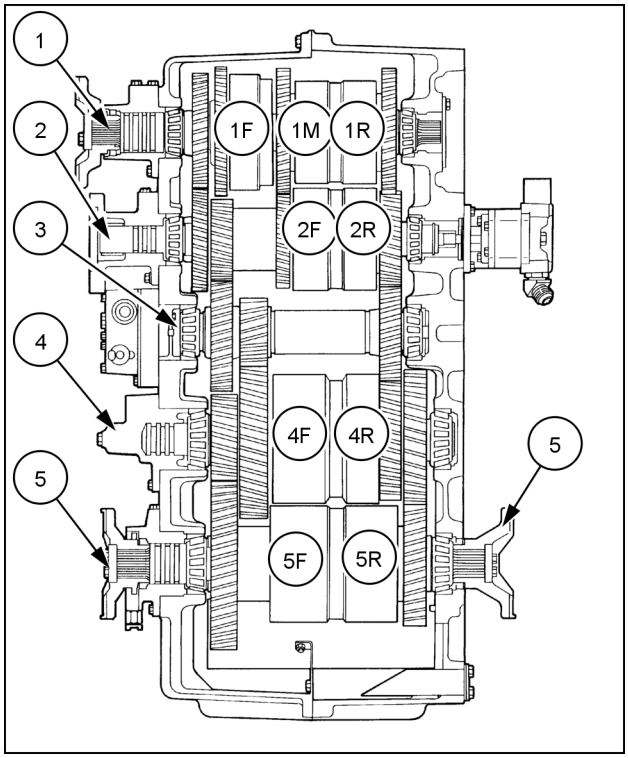
Powershift transmission - Overview - Theory of operation

STEIGER®	NA (Transmission = Powershift transmission)



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1. First (1st) input shaft	4. Fourth (4th) master clutch shaft
2. Second (2nd) pump shaft	5. Fifth (5th) output shaft
3. Third (3rd) counter shaft	

The powershift transmission is hydraulically actuated and electronically controlled.

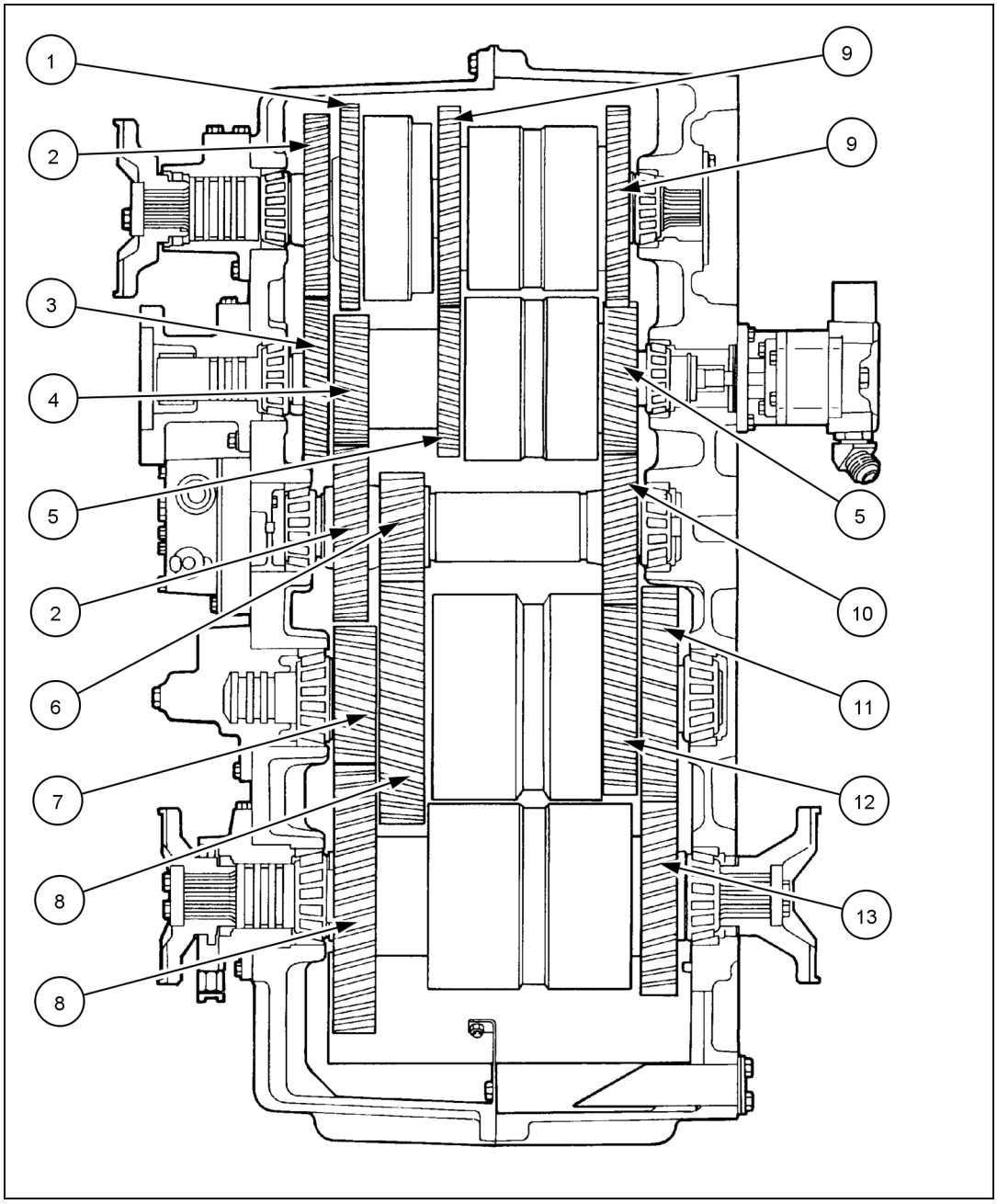
The transmission has five shafts with nine clutches in a vertical configuration. The five shafts can be identified as follows: input (first) shaft, pump (second) shaft, counter (third) shaft, master clutch (fourth) shaft and output (fifth) shaft. The clutches can be identified by the shaft and position on the shaft, for example the front clutch on the pump shaft is 2F and the rear clutch on the output shaft is 5R.

The input shaft **(1)** has two forward speed clutches, **(1M)** and **(1F)**, and the reverse clutch **(1R)**. The pump shaft has two forward speed clutches, **(2F)** and **(2R)**, and drives both the transmission lubrication pump and the tractor hydraulic system pump. The counter shaft **(3)** has all splined gears and transfers power from the input and pump shafts to the master clutch shaft **(4)**. The master clutch shaft has the master clutch **(4F)** and a second clutch **(4R)** that work in combination with all the other clutches for all forward and reverse speeds. The output shaft **(5)** has two clutches, **(5F)** and **(5R)**, that work in combination with the **(4)** master clutch shaft for all forward and reverse speeds.

All shafts are located and supported by single row tapered roller bearings. The shaft end play clearance or preload is set by installing shims at the front end of each shaft.

All gears are in constant mesh. Power flow through the transmission is achieved when one clutch on the input **(1)** or pump shaft **(2)**, one clutch on the master clutch shaft **(4)** and one clutch on the output shaft **(5)** are engaged. Various combinations of three clutches on the four shafts, through the counter shaft **(3)**, provide sixteen speeds in forward and two speeds in reverse.

The master clutch **(4F)** mounted on the fourth shaft provides a smooth and controlled start up in forward or reverse. Actuation of the foot pedal operated potentiometer, in the cab, sends an electrical signal to the computer controller. The controller sends an electrical signal to the valve on the fourth shaft front bearing retainer. The valve modulates the oil pressure to the master **(4F)** clutch. Actuation of the master clutch foot pedal will interrupt the electrical signal to the 4th and 5th shaft clutches solenoid valves, releasing the clutches and stopping the power flow through the transmission.



