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DRUMMOND MICROINJECTION APPARATUS

THE OOCYTE PIPET	3-00-510-X
NANOJECT	3-00-203-X
NANOJECT, VARIABLE	3-00-203-XV

Several years ago, Drummond became aware, to our surprise, that our *Digital 10 UL Microdispenser* had become the instrument of choice for *Xenopus Oocyte* injection. We have subsequently modified this device in order to enhance its suitability to this technique. Despite subsequent developments, it remains an excellent choice, particularly for scientists just entering this field.

As we acquired experience in this technique, two facts became apparent. Vibration (tip movement) of any sort was unacceptable, and most injection volumes were at approximately 50 nanoliters. Any further improvements to our *Digital Microdispenser (510X)* seemed uneconomical, which prompted a complete redesign.

Drummond now offers two automatic, remotely controlled injectors. Both eliminate vibration by using a stepping motor drive, and both will inject 46 nanoliters on command. The original, and less expensive unit, the "*Nanoject*" can be adapted to lesser or greater volumes by supplying a custom chip. The new "*Nanoject Variable*", as delivered, will provide volumes from 4.6 to 73.6 nanoliters in 16 steps, which are changed at will.

All of the above equipment is supplied ready to use with raw glass capillaries for pulling tips. All require backfilling with oil (or other liquid). Reasonable spare parts are provided. All units are compatible with most micromanipulators, requiring approximately .4" (1 cm) "V" clamp. Individual specifications follow.

DRUMMOND SCIENTIFIC COMPANY
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BROOMALL, PA 19008 U.S.A.

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02/91

**OPERATING INSTRUCTIONS
DRUMMOND "NANOJECT" AUTOMATIC INJECTOR
CATALOG NUMBER 3-00-203-X**

This equipment is ready for use as received; it does require a 110 volt, 60 hertz outlet and pulled capillary tips.

CONTENTS: Each unit includes the following components:

- a. Injector head with cord.
- b. Control box.
- c. Power supply with cord.
- d. 1 vial 3 1/2" capillaries. Catalog #3-00-203-G/X
- e. 1 vial 7" capillaries. Catalog #3-00-203-G/XL
- f. 1 replacement "O" ring kit. Catalog #3-00-002-K3
- g. 1 Allen wrench.
- h. 1 3 1/2" needle. Catalog #3-00-027

OPERATION: The injector head should be mounted in a micromanipulator. Brinkman model MM-33 is suitable. The aluminum barrel assembly, maximum O.D. 11 mm, provides an ideal clamping surface.

Pulled capillary tips must be backfilled with oil (or other non-compressible fluid) before attachment on injector. Silicone or mineral oil as well as water are commonly used. Backfilling is facilitated by using a 26 G needle, 3" long; i.e., disposable spinal needle.

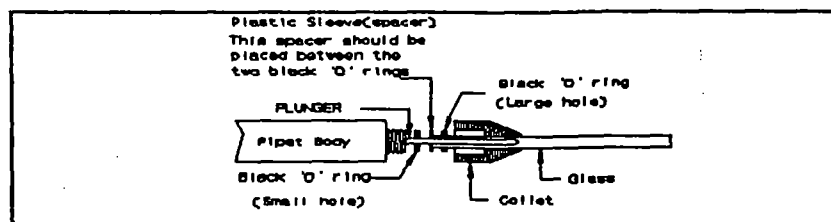
The "Nanoject" will not operate properly without oil!

The three control switches work as follows:

- FILL:** Reverses plunger movement while button is depressed. Buzzer will sound at extreme fill position.
- EMPTY:** Plunger moves forward while button is depressed. Buzzer will sound at extreme position. Empty speed is approximately twice as rapid as fill; i.e. 46 nanoliters/sec.
- INJECT:** Depressing button injects 46 nanoliters of solution. Releasing button unlocks system for next injection.

SERVICE: Gaskets, holding and sealing capillary tips, need periodic replacement. The plunger wire can be replaced if accidentally bent. This wire is held in place by two set screws. Access by removing the black aluminum barrel (turn counter-clockwise). Do not remove the adjacent large black nut.

NOTES: Through chip substitution other "inject" volumes can be provided. Add-on chips are available in any multiple of 4.6 nanoliters, and are identified by Catalog #3-00-023 (plus volume desired). A 3.5mm jack is provided to connect footswitch (Catalog #3-00-026) or other remote control.



Note: Plastic sleeve (spacer) should be positioned with "shelf" facing pipet tip.

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R-1: 04/91

OPERATING INSTRUCTIONS
DRUMMOND "NANOJECT VARIABLE" AUTOMATIC INJECTOR
CATALOG NUMBER 3-00-203-XV

This equipment is ready for use as received; it does require a 110 volt, 60 hertz outlet and pulled capillary tips.

CONTENTS: Each unit includes the following components:

- a. Injector head with cord.
- b. Control box.
- c. Power supply with cord.
- d. 1 vial 3 1/2" capillaries. Catalog #3-00-203-G/X
- e. 1 vial 7" capillaries. Catalog #3-00-203-G/XL
- f. 1 replacement "O" ring kit. Catalog #3-00-002-K3
- g. 1 Allen wrench.
- h. 1 3 1/2" needle. Catalog #3-00-027

OPERATION: The injector head should be mounted in a micromanipulator. Brinkman model MM-33 is suitable. The aluminum barrel assembly, maximum O.D. 11 mm, provides an ideal clamping surface.

