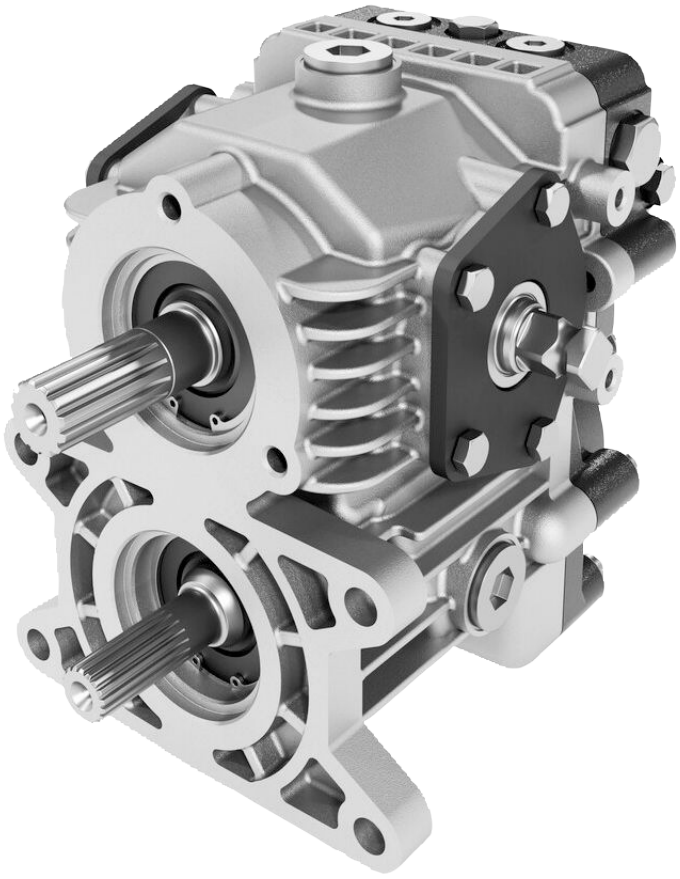
ENGINEERING
TOMORROW

Service Manual

3232
Closed Circuit Axial Piston Transmission



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Revision history

Table of revisions

Date	Changed	Rev
April 2025	Fixed typo	0102
March 2025	First edition	0101

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Introduction

Overview

This manual includes information on the installation, maintenance, and minor repair of 3232 transmission (HST). It includes a description of the unit and its individual components, troubleshooting information, and minor repair procedures.

Performing minor repairs may require removal from the vehicle/machine. Thoroughly clean the unit before beginning maintenance or repair activities. Since dirt and contamination are the greatest enemies of any type of hydraulic equipment, follow cleanliness requirements strictly. This is especially important when changing the system filter and when removing hoses or plumbing.

A worldwide network of Danfoss Authorized Service Centers is available for major repairs. Danfoss trains and certifies Authorized Service Centers on a regular basis. You can locate your nearest Authorized Service Center using the distributor locator at *www.danfoss.com*.

Warranty

Performing installation, maintenance, and minor repairs according to the procedures in this manual will not affect your warranty. Major repairs requiring the removal of the units center section voids the warranty unless completed by a Danfoss Global Service Partner.

General Instructions

Follow these general procedures.

Remove the unit

Prior to performing major repairs, remove the unit from the vehicle/machine. Chock the wheels on the vehicle or lock the mechanism to inhibit movement. Be aware that hydraulic fluid may be under high pressure and/or hot. Inspect the outside of the HST and fittings for damage. Cap hoses and plug ports after removal to prevent contamination.

Keep it clean

Cleanliness is a primary means of assuring satisfactory HST life, on either new or repaired units. Clean the outside of the HST thoroughly before disassembly. Take care to avoid contamination of the system ports. Cleaning parts using a clean solvent wash and air drying is usually adequate.

As with any precision equipment, keep all parts free of foreign materials and chemicals. Protect all exposed sealing surfaces and open cavities from damage and foreign material. If left unattended, cover the transmission with a protective layer of plastic.

Lubricate moving parts

During assembly, coat all moving parts with clean hydraulic fluid. This assures that these parts are lubricated during start-up.

Replace all O-rings and gaskets

Danfoss recommends you replace all O-rings, seals, and gaskets during repair.Lightly lubricate all O-rings with clean petroleum jelly prior to assembly. Grease must be soluable in hydraulic fluid.

Secure the unit

For major repair, place the unit in a stable position with the shaft pointing downward. It is necessary to secure the transmission while removing and torquing components and fasteners.

Safety Precautions

Always consider safety precautions before beginning a service procedure. Protect yourself and others from injury. Take the following general precautions whenever servicing a hydraulic system.

Introduction

Unintended machine movement

Warning

Unintended movement of the machine or mechanism may cause injury to the technician or bystanders. To protect against unintended movement, secure the machine or disable/disconnect the mechanism while servicing.

Flammable cleaning solvents

Warning

Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

Fluid under pressure

Warning

Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury and/or infection. This fluid may also be hot enough to cause burns. Use caution when dealing with hydraulic fluid under pressure. Relieve pressure in the system before removing hoses, fittings, gauges, or components. Never use your hand or any other body part to check for leaks in a pressurized line. Seek medical attention immediately if you are cut by hydraulic fluid.

Personal safety

Warning

Protect yourself from injury. Use proper safety equipment, including safety glasses, at all times.

Hazardous material

Warning

Hydraulic fluid contains hazardous material. Avoid prolonged contact with hydraulic fluid. Always dispose of used hydraulic fluid according to environmental regulations.

Introduction

Symbols Used in Danfoss Literature

	WARNING may result in injury
	CAUTION may result in damage to product or property
	Non-reusable part, use a new part
	External hex head
	Internal hex head
	Lubricate with hydraulic fluid
	Apply grease / petroleum jelly
	Inspect for wear or damage
	Clean area or part
	Be careful not to scratch or damage
	Note correct orientation
	Torque specification
	Press in – press fit
	Measurement required
	Pull out with tool – press fit
	Flatness specification
	Parallelism specification
	Cover splines with installation cylinder
	Mark orientation for reinstallation

The symbols above appear in the illustrations and text of this manual. They are intended to communicate helpful information at the point where it is most useful to the reader. In most instances, the appearance of the symbol itself denotes its meaning. The legend above defines each symbol and explains its purpose.

