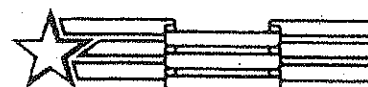


Ingersoll

HYDRAULIC SYSTEM
HOW IT WORKS
Service Manual 9-50884

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QUALITY IN THE AMERICAN TRADITION

Ingersoll Tractor Company

Portland, ME 04103

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DEFINITIONS OF MAJOR COMPONENTS

RESERVOIR

1. **Atmospheric hydraulic reservoir.** This is the hydraulic oil storage tank. The area above the oil level is vented to the atmosphere through a small, baffled hole in the fill cap. The reservoir also helps to dissipate heat created when the hydraulic system is working and is internally baffled on some units to prevent aeration of oil.

SUCTION LINE

2. **Pump inlet line (commonly called suction line).** This hose or tube carries oil from the reservoir outlet to the pump inlet. It normally operates under negative pressure (created by gear rotation at the pump inlet) must be non-collapsible and connections must be tight to prevent air entry. On units with two section gear pumps, the reservoir may have two outlets and the pump will have two inlets.

PUMP

3. **The hydraulic pump is gear type, positive displacement and driven by the engine crankshaft.** As shown in Fig. 1 the gears rotate in the direction of the heavy black arrows drawing oil into gear tooth pockets (on the inlet side) and trapping oil between the gears and pump housing as the gears rotate. Oil is discharged on the outlet side as the gear teeth come back into mesh with each other. The pump is equipped with a pressure-balanced loading or wear plate to provide an effective seal for the gear ends over a full range of operating pressures. Return oil passages are provided in the pump housing and idler gear shaft to prevent pressure buildup behind the shaft seal.

The purpose of the hydraulic pump is to create oil flow (measured in gallons per minute (GPM) or liters per minute (l/min)).

Resistance to flow resulting from work done by the hydraulic motor or cylinder causes pressure in the system. This is measured in pounds per square inch (PSI) or kilopascals (kPa).

Some units are equipped with a two section gear pump. The two sections are stacked one behind the other and the pump drive shaft is common to both sections. Each section provides oil to separate hydraulic circuits. The size of each gear section and pump speed determines the displacement of each section.

SYSTEM RELIEF VALVE

4. Some units, depending on model and PIN number, are equipped with a separate **system relief valve**. Maximum system pressure in that circuit is controlled by the relief valve setting.

TRAVEL CONTROL VALVE

5. **The travel control valve** is of open center design. Depending on model and PIN number, this valve may also contain pressure relief for travel circuit, attachment lift circuit, and/or holding valve. The valve controls the direction of oil flow and the volume of oil flowing in each circuit.

The travel control spool is manually centered on tractors and spring centered on 600 and 6000 series loaders.

The attachment lift spool (optional on some model tractors) is spring centered and also has float position with detent mechanism.

Travel control valves on 600 series loaders are equipped with a power-beyond sleeve which connects the open center passage to an additional external port and on to the loader bucket valve/power steering valve.

To achieve full speed and power, the valve spool must be moved to the end of its stroke. To achieve the variable speed or feathered action of hydraulic motor or cylinder, the valve is moved less than full stroke. This divides the oil flow from the pump between the work device (motor or cylinder) and return to reservoir.

For clarity, most oil flow diagrams are shown with the valve spool in neutral or fully stroked.

6. **Full range hold valve.** The full range hold valve is a single, spring centered spool in the valve body with pressure sensing orifices and check valves. It provides dynamic braking of the hydraulic drive system automatically over the full range of travel speeds and engine throttle settings.

This valve may be a separate body installed between the control valve and motor or may be built into the travel control valve.

DEFINITIONS OF MAJOR COMPONENTS (cont.)

TRANSAXLE HYDRAULIC MOTOR

7. The hydraulic motor produces rotary motion from the hydraulic flow created by the pump to turn the two speed transaxle. The motor will perform with equal efficiency in either direction yielding a full and equal range of speed and power in both forward and reverse.

LIFT CYLINDER

8. The attachment lift cylinder lifts when extending and lowers when retracting. The cylinder piston seal is an o-ring and there is an o-ring and wiper seal on the piston rod.

POWER STEERING VALVE

9. Some models are equipped with power steering to reduce operator steering effort. The power steering valve directs hydraulic pump flow to either end of the double acting power steering cylinder while also diverting return oil from the opposite end of the cylinder. The power steering valve may also contain a relief valve to control maximum pressure in the power steering circuit.

In situations where tractor hydraulic pump cannot supply oil to the power steering valve (such as dead engine), the power steering valve will then act as a manual steering pump. Manual steering will continue as long as oil is available to the power steering valve.

POWER STEERING FLOW DIVIDER

10. Some power steering model tractors are equipped with a power steering flow divider. As its name implies, the flow divider splits hydraulic pump flow between the power steering circuit and the tractor hydraulic system.

The flow divider also acts as a priority valve to ensure that the first 2.0 GPM (7.6 liters/min.) goes to power steering. After priority flow to power steering is satisfied, the remainder of the hydraulic pump flow supplies the tractor hydraulic system.

HYDRAULIC PTO VALVE

11. The hydraulic PTO valve (optional on some tractors) is of open center design and is connected into the system to provide hydraulic oil for hydraulic driven attachments. On some models, this valve may contain a circuit relief valve.

FLOW CONTROL VALVE

12. The flow control valve (optional) is designed to provide a more sensitive control of the oil going to the travel control valve. This valve may be installed where an operator performs a lot of idling and requires a more absolute control at low ground speeds. This valve contains a rotary orifice operated by the handle allowing from no flow to full pump flow to the travel control valve.

LOADER VALVE

13. The two spool loader valve is of open center design and used on tractors equipped with loader. One spool directs oil to the loader lift cylinders; the other spool directs oil to the bucket tilt cylinder.

BACKHOE VALVE

14. The backhoe valve is of open center design and is comprised of a series of individual valves stacked together. This valve controls all operations of the backhoe assembly and is a part of the backhoe. Tractor hydraulic pump supplies oil to the backhoe valve.

EXPLANATION OF CODING KEY

The following flow diagrams have been coded for ease of understanding. The following coding is used.



is used to designate supply oil to the hydraulic pump. This includes oil in the reservoir and the suction line. This oil is either at atmospheric pressure or below.



is used to designate pump supply oil (oil leaving the pump outlet port). This oil flow will be considered pump flow until it enters a work device (cylinder or motor) or a return oil passage. The pressure of this oil is determined by the resistance to flow caused by the work device (motor or cylinder) and is limited by the relief valve.



is used to designate return oil. Oil with a free flow path back to the oil cooler and reservoir will be considered return oil. Return oil is always low pressure.



is used to designate power beyond oil. This oil is routed through the travel or backhoe valve and out the power beyond sleeve to down stream attachments. The addition of a power beyond sleeve routes relief oil flow back to the reservoir preventing relief pressure stacking.



is used to designate retard oil flow or hold valve oil flow - This is return oil from the hydraulic motor, restricted at the return port of the travel valve. The pressure of this oil flow will vary with the amount of retard being applied.



is used to designate series connection oil. This system design provides for hydraulic circuits to be connected in series. Series connection oil is oil from the return side of one work device that is energizing a second work device. That is, return oil from the first device becomes supply oil for the second.

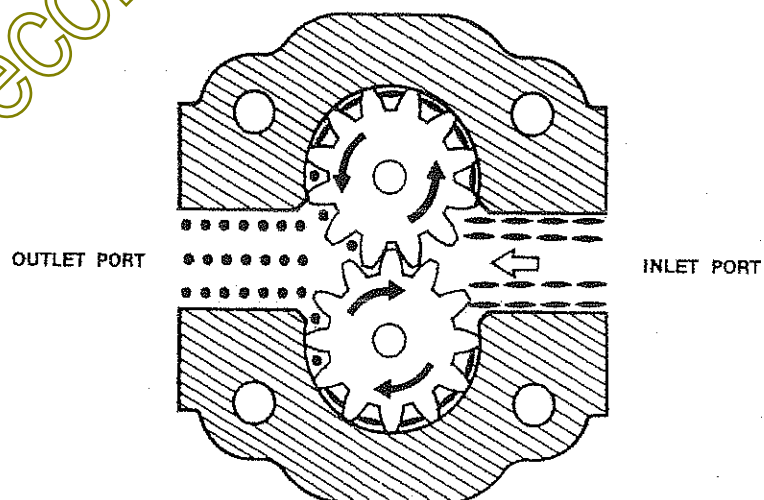


is used to designate controlled flow oil. Metered oil from the optional flow control valve to the travel valve inlet in the controlled flow oil. This oil flow is adjustable from stop to full flow by turning the rotary orifice of the valve.



is used to designate static oil. This is oil trapped by valving in the system with no way of escape.

HYDRAULIC PUMP
FIGURE 1



200-400 SERIES TRACTORS WITH HYDRAULIC LIFT

OIL FLOW

Neutral Drive - Neutral Lift

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the travel valve.

TRAVEL CONTROL VALVE

Both the travel and lift spools are in neutral providing an open, resistance free pathway, for the oil to follow through the valve. From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

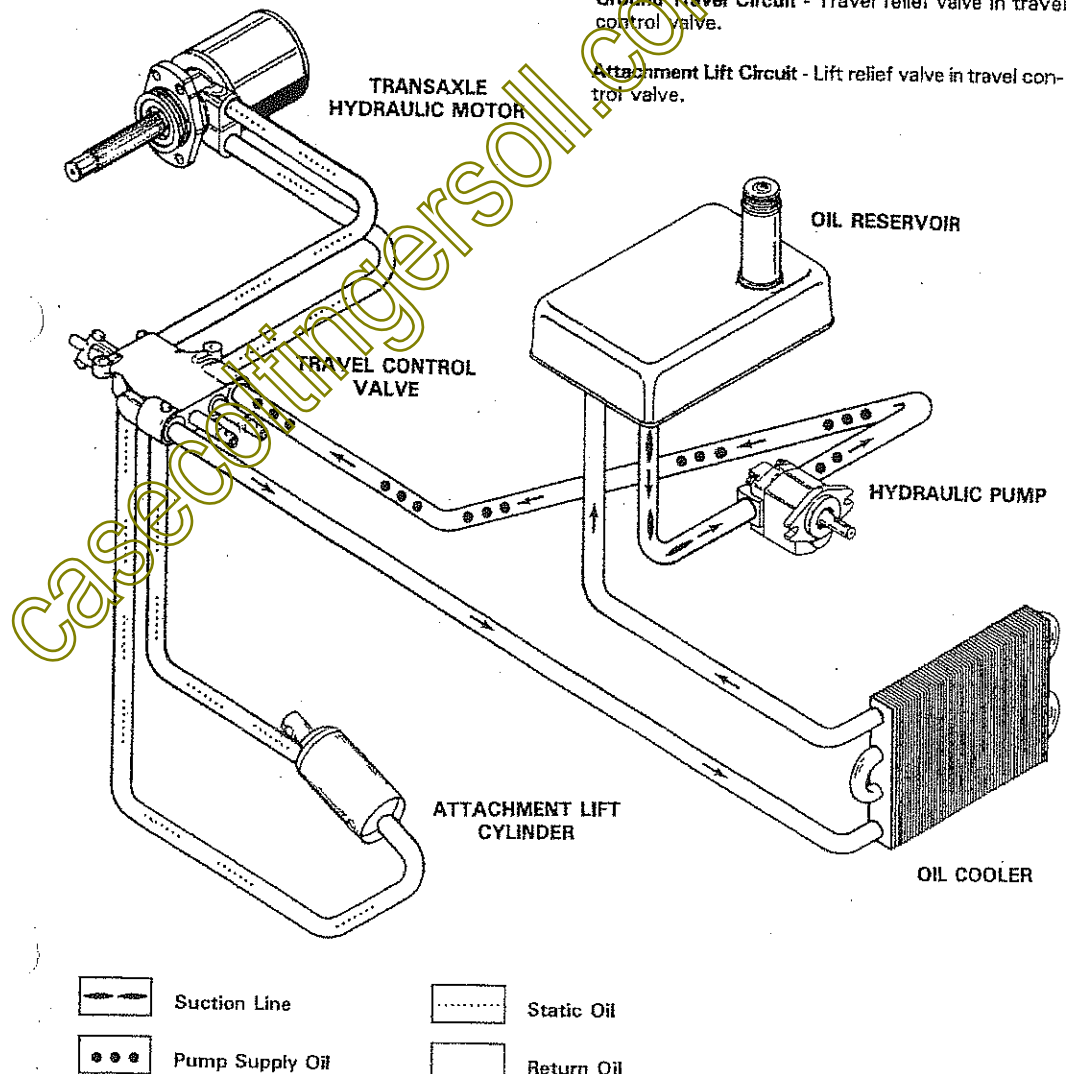
MOTOR AND CYLINDER

The transaxle hydraulic motor and lift cylinder are static.

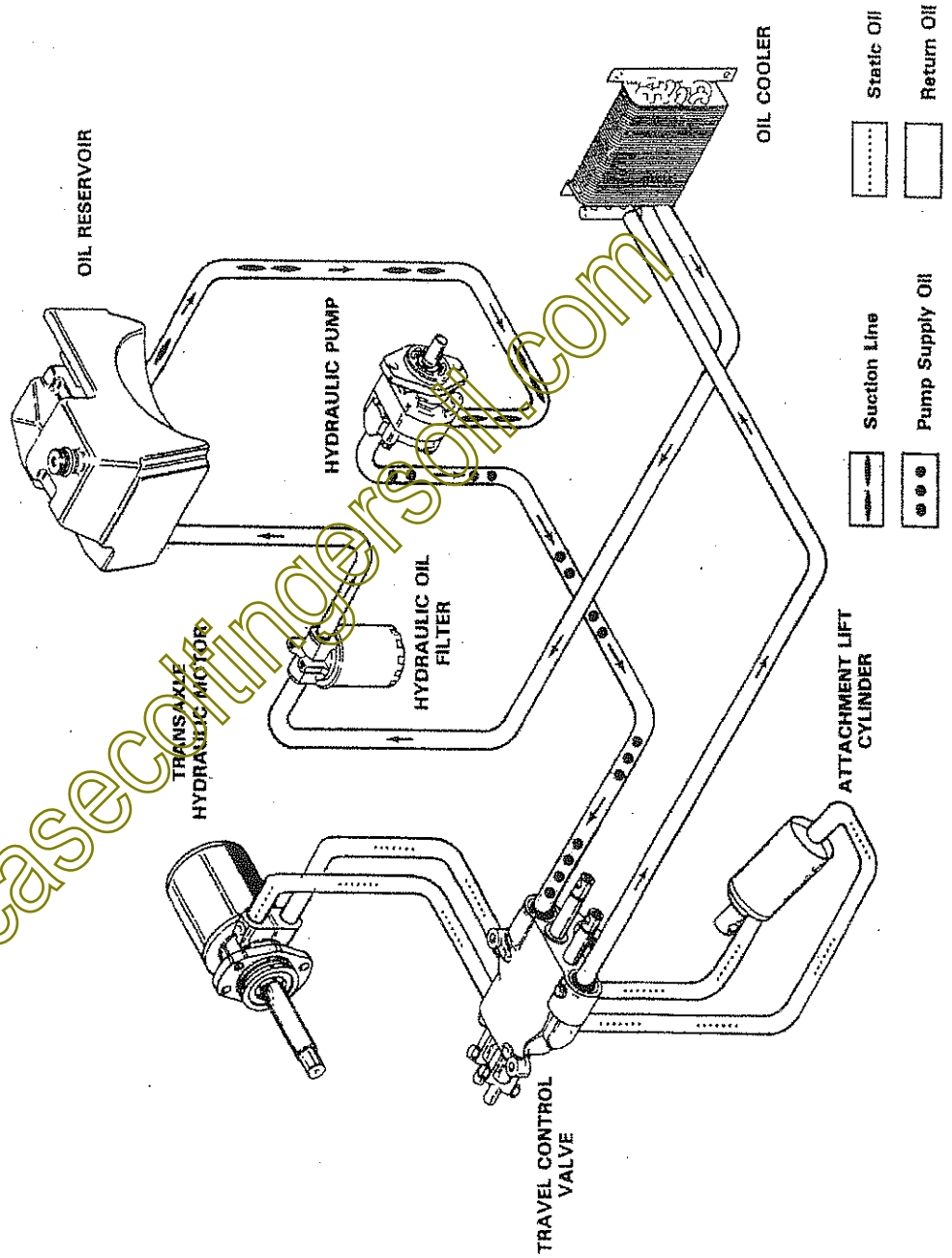
RELIEF VALVE LOCATIONS

Ground Travel Circuit - Travel relief valve in travel control valve.

Attachment Lift Circuit - Lift relief valve in travel control valve.



3000-4000 SERIES TRACTORS NEUTRAL DRIVE - NEUTRAL LIFT



3000-4000 SERIES TRACTORS

OIL FLOW

Neutral Drive - Neutral Lift

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet of the pump and discharged from the outlet side of the pump into the inlet of the travel valve.

TRAVEL CONTROL VALVE

Both the travel and lift spools are in neutral providing an open, resistance free pathway, for the oil to follow through the valve. From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

On later production units, a hydraulic oil filter is located between the oil cooler and the reservoir.

MOTOR AND CYLINDER

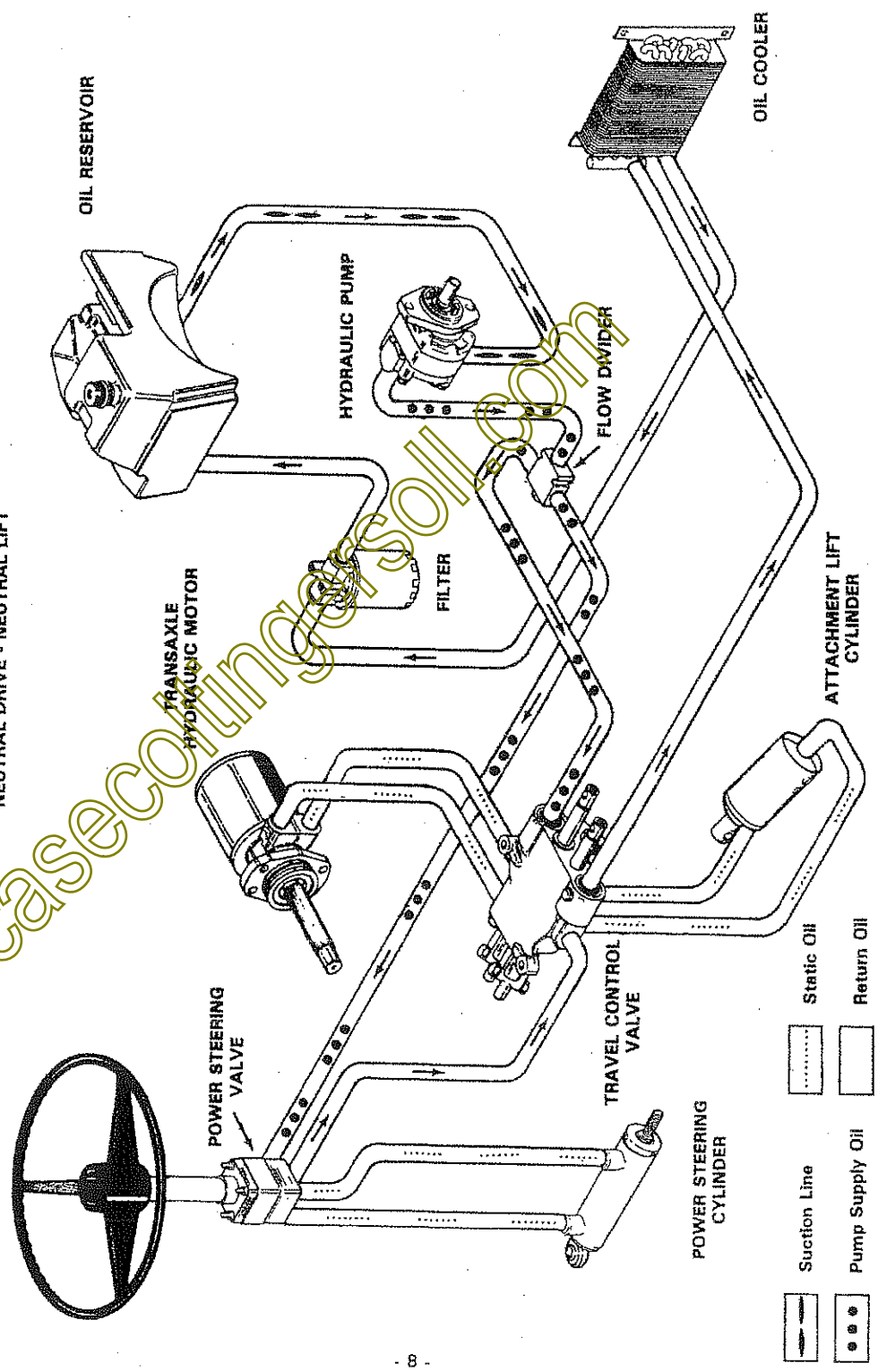
The transaxle hydraulic motor and lift cylinder are static.

RELIEF VALVE LOCATIONS

Ground Travel Circuit - Travel relief valve in travel control valve.

Attachment Lift Circuit - Lift relief valve in travel control valve.

3000-4000 SERIES TRACTORS WITH POWER STEERING PRIOR TO PIN 14167800
 NEUTRAL DRIVE - NEUTRAL LIFT



3000-4000 SERIES TRACTORS WITH POWER STEERING
PRIOR TO PIN 14167800

OIL FLOW

Neutral Drive - Neutral Lift

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump to the inlet of the flow divider valve.

FLOW DIVIDER VALVE

Oil enters the flow divider valve and contacts the flow divider spool. The first 2 GPM (7.6 liters/min) is diverted to the power steering valve as priority flow. Additional flow shifts the flow divider spool and diverts the remainder of pump flow to the inlet of the travel control valve.

POWER STEERING VALVE

Priority flow from the flow divider valve enters the power steering valve. During a turning mode, the power steering valve diverts pressure oil to one end of the cylinder. In a non-steering mode, inlet flow passes thru the steering valve and is directed out the return port of the steering valve.

Return oil from the power steering valve is connected to the case drain port on the R.H. side of the travel control valve. Return oil then joins control valve return oil going to the oil cooler, hydraulic filter and reservoir.

TRAVEL CONTROL VALVE

Both the travel and lift spools are in neutral providing an open, resistance free pathway, for the oil to flow through the valve. From the valve outlet, oil flow continues through the oil cooler, hydraulic oil filter and back to reservoir.

MOTOR AND CYLINDER

The transaxle hydraulic motor and lift cylinder are static.

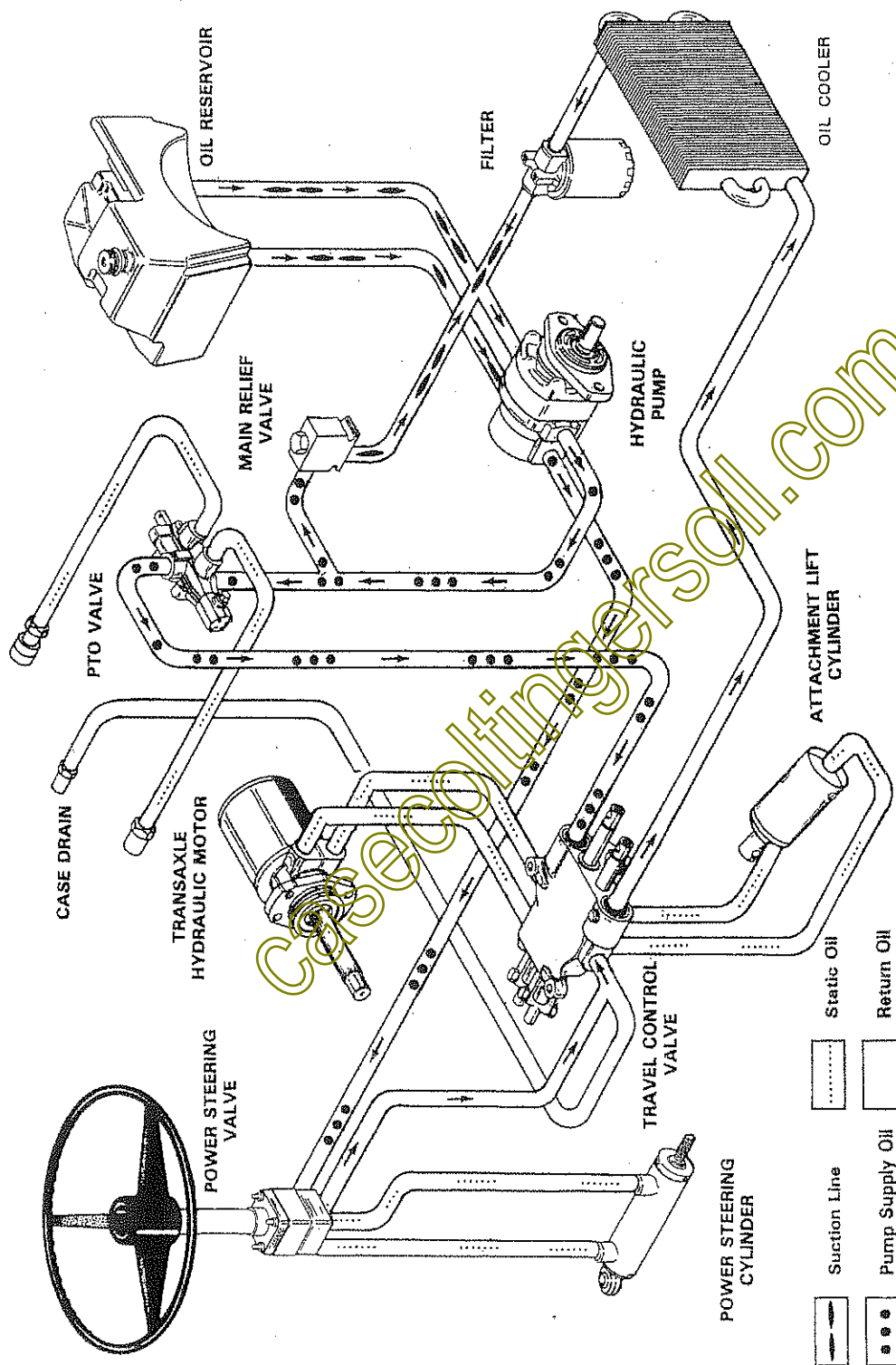
RELIEF VALVE LOCATIONS

Power Steering Circuit - Power steering relief valve in power steering valve.