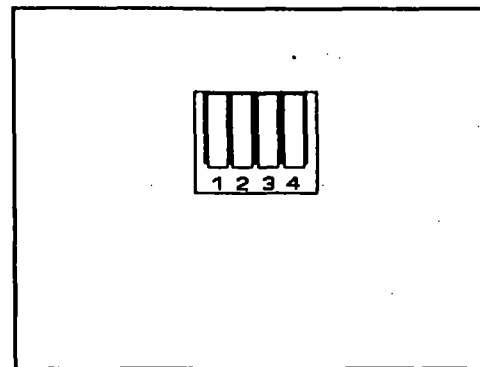
Pulled capillary tips must be backfilled with oil (or other non-compressible fluid) before attachment on injector. Silicone or mineral oil as well as water are commonly used. Backfilling is facilitated by using a 26 G needle, 3" long; i.e., disposable spinal needle. The "Nanoject" will not operate properly without oil!

The three control switches work as follows:

- FILL:** Reverses plunger movement while button is depressed.
Buzzer will sound at extreme fill position.
- EMPTY:** Plunger moves forward while button is depressed.
Buzzer will sound at extreme position. Empty speed is approximately twice as rapid as fill; i.e. 46 nanoliters/sec.
- INJECT:** Depressing button injects 46 nanoliters of solution.
Releasing button unlocks system for next injection.

Dip Switch: Located on side of control box. The following "code" permits the operator to select any of the following 16 volumes.

VOLUME	1	2	3	4
4.6nl.	D	D	D	D
9.2nl.	U	D	D	D
13.8nl.	D	U	D	D
18.4nl.	U	U	D	D
23.0nl.	D	D	U	D
27.6nl.	U	D	U	D
32.2nl.	D	U	U	D
36.8nl.	U	U	U	D
41.4nl.	D	D	D	U
46.0nl.	U	D	D	U
50.6nl.	D	U	D	U
55.2nl.	U	U	D	U
59.8nl.	D	D	U	U
64.4nl.	U	D	U	U
69.0nl.	D	U	U	U
73.6nl.	U	U	U	U



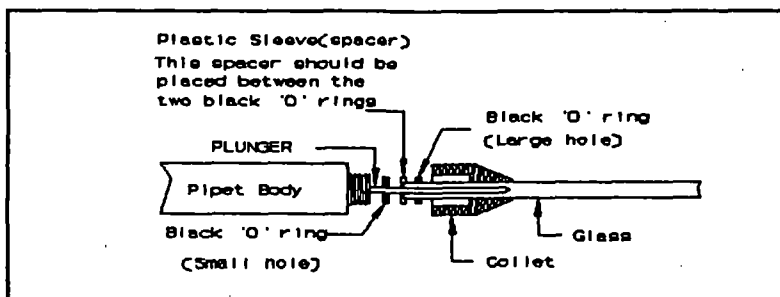
DIP SWITCH

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OPERATING INSTRUCTIONS
DRUMMOND "NANOJECT VARIABLE" AUTOMATIC INJECTOR
CATALOG NUMBER 3-00-203-XV
(cont'd)

- SERVICE:** Gaskets, holding and sealing capillary tips, need periodic replacement. The plunger wire can be replaced if accidentally bent. This wire is held in place by two set screws. Access by removing the black aluminum barrel (turn counter-clockwise). Do not remove the adjacent large black nut.
- NOTES:** This unit is provided with a 3.5mm jack to allow footswitch (Catalog #3-00-026) or other remote control to be connected.



Note: Plastic sleeve (spacer) should be positioned with "shelf" facing pipet tip.

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**DRUMMOND MICROINJECTION APPARATUS
INDIVIDUAL SPECIFICATIONS**

	OOCYTE MICRODISPENSER 3-00-510-X	NANOJECT 3-00-203-X	NANOJECT VARIABLE 3-00-203-XV
OPERATION	Manual	Automatic	Automatic
WEIGHT	2 oz.	3.5 oz.	3.5 oz.
GLASS-PROPERTIES	N-51-A Borosilicate Softening point 780°C	N-51-A Borosilicate Softening point 780°C	N-51-A Borosilicate Softening point 780°C
GLASS-DIMENSIONS	O.D. .047" (1.17mm) I.D. .0274" (.68mm)	O.D. .040" (1.0mm) I.D. .020" (.5mm)	O.D. .040" (1.0mm) I.D. .020" (.5mm)
INJECTION SPEED	Manual	23 nanoliters/sec.	23 nanoliters/sec.
FILL SPEED	Manual	23 nanoliters/sec.	23 nanoliters/sec.
EMPTY SPEED	Manual	46 nanoliters/sec.	46 nanoliters/sec.
VOLUME RANGE	30 nanoliters to 10 UL	46 nanoliters Fixed	4.6 - 73.6 nanoliters
SMALLEST VOLUME	30 nanoliters	46 nanoliters	4.6 nanoliters
TO CHANGE VOLUME	Manual	Special chip	Set switch
VOLUMES GREATER THAN 100 NANOLITERS	Yes	Yes Special chip	Yes Special chip
PRICE	\$178.50	\$495.00	\$695.00

NOTE: Footswitch, Catalog #3-00-026, available as accessory for automatic injectors.

Special Needle for backfilling pulled capillaries available, Catalog #3-00-027, 26 Gauge x 3½ long

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**DRUMMOND MICROINJECTION APPARATUS
PARTS PRICE LIST**

**MANUAL INJECTOR
3-00-510-X**

**NANOJECT + VARIABLE
3-00-203-X + XV**

	<u>CATALOG #</u>	<u>PRICE</u>	<u>UNIT SIZE</u>	<u>CATALOG #</u>	<u>PRICE</u>	<u>UNIT SIZE</u>
REPLACEMENT GLASS 3.5"	3-00-210-G	\$ 9.98	Vial/100	3-00-203-G/X	\$ 9.98	Vial/100
REPLACEMENT GLASS 8"	3-00-210-G-8	13.23	Vial/100	N/A		
REPLACEMENT GLASS 7"	N/A			3-00-203-G/XL	13.23	Vial/100
"O" RING KIT	3-00-002-1	.68	Each	3-00-002-K3	3.31	Kit
REPLACEMENT PLUNGER	3-00-000-210-X	3.94	Each	3-00-000-203-X	3.94	Each
26G/3½" NEEDLE	3-00-027	5.00	Each	3-00-027	5.00	Each
SPECIAL "CHIP"	N/A			3-00-023	35.00	Each
FOOTSWITCH	N/A			3-00-026	50.00	Each

