



HYDRAULIC SELF CENTERING STEADY REST

INSTRUCTION MANUAL

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1. GENERAL INSTRUCTIONS

1.1 THE OPERATORS INSTRUCTION MANUAL

This manual is written and supplied by the manufacturer and is an integral part of the machine and the equipment.

The instructions given in the manual ensures the safety of bother the operator and the machine as well as enhancing the working life of the machine.

Before servicing any of the equipment, it is important to read this manual carefully.

Your valuable suggestions to improvements to this manual will be appreciated by us.

YOU ARE REQUESTED TO:

- Go through this operators manual before operating the steady rest
- Give special care to the paragraphs preceded with the following symbols.



ATTENTION: *Possibility of injury so follow the instructions carefully.*



CAUTION: *Danger of damages or disruption to the machine / steady or component.*

1.2 SALIENT FEATURES OF KEL SELF CENTERING STEADY REST

- The various models of KEL self centering steadies have been carefully selected to optimize the clamping ranges for the various sizes of lathes and work piece diameters.
- The hardened and ground parts of the KEL self centering Steady Rest made from high quality materials ensures highest precision, robust and vibration free construction gives long service period.
- The durable and compact design of the KEL self centering Steady Rest guarantees highly economical machining.
- Steady Rests are suitable for both stationary and travelling applications.
- Replaceable swarf guards made from special material protects the rollers and other internal parts from the dirt and swarf during the production.
- The compressed air connection eliminates the coolant entry into the Steady Rest.
- Cylinder can be actuated either by hydraulic pressure or by pneumatic pressure.
- The integral check valve provided with the Steady Rest ensures the roller support in case of a sudden drop in pressure.
- The stroke of the cylinder can be controlled by a limit switch and switch rod.
- The centralized lubrication ensures proper lubrication for the rollers and guide way.
- An adjustable three piece swarf guard for the front rollers provides minimal reduction in centering range.
- The KEL self centering Steady Rest has been designed and developed to suit the modern compact CNC lathes where space is at premium. Steady Rests can be provided with a cylinder mounted on the side of the steady housing instead of at the back (if required) to save space.

1.3 WARRANTY

We warrant that all the equipment manufactured and supplied by Kitagawa Europe Ltd are free from defects in material and workmanship. We undertake to repair or replace, at our option, free of charge, part or parts supplied by us within the warranty period which in our option are defective due to fault in design, defective material, workmanship, subject to the following conditions:

1. The warranty shall be in force and effect for 12 months from the date of dispatch, if the equipment is working on double shift basis.
2. This warranty is subjected to punctual compliance to the terms of payment. Non payment or delay in payment in full or part for the equipment shall render this warranty non operative.
3. We undertake no obligation to bear the cost of removal or fitting of any equipment, accessories, components or parts for the purpose thereof.
4. Any equipment, accessories, components and spares which may be defective shall become our property on being replaced in terms of this warranty.
5. This warranty will be rendered invalid if in our opinion the equipment has been repaired or altered by a customer other than our service personnel.
6. The expenses of packing forwarding freight, insurance in connection with repairs and replacement made in accordance with the terms of this warranty shall be borne by the purchaser.
7. In the case of patented or other brought out items our liability under this warranty shall not at any time exceed the liability if any accepted by the manufacturer and or suppliers or such items or part of such items.
8. Claims arising from the warranty will be recognized only if the defect in question is notified to us 15 days after observing the defect.
9. The warranty is not applicable in the case of excessive service conditions, natural wear and tear or any damage due to negligent handling, storage, transport, improper operation, inadequate or improper maintenance or servicing, accidents, act of providence and faults of third parties.
10. Except as above the buyer has no other rights under this warranty and in particular no right to repudiate any agreement, to claim any reduction in the purchase price or to demand any payment for damages or compensation for accrued or consequential losses.
11. We reserve the right to make any changes additions or improvements in equipments previously sold.
12. This warranty is in lieu of all warranties whether by law or otherwise expressed or implied and all other obligations or liabilities on our part, and we neither assume nor authorize anyone to assume on our behalf; any other liabilities in connection with sale of equipment thereof.

13. The rollers used on the Steady Rest are consumables and are therefore not covered under this warranty.

1.4 GENERAL SAFETY INSTRUCTIONS



The installation or maintenance of the Steady Rest should be carried out only by qualified persons.



During operation the Steady Rest should be protected from parts in motion or from accidents during operation.



Maintenance and control of the Steady Rest should be carried out only after the machine has been completely shut down.



Changes to the shape and details carried out in an arbitrary manner are dangerous and are not allowed.



Do not surpass the greatest agreed speed of rotation from the rollers with the piece in machining.



Always assure that sufficient clamping force is applied by the rollers on the component with respect to the component and the speed of rotation.



The FRU series Steady Rests are equipped with a safety valve. This safety valve should not be tampered with.

2. STEADY REST

2.1 USE OF STEADY REST

Steady rests are normally used for support during internal and end machining operations, and also as a support for the machining of long and slender components.

Fig. 2 and Fig. 3 illustrate these two typical applications of Steady Rests.

On conventional Steady Rests three screws 120° apart are adjusted manually, to precisely place the work piece in line with the machine axis. These machines face a few problems, especially when used with high speed CNC machines.

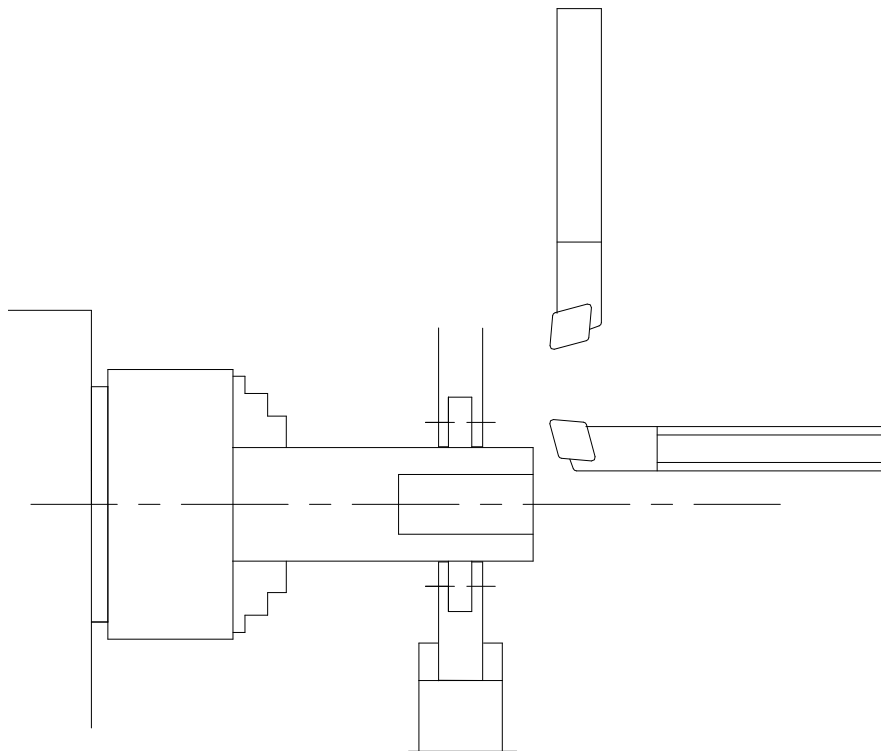


Fig. 2

SUPPORT FOR INTERNAL AND END MACHINING

The centering process is not reliable and depends largely on the operator's expertise. This also adversely affects the repeatability of the component's accuracy.

The steady screws, though made of softer materials, frequently leave scratch marks, on the finished component thus affecting the surface finish.

2.2 ADVANTAGES OF KEL SELF CENTERING

The KEL self centering Steady Rest works on an entirely different principle. Three rollers hold the workpiece at points approximately 120° apart. The middle roller is pushed onto the workpiece axially, while the other two rollers form exact curves as they move along precise cam surface rigidly attached to the middle roller arm. These three rollers move in such a way that they always inscribe concentric circles between them.

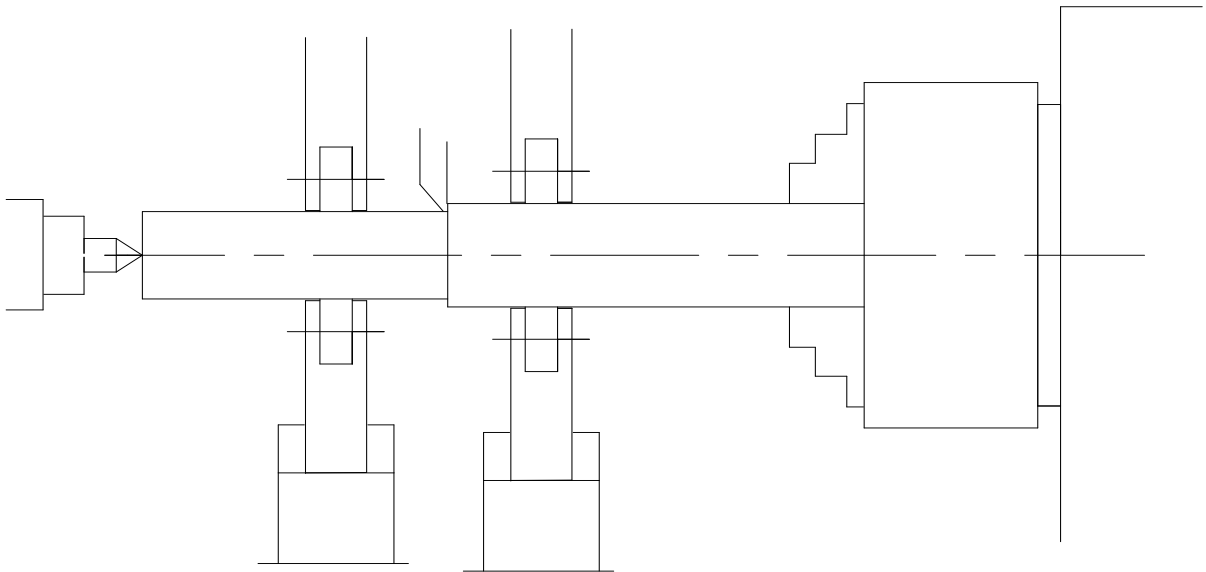


Fig. 3
SUPPORT FOR SHAFT MACHINING WITH ONE OR MORE STEADY REST

2.3 STATIONARY STEADY RESTS

Steady Rests are commonly used to support long shafts, for machining end faces and for combined internal and external machining.

