Repair Procedures
Rotac® Model SS-012 (SPEC.)

Document # 26-17-0116
For Bill of Material – 420659-S-B

Read the entire contents of these instructions before installing the actuator and before making any connections to the actuator.

These instructions **MUST** be followed in all respects to avoid damage to the actuator and associated components and/or injury to personnel.

Micromatic LLC
525 Berne St.
Berne, IN 46711 USA
Phone 260.589.2136 Fax 260.589.8966
www.micromaticllc.com

ACTUATOR DISASSEMBLY, INSPECTION AND ASSEMBLY

INTRODUCTION

These instructions provide overhaul instructions and parts list for the SS-012-1V-FT-Z-B-Z-A-2 (SPEC.) ROTAC® Waste Tipper Rotary Vane Actuator.

Do NOT attempt to overhaul an actuator without having a seal kit on hand. Refer to the parts list, Figure 3, for information regarding seal kits. The exploded view drawing, Figure 3, should be used for reference in following the overhaul instructions.

DISASSEMBLY

Read the special instructions below before proceeding. Reference Figure 3 for relative part location(s).

1. Clean exterior of unit as clean as possible. This will help assure that any material found in the unit is a result of wear, system contamination or damage. A more accurate evaluation of the unit and operation system is thus obtained.
2. Remove all burrs from the shaft (1) extension.
3. Before disassembly, the body (2) heads (5, 6) and shaft (1) should be marked in order to return parts to their relative positions during assembly.
4. **Do NOT** hold a rotary actuator in a vise unless special precautions are taken to avoid marring or distorting the body or ends. The preferred method of holding the actuator during disassembly is mounting on a holding fixture, which simulates normal actuator mounting.
5. After removing head screws from both heads (5, 6), strike end of shaft with plastic mallet or aluminum bar stock and allow the shaft to push the head off. These units have threaded holes in the head that will assist you to separate the head from the body. **DO NOT** PRY HEADS OFF!!! Damage will occur to body or heads.
6. Pull the shaft out, with a straight even pull, being careful that the shaft (1) vane does not fall and nick the body (2).

IMPORTANT: Do NOT allow the shaft (1) to “cock/tilt” as this may break the sharp edges on the body causing internal leakage during operation.

7. Remove all seals and inspect for cuts, nicks, or any other unusual conditions of the seal. (Compare to new seal kit).

INSPECTION/EVALUATION

1. Examine oil residue inside the actuator. This may give a clue as to why any damage has occurred.
   A. Dirty or gritty oil will cause scoring of internal surfaces.
   B. Varnish on internal parts can be a sign of oil in system running too hot.
   C. Metal particles - Metal chips may be found from valve spools, actuator internal parts and other metal components in the system.

   The appearance of any of the above will require total flushing and cleaning of the entire system.
2. Wash all parts thoroughly and examine for defects.

A. **Shaft** (Figure 1)

i Examine the shaft for cracks at "A" diameter, keyways, and any other areas where stress may be applied.

ii Spot check by Magnaflux can be used to check for cracks. Three different materials are needed and **MUST** be applied in order:

1 SKC-S Cleaner

2 SKL-HF/SKL-S Penetrant

3 SKD-S Developer

4 FOLLOW THE DIRECTIONS ON BACK OF THE CANS CAREFULLY.

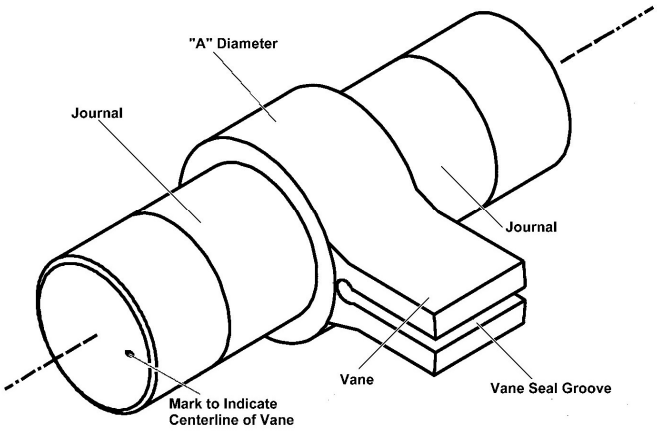


Figure 1 – Shaft Definitions

iii Scoring on "A" (major) diameter. Figure 1. Any scratch 0.010 inches or deeper indicates replacement.

iv Scoring or galling on shaft journal. See Figure 1.

