                       | Worn second speed gear or countershaft gear in four speed transmission                    | Replace gears as necessary           |
| REVERSE - THIRD       | Worn or rough planetary gears in forward and reversing unit                               | Replace gears as necessary           |
|                       | Worn or rough countershaft gear in third speed main shaft gear in four speed transmission | Replace gears as necessary           |
| REVERSE - FOURTH      | Worn or rough planetary gears in forward and reversing unit                               | Replace gears as necessary           |
|                       | Worn or rough countershaft gear or main drive gear in four speed transmission             | Replace gears as necessary           |

#### TRANSMISSION OVERHEATING

|                                 | POSSIBLE CAUSE                              | CORRECTIVE MEASURE   |
|---------------------------------|---|--|
| FORWARD AND REVERSING UNIT ONLY | Oil level low                               | Fill to correct level  |
|                                 | Cooler too small or restricted oil passages | Cooler must be connected correctly. All external oil lines should have minimum inside diameter of 13/32 inch. Cooler must permit free flow of oil from regulator valves. |
|                                 | Pump pressure low - worn or damaged pump    | Check transmission pressures at gauging outlets. Inspect pump assembly if pressures are low. Replace pump assembly if worn or damaged.                                   |
|                                 | Converter sprag clutch worn and slipping    | Replace converter assembly   |

#### TRANSMISSION WILL NOT PULL

|            | POSSIBLE CAUSE                                      | CORRECTIVE MEASURE                                     |
|------------|---|--|
| ALL SPEEDS | Converter drive lugs sheared or not engaged in pump | Replace converter parts as necessary                   |
|            | Pump gears siezed and converter drive lugs sheared  | Replace pump assembly and converter parts as necessary |

|   |  |   |
|---|--|---|
|   | Insufficient oil in forward and reversing unit   | Fill to correct level   |
|   | Worn or damaged bushings in forward and reversing unit   | Disassemble and inspect transmission. Replace worn parts.   |
| ALL RATIOS FORWARD ONLY                 | Worn or broken sealing rings in forward clutch of forward and reversing unit   | Disassemble and inspect clutch assembly. Replace parts as necessary   |
|   | Clutch plates worn or broken in forward clutch assembly.   | Disassemble and inspect clutch assembly. Replace parts as necessary   |
| ALL RATIOS REVERSE ONLY                 | Worn or broken sealing rings on reverse clutch piston  | Disassemble and replace damaged or worn parts as necessary  |
|   | Broken or worn reverse clutch plates   |   |
| LOW SPEED ONLY IN FORWARD OR REVERSE    | Low speed main shaft gear not meshing with countershaft gear in four speed transmission  | Disassemble and inspect four speed transmission for broken gears, bent fork, or shift rails. Replace parts as necessary |
| SECOND SPEED ONLY IN FORWARD OR REVERSE | Low and second speed synchronizer collar broken or stuck. Not engaging second speed main shaft gear                                      |   |
|   | Teeth broken on second speed main shaft gear or countershaft gear  |   |
| THIRD SPEED ONLY IN FORWARD OR REVERSE  | Third and fourth speed synchronizer collar broken or not engaging clutch teeth on third speed main shaft gear of four speed transmission |   |
|   | Teeth broken on third speed main shaft gear or countershaft gear   |   |
| FOURTH SPEED ONLY IN FORWARD OR REVERSE | Synchronizer collar not engaging clutch teeth on main drive gear of four speed transmission  |   |

#### HARD SHIFTING

|                            | POSSIBLE CAUSE   | CORRECTIVE MEASURE   |
|----------------------------|--|--|
| FORWARD AND REVERSING UNIT | Rotary control valve burred or nicked                      | Disassemble valve and remove nicks or burrs.   |
|                            | Forward and reversing lever bent or interfering on housing | Remove and replace as necessary  |
| FOUR SPEED TRANSMISSION    | Synchronizer collar or blocker rings worn                  | Disassemble transmission and inspect. Replace damaged, broken or worn parts as necessary |
|                            | Gear teeth on sliding gear damaged                         |  |