Steady Rests normally used for stationary application may be fitted with a manual or centralised lubrication system.

If the Steady Rest is used to support the workpiece in place of the machine tailstock, then the following precautions should be taken:

- The Steady Rest must be integrated to the machine cycle.
- For safety reasons a non-return valve should be provided in the pressure line so that the clamping of the workpiece continues until the spindle stops - in case of a sudden drop in pressure.

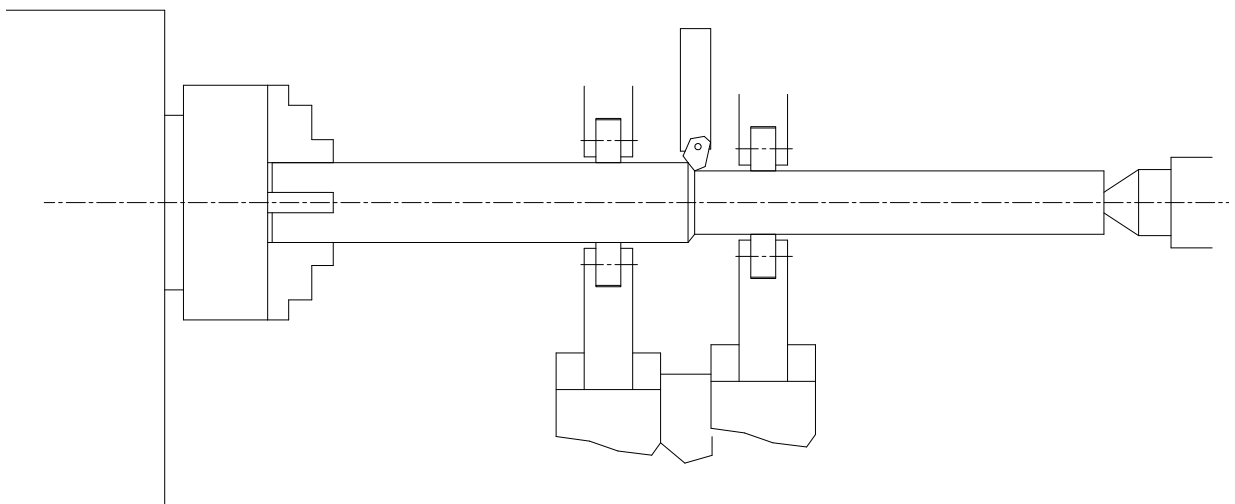


FIG . 4

2.4 TRAVELLING STEADY RESTS

Under certain conditions it may be advantageous to use a travelling Steady Rest to counteract radial cutting forces. To obtain optimum results the distance between the Steady Rest rollers and the cutting tool can only be obtained in practice, and will depend on the component as well as the application. (As a guide, positioning between 60 mm to 100mm behind the tool is recommended.) Normally rollers will follow further than be in front of the cutter unless the work piece is absolutely round and concentric.

A travelling Steady Rest, whether it is hydraulically or pneumatically actuated can only be used when the component is driven by a chuck while also being supported by a tailstock centre. If profiles or tapers are involved utmost care should be taken during the planning of the operation or contact Kitagawa for advice. While care should always be taken to ensure that sufficient roller pressure is used to safely support the component during cutting, it is equally important to not use excessive pressure as this will adversely affect the life of the roller bearings. In addition travelling steady applications impart an axial load on the roller bearings. The use of a Steady Rest connected to a centralised lubrication system is essential for such applications.

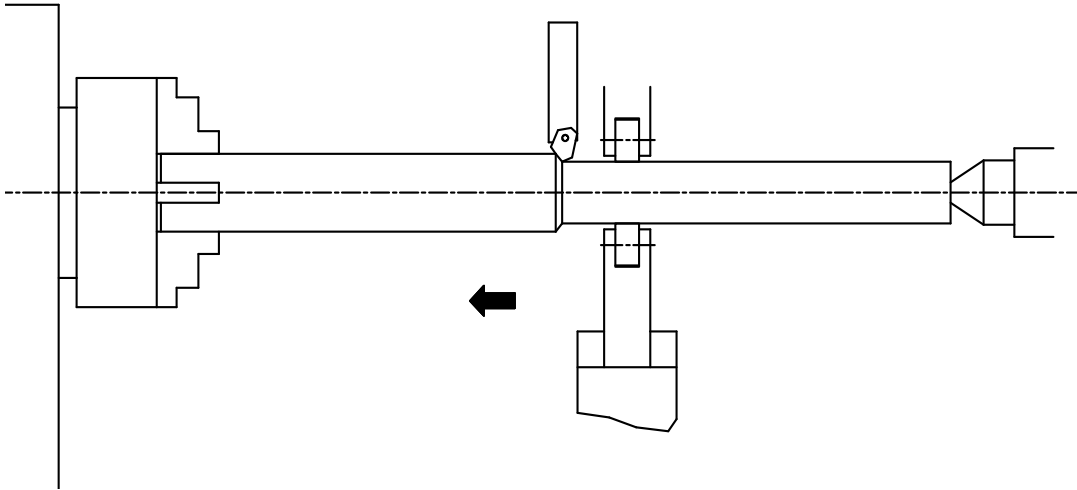
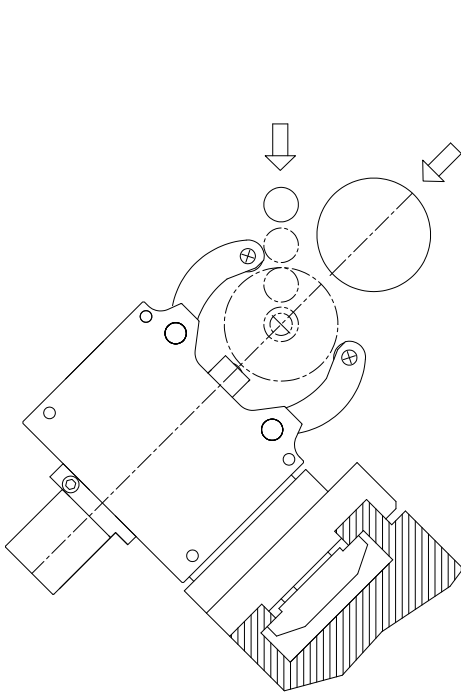


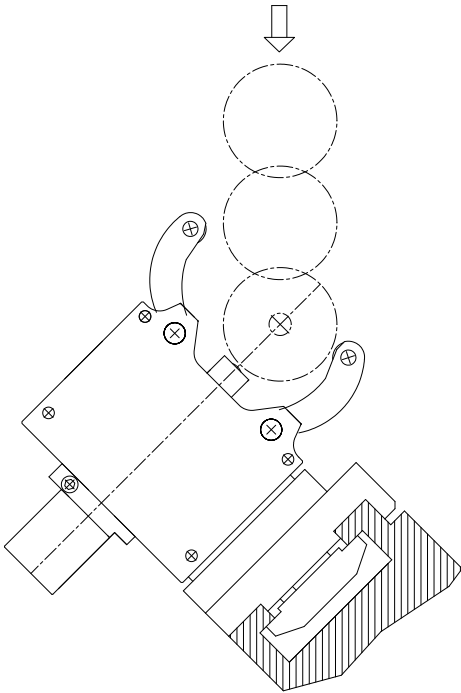
FIG. 5

**2.5 KEL SELF CENTERING
STEADY REST MODELS**

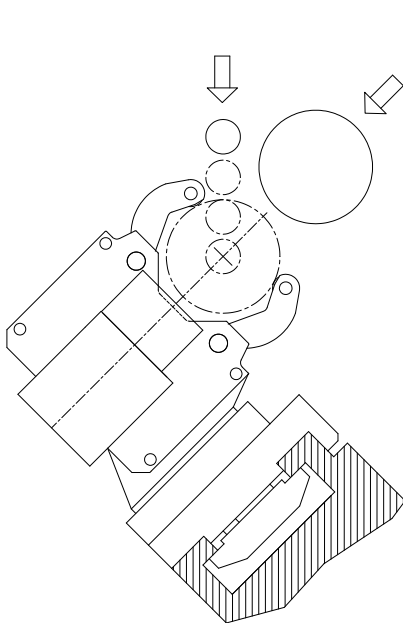
FIG. 6



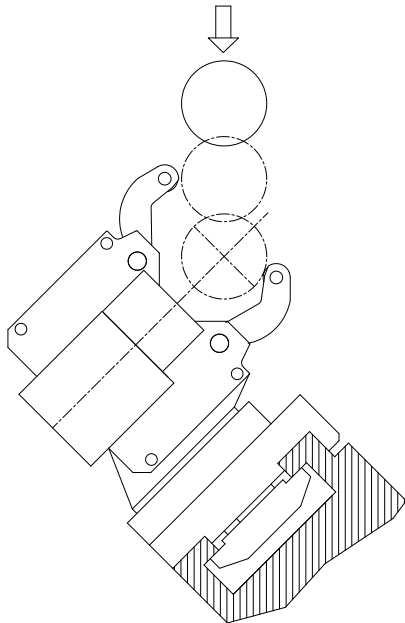
FRM & FRE SERIES



FRMA & FREASERIES (ARMS EXTRA OPENING)



FRUB & FREB SERIES
(CYLINDER SIDE MOUNTED)



FRUAB & FREAB SERIES
(CYLINDER SIDE MOUNTED WITH ARMS
EXTRA OPENING)

