



Chelsea® Power Take-Off

280 Series Service Manual

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



ENGINEERING YOUR SUCCESS.



WARNING

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The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

Offer of Sale

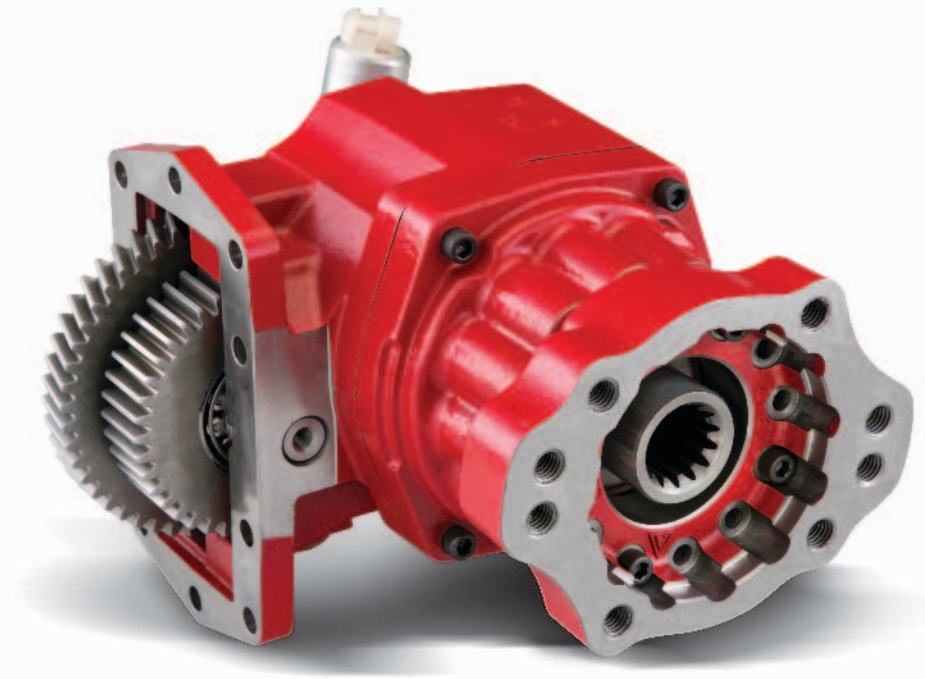
The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated in the "Offer of Sale".

Section 1: P.T.O. Information	1-12
P.T.O. Overview	2
Model Number Designation	3
Assembly Arrangements	4
Exploded View – 280GMFJP-B3RK	5
Bill of Materials – 280GMFJP-B3RK	6
Exploded View – 280GMFJP-B5RK	7
Bill of Materials – 280GMFJP-B5RK	8
Exploded View – 280GMFJP-B8RK	9
Bill of Materials – 280GMFJP-B8RK	10
Exploded View – 280GMFJP-B3BA	11
Bill of Materials – 280GMFJP-B3BA	12
Section 2: Disassembly/Assembly	13-20
Disassembly	14-17
Assembly	18-20
Section 3: Charts	21-23
Torque Chart	22
Gear Chart	23
Section 4: Installation Schematics	24-26
Shift Installation Kit without Electronic Overspeed Control (SK-347 Rev G)	25
Installation “RF”, “RK”, “RS”, “RY”, “RZ” & “UN” Wet Spline 280 Series (SK-508)	26
Section 5: Installation Instructions	27-29
Mounting the P.T.O. on the Transmission	28-29
Section 6: Troubleshooting Instructions	30-33
Troubleshooting	31-33
Section 7: Kits	34-36
Kits Bill of Materials	35-36
Offer of Sale	40

S E C T I O N 1

NOTES

1	Visually inspect parts before assembly for flaws.
2	The item numbers identifying parts are the same item numbers used on the engineering drawings.
3	Ensure tools and fixtures are current and have the required inspection and calibration labels and/or tags.
4	The terms OUTPUT and DRIVE are used interchangeably.
5	Lubricate most bearings before assembly. Use MELCOMOL "Y", EP-2 or equal.
6	When assembling bearings, always place the bearings rounded end into the part.
7	Use Parker O-Lube or equal to lubricate O-Rings and seals before assembly.
8	When assembling O-Rings, do not roll it into their grooves. Use a O-Ring tool for assembly. O-Rings are not to be twisted or damaged.
9	Always reference the current Chelsea Parts List for part numbers and assemblies. 280 Series is HY25-2280-M1/US

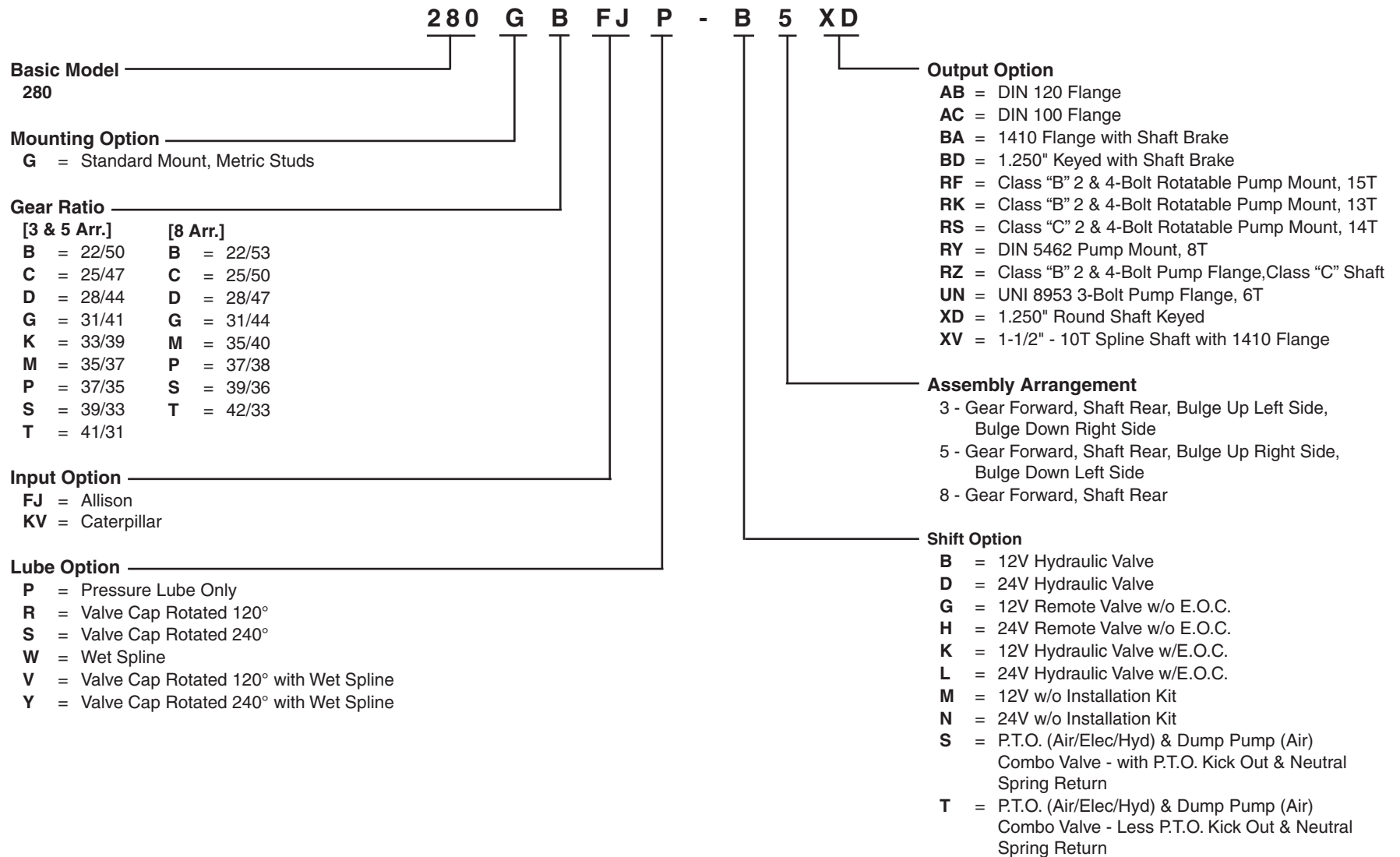
**Suggested Tools**

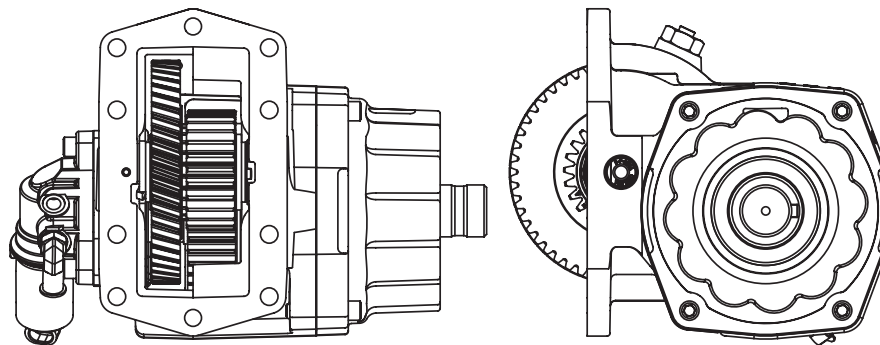
Safety Glasses	Oil Seal Slide	Shop Press	3/16" Hex Wrench
Oil Seal Driver	Pliers	5/32" Hex Bit Driver	Hammer/Mallet
1/2" Socket	1/2" Hex Wrench		

Suggested Service Kits

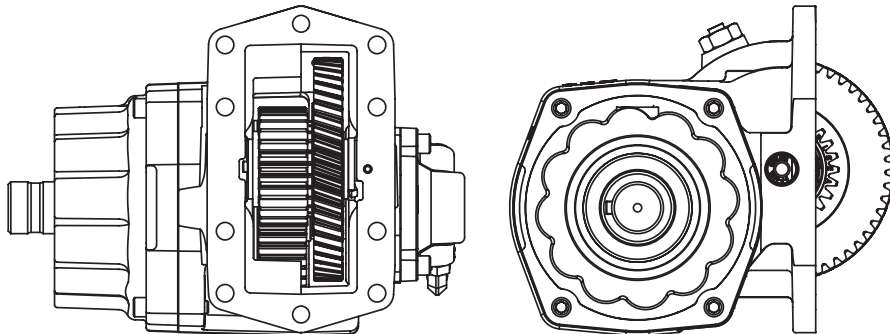
Part Number	Description
329071-62X	Gasket & Seal Kit (All Outputs Except BA)
329071-63X	Bearing Kit ("AC", "XD", "XV", "RF", "RK", "RS", "RY", "RZ") (All Outputs Except "BA", "UN")
329071-64X	Bearing Kit ("BA", "UN" Outputs)
329678X	Gear & Clutch Plates Kit (All)
7170-86X	Mounting Kit ("FJ" Gear Pitch)
7170-117X	Mounting Kit ("KV" Gear Pitch)