Ground Travel Circuit - Travel relief valve in travel control valve.

Attachment Lift Circuit - Lift relief valve in travel control valve.

3100-4100 SERIES TRACTORS
NEUTRAL DRIVE - NEUTRAL LIFT - HYDRAULIC PTO DISENGAGED



3100-4100 SERIES TRACTORS

OIL FLOW

Neutral Drive - Neutral Lift - Hydraulic PTO Disengaged

PUMP

The hydraulic pump used on these models is a two section gear pump. The front pump section (nearest pump shaft end) supplies oil to the hydraulic PTO and travel control valve. The rear pump section (furthest from pump shaft end) supplies oil to the power steering valve.

Oil is drawn from the reservoir through the suction lines and into the inlet sides of each pump section. Oil is discharged from the outlet side of the front pump section to the inlet of the PTO valve. Oil is discharged from the rear pump section to the inlet of power steering valve.

POWER STEERING VALVE

Oil from the rear pump section enters the power steering valve inlet. During a turning mode, the power steering valve diverts pressure oil to one end of the power steering cylinder and allows oil to return from the opposite end of the cylinder. In a non-steering mode inlet flow passes through the steering valve and is directed out the return port of the steering valve.

Return oil from the power steering valve is connected to the case drain port on the R.H. side of the travel control valve. Return oil then joins control valve return oil going to the oil cooler, hydraulic filter and reservoir.

MAIN RELIEF VALVE

Oil from the front pump section is directed to the hydraulic PTO valve and main relief valve. If hydraulic oil pressure in the hydraulic PTO circuit or travel control circuit exceeds the main relief valve setting, the relief valve will open.

Oil passing over the main relief valve is directed to the inlet side of the front pump section.

HYDRAULIC PTO VALVE

Oil from the front pump section is directed to the inlet of the PTO valve via the main relief valve. With the PTO valve in the OFF or disengaged position, oil passes through the valve to the outlet port. From the valve outlet, oil flow continues to the travel control valve inlet.

TRAVEL CONTROL VALVE

Both the travel and lift spools are in neutral providing an open, resistance free pathway for the oil to follow through the valve. From the valve outlet, oil flow continues through the oil cooler, hydraulic oil filter and back to reservoir.

MOTOR AND CYLINDER

The transaxle hydraulic motor and attachment lift cylinder are static.

RELIEF VALVE LOCATIONS

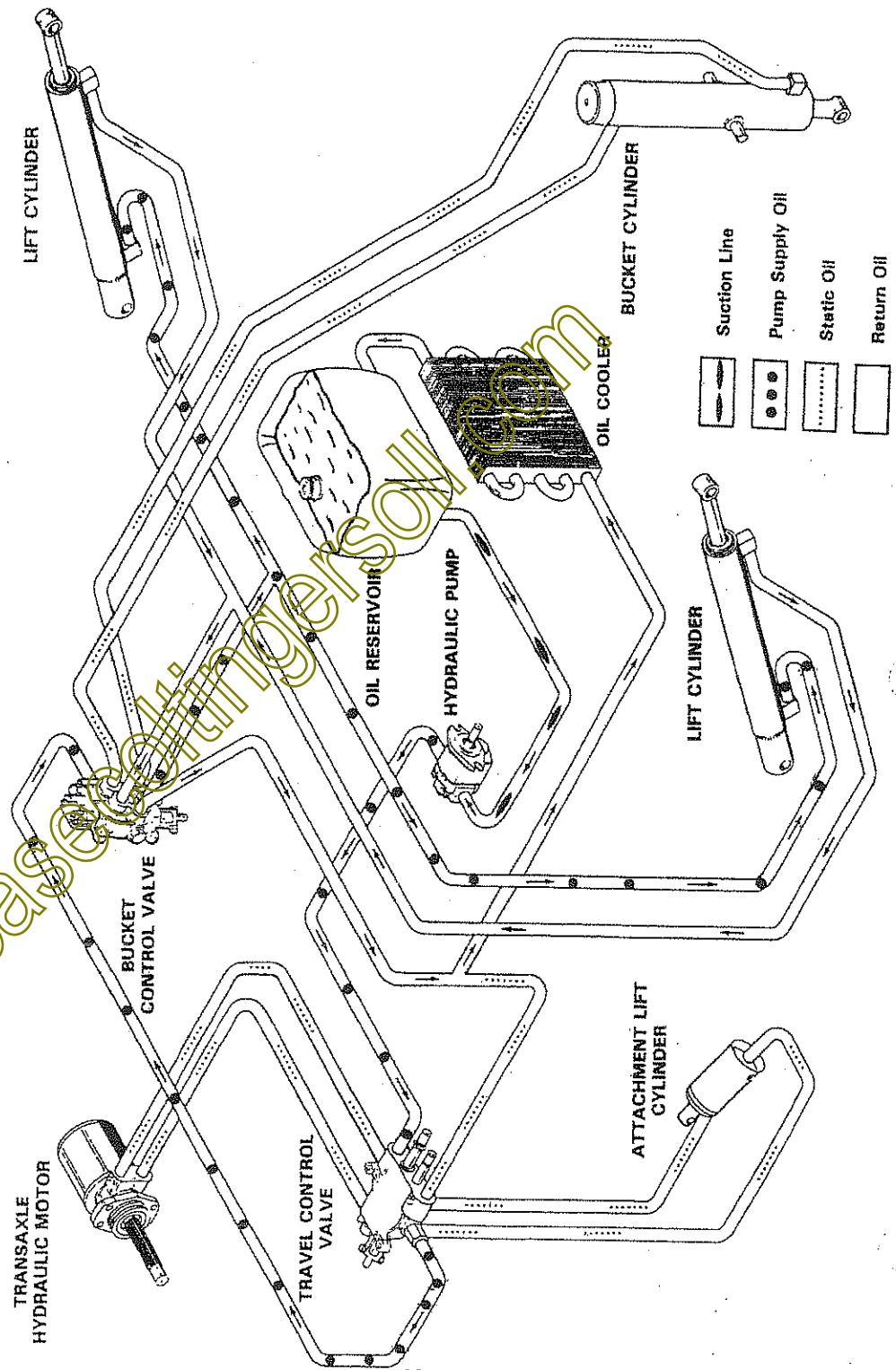
Power Steering Circuit - Power steering relief valve in power steering valve.

Hydraulic PTO Circuit - Circuit pressure controlled by main relief valve.

Ground Travel Circuit - Circuit pressure controlled by main relief valve.

Attachment Lift Circuit - Lift relief valve in travel control valve.

600 SERIES LOADER TRACTORS
 NEUTRAL DRIVE - NEUTRAL ATTACHMENT LIFT - NEUTRAL BUCKET TILT - RAISE LOADER LIFT



600 SERIES LOADER TRACTORS AND BACKHOE

The hydraulic drive system for 600 series loaders functions the same as the tractors with some minor differences.

The hydraulic tubes between the travel valve and hydraulic motor are reversed resulting in opposite spool movement for forward and reverse as compared with tractors.

The travel valve contains a power beyond sleeve which taps into the open

center passage after attachment lift spool to carry supply oil flow into the two spool loader bucket control valve.

The two spool bucket control valve is added to control the loader lift and bucket circuits.

The hydraulic PTO and 3-pt hitch (both optional) are connected in the same method as on tractors.

600 SERIES TRACTORS

OIL FLOW

Neutral Drive - Neutral Attachment Lift - Neutral Bucket Tilt - Raise Loader Lift.

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the travel valve.

TRAVEL VALVE

The travel valve spool and the attachment lift spool are in the neutral position. This allows supply oil to pass through the open center passage and to the power beyond sleeve and into the loader bucket control valve.

LOADER BUCKET CONTROL VALVE

The bucket tilt spool is in neutral allowing oil to flow through the open center passage to the loader lift spool.

The loader lift spool is stroked out of the valve body. This:

- closes the open center passage of the loader lift spool blocking the free flow path of oil
- opens the passage for supply oil to leave the lower work port of the valve to the piston ends of both loader lift cylinders.
- open the passage for return oil from the rod ends of both loader lift cylinders into the upper work port of the valve and on to the valve outlet port.

From the valve outlet port, oil flow continues through the oil cooler and back to reservoir.

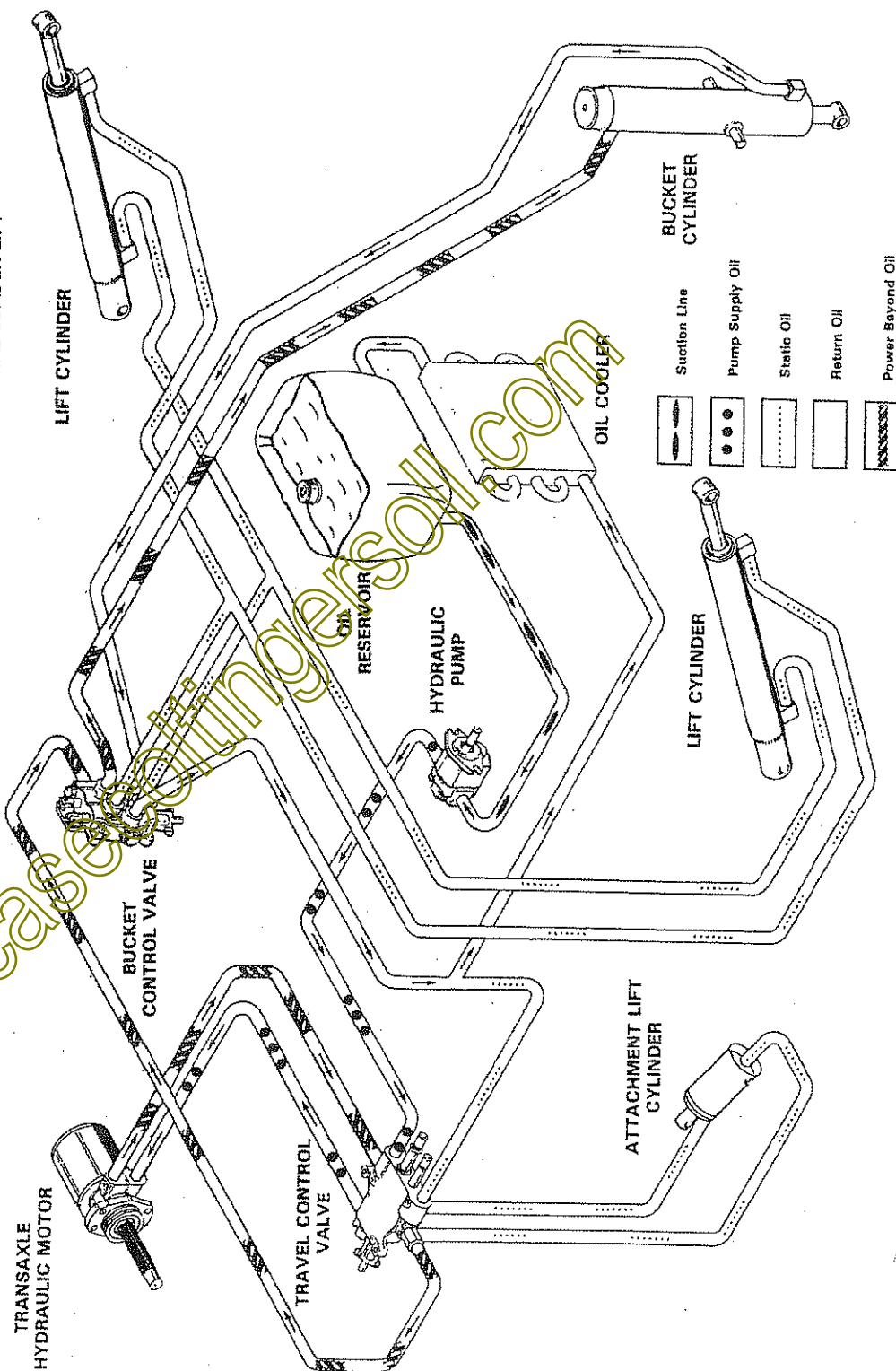
TRANSAXLE HYDRAULIC

The transaxle hydraulic motor is static.

CYLINDERS

The attachment lift cylinder is static. The bucket tilt cylinder is static. The loader lift cylinders are extending.

600 SERIES LOADER TRACTORS FORWARD DRIVE - NEUTRAL ATTACHMENT LIFT - ROLLBACK LOADER BUCKET - NEUTRAL LOADER LIFT



600 SERIES TRACTORS

OIL FLOW

Forward Drive - Neutral Attachment Lift - Rollback Loader Bucket - Neutral Loader Lift.

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the travel valve.

TRAVEL CONTROL VALVE

The travel spool is stroked out of the valve body. This:

- closes the open center passage blocking the free flow path of oil.
- opens the passage for pump supply oil to leave the rear work port of the valve to the travel hydraulic motor.
- opens the passage for return oil from the hydraulic motor to enter the front work port and flow through the lift valve open center passage to the power beyond sleeve.

From the power beyond sleeve, oil flow continues to the loader bucket control valve.

The lift spool is in neutral.

LOADER BUCKET CONTROL VALVE

The bucket tilt spool is stroked into the valve body. This:

- closes the open center passage blocking the free flow path of oil.
- opens the passage for power beyond supply oil to leave the top work port of the loader bucket control valve to the piston end of the valve outlet port.
- opens the passage for return oil from the rod end of the tilt cylinder to the bottom port of the loader bucket control valve and to the valve-outlet port.

The loader lift spool is in neutral.

From the valve outlet port oil flow continues through the oil cooler and back to reservoir.

TRANSAXLE HYDRAULIC MOTOR

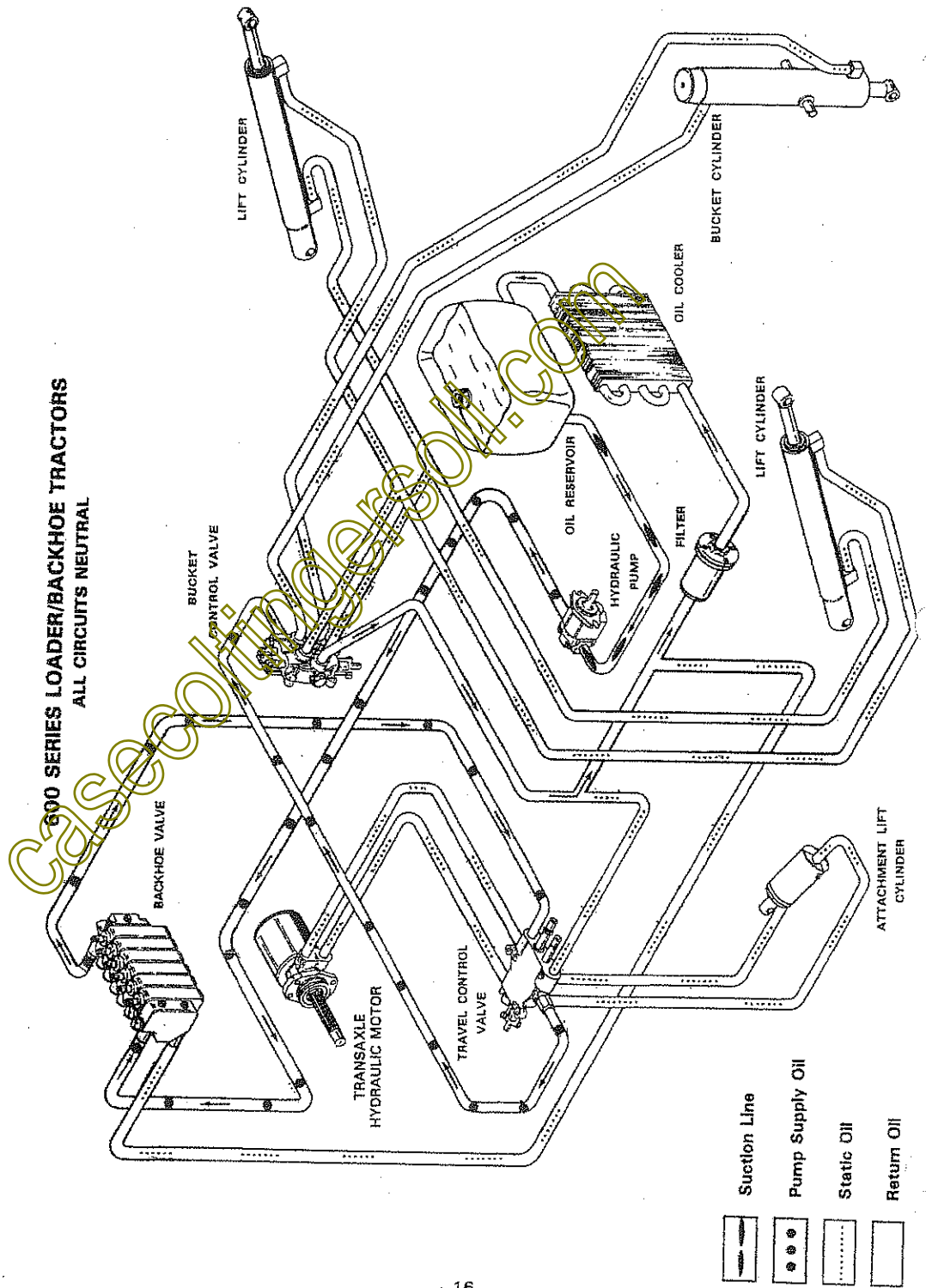
The transaxle hydraulic motor is driven in the forward direction by the oil flow passing through it.

CYLINDER

The attachment lift cylinder is static. The bucket tilt cylinder is extending. The loader lift cylinders are static.

The drive circuit and bucket circuit are in series. Therefore, when both circuits are actuated simultaneously, the pressures generated by resistance to flow in each circuit add.

600 SERIES LOADER/BACKHOE TRACTORS
ALL CIRCUITS NEUTRAL



600 SERIES LOADER/BACKHOE TRACTORS

OIL FLOW

646 or 648 Series "B" backhoe. All circuits neutral.

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the backhoe valve.

BACKHOE VALVE

All spools in the backhoe valve bank are in the neutral position. Oil passes through the open center passage and leaves the power-beyond port to the travel valve inlet port.

Backhoe return line oil is static. This line carries return oil from stroking cylinders and relief valve discharge only.

TRAVEL CONTROL VALVE

Both the travel and lift spools are in the neutral position.

This allows supply oil to pass through the open center passage and to the power-beyond sleeve and into the loader bucket control valve.

LOADER BUCKET CONTROL VALVE

The bucket tilt and loader lift spools are in the neutral position.

This allows supply oil to pass through the open center passage, out the outlet port and into the return line.

MOTOR AND CYLINDERS

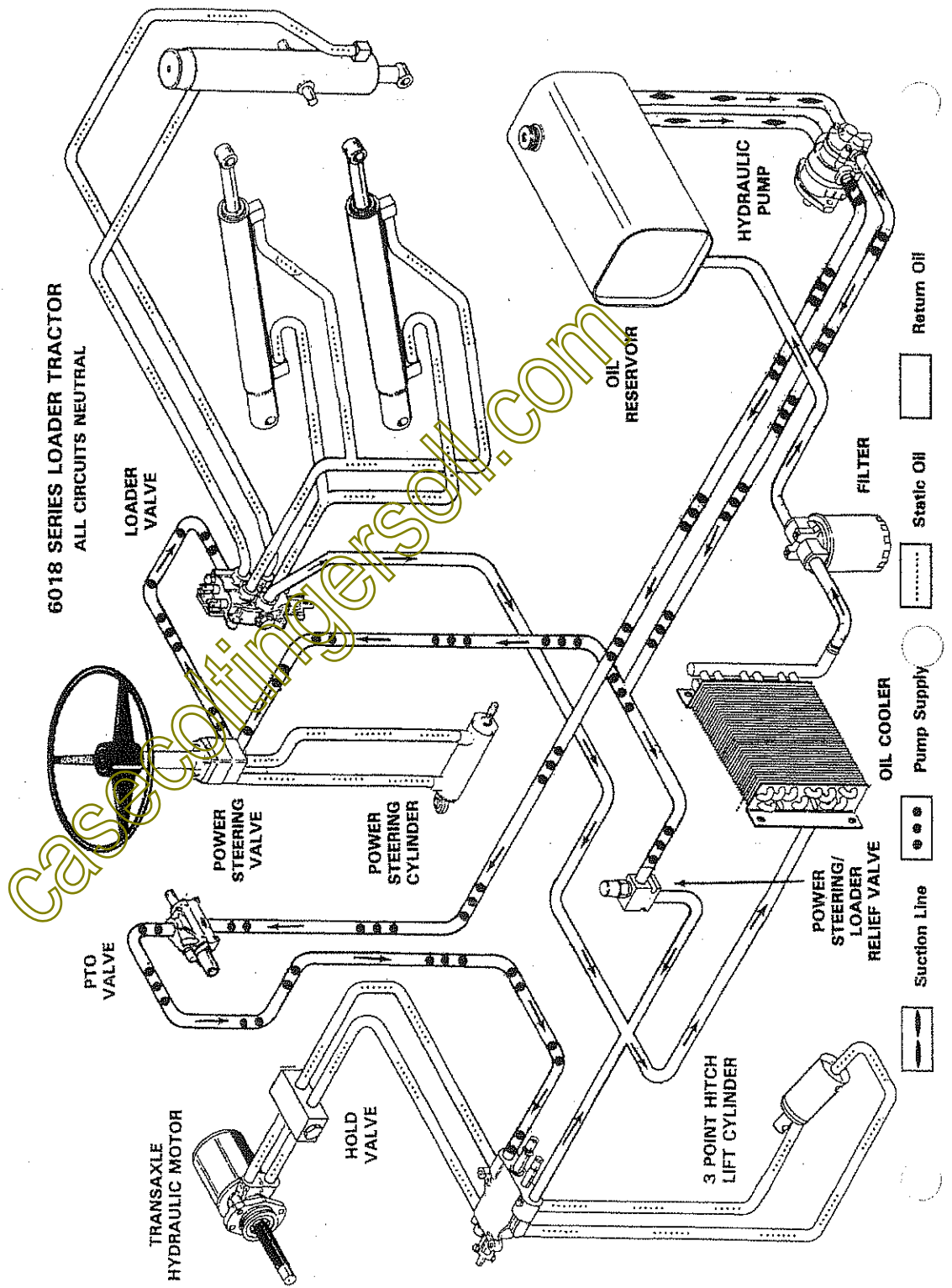
The transaxle hydraulic motor and cylinders are static.

NOTE: Consult Backhoe Service Manual Section for detailed backhoe information.

Early production Model 644 and 646 backhoes were not equipped with a backhoe return line. A direct series oil connection was provided as used in the hydraulic PTO valve attachment.

Model 646 Series "B" and 648 backhoes are provided with separate backhoe return and power-beyond lines.

Model 648 loaders and loader backhoes incorporate hydraulic power steering. Consult the Power Steering Service Manual section for detailed information on the power steering system.



6018 SERIES LOADER TRACTORS

OIL FLOW

Neutral Drive - Neutral Attachment Lift - Hydraulic PTO - Disengaged - Neutral Bucket Tilt - Neutral Loader Lift.

PUMP

The hydraulic pump used on these models is a two section gear pump. The front pump section (furthest from pump shaft end) supplies oil to the power steering and loader circuits. The rear pump section (nearest pump shaft end) supplies oil to the hydraulic PTO valve and travel control valve.

Oil is drawn from the reservoir through the suction lines and into the inlet sides of each pump section.

Oil is discharged from the outlet side of the front pump section to the inlet of the power steering valve. Oil is discharged from the outlet side of the rear pump section to the inlet of the PTO valve.

POWER STEERING/LOADER RELIEF VALVE

Oil from the front pump section is directed to the inlet of the power steering valve and on to the loader valve. The relief valve is tied into the circuit between the pump and the power steering valve. If pressure in the power steering or loader circuit exceeds the relief valve setting, the relief valve will open allowing oil to return through the oil cooler to the reservoir.

POWER STEERING VALVE

Oil from the front pump section enters the power steering valve inlet. During a turning mode, the power steering valve diverts pressure oil to one end of the power steering cylinder and allows oil to return from the opposite end of the cylinder. In a non-steering mode, the inlet flow passes thru the steering valve and is directed to the outlet of the power steering valve. All return or outlet oil is directed to the inlet of the loader valve.

LOADER BUCKET VALVE

The loader bucket valve is a two spool valve. One spool controls loader lift and lower. The other spool controls bucket tilt.

With both spools in the neutral position, supply oil passes through the open center passage. From the valve outlet port, oil flow continues through the oil cooler, oil filter and to the reservoir.

HYDRAULIC PTO VALVE

Oil from the rear pump section is directed to the inlet of the PTO valve. With the PTO valve in the OFF or disengaged position, oil passes thru the valve to the outlet port. From the outlet port, oil flow continues to the travel control valve inlet.

