

SERVICE MANUAL Transmission VPD2500

MARMON-HERRINGTON HYDROMECH

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1 Preface

The Present Document gives directions to the trained personnel to repair the Marmon Herrington (MH) Variable Power Divider (VPD2500).

Customary tools and devices, which are workshop standard, are supposed to be available.

Disassembly of and assembly of one version only is explained in this document. Differing working sequences of other possible versions can easily be recognized by the skilled professional. For such jobs, see enclosed sectional and perspective views.

The repair of the component may require changed working sequences and/or differing adjustment or checking of data, according to the technical development of the product over the years.

Therefore, we recommend rendering your MH product only to the hands of properly trained personnel.

Damages caused by improperly or unprofessionally executed repair work through untrained personnel and the resulting consequences are excluded from any contractual liability.

This also applies when NON-ORIGINAL-PARTS are being used.

General Working Directions

The company repairing M-H Components is in any case responsible for all aspects of safety.

The valid safety regulations and legal directives must be obeyed to avoid injury of persons and damage of the product during maintenance and repair.

The proper repair of the M-H Product requires adequately trained personnel. To undergo training is the obligation of the repairer.

Always assure professional and clean working conditions. Components shall always be cleaned before disassembly.

The use of indicated tools is a precondition.

After disassembly, all parts must be cleaned. This applies, in particular, to corners, nooks and oil catchers in housings and covers.

Carefully remove old sealing compound.

Clean surfaces thoroughly before sealing.

Lubrications bores, grooves and pipes are to be checked to be free from obstructions. They must be free from deposits, contamination, and preservatives. The latter applies particularly for new parts.

Parts that are being damaged during disassembly are to be replaced by new ones.

E.g.: radial oil seals, o-rings, groove-rings, seal cups, protection cap, etc.

Parts as bearings, thrust washers, synchromesh parts etc., which are liable to normal wear must be checked by the skilled professional. They must judge if a part can be reused or not.



Parts, which have a shrink fit, must be driven to their end position after cooling down to assure perfect seating. Before pressing-in parts like shafts, bearings etc. both contact surfaces must be oiled/lubricated.

On the assembly all given adjustment tolerances, check data and tightening torques have to be observed. M-H Components are to be filled with oil after the repair. Observe filling instructions and lubrication chart. After filling, the oil drain and oil level plugs must be tightened to correct torque.

Use Original M-H Parts only!

2 Technical Data

VPD#	
Max. input torque	895 Nm (660 ft-lb _f)
Max. input speed	2600 rpm
Max input power	194 kW (260 hp)
Engine Mount	SAE No. 3
PTO Output Flange	1410 SAE
Oil Quantity*	Typically 15-19 L (4-5 gal)
Dry/Wet Weight	205 kg (450 lb _f)
Max operating temperature	90°C (194°F)

*Oil quantity is dependent on length cooler hose lines, size of oil cooler, etc. Please refer to body builder for more information.



3 General Service Work

3.1 Oil Fill/Drain Procedure

3.1.1 Oil Draining

To drain VPD oil, remove drain plug using 10 mm hex key from bottom of VPD (item 40). Reinstall plug after oil has drained, torquing to 70 Nm (50 ft lbs)



3.1.2 Oil Filling Procedure

The VPD is filled with oil through a plug (item 20) on the top of the central housing. Remove plug with 10mm hex key wrench.





Oil capacity is approximately 5 gallons (oil cooler, hoses, etc. included), but oil level should be checked with oil level gauge on side of central housing. Oil level is checked with engine running at idle (<1000 rpm) with VPD in road mode. Oil temperatures should be around 60°C (140° F). Add or remove as necessary when oil is cold and engine is not running.



3.1.3 Acceptable Oil

The VPD requires use of specialized lubricants designed for use with hydrostatic pumps, motors, and wet clutches. A list of acceptable lubricants can be found below.

- SHELL SPIRAX S4 TXM
- BP AGRI SUPER UNIVERSAL 10W-40
- CASTROL AGRI MP PLUS 10W-40
- KUWAIT PETROLEUM Q8 T 1000 D SAE 10W-30
- MOTUL SUPER AGRI 10W-30
- PETRONAS LUBRICANTS MULTI VT (SAE 10W-30)
- SHELL SPIRAX S4 TX
- SHELL SPIRAX S4 TXM
- SHELL SPIRAX S4 CX



3.1.4 Oil Filter Change

The oil filter should typically be changed every 1000 hours of use or annually (whichever comes first). Unscrew the filter canister with a 27mm wrench. Be careful of hot oil which can burn skin. Discard of oil in filter housing appropriately according to local waste oil requirements and clean the housing thoroughly.

Remove filter element and dispose of properly. Replace only with a genuine filter from Marmon-Herrington. Lubricate O-ring on new filter and re-install. Check O-ring on filter housing for damage and replace if necessary. Lubricate O-ring and reinstall hand tight.



3.1.5 Notes on Hoses and Coolers

3.1.5.1 Hose Notes

The VPD uses high pressure hoses to transmit power. These hoses need to be inspected frequently in order to prevent personal or property damage.

- Inspect hoses only when the engine is off
- Follow appropriate lockout tag procedures on the truck
- Remove access panels and inspect hose and fittings for damage or leaks

Inspect the hose cover for:

- Abrasion
- Blisters
- Cracks or cuts
- Hardness
- Color changes



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severe injury. Disconnect power before

Disconnect power before servicing hydraulic system.



Replace damaged hoses and take appropriate measures to prevent damage to new hoses. Damage includes overheating, scratches, etc.

The service life of a hose should not exceed 6 years. The service life of a hose, including storage time, should not exceed 6 years.

Replace hoses only with genuine Marmon-Herrington replacement parts.

High pressure hoses on the VPD utilize ISO Code 62 fittings. Use a new seal every time the hose is removed.

Bolt torques for both Pump and Motor Code 62 fittings can be found in section 3.3. Torque these bolts in a crisscross pattern as shown below.



Reference VPD Installation and Operation Manual (MM3VPD) for more information.



3.1.5.2 Cooler Notes

The VPD utilizes an external oil to air radiator for heat rejection. This oil cooler is critical for proper function and longevity of the VPD. Fan size is dependent on application and user should consult with body builder for information on cooling unit.

The VPD oil cooler should be inspected on a daily basis for dirt, damage or debris blocking the cooling fins and fan. It is recommended to include the VPD oil cooler in the truck preventative maintenance program.

Cleaning the cooler every 250 hours of operation will help to ensure best performance. More frequent cleaning may be needed if used in a particularly dirty environment

The oil cooler uses a fan to provide sufficient airflow at low speeds. The fan is critical for correct operation of the VPD.

Fan function can be checked manually. With the vehicle key in the 'Run' position, unplug the temperature sensor from the VPD valve block. The fan should turn on immediately. If the fan does not turn on, check fuses and wiring for faults. Reconnect the sensor when finished.

Consult body builder for information on oil cooler unit.





3.2 Service Intervals

With regular inspection and maintenance, the VPD is designed to last the lifetime of the truck chassis.