General Description

Basic Design

The 3232 was designed as one housing U-style transmission in a U-shaft configuration. It houses a variable axial piston pump with fixed displacement axial piston motor to provide infinite gear ratio in a compact size. This design provides longer life and higher performance in the same package and is well suited for agricultural vehicles.

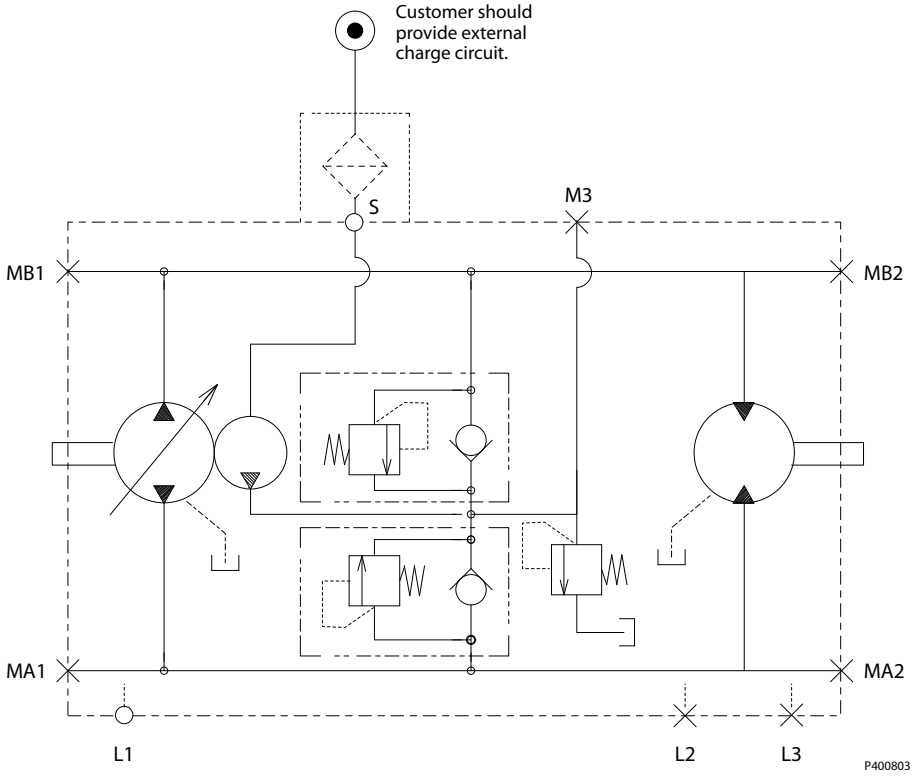
Key Features

- Proven and optimized 9 piston rotating group
- Compact one housing design
- Longer life kit and higher duty capability in the most compact design in its class
- Optimized for short shaft center-line distance
- Robust Cylinderblock, Piston material and Valveplate

Typical Applications

- Harvester

Schematic Diagram



- L1, L2 and L3 are case drain ports.
- S is Suction port. Customer should provide external charge circuit.
- M3 is Charge pressure gauge port.

Operation

Check / High Pressure Relief Valve

The 3232 is equipped with a combination high pressure relief and charge check valve. The high-pressure relief function is a dissipative (with heat generation) pressure control valve for the purpose of limiting excessive system pressures. The charge check function acts to replenish the low-pressure side of the working loop with charge oil. Each side of the transmission loop has a dedicated HPRV valve that is non-adjustable with a factory set pressure. When system pressure exceeds the factory setting of the valve, oil is passed from the high pressure system loop, into the charge gallery, and into the low pressure system loop via the charge check.

The pump order code allows for different pressure settings to be used at each system port. HPRV valve with orifice is available to gain wider neutral dead-band. When HPRV valves with orifice are used, it is only for High pressure ports when vehicle goes in reverse. The system pressure order code for pumps with only HPRV is a reflection of the HPRV setting.

The system pressure order code for pumps configured with pressure limiter and HPRV is a reflection of the pressure limiter setting.

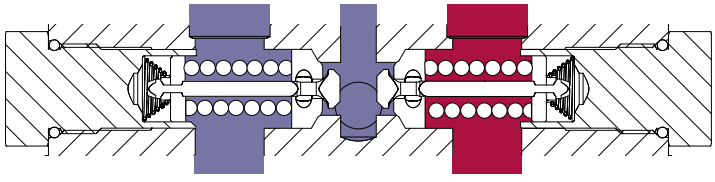
Check / High Pressure Relief Valve with Orifice

As an option, The 3232 offers Check / HPRV with an orifice produce a larger neutral deadband.

In some applications, it is desirable to use Check / HPRV with an orifice to expand neutral dead band, which would help provide a larger margin of safety for vehicle movement in neutral and provide easier adjustment of the vehicle linkage for machine neutral. The orifice connects the working loop, which is a main hydraulic circuit, to a charge circuit. It always allows some internal leakage to ensure the expanding neutral dead band around neutral position of control shaft. However, it decreases the volumetric efficiency, particularly at high system pressure in the working loop. Check / HPRV with an orifice has possibility to increase downhill creep. It is recommended to install the orifice in a specific working loop, which is pressurized when the vehicle moves in reverse.

The HPRV are set at the following flow rates

Check / HPRV without orifice	6 l/min [1.4 US gal/min]
Check / HPRV with orifice	18 l/min [4.8 US gal/min]



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Caution

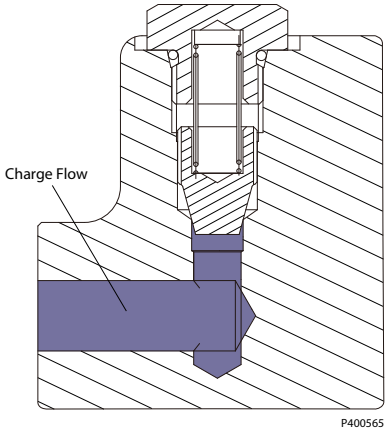
HPRVs are factory set at a low flow condition. Any application or operating condition which leads to elevated HPRV flow will cause a pressure rise with flow above a valve setting. Consult factory for application review.