When the hydraulic PTO valve is engaged, the circuit is protected by a relief valve in the PTO valve.

TRAVEL CONTROL VALVE

The travel valve spool and the attachment lift spool are in the neutral position. This allows supply oil to pass through the open center passage to the valve outlet port. From the valve outlet, oil flow continues through the oil cooler, oil filter and to the reservoir.

If the travel valve spool is moved to the forward or reverse positions, oil is diverted to one of the valve work ports. Oil then flows to the hold valve and on to the transaxle hydraulic motor. The main relief valve in the travel control valve will open if circuit pressure exceeds the relief valve setting.

RELIEF VALVE LOCATIONS

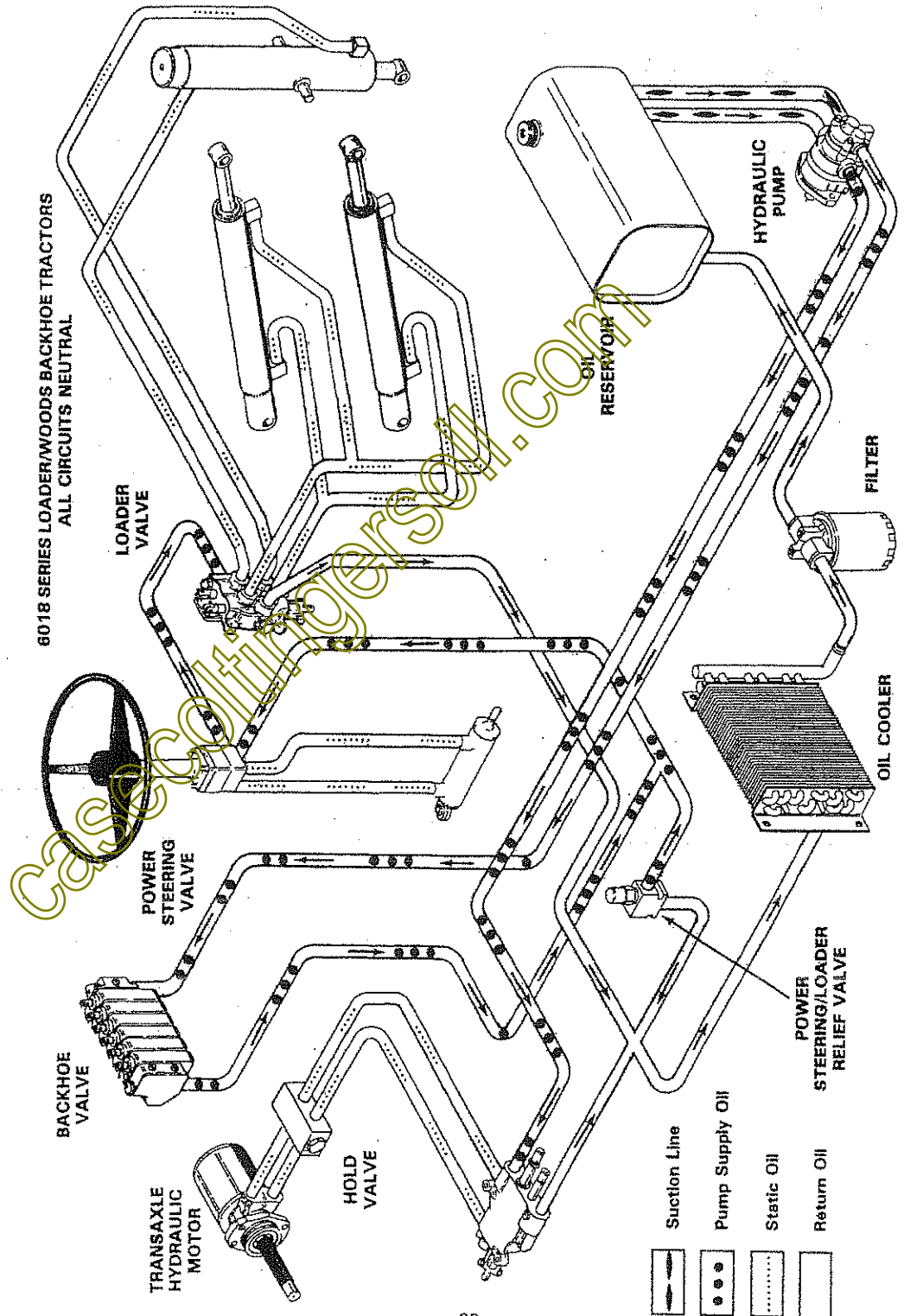
Power Steering/Loader Circuit - Power steering/loader relief valve.

Hydraulic PTO Circuit - Relief valve in PTO valve.

Ground Travel Circuit - Circuit pressure controlled by travel relief valve in travel control valve.

Attachment Lift Circuit - Lift relief valve in travel control valve.

6018 SERIES LOADER/WOODS BACKHOE TRACTORS
ALL CIRCUITS NEUTRAL



6018 SERIES LOADER/BACKHOE TRACTORS WOODS BACKHOE

OIL FLOW

Neutral Drive - Neutral Attachment Lift - Neutral Bucket Tilt - Neutral Loader Lift - Neutral Backhoe

PUMP

The hydraulic pump used on these models is a two section gear pump. The front pump section (furthest from pump shaft end) supplies oil to the backhoe valve, power steering valve and loader valve. The rear pump section (nearest pump shaft end) supplies oil to the travel control valve.

Oil is drawn from the reservoir through the suction lines and into the inlet sides of each pump section.

Oil is discharged from the outlet side of the front pump section to the inlet of the backhoe valve. Oil is discharged from the outlet side of the rear pump section to the inlet of the travel control valve.

BACKHOE VALVE

Oil from the front pump section enters the inlet of the backhoe valve. The backhoe valve consists of a series of individual spool valves. When the spools are moved from their neutral position, oil flow is used to control backhoe boom cylinders, bucket cylinder, boom swing cylinders and/or stabilizer cylinders.

With all spools in the neutral position, supply oil passes through the open center passage. From the valve outlet port, oil flows to the inlet of the power steering valve.

POWER STEERING/LOADER RELIEF VALVE

Oil from the backhoe valve outlet is directed to the inlet of the power steering valve and on to the loader valve. This relief valve is tied into the circuit between the backhoe valve and the power steering valve. If pressure in the power steering or loader circuit exceeds the relief valve setting, the relief valve will open allowing oil to return through the oil cooler to the reservoir.

POWER STEERING VALVE

Oil from the backhoe valve, outlet enters the power steering valve inlet. During a turning mode, the power steering valve diverts pressure oil to one end of the power steering cylinder and allows oil to return from the opposite end of the cylinder. In a non-steering mode, the inlet flow passes thru the steering valve and is directed to the outlet of the power steering valve. All return or outlet oil is directed to the inlet of the loader valve.

LOADER BUCKET VALVE

The loader bucket valve is a two spool valve. One spool controls loader lift and lower. The other spool controls bucket tilt.

With both spools in the neutral position, supply oil passes through the open center passage. From the valve outlet port, oil flow continues through the oil cooler, oil filter and to the reservoir.

TRAVEL CONTROL VALVE

The travel valve spool and the attachment lift spool are in the neutral position. This allows supply oil to pass through the open center passage to the valve outlet port. From the valve outlet, oil flow continues through the oil cooler, oil filter and to the reservoir.

If the travel valve spool is moved to the forward or reverse positions, oil is diverted to one of the valve work ports. Oil then flows to the hold valve and on to the transe axle hydraulic motor. The main relief valve in the travel control valve will open if circuit pressure exceeds the relief valve setting.

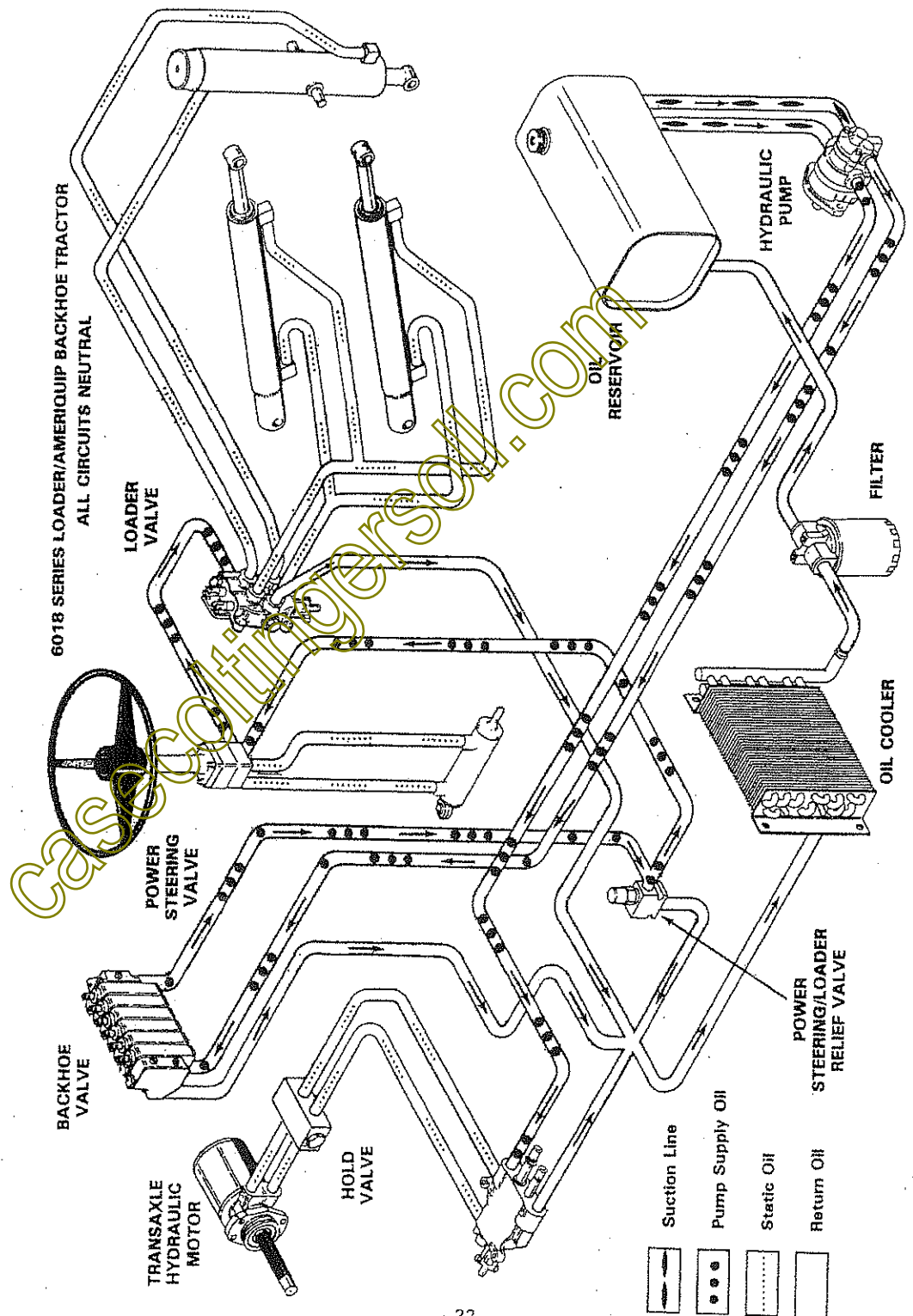
RELIEF VALVE LOCATIONS

Backhoe Circuit - Relief valve in backhoe valve.

Power Steering/Loader Circuit - Power steering/loader relief valve.

Ground Travel Circuit - Circuit pressure controlled by travel relief valve in travel control valve.

Attachment Lift Circuit - Lift relief valve in travel control valve.



6018 SERIES LOADER/BACKHOE TRACTORS AMERIQUE BACKHOE

OIL FLOW

Neutral Drive - Neutral Attachment Lift - Neutral Bucket Tilt - Neutral Loader Lift - Neutral Backhoe

PUMP

The hydraulic pump used on these models is a two section gear pump. The front pump section (furthest from pump shaft end) supplies oil to the backhoe valve, power steering valve and loader valve. The rear pump section (nearest pump shaft end) supplies oil to the travel control valve.

Oil is drawn from the reservoir through the suction lines and into the inlet sides of each pump section.

Oil is discharged from the outlet side of the front pump section to the inlet of the backhoe valve. Oil is discharged from the outlet side of the rear pump section to the inlet of the travel control valve.

BACKHOE VALVE

Oil from the front pump section enters the inlet of the backhoe valve. The backhoe valve consists of a series of individual spool valves. When the spools are moved from their neutral position, oil flow is used to control backhoe boom cylinders, bucket cylinder, boom swing cylinders and/or stabilizer cylinders.

With all spools in the neutral position, supply oil passes through the open center passage and out the power - beyond port to the inlet of the power steering valve.

Backhoe return line oil is static. This line carries return oil from stroking cylinders and relief discharge only.

POWER STEERING/LOADER RELIEF VALVE

Oil from the backhoe valve outlet is directed to the inlet of the power steering valve and on to the loader valve. This relief valve is tied into the circuit between the backhoe valve and the power steering valve. If pressure in the power steering or loader circuit exceeds the relief valve setting, the relief valve will open allowing oil to return through the oil cooler to the reservoir.

POWER STEERING VALVE

Oil from the backhoe valve, outlet enters the power steering valve inlet. During a turning mode, the power steering valve diverts pressure oil to one end of the power steering cylinder and allows oil to return from the opposite end of the cylinder. In a non-steering mode, the inlet flow passes thru the steering valve and is directed to the outlet of the power steering valve. All return or outlet oil is directed to the inlet of the loader valve.

LOADER BUCKET VALVE

The loader bucket valve is a two spool valve. One spool controls loader lift and lower. The other spool controls bucket tilt.

With both spools in the neutral position, supply oil passes through the open center passage. From the valve outlet port, oil flow continues through the oil cooler, oil filter and to the reservoir.

TRAVEL CONTROL VALVE

The travel valve spool and the attachment lift spool are in the neutral position. This allows supply oil to pass through the open center passage to the valve outlet port. From the valve outlet, oil flow continues through the oil cooler, oil filter and to the reservoir.

If the travel valve spool is moved to the forward or reverse positions, oil is diverted to one of the valve work ports. Oil then flows to the hold valve and on to the transaxle hydraulic motor. The main relief valve in the travel control valve will open if circuit pressure exceeds the relief valve setting.

RELIEF VALVE LOCATIONS

Backhoe Circuit - Relief valve in backhoe valve.

Power Steering/Loader Circuit - Power steering/loader relief valve.

Ground Travel Circuit - Circuit pressure controlled by travel relief valve in travel control valve.

Attachment Lift Circuit - Lift relief valve in travel control valve.

FORWARD GROUND TRAVEL - NEUTRAL LIFT

OIL FLOW

Forward Ground Travel - Neutral Lift

TRAVEL CONTROL VALVE

Oil from the hydraulic pump is supplied to the travel control valve.

The travel valve spool is stroked into the valve body.

This:

- a. closes the open center passage blocking the free flow path of oil.
- b. opens the passage for pump supply oil to leave the front work port of the valve to the transaxle hydraulic motor.
- c. opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve.
- d. if tractor is equipped with hold valve, holding valve spools shifts whenever tractor is moving.

From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

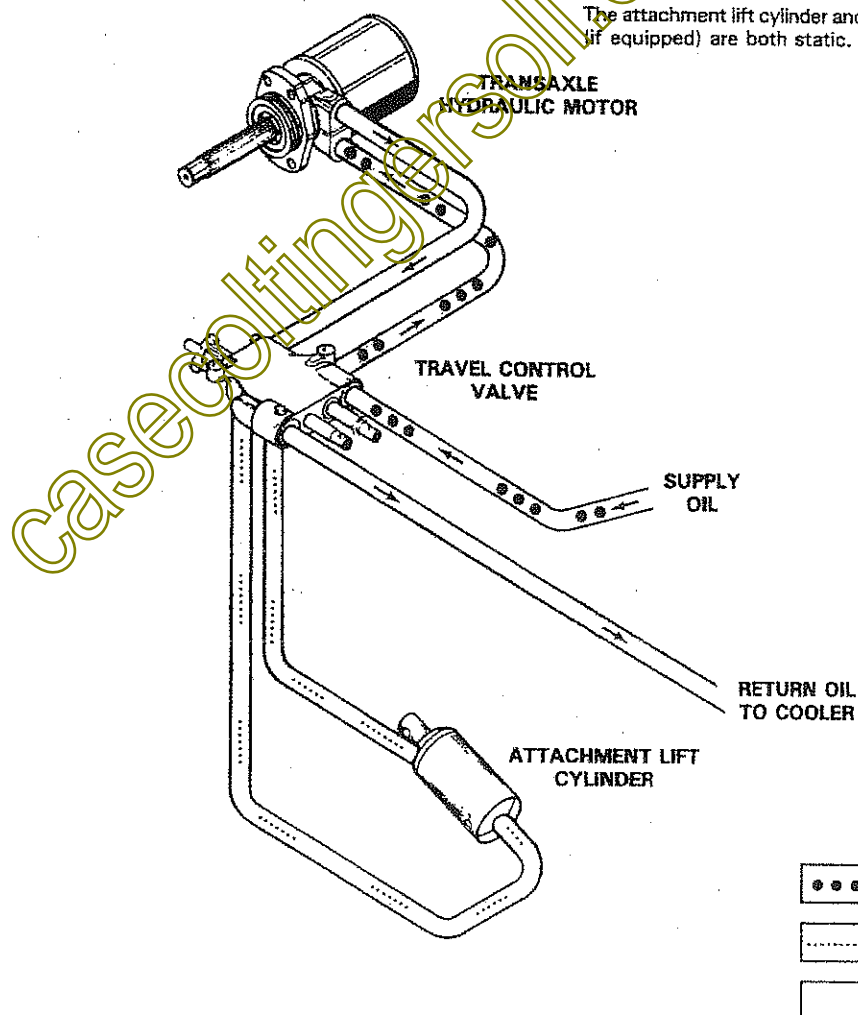
The lift valve spool is in neutral.

TRANSAXLE HYDRAULIC MOTOR

The transaxle motor is driven in the forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER(S)

The attachment lift cylinder and 3 point hitch cylinder (if equipped) are both static.



REVERSE GROUND TRAVEL - NEUTRAL LIFT

OIL FLOW

Reverse Ground Travel - Neutral Lift

TRAVEL CONTROL VALVE

Oil from hydraulic pump is supplied to the travel control valve.

The travel valve spool is stroked out of the valve body.

This:

- closes the open center passage blocking the free flow path of oil.
- opens the passage from pump supply oil to leave the rear work port of the valve to the transaxle hydraulic motor.

- opens the passage for return oil from the transaxle hydraulic motor to enter the front work port and flow to the outlet port of the valve.

- if tractor is equipped with hold valve, holding valve spool shifts whenever tractor is moving.

From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

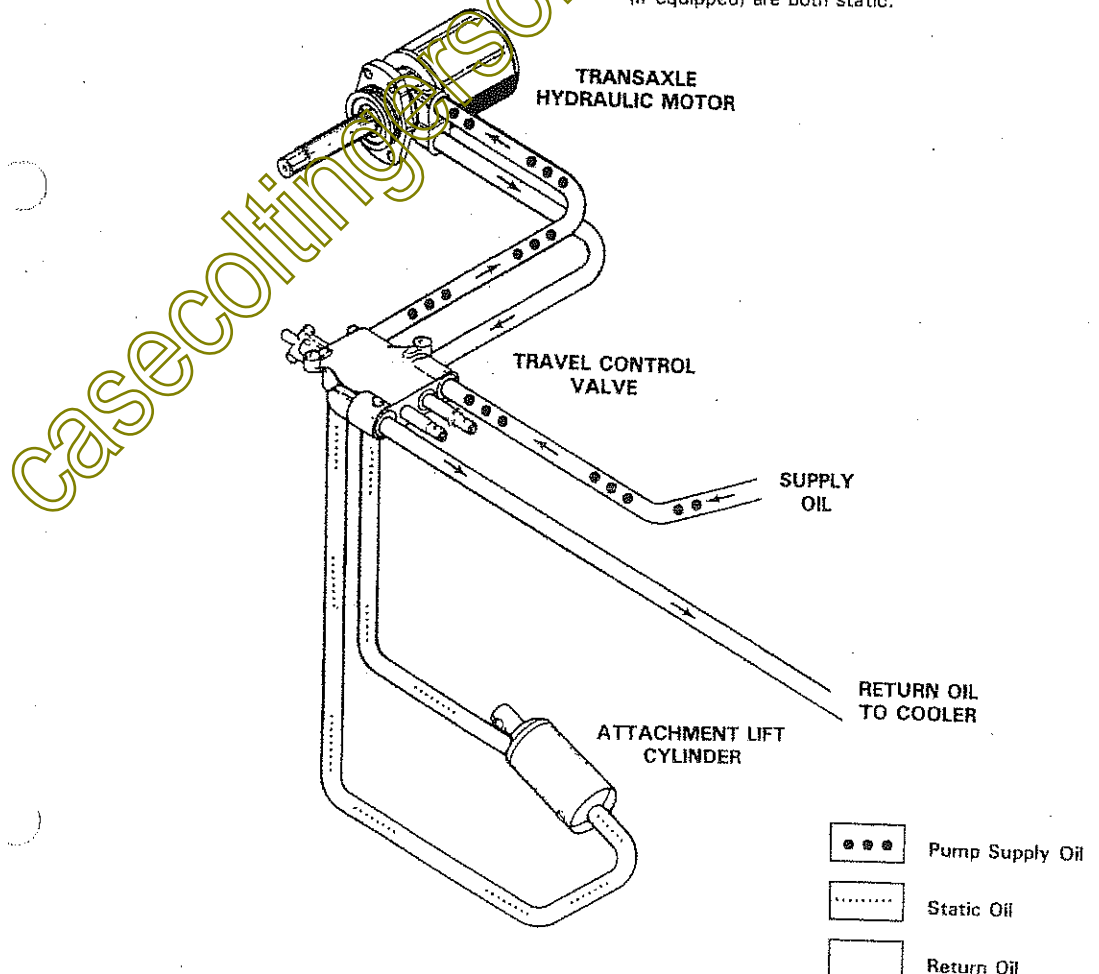
The lift valve spool is in neutral.

TRANSAXLE HYDRAULIC MOTOR

The transaxle motor is driven in the reverse direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER(S)

The attachment lift cylinder and 3 point hitch cylinder (if equipped) are both static.



FORWARD GROUND TRAVEL - NEUTRAL LIFT DYNAMIC BRAKING OR DOWNHILL MODE

OIL FLOW

Forward Ground Travel - Dynamic Braking - Neutral Lift

When the travel control lever is moved toward neutral or when going downhill, the engine and hydraulic system are used for braking. In this mode, the inertia of the machine drives the transaxle hydraulic motor which in turn acts as a pump pushing oil to the travel control valve.

As explained below, the travel control valve and/or hold valve are used to create hydraulic restrictions which act to dynamically brake the tractor.

TRAVEL CONTROL VALVE/HOLD VALVE

The travel valve spool is either partially or fully stroked into the valve body depending on the speed the operator selects.

The hold valve senses the pressure in the inlet line to the transaxle hydraulic motor. If this pressure drops, indicating cavitation can occur (resulting in free-wheel) the hold valve spool shifts automatically to restrict the outlet line from the hydraulic motor.

Refer to hold valve section for more details of hold valve operation.

From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

The lift valve spool is in neutral.

TRAVEL CONTROL VALVE

(Early 200-400 series tractors when not equipped with Hold Valve.)

The travel valve spool is partially stroked into the valve body to the retard detent as indicated on the tractor dash. This:

- a. partially closes the open center passage partially restricting the supply oil flow.
- b. opens the passage for pump supply oil to leave the front work port of the valve to the transaxle hydraulic motor.
- c. the passage for return oil from the hydraulic motor remains restricted. This restriction places an effective back-pressure on the hydraulic motor allowing dynamic braking to occur.

Return oil, entering the rear work port, joins the restricted flow from the partially closed open center passage and flows to the outlet port of the valve.

From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

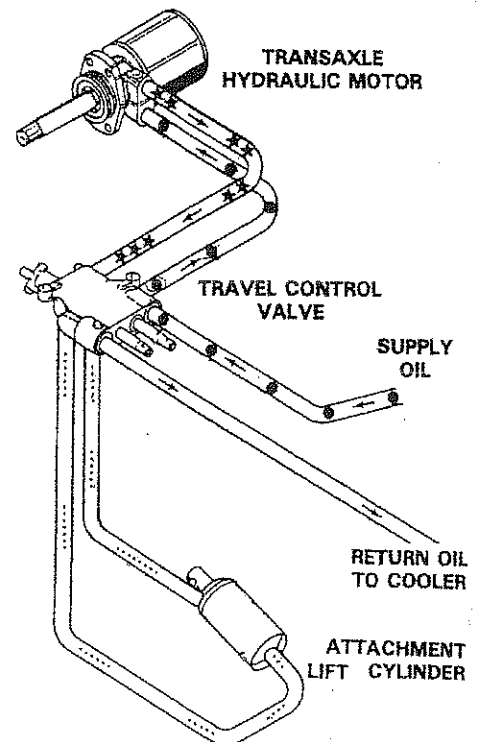
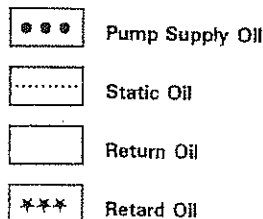
The lift valve spool is in neutral.

TRANSAXLE HYDRAULIC MOTOR

The transaxle hydraulic motor is driven by the oil flow passing through it and by the inertia of the machine. The motor is prevented from cavitating by the restriction on its outlet port.

