

9030 BIDIRECTIONAL™ TRACTOR SERVICE MANUAL CONTENTS

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- SERIAL NUMBER INFORMATION

This service manual refers to serial number breaks at various times throughout the text. It is important to understand the order in which 9030 Bidirectional tractors were built. The following chart shows how 9030 tractors were built in the following ranges based on year of production:

SERIAL NUMBER RANGE YEAR OF PRODUCTION

0470100 - 0479999	1991
0487501 - 0489999	1992
0932000 - 0939999	1993
0200000 - AND ABOVE	1994 AND ON

An example of correctly identifying a unit follows:

The text reads "units built after *S/N* 0200234 " The tractor being repaired is *S/N* 0487698. 0487698 is a tractor built **before** *S/N* 0200234 and will not *have* the component or feature described in the text.

SECTION 1

ENGINE SYSTEMS

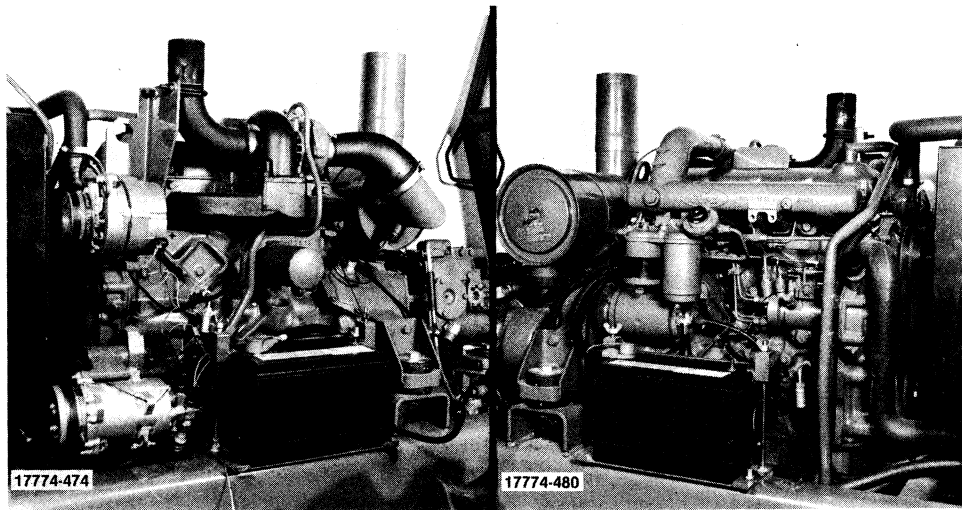
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SECTION 1

ENGINE SYSTEMS

DIESEL ENGINE



Four Cylinder Engine — Left Side
SHIELDS REMOVED FOR CLARITY

Four Cylinder Engine — Right Side
SHIELDS REMOVED FOR CLARITY

Figure 1-1

DESCRIPTION AND OPERATION

This section describes the overhaul and repair of the 4-cylinder direct injection diesel engine.

NOTE: The engine used in the 9030 tractor is of special manufacture. A “BSD” engine is NOT to be used in a 9030. See S/B 4/92-G12 for further information on engine differences between a 9030 and a BSD engine.

The engine, Figure 1-1, features a cross flow cylinder head with the inlet and exhaust manifolds on opposite sides of the head. The combustion chamber is formed in the crown of the piston which has two compression and one oil control ring all located above the piston pin.

The cylinder head assembly incorporates the valves, valve springs, and the spring retainers. Valve guides are an integral part of the cylinder head with replaceable valve seats pressed into the valve ports. Valve guides are not replaceable.

Cylinder Head Assembly

The cylinder head assembly incorporates the valves, valve springs, and rotators. The valve rocker arm shaft assembly is bolted to the cylinder block, through the head. The intake and exhaust manifolds are bolted to the head, the intake on the right side, and the exhaust on the left. The water outlet connection and thermostat are attached to the front of the cylinder head.

Valve guides are integral with the cylinder head, and valves with oversize stems are available for service. Special replaceable cast alloy valve seats are pressed into each valve port, and exhaust valves are fitted with positive valve rotators. The valves use umbrella-type seals.

Valve lash is maintained by self-locking adjusting screws. The cam shaft runs in four replaceable bearings, and is driven by the camshaft idler gear in mesh with the camshaft and crankshaft gears. Camshaft thrust is controlled by a plate secured to the block and located between the camshaft gear and the front journal of the camshaft.

The cylinder head bolts are evenly spaced in a six-point pattern around each cylinder. Diesel engine injectors are mounted outside the rocker cover.

The engine cylinder head is designed with the entire face of the cylinder head flat. The combustion chambers are recessed into the piston crowns.

Crankshaft Assembly

The crankshaft is supported in the cylinder block by five main bearings and the crankshaft end thrust is controlled by a thrust bearing located on the center main bearing.