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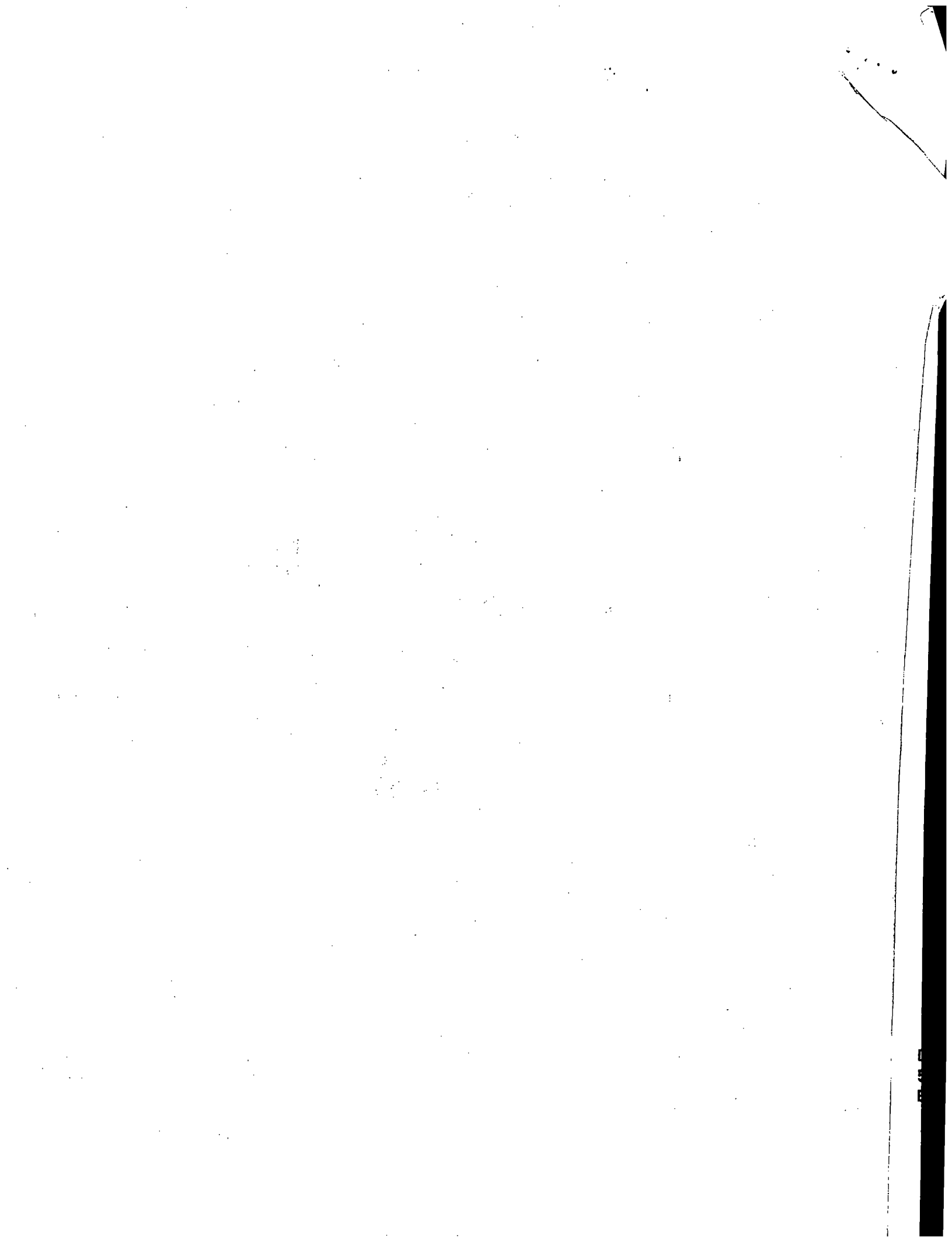
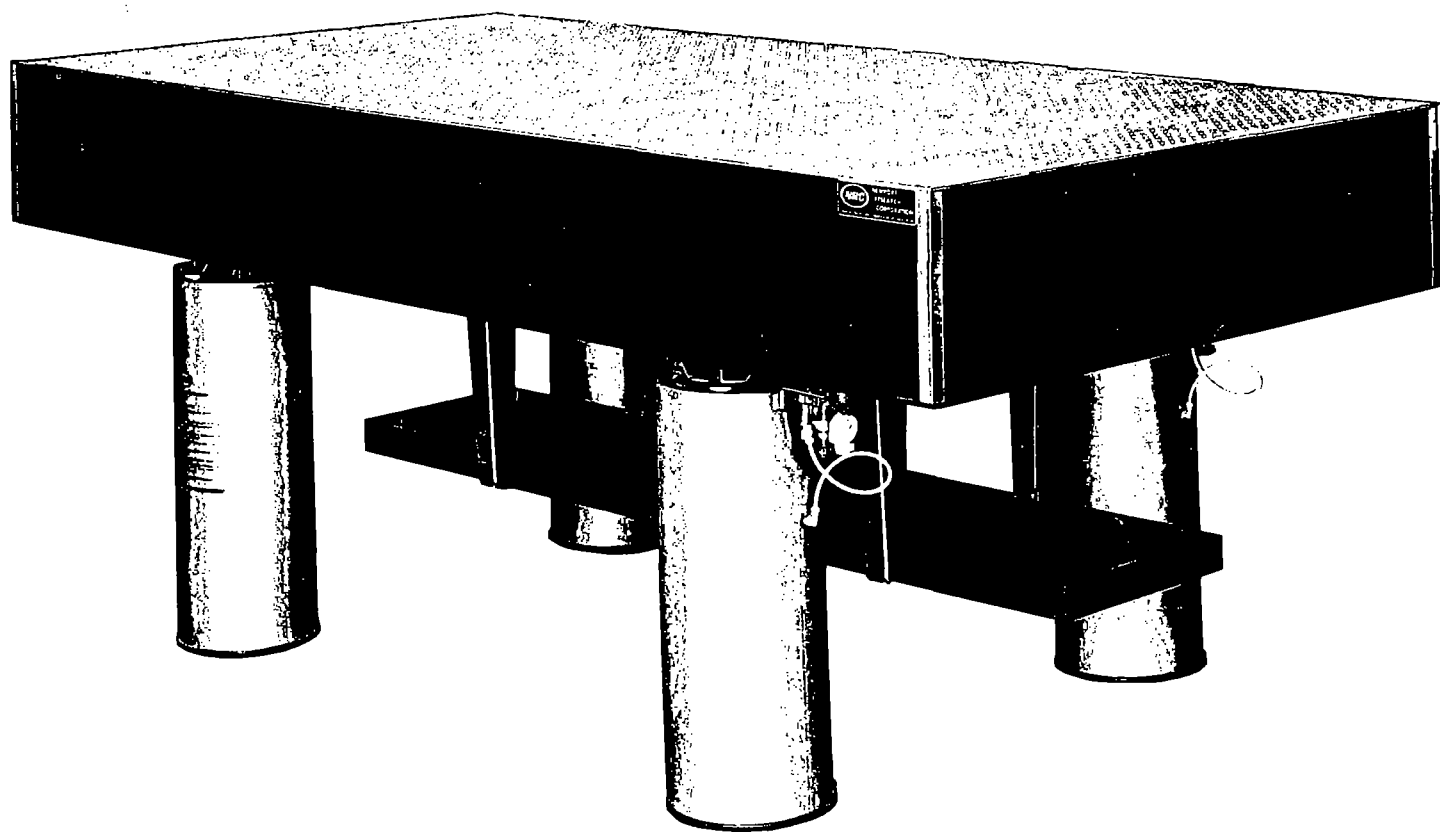