ATTACHMENT LIFT CYLINDER(S)

The attachment lift cylinder and 3 point hitch cylinder (if equipped) are both static.



TRAVEL CONTROL VALVE - NEUTRAL DRIVE

OIL FLOW

Neutral Drive - Neutral Lift

TRAVEL SPOOL

The travel spool is in the neutral (centered) position. The open center passage to the lift spool supply passage is open. The oil at the travel spool work ports is static.

TRAVEL RELIEF VALVE

The travel relief valve is seated.

NOTE: Travel control valve used on 3100-4100 series tractors are not equipped with this relief valve. System is protected by main relief valve.

TRAVEL VALVE WITH INTEGRAL HOLD VALVE

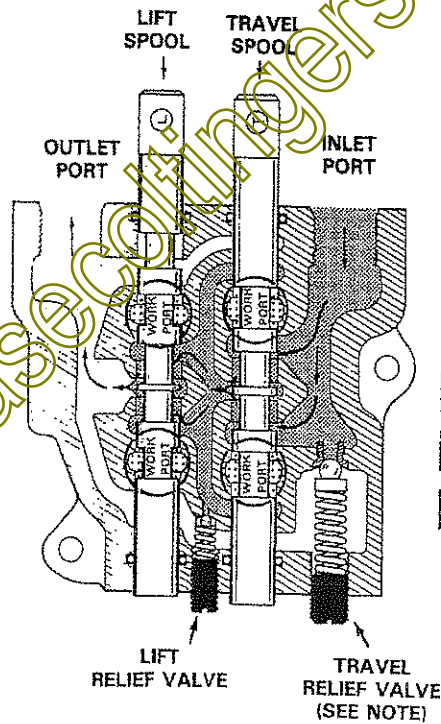
With the travel spool in the neutral position, no pump supply oil is diverted to the hold valve spool. The springs on each end of the spool hold the spool in a centered position.

LIFT SPOOL

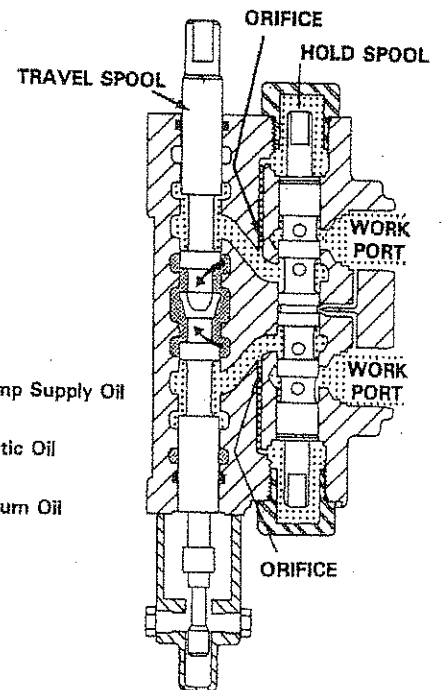
The lift spool is in the neutral (centered) position. The open center passage to the return passage and valve outlet port is open. The oil at the lift spool work ports is static.

LIFT RELIEF VALVE

The lift relief valve is seated.



TRAVEL CONTROL VALVE
BOTTOM VIEW



TRAVEL CONTROL VALVE/HOLD VALVE
SIDE VIEW

TRAVEL CONTROL VALVE - FORWARD DRIVE

OIL FLOW

Forward Drive - Neutral Lift

TRAVEL SPOOL

The travel spool is stroked into the valve body. This closes the open center passage allowing pump supply oil to flow from the forward work port to the transaxle hydraulic motor and return oil from the transaxle hydraulic motor to enter the rear work port.

On 600 and 6000 series tractors, travel spool is moved out which reverses pressure and return ports on these models. However, lines between valve and transaxle motor are also reversed.

On tractors equipped with separate hold valve, refer to section later in this manual explaining operation. On tractors with hold valve built into control valve, refer to following section. Both valves function the same.

Return oil from the hydraulic motor enters the supply passage for the lift spool.

TRAVEL VALVE WITH INTEGRAL HOLD VALVE

Pump supply oil diverted from the travel spool enters the hold valve spool. Oil unseats the check ball in the spool and flows out the forward work port on the valve.

Pressure oil also passes thru the orifice on the side and goes to the end of the hold valve spool. This additional oil pressure shifts the spool which allows return oil to pass by the hold spool to return.

LIFT SPOOL

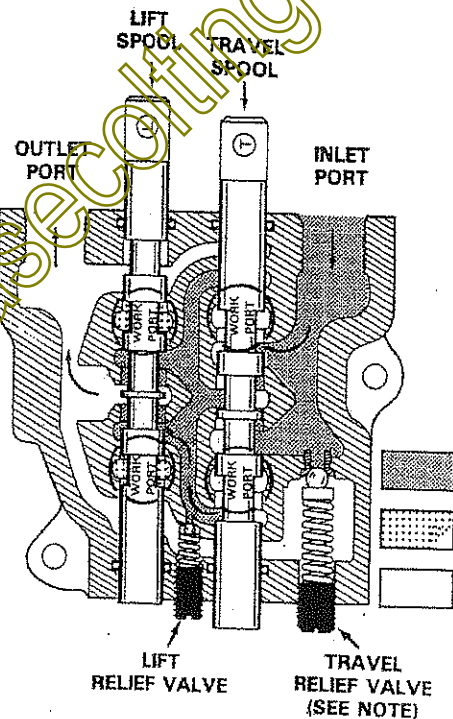
The lift spool is in the neutral (centered) position. The open center passage to the return passage and valve outlet port is open.

The oil at the lift spool work ports is static.

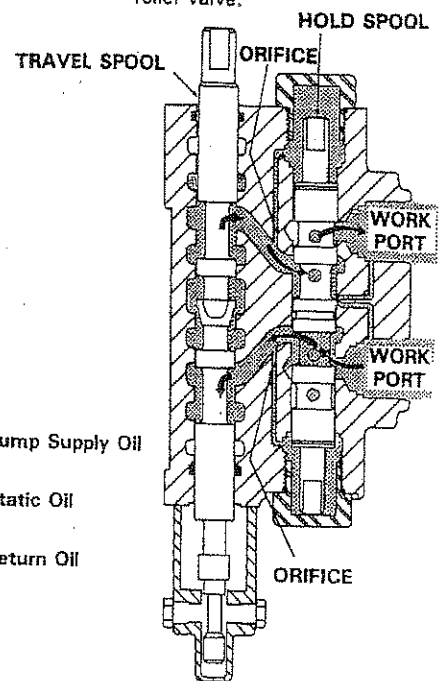
TRAVEL RELIEF VALVE

The travel relief valve will remain seated as long as pressures generated in the travel circuit remains less than the relief valve preset opening pressure.

NOTE: Travel control valve used on 3100-4100 series tractors are not equipped with this relief valve. System is protected by main relief valve.



TRAVEL CONTROL VALVE
BOTTOM VIEW



TRAVEL CONTROL VALVE/HOLD VALVE
SIDE VIEW

OIL FLOW

Reverse Drive - Neutral Lift

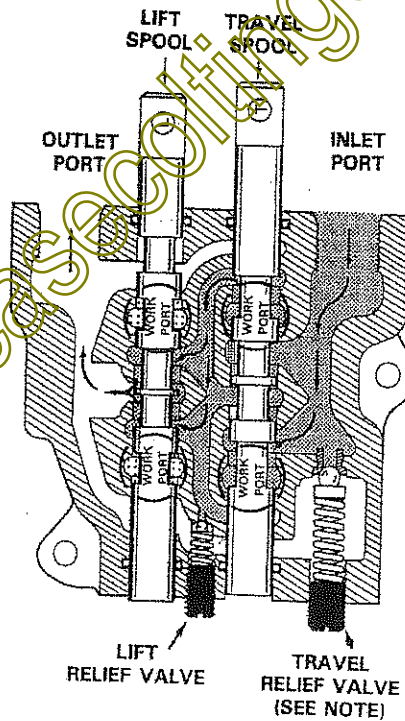
TRAVEL SPOOL

The travel spool is stroked out of the valve body. This closes the open center passage allowing pump supply oil to flow from the rear work port to the transaxle hydraulic motor and return oil from the transaxle hydraulic motor to enter the front work port.

On 600 and 6000 series tractors, travel spool is moved in which reverses pressure and return ports on these models. However, lines between valve and transaxle motor are also reversed.

On tractors equipped with separate hold valve, refer to section later in this manual explaining operation. On tractors with hold valve built into control valve, refer to following section. Both valves function the same.

Return oil from the hydraulic motor enters the supply passage for the lift spool.



TRAVEL CONTROL VALVE
BOTTOM VIEW

TRAVEL CONTROL VALVE - REVERSE DRIVE

TRAVEL VALVE WITH INTEGRAL HOLD VALVE

Pump supply oil diverted from the travel spool enters the hold valve spool. Oil unseats the check ball in the spool and flows out the reverse work port on the valve.

Pressure oil also passes thru the orifice on the side and goes to the end of the hold valve spool. This additional oil pressure shifts the spool which allows return oil to pass by the hold spool to return.

LIFT SPOOL

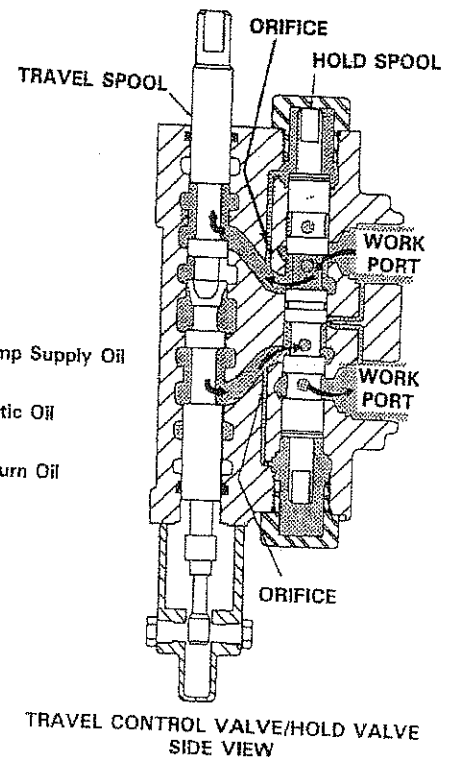
The lift spool is in the neutral (centered) position. The open center passage to the return passage and valve outlet port is open.

The oil at the lift spool work ports is static.

TRAVEL RELIEF VALVE

The travel relief valve will remain seated as long as pressure generated in the travel circuit remains less than the relief valve preset opening pressure.

NOTE: Travel control valve used on 3100-4100 series tractors are not equipped with this relief valve. System is protected by main relief valve.



TRAVEL CONTROL VALVE/HOLD VALVE
SIDE VIEW

TRAVEL CONTROL VALVE - FORWARD DRIVE DECELERATION OR DYNAMIC BRAKING

OIL FLOW

Forward Drive - Deceleration or Braking - Neutral Lift

During a deceleration of the tractor, the transaxle hydraulic motor is driven by the inertia of the tractor and it actually acts as a pump pushing oil back to the travel control valve. Restricting this oil by the travel spool and/or hold valve creates the dynamic braking.

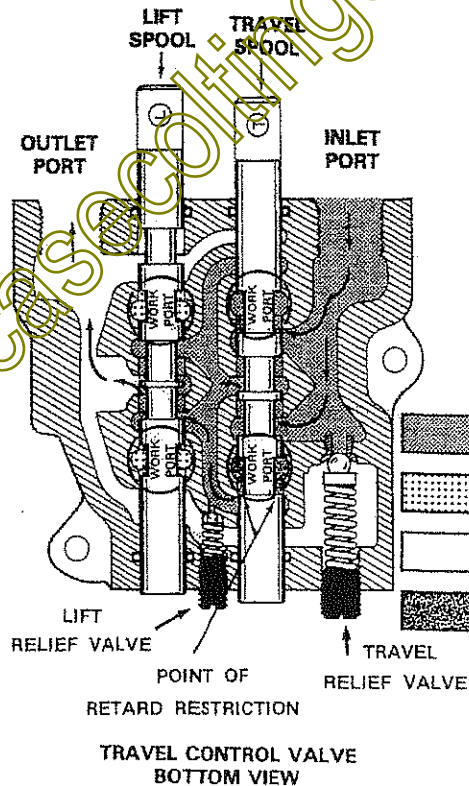
TRAVEL SPOOL - Early 200-400 series tractors when not equipped with hold valve.

The travel spool is stroked slightly into the valve body into the retarding position.

This partially closes the open center passage. Some pump supply oil still penetrates the open center passage.

This opens the path for pump supply to flow from the forward work port to the hydraulic motor.

A slight overlap exists between the travel spool and rear work port. This restricts return oil from the hydraulic motor. (Feathering grooves in the valve casting or valve spool exist at this point of overlap).



This restriction prevents the hydraulic motor from cavitating.

TRAVEL SPOOL - with separate or intergreed hold valve. (Both valves function the same).

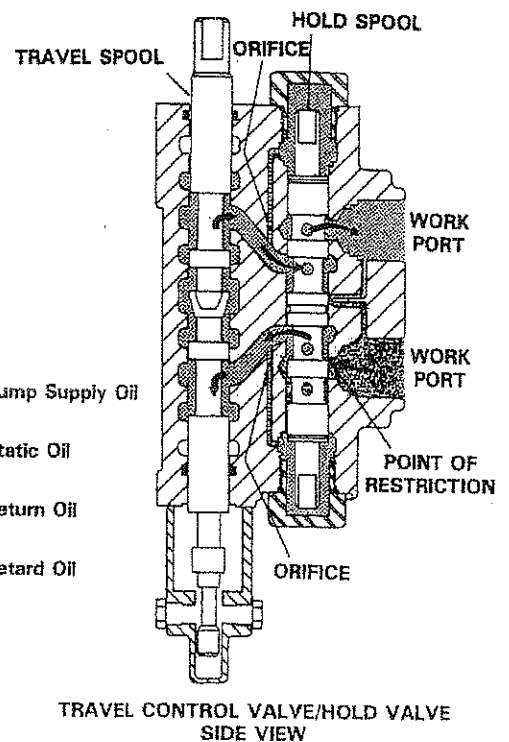
The travel valve spool is partially or fully stroked into the valve body depending on the speed the operator selects.

HOLD VALVE

Pump supply oil diverted from the travel spool enters the hold valve spool. Oil unseats the check ball in the spool and flows out the forward work port on the valve.

Pressure oil also passes thru the orifice on the pressure side and goes to the end of the hold valve spool. This additional oil pressure shifts the spool which allows return oil to pass by the hold spool to return.

In the deceleration mode, pump supply pressure decreases since inertia of tractor is propelling the tractor. This decreases oil pressure on end of hold valve spool. Hold valve spool shifts toward center which further restricts return oil. Increase of return oil pressure acts to increase dynamic braking on transaxle motor.



600 SERIES LOADER TRAVEL VALVE

OIL FLOW

Neutral Drive - Neutral Lift

TRAVEL SPOOL

The travel spool is in the neutral (centered) position. The open center passage to the lift spool supply passage is open.

The oil at the travel spool work ports is static.

LIFT SPOOL

The lift spool is in the neutral (centered) position. The open center passage is connected by a "power beyond sleeve" to a power beyond port. Pump supply oil flow continues to the loader bucket valve.

The oil at the lift spool work ports is static.

TRAVEL RELIEF VALVE

The travel relief valve is seated.

LIFT RELIEF VALVE

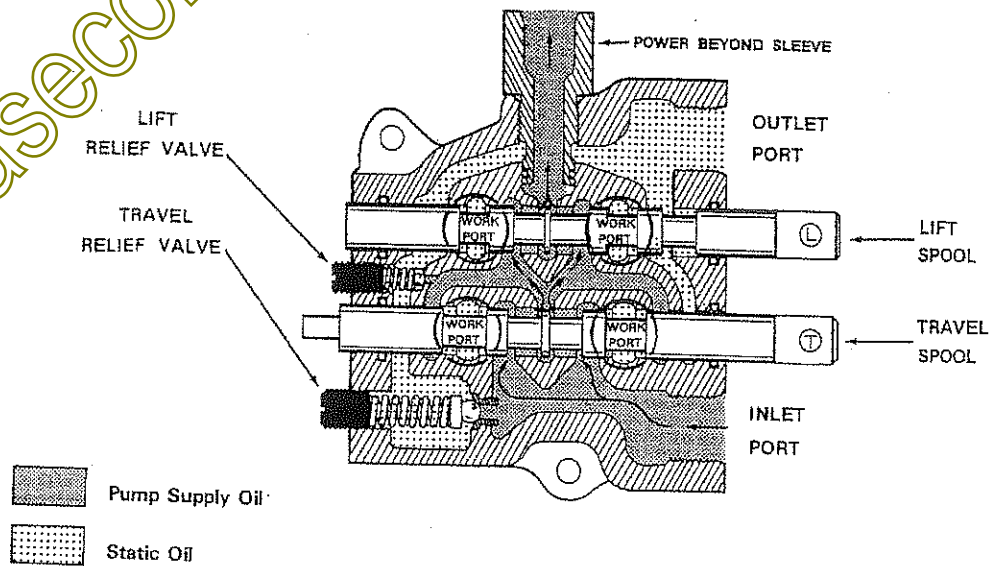
The lift relief valve will remain seated as long as pressures generated in the "power beyond" circuit remain less than the relief valve preset opening pressure.

NOTE: For forward, reverse, raise, lower and float oil flows refer to the tractor valve oil flows in this manual.

Power beyond oil flow is blocked when the attachment lift spool is stroked into the raise or lower positions.

Power beyond oil flow is continuous when the attachment lift spool is stroked into the float position.

The attachment lift circuit in the float position will raise when the power beyond circuit is pressurized.



HYDRAULIC HOLD VALVE

OIL FLOW

Neutral

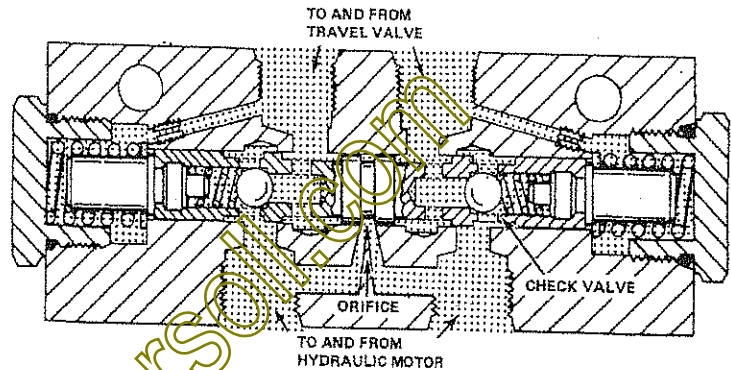
NOTE: The full range hold valve may be a separate body installed between the control valve and motor or may be built into the control valve.

Holding Valve - Spool is centered

There is no hydraulic pressure existing in work ports to and from travel control valve. Therefore, the spool is centered by the springs in the end caps.



Static Oil



OIL FLOW

Forward (Slow to Full Speed)

NOTE: The full range hold valve may be a separate body installed between the control valve and motor or may be built into the control valve.

Holding Valve - Spool is shifted to right, left side check valve opens.

Travel valve directs oil into left port of holding valve. Resistance from check valve, resistance from hydraulic motor, and restricted "Return from Hydraulic Motor" port causes pressure rise through left hand orifice to shift spool to right, compressing spring on right side. This opens the passage for return oil.

If the oil pressure into the hydraulic motor becomes less than the oil pressure out of the hydraulic motor (motor cavitation), the accompanying drop in pressure in the oil supply from the travel valve allows the compressed right spring to shift spool part way to left.

This restricts "Return from Hydraulic Motor" port, preventing cavitation.

The seated check ball in the right side of the spool prevents oil flow.

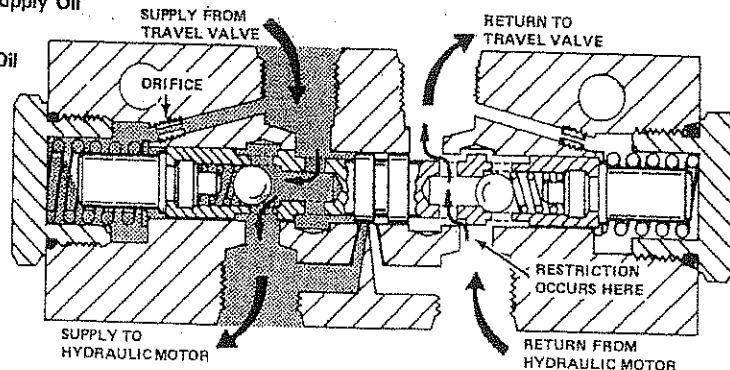
A small amount of oil can pass through orifices between the motor work ports to prevent hydraulic lock when the spool centers.



Pump Supply Oil



Return Oil



ATTACHMENT/3 POINT HITCH HYDRAULIC LIFT — RAISE MODE —

OIL FLOW

Forward Ground Travel, Hydraulic Lift-Raising

Depending on model and available options, units may have either attachment lift system, 3 point hitch lift or both lift systems.

TRAVEL CONTROL VALVE

Oil from the hydraulic pump is supplied to the travel control valve.

The travel valve spool is stroked into the valve body. This:

- closes the open center passage blocking the free flow path of oil.
- opens the passage for pump supply oil to leave the front work port of the valve to the transaxle hydraulic motor.
- opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the open center of the lift spool.

The lift spool is stroked out of the valve body. This:

- closes the open center passage of the lift spool blocking the free flow path of oil.

- opens the path for return oil from the transaxle motor to leave the rear work port of the valve to the piston end of the attachment lift and 3 point hitch cylinders.

- opens the passage for return oil from the rod end of both cylinders to the front work port of the valve and to the valve outlet port.

From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

TRANSAXLE HYDRAULIC MOTOR

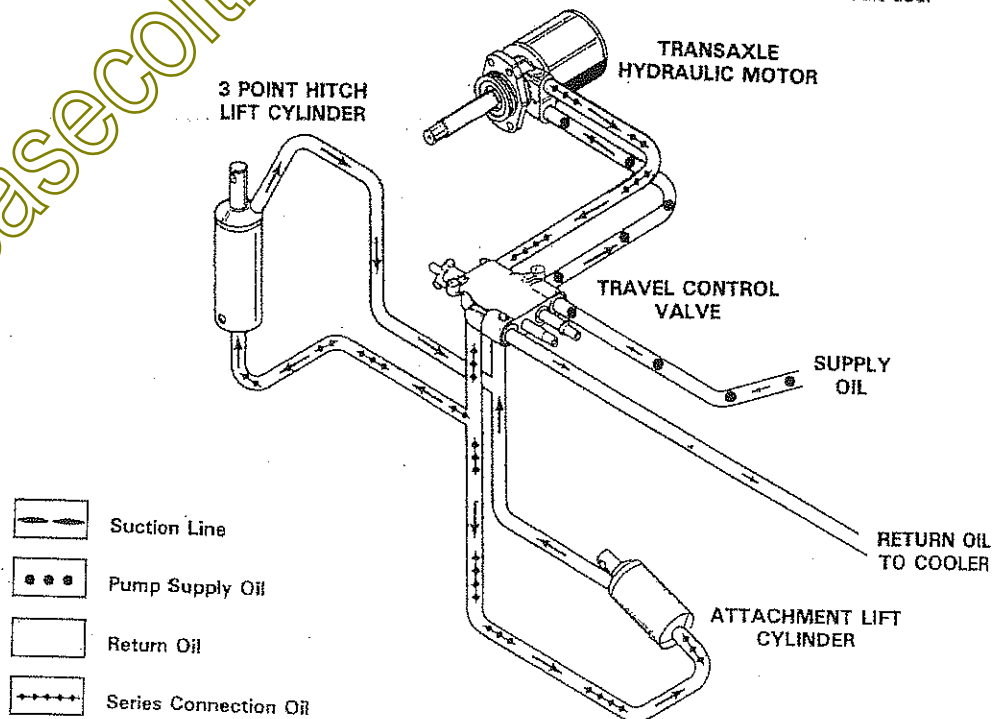
The transaxle hydraulic motor is driven in the forward direction by the oil flow passing through it.

LIFT CYLINDER

The attachment lift and/or 3 point lift extends (opens) as supply oil enters the piston end and return oil leaves the rod end.

If unit has both lift systems, since the cylinders are teed together the one offering the least resistance will move first.

The drive circuit and lift circuit are in series with each other. Therefore, when both circuits are actuated simultaneously, the pressures generated by resistance to flow in each circuit add.



ATTACHMENT/3 POINT HYDRAULIC LIFT — FLOAT MODE —

OIL FLOW

Forward Ground Travel, Hydraulic Lift - Float

Depending on model and available options, units may have either attachment lift system, 3 point hitch lift or both lift systems.

TRAVEL CONTROL VALVE

The travel valve spool is stroked into the valve body. This:

- a. closes the open center passage blocking the free flow path of oil.
- b. opens the passage for pump supply oil to leave the front work port of the valve to the transaxle hydraulic motor.
- c. opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the open center of the lift spool.

The lift spool is stroked completely into the valve body and is held by two (2) spring loaded detent balls. This:

- a. opens the open center passage allowing return oil from the transaxle hydraulic motor to flow to the valve outlet port.

- b. opens both lift circuit work ports to the return passage within the valve body.

Oil displaced by movement of the piston flows to the valve outlet port.