Operation

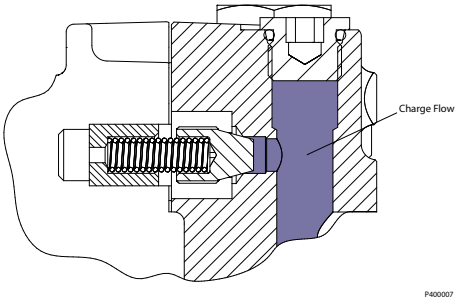
CPRV (Charge Pressure Relief Valve)

The charge pressure relief valve maintains charge pressure at a designated level above case pressure. The charge pressure relief valve is a direct acting poppet valve which opens and discharges fluid to the HST case when pressure exceeds a designated level. 3232 is equipped with a gerotor charge pump and the CPRV is set at 2300 rpm. The charge pressure relief valve setting is specified on the model code of the 3232.

Charge Pressure Relief Valve Function (Suction Filtration)



Charge Pressure Relief Valve Function (Charge Filtration)



Control

Direct Displacement Control

The 3232 features Direct Displacement Control (DDC) . The swashplate angle is set directly by a control lever or linkage attached directly to the swashplate control arm. Control lever movement changes the speed and rotating direction of the motor by increasing or decreasing the swashplate angle.

The control input shaft is configurable on both of left and right hand side of the 3232.

Control Handle Requirements

Maximum allowable control arm torque is 79.1 N•m [700 lbf•in]. The approximate torque necessary to rotate the control arm at 300 bar system operating pressure and 3000 rpm is 30 N•m with the standard valveplate. Minimum torque necessary to hold the swashplate at a zero angle for neutral is 2.3 N•m [20 in•lbf]. The actual value will vary due to the influence of pump operating conditions. For mating dimensions, see Installation drawings in 3232 Technical Information Manual BC503730922772.

Operation

Warning

With no external forces applied to the swashplate trunnion, internal hydraulic forces may not return the swashplate to the neutral position under all conditions of operation.

Operating Parameters

Overview

This section defines the operating parameters and limitations for 3232 with regard to input speeds and pressures. For actual parameter data, refer to the Operating Parameters in the Technical Specifications section.

Input / Output Speed

Minimum speed is the lowest input speed recommended during engine idle condition. Operating below minimum speed limits pump's ability to maintain adequate flow for lubrication and power transmission.

Rated speed is the highest input speed recommended at full power condition. Operating at or below this speed should yield satisfactory product life.

Maximum speed is the highest operating speed permitted. Exceeding maximum speed reduces product life and can cause loss of hydrostatic power and braking capacity. Never exceed the maximum speed limit under any operating conditions.

Operating conditions between rated speed and maximum speed should be restricted to less than full power and to limited periods of time. For most drive systems, maximum unit speed occurs during downhill braking or negative power conditions.

Warning

Unintended vehicle or machine movement hazard.

Exceeding maximum speed may cause a loss of hydrostatic drive line power and braking capacity. An independent braking system is required, redundant to the hydrostatic transmission, which is sufficient to stop and hold the vehicle or machine under all conditions of operation in the event of hydrostatic drive power loss.

System Pressure

System pressure is the differential pressure measured between the gage ports Ma and Mb. It is the dominant operating variable affecting hydraulic unit life. High system pressure, which results from high load, reduces expected life. Hydraulic unit fatigue life depends on speed and normal operating—or weighted average—pressure that you can only determine from a duty cycle analysis.

Maximum Working Pressure is the highest recommended application pressure. Maximum working pressure is not intended to be a continuous pressure. Propel systems with application pressures at, or below, this pressure should yield satisfactory unit life given proper component sizing.

Maximum pressure (peak) is the highest intermittent pressure allowed under any circumstances. Applications with applied pressures between maximum working and maximum intermittent require factory approval with complete application, duty cycle, and life expectancy analysis.

All pressure limits are differential pressures referenced to low loop (charge) pressure. Subtract low loop pressure from gauge readings to compute the differential.

Input Power

Maximum continuous input power is the highest recommended input power to HST excluding PTO output power.

Operating Parameters

Charge Pressure

An internal charge relief valve regulates charge pressure. Charge pressure maintains a minimum pressure in the low side of the transmission loop. Charge pressure is the differential pressure above case pressure.

Minimum charge pressure is the lowest pressure safe working conditions allow in the system.

Maximum charge pressure is the highest charge pressure the charge relief adjustment allows, and which provides normal component life.

Charge flow to transmission must be sufficient to provide adequate charge pressure.

Case Pressure

Under normal operating conditions, the rated case pressure must not be exceeded. During cold start case pressure must be kept below **maximum intermittent case pressure**. Size drain plumbing accordingly.

Caution

Possible component damage or leakage

Operation with case pressure in excess of stated limits may damage seals, gaskets, and/or housings, causing external leakage. Performance may also be affected since charge and system pressure are additive to case pressure.

Viscosity

Maintain fluid viscosity within the recommended range for maximum efficiency and bearing life. **Minimum viscosity** should only occur during brief occasions of maximum ambient temperature and severe duty cycle operation. **Maximum viscosity** should only occur at cold start. Limit speeds until the system warms up. Refer to the fluid specifications in 3232 Technical Information Manual BC503730922772.

Temperature

1. Maintain fluid temperature within the limits shown in the Technical Specification section.

   Minimum temperature relates to the physical properties of the component materials. Cold oil may affect the ability of the transmission to provide flow and transmit power.

   Continuous temperature should not be exceeded for longer than 2 minutes (single event) or for more than 2% of the application duty cycle. Operating the unit at or below continuous temperature should yield satisfactory unit life. The application's cooling system shall be designed to maintain the oil temperature below the continuous temperature limit.

   Maximum intermittent temperature: is based on material properties. Don't exceed it.
2. Measure maximum temperature at the hottest point in the system.

   Refer to the Fluid Specifications in 3232 Technical Information manual BC503730922772 for data.
3. Ensure fluid temperature and viscosity limits are concurrently satisfied.