3. MODE OF OPERATION

3.1 OPERATING PRINCIPLE

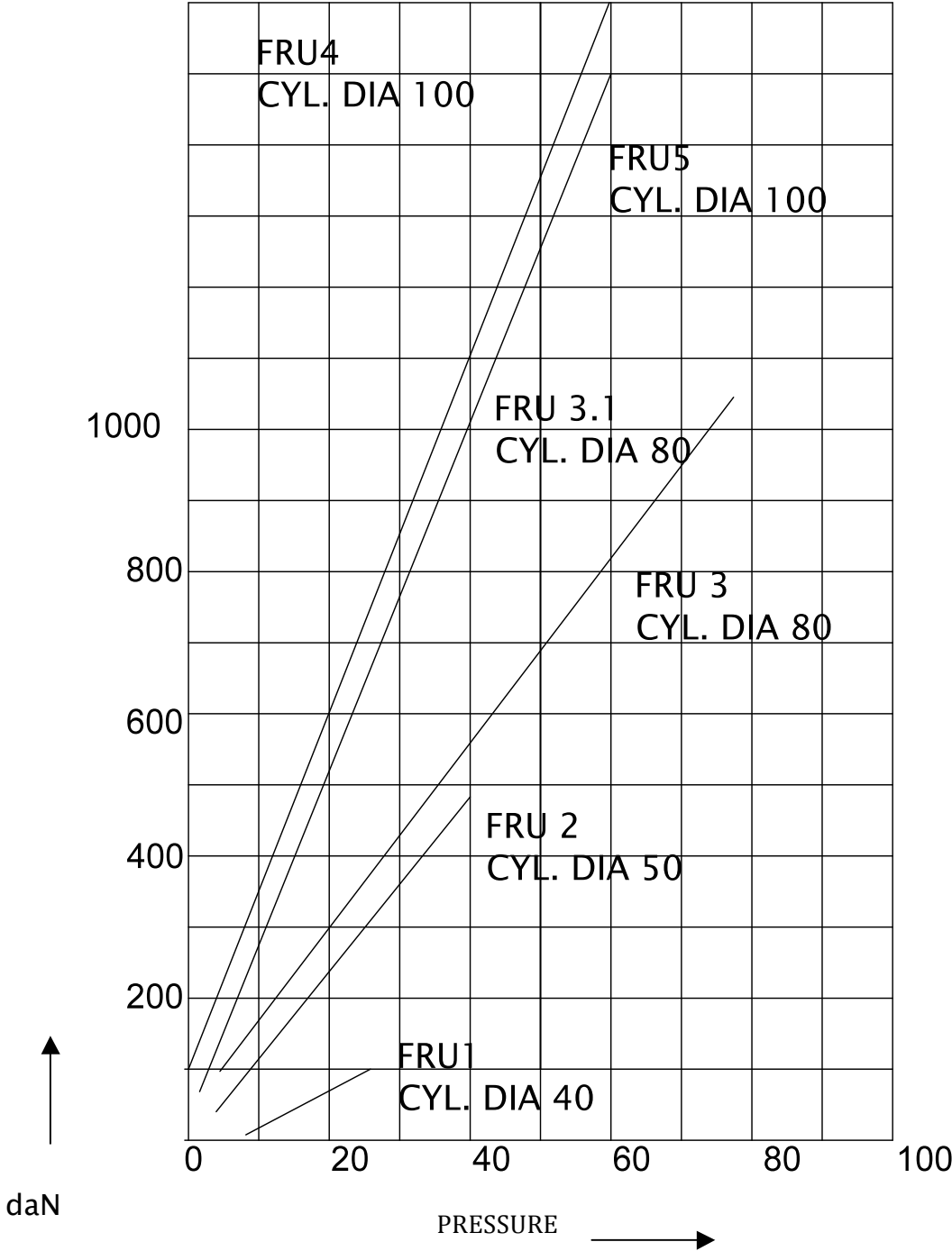


Fig. 7 Clamping Force Graph for KEL Steady Rests.

- The working pressure of the KEL Steady Rest is determined by the cutting operation and the selected size of the steady operating cylinder. The extent to which the work pieces can be turned through the gap between the rollers is naturally limited to slow feed rates and shallower depths of cut.

- Fig. 7 gives the clamping forces acting on the work piece for various actuation pressures for the full range of KEL self centering Steady Rests. The required pressure is determined by the piston area of the Steady, the service life of the rollers, the size and weight of the workpiece as well as its length/diameter ratio. During the machining operation the workpiece must be sufficiently firm. High in feed forces will roll the running contact of the Steady Rest in.
- The Steady Rest itself does not restrict the clamping action of the rollers arms by means of the hydraulic or pneumatic actuating cylinder. The steady rollers adjust their hold positively and automatically to the workpiece diameter.

3.2 CONTROL SYSTEM

- All cylinders can be operated hydraulically or pneumatically. Fig. 8 and Fig. 9 show typical control circuits for hydraulic and pneumatic operation.
- Operation of the Steady Rest is via a 4/2 way double solenoid valve. This valve can be controlled manually from a foot operated impulse generator or directly by the CNC system.



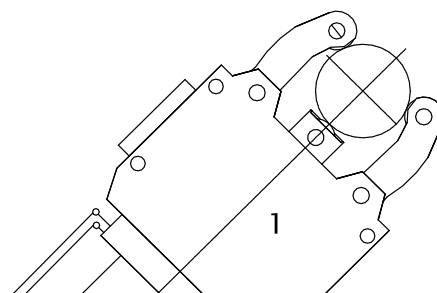
All of the tubes for connection have to be a minimum of 8 mm inside and a suitable diameter to support a pressure until 100 bar.



For connections we recommend standard high pressure hoses with appropriate end connections that can unfasten rapidly to cut the circuit in case of accidents.