TABLE SYSTEM INSTRUCTION MANUAL



 **Newport**

Check for Shipping Damage

Damage does occur occasionally. **Before** beginning assembly, please check carefully for any damage that may have occurred in transit. If there is any damage, please CALL NEWPORT IMMEDIATELY.

Oil from the air mounts indicates the crate was tipped over. Please refer to the troubleshooting section on page 7

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Telex 685535
P/N 4086 Rev.A
IN-03862

Table System Instruction Manual

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General Information

Safety Considerations

The table top is attached to the air mounts by ¼-20 screws for positioning purposes only. Given enough force, such as in the case of a major earthquake, it is possible to push the table top over. While the likelihood of this happening is small, you may wish to install stands permanently affixed to the floor. The isolation performance is not affected so long as these stands do not touch the table top while the table is floating.

Electrically, the table top is equivalent to a metallic conductive plate. Proper consideration should be given to electrical grounding.

If your load has a high center-of-mass, or is particularly heavy, the table top may oscillate. This problem is intrinsic with any spring-mass system. Please call Newport. The solutions are discussed in entry 15 of the installation instructions on page 5.

The maximum rated operating pressure of the air mounts is 100 psi (7.0 kg/cm²).

When the table is floating, keep fingers away from the area between the air mount and the bottom of the restraint plate.

Performance

The isolation system operates on the principle of air pistons, which are equivalent to soft springs. The main advantages of the Newport system, in comparison with other designs, are: low vertical resonant frequency with low Q; a horizontal decoupling system that offers effective isolation even for low amplitude vibrations; and a working surface that is rigid statically and yet has high internal damping for high dynamic rigidity.

Standard leveling valves control the height of the table nominally to ± 0.01 " (.3 mm) accuracy, which is adequate for most applications.

The total excursion of the table can also be reduced, please see entry 12 of the installation instruction on page 5.

How the system feels or performs can generally be adjusted to suit your personal preference. There are many parameters at our disposal. Please consult Newport personnel. It is important that you are satisfied with the way our products work.

Cleaning Procedure

The RS, KNS and MST Series table tops are made of 400 series ferromagnetic stainless steel. This stainless steel is relatively corrosion resistant and offers you the convenience of mounting with magnetic bases. After uncrating, spray a generous amount of household cleaner, such as "409" or "Fantastik" on the working surface so that some of the fluid drips into the mounting holes. After wiping down, repeat the process.

Unless you are operating in a particularly corrosive environment, an occasional wipedown with these cleaners will keep the table top attractive.

The protective epoxy coating of the black painted tops can also be cleaned the same way. Care must be exercised to remove all abrasive material before cleaning to avoid scratching the coated surface.

Mounting Holes

Polishing grits lodged in the mounting holes can only be cleaned by chasing each hole. This is effectively accomplished when you use a mounting hole for the first time by tightening a screw with the use of a screwdriver, or the ball driver provided.

All mounting holes are 1/4-20 unless specified. Metric series tables have M6 holes unless specified.

Handling

The table tops are heavy, with a typical 4'x8' (1.2m x 2.4m) table weighing about 1,100 pounds (500 kg). They can be moved relatively inexpensively by local "machinery movers" listed in the yellow pages of the phone book.

The table top should be moved separately from the air mounts.

Honeycomb table tops are good load bearing structures. Care, however, must be exercised **NOT to apply any force that effectively peels the skins away from the structure.** Also the decorative formica sides are not designed to support heavy loads.

The table top can be tipped on its sides onto a padded dolly to facilitate moving. However the edge of **both** skins must be supported at the same time.