See [Page 35-36](#) for Kits Bill of Materials

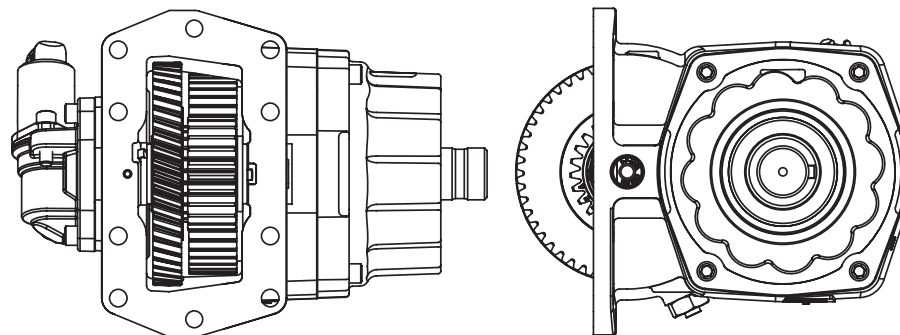




Assembly 3

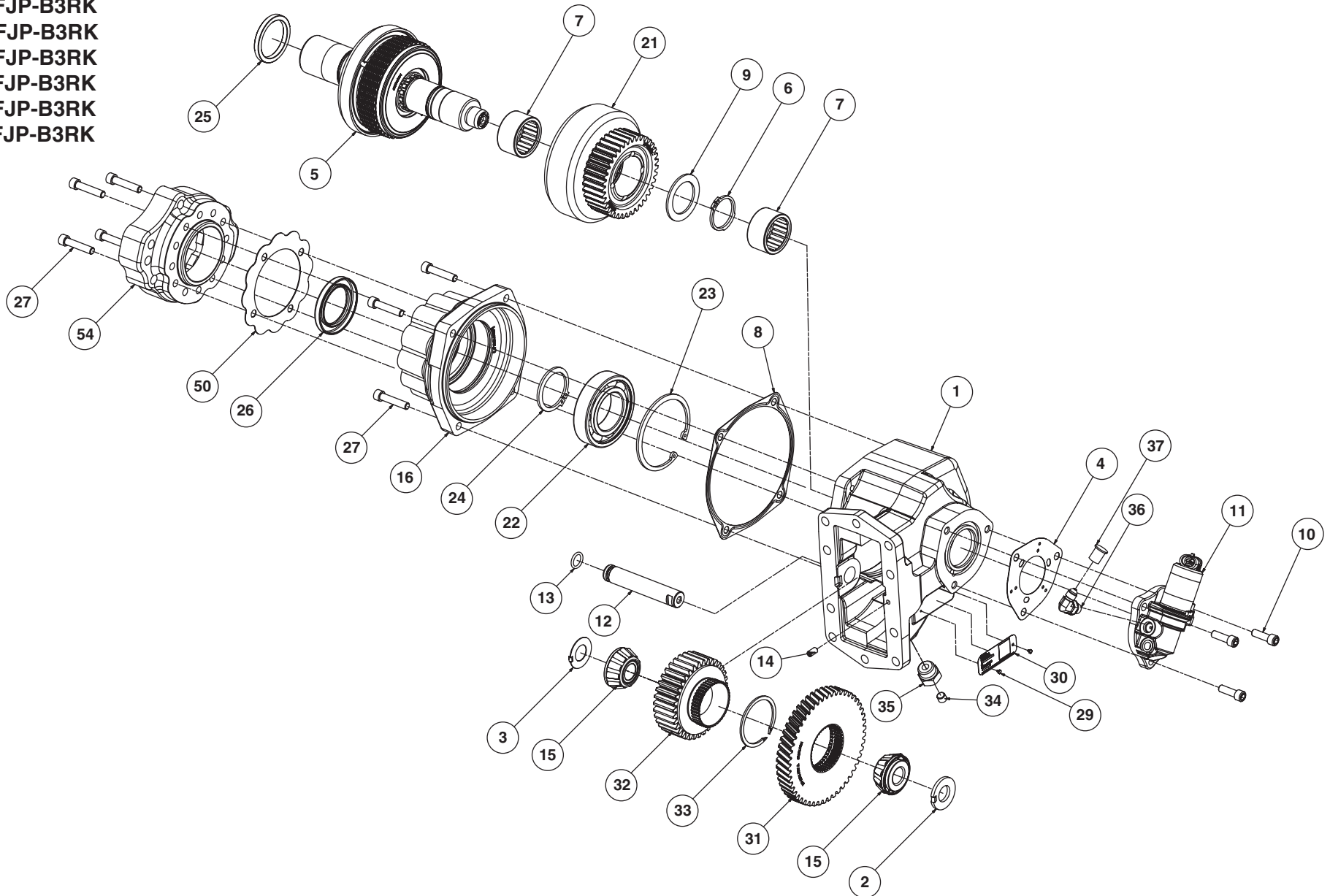


Assembly 5



Assembly 8

280GBFJP-B3RK
280GCFJP-B3RK
280GDFJP-B3RK
280GGFJP-B3RK
280GKFJP-B3RK
280GPFJP-B3RK
280GSFJP-B3RK
280GTFJP-B3RK



Bill of Materials**Service Manual
280 Series****280GMFJP-B3RK**

Item	Part Number	Description	Qty.
1	1-P-703	Housing.....	1
2	14-P-73-1	Spacer .762" x 1.500" x .150" Thickness As Required	1 or
	14-P-73-2	Spacer .762" x 1.500" x .153"	1 or
	14-P-73-3	Spacer .762" x 1.500" x .156"	1
3	31-P-102	Washer Thrust .754" x .440" x .030"	1
4	22-P-112	Gasket.....	1
5	329724-4X	Drive Shaft & Clutch Assembly "RK".....	1
6	379746	Lockring	1
7	560972	Bearing Needle Roller Assembly 1.500" x 1.875" x 1.000".....	2
8	22-P-101	Gasket.....	1
9	31-P-70	Washer Thrust 1.507" x 2.167" x .094"	1
10	378447-6	Capscrew SH .312" - 18 x 1.000"	3
11	329463-12X	12V Valve Cap Assembly.....	1
12	9-P-106	Idler Shaft .75"	1
13	28-P-191	O-Ring .549" x .103"	1
14	378452-7	Set Screw SH .250" - 20 x .500"	1
15	550439	Tapered Bearing Cone .750" x .8598"	2
16	21-P-767	Bearing Cap.....	1
21	2-P-933 ⁽¹⁾	Output Gear 37T.....	1
22	550311	Ball Bearing 1.77" x 3.346" x .748"	1
23	378263	Lockring	1
24	379555	Lockring	1

⁽¹⁾ See [Page 23](#) for other Gear Options

Item	Part Number	Description	Qty.
25	4-P-187	Spacer 1.776" x 2.200" x .239"	1
26	28-P-267	Oil Seal 2.627" x 1.750" x .312"	1
27	378447-8	Capscrew SH .312" - 18 x 1.500"	4
29	378422	Drive Screw.....	2
30	68-P-51	Name Plate	1
31	5-P-1491 ⁽¹⁾	Input Gear 50T ("FJ" Gear Pitch)	1
32	5-P-1482 ⁽¹⁾	Gear Ratio 35T	1
33	379522	Lockring	1
34	379231	Pipe Plug .125" - 27	1
35	379242	Adapter Straight .125" - 27 x .750" - 16	1
36	379486	Fitting 90°.....	1
37	379564-2	Cap Thread .438".....	1
50	35-P-101	Gasket Bearing Cap Wet Spline	1
54	21-P-731	Pump Flange	1

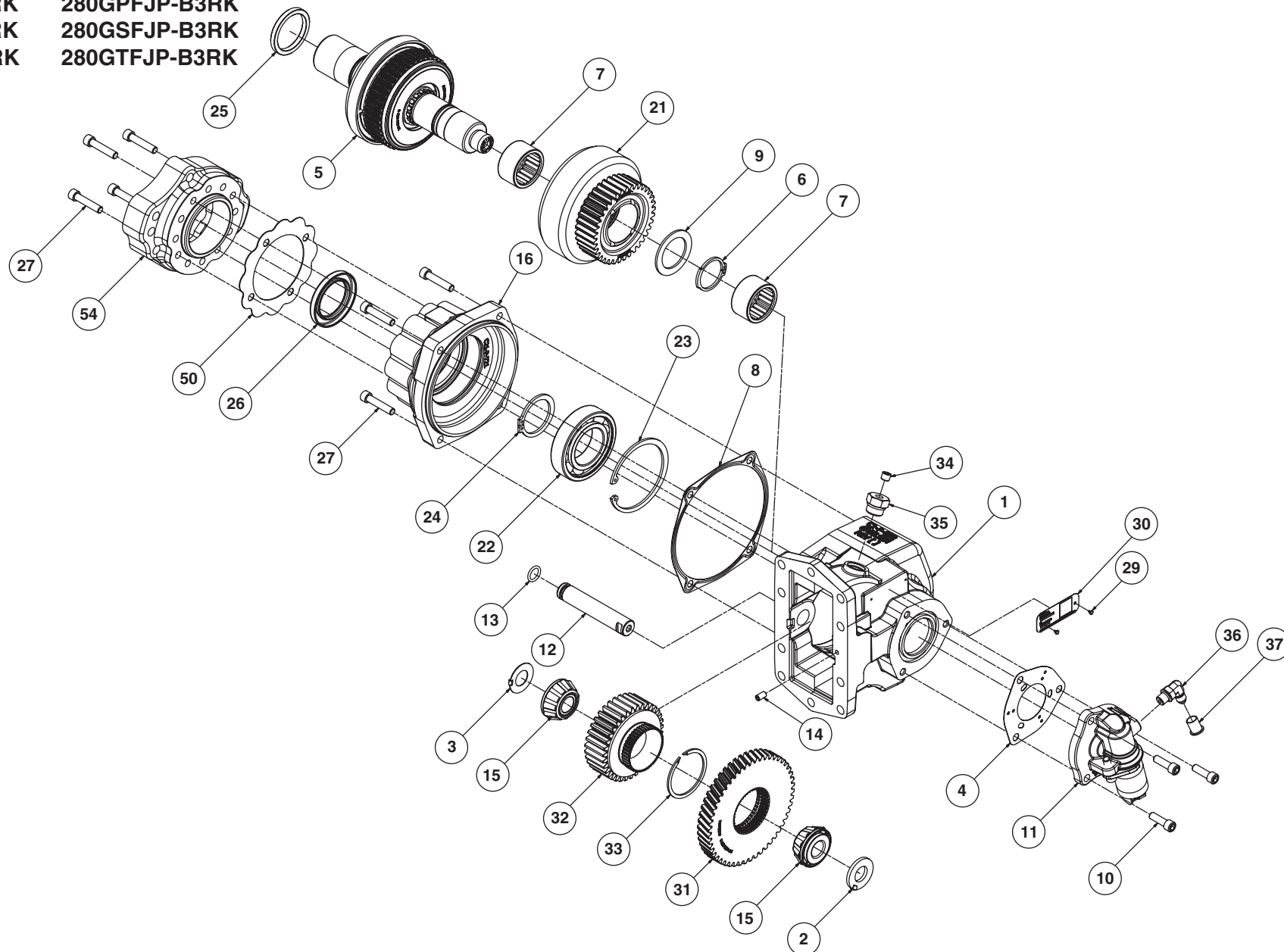
Service Kits

Part Number	Description
329071-62X	Gasket & Seal Kit (All Outputs Except "BA")
329071-63X	Bearing Kit "AC", "XD", "XV", "RF", "RK", "RS", "RY" and "RZ" (All Outputs Except "BA" and "UN")
329678X	Gear & Clutch Plates Kit (All)

See [Page 35-36](#) for Kits Bill of Materials

280GBFJP-B3RK
280GCFJP-B3RK
280GDFJP-B3RK
280GGFJP-B3RK

280GKFJP-B3RK
280GPFJP-B3RK
280GSFJP-B3RK
280GTFJP-B3RK



Bill of Materials**Service Manual
280 Series****280GMFJP-B5RK**

Item	Part Number	Description	Qty.
1	1-P-705	Housing.....	1
2	14-P-73-1	Spacer .762" x 1.500" x .150" Thickness As Required	1or
	14-P-73-2	Spacer .762" x 1.500" x .153"	1or
	14-P-73-3	Spacer .762" x 1.500" x .156"	1
3	31-P-102	Washer Thrust .754" x .440" x .030"	1
4	22-P-112	Gasket.....	1
5	329724-4X	Drive Shaft & Clutch Assembly "RK".....	1
6	379746	Lockring	1
7	560972	Bearing Needle Roller Assembly 1.500" x 1.875" x 1.000".....	2
8	22-P-101	Gasket.....	1
9	31-P-70	Washer Thrust 1.507" x 2.167" x .094"	1
10	378447-6	Capscrew SH .312" - 18 x 1.000"	3
11	329463-12X	12V Valve Cap Assembly.....	1
12	9-P-106	Shaft Idler .75"	1
13	28-P-191	O-Ring .549" x .103"	1
14	378452-7	Set Screw SH .250" - 20 x .500"	1
15	550439	Tapered Bearing Cone .750" x .8598"	2
16	21-P-767	Bearing Cap.....	1
21	2-P-933 ⁽¹⁾	Output Gear 37T.....	1
22	550311	Bearing Ball 1.77" x 3.346" x .748"	1
23	378263	Lockring	1
24	379555	Lockring	1

⁽¹⁾ See [Page 23](#) for other Gear Options

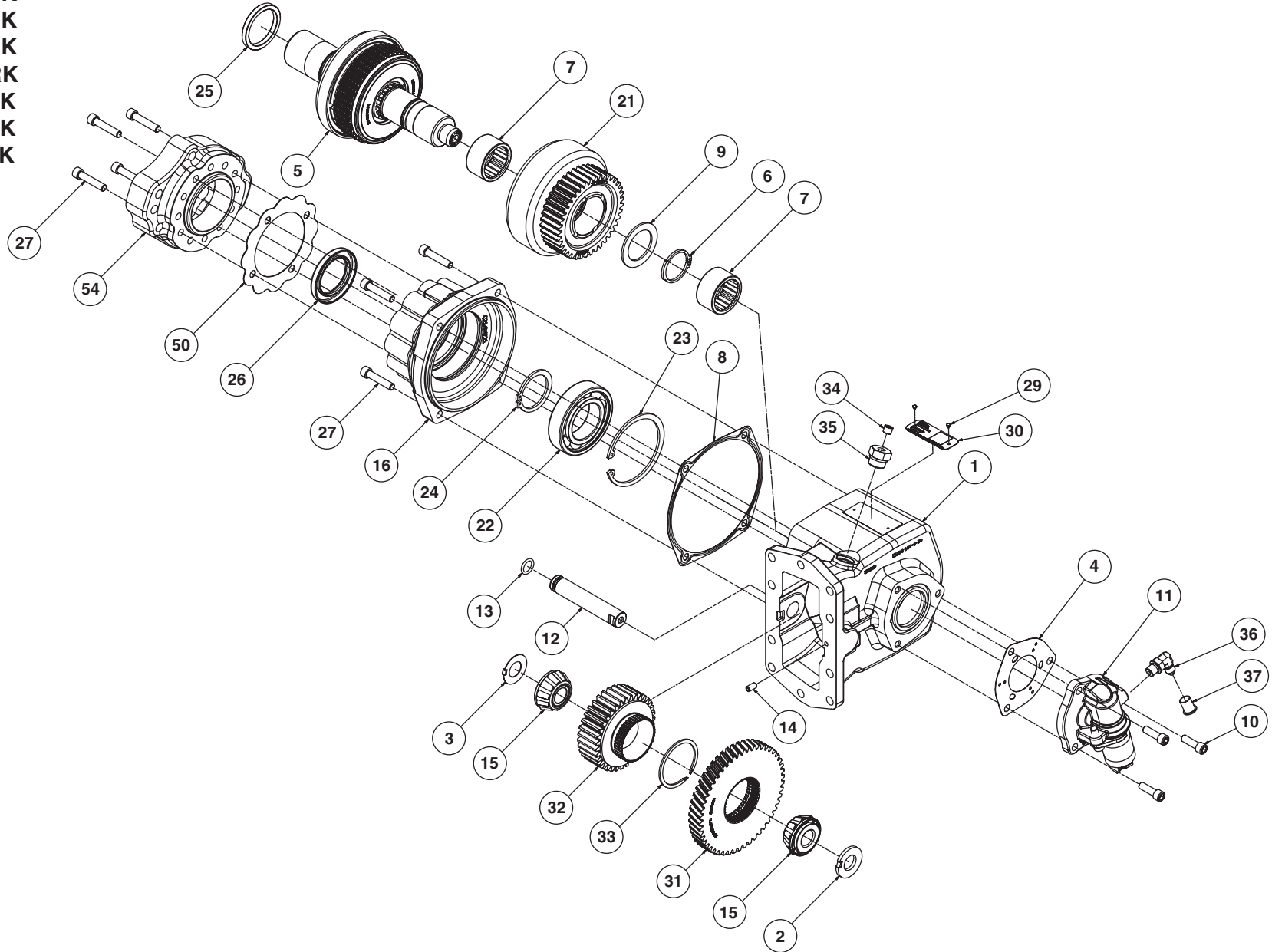
Item	Part Number	Description	Qty.
25	4-P-187	Spacer 1.776" x 2.200" x .239"	1
26	28-P-267	Oil Seal 2.627" x 1.750" x .312"	1
27	378447-8	Capscrew SH .312" - 18 x 1.500"	4
29	378422	Drive Screw.....	2
30	68-P-51	Name Plate	1
31	5-P-1491 ⁽¹⁾	Gear Input 50T ("FJ" Gear Pitch)	1
32	5-P-1482 ⁽¹⁾	Gear Ratio 35T	1
33	379522	Lockring	1
34	379231	Plug Pipe .125" - 27	1
35	379242	Adapter Straight .125" - 27 x .750" - 16	1
36	379486	Fitting 90°.....	1
37	379564-2	Cap Thread .438".....	1
50	35-P-101	Gasket Bearing Cap Wet Spline	1
54	21-P-731	Pump Flange	1