Hydraulic Circuit

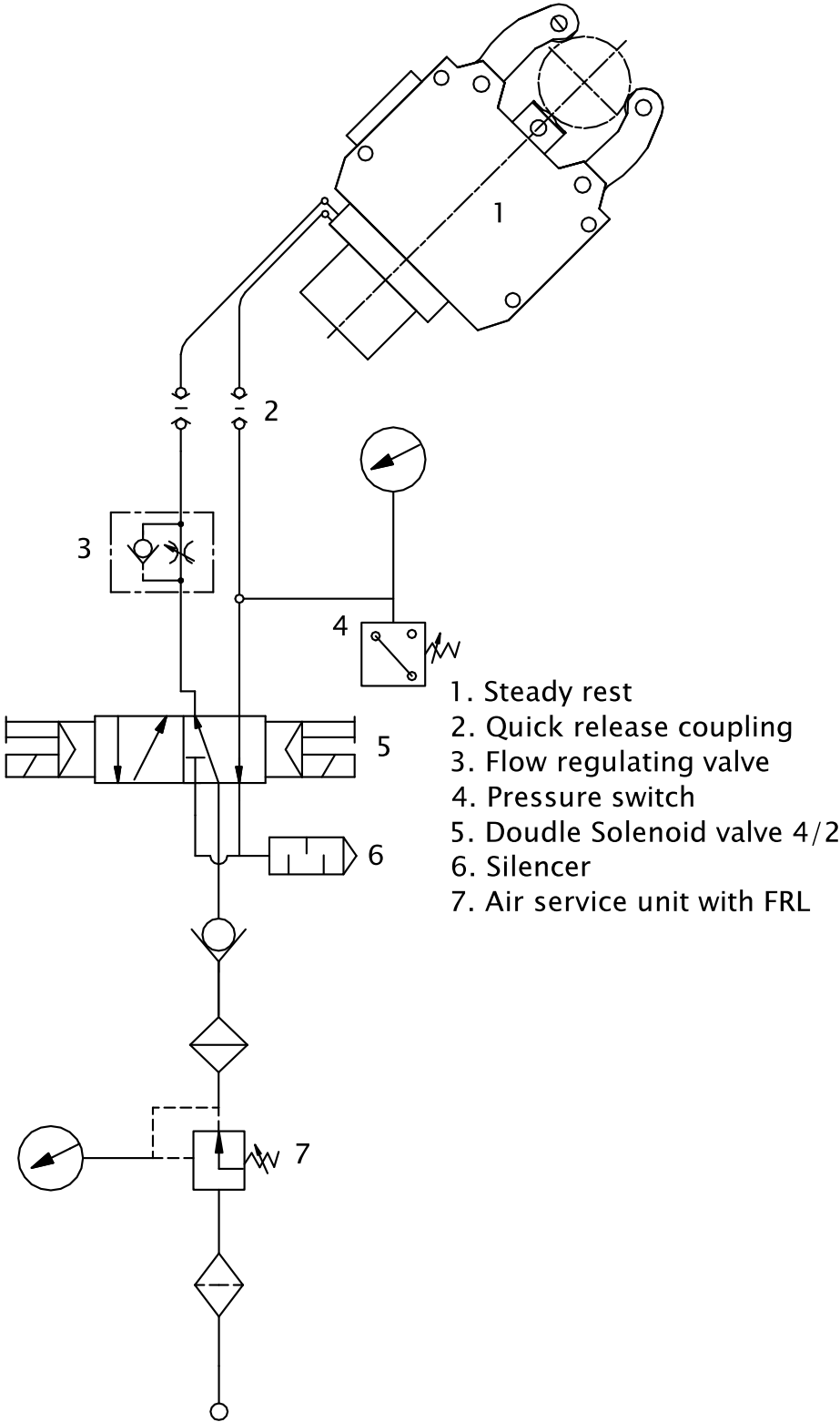
Fig. 8



Pneumatic Circuit
fig:9

E

Pneumatic Circuit
Fig. 9

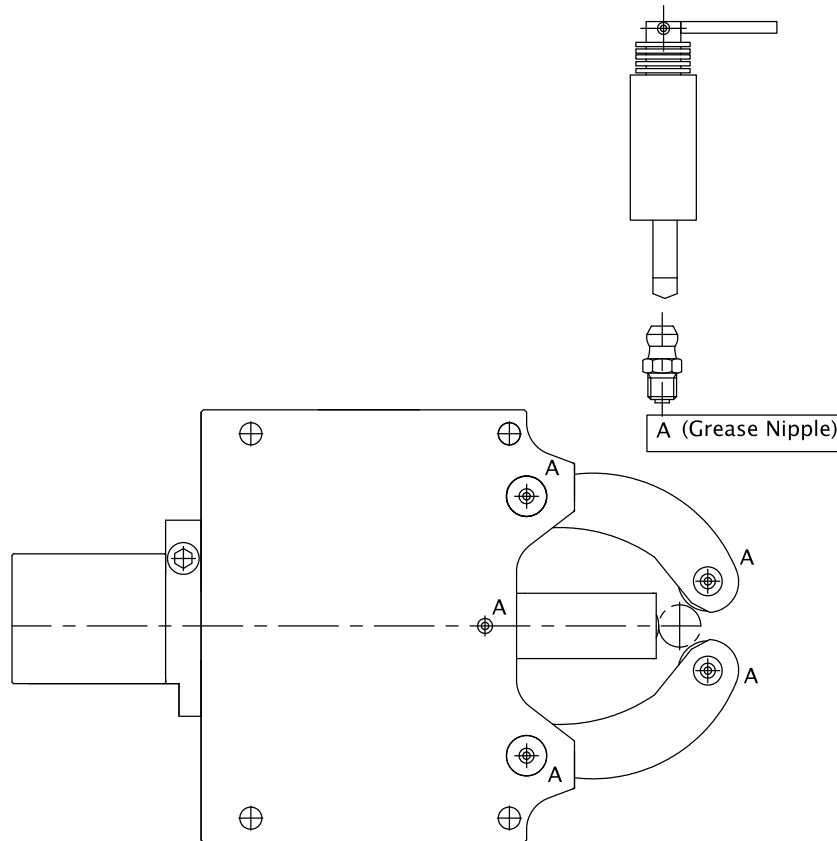


4. FEATURES

4.1 LUBRICATION

Manual lubrication

Fig. 10



MANUAL LUBRICATION: (FRU-M/ FRU-A-M)

This lubrication system is used for light duty working conditions and low building of swarf. Under normal working conditions and a maximum peripheral speed of 600 M/min the roller bearing assembly should be lubricated every 4 hours. This can be done by applying a grease gun to the grease nipples on the roller and pivot pins. The old grease must be pumped out as far as possible and supplemented by the new grease. However, during lubrication care should be taken to avoid over-lubrication or excessive working-in of the grease. A precondition of the lubrication is that the superfluous grease should always be allowed to escape from the bearing. The following grade of grease is recommended for use with self centering Steady Rests: **“DIN 51402”**

CENTRALISED OIL LUBRICATION: (FRU-Z / FRU-A-Z)

This lubrication system is used in heavy working conditions with a high build of swarfs as well as travelling steady rest applications. The KEL self centering steady

can be supplied with centralised lubrication. The G1/8" lubrication point is located on the narrow side of the housing and must be on the top when the steady is mounted. The roller assemblies and pivot pins are fed via lubrication channels and the moving surfaces of the middle arm are supplied via a large oil groove. The operating pressure for the centralised oil lubrication should be between 10 and 30 bars and should be set so as to provide approximately 0.4 cc of oil per point every 5 minutes.

At the time of commissioning each new steady rest or after long periods of continuous operation it is necessary to give it several shots of oil. Seals fitted to the moving parts guarantee full lubrication oil pressure at the rollers.

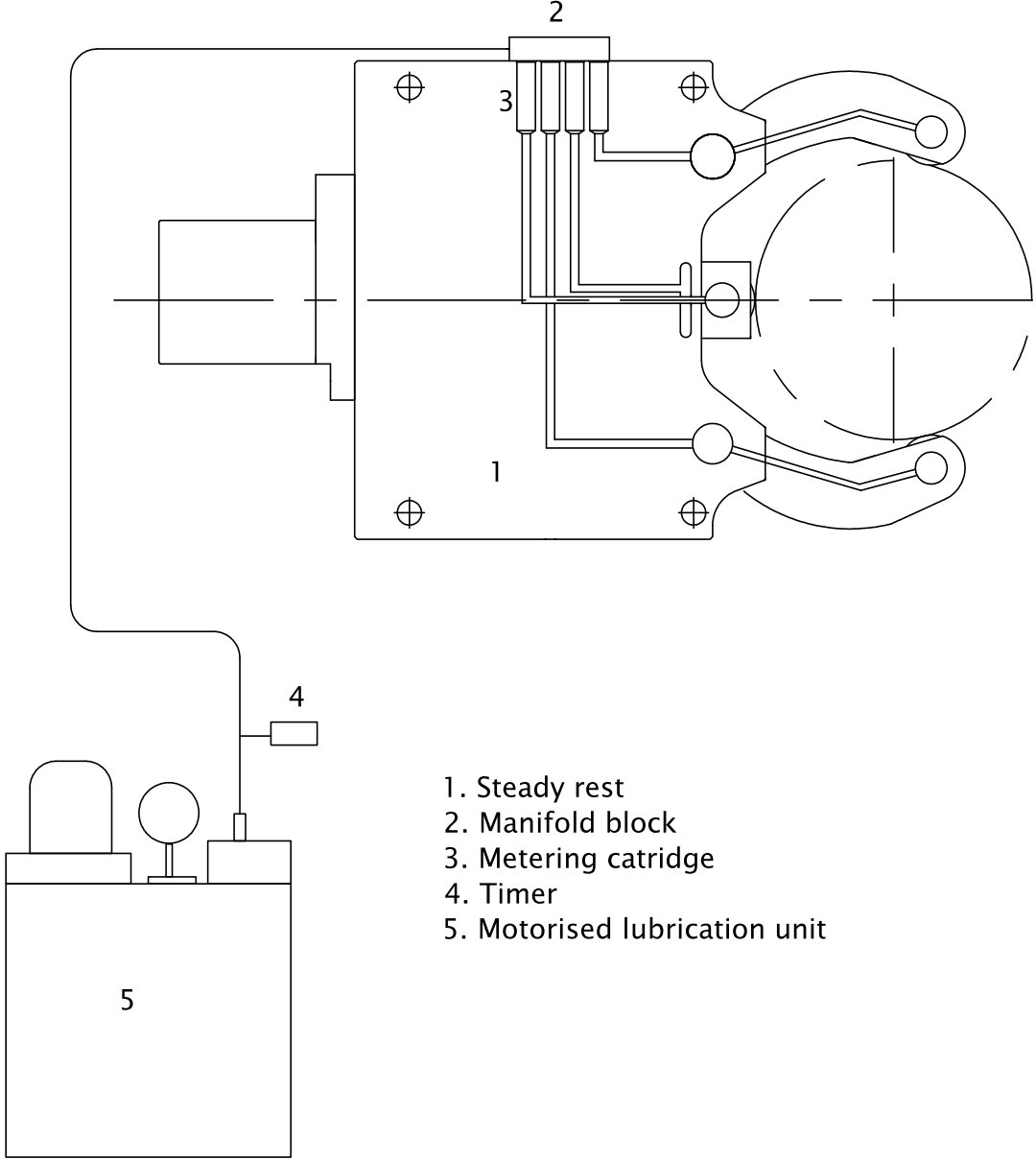
Recommended grade of lubrication oil: **SERVO WAY 68**



The guarantee does not cover the damages caused to the KEL self centering Steady Rest if the lubrication is not adapted as per the instructions.

Centralised Lubrication Circuit

Fig. 11



4.2 STEADY ROLLERS

- Standard Steady Rests are equipped with high accuracy roller bearing assemblies which are sealed laterally. These rollers are spherical ($R = 500$) for tapered workpieces so as to avoid a wide surface contact and to reduce the marking of the workpiece.
- Frequent lubrication of the steady rollers is essential for the long and trouble free operation of these rollers. (More details regarding lubrication is given in Section 6 of this manual.)
- The KEL self centering Steady Rests have been designed and developed to suit the modern compact CNC Lathes, where space is at a premium. Steady Rests can be offered with the cylinder mounted on the side of the steady housing instead of at the back, (if required) to save space.



All bearings need to be run-in carefully to prolong their life and accuracy. During the running-in period it is essential that maximum pressure and speeds should not be used.



While lubricating the rollers with grease or with some impulses of oil that should exude from the rollers.



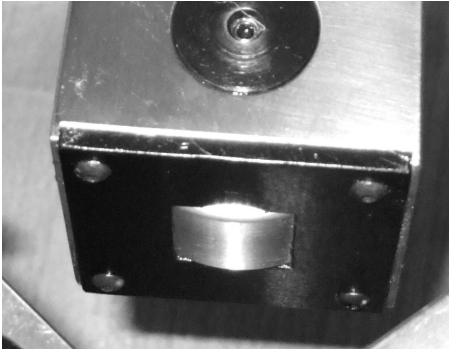
Do not use the steady rollers on rolled or similar unfinished workpieces.



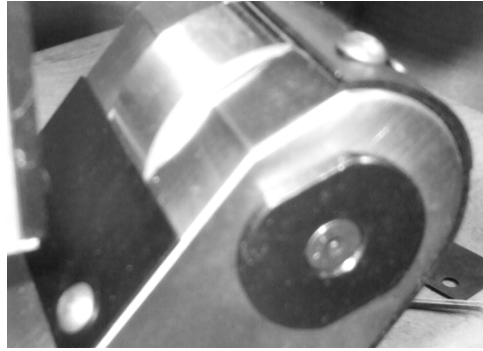
Ensure the swarf protection for the rollers.