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PS4 transmission gear identification chart

1. 51 tooth	8. 52 tooth
2. 46 tooth	9. 50 tooth
3. 41 tooth	10. 39 tooth
4. 30 tooth	11. 42 tooth
5. 37 tooth	12. 48 tooth
6. 21 tooth	13. 38 tooth
7. 26 tooth	

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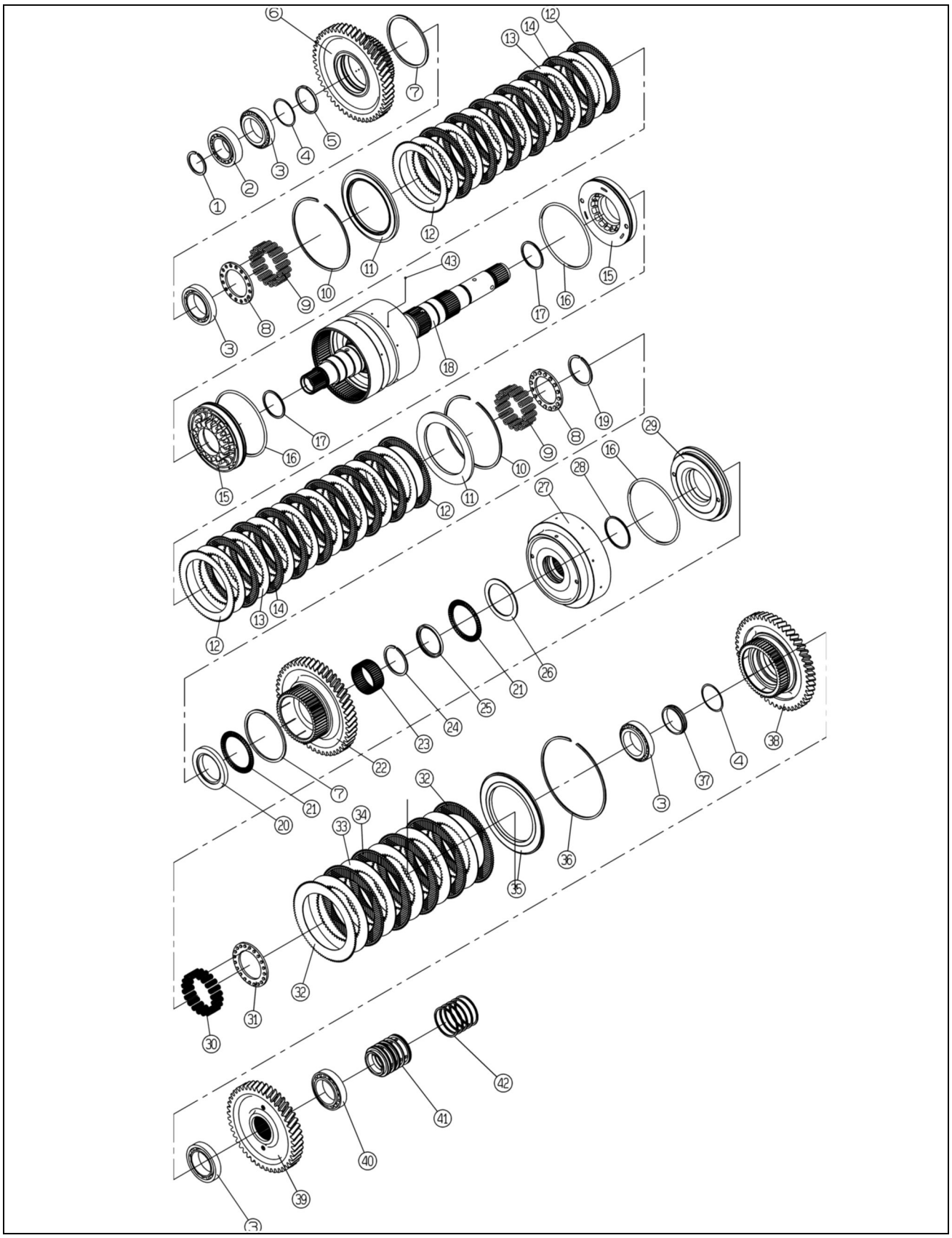
(*) See content for specific models

Shaft assemblies - Exploded view - PS4 Transmission

Steiger® 370	NA (Transmission = Powershift transmission)
Steiger® 420 Rowtrac™	NA (Transmission = Powershift transmission)
Steiger® 420	NA (Transmission = Powershift transmission)
Steiger® 470 Quadtrac®	NA (Transmission = Powershift transmission)
Steiger® 470 Rowtrac™	NA (Transmission = Powershift transmission)
Steiger® 470	NA (Transmission = Powershift transmission)
Steiger® 500 Quadtrac®	NA (Transmission = Powershift transmission)
Steiger® 500 Rowtrac™	NA (Transmission = Powershift transmission)
Steiger® 500	NA (Transmission = Powershift transmission)

PS4 INPUT (FIRST) SHAFT
(For parts identification only, clutch plate quantities may vary)

1. SELECT SNAP RING	23. NEEDLE BEARING
2. BEARING	24. SNAP RING
3. BEARING	25. SPACER
4. SHIMS	26. THRUST WASHER
5. BEARING SPACER	27. 1F CLUTCH DRUM
6. 1R CLUTCH GEAR	28. RING SEAL
7. RING SEAL	29. PISTON, 1F CLUTCH
8. SPRING RETURN PLATE	30. RETURN SPRINGS
9. RETURN SPRING	31. 1F SPRING PLATE
10. SNAP RING	32. PLATE, CLUTCH FACED
11. CLUTCH END PLATE	33. PLATE, STEEL
12. FACED PLATE	34. PLATE, FACED CLUTCH
13. STEEL PLATE	35. PLATE, CLUTCH END
14. FACED PLATE	36. SNAP RING
15. PISTON	37. 1F BEARING SPACER
16. D-RING	38. 1F GEAR
17. RING SEAL	39. DRIVE GEAR
18. 1ST DRUM ASSEMBLY SHAFT	40. BEARING
19. RETAINING RING	41. CARRIER, PISTON RING
20. THRUST WASHER	42. RING SEAL
21. THRUST BEARING	43. STEEL BALL
22. GEAR, 1M	



