SERVICE TECHNICAL TRAINING PROGRAM

REFERENCE MANUAL

COMPACT LOADER SERIES

MODELS CL-25, CL-45, CL-55 and CL-65

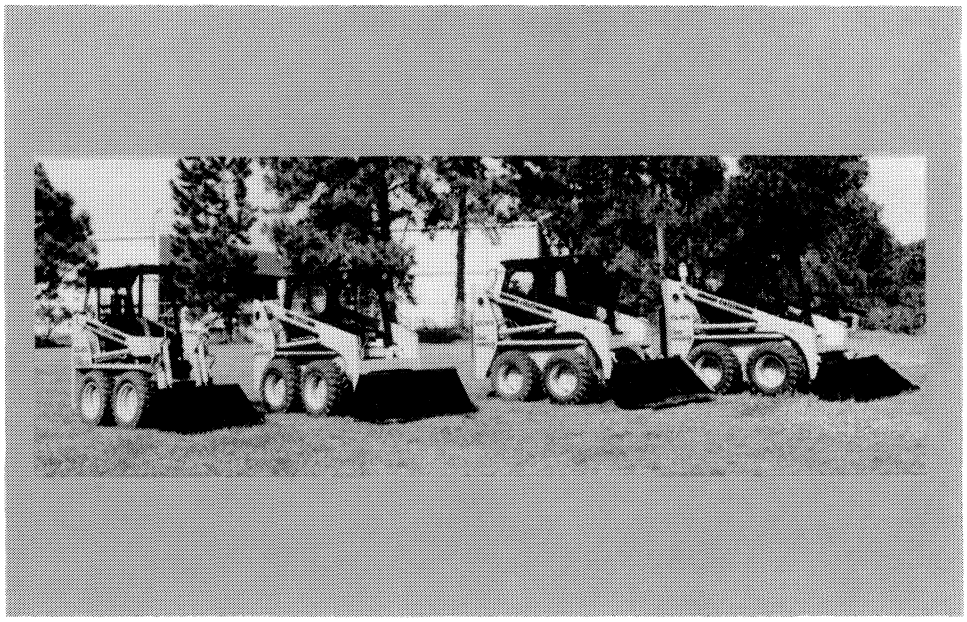
Ford

Tractors Equipment

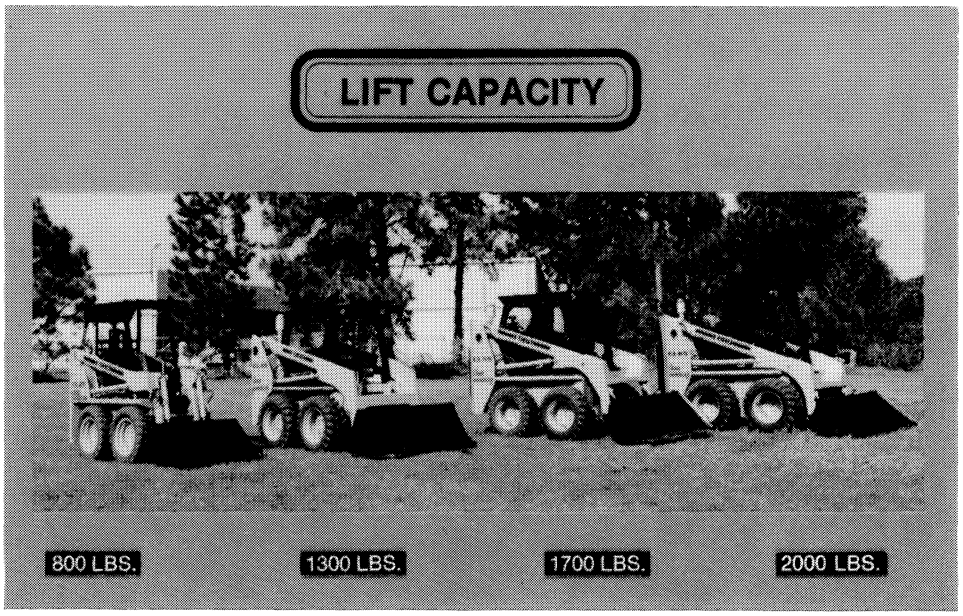
NAME _____

40002540
Reprinted

COMPACT LOADERS



The new compact loader line consists of the four models shown here, plus a fifth one scheduled to be added in the fall. The present lineup includes the CL-25, CL-45, CL-55 and CL-65. The CL-35, to come, will fit between the 25 and 45.



The differences between models are basically lift capacity and power ratings. Capacities are 800, 1300, 1700 and 2000 lbs. for CL-25, 45, 55 and 65, respectively. The CL-35 is expected to come in at 1000 lbs.

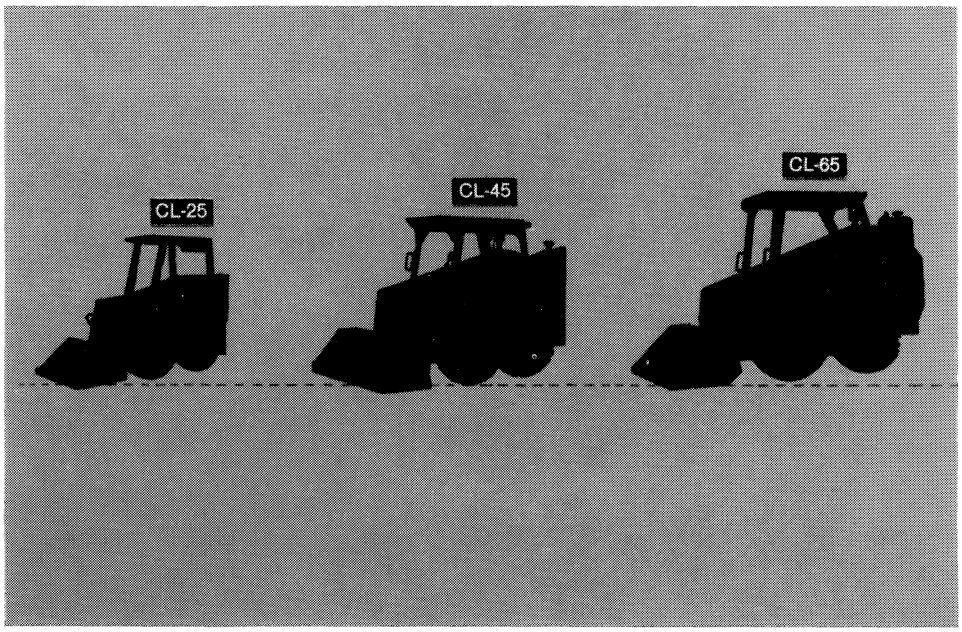
COMPACT LOADERS

COMPACT LOADER ENGINE LINE UP

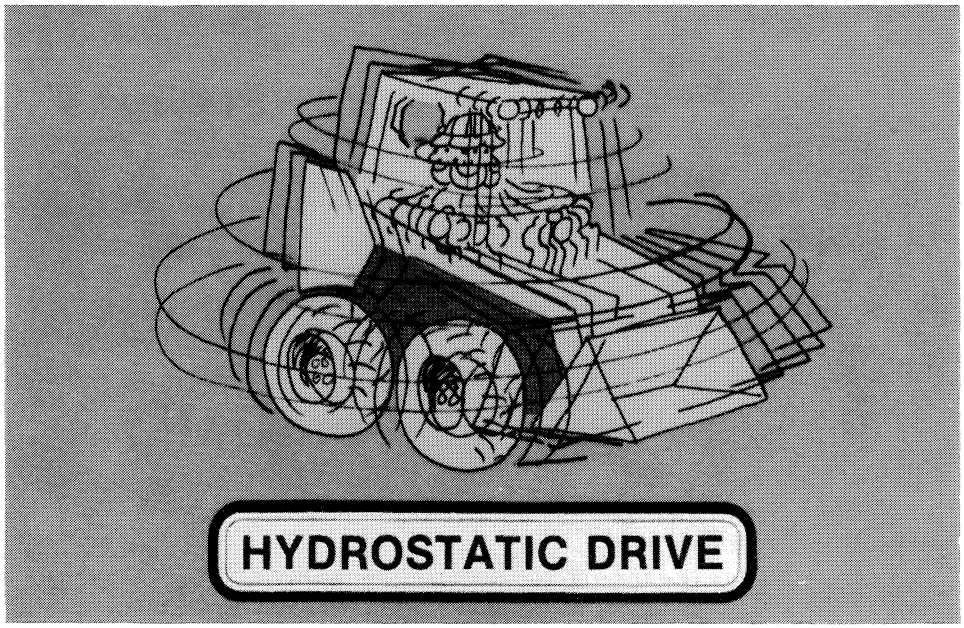
		CL-25	CL-35	CL-45	CL-55	CL-65
PRESENT	NO. OF CYLINDERS	3		4	4	4
	CID	58.2		130.2	130.2	201.3
	HP/RPM	20/2650		43/2500	43/2500	62/2600
FUTURE	NO. OF CYLINDERS		3	3		
	CID		85.2	103.8		
	HP/RPM		28/2700	33/2650		

The engine lineup is drawn from the 1000-series tractor line, except for the CL-65 engine which, though of the same family, is larger than any of the 1000-series engines. The CL-25 engine, at 58 cubic inches, is the same as in the 1310 tractor. The CL-35 is scheduled to use the 1710 engine, at 85 cubic inches. Eventually, the CL-45 will have the 3-cylinder, 97-cubic-inch 1910 engine which will be available in the fall of '83. Until then, CL-45's will be equipped with the same engine as in the CL-55, the 4-cylinder, 130-cubic-inch, 2110 tractor engine. The CL-65 engine is a 4-cylinder similar to the CL-55 engine, but with 201 cubic inches.