Air Supply

The air supply should be connected during operation. Air is used only when the pressure is automatically adjusted to compensate for load changes. The air supply should be shut off at the end of a day or when there are extensive setup changes.

Use bottled nitrogen, or mechanically compressed air to operate the isolation system. The operating pressure is determined by the total load divided by the diaphragm area, and is typically in the 50 psi (3.5 kg/cm²) range. The maximum rated operating pressure is 100 psi (7.0 kg/cm²).

Air from a mechanical compressor generally contains water and dirt, which will cause the leveling valves to fail. Please use our Model ARF air regulator/filter, for maintenance free operation.

Do not use bottled carbon dioxide, since "icing" can occur during rapid filling of the air mounts.

Installation of Air Mounts

1. Position the air mounts according to Figure 1 and the size chart.
2. Attach the leveling valves to the brackets of the legs and tighten the hex-head bolt. Only three leveling valves are supplied for each system, because a plane is defined by three points. All valves are alternate and interchangeable. Turn all the metering valves off clockwise. (See Figure 2) The sensing arm on top of the valve is adjustable for orientation. It can be rotated to any position needed. There is some drag, but it will move. On each of the two valved corner legs opposite each other, point the arm directly at the nearest corner of the table. On the remaining valved leg, point the arm directly across the narrow part of the table at the opposing slave leg. (On a three leg system, this arm should point directly at the narrow side of the table.)
3. Place the table top on the air mounts. Please refer to an earlier section on "Handling."
4. Use the 1/4-20 screws supplied to bolt the air mount restraint plates to the bottom of the table. The corners can be lifted sequentially with the use of a hydraulic jack.
5. Connect the air lines as shown in Figure 1 and 2. To assure leak-proof connections, cut the air lines to length with a sharp razor blade so that the ends are clean and square. Fittings on the valves are color coded. Yellow is for supply air and red is for air out to the leg. On legs shown in Figure 1 as having a "tee" connector, remove orange plug from fitting with red button. This gives the equivalent of a "tee" valve. Remove plug by pressing on red button and pulling plug. A firm tug on the hose after insertion will help to seat it and seal the fitting.

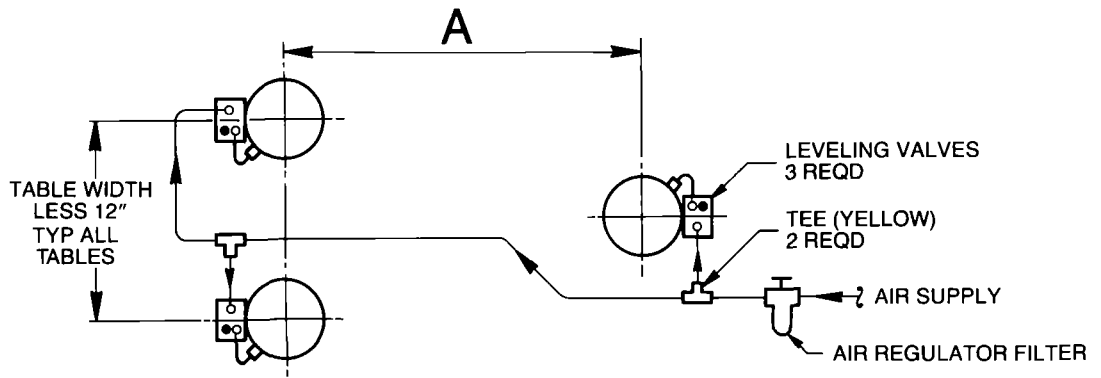
*** CAUTION: DO NOT ATTEMPT TO PRY COLORED BUTTONS OUT OF FITTING WITH A SCREWDRIVER!**

6. Turn on the air supply and set the model ARF air regulator/filter to approximately 50 psi.
7. Check for leaks in the connections.
8. Open the metering valves 2 turns to fill the air mounts.
9. Slowly increase the air supply pressure until the table floats. Ideally, the supply pressure should be 5-10 psi above the pressure reading of any of the leveling valves.
10. The leveling valves are factory adjusted. If necessary, the flatness of the floor can be compensated for by adjusting knurled screw(s) of the leveling valves so that the table floats level. Loosen knurled jam nut prior to adjusting screw and re-tighten afterwards. Adjustment of all three valves may be necessary to raise any one corner.

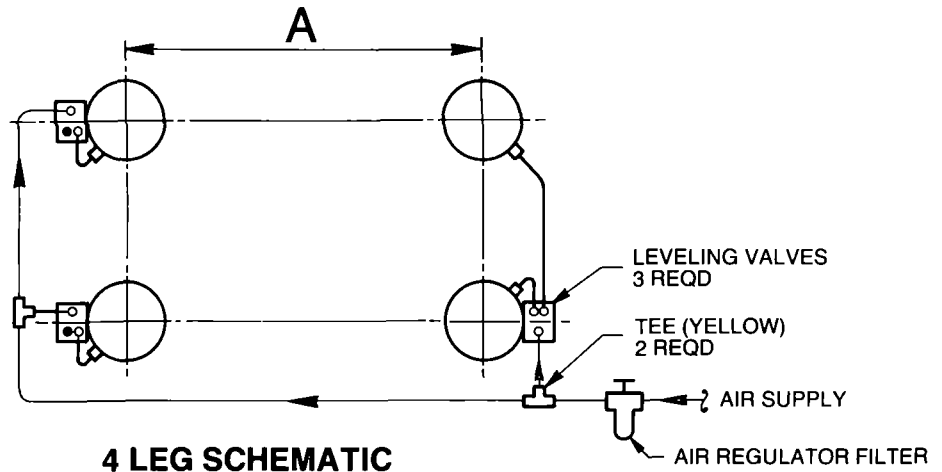
*** CAUTION: ONLY A SMALL ADJUSTMENT IS REQUIRED. DO NOT TOUCH THE SET-SCREW NEAR THE PIVOT POINT OF THE ACTUATING AREA.**