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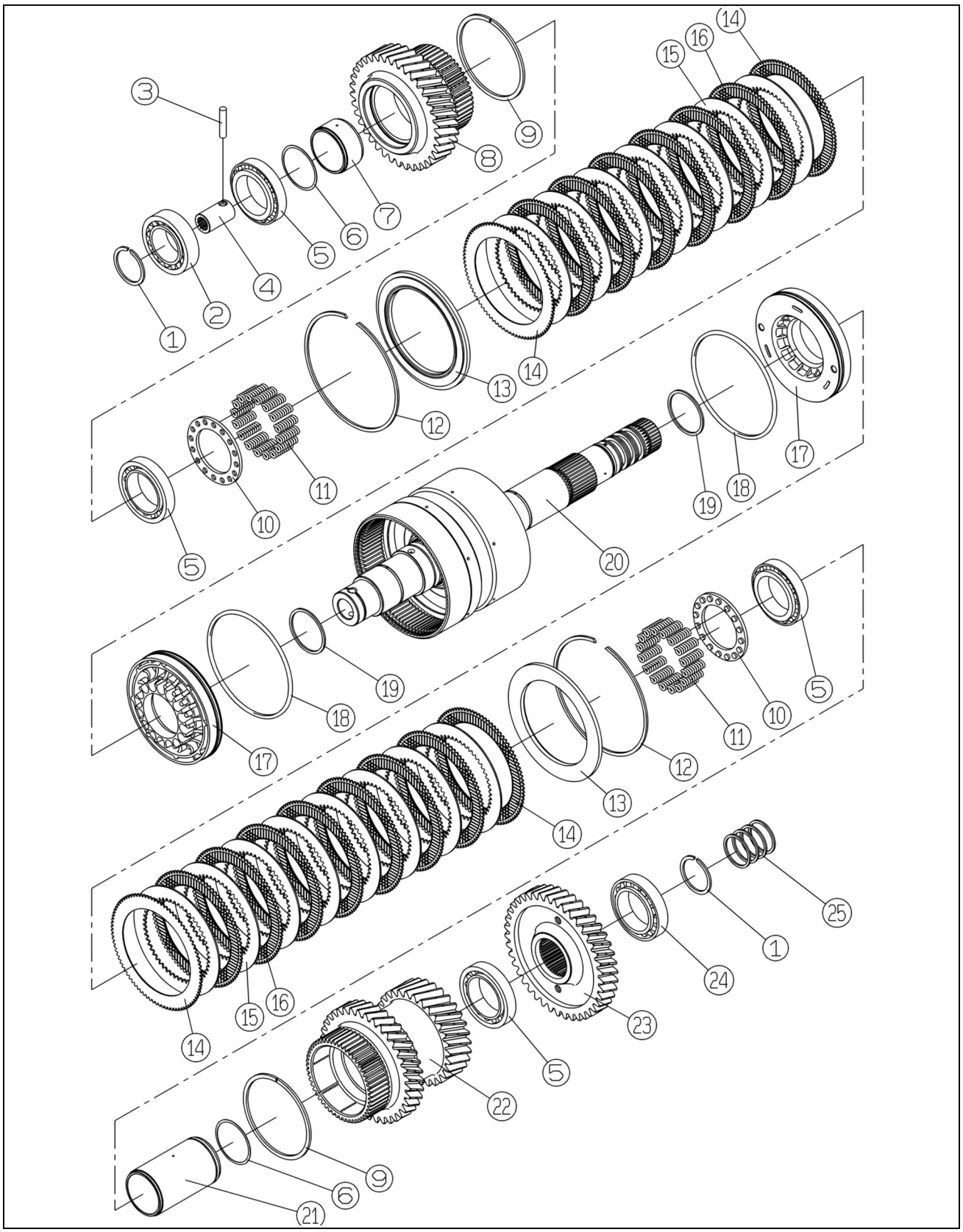
PS4 PUMP (SECOND) SHAFT
(For parts identification only, clutch plate quantities may vary)

1. SELECT SNAP RING	14. PLATE, FACED
2. BEARING	15. STEEL PLATE
3. NEEDLE	16. PLATE, FACED
4. PUMP SLEEVE COUPLING	17. CLUTCH PISTON
5. BEARING	18. D-RING
6. SHIMS	19. RING SEAL
7. 2R BEARING SPACER	20. 2ND DRUM ASSEMBLY SHAFT
8. 2R GEAR	21. 2F BEARING SPACER
9. SEAL RING	22. 2M GEAR
10. SPRING RETURN PLATE	23. DRIVEN GEAR
11. RETURN SPRINGS	24. BEARING
12. SNAP RING	25. RING SEAL
13. CLUTCH END PLATE	



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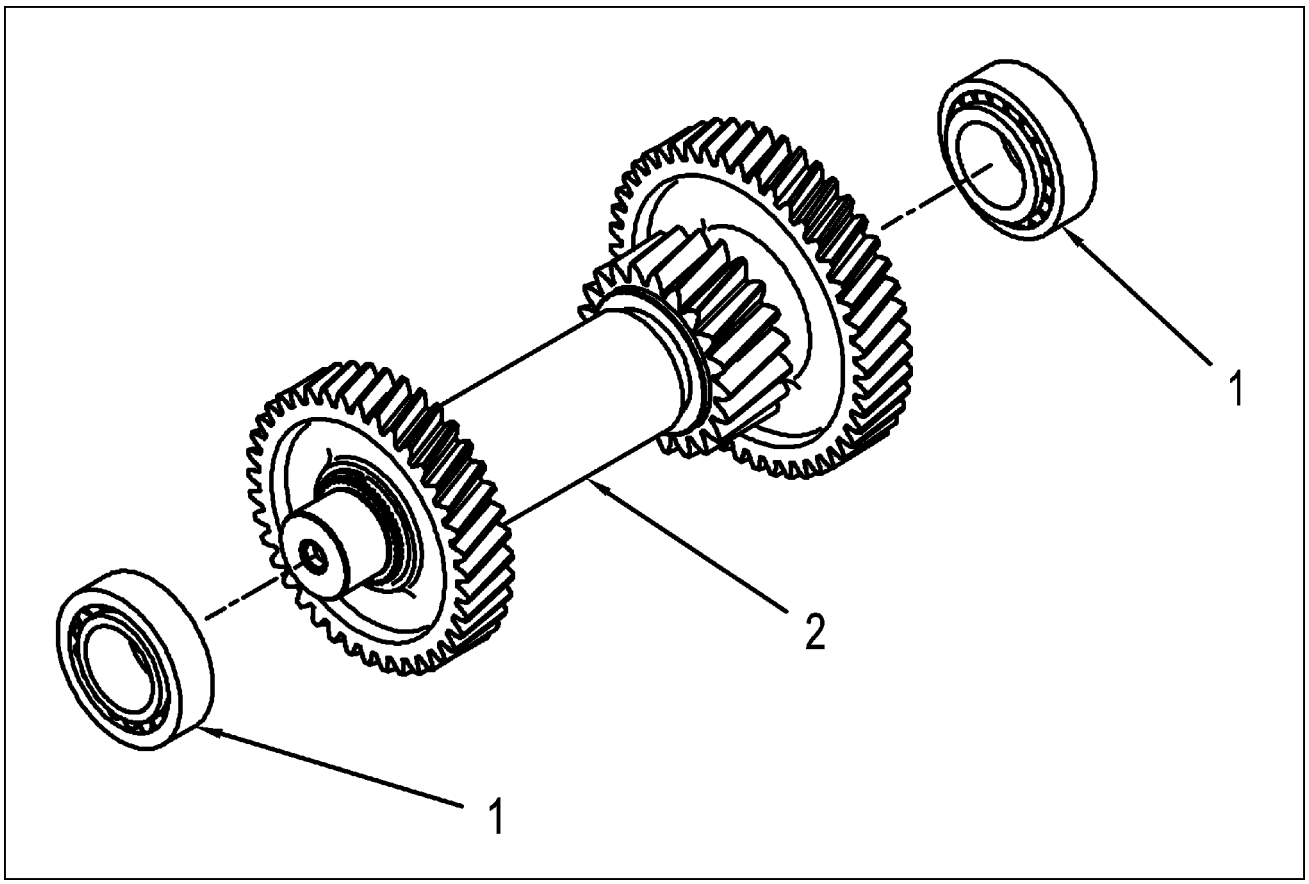
PS4 COUNTER (THIRD) SHAFT

