



**YAMAHA**

**DE CARBON  
MONOCROSS SUSPENSION**

# **Service Manual**

## NOTICE

This manual pertains to the DeCarbon monocross suspension found on the "F" model YZ's (YZ125F, YZ250F, and YZ400F) and on "G" model YZ's and one IT (YZ125G, YZ250G, YZ465G, and IT175G). It is intended for reference and use by a trained and qualified mechanic working in an authorized Yamaha dealership equipped with the facilities, tools, and equipment required to safely service the monocross suspension. Qualified mechanics are those individuals certified by the appropriate Yamaha importer to have the ability to service the monocross suspension according to the manual's recommendations. Certification can include formal training, motorcycle service experience, monocross suspension service experience, or any other requirement deemed necessary by the Yamaha importer.

The maintenance of the monocross suspension system differs considerably from that of conventional suspension systems. The service mechanic must have a complete knowledge of the system to assure that it safely reproduces its original performance characteristics. The mechanic or customer may be harmed if the monocross suspension is not serviced correctly. For this reason, only mechanics authorized by the appropriate Yamaha importer may service the monocross suspension. Under no circumstances may the contents of this manual be disclosed to a third party.

Particularly important information is distinguished in this manual by the following notations:

**NOTE:** A **NOTE** provides key information to make procedures easier or clearer.

**CAUTION:** A **CAUTION** indicates special procedures that must be followed to avoid damage to the monoshock.

**WARNING:** A **WARNING** indicates special procedures that must be followed to avoid injury to a machine operator or person inspecting or repairing the monoshock.

YAMAHA MONOCROSS SUSPENSION  
(DE CARBON SYSTEM)  
SERVICE MANUAL  
1st Edition, June 1980

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## HOW TO USE THIS MANUAL

This manual provides complete instructions for disassembling and assembling certain DeCarbon monoshocks found on Yamaha motorcycles. Each chapter is sequential. By following the procedure section by section, you can disassemble then assemble a monoshock. Except for the sections entitled "Disassembling the Rod-Piston Assembly" and "Assembling the Rod-Piston Assembly", each section in a chapter applies to all appropriate monoshocks.

Before beginning work on any monoshock, you must identify the external construction (X or R) and the rod-piston assembly used on that particular shock. The external construction will direct you to the correct chapter. Chapter 4: "The X Monoshock" pertains to monoshocks with an X construction; those monoshocks without a separate gas reservoir. Chapter 5: "The R Monoshock" pertains to monoshocks with an R construction; those monoshocks with a separate gas reservoir.

As explained in Chapter 1, Yamaha uses three types of rod-piston assemblies in its monoshocks: 2X3, 2X4, and 3R4 rod-pistons. Each section in this manual that deals with disassembling or assembling a rod-piston assembly is divided into subsections. These subsections give the instructions for disassembling or assembling a specific rod-piston assembly. When you come to the section entitled "Disassembling the Rod-Piston Assembly" or "Assembling the Rod-Piston Assembly", follow the instructions in the subsection that apply to that particular rod-piston assembly found in your monoshock. Ignore the set of instructions in the other subsection, proceed to the next section in the chapter, and continue work.

For example: the monoshock on an IT175G is a 3R6 monoshock. It has an R construction and a 2X3 rod-piston assembly. When working on a 3R6 monoshock, follow the instructions in Chapter 5: "The R Monoshock." The section entitled "Disassembling the Rod-Piston Assembly", however, contains instructions for disassembling two types of rod-pistons: the 2X3 and the 3R4 rod-pistons. Since this monoshock has a 2X3 rod-

piston assembly, follow the instructions in subsection A: "Disassembling the 2X3 Rod-Piston Assembly" and ignore the instructions in subsection B: "Disassembling the 3R4 Rod-Piston Assembly." When you have disassembled the rod-piston, proceed to the next section in Chapter 5 ("Removing the Hose Assembly") and continue your work. Do the same when assembling the rod-piston assembly. Follow the instructions for the 2X3 rod-piston and ignore those for the 3R4 rod-piston.

Whenever a part is mentioned in the text, the part name is followed by a number in parentheses. This number is the reference number for that part. Reference numbers in the text are keyed to the exploded diagram that precedes each section.

You will also notice a number in parentheses following the names of some parts in the legends of the exploded diagrams. This is the number of that part needed for one (1) complete assembly of the exploded component. If no number follows a part in the legend, that part is used once in one complete assembly.

## TERMS

When the manual text refers to a vise, use a vise with soft jaws so no part of the monoshock will be marred or damaged. Use a high-temperature, lithium grease whenever the text calls for grease or directs you to grease a particular part or component.

## SHOP CONDITIONS

**CAUTION:** *The procedures described in this manual MUST be performed in a clean environment. The work area, tools, and equipment must be clean and dust free. A monoshock's performance will be adversely affected if a shock is assembled with dust or any foreign matter on the parts. Always work in a CLEAN area when servicing a monoshock. Blow all parts clean with compressed air before installing them in the monoshock.*

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# CHAPTER 1. GENERAL INFORMATION

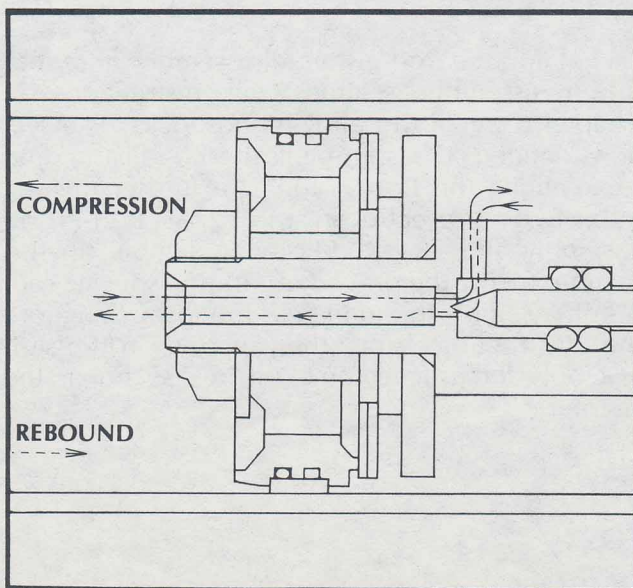
## THEORY OF OPERATION

Shock absorbers function in a motorcycle by converting the kinetic energy of the suspension into heat and dispersing that heat into the atmosphere. When a shock contracts or rebounds, the piston and rod move through the oil in the cylinder. This movement forces oil through the valving in the rod and piston. The friction generated by this movement through the oil converts the kinetic energy into heat, and this heat is dissipated into the atmosphere.

A monoshock damps the energy from the suspension in the same manner. When a motorcycle goes over a small bump, the monocross suspension contracts. The rod and piston move through the oil and into the cylinder. Oil on one side of the piston flows to the other side by passing through the orifice in the center of the rod. Part of the energy from the contracting motion is damped by the movement of oil through the orifice. This energy is converted into heat and dissipated into the atmosphere. The remaining energy in the suspension is absorbed and stored by the gas-and-compression spring.

When the monoshock stops contracting, the gas-and-compression spring releases the energy it has absorbed and the shock rebounds. The rod and piston move out of the cylinder, oil flows back through the orifice, and more kinetic energy is converted into heat and dispersed.

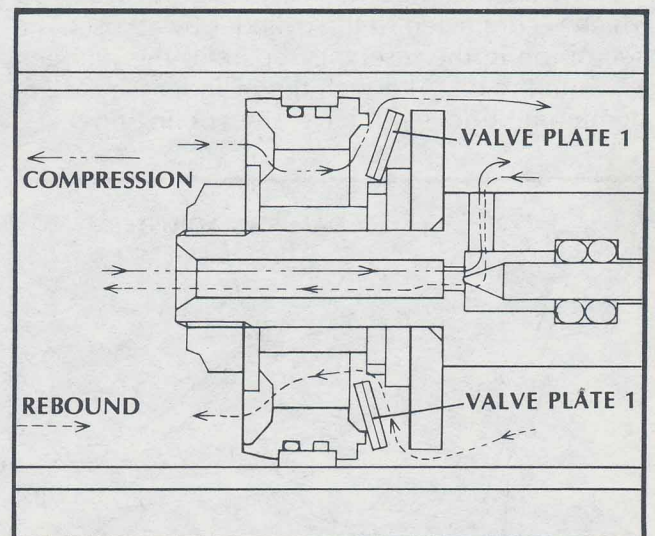
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The damping process is slightly different when you jump a motorcycle or go over large whoops. When a motorcycle comes down off a jump, a

great deal of energy is transmitted to the suspension. The monoshock contracts with a great deal of force, and the piston moves rapidly through the oil. Some oil passes through the orifice in the rod and damps part of the energy. More energy, however, is present in the suspension than can be damped by the movement of oil through the orifice in the rod. The pressure in the cylinder increases, and this increased pressure opens valve plate 1.

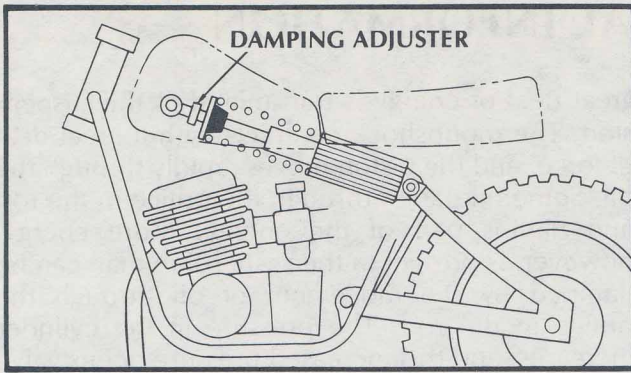
As described above, the gas-and-compression spring stores the remaining energy. When the suspension stops contracting, the spring releases the energy and the monoshock rebounds. Oil flows back through the orifice in the rod and through valve plate 1.



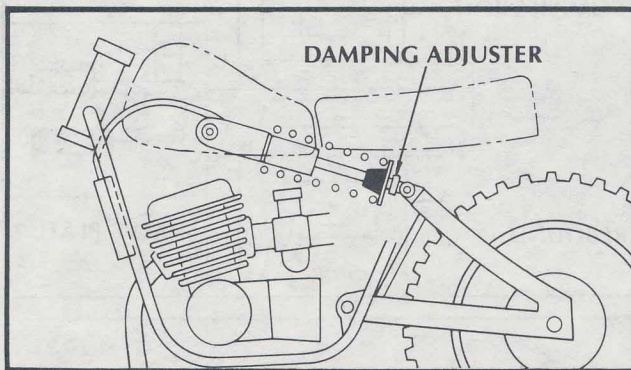
## CONSTRUCTION AND IDENTIFICATION

Yamaha monoshocks are identified by the external construction and by the rod-piston assembly. Two types of external constructions are found on Yamaha monoshocks: the X construction and the R construction.

The X construction (2X3 and 2X4 monoshocks) is used on YZ125F, YZ250F, and YZ400F models. These monoshocks are mounted to the motorcycle with the damper subassembly facing the rear of the motorcycle. The cylinder mounting bracket is mounted to the swingarm while the upper mounting bracket is bolted to the frame. The cylinder is made of aluminum and has cooling fins to help dissipate the heat. The nitrogen gas and oil in the cylinder are completely separated by the free piston.



The R construction (3R3, 3R4, and 3R6 monoshocks) is found on the IT175G, YZ125G, YZ250G, and YZ465G. These monoshocks are mounted with the damper subassembly positioned toward the front of the motorcycle. The cylinder mounting bracket mounts to the frame while the upper mounting bracket mounts at the swingarm. The R construction uses a separate gas reservoir which is connected to the cylinder by a hose. The free piston in the reservoir separates the nitrogen gas from the oil. Although the cylinder is made of aluminum, it does not have any cooling fins.



In addition to the external constructions, Yamaha also uses three rod-piston assemblies in its monoshocks: 2X3, 2X4, and 3R4 rod-pistons. As a result, there are five (5) types of Yamaha monoshocks: 2X3, 2X4, 3R3, 3R4, and 3R6. The monoshock type is printed on the i.d. tag found on each shock. The tag is on the cylinder on X monoshocks and on the gas reservoir on R monoshocks.

Before beginning any work on a monoshock, you must identify the external construction and the rod-piston assembly so you can locate the correct instructions for that particular shock. The major difference between external constructions is obvious: R shocks have a separate gas reservoir while X shocks do not.

The noticeable differences between rod-piston assemblies are slight, but these differences greatly affect the damping characteristics of the shock. You must identify the rod-piston assembly before beginning any work so you can locate the correct instructions for that particular rod-piston assembly.

Use the chart on the next page to identify the external construction and the rod-piston assembly of the shock you are working on. Locate the appropriate instructions and proceed accordingly.

Do not confuse the monoshock type with the rod-piston assembly. Although these designators are similar, they refer to two distinct units. A rod-piston assembly designator (2X3 rod-piston) refers to a specific rod-piston construction. The monoshock type (3R6 shock), however, refers to the combination of external construction and rod-piston assembly used in that type of shock.

For example: a 3R6 monoshock (from an IT175G) has an R construction and a 2X3 rod-piston. If you are working on a 3R6 monoshock, follow the instructions in Chapter 5. When you come to the rod-piston assembly section, follow the instructions for the 2X3 rod-piston assembly found in Chapter 5.

Except for the rod-piston disassembly and rod-piston assembly sections, all instructions in Chapter 5 pertain to all R monoshocks. The sections entitled "Disassembling the Rod-Piston" and "Assembling the Rod Piston" are further divided into two subsections: the 2X3 Rod-Piston Assembly and 3R4 Rod-Piston Assembly. In this section, follow the procedures for the specific rod-piston assembly found in your monoshock. Ignore the instructions for the second rod-piston assembly and proceed on to the next section in the chapter.

## IDENTIFICATION CHART

		EXTERNAL CONSTRUCTION		ROD-PISTON ASSEMBLY (PISTON, VALVE AND RELATIVE PARTS)		
TYPE OF MONOSHOCK	RELATIVE MODEL	X CONSTRUCTION	R CONSTRUCTION	2X3 ROD-PISTON	2X4 ROD-PISTON	3R4 ROD-PISTON
2X3	YZ125F	0		0		
2X4	YZ250F YZ400F	0			0	
3R3	YZ125G		0			0*
3R4	YZ250G YZ465G		0			0
3R6	IT175G		0	0		

\*The construction and configuration are identical to the 3R4 Rod-Piston, but the dimensions of the valve parts are slightly different.



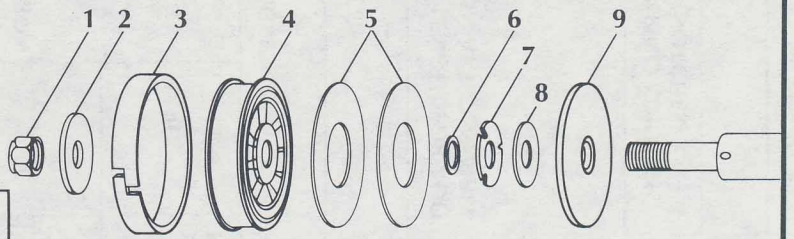
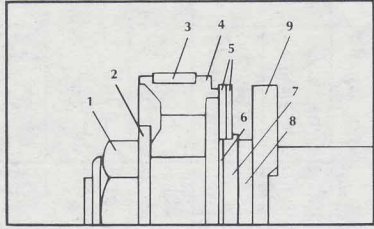
## ROD-PISTON COMPONENTS

REF. NO.	PART	2X3 ROD-PISTON	2X4 ROD-PISTON	3R3 ROD-PISTON*	3R4 ROD-PISTON
1	U-Nut	0	0	0	0
2	Piston Baffle	12/29/25mm (0.5/1.1/0.1 in.)		12/25.5/1.4mm (0.5/1/0.05 in.)	
3	Piston Ring	Non-directional		Directional	
4	Piston	Without Seal Ring Groove		With Seal Ring Groove	
5	Valve Plate 1	25/42.5/0.46mm (1/1.7/0.02 in.)		25/41/0.46mm (1/1.6/0.02 in.)	25/42.5/0.46mm (1/1.7/0.02 in.)
6	Valve Set Shim	12/19/0.36mm (0.5/1.3/0.01 in.)			
7	Center Plate	12/25/0.92mm (0.5/1/0.04 in.)	12/-/1.3mm (0.5/-/0.05 in.)	12/25/0.77mm (0.5/1/0.03 in.)	12/25/0.82mm (0.5/1/0.03 in.)
8	Control Washer	12/25/0.55mm (0.5/1/0.02 in.)	12/25.8/1.0mm (0.5/1/0.04 in.)	12/26.0/1.4mm (0.5/1/0.06 in.)	12/26.5/1.4mm (0.5/1/0.06 in.)
9	Seat Washer	12/42.5/2.5mm (0.5/1.7/0.1 in.)		12/41/3.2mm (0.5/1.6/0.1 in.)	
10	Expansion Clip			0	0
11	Ring Seal			0	0

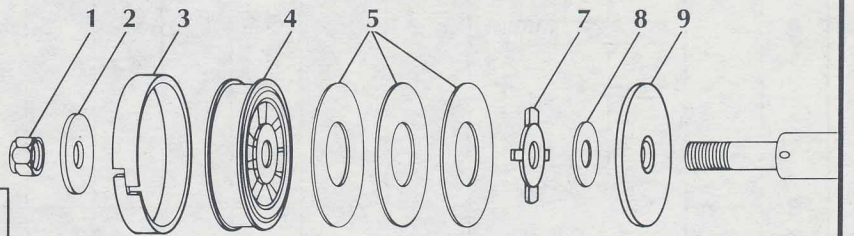
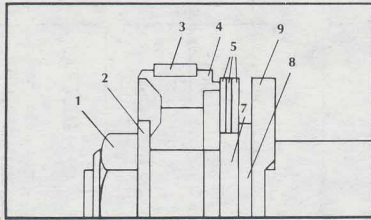
(inner diameter/outer diameter/thickness)

\*The construction and configuration are identical to the 3R4 Rod-Piston, but the dimensions of the valve parts are slightly different.

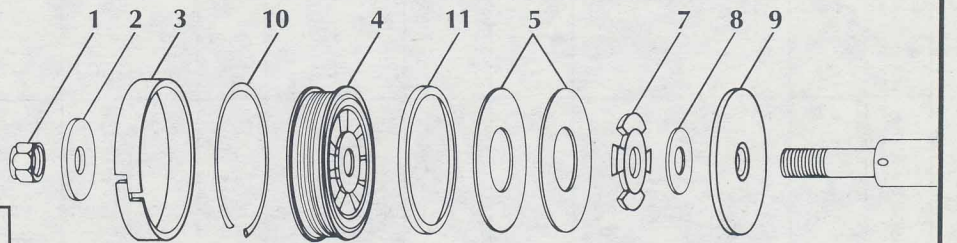
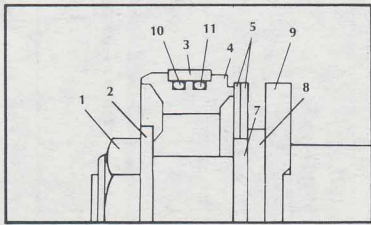
**2X3 ROD-PISTON**



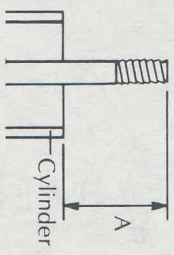
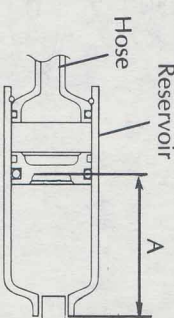
**2X4 ROD-PISTON**



**3R4 ROD-PISTON**



**SERVICE DATA** NOTE: Color code is painted at the end of each coil spring.

TYPE OF M.X.S.		2X3 TYPE (without the reservoir)	2X4 TYPE (without the reservoir)		3R3 TYPE (with the reservoir)	3R4 TYPE (with the reservoir)		3R6 TYPE (with the reservoir)
MODEL	EYE TO EYE	YZ125F	YZ250F	YZ400F	YZ125G	YZ250G	YZ465G	IT175G
SET LENGTH		295 mm (11.6 in.)	308 mm (12.1 in.)	306 mm (12 in.)	356 mm (14 in.)	335 mm (13.2 in.)		335 mm (13.2 in.)
S.T.D.		2.17 ~ 3.75	2.55 ~ 5.03		1.8 ~ 3.1	2.1 ~ 5.1		2.2 ~ 4.6
COMPRESSION SPRING	S.T.D.	Spring Rate (kg/mm)	Pink (90501-98540)	Blue (90501-99479)	Red (3R3-22210-00)	None (3R4-22210-00)	Yellow (3R6-22210-00)	
		Color Code (Part No.)	White, Yellow (90501-98478)	Yellow (90501-99481)	Red Green (3R3-22210-10)	Green (3R4-22210-10)	Yellow, Green (3R6-22210-10)	
		Spring Rate (kg/mm)	1.91 ~ 4.02	2.09 ~ 4.91	1.7 ~ 2.8	2.0 ~ 4.6	2.0 ~ 4.2	
GAS PRESSURE	SOFT	Color Code (Part No.)	White, Red (90501-98477)	Red (90501-99480)	Red, Blue (3R3-22210-20)	Blue (3R4-22210-20)	Yellow, Blue (3R6-22210-20)	
		Spring Rate (kg/mm)	2.72 ~ 4.03	2.96 ~ 5.05	1.9 ~ 3.6	2.2 ~ 5.7	2.41 ~ 5.2	
		Color Code (Part No.)	White, Red (90501-98477)	Red (90501-99480)	Red, Blue (3R3-22210-20)	Blue (3R4-22210-20)	Yellow, Blue (3R6-22210-20)	
OIL CAPACITY	HARD	Spring Rate (kg/mm)	15 ± 0.5 kg/cm <sup>2</sup> (213 psi)	17 ± 0.5 kg/cm <sup>2</sup> (242 psi)	15 ± 0.5 kg/cm <sup>2</sup> (213 psi)			
		Color Code (Part No.)	White, Red (90501-98477)	Red (90501-99480)	Red, Blue (3R3-22210-20)	Blue (3R4-22210-20)	Yellow, Blue (3R6-22210-20)	
SPECIFIED LENGTH FOR ROD OR FREE PISTON AT REASSEMBLY		344 cm <sup>3</sup> (cc) (0.364 quart)	345 cm <sup>3</sup> (cc) (0.365 quart)					
S.T.D. DAMPING ADJUSTER POSITION (NOTCHES)								
OIL		14	12	9	11	15		
		Yamaha suspension oil C or equivalent		Yamaha suspension oil F or equivalent		Yamaha suspension oil D or equivalent		
		A = 50 ± 2mm (2.0 ± 0.08 in.)		A = 130 ~ 138 mm (5.1 ~ 5.4 in.)				

# CHAPTER 2. ADJUSTING THE MONOSHOCK

## TUNING

### A. Adjustments and Effects

1. Damping (orifice) adjustment
  - a. Turning the damping adjuster clockwise: increases the damping; the shock absorber becomes stiffer.
  - b. Turning the damping adjuster counterclockwise: decreases the damping; the shock absorber becomes softer.
2. Gas pressure
  - a. Increasing the gas pressure: achieves the same effect as when the preload is increased; the absorber becomes stiffer and rebounds more quickly.
  - b. Decreasing the gas pressure: achieves the same effect as when the preload is decreased; the absorber becomes softer and rebounds more slowly.

3. Spring set length
  - a. Shortening the set length: increases the preload; the shock becomes stiffer and rebounds more quickly.
  - b. Lengthening the set length: decreases the preload; the shock becomes softer and rebounds more slowly.
4. Spring replacement
  - a. Using the hard type: the spring rate is higher; the spring is stiffer and rebounds more quickly.
  - b. Using the soft type: the spring rate is lower; the spring is softer and rebounds more slowly.

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### B. Symptoms and Adjustments

The general procedure for shock adjustment is described below. Each adjustment should be made after you fully understand the effects of that particular adjustment.

## SEQUENCE

SYMPTOM	1	2	3	4
<b>Bottoming</b>	Shorten the set length (increase preload)	Increase damping	Increase gas pressure	Replace spring (hard type)
<b>Soft</b>	Increase damping	Shorten set length (Increase preload)	Increase gas pressure	Replace spring (hard type)
<b>Hard</b>	Decrease damping	Extend the set length (Decrease preload)	Decrease gas pressure	Replace spring (soft type)

### C. Tuning Notes:

1. It is advisable to use the standard setting. If it does not suit your preference, then make an adjustment according to the table above and the following instructions.
  - a. Set length should be adjusted in 3mm (0.1 in.) increments.
  - b. Damping should be adjusted in increments of 2 clicks.
  - c. Gas pressure should be adjusted within the 13 kg/cm<sup>2</sup> to 20 kg/cm<sup>2</sup> (185 to 284 psi) range.
2. Start adjustments using sequence 1. After each test ride, proceed to the next sequence, if necessary.

## ADJUSTMENT

### A. Checking the Gas Pressure

Always use a check gauge to check the nitrogen pressure in the gas chamber. Remove the panhead screw from the gas filler plug and insert the oiled needle into the rubber valve.

### B. Bleeding the Gas

Oil the monoshock needle and carefully insert the needle into the gas filler plug. Slowly push the rod into the cylinder until the rod bottoms.

**NOTE: Always replace the safety sheave on the check gauge to protect the needle from damage.**

### C. Adding Nitrogen Gas

1. Remove the panhead screw from the gas filler plug.
2. Thread the monoshock needle onto the nitrogen pressure hose and lightly oil the needle.
3. Completely close the regulator by turning the knob counterclockwise.
4. Open the nitrogen bottle main valve.
5. Insert the monoshock needle into the gas filler plug.

**CAUTION: Support the monoshock needle when you pressurize the system so the needle will not be damaged.**

6. Adjust the gas pressure to the desired level. Hold this pressure for one minute. Do not over-charge the gas chamber.

MAXIMUM STATIC PRESSURE  
20 kg/cm<sup>2</sup> (284 psi)

**WARNING: Do not charge the system with one large burst of gas. Gradually increase the pressure until the desired pressure is attained.**

7. Close the main valve of the nitrogen bottle. Remove the monoshock needle from the gas filler plug. The nitrogen in the hose will flow out. Back off the pressure regulator.
8. Check the pressure with a check gauge.

**NOTE: Approximately 5 psi will be lost from the gas chamber when you verify the pressure with a check gauge. ALWAYS verify the pressure with a check gauge. Do not rely on the regulator.**

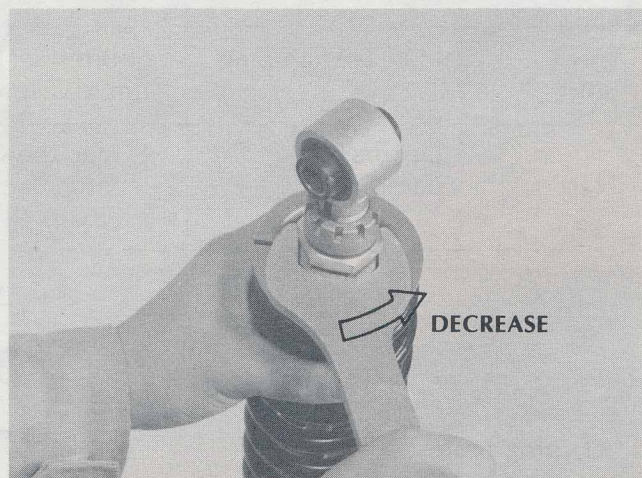
9. Reinstall the panhead screw in the gas filler plug.

10. Replace the safety sheave on the monoshock needle.

### D. Adjusting the Preload

The preload is adjusted by changing the set length of the spring: a shorter set length increases the preload, a longer set length decreases the preload.

To adjust the preload, remove the monoshock from the motorcycle and loosen the jam nut. Adjust the spring set length by turning the spring adjuster with the special wrench. To increase the preload, turn the spring adjuster clockwise. To decrease the preload, turn the spring adjuster counterclockwise. Never attempt to turn the adjuster beyond the maximum or minimum setting.



Whenever adjusting the preload, adjust the spring set length in 3mm (0.1 in.) increments. Always tighten the jam nut against the spring adjuster and torque the jam nut to specification.

JAM NUT TORQUE:  
6.5 m-k (47 ft.-lbs.)

## STANDARD SET LENGTH

MONOSHOCK	MODEL	SET LENGTH
2X3	YZ125F	295mm (11.6 in.)
2X4	YZ250F	308mm (12.1 in.)
	YZ400F	306mm (12.0 in.)
3R3	YZ125G	356mm (14.0 in.)
3R4	YZ250G	356mm (14.0 in.)
	YZ465G	356mm (14.0 in.)
3R6	IT175G	335mm (13.2 in.)

### E. Adjusting the Damping

To set the damping, turn the damping adjuster clockwise until it bottoms; then back it out to the standard setting.

The damping can be increased by turning the damping adjuster clockwise. Turning the damping adjuster counterclockwise will decrease the damping.

Adjust the damping in increments of 2 clicks.

## STANDARD DAMPING SETTING

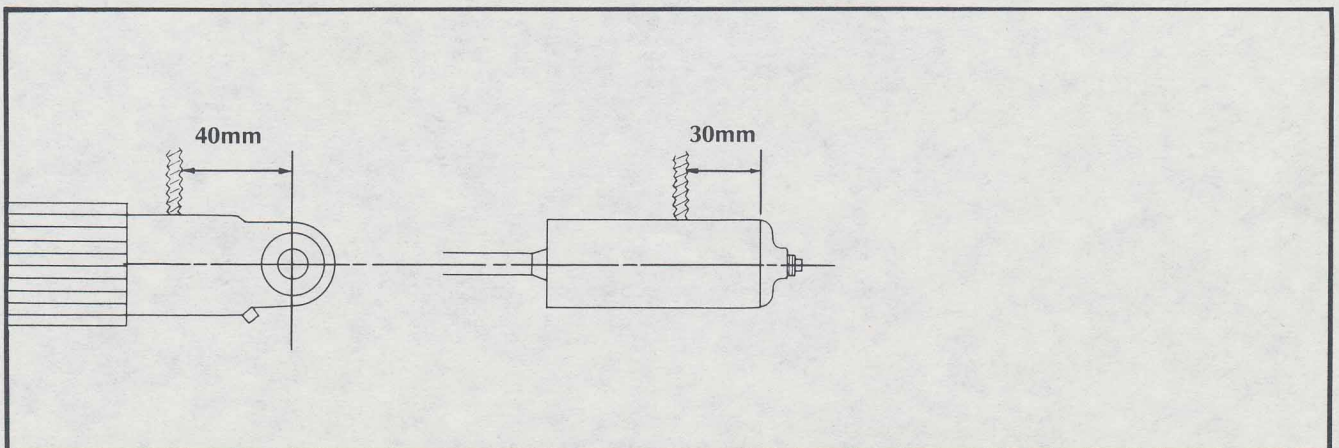
MONOSHOCK	MODEL	SETTING
2X3	YZ125F	14 Clicks Out
2X4	YZ250F	12 Clicks Out
	YZ400F	
3R3	YZ125G	9 Clicks Out
3R4	YZ250G	11 Clicks Out
	YZ465G	
3R6	IT175G	15 Clicks Out

## HANDLING NOTES

**WARNING:** Never subject a monoshock to an open flame or other high heat source. The monoshock contains highly compressed nitrogen gas. High temperatures could cause the unit to explode due to excessive gas pressure.

Gerard Rouquette

**DISPOSAL NOTES:** The gas pressure must be released before disposal. To do so, bleed the gas from the monoshock. Drill a 2 to 3mm (0.08 to 0.12 in.) hole through the cylinder wall at a point 40mm (1.6 in.) above the bottom of the cylinder, or drill the reservoir at a point 30mm (1.2 in.) above the bottom of the reservoir.



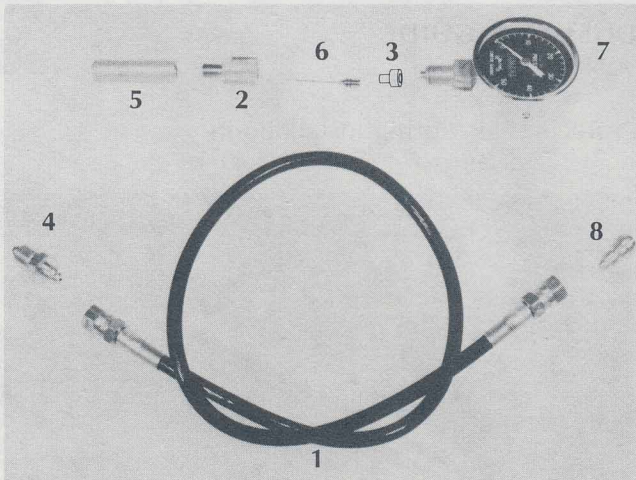
## CHAPTER 3: SPECIAL TOOLS

The following special tools are required when servicing the monocross suspension.

### GAUGE SET 90890-01160

To check the nitrogen gas pressure or refill with nitrogen gas, the following tools are required:

1. Hose ..... 90890-01158
2. Joint gauge ..... 90890-01161
3. Joint holder ..... 90890-01162
4. Joint hose end ..... 90890-01163
5. Joint cover ..... 90890-01164
6. Needle ..... 90890-01167
7. Check gauge ..... 90890-03063
8. Joint ..... 90890-01165



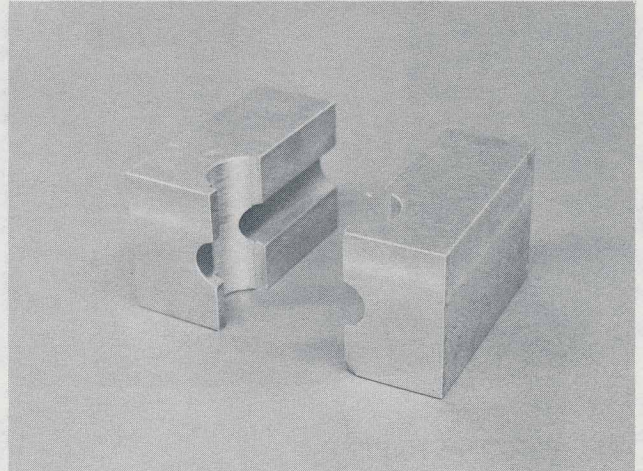
### SPECIAL WRENCH 1W1-28135-00

The special wrench is used to loosen or tighten the spring adjuster.



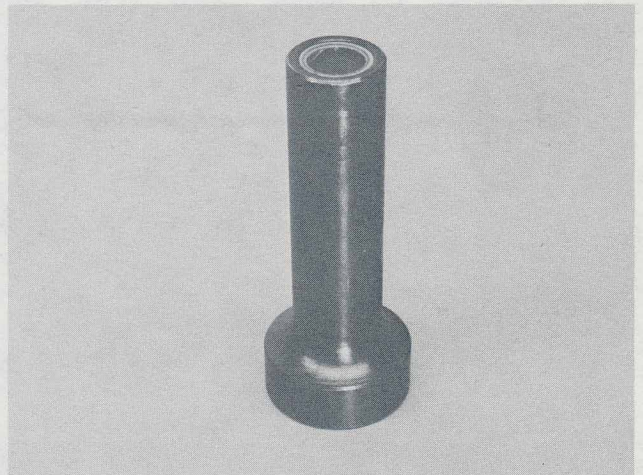
### ROD HOLDER 90890-01313

The rod holder firmly grips the shock rod in a vise.



### ROD GUIDE COMPRESSOR 90890-01314

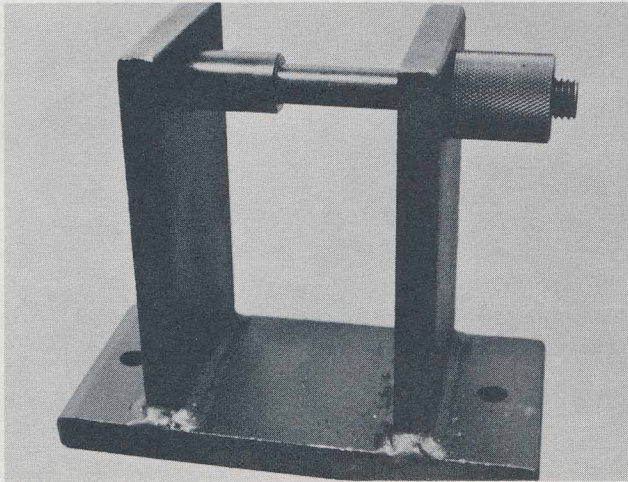
The rod guide compressor pushes the rod guide into the cylinder so the upper circlip can be removed.



**CASE HOLDER**

90890-01315

The case holder secures the damper subassembly so it can be placed in the press.



**O-RING INSTALLER**

90890-01316

Installs o-rings without nicks or scratches.

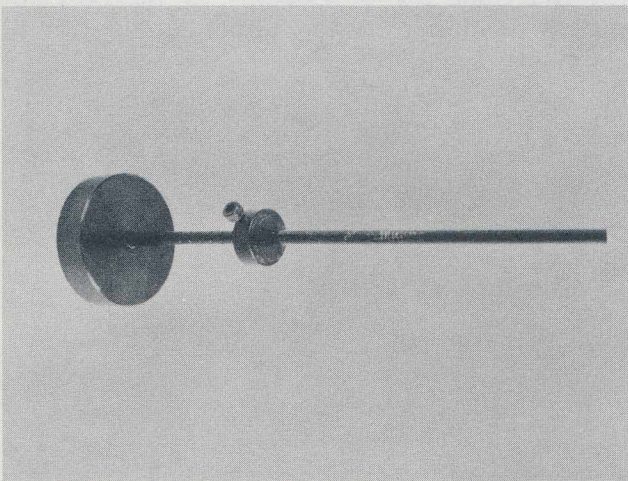


**FREE PISTON STOPPER**

90890-01317

Lee Waldie Craig Scott Chris Koira

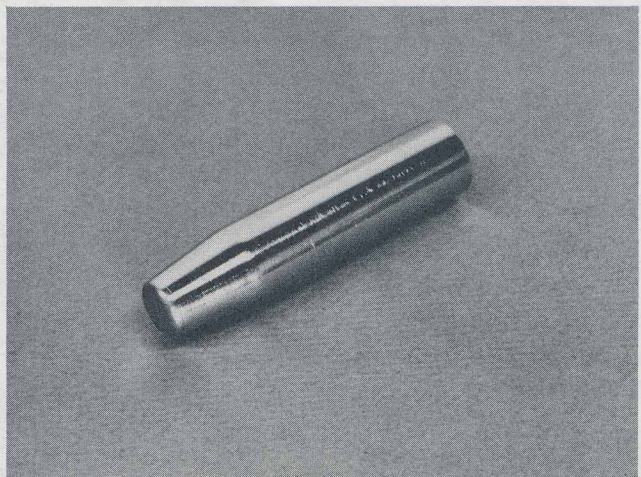
This tool sets the free piston at the proper depth in the gas reservoir.



