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DRIVE LINE

A technical publication from Joseph Industries,

the specialist in drive line replacement components for the industrial/construction equipment markets

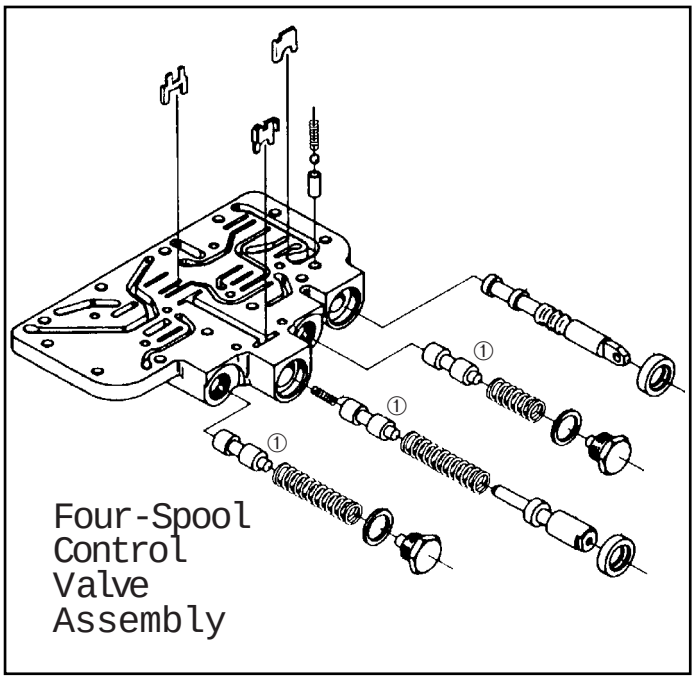
The Control Valve Assembly the brains behind the transmission

Borg Warner-type transmissions utilize a variety of control valve assemblies. These control valve assemblies may differ in appearance, but what they all have in common is a collection of valves, springs and passages. By directing hydraulic pressure to forward/reverse clutches and high/low clutch packs, this assembly of parts controls the transmission direction and speed range.

Top-down view of the PR1 transmission with its manual valve assembly.

Driver demand is transferred to the control valve assembly via the selector lever and linkage. In most cases this transfer is manual, but two Borg Warner transmissions have optional electric valve assemblies. The majority of the Borg Warner-type transmissions utilize external bolt-on valve assemblies. However, several models employ an internal valve assembly.

A typical inspection process for valve assemblies includes checking valves for nicks, burrs and scratches. Washed and air-dried valves should slide freely in their respective bores. Small burrs may be removed by using a crocus cloth. However, care should be taken not to round the valve(1) land edges. The sharp edge radius keeps the valve openings clean, preventing dirt from entering the hydraulic system. Valve body surfaces should be flat without deep scratches. Valve body surfaces may be lapped when proper equipment is used.



Four-Spool Control Valve Assembly

(1) In some instances, the valve may be referred to as a spool. For consistency, the valve assembly component identified as number 1 in the illustration, and which functions as an open/close mechanism for the flow of hydraulic fluid, will be referred to as the valve.

The Velvet Drive* Transmission is a Construction Work Horse

Borg Warner's 10-16 transmission is a common drive line component in the construction industry. It can be found in a variety of rubber tire backhoe loader applications. Also referred to as the velvet drive industrial transmission, the 10-16 is a single-speed forward and reversing unit with an internal valve assembly. The 10-16 may be used alone or in conjunction with an auxiliary transmission. A torque

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*Velvet Drive is a trade name of Velvet Drive Transmissions, a Division of Regal-Beloit Corp.