1. BEARING	2. COUNTER (THIRD) SHAFT



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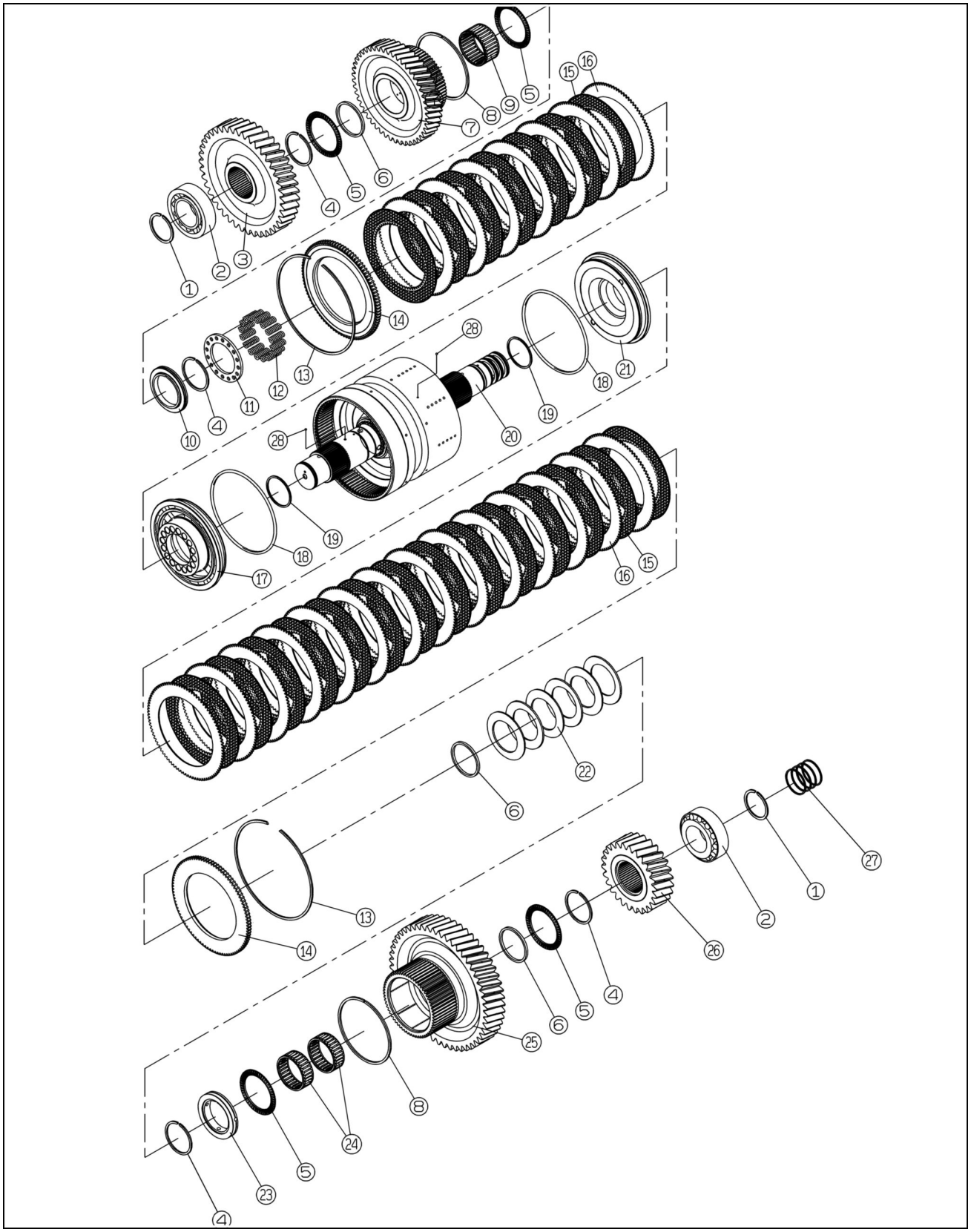
PS4 MASTER CLUTCH (FOURTH) SHAFT
(For parts identification only, clutch plate quantities may vary)

1. SELECT SNAP RING	15. FACED PLATE
2. BEARING	16. STEEL PLATE
3. 4R DRIVE GEAR	17. PISTON. RR CLUTCH
4. RETAINING RING	18. D-RING
5. THRUST BEARING	19. RING SEAL
6. NEEDLE BEARING SPACER	20. 4TH DRUM ASSEMBLY SHAFT
7. 4R DRIVEN GEAR	21. FR CLUTCH PISTON
8. RING SEAL	22. SPRING PLATE
9. NEEDLE BEARING	23. THRUST WASHER
10. THRUST WASHER	24. NEEDLE BEARING
11. SPRING PLATE	25. 4F DRIVEN GEAR
12. RETURN SPRING	26. 4F DRIVE GEAR
13. SNAP RING	27. RING SEAL
14. CLUTCH END PLATE	28. STEEL BALL



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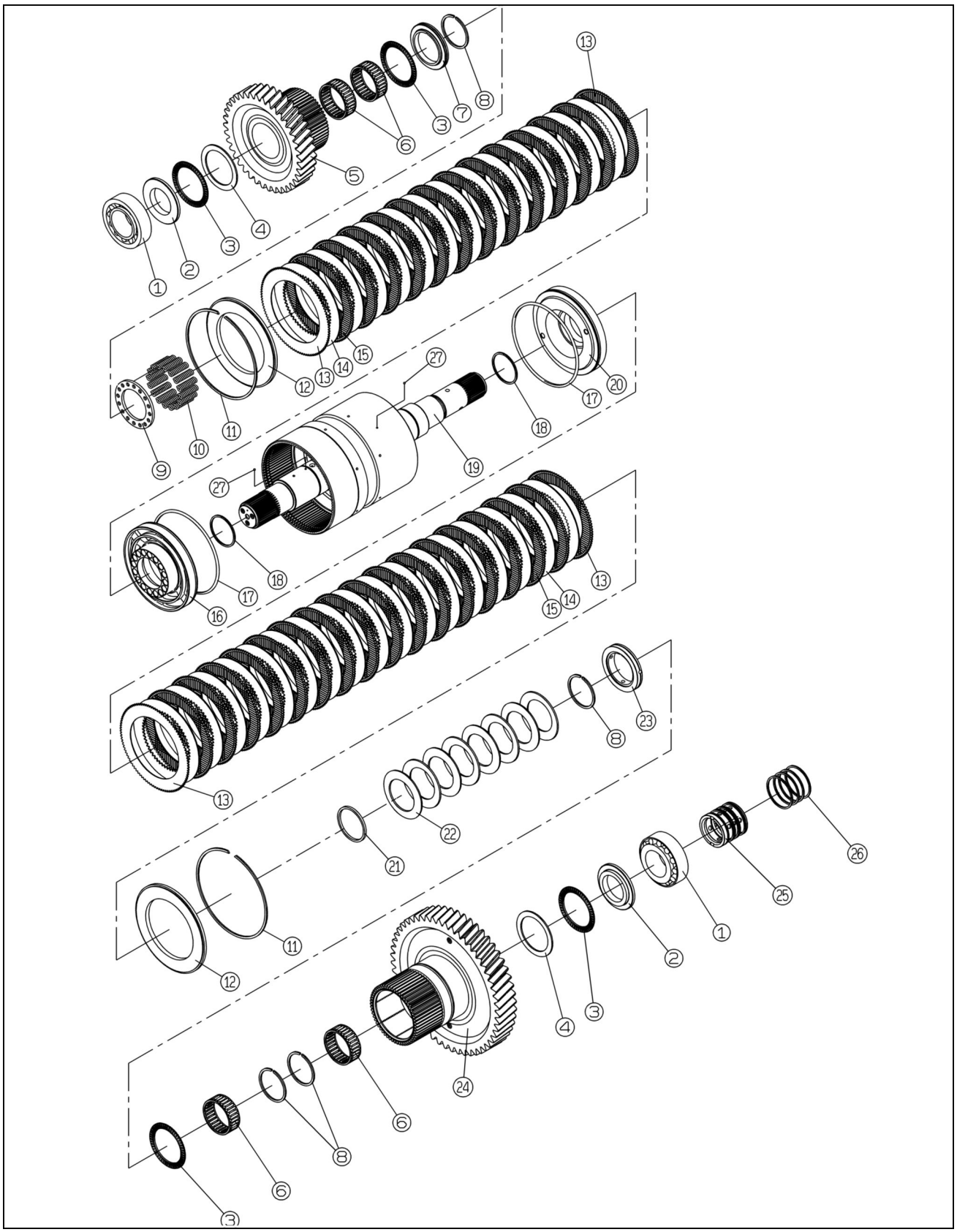
PS4 OUTPUT (FIFTH) SHAFT
(For parts identification only, clutch plate quantities may vary)