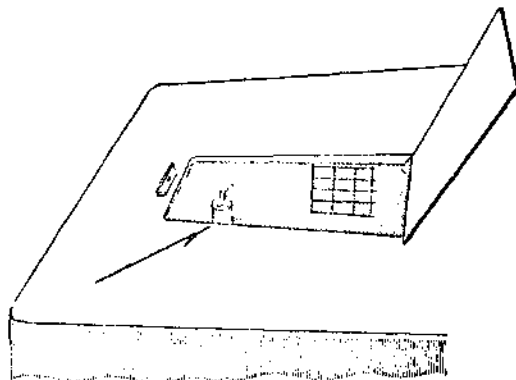
## HYDRAULIC SYSTEM DESCRIPTION

The 166 has one triple gear main pump. The first section delivers oil to the loader valve. The second section to swing valve. Power beyond 1st and 2nd section to backhoe valve. The third section delivers to power brakes and power steering, going through relief then to power brakes. Power beyond to steering and return to reservoir through oil cooler.

The 166 Hydraulic System consists of:

- A. One (1) Pump (Triple Gear).
- B. One (1) Strainer - 20 Mesh on the suction.
- C. One (1) Filter on the return.
- D. One (1) Reservoir.
- E. Thirteen (13) Cylinders.
- F. One (1) Backhoe Control Valve.
- G. One (1) Loader Control Valve.
- H. One (1) Swing and Outrigger Control Valve.
- I. One (1) Oil Cooler
- J. One (1) Steering Valve.
- K. One (1) Master Brake Valve.
- L. Two (2) Directional Brake Valves.

HYDRAULIC OIL TANK  
CAP AND DIPSTICK



The 166 loader backhoe system has a capacity of thirty-three (33) U.S. Gallons.

SAE-10 SD - Below 32<sup>o</sup>  
SAE-20 SD - Above 32<sup>o</sup>

It should be checked every ten (10) hours and changed every eight-hundred (800) hours.

The hydraulic reservoir is located at the front of the loader backhoe and is bolted to the frame. The tank has a dipstick in the top of the tank to check the hydraulic oil level and to add oil as needed.

From the tank, the oil flows through the wire mesh element located inside the tank to the hydraulic pump mounted on the front axle support. The oil will flow to the cooler through the return line filter and on to the reservoir.

The hydraulic control valves are factory set and should not be adjusted. Contact your dealer for information on control valve adjustment.

NOTE: The hydraulic system is pressurized. Release the pressure from the hydraulic reservoir before doing any service work requiring disconnecting of lines or removing of plugs. Loosen hydraulic reservoir dipstick until pressure is released.

HYDRAULIC TROUBLE SHOOTING

The following trouble shooting suggestions are presented as an aid in recognizing operational troubles, their probable cause, and the remedy. Many of these suggestions apply to the oil filter, pump, and reservoir that are used for the operation of the Backhoe, but are actually part of the loader hydraulic system.

**NOTE:** The hydraulic system is pressurized. Release the pressure from hydraulic reservoir before doing any service work requiring disconnecting of lines or removing of plugs. Loosen hydraulic reservoir dipstick until pressure is released.

BACKHOE WILL NOT OPERATE AT FULL CAPACITY:

1. Low oil level. Fill reservoir to correct level.
2. Low oil pressure. Check and adjust pressures.
3. Oil leakage. Check all connections and seals.
4. Improper installation. Recheck installation.
5. Defective pump or pump drive. Repair or replace defective parts.
6. Restriction in hydraulic lines. Check lines for restrictions.
7. Mechanical obstruction of moving parts. Correct or remove obstructions.
8. Defective control of cushion valve. Repair or replace valve.
9. Improper hydraulic oil. Use recommended oil.
10. Low pump speed. Operate unit at recommended speed.
11. Pins binding or froze. Clean and lubricate or replace pins.
12. Main relief valve setting too low. Check and adjust the relief valve.
13. Suction strainer dirty. Clean or replace with a new strainer.

HOSES FAIL:

1. Hoses incorrectly connected. Check hoses and reconnect correctly.
2. Hoses rubbing on unit. Reposition hoses.
3. Main relief valve pressure setting too high. Adjust to correct pressure setting.
4. Boom, crowd, or bucket circuit hoses breaking. Check and adjust circuit relief valves.