From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

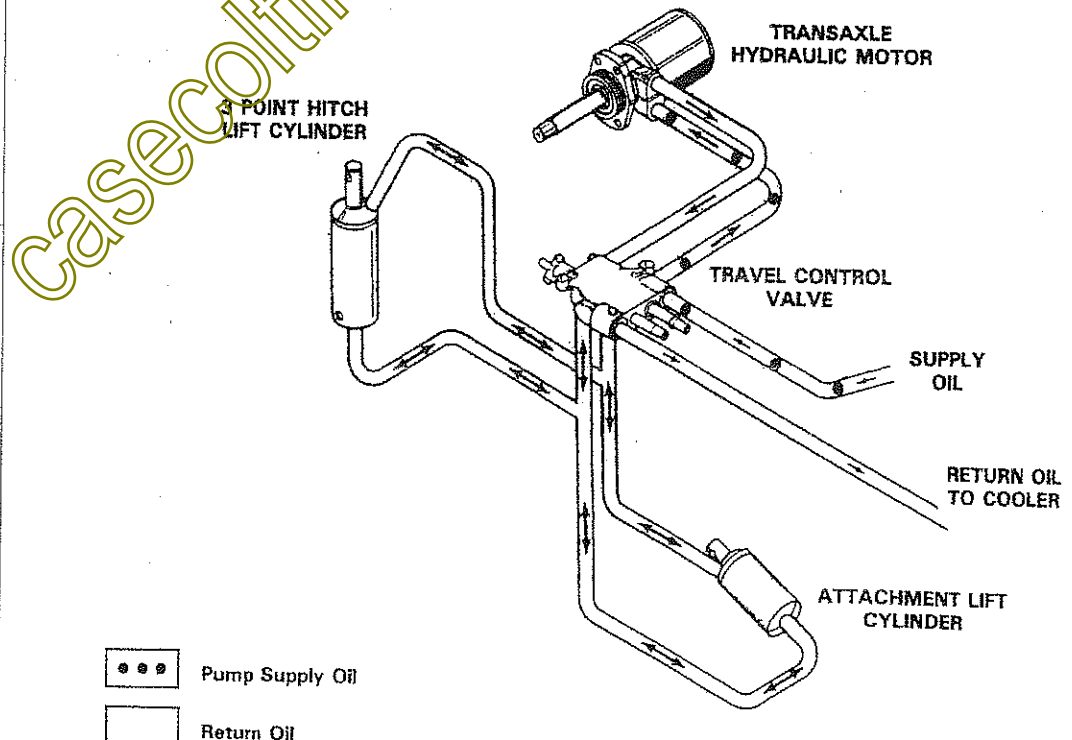
TRANSAXLE HYDRAULIC MOTOR

The transaxle hydraulic motor is driven in the forward direction by the oil flow passing through it.

LIFT CYLINDER

The lift cylinder piston for attachment lift and/or 3 point lift moves in and out (attachment follows contour of ground) without hydraulic resistance.

It is normal for the lift cylinder to extend when in the float position when no load is applied. This is caused by the difference in surface area between the piston and rod end of the cylinder.



ATTACHMENT/3 POINT HYDRAULIC LIFT — LOWER MODE —

OIL FLOW

Neutral Ground Travel, Hydraulic Lift - Lower

Depending on model and available options, units may have either attachment lift system, 3 point hitch lift or both lift systems.

TRAVEL CONTROL VALVE

Oil from the hydraulic pump is supplied to the travel control valve.

The travel spool is in neutral, allowing pump supply oil to flow through, resistance free, to the lift spool.

The lift spool is stroked into the valve body. This:

- a. closes the open center passage of the lift spool blocking the free flow path of oil.
- b. opens the path for pump supply oil to leave the front work port of the valve to the rod end of both the attachment lift and 3 point hitch cylinders.

- c. opens the passage for return oil from the piston ends of both cylinders into the rear work port of the valve and to the valve outlet port.

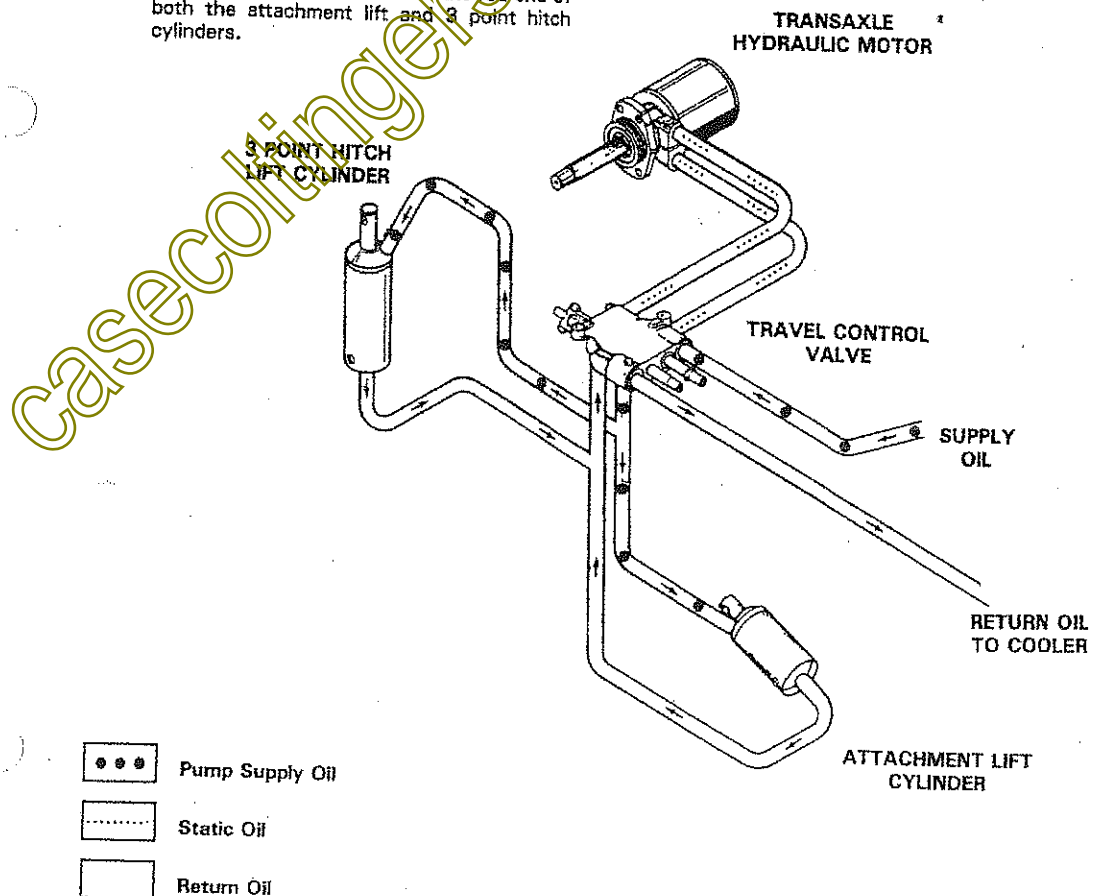
From the valve outlet, oil flow continues through the oil cooler and back to the reservoir.

TRANSAXLE HYDRAULIC MOTOR

The transaxle hydraulic motor is static.

LIFT CYLINDERS

The lift cylinder rods retract (close) as supply oil enters the rod ends and return oil leaves the piston ends. If unit has both lift systems, since the cylinders are tied together, the one offering the least resistance will move first.



TRAVEL CONTROL VALVE - ATTACHMENT LIFT

OIL FLOW

Neutral Drive-Raise Lift

TRAVEL SPOOL

The travel spool is in the neutral (centered) position. The open center passage to the lift spool supply passage is open. The oil at the travel spool work ports is static.

ATTACHMENT LIFT SPOOL

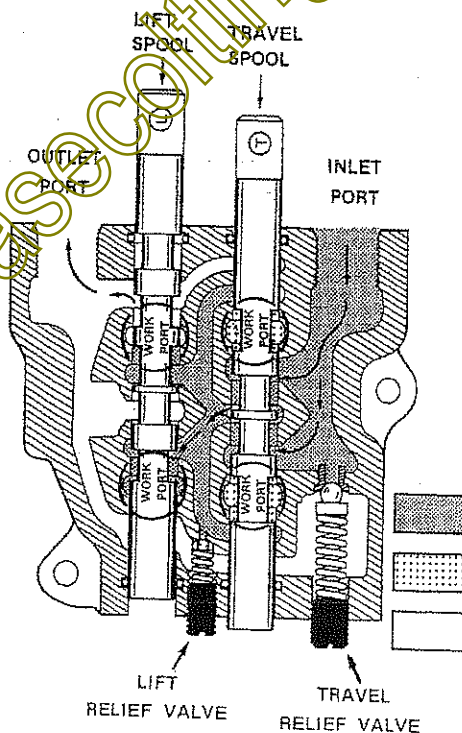
The lift spool is stroked out of the valve body. This closes the open center passage allowing pump supply oil to leave the rear work port to the lift cylinder. Return oil from the lift cylinder enters forward work port and flows into the return passage and out the valve outlet port.

TRAVEL RELIEF VALVE (if so equipped)

The travel relief valve is seated.

LIFT RELIEF VALVE

The lift relief valve will remain seated as long as pressures generated in the lift circuit remain less than the relief valve preset opening pressure.



OIL FLOW

Neutral Drive - Lower Lift

TRAVEL SPOOL

The travel spool is in the neutral (centered) position.
The open center passage to the lift spool supply passage is open.

The oil at the travel spool work ports is static.

ATTACHMENT LIFT SPOOL

The lift is stroked into the valve body. This closes the open center passage allowing pump supply oil to leave the front work port to the lift cylinder and return from the lift cylinder to the rear work port.

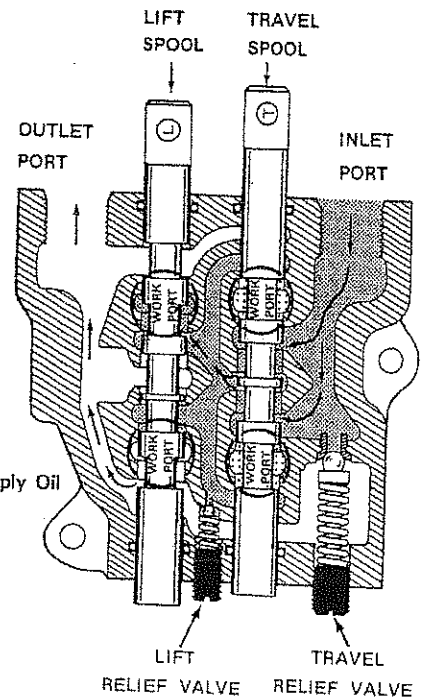
Return oil from the lift cylinder enters the return oil passage and flows to the valve outlet port.

TRAVEL RELIEF VALVE (if so equipped)

The travel relief valve is seated.

LIFT RELIEF VALVE

The lift relief valve will remain seated as long as pressures generated in the lift circuit remain less than the relief valve preset opening pressure.



TRACTOR TRAVEL VALVE - ATTACHMENT LIFT

OIL FLOW

Forward Drive - Raise Lift

TRAVEL SPOOL

The travel spool is stroked into the valve body. This closes the open center passage allowing pump supply oil to flow from the forward work port to the hydraulic motor and return oil from the hydraulic motor to enter the rear work port.

Return oil from the hydraulic motor enters the supply passage for the lift spool.

LIFT SPOOL

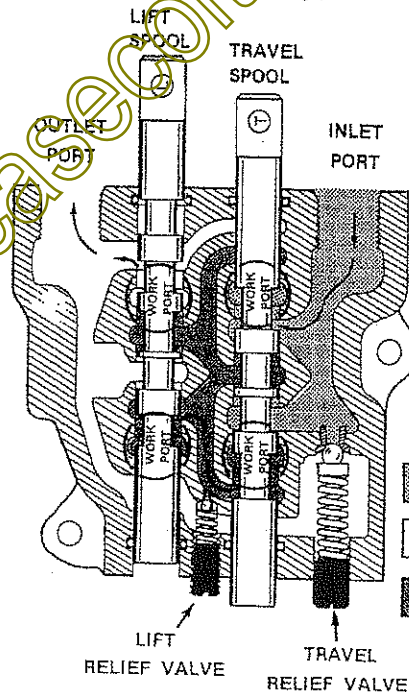
The lift spool is stroked out of the valve body. This closes the open center passage allowing series connection oil returned from the hydraulic motor to leave the rear work port to the lift cylinder. Return oil from the lift cylinder enters the forward work port and flows into the return galley and out the valve outlet port.

TRAVEL RELIEF VALVE (if so equipped)

The travel relief valve will remain seated as long as the sum of travel circuit pressure plus lift circuit pressure remains less than the relief valve preset opening point.

LIFT RELIEF VALVE

The lift relief valve will remain seated as long as pressures generated in the lift circuit remain less than the relief valve preset opening point.



OIL FLOW

Forward Drive - Float Lift

TRAVEL SPOOL

The travel spool is stroked into the valve body. This closes the open center passage allowing pump supply oil to flow from the forward work port to the hydraulic motor and return oil from the hydraulic motor to enter the rear work port.

Return oil from the hydraulic motor enters the supply passage for the lift spool.

LIFT SPOOL

The lift spool is stroked fully into the valve body and is physically held in the detent mechanism.

The open center passage is open allowing supply oil to flow into the return oil galley.

Both lift spool work ports are open to the return oil galley.

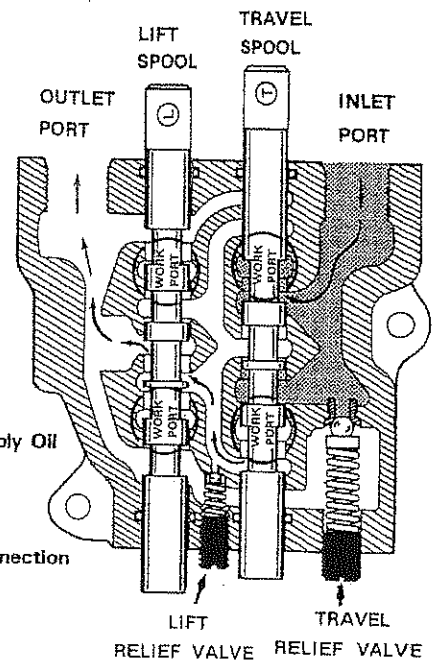
This allows the lift cylinder piston to move in and out (attachment follows contour of ground) without hydraulic resistance.

TRAVEL RELIEF VALVE (if so equipped)

The travel relief valve will remain seated as long as the pressure generated in the travel circuit remain below the relief valve preset opening point.

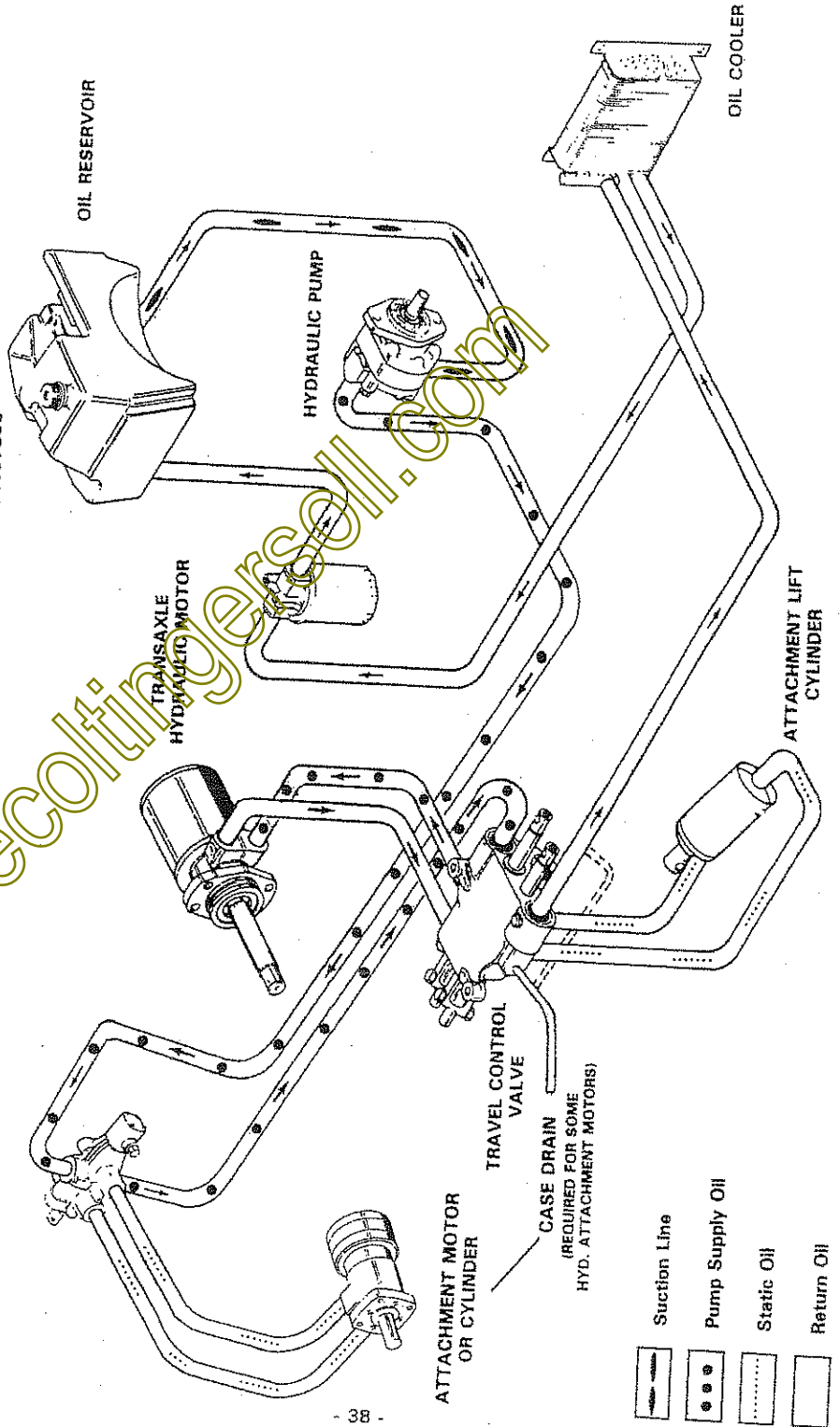
LIFT RELIEF VALVE

The lift relief valve is seated.



HYDRAULIC PTO CIRCUIT
 FORWARD DRIVE - NEUTRAL LIFT - DISENGAGED PTO
 (200-400 SERIES TRACTORS (ALL)
 3000-4000 SERIES TRACTORS PRIOR TO PIN 14167800

HYDRAULIC PTO
 VALVE



HYDRAULIC PTO CIRCUIT - NEUTRAL PTO
200-400 SERIES TRACTORS (ALL)
3000-4000 SERIES TRACTORS PRIOR TO PIN 14167800

GENERAL INFORMATION

The hydraulic PTO valve is used for operation of hydraulic attachments such as hydraulic driven mowers, vacuum system blower, tiller, log splitter or other compatible hydraulic equipment. Refer to the Hydraulic Test Procedures section of this manual for the flow and pressure specifications of each model tractor.

The hydraulic PTO valve is a single spool, open center valve with relief.

NOTE: Some earlier production valves used on 200-400 tractors were provided without relief valves. Care should be used with these to prevent excessive pressure buildup.

The hydraulic PTO valve is connected in series between the pump and travel control valve.

OIL FLOW

Forward Drive - Neutral Lift - Neutral/Disengaged PTO

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the hydraulic PTO valve.

HYDRAULIC PTO VALVE

The PTO valve spool is in the neutral position. This allows oil to pass through the open center passage and on to the travel control valve.

TRAVEL CONTROL VALVE

The travel control valve spool is stroked into the valve body. This:

- a. closes the open center passage blocking the free flow path of oil.
- b. opens the passage for supply oil (from the PTO valve) to leave the front work port of the valve to the transaxle hydraulic motor.
- c. opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve. From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

The lift valve spool is in neutral.

HYD. PTO ATTACHMENT MOTOR OR CYLINDER

The attachment hydraulic motor or cylinder connected to the PTO valve is static.

TRANSAXLE HYDRAULIC MOTOR

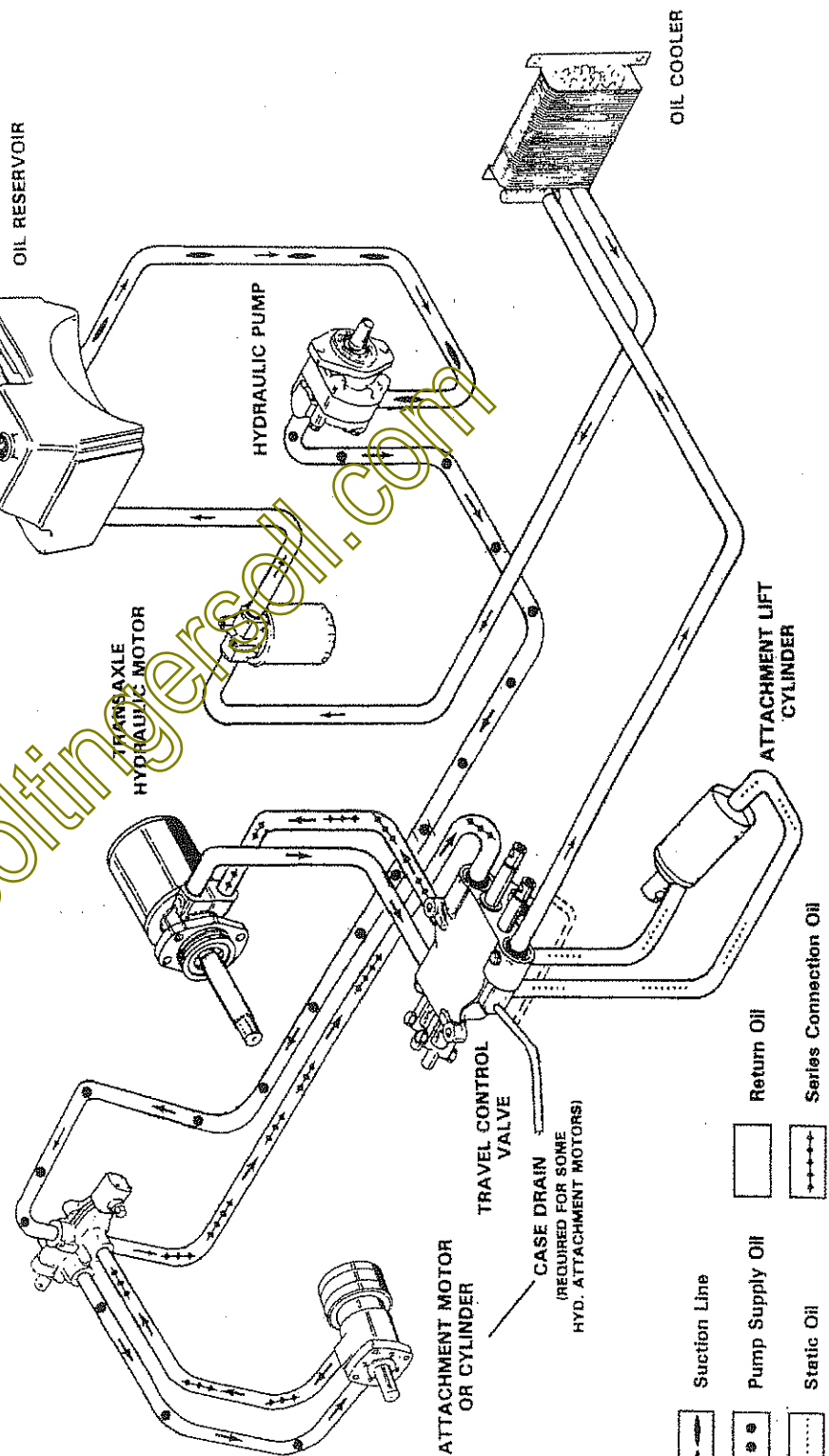
The travel motor is driven in forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.

HYDRAULIC PTO CIRCUIT
FORWARD DRIVE - NEUTRAL LIFT - PTO ENGAGED (ON)
200-400 SERIES TRACTORS (ALL)
3000-4000 SERIES TRACTORS PRIOR TO PIN 14167800

HYDRAULIC PTO
VALVE



HYDRAULIC PTO CIRCUIT - PTO ENGAGED
200-400 SERIES TRACTORS (ALL)
3000-4000 SERIES TRACTORS PRIOR TO PIN 14167800

OIL FLOW

Forward Drive - Neutral Lift - PTO Engaged (On)

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the hydraulic PTO valve.

HYDRAULIC PTO VALVE

The PTO valve spool is stroked in or out the valve body when PTO handle is moved to engage position. This:

- a. closes the open center passage blocking the free flow path of oil.
- b. opens the passage for pump supply oil to leave the pressurized work port of the PTO valve to the attachment hydraulic motor.
- c. opens the passage for return oil from the attachment hydraulic motor to enter the return work port of the PTO valve and flow to the outlet port of the valve.
- d. If valve spool is moved into the valve body during engagement, the work port nearest the spool end of valve becomes the pressurized port. If valve spool is moved out of the valve body during engagement, the work port furthest from the spool end of valve becomes the pressurized port.

If pressure in the PTO circuit exceeds the relief valve setting in the PTO valve, the relief valve will open allowing high pressure oil to pass to the outlet port of the PTO valve.

From the outlet port, oil flow continues to the inlet port of the travel valve.

TRAVEL CONTROL VALVE

The travel valve is stroked into the valve body. This:

- a. closes the open center passage blocking the free flow path of oil.

- b. opens the passage for supply oil (from the PTO valve) to leave the front work port of the valve to the transaxle hydraulic motor.

- c. opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve. From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

The lift valve spool is in neutral.

HYDRAULIC PTO ATTACHMENT MOTOR OR CYLINDER

The rotary attachment motor is driven by the oil flow passing through it or the hydraulic cylinder is extended or retracted.