1. BEARING	15. FACED CLUTCH PLATE
2. THRUST WASHER	16. RR CLUTCH PISTON
3. NEEDLE BEARING	17. D-RING
4. THRUST WASHER	18. RING SEAL
5. 5R DRIVEN GEAR ASSEMBLY	19. SFT DRUM ASSEMBLY 5TH
6. NEEDLE BEARING	20. FR CLUTCH PISTON
7. THRUST WASHER	21. NEEDLE BEARING SPACER
8. RETAINING RING	22. SPRING PLATE
9. SPRING PLATE	23. THRUST WASHER
10. RETURN SPRING	24. 5F DRIVEN GEAR
11. SNAP RING	25. CARRIER PISTON
12. CLUTCH END PLATE	26. RING SEAL
13. CLUTCH FACED PLATE	27. STEEL BALL
14. STEEL PLATE	



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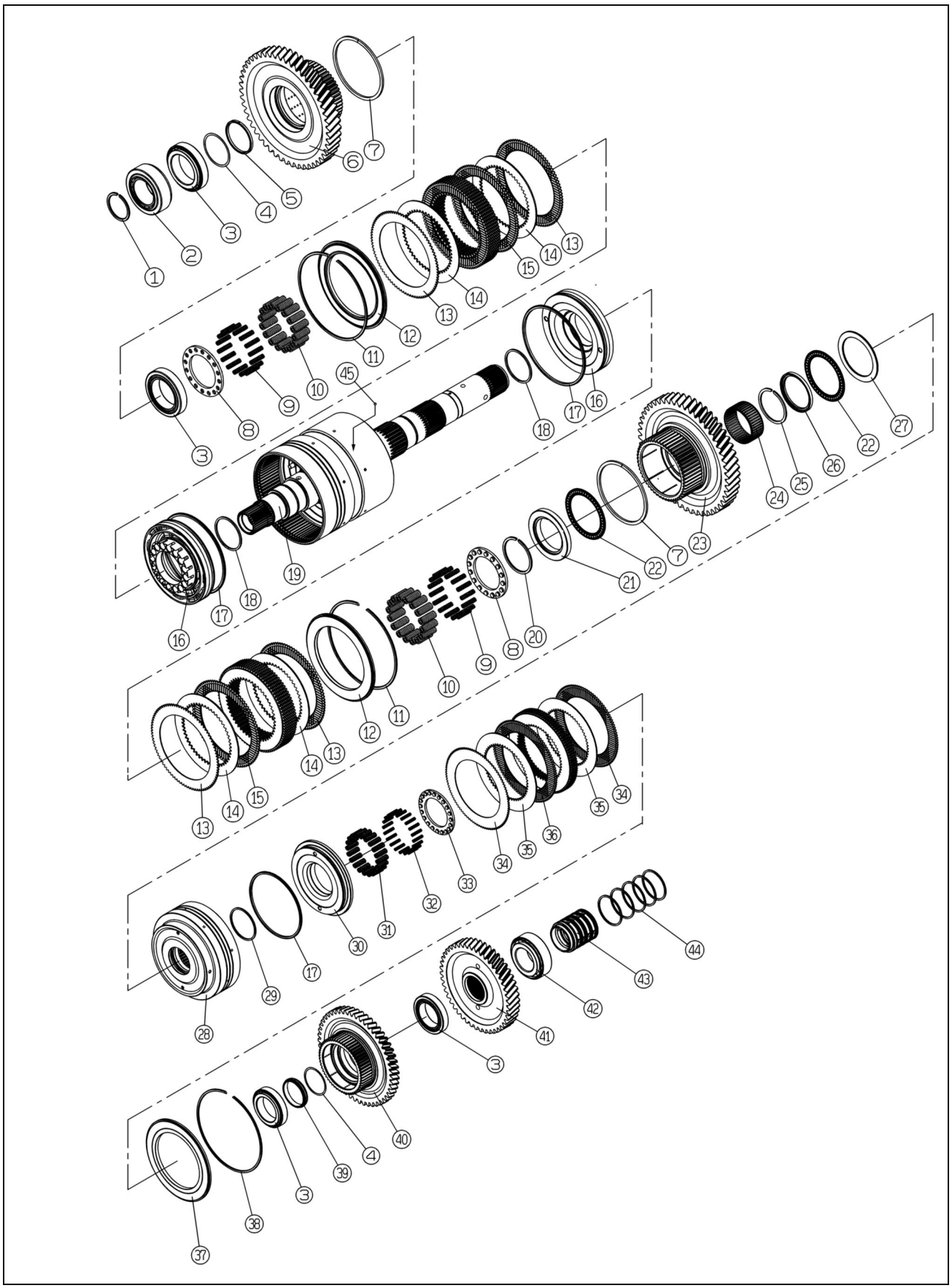
Shaft assemblies - Exploded view - PS6 Transmission

Steiger® 500 Quadtrac®	NA (Transmission = Powershift transmission)
Steiger® 500	NA (Transmission = Powershift transmission)
Steiger® 540 Quadtrac®	NA (Transmission = Powershift transmission)
Steiger® 540	NA (Transmission = Powershift transmission)
Steiger® 580 Quadtrac®	NA (Transmission = Powershift transmission)
Steiger® 580	NA (Transmission = Powershift transmission)
Steiger® 620 Quadtrac®	NA (Transmission = Powershift transmission)
Steiger® 620	NA (Transmission = Powershift transmission)

PS6 INPUT (FIRST) SHAFT
(For parts identification only, clutch plate quantities may vary)

1. SELECT SNAP RING	23. 1M GEAR
2. BEARING	24. NEEDLE BEARING
3. BEARING	25. SNAP RING
4. SHIMS	26. SPACER
5. BEARING SPACER	27. THRUST WASHER
6. 1R CLUTCH GEAR	28. 1F CLUTCH DRUM
7. RING SEAL	29. RING SEAL
8. SPRING RETURN PLATE	30. 1F CLUTCH PISTON
9. RETURN SPRING	31. RETURN SPRING
10. RETURN SPRING	32. RETURN SPRING
11. SNAP RING	33. PLATE, 1F SPRING
12. CLUTCH END PLATE	34. PLATE, FACED CLUTCH
13. FACED PLATE	35. STEEL PLATE
14. STEEL PLATE	36. FACED CLUTCH PLATE
15. FACED PLATE	37. CLUTCH END PLATE
16. PISTON	38. SNAP RING
17. D-RING	39. 1F BEARING SPACER
18. RING SEAL	40. 1F GEAR
19. 1ST DRUM ASSEMBLY SHAFT	41. DRIVE GEAR
20. RETAINING RING	42. TAPER ROLLER BEARING
21. THRUST WASHER	43. PISTON RING CARRIER
22. THRUST BEARING	44. RING SEAL
	45. STEEL BALL