Please follow General Service intervals as follows:

Maintenance Chart					
Product: Variable Power Divider					
		250	1,000	15,000	
Item	Daily	Hrs	Hrs	Hrs	6 yrs
Inspect Hydraulic Hoses	Х				
Inspect Hydraulic Hard Lines	Х				
Inspect Housing for Leaks	Х				
Inspect PTO Seals for Leaks	Х				
Inspect VPD Oil Cooler for Damage	Х				
Check Oil Level	Х				
Clean VPD Oil Cooler Fins		Х			
Check VPD Breather		Х			
Check Cooler Fan Function	Х				
Change VPD Oil and Filter*			Х		
Replace Bearings**				Х	
Replace Hydraulic Hoses					Х

*Or annually, whichever comes first

** in case of transmission repair

These are general maintenance intervals and maintenance intervals may change, application depending. Refer to body builder for preferred Service Schedule

2 I I

3.3 Tightening Torques







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DETAIL A
Flexplate not Shown
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DETAIL A

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DETAIL C





DETAIL D

		Wrench		Torque	Torque		
Location	Description	Size	Туре	(Nm)	(ft-lbs)	Quantity	Threadlocking
		н	ousing I	asteners			
	Rear Housing to		Flanged				
10	Central Housing	15	Hex	46	35	19	Loctite 243
	Front Housing to		Flanged				
20	Central Housing	15	Hex	46	35	24	Loctite 243
30	Closing Plate	10	Hex	10	7	4	None
			Socket				
40	Drain Plug	10	Hex	70	50	1	None
			Socket				
50	Fill Plug	10	Hex	70	50	1	None
							Locktab,
60	Sight Glass	19	Hex	8	6	2	Loctite 271
			Socket				
70	Pickup Tube Flange	5	Hex	9.5	7	2	Loctite 243
80	Output Shaft Cover	13	Hex	23	17	4	Loctite 243
90	Input Shaft Cover	13	Hex	23	17	5	Loctite 243
			Pui	mp			
	Pump to Central						
100	Housing	19	Hex	80	60	2	Loctite 243
	Pump Case Drain						
110	Stud Fitting	27	Hex	70	50	2	None
	Pickup Tube Stud						
120	Fitting	41	Hex	140	100	1	None
	Pump Case Tube						
130	Stud Fitting	27	Hex	70	50	1	None



		Wrench		Torque	Torque		
Location	Description	Size	Туре	(Nm)	(ft-lbs)	Quantity	Threadlocking
	Filter Tube Elbow						
140	Stud Fitting	24	Hex	55	40	2	None
			Мо	tor			
	Motor Plate to		Flanged				
150	Central Housing	15	Hex	46	35	2	Loctite 243
	Motor Plate to						
160	Central Housing	17	Hex	46	35	2	Loctite 243
	Motor to Motor						
170	Plate	17	Hex	46	35	4	Loctite 243
	Motor Case Drain						
180	Stud Fitting	24	Hex	46	35	1	None
		Fi	ittings a	nd Hoses			
	Pump Code 62					-	
190	Fitting	17	Hex	46	35	8	None
200	Motor Code 62	12	Llavi	22	25	0	Nega
200	Fitting	13	нех	32	25	ð	None
	Dump to Motor			1.5-2	1.5-2		
210	Case Drain Hose	27	Ηον	flats	flats	1	None
210	Pickup Tube to	27	TIEX	5 wrench	5 wrench	1	None
220	Pump	41	Нех	flats	flats	1	None
220	Pickup Tube to	71	ПСХ	nacs	11415	1	None
230	Sump	5	Hex	10	7	1	Loctite 243
	p			1.5-2	1.5-2	_	1000000 1.0
	High Pressure Hose			wrench	wrench		
240	to Motor Elbow	30	Hex	flats	flats	2	None
				1.5-2	1.5-2		
				wrench	wrench		
250	Case Tube	32	Hex	flats	flats	2	None
				1.5-2	1.5-2		
				wrench	wrench		
260	Filter Tubes	32	Hex	flats	flats	4	None
				1.5-2	1.5-2		
270	Clutch Activation	10		wrench	wrench	2	News
270	Tube	19	нех	flats	flats	2	None
	1	1	Clu	tch			
	Clutch Activation						
280	Tube Stud Fitting	19	Hex	35	25	1	None
	Clutch Housing to		Socket		. –	-	
290	Central Housing	6	Hex	23	17	6	Loctite 243
300	Clutch Flange	17	Hex	46	35	1	Loctite 271
			Valve	Block			
	Valve Block to						
310	Central Housing	13	Hex	23	17	4	Loctite 243
320	Filter Mount	13	Hex	23	17	2	Loctite 243
330	Filter Sensor	22	Hex	25	18	1	None



Location	Description	Wrench Size	Type	Torque (Nm)	Torque (ft-lbs)	Quantity	Threadlocking
240	Eiltor Canistor	27	Цох	40	20	1	Nono
540		27	пех	40	50	I	None
350	Stud Fitting	27	Hex	70	50	4	None
550	Clutch Activation		Пех			•	Hone
360	Stud Fitting	19	Hex	35	25	1	None
	Oil Cooler Stud						
370	Fitting	27	Hex	70	50	2	None
	Oil Filter Tube Stud						
380	Fitting	24	Hex	55	40	2	None
390	Clutch Valve	1 inch	Hex	30	22	1	None
	Clutch Valve Coil						
400	Nut	24	Hex	3	2.2	1	None
410	Thermostat Valve	27	Hex	60	45	1	None
			Socket				
420	Check Valve	14	Hex	70	50	1	None
			Sen	sors			
			Socket				
430	Input Speed Sensor	5	Hex	5	3.5	2	Loctite 243
			Socket				
440	Clutch Speed Sensor	5	Hex	5	3.5	2	Loctite 243
			Socket		_		
450	Motor Speed Sensor	4	Hex	10	7	1	None
460	Temperature Sensor	19	Hex	24	17	1	None
470	Pressure Sensor	22	Hex	30	22	3	None
			Flexp	olate			
480	Flexplate	22	Hex	140	100	8	Loctite 243
490	Output Flange	24	Hex	195	145	1	Loctite 243
			Otl	ner			
	Planetary Bearing		Flanged				
500	Plate	15	Hex	46	35	4	Loctite 243
		-	Groove	Rolling	Rolling		
510	Idler Gear Pin	KM5	Nut	Torque	Torque	1	Lockwasher
			Socket				
520	Restrictor	5	Hex	10	7	5	Loctite 243
	Bearing Plate to		Flanged				
530	Front Housing	15	Hex	46	35	4	Loctite 243
540	Ring Gear to Drive	-	Socket	40	_	_	
540	Gear	5	Hex	10	7	4	Loctite 243
550	Motor Gear	17	Hex	46	35	1	Loctite 271



3.4 Sensor & Component Diagram





4 Technical Definitions, Consumables, and Tools

4.1 Technical Definitions

The terms used in the repair manual were chosen with the current standard in mind.

The application and definition of operations and work instructions is explained here.

Designations	Explanations
Remove	Removal of a component from a component group or of a part from an assembly without first removing any other components.
Mount	To fit a part to an assembly or a component to a component group without any further components being involved.
Disconnect	To separate a detachable connection of wire, tubing, or hose.
Connect	To bring together a detachable connection of wire, tubing, or hose
Pull off	To remove a component that is press-fitted to another.
Push on	To join two components by press-fitting.
Unscrew	To open a rotary connection.
Screw down	To close a rotary connection.
Removing	Removal of a component from a component group or of a part from an assembly when other components must first be displaced.
Install	To attach a component to a component group or a part to an assembly, if for functional reasons, other component groups will be attached.
Loosen	Partial detachment of fixing elements in a component or a part.
Remove	To detach the fixing elements of a component or a part.
Tighten	To firmly attach the fixing elements of a component or part.
Disassembly	Dismantling of component groups into their constituent parts.
Assembly	The joining together of parts of a component group.
Set, Adjust	Correction of deviation with the help of the proper tools or equipment.
Fill	Adding or topping - up of fluids.



Renew	Replacement of an accessory material with a new one.
Replacement	Substitution of a machine, component group or part with a new or reconditioned one of the same type.
Measure	Determination of the current nominal condition by investigating physical size.
Checking	Comparison of the current nominal condition against a set standard.
Cleaning	Removal of foreign and auxiliary materials.
Service	Measures necessary to maintain proper functioning.