TRANSAXLE HYDRAULIC MOTOR

The travel motor is driven in forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.

The hydraulic PTO circuit and travel control valve circuit are connected in series. Therefore, when both circuits are actuated simultaneously, the pressures generated by resistance to flow in each circuit add.

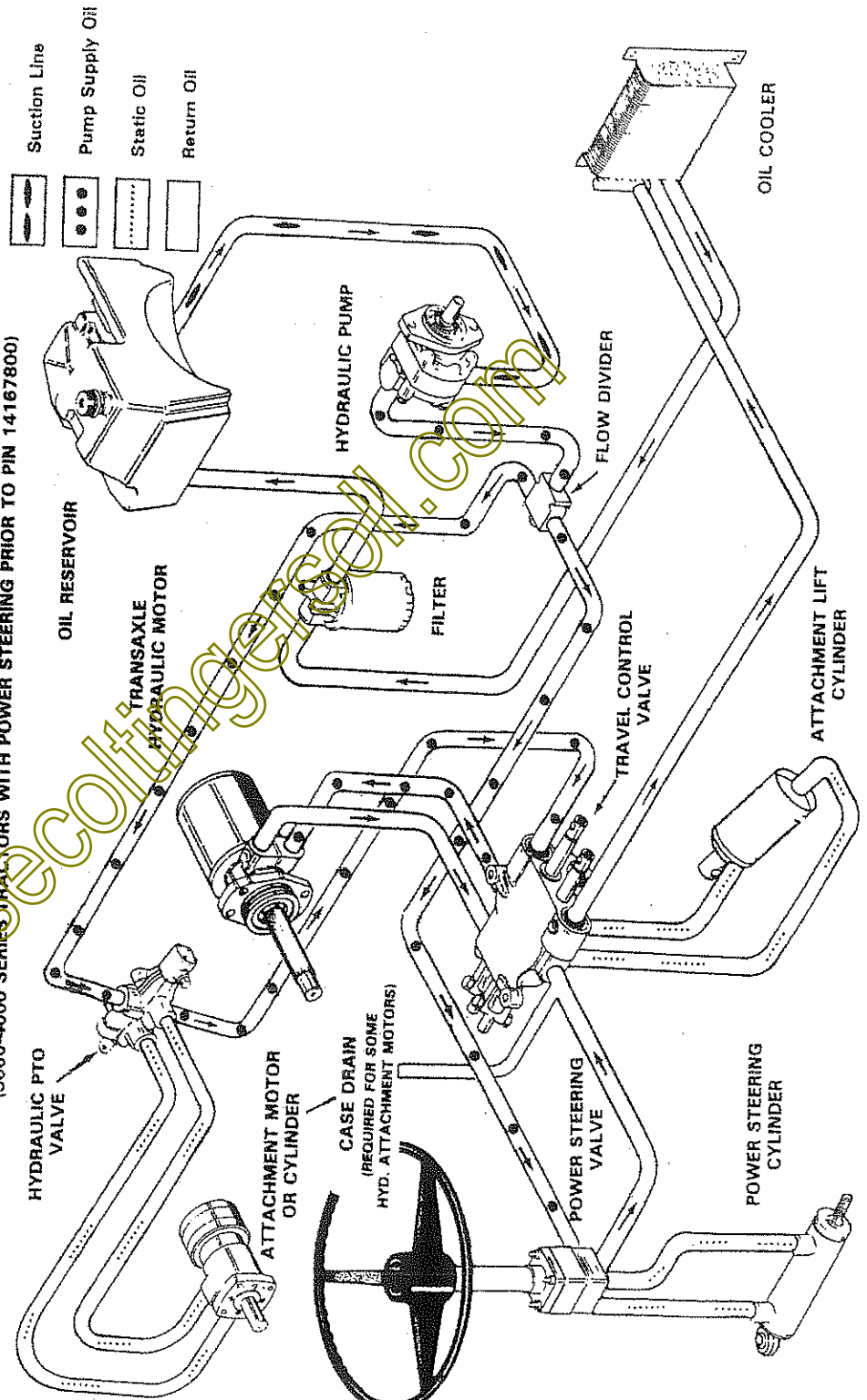
RELIEF VALVE LOCATIONS

PTO Circuit - Relief valve in PTO valve.

Ground Travel Circuit - Travel relief valve in travel control valve.

Attachment Lift Circuit - Lift relief valve in travel control valve.

HYDRAULIC PTO CIRCUIT
FORWARD DRIVE - NEUTRAL LIFT - NEUTRAL/DISENGAGED PTO
(3000-4000 SERIES TRACTORS WITH POWER STEERING PRIOR TO PIN 14167800)



HYDRAULIC PTO CIRCUIT - NEUTRAL PTO (3000-4000 SERIES TRACTORS WITH POWER STEERING PRIOR TO PIN 14167800)

GENERAL INFORMATION

The hydraulic PTO valve is used for operation of hydraulic attachments such as hydraulic driven mowers, vacuum system blower, tiller, log splitter or other compatible hydraulic equipment. Refer to the Hydraulic Test Procedures section of this manual for the flow and pressure specifications of each model tractor.

The hydraulic PTO valve is a single spool, open center valve with relief.

The hydraulic PTO valve is connected in series between the power steering flow divider valve and tractor travel control valve.

OIL FLOW

Forward Drive - Neutral Lift - Neutral/Disengaged PTO

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the flow divider valve.

FLOW DIVIDER VALVE

Oil enters the flow divider valve and contacts the flow divider spool. The first 2 GPM (7.6 liters/min.) is diverted to the power steering valve as priority flow.

Additional flow shifts the flow divider spool and diverts the remainder of pump flow to the inlet of the PTO valve.

HYDRAULIC PTO VALVE

The PTO valve spool is in the neutral position. This allows oil to pass through the open center passage and on to the inlet of the travel control valves.

TRAVEL CONTROL VALVE

The travel control valve spool is stroked into the valve body. This:

- closes the open center passage blocking the free flow path of oil.
 - opens the passage for supply oil (from the PTO valve) to leave the front work port of the valve to the transaxle hydraulic motor.
 - opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve.
- From the valve outlet, oil flow continues through the oil cooler and back to the hydraulic oil filter and reservoir.

The lift valve spool is in neutral.

HYDRAULIC PTO ATTACHMENT MOTOR OR CYLINDER

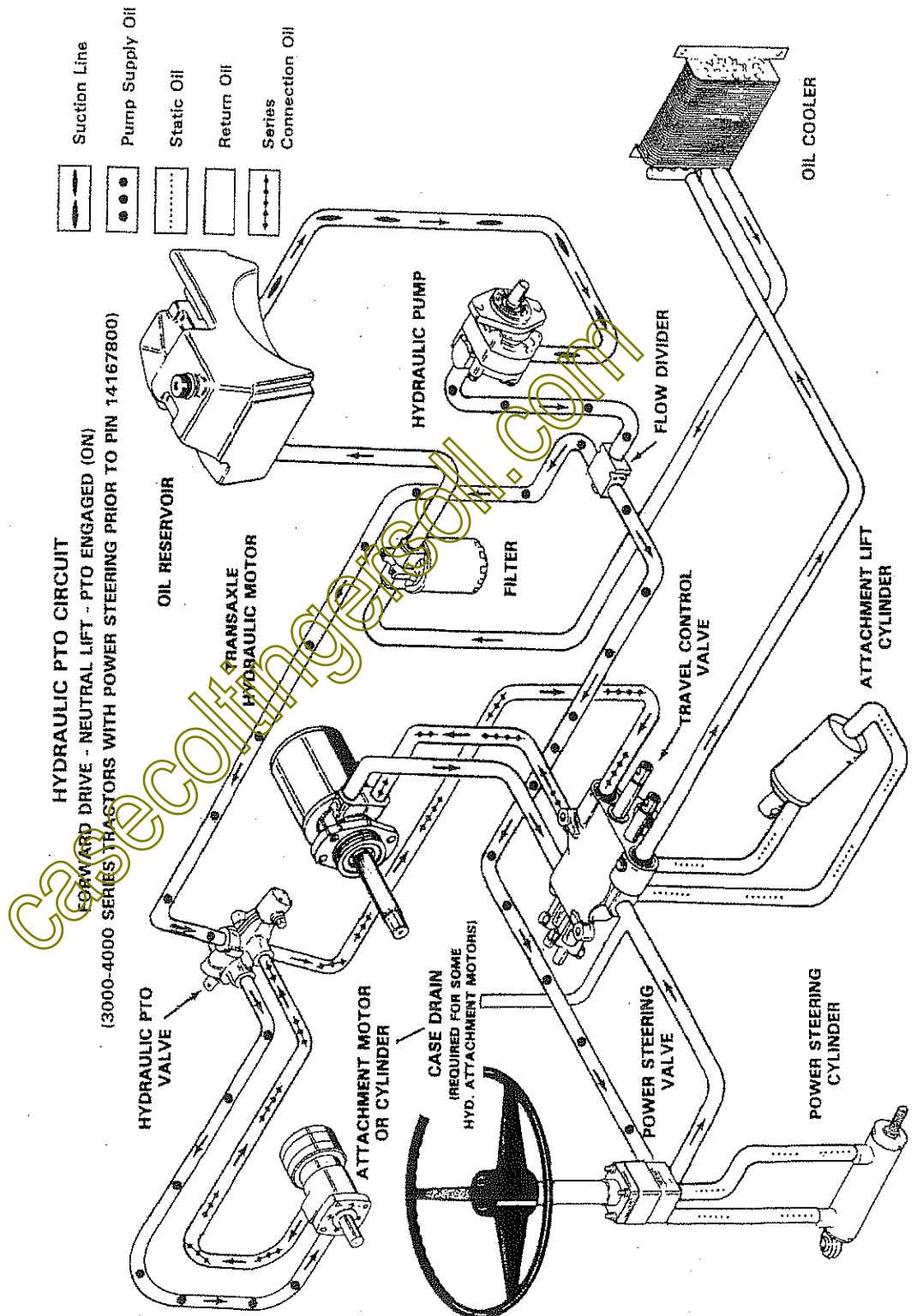
The attachment hydraulic motor or cylinder connected to the PTO valve is static.

TRANSAXLE HYDRAULIC MOTOR

The travel motor is driven in forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.



HYDRAULIC PTO CIRCUIT - PTO ENGAGED (3000-4000 SERIES TRACTORS WITH POWER STEERING PRIOR TO PIN 14167800)

OIL FLOW

Forward Drive - Neutral Lift - PTO Engaged (On)

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the flow divider valve.

FLOW DIVIDER VALVE

Oil enters the flow divider valve and contacts the flow divider spool. The first 2 GPM (7.6 liters/min.) is diverted to the power steering valve as priority flow.

Additional flow shifts the flow divider spool and diverts the remainder of pump flow to the inlet of the PTO valve.

HYDRAULIC PTO VALVE

The PTO valve is stroked into the valve body when PTO handle is moved forward. This:

- a. closes the open center passage blocking the free flow path of oil.
- b. opens the passage for pump supply oil to leave the front work port of the PTO valve to the attachment hydraulic motor.
- c. opens the passage for return oil from the attachment hydraulic motor to enter the rear work port of the PTO valve and flow to the outlet port of the valve.

If pressure in the PTO circuit exceeds the relief valve setting in the PTO valve, the relief valve will open allowing high pressure oil to pass to the outlet port of the PTO valve.

From the outlet port, oil flow continues to the inlet port of the travel valve.

TRAVEL CONTROL VALVE

The travel valve is stroked into the valve body. This:

- a. closes the open center passage blocking the free flow path of oil.

- b. opens the passage for supply oil (from the PTO valve) to leave the front work port of the valve to the transaxle hydraulic motor.

- c. opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve. From the valve outlet, oil flow continues through the oil cooler and back to the hydraulic oil filter and reservoir.

The lift valve spool is in neutral.

HYDRAULIC PTO ATTACHMENT MOTOR OR CYLINDER

The attachment motor is driven by the oil flow passing through it or the hydraulic cylinder is extended or retracted.

TRANSAXLE HYDRAULIC MOTOR

The travel motor is driven in forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.

The Hydraulic PTO circuit and travel control valve circuit are connected in series. Therefore, when both circuits are actuated simultaneously, the pressures generated by resistance to flow in each circuit add.

RELIEF VALVE LOCATIONS

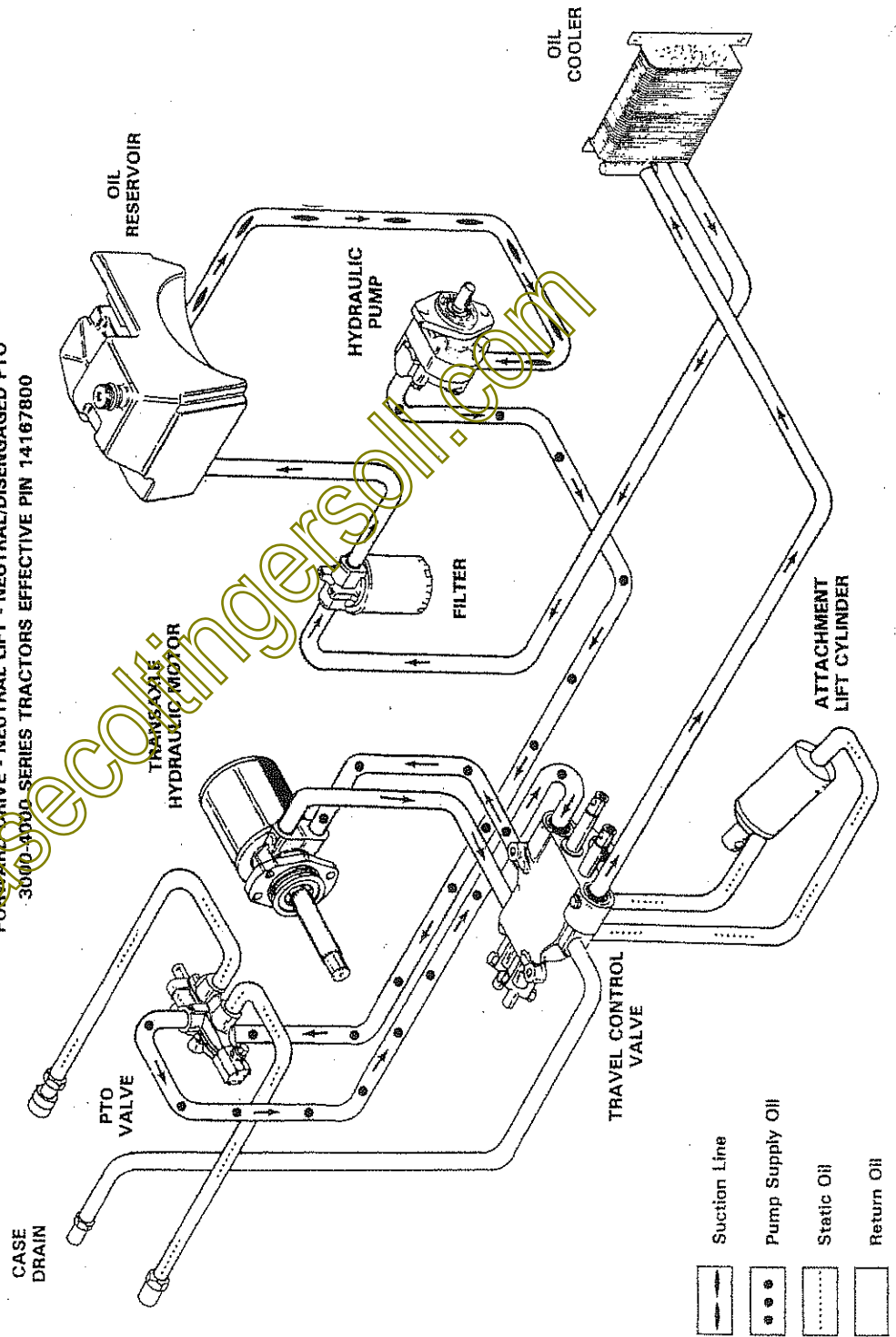
PTO Circuit - Relief valve in PTO valve

Ground Travel Circuit - Travel relief valve in travel control valve

Attachment Lift Circuit - Lift relief valve in travel control valve

Power Steering Circuit - Relief valve in power steering valve.

HYDRAULIC PTO CIRCUIT
FORWARD DRIVE - NEUTRAL/LIFT - NEUTRAL/DISENGAGED PTO
3000-4000 SERIES TRACTORS EFFECTIVE PIN 14167800



HYDRAULIC PTO CIRCUIT - NEUTRAL PTO
3000/4000 SERIES TRACTORS EFFECTIVE PIN 14167800

GENERAL INFORMATION

The hydraulic PTO valve is used for operation of hydraulic attachments such as hydraulic driven mowers, vacuum system blower, tiller, etc. Refer to the Procedures section of this manual for the flow and pressure specifications of each model tractor.

The hydraulic PTO valve is a single spool, open center valve with relief.

The hydraulic PTO valve is connected in series between the pump and tractor travel control valve.

OIL FLOW

Forward Drive - Neutral Lift - Neutral/Disengaged PTO

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the hydraulic PTO valve.

HYDRAULIC PTO VALVE

The PTO valve spool is in the neutral position. This allows oil to pass through the open center passage and on to the travel control valve.

TRAVEL CONTROL VALVE

The travel control valve spool is stroked into the valve body. This:

- closes the open center passage blocking the free flow path of oil.
- opens the passage for supply oil (from the PTO valve) to leave the front work port of the valve to the transaxle hydraulic motor.
- opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve. From the valve outlet, oil flow continues through the oil cooler and back to the hydraulic oil filter and reservoir.

The lift valve spool is in neutral.

HYDRAULIC PTO ATTACHMENT MOTOR OR CYLINDER

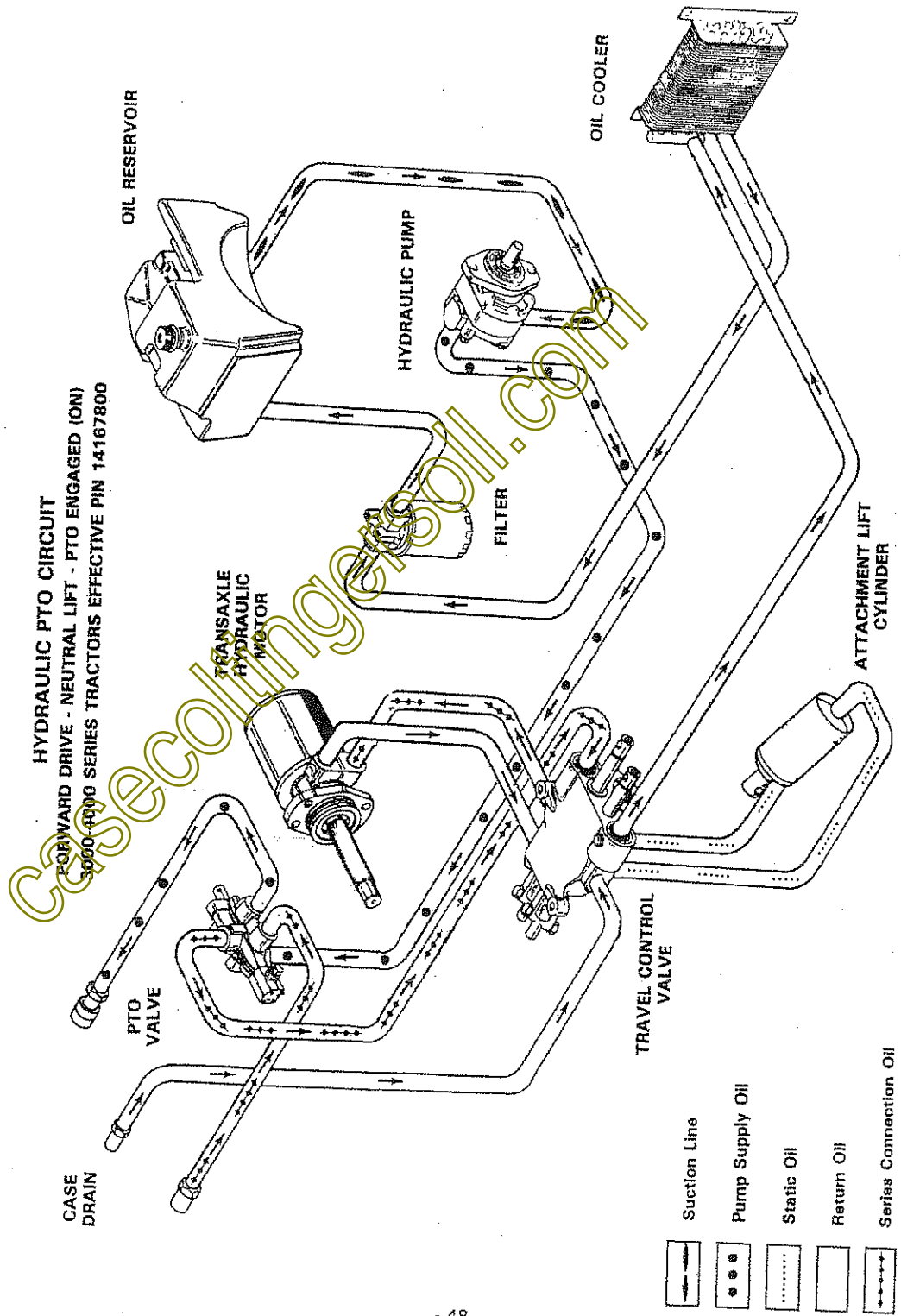
The attachment hydraulic motor or cylinder connected to the PTO valve is static.

TRANSAXLE HYDRAULIC MOTOR

The travel motor is driven in forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.



HYDRAULIC PTO CIRCUIT - PTO ENGAGED
3000-4000 SERIES TRACTOR EFFECTIVE PIN 14167800

OIL FLOW

Forward Drive - Neutral Lift - PTO Engaged (On)

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the hydraulic PTO valve.

HYDRAULIC PTO VALVE

The PTO valve is stroked into the valve body when PTO handle is moved to the right or ON position. This:

- closes the open center passage blocking the free flow path of oil.
- opens the passage for pump supply oil to leave the L.H. work port of the PTO valve to the attachment hydraulic motor.
- opens the passage for return oil from the attachment hydraulic motor to enter the R.H. work port of the PTO valve and flow to the outlet port of the valve.

If pressure in the PTO circuit exceeds the relief valve setting in the PTO valve, the relief valve will open allowing high pressure oil to pass to the outlet port of the PTO valve.

From the outlet port, oil flow continues to the inlet port of the travel valve.

TRAVEL CONTROL VALVE

The travel valve is stroked into the valve body. This:

- closes the open center passage blocking the free flow path of oil.

- opens the passage for supply oil (from the PTO valve) to leave the front work port of the valve to the transaxle hydraulic motor.

- opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve. From the valve outlet, oil flow continues through the oil cooler and back to the hydraulic oil filter and reservoir.

The lift valve spool is in neutral.

HYDRAULIC PTO ATTACHMENT MOTOR OR CYLINDER

The rotary attachment motor is driven by the oil flow passing through it or the hydraulic cylinder is extended or retracted.

TRANSAXLE HYDRAULIC MOTOR

The travel motor is driven in forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.

The hydraulic PTO circuit and travel control valve circuit are connected in series. Therefore, when both circuits are actuated simultaneously, the pressures generated by resistance to flow in each circuit add.

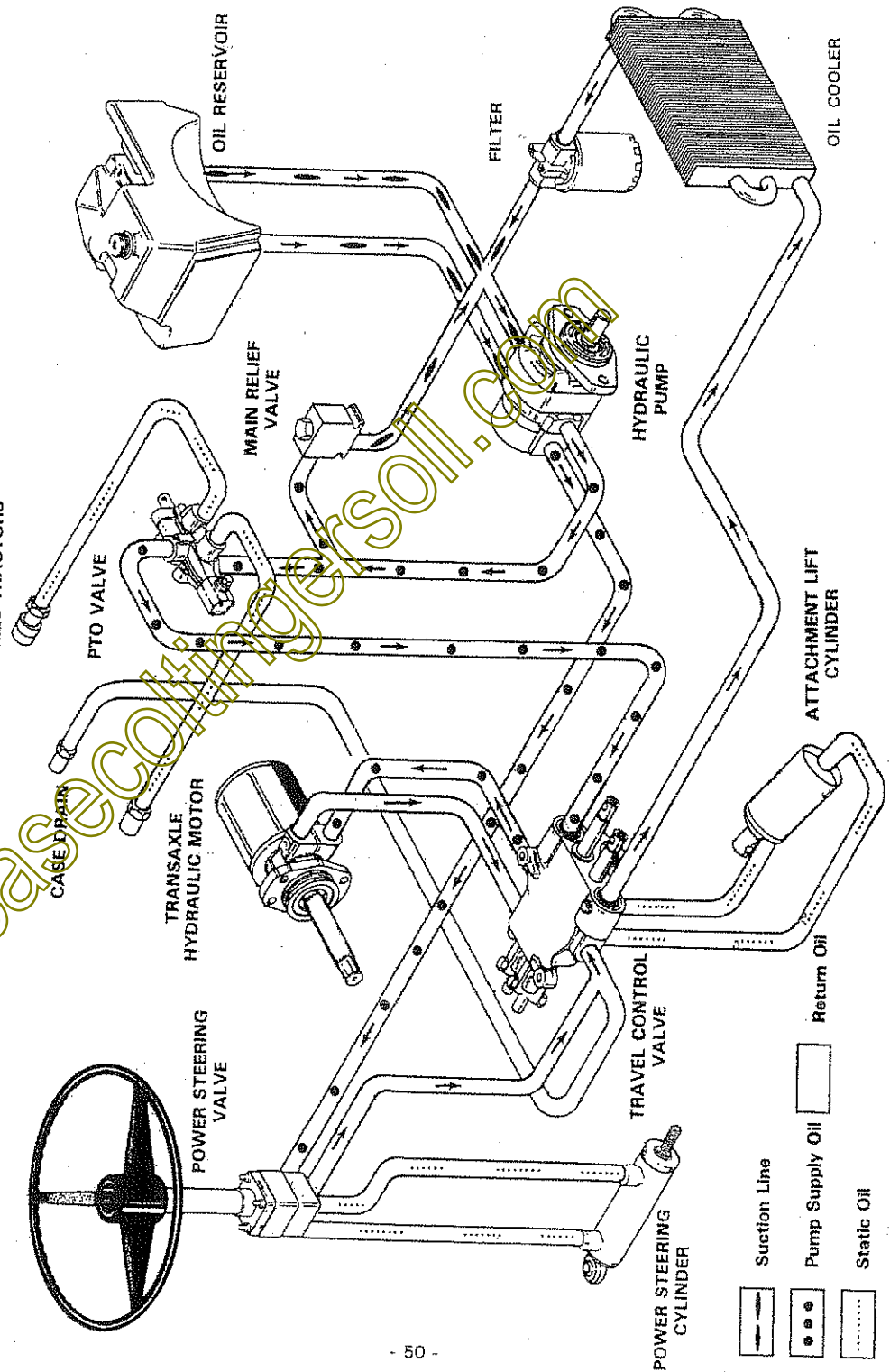
RELIEF VALVE LOCATIONS

PTO Circuit - Relief valve in PTO valve.