1 This problem can be repaired with hard chrome, however, many critical dimensions **MUST** be held. This type of repair should be performed by the actuator manufacturer.

v Scoring or galling on end of "A" (major) diameter. See Figure 1.

1 This is another problem that can be repaired; however, it is recommended that this type of repair be performed by the actuator manufacturer.

B. **Body**

i Any light scoring can be polished out with 400-grit emery cloth or its equivalent. Scoring of 0.010 inches or more deep indicates replacement of this part. When pressurized, the body will expand and contract. For this reason, plating or sleeving is not recommended by the factory for repair.

ii Cracks may be found across the dowel holes, screw holes, or ports. This indicates replacement of this part.

iii Dowel holes may be elongated or out of round. These holes may be drilled oversize or re-bushed. However, the proper size and location of the dowel hole **MUST** be known to accomplish this repair.

C. **Heads**

i Scoring on the face of the head **MUST** be repaired. Possible causes are:

1 Contamination particles in the oil.

2 Axial / side load onto shaft.

ii Minor scoring can be polished out with 400-grit emery cloth, hand stoning or equivalent.

iii Cracks in head are usually around bolt circle or dowel pattern and if this occurs, replacement of the part is necessary.

D. **Seals - It is recommended that all seals be replaced.**

i Cut or shaved seal is usually done during assembly. This can occur in a number of different ways. Refer to the assembly instructions to carry out proper assembly.

SEAL REPLACEMENT AND ASSEMBLY

1. **Cleanliness and area preparation:**
    a. The assembly area **MUST** be clean and free from all dirt, dust, or other harmful material.
    b. A plastic or metal-covered workbench is the best. Parts should be re-cleaned if necessary.
    c. A small pliable brush should be used to clean seal grooves, dowel holes, screw holes, and other hard-to-get-at areas.
    d. Remove all burrs that may be on any part. **Do NOT** break corners on shaft "A" diameter or body. These sharp edges are important to the operation and function of the actuator.

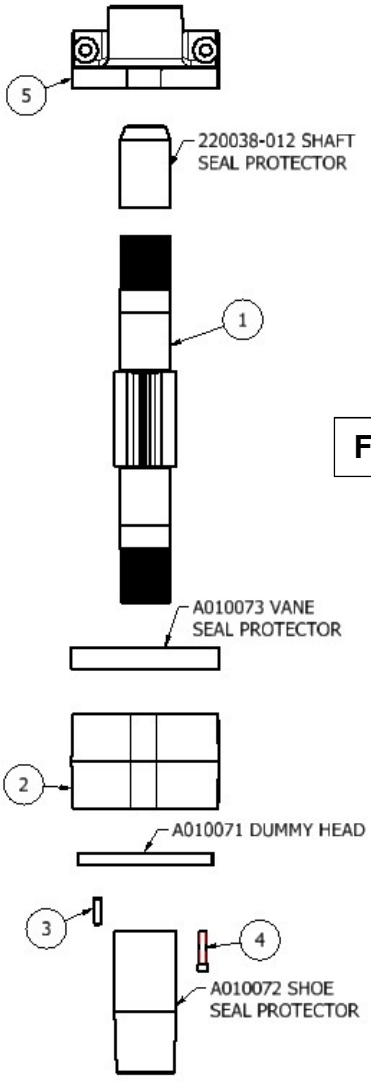


Figure 2 – Assembly Tools

2. **Tools**
    a. During the assembly of the unit, the seals need to be protected. Assembly tools are required to install seal kits. The tools are:
        i. A010074 dummy head
        ii. A010072 shoe seal protector
        iii. A010075 vane seal protector
        iv. 220038-012 shaft seal protector
    b. Alternatively, the “Shim Stock Method” can be utilized
        i. This method is not recommended as it is difficult to perform properly