COMPACT LOADERS

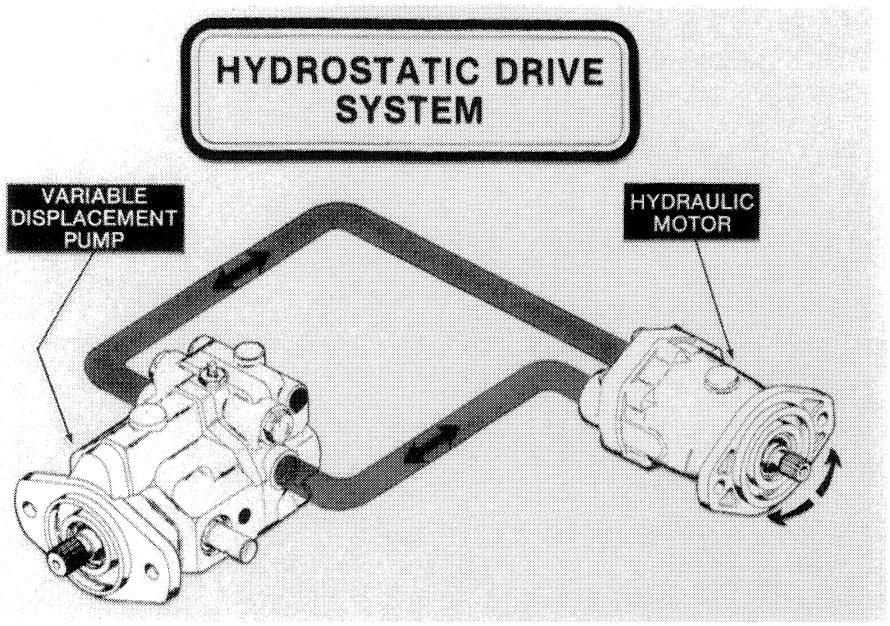


While there are dimensional variations from model to model, the four — eventually five — fall into three basic configurations, distinguished by drive pump and motor size and final drive layout. The CL-25 is by itself, the CL-35 is scheduled to be almost identical to the CL-45 except for power, and the CL-55 and 65 have a lot in common with each other, but little with the rest of the line.



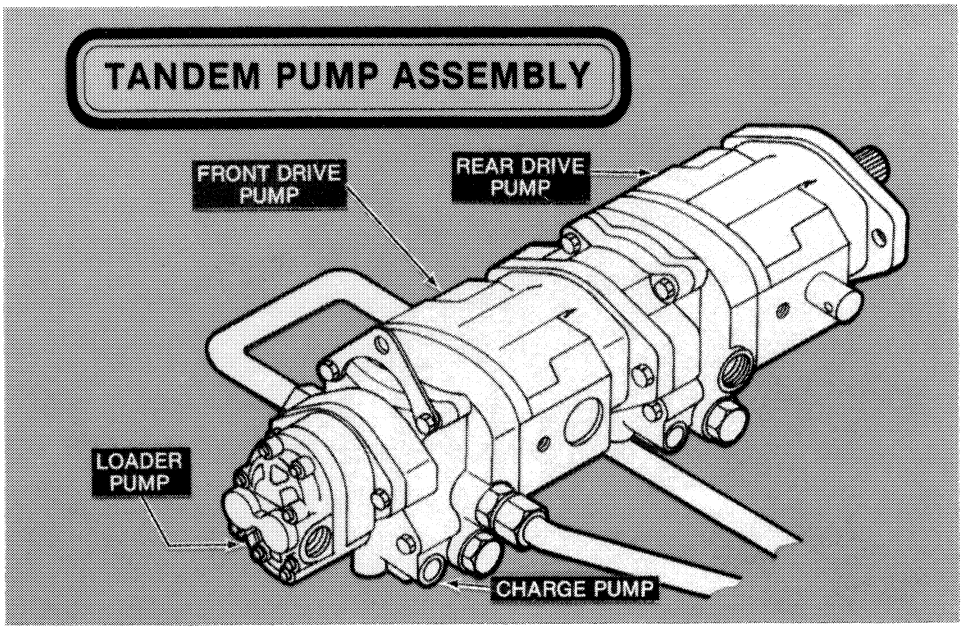
One feature all models have in common is hydrostatic drive, permitting infinitely variable speed control forward and reverse. Separate drive systems power left and right side wheels, so that speed, and direction, can be varied from side to side for skid-steer capability.

COMPACT LOADERS



Each hydrostatic drive system consists of a variable-displacement pump capable of delivering oil at flow rates from zero to maximum in either direction, and a positive-displacement hydraulic motor connected to the pump in a closed loop. The lines connecting pump and motor carry either high or low pressure depending on the direction of pump delivery.

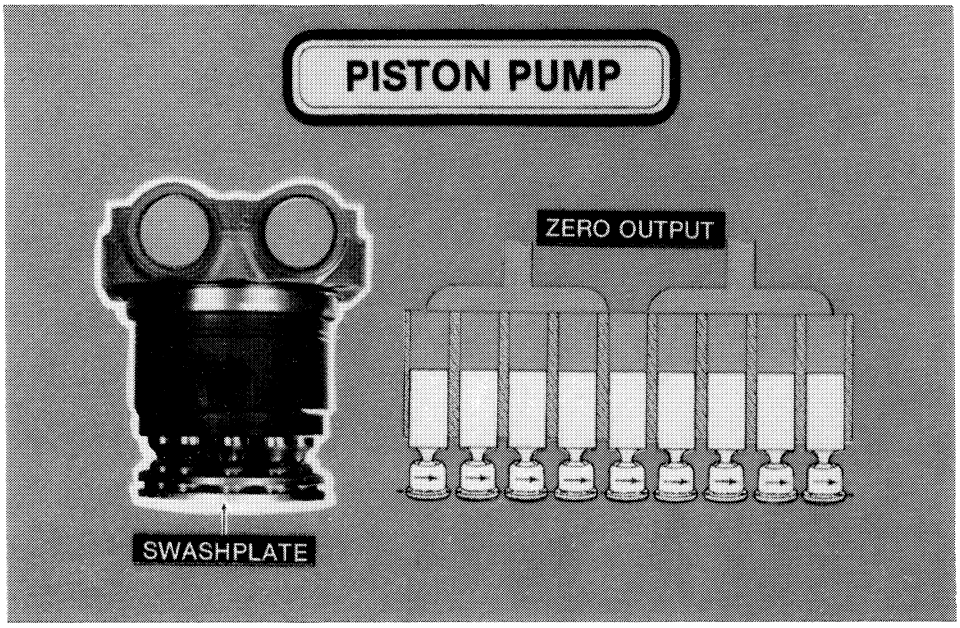
COMPACT LOADERS



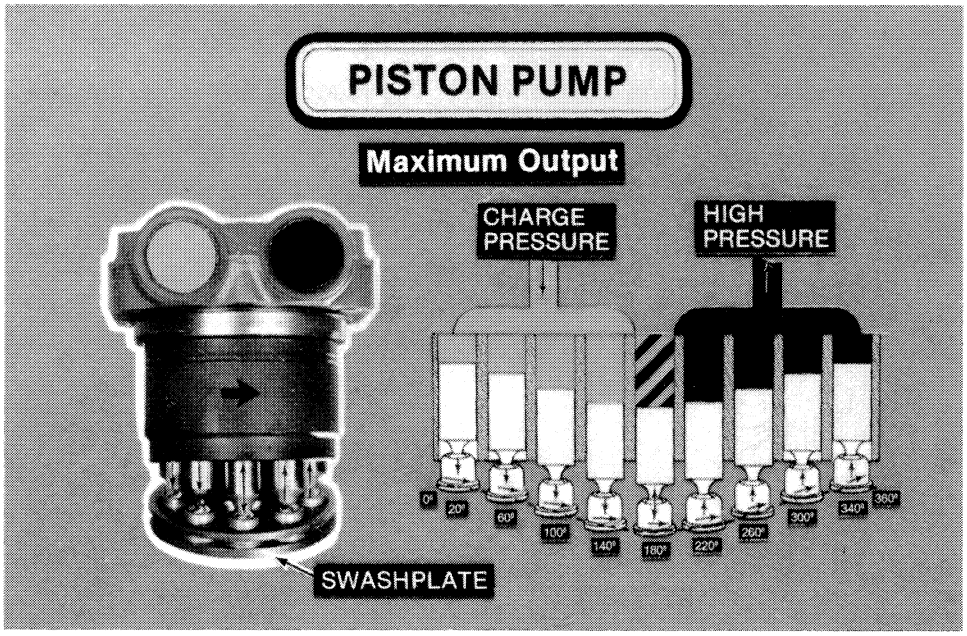
Left and right side drive pumps are combined in a tandem assembly, also including a charge pump for drive pump supply, and the loader and auxiliary hydraulic system gear pump. The CL-25 tandem pump assembly incorporates drive pumps of 1.24 cubic inch per revolution maximum displacement, and a loader and auxiliary pump of 0.58 cubic inch displacement. A similar, but larger pump assembly is used in all the larger models, with drive pump displacement up to 2.48 cubic inches and a 1.48-cubic-inch loader pump. While the pumps are the same, the CL-45 drive pumps — as shown here — are inverted as compared with the CL-55 and 65 installation. As a result, the relationship of front and rear pumps to left and right side drives is reversed for correct control lever response.