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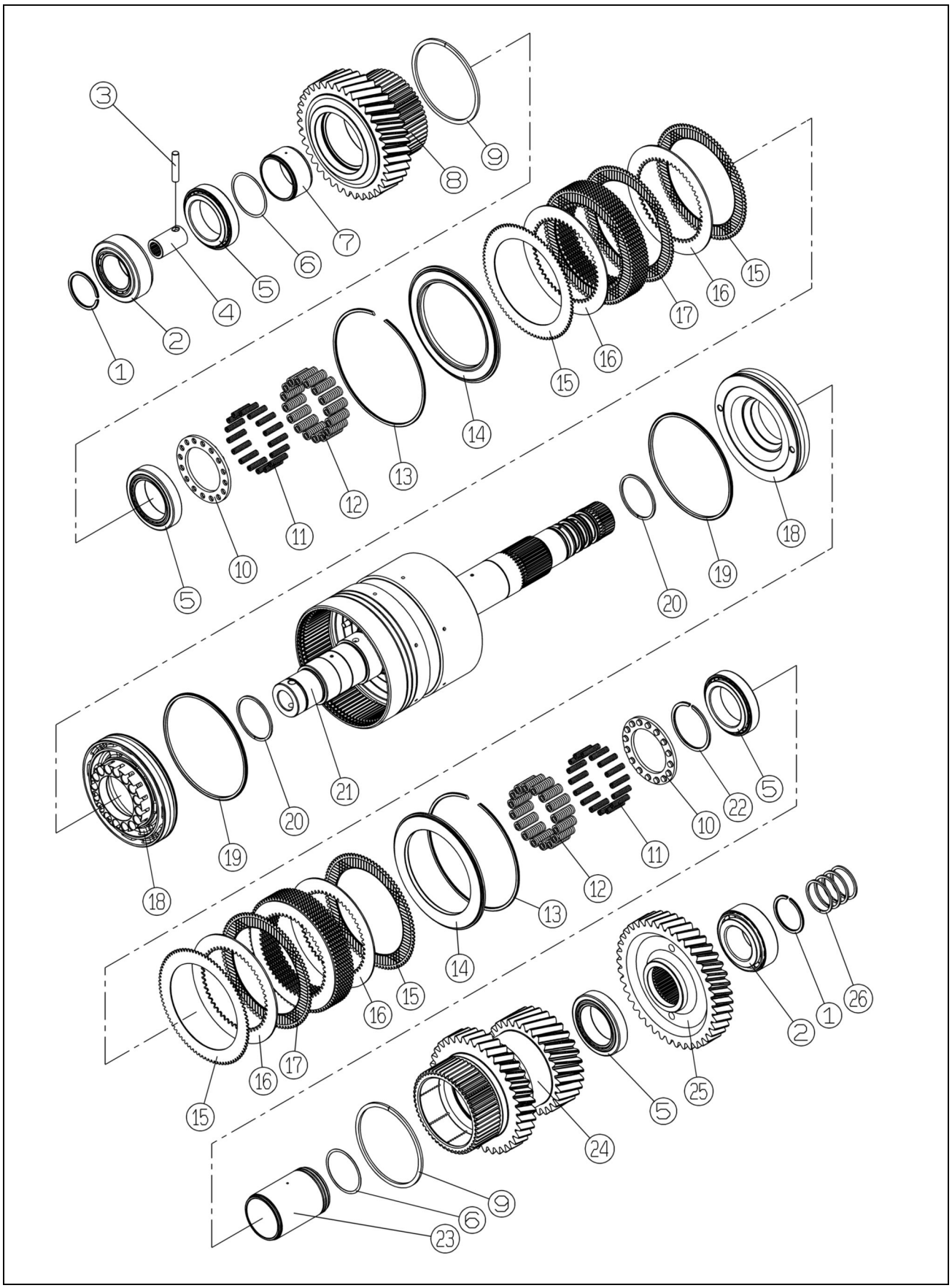
PS6 PUMP (SECOND) SHAFT
(For parts identification only, clutch plate quantities may vary)

1. SELECT SNAP RING	14. PLATE, CLUTCH END
2. BEARING	15. FACED PLATE
3. NEEDLE	16. STEEL PLATE
4. PUMP SLEEVE COUPLING	17. FACED PLATE
5. BEARING	18. CLUTCH PISTON
6. SHIMS	19. D-RING
7. 2R BEARING SPACER	20. RING SEAL
8. 2R GEAR	21. 2ND DRUM ASSEMBLY SHAFT
9. SEAL RING	22. RETAINING RING
10. SPRING RETURN PLATE	23. 2F BEARING SPACER
11. RETURN SPRINGS	24. 2M GEAR
12. RETURN SPRINGS	25. DRIVEN GEAR
13. SNAP RING	26. RING SEAL



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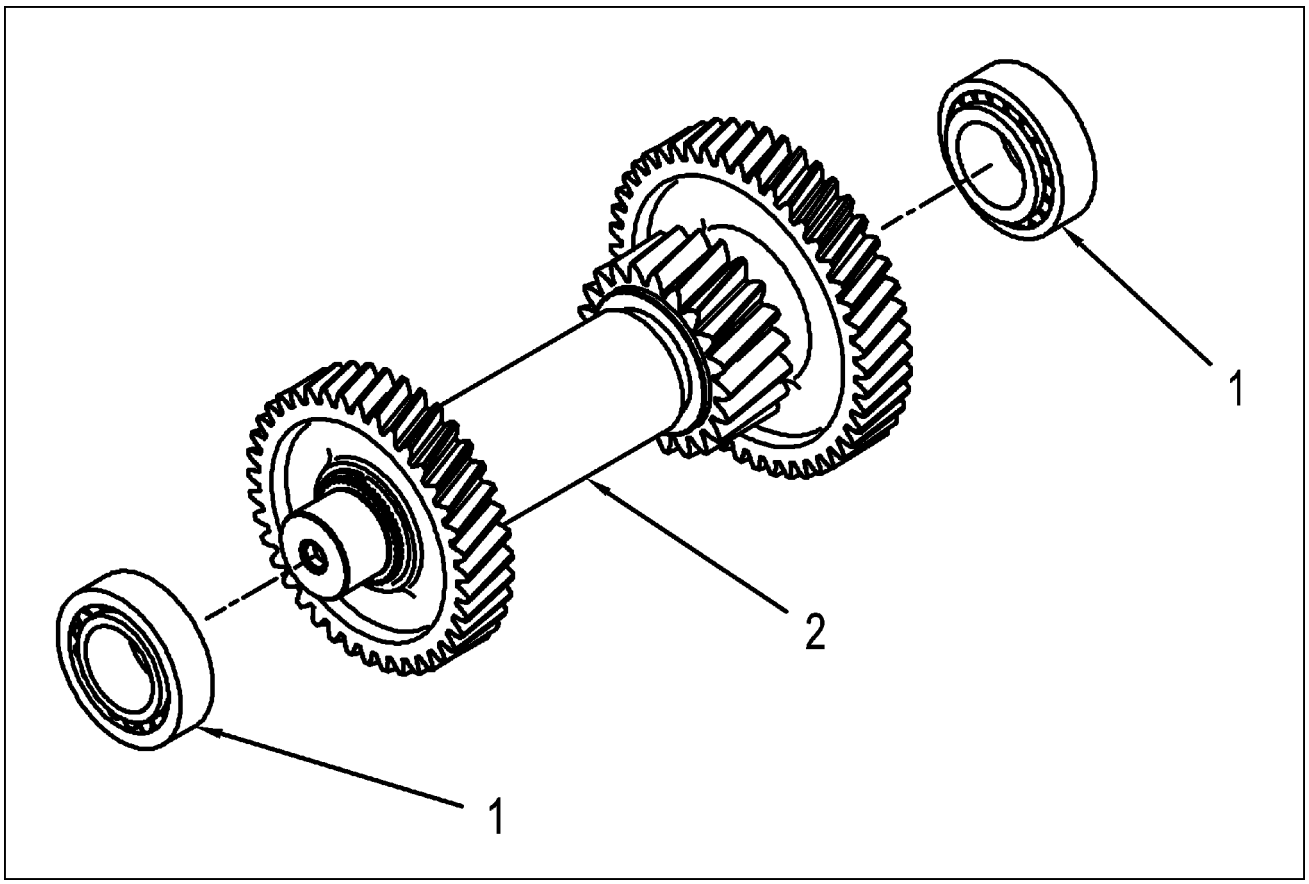
PS6 COUNTER (THIRD) SHAFT