4.3 SWARF PROTECTION FOR THE STEADY REST

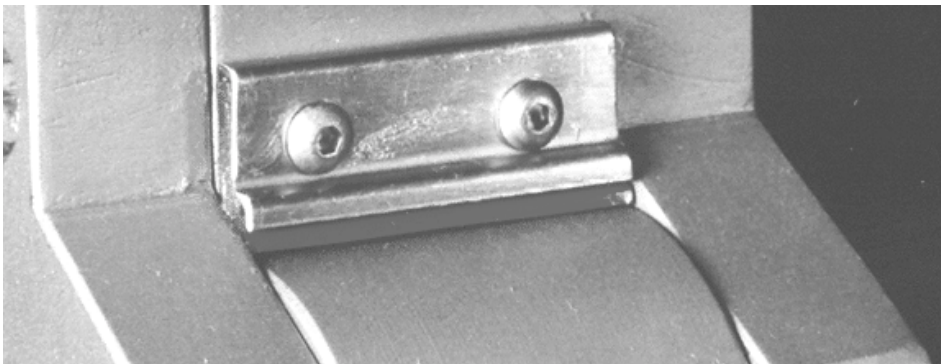
It is recommended that the Steady Rest should be protected from the swarfs during the machining operation. If swarf falls on the roller clamping area it could be picked up by the roller and ground into the surface of the workpiece. The result could be a broken tool or unsatisfactory surface finish on the workpiece. The KEL self centering Steady Rest is provided with a 3-piece swarf guard for the rollers of the arms and a roller stripper for the cam lever. Wipers are also provided to wipe-out the swarf on the pivot arms area.



Swarf guard for middle arm
Fig. 12



3 piece swarf guard for arms
Fig. 13



Wiper for arms
Fig. 14



The middle arm swarf guard is factory set and does not have to be adjusted.



The swarf guard has to be adjusted with respect to the job diameter for proper swarf guarding.



The 3-piece swarf guard is consumables and should be replaced when damaged.

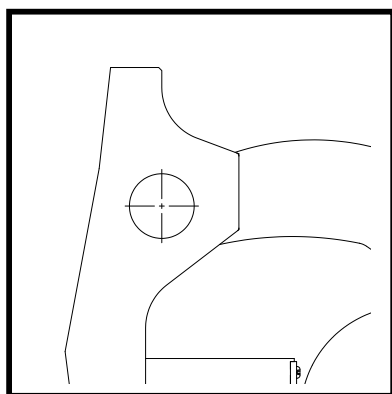


Fig. 15
3-piece swarf guard arrangement and component

4.4 COMPRESSED AIR CONNECTION

Corrosive and contaminating substances may enter into the main body during operations. The KEL self centering Steady Rest is provided with a connection for compressed air. The compressed air produces pressure inside the Steady Rest and excludes the small area between the arms and wiper, and removes the coolant and other substances.

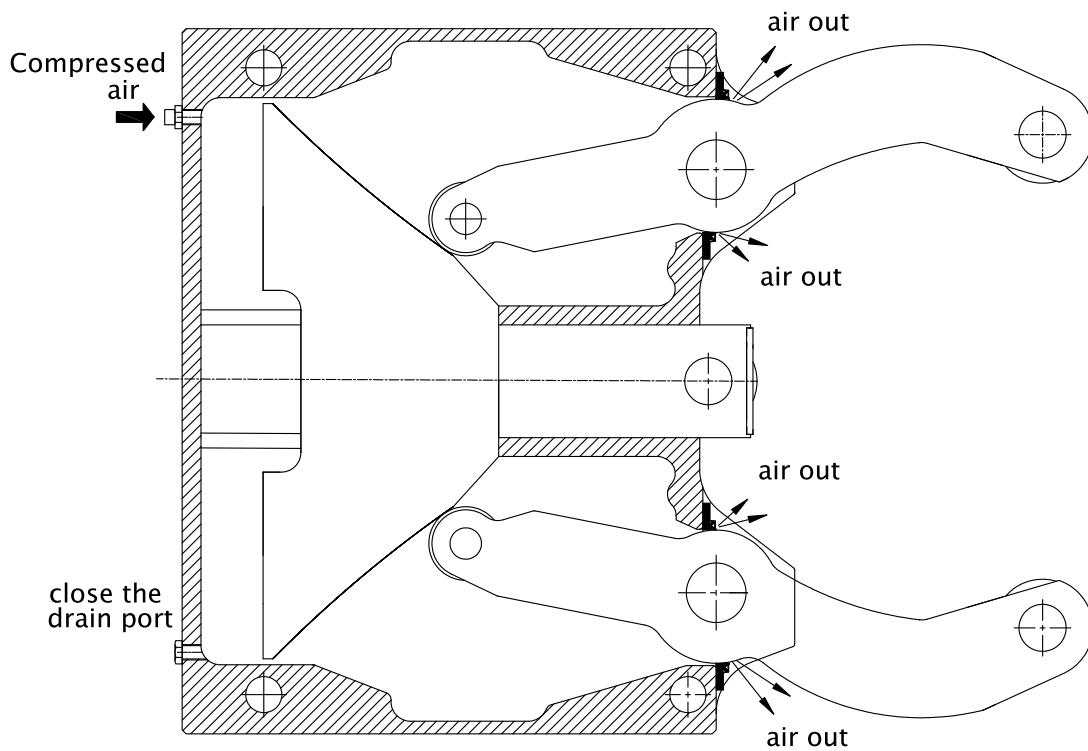


Fig. 16



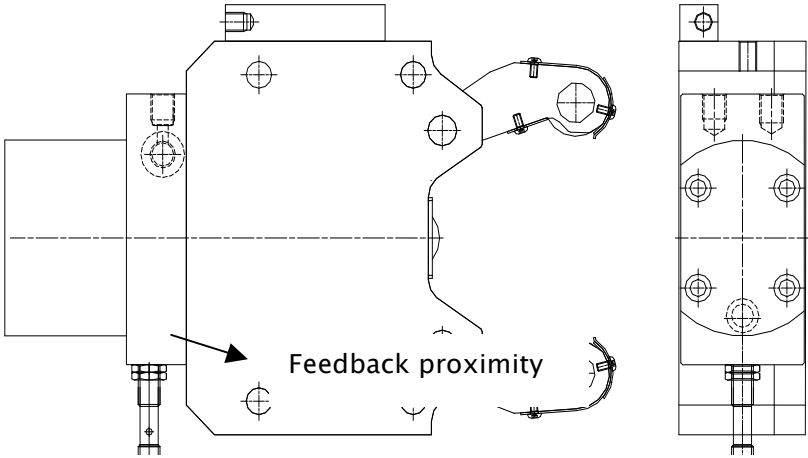
Plug the drain port only while compressed air supplied to the steady.



Required pressure of compressed air: 0.5 to 1.5 bar.

4.5 FEEDBACK SYSTEM

The KEL self centering Steady Rest is equipped with a feedback system for the opening signal. This is achieved via a limit switch integrated in the actuating cylinder cover.



Feedback
proximity

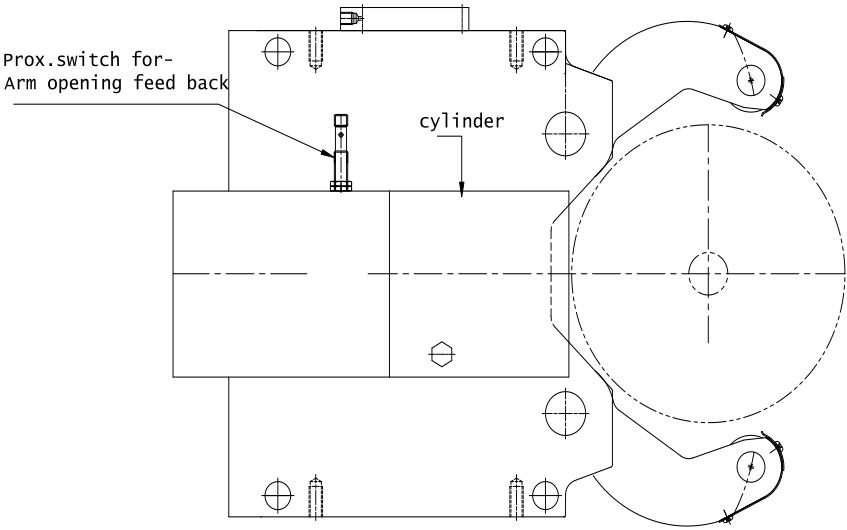


Fig. 17
Feedback proximity arrangement for rear mounted and side mounted steadies

4.6 SAFETY VALVE

The actuating cylinder of the KEL self centering Steady Rest is provided with an integral safety valve. In case of an unexpected fall in pressure or a leakage in the hose during the operation, the workpiece remains fully supported.

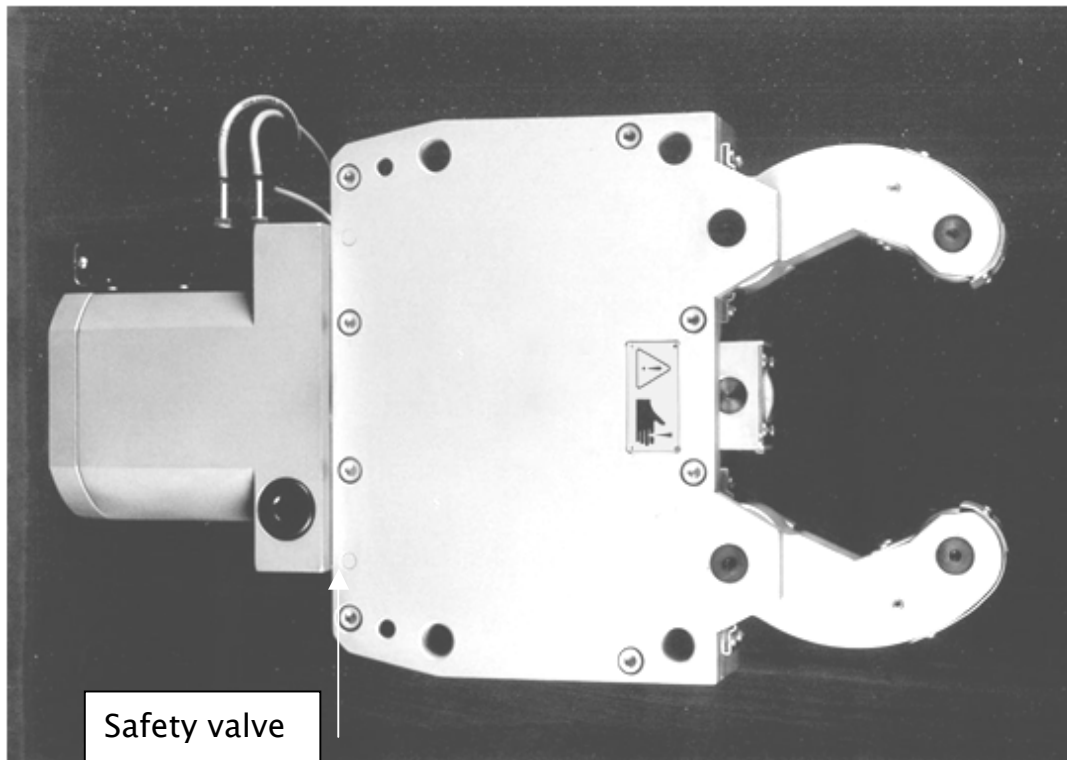


Fig. 18
The safety valve system with FRU Steady



The safety valve should not be dismissed or tampered with.
The guarantee does not cover damages to the Steady Rest if the safety valve is dismissed or tampered with.