Ground Travel Circuit - Travel relief valve in travel control valve.

Attachment Lift Circuit - Lift relief valve in travel control valve.

HYDRAULIC PTO CIRCUIT FORWARD DRIVE - NEUTRAL LIFT - NEUTRAL/DISENGAGED PTO 3100-4100 SERIES TRACTORS



HYDRAULIC PTO CIRCUIT - NEUTRAL PTO 3100-4100 SERIES TRACTORS

GENERAL INFORMATION

The hydraulic PTO valve is used for operation of hydraulic attachments such as hydraulic driven mowers, vacuum system blower, tillage splitter or other compatible hydraulic equipment. Refer to the Hydraulic Test Procedures section of this manual for the flow and pressure specifications of each model tractor.

The hydraulic PTO valve is a single spool, open center valve.

The hydraulic PTO valve is connected in series between the pump and tractor control travel valve.

OIL FLOW

Forward Drive - Neutral Lift - Neutral/Disengaged PTO

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the front pump section and discharged from the outlet side of the pump into the inlet of the hydraulic PTO valve.

HYDRAULIC PTO VALVE

The PTO valve spool is in the neutral position. This allows oil to pass through the open center passage and on to the travel control valve.

TRAVEL CONTROL VALVE

The travel control valve spool is stroked into the valve body. This:

- closes the open center passage blocking the free flow path of oil.
- opens the passage for supply oil (from the PTO valve) to leave the front work port of the valve to the transaxle hydraulic motor.
- opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve.

From the valve outlet, oil flow continues through the oil cooler and back to the hydraulic oil filter and reservoir.

The lift valve spool is in neutral.

HYDRAULIC PTO ATTACHMENT MOTOR OR CYLINDER

The attachment hydraulic motor or cylinder connected to the PTO valve is static.

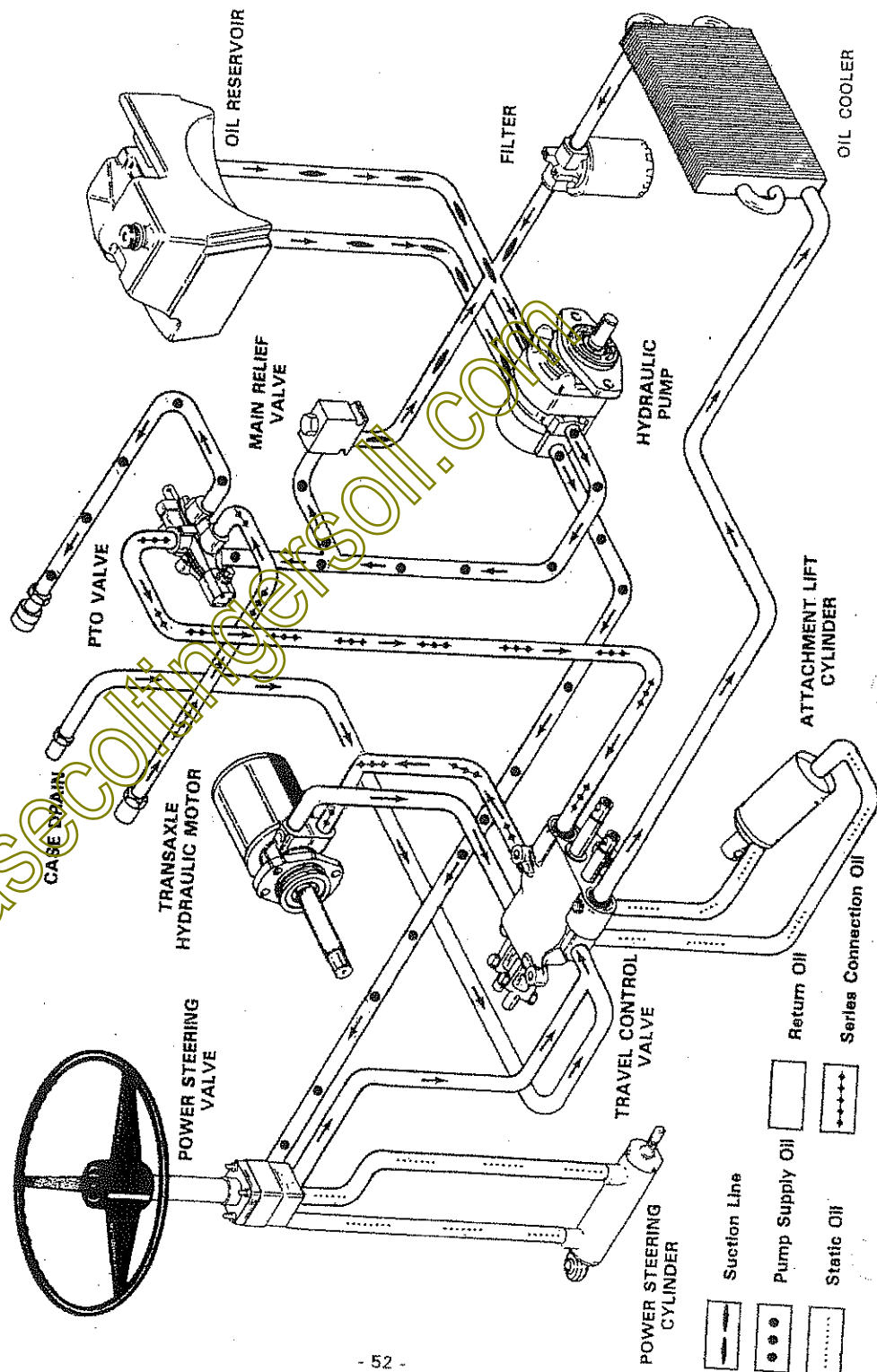
TRANSAXLE HYDRAULIC MOTOR

The travel motor is driven in forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.

HYDRAULIC PTO CIRCUIT
FORWARD DRIVE - NEUTRAL LIFT - PTO ENGAGED (ON)
3100-4100 SERIES TRACTORS



HYDRAULIC PTO CIRCUIT - PTO ENGAGED 3100-4100 SERIES TRACTORS

OIL FLOW

Forward Drive - Neutral Lift - PTO Engaged (On)

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the hydraulic PTO valve.

HYDRAULIC PTO VALVE

The PTO valve is stroked into the valve body when PTO handle is moved to the right or ON position. This:

- a. closes the open center passage blocking the free flow path of oil.
- b. opens the passage for pump supply oil to leave the L.H. work port of the PTO valve to the attachment hydraulic motor.
- c. opens the passage for return oil from the attachment hydraulic motor to enter the R.H. work port of the PTO valve and flow to the outlet port of the valve.

If pressure in the PTO circuit exceeds the main relief valve setting, the relief valve will open allowing high pressure oil to pass to the inlet fitting on the front pump section.

From the outlet port, oil flow continues to the inlet port of the travel valve.

TRAVEL CONTROL VALVE

The travel valve is stroked into the valve body. This:

- a. closes the open center passage blocking the free flow path of oil.

- b. opens the passage for supply oil (from the PTO valve) to leave the front work port of the valve to the transaxle hydraulic motor.

- c. opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve.

From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

The lift valve spool is in neutral.

HYDRAULIC PTO ATTACHMENT MOTOR OR CYLINDER

The rotary attachment motor is driven by the oil flow passing through it or the hydraulic cylinder is extended or retracted.

TRANSAXLE HYDRAULIC MOTOR

The travel motor is driven in forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.

The Hydraulic PTO circuit and travel control valve circuit are connected in series. Therefore, when both circuits are actuated simultaneously, the pressures generated by resistance to flow in each circuit add.

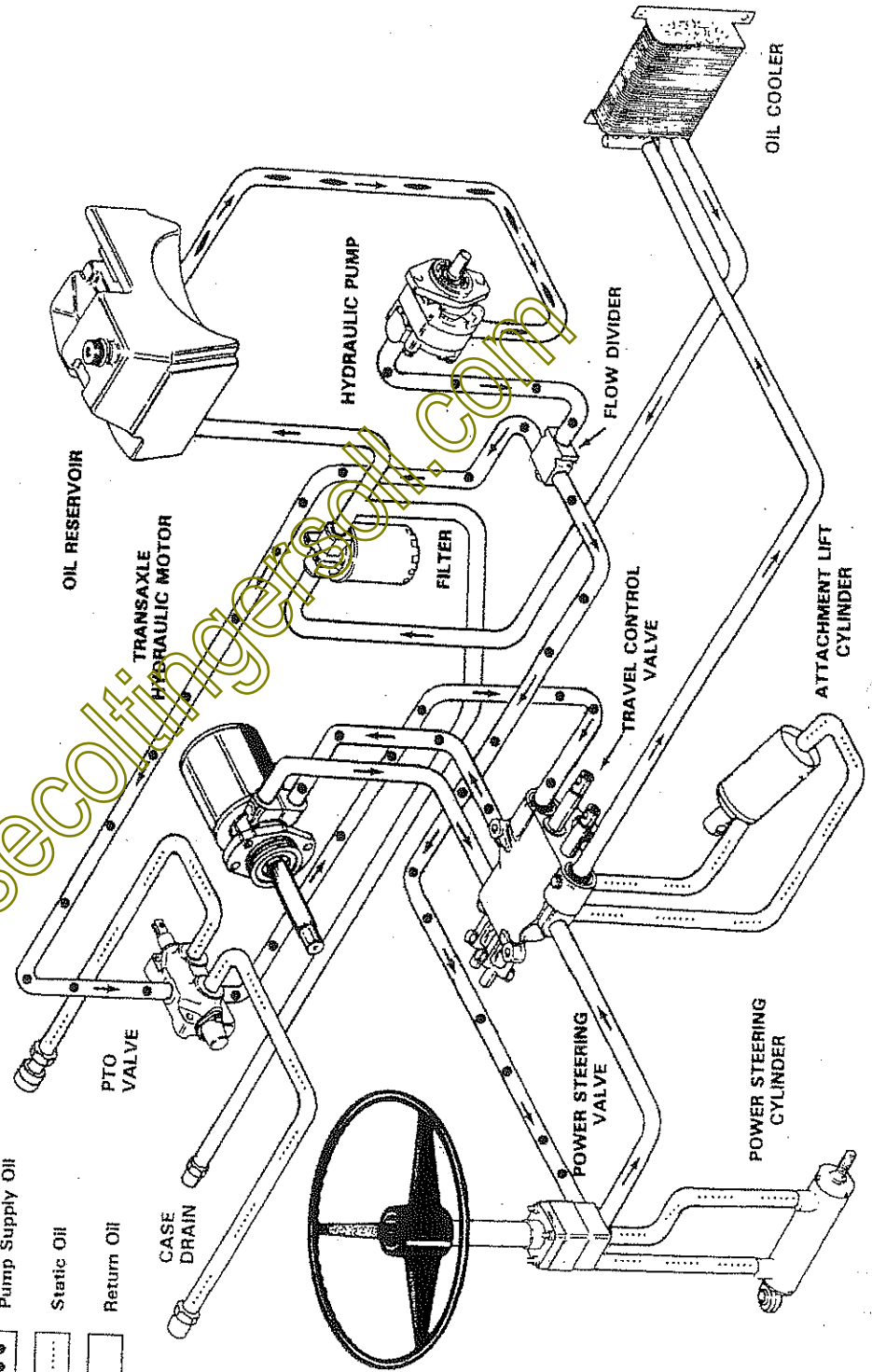
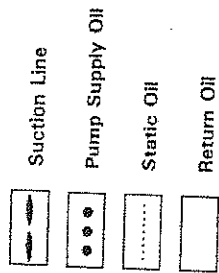
RELIEF VALVE LOCATIONS

PTO Circuit - controlled by main relief valve.

Ground Travel Circuit - controlled by main relief valve.

Attachment Lift Circuit - Lift relief valve in travel control valve.

HYDRAULIC PTO CIRCUIT **FORWARD DRIVE - NEUTRAL LIFT - PTO DISENGAGED** **(3000-4000 SERIES TRACTORS WITH POWER STEERING 14181900 & AFTER)**



HYDRAULIC PTO CIRCUIT - NEUTRAL PTO
(3000-4000 SERIES TRACTORS WITH POWER STEERING PIN 14181900 & AFTER)

GENERAL INFORMATION

The hydraulic PTO valve is used for operation of hydraulic attachments such as hydraulic driven mowers, vacuum system blower, tillage implement or other compatible hydraulic equipment. Refer to the Hydraulic Test Procedures section of this manual for the flow and pressure specifications of each model tractor.

The hydraulic PTO valve is a single spool, open center valve with relief.

The hydraulic PTO valve is connected in series between the power steering flow divider valve and tractor travel control valve.

OIL FLOW

Forward Drive - Neutral Lift - Neutral/Disengaged PTO

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the flow divider valve.

FLOW DIVIDER VALVE

Oil enters the flow divider valve and contacts the flow divider spool. The first 2 GPM (7.6 liters/min.) is diverted to the power steering valve as priority flow.

Additional flow shifts the flow divider spool and diverts the remainder of pump flow to the inlet of the PTO valve.

HYDRAULIC PTO VALVE

The PTO valve spool is in the neutral position. This allows oil to pass through the open center passage and on to the inlet of the travel control valves.

TRAVEL CONTROL VALVE

The travel control valve spool is stroked into the valve body. This:

- a. closes the open center passage blocking the free flow path of oil.
 - b. opens the passage for supply oil (from the PTO valve) to leave the front work port of the valve to the transaxle hydraulic motor.
 - c. opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve.
- From the valve outlet, oil flow continues through the oil cooler and back to the hydraulic oil filter and reservoir.

The lift valve spool is in neutral.

HYDRAULIC PTO ATTACHMENT MOTOR OR CYLINDER

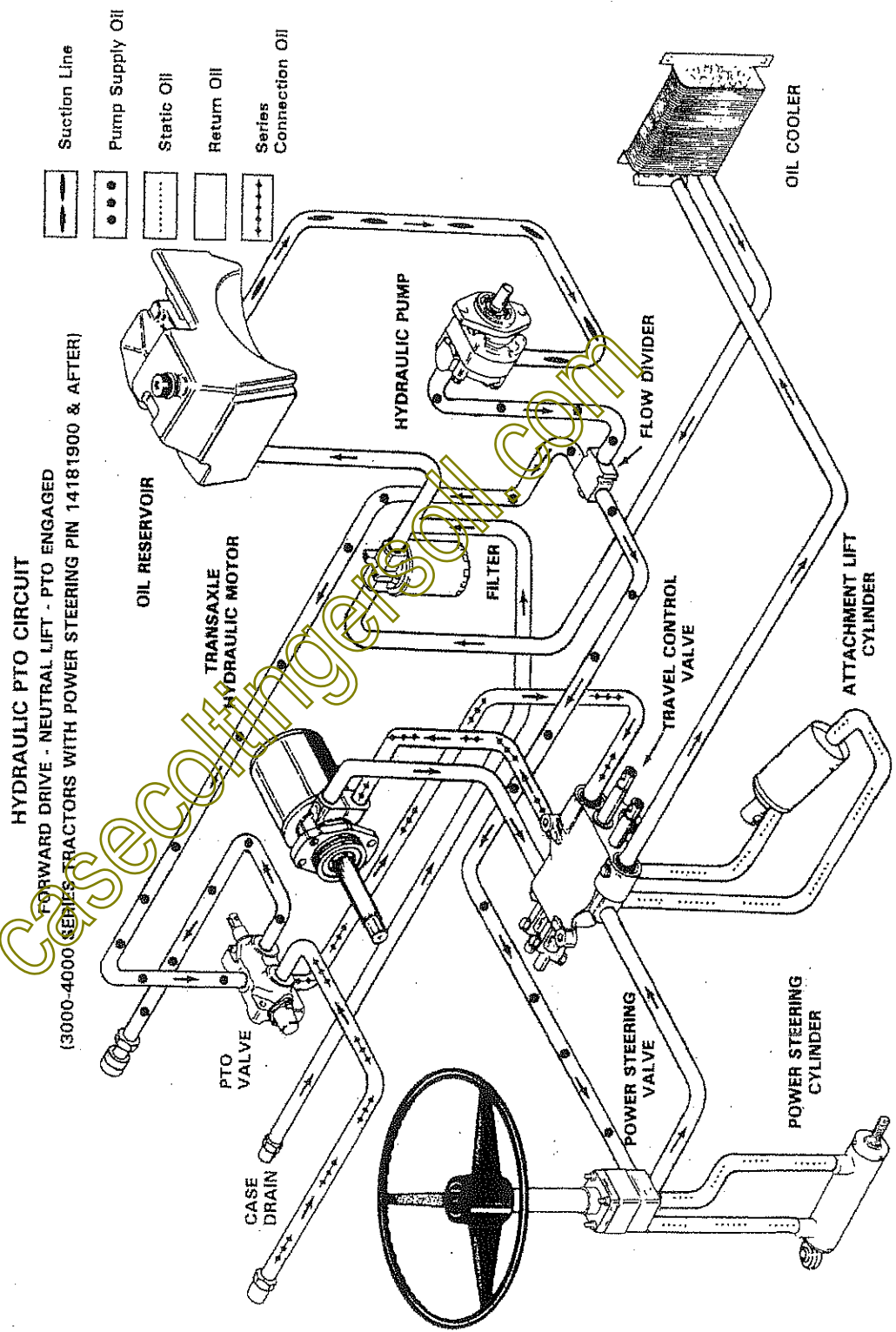
The attachment hydraulic motor or cylinder connected to the PTO valve is static.

TRANSAXLE HYDRAULIC MOTOR

The travel motor is driven in forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.



HYDRAULIC PTO CIRCUIT - PTO ENGAGED (3000-4000 SERIES TRACTORS WITH POWER STEERING PIN 14181900 & AFTER)

OIL FLOW

Forward Drive - Neutral Lift - PTO Engaged (On)

PUMP

- b. opens the passage for supply oil (from the PTO valve) to leave the front work port of the valve to the transaxle hydraulic motor.

- c. opens the passage for return oil from the transaxle hydraulic motor to enter the rear work port and flow to the outlet port of the valve. From the valve outlet, oil flow continues through the oil cooler and back to the hydraulic oil filter and reservoir.

FLOW DIVIDER VALVE

Oil enters the flow divider valve and contacts the flow divider spool. The first 2 GPM (7.6 liters/min.) is diverted to the power steering valve as priority flow.

Additional flow shifts the flow divider spool and diverts the remainder of pump flow to the inlet of the PTO valve.

HYDRAULIC PTO VALVE

The PTO valve is stroked into the valve body when PTO handle is moved to the right or ON position. This:

- a. closes the open center passage blocking the free flow path of oil.
- b. opens the passage for pump supply oil to leave the front work port of the PTO valve to the attachment hydraulic motor.
- c. opens the passage for return oil from the attachment hydraulic motor to enter the rear work port of the PTO valve and flow to the outlet port of the valve.

If pressure in the PTO circuit exceeds the relief valve setting in the PTO valve, the relief valve will open allowing high pressure oil to pass to the outlet port of the PTO valve.

From the outlet port, oil flow continues to the inlet port of the travel valve.

TRAVEL CONTROL VALVE

- The travel valve is stroked into the valve body. This:
- a. closes the open center passage blocking the free flow path of oil.

The lift valve spool is in neutral.

HYDRAULIC PTO ATTACHMENT MOTOR OR CYLINDER

The rotary attachment motor is driven by the oil flow passing through it or the hydraulic cylinder is extended or retracted.

TRANSAXLE HYDRAULIC MOTOR

The travel motor is driven in forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.

The Hydraulic PTO circuit and travel control valve circuit are connected in series. Therefore, when both circuits are actuated simultaneously, the pressures generated by resistance to flow in each circuit add.

RELIEF VALVE LOCATIONS

PTO Circuit - Relief valve in PTO valve

Ground Travel Circuit - Travel relief valve in travel control valve

Attachment Lift Circuit - Lift relief valve in travel control valve

Power Steering Circuit - Relief valve in power steering valve.

HYDRAULIC PTO VALVE

OIL FLOW

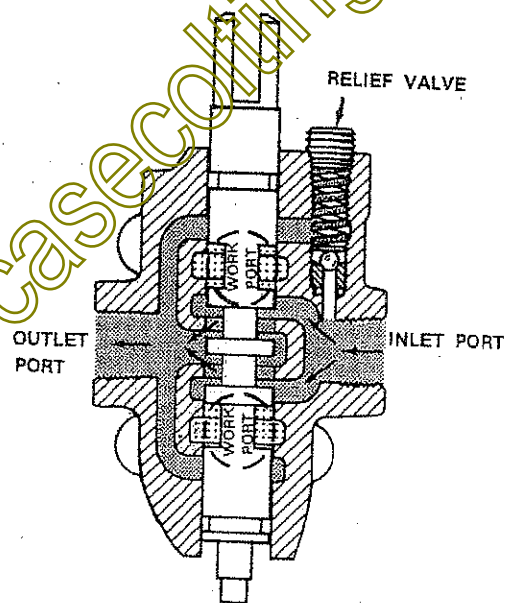
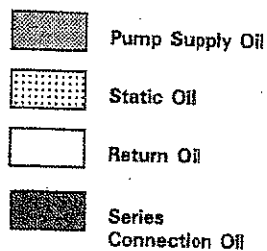
Neutral - PTO OFF (Disengaged)

VALVE SPOOL

The valve spool is in the neutral (centered) position. The open center passage is open allowing pump supply oil to pass through the valve and continue to circuits downstream.

PTO RELIEF VALVE (If so equipped)

The PTO relief valve is seated.



PTO VALVE - NEUTRAL

OIL FLOW

PTO On - Engaged

VALVE SPOOL

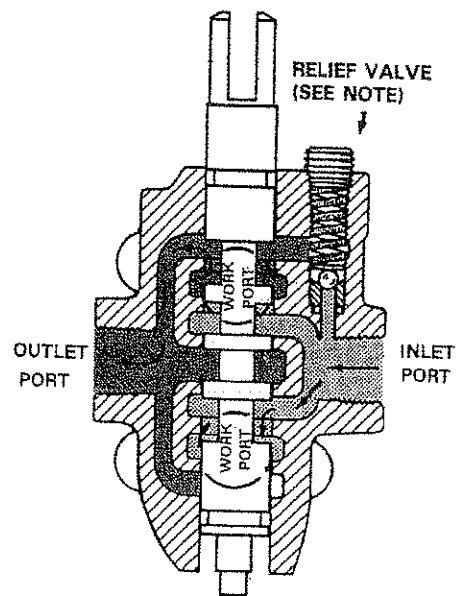
The valve spool is stroked in or out of the valve body. This closes the open center passage allowing pump supply oil to flow from the valve work port to the attachment hydraulic motor. Return oil from the hydraulic motor enters the other valve work port, flows into the return oil passage and out the valve outlet port.

If valve spool moves into body when engaged, work port nearest spool end of valve becomes pressurized port. If valve spool moves out of body when engaged, work port furthest from spool end of valve becomes pressurized port.

PTO RELIEF VALVE (If so equipped)

The PTO relief valve will remain seated as long as pressure generated in the PTO circuit remain less than the relief valve preset opening point.

NOTE: PTO valve used on 3100-4100 series tractors are not equipped with relief valve. System is protected by main relief valve.