Service Kits

Part Number	Description
329071-62X	Gasket & Seal Kit (All Outputs Except "BA")
329071-63X	Bearing Kit "AC", "XD", "XV", "RF", "RK", "RS", "RY" and "RZ" (All Outputs Except "BA" and "UN")
329678X	Gear & Clutch Plates Kit (All)

See [Page 35-36](#) for Kits Bill of Materials

280GBFJP-B3RK
280GCFJP-B3RK
280GDFJP-B3RK
280GGFJP-B3RK
280GPFJP-B3RK
280GSFJP-B3RK
280GTFJP-B3RK



Bill of Materials**Service Manual
280 Series****280GMFJP-B8RK**

Item	Part Number	Description	Qty.
1	1-P-708	Housing.....	1
2	14-P-73-1	Spacer .762" x 1.500" x .150" Thickness As Required	1 or
	14-P-73-2	Spacer .762" x 1.500" x .153"	1 or
	14-P-73-3	Spacer .762" x 1.500" x .156"	1
3	31-P-102	Washer Thrust .754" x .440 x .030"	1
4	22-P-112	Gasket.....	1
5	329724-4X	Drive Shaft & Clutch Assembly "RK".....	1
6	379746	Lockring	1
7	560972	Bearing Needle Roller Assembly 1.500" x 1.875" x 1.000".....	2
8	22-P-101	Gasket.....	1
9	31-P-70	Washer Thrust 1.507" x 2.167" x .094"	1
10	378447-6	Capscrew SH .312" - 18 x 1.000"	3
11	329463-12X	12V Valve Cap Assembly.....	1
12	9-P-106	Idler Shaft .75"	1
13	28-P-191	O-Ring .549" x .103"	1
14	378452-7	Set Screw SH .250" - 20 x .500"	1
15	550439	Tapered Bearing Cone .750" x .8598"	2
16	21-P-767	Bearing Cap.....	1
21	2-P-930 ⁽¹⁾	Output Gear 40T.....	1
22	550311	Ball Bearing 1.77" x 3.346" x .748"	1
23	378263	Lockring	1
24	379555	Lockring	1

⁽¹⁾ See [Page 23](#) for other Gear Options

Item	Part Number	Description	Qty.
25	4-P-187	Spacer 1.776" x 2.200" x .239"	1
26	28-P-267	Oil Seal 2.627" x 1.750" x .312"	1
27	378447-8	Capscrew SH .312" - 18 x 1.500"	4
29	378422	Drive Screw.....	2
30	68-P-51	Name Plate	1
31	5-P-1491 ⁽¹⁾	Input Gear 50T ("FJ" Gear Pitch)	1
32	5-P-1482 ⁽¹⁾	Gear Ratio 35T	1
33	379522	Lockring	1
34	379231	Pipe Plug .125" - 27	1
35	379242	Adapter Straight .125" - 27 x .750" - 16	1
36	379486	Fitting 90°.....	1
37	379564-2	Cap Thread .438".....	1
50	35-P-101	Gasket Bearing Cap Wet Spline	1
54	21-P-731	Pump Flange	1

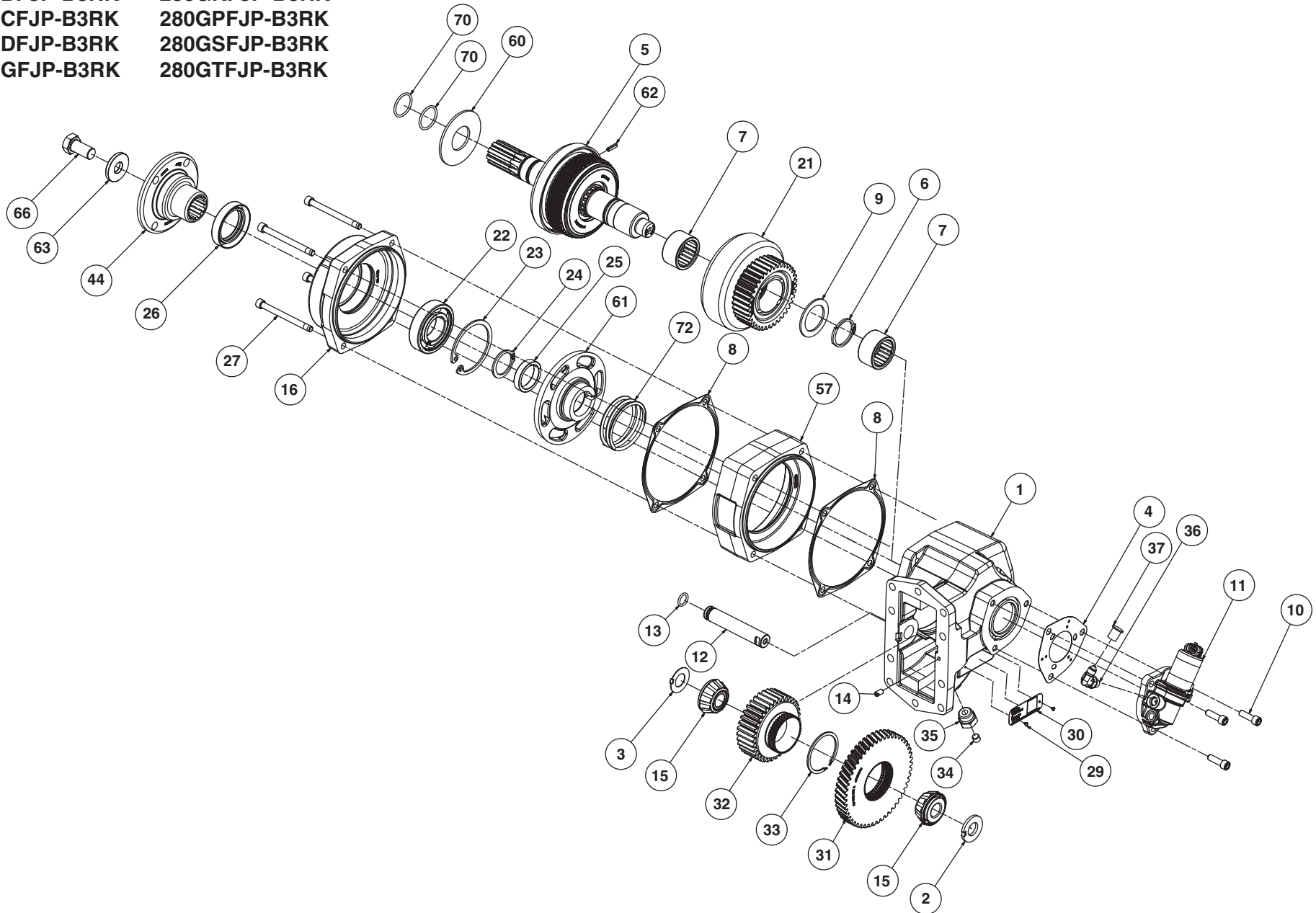
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Part Number	Description
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329071-63X	Bearing Kit "AC", "XD", "XV", "RF", "RK", "RS", "RY" and "RZ" (All Outputs Except "BA" and "UN")
329678X	Gear & Clutch Plates Kit (All)

See [Page 35-36](#) for Kits Bill of Materials

280GBFJP-B3RK
280GCFJP-B3RK
280GDFJP-B3RK
280GGFJP-B3RK

280GKFJP-B3RK
280GPFJP-B3RK
280GSFJP-B3RK
280GTFJP-B3RK



Bill of Materials**Service Manual
280 Series****280GMFJP-B3BA**

Item	Part Number	Description	Qty.	Item	Part Number	Description	Qty.
1	1-P-703	Housing.....	1	27	378447-16	Capscrew SH .312" - 18 x 3.500"	4
2	14-P-73	Spacer .762" x 1.500" x .156"	1	29	378422	Drive Screw.....	2
3	31-P-102	Washer Thrust .754" x .440" x .030"	1	30	68-P-51	Name Plate	1
4	22-P-112	Gasket.....	1	31	5-P-1491 ⁽¹⁾	Input Gear 50T ("FJ" Gear Pitch)	1
5	329723X	Drive Shaft & Clutch Assembly	1	32	5-P-1482 ⁽¹⁾	Gear Ratio 35T	1
6	379746	Lockring	1	33	379522	Lockring	1
7	560972	Bearing Needle Roller Assembly 1.500" x 1.875" x 1.000".....	2	34	379231	Pipe Plug .125" - 27	1
8	22-P-101	Gasket.....	2	35	379242	Adapter Straight .125" - 27 x .750" - 16	1
9	31-P-70	Washer Thrust 1.507" x 2.167" x .094"	1	36	379486	Fitting 90°.....	1
10	378447-6	Capscrew SH .312" - 18 x 1.000"	3	37	379564-2	Cap Thread .438"	1
11	329463-12X	12V Valve Cap Assembly.....	1	44	380081	Companion Flange 1410	1
12	9-P-106	Idler Shaft .75"	1	57	23-P-68	Spacer Drag Brake Bearing Cap	1
13	28-P-191	O-Ring .549" x .103"	1	60	31-P-113	Washer Thrust 1.385" x 3.125" x .125"	1
14	378452-7	Set Screw SH .250" - 20 x .500"	1	61	329410X	Brake Assembly	1
15	550439	Bearing Tapered Cone .750" x .8598"	2	62	379977	Spring Pin	1
16	21-P-773	Bearing Cap.....	1	63	4-P-130	Washer.....	1
21	2-P-933 ⁽¹⁾	Output Gear 37T	1	66	378435-7	Hex. Head Capscrew .625" - 11 x 1.250".....	1
22	550010	Ball Bearing 1.378" x 2.8346" x .6693"	1	70	28-P-244	O-Ring 1.174" x .103"	2
23	378895	Lockring	1	72	37-P-60	Spring 2.531" x 2.13" x .172"	1
24	378576	Lockring	1				
25	4-P-186	Spacer 1.385" x 1.750" x .365"	1				
26	28-P-212	Oil Seal 2.506" x 1.750" x .315"	1				

⁽¹⁾ See [Page 23](#) for other Gear Options**Service Kits**

Part Number	Description
329071-64X	Bearing Kit ("BA" and "UN" Outputs)
329678X	Gear & Clutch Plates Kit (All)

See [Page 35-36](#) for Kits Bill of Materials

**S
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2**

Before disassembling any Chelsea P.T.O. inspect it for clues to the failure. Do this now so you don't lose valuable evidence during disassembly.

Check the case for wear or damage. Gears should spin freely, with no side-to-side movement. The output shaft should turn with no radial movement.

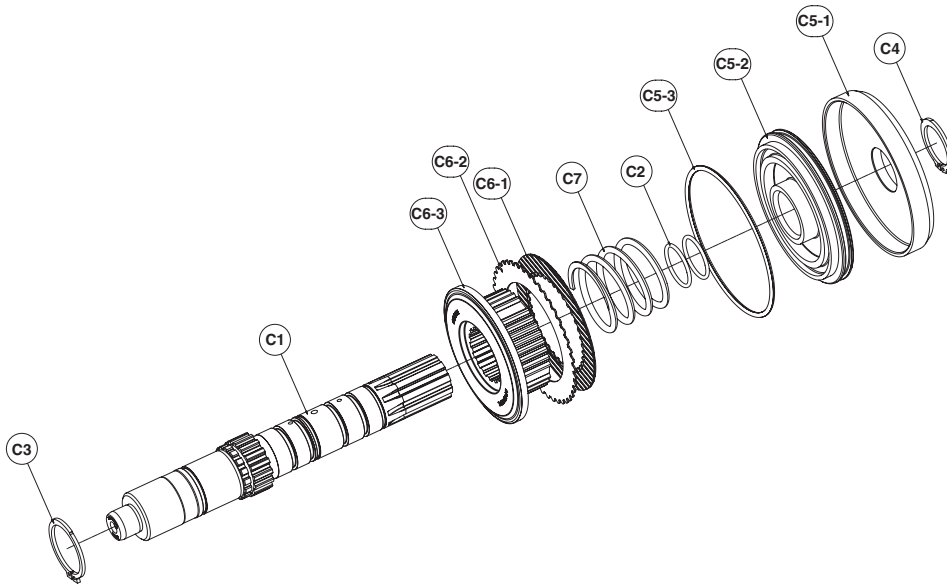
Disassembly

1. Output Bearing and Clutch Pack
 - 1.1. Remove the four Pump Flange Cap Capscrews (27). Lift the Pump Flange (54) from the Open End Bearing Cap (16).
 - 1.2. Remove the four Capscrews (27) from the Open End Bearing Cap (16), lift the Bearing Cap (16), Gasket (8) and Shaft/Clutch Assembly (5) from the Housing (1).
 - 1.3. **NOTE:** At this point Items (25), (5), (7), (21), (9) and (6) will come out of the unit.
 - 1.4. Place the Assembly in a Soft-Jawed Vise. Support the Shaft above the Bearing surface.
- 1.5. Use a Screwdriver or a Seal Remover to pry the Oil Seal (26) from the Bearing Cap (16). **Important:** This Seal will be damaged during removal. Replace it with a new one.
- 1.6. Remove the Retaining Ring (24) from the Output Shaft.
- 1.7. Support the Assembly directly underneath the Bearing Cap (16). Using an Arbor Press, press the Output Shaft through the Bearing Cap (16).
- 1.8. Remove the Retaining Ring (23) and Bearing (22) from the Bearing Cap (16). If the Bearing sticks, tap it with a Soft Mallet and a Driver.