1. BEARING	2. COUNTER (THIRD) SHAFT



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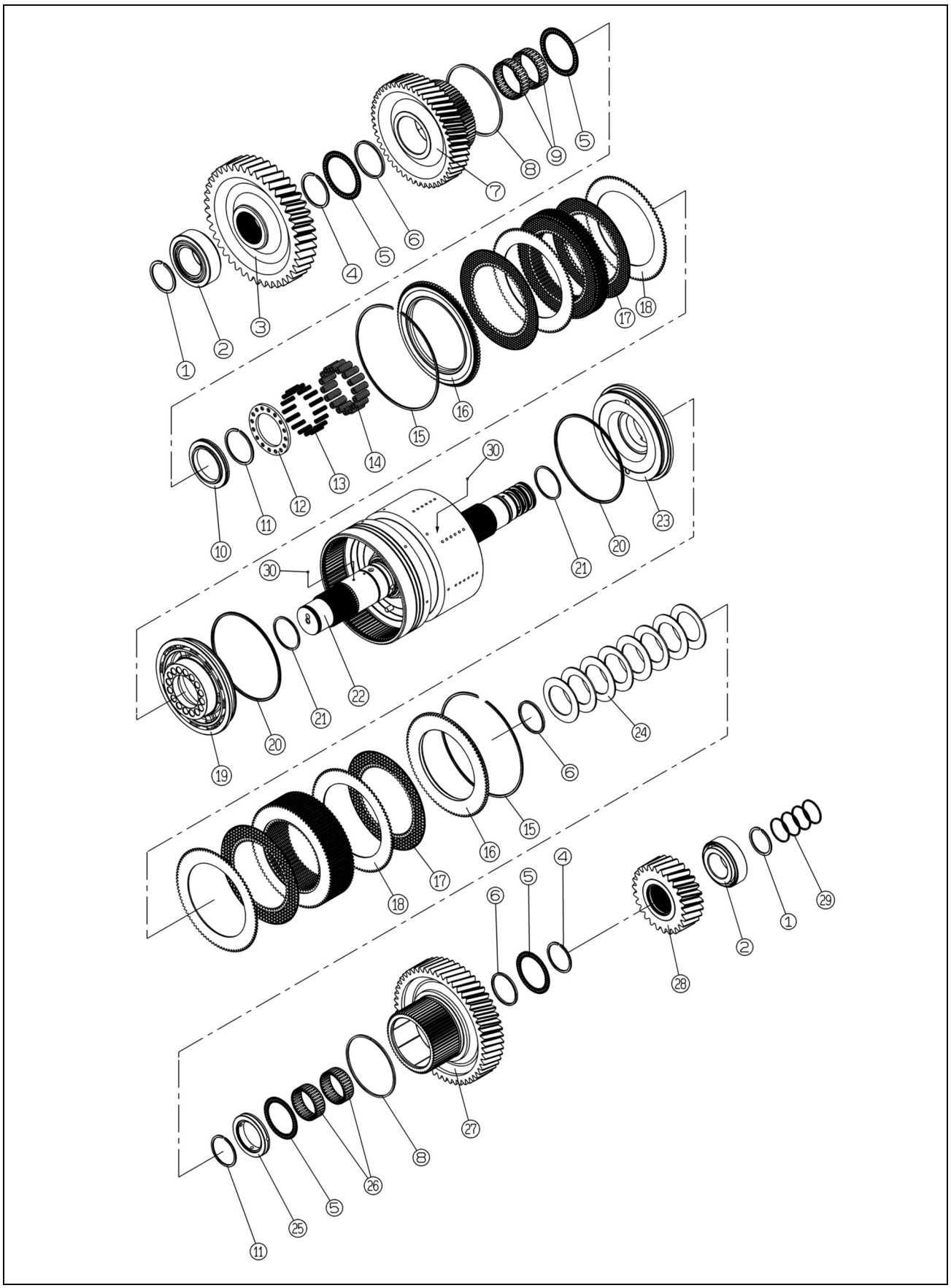
PS6 MASTER CLUTCH (FOURTH) SHAFT
(For parts identification only, clutch plate quantities may vary)

1. SELECT SNAP RING	16. CLUTCH END PLATE
2. BEARING	17. FACED PLATE
3. 4R DRIVE GEAR	18. STEEL PLATE
4. RETAINING RING	19. RR CLUTCH PISTON
5. THRUST BEARING	20. D-RING
6. NEEDLE BEARING SPACER	21. RING SEAL
7. 4R DRIVEN GEAR	22. 4TH DRUM ASSEMBLY SHAFT
8. RING SEAL	23. FR CLUTCH PISTON
9. NEEDLE BEARING	24. SPRING PLATE
10. THRUST WASHER	25. THRUST WASHER
11 RETAINING RING	26. NEEDLE BEARING
12. SPRING PLATE	27. 4F DRIVEN GEAR
13. RETURN SPRING	28. 4F DRIVE GEAR
14. RETURN SPRING	29. RING SEAL
15. SNAP RING	30. STEEL BALL



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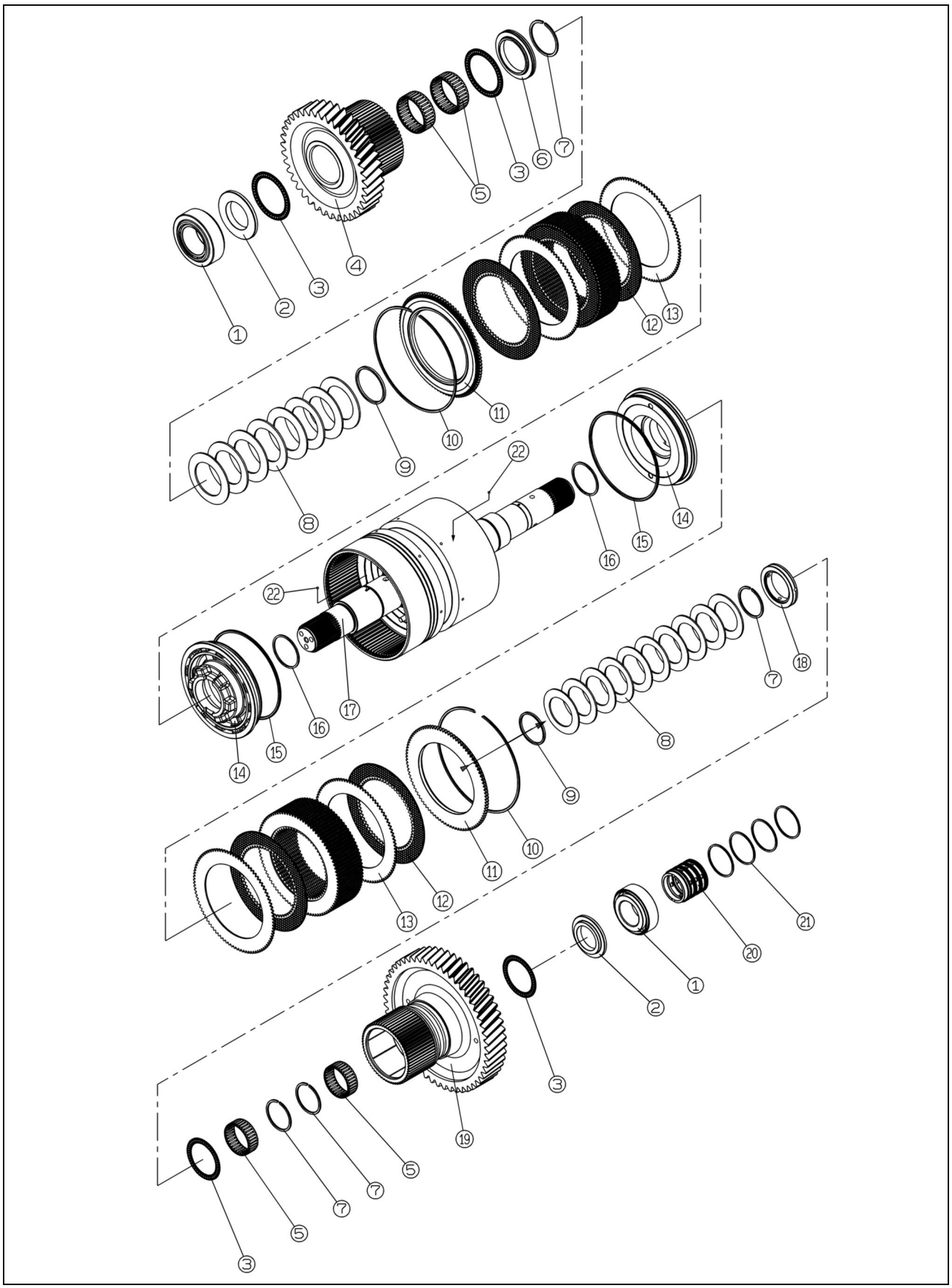
PS6 OUTPUT (FIFTH) SHAFT
(For parts identification only, clutch plate quantities may vary)