HYDRAULIC SYSTEM NOISE:

1. Low oil supply. Fill reservoir to correct level.
2. Air in system. Tighten fittings on suction side of pump.
3. Improper hydraulic oil. Use recommended oil.
4. Damaged or worn pump. Repair or replace pump.
5. Clogged suction line. Check for kinks and blockage. Repair or replace.
6. Oil not at operating temperature. Run engine until oil reaches proper temperature.

HYDRAULIC CYLINDER FAILURE:

1. Leaking or broken hoses. Check for rubbing hoses, repair or replace.
2. External cylinder oil leakage. Repair or replace seals or defective parts.
3. Internal cylinder oil leakage. Repair or replace piston packing or defective parts.

CONTROL VALVE FAILURE:

1. Sticky valve spool. Check for dirty or binding spool, clean or correct defective spool.
2. Spool or valve section external oil leaks. Replace seals.
3. Spools not returning to neutral. Check centering spring. Check for bent spool, dirt, binding. Repair or replace.
4. Spool by-passing oil. Replace valve section.
5. Check valve not holding. Check for defective poppet or seat. Repair or replace.
6. Circuit relief valves defective. Repair or replace.
7. Anti-cavitation valve defective. Repair or replace.

SWING SYSTEM FAILURE:

1. Swing cylinder leaking. Replace defective seals or parts.
2. Relief valve stuck open. Clean or replace valve.
3. Incorrect cushion relief pressure. Check and adjust for correct relief pressure.

4. Faulty cushion valve. Check for defective parts and replace.
5. Broken swing mechanism. Repair or replace.

#### OIL HEATING:

1. Relief pressure set too low. Correct setting of valve.
2. Excessive oil by-pass over relief by holding control levers too long. Release levers before reaching end of cylinder travel.
3. Wrong viscosity oil used. Use correct oil.
4. Oil level low in reservoir. Maintain proper oil level.
5. Defective cylinders. Repair or replace.
6. Defective pump. Repair or replace.
7. Dirty or plugged cooler. Clean the cooler.

#### OIL FOAMING:

1. Air leaking into low pressure line. Tighten fitting or replace line.
2. Water in oil. Drain and refill with new oil.
3. Wrong type oil used. Drain and refill with correct oil.
4. Too much oil passing over relief. Repair or adjust relief valves, use correct operating methods.
5. Low oil level.

#### LOW LIFT OR CROWD CAPACITY:

1. Low oil supply. Check and add oil if necessary.
2. Low relief valve settings. Correct settings.
3. Missing bucket teeth or shanks (crowd circuit). Replace as necessary.
4. Leaking hoses or fittings. Repair or replace.
5. Defective anti-cavitation valve (boom cylinder circuit). Repair or replace.

#### NOISY PUMP:

1. Oil supply low. Fill reservoir to proper level.
2. Strainer clogged, starving pump. Clean strainer.
3. Cold oil. Operate at idle to warm up oil.
4. Air in system. Tighten connections.
5. Loose or worn parts. Replace worn parts.

#### CONTROL VALVE SPOOLS DO NOT RETURN TO NEUTRAL:

1. Broken springs. Replace springs.
2. Bent spool. Replace valve.
3. Foreign particles. Clean system.
4. Misalignment of operating linkage. Align linkage.

#### LIFT CYLINDER CONTROL VALVE SPOOL WILL NOT STAY IN FLOAT POSITION:

1. Worn detent. Replace detent.
2. Broken detent. Replace detent.

#### NO MOTION, SLOW OR JERKY ACTION OF HYDRAULIC SYSTEM:

1. Load larger than capacity. Check specifications.
2. Relief valve not properly adjusted. Adjust relief valve.
3. Foreign particles in valve. Disassemble and clean.
4. Leaky conditions on control valve. Replace "O" rings and tighten.
5. Sheared drive key. Replace key.
6. Worn pump. Repair pump.
7. Defective valve. Replace valve.
8. Low oil level.