The loader pump displacement ratings, in cubic inches per revolution, translate into gpm at rated engine rpm as follows: The 0.58-cubic-inch pump in the CL-25 delivers 6.8 gpm at 2000 PSI, and the 1.24-cubic-inch pump in the larger models delivers approximately 15 gpm.

COMPACT LOADERS

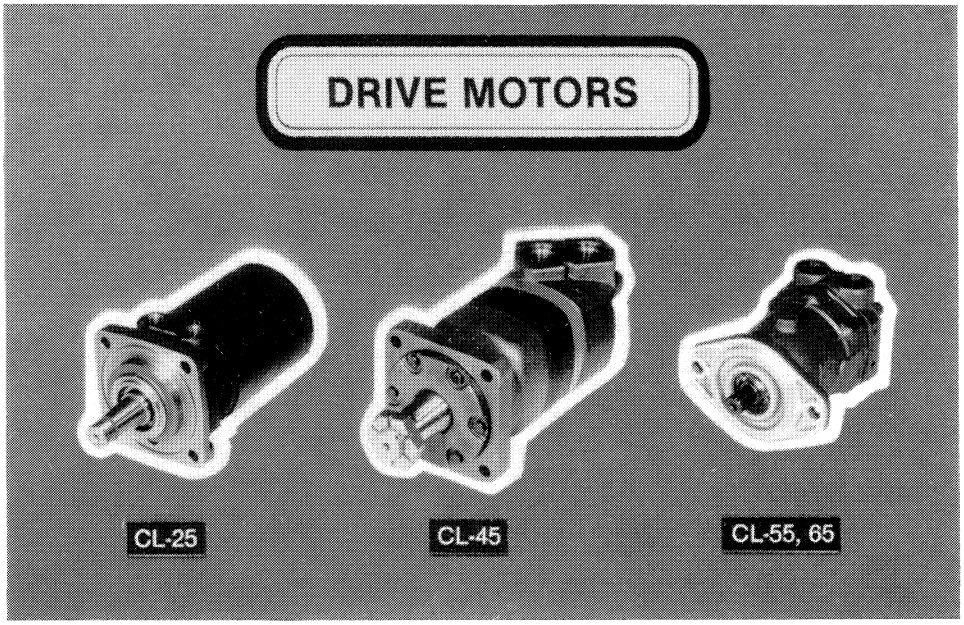


The hydrostatic drive pumps are of piston type, each containing nine pistons with ball-joint slippers revolving in contact with a tiltable "swashplate". The swashplate is in effect a variable cam which varies piston stroke according to the angle at which it is set by the control linkage. At zero degrees, or ninety degrees to the pump axis, the piston stroke is zero and the pistons revolve without pumping.

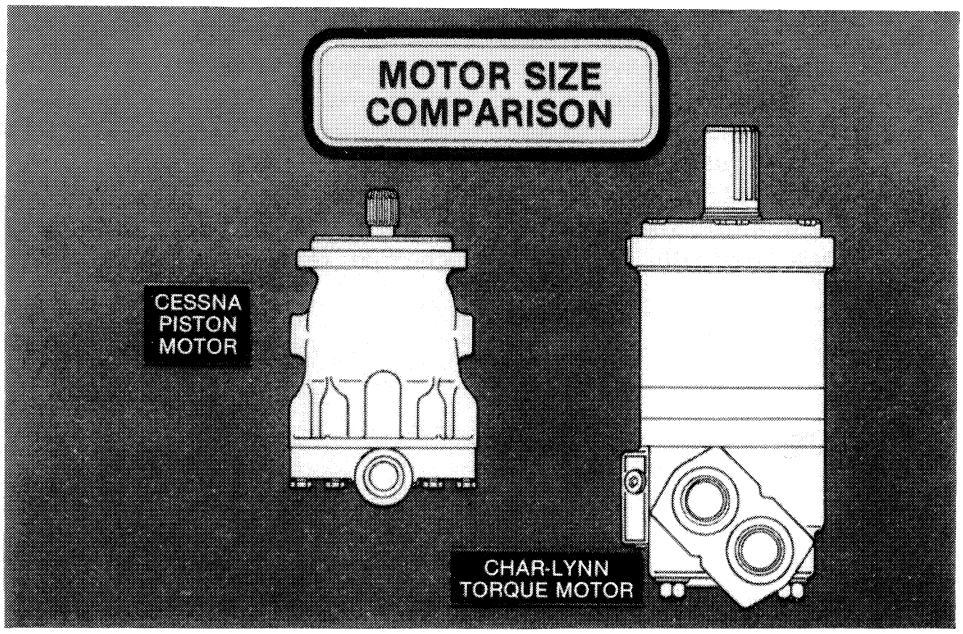


When the swashplate is tilted from the zero position, the pistons follow the swashplate surface, admitting oil until each piston reaches its maximum "down-stroke". As the pistons revolve past the maximum volume position, the inlet port is cut off and the discharge port is uncovered. As the pistons ride up the swashplate toward the minimum volume position, oil is forced out into the high pressure line. This pressurized flow then passes through the motor and returns to the inlet side of the pump.

COMPACT LOADERS

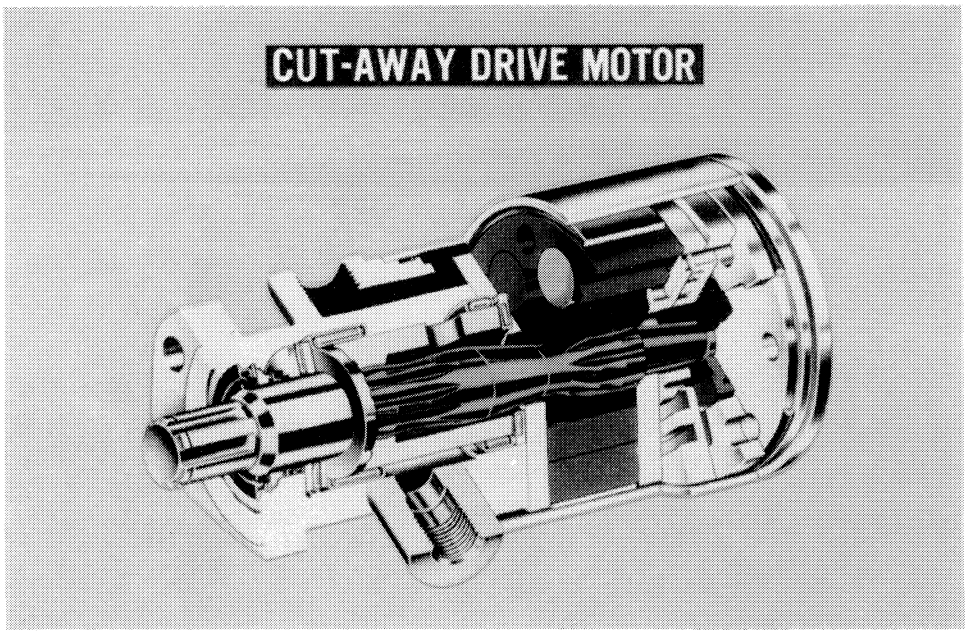


The hydrostatic drive motors in Ford compact loaders are of two types. CL-55 and 65 models are equipped with piston-type motors, similar to the swashplate pumps except that the swashplate angle is not variable. CL-25 and 45 models are equipped with rotor-type torque motors, as used in previous Ford compact loaders.



The differences between piston and rotor-type motors are considerable. Piston motors are smaller and lighter in weight for comparable power capabilities, reflecting their aircraft industry background. Compactness is desirable in compact loaders where space is at a premium, but there's a price to be paid. The piston motor is a relatively high-speed, low-torque device, and requires considerable gearing down to meet the driving speed and torque requirements of loader operation.