5. BRACKET FOR STEADY MOUNTING

5.1 BRACKETS

The trouble free operation of the KEL Steady Rest depends to a large extent on it being rigidly and accurately mounted on to the machine tool.

The basic conceptual design of the Steady Rest mounting brackets for flat and slant bed lathes are shown in Fig. 19 and Fig. 20 respectively. The brackets should have a wall thickness of between 40 to 50mm and have supporting webs for strength of the upright section. The Steady Rest can be mounted on the left or right hand side.

The design of the bracket is determined by the size of the Steady Rest and prevailing conditions:

- Space available on the machine.
- Centre height of the machine tool
- Shape of the machine bed (if the Steady Rest is to be used for fixed application).
- Relative position of the cutting tool (cutting forces must always act on the middle roller).

After the mounting bracket has been firmly mounted on the bed guide way or on the tool side and checked for accuracy, the Steady Rest is attached to the bracket with four fixing screws.



Care must be taken that the steady sits with its housing and not with its cover against the bracket.



The Steady Rest has to be realigned each time the operating pressure is changed.

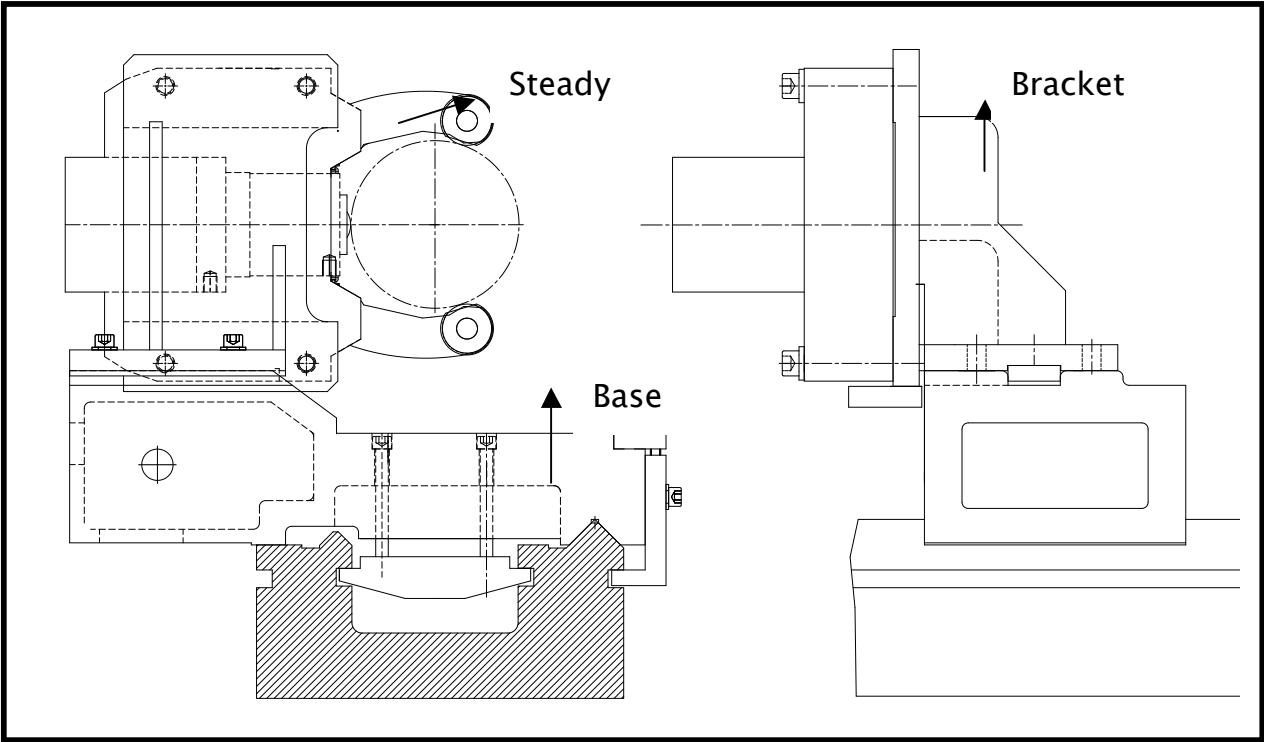
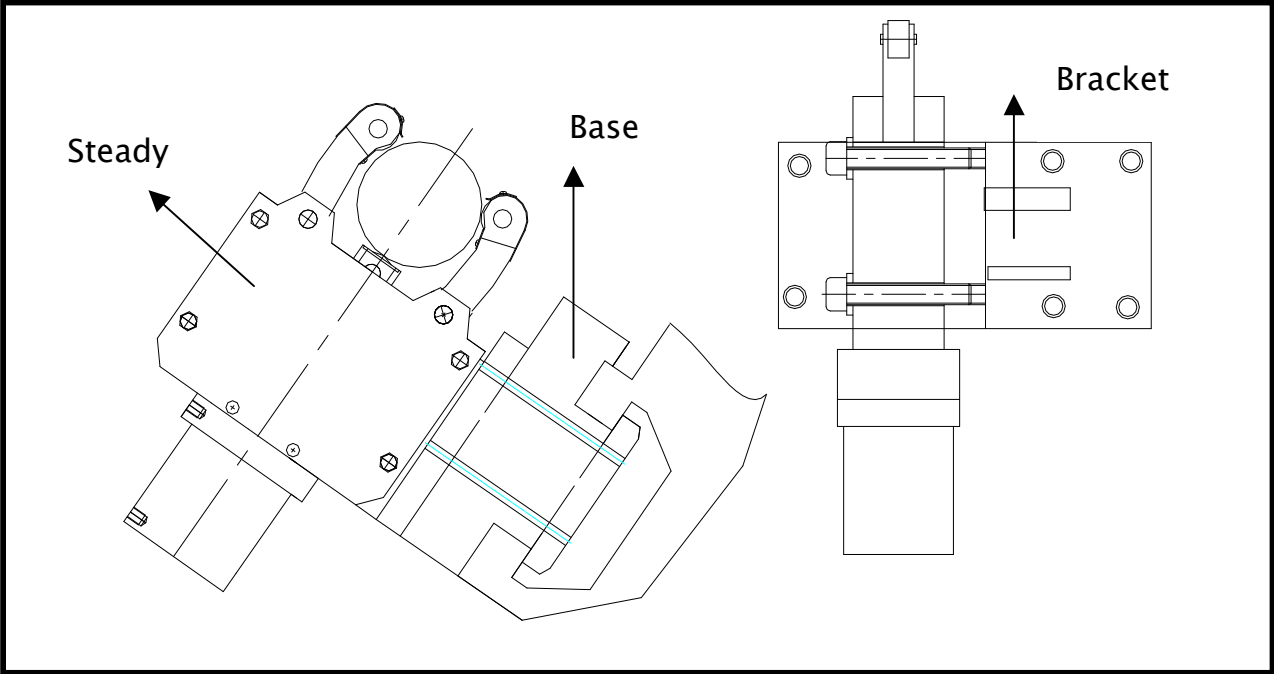


Fig. 19
Mounting of steady on flat bed lathe



Mounting of steady on slant bed lathe
Fig. 20

5.2 ALIGNMENT PROCEDURE FOR THE STEADY REST

The steady must be aligned accurately to the machine spindle axis. The performance of the Steady Rest depends entirely on how accurately it is aligned. The following steps may be taken to align the Steady Rest;

- Clamp the test mandrel between centres (the bar should be a hardened and ground shaft).
- Check the test bar in both the planes. To achieve the best accuracy, the diameter of the rest bar must match that of the workpiece exactly.
- Place two dial gauges with a reading accuracy of 0.01mm as shown in Fig. 21 against the test bar and set to 0.
- Loosen the four fixing screws on the Steady Rest mounting bracket a little so that the Steady Rest is held only friction tight.
- Extra alignment aids may be required for Steady Rests of more than 200mm diameter range.
- Close the Steady Rest on the test bar.
- Check the readings of the dial gauges to see whether the test bar has been shifted from the centre line. If it has, the Steady Rest must be moved by hand or by the alignment aid until the dial gauges once again read 0.
- Retighten the fixing screws and observe the dial gauges to check that the pointers stay at 0.
- Loosen the fixing screws of the Steady Rest and close it on the test bar once more.

- Check the dial gauges to see whether the test bar has stayed in position. If the pointers move, the aligning operation must be repeated.
- Open the Steady Rest; remove the two dial gauges and the test bar.
- The Steady Rest is now aligned.