Disassembly

2. Clutch Pack and Output Shaft

- 2.1. Remove the Spacer (25) from the Shaft (C1).
- 2.2. Remove the Retaining Ring (6), Thrust Washer (9) and Output Gear (21). Inspect the Washer (9) for heat damage. Replace if necessary.
- 2.3. Next, compress the Clutch Assembly (5).
- 2.4. Remove the Retaining Ring (C4)
- 2.5. Slide the Clutch Back-Up Cylinder (C5-1) and Piston (C5-2) off the Shaft (C1). Remove the O-Ring (C5-3) from the Piston (C5-2). Inspect the Piston for galling or scratches.
- 2.6. Remove the Return Spring (C7). Check it for cracks or breaks. Also remove the two Shaft O-Rings (C2) that seal off the Piston (C5-2) and Clutch Back-Up Cylinder (C5-1).
- 2.7. Remove and inspect the Clutch Plates (C6-2) and Friction Discs (C6-1). If debris is present but the Chelsea P.T.O. Gears (C6-3) aren't damaged, it indicates possible transmission problems. If the components are burnt, the problem may be low lubricant levels, misapplication, or P.T.O. engagement at too high an R.P.M.
- 2.8. Remove the Clutch Gear (C6-3) off the Shaft (C1). Check it for wear or damage. Replace if necessary. Retaining Ring (C3) can stay on the Shaft (C1) if they aren't damaged.
- 2.9. Remove and inspect Shaft (C1) especially the Bearing surfaces for nicks, scratches, or other damage. The best way to discover these problems is to run your fingernail across the Shaft (C1) surface. If you feel a scratch, replace the Shaft (C1). Also make sure the Pressure Port is clear. Do this by blowing air through the hole.
- 2.10. Reference main drawing. Using an appropriate driver, press the Internal Needle Bearing (7) from the Output Gear (21). Press against the flat surface of the Bearing (7).
- 2.11. Inspect the Output Gear (21) for cracks, pitting, missing teeth or other damage. Replace if necessary.



Item	Part Number	Description	Qty.
C1	3-P-1072	Output Shaft 10T Straight (329723X)	1 or
C1-1	3-P-1141	Output Shaft 1.25" Keyed (329723-1X).....	1
C2	28-P-244	O-Ring 1.174" x .103"	2
C3	380069	Lockring	1
C4	378576	Lockring	1
C5	329179-1X	Ass'y Piston & Back-Up Cylinder	1
C5-1	379323-1	Cylinder Clutch Back-Up	1
C5-2	380057-1	Piston Clutch Hydraulic	1
C5-3	28-P-178	O-Ring 4.484" x .138"	1
C6	329678X	Gear & Plates Kit	1
C6-1	379485	Disc Friction	11
C6-2	380065	Clutch Plate	10
C6-3	2-P-858	Output Gear 36T	1
C7	37-P-39	Spring 2.552" x 1.985"	1

Disassembly

3. Valve & Cap Assembly

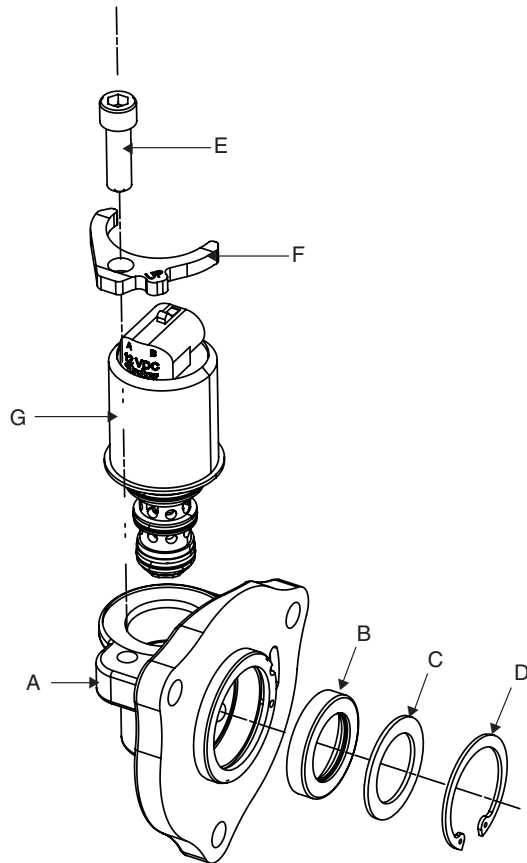
3.1. Remove the three Socket Head Capscrews (10), Valve Assembly (11), and Valve Cap Gasket (4) from the Chelsea P.T.O.

3.2. Carefully remove the Retaining Ring (D) and Washer (C). Visually inspect the Oil Seal (B) now. If you see signs of wear or leakage, remove the Seal (B).

Important: Do not nick the Seal Bore. This could result in leakage or further damage to the P.T.O.

3.3. Remove the Solenoid Valve (G) Socket Capscrew (E). Use a Screwdriver in the Shaft Seal Opening to carefully pry the Solenoid Valve (G) loose from the Housing (A). Be careful not to damage the Seal.

3.4. Remove the Solenoid Valve (G) from the cap. Check the O-Rings for damage. If they are damaged, replace the O-Rings.



Item	Part Number	Description	Qty.
11	329442-12X	Valve & Cap Assembly (12V) ("KV" Pitch Only).....	1 or
	329442-24X	Valve & Cap Assembly (24V) ("KV" Pitch Only).....	1
	329463-12X	Valve & Cap Assembly (12V) ("FJ" Pitch Only).....	1 or
	329463-24X	Valve & Cap Assembly (24V) ("FJ" Pitch Only).....	1
A	34-P-143	Valve Cap	1
B	28-P-119	Oil Seal (Hi Pressure).....	1
C	378811	Washer	1
D	378849	Retaining Ring	1
E	378447-6	Sockethead Capscrew .312" - 18 x 1.00"	1
F	379995	Clamp ("KV") Included with 379993 Valve	1 or
	380012	Clamp ("FJ") used with 380011 Valve.....	1
	380124	Clamp ("FJ") used with 380123 Valve.....	1
G	379993-12	Hydraulic Valve (12V) ("KV") (White Connector).....	1 or
	379993-24	Hydraulic Valve (24V) ("KV") (Black Connector)	1
	380011-12	Hydraulic Valve (12V) ("FJ") (White Side Connector)	1
	380011-24	Hydraulic Valve (24V) ("FJ") (Black Side Connector).....	1 or
	380123-12	Hydraulic Valve (12V) ("FJ") (White Connector Top) (New Style)	1 or
	380123-24	Hydraulic Valve (24V) ("FJ") (Black Connector Top) (New Style)	1

Disassembly

4. Input Gear Sub-Assembly
 - 4.1. Next, remove Set Screw (14) from Main Housing (1).
 - 4.2. Pull the Idler Shaft (12) from the Housing (1) by using a long threaded 3/8" - 16 Bolt. Replace Shaft (12) if it is nicked or scratched. Inspect the Shaft O-Ring (13) for nicks or cuts, replace if necessary.
 - 4.3. Remove the Input Gear section (31), (32) & (33), one Spacer (2) and one Thrust Washer (3). Remove the two Tapped Bearing Cones (15) from the Gear. Inspect Gear Races and Teeth for cracks, nicks, heat signs or other damage. Replace if necessary.
 - 4.4. Press the remaining Needle Bearing (7) from the Housing (1). **Important:** This Bearing (7) will be damaged during removal. Replace it with a new one.
 - 4.5. Inspect the Housing (1) for deep grooves, gouges, and cracks. Make sure sealing surfaces are smooth
 - 4.6. Chelsea strongly recommends that you replace all used Retaining Rings, O-Rings, Seals, Bearings and Gaskets with new ones during P.T.O. service. Also replace any worn or damaged components you found during disassembly.
 - 4.7. Clean all reusable components.

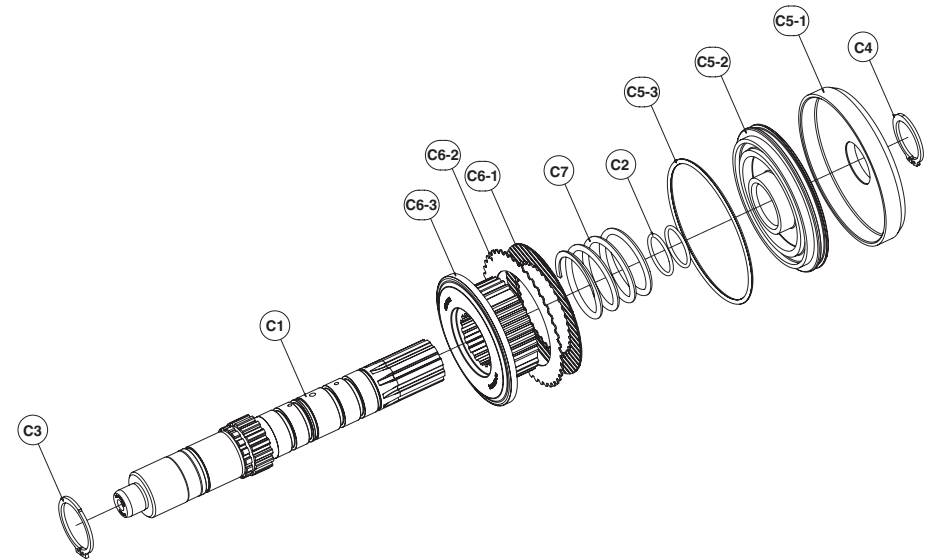
Assembly

1. Assembly

1.1. Output Shaft and Clutch Pack Assembly - Standard

- 1.1.1. If the Spacer (25) and Retaining Ring (C4) were removed from the Shaft earlier, replace them with new ones now.
- 1.1.2. Lubricate the Output Shaft (C1). Secure it in a Vise, making certain not to scratch it.
- 1.1.3. Install the Clutch Gear (C6-3).
- 1.1.4. Lubricate the metal Clutch Plates (C6-1). Then starting with a Friction Disc (C6-1) (which has teeth on the inner diameter), alternately stack all the Friction Discs (C6-1) and Clutch Plates (C6-2) (which have teeth on the outer diameter) on the Shaft.
- 1.1.5. Install the two O-Rings (C2) on the Shaft.
- 1.1.6. Install the Return Spring (C7).
- 1.1.7. Lubricate a new Block Vee Ring (C5-3) and position it on the Piston (C5-2). The open face of the Ring should face toward the Clutch Back-Up Cylinder (C5-1).
- 1.1.8. Install the Piston (C5-2), centering it over the Spring. Install the Clutch Back-Up Cylinder (C5-1).
- 1.1.9. Compress the Piston and Clutch Assembly down past the Retaining Ring groove. Install a new Retaining Ring (C4).
- 1.1.10. **NOTE:** If servicing a unit with a Shaft Brake ("BD" output) refer to "Shaft Brake Assembly" if standard Shaft Output go to 1.1.11
 - 1.1.10.1. Shaft Brake Assembly
 - 1.1.10.2. Slide Washer (60) onto output side of Shaft.
 - 1.1.10.3. Slide the two O-Rings (70) onto Shaft and into the grooves in shaft. Take care not to nick O-Rings.
 - 1.1.10.4. Slide Spring (72) onto output side of Shaft.
 - 1.1.10.5. Install Brake Assembly (61) onto Shaft making sure the slot slides over the Pin (62) on the Shaft.
 - 1.1.10.6. Install Spacer (25)
 - 1.1.10.7. Install Snap Ring (24) on shaft to hold Brake Assembly on Shaft.
 - 1.1.10.8. Go to 1.1.12
- 1.1.11. Install the Spacer (25)
- 1.1.12. Lubricate a new Ball Bearing (22) and install it into the Bearing Cap (16). Use a soft Mallet and a proper Driver to do this.
- 1.1.13. Secure the Bearing with a new Retaining Ring (23).
- 1.1.14. Position the Bearing Cap over the Output Shaft. Support the Shaft Assembly in a press, being careful not to damage it. Using an appropriate Driver, press on the inner Bearing Race until resistance is felt.
- 1.1.15. Secure the Assembly with a new Retaining Ring (24)

- 1.1.16. Lubricate a new Bearing Cap Oil Seal (26). Then using an appropriate Shaft Seal Slide, Driver and a soft Mallet or Press, install it into the Bearing Cap (16).



Item	Part Number	Description	Qty.
C1	3-P-1072	Output Shaft 10T Straight (329723X)	1 or
C1-1	3-P-1141	Output Shaft 1.25\" Keyed (329723-1X).....	1
C2	28-P-244	O-Ring 1.174\" x .103\"	2
C3	380069	Lockring	1
C4	378576	Lockring	1
C5	329179-1X	Ass'y Piston & Back-Up Cylinder.....	1
C5-1	379323-1	Cylinder Clutch Back-Up	1
C5-2	380057-1	Piston Clutch Hydraulic.....	1
C5-3	28-P-178	O-Ring 4.484\" x .138\"	1
C6	329678X	Gear & Plates Kit.....	1
C6-1	379485	Disc Friction	11
C6-2	380065	Clutch Plate	10
C6-3	2-P-858	Output Gear 36T	1
C7	37-P-39	Spring 2.552\" x 1.985\"	1

Assembly

1.3. P.T.O. Housing

- 1.3.1. Lubricate a new Needle Bearing (7) and install it into the Chelsea P.T.O. Housing (1). Using a proper Driver will help ensure that the Bearing is seated properly. Press on the flat side of the Bearing. The rounded side of the Bearing should face away from the Housing (1).

1.4. Output and Flange Assembly Installation

- 1.4.1. Place a new Gasket (8) on the P.T.O. Housing (1) mating face.
- 1.4.2. **Caution:** Do not use sealing compounds. It could affect the correct operation of the transmission. Install the Clutch Pack/ Bearing Cap Assembly into the Chelsea P.T.O. Housing (1)
- 1.4.3. **NOTE:** See "BA" Flange Output for Shaft Brake Installation
- 1.4.4. Secure the Bearing Cap (16) with Socket Head Capscrews (27). Tighten them, and torque to 16-20 Lbs. ft. (22 – 27 N.m.).
- 1.4.5. **"XD" Output Option**
 - 1.4.5.1. Use a soft Mallet to install a new Woodruff Key (63) into the Output Shaft.
- 1.4.6. **"VX" Output Option**
 - 1.4.6.1. Place a new Gasket (8) on the P.T.O. Housing (1) mating face.
 - 1.4.6.2. **Caution:** Do not use sealing compounds. It could affect the correct operation of the transmission. Install the Clutch Pack/ Bearing Cap Assembly into the Chelsea P.T.O. Housing (1)
 - 1.4.6.3. Secure the Bearing Cap (16) with Socket Head Capscrews (27). Tighten them, and torque to 16-20 Lbs. ft. (22 – 27 N.m.).
 - 1.4.6.4. Install Output Shaft Companion Flange (44) onto Output Shaft
 - 1.4.6.5. Install Washer (63) and Hex Head Capscrew (66) into Threaded Bore on Output Shaft and torque to 75-85 Lbs. ft. [102 – 115 N.m.].