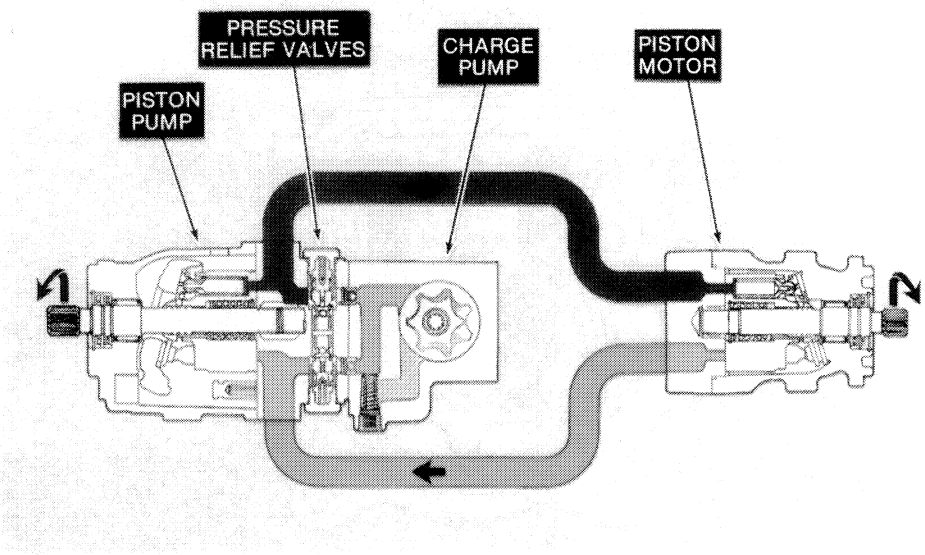
COMPACT LOADERS



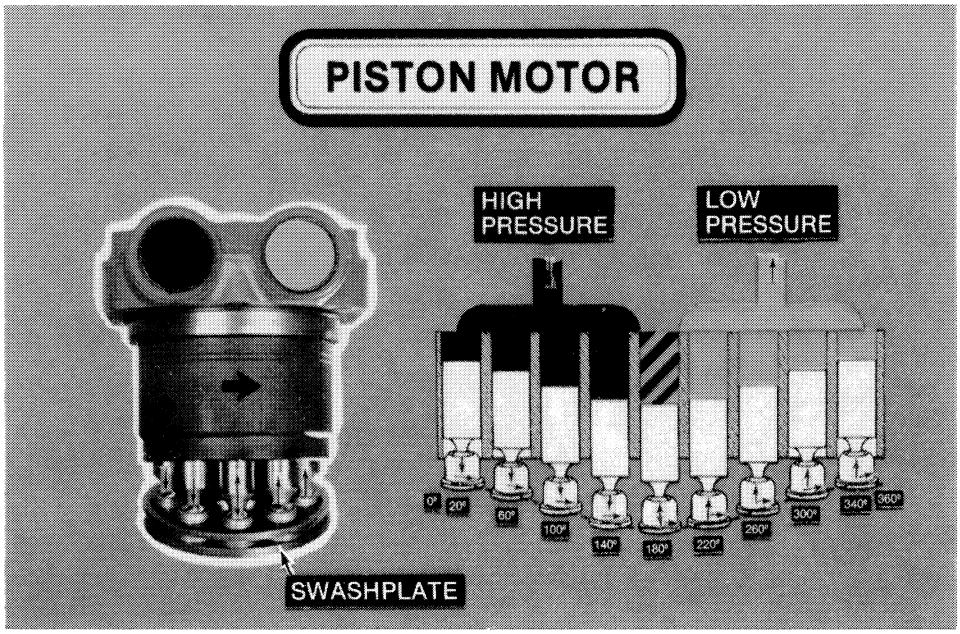
The rotor type motor — or torque motor — is a more recent development for this type of application. This is a Ross Torqmotor, similar to the motors used in the CL-25. It's a low-speed, high-torque device, heavier and bulkier than the piston motor but requiring much less final drive reduction. Comparing the Cessna piston motor used in CL-55 and 65 loaders with the Char-Lynn torque motor used in the CL-45 under comparable input conditions, the torque motor develops over ten times the torque at less than one-tenth the speed.

The CL-25 drive system is similar to the CL-45, but with smaller Ross torque motors and smaller drive pumps.

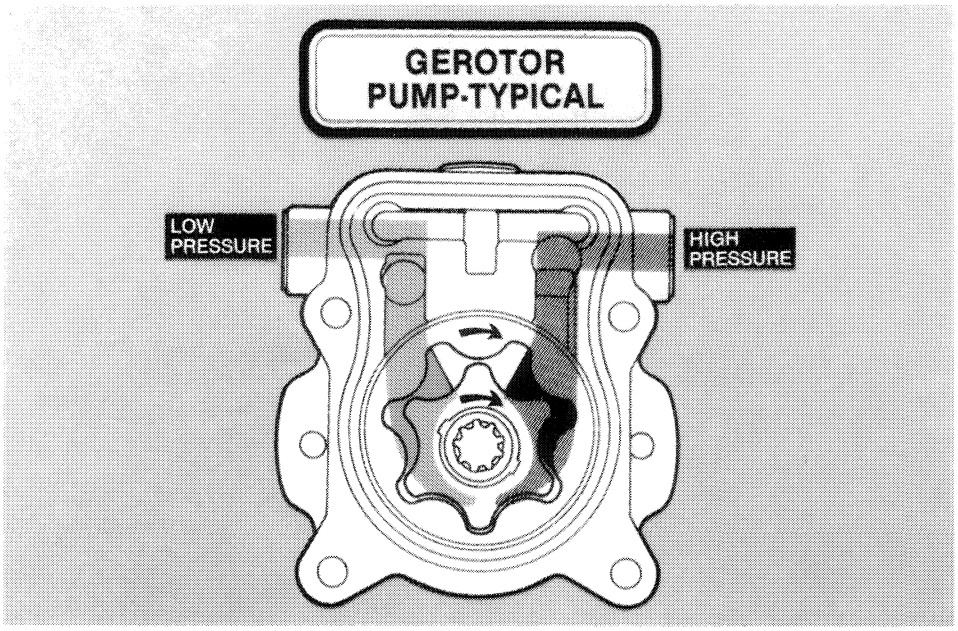
The reason for the difference lies in the different displacement characteristics of the two motor types. The Cessna piston motor makes one revolution for every 2.48 cubic inches of oil flow, while the Char-Lynn torque motor requires nearly 30 cubic inches per revolution. The Ross motor in the CL-25 displaces 18 cubic inches per revolution.



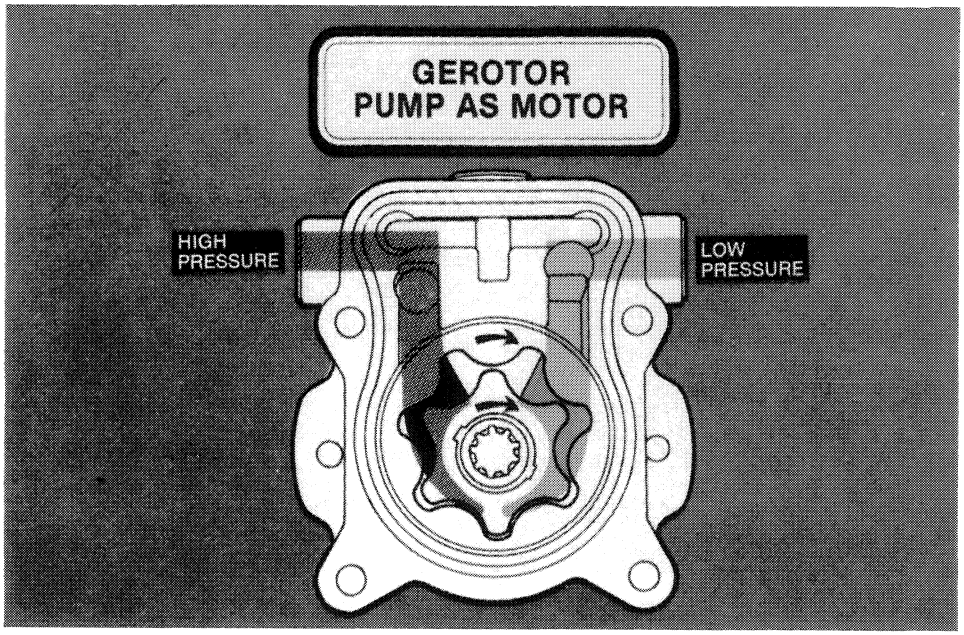
To understand the operation of hydrostatic drive motors, it may help to think of them as pumps with functions reversed. Instead of driving a shaft to displace and pressurize fluid, fluid under pressure is forced through the pump elements, displacing them to drive the shaft. Any pump can be made to act as a motor in this way. In the case of the piston motor, the motor is almost identical to the piston pump.



Where revolving pistons in the pump follow the "ups and downs" of the variable swashplate to displace fluid, in the motor, pressure on the pistons forces them to slide "down" the fixed swashplate, causing the piston block to revolve. With nine pistons in the motor, at any instant four are being driven "down" the swashplate by oil pressure from the high pressure port, four are riding up the "upstroke" side of the swashplate and discharging through the low pressure port, and one is in transition at one end of its stroke — in effect, at top or bottom dead center.

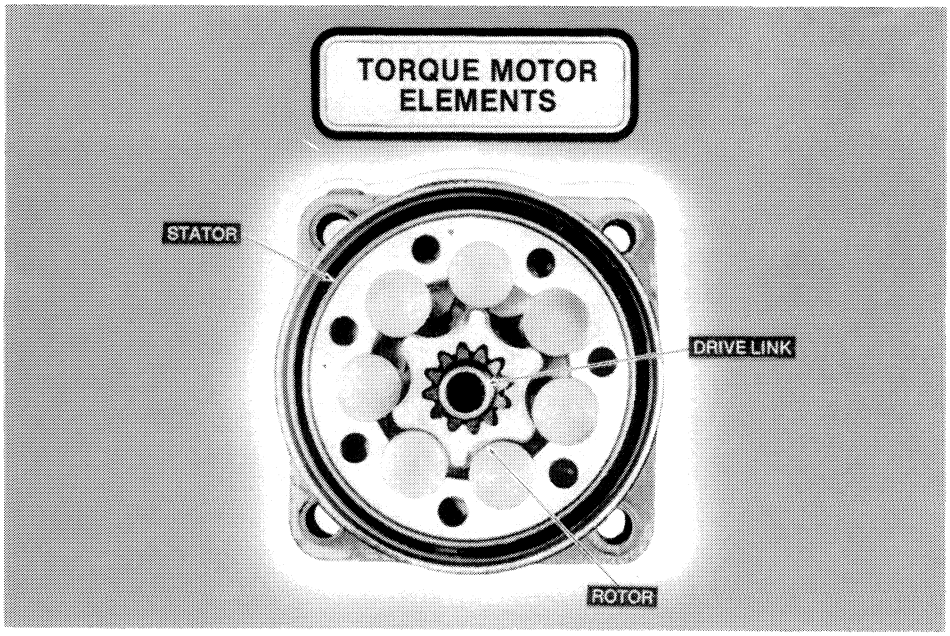


Like piston pumps, gear and rotor pumps will also function as motors. In the familiar type of rotor — or Gerotor — pump, each rotor rotates about its own center, but because the rotors are eccentric to each other the space between them is not uniform. An unequal number of meshing lobes form a number of chambers between the rotors, which expand and contract as the rotors rotate. When used as a pump, the expanding chambers draw in oil as their volume increases, and squeeze it out as they contract.