4.2 General Tool List

Tools	Assembly	Disassembly
Air Gun	х	
Heat Gun	х	
Rivet Tool	х	
Brass Hammer	х	
M10 Lifting eye	х	х
Plastic Hammer	х	х
1/8" Punch	х	
3/16" Punch	х	
Snap Ring Pliers	х	х
Feeler Gauge (0.1-0.5mm)	х	
6mm Gauge Blocks	х	
Torque Wrench(es) (capable of 10 – 195 Nm)	х	
4mm hex Key Socket	х	х
5mm Hex Key Socket	х	х
6mm Hex Key Socket	х	х
10mm Hex Key Socket	х	х
12mm Hex Key Socket	х	х
10mm Hex Socket	х	х
13mm Hex Socket	х	х
15mm Hex Socket	х	х
17mm Hex Socket	х	х
19mm Hex Socket	х	x
20mm Hex Socket (tool this)	х	x
22mm Hex Socket	х	x

TECO DE

24mm Hex Socket	x	х
27mm Hex Socket	х	х
41mm Hex Socket	x	х
19mm Open Wrench	х	х
27mm Open Wrench	х	х
30mm Open Wrench	x	х
32mm Open Wrench	х	х
41mm Open Wrench	х	х
KM5 Socket	х	х
Paint Pen	х	х
Depth Gage	х	
Gear Caliper	х	
Standard Caliper	х	
Bearing Heater	х	
Bearing Freezer	х	
Bearing Driver	х	
Seal Driver	х	
Dial Indicating Torque Wrench	х	
Lifting Straps	х	х
Lift Device (crane)	х	х
Engine Stand	x	х
Roller Spreader	х	
Swivel socket	х	х

4.3 Table of Consumables

Consumables
Grease (NLGI 2 Compliant)
Shell Spirax S4 TXM (Lubricant)
Loctite 243
Loctite 271
Loctite 518
Soapy Water
Brake Cleaner
Dynatex Gasket Maker (47206)



4.4 Specialty Tools

Specialized Tools	Part #
Hydromotor Stand	MT946010
VPD Stand Plate	MT951116
PTO Wrench	MT946015
Flexplate Wrench	MT946032
Idler Gear Fixture	MT946019
Pump Lift Jig	MT946027
Input Shaft Drive Socket	MT946461
Gear z32 Drive Socket	MT946462
Ring Gear Carrier Drive	MT946463

Contact Marmon-Herrington for information on specialty tools

It is recommended for both assembly and disassembly that the VPD is mounted to an engine stand with the VPD stand plate

5 Disassembly

5.1 Miscellaneous Part Removal

With VPD on engine stand, remove Oil Drain Plug and seal from bottom of VPD using 10 mm hex key

Make sure oil is removed from VPD before beginning disassembly. See section 3.1.1 for more details.



Figure 1

Remove Oil fill plug using 10 mm hex key from top of VPD



Figure 2

Remove breather by hand



Figure 3

Using Pliers, gently pull off both locking tabs that are mated to the securing bolt and Oil level housing. Make sure oil is drained prior to removing this piece.

Once tabs are free, using 17 mm socket, remove hex bolts that secure oil level glass to housing. Take care as oil level glass assembly can come apart. Set bolts and oil level assembly

Note: Sight glass should be labeled with part number on insert. Make sure to leave assembly in one piece and not to mix oil level glass with other assemblies from other VPDs



Figure 4

Using 10 mm socket wrench, remove the 4 bolts securing engine closing plate to housing

Removal of Engine Closing plate is not necessary for VPD Disassembly. Only for disassembly from transmission



Figure 5

Remove PTO Bolt (MT945589) using 17 mm hex socket. Set aside flange, bolt, and washer.



Figure 6

Remove PTO lubrication tubing nuts with 19mm wrench, leaving fittings attached to respective components. Plug both exposed ports and tubing.



Figure 7

Remove charge pump flow pipes from valve block and pump using 27 mm wrench, leaving fittings attached to respective components. Plug exposed ports and tubing



Figure 8

Remove pump cooler pressure pipe from valve block and pump using 32 mm wrench, leaving fittings attached to respective component. Plug exposed ports and tubing



Figure 9

Remove tubing nuts for oil cooler lines if not already removed using 32 mm wrench



Figure 10

5.2 Valve Block Removal

Filter Housing Can be removed by use of 27 mm wrench on base of filter housing. Filter element then can be swapped for new element



Figure 11

Remove the 4 M8x160 bolts using 13 mm hex socket and set aside. Remove Valve Block



Figure 12



Figure 13

Make sure the 3 mounting surface side o-rings stay with the valve block. They are as follows:

GBL -> 11x2.5 (MT945603) T3 -> 11x2.5 (MT945603) GBS -> 11x.25 (MT945602)

All sensors, solenoids, and port fittings can be removed from valve block using appropriate wrench as dictated in section 3.3 of this manual



Figure 14

Remove Filter from housing using 13 mm hex socket. Discard the two 27x3.2mm o-rings



5.3 Remove PTO

To Remove PTO assembly from housing, remove 6 M8x25 bolts using 6mm hex key and set bolts aside

Make sure PTO flange is removed by this step (section 5.1)



Install M10 lifting eye into output shaft (A). With help of lifting device, lift PTO assembly directly away from VPD housing (B). Set aside PTO assembly.



В

Figure 16

Δ

Pressure sensor (A), speedo sensor (B), and PTO lubrication stud (C) can be removed and installed based on section 3.3

С

Snap Ring (A) can be removed using snap ring pliers. If removed, replace with new snap ring. Seal (B) can be removed and serviced as well



Figure 18

5.4 Hydropump Removal

To begin Hydropump removal, begin by removing code 62 flanges on top of pump using 13 mm wrench. Set aside the bolts, washers, and flange halves. Make sure there is no pressure in the lines before operating on them. Once hoses are removed, use plastic plugs on both the hoses and the pump ports.



Figure 19

Remove sump pick up tube by first removing pump connection using 41 mm Wrench on tube nut.



Figure 20



Remove lower sump pick up tube connection using 5 mm hex key. Plug sump pick up tube on both ends

28x3.5 o-ring (MT945541) can be serviced once lower sump pick up tube is removed. Plug sump

pick up port to prevent contaminants



Figure 21



Figure 22

Remove case drain pump hose from bottom of pump housing using 27 mm hex wrench. Plug port and hose and set aside.



Attach MT946027 lift jig using M10 bolts into pump ports as shown. Make sure lift straps are taut before moving to next step



Figure 24



Figure 25



Figure 26

Remove both M12 bolts securing pump to housing using 19mm hex socket.

Lift pump directly away from VPD using lifting device. Once free, 100x3 o-ring (MT945561) for pump/housing mate can be serviced.

Stud fittings can be serviced based on section 3.3



Figure 27

5.5 Remove Hydromotor

To remove hydromotor, begin by removing Speed sensor using 4 mm hex key and set aside



Figure 28

Remove pump case drain tube using 27 mm wrench and set tube aside. Make sure to plug both port and tube.



Figure 29

Hydraulic tubes can be freed from 90° code 62 fittings using 30 mm wrench. Plug both tubs and ports.



Figure 30

To remove hydromotor assembly from housing, begin by securing motor with lift straps and lift device as shown



Figure 31

Remove the quantity 4 bolts securing the motor assembly to the housing. Two bolts will be M10x35 flange head (A) and require a 15mm hex. Two will be M10x80 (B) hex head with washers and requires a 17mm hex.



Figure 32

Lift motor directly away from VPD housing. Set aside.