Technical Specifications

General Specifications

Design	U-style HST with variable displacement piston pump and fixed motor
Direction of Rotation	Clockwise Counterclockwise
Recommended Installation Position	Discretionary: The housing must be filled with hydraulic fluid

Physical Properties

Features		Units	3232
Displacement	Pump side[1]	cm^3/rev [in^3/rev]	0-31.5 [0-1.92]
	Motor side		31.5 [1.92]
Torque at maximum displacement (theoretical)		N•m/bar [lbf•in/1000 psi]	0.50 [304.7]
Mass moment of inertia of rotating components	Pump side	kg•m^2 [slug•ft^2]	0.0019 [0.0014]
	Motor side		0.0019 [0.0014]
Weight dry		kg [lb]	22 [48.5]
Oil volume	Case only	liter [US gal]	1.5 [0.40]
	With passage		1.6 [0.42]

[1] Max Swash angle is 18 deg.

Operating Parameters

Features		Units	3232
Input speed	Minimum	min^{-1} (rpm)	1000
	Rated		3200
	Maximum		3400
System pressure	Maximum working pressure	bar [psi]	300 [4350]
	Maximum pressure		345 [5004]
Input power	Maximum	kw [HP]	29.8 [40]
Charge pressure	Minimum	bar [psi]	5 [72.5]
Case pressure	Rated	bar [psi]	1 [14.5]
	Maximum		3 [43.5]

Technical Specifications

Fluid Specifications

Features		Units	3232
Viscosity	Minimum	$mm^2/sec.$ [SUS]	7 [49]
	Continuous		12-60 [66-280]
	Maximum		1600 [7500]
Temperature	Minimum	Degrees C [Degrees F]	-40 [-40]
	Recommended range		+82 [+180]
	Maximum		+104 [+220]
Filtration (recommended minimum)	Cleanliness per ISO 4406		22/18/13
	Efficiency (charge pressure filtration)	β-ratio	β15-20=75(β10≥10)
	Efficiency (suction and return line filtration)		β35-45=75(β10≥2)
	Recommended inlet screen mesh size	µm	100-125

Fluid and Filter Maintenance

Fluid and Filter Recommendations

To ensure optimum life, perform regular maintenance of the fluid and filter. Contaminated fluid is the main cause of unit failure. Take care to maintain fluid cleanliness when servicing.

Check the reservoir daily for proper fluid level, the presence of water, and rancid fluid odor. Fluid contaminated by water may appear cloudy or milky or free water may settle in the bottom of the reservoir. Rancid odor indicates the fluid has been exposed to excessive heat. Change the fluid immediately if these conditions occur. Correct the problem immediately.

Inspect vehicle for leaks daily.

Change the fluid and filter per the vehicle/machine manufacturer's recommendations or at these intervals.

We recommend first fluid change occur at 500 hours of operation.

Fluid and Filter Change Interval

Reservoir Type	Max. Oil Change Interval
Sealed	2000 Hours
Breather	500 Hours

Caution

High temperatures and pressures accelerate fluid aging. This may require more frequent fluid changes.

Change the fluid more frequently if it becomes contaminated with foreign matter (dirt, water, grease, etc.) or if the fluid is subjected to temperature levels greater than the recommended maximum. Dispose of used hydraulic fluid properly. Never reuse hydraulic fluid.

Change filters when changing fluid or when the filter indicator directs. Replace all fluid lost during filter change

Warning

Hydraulic fluid contains hazardous material. Avoid contact with hydraulic fluid. Always dispose of used hydraulic fluid according to state, and federal environmental regulations. Never reuse hydraulic fluid.

Pressure Measurements

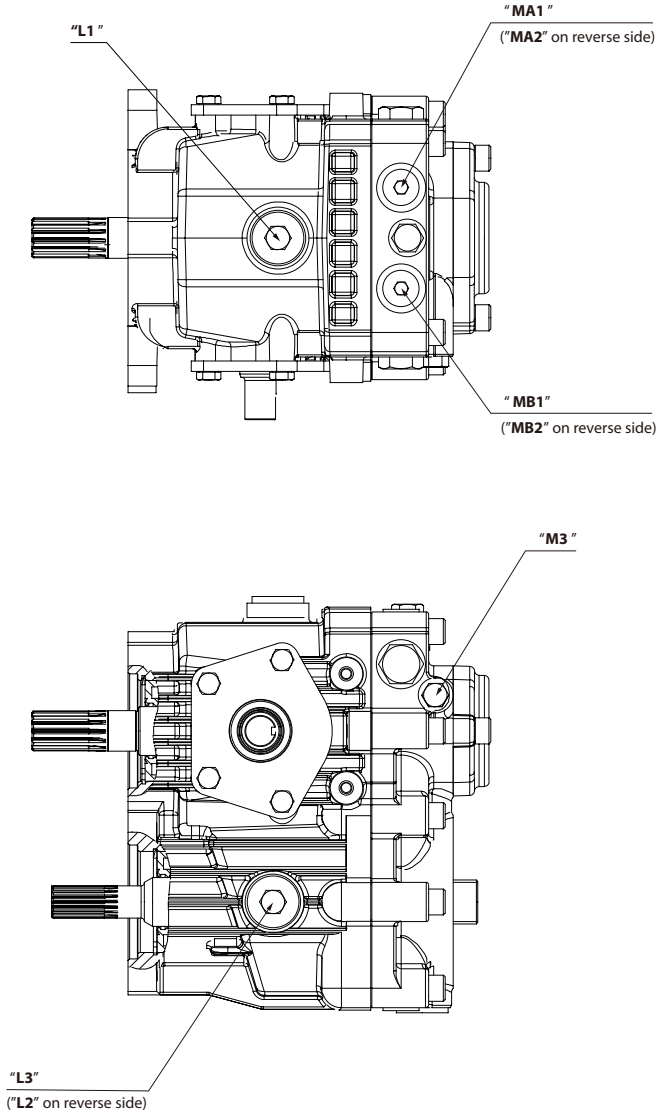
Port Locations and Gauge Installation - Center Section: Option J

The following table and drawing show the port location and gauge sizes needed.