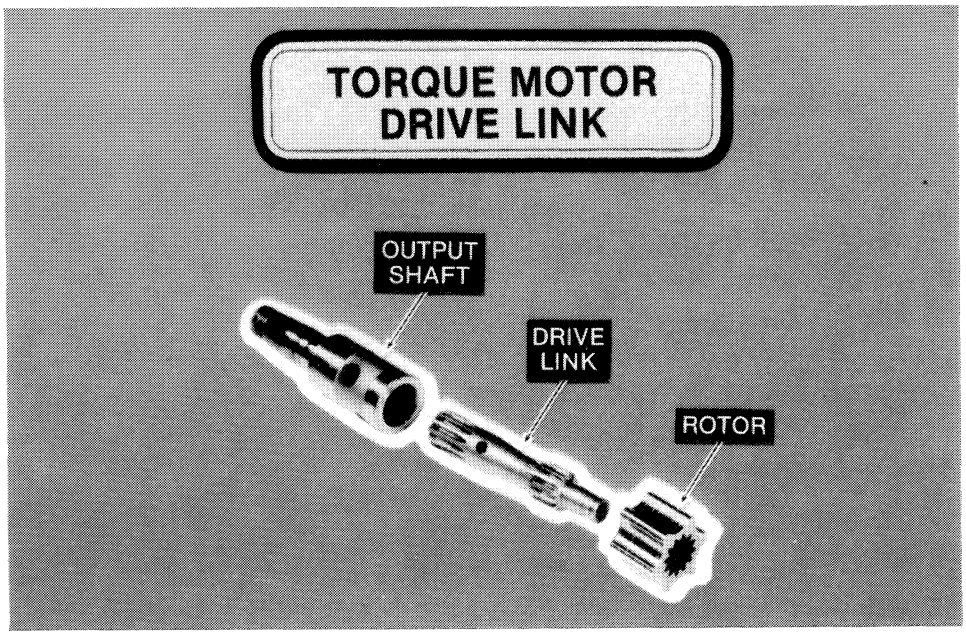


If used as a motor, high pressure oil would be admitted to the expanding chambers up to maximum volume, then the inlet port would be cut off and the outlet port opened. The contracting chambers would discharge oil through the outlet port to return to the pump.

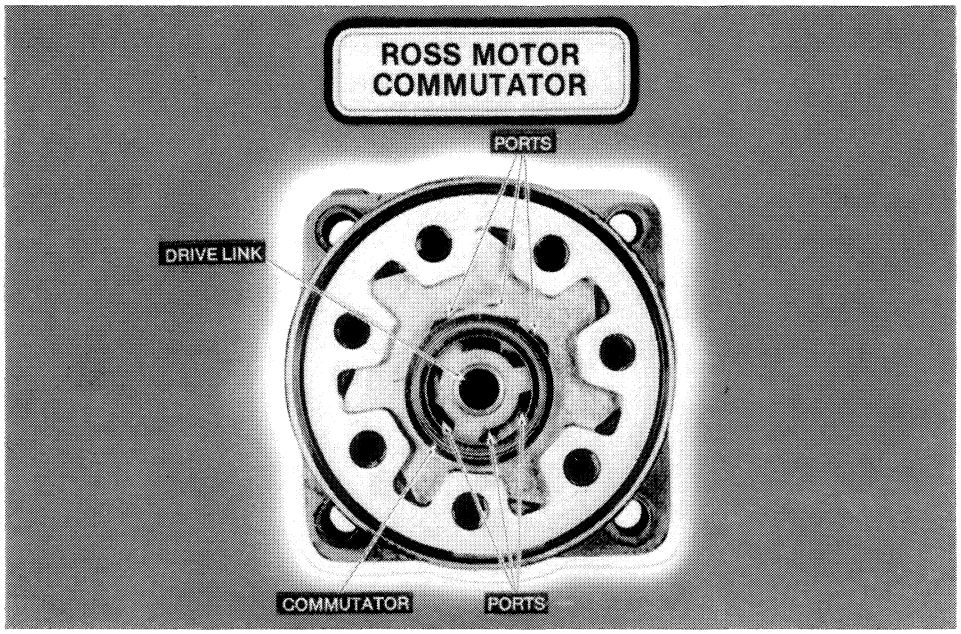
COMPACT LOADERS



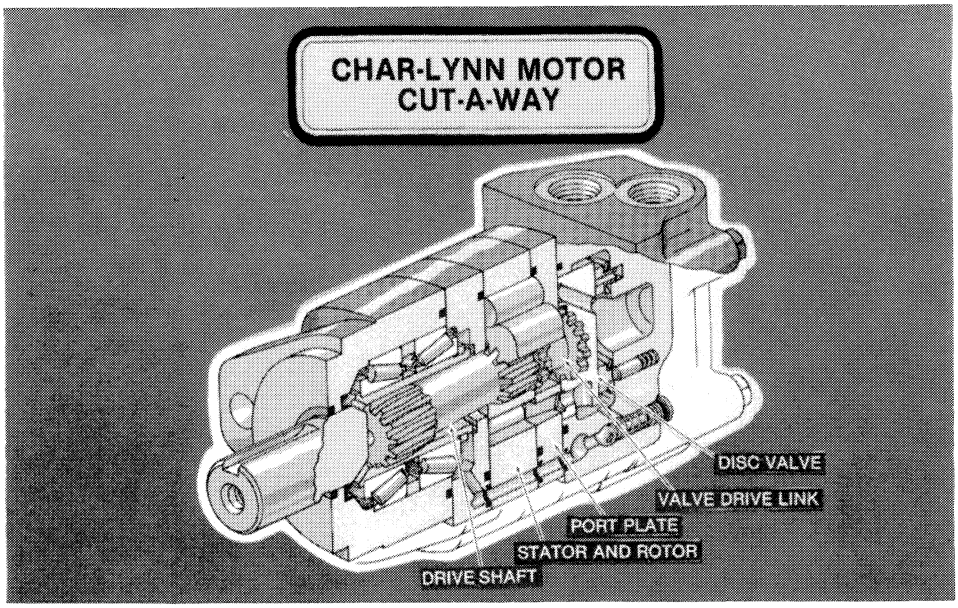
The rotor-type torque motors used in Ford compact loaders work much the same, but with a few mechanical differences. First, the outer rotor becomes a stator, and does not rotate. Roller vanes replace the fixed lobes in the stator to reduce friction and wear. The inner rotor, which is splined to and drives a drive link to the output shaft, must run eccentrically to rotate in the fixed stator.



Splines on the drive link between rotor and output shaft are barrel-shaped to accommodate the wobbling motion imparted by the eccentrically-running rotor. Then, since the expanding and contracting chambers change position as the rotor revolves, the high and low pressure porting must move in time with them.

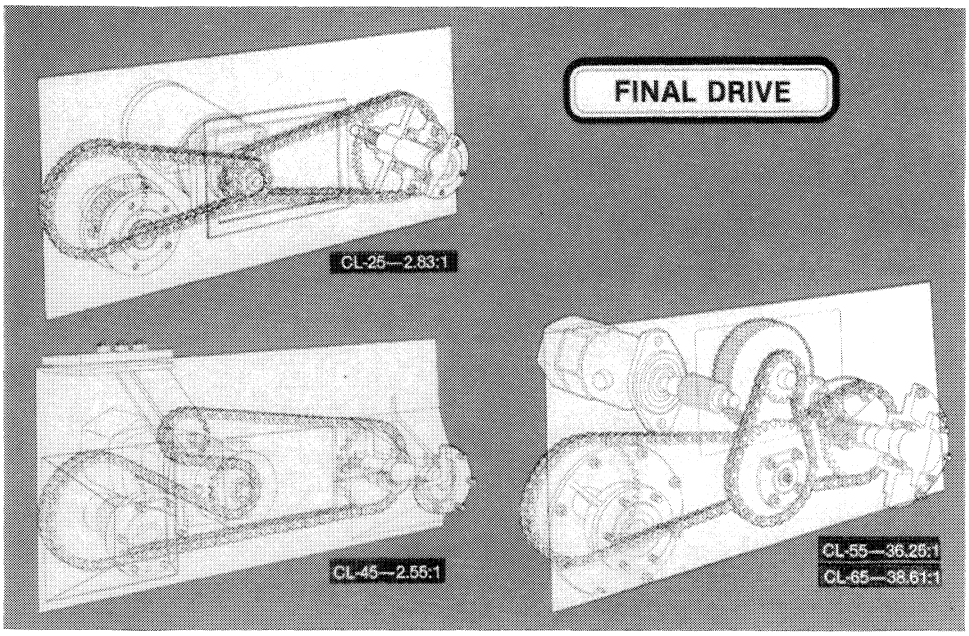


In the Ross torque motor, the porting is made to rotate with the rotor by a "commutator", which revolves eccentrically to cover and uncover ports to the expanding and contracting chambers. High and low pressure lines from the pump connect to the commutator chamber through the space surrounding the stator, and through the central bore in the drive link.