Figure 33



Figure 34

Using cradle MT946010 can help for the next few steps

O-Ring 194.5x3 (MT945562) can now be serviced





To remove hydromotor gear from assembly, use 17 mm hex socket to remove bolt securing gear to assembly. Set aside bolt and washer

Lift gear directly away from motor



Figure 35

Mark orientation of motor with paint pen before removal from flange.

Remove the 4 M10x35 bolt and washers with a 17 mm wrench.



Figure 36

With motor removed from mounting flange, 100x3 o ring (MT945561) can be serviced.



Figure 37

Case drain stud fitting can be removed using 24 mm wrench



Figure 38

Mark orientation of Code 62 flanges using paint pen before removal. To Remove Code 62 flanges from hydromotor, use 13 mm wrench. O-ring for code 62 flanges can be serviced at this point.



Figure 39

5.6 Remove Front Housing

Rotate the VPD so front housing is facing upwards. Secure the front housing to lifting device through use of lifting eyes and lifting straps



Figure 40

Remove the following bolts securing front housing to the central housing, as shown in figures using 15 mm wrench:

side -> qty 5 M10x35 Flange (MT945560)

front -> qty 19 M10x70 Flange (MT945546



Figure 41

Gently lift housing using lift device. Some rotation of input shaft may be necessary to free housing



Figure 42
Lay front housing assembly interior facing upward, ensuring that no weight is placed upon the input shaft. Use stands as necessary

Remove v-ring A (1250001064) and o-ring 18x3 B (MT945548) in upper portion of front housing assembly. Check central housing if not in shown



Figure 43



Figure 44

Remove oil distributor securing ring gear to assembly using 5mm hex key to remove 4 M6x20 bolts (MT945529). Set aside bolts and oil distributor block



location

Ring gear can be removed by pulling directly away from front housing assembly.



Figure 46

Flip housing over so front of housing is facing upwards. Remove the 5 M8x25 bolts using a 13 mm hex wrench.



Figure 47

Use two of theM8x25 bolts in the pusher bolt holes to remove input cover. Make sure to alternate turns when using pusher bolt holes. Once free, remove cover from shaft.



Figure 48

The input shaft seal 52x35 A (MT945502)as well as the input flange 68x2 o-ring B (MT945550) on the input flange can now be serviced.



Figure 49

Shims can also be removed. Measure the shim pack thickness and record measurement. Check both input seal cover and input bore for shims



Remove the 4 M10x35 bolt (MT945560) to free the bearing plate using 15mm hex socket. Lift directly away from housing.



Figure 51

Remove 8x2.5 O-ring (MT945547) from front housing assembly and set aside. If not present, check bearing plate from previous step.



Figure 52

Remove ring gear drive by pulling directly away from housing



Remove input drive gear by pulling directly away

from housing and set gear aside



Remove V-Ring that was behind ring gear drive gear and set aside.



Figure 55

Races can be removed using flathead screwdriver or appropriate puller in cutouts in housing.



Figure 56

Inspect Front housing port and restrictors for any signs of blockage or damage



Figure 57

Inspect Bearing Plate port and restrictors for any signs of blockage or damage



Figure 58

To remove pins from bearing housing, insert M5x0.8 bolt and pull out



Figure 59

5.7 Remove Central Housing/Front Housing Internals

Remove 28x.3.5 o-ring (MT945541) from sump adapter cavity and set aside (red). Remove the M8 socket heads using an 5mm hex key (blue). Pull flange cap directly outwards



Figure 60

Make sure the 31x2 o ring (MT945542) comes out with flange cap. O-ring can now be serviced. Inspect flange cap and set aside



Figure 61

Making sure VPD assembly is upright, remove sunshaft (MT946501) from planet gear assembly. Inspect sunshaft for any damage on teeth, splines, or restrictors



Using Snap Ring pliers, Remove snap ring (MT945528) securing planetary carrier to central housing. Planet Carrier can be removed by pulling straight out



These next few steps will deal with disassembling Planet Carrier (MT946502). To remove planet pin, drive spring pin (A/MT945530) until it is flush with planet pin (B)

emove planet pin, until it is flush

Slide out planet pin (MT946503). Remove spring pin from planet pin for reassembly later. Inspect planet pin for any damages and check ports for any debris



Figure 64



Thrust washers (1250001608) can be serviced once pin is free. Inspect carrier ports as well for any damage or restrictions.



Figure 66

Planet gear bearings can be removed with bearing driver. Inspect gear (1250001007) and bearings (1250001071) for any damage. Be careful not to lose bearing pins

End Planetary Carrier Disassembly



Figure 67

Continuing with VPD disassembly, prepare to remove idler gear assembly by lifting lock tab (MT945525) away from locknut. Idler pin can be found next to valve block mounting surface



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Loosen lock nut (MT945524) with KM5 socket. For safety, make sure locknut is pointing towards ground to prevent idler gear from falling out of position. Set aside locknut, lock tab, and washer (1250001041)



Figure 69

Remove idler gear assembly from housing by pulling directly away and set aside. Inspect the idler gear for any damage on teeth, bearings, restrictors, and shaft.



Idler gear assembly can be disassembled into components by removing dowel (A) from Pin (B) then separating Gear (C) from Pin



Figure 71

Remove 28x3.5 o-ring (MT945541) from idler shaft bore.

Remove Snap ring (MT945571) from central

housing using snap ring pliers



Figure 72



Figure 73

Remove 4 M10x35 bolts (MT945560) securing bearing plate to central housing and set aside both bolts and washers. Remove plate and inspect for any damage.



Figure 74



Remove bearing race from bore then remove shim stack. Check both bearing plate and gear for shims, gather, and set aside. Measure shim stack and record measurement

Remove gear z32 from bore. Inspect gear and bearing for any damage. Inspect pins in housing

for any damage



Figure 75



Dowel Pins can be removed by threading in M5x0.8 bolt



5.8 Remove Rear Housing

Rotate VPD so rear housing faces upwards. Remove M16x35 bolt in center of flex plate assembly using 24 mm wrench. Set aside bolt

Remove Flexplate assembly from rear housing. Washer (1250001086) can be pushed out from rear of flexplate assembly to access it and the o-



Figure 78



Figure 79

When removing washer, make sure the outer 39x2 o-ring (MT945514) and face 22x2.5 o-ring (MT945515) are removed as well. Inspect washer for any damage.



Figure 80

rings on it.

Flexplate disassembly is as follows and can be skipped if no service is necessary:

Drive out spring pin (MT945519) from behind the flex plate assembly by way of 8mm punch.



Figure 81

Remove the 8 M14x30 (MT945518) bolts using a 24 mm wrench. Separate the wear plate, flexplate, and output flange.



Figure 82

Flexplate assembly should be fully disassembled



Remove output bearing cover by removing 4 M8x25 bolts with 13 mm wrench. Use pusher bole holes with the removed M8x25. Alternate half turn each bolt when using pusher bolt holes.



Figure 84

With output bearing cover removed, the 76x2 oring (MT945565) and 55x70 (MT945566) seal can be removed



Remove any shims that rest on output shaft bearing. Check output seal for any as well. Measure shim stack and record measurement



Install M10 lifting eyes onto rear housing face and secure to lifting device with lifting straps.



Figure 87

Remove the 8 M10x35 flange bolts (MT945560) that are located on central housing that mate to rear housing using 15mm wrench.



Figure 88

Remove the 11 M10x70 flange bolts (MT945546) from rear housing that mate to central housing using 15 mm wrench.





Using lifting device, lift rear housing from central housing assembly. Set housing aside.

Be aware that sun shaft drive gear may be in rear housing bore (B) during lifting procedure.



Figure 90

Housing pins can be removed with use of M5x0.8 Bolt



5.9 Remove Central Housing Internals (rear housing side)

Remove sunshaft drive gear (1250001020) by hand. Inspect sunshaft teeth and gears for any damage.