#### HYDRAULIC CYLINDERS

##### - SEAL REMOVAL & REPLACEMENT -

#### GENERAL & PREPARATORY:

The following information concerns step by step procedures for internal servicing of all cylinders. In all cases, if possible, use the specific cylinder assembly drawing as an additional service reference. The material is grouped in sequence in three sections---

1. Preparation of the cylinder for service: Withdrawal of the piston rod head group, as a single assembly from the cylinder case and breakdown of this assembly into components.
2. Actual "seal removal and replacement": A bench procedure involving only the cylinder head, piston and related seals.
3. Reassembling the piston rod head group: Insertion into the cylinder case and completion of the service procedure.

SUGGESTED - RECOMMENDED SMALL TOOLS:

Spanner Wrench (#7005358). Fits all cylinder heads (bores 2 1/2" diameter and up) and fits all buttress threaded circular piston nuts (where used). Buttress nut locks need 3/16" Allen Wrench.

Spanner Wrench (common scissor type with 1/4" spuds). Fits all cylinder heads (bores 2" diameter and down).

Hex Nut Socket & Handle. Fits all "V" thread piston nuts. See nut torque chart of Section 3 for size. (1-1/4" max.).

Needle Nose Plier and Ice Pick or Sharp Pointed Awl. For removal and replacement of seals (Use as further instructed only).

No ring compressors, assembly sleeves, mauls or other tools required. Avoid all possible use of pipe or chain wrenches.

CAUTION: If solvent is used to clean internal components or internal of case, all traces must be blown, or wiped dry, or otherwise removed. Any residual solvent will attack and destroy the seals. EXCEPTION: Seal kit numbers with second diget "V" (Viton). Standard seal kits, second diget "0", compatible with normal petroleum base fluids ONLY.

WARNING: Little withdrawal or reassembly force, push or pull is necessary since the piston is almost frictionless in the cylinder bore. Do not use air pressure to "assist" in withdrawal or to retract cylinder rod. An instantly explosive compressed air missile action will result.

#### 1. PREPARATION OF THE CYLINDER FOR SERVICE

- (A) Open all ports. Remove any "checks" or demountable valves and drain of all oil. Use care not to damage any above involved seals unless they are to be replaced new and are on hand. They are not included in this seal kit and must be ordered separately, and service instructions on these items are not included herein.
- (B) Wipe, wash, or otherwise clean outside of cylinder of any loose dirt, etc. Provide CLEAN AREA for disassemble, reassembly.
- (C) Position and secure the cylinder for procedure with rod fully retracted. Note suggested positions below. All show situation at point of final withdrawal of rod assembly or insertion on reassembly.
- (D) Screw head completely out of threads, 1/2 inch of the head (Pilot "0" ring end) still supports and loosely centers the rod boss end of the assembly.
- (E) If cylinder is in the horizontal position, slightly raise rod end to center (to take load off head pilot, then completely withdraw assembly from the case. Do not allow a long or heavy assembly to hang horizontally unsupported while partially withdrawn from the case.
- (F) Position and secure piston rod head assembly for final breakdown into components.
- (G) Remove piston nut, piston nut plate (if any), and the piston. Pick out the stinger static "0" ring and remove any piston thrust plates. Slide off any included stop tube and the cylinder head.

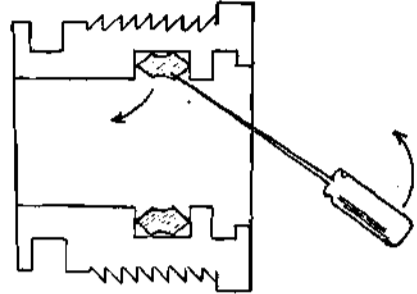
NOTE: If the cylinder drawing is not available for reference, a sketch or notation must be made during component removal from the cylinder rod since each part must take its original relative position on reassembly. Wipe excess oil from head and piston and proceed below.

## 2. ACTUAL SEAL REMOVAL & REPLACEMENT

This is a bench procedure and should be done in a clean warm (70° +) area, as the seals are much more pliable, workable and less subject to installation damage when warm. **IMPORTANT:** use tools only as suggested below with maximum emphasis on use of "fingers only" to prevent damage to the relatively soft metal seal pockets and grooves, and prevent "fretting", slivering, cutting or otherwise damaging seals during installation. Do not attempt removal or replacement of piston seals unless or until piston has been removed from the rod and is a single unit.