1.4.7. "BA" Output Option

- 1.4.7.1. Place a new Gasket (8) on the P.T.O. Housing (1) mating face.
- 1.4.7.2. **Caution:** Do not use sealing compounds. It could affect the correct operation of the transmission. Install the Clutch Pack/ Bearing Cap Assembly into the Chelsea P.T.O. Housing (1)
- 1.4.7.3. Install Shaft Brake Housing (1) Spacer (57) with another Gasket (8)
- 1.4.7.4. Secure the Bearing Cap (16) with Socket Head Capscrews (27). Tighten and torque to 16-20 Lbs. ft. (22 – 27 N.m.).
- 1.4.7.5. Install Output Shaft Companion Flange (44) onto Output Shaft
- 1.4.7.6. Install Washer (63) and Hex Head Capscrew (66) into Threaded Bore on Output Shaft and torque to 75-85 Lbs.ft. [102 – 115 N.m.].

1.4.8. Pump Flange Options

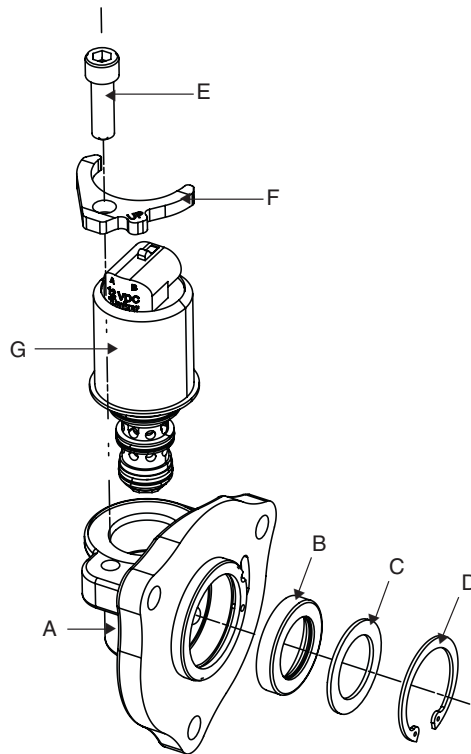
- 1.4.8.1. Install Rotatable Flange (54) and Gasket (50) after installing P.T.O. on transmission or on bench. Torque the four Socket Head Capscrews (27) to 16-20 Lbs. ft. [22 – 27 N.m.].

1.5. Input Gear Assembly

- 1.5.1. Install new, lubricated Bearing Cones (15) into the Input Gear (31), (32) and (33). The tapers should go toward the center of the Gear.
- 1.5.2. Next, place Tabbed Washer (12) next to the tall side of the Gear. This Washer shims the unit.
- 1.5.3. Place the Thrust Washer (3) on the ratio side of the Gear. Place the components into the Housing (1).
- 1.5.4. Align the Gear Assembly with the Idler Shaft (12) hole.
- 1.5.5. Place a new, lubricated O-Ring (13) on the Idler Shaft (12). Push it into the Housing (1) from the side opposite of the Roll Pin until it is just below the Housing (1) surface. Use the special alignment tool to make the job easier. The Shaft can only be installed from one direction because of the Roll Pin in the Housing (1).
- 1.5.6. **NOTE:** Once the Input Gear Assembly is installed, spin the Gear to seat the Tapered Bearing Cones. There should be no side-to-side Gear movement. If side-to-side movement exists, re-shim the Gear with the appropriate thickness of shims.

Assembly

- 1.6. Valve Cap Assembly
 - 1.6.1. If the Valve Assembly Oil Seal (**B**) was worn or damaged, replace it now. Lubricate a new Seal. Install it carefully with the proper Driver. **Important:** Avoid nicking the Housing (**1**). This could cause leakage or other PTO damage.
 - 1.6.2. Next install the Washer (**C**) and Retaining Ring (**D**).
 - 1.6.3. Lubricate and attach the Solenoid Valve (**G**) to the Cap (**A**).
 - 1.6.4. Next install the Clamp (**F**) and Socket Head Capscrew (**E**). Secure the Solenoid to the Valve Cap (**A**) with Socket Head Capscrew (**E**). Torque it to 96 – 120 in-lbs (11 – 14 Nm).
 - 1.6.5. Place a new Valve Cap Gasket (**4**) on the Valve Assembly. Make sure the holes are aligned. **Caution:** Do not use sealing compounds. It could affect the correct operation of the transmission.
 - 1.6.6. Attach the Valve Assembly to the PTO Housing (**1**). Tighten the three Capscrews (**10**) and torque them to 192 – 240 in-lbs (22 – 27 Nm).
2. Final Check
 - 2.1. While holding the Input Gear, turn the Output Shaft. If everything is assembled correctly, the Shaft will turn freely. Next, roll the Gears. They should roll freely. No side-to-side wobble should occur if the unit is assembled correctly.
 - 2.2. The unit is ready to be installed back on the transmission



Item	Part Number	Description	Qty.
11	329442-12X	Valve & Cap Assembly (12V) ("KV" Pitch Only).....	1 or
	329442-24X	Valve & Cap Assembly (24V) ("KV" Pitch Only).....	1
	329463-12X	Valve & Cap Assembly (12V) ("FJ" Pitch Only).....	1 or
	329463-24X	Valve & Cap Assembly (24V) ("FJ" Pitch Only).....	1
A	34-P-143	Valve Cap	1
B	28-P-119	Oil Seal (Hi Pressure).....	1
C	378811	Washer	1
D	378849	Retaining Ring	1
E	378447-6	Sockethead Capscrew .312" - 18 x 1.00"	1
F	379995	Clamp ("KV") Included with 379993 Valve	1 or
	380012	Clamp ("FJ") used with 380011 Valve.....	1
	380124	Clamp ("FJ") used with 380123 Valve.....	1
G	379993-12	Hydraulic Valve (12V) ("KV") (White Connector).....	1 or
	379993-24	Hydraulic Valve (24V) ("KV") (Black Connector)	1
	380011-12	Hydraulic Valve (12V) ("FJ") (White Side Connector)	1
	380011-24	Hydraulic Valve (24V) ("FJ") (Black Side Connector).....	1 or
	380123-12	Hydraulic Valve (12V) ("FJ") (White Connector Top) (New Style)	1 or
	380123-24	Hydraulic Valve (24V) ("FJ") (Black Connector Top) (New Style)	1

SECTION 3

Torque Chart**Service Manual
280 Series**

Location	Torque (English)	Torque (Metric)
Idler Pin Screw Set	20 - 30 In. Lbs.	2 - 3 N.m.
Bearing Cap Open	24 - 28 Lbs. ft.	33 - 38 N.m.
Rotatable Flanges		
“RK”, “RF”, “RY” and “RS” (378447-8) (Qty. 4)	16 - 20 Lbs. ft.	22 - 27 N.m.
Valve Cap Assembly	24 - 28 Lbs. ft.	33 - 38 N.m.
Hydraulic Valve Clamp	96 - 120 In. Lbs.	11 - 13 N.m.
Shaft Nut “BA” and “XV” (378435-7)	75 - 85 Lbs. ft.	102 - 115 N.m.
Straight Thread Connector 90° (379486)	120 - 156 In. Lbs.	14 - 18 N.m.
Speed Sensor Port		
With E.O.C. (379243)	25 - 30 Lbs. ft.	34 - 41 N.m.
Without E.O.C.		
O-Ring Boss Plug (379242)	25 - 30 Lbs. ft.	34 - 41 N.m.
Pipe Plug (379231)	8 - 12 Lbs. ft.	11 - 16 N.m.

“3” and “5” Assembly Gear Chart

Gear Designator	Input Gear (31)	No. Teeth Input	Ratio Gear (32)	No. Teeth Ratio	Output Gear (21)	No. Teeth Output
280*BFJ	5-P-1491	50	5-P-1478	22	2-P-926	50
280*CFJ	5-P-1491	50	5-P-1495	25	2-P-927	47
280*DFJ	5-P-1491	50	5-P-1479	28	2-P-928	44
280*GFJ	5-P-1491	50	5-P-1480	31	2-P-929	41
280*KFJ	5-P-1491	50	5-P-1481	33	2-P-931	39
280*MFJ	5-P-1491	50	5-P-1482	35	2-P-933	37
280*PFJ	5-P-1491	50	5-P-1483	37	2-P-935	35
280*SFJ	5-P-1491	50	5-P-1484	39	2-P-936	33
280*TFJ	5-P-1491	50	5-P-1497	41	2-P-937	31
280*BKV	5-P-1493	45	5-P-1478	24	2-P-926	50
280*CKV	5-P-1493	45	5-P-1495	22	2-P-927	47
280*DKV	5-P-1493	45	5-P-1479	28	2-P-928	44
280*GKV	5-P-1493	45	5-P-1480	31	2-P-929	41
280*KKV	5-P-1493	45	5-P-1481	33	2-P-931	39
280*MKV	5-P-1493	45	5-P-1482	35	2-P-933	37
280*PKV	5-P-1493	45	5-P-1483	37	2-P-935	35
280*SKV	5-P-1493	45	5-P-1484	39	2-P-936	33
280*TKV	5-P-1493	45	5-P-1497	41	2-P-937	31

“8” Assembly Gear Chart

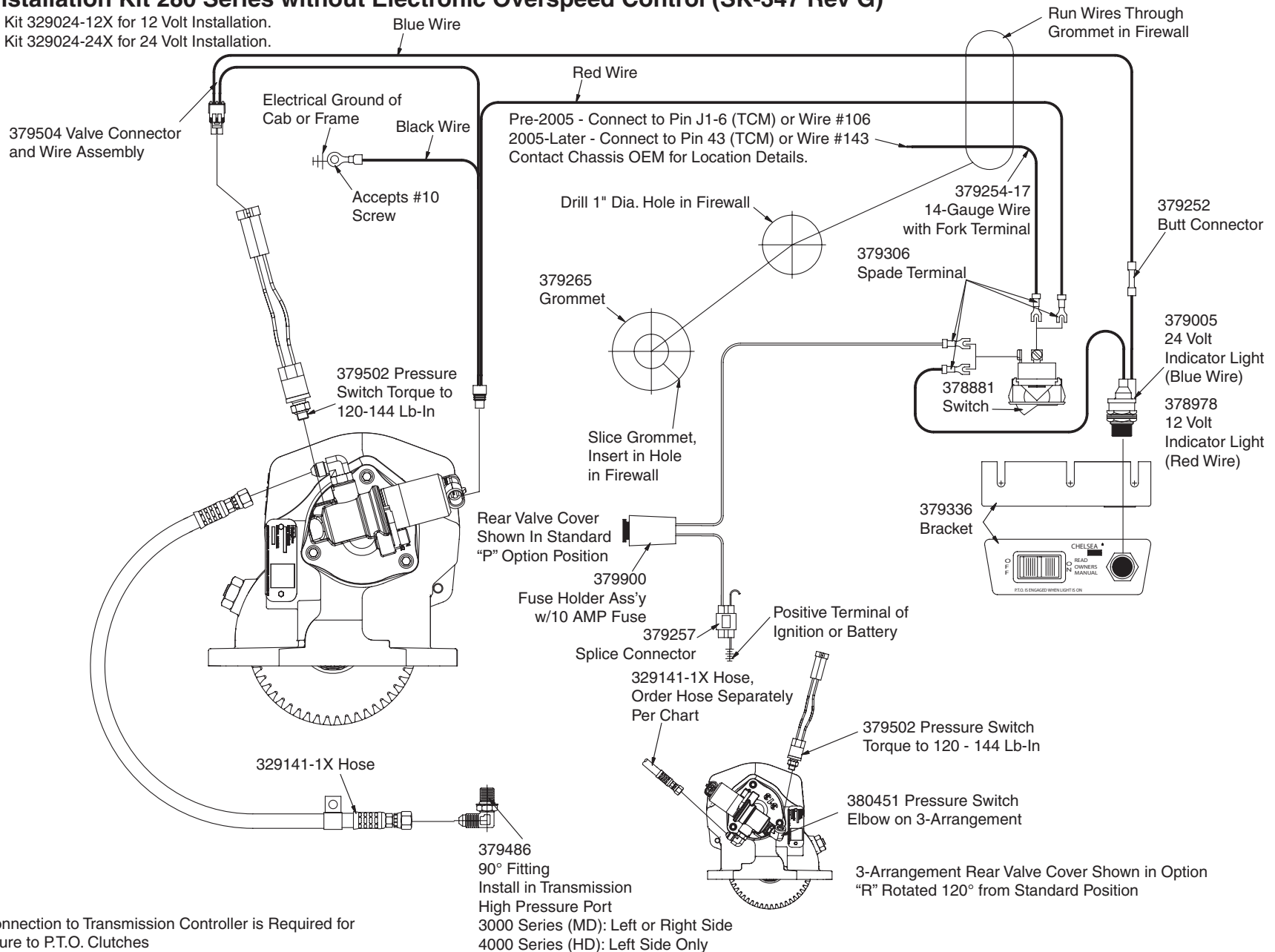
Gear Designator	Input Gear (31)	No. Teeth Input	Ratio Gear (32)	No. Teeth Ratio	Output Gear (21)	No. Teeth Output
280*BFJ	5-P-1491	50	5-P-1478	22	2-P-925	53
280*CFJ	5-P-1491	50	5-P-1495	25	2-P-926	50
280*DFJ	5-P-1491	50	5-P-1479	28	2-P-927	47
280*GFJ	5-P-1491	50	5-P-1480	31	2-P-928	44
280*MFJ	5-P-1491	50	5-P-1482	35	2-P-930	40
280*PFJ	5-P-1491	50	5-P-1483	37	2-P-932	38
280*SFJ	5-P-1491	50	5-P-1484	39	2-P-934	36
280*TFJ	5-P-1491	50	5-P-1485	42	2-P-936	33
280*BKV	5-P-1493	45	5-P-1478	22	2-P-925	53
280*CKV	5-P-1493	45	5-P-1495	25	2-P-926	50
280*DKV	5-P-1493	45	5-P-1479	28	2-P-927	47
280*GKV	5-P-1493	45	5-P-1480	31	2-P-928	44
280*MKV	5-P-1493	45	5-P-1482	35	2-P-930	40
280*PKV	5-P-1493	45	5-P-1483	37	2-P-932	38
280*SKV	5-P-1493	45	5-P-1484	39	2-P-934	36
280*TKV	5-P-1493	45	5-P-1485	42	2-P-936	33