Port Information (Center Section: Option J)

Port Identifier	Port Size	Wrench Size	Pressure Obtained	Gauge Size, bar [psi]
L1, L2, L3	7/8-14 UNF	3/8 internal hex	Case Drain	10 [145.04]
MA1, MA2, MB1, MB2	3/4-16 UNF	5/16 internal hex	System Pressure	500 [7251.90]
M3	7/16-20 UNF	9/16 external hex	Charge Pressure	50 [725.19]

Port Locations



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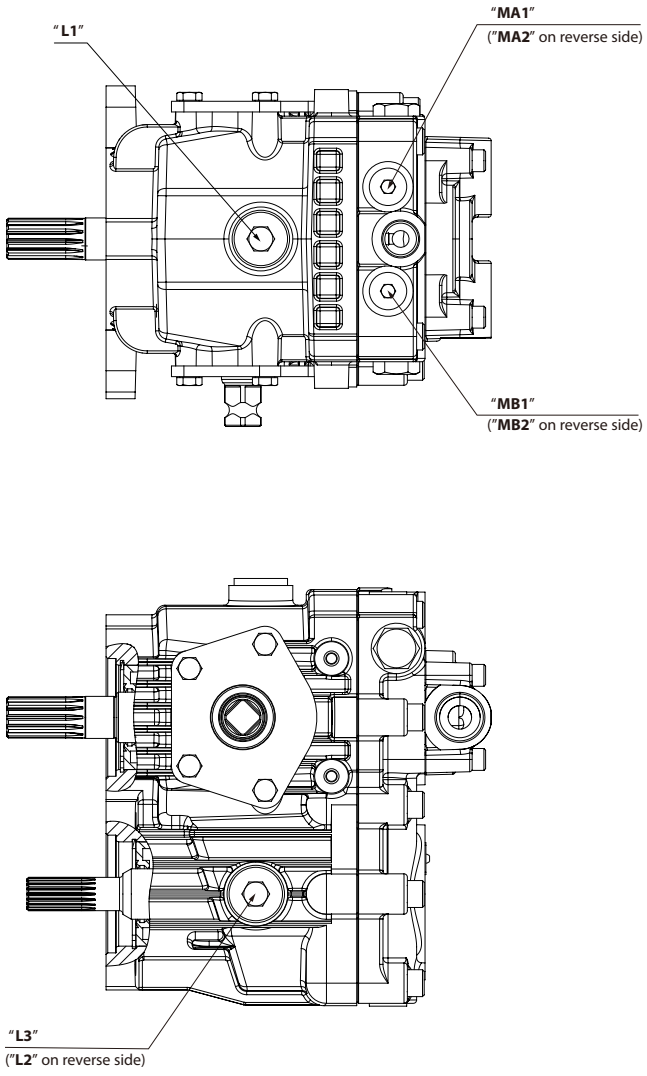
Pressure Measurements

Port Locations and Gauge Installation - Center Section: Option R

Port Information (Center Section: Option R)

Port Identifier	Port Size	Wrench Size	Pressure Obtained	Gauge Size, bar [psi]
L1, L2, L3	7/8-14 UNF	3/8 internal hex	Case Drain	10 [145.04]
MA1, MA2, MB1, MB2	3/4-16 UNF	5/16 internal hex	System Pressure	500 [7251.90]

Port Locations



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Initial Startup Procedure

Startup Procedure

Always follow this procedure when starting up a new 3232 installation or when the transmission has been removed and reinstalled on a machine. If the unit was torn down and reassembled before reinstalling on a machine, the product should be tested on a test stand and pass the necessary quality checks according to the test specification for 3232 transmissions.

Warning

This service procedure may require disabling a vehicle/machine (raising the wheels off the ground, or disconnecting the work function) to prevent injury to the technician and bystanders. Take the necessary safety precautions.

1. Before installing the transmission, inspect the unit for possible damage incurred during shipping and handling.
2. Make certain all system components (reservoir, hoses, valves, fittings, heat exchanger, and so forth) are clean before filling with fluid.
3. Install new system filter element(s) if necessary. Check that inlet line fittings are properly tightened and free of air leaks.
4. Install the transmission. Install a 50 bar [1000 psi] gauge in the charge pressure gauge port M3.
5. Fill the housing by adding filtered hydraulic fluid to the upper case drain port.
6. Fill the reservoir with hydraulic fluid of the recommended type and viscosity. Use a 10-micron filler filter. Ensure construction plug is closed after filling is complete.
7. Place the control lever in neutral, The control linkage must be disconnected from the transmission during initial start up.

   Caution

   After start-up the fluid level in the reservoir may drop due to system components filling with fluid. Damage to hydraulic components may occur if the fluid supply runs out. Ensure reservoir remains full of fluid during start-up.

   Air entrapment in oil under high pressure may damage hydraulic components. Check carefully for inlet line leaks.

   Do not run at maximum pressure until system is free of air and fluid has been thoroughly filtered.
8. Use a common method to disable the engine to prevent it from starting. Crank the starter for several seconds. Do not to exceed the engine manufacturer's recommendation. Wait 30 seconds and then crank the engine a second time as stated above. This operation helps remove air from the system lines. Refill the reservoir to recommended full oil level.
9. When the gauge begins to register charge pressure, enable and start engine. Let the engine run for a minimum of 30 seconds at low idle to allow the air to work itself out of the system. Check for leaks at all line connections and listen for cavitation. Check for proper fluid level in reservoir.
10. When adequate charge pressure is established (as shown in model code), increase engine speed to normal operating rpm to further purge residual air from the system.
11. Shut the off engine. Connect the control linkage. Start the engine, checking to be certain the pump remains in neutral. Run the engine at normal operating speed and carefully check for forward and reverse control operation.
12. Continue to cycle between forward and reverse for at least 5 minutes to bleed all air and flush system contaminants out of the system loop.

    Charge pressure may decrease slightly during forward or reverse operation.
13. Check that the reservoir is full. Remove charge pressure gauge and cap charge pressure port (M3). The transmission is now ready for operation.

Troubleshooting

Overview

This section provides general steps to follow if you observe undesirable system conditions. Follow the steps listed until you solve the problem. Some of the items are system specific. We reference the section in this manual of more information is available. Always observe the safety precautions listed in the Introduction section and any precautions related to your specific equipment.