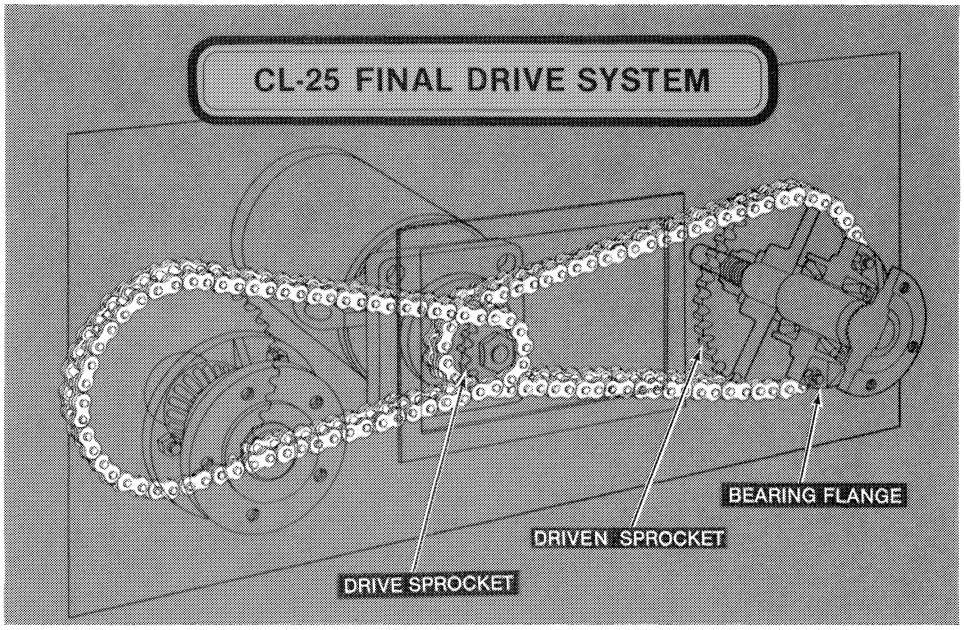


The Char-Lynn motor used in the CL-45 loader times the porting with a concentrically-rotating disc valve, driven by the rotor through a wobbling splined drive link. Though functionally similar to the Ross motor, it's designed for heavier duty, with tapered roller output shaft bearings instead of needle bearings, and with eight rotor lobes instead of six.

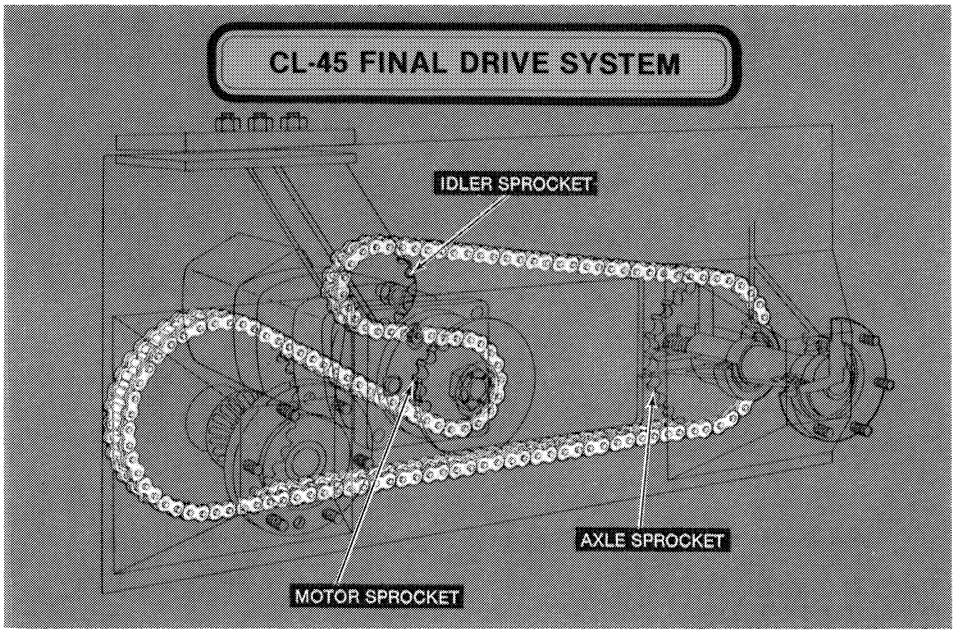
COMPACT LOADERS



Because of the differences in motor characteristics and duty class, three different final drive layouts are used in the compact loader line. All feature chain final drive, with single reduction in CL-25 and 45 models, and a triple-reduction gear and chain system in CL-55's and 65's. The triple reduction system combines one stage of gear reduction with two stages of chain. Total reduction in the CL-25 final drive is 2.83 to 1, in the CL-45 it's 2.55 to 1, and in the CL-55 and 65, with high-speed piston motors, it's 36.25 and 38.61 to 1.



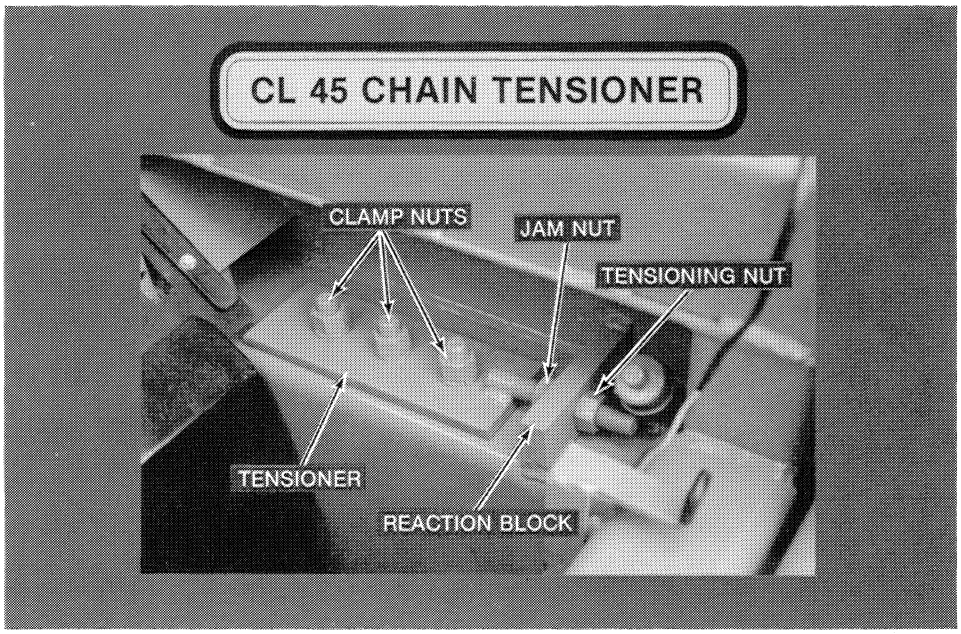
In the CL-25 two short chains connect the double drive sprocket, mounted on the motor shaft, to the axle driven sprockets. The bolt circles in the axle bearing flanges are eccentric to the bearing bores to permit adjusting chain tension at initial assembly. Because of the short chain lengths, tension adjustment is not recommended in service, since excessive backlash will not develop until a chain is worn to the point of replacement. When replacing a drive chain, the best position of the eccentric bearing flanges must be determined by trial and error.



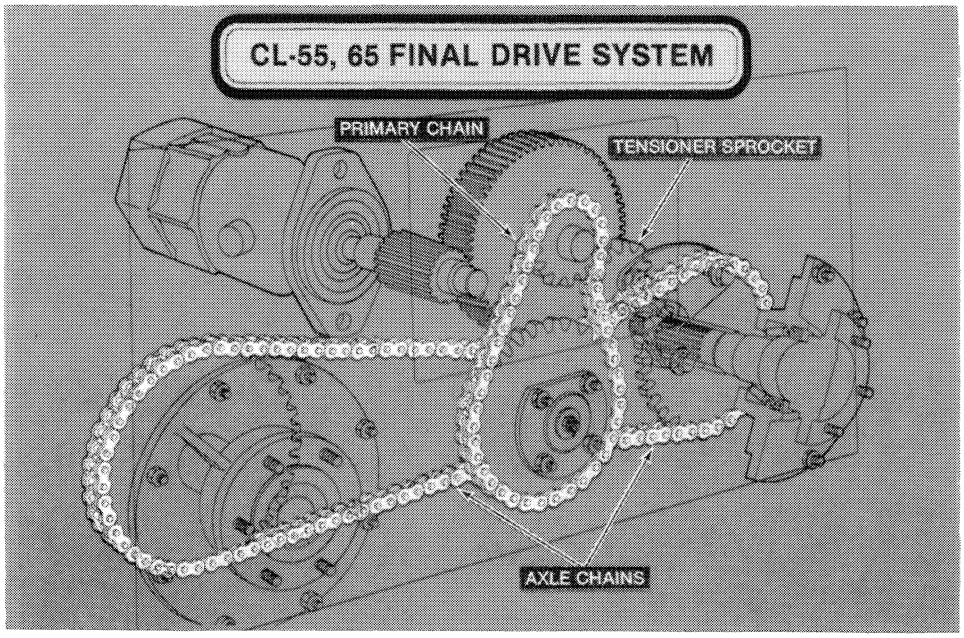
The CL-45 final drive system incorporates a single chain on each side connecting the axle sprockets and the motor sprocket, with an adjustable idler sprocket to control chain tension. Because the tensioner location is symmetrical side-to-side, and the drive motors are offset from each other fore-and aft, the right-side chain is longer than the left-side chain — 113 links as compared to 103.