11. Remove the three red plastic clips from the restraint plate on each leg. Do not discard clips. They may be useful in the future.
12. Translate and rotate the air mounts until the restraint stops do not touch the restraint plate. This can be done relatively easily when the table is floating, especially when you have a smooth and hard floor. The table does not isolate until it floats freely. (The restraint stop can be adjusted up close to touching the restraint plate when floating to save air and limit excursion). Check the height of the restraint stop such that the table rests evenly on all the stops when deflated. This is particularly important for heavy loads.
13. At this point, the table is floating and operational. Push the table top gently to check if the table floats freely both vertically and horizontally.
14. Push down on one end of the table and allow the air legs to fill to the present air supply pressure. Release the table to check if it returns to the preset position.
15. "Hunting" or oscillation may occur for heavy loads with high center-of-mass. This problem is intrinsic with any soft spring-mass system. The solutions evolve around a combination of increasing the leg spacing, decreasing the load or reducing its center of mass, reducing the Q of the feedback system, or increasing the spring constant. The feedback loop can be stabilized by restricting the air flow, by decreasing the air supply pressure and also by closing down the metering valve. It is necessary to contact Newport in order to increase the spring constant. Centering of the load can also help stabilize the system.
16. Leveling accuracy may be adjusted by moving the knurled screw(s) inward toward the valve. As the accuracy is improved, isolation performance will diminish. The standard (outermost) setting from the factory should level to $\pm .010$ with optimum isolation performance.

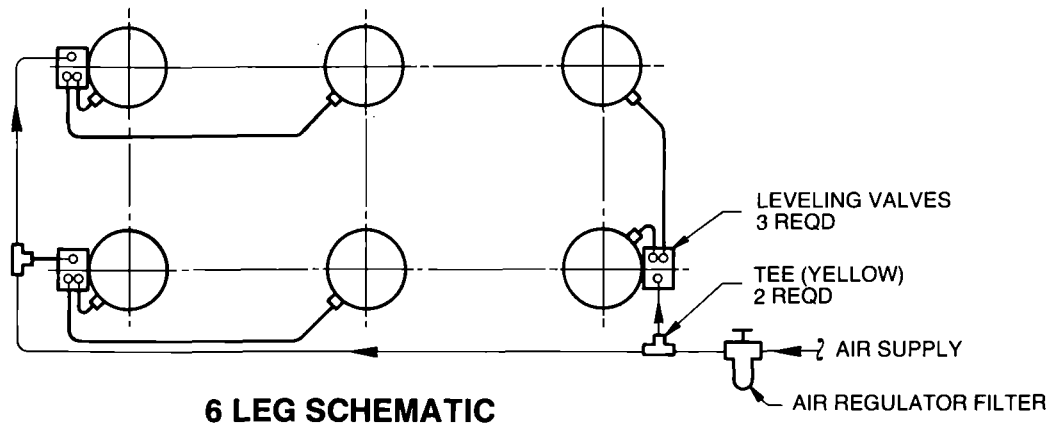
TABLE LENGTH	A	A METER
6'	40"	987 mm
8'	52"	1282 mm
10'	66"	1628 mm
12'	80"	1974 mm
14'	94"	2320 mm
16'	104"	2565 mm
18'	120"	2962 mm
20'	134"	3308 mm