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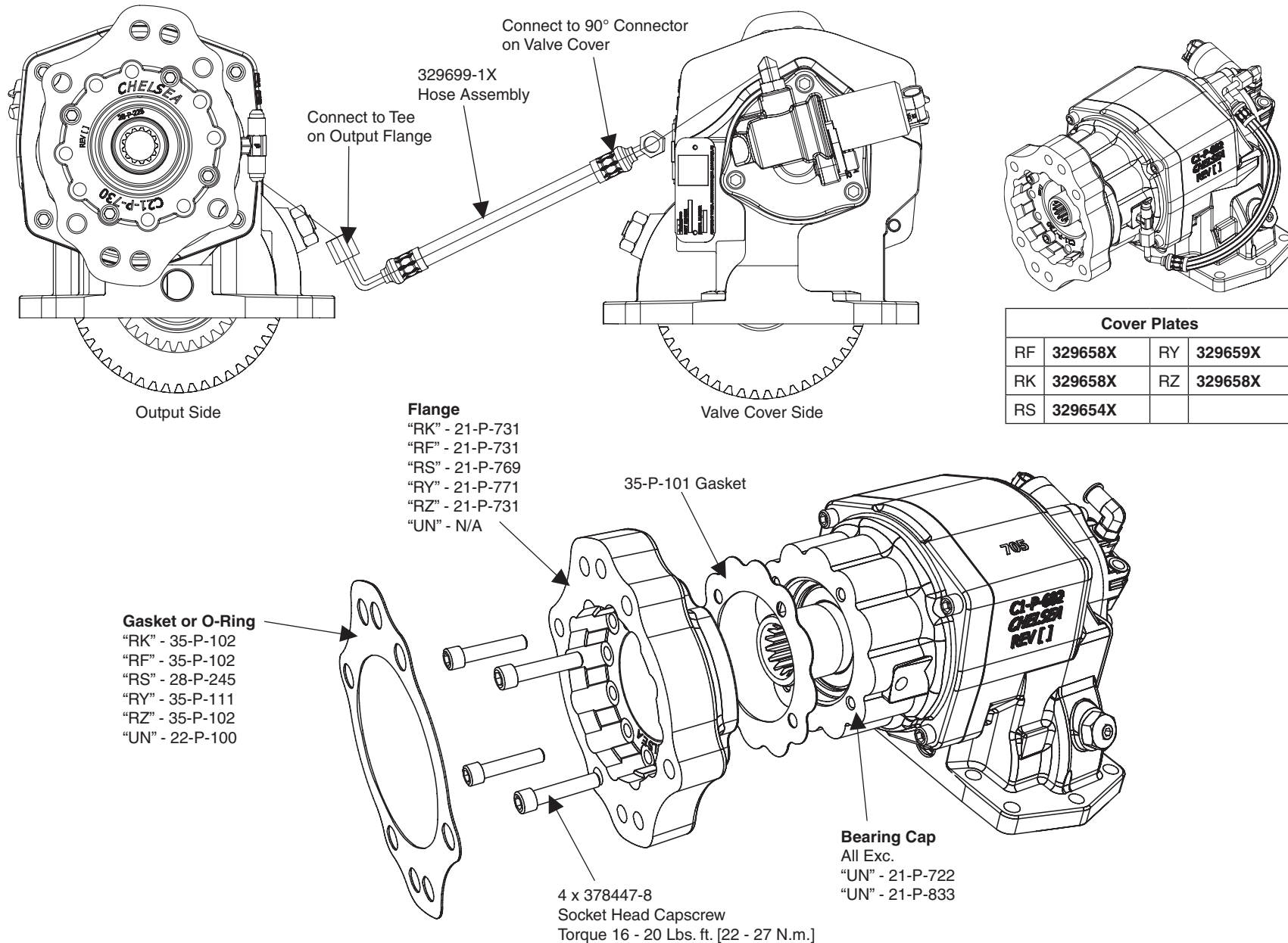
4**

Shift Installation Kit 280 Series without Electronic Overspeed Control (SK-347 Rev G)

Reference Kit 329024-12X for 12 Volt Installation.
 Reference Kit 329024-24X for 24 Volt Installation.



Installation “RF”, “RK”, “RS”, “RY”, “RZ” & “UN” Wet Spline 280 Series (SK-508)



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5**

Mounting the P.T.O. on the Transmission for Allison

When installing a P.T.O., always wear protective clothing and safety glasses.

1. Begin by draining the oil from the transmission. Use caution, since the oil may be hot (**Fig. 1**).

NOTE: Installation shown is for Left Side (Street Side) of transmission.

2. Remove the P.T.O. aperture plate with a 15mm socket (**Fig. 2**).
3. Remove the gasket and clean the aperture surface (**Fig. 3**).

NOTE: Do not reuse the gasket that comes with the transmission.

4. Using a screwdriver, install the guide pins until they bottom out (**Fig. 4**).

NOTE: Do not use sealing compounds because they are generally incompatible with automatic transmission fluid.

5. Install the special gasket over the guide pins. The ribbed surface should face outward, toward the installer (**Fig. 5**).

NOTE: To ensure proper backlash and sealing of P.T.O. to transmission only use gasket furnished with the P.T.O.

6. Position the P.T.O. and secure it with the top capscrew (**Fig. 6**).
7. Install the remaining capscrews. Torque all to 40 - 50 Lbs. ft. (54 - 68 N.m. or 5.5 - 6.9 Kg.m) (**Fig. 7**).

NOTE: Always use a crossing pattern with tightening capscrews.

8. If installing a wet spline output, attach hose to tee fitting on output flange. If non wet spline option attach hose to fitting at P.T.O. valve (**Fig. 8**).

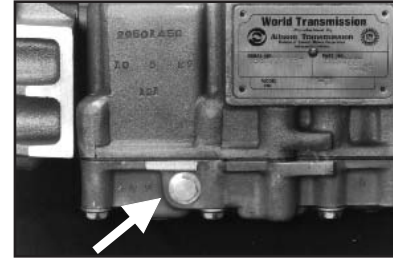


Fig. 1



Fig. 5



Fig. 2

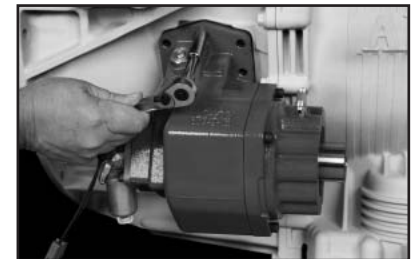


Fig. 6



Fig. 3

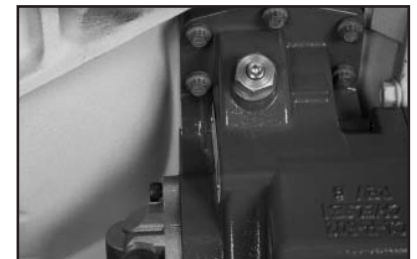


Fig. 7



Fig. 4



Fig. 8

9. Remove the Transmission High Pressure port plug and securely install the 90° elbow fitting supplied with the P.T.O. (**Fig. 9**).
10. Wet spline Option - Connect the pressure hose between the tee fitting on the output bearing cap and high pressure port on the transmission. Non-Wet spline Option - Attach hose between P.T.O. valve fitting and High Pressure Port on the transmission (**Fig. 10**).
11. After determining the position of the rotatable flange /pump, install the flange with the gasket and cap screws supplied with the P.T.O. (**Fig. 11**).

Installing Rotatable Flanges

The rotatable flange is shipped loose with the P.T.O. units for ease of installation. After determining the flange position, attach the flange to the P.T.O. bearing cap using the capscrews provided in the bag kit. After installing the capscrews make sure to torque the screws to 16 - 20 Lbs. ft. [22-27 N.m.]. Consideration should be taken on the size and weight of the pump being installed.

CAUTION: If not installing direct mount pump at this time install gasket, cover plate and bolts to wet spline output option to prevent transmission fluid from leaking out of P.T.O. flange if truck engine is turned "ON" (**Fig. 12**).

NOTE: Also see [page 22](#) for rotatable flange/wet spline information.

12. Complete the assembly by installing the electrical connection to the valve assembly (**Fig. 13**) and the pressure switch (**Fig. 14**).
13. Reference SK-Drawings in this book for complete installation information.

NOTE: After installation is complete refill transmission with oil as per manufacture recommendation. Run PTO for approximately 5-10 minutes. Check for any unusual noise or vibration also check for leaks and/or loose fittings or fasteners. Disengage P.T.O. and shut vehicle engine off.



Fig. 9

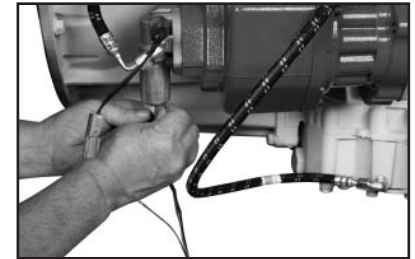


Fig. 13



Fig. 10



Fig. 14

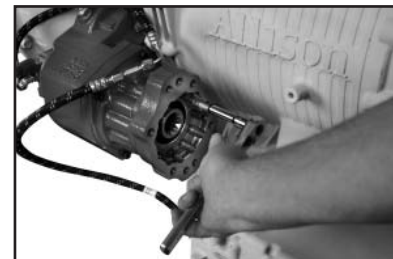


Fig. 11

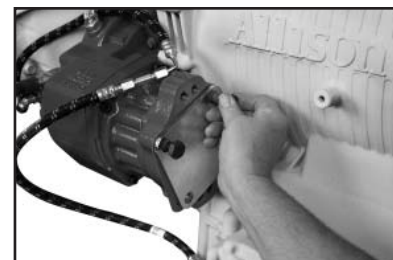
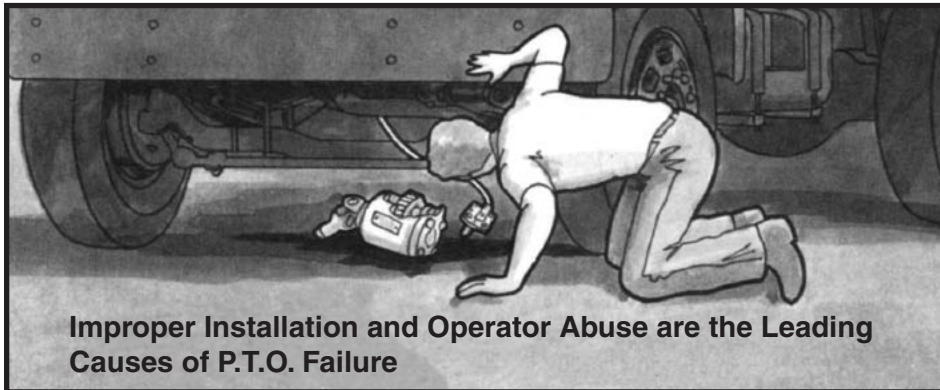


Fig. 12

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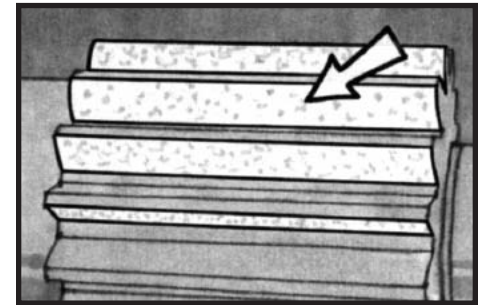
The Chelsea P.T.O. is designed and built to meet the rugged demands of the Mobile Equipment Industry. With proper use and maintenance, the Chelsea P.T.O. will provide a long service life, both on-highway and off. Yet, if a problem does arise, it is important to diagnose its causes and correct it at once.

The first place to look when troubleshooting a P.T.O. failure is in the application itself. Repeated or premature failure may be a sign of an incorrect application. This can be discovered by using the Chelsea HY25-3001/US General Information Catalog or HY25-3000/US Applications Catalog. Check to see if the proper P.T.O. was specified for the transmission, then find out if the torque handling capabilities of the P.T.O. are satisfactory for the job being done. A P.T.O. works best when it is properly specified for the transmission and job requirement.

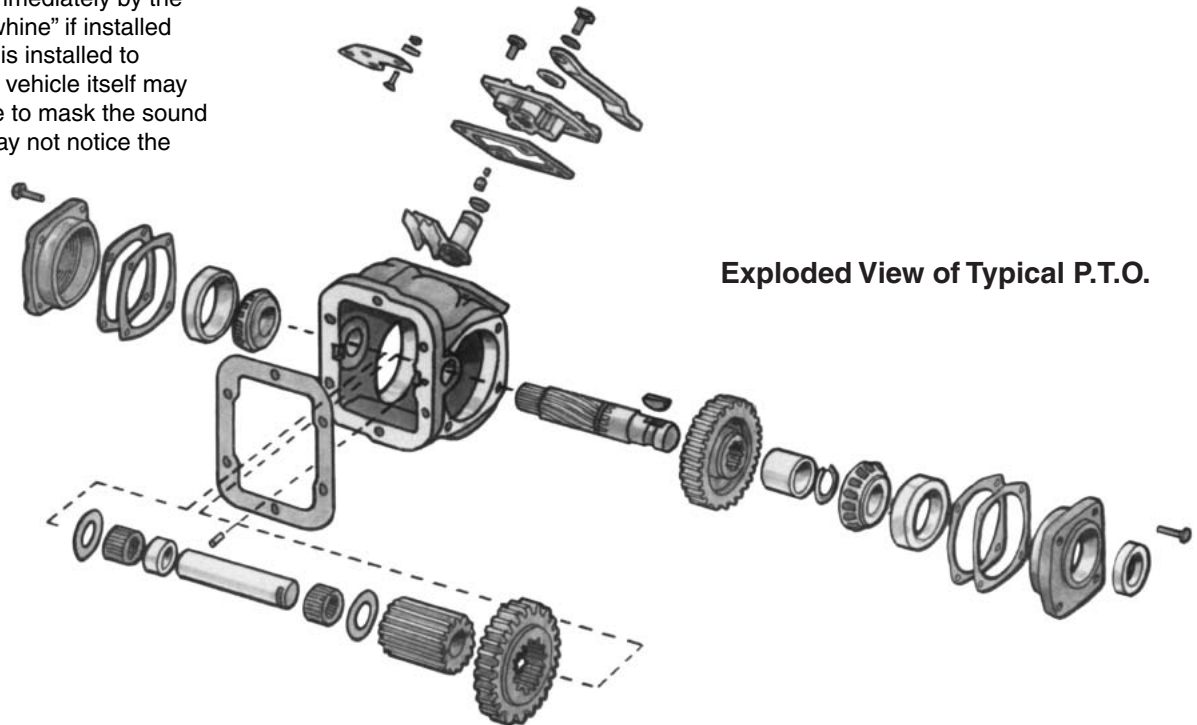
If the P.T.O. was correctly specified and then failed prematurely, there are two likely causes: improper installation and/or operator misuse. These are tough problems because they involve people as well as product. An improperly installed P.T.O. can normally be identified immediately by the sound it makes. It will "whine" if installed too tightly, or "clatter" if it is installed too loosely. Sometimes, the vehicle itself may contribute enough noise to mask the sound of the P.T.O. and one may not notice the problem.