The greater length of the single chain makes the CL-45 system more sensitive to elongation with wear than the CL-25 system with its shorter chains.

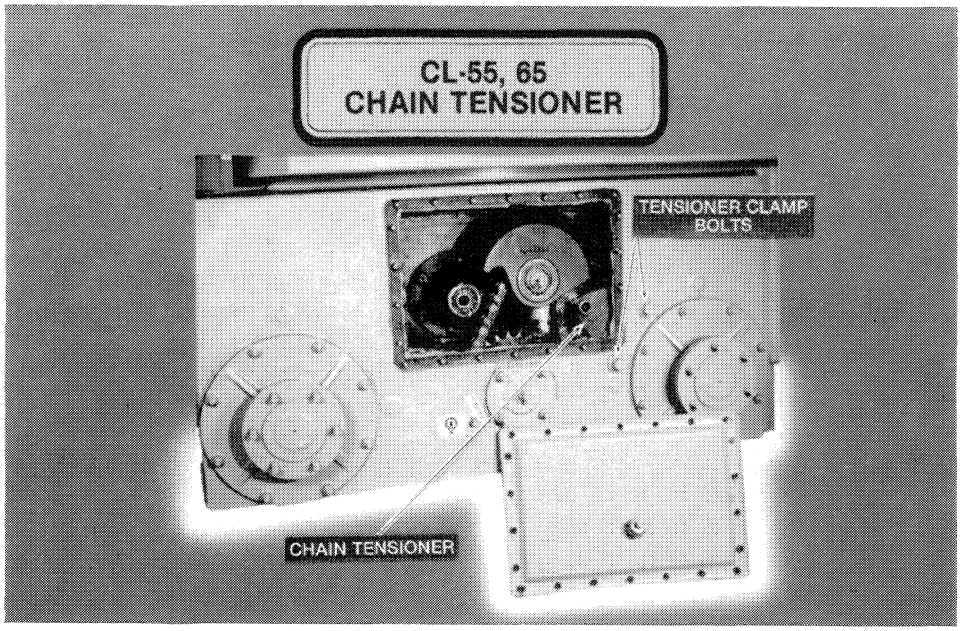
Therefore, routine tension checks are recommended for this model, after the first fifty hours and every 200 hours thereafter. Chain tension is checked by measuring front wheel backlash, with the front wheel raised while the rear wheel is grounded and blocked to prevent rolling. The parking brake should be released. If backlash exceeds one inch at the center of the tread, adjustment is called for.



To adjust chain tension, three clamp nuts on the tensioner must be loosened, just enough to permit fore-and-aft movement. The jam nut at the rear of the reaction block must be backed off and the front nut tightened until front wheel backlash is within one inch. After tightening the jam nut, and torquing the clamp nuts to 150 lbs.-ft., backlash should be rechecked, and readjusted if necessary.

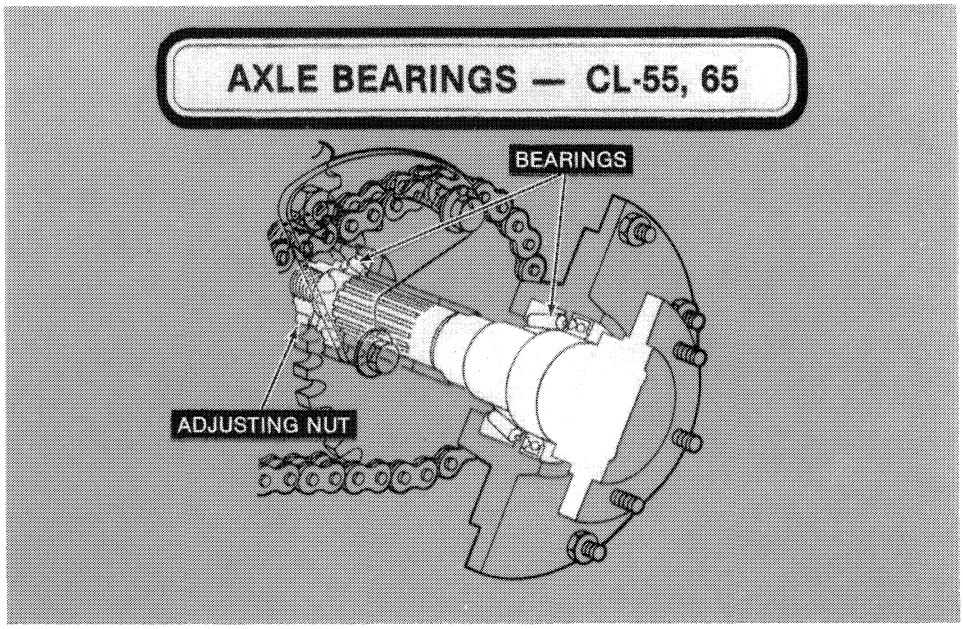


In the CL-55 and 65 final drive system, the axle sprockets are connected to the double drive sprocket by two relatively short chains. Half links are available to permit adjusting the length of the axle drive chains. Tensioning of the primary drive chain, from the reduction gear to the axle drive sprocket, is by means of a tensioner accessible through the chain case access cover.

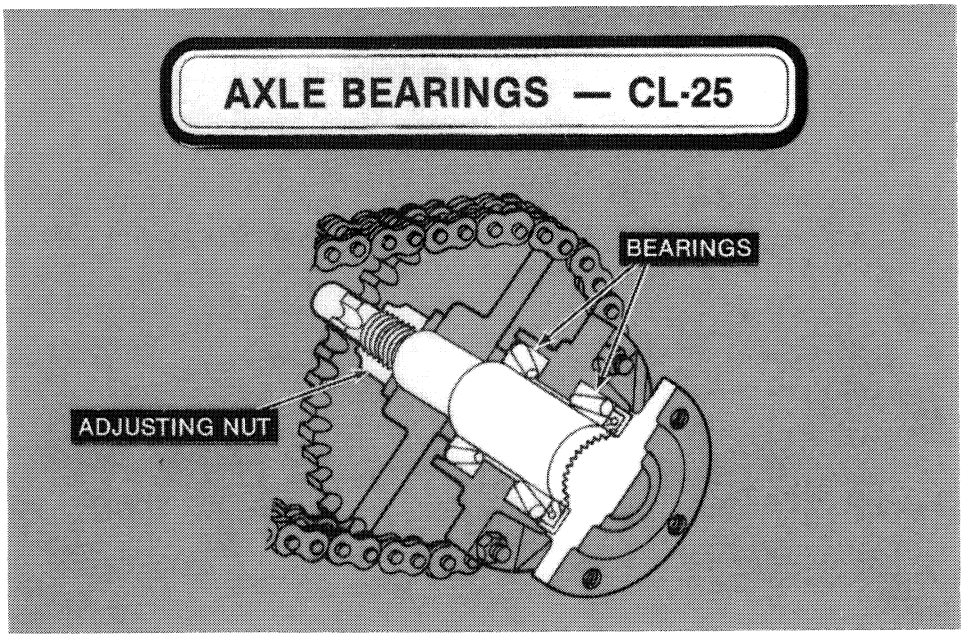


Two clamp bolts through the chain case outer wall lock the tensioner in position, and must be loosened for tension adjustment. When properly tensioned, the long span of the primary chain should deflect 1/2 to 3/4 inch. After adjusting, the tensioner clamp bolts should be torqued to 80 to 85 lbs.-ft.

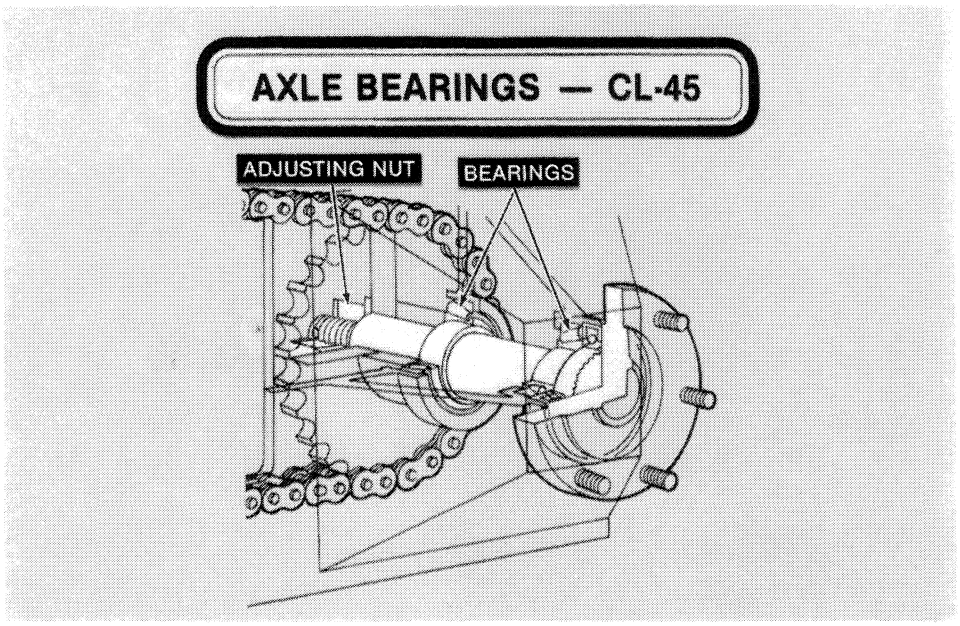
Because of manufacturing tolerances on chain and sprockets, it is advisable to run the drive system through several revolutions of the drive motor, while checking for tight spots. If any appear, tension should be eased accordingly.