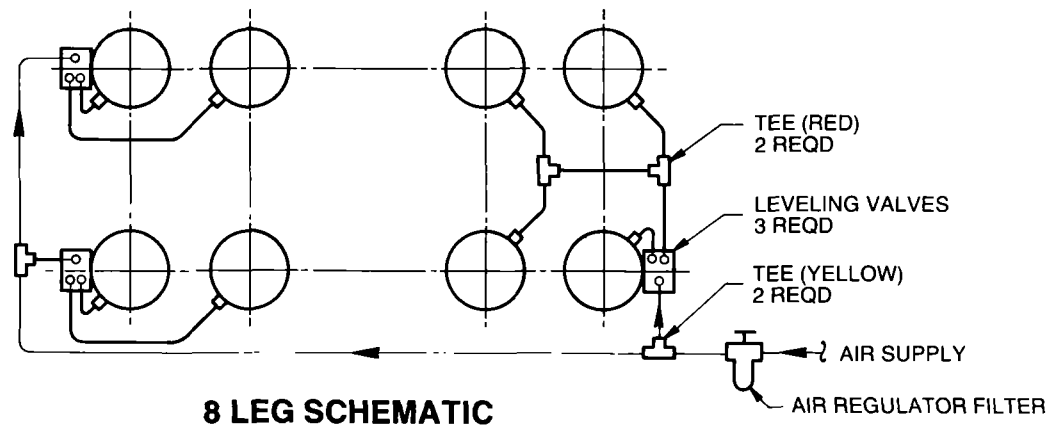
3 LEG SCHEMATIC



4 LEG SCHEMATIC



6 LEG SCHEMATIC

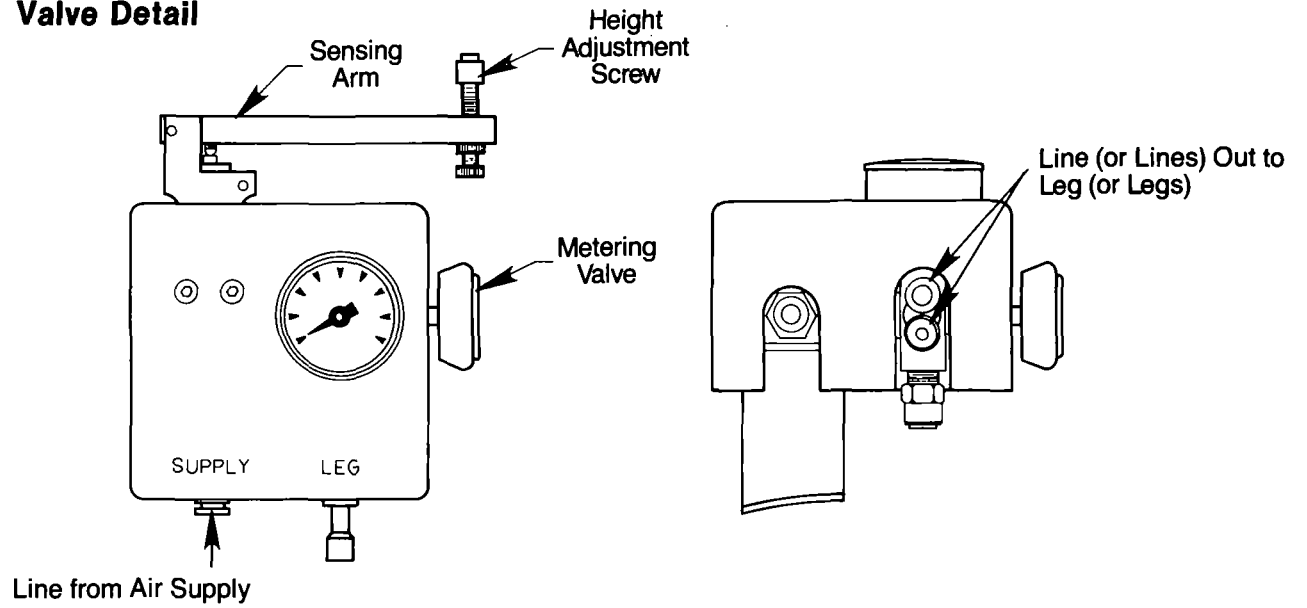


8 LEG SCHEMATIC

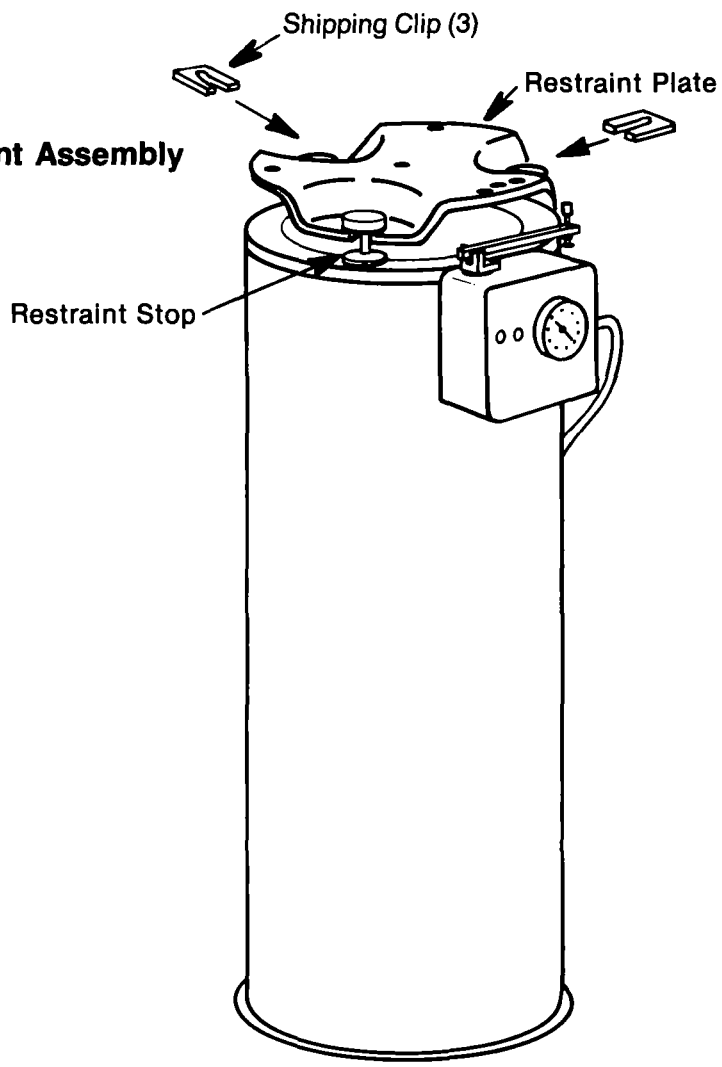
Figure 1

NOTE: If your system is not covered by this diagram, please contact Newport Applications Engineering at 714/965-5473.

**Figure 2
Valve Detail**



**Figure 3
Air Mount Assembly**



Troubleshooting

The table does not float

1. The supply pressure should be 5-10 psi (.4-.7 kg/cm²) above the pressure reading of any of the leveling valves. As the load increases, the supply pressure should be increased.
2. Check to see if all the air lines are connected properly, and the valves are turned on.
3. The valves may be clogged. Always use an air regulator/filter, such as our Model ARF, when mechanically compressed air is used.

Poor Isolation

1. Vibration may be transmitted to the table due to direct physical contact of the equipment mounted to the table top with the surroundings.
2. The restraint stops are not free-floating. Check each of the three restraint stops on each air mount.
3. The equipment mounted to the table has very low resonant frequency, due to lack of rigidity, or has some very pronounced resonances to drive critical components that have similar resonant frequencies.
4. Air currents may be driving the components mounted on the table. Newport table enclosures are designed specifically to overcome this problem.

Table top oscillates

This is due to the high-center-of-mass instability problem. Please consult Newport and also refer to entry 15 (on page 5). Sometimes, the problem is eliminated simply by reducing the air supply pressure to 5-10 psi (.4-.7 kg/cm²) above the air mount pressure, and by opening the metering valves only a half turn.

Air mounts bleed constantly

The leveling valve is defective. Mechanically compressed air contains dirt, which may lodge in the valves to prevent the seals from seating properly.