### HEAD SEAL REMOVAL

- A. Crowd a slack section in the "O" ring with fingers and roll it out of it's groove.
- B. Pick back-up washer out of groove with needle nose pliar.
- C. Pinch wiper lip with pliar and pull out of pocket.
- D. Position head with wiper pocket up on bench. Puncture "U" cup (with ice pick or awl) at any point on the "heel-belly" corner. Pry and lift this section out of groove. Push cup down the rod hole and away from you. This will peel and roll the cup out and free of its pocket. Remove with fingers.



### PISTON SEAL REMOVAL

- E. Piston with cast iron rings. Spread rings at split. Push over ring land and off nearest end of piston.
- F. With a thin blade, putty knife corner or steel rule, carefully pry up a section of the teflon ring until it can be gripped with the pliar, then twist, break and remove ring.
- G. Carefully "prick" "O" ring at a point (with a pin or needle), lift out of groove and remove with fingers.

Wash and dry, or otherwise clean head and piston. Carefully dress any accidentally caused nicks or gouges. Do not preassemble oil or otherwise lubricate head, piston or seals. The added slipperyness at this point may create more problems than it will solve. Lubricate only as suggested below.

### PISTON SEAL REPLACEMENT

- H. Install "O" ring (the one under the teflon ring), making sure it is free of twists.
- I. Position piston (nut face down) on the bench. The teflon ring installation described in 2 - J (below) for all piston styles must be made from side opposite piston nut face.  
**WARNING:** The teflon ring cannot be "slid" over the major diameter of the piston at once without rendering the ring useless, since this will stretch the ring beyond it's elastic limit. It cannot properly contract into it's groove (after installation) and, therefore, will likely "sag" out of it's groove, get caught, cut and destroyed in the thread assembly bevel area of the cylinder case, when final assembly is attempted. Proceed only as instructed. The objective is to: get the ring into position, free of twists without "fretting" or slivering off particles of the teflon and with the least possible stretch. The procedure is much the same as "walking" a steel beaded automotive tire of and down into a drop center rim wheel, but with fingers only for tools.
- J. "Walk" the teflon ring over and down into the first ring groove---it almost falls on. The ring is half-way home, but the next move is tougher. Extra long pistons have additional walk-on, drop center assembly grooves. Piston without cast iron rings have a smaller diameter hub which serves the same purpose as an assembly groove.
- K. Stand piston on edge, either on table or in your lap. You will be working from left to right if right handed. If you are a lefty, reverse position. With thumb and forefinger, pick up a thumbs length section of the ring. Move it over and down on top of the "O" ring, and thumb force it down tightly. Progressively, a little at a time, slide the rest of the ring across and down into the groove while closely following up with a smoothing thumb. Keep cross-over section as short as practical so that total ring circumference is at a minimum and stretch is least. As soon as noticed, straighten any developing twists. Continue procedure until installation is complete. Smooth the entire ring circumference with the fingers. The ring will contract enough to affect a snug fit to the "O" ring underneath and should project out from the piston surface by approximately 1/32 inch.

- L. Install any included cast iron rings from their nearest sides.

#### HEAD SEAL REPLACEMENT

- M. Install "O" ring and back-up. Same relative position as removed.
  - N. Position cylinder head on bench (Rod wiper pocket up).
  - O. Place "U" cup on bench (heel up, lips down). Finger force cup into a closed "C" shape. With pliar, grip and hold cup in this position.  
Insert into cup head groove. Release pliar and allow cup to snap into position. Help with fingers if necessary.
  - P. Install wiper (lip facing outward).
- Torque tolerance is plus or minus 10%, straight pull or impact.  
See torque chart.