The Velvet Drive Transmission is a Construction Work Horse

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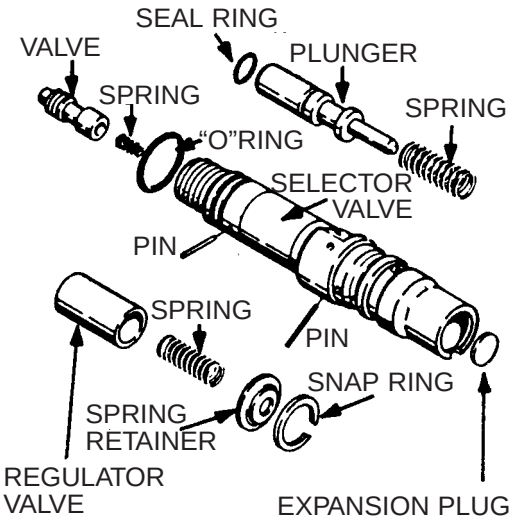
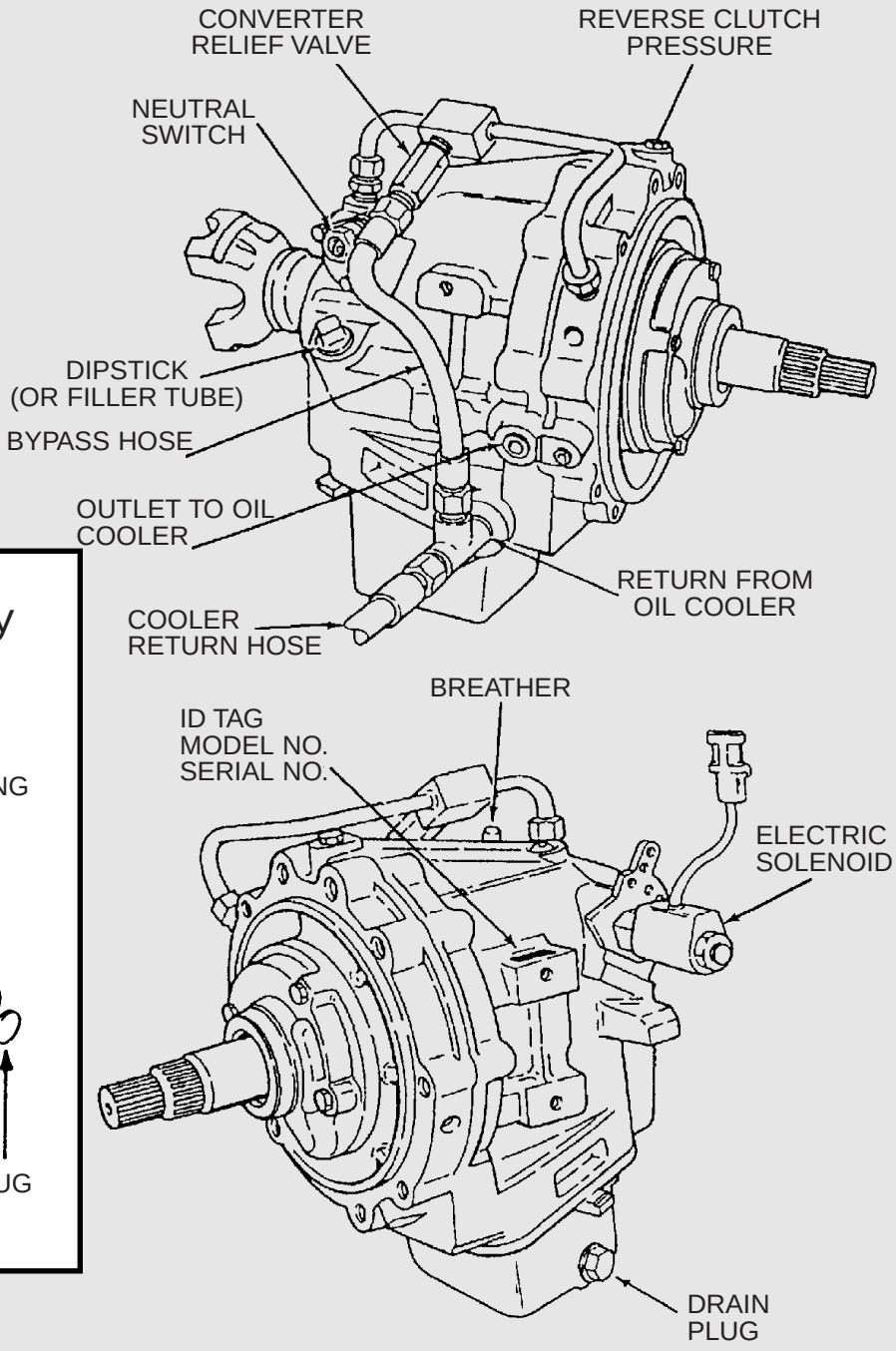
converter between engine and transmission permits stopping the vehicle in gear with the engine running. The 10-16 transmission consists of a planetary gear set, a multiple-disc reverse clutch and a multiple-disc forward clutch. The input and output shafts are coaxial. Hydraulic pressure is supplied by a gear-type oil pump driven at engine speed by the torque converter hub.