ii. Place 0.002-inch maximum thickness shim stocks against the faces of vane seal that contact body Slide the wingshaft (1) into the body until the vane is almost fully installed inside the body. Then remove the shim stock and at the same time slide the wingshaft completely into position.
iii. Shim stock must protect seals from being 'shaved' or cut during installation.

CAUTION: Sharp edges on shim stock may be dangerous. Use extreme care when handling.

3. **Assembly** - Reference Figure 3.
   a. Place body (2) on a flat surface. Put the head dowel pins (3) into the body for the dummy head. Attach the dummy head so that it is properly seated. Turn the body and dummy head over so that the dummy head is on the flat surface.
   b. Install the shoe cushion seal (11) and shoe cap seal (10) into the body (2). If they were removed previously, install cross-port plugs (17) into body per Table 1, Torque Specifications.
   c. Use a lubricant on all seals and internal parts that is compatible with the driving fluid used.
      i. Hydraulic oil, DS-ES Lubriplate by Fiske Brothers and Petroleum jelly is also compatible in most hydraulic systems.

      i Lubricate the shoe cap seal (10) and the ID of the body (2).

   b Insert the vane cushion seal (15) and "C" shaped shaft vane cap seal (14) in vane of the shaft (1). Lubricate with grease to hold the seals in position. Lubricate the "A" diameter of the shaft (see Figure 1). Use care to avoid nicking or cutting the vane seals.

      i NOTE: All vane cap seal corners **MUST** remain sharp.

   c Place the vane seal protector on the body and assure that it is properly seated.

   d Place the shoe seal protector over the shaft extension and place this assembly into the dummy head. Rotate the shaft (1) approximately 90° from the shoe position. Slide the shaft (1) into the body (2) until the vane is fully installed.

   e Remove the vane seal protector and the shoe seal protector.

   f Install shaft cushion seal (12) and shaft cap seal (13) into the head (5). Smooth out ripples or wrinkles in the installed shaft cap seal (13). Install dirt excluder seal (6) into the head (5).

   g Place wavy spring (7), hub ring seal (8), and hub cap seal (9) into the head (5). Ensure that hub cap seal (9) is free to move axially.

   h Place head O-ring seal (16) into the groove in the head (5).

   i Lubricate all seals and internal parts with grease sufficient enough to maintain the seals in position when the head is inverted and installed on the body (2).

   j Invert the head (5) and carefully slide it down over the shaft (1).

      i NOTE: **Do NOT** hammer on the head (5) or allow the hub cap seal (9) or head O-ring seal (16) to become dislodged from its cavity as the head (5) is mated to the body (2). Install two screws (4) 180° apart and tighten the screws (4) to pull the head (5) onto the body (2).

   k Install the head dowel pins (3) into the head and the remainder of the screws (4) through the head (5) and into the body (2).

   l Turn the assembly over and remove the dummy head.

   m Install shaft cushion seal (12) and shaft cap seal (13) into the second head (5). Smooth out ripples or wrinkles in the installed shaft cap seal (13). Install dirt excluder seal (6) into the head (5). Place wavy spring (7), hub ring seal (8), and hub cap seal (9) into the head (5). Insure that hub cap seal (9) is free to move axially.

   n Place head O-ring seal (16) into the groove in the head (5).

o Lubricate all seals and internal parts with grease, sufficient enough to maintain the seals in position when the head (5) is inverted and installed on the body (2)

p Invert the head (5) and carefully slide it down over the shaft (1).