Remove output gear (1250001001) by hand. Inspect output gear and shaft for any damage on teeth, splines, bearings, etc.



Figure 93

In central housing bore where output gear rested, remove snap ring (MT945459) securing oil pipe in central housing using snap ring pliers. Remove oil pipe (1250001062) by hand



Figure 94

Inspect oil pipe including o rings 20x2.5 (MT945556) and 11x3 (MT945555)

VPD Fully Disassembled



6 Assembly

6.1 Central Housing Assembly

Affix central housing (MT946506) to engine stand as shown. Inspect housing, ports and plugs on central housing for any damages.



Figure 96

Install snap ring MT945571 into groove in central housing using snap ring pliers



Figure 97

Inspect sump pick up bore for damage and if none, grease bore.



Install MT945542 (31x2) o-ring onto flange cap (1250001057) with grease



Figure 99

Install flange cap into central housing as shown in Figures 6 and 7. Fasten to housing using 2 MT945543 and MT945544 (M6x30 screw and M6 Washer). Apply Loctite 243 and torque to 9.5 Nm





Figure 100

Inspect dowel pins (MT945536) for gear Z32. They must be installed and installed correctly. Reference figure shown for position and orientation.



Figure 103



Figure 102



Figure 104

Zero the depth gage against the 6mm gauge blocks and confirm it is a repeatable measurement

Place 6mm gauge blocks on top of machined face of bearing plate (1250001052) as shown in figure 11. Measure the depth (mm) from the gauge blocks to the mounting face. Record this measurement (AB)



Figure 105

Measure the depth (mm) of z32 bearing bore on central housing as shown in figure 12. Be sure depth is measured from machined surfaces as shown. Record all 4 measurements (A1, A2, A3, & A4)



Measure Thickness of Gear z32 (1250001010) from machined surface as shown using long tooth calipers (see figure 96) Record measurement (AC)



Use the following formulas to calculate shim stack

 $AB + \frac{(A1 + A2 + A3 + A4)}{4} + (AC + 43.5) + 0.07$ = min thickness (mm)

 $AB + \frac{(A1 + A2 + A3 + A4)}{4} + (AC + 43.5) + 0.13$ = max thickness (mm)

Combine the 4 following shim sizes to be within the min and max values calculated above.

MT945537 (80x90x1.0) MT945538 (80x90x0.3) MT945539 (80x90x0.1) MT945540 (80x90x0.5)

Install the shim stack into the bearing plate bore



Figure 108

Install MT945527 Bearing Race into bearing plate using bearing driver, ensure that it is fully seated. Freezing race is recommended. Be sure to use proper PPE when interacting with frozen objects.



Figure 109

Install MT945527 bearing race into central housing bore using bearing driver freezing race is recommended



Figure 110



Install 30210 bearings onto gear z32 as shown. Heating bearings to 150° C (300° F) is recommended through use of bearing heater. Please use proper PPE when interacting with hot objects.



Figure 111

Oil bearings and place gear z32 into central housing with spline facing upwards as shown



Figure 112



Figure 113

Install bearing plate (1250001052) into central housing using M10x35 bolt (MT945560). Torque to 46 Nm. **Do not apply any thread locker at this step.**

Check Rolling Torque of gear using MT946462 It must be within 2 Nm \pm 1 (1.5 lbft \pm 0.75). If not, doublecheck shim stack, calculations, housing, etc.



Figure 114

6.2 Front Housing Assembly

Inspect housing, ports, and plugs for damage around housing mating surfaces. Blow out oil passages with compressed air as shown



Figure 115

Check dowel pins (MT945536) are not damaged and install into location shown on front housing. Pins can be driven in with brass hammer.



Figure 116

Grease v ring seal (1250001064) and install into location on front housing shown. Tapered edge should face outward from housing.



Figure 117

Inspect and confirm no damage appears on bearing plate (1250001033) and check to make sure the plugs are installed. Blow out oil port passages with shop air.

Figure 118



Figure 119



Figure 120

Measure depth (mm) of ring gear bearing bore on bearing plate. Be sure depth is measured from machined surfaces as shown. Record this measurement (B1)

Measure depth (mm) of ring gear bearing bore in front housing. Be sure depth is measured from machined surfaces as shown. Record this measurement (B2)



Measure thickness of ring gear drive gear (1250001004) as shown in figure. Record this measurement (B3)

Figure 121

Using below formulas, calculate required shim thickness

(B1 + B2) - (B3 + 39.5) + 0.07= min thickness in mm

(B1 + B2) - (B3 + 39.5) + 0.13= max thickness in mm

Available shims include:

MT945510 (70x80x1) MT945511 (70x80x0.1) MT945533 (70x80x0.15) MT945513 (70x80x0.3)

Install shim pack into bearing plate followed by bearing race (MT945516) using bearing drive to ensure fully seated. Freezing race is recommended



Figure 122

Heat bearing MT945516 to 150° C (300°F) and install onto ring gear drive gear. Repeat for both ends of gear. Make sure use proper ppe when handling hot equipment



Figure 123

Oil bearings of ring gear drive gear and install into front housing spline side up. Install bearing plate using MT945560 bolts and torque to 46Nm. **Do not apply thread locker at this time**

Check Rolling Torque of ring gear drive gear using MT946463. It must be within 2 Nm \pm 1 (1.5 lbft \pm 0.75). If not within, recheck measurements and shim stack. If within torque spec, remove bearing plate and proceed to next step





Figure 125

Measure depth (mm) of input gear bearing bore on bearing plate. Be sure depth is measured from machined surfaces as shown. Record this measurement (C1)

Measure thickness (mm) of input gear

signs of damage.

(1250001003) as shown in figure 38. Record this measurement (C2). Inspect gear teeth for any



Figure 126



Figure 127

Install input bearing cover (1250001022) using 2 MT945549 bolts and torque to 23 Nm. Make sure holes are aligned. **Do not apply thread locker at this time.**



Figure 128

Measure depth (mm) of input gear bearing bore on front housing. Be sure depth is machined surfaces as shown in figure. Record this measurement (C3)



Figure 129

Using measurements, calculate shim pack needed with formula below:

(C3 - 36.5 - C2) + C1 + 0.07= min shim thickness in mm

(C3 - 36.5 - C2) + C1 + 0.13= max shim thickness in mm

Shims available include:

MT945503 (63x72x1) MT945504 (63x72x0.3) MT945506 (63x72x0.15) MT945505 (63x72x0.1)

Install shim pack along with bearing race into front housing input gear bore. Use bearing drive to ensure race is fully seated.



Figure 130

Oil bearings of input gear and place input gear in input bore. Install bearing plate and torque bolts to 46 Nm without thread locker.



Figure 131

Check Rolling torque on input side of gearing using MT946461. Rolling torque must be within 2 Nm ±1 (figure 46). If not within spec, recheck measurements, calculations, and shim pack. If within torque, remove bearing plate cover.

Install ring gear drive gear into assembly,





Figure 133

Grease and install 8x2.5 o-ring (MT945547) into port above ring gear drive

Apply Loctite 243 to M10x35 screws x4

housing. Torque to 46 Nm.