Oil from the pump is directed to the pressure regulator and control valves. Converter pressure is maintained by a converter regulator valve. The regulator valve within the valve assembly controls oil pressure

10-16 Valve Assembly



10-16 Velvet Drive Transmission



level for the entire unit. Oil is directed to journals and bushings through transmission case passages to supply pressure lubrication. Oil discharged from the pressure regulator and converter relief valve is directed back to the transmission sump.

Moving the forward and reverse shift lever causes oil to be directed to the appropriate clutch for forward or reverse operation. Selecting neutral directs oil back into the sump, disengaging the clutch packs.

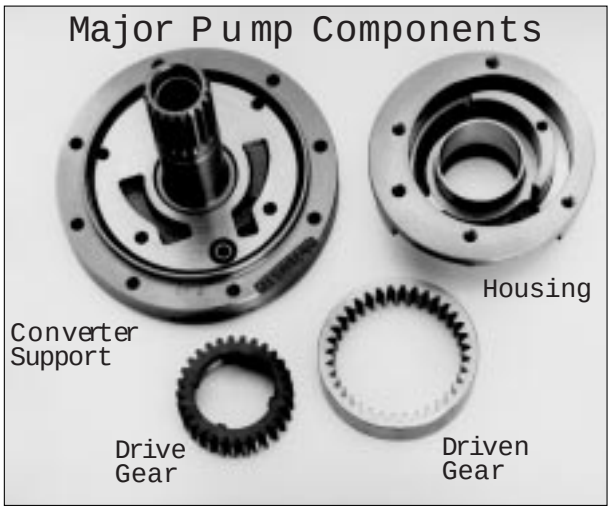
Pumping life into the transmission

If the control valve assembly is the brains behind the transmission, then the pump is the heart of the transmission. Before the transmission can do anything it must have hydraulic pressure. And this pressure is generated by the pump.

The pump housing is mounted to the transmission with its drive gear connected to the torque converter hub. This means that any time the engine is running, whether the transmission is in gear or not, the pump's drive gear is rotating.

The sole purpose of the pump is to deliver more oil than the transmission requires, whether at idle or at high rpm speeds. Hydraulic oil enters the pump through the intake screen and transmission case passages. Oil leaving the pump is directed through case and adapter passages to the pressure regulator valve, the open valve body passages and the torque converter.

The pump is designed to have more capacity than the transmission requires. It is the pressure regulator valve's job to handle the excess oil pressure. After oil has filled all open circuits, line pressure increases, building on the end of the pressure regulator valve. The pressure buildup reaches a point where it overcomes an opposing spring force, opening the regulator valve. The opening draws mainline oil back into the sump. This lowers the pressure until it is balanced against the opposing spring force. At this point the oil line pressure is regulated.



Common Borg Warner-type automatic transmissions

Old Designation	New * Designation	Type	Typical Applications
T11	10-11	2-speed	lift trucks
T12	10-01	1-speed	lift truck, utility construction vehicles
T17	10-10	1-speed	lift trucks
T22	10-08	1- & 2-speeds	lift trucks, locomotives
T27	10-12	2-speed	lift trucks
T72	10-16	1 speed	backhoe tractors
PR1	10-21	1-speed	lift trucks, utility construction vehicles
PR2	10-22	2-speed	lift trucks

*This designation changes once the original equipment manufacturer assigns its own OEM part number to the Borg Warner transmission.

Drive Line talks back

This feature is your opportunity to present the experts at Joseph Industries with your drive line component questions. Send your questions and comments to Drive Line, c/o Joseph Industries, 10039 Aurora-Hudson Rd., Streetsboro, Ohio 44241.

How is reliability assured with Joseph Industries' rebuilt transmissions?
As standard practice, all Joseph and Concora rebuilt transmissions have new bearings, gaskets, rubber lip seals, sealing rings, clutch plates and pump. All gears, drums and brakes are inspected for wear. All components showing visible signs of wear are replaced. Before each transmission is shipped, hydraulic pressure is tested at two rpm levels ensuring the unit meets all pressure levels specified in the O.E.M.'s service manual.

How does the transmission core policy work?
Every transmission sent to Joseph Industries for rebuilding is issued a core refund. Subtacted from this refund is the replacement cost of worn components not part of the rebuild kit. Parts replaced as standard practice in rebuilding a transmission include bearings, gaskets, rubber lip seals, sealing rings, clutch plates and the pump.

Can you offer some tips for rebuilding a transmission?
1. Be thorough.
2. Clean every part before reassembly. Dirt in the system can accelerate component wear.
3. Check everything, replacing all worn parts. Remember, wear causes pressure losses.
4. Check all clearances, making sure they meet the manufacturer's specifications outlined in the service manual.