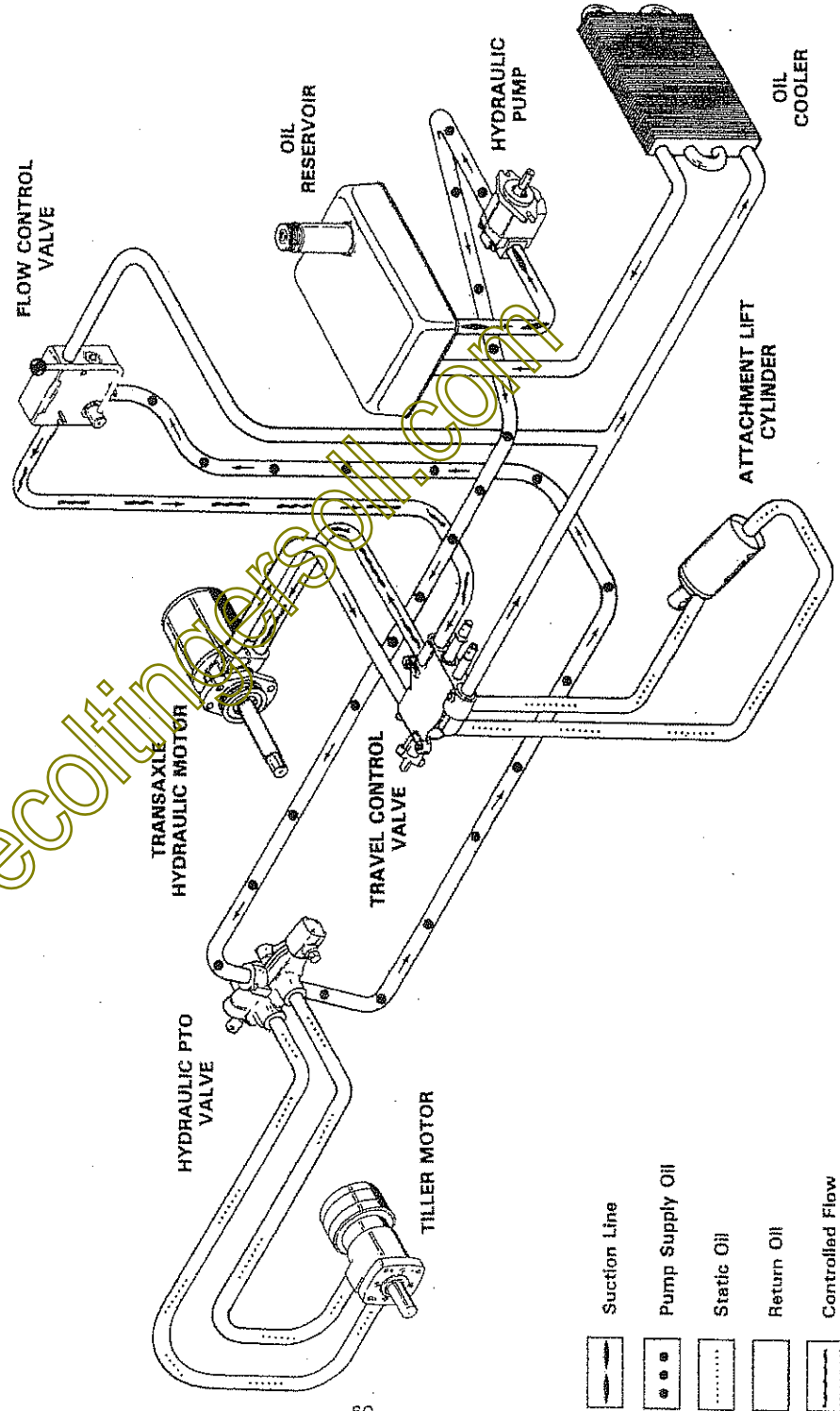


PTO VALVE - ENGAGED

NOTES

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FLOW CONTROL VALVE
 FORWARD DRIVE - NEUTRAL LIFT - NEUTRAL HYDRAULIC PTO - FULL SPEED FLOW CONTROL
 200-400 SERIES TRACTORS (ALL)
 3000-4000 SERIES TRACTORS PRIOR TO PIN 14167800



-  Suction Line
-  Pump Supply Oil
-  Static Oil
-  Return Oil
-  Controlled Flow

FLOW CONTROL VALVE - FULL SPEED FLOW CONTROL

200-400 SERIES TRACTORS (ALL)

3000-4000 SERIES TRACTORS PRIOR TO PIN 14187800

GENERAL INFORMATION

The optional hydraulic flow control valve provides more precise ground speed control of the tractor when using the tiller commercially or in adverse soil conditions. This is achieved by metering oil to the tractor travel valve (with the travel valve placed in full forward or full reverse). The amount of metered oil depends on the position of the flow control valve handle and does not change with pressure requirements at the tractor drive motor.

The flow control valve is connected in series between the hydraulic PTO valve and the tractor travel valve.

The inlet port is connected to the outlet of the hydraulic PTO valve to receive supply oil.

The controlled flow port is connected to the travel valve inlet.

The excess flow port is connected to the return line just ahead of the oil cooler.

The flow control valve contains a rotary orifice to which the handle is attached and a spring tensioned pressure balanced spool.

See the internal valve oil flow section of the manual for more detail.

OIL FLOW

Forward Drive - Neutral Lift - Neutral Hydraulic PTO - Full Speed Flow Control

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the hydraulic PTO valve.

NOTE: On 3000-4000 series tractors with power steering, oil from the pump is supplied to the PTO valve via the power steering flow divider valve.

HYDRAULIC PTO VALVE

The PTO valve spool is in the neutral position. This allows oil to pass through the open center passage and on to the flow control valve.

FLOW CONTROL VALVE

The rotary orifice (operated by handle) is positioned so it is fully opened. The pressure drop created by oil flow through the orifice is not enough to overcome spring tension and the spool remains seated to the right.

This closes the excess flow port and full pump flow is available to the controlled flow port.

From the controlled flow port of the flow control valve, oil enters the travel valve inlet port.

TRAVEL CONTROL VALVE

The travel valve spool is stroked into the valve body. This:

- closes the open center passage blocking the free flow path of oil,
- opens the passage for supply oil from the flow control valve to leave the front work port of the valve to the transaxle hydraulic motor,
- opens the passage for return oil from the hydraulic motor to enter the rear work port and flow to the outlet port of the valve.

From the valve outlet, oil flow continues through the oil cooler and back to reservoir.

The lift valve spool is in neutral.

TILLER MOTOR

The rotary tiller motor is static.

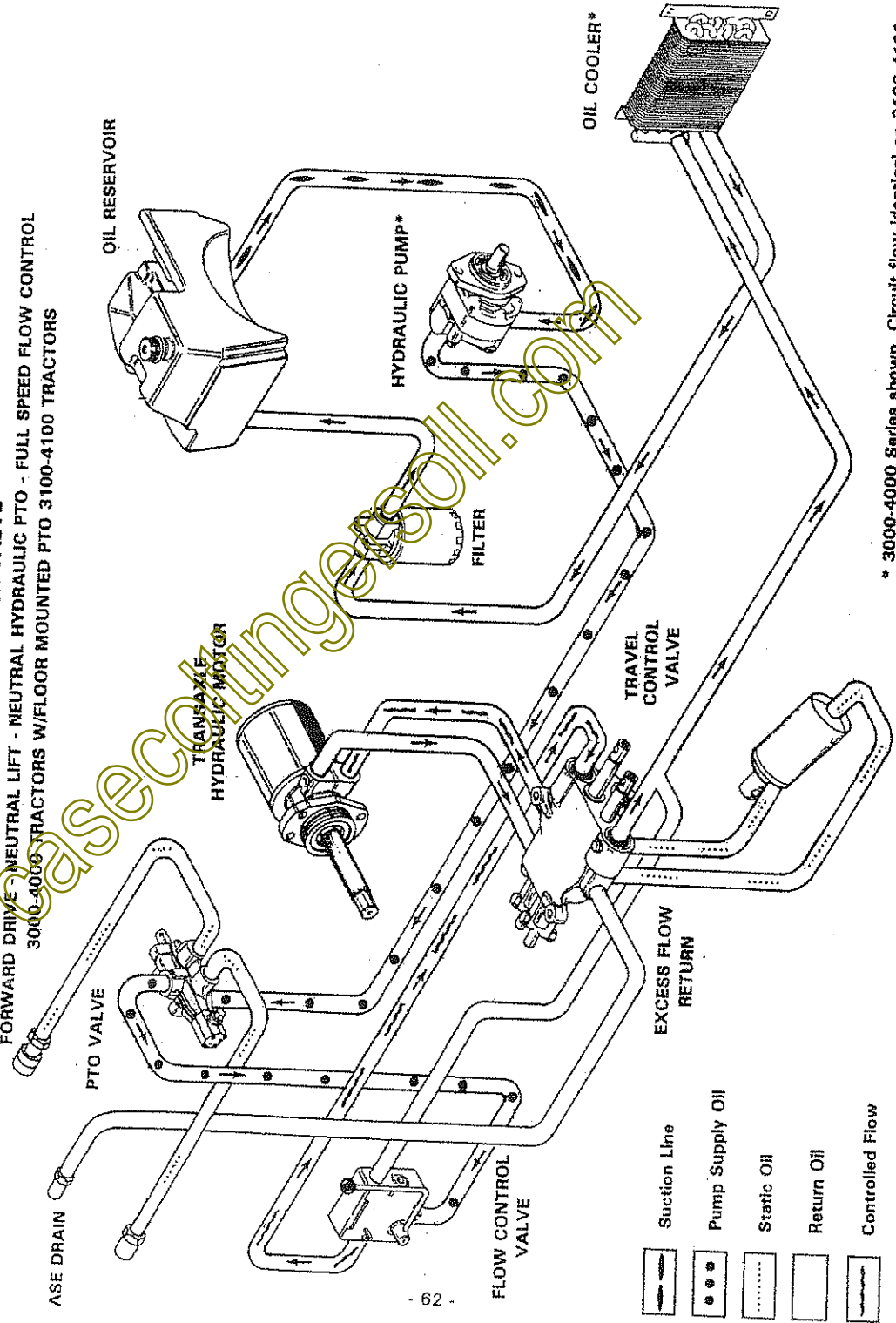
TRANSAXLE HYDRAULIC MOTOR

The transaxle motor is driven in the forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.

FLOW CONTROL VALVE
FORWARD DRIVE - NEUTRAL LIFT - NEUTRAL HYDRAULIC PTO - FULL SPEED FLOW CONTROL
3000-4000 TRACTORS W/FLOOR MOUNTED PTO 3100-4100 TRACTORS



* 3000-4000 Series shown. Circuit flow identical on 3100-4100.

FLOW CONTROL VALVE - FULL SPEED FLOW CONTROL 3000-4000 TRACTORS W/FLOOR MOUNTED PTO 3100-4100 TRACTORS

GENERAL INFORMATION

The optional hydraulic flow control valve provides more precise ground speed control of the tractor when using the tiller commercially or in adverse soil conditions. This is achieved by metering oil to the tractor travel valve (with the travel valve placed in full forward or full reverse). The amount of metered oil depends on the position of the flow control valve handle and does not change with pressure requirements at the tractor drive motor.

The flow control valve is connected in series between the hydraulic PTO valve and the tractor travel valve.

The inlet port is connected to the outlet of the hydraulic PTO valve to receive supply oil.

The controlled flow port is connected to the travel valve inlet.

The excess flow port is connected to the return line just ahead of the oil cooler.

The flow control valve contains a rotary orifice to which the handle is attached and a spring tensioned pressure balanced spool.

See the internal valve oil flow section of the manual for more detail.

OIL FLOW

Forward Drive - Neutral Lift - Neutral Hydraulic PTO - Full Speed Flow Control

PUMP

Oil is drawn from the reservoir, through the suction line and into the inlet side of the pump and discharged from the outlet side of the pump into the inlet of the hydraulic PTO valve.

NOTE: On 3100-4100 series tractors, oil is supplied to the PTO valve from the front pump section (nearest pump shaft) of the two section hydraulic pump.

HYDRAULIC PTO VALVE

The PTO valve spool is in the neutral position. This allows oil to pass through the open center passage and on to the flow control valve.

FLOW CONTROL VALVE

The rotary orifice (operated by handle) is positioned so it is fully opened. The pressure drop created by oil flow through the orifice is not enough to overcome spring tension and the spool remains seated to the right. This closes the excess flow port and full pump flow is available to the controlled flow port.

TRAVEL CONTROL VALVE

The travel valve spool is stroked into the valve body. This:

- a. closes the open center passage blocking the free flow path of oil,
- b. opens the passage for supply oil from the flow control valve to leave the front work port of the valve to the transaxle hydraulic motor,
- c. opens the passage for return oil from the hydraulic motor to enter the rear work port and flow to the outlet port of the valve.

From the valve outlet, oil flow continues through the oil cooler and back to hydraulic oil filter and reservoir.

The lift valve spool is in neutral.

TILLER MOTOR

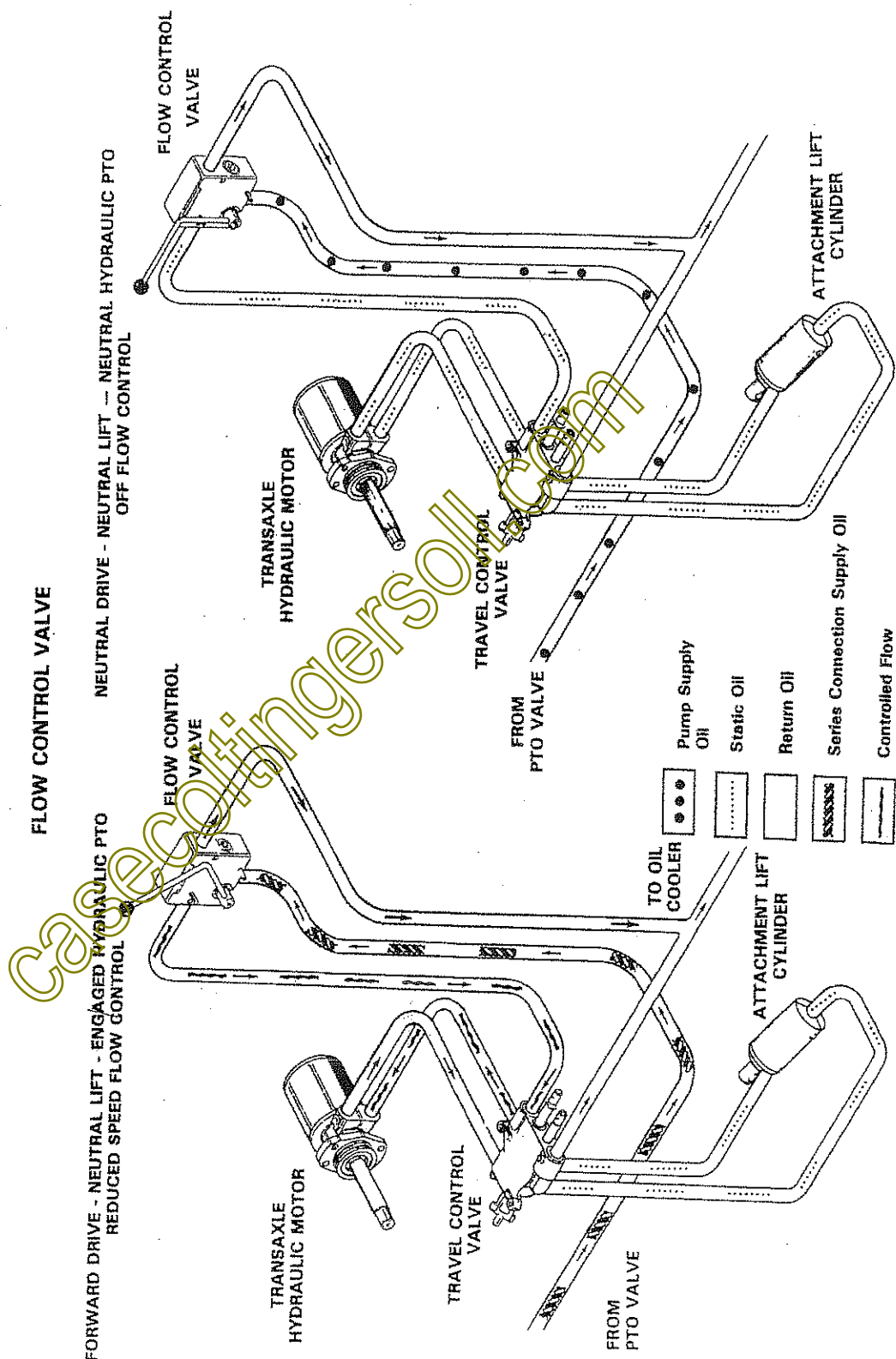
The rotary tiller motor is static.

TRANSAXLE HYDRAULIC MOTOR

The transaxle motor is driven in the forward direction by the oil flow passing through it.

ATTACHMENT LIFT CYLINDER

The attachment lift cylinder is static.



REDUCED SPEED FLOW CONTROL

OIL FLOW

Forward Drive - Neutral Lift - Engaged Hydraulic PTO - Reduced Speed Flow Control

PUMP AND PTO VALVE

Oil from the reservoir travels thru the pump and PTO valve as explained previously. From the outlet port of the PTO valve, oil flow continues to the inlet of the flow control valve.

FLOW CONTROL VALVE

The rotary orifice (operated by handle) is positioned so it is only partially opened. Flow through the orifice (restriction) causes a relative pressure drop on the controlled flow side of the spring tensioned spool. The spool shifts partway to the left, partially compressing the spring and opening the excess flow port slightly.

The reduced flow volume from the controlled flow port continues to the travel valve inlet.

The excess flow goes into the return line ahead of the oil cooler, goes through the oil cooler and returns to reservoir.

TRAVEL CONTROL VALVE

The travel valve is stroked into the valve body. This sends oil to the transaxle hydraulic motor and the tractor is driven in the forward direction.

The PTO valve and travel valve are in series and their pressures add.

TILLER MOTOR

The rotary tiller attachment motor is driven in the forward direction by the oil flow passing through it.

ATTACHMENT LIFT

The attachment lift will lift at reduced speed whenever the flow control is set in a "reduced speed" position.

FLOW CONTROL VALVE

OFF FLOW CONTROL

OIL FLOW

Neutral Drive - Neutral Lift - Neutral Hydraulic PTO - OFF Flow Control

PUMP AND PTO VALVE

Oil from the reservoir travels thru the pump and PTO valve as explained previously. From the outlet port of the PTO valve, oil flow continues to the inlet of the flow control valve.

FLOW CONTROL VALVE

The rotary orifice (operated by handle) is positioned so it is completely shut off. No flow through the orifice is possible resulting in a low pressure area on the controlled flow side of the spring tensioned spool.

The spool then shifts fully to the left completely opening the excess flow port and closing the controlled flow port.

Oil from the excess flow port enters the return line ahead of the oil cooler, goes through the oil cooler and returns to reservoir.

TRAVEL CONTROL VALVE

No oil is entering the travel valve because the controlled flow port in the Flow Control Valve is static. Therefore, there is no oil flow through the travel or lift circuit.

TILLER MOTOR

The rotary tiller motor is static.

TRANSAXLE HYDRAULIC MOTOR

The travel motor is static.

ATTACHMENT LIFT

The attachment lift cylinder is static. Since no oil flow is entering the travel control valve, the attachment lift cannot be raised.

HYDRAULIC FLOW CONTROL VALVE

OIL FLOW

Stop Flow Control

ROTARY SPOOL

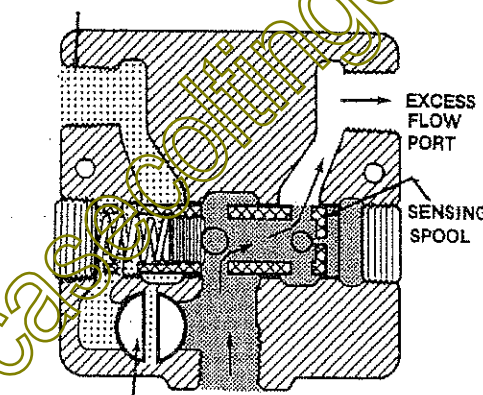
The rotary spool is positioned by its handle in the off position.

SENSING SPOOL

The flow through the rotary spool is stopped. Oil flow on the controlled flow side of the sensing spool is static, pressure is zero causing the sensing spool to shift fully to the left, compressing the spring.

Supply oil flow on the excess flow side of the sensing spool flows freely through the excess flow port.

CONTROLLED
FLOW PORT



ROTARY SPOOL INLET PORT

OIL FLOW

Reduced Speed Flow Control

ROTARY SPOOL

The rotary spool is positioned by its handle in a position less than full flow.

SENSING SPOOL

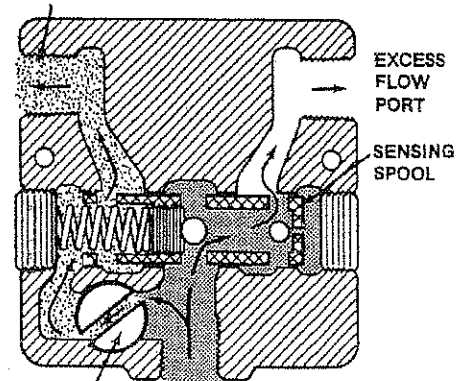
The flow through the rotary spool is restricted resulting in a pressure drop on the controlled flow side.

The resulting pressure differential (lower on controlled flow side, higher on excess flow side) causes the sensing spool to shift to the left partially compressing the spring.

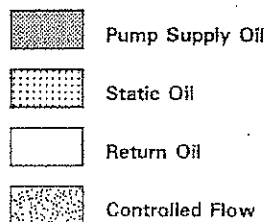
This partially opens the flow to the excess flow port and reduces the flow to the controlled flow port.

The greater the restriction at the rotary spool, the further the spool will shift to the left and less oil will be available at the controlled flow port.

CONTROLLED
FLOW PORT



ROTARY SPOOL INLET PORT



HYDRAULIC FLOW CONTROL VALVE

OIL FLOW

Full Speed Flow Control

ROTARY SPOOL

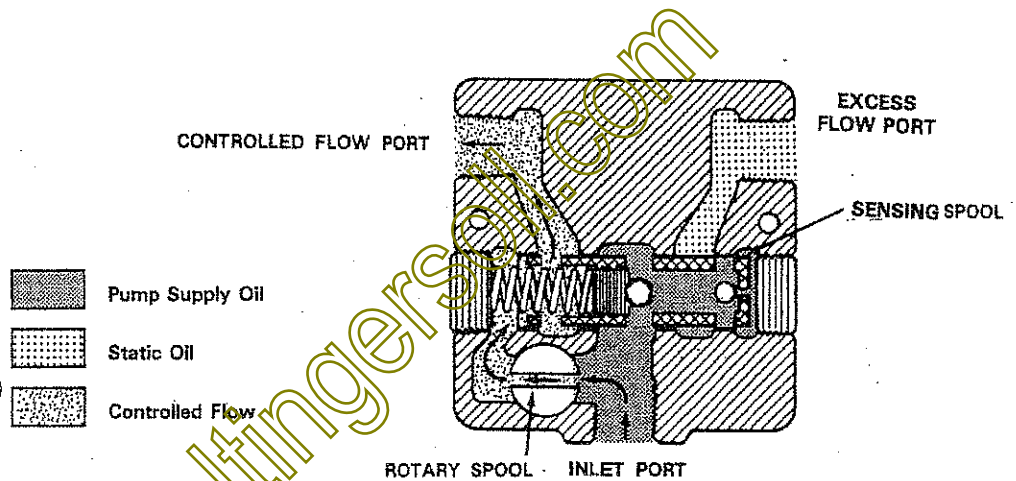
The rotary spool is positioned by its handle in the full flow position.

SENSING SPOOL

The flow through the rotary spool orifice is unrestricted resulting in negligible pressure drop on the controlled flow side. The spring holds the sensing spool fully to the right.

The controlled flow port is fully open.

The excess flow port is fully closed.



LOADER BUCKET CONTROL VALVE

OIL FLOW

Neutral Tilt-Raise Lift

TILT SPOOL

The tilt spool is in the neutral (centered) position. The open center passage to the lift spool supply passage is open.

The oil in the tilt spool work ports is static.

LIFT SPOOL

The lift spool is stroked out of the valve body. This closes the open center passage and allows pump supply oil to leave the lower work port to the loader lift cylinders. Return oil from the loader lift cylinders can enter the upper work port of the valve, enters the return oil passage and leaves the valve outlet port.

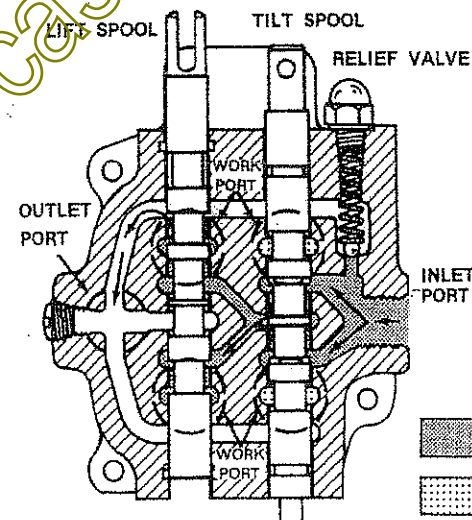
LOADER BUCKET RELIEF VALVE

The loader bucket relief valve will remain seated as long as pressures in the lift circuit remain less than the relief valve preset opening pressure.

Later production units may not be equipped with this relief valve. Relief protection is achieved at the attachment lift relief in the travel valve or power steering/loader relief valve.

NOTE: Lower lift would be the opposite of the lift spool position described above.

Float position would be the same as described for the attachment lift cylinder spool in previous diagrams.



OIL FLOW

Rollback Tilt - Neutral Lift

TILT SPOOL

The tilt spool is stroked into the valve body. This closes the open center passage and allows pump supply oil to leave the upper work port to the loader tilt cylinder. Return oil from the tilt cylinder enters

The loader bucket relief valve will remain seated as

LIFT SPOOL

Oil supply to the lift spool is static.

LOADER BUCKET RELIEF VALVE

The loader bucket relief valve will remain seated as long as pressures in the tilt circuit remain less than the relief valve preset opening pressure.

Later production units may not be equipped with this relief valve. Relief protection is achieved at the attachment lift relief in the travel valve or power steering/loader relief valve.

NOTE: Tilt spool dump would be the opposite of the tilt spool rollback position described above.

Feathering the tilt spool will allow some supply oil to reach the lift spool allowing simultaneous operation of tilt and lift spools.