If a problem is allowed to continue, then damage to the P.T.O. will result. A unit that has been mounted too loosely could result in broken gear teeth. A unit that is mounted too tightly could result in premature wear to the gear teeth. Also, when a P.T.O. is installed without enough filler blocks, spacers, or gaskets between it and the transmission, a deep wear pattern will occur on the gear teeth. These patterns will lead to fatigue and early tooth failure. To help prevent this from occurring, always test the P.T.O. for noise just after it is installed.

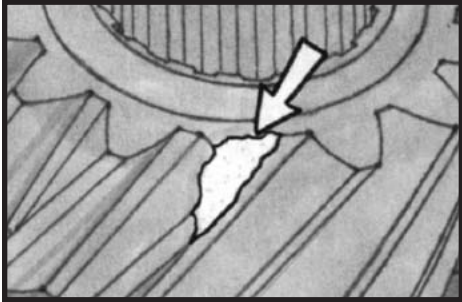
Whatever the reason for a P.T.O. failure, there will be confusion over who, or what, is at fault. More than likely the product will be blamed. Although the P.T.O. cannot defend itself, its failed parts will tell a story.



The first parts to inspect should be the gears. Check the surface of the gear teeth for signs of pitting . . . pitting is a normal wear pattern in most cases. However, contaminants in the oil or an installation that is too tight will cause severe pitting.

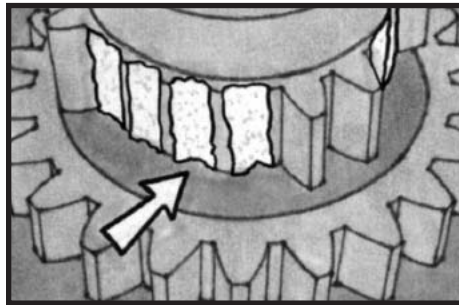


Once pitting of the gear surfaces has begun, there is nothing that can stop it. Severe pitting will eventually lead to gear tooth failure, therefore the damaged gear should be replaced when a P.T.O. is repaired or rebuilt.

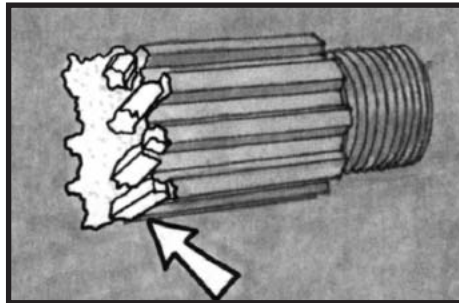


Sometimes a gear will chip a tooth because of mishandling or improper shifting. Even though a P.T.O. may continue to run with a chipped tooth, the damaged gear should be replaced immediately. It will damage the other teeth it comes in contact with during operation, not to mention the possible damage which could result from the loose chip. If the problem is allowed to continue, then failure to other parts in the P.T.O. or transmission could result.

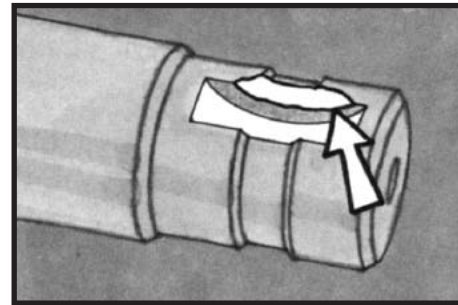
Another possible problem during vehicle operation is "shock load." This occurs when the torque demands on a P.T.O. are suddenly greater than it was designed to take. "Shock load" could be caused by torque overloads, improper shifting, equipment failure, or excessive loads over a short period of time. If this happens, the P.T.O. is likely to fail immediately. The vehicle operator may not even be aware of the reason for the P.T.O. failure.



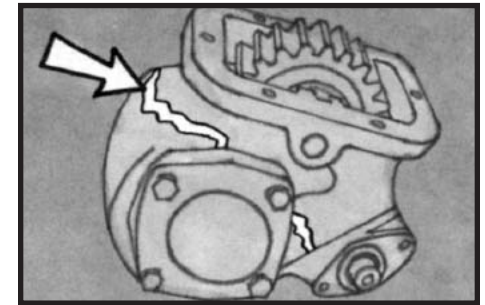
Worn gears can easily be affected by "shock load." If the worn gears are not replaced, they can eventually lead to broken gear teeth. This is the most severe form of P.T.O. failure. Worn or damaged gears are likely to break because of their reduced load carrying capacity. To prevent the possibility of broken gear teeth, always inspect auxiliary equipment for possible freeze-up. Also, recheck P.T.O. application, operating conditions and P.T.O. installation.



P.T.O. shafts are also vulnerable to operating abuse. If the shaft break is irregular, this usually indicates a torsional overload. Bending fatigue failure usually shows up as a smooth, flat break. To correct a P.T.O. shaft problem replace the failed shaft and check the speed and operating angle of the universal joint. Also, make sure the P.T.O. driveshaft is properly phased, (yokes in-line with each other). If a driveline is improperly installed it will cause vibration, which may lead to P.T.O. driveshaft or driven equipment problems.

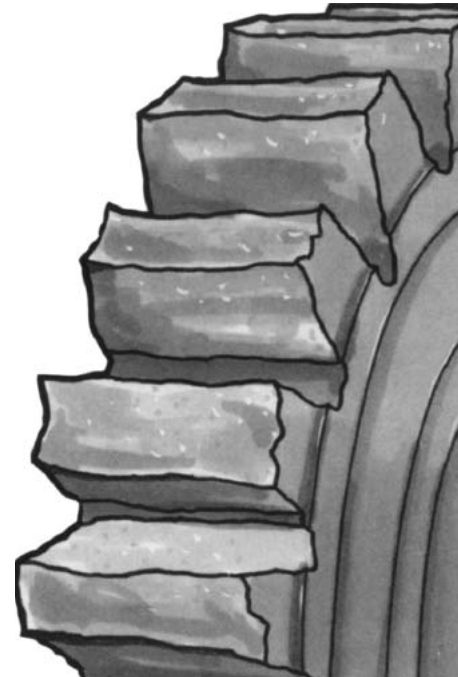


When inspecting a P.T.O. output shaft, always inspect the keyway. Sometimes a P.T.O. will fail because of a displaced keyway on the shaft caused by a loose fitting yoke or equipment freeze-up. Proper maintenance on auxiliary equipment and replacing a worn yoke and/or P.T.O. driven shaft will prevent this problem.

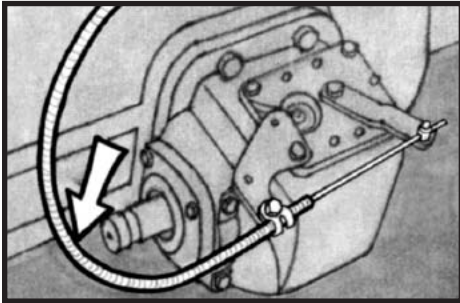


One of the most serious problems a P.T.O. can suffer is a cracked case. This condition can lead to oil loss and eventual transmission failure. Improper installation, poorly torqued bolts, or an unsupported direct mount pump can cause such a problem. A P.T.O. case can also be damaged by foreign objects meshing between the gear teeth, severe shock load, or even hitting an obstacle in the road.

Prevention is the best cure for P.T.O. case damage. Therefore, always torque the P.T.O. flange bolts in sequence and the proper specifications. Also, be sure to check the weight of the direct mount pump and, if it is over forty pounds, make a support bracket for it.

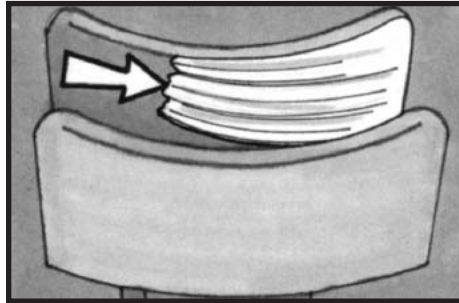


Deep Mesh Pattern Caused by Improper Backlash Adjustment

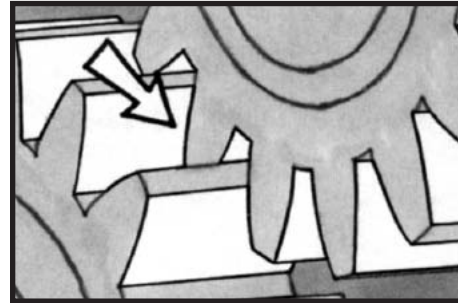


Shifting problems are sometimes a complaint an operator will have about his P.T.O. A P.T.O. that is hard to shift may be caused by a tight bend in the shifter cable, poor leverage, a gear that is installed backwards, or too tight of an installation. Many of these problems can be solved by inspecting the P.T.O. installation and making the proper adjustments regarding cable length, gear position, or shift lever.

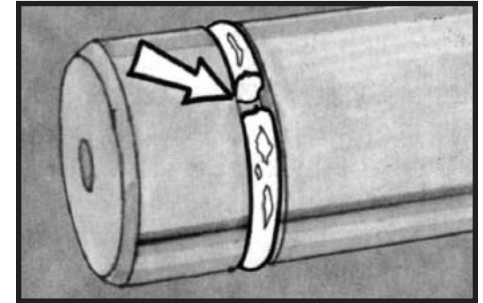
Remember, a lever-operated shift linkage should not be connected to a wire shift cover. The mechanical advantage of the lever is often too great for the wire shift cover and could severely damage it. Also inversely, don't use a cable with a lever shift cover. The cable isn't capable of transmitting the force necessary to shift a lever mechanism.



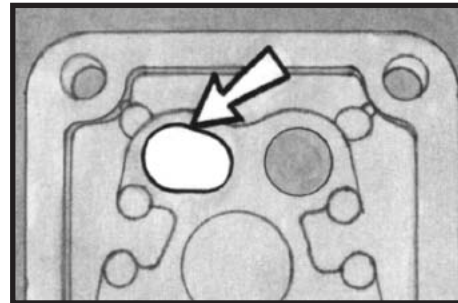
Most shifting complaints are caused by improper shifting procedure or incorrect linkage installation. Both of these situations will cause premature wear on the shift pad or fork and the shift rod or rail. To prevent this premature wear, avoid overshifting or undershifting the P.T.O. Overshifting causes the shifter fork to press against a P.T.O. gear during operation. This results in unnecessary friction and wear.



Undershifting allows incomplete gear tooth contact with the driver gear. This means only part of the tooth width is transmitting the torque and R.P.M. during P.T.O. operation. This situation can lead to gear failure or it could cause the P.T.O. to jump out of gear. These two problems can be overcome by checking linkage adjustments and proper operator training.



Seals and O-Rings may cause special problems in P.T.O. operations. Improper installation or heat build-up can cause O-Rings and seals to fail prematurely. Once seals or O-Rings fail, they should be replaced. The proper procedure for installing these parts is to lubricate them first so they will easily slide on the shaft.



Shifting problems can also be caused by a worn or elongated shifter poppet hole. This causes the P.T.O. to jump out of gear and the parts in the shifter assembly to break or become loose. If this happens, replace those parts that are worn.

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Kits Bill of Materials

329071-62X	Gasket & Seal Kit (All Outputs Except "BA",)	
2-P-112	Gasket.....	1
22-P-101	Gasket.....	1
28-P-191	O-Ring .549" x .103"	1
28-P-119	Oil Seal 1.379" x .875" x .250"	1
28-P-211	Oil Seal 3.001" x 2.00" x .375"	1
28-P-267	Oil Seal 2.627" x 1.750" x .312"	1
28-P-285	O-Ring 1.597" x .103"	2
28-P-178	O-Ring 4.484" x .138"	1
35-P-101	Bearing Cap Gasket Wet Spline	1
329071-63X	Bearing Kit "AC", "XD", "XV", "RF", "RK", "RS", "RY", "RZ" (All Outputs Except "BA" and "UN")	
379746	Lockring	1
378263	Lockring	1
379555	Lockring	1
560972	Needle Roller Bearing Ass'y 1.500" x 1.875" x 1.000"	1
550311	Ball Bearing 1.77" x 3.346" x .748"	1
550439	Tapered Cone Bearing .750" x .8598"	2
561056	Plain Bearing 1.500" x 1.656" x 1.00"	1
31-P-102	Thrust Washer .754" x .440" x .030"	1
14-P-73-1	Spacer .762" x 1.500" x .150"	1
14-P-73-2	Spacer .762" x 1.500" x .153"	1
14-P-73-3	Spacer .762" x 1.500" x .156"	1
329071-64X	Bearing Kit ("BA", "UN" Outputs)	
379746	Lockring	1
378263	Lockring	1
379555	Lockring	1
378895	Lockring	1
378576	Lockring	1
550010	Ball Bearing 1.378" x 2.8346" x .6693"	1
560972	Needle Roller Bearing Ass'y 1.500" x 1.875" x 1.000"	1
550439	Tapered Cone Bearing .750" x .8598"	2
561056	Plain Bearing 1.500" x 1.656" x 1.00"	1
31-P-102	Thrust Washer .754" x .440" x .030"	1
14-P-73-1	Spacer .762" x 1.500" x .150"	1
14-P-73-2	Spacer .762" x 1.500" x .153"	1
14-P-73-3	Spacer .762" x 1.500" x .156"	1