**DUST SEAL GUIDE**

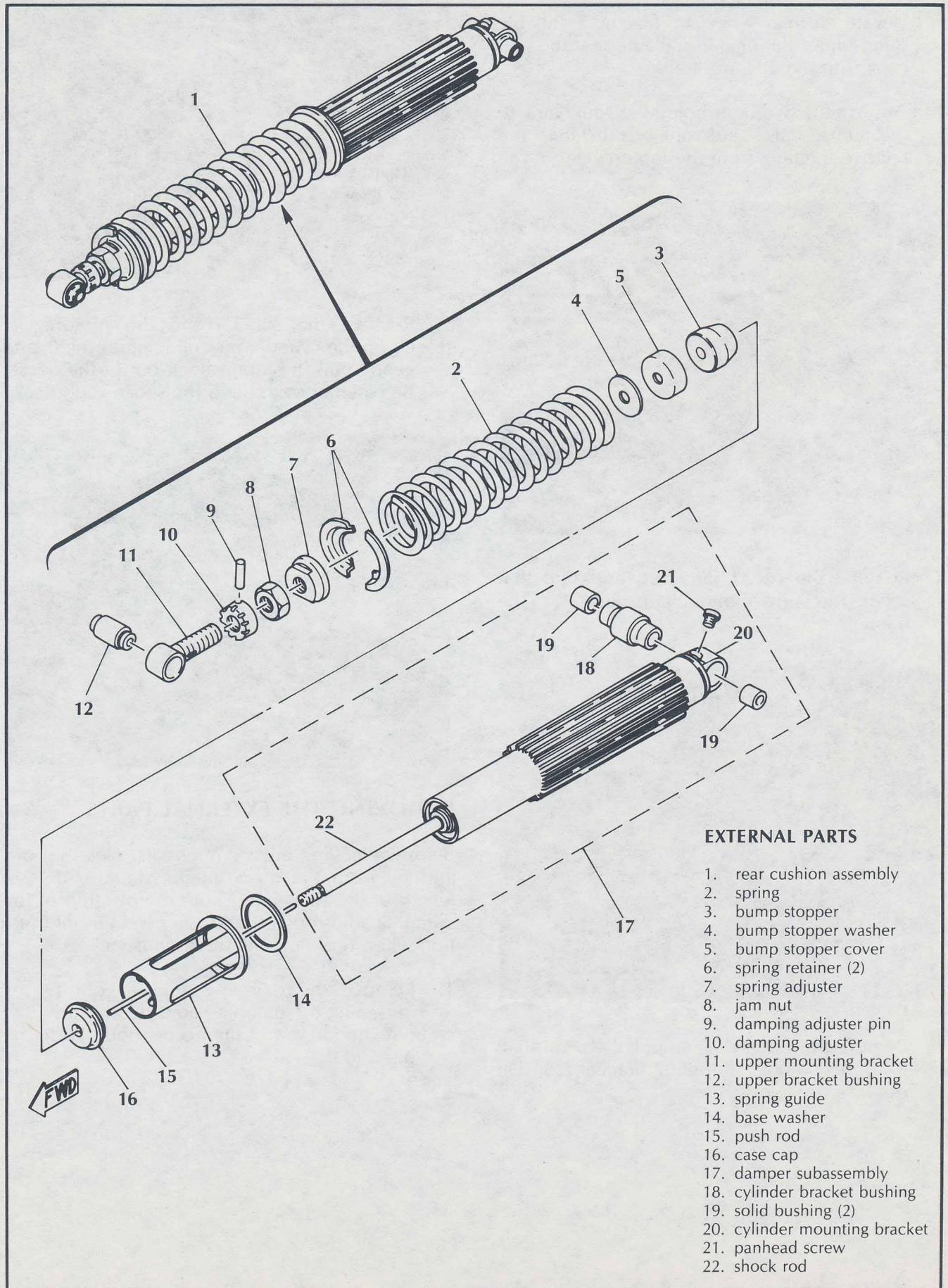
90890-01318

Protects seals during installation.





# CHAPTER 4. THE X MONOSHOCK

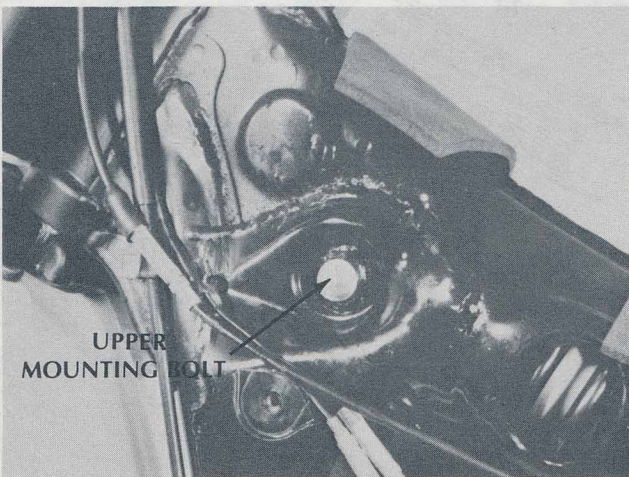


## REMOVING THE MONOSHOCK FROM THE MOTORCYCLE

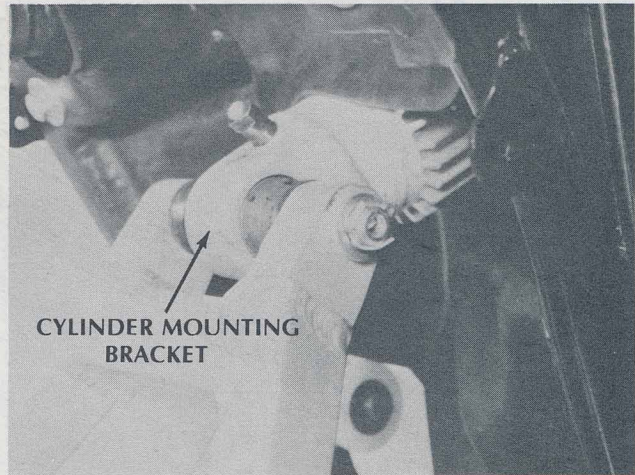
1. Elevate the rear wheel by placing a suitable stand under the engine. Be sure that the pet-cock is in the OFF position.
2. Remove the two bolts holding the fuel tank to the frame. Raise the front of the tank, and remove the tank from the motorcycle.



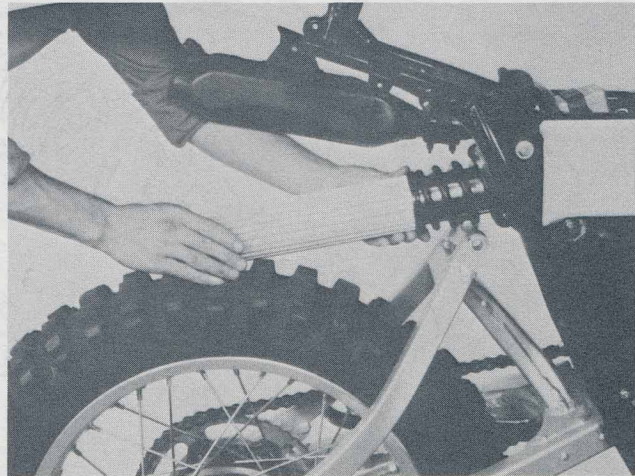
3. Remove the cotter pin, nut, and bolt that secure the upper mounting bracket (11) to the frame.



4. Remove the cotter pin and pull the pivot shaft from the cylinder mounting bracket (20). Do not lose the two washers.



5. Remove the shock from the motorcycle. Grasp the cylinder mounting bracket (20) and gently pull the monoshock out of the frame. Be careful not to bend the shock rod.

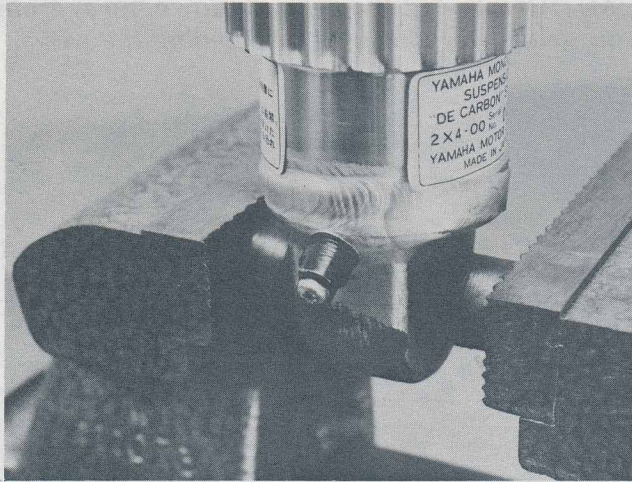


## REMOVING THE EXTERNAL PARTS

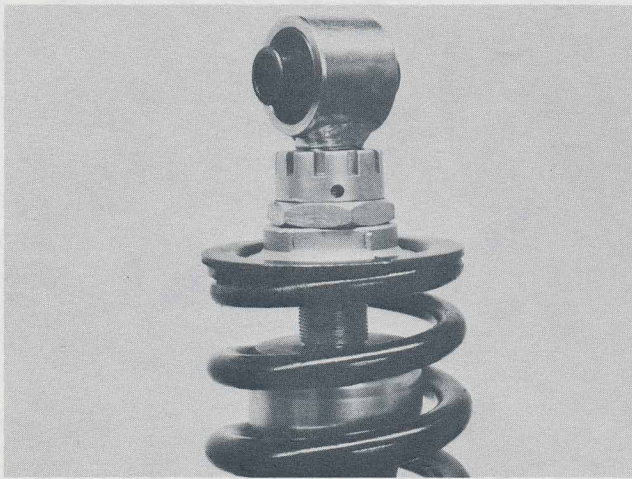
Before removing any components, clean all dirt and oil from the monoshock. Measure the set length of the spring and note the position of the damping adjuster (10). You will need this information when reassembling the monoshock.

1. Remove the damping adjuster pin (9) by loosening the damping adjuster (10) until the pin can fall out of the access hole. Place the pin aside.

- Secure the monoshock in a vise with soft jaws. The vise should grip the cylinder mounting bracket (20) as shown in the photograph.

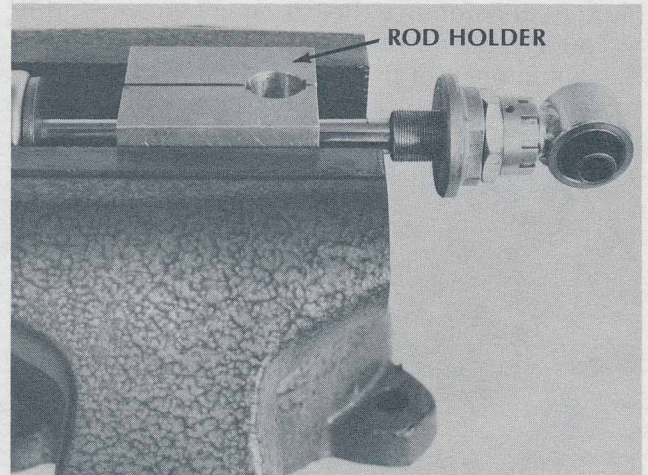


- Loosen the damping adjuster (10) until it contacts the upper mounting bracket (11).
- Loosen the jam nut (8) and thread it up against the damping adjuster (10).  
Gerard Rouquette
- Loosen the spring adjuster (7) and thread it up against the jam nut (8).

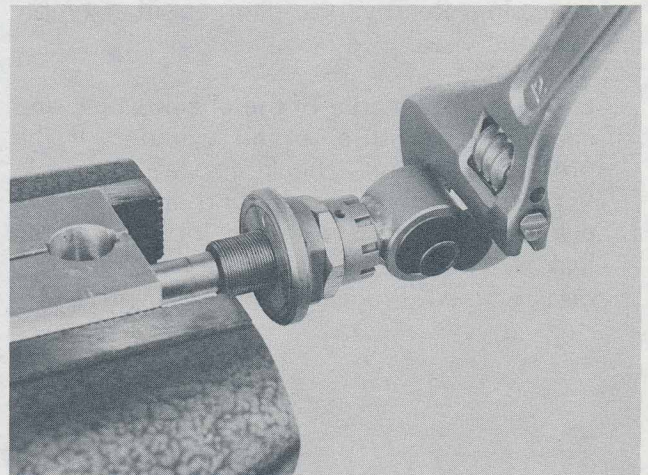


- Compress the spring (2) and remove both spring retainers (6).
- Remove the spring (2), spring guide (13), and base washer (14).
- Remove the damper subassembly from the vise. Clean all dirt and oil from the rod holder.
- Place the shock rod (22) in the rod holder and secure the rod holder in the vise. The rod holder must firmly grip the rod.

**CAUTION:** Do not slide the rod holder over the shock rod. The rod must not be scratched, nicked, or damaged in any way. Any damage to the rod could lead to a seal leak.



- Place a crescent wrench on the upper mounting bracket (11) as shown in the photograph. The flats of the wrench must rest against the eye of the bracket.



- Steady the wrench with your free hand and remove the upper mounting bracket (11) from the shock rod (22).

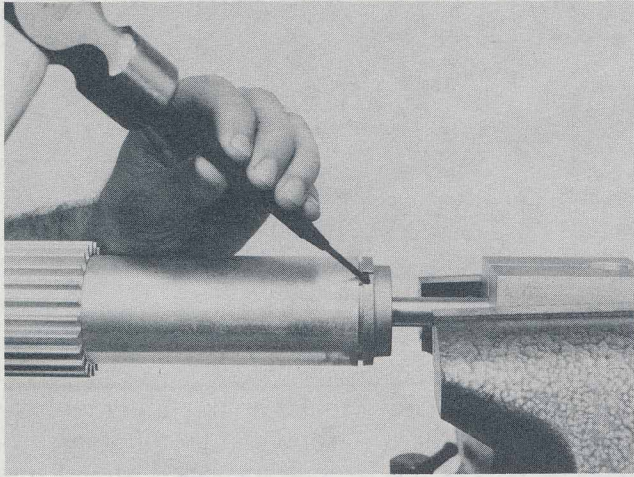
**CAUTION:** The bracket is secured to the shock rod with Loctite. Be sure the rod does not rotate in the rod holder.

- Remove the bump stopper washer (4), the bump stopper cover (5), and the bump stopper (3). The bump stopper and the bump stopper cover might come off as one unit.

13. Remove the push rod (15) from the shock rod (22).

**CAUTION: Do not bend the push rod.**

14. Carefully remove the case cap (16) with a drift punch. Be sure to drift around the entire circumference of the cap.

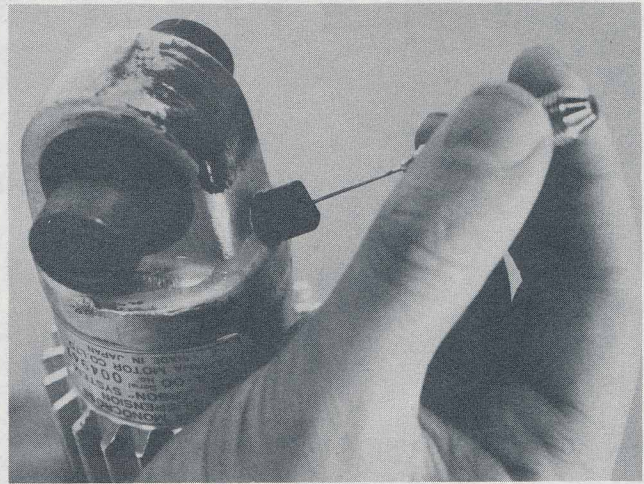


15. Remove the panhead screw (21) from the gas filler plug. Remove the damper subassembly from the vise.

16. Lubricate the needle of the check gauge and check the pressure in the cylinder. If the pressure is low, check for a gas leak. Repressurize the system, and immerse the cylinder in water. Note the location of the leak so you can repair it when the shock is disassembled. Proceed with your work.

17. Lubricate the monoshock needle and insert it in the gas filler plug. Bleed **all** the gas from the monoshock.

**CAUTION: Direct the cylinder down, away from you, whenever checking or bleeding the gas.**

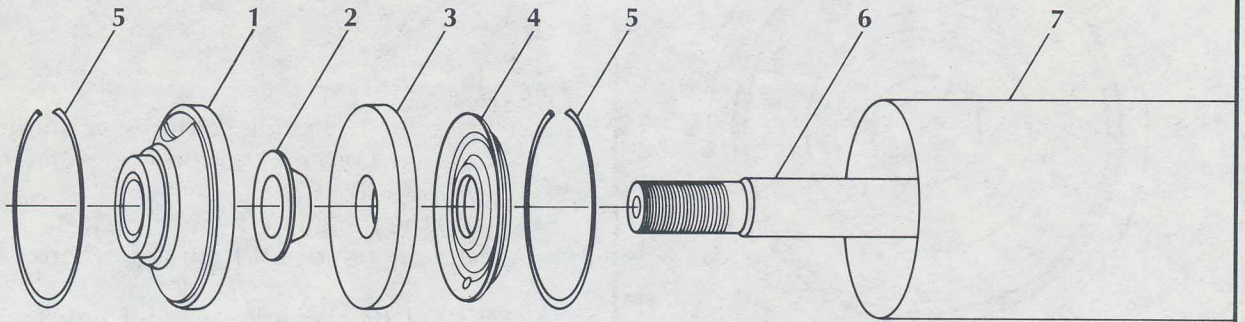


18. When the gas has been bled, gently push the shock rod (22) into the cylinder until it bottoms. This will help bleed any remaining gas. Keep the needle in the plug until instructed to remove it.

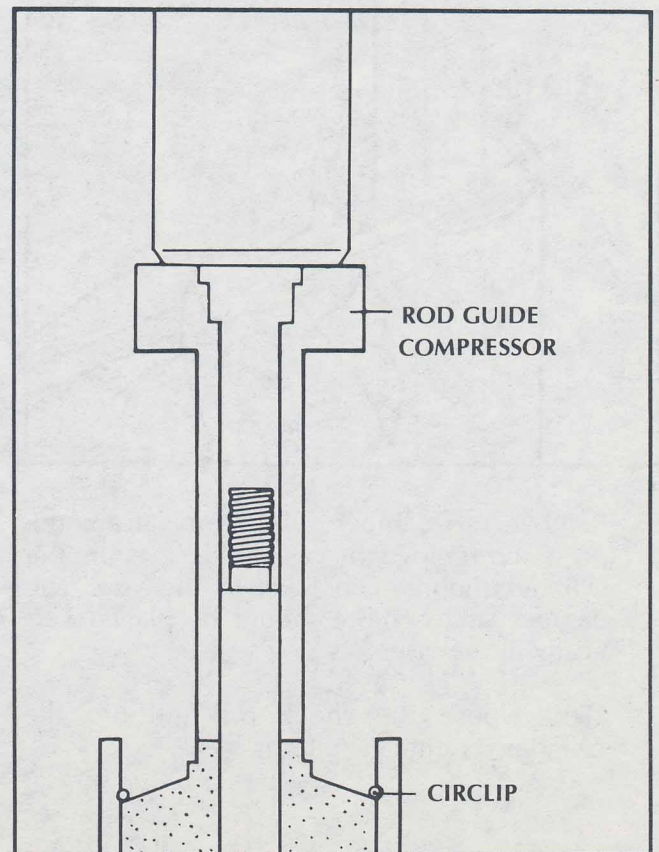
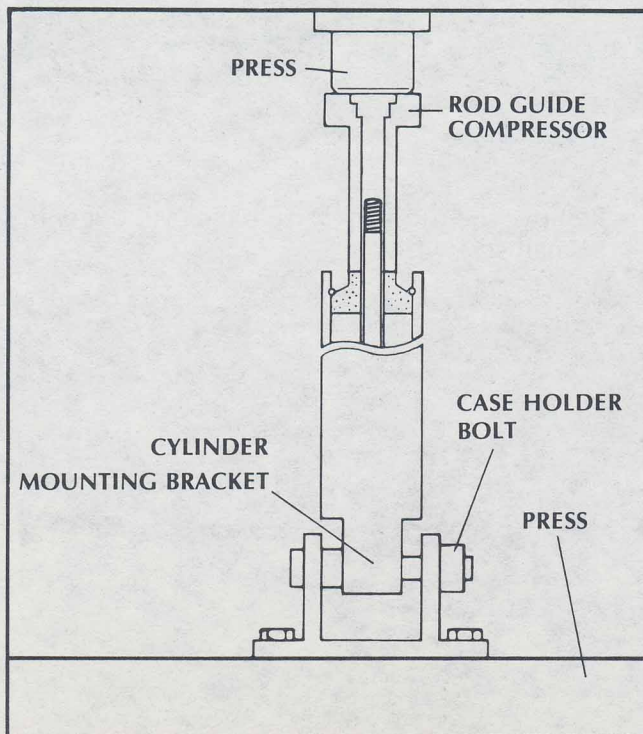
# REMOVING THE ROD GUIDE AND RELATED PARTS

## ROD GUIDE AND RELATED PARTS

1. rod guide
2. rod seal
3. static seal
4. seal retainer
5. circlip (2)
6. shock rod
7. cylinder

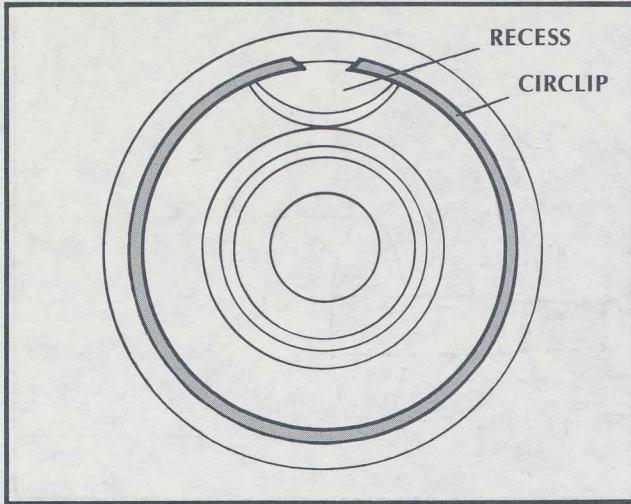


1. Place the case holder in the press.
2. Install the rod guide compressor on the damper subassembly, and secure the subassembly in the case holder. The case holder bolt must pass through the cylinder mounting bracket as shown in the illustration. Carefully align the damper subassembly in the press.
3. Slowly apply pressure to the rod guide compressor. Compress the rod guide (1) until the upper circlip (5) is exposed. Use a minimal amount of pressure. Excessive pressure could damage some of the internal parts.

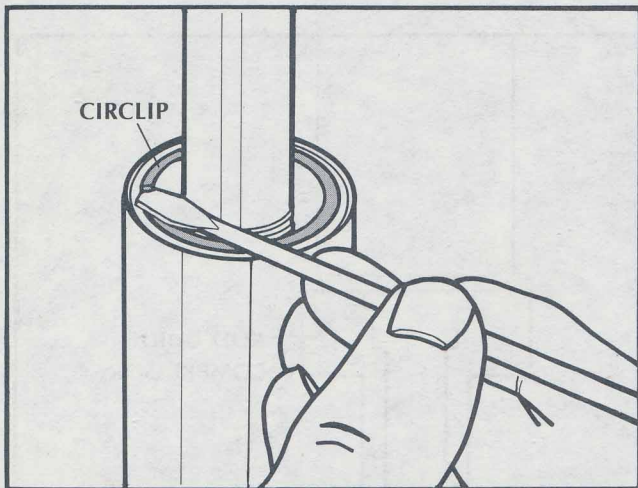


4. Rotate the circlip in the groove until the circlip ends are in the recess of the rod guide as shown in the illustration.

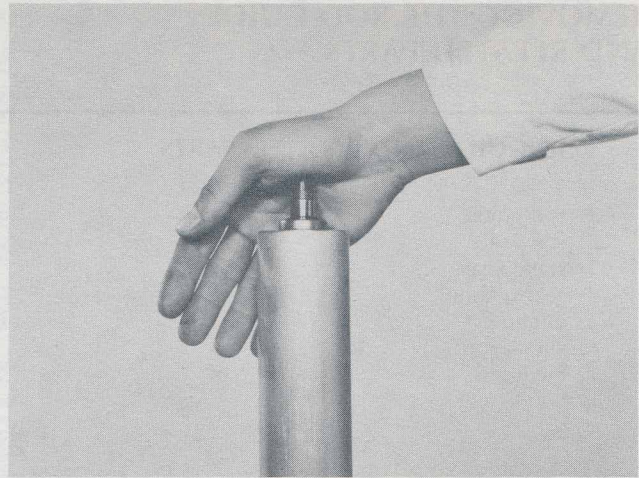
**CAUTION:** If the circlip cannot be rotated within the groove, the damper subassembly may be off center. Remove the damper subassembly and carefully realign it in the press.



5. Using a scribe or two small screwdrivers, carefully remove the upper circlip (5) from the cylinder. Be careful not to scratch the cylinder walls.



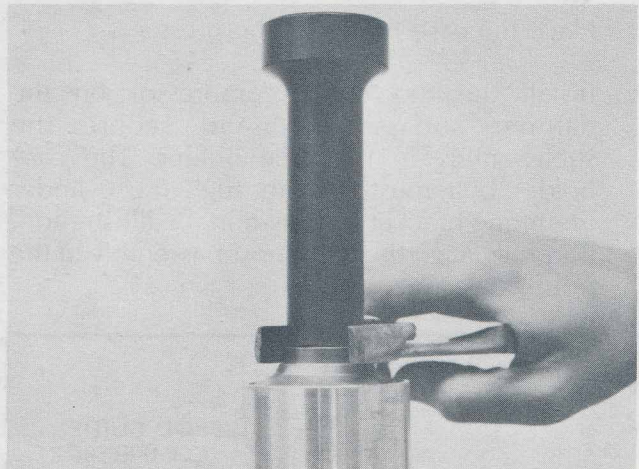
6. Remove the damper subassembly from the press and remove the case holder. Secure the cylinder mounting bracket in the vise. The damper subassembly should be placed vertically in the vise.
7. Gently push the shock rod (6) into the cylinder (7) until it bottoms.



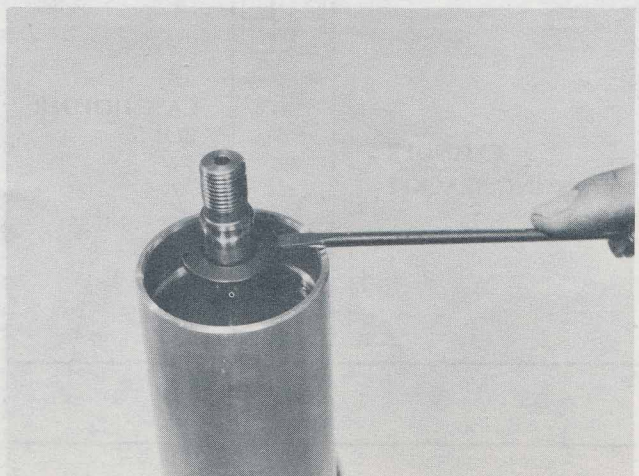
8. Place the rod guide compressor on the shock rod (6) to protect the rod from scratches.
9. Grip the rod guide (1) with a pair of pliers and carefully remove it from the cylinder (7).

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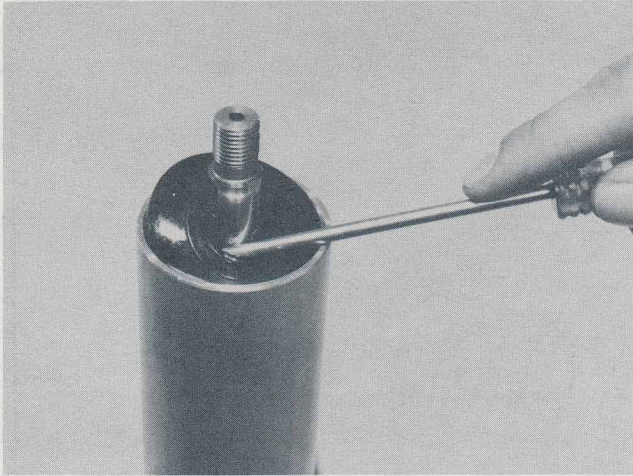
**NOTE:** Oil the cylinder walls if you have difficulty removing the rod guide.



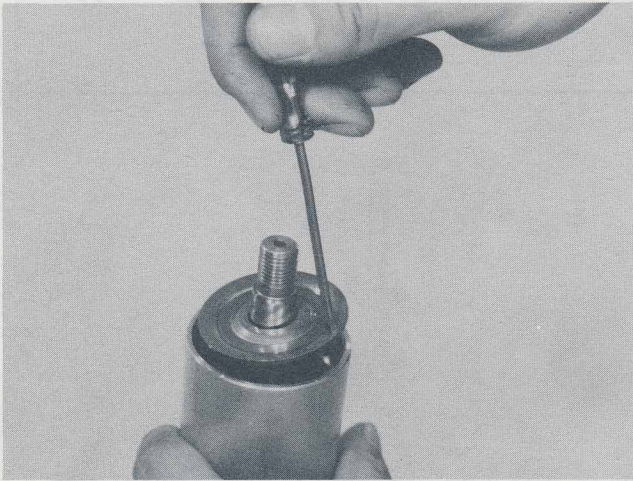
10. Remove the rod seal (2) from the cylinder with a small screwdriver.



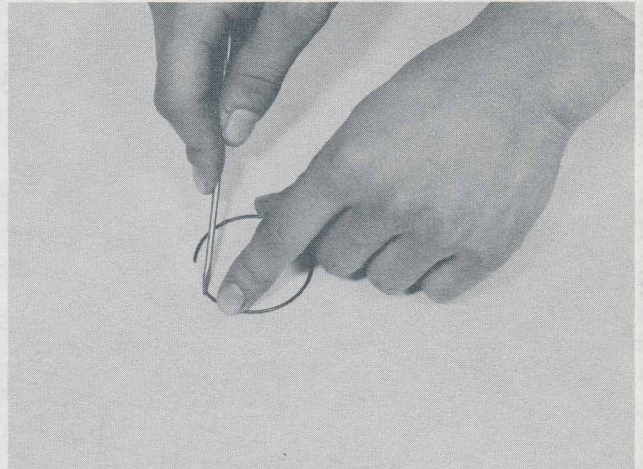
11. Remove the static seal (3) from the cylinder with a small screwdriver or a scribe.



12. Remove the seal retainer (4) from the cylinder.



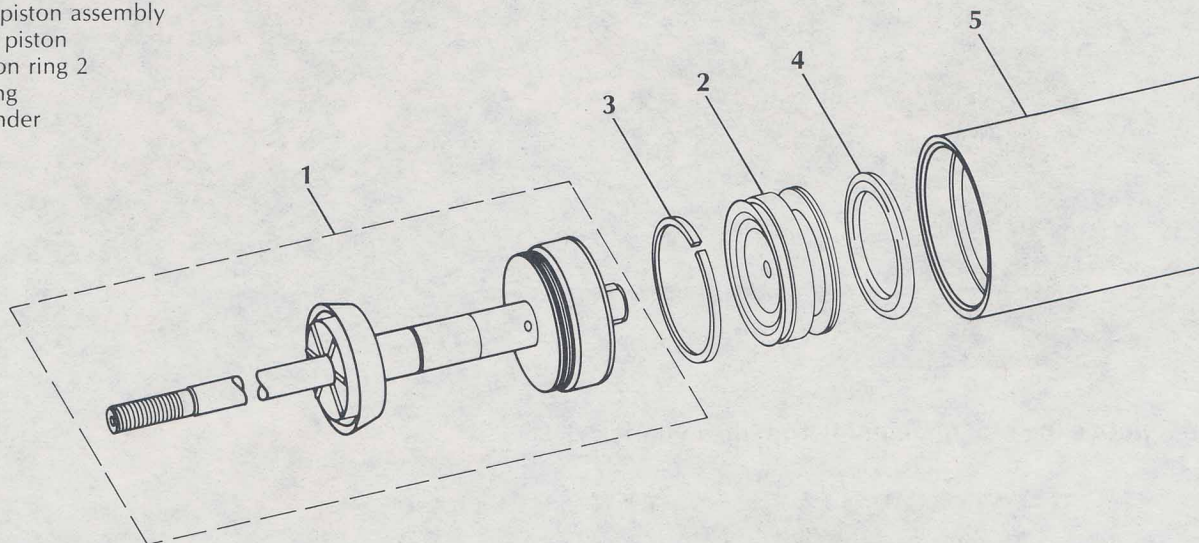
13. Remove the lower circlip (5) from the cylinder. Use a screwdriver and your forefinger as shown in the photograph.



## REMOVING THE ROD-PISTON ASSEMBLY AND FREE PISTON

### CYLINDER

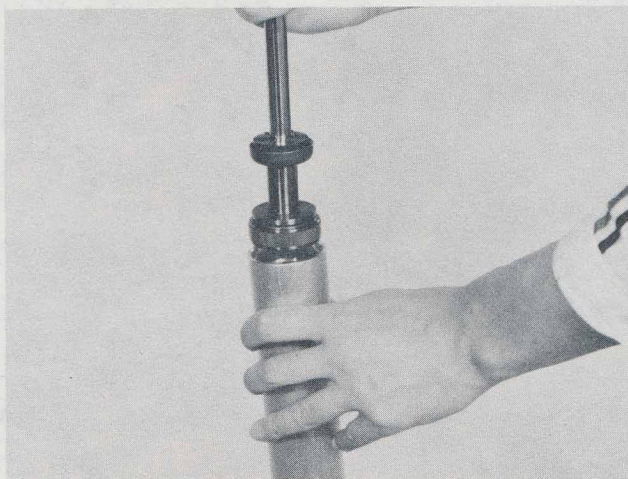
1. rod-piston assembly
2. free piston
3. piston ring 2
4. o-ring
5. cylinder



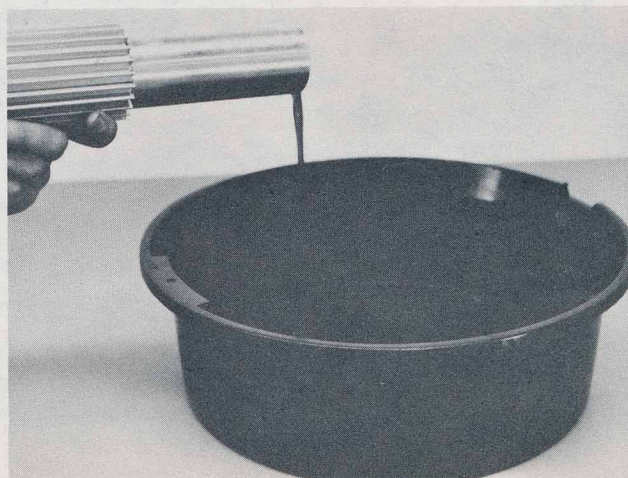
1. Drain some of the oil from the cylinder. Carefully deburr the circlip grooves in the cylinder (5) with 1200 grit sandpaper. This will prevent damage to the rod assembly (1) and the free piston (2) when they are removed.



2. Slowly remove the rod-piston assembly (1) from the cylinder (5) and place it aside.



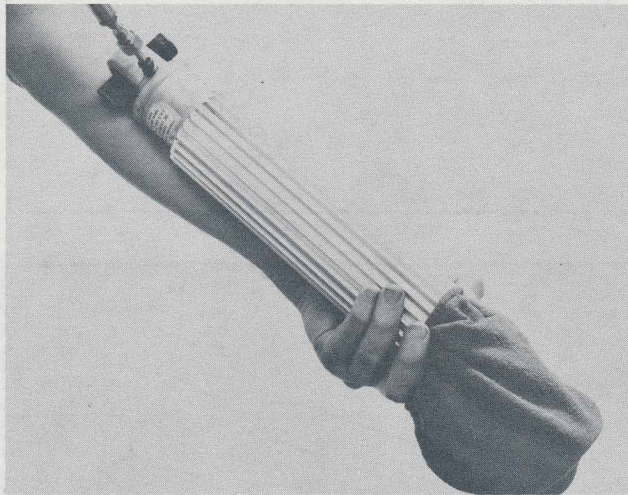
3. Drain the remaining oil from the cylinder.





4. Remove the free piston (2) from the cylinder. Cover the opening of the cylinder with a cloth and direct the opening downward. Blow a few short bursts of compressed air through the monoshock needle into the cylinder. The air will blow the free piston into the cloth. The cloth will catch the free piston and prevent damage to the piston.

**WARNING:** Do not use nitrogen or any other highly compressed gas to perform this procedure. Compressed air will be sufficient. Be sure to follow the instructions to the letter.



5. Remove piston ring 2 (3) and the O-ring (4) from the free piston. Pinch the O-ring until there is a loop for you to grasp.



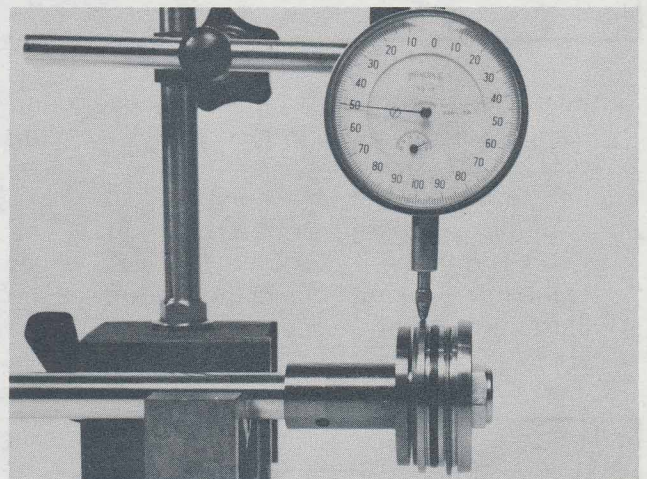
6. Remove the monoshock needle from the gas filler plug.

## DISASSEMBLING THE ROD-PISTON ASSEMBLY

1. Measure the piston runout at the location shown in the photograph. Support both ends of the rod in V-blocks placed on a surface plate. Place the dial gauge at the piston and rotate the rod. If piston runout exceeds the maximum specification, replace the rod.

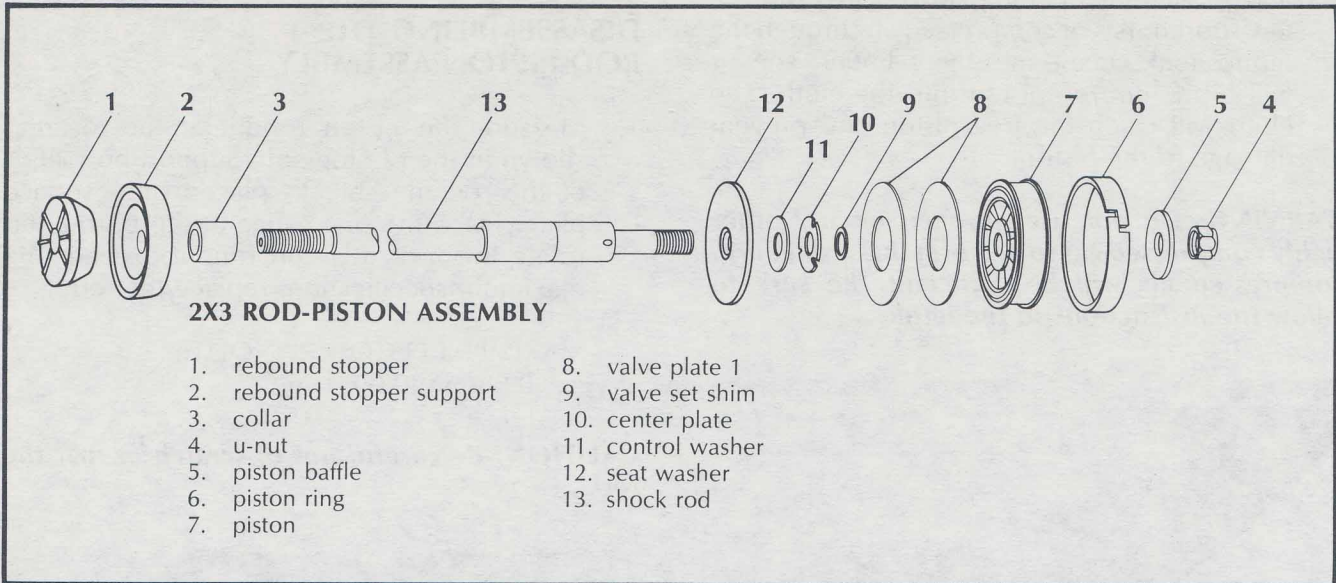
MAXIMUM PISTON RUNOUT:  
0.08mm (0.0031 in.)