#### 3. REASSEMBLY

- A. With clean, non-fibrous bearing grease, generously smear the rod hole in the head as well as the exposed surfaces of the "U" cup and rod wiper.
- B. Carefully start the wiper lip over the stinger rod step or shoulder (no hammers) and onto the rod proper. Push head all the way to rod pin boss.
- C. Replace any previously removed stop tube on the rod, while making sure the position retaining or dimpled lip of the tube is away from the head and is holding the tube from slipping down the rod. Re-dimple that edge, if necessary.
- D. Replace any included thrust plates up against the stinger rod stop or shoulder.
- E. Generously lubricate or grease (non-fibrous grease) the entire exposed stinger thread area and install the "O" ring (piston slinger) in it's groove, free of twists.
- F. CAREFULLY (to avoid scuffing), and with nut face toward you, move piston over thread area onto pilot surface next to the "O" ring, with a rotary motion, hand force piston over the "O" ring and up against thrust plates or stinger shoulder. (No hammers).
- G. Replace any piston nut plate (washer) and start the piston nut. Tighten nut and torque as indicated on torque chart. Buttress nuts not included in seal kits. Normally not needed new.
- H. Fill cylinder case threads and generously smear assembly bevel area just beyond the threads, using the non-fibrous bearing grease.
- I. Oil can squirt and hand pat smear (with cylinder oil) the entire piston bearing and seal areas. Grease smear the head "O" ring and threads.
- J. With piston rod head group aligned with the cylinder case bore, insert piston into case thread area. Models with cast iron rings require slight finger compression of the rings for case entry. A very slight up and down or side to side (not rotary) at the rod pin boss end will help the seals through the assembly bevel area. While holding alignment, slide the piston down the bore until the pilot end of the head enters the case and now supports it's end of the assembly.
- K. Start the threads by rotating (clockwise) the rod pin boss while further centering with and pushing down the bore. Continue to hand crank the rod boss until the rod begins to turn in the head, then take over with the spanner wrench. Turn on down to shoulder and torque as specified.
- L. Replace any checks or valves removed in 1 - A.

TORQUE CHART FOR HYDRAULIC CYLINDERS

166-16 BACKHOE

| CYLINDER | HEAD FT. LBS. | ROD NUT FT. LBS. |
|----------|---------------|------------------|
| Boom     | 600           | 800              |
| Crowd    | 600           | 800              |
| Bucket   | 400           | 800              |

166-13 BACKHOE

|         |     |     |
|---------|-----|-----|
| Boom    | 400 | 700 |
| Crowd   | 400 | 700 |
| Bucket- | 300 | 700 |

166-13 BASE MACHINE

166-15

|               |     |     |
|---------------|-----|-----|
| Swing         | 300 | 700 |
| Loader Lift   | 200 | 600 |
| Loader Bucket | 125 | 600 |
| Loader Bucket | 125 | 600 |
| Outrigger     | 400 | 700 |

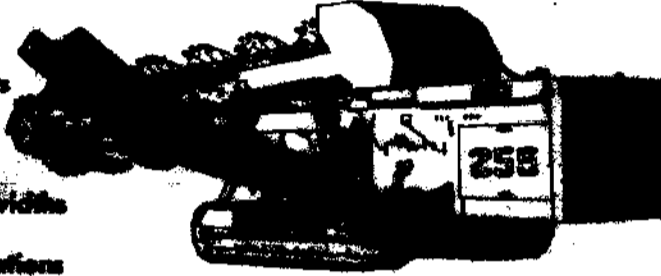
Western Machinery Co - Toledo

838-5014

BOB ROCKWELL FIELD - SAUBERMAN

# NOTHING DIGS SO WELL AS A PARSONS

- ★ 15 Models
- ★ Wheel and Ladder Types
- ★ Up to 25 foot depths
- ★ From 6 inch to 6 foot widths
- ★ 25 Width-Depth Combinations



A Parsons TRENCHER teamed up with the old Parsons Backhoe-Loader is the best team to get the job done fast and well. Both are strong on performance and the better the performance the more profits are made.

The benefits of owning and working the Parsons Tranchers are the results of over 60 years of development and manufacturing of a complete line of sizes of Tranchers.

The many features that are incorporated in all of the Parsons Tranchers are all designed to provide top performance at a low operating cost to produce exceptionally high ratio of profits.

See your Parsons distributor - he will show you why the TRENCHER lasts so long - - why so few repairs and replacement parts are needed to keep your jobs on schedule.



**Parsons**

Division of Korsching Company  
Stouten, Iowa 50208

P-168-172-\$2.50

Printed in U.S.A.