Axle bearing arrangement also varies from model to model. Tapered roller bearings are used in all cases. CL-55 and 65 bearings are straddle-mounted, with inboard bearing supports mounted in the chain case inboard wall. Bearing adjustment is by means of castle nuts and cotter pins on the inboard ends of the axles, accessible through a removable cover on the inboard bearing support.



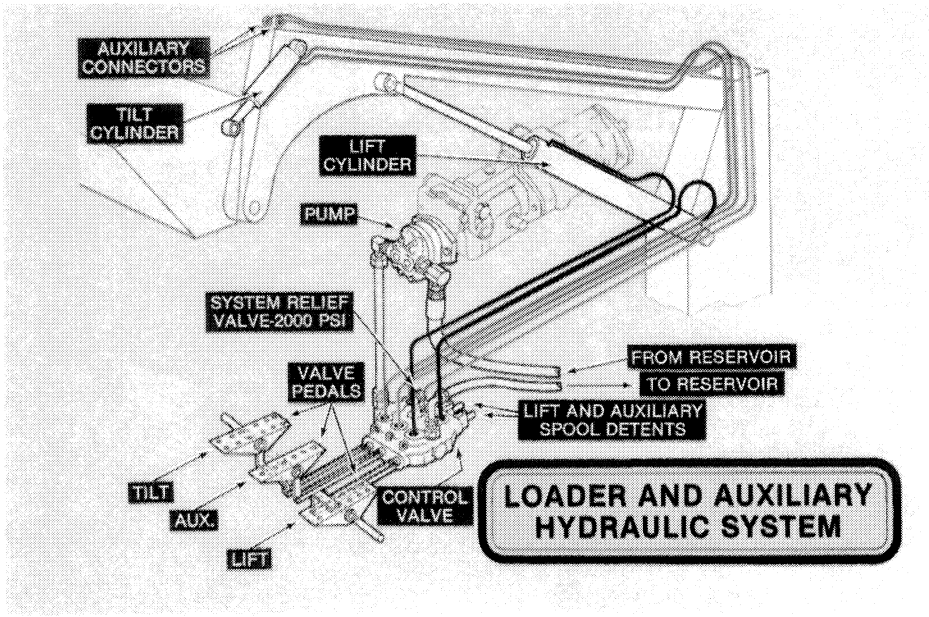
CL-25 axle bearings are overhung-mounted, in bearing flanges bolted to the chain case outboard wall. Removable covers on the inboard wall permit access to the bearing nuts for adjustment. The CL-25 rear axle shafts include inboard extensions on which the parking brake discs are mounted. The brake discs and calipers must be removed for access to the bearing nuts.



CL-45 axle bearings are also overhung-mounted, in bearing recesses built into axle housings projecting from the chain case outboard wall. Access to the bearing nuts is through removable cover plates on the inboard wall. Because of the increased outboard projection of CL-45 wheel flanges, CL-45 wheel discs are dished convex, as compared with concave-dished wheels for the other models.

Bearing adjustments should be made with axle drive chains slackened or removed to permit proper feel of bearing tightness. When bearing drag is felt, the castle nut should be backed off one to two notches, and pinned.

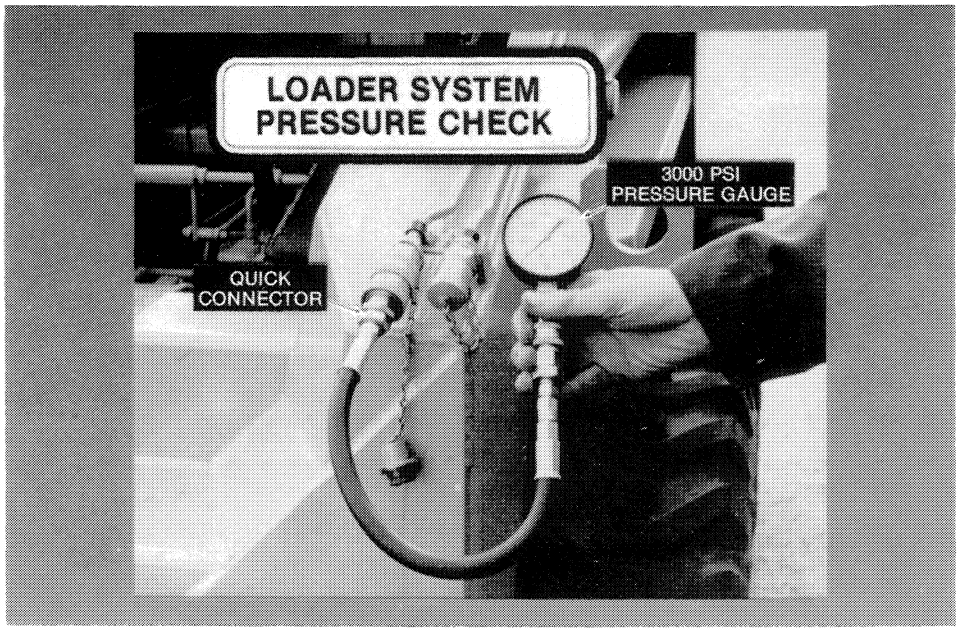
COMPACT LOADERS



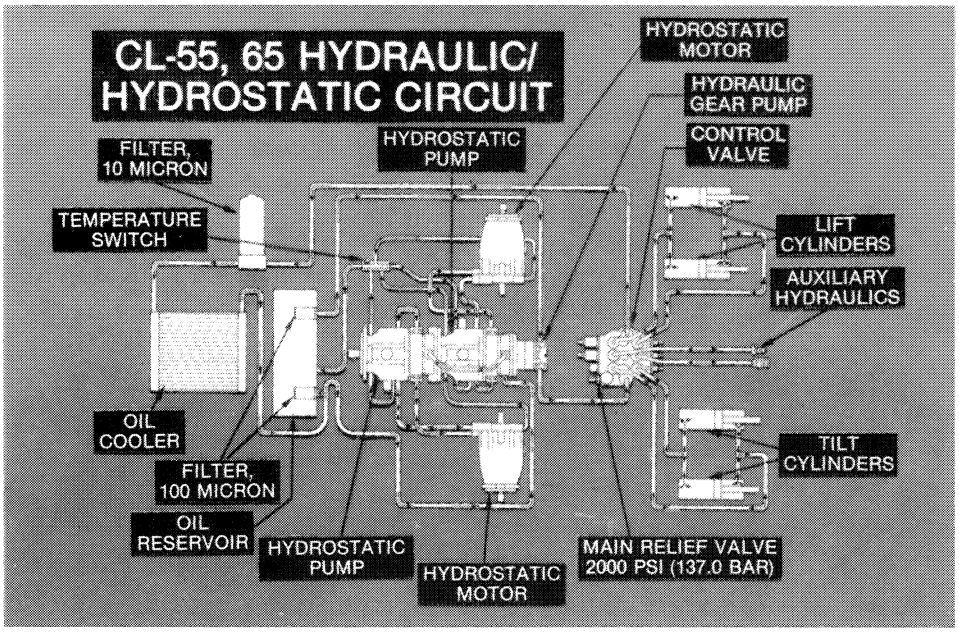
Obviously the three basic compact loader configurations don't have much in common where drive systems are concerned. In terms of loader and auxiliary functions, the differences are nowhere near as great.

Gear-type hydraulic pumps are used in all models, the only difference being the smaller displacement of the CL-25 pump, 0.58 cubic inches as compared with 1.48 in the larger models. The same three-spool control valve, operated by foot pedals, is used in all models, to control boom lift, bucket tilt and auxiliary equipment operation. Detents are included on lift and auxiliary spools for bucket float and continuous auxiliary operation. Since there's no bypassing in the auxiliary circuit when the spool is in the detent position, the auxiliary pedal must be returned to neutral when not in use. Otherwise, a hydraulic lock condition would exist which could cause hard starting and possible starter damage.

A pressure relief valve for the loader and auxiliary system is included in the control valve, set at 2000 PSI.



The relief valve pressure setting can be checked at the auxiliary connectors, with a 3000-PSI pressure gauge connected to a quick coupler and the auxiliary pedal actuated.



The rest of the hydraulic system serves the hydrostatic drive. When you pack this much plumbing into the limited space available in a compact loader, it gets to looking complicated, but the schematic helps in sorting it out. This is the CL-55 and 65 hydraulic system. It's representative of the whole line, but there are detail differences between the three basic configurations. The drive pumps in CL-45, 55 and 65 models include built-in pressure relief valves set at 3750 PSI, which dump excess-pressure oil internally, from the discharge side back to the inlet side.