System Operating Hot

Item	Description	Action
Oil level in reservoir.	Insufficient hydraulic fluid does not meet cooling demands of system.	Fill reservoir to proper level.
Heat exchanger.	Heat exchanger is not sufficiently cooling the system.	Check air flow and input air temperature for heat exchanger. Clean, repair or replace heat exchanger.
System relief pressure settings	If the system relief valves are worn, contaminated, or valve settings are too low, the relief valves get overworked.	Verify settings of high pressure relief valves and adjust or replace as necessary.
System pressure.	Frequent or long term operation over system relief setting creates heat in system.	Measure system pressure. If pressure is too high, reduce loads.

Transmission Operates Normally in One Direction Only

Item	Description	Action
Control linkage	Control linkage is operating improperly.	Repair/replace linkage
Interchange charge check/ HPRVs	Interchanging the charge check/HPRVs will show if the problem is related to the valve function.	If the problem changes direction, replace the defective valve.

System will not Operate in Either Direction

Item	Description	Action
Oil level in reservoir	Insufficient hydraulic fluid to supply system loop.	Fill reservoir to proper level.
Charge pressure with pump in neutral	Low charge pressure insufficient to recharge system loop	Measure charge pressure with the pump in neutral. If pressure is low, go to next step.
System pressure	Low system pressure does not provide enough power to move load.	Measure system pressure. Continue to next step.
Charge check/HPRVs	Low system pressure does not provide enough power to move load.	Repair or replace charge check/HPRVs
Control linkage	Linkage operating improperly.	Repair/replace linkage

System Noise or Vibration

Item	Description	Action
Reservoir oil level	Low oil level leads to cavitation.	Fill reservoir.
Aeration of the oil/charge inlet vacuum	Air in the system decreases efficiency of units and controls. Air in the system is indicated by excessive noise in HST, foaming in oil, and hot oil.	Find location where air is entering into the system and repair. Check that inlet line is not restricted and is proper size.
Cold oil	If oil is cold, it may be too viscous for proper function and pump cavitates	Allow the oil to warm up to its normal operating temperature with engine at idle speed.
Charge inlet vacuum	High inlet vacuum causes noise/cavitation.	Check that inlet line is not restricted and is proper size. Check filter.
Shaft couplings	A loose shaft coupling causes excessive noise.	Replace loose shaft coupling.
Shaft alignment	Misaligned HST and prime mover shafts create noise.	Align shafts.
Charge check/HPRVs	Unusual noise may indicate sticking valves. Possible contamination.	Clean/replace valves and test the unit.

Troubleshooting

Sluggish System Response

Item	Description	Action
Oil level in reservoir	Low oil level causes sluggish response.	Fill reservoir.
Charge check/HPRVs	Incorrect pressure settings affects system reaction time.	Replace charge check/HPRVs
Low prime mover speed	Low engine speed reduces system performance	Adjust engine speed.
Air in system	Air in system produces sluggish system response	Fill tank to proper level. Cycle system slowly for several minutes to remove air from system.
Charge inlet vacuum	Inlet vacuum is too high resulting in reduced system pressure.	Measure charge inlet vacuum. Inspect line for proper sizing. Replace filter. Confirm proper bypass operation.
Control linkage	Linkage operating improperly	Repair or replace control linkage

Required Tools and Standard Procedures

Required Tools

The service procedures described in this manual can be performed using common mechanic's hand tools. Special tools, if required, are shown. When testing system pressure, calibrate pressure gauges frequently to ensure accuracy. Use snubbers to protect gauges.

Standard Procedures

Caution

Contamination can damage internal components and void the warranty. Take precautions to ensure system cleanliness when removing and reinstalling system lines.

1. With the prime mover off, thoroughly clean all dirt and grime from the outside of the transmission. Ensure the surrounding areas are clean and free of contaminants such as dirt and grime.
2. If removing the transmission, tag each hydraulic line connected to the transmission. If you disconnect hydraulic lines, plug each open port to keep dirt and contamination out of the transmission.
3. Inspect the system for contamination. Look at the hydraulic fluid for signs of system contamination, such as oil discoloration, foam in the oil, sludge, or small metal particles.
4. Remove the transmission.

   Caution

   Be careful not to damage solenoids and electrical connections when using straps or chains to remove transmission from machine.
5. Perform transmission function test.
6. Before re-installing the transmission on the machine, test for leaks , drain the system, flush all lines, replace all filters, and fill with new hydraulic fluid.

Charge Check/HPRV Adjustments

The Charge Check/HPRV combines the charge check and high pressure relief functions. Whenever you replace a Charge Check/HPRV, operate the vehicle/machine through its full range of functions to ensure proper HST operation. The Charge Check/HPRVs are preset at the factory. No adjustment is possible.

Checking for proper charge check/HPRV operation

If you suspect Charge Check/HPRV malfunction, swap valves and test operation. If the symptoms switch direction, replace the faulty valve.

Minor Repair

Shaft Seals

Removal

1. Using a snap ring pliers, remove retaining ring (F125, H125, Y500).
2. Use a slide-hammer style puller to remove seal (F115, H115). Be careful not to damage the shaft or seal bore when removing the seal. Discard seal.

Inspection

Inspect retaining ring for wear or damage.

Assembly

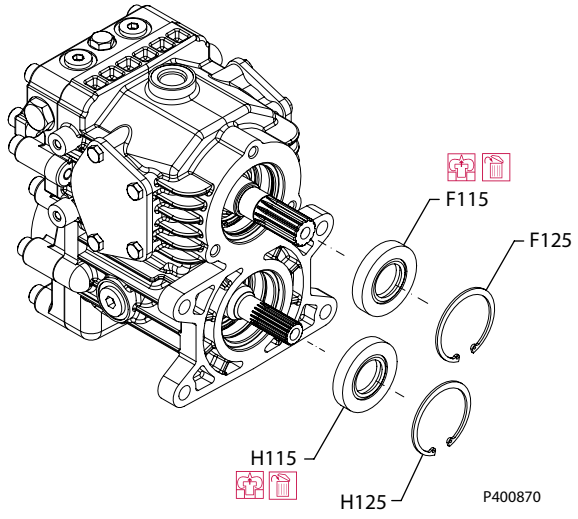
1. Lubricate inside diameter of new seal. Cover the shaft splines with protective sleeve to avoid damaging the seal during installation.
2. Using a seal installation tool, start the seal into the housing bore. Hand press the seal the rest of the way into the housing bore. Ensure the seal clears the retaining ring groove in the housing. Remove the protective sleeve from the shaft.