A crankshaft driven dynamic balancer counteracts out-of-balance forces and thereby reduces engine vibration. The balancer housing is bolted to the bottom of the cylinder block and contains two meshing gears which are driven and timed from a gear on the crankshaft.

Front and rear crankshaft oil sealing is effected by a one piece, single lip type seal.

The piston is connected to the crankshaft by a heavy I-beam connecting rod with a tapered top end. The crankshaft end of the connecting rod has an insert-type copper lead or aluminum tin alloy bearing. The piston end of the connecting rod has a replaceable bronze bushing. The piston pin is a free-floating steel pin held in place in the piston by two snap rings.

Pistons

Pistons are an aluminum alloy with combustion chambers recessed into the piston crowns. Each piston has two compression rings and one oil control ring, all of which are located above the piston pin.

Connecting Rods

The piston connecting rods have replaceable bronze piston pin bushings. A centrally drilled hole facilitates both pressure lubrication of the piston pin bushing and cooling of the piston crown. Full-floating piston pins are retained by two snap rings in each piston.

Manifolds

The aluminum intake and cast iron exhaust manifolds are on opposite sides of the cylinder head for better heat distribution in the head, and less heat transfer to the intake manifold. All tractors are fitted with vertical exhaust systems.

The intake manifolds are connected through tubing to the air cleaner. The turbocharger crossover tube is provided with a tapped hole for installation of an ether cold starting aid kit.

Cylinder Block Assembly

The cylinder block is a cast iron alloy with heavy webbing and deep cylinder skirts. The block features full length water jackets for cooling the cylinders, which are bored integral with the block. Cylinders are in-line and vertical, and numbered from 1 to 4, front to rear.

The oil pan is attached to the bottom of the cylinder block and is the sump for the lubrication system. The engine front cover is attached to the front engine adapter plate forming a cover for the timing gears.

The crankshaft gear is keyed and press fitted on the front of the crankshaft (later engines do not use a key). The crankshaft gear drives the idler gear, which is attached to the front of the cylinder block. The idler gear drives the camshaft gear and the injection pump drive gear.

The camshaft gear is attached to the front of the camshaft by a key, bolt, lock washer, and flat washer. This ensures the gear maintains correct position on the camshaft.

All the timing gears are timed to each other via an identification mark to insure proper gear position in relation to each other.

Lubrication System

Lubrication of the engine is maintained by a gerotor type oil pump mounted at the base of the engine block. The oil pump is driven from the camshaft and draws oil from the engine sump through a wire mesh screen.

A spring loaded relief valve in the pump body limits the pressure in the system by directing excess oil back to the intake side of the pump.

Oil passes from the pump to an external, throw-away, spin-on type filter incorporating a relief valve which permits oil to be bypassed if filter blockage occurs, and so ensures engine lubrication at all times.

Oil flows from the filter to the main oil gallery which runs the length of the cylinder block and intersects the camshaft follower chambers.

The main gallery also supplies oil to the crankshaft main bearings and to the connecting rod journals via drillings in the crankshaft. Drilled passages from each main bearing direct oil to the camshaft bearings.

The idler gear bushing is pressure lubricated through a drilled passage from the front main bearing. The gear has small oil passages machined on both sides which allow the oil to escape.

The timing gears are lubricated by oil from the cam follower chamber and the pressure lubricated idler gear bushing.

The dynamic balancer is lubricated through a drilled passage from the cylinder block intermediate thrust bearing web to the balancer housing. Oil flows through the balancer housing to the drilled balancer gear shafts and on to the bushings in the balancer gears.

Cylinder walls, piston, and piston pins are splash lubricated by the connecting rods and rotating crankshaft.

The connecting rods have a centrally drilled hole which facilitates both pressure lubrication of the piston pin bushing and cooling of the piston crown.

An intermittent flow of oil is directed to the valve rocker arm shaft assembly via a drilled passage in the cylinder block located vertically above No. 1 camshaft bearing. This drilling aligns with a corresponding hole in the cylinder head.

As the camshaft turns, holes in the camshaft and camshaft bearing align and a regulated stream of oil is directed to the cylinder head and on up the rocker arm shaft support bolt to the rocker shaft.

The oil flows from the shaft through drilled holes in each rocker arm bushing to lubricate both ends of the arms. Excess oil flows down the push rods and assists in lubricating the cam followers before draining back into the sump through cored openings in the block.

A water-to-oil type oil cooler, located in the base of the radiator, is connected into the lubrication system main oil gallery and cools a portion of the circulating oil. A restrictor at the oil outlet limits the flow to the cooler and maintains internal lubrication at low engine speeds. Return oil from the cooler is fed back to the engine sump via a pipe tapped into the skirt of the cylinder block.

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