**CAUTION:** Be careful not to scratch or mar the rod.

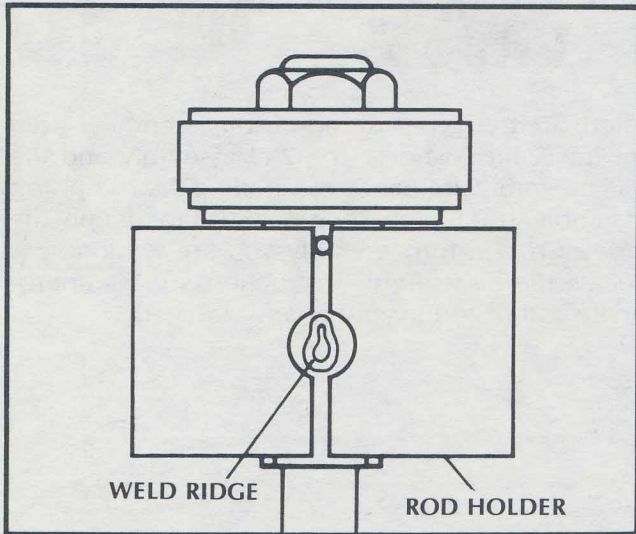
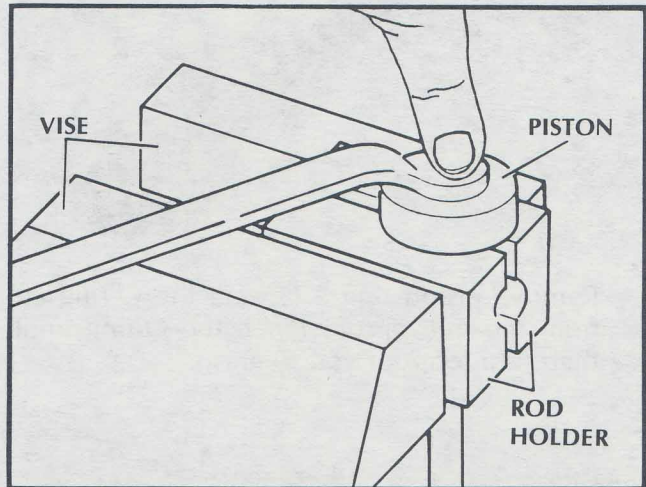


There are two types of rod-piston assemblies used on the X monoshock: the 2X3 assembly and the 2X4 assembly. Before disassembling the rod-piston assembly, use the chart on page 1-3 to identify the type of rod-piston assembly you are working on. Locate the disassembly instructions for the appropriate rod-piston assembly and proceed.

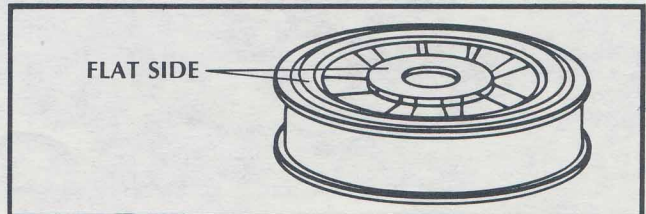
## A. Disassembling the 2X3 Rod-Piston Assembly



1. Remove the rebound stopper (1), the rebound stopper support (2), and the collar (3) from the shock rod (13).
2. Carefully place the stepped portion of the shock rod in the rod holder. The weld ridges of the rod must **not** contact the holder; see the illustration below. Secure the holder in the vise.



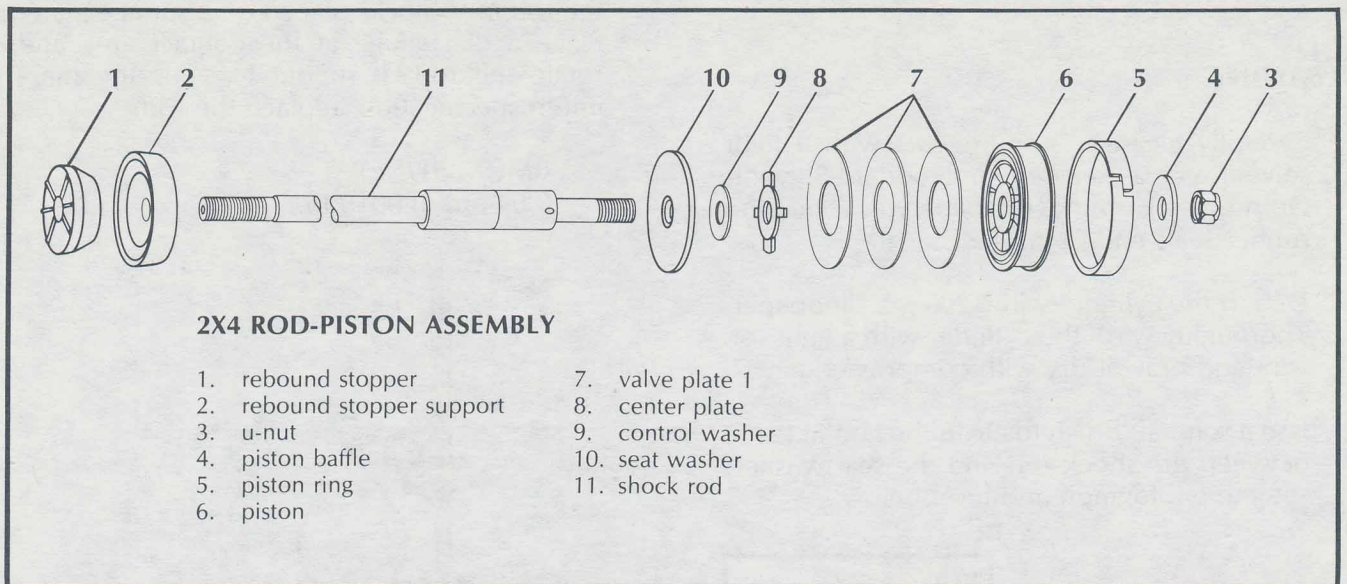
4. Remove the piston baffle (5) and the piston (7) from the rod, and place them aside. When placing the piston on the bench, be sure that the flat side faces upward.



3. Remove the piston ring (6) from the piston, and remove the U-nut (4).

5. Remove both pieces of valve plate 1 (8), the valve set shim (9), the center plate (10), the control washer (11), and the seat washer (12).

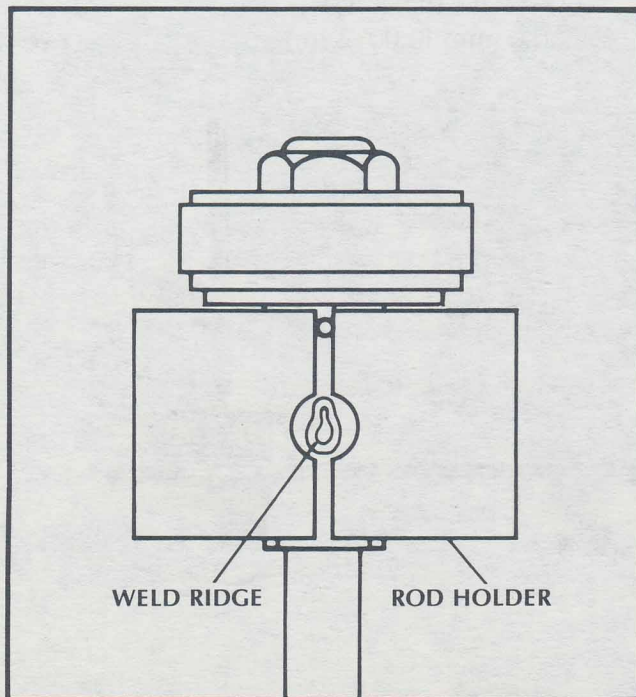
## B. Disassembling the 2X4 Rod-Piston Assembly



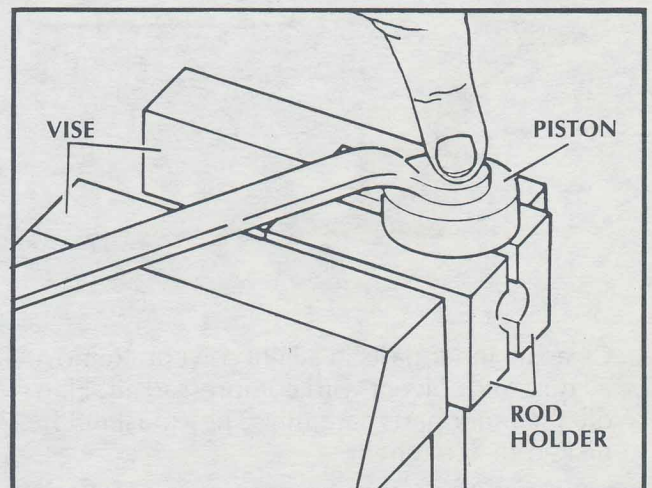
1. Remove the rebound stopper (1) and the rebound stopper support (2) from the shock rod (11).

Lee Waldie Craig Scott Chris Koira

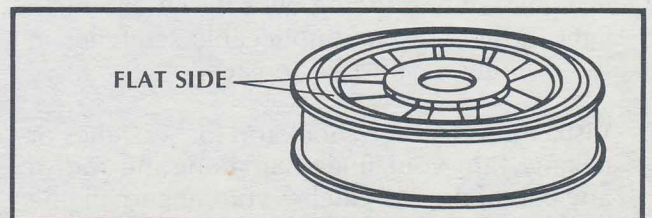
2. Carefully place the stepped portion of the shock rod in the rod holder. The weld ridges of the rod must **not** contact the holder; see the illustration below. Secure the holder in the vise.



3. Remove the piston ring (5) from the piston (6), and remove the U-nut (3).



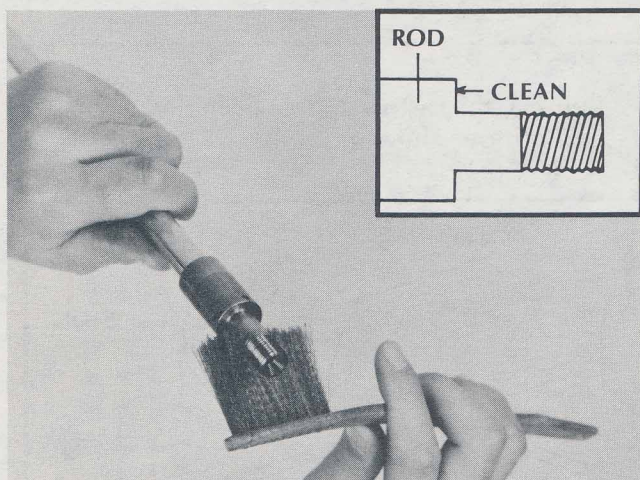
4. Remove the piston baffle (4) and the piston (6) from the rod, and place them aside. When placing the piston on the bench, be sure that the flat side faces upward.



- Remove all three pieces of valve plate 1 (7), the center plate (8), the control washer (9), and the seat washer (10).

## CLEANING

- Carefully clean all components with a light solvent such as kerosene or Stoddard Solvent. Do not use gasoline. Gasoline will attack the rubber seals and O-rings.
- Deburr the cylinder with 1200 grit sandpaper. Thoroughly wash the cylinder with a light solvent and blow it dry with compressed air.
- Use a soft hair brush to clean the contact area between the shock rod and the seat washer; see the photograph and inset below.



- Clean all inner parts in a light solvent. Remove all dust and solvent with compressed air. Handle the inner parts carefully. They must not be nicked or scratched.

Mark Boddy

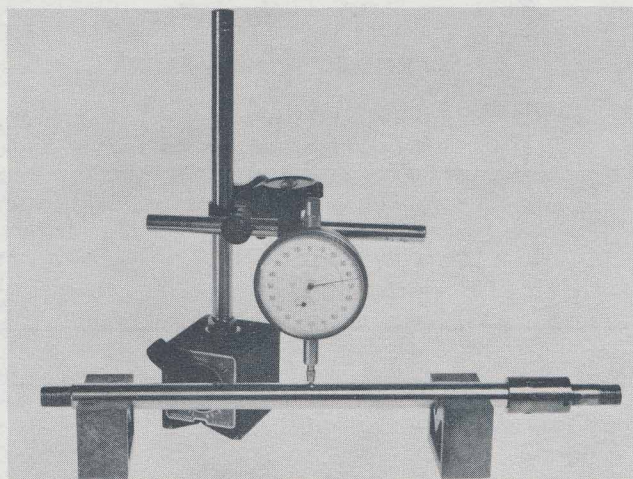
- Place all the cleaned parts on a tray to keep them dust free.

## INSPECTION

- Visually inspect the cylinder. Sight down the cylinder while standing beneath an overhead light. If there are any noticeable scratches in the cylinder, it must be replaced.
- Visually inspect the shock rod for scratches or flaking. Run your fingernail along the rod. If any part of the rod catches your fingernail, the rod must be replaced.

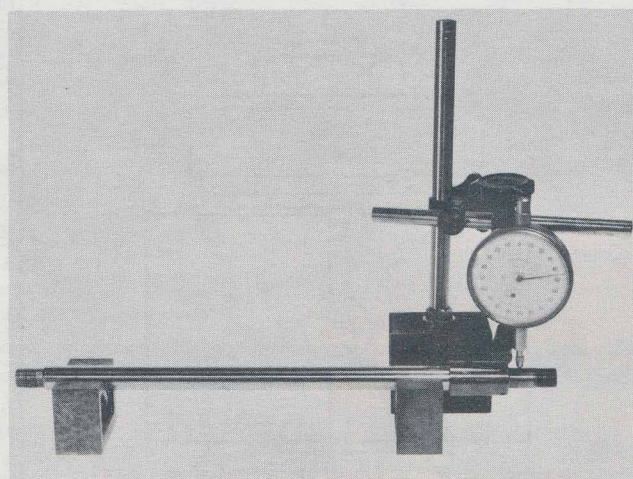
- Check the runout at the contact area between the rod and the rod seal. Support both ends of the rod in V-blocks placed on a surface plate. Place a dial gauge at the contact area and rotate the rod. If runout exceeds the maximum specification, replace the rod.

MAXIMUM RUNOUT:  
0.04mm (0.0016 in.)

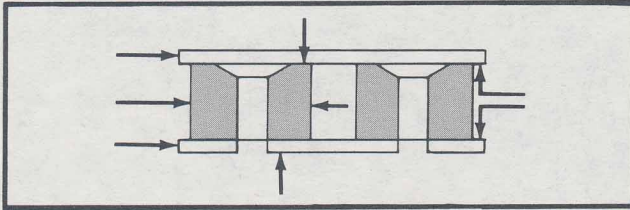


- Check the runout at the contact area between the shock rod and the piston. If runout exceeds maximum specifications, replace the rod.

MAXIMUM RUNOUT:  
0.03mm (0.0012 in.)



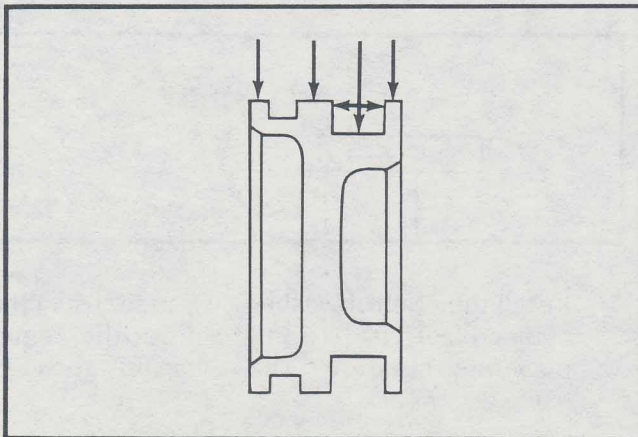
5. Inspect the piston. Pay particular attention to the outer surfaces and to the piston-to-valve-plate-1 contact area (the flat side). If the piston has any scratches that can catch your fingernail, replace the piston and all the valve parts.



6. Inspect the valve parts. If there are any high spots or scratches that can catch your fingernail, replace the piston and all the valve parts.

**CAUTION: If any valve parts must be replaced or if the piston must be replaced, replace all the valve parts and the piston. The piston and valve parts must be replaced as an assembly.**

7. Inspect the free piston. Pay particular attention to the O-ring groove and to the outer surfaces of the free piston. If the free piston has any scratches that can catch your fingernail, replace the free piston.



## ASSEMBLY

**Before installing any part on the monoshock, be sure that it is clean and free of all dust. Always blow the part clean with compressed air prior to installation.**

Whenever reassembling a shock, always replace these parts with new ones.

### PISTON

Piston Ring  
U-nut

### FREE PISTON

O-ring

### ROD GUIDE

Static Seal  
Rod Seal  
Rebound Stopper

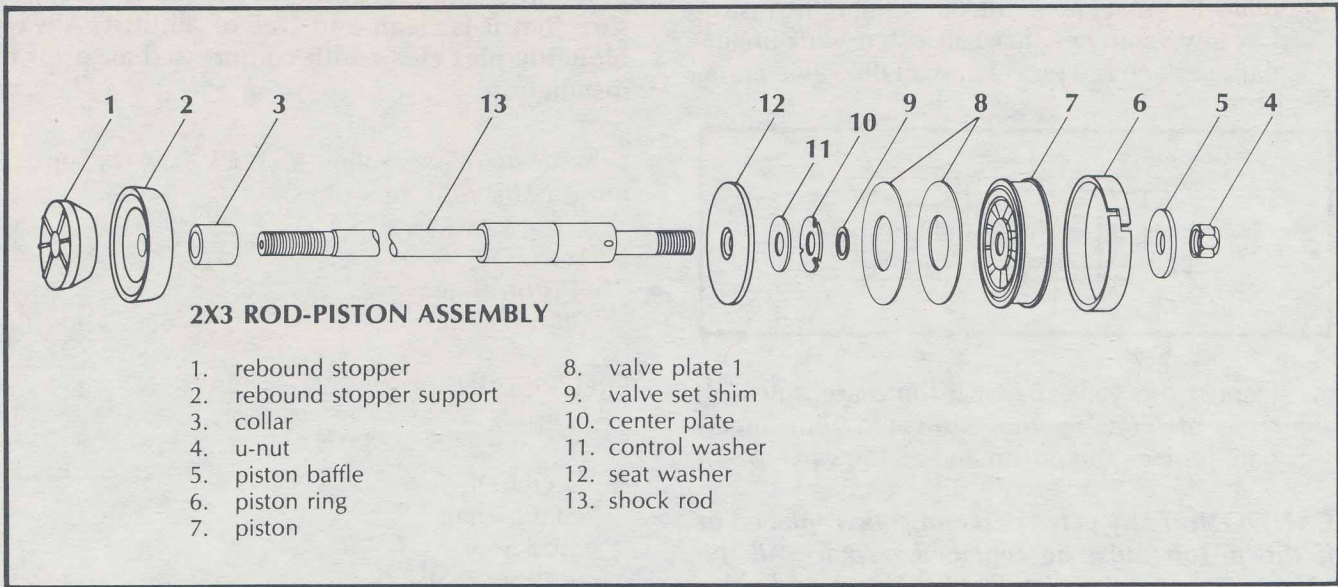
### REPLACE ALL CIRCLIPS

## ASSEMBLING THE ROD-PISTON ASSEMBLY

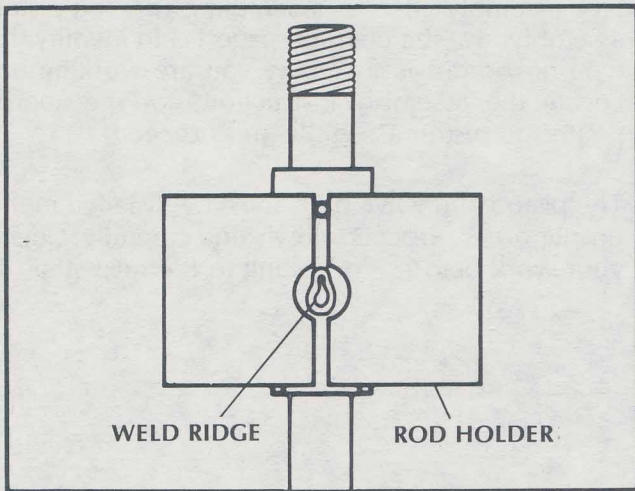
There are two types of rod-piston assemblies used on the X monoshock: the 2X3 assembly and the 2X4 assembly. Before assembling the rod-piston assembly, use the chart on page 1-3 to identify the type of rod-piston assembly you are working on. Locate the assembly instructions for the appropriate rod-piston assembly and proceed.

The piston and valve parts must be installed in the proper order. Proceed slowly and carefully. Check your work before proceeding to the next step.

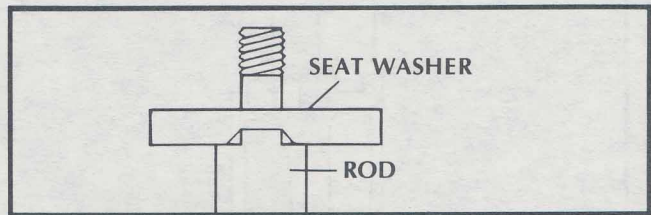
## A. Assembling the 2X3 Rod-Piston Assembly



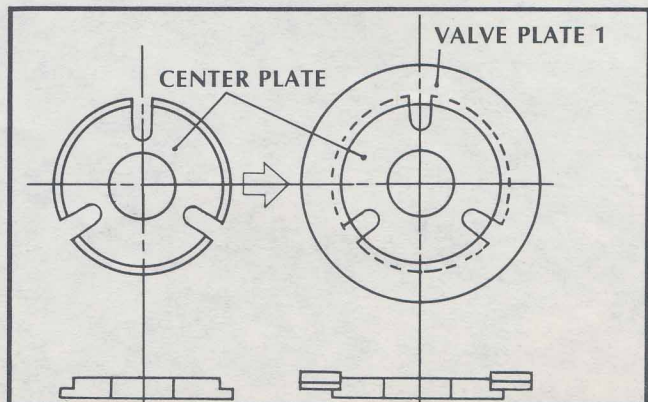
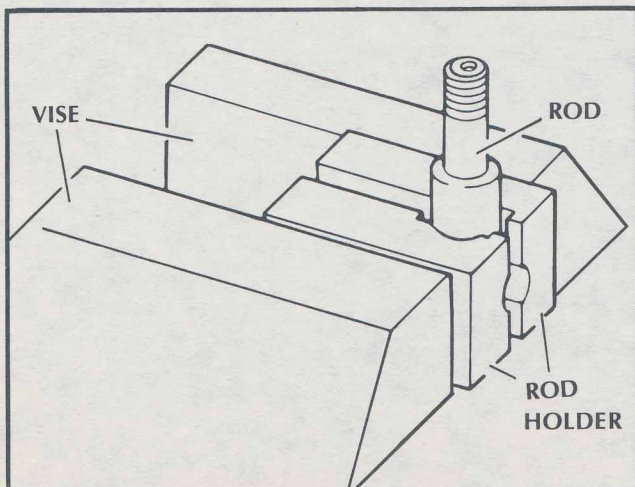
- Place the stepped portion of the shock rod (13) in the rod holder, and secure the holder in the vise. Carefully locate the shock rod in the rod holder so that the weld ridges of the rod do not contact the holder.

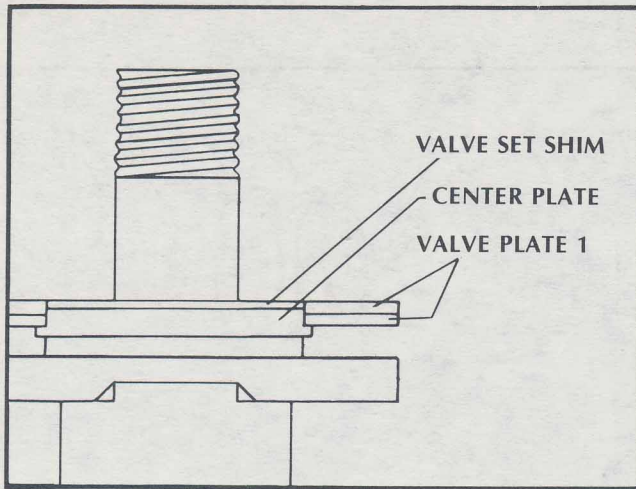


- Carefully clean the entire rod with compressed air.
- Install the seat washer (12) on the shock rod (13). The chamfered side of the seat washer (12) must face the stepped portion of the rod as shown in the illustration.



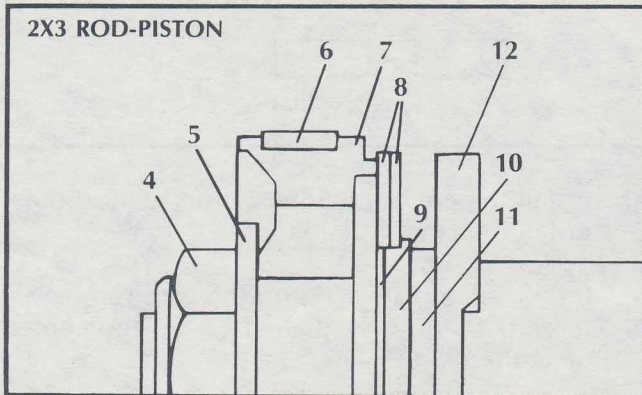
- Install the control washer (11); then install the center plate (10). The flat side of the center plate must face down and rest against the control washer (11).
- Install valve plate 1 (8) and center both pieces on the center plate (10). Install the valve set shim (9).





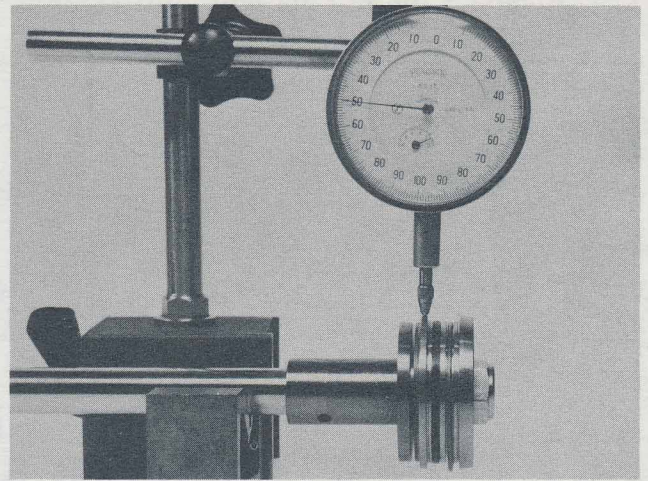
6. Clean the piston (7) and install it on the shock rod. The flat side of the piston must face down and rest on valve plate 1 (8).
7. Install the piston baffle (5).
8. Check valve plate 1 (8). When both pieces are properly centered, install a new U-nut (4). Use a small amount of Loctite, and torque the U-nut to specification.

**TIGHTENING TORQUE:**  
375 kg-cm (27 ft-lbs)



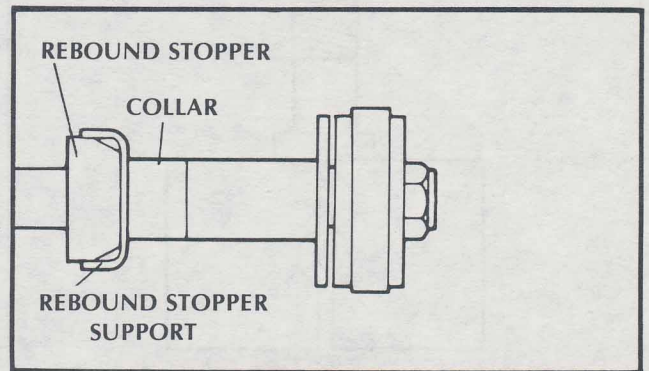
9. Remove the rod-piston assembly from the vise, and check for piston runout. Support the rod on V-blocks placed on a surface plate as shown in the photograph. If the runout exceeds specification, replace the rod.

**MAXIMUM RUNOUT:**  
0.08mm (0.0031 in.)

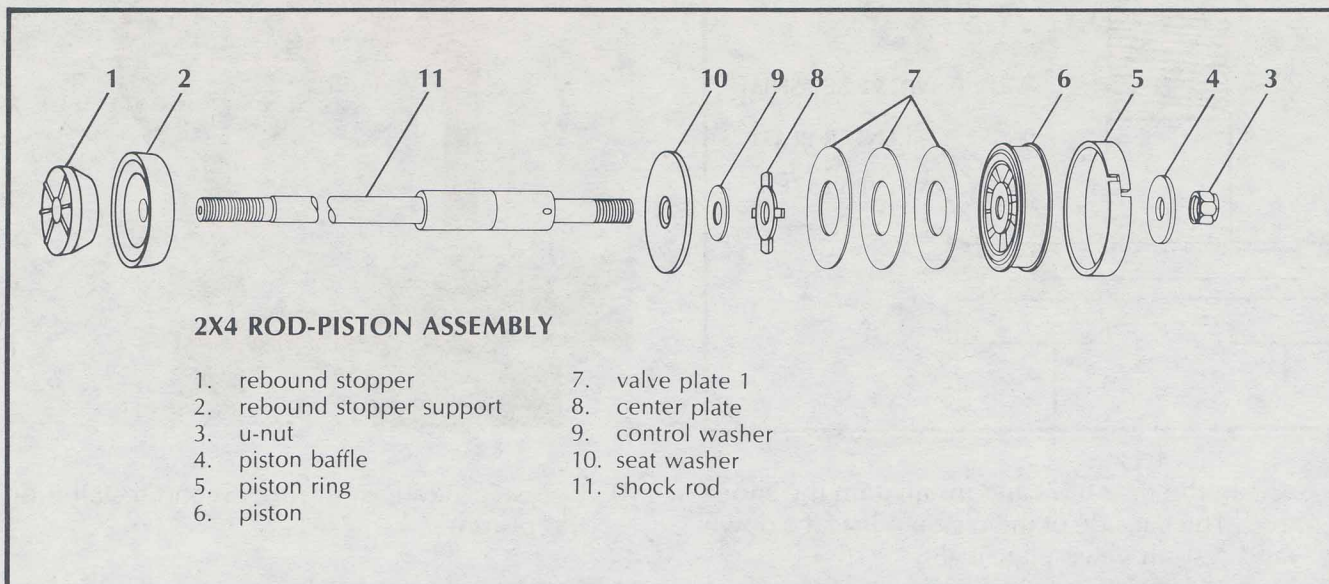


10. Grease a new piston ring (6) and install it on the piston.
11. Fit the collar (3) in place against the stepped portion of the rod.
12. Install the rebound stopper support (2) and seat it against the collar (3).
13. Install a new rebound stopper (1) and seat it against the rebound stopper support (2).

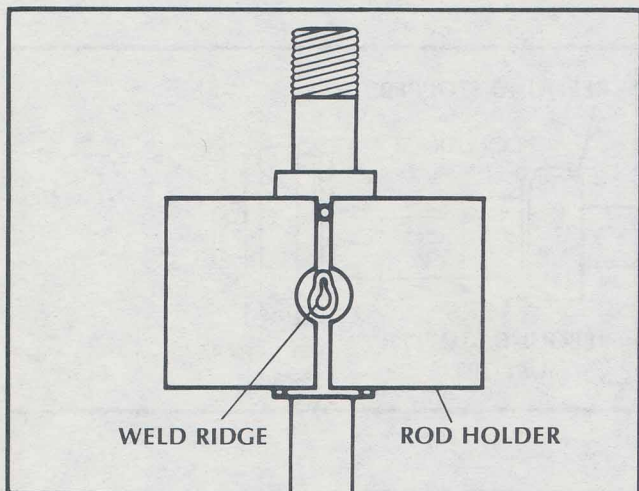
Lee Waldie Craig Scott Chris Koira



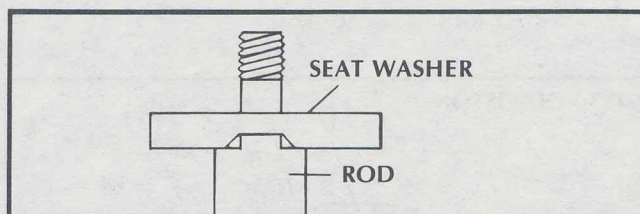
## B. Assembling the 2X4 Rod-Piston Assembly



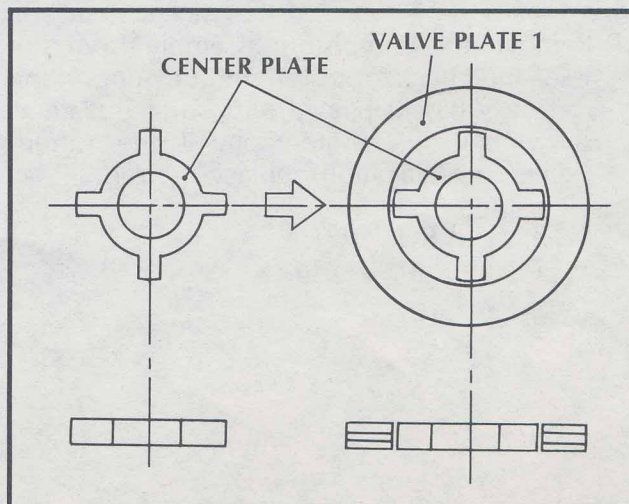
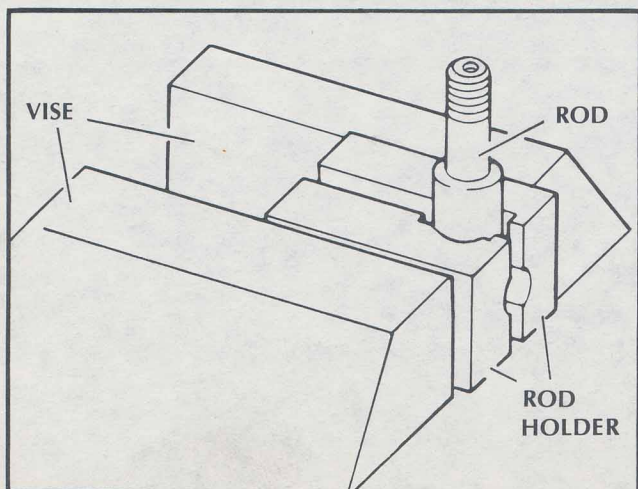
- Place the stepped portion of the shock rod (11) in the rod holder and secure the holder in the vise. Carefully locate the shock rod in the rod holder so that the weld ridges of the rod do not contact the holder.



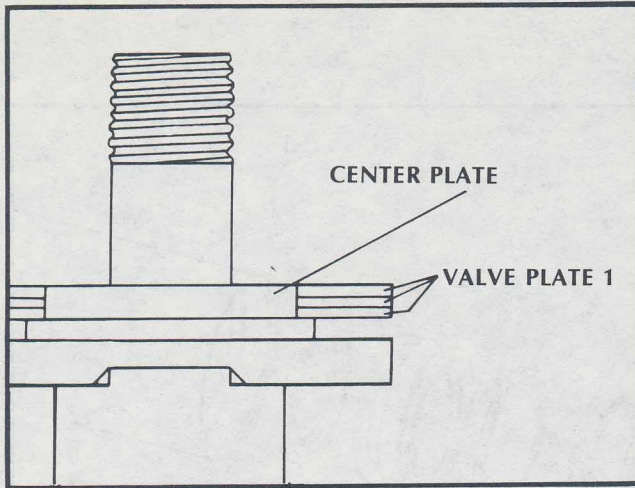
- Clean the entire rod with compressed air.
- Install the seat washer (10) on the shock rod (11). The chamfered side of the seat washer (10) must face the stepped portion of the rod as shown in the illustration.



- Install the control washer (9) on the rod then install the center plate (8).
- Install valve plate 1 (7) on the rod. Center all three parts of valve plate 1 (7) on the center plate (8).

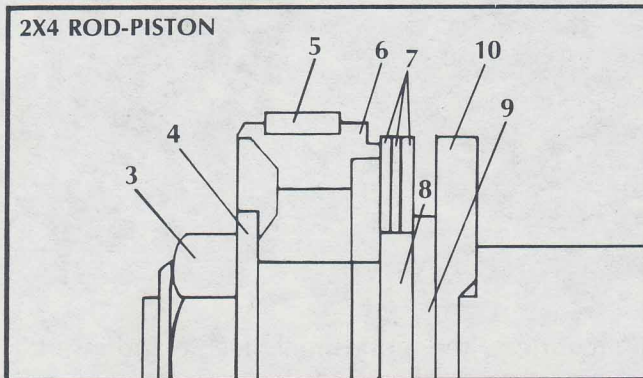






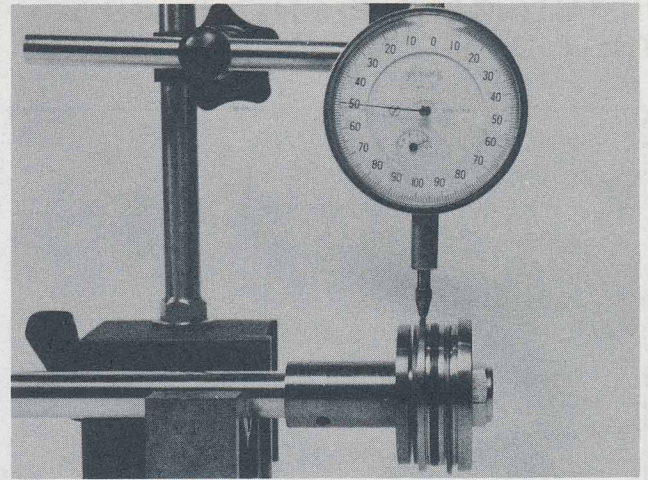
6. Clean the piston (6) and install it on the shock rod. The flat side of the piston must face down and rest on valve plate 1 (7).
7. Install the piston baffle (4).
8. Check valve plate 1 (7). When all three pieces are properly centered, install a new U-nut (3). Use a small amount of Loctite, and torque the U-nut to specification.

**TIGHTENING TORQUE:**  
375 kg-cm (27 ft-lbs)

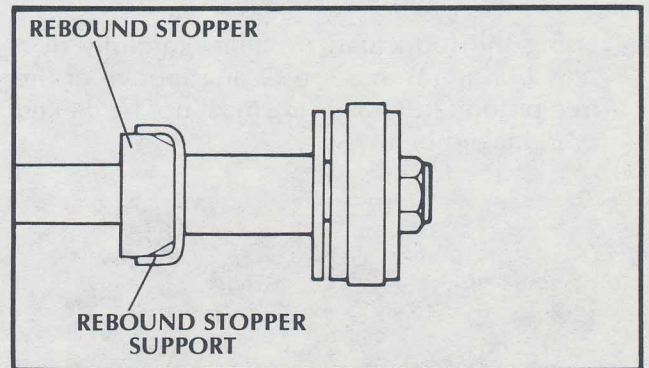


9. Remove the rod-piston assembly from the vise and check for piston runout. Support the rod on V-blocks placed on a surface plate as shown in the photograph. If the runout exceeds the specification, replace the rod.

**MAXIMUM RUNOUT:**  
0.08mm (0.0031 in.)



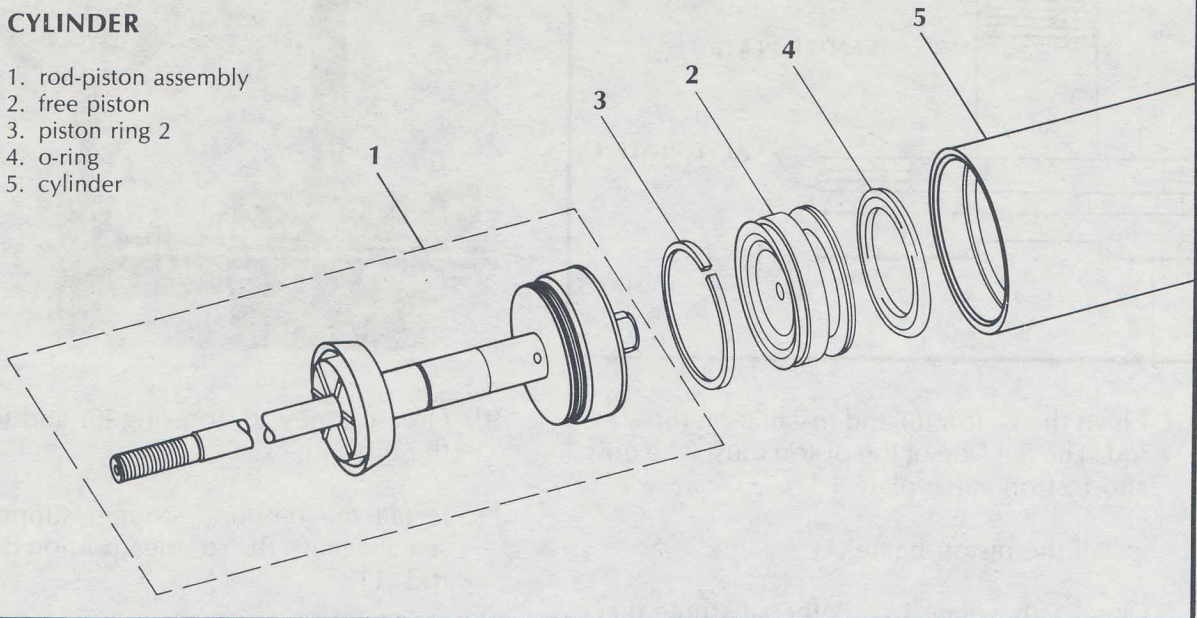
10. Grease a new piston ring (5) and install it on the piston.
11. Install the rebound stopper support (2) and seat it against the stepped portion of the shock rod (11).
12. Install a new rebound stopper (1) and seat it against the rebound stopper support (2).



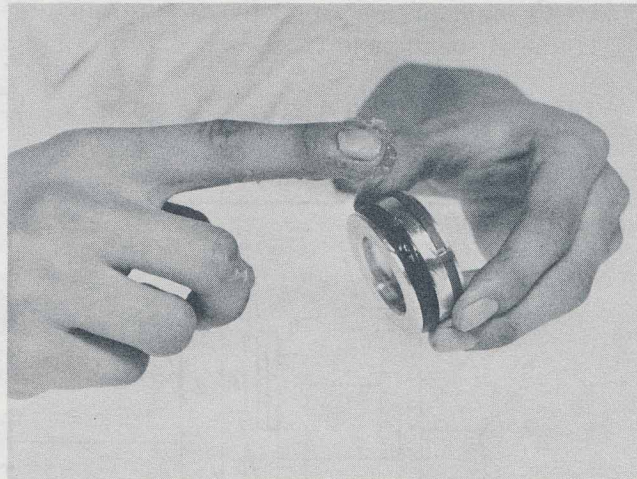
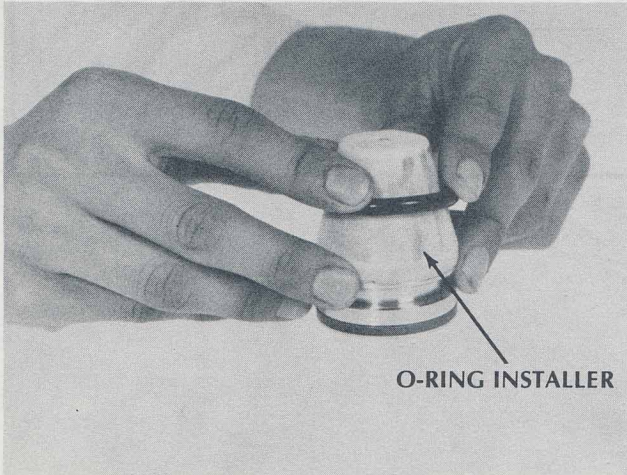
## INSTALLING THE FREE PISTON AND THE ROD-PISTON ASSEMBLY

### CYLINDER

1. rod-piston assembly
2. free piston
3. piston ring 2
4. o-ring
5. cylinder



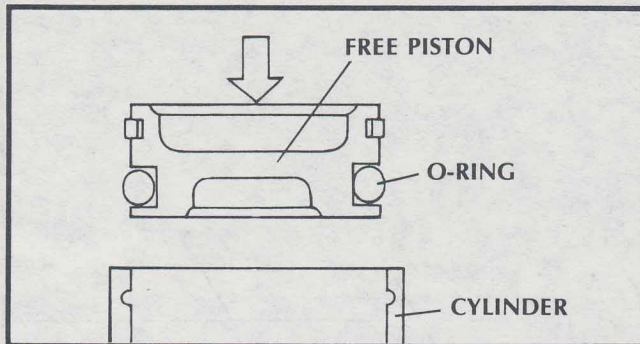
1. Grease the O-ring groove in the free piston (2), and grease the O-ring installer.
2. Using the lubricated installer, carefully fit a new O-ring (4) into the O-ring groove of the free piston (2). The O-ring must not be nicked or damaged in any way.



3. Fit piston ring 2 (3) onto the free piston (2). Apply grease to the entire free piston.

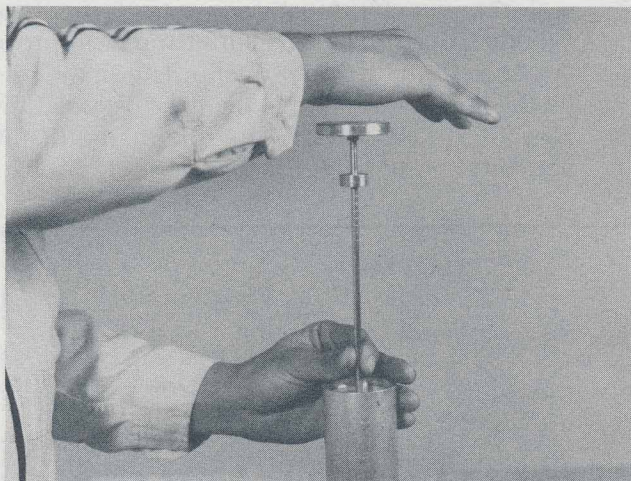
4. Lubricate the monoshock needle and insert it into the gas filler plug.
5. Oil the cylinder walls and secure the cylinder mounting bracket in a vise with soft jaws. The cylinder should be placed vertically in the vise.

- Carefully place the free piston (2) in the cylinder (5) and gently push the free piston down into the cylinder. The free piston must be installed with the O-ring side facing down into the cylinder.



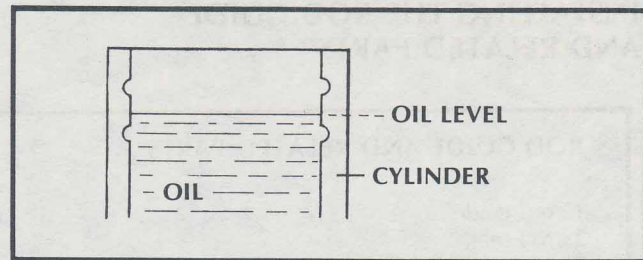
- Set the collar of the free piston stopper at 100mm and gently push the free piston 100mm into the cylinder as shown in the photograph.

**NOTE: Proper free piston installation is essential if you are to achieve the maximum performance from the monoshock. Be sure that the free piston is correctly located in the cylinder.**



- Add oil to the cylinder until the oil level is between the two circlip grooves. Wait a few minutes before proceeding so any air in the oil can rise to the surface.

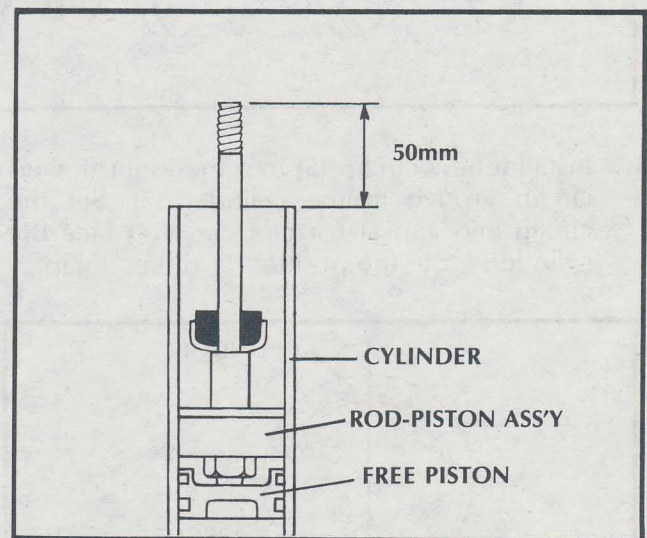
**CAUTION: Always pour oil down the cylinder walls. This will help eliminate the possibility of air becoming trapped in the oil.**



- Place the rod-piston assembly (1) in the cylinder, and slowly push it into the cylinder (5) until 50mm of the rod remain above the cylinder as illustrated. This procedure sets the free piston at the proper depth. Be careful not to scuff the cylinder walls.

**CAUTION: Take extra care to perform this operation correctly. If the rod-piston assembly is pushed too far into the cylinder, you will have to disassemble the cylinder and begin again.**

Lee Waldie Craig Scott Chris Koira

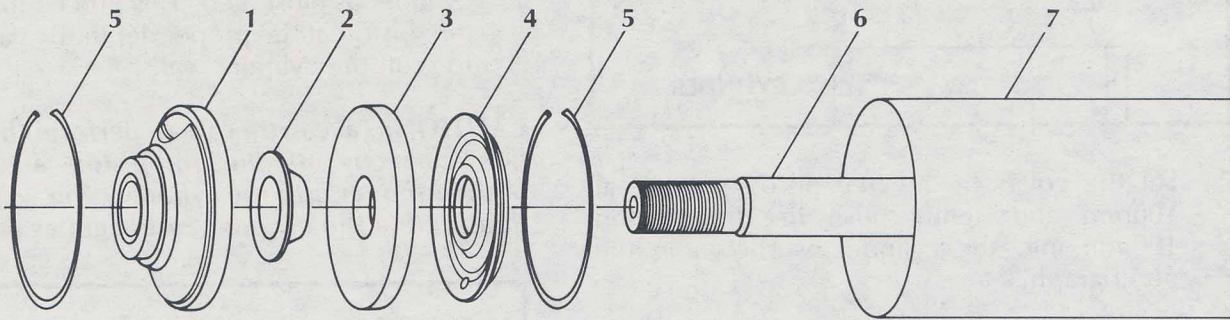


- Hold the rod at this position and remove the monoshock needle from the gas filler plug. This is a very critical operation. It effectively locks the free piston in place. Shock performance will suffer if the free piston is not set at the proper depth in the cylinder.

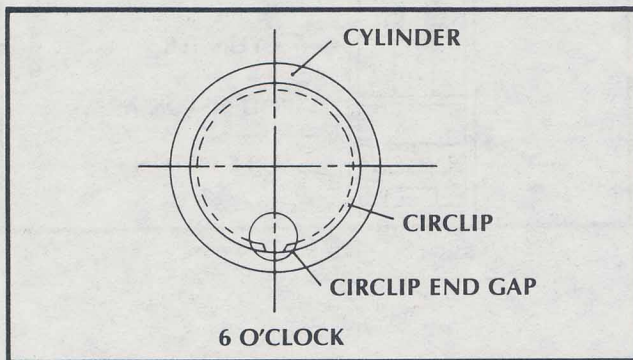
## INSTALLING THE ROD GUIDE AND RELATED PARTS

### ROD GUIDE AND RELATED PARTS

1. rod guide
2. rod seal
3. static seal
4. seal retainer
5. circlip (2)
6. shock rod
7. cylinder

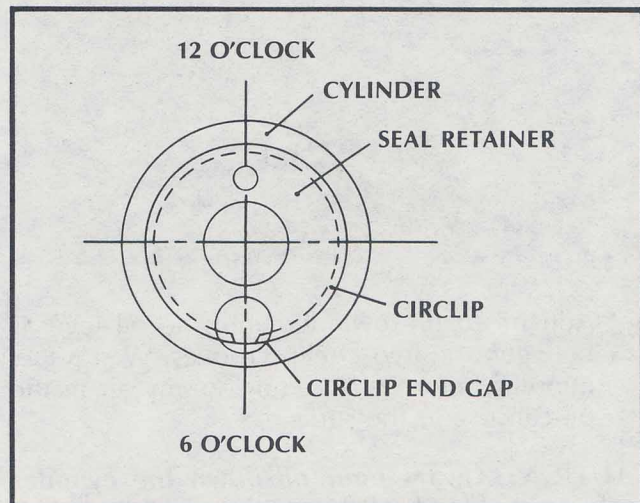


1. Install a new circlip (5) into the inner (lower) circlip groove in the cylinder (7). Set the circlip end gap at 6 o'clock as you face the cylinder. Note the position of the end gap.

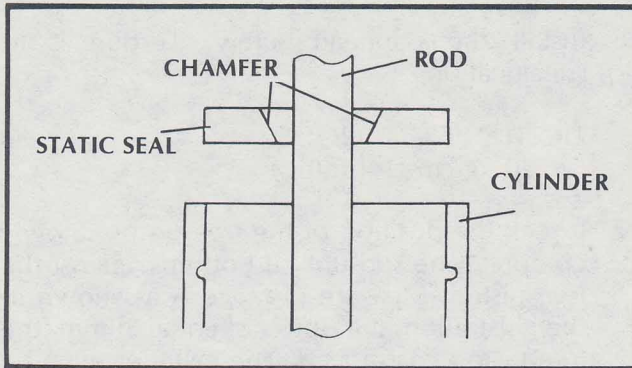


2. Very slowly pull the rod upward but do not expose the piston to air. Let the rod sink back into the oil until it bottoms. Hold the rod straight so it won't bind against the cylinder walls, but do not push it into the cylinder. This operation will help bleed trapped air from the system.
3. Place the dust seal guide on the rod. This will protect the seals during installation.

4. Slip the seal retainer (4) over the rod (6) and into the cylinder (7). The circlip land on the seal retainer (4) must face down into the cylinder, and the seal retainer must be properly seated on the inner circlip. The small hole on the seal retainer must be at 12 o'clock. It is very important that this hole be diametrically opposite the end gap of the inner circlip.

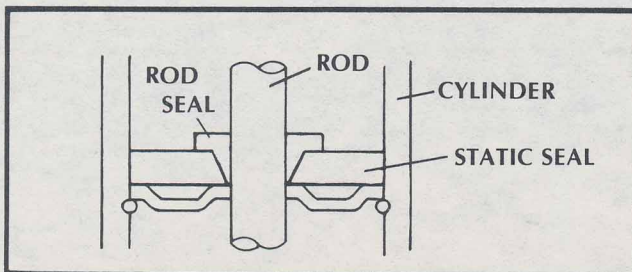
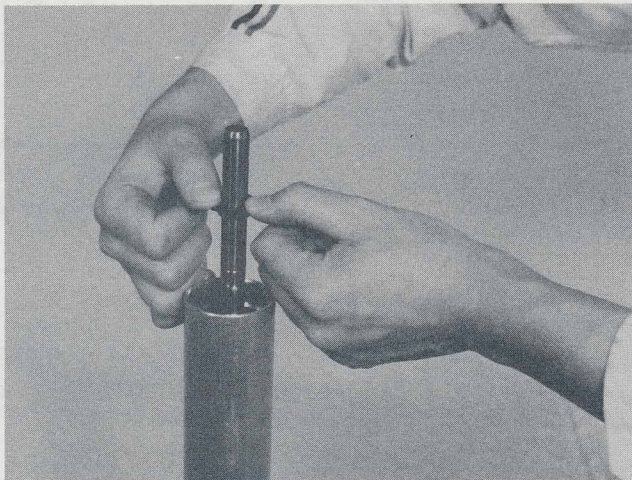


- Grease a new static seal (3), slip it over the rod (6), and install it in the cylinder (7). The chamfered side of the static seal must face upward (the i.d. markings should face down into the cylinder). Carefully seat the static seal (3) on the seal retainer (4).

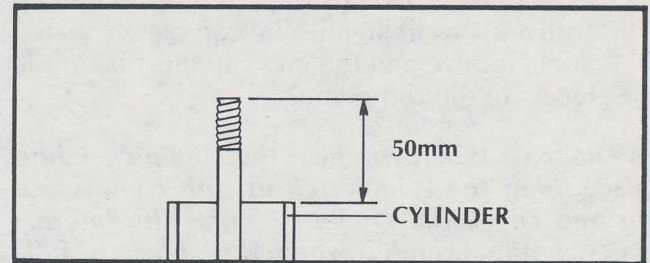


- Grease the entire surface of a new rod seal (2), slip it over the rod (6), and install it in the cylinder (7). The rod seal (2) fits into the chamfered hole of the static seal (3). The rod seal must be fully seated in the static seal (3).

**NOTE: If the rod seal (2) cannot be fully seated in the static seal (3), the static seal (3) or the seal retainer (4) may not be properly installed. Remove them both and reinstall them. Take care that both the seal retainer (4) and static seal (3) are correctly installed in the cylinder (7).**

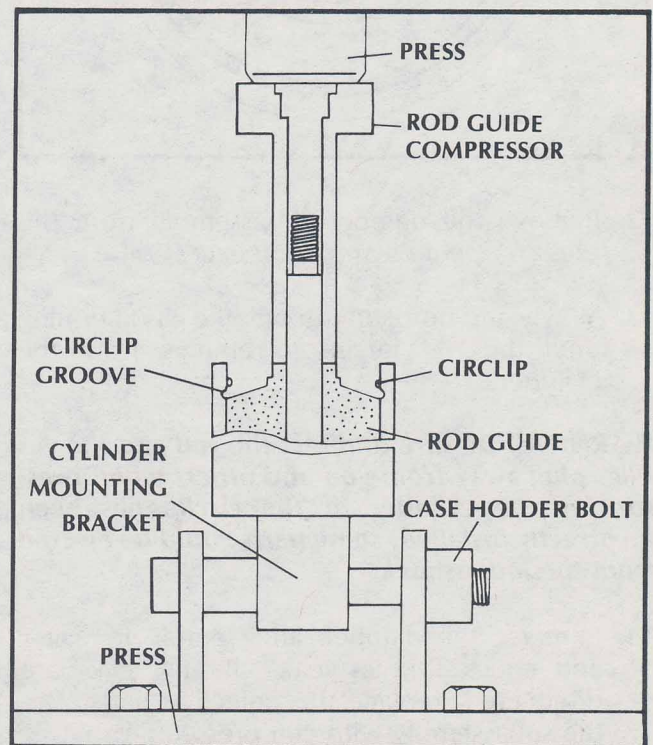


- Check the rod length. The rod should extend 50mm beyond the edge of the cylinder as shown in the illustration. If this is not the case, the free piston has moved. You must disassemble the cylinder and reassemble it correctly; otherwise, the monoshock will not perform to maximum capability.



Mark Boddy

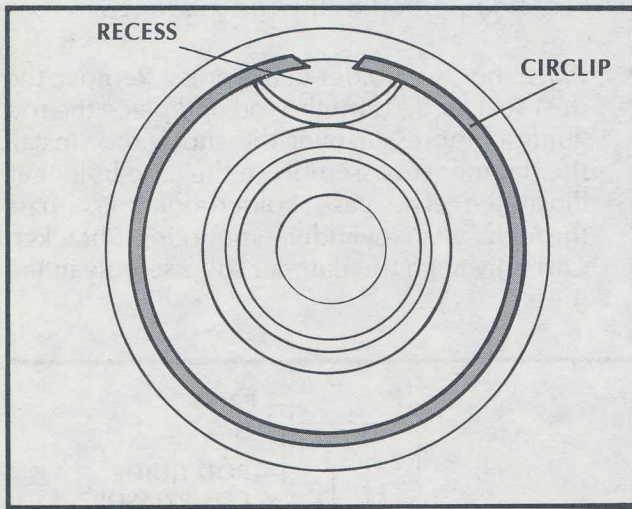
- Place the rod guide (1) in the cylinder and place a new circlip (5) around the rod guide (1). The circlip end gaps must be in the recessed portion of the rod guide (1).
- Place the case holder in the press. Remove the dust seal guide from the rod and place the rod guide compressor over the shock rod. Install the damper subassembly in the case holder as illustrated. The case holder bolt must pass through the cylinder mounting bracket. Carefully align the damper subassembly in the press.



10. Slowly apply pressure to the rod guide compressor and compress the rod guide (1) into the cylinder (7). Use a minimal amount of force. Compress the rod guide (1) until the upper circlip groove is completely exposed, but no further; see the illustration on the preceding page.

11. Install a new circlip (5) in the upper circlip groove. The circlip must be completely seated in the groove and the end gap must be in the recess of the rod guide.

**WARNING: When you hear the circlip click into place, blow the cylinder clean with compressed air and check the circlip. It holds the internal parts in the cylinder when the shock is fully pressurized. Some parts could be ejected from the monoshock if this circlip is NOT correctly seated in its groove.**



12. Remove the damper subassembly from the press. Wipe it clean of any excess oil.

13. Slowly add nitrogen through the gas filler plug until the rod begins to emerge from the cylinder.

**WARNING: Be sure to direct the rod and the gas filler plug away from you and others when pressurizing the cylinder. If the circlip has been incorrectly installed, some parts could be ejected from the monoshock.**

14. Immerse the damper subassembly in water and check for gas leaks. If any leaks are discovered, replace the defective parts. Dry the subassembly with compressed air.

15. If there are no leaks, adjust the gas pressure to specification. Always check the pressure with a monoshock gauge.

**SPECIFIED GAS PRESSURE:**

2X3 Shock: 15 kg/cm<sup>2</sup> (213 psi)

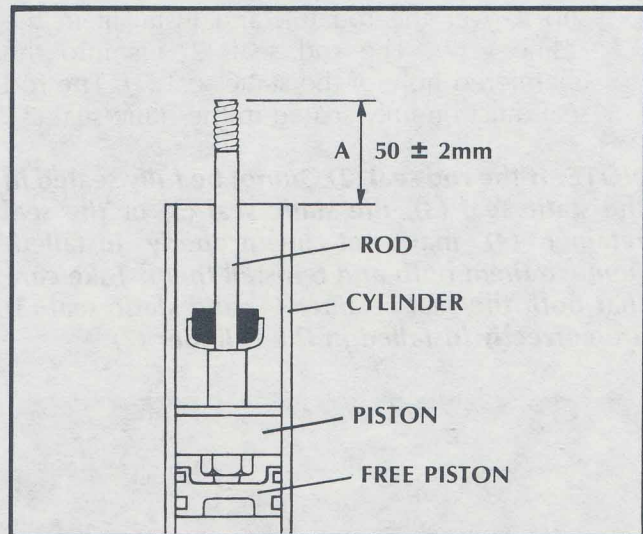
2X4 Shock: 17 kg/cm<sup>2</sup> (242 psi)

16. Install the panhead screw. Torque it to specification.

**TIGHTENING TORQUE:**

20 kg-cm (1.4 ft-lbs.)

17. Check the position of the free piston. Slowly compress the rod until it bottoms against the free piston. Measure distance A as shown in the illustration. If it does not equal 50mm, the free piston has moved. The cylinder must be disassembled and reassembled correctly.



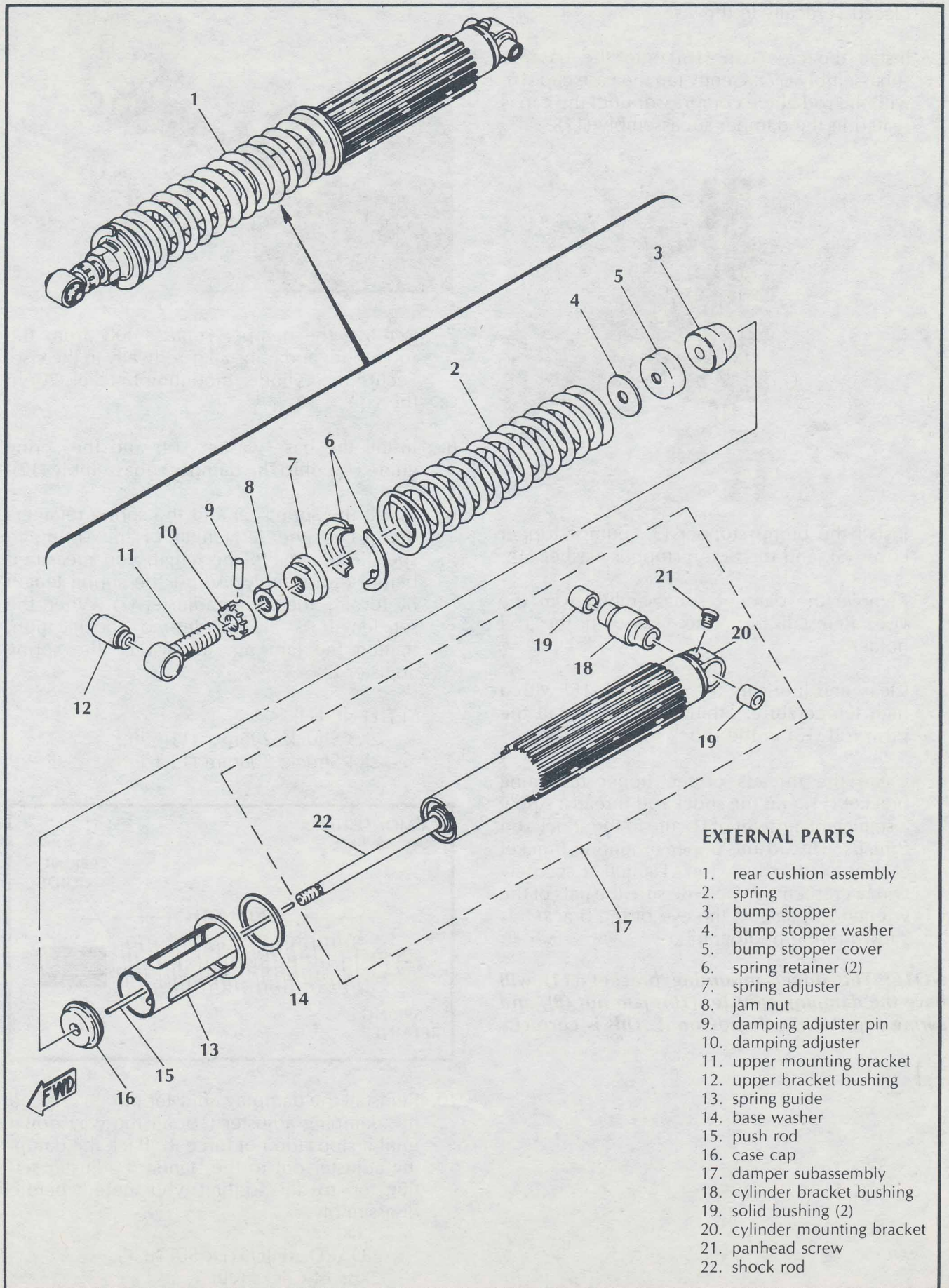
18. Check the stroke of the rod. Any deviation from specification will adversely affect the monoshock's performance. If the stroke is not within specification, disassemble the cylinder and reassemble it correctly.

**DAMPING STROKE:**

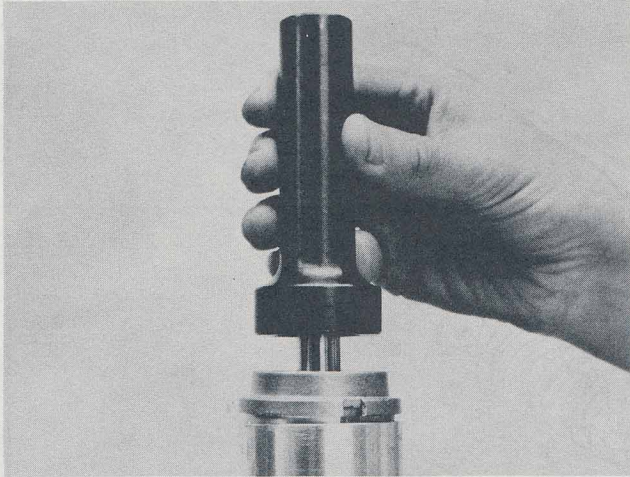
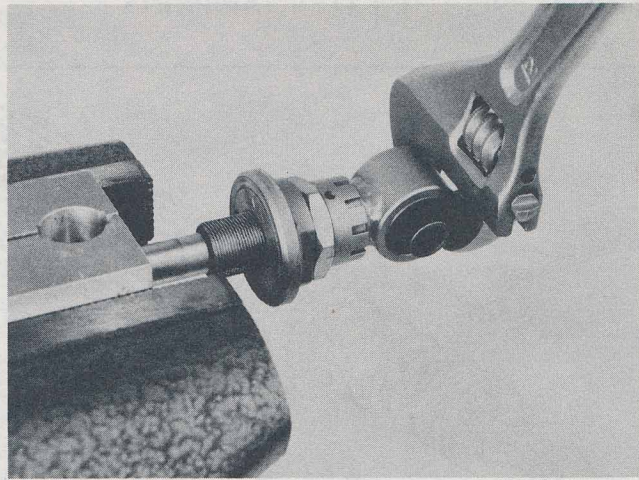
2X3: 148-154mm (5.8-6.1 in.)

2X4: 155-161mm (6.1-6.3 in.)

# INSTALLING THE EXTERNAL PARTS



1. Secure the cylinder mounting bracket in the vise. The damper subassembly should be placed vertically in the vise.
2. Install the case cap (16) onto the damper subassembly (17). Gently tap the case cap (16) with the rod guide compressor until the cap is seated in the damper subassembly (17).



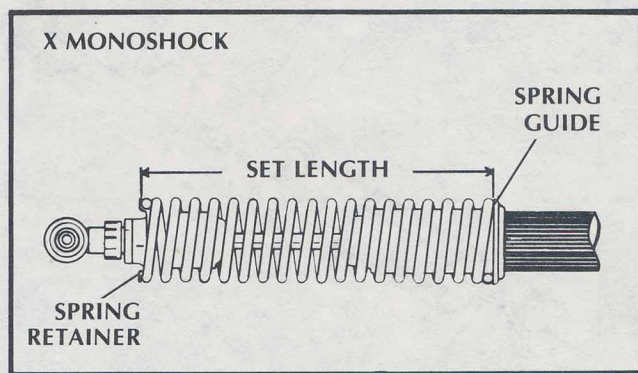
3. Install the bump stopper (3), bump stopper cover (5), and the bump stopper washer (4).
4. Remove the damper subassembly from the vise. Reinstall it in the vise with the rod holder.
5. Clean and lubricate the push rod (15) with a high temperature, lithium grease. Install the push rod (15) in the shock rod (22).
6. Clean the threads of the upper mounting bracket (11) and the shock rod threads. Apply a sufficient amount of Loctite to the shock rod threads. Thread the upper mounting bracket (11) onto the shock rod. Tighten it securely with a crescent wrench. Be sure the flats of the wrench rest against the eye of the bracket as shown in the photograph.

**NOTE: The upper mounting bracket (11) will have the damping adjuster (10), jam nut (8), and spring adjuster (7) already on it. This is correct.**

7. Remove the damper subassembly from the rod holder and reinstall it vertically in the vise. Secure the cylinder mounting bracket (20) in the vise.
8. Install the base washer (14) and the spring guide (13) onto the damper subassembly (17).
9. Install the spring (2) and the spring retainers (6). Adjust the set length of the spring to specification or to the length you measured before disassembly. Adjust the spring length by turning the spring adjuster (7). When the set length is at the desired specification, tighten the jam nut (8) against the spring adjuster (7).

**SET LENGTH:**

2X3 Shock: 295mm (11.6 in.)  
2X4 Shock: 308mm (12.1 in.)



10. Reinstall the damping adjuster pin (9). Thread the damping adjuster (10) all the way down until it stops (do not force it). Back the damping adjuster out to the standard adjuster setting or to the setting you noted before disassembly.

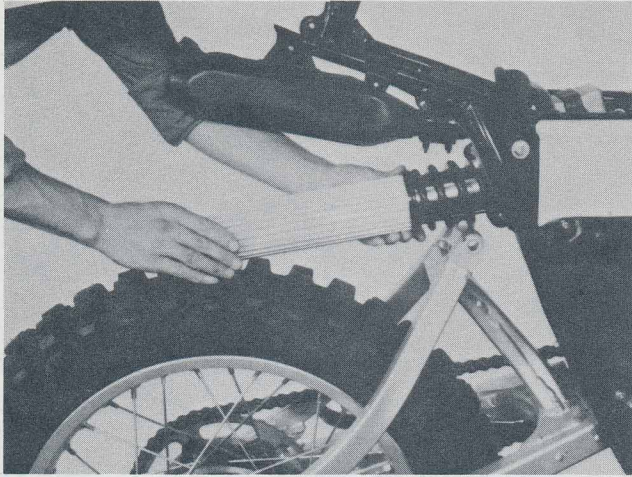
**STANDARD ADJUSTER SETTING:**

2X3: 14 Clicks Out  
2X4: 12 Clicks Out

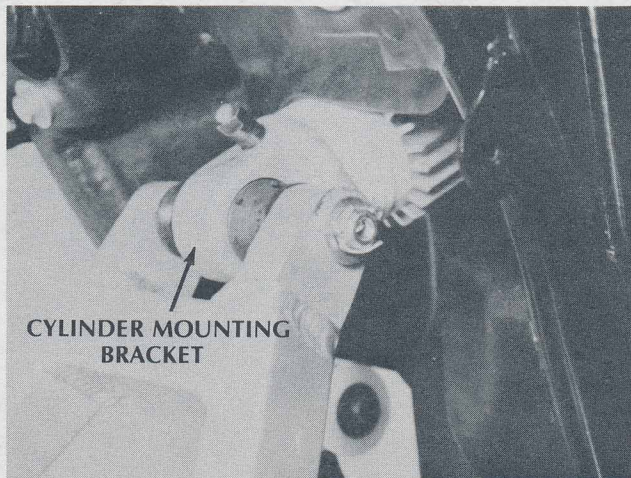


## INSTALLING THE MONOSHOCK ON THE MOTORCYCLE

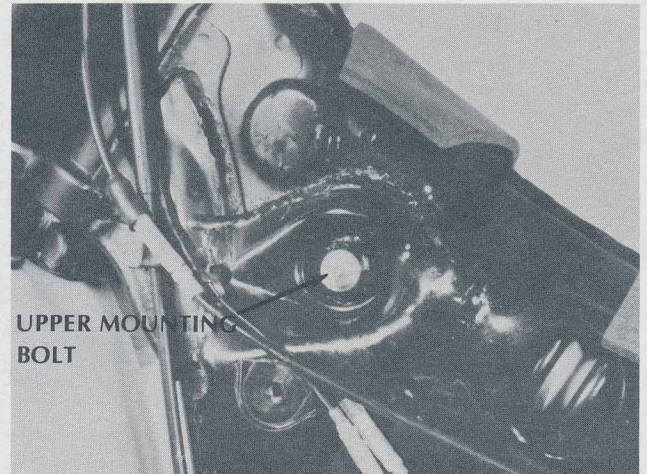
1. Carefully insert the monoshock into the frame from the rear of the bike. Be sure that the upper mounting bracket (11) faces the front of the motorcycle.



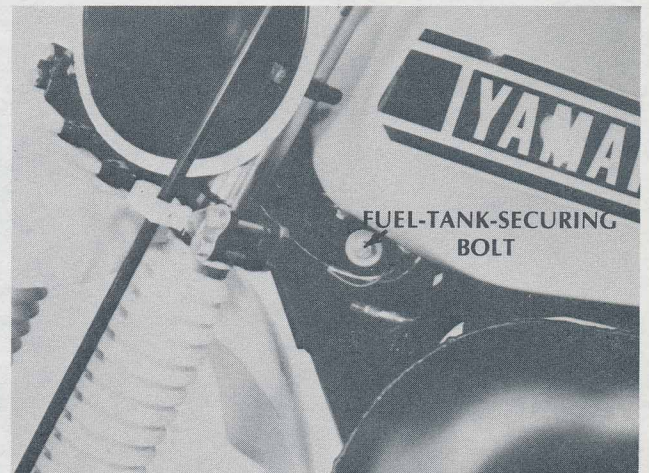
2. Reinstall the pivot bolt through the swingarm and through the cylinder mounting bracket (20). Be sure that a washer is between each bushing (19) and the swingarm pivot. Always use a new cotter pin.



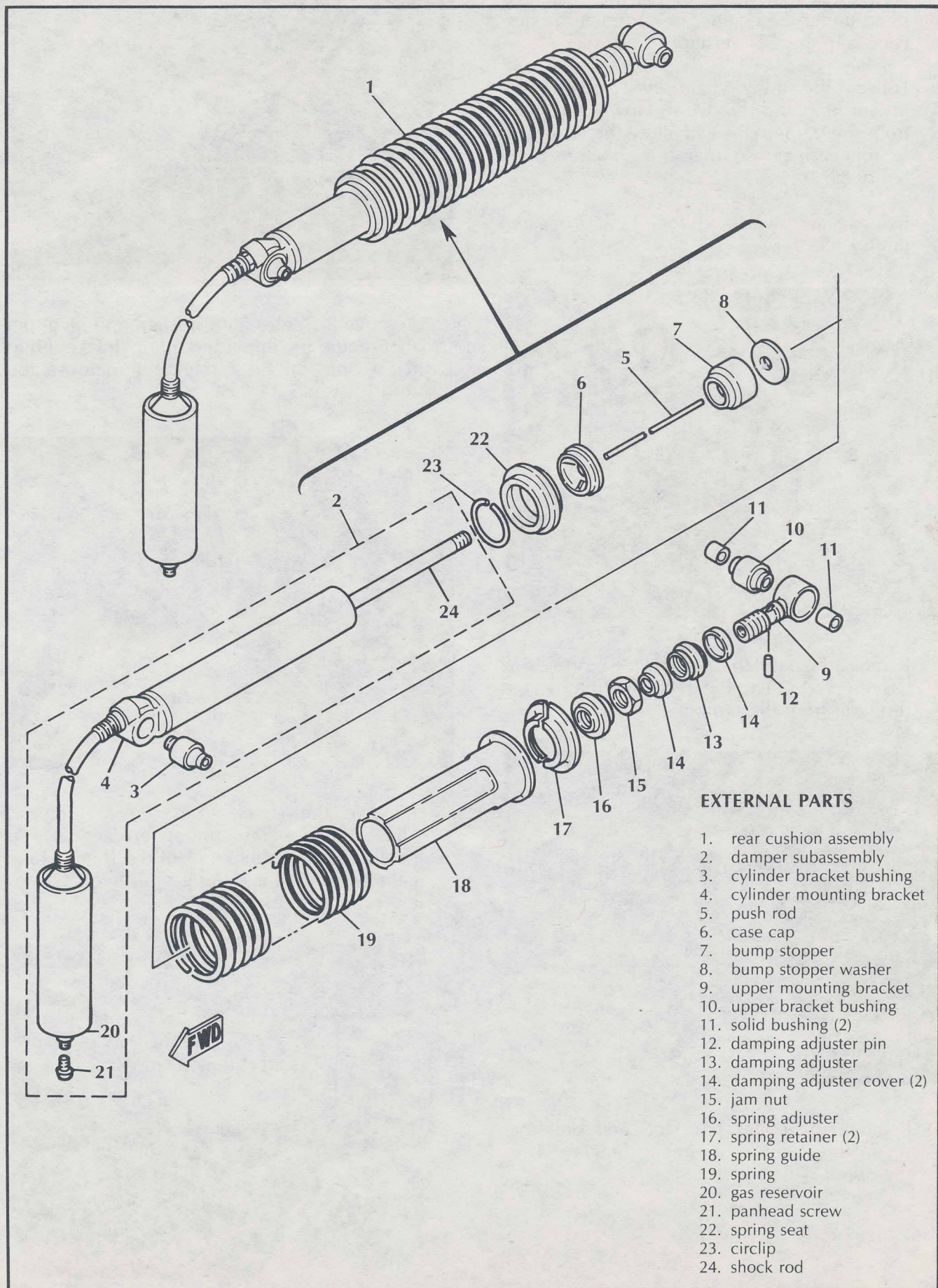
3. Reinstall the upper mounting bracket (11) to the frame. Use a new cotter pin.



4. Reinstall the fuel tank on the motorcycle and secure it to the frame with the two bolts.

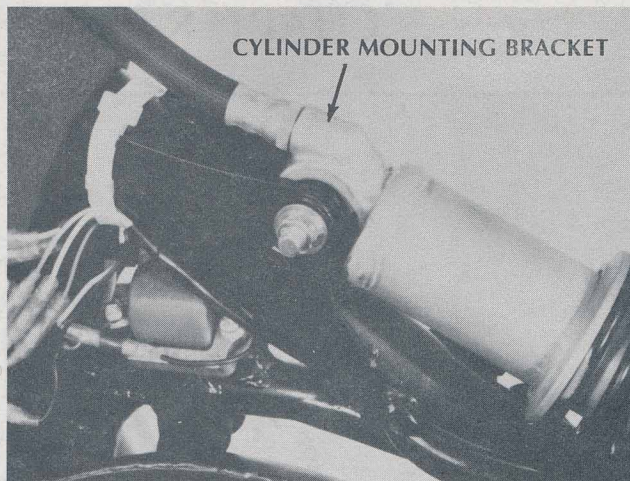


# CHAPTER 5. THE R MONOSHOCK

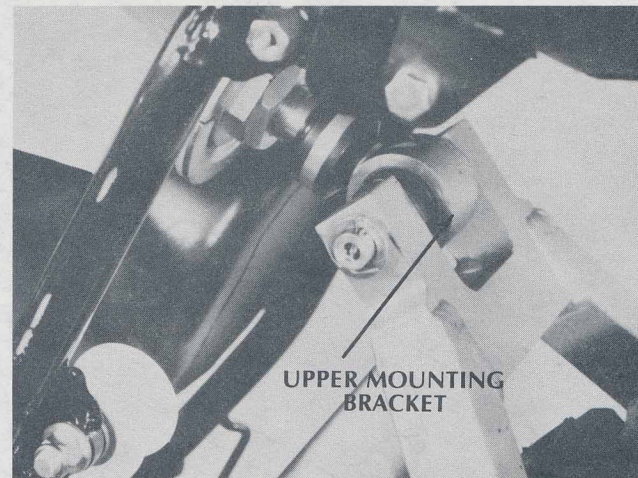


## REMOVAL FROM THE MOTORCYCLE

1. Elevate the rear wheel by placing a suitable stand under the engine. Be sure that the petcock is in the OFF position.
2. Loosen the drive chain by removing the master link, and remove the lower tensioner from the frame. This will allow the swingarm to move freely so that the shock can be removed.
3. Remove the seat and fuel tank from the motorcycle.



6. Remove the cotter pin, washer, and pivot pin that secure the upper mounting bracket (9) to the swingarm. Be careful not to lose the thrust washers.

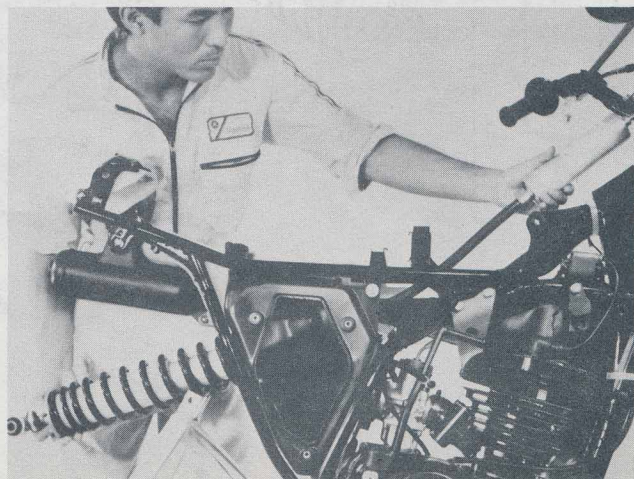


4. Remove the band that secures the monoshock gas reservoir (20) to the frame and remove the reservoir from the grommet.



7. Remove the shock from the motorcycle. Grasp the upper mounting bracket (9) and gently pull the shock out of the frame. Take care not to damage the gas reservoir (20) or the rubber hose.

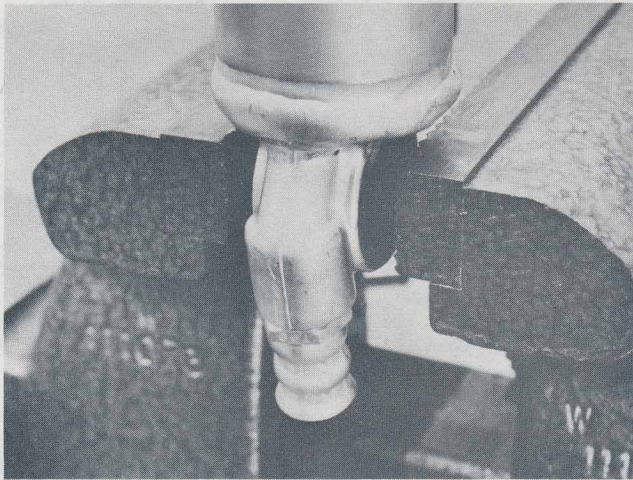
5. Remove the cotter pin, nut, and bolt that secure the cylinder mounting bracket (4) to the upper part of the frame.



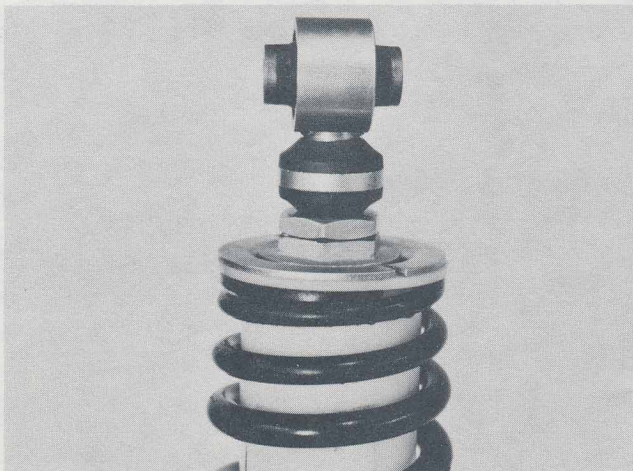
## REMOVING THE EXTERNAL PARTS

Before removing any components, clean all the dirt and oil from the monoshock. Measure the set length of the spring, and note the position of the damping adjuster (13). You will need this information when reassembling the monoshock.

1. Secure the monoshock in a vise with soft jaws. Grip the cylinder mounting bracket (4) as shown in the photograph.



2. Loosen the damping adjuster (13) until it contacts the upper mounting bracket (9).
3. Loosen the jam nut (15) and thread it up against the damping adjuster (13).
4. Loosen the spring adjuster (16) and thread it up against the jam nut (15).

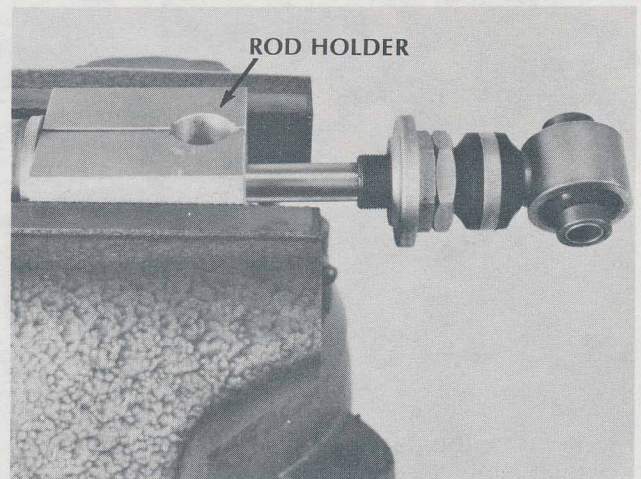


5. Compress the spring (19) and remove both spring retainers (17).

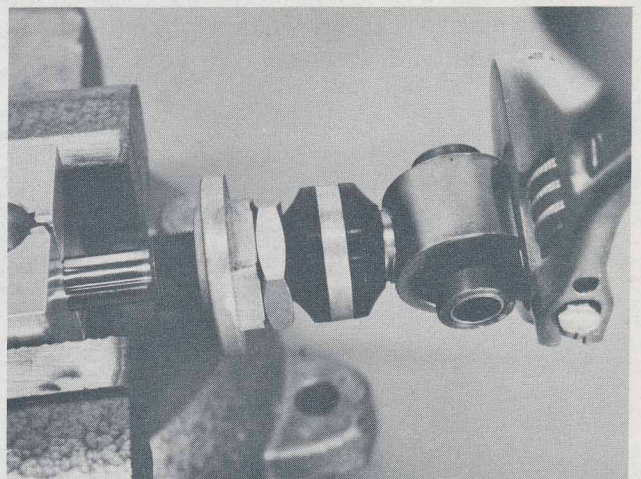
6. Remove the spring (19), spring guide (18), and the spring seat (22).
7. Remove the damper subassembly from the vise. Clean all dirt and oil from the rod holder.
8. Place the shock rod (24) in the rod holder and secure the rod holder in the vise. The rod holder must firmly grip the rod.

**CAUTION: Do not slide the rod holder over the shock rod. The rod must not be scratched, nicked, or damaged in any way. Any damage to the rod could lead to a seal leak.**

Lee Waldie Craig Scott Chris Koira



9. Place a crescent wrench on the upper mounting bracket (9) as shown in the photograph. The flats of the wrench must rest against the eye of the bracket.



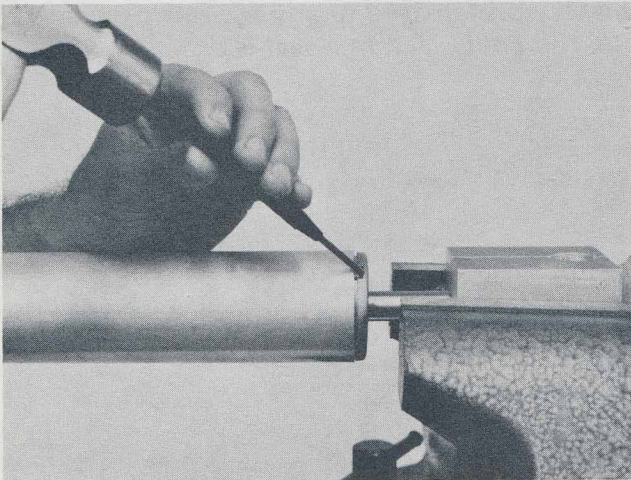
10. Steady the wrench with your free hand and remove the upper mounting bracket (9) from the shock rod (24).

**CAUTION: The bracket is secured to the shock rod with Loctite. Be sure the rod does not rotate in the rod holder.**

11. Remove the bump stopper washer (8) and the bump stopper (7).
12. Remove the push rod (5) from the shock rod and place it on the bench.

**CAUTION: Do not bend the push rod.**

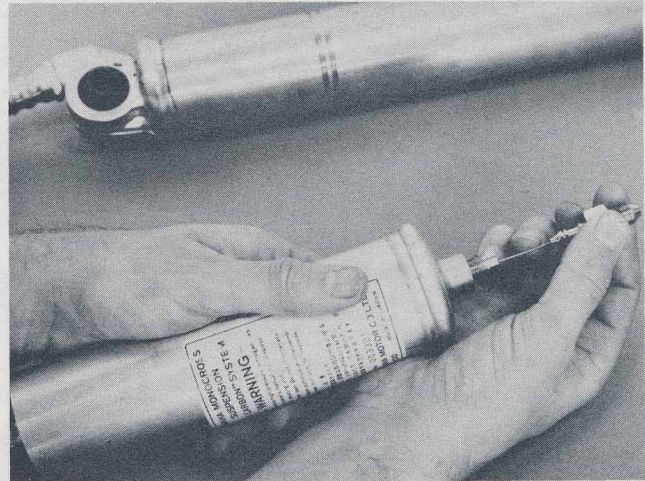
13. Carefully remove the case cap (6) with a drift punch. Be sure to drift around the entire circumference of the cap.



14. Remove the panhead screw (21) from the gas filler plug. Remove the damper subassembly from the vise.
15. Lubricate the needle of the check gauge and check the gas pressure in the gas reservoir. If the pressure is low, check for a gas leak. Repressurize the system and immerse the reservoir and hose in water. Note the location of the leak so you can repair it when the shock is disassembled. Proceed with your work.

16. Lubricate the monoshock needle and insert it in the gas filler plug. Bleed **all** the gas from the monoshock.

**CAUTION: Direct the gas reservoir and the cylinder away from you whenever checking or bleeding the gas.**

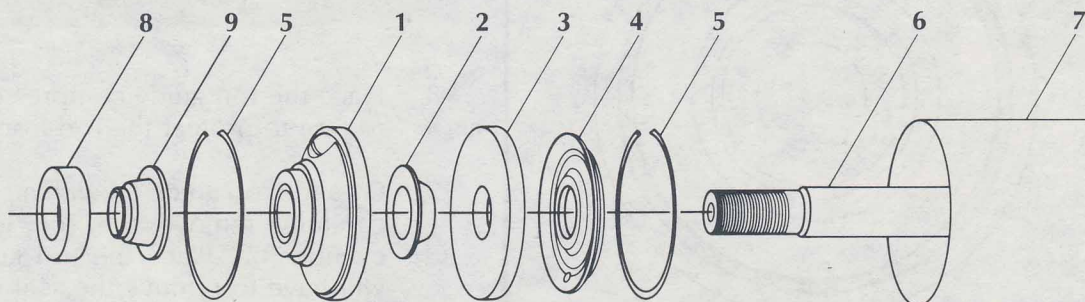


17. When the gas has been bled, gently push the shock rod (24) into the cylinder until it bottoms. This will help bleed any remaining gas. Keep the needle in the plug until instructed to remove it.

## REMOVING THE ROD GUIDE AND RELATED PARTS

### ROD GUIDE AND RELATED PARTS

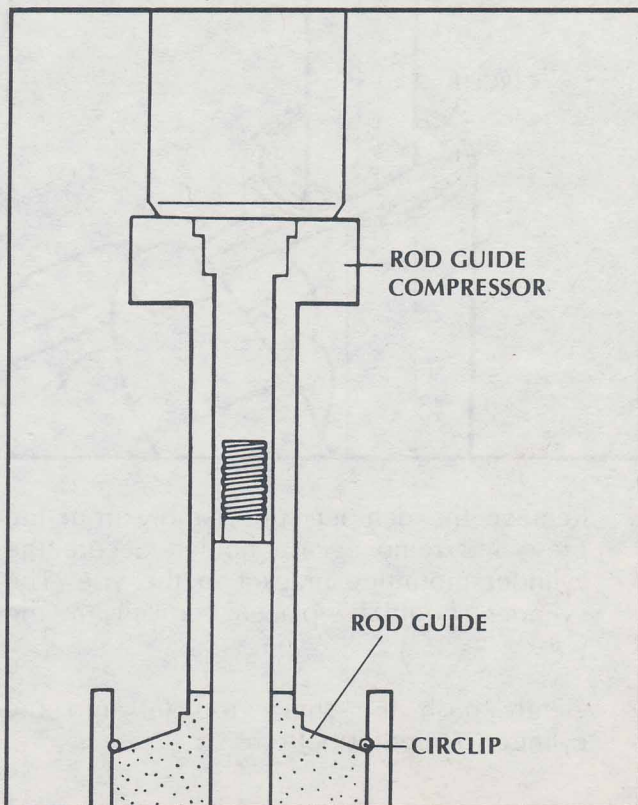
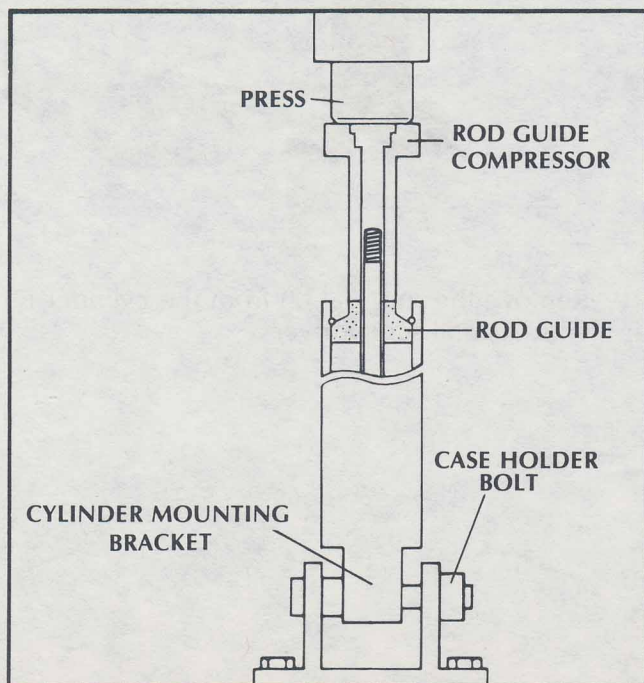
1. rod guide
2. rod seal
3. static seal
4. seal retainer
5. circlip (2)
6. shock rod
7. cylinder
8. seal ring housing
9. dust seal



1. Place the case holder in the press.
2. Install the rod guide compressor on the damper subassembly, and secure the subassembly in the case holder. The case holder bolt must pass through the cylinder mounting bracket as shown in the illustration. Carefully align the damper subassembly in the press.

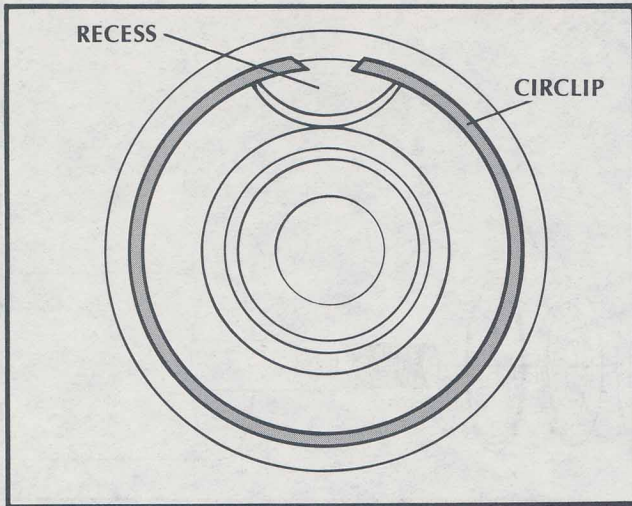
3. Slowly apply pressure to the rod guide compressor. Compress the rod guide (1) until the upper circlip (5) is exposed. Use a minimal amount of pressure. Excessive pressure could damage some of the internal parts.

Gerard Rouquette

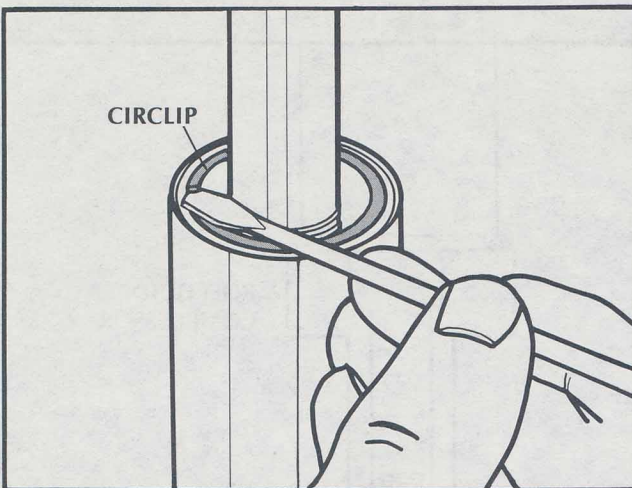


4. Rotate the circlip in the circlip groove until the circlip ends are in the recess of the rod guide; see the illustration below.

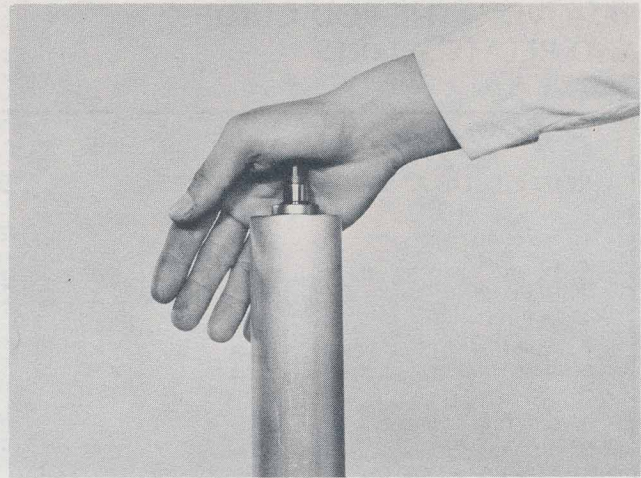
**CAUTION:** *If the circlip cannot be rotated within the groove, the damper subassembly may be off center. Remove the damper subassembly from the press and carefully realign it.*



5. Using a scribe or two small screwdrivers, carefully remove the upper circlip (5) from the cylinder. Be careful not to scratch the cylinder walls.

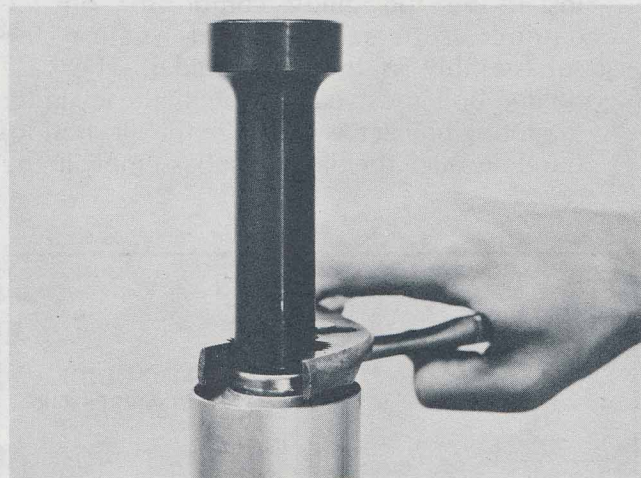


6. Remove the damper subassembly from the press and remove case holder. Secure the cylinder mounting bracket in the vise. The cylinder should be placed vertically in the vise.
7. Gently push the shock rod (6) into the cylinder (7) until it bottoms.

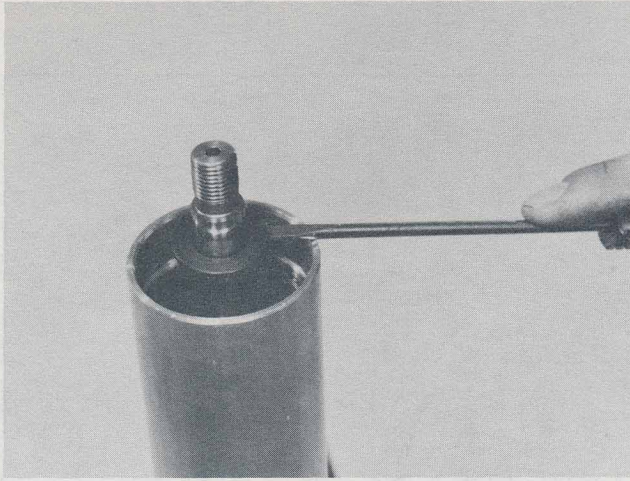


8. Place the rod guide compressor on the shock rod (6) to protect the rod from scratches.
9. Grip the rod guide (1) with a pair of pliers and carefully remove the rod guide from the cylinder (7). Place the rod guide aside. You will have to remove the seal ring housing (8) and the dust seal (9) later.

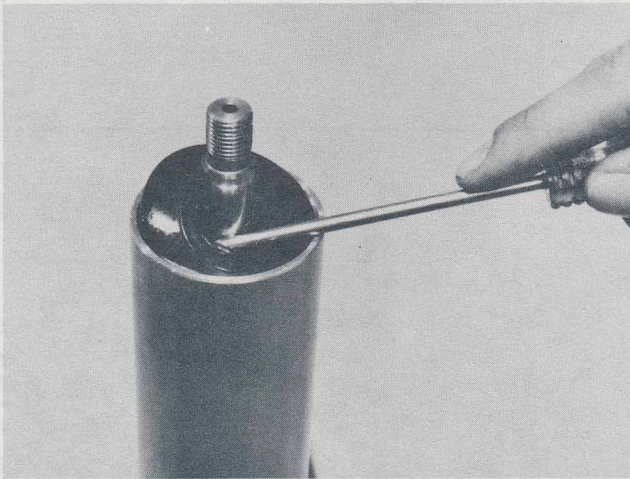
**NOTE:** *Oil the cylinder walls if you have difficulty removing the rod guide.*



10. Remove the rod seal (2) from the cylinder (7) with a small screwdriver.



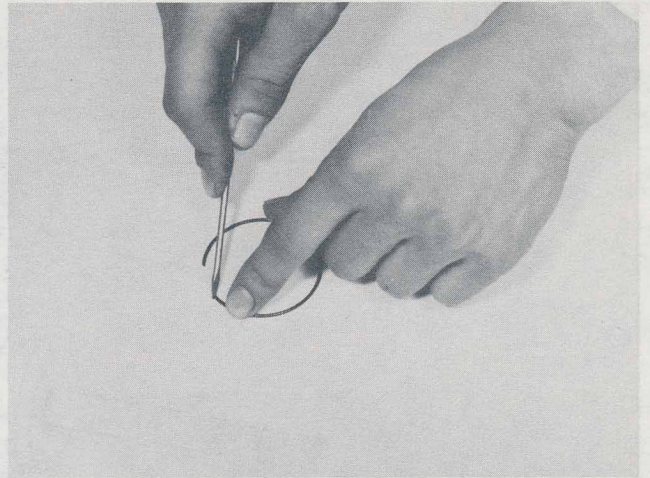
11. Remove the static seal (3) from the cylinder with a small screwdriver.



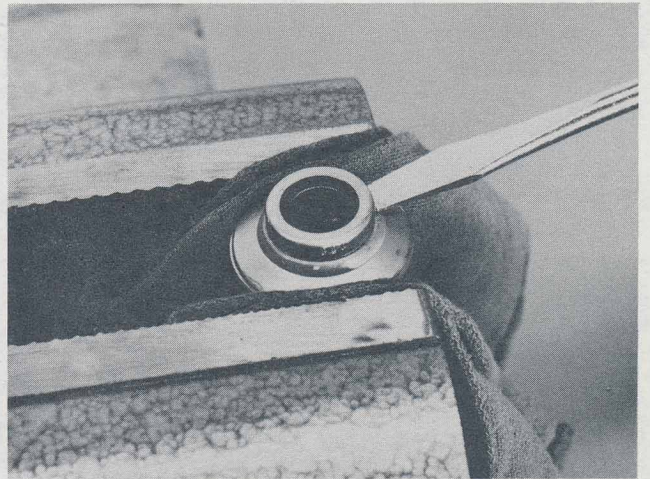
12. Remove the seal retainer (4) from the cylinder.



13. Remove the lower circlip (5) from the cylinder. Use a screwdriver and your forefinger as shown in the photograph.



14. Install the rod guide (1) in the vise as shown in the photograph. Pry off the seal ring housing (8) and remove the dust seal (9). Be careful not to scratch or mar the rod guide.

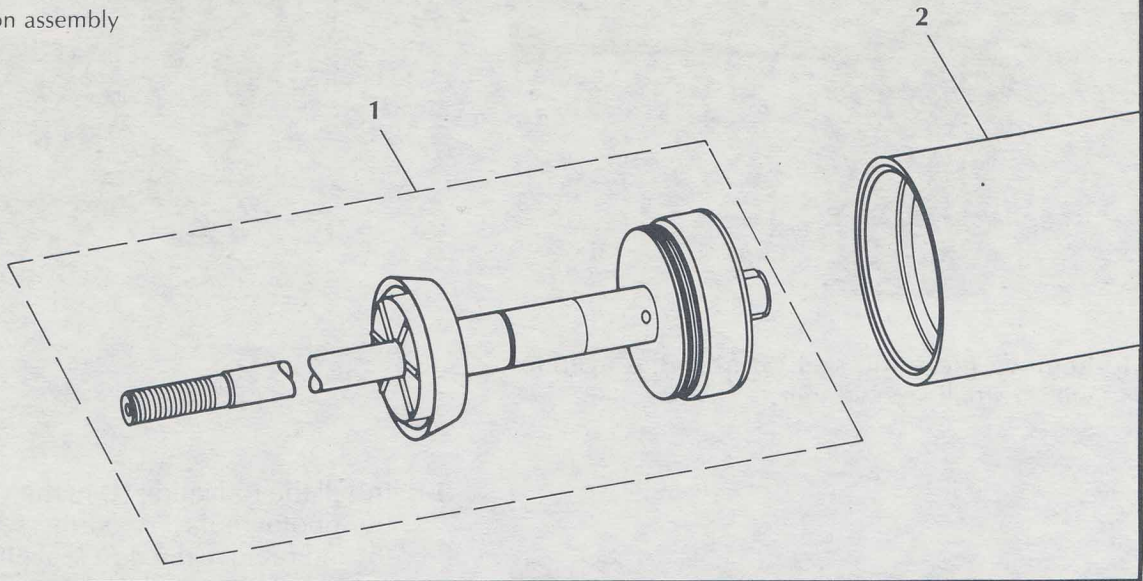




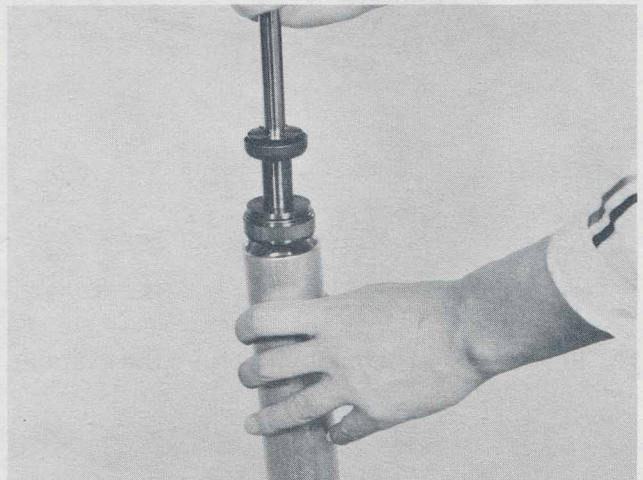
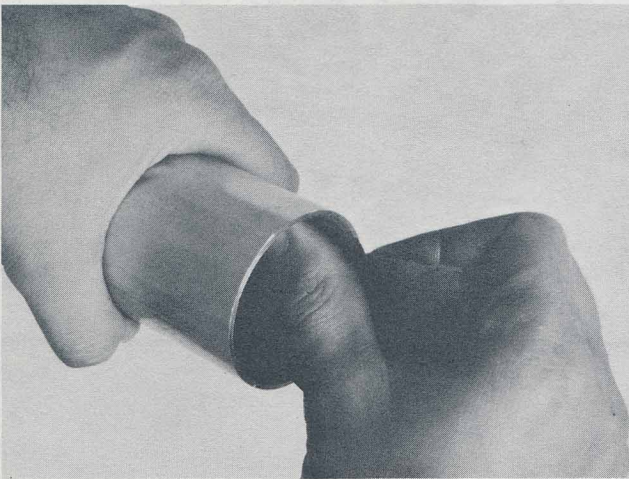
## REMOVING THE ROD-PISTON ASSEMBLY

### CYLINDER

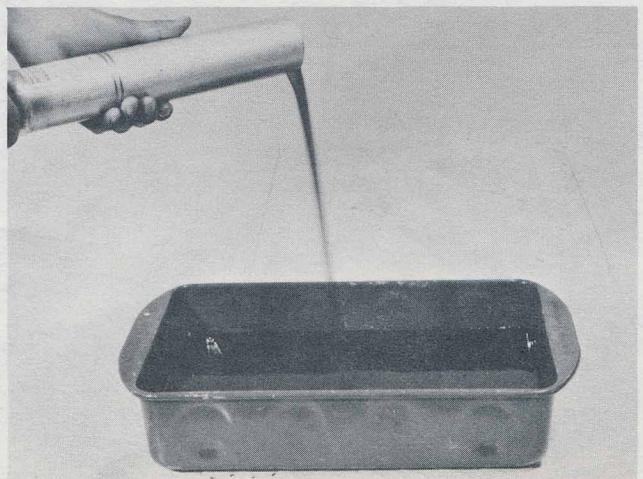
1. rod-piston assembly
2. cylinder



1. Drain some oil from the cylinder. Deburr the circlip grooves in the cylinder (2) with 1200 grit sandpaper. This will prevent damage to the rod-piston assembly (1) when it is removed from the cylinder.



3. Drain the remaining oil from the cylinder.

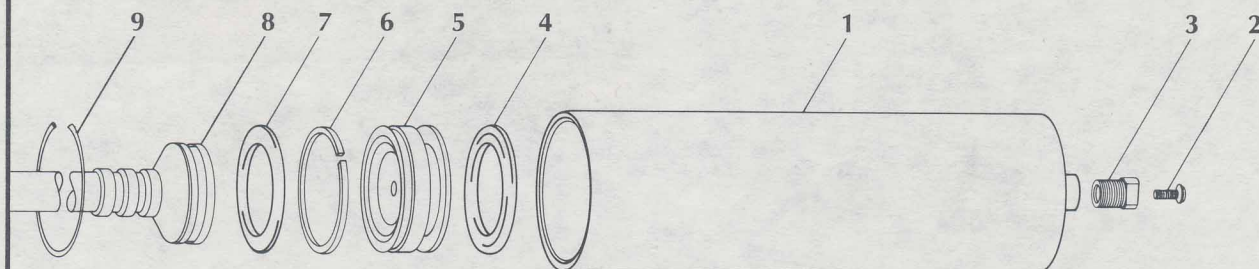


2. Slowly pull the rod-piston assembly (1) from the cylinder (2) and place it aside.

## DISASSEMBLING THE RESERVOIR

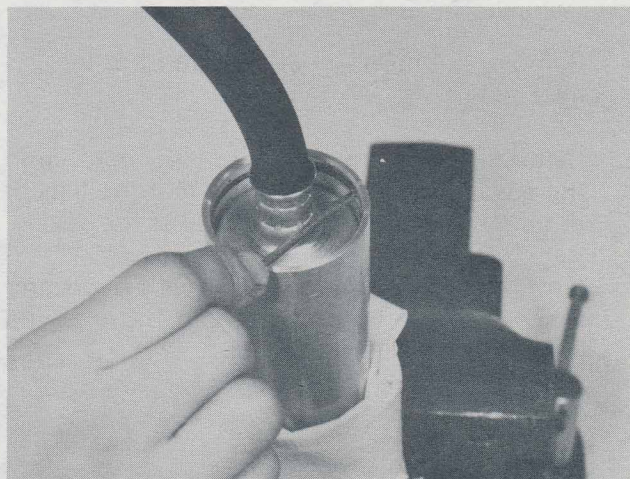
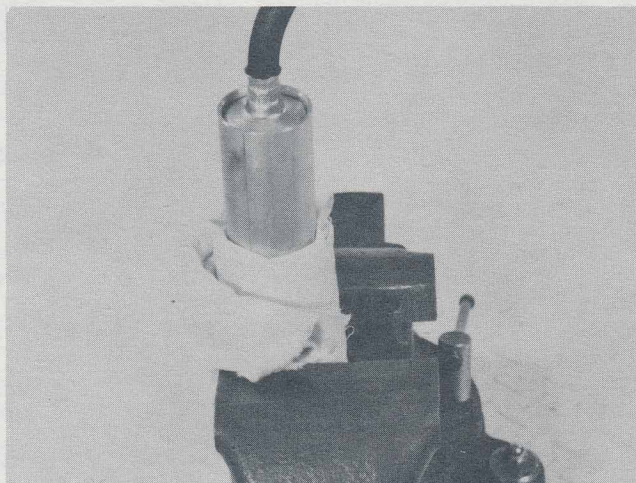
### GAS RESERVOIR

1. gas reservoir
2. panhead screw
3. gas filler plug
4. o-ring
5. free piston
6. piston ring 2
7. o-ring
8. hose cap
9. circlip



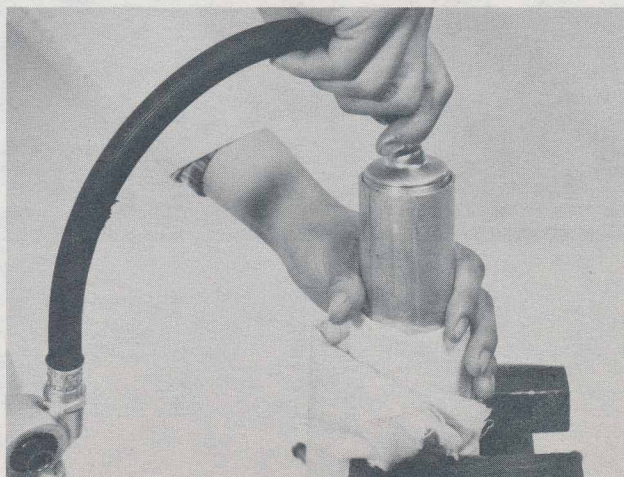
Lee Waldie Craig Scott Chris Koira

1. Wrap the gas reservoir (1) in a cloth, and secure the reservoir in the vise. Use a minimal amount of force so the reservoir will not be damaged or distorted.



2. Press the hose cap into the reservoir and carefully remove the circlip (9) with a scribe or small screwdriver. Do not mar the reservoir walls.

3. Slowly remove the hose cap (8) from the reservoir (1). Drain any remaining oil from the reservoir.



4. Use 1200 grit sandpaper and deburr the circlip groove in the reservoir. Thoroughly wash the gas reservoir with a light solvent like kerosene or Stoddard Solvent. Do not use gasoline. Gasoline will damage the O-ring.

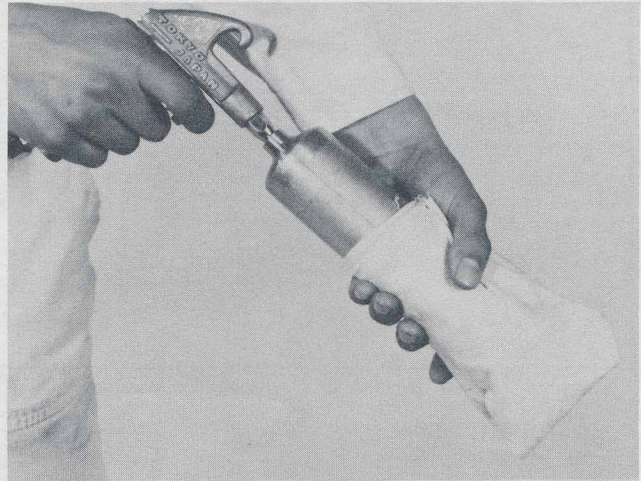
**CAUTION:** Any burrs on the edges of the circlip groove will damage the O-ring when the free piston is removed.



8. Cover the opening of the reservoir with a cloth, and direct the opening down, towards the floor. Remove the free piston (5) by blowing a few short bursts of compressed air into reservoir neck. The cloth will catch the free piston and prevent piston damage.

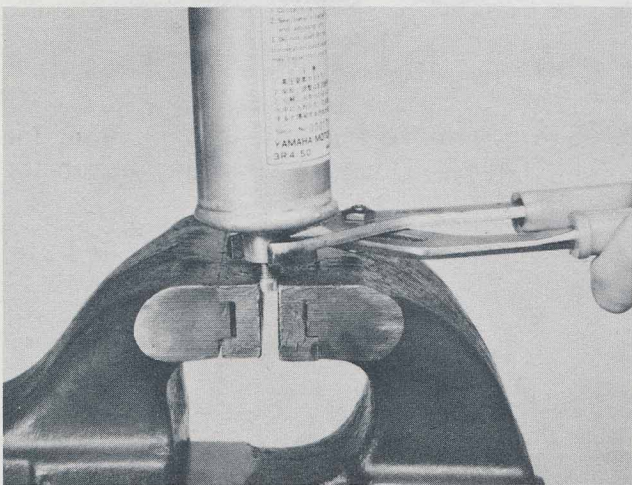
Mark Boddy

**WARNING:** Do not use nitrogen or any other highly compressed gas to perform this procedure. Compressed air will be sufficient. Be sure to follow the instructions to the letter.



5. Remove the monoshock needle from the gas filler plug.
6. Reinstall the reservoir in the vise, but clamp the gas filler plug (3). Be sure that the flats of the plug are caught by the flats of the vise.
7. Grip the neck of the reservoir with pliers and rotate the reservoir until it can be removed from the gas filler plug.

9. Remove the O-ring (4) and piston ring 2 (6) from the free piston (5).

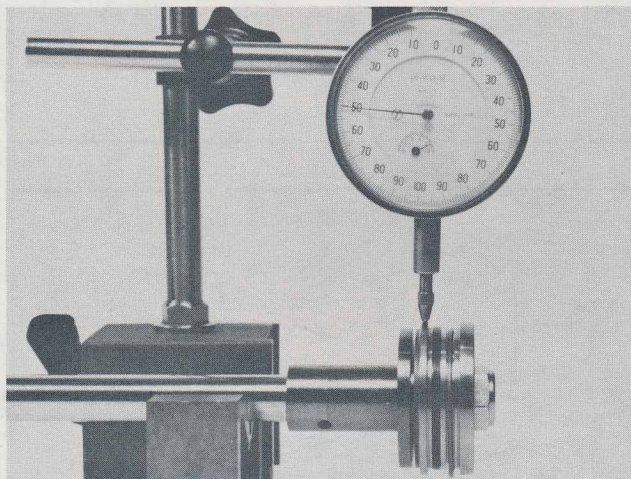


## DISASSEMBLING THE ROD-PISTON ASSEMBLY

1. Measure the piston runout at the location shown in the photograph. Support both ends of the rod in V-blocks placed on a surface plate. Place the dial gauge at the piston and rotate the rod. If piston runout exceeds the maximum specification, replace the rod.

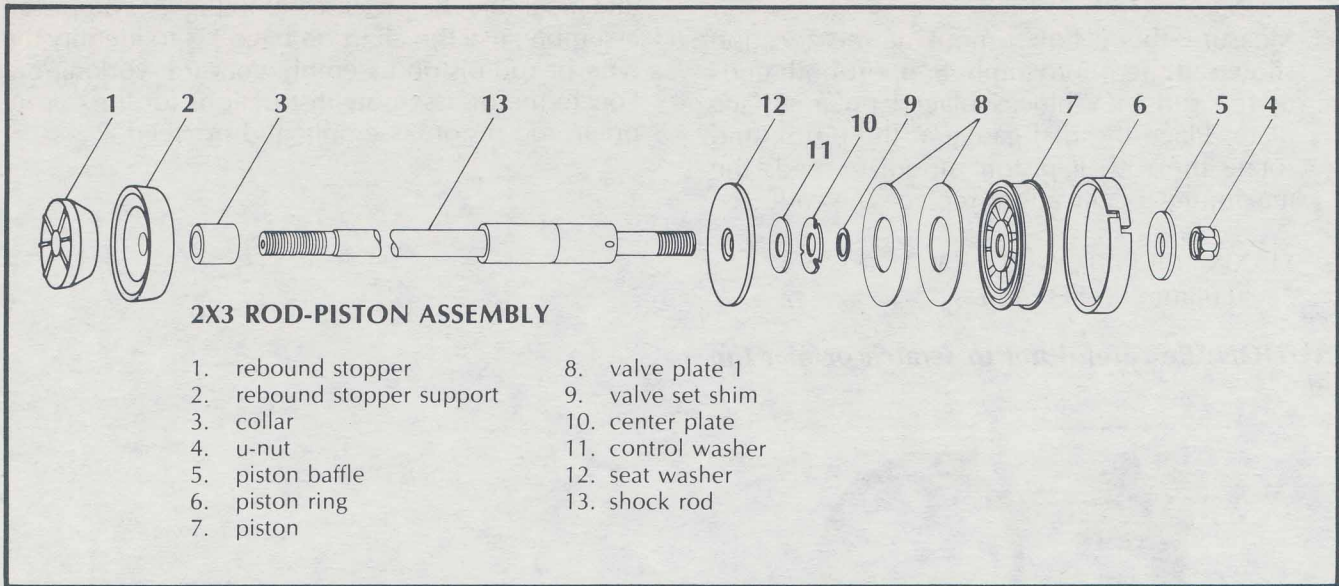
MAXIMUM PISTON RUNOUT:  
0.08mm (0.0031 in.)

**CAUTION:** *Be careful not to scratch or mar the rod.*

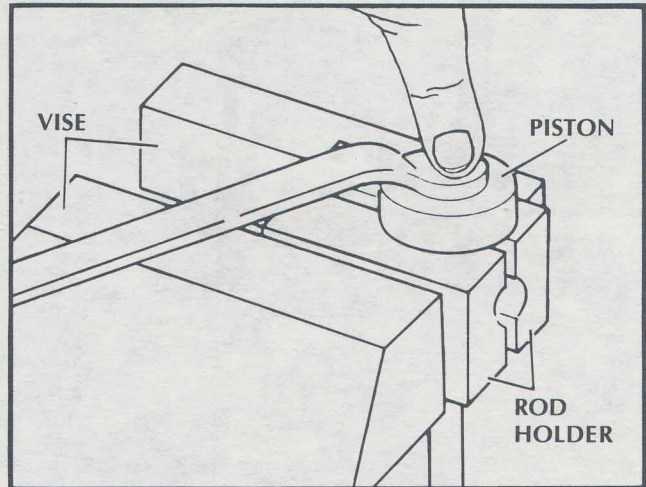


There are two types of rod-piston assemblies used on the R monoshock: the 2X3 assembly and the 3R4 assembly. Before disassembling the rod-piston assembly, use the chart on page 1-3 to identify the type of rod-piston assembly you are working on. Locate the disassembly instructions for the appropriate rod-piston assembly and proceed.

## A. Disassembling the 2X3 Rod-Piston Assembly

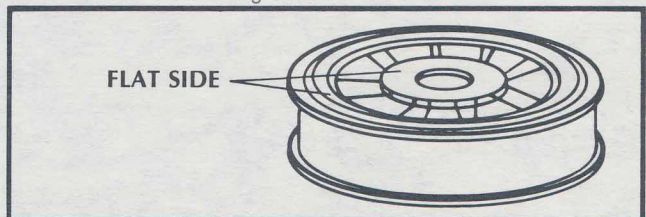
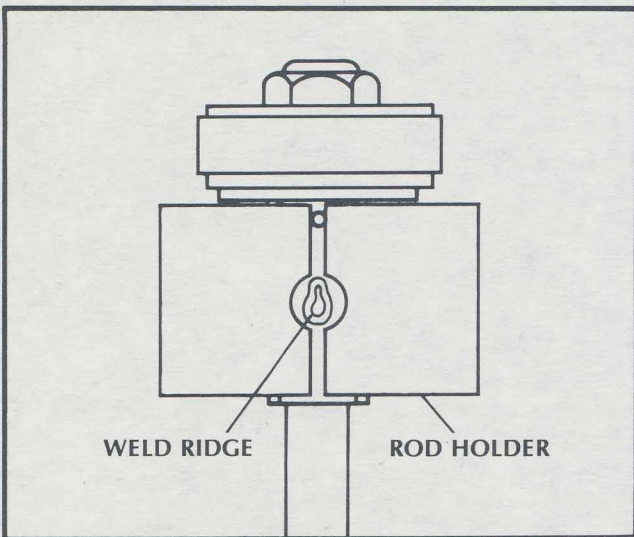


1. Remove the rebound stopper (1), the rebound stopper support (2), and the collar (3) from the shock rod (13).
2. Carefully place the stepped portion of the shock rod in the rod holder. The weld ridges of the rod must **not** contact the holder; see the illustration below. Secure the holder in the vise.



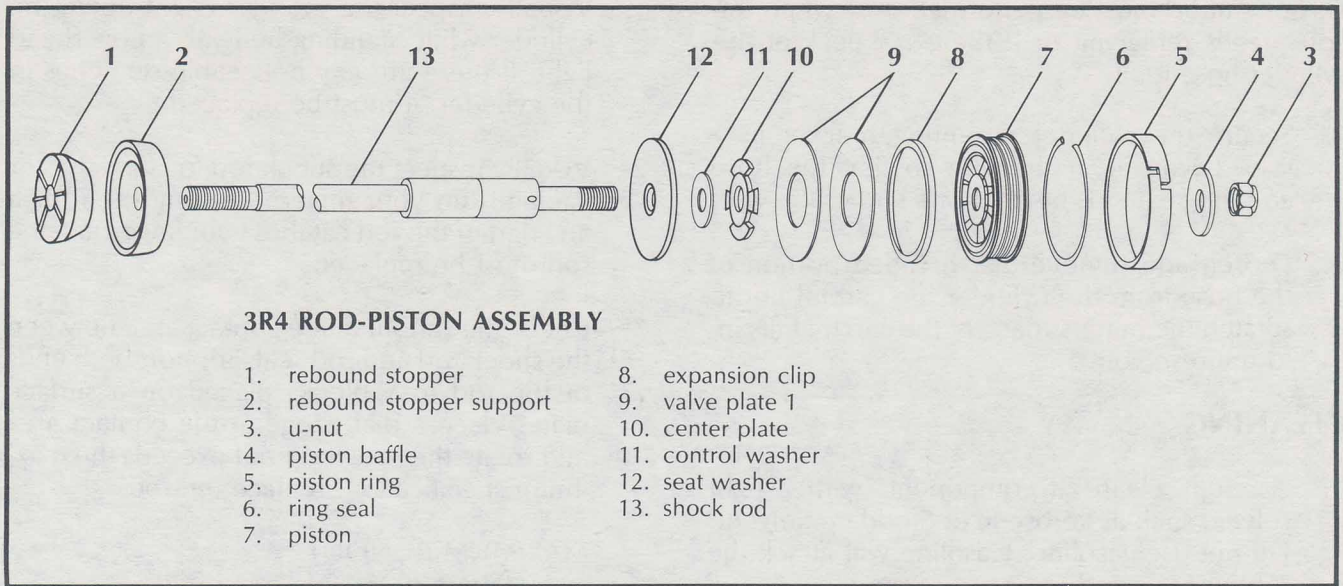
4. Remove the piston baffle (5) and the piston (7) from the rod. When placing the piston on the bench, be sure that the flat side faces upward.

Lee Waldie Craig Scott Chris Koira

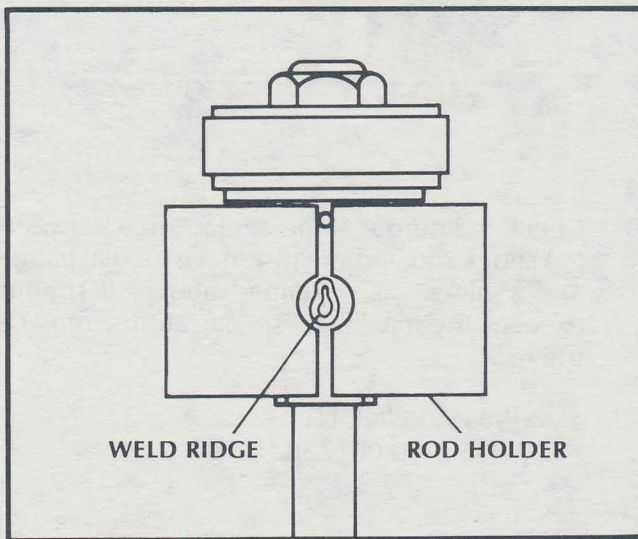


3. Remove the piston ring (6) from the piston (7), and remove the U-nut (4).
5. Remove both pieces of valve plate 1 (8), the valve set shim (9), the center plate (10), the control washer (11), and the seat washer (12).

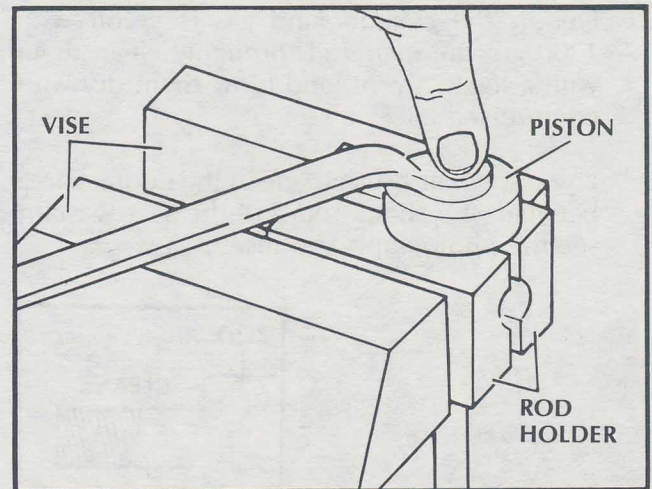
## B. Disassembling the 3R4 Rod-Piston Assembly



1. Remove the rebound stopper (1) and the rebound stopper support (2) from the shock rod (13).
2. Carefully place the stepped portion of the shock rod in the rod holder. The weld ridges of the rod must **not** contact the rod holder; see the illustration below. Secure the holder in the vise.

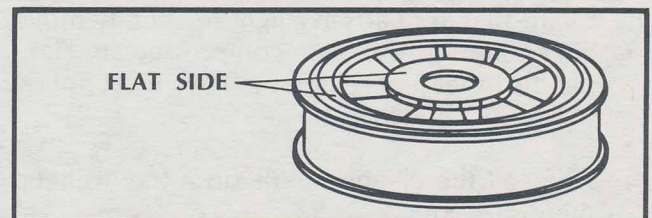


3. Remove the piston ring (5) from the piston (7), and remove the U-nut (3).



4. Remove the piston baffle (4) and the piston (7) from the rod. Remove the ring seal (6) and the expansion clip (8). When placing the piston on the bench, be sure that the flat side faces upward.

**NOTE: Do not confuse the expansion clip (8) with a circlip. They are not interchangeable.**



5. Remove both pieces of valve plate 1 (9), the center plate (10), the control washer (11), and the seat washer (12).

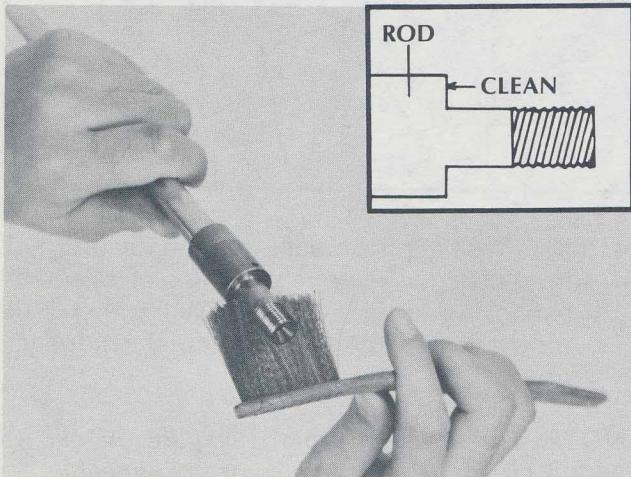
## REMOVING THE HOSE ASSEMBLY

This operation must be performed only when the hose needs replacing or if there is a leak at the cylinder-hose joint.

1. Secure the cylinder mounting bracket in a vise. Locate it in the vise so that the hose coupling extends beyond one end of the vise.
2. Loosen and remove the threaded portion of the hose from the cylinder. Be careful not to scratch the outer surface of the cap that fits into the reservoir.

## CLEANING

1. Carefully clean all components with a light solvent such as kerosene or Stoddard Solvent. Do not use gasoline. Gasoline will attack the rubber seals and O-rings.
2. Deburr the cylinder and gas reservoir with 1200 grit sandpaper. Thoroughly clean them with a light solvent, and blow them dry with compressed air.
3. Use a soft hair brush to clean the contact area between the shock rod and the seat washer; see the photograph and inset below.

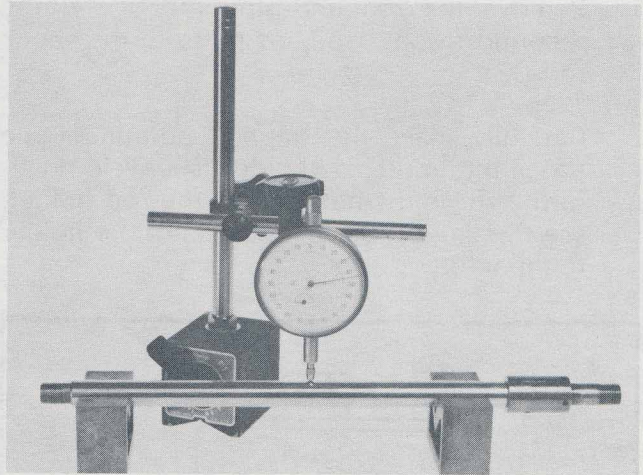


4. Clean all inner parts in a light solvent. Remove all dust and solvent with compressed air. Handle the inner parts carefully. They must not be nicked or scratched.
5. Place all the cleaned parts on a tray to keep them dust free.

## INSPECTION

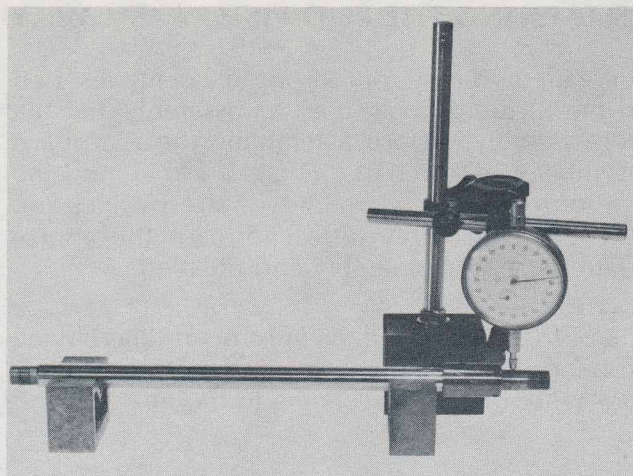
1. Visually inspect the cylinder. Sight down the cylinder while standing beneath an overhead light. If there are any noticeable scratches in the cylinder, it must be replaced.
2. Visually inspect the shock rod for scratches or flaking. Run your fingernail along the rod. If any part of the rod catches your fingernail, the rod must be replaced.
3. Check the runout at the contact area between the shock rod and rod seal. Support both ends of the rod in V-blocks placed on a surface plate. Place a dial gauge at the contact area and rotate the rod. If runout exceeds the maximum specification, replace the rod.

MAXIMUM RUNOUT:  
0.04mm (0.0016 in.)

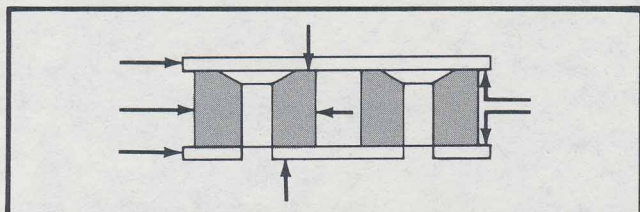


4. Check the runout at the contact area between the shock rod and the piston. Use a dial gauge and V-blocks as explained above. If runout exceeds the maximum specifications, replace the rod.

MAXIMUM RUNOUT:  
0.03mm (0.0012 in.)



5. Inspect the piston. Pay particular attention to the outer surfaces and to the piston-to-valve-plate-1 contact area (the flat side). If the piston has any scratches that can catch your fingernail, replace the piston and all the valve parts.

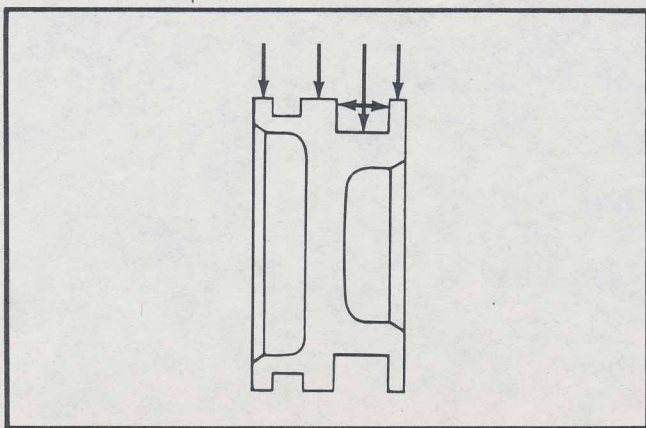


6. Inspect the valve parts. If there are any high spots or scratches that can catch your fingernail, replace the piston and all the valve parts.

**CAUTION: If any valve parts must be replaced or if the piston must be replaced, replace ALL the valve parts AND the piston. The piston and valve parts must be replaced as an assembly.**

7. Inspect the free piston. Pay particular attention to the O-ring groove and to the outer surfaces of the free piston. If the free piston has any scratches that can catch your fingernail, replace the free piston.

Gerard Rouquette



8. Inspect the gas reservoir. Sight down the gas reservoir while standing beneath an overhead light. If it has any serious scratches or dents in the walls, replace the reservoir.
9. Inspect the hose assembly. If there is a scratch or crack in the hose, replace it.

## ASSEMBLY

**Before installing any part on the monoshock, be sure that it is clean and free of all dust. Always blow the part clean with compressed air prior to installation.**

Whenever reassembling a monoshock, always replace these parts with new ones.

### ROD GUIDE

- Dust Seal
- Static Seal
- Rod Seal
- Rebound Stopper

### PISTON

- Piston Ring
- Ring Seal
- U-nut

### FREE PISTON

- O-ring

### RESERVOIR

- O-ring
- Gas Filler Plug

### REPLACE ALL CIRCLIPS

## ASSEMBLING THE HOSE TO THE CYLINDER

1. Thoroughly remove all the Loctite from the threaded portion of the cylinder-hose joint. Use a die if necessary.

DIE THREAD DIAMETER:  
M12 x 1.25

2. Carefully wash the cylinder with a light solvent, and blow it dry with compressed air.
3. With an appropriately sized tap, remove all remaining Loctite from the threaded portion of the hose.

TAP THREAD DIAMETER:  
M12 x 1.25



4. Thoroughly clean the threads with solvent. Remove all solvent with compressed air.

**CAUTION: Solvent could harm the hose if left on it for a period of time. Be sure to dry the hose with compressed air.**

5. Grip the cylinder in a vise, and connect the hose to the cylinder. Use a sufficient amount of Loctite. Torque the nut to specification.

**TIGHTENING TORQUE:**  
400 kg-cm (29 ft-lbs.)

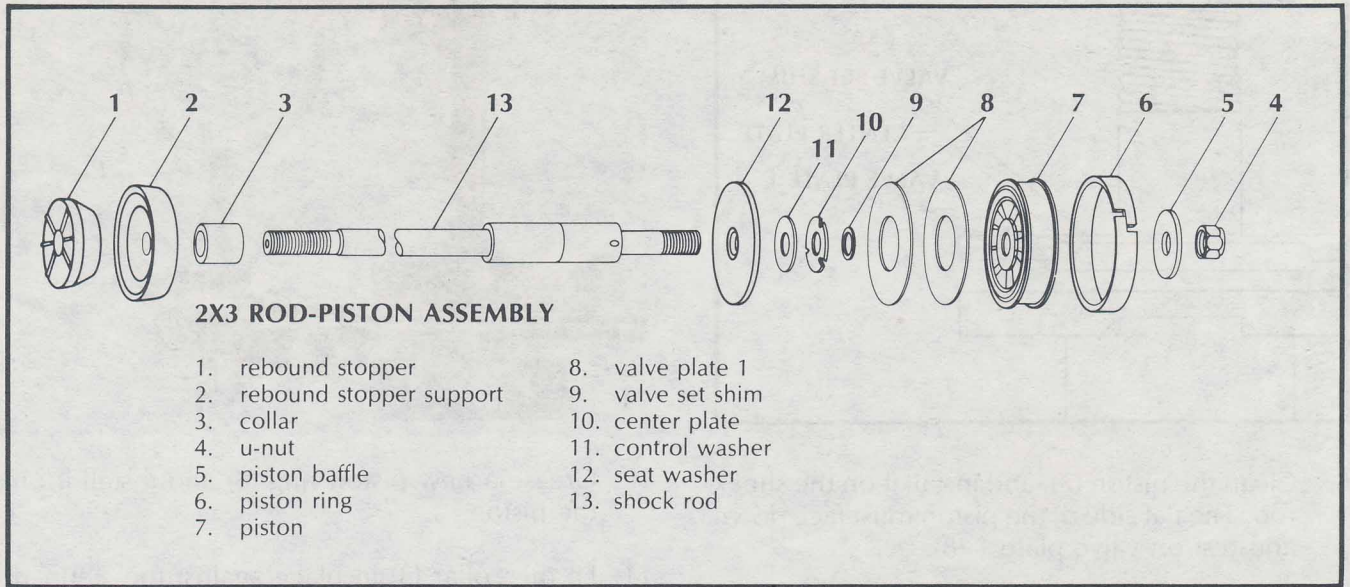


## ASSEMBLING THE ROD-PISTON ASSEMBLY

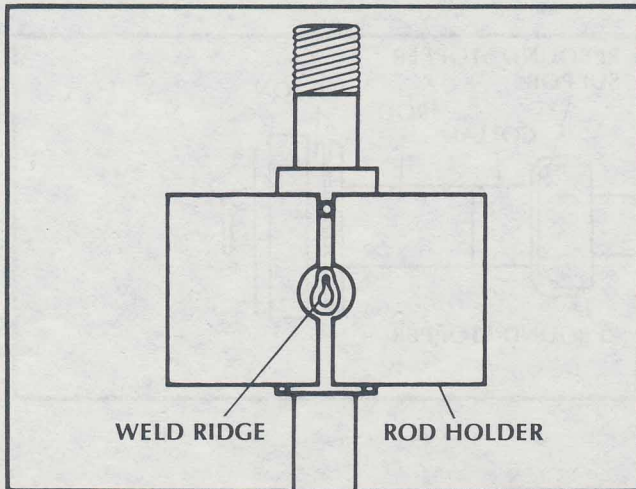
There are two types of rod-piston assemblies used on the R monoshock: the 2X3 assembly and the 3R4 assembly. Before assembling the rod-piston assembly, use the chart on page 1-3 to identify the type of rod-piston assembly you are working on. Locate the assembly instructions for the appropriate rod-piston assembly and proceed.

The piston and valve parts must be installed in the proper order. Proceed slowly and carefully. Check your work before proceeding to the next step.

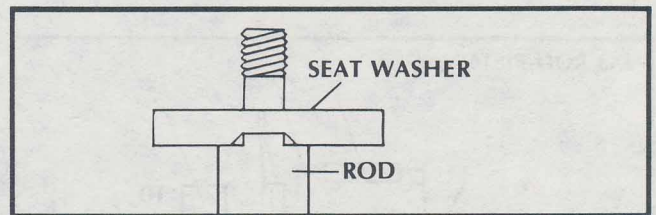
## A. Assembling the 2X3 Rod-Piston Assembly



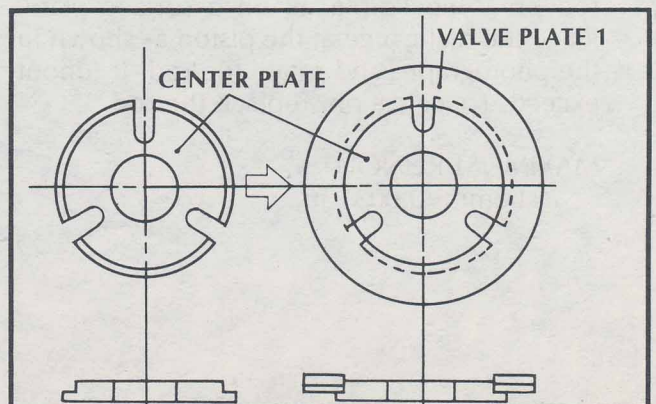
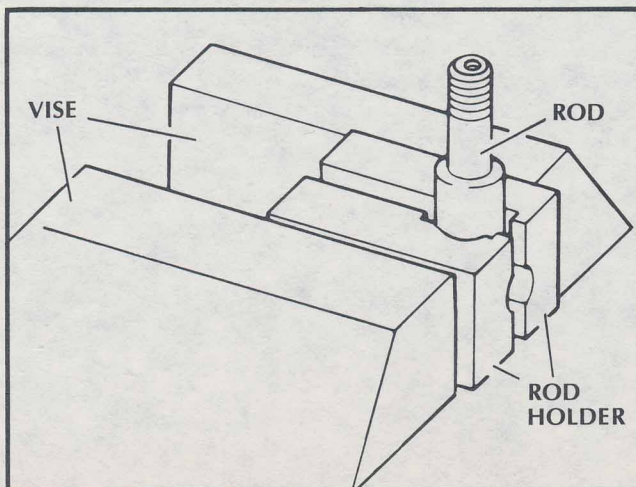
- Place the stepped portion of the shock rod (13) in the rod holder, and secure the holder in the vise. Carefully locate the shock rod in the rod holder so that the weld ridges of the rod do not contact the holder.

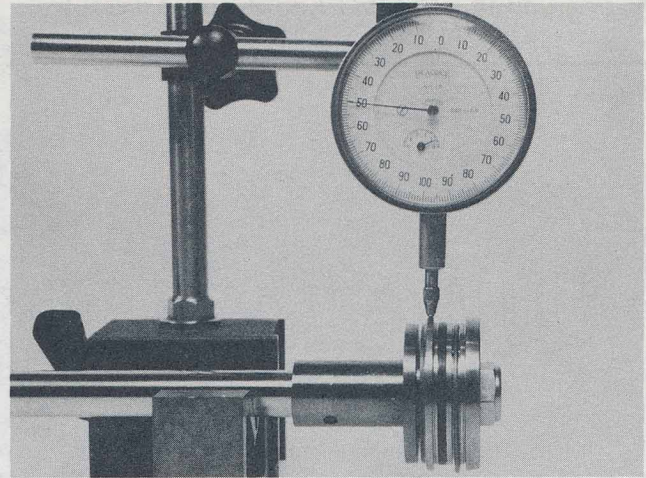
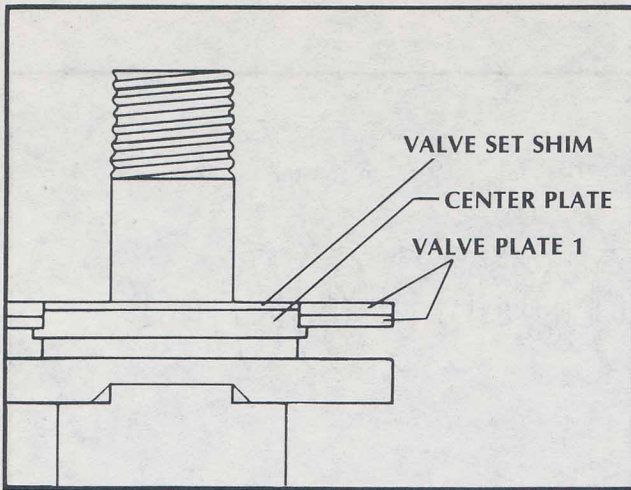


- Carefully clean the entire rod with compressed air.
- Install the seat washer (12) on the shock rod (13). The chamfered side of the seat washer (12) must face the stepped portion of the rod as shown in the illustration.



- Install the control washer (11); then install the center plate (10). The flat side of the center plate must face down and rest against the control washer (11).
- Install valve plate 1 (8) and center both pieces on the center plate (10). Install the valve set shim (9).

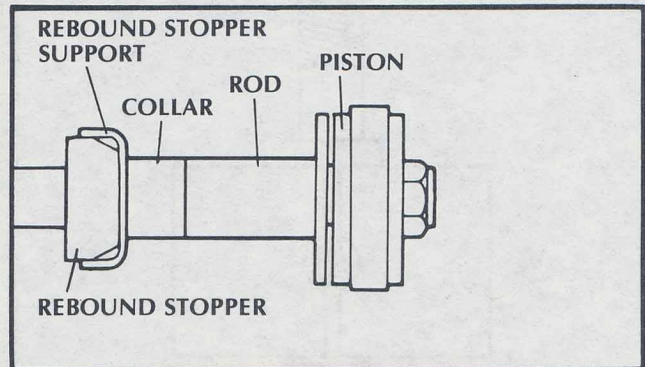
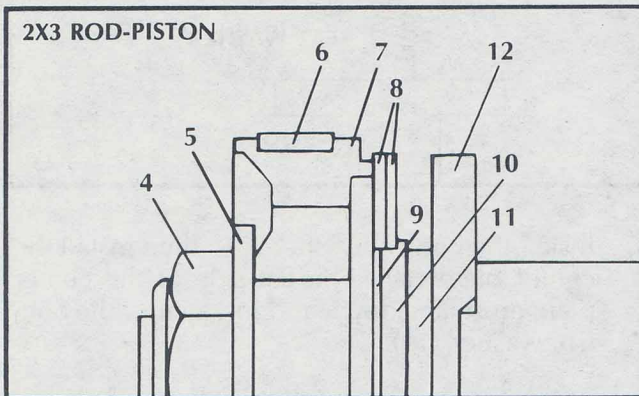




6. Clean the piston (7), and install it on the shock rod. The flat side of the piston must face down and rest on valve plate 1 (8).
7. Install the piston baffle (5).
8. Check valve plate 1 (8). When both pieces are centered, install a new U-nut (4). Use a small amount of Loctite, and torque the U-nut to specification.

**TIGHTENING TORQUE:**  
375 kg-cm (27 ft-lbs)

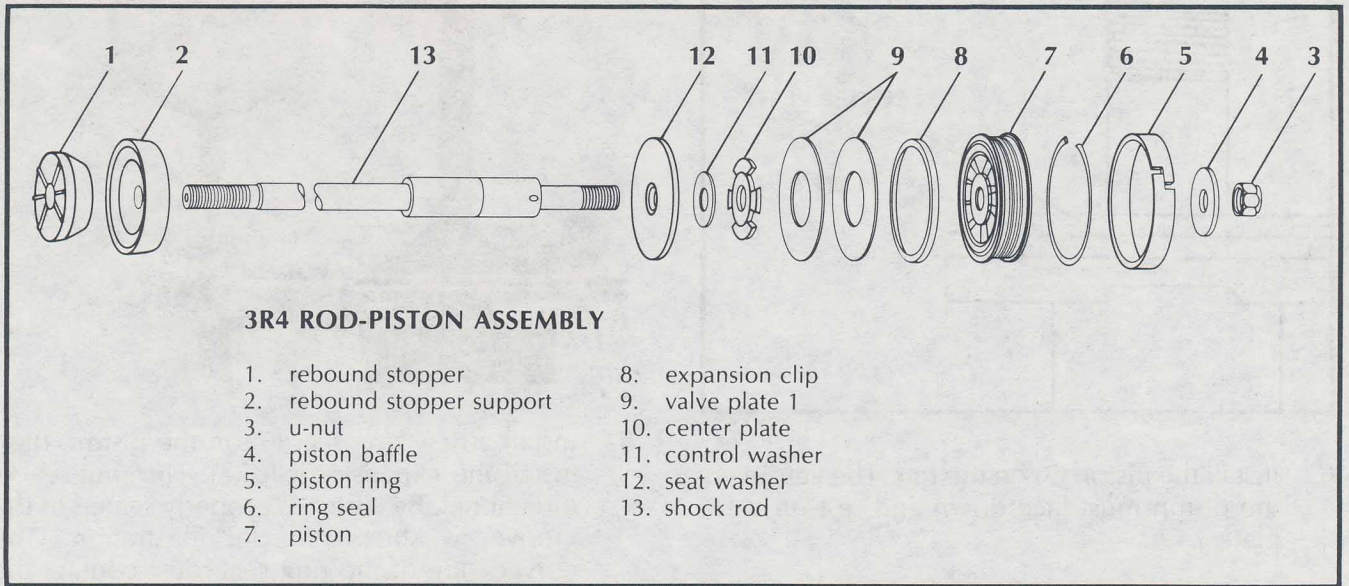
10. Grease a new piston ring (6) and install it on the piston.
11. Fit the collar (3) in place against the stepped portion of the rod.
12. Install the rebound stopper support (2) and seat it against the collar (3).
13. Install a new rebound stopper (1) and seat it against the rebound stopper support (2).



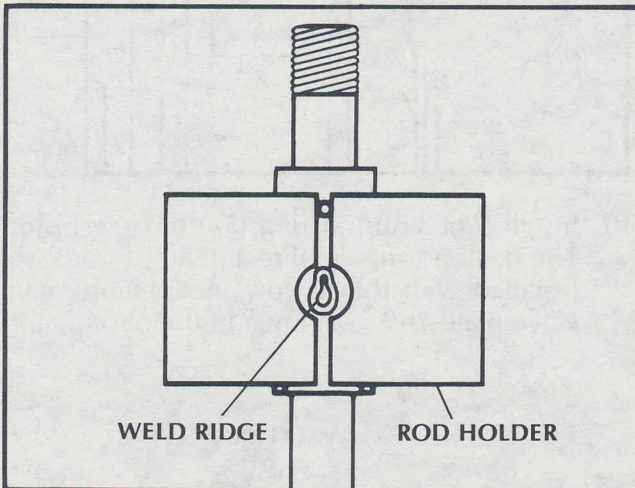
9. Remove the rod-piston assembly from the vise, and check for piston runout. Support the rod on V-blocks placed on a surface plate. Place the dial gauge at the piston as shown in the photograph, and rotate the rod. If runout exceeds specification, replace the rod.

**MAXIMUM RUNOUT:**  
0.08mm (0.0031 in.)

## B. Assembling the 3R4 Rod-Piston Assembly



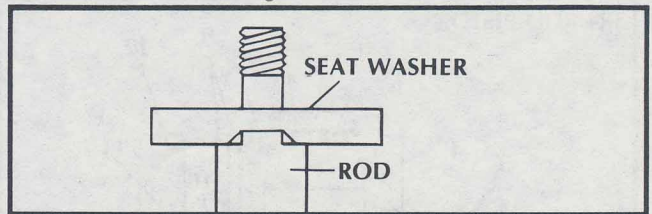
- Place the stepped portion of the shock rod (13) in the rod holder and secure the holder in the vise. Carefully locate the shock rod in the rod holder so that the weld ridges of the rod do not contact the holder.



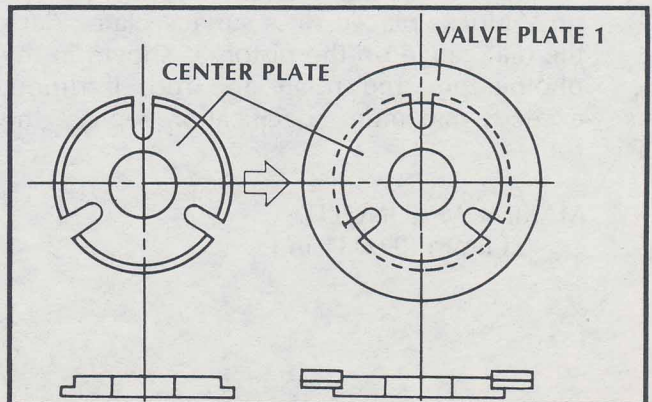
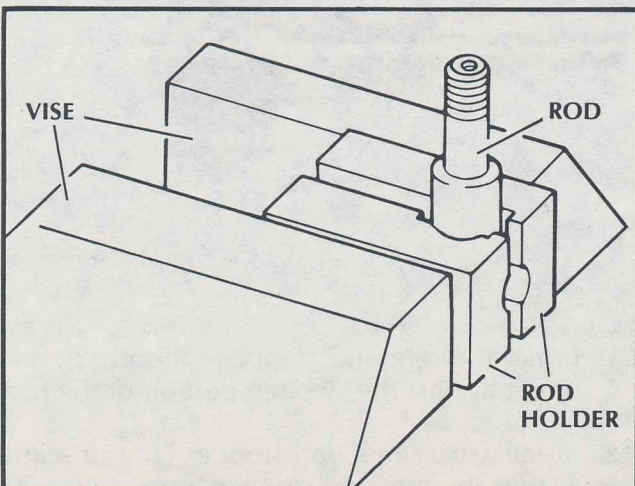
- Clean the entire rod with compressed air.

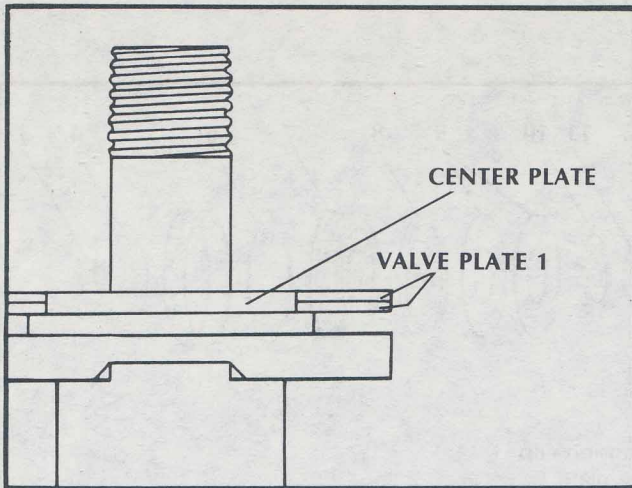
- Install the seat washer (12) on the shock rod (13). The chamfered side of the seat washer (12) must face the stepped portion of the rod as shown in the illustration.

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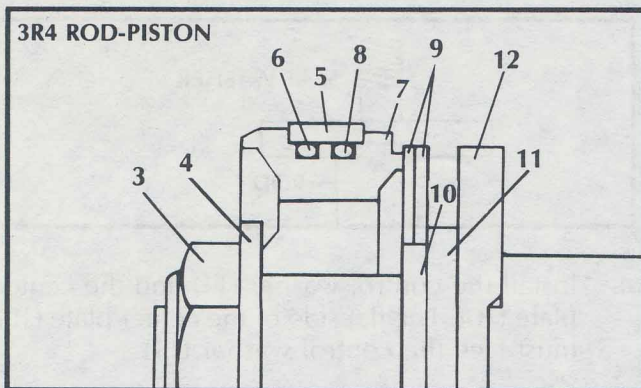
- Install the control washer (11) and the center plate (10). The flat side of the center plate (10) must face the control washer (11).
- Install valve plate 1 (9) onto the rod. Center both pieces on the center plate (10).





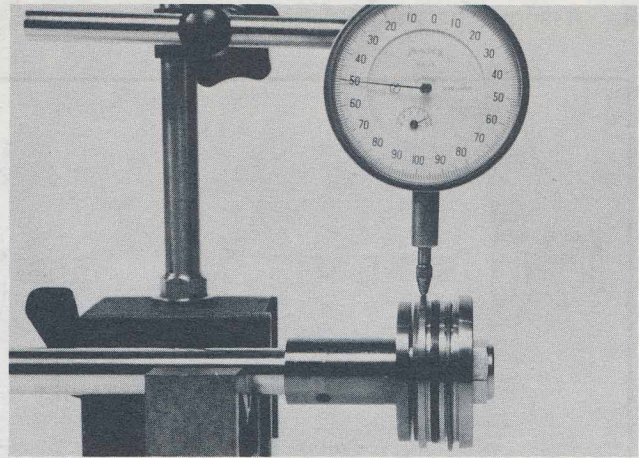
6. Install the piston (7) on the rod. The flat side of the piston must face down and rest on valve plate 1 (9).
7. Install the piston baffle (4) and a new U-nut (3). When both pieces of valve plate 1 (9) are properly centered, torque the U-nut to specification. Use a small amount of Loctite.

**TIGHTENING TORQUE:**  
375 kg-cm (27 ft-lbs)

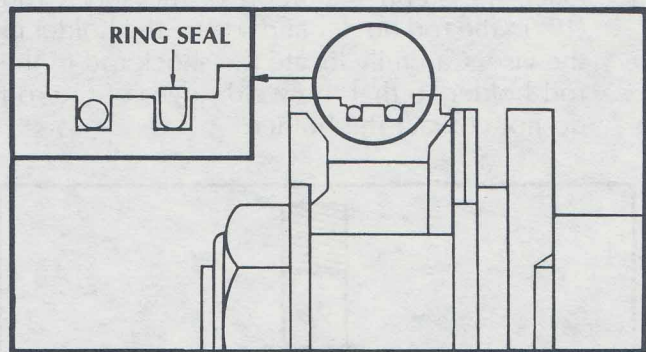


8. Remove the rod-piston assembly from the vise and check for piston runout. Support the rod on V-blocks placed on a surface plate. Place the dial gauge on the piston as shown in the photograph, and rotate the rod. If runout exceeds maximum specification replace the rod.

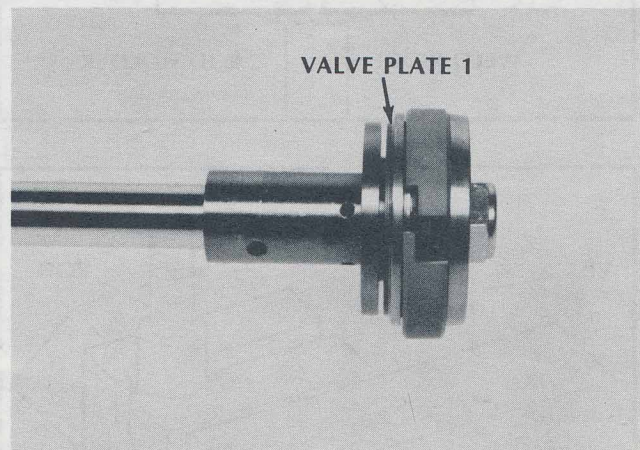
**MAXIMUM RUNOUT:**  
0.08mm (0.0031 in.)



9. Install a new ring seal (6) on the piston, then install the expansion clip (8). The ring seal is directional. Be sure it is properly seated in the groove as shown in the illustration. The curved side of the ring seal must contact the piston.



10. Install a new piston ring (5) onto the piston. The piston ring is directional. It must be installed with the narrow indentation facing valve plate 1 (9) as shown in the photograph.

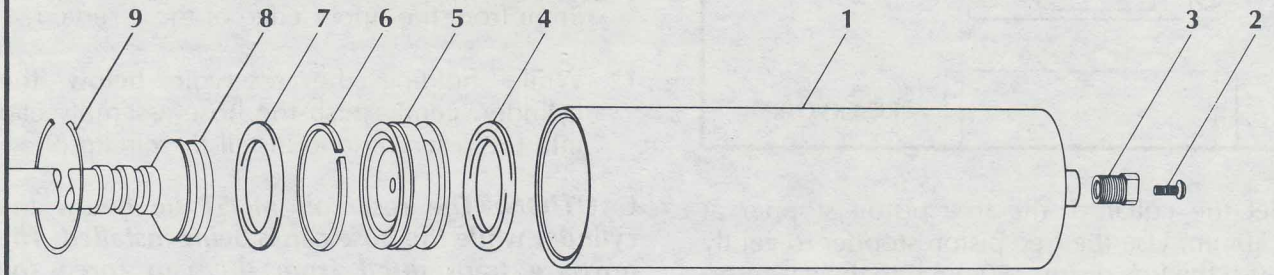


11. Install the rebound stopper support (2), and seat it against the stepped portion of the rod.
12. Install a new rebound stopper (1) and seat it against the rebound stopper support (2).

## ASSEMBLING THE GAS RESERVOIR

### GAS RESERVOIR

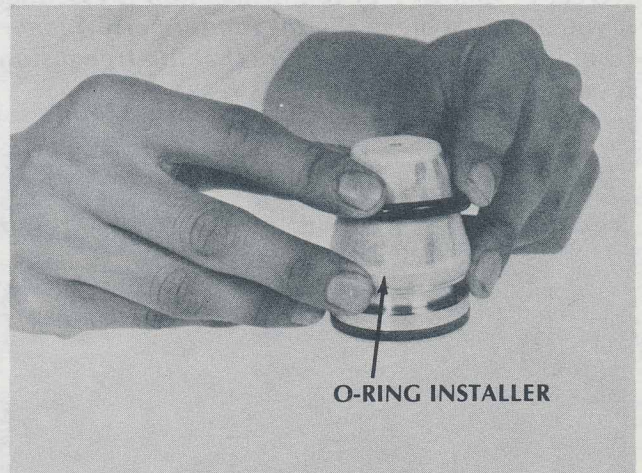
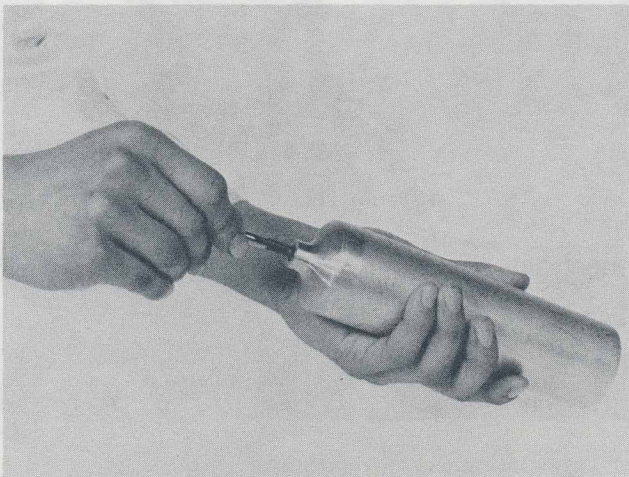
1. gas reservoir
2. panhead screw
3. gas filler plug
4. o-ring
5. free piston
6. piston ring 2
7. o-ring
8. hose cap
9. circlip



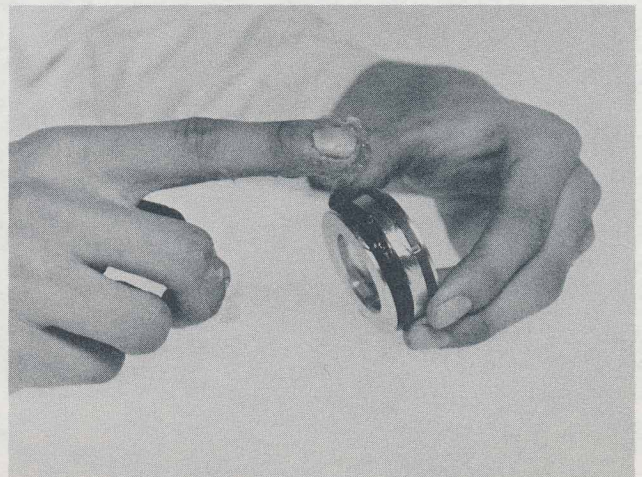
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1. Remove all the remaining Loctite from the threads in the gas reservoir neck. Use a tap if necessary.

TAP THREAD DIAMETER:  
1/8 inches PT

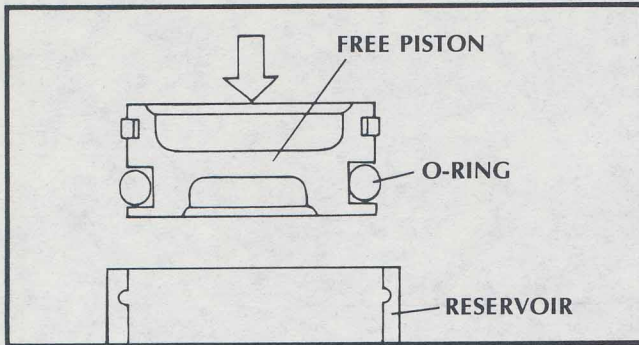


6. Fit piston ring 2 (6) onto the free piston (5). Apply grease to the entire free piston.



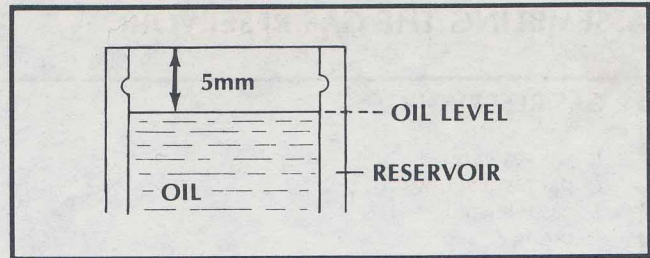
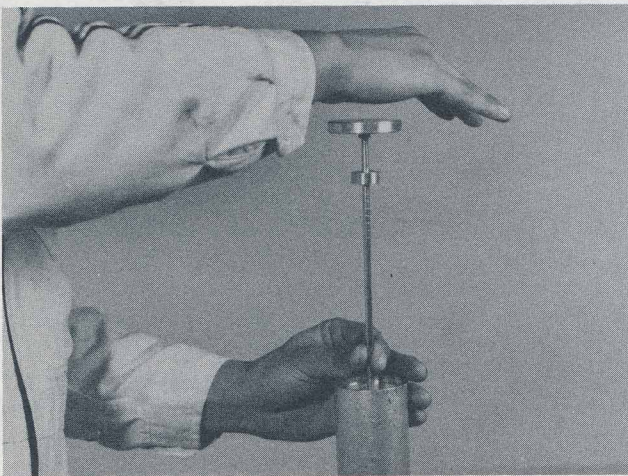
2. Wash the reservoir with light solvent and dry with compressed air.
3. Wrap the gas reservoir (1) in a cloth and secure the reservoir in the vise.
4. Grease the O-ring groove in the free piston (5), and grease the O-ring installer.
5. Using the lubricated installer, carefully fit a new O-ring (4) into the O-ring groove of the free piston (5). The O-ring must not be nicked or damaged in any way.

7. Oil the reservoir walls.
8. Gently push the free piston (5) into the reservoir (1). The free piston must be installed with the O-ring side facing down into the gas reservoir.



9. Set the collar of the free piston stopper at 150mm. Use the free piston stopper to gently push the free piston 150mm into the gas reservoir.

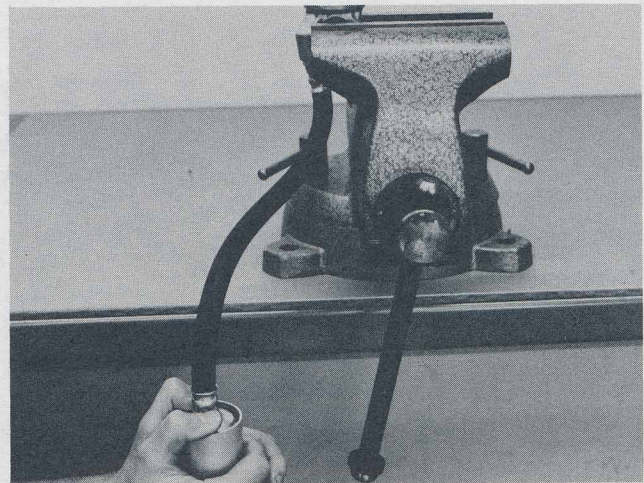
**NOTE:** Proper free piston installation is essential if you are to achieve the maximum performance from the monoshock. Be sure that the free piston is correctly located in the gas reservoir.



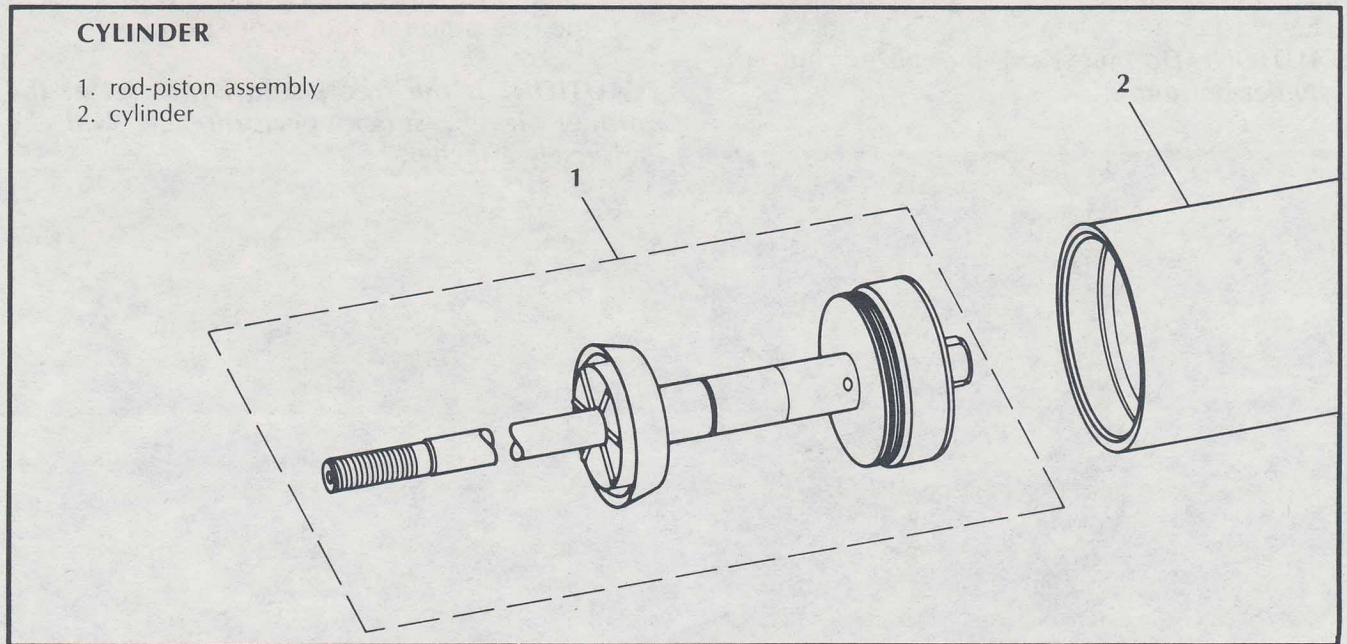
10. Fit the O-ring (7) onto the hose cap (8), and grease the O-ring and the adjacent area.
11. Add oil to the reservoir (1) until the oil level is 5mm from the upper edge of the reservoir.
12. While holding the reservoir **below** the cylinder, gently push the hose assembly cap into the reservoir and install the circlip (9).

**CAUTION:** The reservoir **MUST** be below the cylinder while the hose cap is being installed. The pressure transmitted from the cap forces oil through the hose and into the cylinder. If the reservoir is held below the cylinder, air will be bled from the system instead of becoming trapped in the oil.

**WARNING:** Be sure that the circlip is properly seated in the circlip groove.

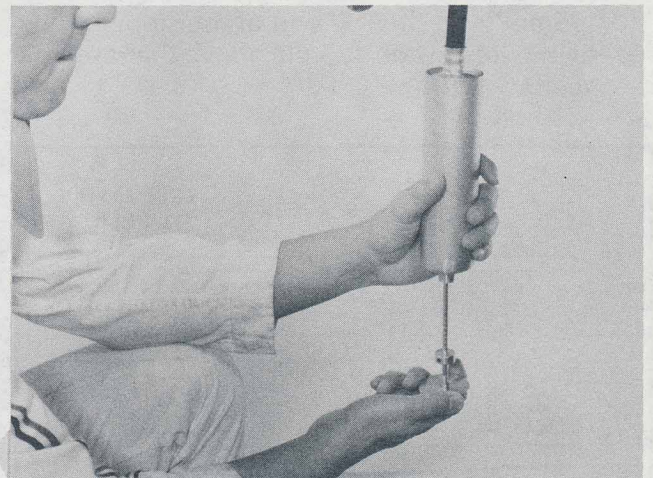
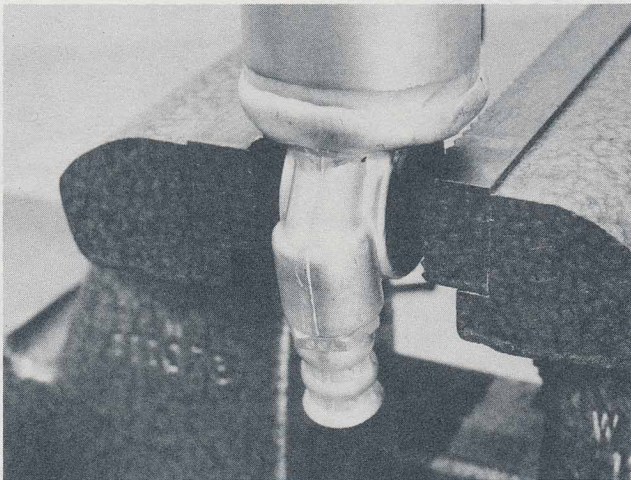


## INSTALLING THE ROD-PISTON

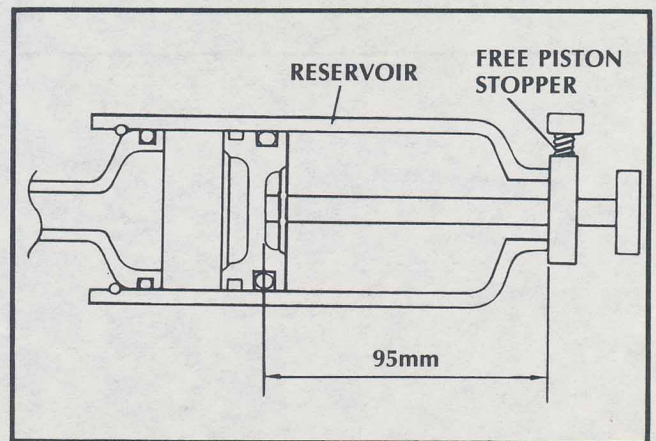


The gas reservoir must be held below the cylinder during the installation of the rod-piston assembly. The relative position of these two components is important so that air will bleed from the system instead of becoming trapped in the oil.

1. Install the cylinder mounting bracket in the vise.



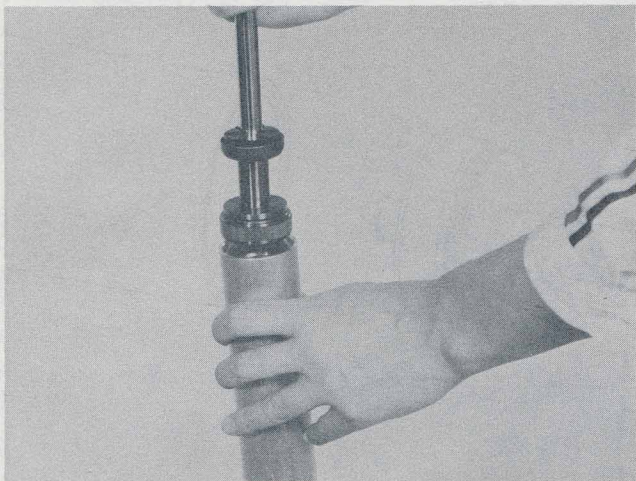
2. Set the collar of the free piston stopper at 95mm from the end of the rod. Use vernier calipers.
3. Insert the free piston stopper into the reservoir neck. Gently push the free piston stopper into the reservoir until the collar bottoms against the neck. This sets the free piston 95mm above the reservoir neck, and forces air out of the system.





- Oil the cylinder walls, and gently push the rod-piston assembly into the cylinder until it lightly bottoms.

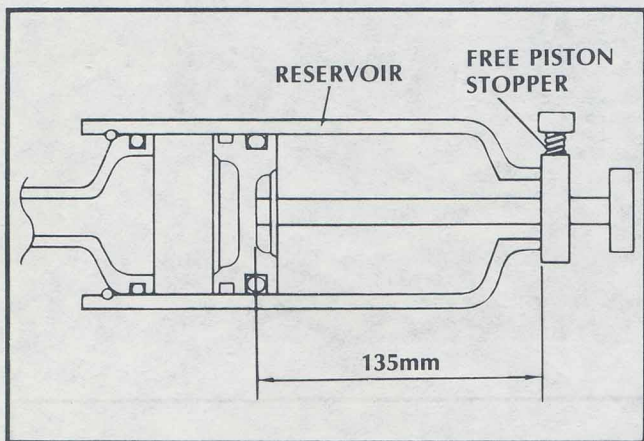
**CAUTION:** Do not slam the piston into the cylinder bottom.



- While holding the free piston in position with the free piston stopper, gently bottom the rod assembly in the cylinder. This effectively locks the free piston in the proper position.

**CAUTION:** If the free piston is not set at the proper level, shock performance will be adversely affected.

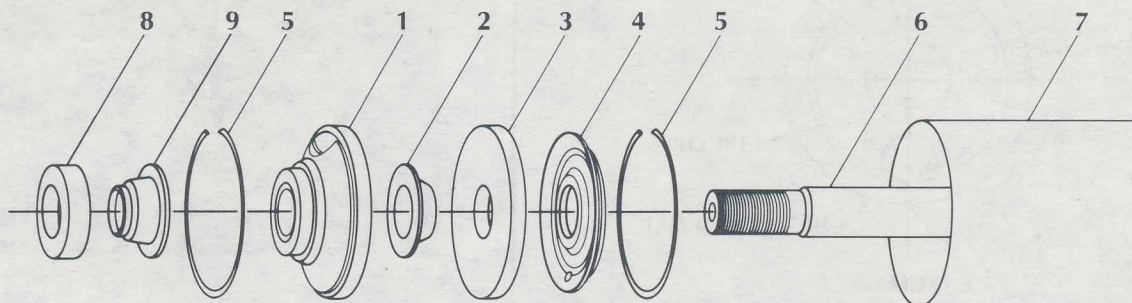
- Set the collar of the free piston stopper at 135mm from the rod end of the stopper, and set the free piston 135mm above the reservoir neck.



## INSTALLING THE ROD GUIDE AND RELATED PARTS

### ROD GUIDE AND RELATED PARTS

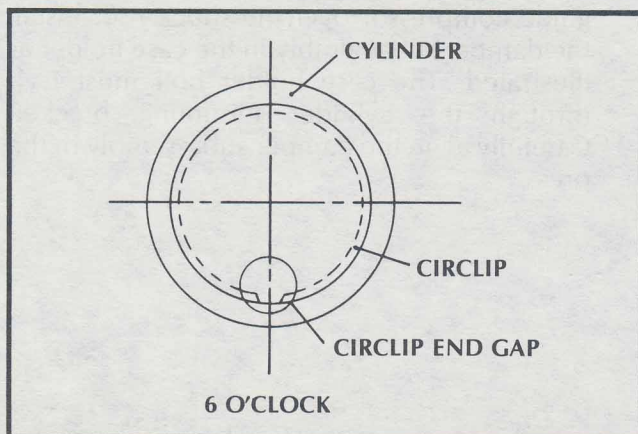
1. rod guide
2. rod seal
3. static seal
4. seal retainer
5. circlip (2)
6. shock rod
7. cylinder
8. seal ring housing
9. dust seal



The free piston must be locked in place until the rod guide has been installed. Use the free piston stopper to prevent movement of the free piston within the gas reservoir. Insert the stopper in the gas neck as you did earlier. Hold it in place while installing the rod guide and related parts.

Be sure to hold the reservoir beneath the cylinder until the rod guide has been installed.

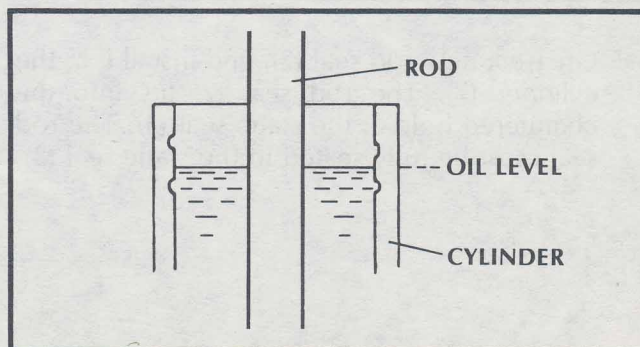
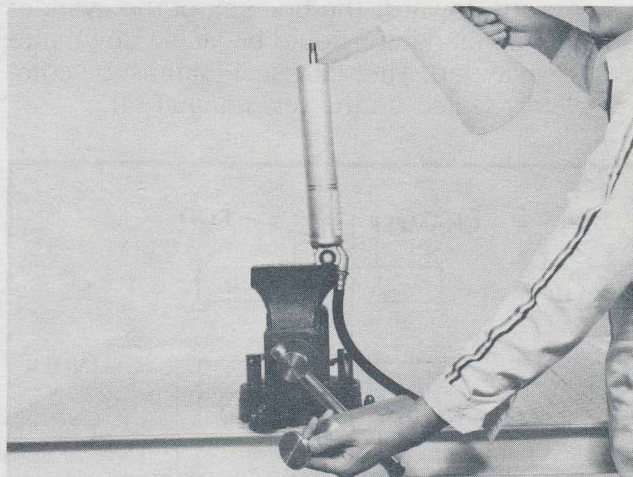
1. Install a new circlip (5) in the lower (inner) groove in the cylinder. Position the end gap at 6 o'clock as you face the cylinder.



2. Slowly add oil to the cylinder until the oil level is between the two circlip grooves. Pour the oil down the side of the cylinder wall so air will not get trapped in the oil. Wait a few

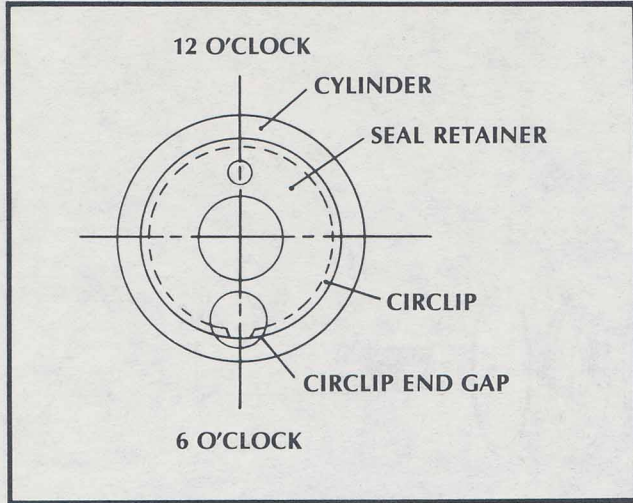
minutes before proceeding so air in the oil can rise to the surface.

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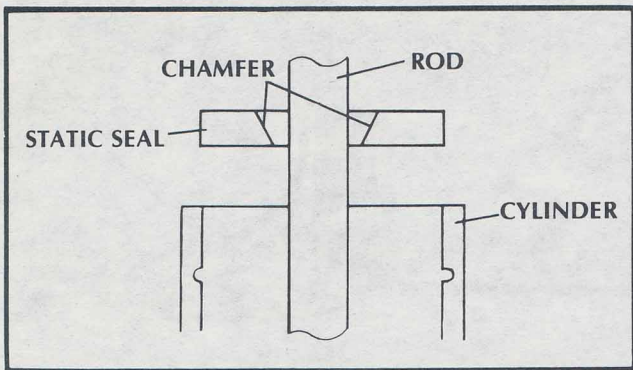


3. Place the dust seal guide on the shock rod. This will protect the seals during installation.

- Slip the seal retainer (4) over the rod (6) and into the cylinder. The circlip land on the seal retainer (4) must face down into the cylinder, and the seal retainer must be properly seated on the inner circlip. The small hole on the seal retainer must be at 12 o'clock. It is very important that this hole be diametrically opposite the end gap of the inner circlip.

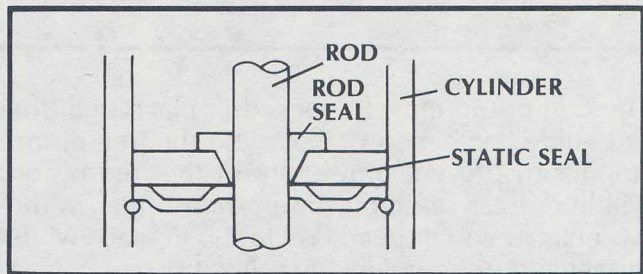
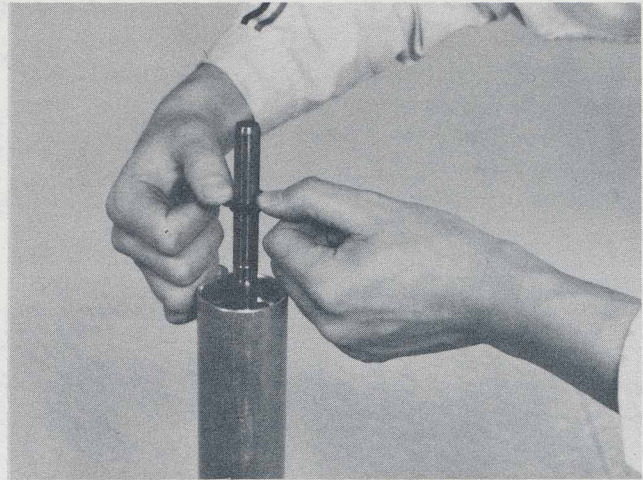


- Grease a new static seal (3), slip it over the rod (6), and install it in the cylinder (7). The chamfered side of the static seal (3) must face upward, towards the opening of the cylinder (the i.d. markings should be facing down into the cylinder). The static seal (3) must be completely seated on the seal retainer (4).

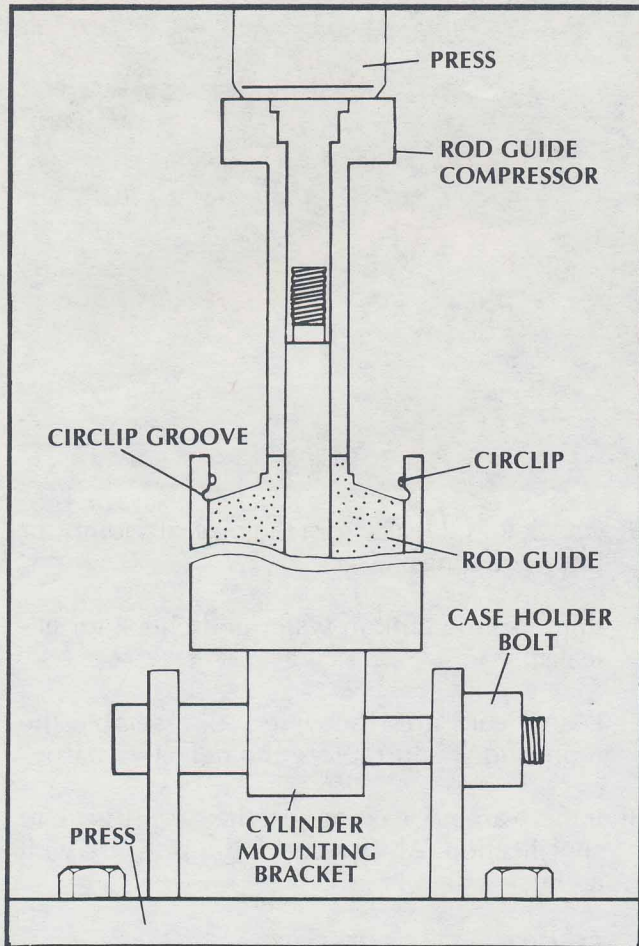


- Grease a new rod seal (2), and install it in the cylinder (7). The rod seal (2) fits into the chamfered hole of the static seal (3). The rod seal must be fully seated in the static seal (3).

**NOTE: If the rod seal (2) cannot be fully seated in the static seal (3), the static seal (3) or the seal retainer (4) may not be properly installed. Remove and reinstall both of them. Take care to assure that both the seal retainer (4) and static seal (3) are correctly installed in the cylinder (7).**



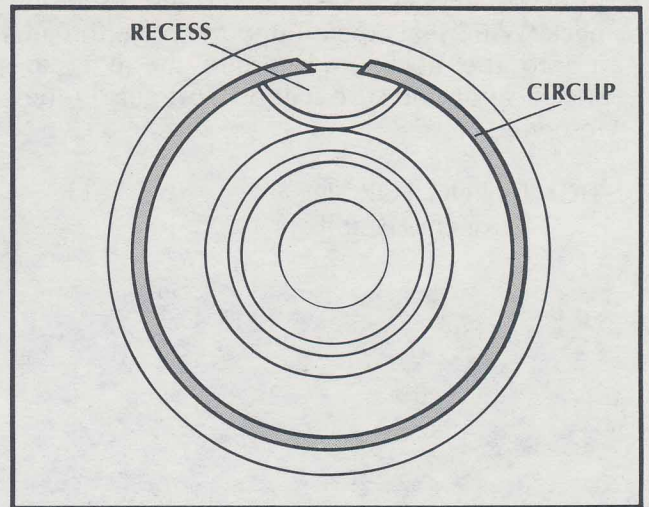
- Place the rod guide (1) in the cylinder (7) and place a new circlip (5) around the rod guide. The circlip end gap must be in the recessed portion of the rod guide.
- Place the case holder in the press. Remove the dust seal guide from the rod and place the rod guide compressor over the shock rod. Install the damper subassembly in the case holder as illustrated. The case holder bolt must pass through the cylinder mounting bracket. Carefully align the damper subassembly in the press.



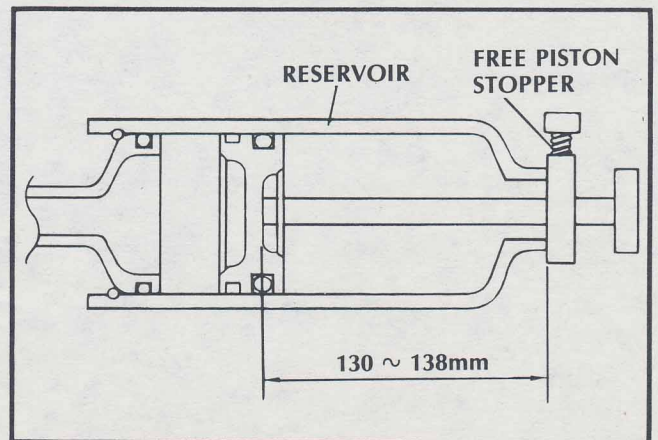
You will require assistance at this point. The free piston must be manually locked in the proper position until the upper circlip has been installed.

9. Lock the free piston in place with the free piston stopper. Hold the free piston in this locked position until the upper circlip is installed.
10. Slowly apply pressure to the rod guide compressor. Compress the rod guide (1) into the cylinder (7) until the upper circlip groove is exposed, as illustrated above, but no further. Apply a **minimal** amount of force.
11. Push the circlip (5) in the upper circlip groove. The circlip must be completely seated in the groove, and the end gap must be in the recess of the rod guide.

**WARNING:** When you hear the circlip click into place, blow the cylinder clean with compressed air and check the circlip. It holds the internal parts in the cylinder when the shock is fully pressurized. Some internal parts could be ejected from the monoshock if this circlip is NOT correctly seated in its groove.

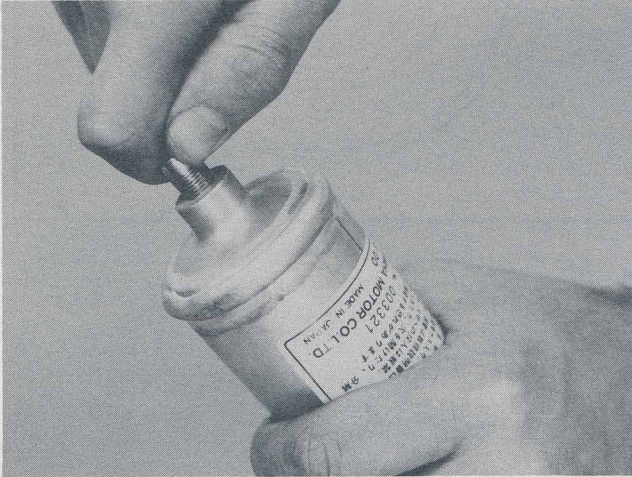


12. Remove the damper subassembly from the case holder and secure it in the vise.
13. Place the dust seal guide on the rod, and install the dust seal (9) over the shock rod and into the cylinder.
14. Carefully fit the seal ring housing (8) on the rod and fit it over the dust seal.
15. Remove the dust seal guide and place the rod guide compressor on the rod. Gently tap the seal ring housing (8) until it is seated in place on the rod guide (1).
16. Check the position of the free piston with the free piston stopper. The free piston must be 130 ~ 138mm from the reservoir neck as illustrated. If the free piston is not at the specified level, disassemble the monoshock and reassemble it correctly. Shock performance will be adversely affected if the free piston is set incorrectly.