(MT945560) and install bearing plate onto central



Figure 134



Figure 135

Check rolling torque at ring gear drive gear with both gears installed using MT946462. Rolling torque must be 4 Nm ±2



Figure 136

Remove bearing input cover. Grease and install 68x2 o-ring (MT945550) onto input bearing cover



Figure 137

Install 35x52x7 seal (MT945502) in input bearing cover with soapy water. Make sure spring side of seal faces inwards. Wipe dry after installation and coat seal surfaces with grease



Figure 138

Apply grease onto chamfer on front housing bore for input bearing cover. Drive bearing cover into bore with use of bearing driver



Figure 139

Install M8x25 bolts qty 5 (MT945549) into cover with Loctite 243 and torque to 23 Nm

Figure 140



Figure 141



Figure 142

Inspect ring gear (125001009) for any signs of damage, chips, dings, burrs. Install into ring gear drive splines

Install oil distributor block (1250001115) onto ring gear drive gear. Apply Loctite 243 to M6x20 bolts x4 (MT945529). Torque to 10 Nm
6.3 Idler Gear Assembly

Place bearing race for MT945501 in freezer and freeze for 30 minutes @ (-75 deg F).



Figure 143

Inspect idler pin (1250001016), checking for any damage or debris along the pin, threads, restrictors, and bore



Figure 144

Heat Bearing (MT945501) to 150°C (300°F) and install into idler pin shaft as shown in figure 59. Ensure bearing is fully seated using bearing driver. Lubricate bearings with oil.



Figure 145

Inspect idler gear (1250001013) tooth profile and ensure it is free of rust, chips, dings, burrs. Using insulated gloves, install MT945501 race into idler gear, tapered end facing out. Use bearing race driver to ensure race is fully seated. Repeat for both sides.



Figure 146

Install idler gear assembly onto pin



Figure 147

Heat Bearing (MT945501) to 150°C (300°F) and install onto bearing shaft as shown in figure 62. Use insulated gloves when installing. Slide bearing in place until the rollers are just touching the race. **DO NOT DRIVE BEARING ON SHAFT WITH HAMMER**



Figure 148

Lubricate the bearings and make sure the gear spins freely on shaft



Figure 149

6.4 Planetary Gear Set Assembly

Inspect the planetary carrier (1250001006) including the ports, plugs, and splines



Figure 150

Inspect the three planetary pins (1250001008) for any damage and that the bores are clean and free of debris. Also check to make sure the 5mm plug is installed onto the end of pin.



Figure 151

Inspect roller bearing (1250001071) for any damage before installing into planet gear (1250001007). Lubricate bearings. Make sure 11 roller pins are present before installing.



Figure 152

Install top and bottom thrust washer (1250001068) into planetary carrier by apply a small amount of lube onto flat side of washer and pressing into place. Make sure tabs are in their respective tab bore.



Figure 153

After thrust washers, install planet gear and bearing assembly into planetary carrier, making sure to line up thrust washers and gear assembly with pin holes.



Figure 154

Install planet pin (1250001008) into planetary carrier, ensuring that the 5 mm through bore lines up with through bore on planetary carrier. A 3/16" punch can help aid in alignment.



Figure 155



Check planet gear clearance using feeler gauge. Range is 0.1mm to 0.5 mm (0.004" to 0.02"). Also check that gear spins freely and smoothly, without binding or noise.

Repeat previous steps for the other 2 planet gears.



Figure 156



Figure 157

6.5 Hydromotor subassembly

To prevent damage, remove speed sensor (MT945497) from hydromotor (MT949969) with 4mm hex key and set aside



Figure 158

Verify Hydromotor part number as A2FM28/61W-VAB027V on id tag

Remove metal plug from ID tag side of hydromotor with 8mm hex key.

Remove plastic plug from side opposite id tag and install previously metal plug in its place. Torque to 46 Nm (34 lb ft).



Figure 159



Inspect hydromotor pilot for damage and then inspect 100x3 o-ring (MT945561) for damage. Grease and install 100x3 o-ring onto motor pilot. Ensure o-ring is fully seated.



Figure 161

Install motor onto motor cover (1250001030 in orientation shown. Jig MT946000 can help aid in assembly.

Lock motor to jig using 3/16" rod/punch to prevent rotation during bolt install. Apply Loctite 243 to M10x35 Bolts (MT945588) and M10 washers (MT945552), qty 4 and install into motor bolt holes. Torque to 46 Nm (34 lbft)





Figure 163

Inspect drive gear (1250001035) for any damage along teeth. Grease splines and install gear onto hydromotor shaft. If gear does not seem to fit, doublecheck splines on both motor and gear. **DO NOT TRY TO FORCE GEAR ONTO MOTOR. DOING SO CAN DAMAGE MOTOR**



Figure 164

Apply Loctite 271 to M10x30 bolt (MT945589). Install bolt and washer (1250001036) onto gear/motor assembly. Torque to 46 Nm. To prevent gear from rotating during install, insert 2 20 mm sockets into gear and place pry bar in between, as shown







Figure 166

Apply Loctite 243 onto M8x30 screws (MT945591) qty 2. Install first flange half (MT946419) onto motor using M8 washers (MT945564) and M8x30 screws. Tighten to finger tight at this step. Place elbow into flange half, as shown in figure.

Apply Loctite 243 onto M8x30 bolt, qty 2. Install second flange half with M8 screw and washer. Tighten to finger tight. Once second flange is tight, rotate elbow fitting to align with bent axis of motor (as shown in figure). Once aligned, torque all flange bolts to 32 Nm (24 lb ft). Repeat the procedure for the second port.

Install Stud fitting (MT951024) into port just above id tag. Torque to 46 Nm (34 lb ft). Cover with a plastic cap to prevent damage to threads during rest of assembly.



Figure 167



Figure 168



Figure 169

Check the o-ring and speed sensor for any damage and reinstall into motor housing. Torque bolt to 10 Nm (7 lb ft).



Figure 170

6.6 Rear Housing Assembly

Place 2 outer races of tapered rolling bearing (MT945516) in freezer for at least 30 minutes

Remove bearing plate from central housing assembly and set it and gear z32 aside.



Figure 171



Inspect sunshaft drive gear (1250001020) and ensure that is free of any rust, chips, damage, etc. Heat ball bearings (MT945579) to 150° C (302°F) and install on sunshaft gear, both sides. Use proper PPE when handling. Once assembled, place sunshaft gear/bearing assembly in freezer.



Figure 173

Inspect) into oil pipe (1250001062), making sure no debris or blockage appears portway and restrictor.

Grease and install 20x2.5 o-ring (MT945556) on the larger diameter end of oil pipe (A). Grease and install 11x3 o-ring (MT945555) onto smaller end of oil pipe (B)



Figure 174



Figure 175

Install oil pipe/o-ring assembly into central housing small diameter end first until fully seated, being careful not to damage o rings

Secure oil pipe assembly with M24 snap ring

(MT945459)



Figure 176



Figure 177





Install output bearing cover (1250001053) to rear housing with 2 M8x25 bolts (MT945549). Torque to 23 Nm. **DO NOT APPLY THREADLOCKER AT THIS TIME**

Measure depth (mm) of output gear bearing bore on rear housing. Be sure depth is measured from machined surfaces as shown. Record this measurement as D2

Measure thickness (mm) of output gear from bearing seating surfaces as shown. Record this measurement as D3.



Figure 179



Figure 181



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Inspect output gear (1250001001) for any signs of damage. Heat tapered roller bearing (MT945516) to 150°C (302°F) and install onto both ends of output gear. Taper should face outwards as shown



Figure 182

Using gloves, remove tapered bearing race (MT945516) from freezer and install into central housing. Use bearing drive to ensure race is fully seated.

Oil bearings on output gear and install output

gear into central housing as shown





Figure 184

Inspect and clean mating surface of central housing. Install dowel pins (MT945535) into housing and are in correct position (if not already installed). Apply Loctite 518 to mating surface of central housing.



Figure 185

Using gloves, remove sunshaft drive gear from freezer and install in central housing as shown. Oil bearings on sunshaft. Use heat gun as needed to prep central housing bearing bore



Figure 187

Use lifting eyes to lift rear housing and lower onto just prepped central housing. A heat gun can be used to help prep bearing bore for installation



Figure 186

Apply Loctite 243 to (x11) M10x70 flange head bolt (MT945546) and install in locations shown. Tighten to 46 Nm.



Figure 188

Apply Loctite 243 to (x8) M10x35 flange bolts (MT945560) and install in locations shown in figure 106. Tighten to 46 Nm



Figure 189



Figure 190

Remove rear output bearing cover and set aside.

Using gloves, place tapered bearing race (MT945516) from freezer and install into rear output. Use bearing driver to ensure race is fully seated.



Figure 191

Calculate appropriate shim pack using the following formula. Install calculated shim pack in rear output bore.

(D1 + D2) - (39.5 + D3) + 0.07= Min Thickness in mm

(D1 + D2) - (39.5 + D3) + 0.13= Max Thickness in mm

Available Shim thicknesses are as follows

MT945510 (70x80x1) MT945511 (70x80x0.1) MT945533 (70x80x0.15) MT945513 (70x80x0.3)

Install output bearing cover with (x2) M8x25 bolts (MT945549) and torque to 23 Nm. **DO NOT USE THREADLOCKER AT THIS TIME**



Figure 192



Figure 193

Install M16x35 bolt (MT945509) onto output shaft hand tight and use 24 mm socket to check rolling torque of output shaft. Torque must be within $2Nm \pm 1$ (1.5lbft ± 0.75). if not within torque, check shim pack calculations and measurements. If within, remove M16x35 bolt and move to next step.



Figure 194

Apply Loctite 243 to (x4) M8x25 bolt (MT945549). Install rear output bearing cover with M8 washers (MT945564). Torque to 23 Nm (17 lbft)



Figure 196



Figure 195

Install output flange (1250001085) onto output shaft as shown, ensuring splines are clean and line up.

Grease and install 22x2.5 o-ring (MT945515) into flange washer (1250001086), shown with red arrow. Grease and install 39x2 o-ring (MT945514) in output washer as well, shown with blue arrow



Figure 197

Install flange washer assembly into output flange with the 22x2.5 o-ring facing towards interior, as shown. Make note of alignment bore before next step



Figure 198

Install flexplate (MT945517) onto rear output flange, ensuring that alignment bore on flexplate lines up with bore on flange



Install wear plate (1250001087), aligning bore with flexplate and flange. Install 2 M14x30 bolts (MT945518) onto wear plate with Loctite 243 and hand tight. Drive 8x25 spring pin into alignment bore. Drive until pin is flush with top of wear plate.

Install the remaining 6 M14x30 bolts into flex plate. Apply Loctite 243 to all bolts. Make sure all 8 bolts (including the 2 installed in previous step) are torqued to 140 Nm (104 lb ft). Use torque handle MT946032 to prevent flexplate from rotating when torquing bolts

Apply Loctite 243 to M16x35 bolt previously installed into rear output shaft. Reinstall and torque to 195 Nm (144 lb ft). Use MT946032 torque handle to prevent flexplate from moving when torquing bolt.



Figure 200



Figure 201



6.7 Idler Gear Install

Flip back to central housing and oil bearings for gear Z32 and place gear into central housing with spline facing outwards

Install bearing plate (1250001052) over gear z32 and secure with (x4) M10x35 bolts (MT945588) and M10 washers (MT945552). Apply Loctite 243

and torque to 46 Nm (34 lb ft)



Figure 203



Figure 204

Grease and install 28x3.5 o-ring (MT945541) into idler gear bore next to valve block mounting surface on central housing



Prepare idler gear for install. Apply masking tape to cover threads of gear (A). Install 5x10 pin (MT945523) into idler with Loctite 638 (B).



Figure 206



Figure 207



Apply grease along length of shaft and oil bearings of idler gear assembly

Install idler gear assembly into idler gear bore, making sure to align pin with notch in central housing (A)

Idler gear assembly install should look as shown



Figure 209

Remove tape from threaded end of idler gear assembly. Apply 6mm (0.25") bead of Dynatex 47206 all around shaft between thread and housing

Install Washer (1250001041/A), KM5 Lock washer (MT945524/B), and KM5 Nut (MT945525/C), as shown. Be careful not to push idler gear out during install. Clean up any excess gasket maker.



Figure 210



Figure 211

Tighten KM5 nut using KM5 socket. While tightening, checking rolling torque of idler gear using torque fixture (MT946019).Rolling torque of gear must be within 0.8-1.2 Nm (0.6 -0.9 lb ft).



Figure 212

Once Rolling torque is achieved, lock nut in place by bending tab from lockwasher down into lock nut. **Do not bend tab fully into groove**



Figure 213

6.8 Central Housing Install

Inspect pump drive gear (1250001032) tooth profile for any signs of damage (rust, chips, dings, burrs). Heat (x2) ball bearings (MT945579) to 150° C (302° F). Using gloves, install bearings on pump drive gear. Places entire pump drive gear assembly in freezer once assembled. A heat gun can also be used on bearing housing



Figure 214

Install planetary gear assembly into central housing as shown. Do not attempt to force unit onto splines



Figure 215

Install Snap Ring (MT945528) onto shaft supporting planetary carrier. Make sure snap ring is fully seated. Once assembled, apply grease onto face of splined shaft.



Figure 216



Figure 217

Inspect tooth, spline profile, and ports on sunshaft (1250001005) for any signs of damage (ruse, chips, dings, burrs).

Make sure machined face of planetary carrier is greased. Lubricate sunshaft with oil, covering entire surface and install sunshaft into planetary carrier as shown



Figure 218



Figure 219



Figure 220

Install v-ring (1250001064) in front housing assembly in location shown, ensuring that tapered edge faces outward.

Apply grease to 18x3 o-ring (MT945548) in front housing assembly as shown in figure 139

Clean seal surface of central housing assembly and apply Loctite 518 with roller applicator to central housing seal surface as shown

Using a brass hammer, install (x2) dowel pins (MT945535) in locations shown. Threads should be facing upwards.

Use a heat gun to prep pump gear drive gear bearing bore in central housing. Using gloves, remove pump gear assembly from freezer and install into central housing bore, splines facing downward, as shown. Lubricate bearings.



Figure 221





Figure 223

Lift front housing assembly and lower onto central housing. Use input flange drive to turn the input gear as front housing is being lowered onto the central housing. If necessary, lightly tap location shown with rubber mallet.



Figure 224





Figure 225

Apply Loctite 243 (x5) to M10x35 flange bolts and torque bolts to 46 Nm (34 lb ft)



Install drain plug (11025210071) and seal ring (00030213220) to bottom of VPD housing as shown in figure 138. Torque to 70 Nm (52 lb ft).



Figure 227

6.9 Power Take Off Install

Clean PTO mounting surface and apply Loctite 528. Make sure V-ring is still in place prior to next step.

Using M10 lifting eye, lift PTO assembly (MT945563). Inspect clutch gear tooth for any signs of rust, chips, dings, burrs. Lower PTO assembly into PTO mount making sure that sensor boss is facing towards the topside of VPD housing as shown



Figure 229



If necessary, tap on the clutch output shaft with a rubber mallet to help seat bearing in bore. Apply Loctite 243 (x6) to M8x25 screws (MT945573) and Torque to 23 Nm (17 lb ft).



Figure 230

6.10 Valve Block Install

Clean Valve block mounting surface using brake cleaner, making sure it's free of dust, dirt, debris and no signs of damage

Remove plastic shipping plugs from valve block assembly (MT945600). Grease and install following o ring in following locations:

GBL: 11x2.5 (MT945603)

T3: 11x2.5 (MT945603)

GBS: 18x2.5 (MT945602)





Figure 232

Apply Loctite 243 (x4) to M8x160 screws (MT945601) and M8 washers (MT945564). Torque bolts to 23 Nm



Figure 233

6.11 Hydropump Install

Verify hydropump part number A4VG28EP3D1/32R. Record hydropump serial number for your records.