  i NOTE: **Do NOT** hammer on the head (5) or allow the hub cap seal (9) or head O-ring seal (16) to become dislodged from its cavity as the head (5) is mated to the body (2). Install two screws (4) 180° apart and tighten the screws (4) to pull the head (5) onto the body (2).

q Install the head dowel pins (3) into the head (5) and the remainder of the screws (4), through the head (5) and into the body (2).

r Apply medium strength thread lock. Loctite 242 or equivalent.

  i This helps ensure proper top torque values are reached and bolts stay tight

s Torque all head screws (4) per Table 1, Torque Specifications.

Factory-built actuators are then tested for internal by-pass leakage and breakaway pressure. See chart in Table 2. Actuator should be cycled 10-20 times before beginning the tests.

TABLE 1 – TORQUE SPECIFICATIONS

MODEL	SCREW SIZE	TORQUE
SS-012 (SPEC.)	SHCS 7/16-14	70 ft-lb (95 Nm) – lightly greased, Loctite 242 or equivalent

TABLE 2 – BREAKAWAY & LEAKAGE CHART

MODEL	BREAKAWAY PRESSURE	INTERNAL BY-PASS LEAKAGE (per minute)
SS-012 (SPEC.)	50 PSI	20 in^3 @ 3,000 PSI for repairs

INTERNAL BY-PASS LEAKAGE:

- Leakage checks to be made at pressure listed.
- The fluid is measured out the exhaust port of the actuator. Pressure to be maintained at psi listed for one (1) full minute before check is started.
- The unit is tested in both directions.

BREAKAWAY PRESSURE:

- An internal pressure, as listed, must accomplish rotation of an actuator shaft through the full stroke.
- The unit is tested in both directions.

EXTERNAL LEAKAGE:

- There should be no external leakage from the unit.