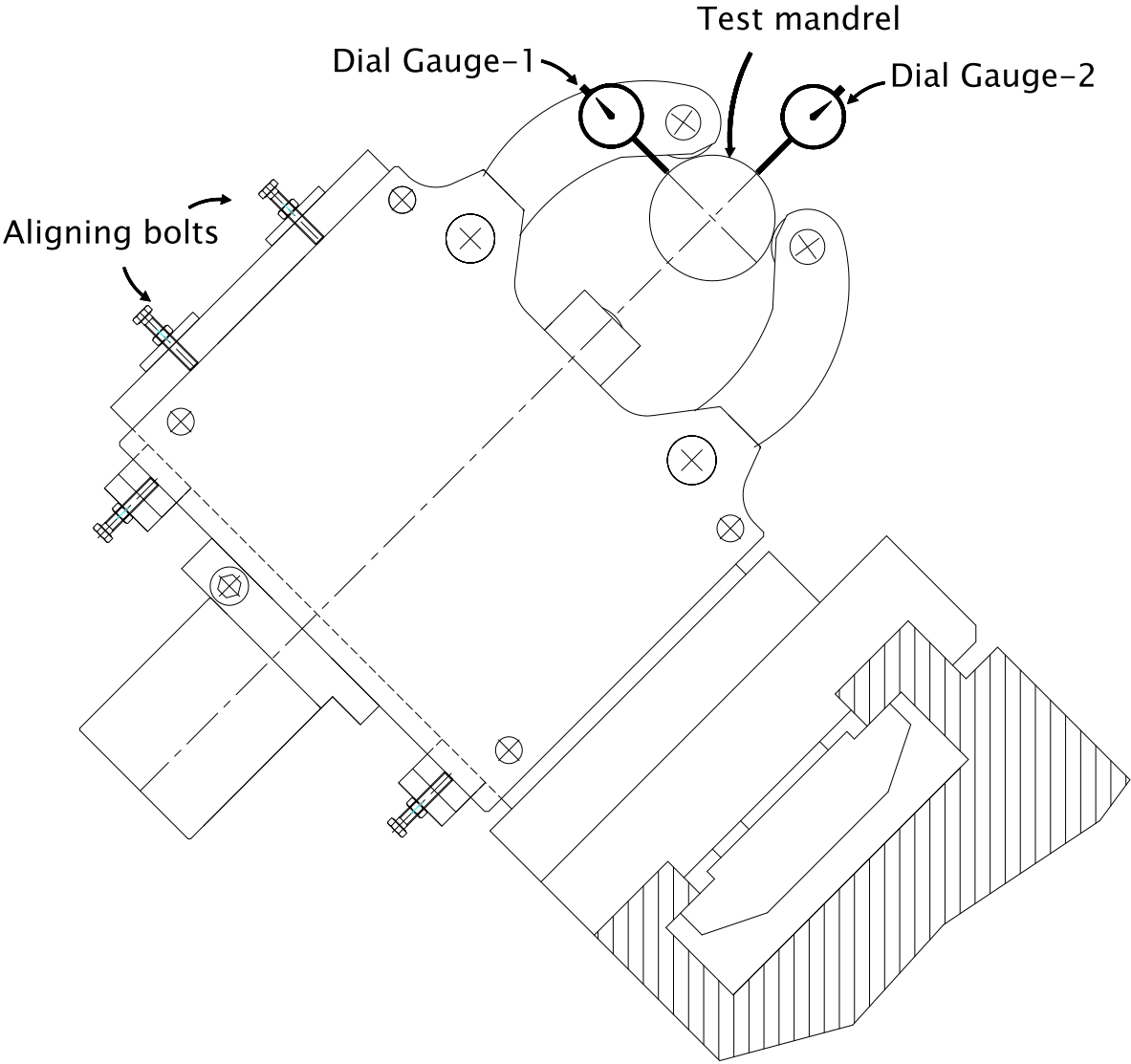


Fig. 21

6. AUXILIARY PROCEDURES

1. Roller changing
2. Grease packing
3. Swarf guard adjusting
4. Seal changing

6.1 ROLLER CHANGING PROCEDURE

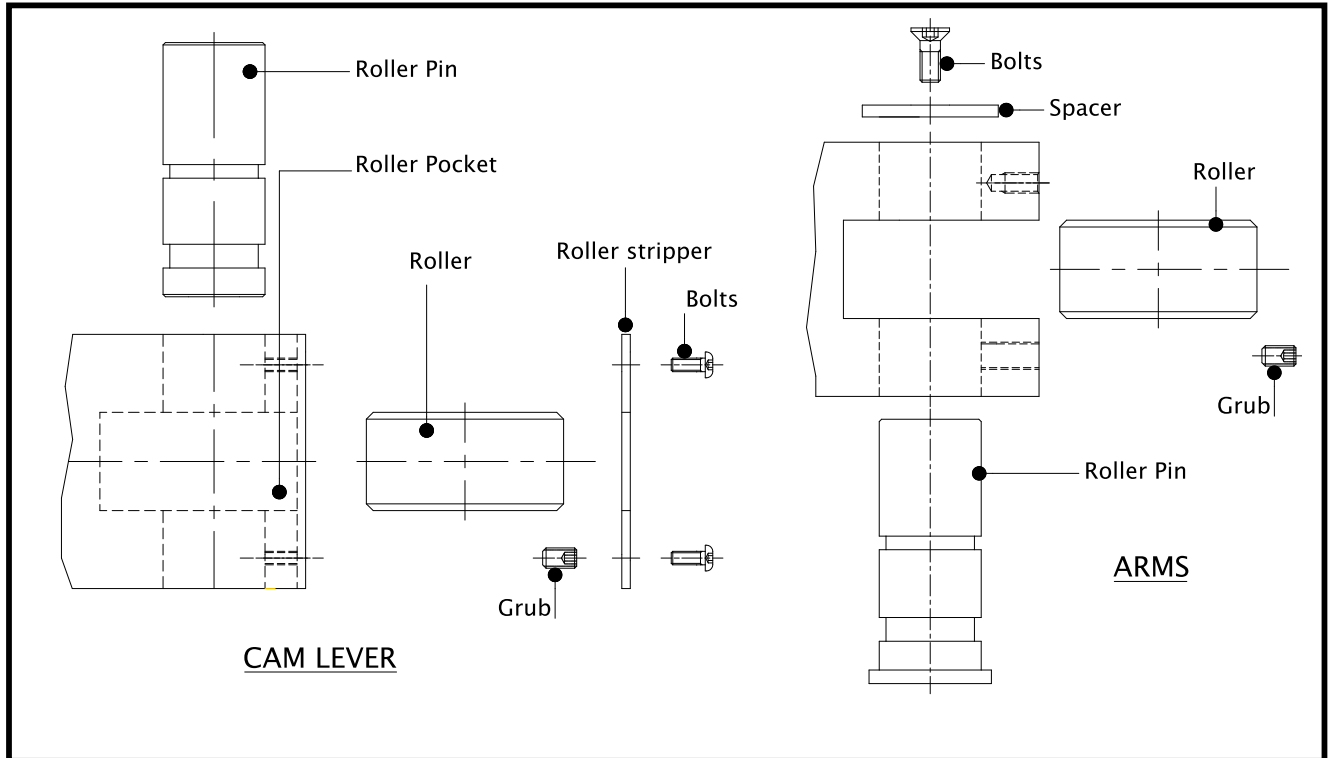


Fig. 23

FOR CAM LEVER

1. Remove the four bolts on the roller stripper.
2. Remove the roller stripper.
3. Remove the grub screw at the bottom side of the cam lever.
4. Push the roller pin from the top and remove it.
5. Remove the roller.

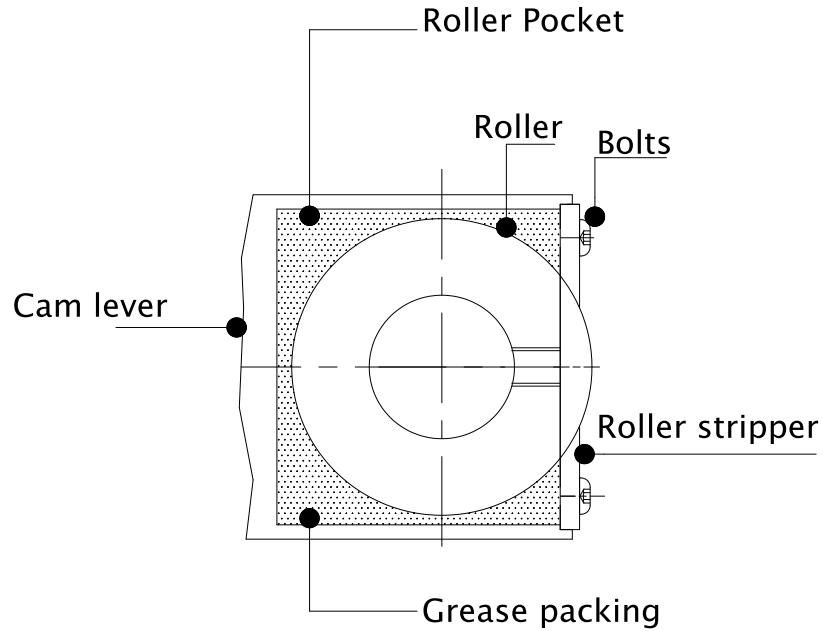
FOR ARMS

1. Remove the swarf guard.
2. Remove the grub screw at the bottom side of the arm.
3. Remove the bolts on the spacer for the roller pin.
4. Remove the spacer.
5. Push the roller pin from the arm and remove it.
6. Remove the roller.



Hammering on roller pin is not allowed.

6.2 GREASE PACKING



1. Remove the 4 bolts.
2. Remove the roller stripper.
3. Fill the roller pocket with grease.
4. Replace the roller stripper and bolt to the cam lever.



Replace grease once a year, or while changing the roller.



Use **SERVO JEM RR3** grease.