Install GE15 stud (MT945585) on the hydropump in the location shown. Torque to 70 Nm (52 ft lbs). Install case drain hose (1250001103). Tighten nut until light wrench resistance is felt. Tighten with a wrench 1.5-2 wrench flats (90°-120°) further.



Figure 234



Remove the code 62 cover plates from the hydropump using 17 mm Wrench. Plug the ports when not in uses to prevent debris from entering the pump



Figure 236



Figure 237

Grease and install 100x3 o ring (MT945561) onto the hydropump lip



Figure 238

minimum of (x2) M10 bolts.

Secure hydropump to lifting device using a

Lower the pump down and install in the VPD housing as shown. Remove the lifting device



Figure 239



Figure 240

Using 41mm socket, install GE28 stud (MT945582) in hydropump. Torque to 140 Nm. **DO NOT USE THREADLOCKER**

Using a 19mm socket, secure with (x2) M12x40 screws (MT945577) and (X2) M12 washers

tight for installation of sump pick up tubes

(MT945578) with Loctite 243. Leave screws finger



Figure 241

Grease and install 28x3.5 o-ring (MT945541). Into sump pickup

Install bottom flanged end of sump pick up tube (1250001058). Apply Loctite 243 to M6x12 screw (MT945545). Install with 5mm allen socket and and M6 washer (MT945544). Torque to 10 Nm.



Figure 242



Figure 243

Install pickup tube (1250001058) to pump. Tighten nut (MT951152) and ferrule (MT951153) until light wrench resistance is felt. Tighten another 5 wrench flats (300°).

Please make sure Ferrule is included in hose before assembling tube to Pump





Figure 245

Using a 19mm socket and Loctite 243, tighten pump mounting screws (x2) to 80 Nm.



Figure 246

6.12 Hydromotor Install

Lift the hydromotor assembly (MT945587) as shown.

Grease 194.5x3 o-ring (MT945562) and install on hydromotor.



Figure 247



Install hydromotor assembly to VPD housing as shown. Install (x2) M10x35 flange bolts (MT945560 item 5) with Loctite 243. Install (x2) M10x80 bolts (MT945559 item 2) and (x2) M10 washers (MT945552 item 3) with Loctite 243. Sequentially install bolts a bit at a time as shown to seat o ring evenly. Torque (x4) to 46 Nm.



Bolt Patte

Figure 249

Install case drain hose (1250001103) onto motor. Check to make sure the hose does not rub anywhere. Using a 27mm wrench, tighten nut to 1.5-2 wrench flats (90-120°) past light wrench resistance.



Inspect high pressure hoses (1250001045) for any damage or debris in hoses.

Install seal ring (MT951155) into code 62 fitting for both hoses.


Install hose into Hydropump using Flange Half (MT946425),M10x35 Bolt (MT945588) and M10 washer (MT945552). Torque all 8 hydropump flange kit bolts to 46 Nm.



Figure 251

Secure the high pressure hoses (1250001045) to the hydromotor. Use a 30 mm wrench, tighten each nut to 4 wrench flats (240°) past light wrench resistance

If not already, rotate VPD to upright position as shown. Install stud fitting (MT945586) to hydropump as shown. Torque to 70 Nm.



Figure 252



Figure 253

Fill/prime hydropump with approved gear oil through stud fitting installed in previous step. Hydropump is full once oil is within 1/2" from the top of the fitting. (about 0.9 liters/30 oz)



Figure 254

6.13 Final Assembly

Install hydropump tube (1250001083) onto hydropump and valve block with nut (MT951148) and ferrule (MT951149).Tighten in the order shown:

#1 – Tighten 5-6 wrench flats (300°) past wrench resistance

#2 – Tighten 5-6 wrench flats (300°) past wrench resistance

#3 – Tighten 1-2 wrench flats (60°) past wrench resistance

Mark each nut with a paint pen once tightened.

Ferrules must be installed on both ends as







Figure 255

Separate EW15LMED (MT945884) stud and elbow. Install stud to hydropump and torque to 70 Nm. Install elbow and leave nut loose for tube installation.



Figure 256

Install tube (1250001090) onto hydropump and valve block with nut (MT951150) and ferrule (MT951151). Tighten in the order shown:

#1 – Tighten 7-8 wrench flats (~420°) past wrench resistance

#2 – Tighten 7-8 wrench flats (~420°) past wrench resistance

#3 – Tighten 2-3 wrench flats (~120°) past wrench resistance

Mark each nut with a paint pen once tightened.



Figure 257

Ferrules must be installed as shown



Separate EW15LMED (MT945884) stud and elbow. Install stud to hydropump and torque to 70 Nm. Install elbow and leave nut loose for tube installation.



all tube (1250001089) onto hydropump and valve block with nut (MT951150) and ferrule (MT951151). Tighten in the order shown:

#1 – Tighten 7-8 wrench flats (~420°) past wrench resistance

#2 – Tighten 7-8 wrench flats (~420°) past wrench resistance

#3 – Tighten 2-3 wrench flats (~120°) past wrench resistance

Mark each nut with a paint pen once tightened.

Ferrules must be installed as shown



Figure 258



Install PTO tube (1250001096) onto valve block and clutch with nut (MT951160) and ferrule (MT951161).Tighten in the order shown:

#1 – Tighten 6-7 wrench flats (~360°) past wrench resistance
#2 – Tighten 10-12 wrench flats (~600°) past wrench resistance

Apply a light coating of Loctite 271 to the splines of the clutch. Install PTO flange (1250001094) and PTO washer (1250001095). Apply Loctite 271 to M10x30 (MT945589) and install.



Figure 259



Figure 260

Using PTO flange holding tool (MT946015) and 17mm socket, torque PTO flange bolt to 46 Nm.



Figure 261



Grease o-ring on speed sensor (MT949966) and install in location shown. Apply Loctite 243 to M6x12 screw (MT945545) and install. Torque to 5 Nm. Mark the head of the screw with a paint pen as it is torqued



Figure 262

Apply Loctite 271 to sight glass bolts and install to VPD housing as shown. Torque bolts to 6-8Nm, then continue to tighten until the next wrench flat aligns with the tab on the lock washer as shown. Do not overtighten bolts



Figure 263

Use a plastic hammer to bend the top and bottom locking tabs against the sight glass housing. Use a slip-joint plier to bend the side locking tabs against the wrench flats on the upper and lower bolts.



Figure 264

Install breather (MT949973) in the location shown. Hand tighten. Assembly complete.



Figure 265



Figure 266



Figure 267

Install fill plug (MT951026) in location shown. Torque to 70 Nm with 10mm allen socket. Mark plug head with a paint pen as it is torqued. Fill with oil before putting cap in per Section 3.1.2

Install closing plate (1250001056) with (x4) M6x16 screw (MT945557) and (x4) M6 washer (MT945544). Torque to 10 Nm.



7 Additional Resources

7.1 Additional Manuals

Manual	Manual #
Parts Manual	MM1VPD
Installation & Operations Manual	MM3VPD
General Wiring Schematic	MM4VPD
MH Error Code and Troubleshooting	MM5VPD

7.2 Contact Information

Parts Department:

Phone:	(502) 253 0277 x 1 / (800) 227 0727 x 1
Email:	partsales@marmon-herrington.com
Website	marmon-herrington.com/contact-parts

Service and Warranty Department

Phone:	(502) 253 0277 x 3 / (800) 227 0727 x 3
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