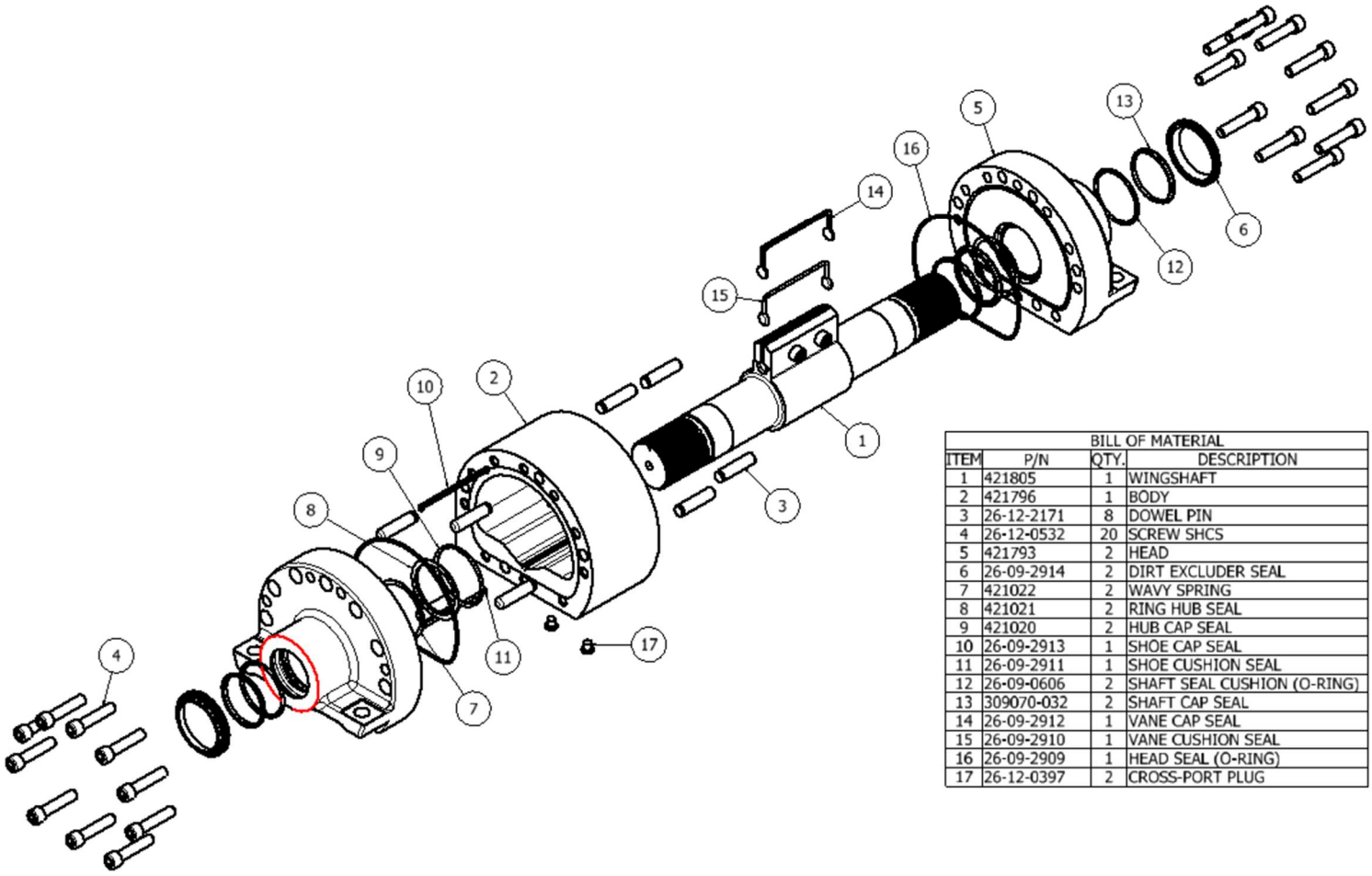
TABLE 3 – Assembly Tools

TOOL	TOOL NUMBER
A010074	Dummy Head
221038-012	Shaft Seal Protector
A010075	Vane Seal Protector
A010072	Shoe Seal Protector

TABLE 4 – Kits

KIT NUMBER	KIT NUMBER
26-97-0274	Seals and Fasteners
420659-K1	Seals Only

FIGURE 3 - Parts View



BILL OF MATERIAL			
ITEM	P/N	QTY.	DESCRIPTION
1	421805	1	WINGSHAFT
2	421796	1	BODY
3	26-12-2171	8	DOWEL PIN
4	26-12-0532	20	SCREW SHCS
5	421793	2	HEAD
6	26-09-2914	2	DIRT EXCLUDER SEAL
7	421022	2	WAVY SPRING
8	421021	2	RING HUB SEAL
9	421020	2	HUB CAP SEAL
10	26-09-2913	1	SHOE CAP SEAL
11	26-09-2911	1	SHOE CUSHION SEAL
12	26-09-0606	2	SHAFT SEAL CUSHION (O-RING)
13	309070-032	2	SHAFT CAP SEAL
14	26-09-2912	1	VANE CAP SEAL
15	26-09-2910	1	VANE CUSHION SEAL
16	26-09-2909	1	HEAD SEAL (O-RING)
17	26-12-0397	2	CROSS-PORT PLUG