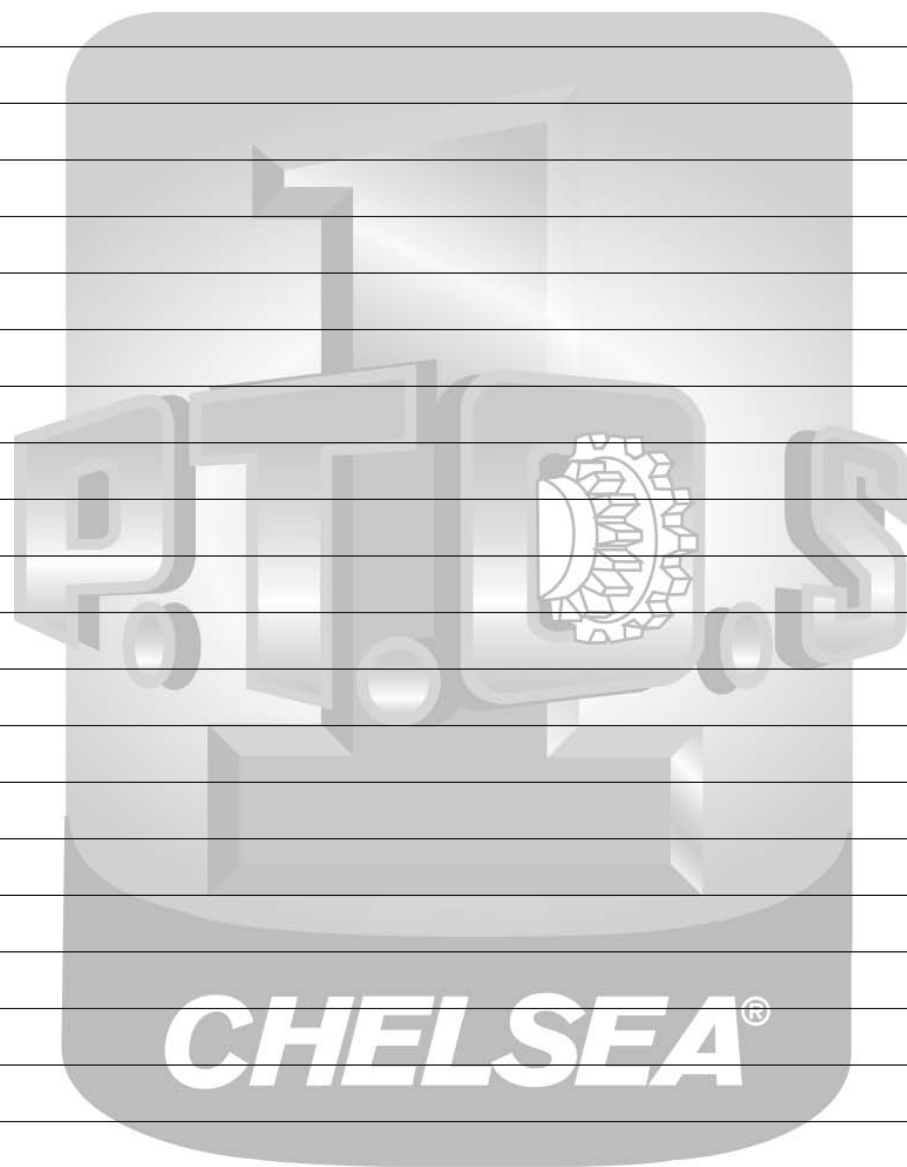
**Service Manual
280 Series**

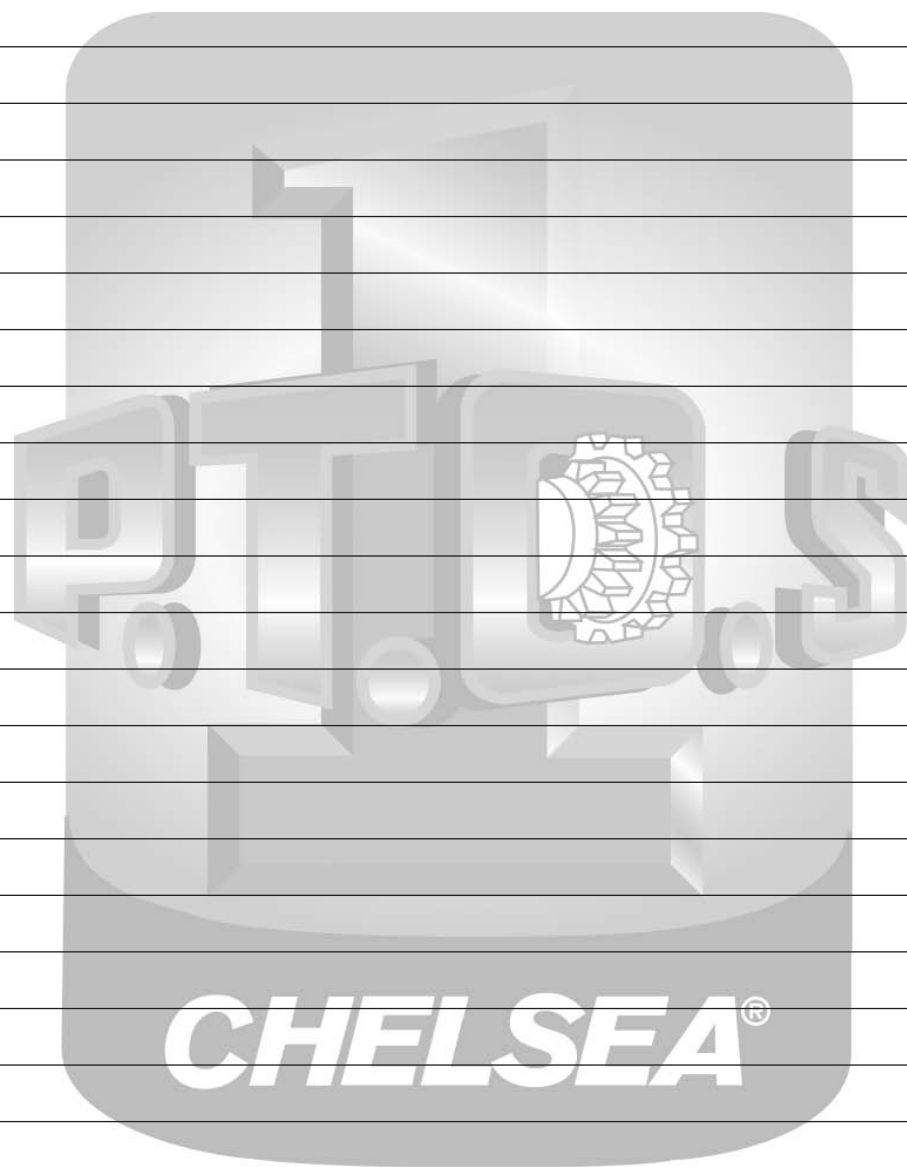
329175-12X	Conversion Kit E.O.C. 12V ("FJ" Pitch)	
28-P-171	O-Ring	1
329650X	Electronic Overspeed Controller.....	1
329076X	Hydraulic Shift	1
379243	Speed Sensor.....	1
329175-24X	Conversion Kit E.O.C. 24V ("FJ" Pitch)	
28-P-171	O-Ring	1
329650X	Electronic Overspeed Controller.....	1
329076X	Hydraulic Shift	1
379243	Speed Sensor.....	1
329354-12X	Conversion Kit 12 Volt Remote Valve (All)	
22-P-112	Gasket	1
500457-6	Mounting Screw.....	2
500357-7	Lockwasher	2
379686-1	Solenoid Valve	1
379449	Screen Adapter.....	1
379258	Bracket.....	1
379564-2	Cap Thread.....	2
329231X	Valve Connector	1
329230X	Connector.....	1
328075X	Hose Assembly.....	1
379700	Tee Female.....	1
380010	Union Female	1
379486	90° Elbow.....	1
329403X	Assembly Seal.....	1
379711	Female Bracket.....	1
379131-1	Adapter	1
SK-432	Installation	1
329057-4X	Hose Assembly.....	2

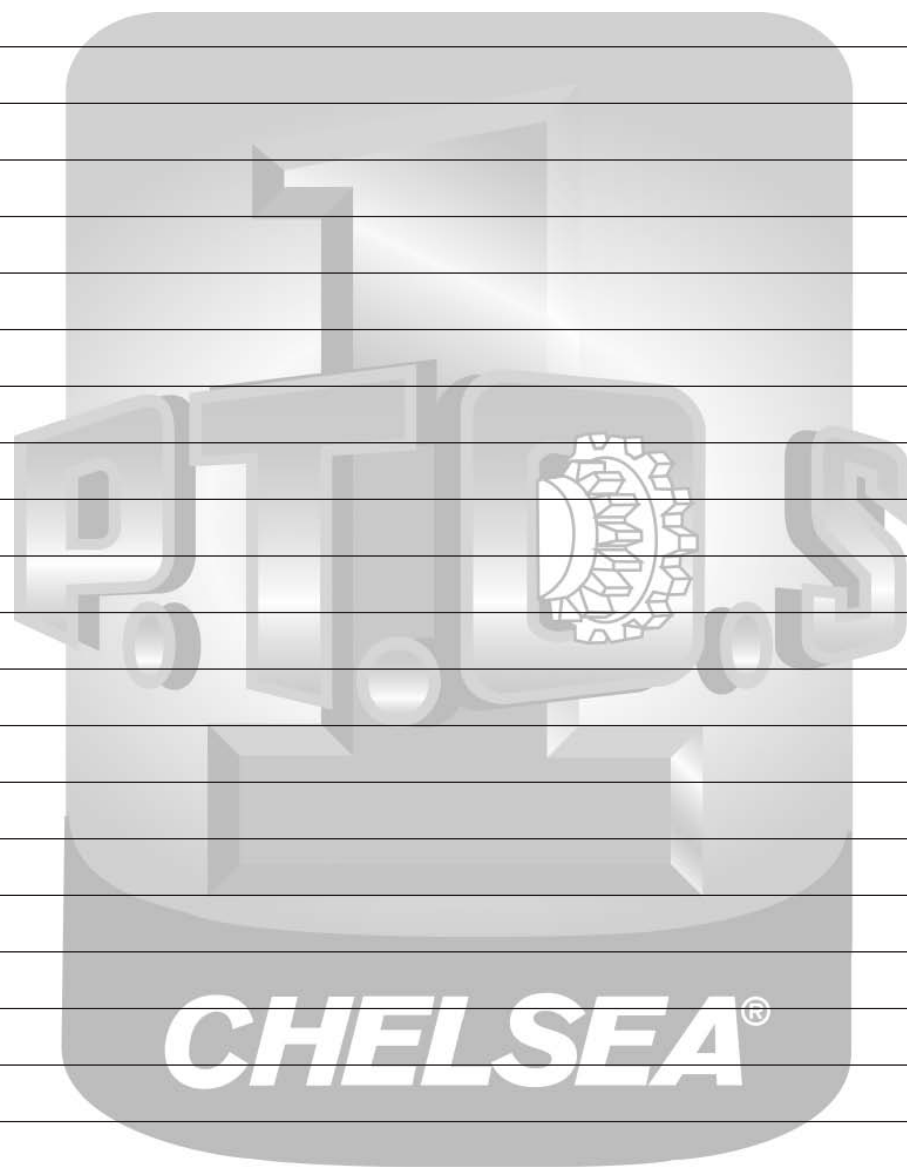
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Kits Bill of Materials**Service Manual
280 Series**

329354-24X	Conversion Kit 24 Volt Remote Valve (All)		329678X	Gear & Clutch Plates Kit (All)	
500457-6	Mounting Screw.....	2	2-P-858	Output Gear 36T.....	1
500357-7	Lockwasher	2	379485	Friction Disc	11
379686-2	Solenoid Valve.....	1	380065	Clutch Plate.....	10
379449	Screen Adapter.....	1			
379258	Bracket.....	1	7170-86X	Mounting Kit ("FJ" Gear Pitch)	
379564-2	Cap Thread.....	2	379451	Screw Pilot.....	2
329231X	Valve Connector	1	379453-10	Capscrew M10 - 1.5" x 1.378"	8
329230X	Connector	1	379486	90° Elbow.....	1
328075X	Hose Assembly.....	1	SK-355	Installation	1
22-P-112	Gasket	1			
379700	Tee Female.....	1	7170-117X	Mounting Kit ("KV" Gear Pitch)	
380010	Union Female	1	379451	Screw Pilot.....	2
379486	90° Elbow.....	1	379453-10	Capscrew M10 - 1.5" x 1.378"	8
329403X	Assembly Seal.....	1	379812	Male Connector	1
379711	Female Bracket.....	1			
379131-1	Adapter.....	1			
SK-432	Installation	1			
329057-4X	Hose Assembly.....	2			
329448-12X	Conversion Kit E.O.C. 12V ("KV" Pitch)				
28-P-171	O-Ring	1			
329650X	Electronic Overspeed Controller.....	1			
329444X	E.O.C. Wire Installation Kit.....	1			
379243	Speed Sensor.....	1			
329448-24X	Conversion Kit E.O.C. 24V ("KV" Pitch)				
28-P-171	O-Ring	1			
329650X	Electronic Overspeed Controller.....	1			
329444X	E.O.C. Wire Installation Kit.....	1			
379243	Speed Sensor.....	1			







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The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods, services or work described will be referred to as "Products".

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3. Delivery Dates; Title and Risk; Shipment. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon placement of the products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyer's request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

4. Warranty. Seller warrants that all products sold, other than the 590 Series, conform to the applicable Parker Chelsea standard specification for the lesser period of 2 years (24 Months) from date of service or 2-1/2 years (30 Months) from date of build (as marked on the product name plate). Seller warrants that the 590 Series will conform to the applicable Seller standard specification for the lesser period of 2 years (24 Months) from date of service or 2000 hours of usage. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for an amount due on any invoice) must be commenced within 12 months from the date of the breach without regard to the date breach is discovered.

6. LIMITATION OF LIABILITY. UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

7. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, will be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. Improper use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

12. Cancellations and Changes. Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidity of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appoints a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) dissolves or liquidates all or a majority of its assets.

17. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. Indemnity for Infringement of Intellectual Property Rights. Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

20. Compliance with Law, U. K. Bribery Act and U.S. Foreign Corrupt Practices Act. Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or countries of the Territory in which Buyer may operate, including without limitation the U.K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that they are familiar with the provisions of the U.K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller.

07/14

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