1. BEARING	15. D-RING
2. THRUST WASHER	16. RING SEAL
3. THRUST WASHER	17. 5TH DRUM SHAFT ASSEMBLY
4. 5R DRIVEN GEAR ASSEMBLY	18. THRUST WASHER
5. NEEDLE BEARING	19. 5F DRIVEN GEAR
6. THRUST WASHER	20. CARRIER PISTON
7. RETAINING RING	21. RING SEAL
8. SPRING PLATE	22. STEEL BALL
9. NEEDLE BEARING SPACER	
10. SNAP RING	
11. CLUTCH END PLATE	
12. CLUTCH FACED PLATE	
13. STEEL PLATE	
14. FR CLUTCH PISTON	



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Shaft assemblies - Inspect - PS4 and PS6 Transmission

STEIGER®	NA (Transmission = Powershift transmission)

General Information

NOTE: *Replace all oil seals, gaskets, O-rings, piston rings, seal rings, snap rings etc., as a part of any maintenance or overhaul procedure. Shims that are damaged or destroyed in disassembly must also be replaced.*

1. Before any service work is done, clean the complete outside surface of the housing. Using an approved cleaning solvent or steam, clean all parts. Parts cleaned with solvent or steam cleaned must be dried and oiled immediately.
2. Examine all parts carefully for grit, dirt and abrasives and reclean them if necessary.
3. Clean all oil passages by working a piece of wire back and forth through the passages and then flushing them with cleaning solvent.
4. Use clean solvent to flush oil pumps, valves, etc.

NOTICE: *Reverse flush all hoses, tubing, coolers, etc., particularly if the unit is being disassembled due to a massive internal failure.*

Cleaning Bearings

Thoroughly wash bearings that have been in service, in clean solvent. Soak bearings in solvent if they are dirty.

NOTICE: *Never spin bearings with compressed air. Oil bearings with clean operating fluid immediately after cleaning. Be sure bearings are oiled before inspection.*

Preventing Entrance of Dirt Into Bearings

Dirt and grit in bearings are often responsible for bearing failure. It is important to keep bearings clean. Keep the wrapper on new bearings until they are to be installed. Do not expose clean bearings if they are not to be assembled at once. Wrap them with a clean lint free cloth or paper to keep out dust.

Previously Sealed Joints

Previously Sealed Joints

1. Where sealants were used be sure the surfaces are clean and that all sealant has been removed from the mating surfaces. The surfaces must be clean for a leak free seal. Use appropriate scraper and gasket remover. Do not use power brushes or sanders.
2. Clean surfaces with denatured alcohol to remove oil and grease residue.
3. Test for clean surfaces by applying a few drops of cool water to the surfaces. Parts are sufficiently clean if water covers the surface of the part in a film. If the water puddles or forms beads, use fresh solvent and reclean.

Inspection

Housings, Case Parts and Machined Surfaces

1. Replace case parts or housings that are cracked.
2. Inspect bores for wear, grooves, scratches and dirt. Remove burrs and scratches with crocus cloth or soft stone. Replace parts that are deeply grooved or scratched.
3. Inspect oil passages for obstructions. If an obstruction is found, remove it with compressed air or by working a wire back and forth through the passage and flushing it with solvent.
4. Inspect machined surfaces for burrs, scratches, nicks and foreign matter. If such defects cannot be removed with crocus cloth or a soft stone, replace the part.
5. Inspect threaded openings for damaged threads. Repair damaged threads with a tap of the correct size.

Bearings

1. Inspect bearings for roughness of rotation. Replace the bearing if the rotation is rough.
2. Inspect bearings for corrosion, scored, cracked, pitted or chipped races, and for indication of excessive wear of balls or rollers. If one of these defects is found, replace the bearings.
3. Inspect bearing bores and shafts for grooved, burred, or galled conditions that would indicate that the bearing has been turning in its housing or on its shaft. If the damage cannot be repaired with a crocus cloth, replace the part.
4. Bearings can be heated in a bearing oven for assembly. Do not use a torch to heat bearings. Do not heat the bearing beyond a temperature of **110 °C** (**230 °F**). Do not leave bearings heated for more than one hour. Heating will temporarily increase the clearance of the inner bearing race so that a hydraulic press may not be needed when installing bearings over shafts.

Thrust Washers and Spacers

Inspect thrust washers for distortion, scores, burrs and wear. Replace any defective thrust washers or spacers.

Flexible Hoses

Inspect all flexible hoses for cracks and soft spots. Replace damaged hoses.

Gears

1. Inspect gears for pitted, nicked, burred or broken teeth. If the defect cannot be removed with a soft stone, replace the gear.
2. Inspect gear teeth for wear that may have destroyed the original tooth shape. If this condition is found, replace both the drive and driven gear.
3. Inspect thrust faces of gears for scores, scratches and burrs. If these defects cannot be removed with a soft stone, replace the gear.

Splined Parts (Gears, Shafts, Clutch Hubs and Drive Couplers)

Inspect splined parts for worn, stripped, twisted, chipped or burred splines. Remove burrs with a soft stone. Replace the part if other defects are found.

Clutch Plates

1. Inspect the clutch friction plates for cracked or glazed surfaces, or for cracked, worn or broken teeth. Replace damaged or worn plates.
2. Inspect the clutch steel plates for discoloration and warpage. Replace damaged steel plates.
3. New friction plates must be soaked in clean operating fluid for 20 minutes before installation.

Snap Rings

Replace damaged or distorted snap rings.

IMPORTANT REBUILD INFORMATION

If there has been a massive system failure, and the transmission must be removed for inspection and rebuilt, the oil cooler and all system hoses must also be cleaned and flushed.
On initial start-up of a rebuilt transmission system, change the filter element(s) after the first 30 minutes of operation, and then again after the first 8 hours of operation. This should be followed by a third filter element change after 50 hours of operation to ensure a clean system. From then on, change the filter element at the interval specified in the operators manual.

NOTICE: *The transmission oil cooler must be flushed after a major failure.*

Springs

Inspect springs for broken or distorted coils. Replace the spring if either of these defects are found. Refer to the specifications below.

PISTON RETURN SPRINGS SPECIFICATIONS				
Spring Location	Wire Diameter	Outside Diameter	Free-Length	Qty/Clutch
1M, 1R, 2F and 2R Clutches	2.6 mm	14.0 mm	36.5 mm	16
1F Clutch	2.3 mm	11.6 mm	35.7 mm	20
4R Clutch	2.6 mm	14.0 mm	36.5 mm	16
5R Clutch	2.6 mm	14.0 mm	45.0 mm	16