   Do not press seal beyond snap ring groove. Stop pressing just when you have room to install the retaining ring into the bore.

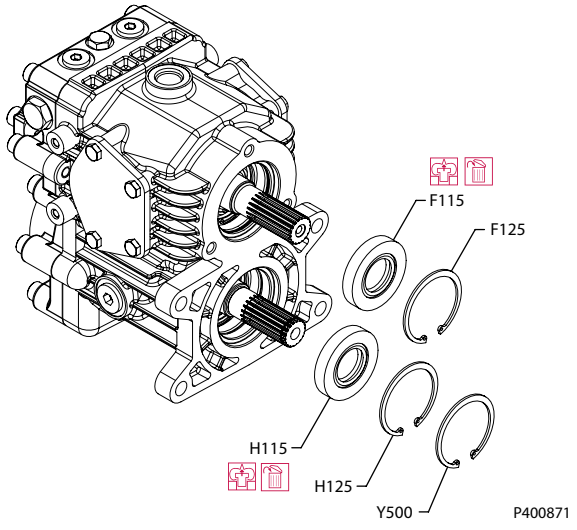
3. Using a snap ring pliers, install retaining ring (F125, H125, Y500).

Shaft Seals

NNN - Special Hardware - Standard Housing



SNN - Special Hardware - Small Housing



Minor Repair

Charge Check/HPRV

The high pressure relief and charge check valve assembly may be removed for cleaning and replacement of the O-rings. These valves are factory set and are not field adjustable. Refer to the transmission model code for the factory setting when ordering replacements.

Removal

1. Using an 24 mm hex wrench, remove the valve seat plug assemblies (J140, J150).
2. Carefully lift the valve (N110, P110) and spring (N100, P100) assemblies from the center section using a magnet.

Inspection

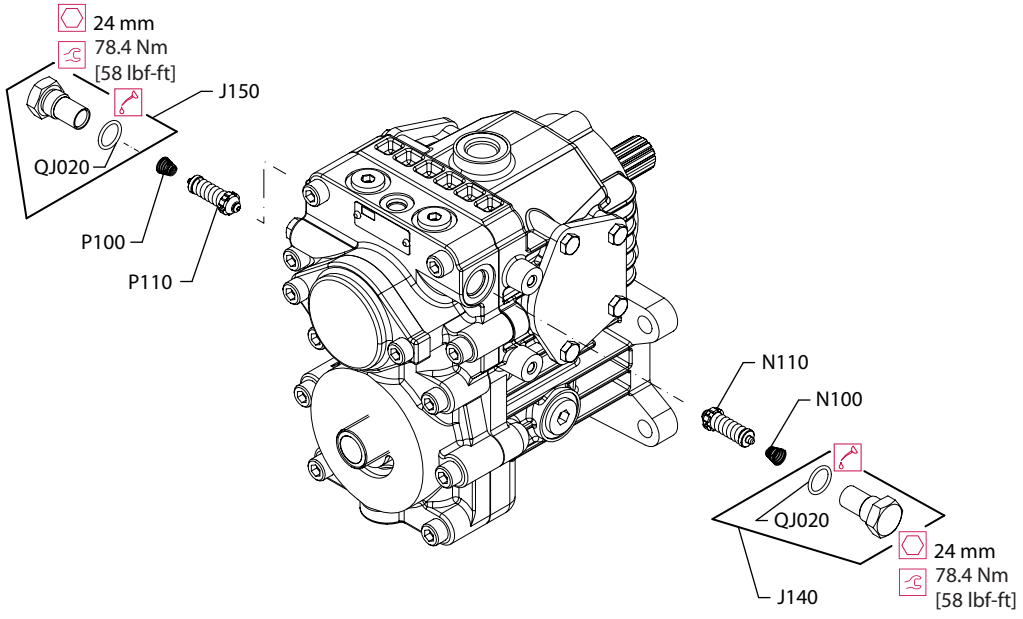
Inspect the valves and mating seats in the valve seat plug assemblies (J140, J150) for damage or foreign material.

Reassembly

1. Lubricate and install new O-rings (QJ020) on valve seat plug assemblies (J140, J150).
2. Verify that the conical springs (N100, P100) are properly retained on the check relief valves (N110, P110). Install the valve assemblies into the center section. Ensure each valve assembly moves freely in its bore.
3. Install the valve seat plug assemblies into the center section and torque to 78.4 N•m [58 lbf•ft].
4. Operate vehicle/machine through full range of controls to ensure proper operation. Check for leaks.

Charge Check/HPRV

J - Center Section - Suction Filter Type



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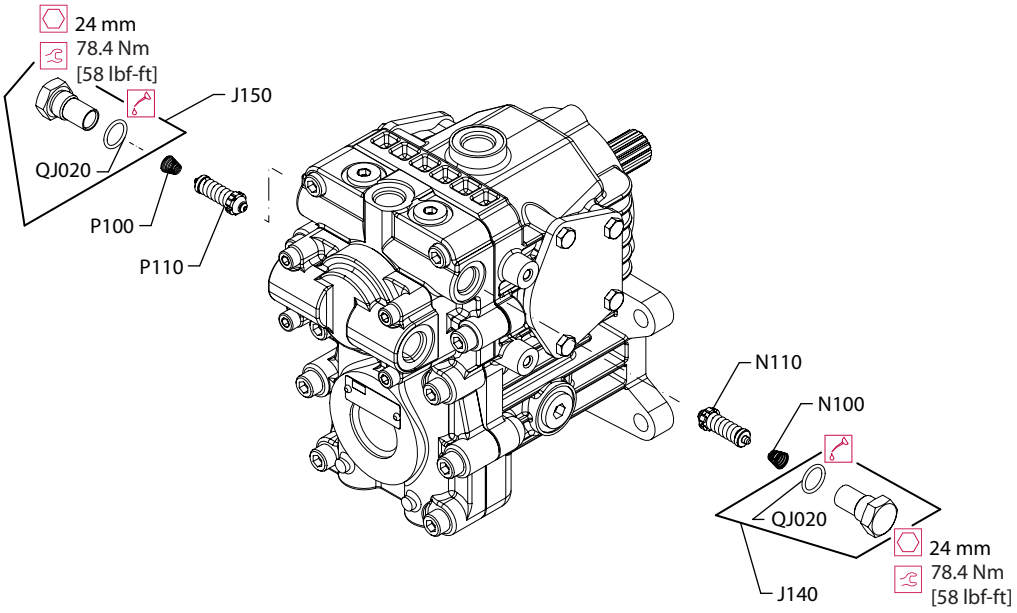
Minor Repair