6.3 SWARF GUARD ADJUSTING

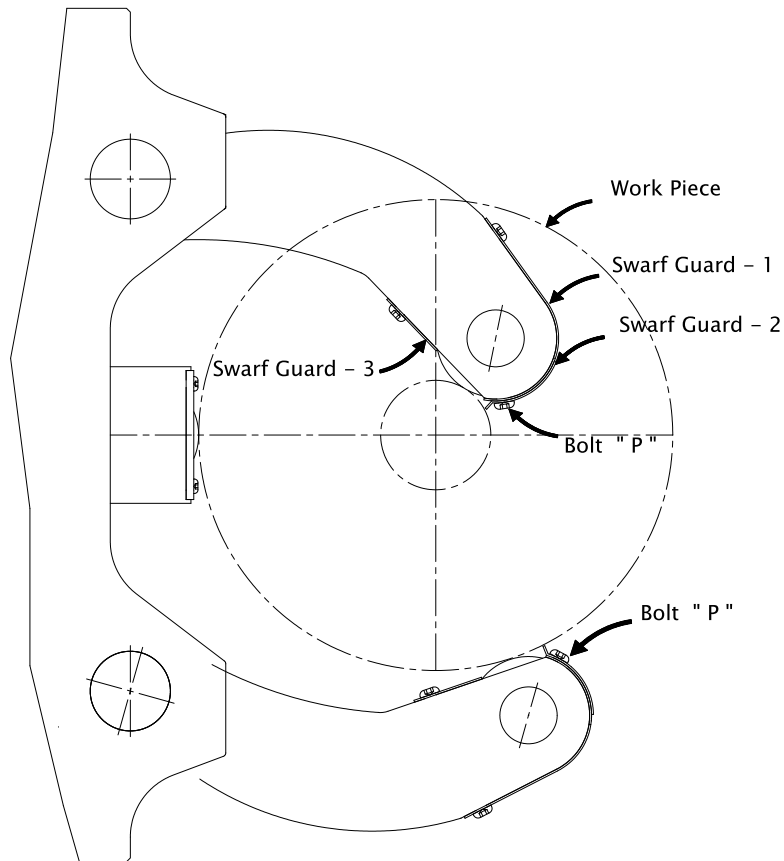


Fig. 25

1. Loosen the bolt P.
2. Adjust the swarf guard 2 to maintain a minimum gap of 0.2 mm with the component.
3. Tighten the bolt P.



Steady should not operate with 3 piece swarf guard below $\varnothing 16$ mm clamping for small range models.



6.4 SEAL CHANGING

Replace the swarf guard no 2 if it is worn out.

PISTON SEAL

1. Loosen the bolts "A" (4 nos) and remove the cylinder.
2. Unfold the locking washer.
3. Loosen the lock nut.
4. Remove the locking washer.
5. Remove the piston.
6. Remove the piston seal and O-Ring.
7. Replace the O-Ring to the groove.
8. Load the piston seal using the taper loading mandrel and pusher.
9. Size the Glyd ring using the sizing ring by pressing gently.
10. Replace the piston on the piston rod and tighten using locking washer and lock nut.
11. Replace the cylinder and bolt it to the end cover.

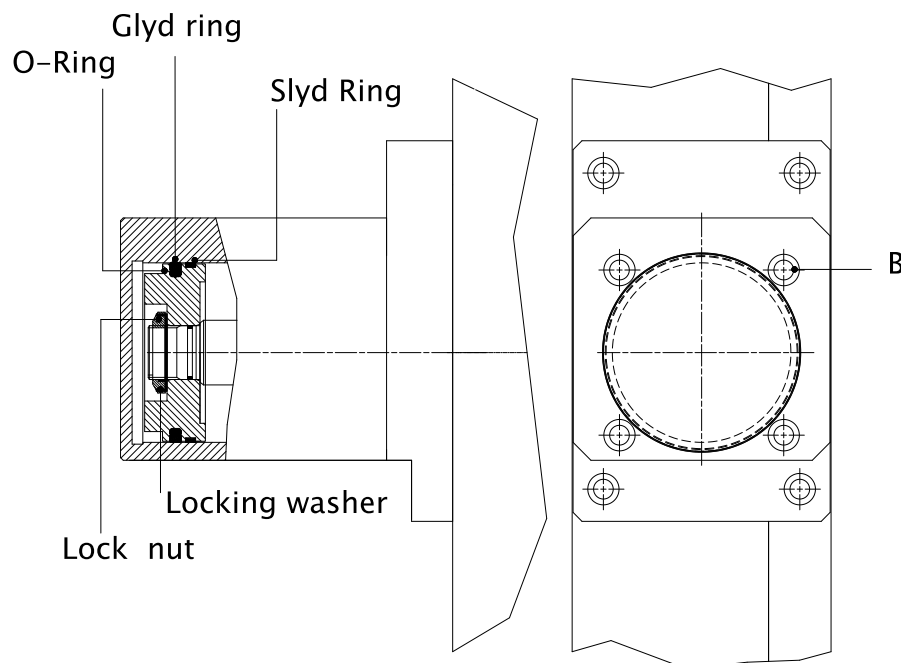


Fig. 26

Fig. 27
SEAL LOADING PROCEDURE

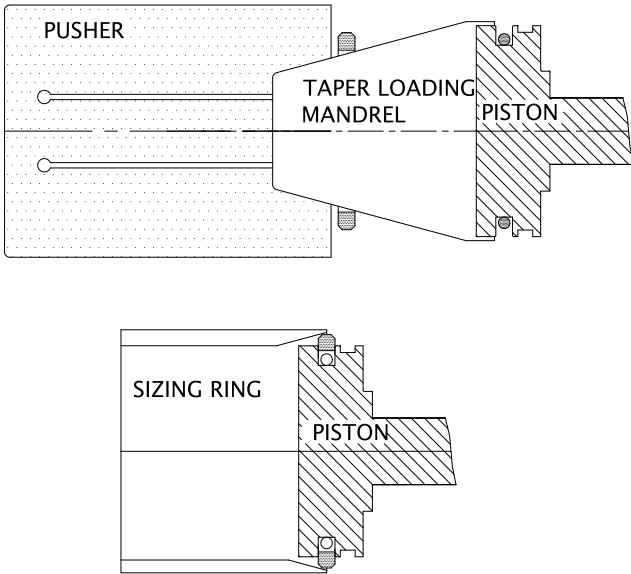
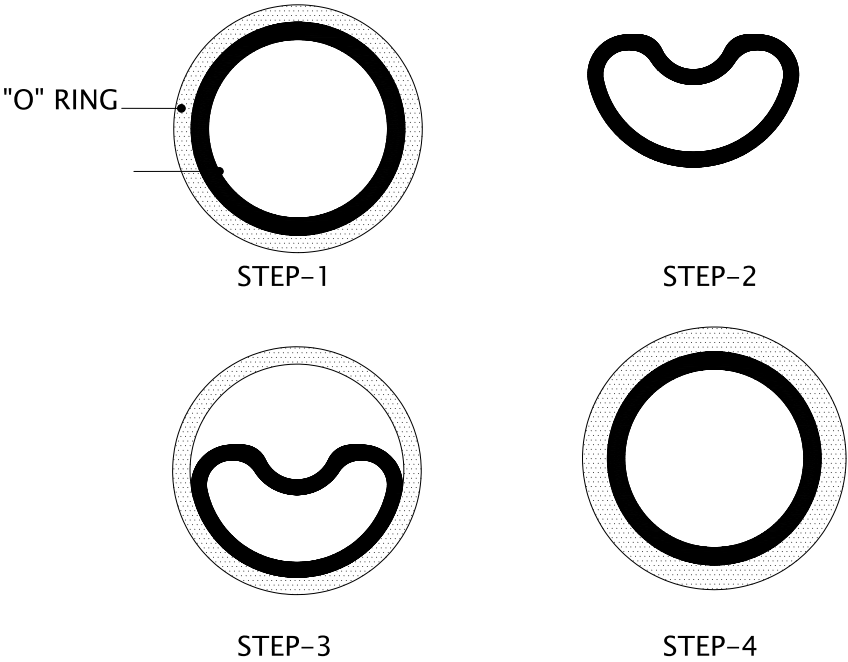


Fig. 28
INTERNAL SEAL ASSEMBLING PROCEDURE



- Step -1:** Teflon seal with O-Ring in Free State.
- Step-2:** Insert the o ring in the groove. Bend the Teflon seal as shown, avoiding sharp corners
- Step -2:** Insert the folded seal in the groove on top of the O-Ring and press gently and firmly to draw the seal into the place.
- Step-4:** Position of the seal after installation

GENERAL INSTRUCTIONS FOR INSTALLATION OF SEALS

1. Check the groove dimensions before seal assembly.
2. Cylinder and piston rod to be chamfered with a 15° chamfer for easy entry.
3. All sharp edges to be round off.
4. Any dust particles, splinters and other foreign particles to be removed carefully and grooves to be cleaned thoroughly.
5. Tools with sharp edges should not be used for assembly of the seals. Use only plastic tools.
6. Cylinder piston rod and seals must be oiled before assembly.
7. Always assemble Teflon seals with care to avoid nicks and scratches on the sealing surface.

8. Keep tools and seals clean as contamination will cause leakage.
9. In case of closed grooves configuration loading tools are recommended for easy and accurate assembly.

7. TROUBLE SHOOTING

Steady not clamping / unclamping:

- Check system pressure
- Check hose pipe, joints for leakage
- Check solenoid valve
- Check all electrical connections

No Lubrication of rollers:

- If lubrication is not reaching any of the rollers, check following.
- Check oil level in oil sump
- Check functioning of timer and solenoid valve in lubrication circuit.
- Check if system pressure is normal
- Disconnect the inlet to distributor block and check if oil is flowing out.

Damaged work piece, poor surface finish, variation in dimensions:

- Check surface of rollers
- If chip breakage is not proper, they get in between roller and work piece and damage roller and work piece.
- Replace rollers if damaged
- Check cutting tool
- Check system pressure
- Check all rollers are in contact with component.
- Check alignment of steady
- Check all bolts that clamp the steady on the bracket on to machine.