TABLE 5 – Troubleshooting Guide

TROUBLE	PROBABLE CAUSE	REMEDY
External Leakage at Shaft	Defective shaft seal cap(s) (13) or O-ring(s) (12).	Replace defective parts.
	Shaft (1) scored or worn.	Repair or replace defective part.
External Leakage at Joint Between Head (5) and Body (2)	Defective head seal O-rings (16), or damaged sealing surface on head (5) or body (2). Improper torque on the head cap screws (4).	Replace defective O-ring. Replace damaged parts. Tighten cap screws to recommended torque.
Excessive Internal Leakage	Defective shoe seal cap (10), shoe seal cushion (11), vane seal cushion (15), and/or vane seal cap (14)	Replace defective parts.
	Defective hub seal cap (9), hub seal ring (8), or wavy spring (7).	Replace defective parts.
	Worn or scratched end faces on heads (5) or in body (2).	Repair or replace.
	Worn or scratched ID of body (2).	Repair or replace.
	Head cap screws (4) not tightened sufficiently.	Tighten to recommended torque.
	"C" style vane seal cap (14) not seated properly (Applicable to units immediately after overhaul only).	Operate through full cycles for a few minutes to attempt to seat seals.

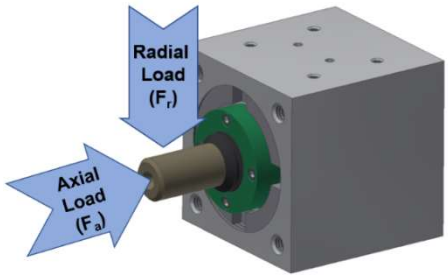
GENERAL INSTALLATION GUIDELINES

IMPORTANT HYDRAULIC FEATURES

1. The standard units are designed to operate in a temperature range of -40° to +180° F when filled with any filtered (10 Micron MAX,) petroleum or mineral base fluid that has viscosity value of 70-250 SSU at 150°F.
    a. Optional Seals are available for alternate fluid compatibilities and higher operating temperatures.
2. Standard units are fitted with Nitrile (Buna N) seals (-30° to +250°F). Fluorocarbon rubber/Viton (-15° to +400°F) and ethylene propylene (-70° to +275°F) seals are available for special fluids and high temperature applications. Filtered, dry, & non-lubricated air may be used; however, the temperature should **NOT** exceed 150°F.
3. THE FLUID PRESSURE APPLIED TO THE ACTUATOR **MUST NOT** EXCEED THE RATED MAXIMUM PRESSURE GIVEN ON THE NAMEPLATE ("MAX. P.S.I"). IN NO CASE IS THE RATED PRESSURE PERMITTED TO BE GREATER THAN WHAT IS STATED P.S.I. A pressure relief valve **MUST** be installed in the supply line to restrict system pressure. The hydraulic system **MUST** be designed to eliminate pressure surges that could exceed the actuator design pressure. Pressure relief valves **MUST** be installed between the control valve and the actuator to eliminate the surge pressure in the actuator which may be caused by attempting to stop a high inertial load. These pressure relief valves **MUST** be adequately sized and installed as close as possible to the actuator and between any control or shutoff valve and the actuator.

IMPORTANT INSTALLATION CONSIDERATIONS

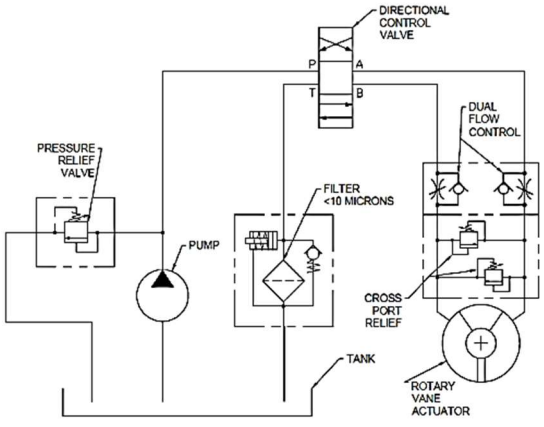
1. It is essential that no axial or radial loads (exc. MPR & 26R models) be transmitted to the output shaft of the actuator. To ensure maximum life for any installation, axial & radial loading caused by improper alignment should be eliminated by use of shims. If these types of loads cannot be avoided, consideration should be given to provide outboard pillow blocks and/or recommendations should be obtained from the factory. (MPR & 26R models allow radial loads as specified on the unit drawing.)