R - Center Section - Remote Filter Type



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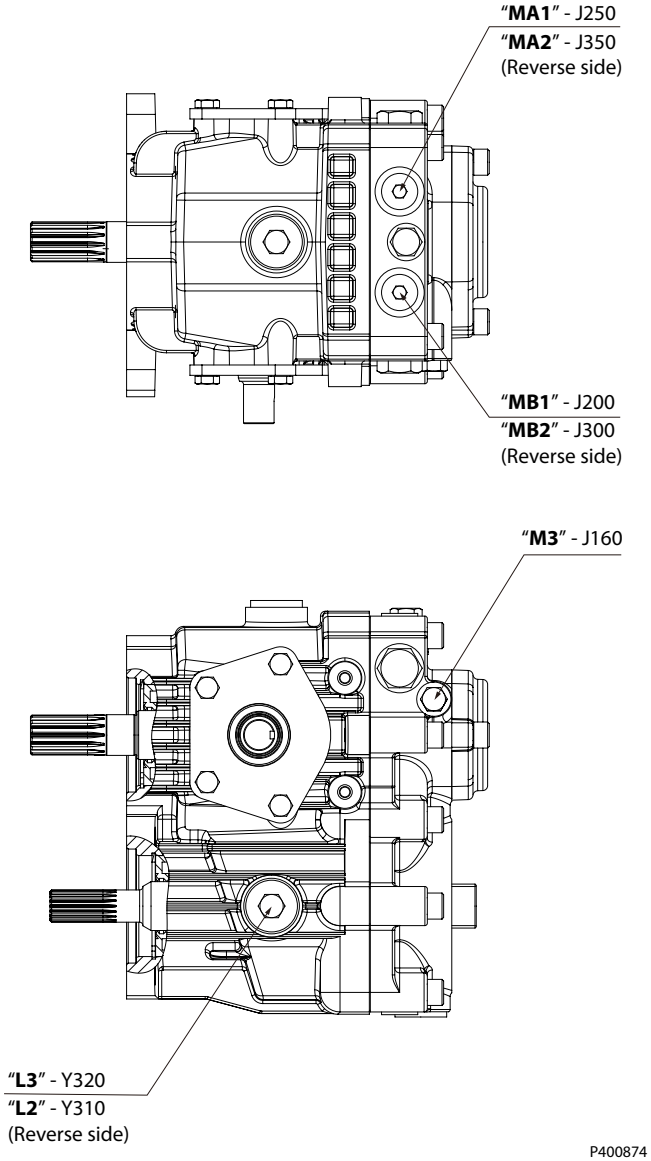
Torque Chart

Plug Size and Torque Chart - Center Section: Option J

Plug Information (Center Section: Option J)

Item	O-ring Plug	Wrench Size	Torque N•m [lbf•ft]
J200, J250, J300, J350	3/4-16 UNF	5/16 internal hex	70.0 [51.6]
J160	7/16-20 UNF	9/16 external hex	29.4 [21.7]
Y310, Y320	7/8-14 UNF	3/8 internal hex	40.0 [29.5]

Plug Locations



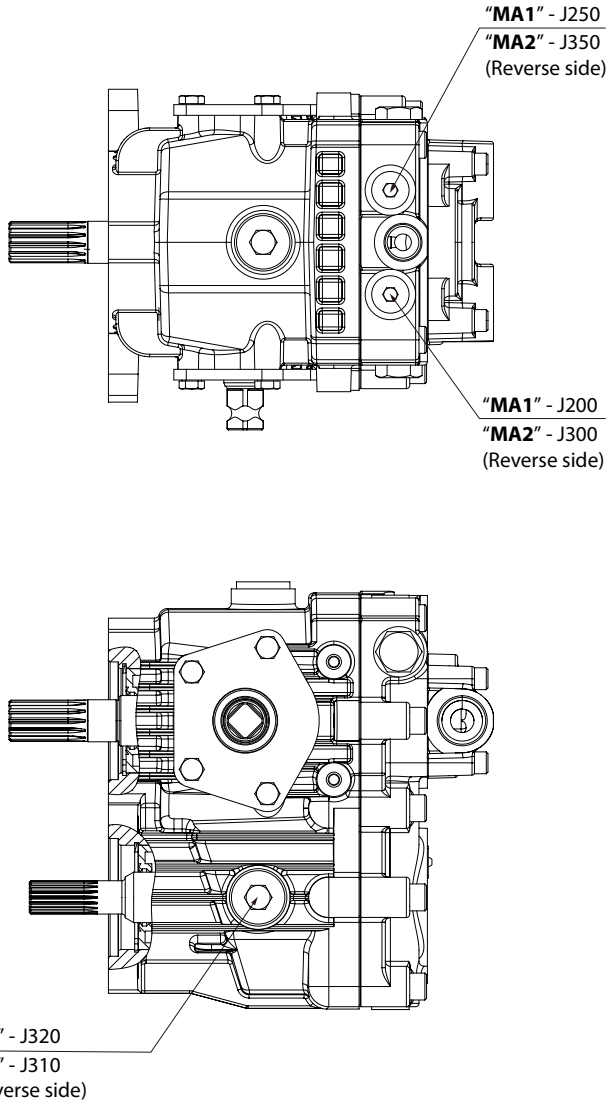
Torque Chart

Plug Size and Torque Chart - Center Section: Option R

Plug Information (Center Section: Option R)

Item	O-ring Plug	Wrench Size	Torque N•m [lbf•ft]
J200, J250, J300, J350	3/4-16 UNF	5/16 internal hex	70.0 [51.6]
Y310, Y320	7/8-14 UNF	3/8 internal hex	40.0 [29.5]

Plug Locations



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