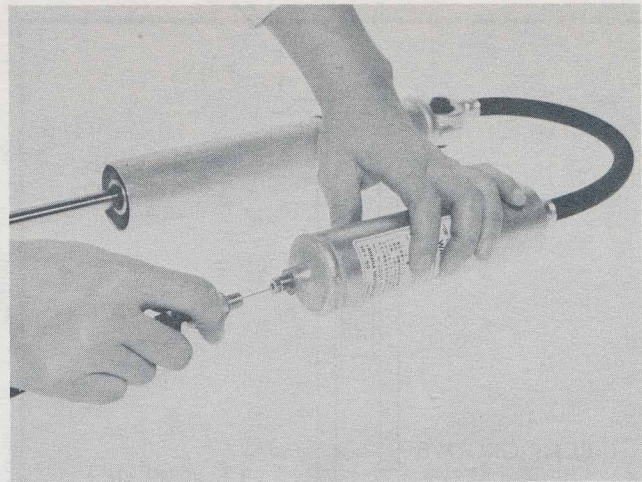
17. Install a new gas filler plug into the reservoir neck. Wind seal tape around the plug, thread it into the neck, and torque the plug to specification. Be sure that no dust gets in the reservoir.

TIGHTENING TORQUE:  
140 kg-cm (10 ft-lbs.)



18. Wipe any excess oil from the shock.
19. Slowly add nitrogen through the gas filler plug until the rod begins to emerge from the cylinder. Be sure to lubricate the needle before inserting it in the gas filler plug.

**WARNING:** Always direct the rod and gas filler plug away from you or others when pressurizing the gas reservoir. If the circlip has been incorrectly installed, some parts could be ejected from the damper subassembly.



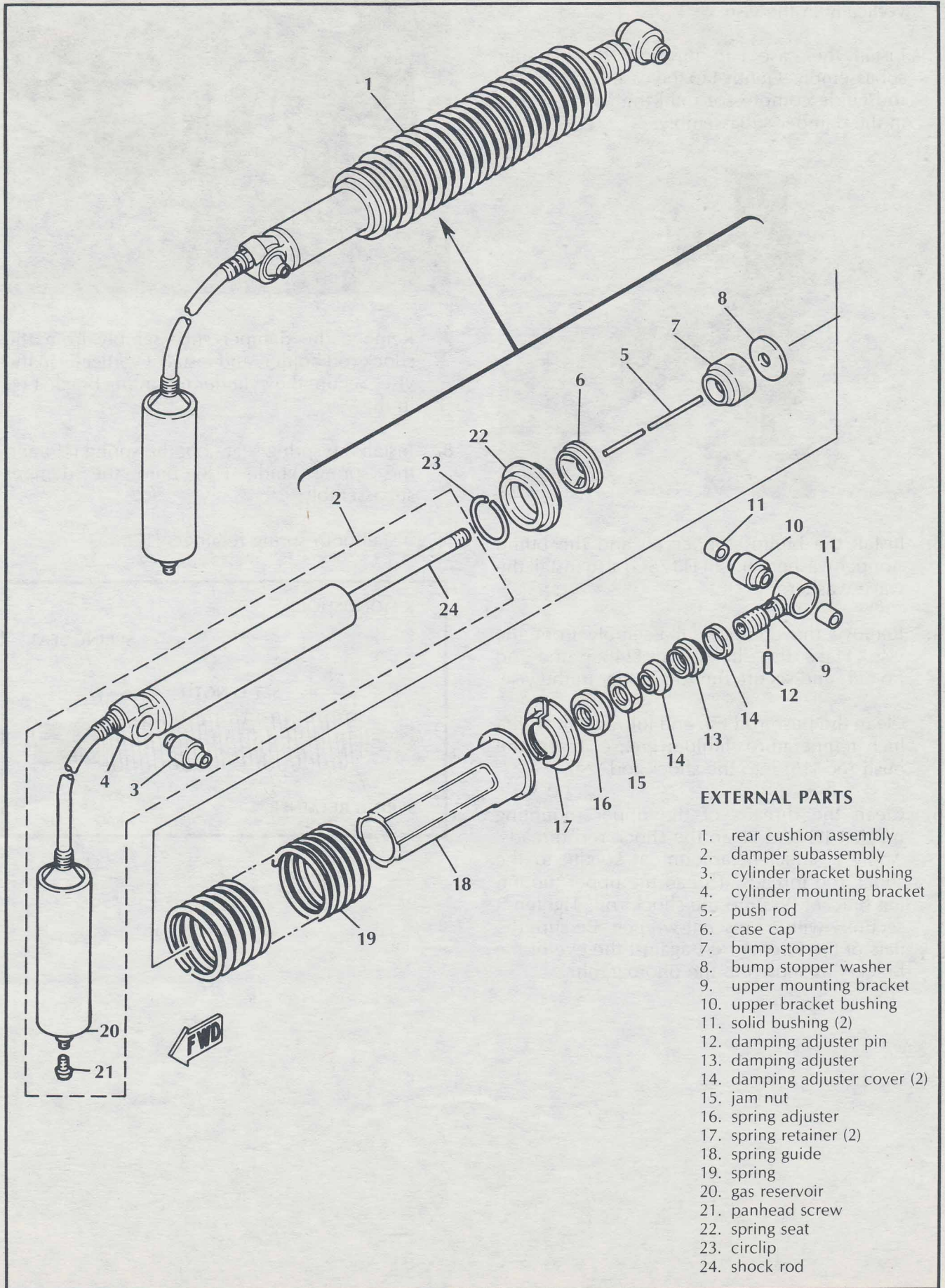
20. Check for oil leaks from the oil seals, joints, or hose couplings.
21. Immerse the tank in water and check for gas leaks.
22. If any leaks are discovered, disassemble the monoshock and replace the defective part.
23. If there are no leaks, adjust the gas pressure to specification. Always check the pressure with a check gauge.

SPECIFIED GAS PRESSURE:  
3R4: 15 kg/cm<sup>2</sup> (213 psi)  
3R6: 15 kg/cm<sup>2</sup> (213 psi)

24. Install the panhead screw in the plug. Torque it to specification.

TIGHTENING TORQUE:  
20 kg-cm (1.4 ft-lbs.)

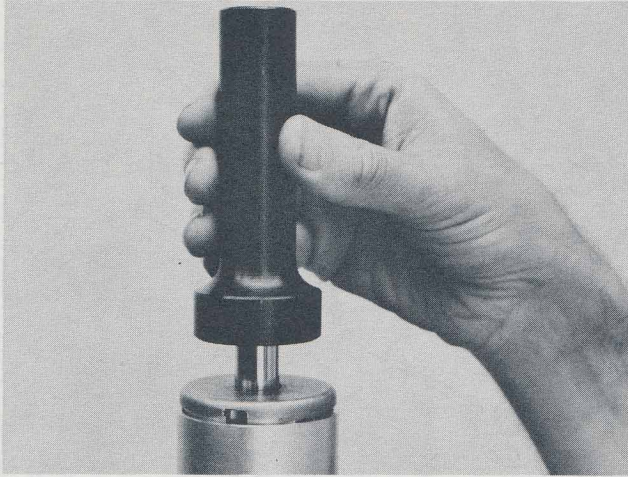
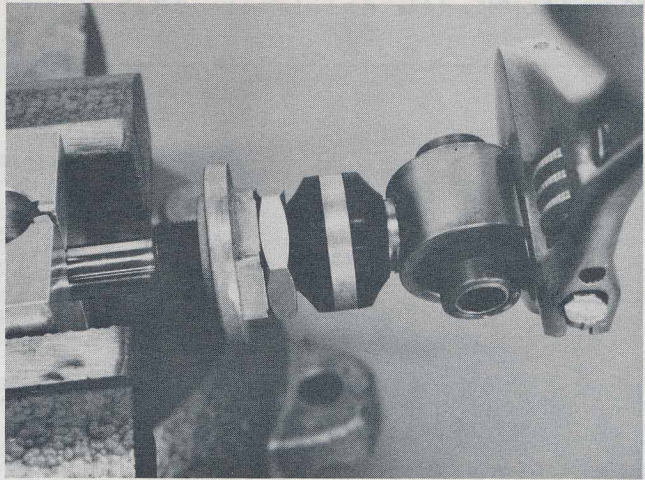
# INSTALLING THE EXTERNAL PARTS



## EXTERNAL PARTS

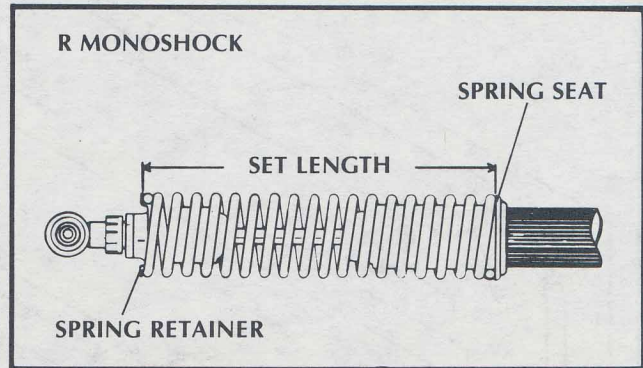
1. rear cushion assembly
2. damper subassembly
3. cylinder bracket bushing
4. cylinder mounting bracket
5. push rod
6. case cap
7. bump stopper
8. bump stopper washer
9. upper mounting bracket
10. upper bracket bushing
11. solid bushing (2)
12. damping adjuster pin
13. damping adjuster
14. damping adjuster cover (2)
15. jam nut
16. spring adjuster
17. spring retainer (2)
18. spring guide
19. spring
20. gas reservoir
21. panhead screw
22. spring seat
23. circlip
24. shock rod

1. Secure the cylinder mounting bracket in the vise. The damper subassembly should be held vertically in the vise.
2. Install the case cap (6) onto the damper subassembly. Gently tap the case cap with the rod guide compressor until the cap is seated in the damper subassembly.



3. Install the bump stopper (7) and the bump stopper washer (9). On IT175G, also install the wave washer.
4. Remove the damper subassembly from the vise. Place the shock rod (24) in the rod holder, and secure the rod holder in the vise.
5. Clean the push rod (5), and lubricate it with a high temperature, lithium grease. Insert the push rod (15) into the shock rod (24).
6. Clean the threads of the upper mounting bracket (9) and clean the shock rod threads. Apply a sufficient amount of Loctite to the shock rod threads. Thread the upper mounting bracket (9) onto the shock rod. Tighten it securely with a crescent wrench. Be sure the flats of the wrench rest against the eye of the bracket as shown in the photograph.

7. Remove the damper subassembly from the shock rod holder, and install it vertically in the vise. Secure the cylinder mounting bracket (4) in the vise.
8. Install the spring seat (22), the spring (19) and the spring guide (18) onto the damper subassembly.
9. Install both spring retainers (17).



- Adjust the set length of the spring to specification or to the length you measured before disassembly. Adjust the spring length by turning the spring adjuster (16). When the set length is at the desired specification, tighten the jam nut (15) against the spring adjuster (16).

**SET LENGTH:**

3R4 Shock: 356mm (14 in.)  
3R6 Shock: 335mm (13.2 in.)

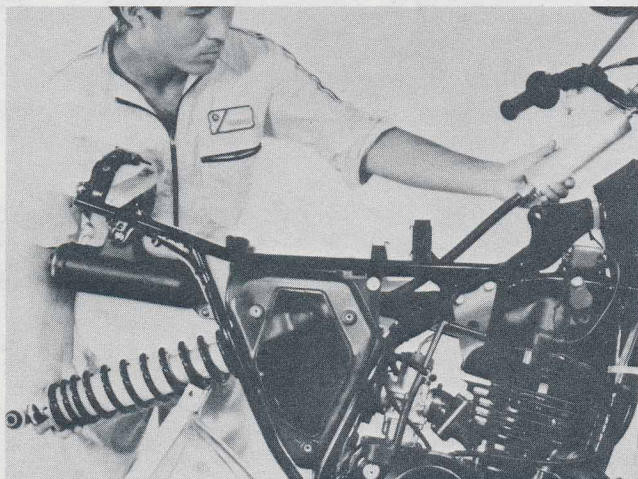
- Thread the damping adjuster (13) all the way down until it stops (do not force it). Back the damping adjuster out to the standard adjuster setting or to the setting you noted before disassembly.

**STANDARD ADJUSTER SETTING:**

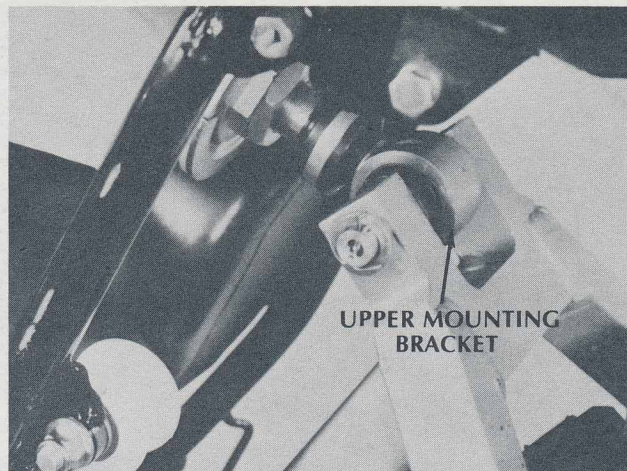
3R4: 11 Click Out  
3R6: 15 Clicks Out

## INSTALLING THE MONOSHOCK ON THE MOTORCYCLE

- Carefully insert the monoshock in the motorcycle frame. Place the reservoir towards the front of the motorcycle. Be careful not to damage the reservoir (20) or the rubber hose.

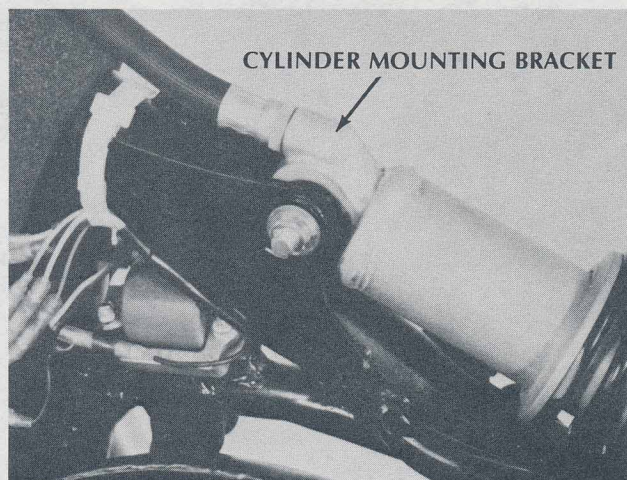


- Reinstall the pivot bolt through the swingarm and through the upper mounting bracket (9). Be sure that a washer is between each bushing and the swingarm pivot. Always use a new cotter pin.



- Reinstall the cylinder mounting bracket (4) to the upper part of the frame. Use a new cotter pin when securing the nut.

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- Install the gas reservoir (20) in the grommet on the frame, and secure the reservoir to the frame with the steel band.



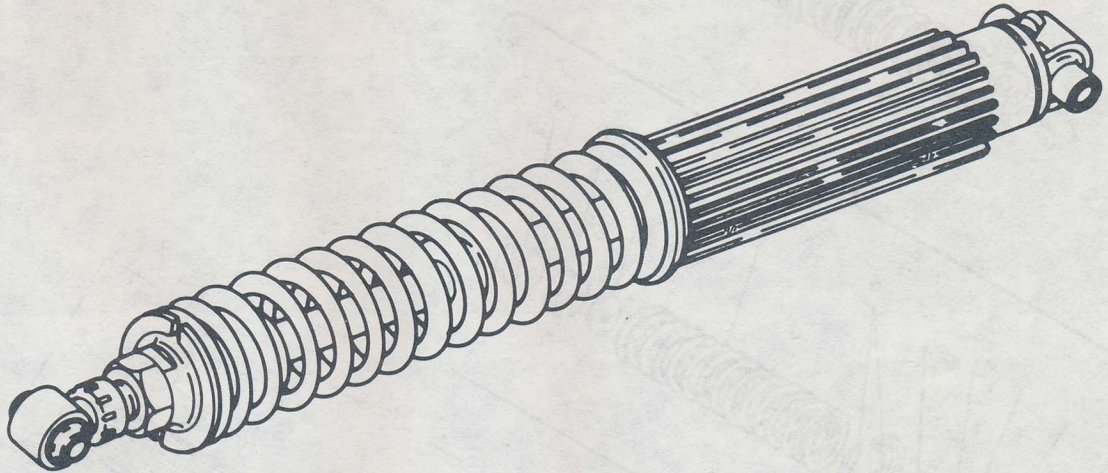
5. Reinstall the fuel tank and the seat.
6. Reinstall the lower tensioner to the frame, and reinstall the master link on the chain.



## CHAPTER 6. PARTS

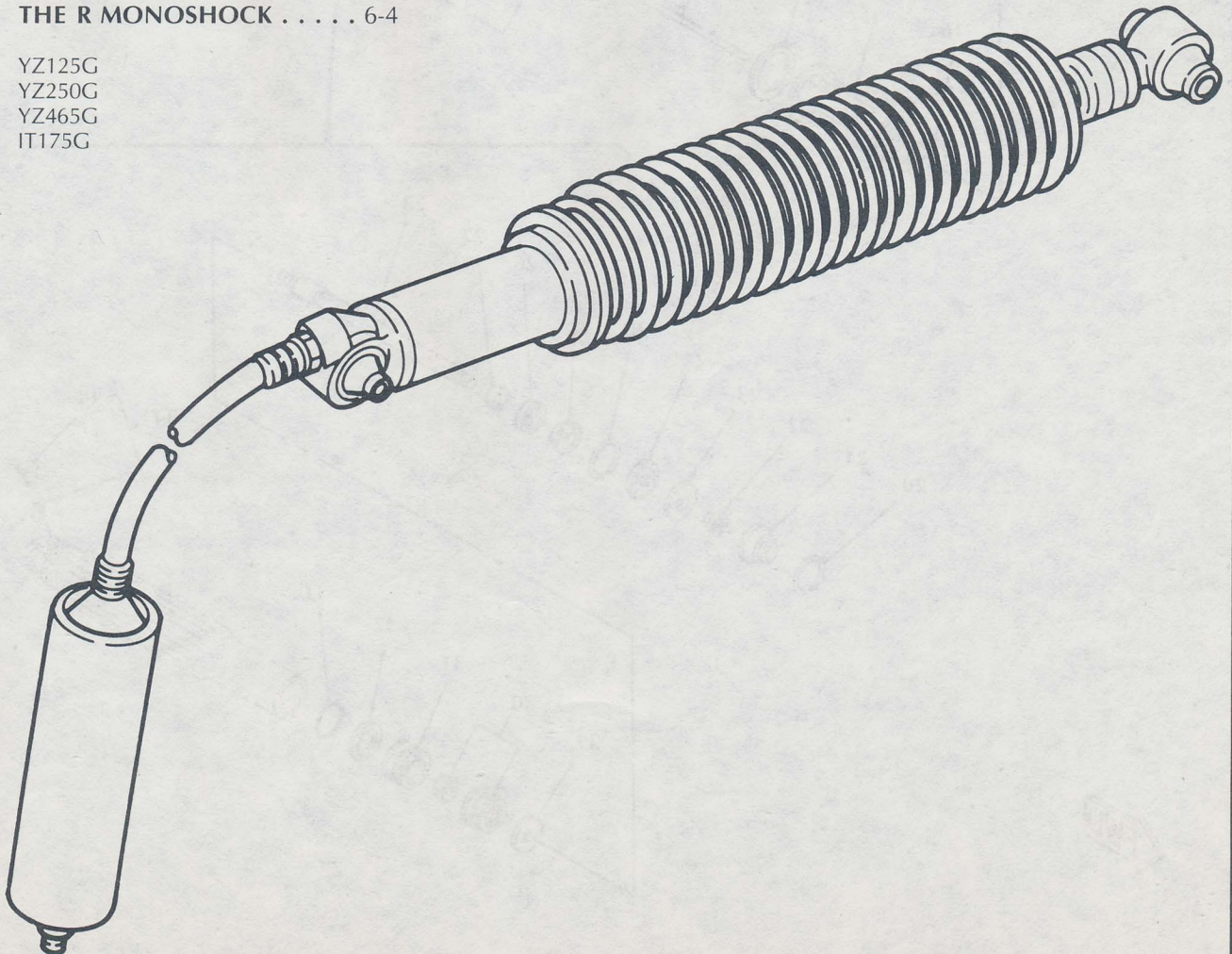
### THE X MONOSHOCK . . . . . 6-2

YZ125F  
YZ250F  
YZ400F

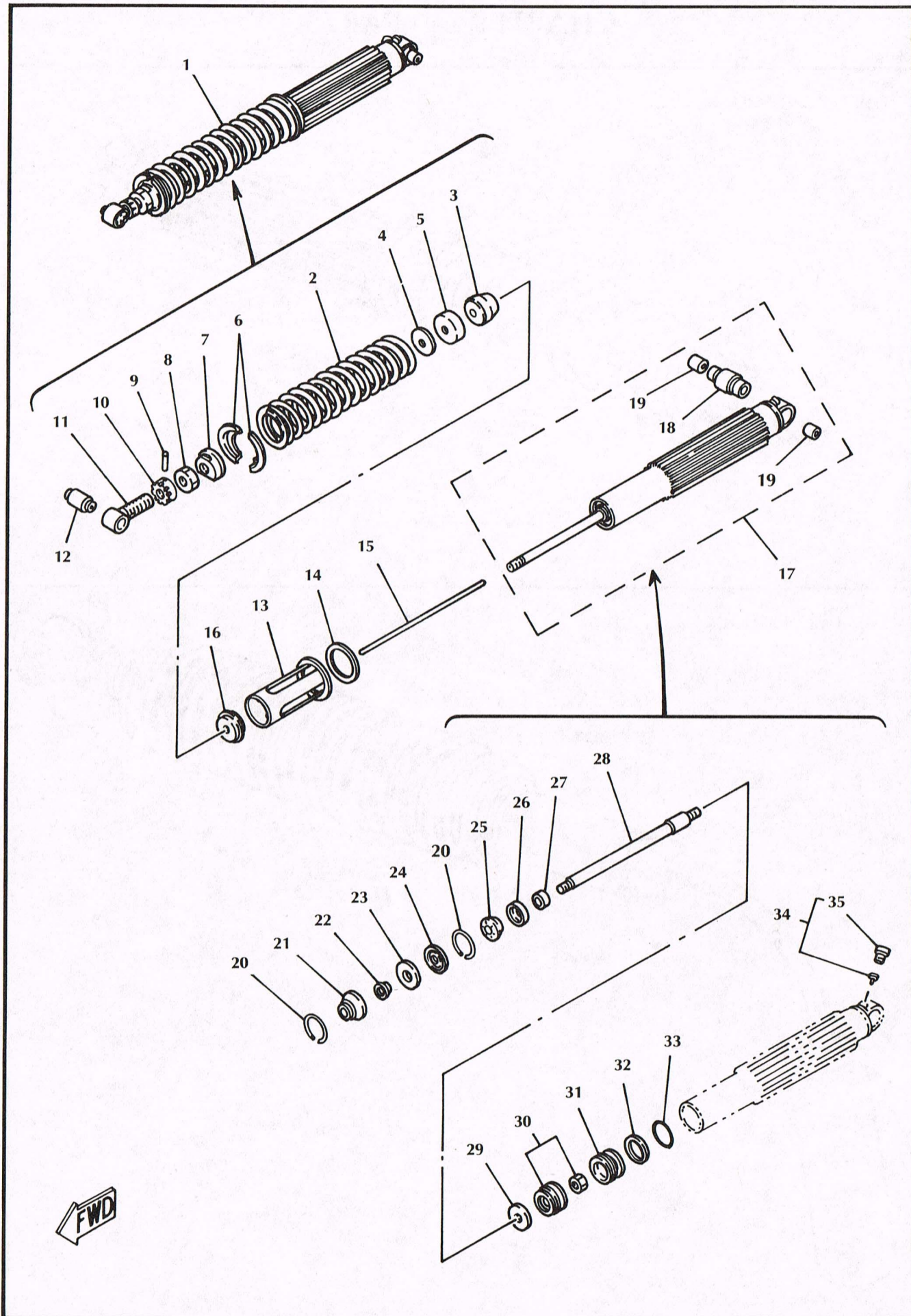


### THE R MONOSHOCK . . . . . 6-4

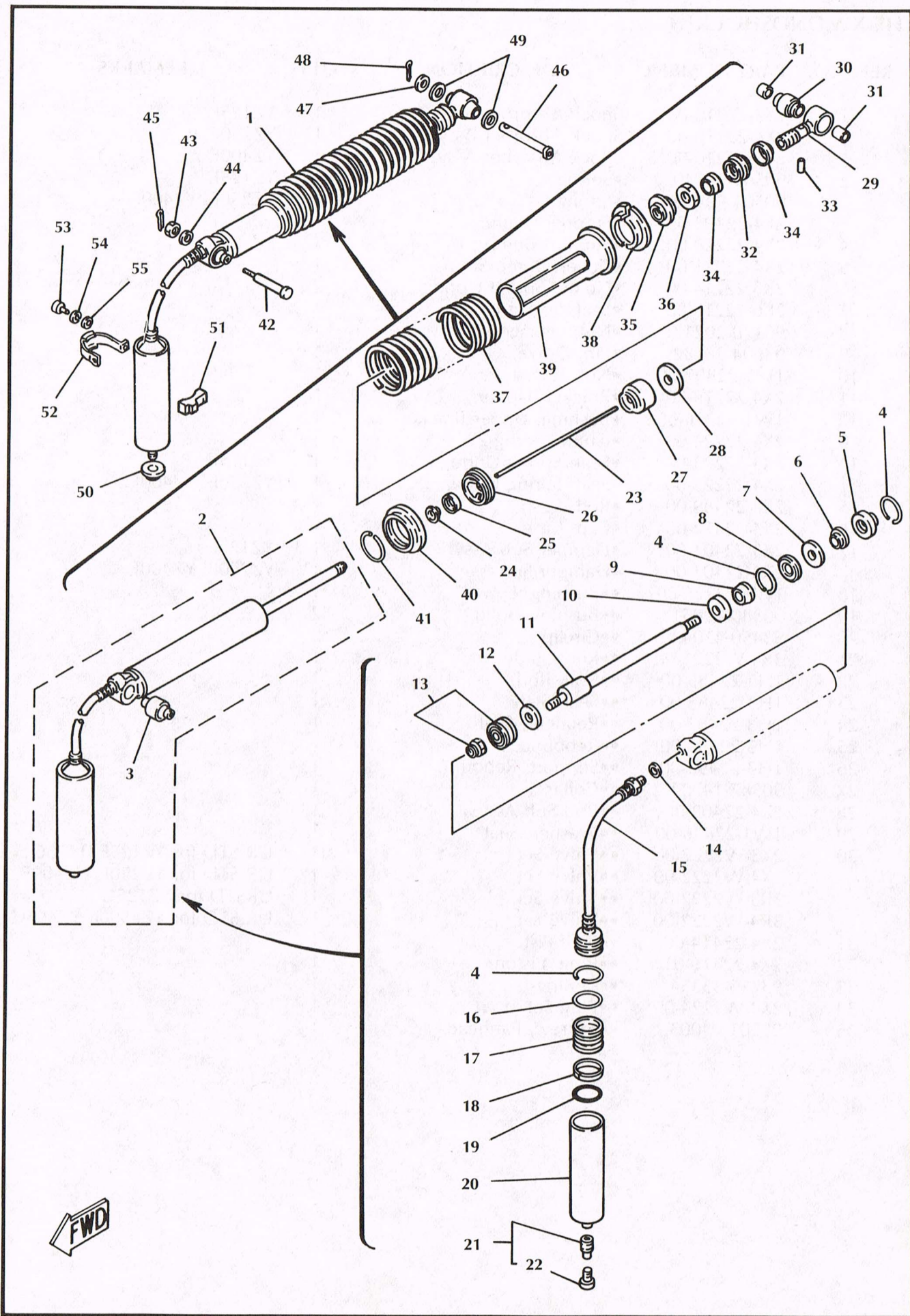
YZ125G  
YZ250G  
YZ465G  
IT175G



## THE X MONOSHOCK



REF. NO.	PART NUMBER	DESCRIPTION	QTY	REMARKS
1	2X3-22210-00	Shock Absorber Assy.	1	YZ125F
	2X4-22210-00	Shock Absorber Assy.	1	YZ250F
	2X5-22210-00	Shock Absorber Assy.	1	YZ400F
2	90501-98540	•Spring	1	YZ125F
	90501-99479	•Spring	1	YZ250F, YZ400F
3	2X4-22493-00	•Stopper, Bump	1	
4	2X4-22228-00	•Support Bump	1	
5	2X4-22221-00	•Cover, Bump Stop	1	
6	2K6-22214-00	•Guide, Spring Upper	2	
7	2K6-22213-00	•Seat, Spring Upper	1	
8	90170-20213	•Nut, Hexagon	1	
9	93604-26132	•Pin, Dowel	1	
10	1W1-22497-00	•Nut, Adjusting	1	
11	2X4-22219-00	•Bracket, Upper	1	
12	1W1-22216-00	•Bushing, Upper Bracket	1	
13	2X4-22224-00	•Guide, Spring 2	1	
14	2X3-22223-00	•Seat, Spring Under	1	YZ125F
	2X4-22223-00	•Seat, Spring Under	1	YZ250F, YZ400F
15	2X4-22489-00	•Rod, Push	1	
16	2X4-22472-00	•Cap, Case	1	
17	2X3-22401-00	•Damper Sub Assy.	1	YZ125F
	2X4-22401-00	•Damper Sub Assy.	1	YZ250F, YZ400F
18	1W1-22226-00	••Bushing, Lower	1	
19	90380-12051	••Bushing, Solid	2	
20	93450-47043	••Circlip	2	
21	3R4-W2221-00	••Rod Guide Set	1	
22	1H3-22485-00	••Seal, Rod	1	
23	1H3-22486-00	••Seal, Static	1	
24	1H3-22487-00	••Retainer, Seal	1	
25	1H3-22494-00	••Rebound, Stop	1	
26	1H3-22495-00	••Support, Rebound	1	
27	90387-14722	••Collar	1	
28	2X4-22402-00	••Rod Sub Assy.	1	
29	1W1-22446-00	••Washer, Seat	1	
30	2X3-W2222-00	••Valve Set	1	UR STD for YZ125F, IT175G
	2X4-W2222-00	••Valve Set	1	UR STD for YZ250F, YZ400F
	3R3-W2222-00	••Valve Set	1	URSTD for YZ125G
	3R4-W2222-00	••Valve Set	1	UR STD for YZ250G, YZ465G
31	2X4-22414-00	••Free Piston	1	
32	2X4-22416-01	••Ring, Piston	1	
33	93210-35354	••O-Ring	1	
34	2X4-W2224-00	••Plug Set	1	
35	98501-04005	•••Screw, Panhead	1	

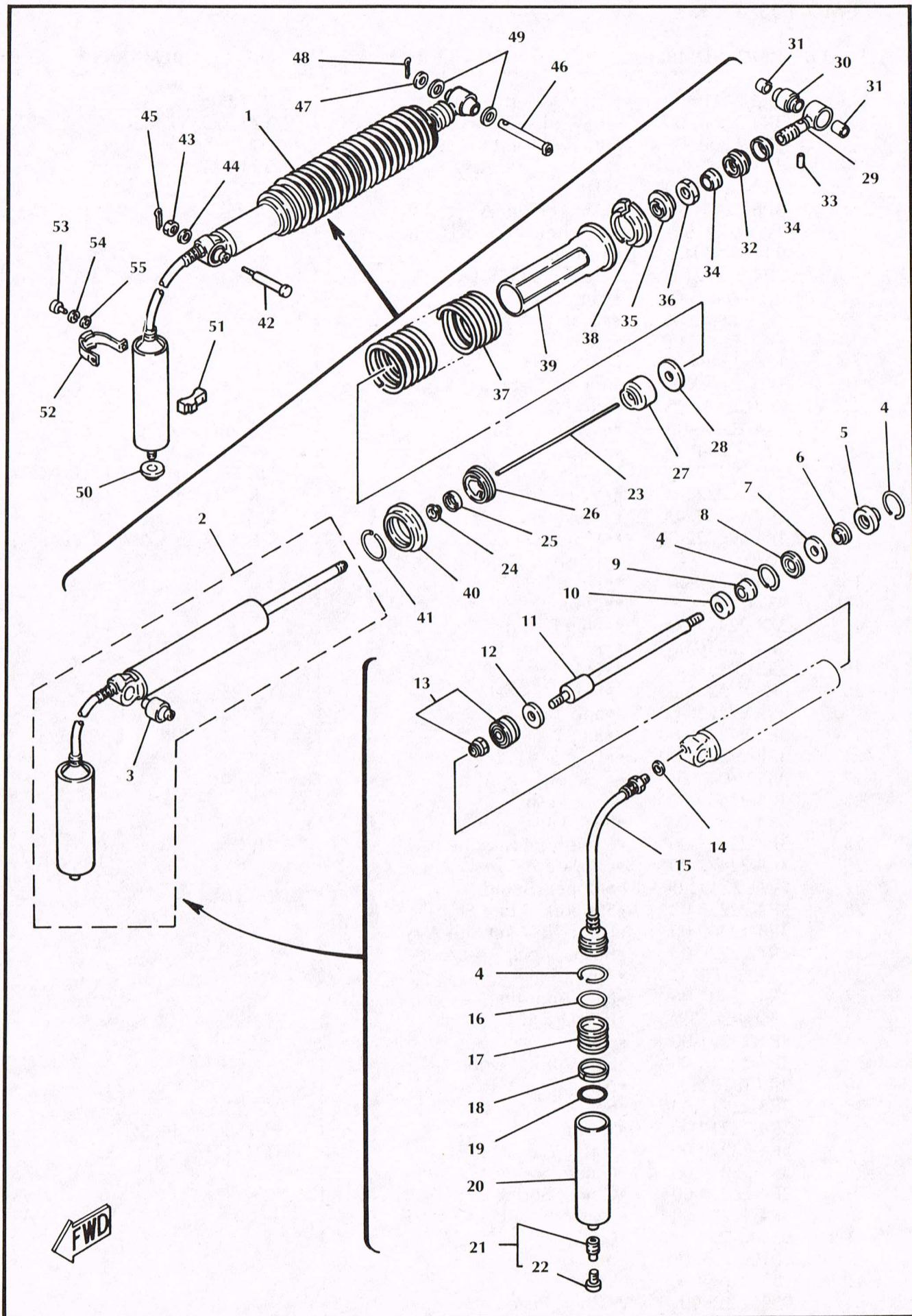


### THE R MONOSHOCK

REF. NO.	PART NUMBER	DESCRIPTION	QTY	REMARKS
1	3R3-22210-00	Shock Absorber Assy.	1	YZ125G
	3R4-22210-00	Shock Absorber Assy.	1	YZ250G, YZ465G
	3R6-22210-00	Shock Absorber Assy.	1	IT175G
2	3R3-22401-00	•Damper Sub Assy.	1	YZ125G
	3R4-22401-00	•Damper Sub Assy.	1	YZ250G, YZ465G
	3R6-22401-00	•Damper Sub Assy.	1	IT175G
3	1W1-22216-00	••Bush, Rear Shock Absorber	1	
4	93450-47043	••Circlip	3	
5	3R4-W2221-00	••Rod Guide Set	1	
6	1H3-22485-00	••Seal, Rod	1	
7	1H3-22486-00	••Seal, Static	1	
8	1H3-22487-00	••Retainer, Seal	1	
9	1H3-22494-00	Rebound, Stop	1	
10	1H3-22495-00	Support, Rebound Stop	1	
11	3R4-22402-00	••Rod Sub Assy.	1	
12	3R4-22446-00	••Washer, Seat	1	YZ125G, YZ250G, YZ465G
	1W1-22446-00	••Washer, Seat	1	IT175G
13	2X3-W2222-00	••Valve Set	1	UR STD for YZ125F, IT175G
	2X4-W2222-00	••Valve Set	1	UR STD for YZ250F, YZ400F
	3R3-W2222-00	••Valve Set	1	UR STD for YZ125G
	3R4-W2222-00	••Valve Set	1	UR STD for YZ250G, YZ465G
14	90201-12790	••Washer, Plate	1	
15	3R4-22470-00	••Hose Set	1	
16	93210-40407	••O-Ring	1	
17	2X4-22414-00	••Free Piston	1	
18	3R4-22416-00	••Ring, Piston	1	
19	93210-35354	••O-Ring	1	
20	3R3-W2226-00	••Sub Tank Set	1	YZ125G
	3R4-W2226-00	••Sub Tank Set	1	YZ250G, YZ465G
	3R6-W2226-00	••Sub Tank Set	1	IT175G
21	3R4-W2224-00	••Plug Set	1	
22	98501-04005	•••Screw, Panhead	1	
23	3R4-22489-00	•Rod, Push	1	
24	3R4-22475-00	•Seal, Dust	1	
25	3R4-22473-00	•Housing, Seal Ring	1	
26	3R4-22472-00	•Cap, Case	1	
27	1W1-22493-00	•Stopper, Bump	1	
28	3R4-22228-00	•Support, Bump Stop	1	
29	3R4-22409-00	•Upper Bracket Sub Assy.	1	
30	3R4-22226-00	•Bush, Shock Absorber	1	
31	90380-12051	•Bush, Solid	2	
32	3R4-22497-00	•Nut, Adjusting	1	
33	93604-26132	•Pin, Dowel	1	
34	3R4-22221-00	•Cover	2	
35	3R4-22213-00	•Seat, Spring Upper	1	
36	90170-20213	•Nut	1	
37	3R3-22212-00	•Spring	1	YZ125G
	3R4-22212-00	•Spring	1	YZ250G, YZ465G
	3R6-22212-00	•Spring	1	IT175G
38	3R4-22214-00	•Guide, Spring 1	2	
39	3R4-22224-00	•Guide, Spring 2	1	
40	3R4-22223-00	•Seat, Spring Lower	1	
41	93440-50078	•Circlip	1	
42	90109-10550	Bolt	1	
43	95302-10700	Nut	1	
44	92902-10600	Washer, Plate	1	

# THE R MONOSHOCK

REF. NO.	PART NUMBER	DESCRIPTION	QTY	REMARKS
45	91401-20025	Pin, Cotter	1	
46	90240-12074	Pin, Clevis	1	
47	92901-12600	Washer, Plate	1	
48	91401-30022	Pin, Cotter	1	
49	1W1-22128-00	Cover, Thrust 1	2	
50	90480-22263	Grommet	1	
51	3R4-22261-00	Damper, Sub Tank	1	
52	3R3-22262-00	Holder, Sub Tank	1	YZ125G, IT175G
	3R4-22262-00	Holder, Sub Tank	1	YZ250G, YZ465G
53	92502-06016	Screw, Panhead	1	
54	92902-06100	Washer, Spring	1	
55	92902-06600	Washer	1	





**YAMAHA MOTOR CO., LTD.**

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