2. In the installation of an END MOUNT actuator it is **essential** that the two (four in some cases) untapped holes in the mounting flange be reamed and fitted with press fit dowels to take the torque. Do **NOT** try to carry the torque load on the threads of the four mounting bolts or the friction under the heads of these mounting bolts alone. In the installation of a foot mount actuator, it is **essential** that fasteners be used in each of the four mounting holes.
3. All mounting bolts **MUST** be tight and of sufficient strength (recommend grade 8 or higher). The actuator **MUST** be aligned properly and attached to sufficiently rigid structure(s) to assure that there are no unrecognized axial or radial loads applied to the Micromatic Actuator shaft or bearings. Use shims where necessary to maintain alignment.
4. The adapter connecting the Micromatic Actuator output shaft to the mechanism should be machined for a slip fit with minimum backlash, and all linkages **MUST** be snug to assure proper response. No axial or radial loads should be transmitted to the actuator.
5. Hydraulic lines **MUST** be at least as large as the ports of the Micromatic Actuator and as short as possible to minimize hydraulic pressure drop issues.
6. If the actuator is mounted with ports other than at the top of the unit, or if only a small portion of the stroke is utilized, a method for bleeding air out of the system **MUST** be provided.

CAUTION: THE INTERNAL STOPS IN THE ACTUATORS ARE NOT DESIGNED TO ABSORB DYNAMIC LOADS. EXTERNAL STOPS MUST BE USED TO LIMIT OUTPUT SHAFT TRAVEL. VANES STRIKING ABUTMENTS WILL RESULT IN PREMATURE ACTUATOR FAILURE

1. Angular travel. Total shaft travel for a standard unit is 280° +/- 5° for single vane and 100° +/- 5° for double vane. Position the output shaft correctly prior to connecting it to the mechanism to insure full angular rotation.
2. The mid-position of travel of each Micromatic Actuator equipped with a standard spline is readily obtainable by positioning the “V” index mark stamped on the end of the shaft 180° opposite the centerline of the hydraulic connecting ports for single vane units, and 90° clockwise from a centerline between the two ports for double vane units. These positions are located while facing the splined end of the actuator. The mid-travel position for each Micromatic Actuator with a standard keyway is readily obtainable by positioning the keyway between the hydraulic connection ports.
3. Direction and speed control for slow speed and light loading applications can be accomplished with relatively simple fluid circuits using hand-operated 4-way valves. Reference the basic schematic:



MICROMATIC LLC WARRANTY

The Company warrants, to the original purchaser, that this product is free from defects in materials and workmanship if properly installed, serviced and operated under normal conditions according to the Company's instructions. The Company's obligation under said warranty and its total legal obligation under this contract is expressly limited to correcting, without charge at its factory, any unit or parts thereof returned to its factory for a defect which occurred during the first 12 months from date of shipment to the original purchaser and which upon examination shall disclose to the company's satisfaction to have been originally defective. Corrections of such defects by repair to, or supplying of replacements for defective parts, shall constitute fulfillment of all obligations to the original purchaser. This warranty shall not apply to any of the Company's products which **MUST** be replaced because of normal wear, which have been subject to misuse, negligence or accident or which shall have been repaired or altered outside the Company's factory unless authorized in writing by the Company. The Company assumes no liability for injury, loss, damage, or expense directly or indirectly resulting from the use of this product or from any other cause. THIS WARRANTY SUPERSEDES, AND IS IN LIEU OF, ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, AND OF ALL OTHER LIABILITIES OR OBLIGATIONS ON THE PART OF THE COMPANY. No distributor, agent, or dealer is authorized to give any other warranties on behalf of the Company nor to assume for the Company any other liability in connection with any of its products. UNDER NO CIRCUMSTANCE WILL THE COMPANY BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL, OR ANY OTHER DAMAGE IN CONNECTION WITH THE USE OF ANY INFORMATION OR MATERIAL CONTAINED HEREIN. THE COMPANY DISCLAIMS ALL WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE