Chelsea® Power Take-Off

277/278 Series Service Manual

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

Parker Chelsea

ENGINEERING YOUR SUCCESS.

CHELSEA®

⚠ WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

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".

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Chelsea: The First Name In Reliability And Simplicity

For reliable operation, easy installation, and quick serviceability, the first name in Power Take-Offs is Chelsea. Just look at the benefits the Chelsea 277/278 Powershift P.T.O. offers.

During installation, a special, supplied gasket eliminates the need to set backlash. The internal lubrication of this unit reduces plumbing. And the dependable weather-tight electrical connections ensure greater unit reliability while reducing wiring time.

Servicing this unit is a snap, too. The slip-fit idler shaft, tapered bearing cones, and clutch pack unit are all easily removed and installed. Plus, there is only one assembly arrangement to service.

Quick. Easy. Reliable. When you need all three, there is only one choice. Chelsea.
The first name in Power Take-Offs.

Table of Contents

Safety Information 1-2

Exploded View

Sub Assembly Clutch Pack 3
Sub Assembly Shaft Brake 3
Output Bearing & Clutch Pack 4

Tools 5

Disassembly

Output Bearing and Clutch Pack 6-10
Valve & Cap (Allison) 329352 11-12
Valve &Cap Bill of Materials 13
Input Gear Sub-Assembly 14-15

Reassembly

Output Bearing and Clutch Pack 16-19
"XD" Output Only 20-22
Valve Assembly 23-25

Troubleshooting 26-29

Torque Chart 30

Offer of Sale 31

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

NOTES

Parker Chelsea

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

These instructions are included for your safety. Read them carefully until you understand them.

General Safety Information

To prevent injury to yourself and/or damage to the equipment:

- Read carefully all owners manuals, service manuals, and/or other instructions.
- Always follow proper procedures and use proper tools and safety equipment.
- Be sure to receive proper training.
- Never work alone while under a vehicle or while repairing or maintaining equipment.
- Always use proper components in applications for which they are approved.
- Be sure to assemble components properly.
- Never use worn-out or damaged components.
- Always block any raised or moving device that may injure a person working on or under a vehicle.
- Never operate the controls of the power take-off or other driven equipment from any position that could result in getting caught in the moving machinery.

Warning: Proper Matching of P.T.O.

A Power Take-Off must be properly matched to the vehicle transmission and to the auxiliary equipment being powered. An improperly matched Power Take-Off could cause severe damage to the vehicle transmission, the auxiliary driveshaft, and/or to the auxiliary equipment being powered. **Damaged components or equipment could malfunction causing serious personal injury to the vehicle operator or to others nearby.**

To avoid personal injury and/or equipment damage:

- Always refer to Chelsea catalogs, literature and owners manuals and follow Chelsea recommendations when selecting, installing, repairing, or operating a Power Take-Off.
- Never attempt to use a power take-off not specifically recommended by Chelsea for the vehicle transmission.
- Always match the Power Take-Offs specified output capabilities to the requirements of the equipment to be powered.
- Never use a Power Take-Off whose range of speed could exceed the maximum safe speed of the equipment to be powered.

Warning: Cold Weather Operation of Power Shift P.T.O.'s

During extreme cold weather operation [32° F (0° C) and lower], a disengaged Powershift Power Take-Off can momentarily transmit high torque that will cause unexpected output shaft rotation. This is caused by the high viscosity of the transmission oil when it is extremely cold. As slippage occurs between the power take-off clutch plates, the oil will rapidly heat up and the viscous drag will quickly decrease.

The Power Take-Off output shaft rotation could cause unexpected movement of the driven equipment resulting in serious personal injury, death, or equipment damage.

To avoid personal injury or equipment damage:

- Driven equipment must have separate controls.
- The driven equipment must be left in the disengaged position when not in operation.
- Do not operate the driven equipment until the vehicle is allowed to warm up.

This symbol warns of possible personal injury.

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Warning: Rotating Auxiliary Driveshafts

- Rotating auxiliary driveshafts are dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.
- Do not go under the vehicle when the engine is running.
- Do not work on or near an exposed shaft when engine is running.
- Shut off engine before working on Power Take-Off or driven equipment.
- Exposed rotating driveshafts must be guarded.

Warning: Guarding Auxiliary Driveshafts

We strongly recommend that a Power Take-Off and a directly mounted pump be used to eliminate the auxiliary driveshaft whenever possible. If an auxiliary driveshaft is used and remains exposed after installation, it is the responsibility of the vehicle designer and P.T.O. installer to install a guard.

Warning: Using Set Screws

Auxiliary driveshafts may be installed with either recessed or protruding set screws. If you choose a square head set screw, you should be aware that it will protrude above the hub of the yoke and may be a point where clothes, skin, hair, hands, etc. could be snagged. A socket head screw, which may not protrude above the hub of the yoke, does not permit the same amount of torquing as does a square head set screw. Also, a square head set screw, if used with a lock wire, will prevent loosening of the screw caused by vibration. Regardless of the choice made with respect to a set screw, an exposed rotating auxiliary driveshaft must be guarded.

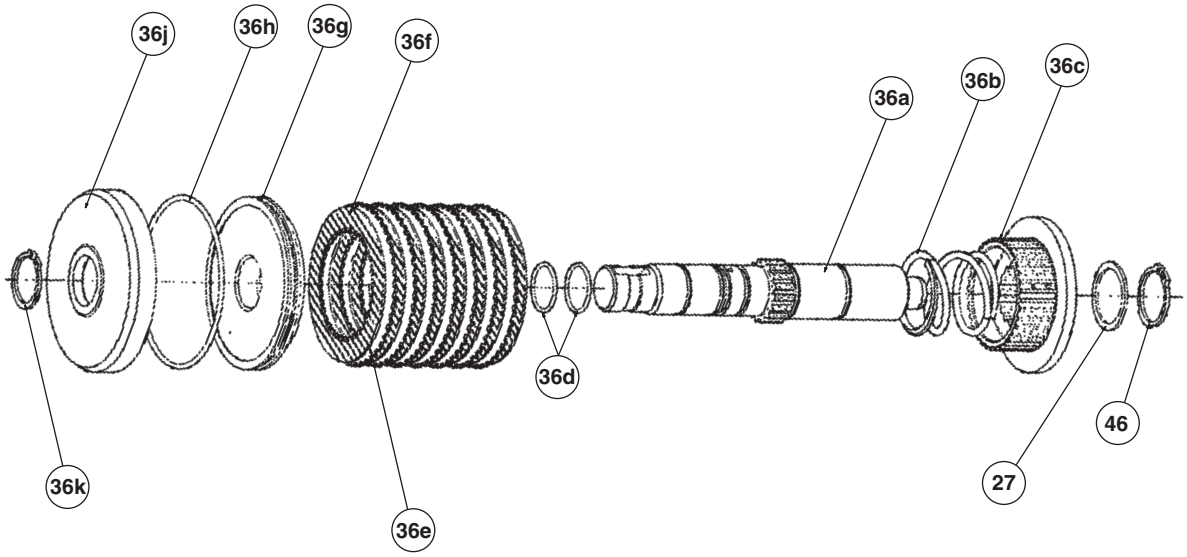
Important: Safety Information and Owners Manual

Chelsea Power Take-Offs are packaged with safety information decals, instructions, and an owner's manual. These items are located in the envelope with the P.T.O. mounting gaskets. Also, safety information and installation instructions are packaged with some individual parts and kits. Be sure to read the owner's manual before installing or operating the P.T.O. Always install the safety information decals according to the instructions provided. Place the owners manual in the vehicle glove compartment.

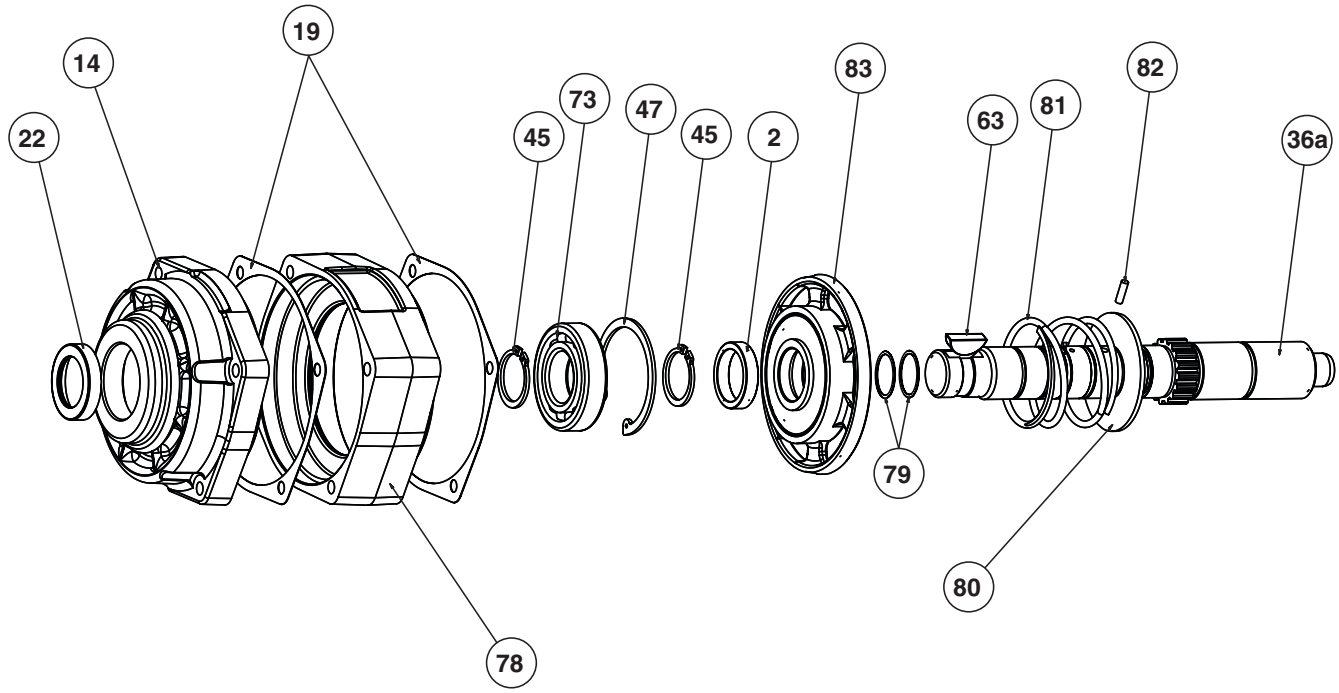
This symbol warns of possible personal injury.

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Sub Assembly Clutch Pack



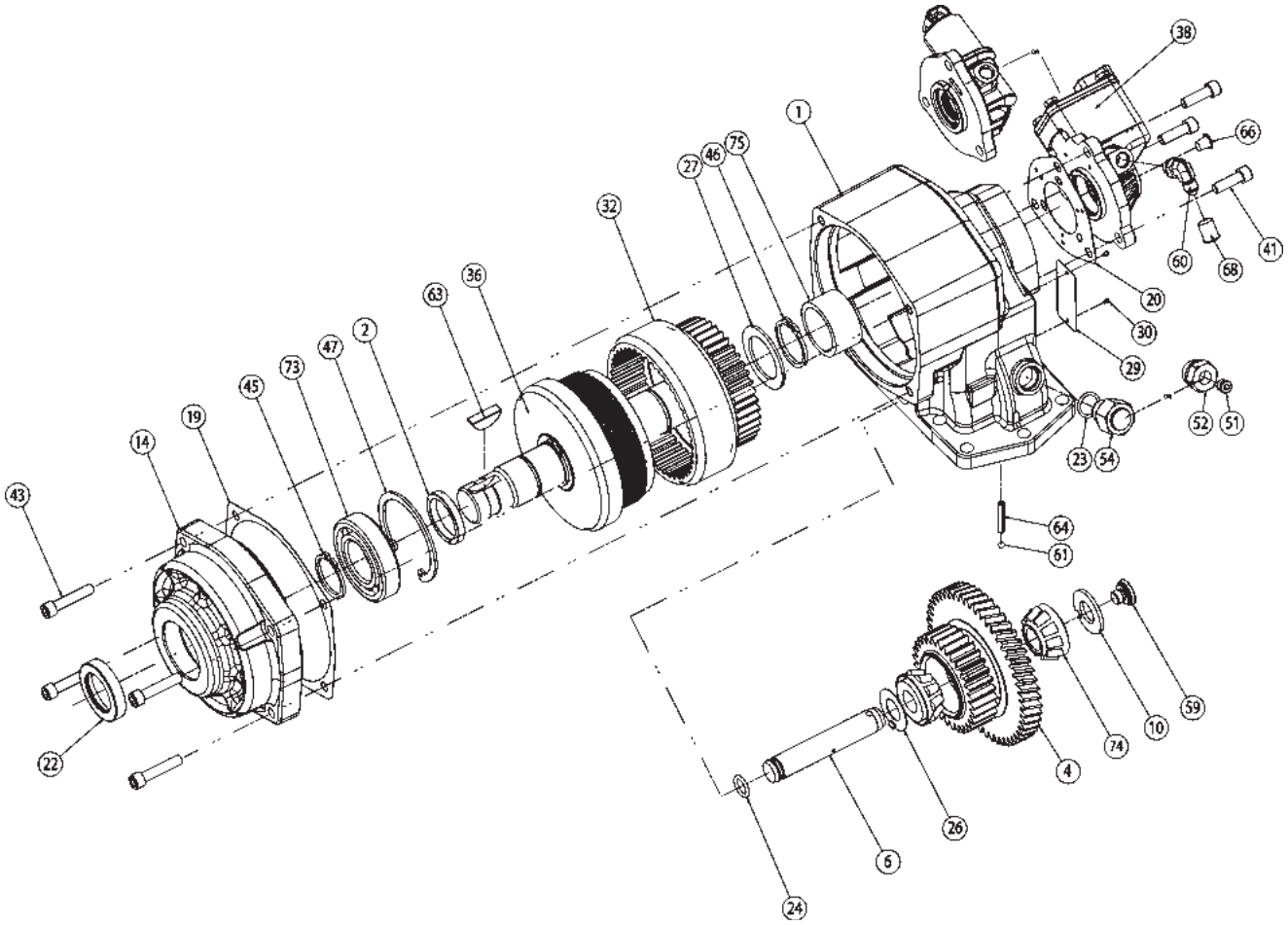
Sub Assembly Shaft Brake

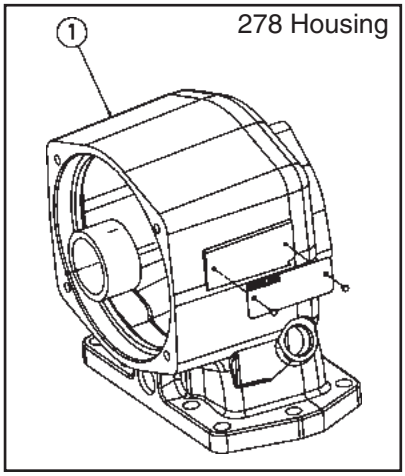


Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

277/278 Powershift P.T.O.

These parts are referenced throughout the disassembly and reassembly instructions for your convenience. Refer to Chelsea Parts List HY25-2277-M1/US for complete parts bills of material and current part numbers.





Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Along with a suitable press, you should have these tools when servicing the Chelsea 277/278 Series Power Take-Off.

- 3/8" socket wrench
- 3/16" socket wrench
- 1/4" Allen wrench
- Screwdriver
- 3/8" combination wrench
- Soft mallet
- Retaining ring pliers
- Oil seal puller
- Safety glasses
- Torque wrench
- Bearing Driver
- O-Ring Sleeve
- Gear Alignment tool
- Oil Seal Driver
- Sockets
  3/8" 6 or 12 point
  3/16" Allen
  1/4" Allen

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Warning: ***during service on a P.T.O., parts can unexpectantly fly up. This could injure eyes or exposed skin. To help prevent injury, wear safety glasses and protective clothing while servicing any P.T.O. Also, use a shield when pressing bearings.***

1. 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.

   As disassembly continues, inspect all parts for clues to the cause of the failure. (Fig. 1)

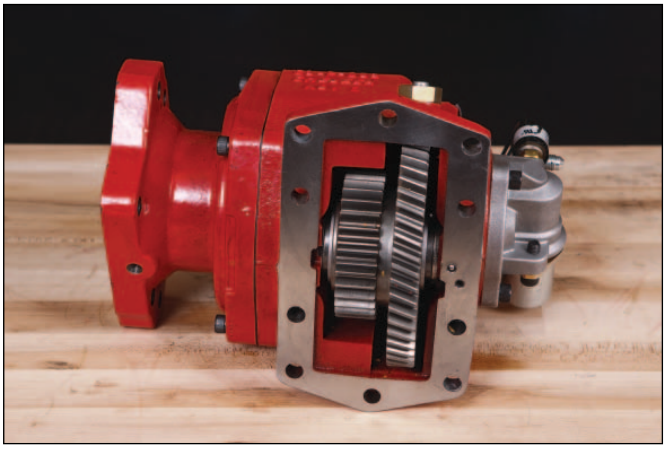


Figure 1

Output Bearing and Clutch Pack

2. Remove the four bearing cap capscrews **(43)**. Lift the bearing cap **(14)**, gasket **(19)** and clutch assembly from the housing. (Fig. 2 & 2A)

Figure 2

Figure 2A

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

3. Place the assembly in a soft-jawed vise. Support the shaft above the bearing surface. (Fig. 3)

Figure 3

4. Use a screwdriver (Fig. 4) or a seal remover (Fig. 4A) to pry the oil seal **(22)** from the bearing cap. **Important:** this seal will be damaged during removal. Replace it with a new one.

Figure 4

Figure 4A

5. Remove the retaining ring **(45)** from the output shaft. (Fig. 5)

Figure 5

6. Support the assembly directly underneath the bearing cap. Using an arbor press, press the output shaft **(36A)** through the bearing cap. (Fig. 6)

Figure 6

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

7. Remove the retaining ring **(47)** and bearing **(73)** from the bearing cap. If the bearing sticks, tap it with a soft mallet and a driver. (Fig. 7)

Figure 7

Clutch Pack and Output Shaft (Reference Page 6)

8. Remove the spacer **(2)** from the shaft. (Fig. 8)

Figure 8

9. Next, compress the clutch assembly and remove the retaining ring **(36k)**. (Fig. 9) Reference: Sub Assembly Dwg Clutch Pack page 6.

Figure 9

10. Slide the clutch back up cylinder **(36j)** and piston **(36g)** off the shaft. Remove the O-Ring **(36h)** from the piston. Inspect the piston for galling or scratches. (Fig. 10)

Figure 10

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

11. Remove the return spring **(36b)**. Check it for cracks or breaks. Also remove the two shaft O-Rings **(36d)** that seal off the piston and clutch back up cylinder. (Fig. 11)

Figure 11

12. Remove and inspect the clutch plates **(36c)** and friction discs **(36f)**. If debris is present but the Chelsea P.T.O. gears 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. (Fig 12)

Figure 12

13. Remove the clutch gear **(36c)** off the shaft. Check it for wear or damage. Replace if necessary. The spacer and retaining ring **(46)** can stay on the shaft if they aren't damaged. (Fig. 13)

Figure 13

14. Remove the retaining ring **(46)**, thrust washer **(27)** and output gear **(32)**. Inspect the washer for heat damage. Replace if necessary. (Fig. 14)

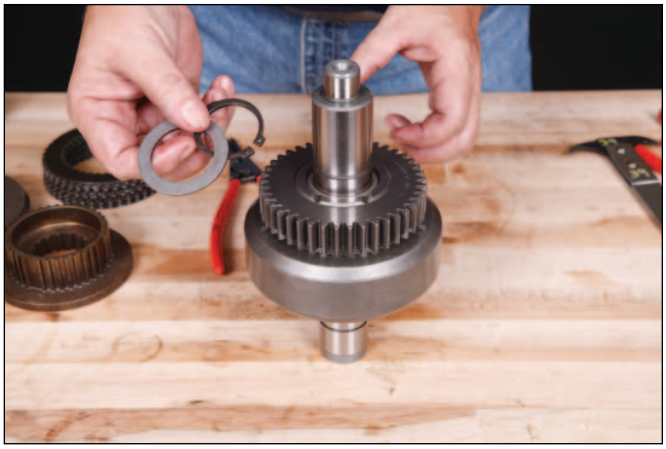


Figure 14

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

15. Remove and Inspect Shaft (**36a**) 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 surface. If you feel a scratch, replace the shaft. Also make sure the pressure port is clear. Do this by blowing air through the hole. (Fig. 15)

Figure 15

16. Using an appropriate driver, press the internal needle bearing **(part # 560972)** from the output gear. Press against the flat surface of the bearing. (Fig. 16)

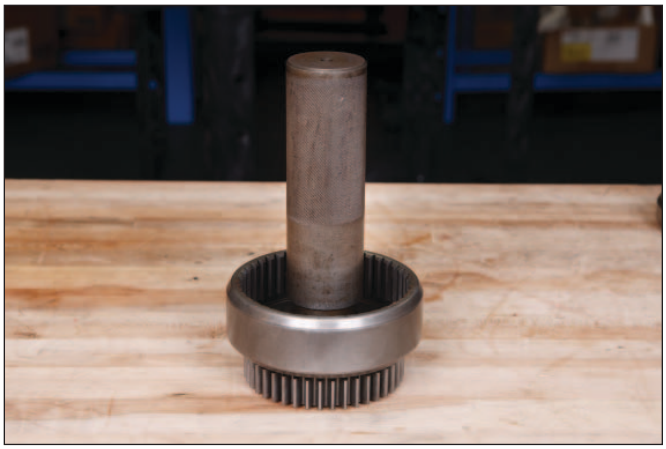


Figure 16

17. Inspect the output gear for cracks, pitting, missing teeth or other damage. Replace if necessary. (Fig. 17)

Figure 17

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Valve & Cap (Allison) 329352

18. Remove the three socket head capscrews **(41)**, valve assembly, and valve cap gasket **(20)** from the Chelsea P.T.O. (Fig. 18 & 18A)

Figure 18

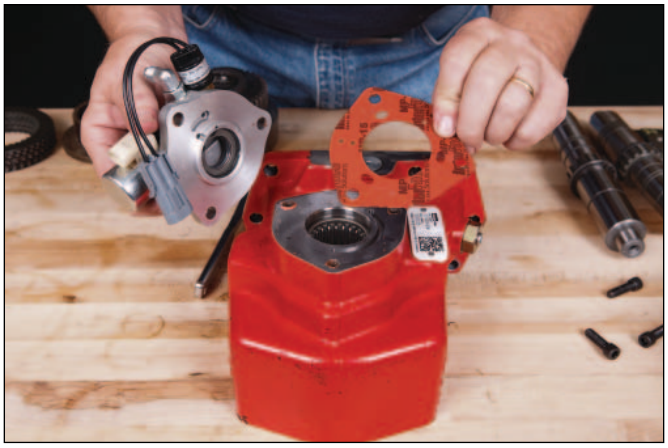


Figure 18A

19. See Page 16. 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. **Important:** do not nick the seal bore. This could result in leakage or further damage to the P.T.O. (Fig. 19, 19A & 19B)

Figure 19

Figure 19A

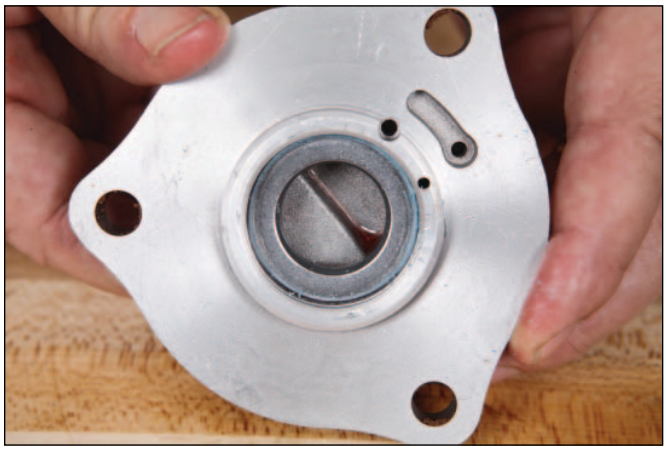


Figure 19B

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

20. Remove the solenoid valve socket capscrew **(E)**. Use a screwdriver in the shaft seal opening to carefully pry the solenoid valve **(G)** loose from the housing. Be careful not to damage the seal. (Fig. 20)

Figure 20

21. Remove the solenoid valve **(E)** from the cap (Fig. 21). Check the O-Rings for damage (Fig. 21A). If they are damaged, replace the O-Rings.

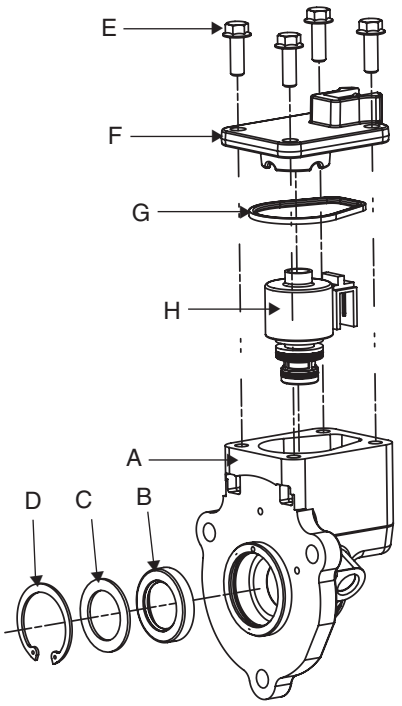
Figure 21

Figure 21A

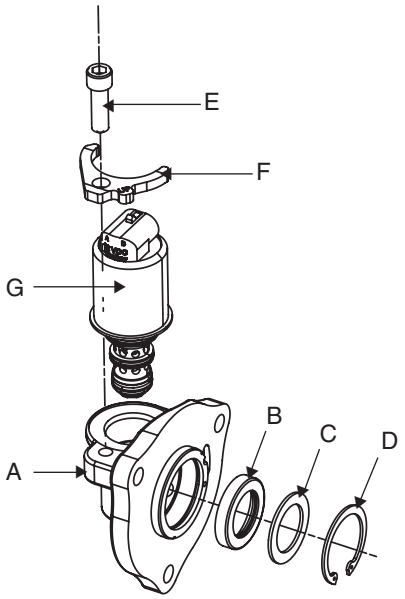
Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Valve & Cap Bill of Materials

329352



329442 & 329463



Item	Part Number	Description	Quantity
38	**329352-12X**	Valve & Cap Assembly (12V)	1 or
	329352-24X	Valve & Cap Assembly (24V)	1
A	**34-P-278**	Valve Cap	1
B	**28-P-119**	Oil Seal (Hi Pressure)	1
C	**378811**	Washer	1
D	**378849**	Retaining Ring	1
E	**379565**	Hexhead Capscrew .250" - 20 x .750"	4
F	**329144X**	Valve Cap Cover (12V)	1 or
	329144-1X	Valve Cap Cover (24V)	1
G	**28-P-193**	Block Ring	1
H	**379604-1**	Hydraulic Valve (12V)	1 or
	379604-2	Hydraulic Valve (24V)	1
39	**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 or
	380011-24	Hydraulic Valve (24V) (“FJ”) (Black Side Connector)	1
	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

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Input Gear Sub-Assembly

22. Next, remove the NWD plug **(59)**. (Fig. 22)

Figure 22

23. Push the idler shaft **(6)** from the housing. It can only be removed from the direction shown here. If it sticks, support the P.T.O. Then use a punch and soft mallet to gently tap the shaft from the housing. Replace it if it is nicked or scratched. Inspect the shaft O-Ring for nicks or cuts, replace if necessary **(24)**. (Fig. 23)

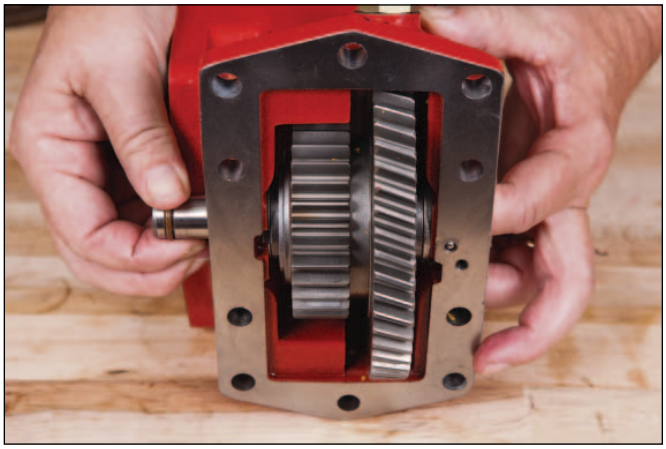


Figure 23

24. Remove the input gear **(4)** and two spacers **(10)**. Remove the two tapped bearing cones **(74)** from the gear. Inspect gear races and teeth for cracks, nicks, heat signs or other damage. Replace if necessary. (Fig. 24)

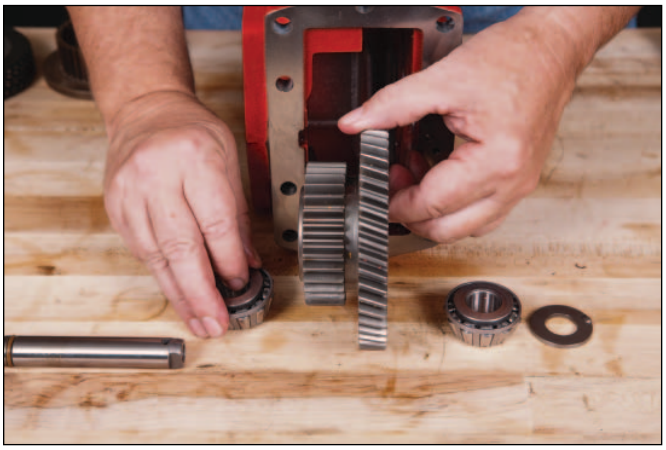


Figure 24

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

25. Press the remaining needle bearing **(75)** from the housing. **Important:** this bearing will be damaged during removal. Replace it with a new one (Fig. 25)

Figure 25

26. Inspect the housing **(1)** for deep grooves, gouges, and cracks. Make sure sealing surfaces are smooth, and that the slotted pin **(64)** is in place. Replace the housing if necessary. (Fig. 26)

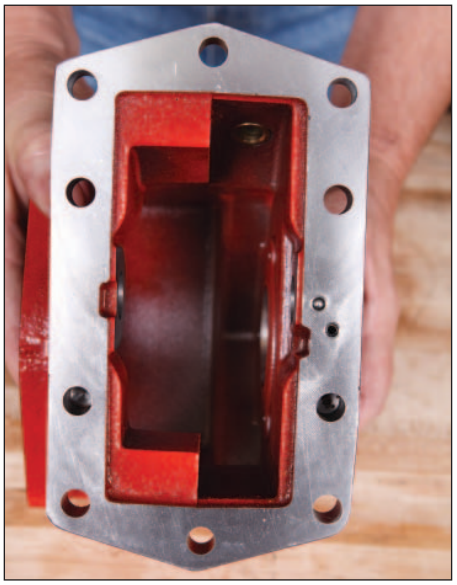


Figure 26

27. 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. (Fig. 27)

Figure 27

28. Clean all reusable components. (Fig. 28)

Figure 28

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Output Bearing and Clutch Pack

1. If the spacer and retaining ring **(46)** were removed from the shaft earlier, replace them with new ones now. (Fig. 1)

Figure 1

2. Lubricate the output shaft **(36a)**. Secure it in a vise, making certain not to scratch it. Install the clutch gear **(36c)**. (Fig. 2)

Figure 2

3. Lubricate a new needle bearing **(part number 560972) (75)**. Press it into the output gear **(32)** using a press and an appropriate driver. (Fig. 3)

Figure 3

4. Install the output gear **(32)**. (Fig. 4)

Figure 4

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

5. Install a thrust washer **(27)**. Secure the assembly with a new retaining ring **(46)**. (Fig. 5 & 5A)

Figure 5

Figure 5A

6. Lubricate the metal clutch plates **(36F)**. Then starting with a friction disc (which has teeth on the inner diameter), alternately stack all the friction discs **(36e)** and clutch plates (which have teeth on the outer diameter) on the shaft. (Fig. 6)

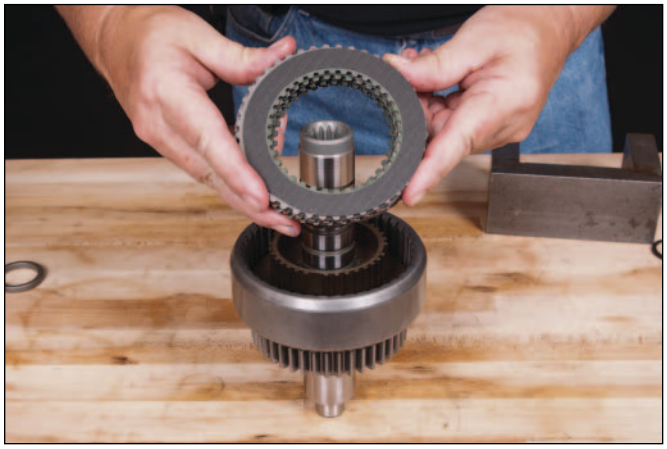


Figure 6

7. Install the two O-Rings **(36d)** on the shaft. (Fig. 7)

Figure 7

8. Install the return spring **(36b)**. (Fig. 8)

Figure 8

9. Lubricate a new block vee ring **(36h)** and position it on the piston **(36g)**. The open face of the ring should face toward the clutch back up cylinder **(36j)**. (Fig. 9)

Figure 9

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

10. Install the piston **(36j)**, centering it over the spring. Install the back up cylinder **(36g)**. (Fig. 10)

Figure 10

11. Compress the piston and clutch assembly down past the retaining ring groove. Install a new retaining ring **(36k)**. (Fig. 11)

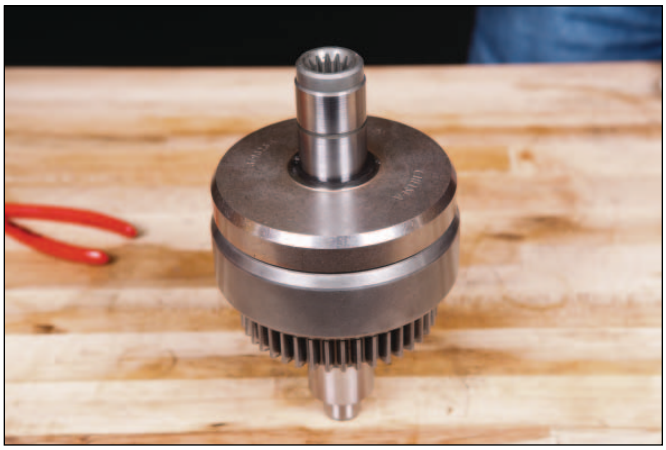


Figure 11

12. Install the spacer **(2)**. (Fig. 12)

Figure 12

13. Lubricate a new ball bearing **(73)** and install it into the bearing cap **(14)**. Use a soft mallet and a proper driver to do this. (Fig. 13)

Figure 13

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

14. Secure the bearing with a new retaining ring **(47)**. (Fig. 14)

Figure 14

15. 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. (Fig. 15)

Figure 15

16. Secure the assembly with a new retaining ring **(45)**. (Fig. 16)

Figure 16

17. Lubricate a new bearing cap oil seal **(22)**. Then using an appropriate driver and a soft mallet or press, install it into the bearing cap **(14)**. (Fig. 17)

Figure 17

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

"XD" Output Only

19. Lubricate a new needle bearing **(75)** 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. (Fig. 18, 18A, 18B & 18C)

Figure 18

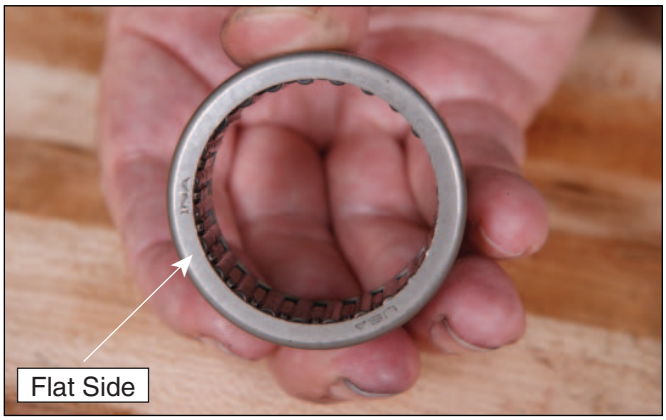


Figure 18A

Figure 18B

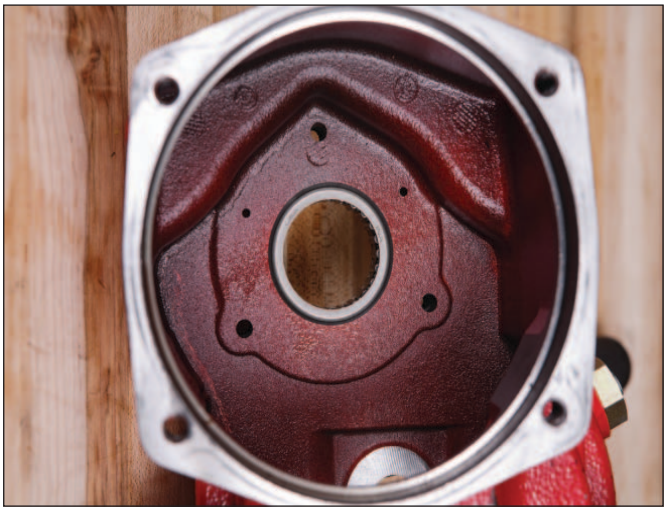


Figure 18C

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

20. Place a new gasket **(19)** on the PTO mating face. **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 PTO housing. (Fig. 19)

Figure 19

21. Secure the bearing cap with socket head capscrews **(43)**. Tighten them, and torque them to 24 - 28 lbs-ft (33 – 39 Nm or 3.3 – 3.9 Kgm). (Fig. 20)

Figure 20

22. Install new, lubricated bearing cones **(74)** into the input gear **(4)**. The tapers should go toward the center of the gear. (Fig. 21)

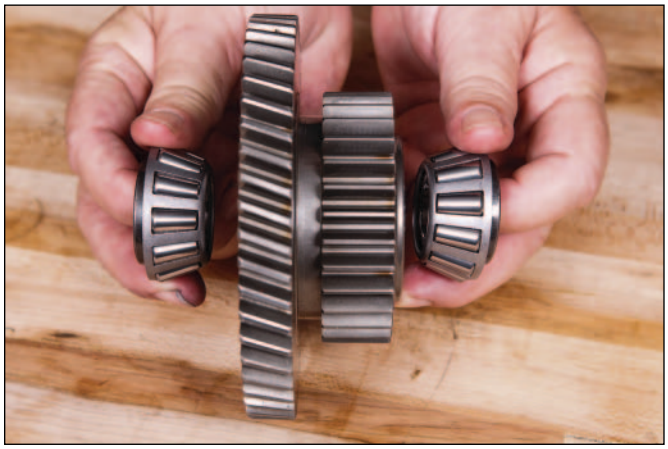


Figure 21

23. Next, place tabbed washer **(10)** next to the tall side of the gear. This washer shims the unit. (Fig. 22)

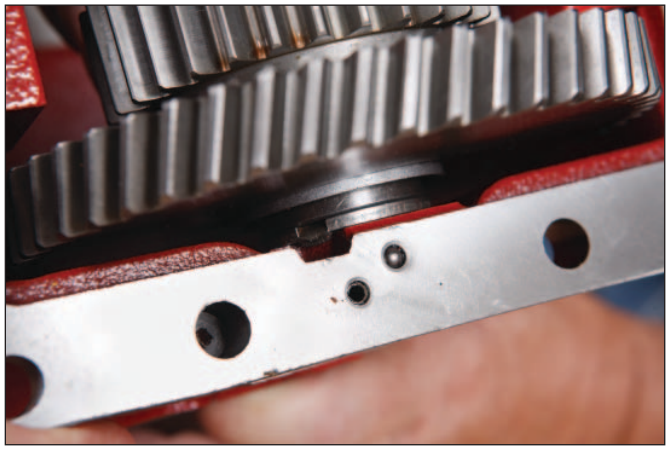


Figure 22

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

24. Place the thrust washer **(26)** on the ratio side of the gear. Place the components into the housing. (Fig. 23)

Figure 23

25. Align the gear assembly with the idler shaft hole. (Fig. 24)

Figure 24

26. Place a new, lubricated O-Ring **(24)** on the idler shaft **(6)**. Push it into the housing from the side opposite of the roll pin until it is just below the housing 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. (Fig. 25)

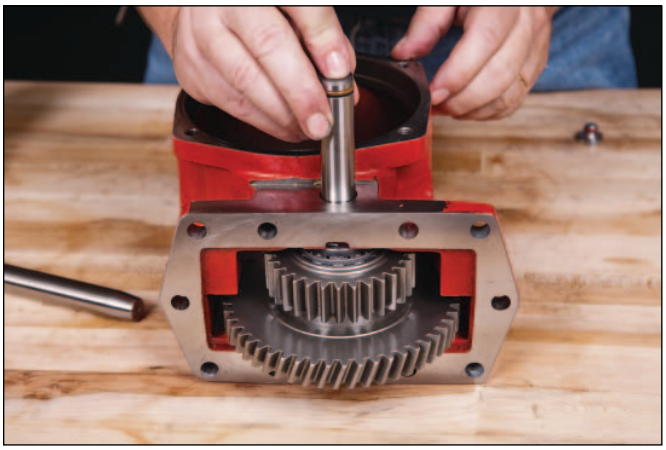


Figure 25

27. Inspect O-Ring on NWD plug **(59)** for cuts or nicks. Lubricate O-Ring on NWD plug and install the NWD plug **(59)**. Torque it to 8 – 12 Lbs. ft. (11 – 16 N.m. or 1.1 – 1.7 Kgm). The gears should turn freely on the shaft. (Fig. 26)

NOTE: Once the shaft 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.

Figure 26

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Valve Assembly

28. If the valve assembly oil seal **(3)** was worn or damaged, replace it now. Lubricate a new seal. Install it carefully with the proper driver. **Important:** avoid nicking the housing. This could cause leakage or other PTO damage. (Fig. 27)

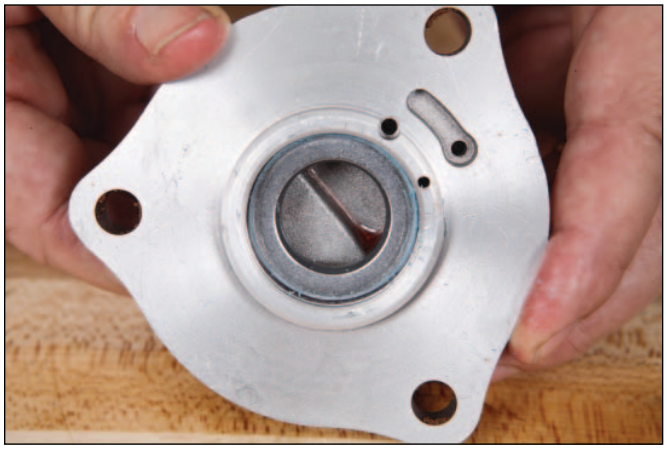


Figure 27

29. Lubricate and attach the solenoid valve **(G)** to the cap. (Fig. 28) Refer to page 13 for valve exploded view.

Figure 28

30. Next install the Clamp **(F)** and Sockethead Capsrew **(E)**. Secure the solenoid to the valve cap (**A**) with hex capscrew **(E)**. Torque it to 96 – 120 in-lbs (11 – 14 Nm).

Figure 29

31. Place a new valve cap gasket **(20)** 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. (Fig. 30)

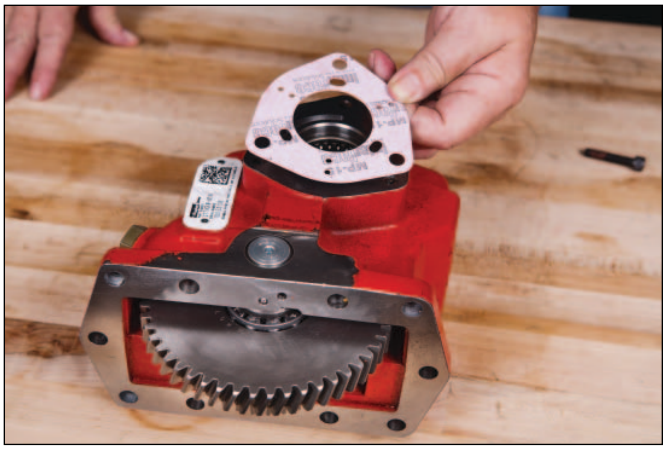


Figure 30

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

32. Attach the valve assembly to the P.T.O. housing. Tighten the three capscrews **(41)** and torque them to 16 – 20 Lbs. ft. (22 – 27 N.m. or 2.2 – 2.8 Kgm). (Fig. 31 & 31A)

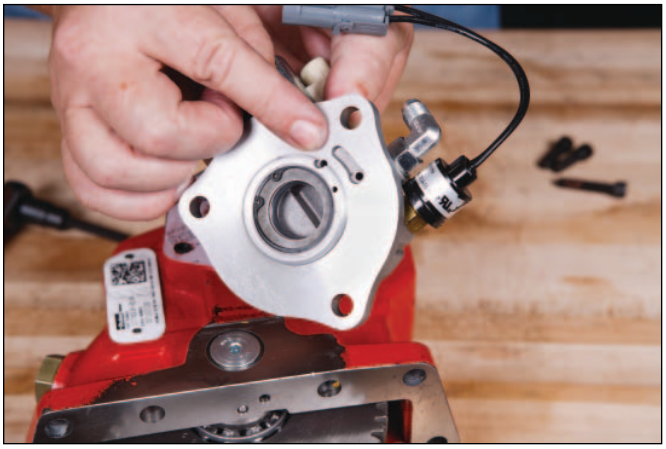


Figure 31

Figure 31A

33. 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. (Fig. 32)

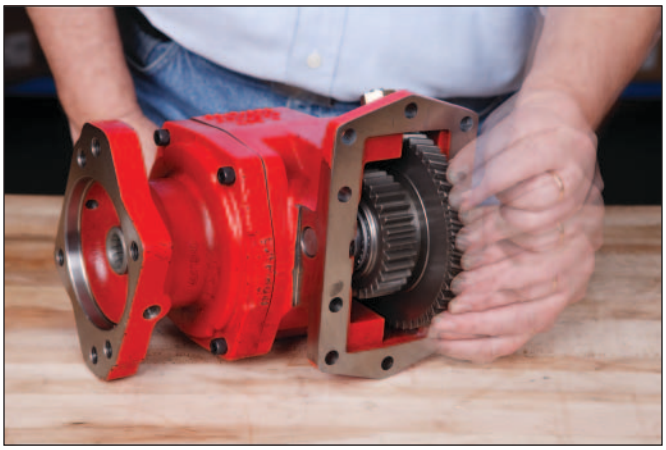


Figure 32

34. There is no end play to check with this unit. This Chelsea P.T.O. is ready for action. (Fig. 33)

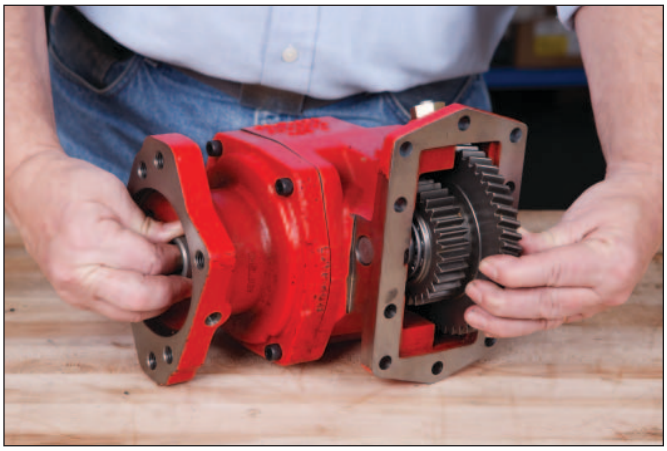


Figure 33

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

18. Use a soft mallet to install a new woodruff key **(63)** into the output shaft. (Fig. 34)

Figure 34

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Powershift P.T.O.s 277/278 Series

Chelsea Powershift P.T.O.s are different from shiftable gear units because they are hydraulically controlled.

The hydraulics are taken from the automatic transmissions which use hydraulic flow and pressure and have external ports to supply hydraulic fluid to the Power Take-Off. (For port locations on various transmission models see page 27).

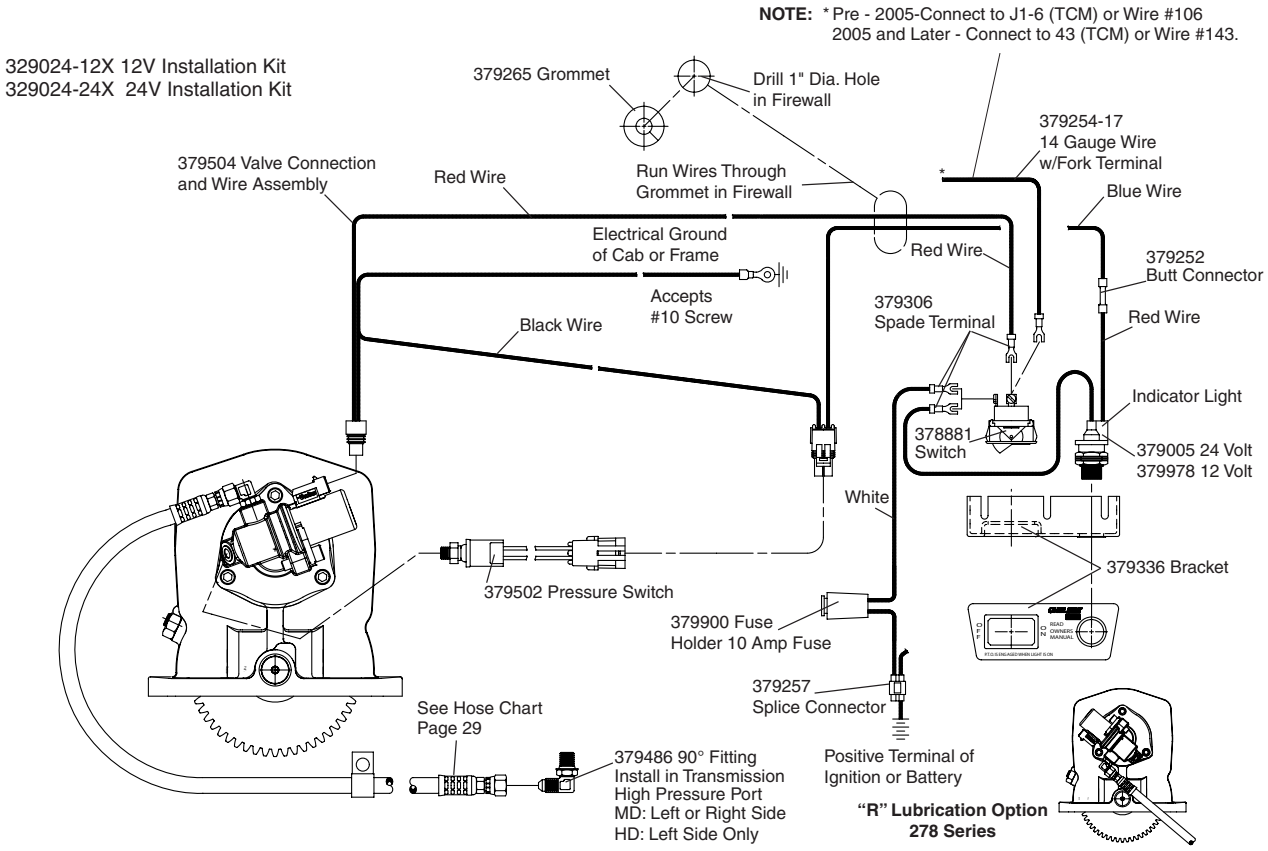
Hydraulic oil is controlled from the transmission ports to engage or disengage the Power Take-Off and lubricate the idler shaft bearings.

The engagement or disengagement of the P.T.O. is actuated by an electrically-controlled solenoid valve.

Hoses must be clear of obstructions and the engine must be at idle or below 1000 R.P.M. upon engagement. When engaged, the solenoid transfers automatic transmission fluid to the P.T.O. which engages the P.T.O. clutch pack making the output shaft turn. This step is critical to P.T.O. life. A low pressure supply or excessive engine speed at engagement will cause the clutch discs of the clutch pack to slip and burn up.

Lubrication of the idler shaft is accomplished through an internal lube passage from the solenoid valve to the P.T.O. idler shaft.

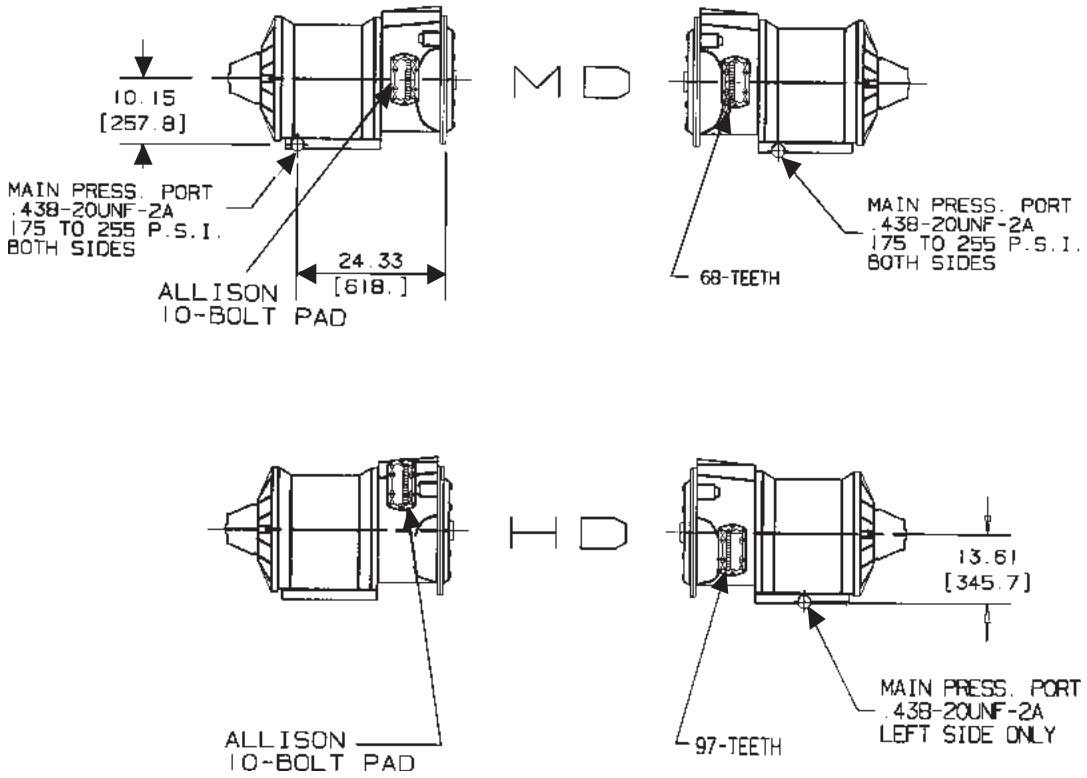
Shift Installation Kit 277 & 278 Series without Electronic Overspeed Control (SK-347 Rev E)



Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Pressure Port and Aperture Opening Identification

1. These drawings represent left and right views of the MD and HD pressure ports on the transmission.



Hose Specifications by Transmission

TRANS.	LOCATION	277 Series	278 Series
MD	L.H. Side (Left Press. Port)	329130-5X	329130-5X
MD	R.H. Side (Right Press. Port)	329075-1X	329075-1X
HD	Top Right (Left Press. Port)	329075-2X	329075-2X
HD	L.H. Side (Left Press. Port)	329130-4X	329075-4X
HD[1, 2]	L.H. Side (Left Press. Port)	329130-5X	329130-5X
HD[1, 2]	Top Right (Right Press. Port)	329130-4X	329075-4X
MD[1, 2]	L.H. Side (Left Press. Port)	329130-5X	329130-5X
MD[1, 2]	R.H. Side (Right Press. Port)	329075-1X	329075-1X

An HD with 2 P.T.O.'s requires a 379556 "T" fitting and a 379703 swivel nut 90 degree elbow to attach 2 hoses to the single port on the left side.

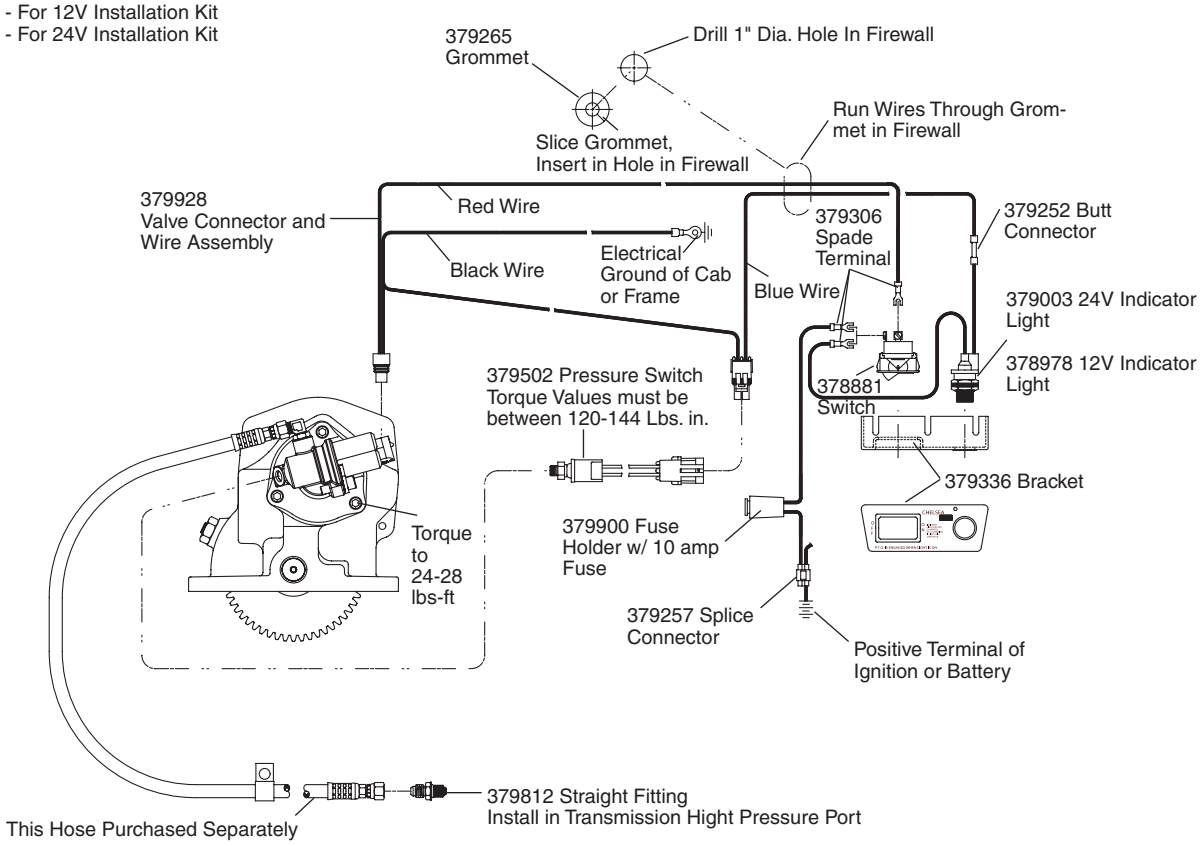
1 Lubrication Option "R", shifter Options "G" and "H" for 277 Series
2 Lubrication Option "R" for 278 Series

Parker Chelsea

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

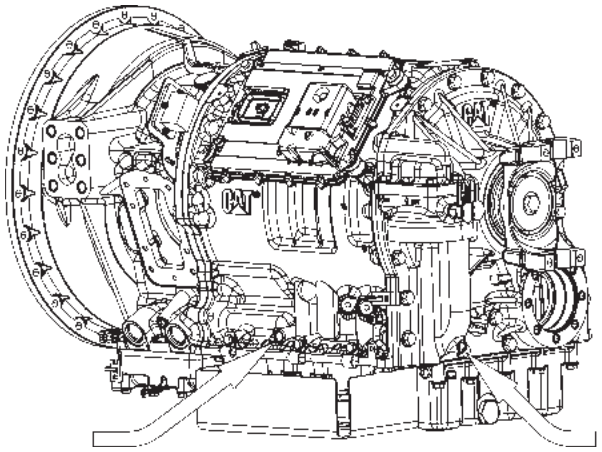
Shift Installation Kit 277 & 278 Series Without Electronic Overspeed Control (SK-411 Rev A)

329443-12X - For 12V Installation Kit
329443-24X - For 24V Installation Kit



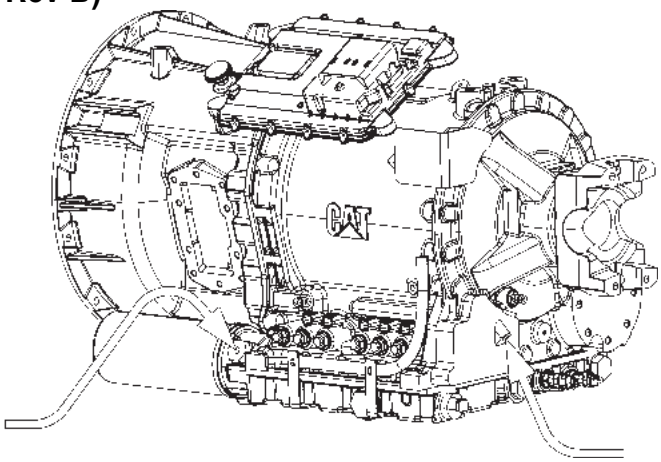
Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Pressure Port Locations & Hose Chart (SK-414 Rev B)



Left Side Port — Rear Port

CX31
(Filter Removed for Clarity)



Left Side Port — Rear Port

CX28

Both High Pressure Connections are -4 O-Ring Boss

HOSE CHART							
Trans.	**P.T.O.**	**P.T.O. Location**	**High Oil Pressure Location**	**P.T.O. Valve Location**	**P.T.O. Fitting**	**Trans. Fitting**	**Trans. P.T.O. Valve Hose #**
		Driver (LHS)	LHS				329075-1X
		Driver (LHS)	Rear	Attached	379486	379812	329075-5X
		Pass. (RHS)	LHS				329075-2X
	277, 278	Pass. (RHS)	Rear			379486	329075-5X
	859	Driver (LHS)	LHS				329130-6X
		Driver (LHS)	Rear	Remote	379486	379812	329130-6X
		Pass. (RHS)	LHS				329130-6X
CX31		Pass. (RHS)	Rear				329130-6X
CX28		Driver (LHS)	LHS			379812	329130-3X
	267	Driver (LHS)	Rear	N/A	379486	379486	329075-5X
		Pass. (RHS)	LHS			379812	329075-2X
		Pass. (RHS)	Rear			379812	329075-5X
		Driver (LHS)	LHS				329130-3X
	867	Driver (LHS)	Rear	N/A	379486	379812	329075-5X
		Pass. (RHS)	LHS				329075-2X
		Pass. (RHS)	Rear			379486	329075-5X

LHS = Left Side of Transmission, 8 o'clock position
RHS = Right Side of Transmission, 1 o'clock position

NOTES:

1. P.T.O. Fitting 379486 and Transmission Fitting 379812 included with the P.T.O. Unit. If Using 379486 in Transmission it Must be Purchased Separately.
2. Hoses to be Purchased Separately.
3. 379486 Elbow Will Not Install on the CX31 Left Hand (Driver) Side Oil Port Due to Transmission Interference. On CX28, 379486 Elbow will Fit on LHS Port.
4. If 379486 is Listed as Transmission Fitting for Rear Location for CX31. Route Hose Along Right Hand (passenger) Side of Transmission and Under Transmission Output Yoke. For the CX28, Route Hose Under the ECM.

Parker Chelsea

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

LOCATION	TORQUE (ENGLISH)	TORQUE (METRIC)
NWD Plug	120 - 156 In. Lbs.	14 - 18 N.m.
Bearing Cap Closed/Open	24 - 28 Lbs. ft.	33 - 39 N.m.
Rotatable Flanges		
"PA", "PF", "RA", "RB", "RF", "RG" (378447-6) (Qty. 4)	16 - 20 Lbs. ft.	22 - 27 N.m.
"RC", "RD", and "RH" (378446-4) (Qty. 6)	8 - 12 Lbs ft.	11 - 16 N.m.
"RK", "RM" (378447-8) (Qty. 4)	16 - 20 Lbs. ft.	22 - 27 N.m.
Valve Cap Assembly Hydraulic Valve Clamp	24 - 28 Lbs. ft. 96 - 120 In. Lbs.	33 - 39 N.m. 11 - 13 N.m.
Shaft Nut "XV" (378435-7)	75 - 85 Lbs. ft.	102 - 115 N.m.

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

OFFER OF SALE

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".

1. Terms and Conditions. Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found on-line at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer's order or any other document issued by Buyer.

2. Price Adjustments; Payments. Prices stated on Seller's quote or other documentation offered by Seller are valid for 30 days, and do not include any sales, use, or other taxes unless specifically stated. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and is due 30 days from the date of invoice or such other term as required by Seller's Credit Department, after which Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

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 Buyers' 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. Parker Chelsea warrants that all products sold conform to the applicable Parker Chelsea standard specification for the lesser period of: (A) 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). (B) Except 590 Series: 1 year (12 Months) from Date of service or 1200 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 COM-PRISES THE SOLE AND ENTIRE WARRANTY PERTAIN-ING 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. Invalidation 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) appointments 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.

05/14

Parker Hannifin Corporation
Chelsea Products Division
Olive Branch, MS 38654 USA

Parker Worldwide

Europe, Middle East, Africa

AE – United Arab Emirates, Dubai
Tel: +971 4 8127100
parker.me@parker.com

AT – Austria, Wiener Neustadt
Tel: +43 (0)2622 23501-0
parker.austria@parker.com

AT – Eastern Europe, Wiener Neustadt
Tel: +43 (0)2622 23501 900
parker.easteurope@parker.com

AZ – Azerbaijan, Baku
Tel: +994 50 22 33 458
parker.azerbaijan@parker.com

BE/LU – Belgium, Nivelles
Tel: +32 (0)67 280 900
parker.belgium@parker.com

BG – Bulgaria, Sofia
Tel: +359 2 980 1344
parker.bulgaria@parker.com

BY – Belarus, Minsk
Tel: +375 17 209 9399
parker.belarus@parker.com

CH – Switzerland, Etoy
Tel: +41 (0)21 821 87 00
parker.switzerland@parker.com

CZ – Czech Republic, Klecany
Tel: +420 284 083 111
parker.czechrepublic@parker.com

DE – Germany, Kaarst
Tel: +49 (0)2131 4016 0
parker.germany@parker.com

DK – Denmark, Ballerup
Tel: +45 43 56 04 00
parker.denmark@parker.com

ES – Spain, Madrid
Tel: +34 902 330 001
parker.spain@parker.com

FI – Finland, Vantaa
Tel: +358 (0)20 753 2500
parker.finland@parker.com

FR – France, Contamine s/Arve
Tel: +33 (0)4 50 25 80 25
parker.france@parker.com

GR – Greece, Athens
Tel: +30 210 933 6450
parker.greece@parker.com

HU – Hungary, Budaoers
Tel: +36 23 885 470
parker.hungary@parker.com

IE – Ireland, Dublin
Tel: +353 (0)1 466 6370
parker.ireland@parker.com

IT – Italy, Corisico (MI)
Tel: +39 02 45 19 21
parker.italy@parker.com

KZ – Kazakhstan, Almaty
Tel: +7 7273 561 000
parker.easteurope@parker.com

NL – The Netherlands, Oldenzaal
Tel: +31 (0)541 585 000
parker.nl@parker.com

NO – Norway, Asker
Tel: +47 66 75 34 00
parker.norway@parker.com

PL – Poland, Warsaw
Tel: +48 (0)22 573 24 00
parker.poland@parker.com

PT – Portugal, Leca de Palmeira
Tel: +351 22 999 7360
parker.portugal@parker.com

RO – Romania, Bucharest
Tel: +40 21 252 1382
parker.romania@parker.com

RU – Russia, Moscow
Tel: +7 495 645-2156
parker.russia@parker.com

SE – Sweden, Spånga
Tel: +46 (0)8 59 79 50 00
parker.sweden@parker.com

SK – Slovakia, Banská Bystrica
Tel: +421 484 162 252
parker.slovakia@parker.com

SL – Slovenia, Novo Mesto
Tel: +386 7 337 6650
parker.slovenia@parker.com

TR – Turkey, Istanbul
Tel: +90 216 4997081
parker.turkey@parker.com

UA – Ukraine, Kiev
Tel: +380 44 494 2731
parker.ukraine@parker.com

UK – United Kingdom, Warwick
Tel: +44 (0)1926 317 878
parker.uk@parker.com

ZA – South Africa, Kempton Park
Tel: +27 (0)11 961 0700
parker.southafrica@parker.com

North America

CA – Canada, Milton, Ontario
Tel: +1 905 693 3000

MX – Mexico, Toluca
Tel: +52 72 2275 4200

Asia Pacific

AU – Australia, Castle Hill
Tel: +61 (0)2-9634 7777

CN – China, Shanghai
Tel: +86 21 2899 5000

HK – Hong Kong
Tel: +852 2428 8008

IN – India, Mumbai
Tel: +91 22 6513 7081-85

JP – Japan, Fujisawa
Tel: +81 (0)4 6635 3050

KR – South Korea, Seoul
Tel: +82 2 559 0400

MY – Malaysia, Shah Alam
Tel: +60 3 7849 0800

NZ – New Zealand, Mt Wellington
Tel: +64 9 574 1744

SG – Singapore
Tel: +65 6887 6300

TH – Thailand, Bangkok
Tel: +662 717 8140

TW – Taiwan, New Taipei City
Tel: +886 2 2298 8987

South America

AR – Argentina, Buenos Aires
Tel: +54 3327 44 4129

BR – Brazil, Cachoeirinha RS
Tel: +55 51 3470 9144

CL – Chile, Santiago
Tel: +56 2 623 1216

Pan Am, Miami
Tel: +1 305-470-8800

Supersedes HY25-6277-M1/US June 2014 HY25-6277-M1/US May 2015

Parker Hannifin Corporation
Chelsea Products Division
8225 Hacks Cross Road
Olive Branch, Mississippi 38654 USA
Tel: (662) 895-1011
Fax: (662) 895-1069
www.parker.com/chelsea