Oil leakage from the air mount

Oil will leak from the piston (metal cup above the rubber diaphragm) if the air mounts are tipped over. Loss of more than 1/8 cup (30 ml) should be replaced (call us for the replacement oil) although small losses would not affect the isolation performance.

To add oil to the air mounts:

1. Release air from the mounts.
2. Remove the restraint plate by unscrewing the restraint stops.
3. Grasp the piston, **without** pulling the piston out of the rubber diaphragm, turn the restraint plate counterclockwise to detach the plate from the piston. Tip the piston and fill in about 1/2 cup (118 ml) of the damping fluid (available from Newport). In the event that you have removed the piston from the diaphragm, the piston can be reinserted after pressurizing the air mounts slightly to 5-10 psi.
4. Reverse the above steps.

This oil can be cleaned off with mineral spirits. (DANGER: Flammable fluids.)

Installation of XLC Casters

CAUTION: MOVE TABLE CAREFULLY AND SLOWLY. FOLLOW THESE INSTRUCTIONS TO THE LETTER.

Installation with New Table Systems

1. Air mounts ordered with casters are pre-drilled with three .406" (10.5 mm) diameter holes, or added, as shown in the diagram. The casters are designed to work with air mounts that are 22" (560 mm) or higher without modifications, and that were purchased during 1982 or later.
2. Remove all three 3/8"-16 bolts from the circumference of the mounting plate.
3. Remove the rubber damping ring from the bottom of the air leg.

IMPORTANT: Air legs must not be tilted over 30° from vertical.

4. Place the casters in the air mounts. Align the mounting holes and tighten the bolts securely.
5. Replace rubber damping ring.
6. With the casters retracted, proceed to install the air mounts according to the air mount installation instructions.

Installation to an Existing Table System

Follow the instruction above after the air mounts are removed from the table. The table top can be lifted with the use of a die-cart, a camper-jack or the equivalent of a fork lift after the legs are relieved of air pressure and unbolted from the table. A hydraulic automobile jack can also be used to block up one corner at a time.

Procedure to Move the Table System

1. Check that the air mounts are bolted to the bottom of the table.
2. Disconnect air supply and release air from all three leveling valves. Remove the split rubber washer from all three upper restraint stops on each leg. Insert a jack nut between each upper restraint stop and the restraint plate.
3. Extend all jack-nuts until snug. It is **IMPORTANT** to tighten each jack-nut with the use of the two wrenches supplied with the kit to stiffen the air mounts.
4. Insert the crank supplied with the kit through the large diameter access hole in the leg. Lower the caster wheels by turning the crank clockwise until it can no longer be turned.
5. The table can now be moved **CAUTION: MOVE SLOWLY AND WITH CAUTION.**
6. Reverse the above steps before using the table.

Modify standard XL or KL leg as shown here for installation of XLC Caster.

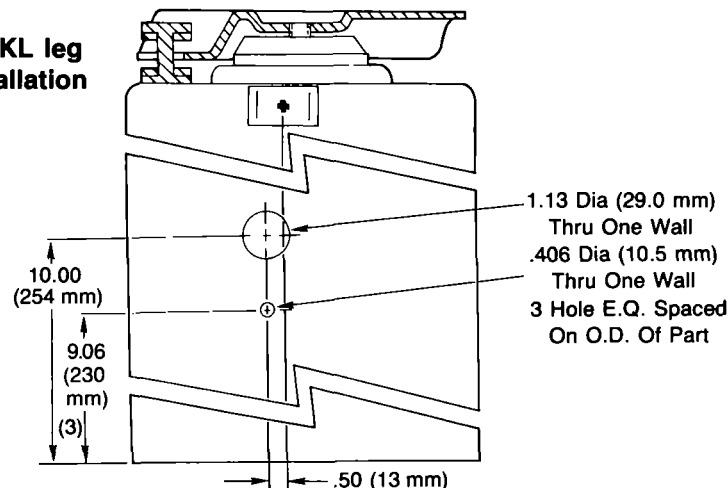
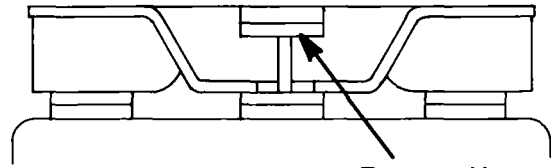
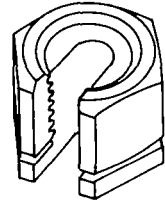


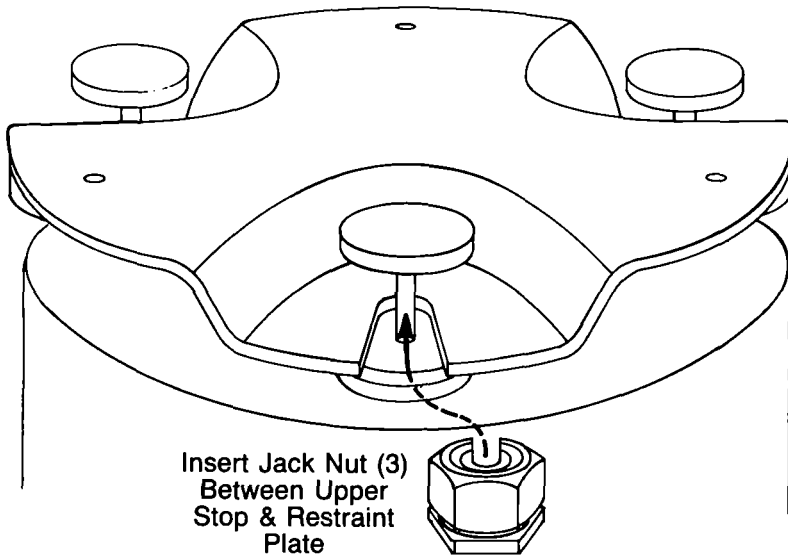
Figure 4—XLC Retractable Casters



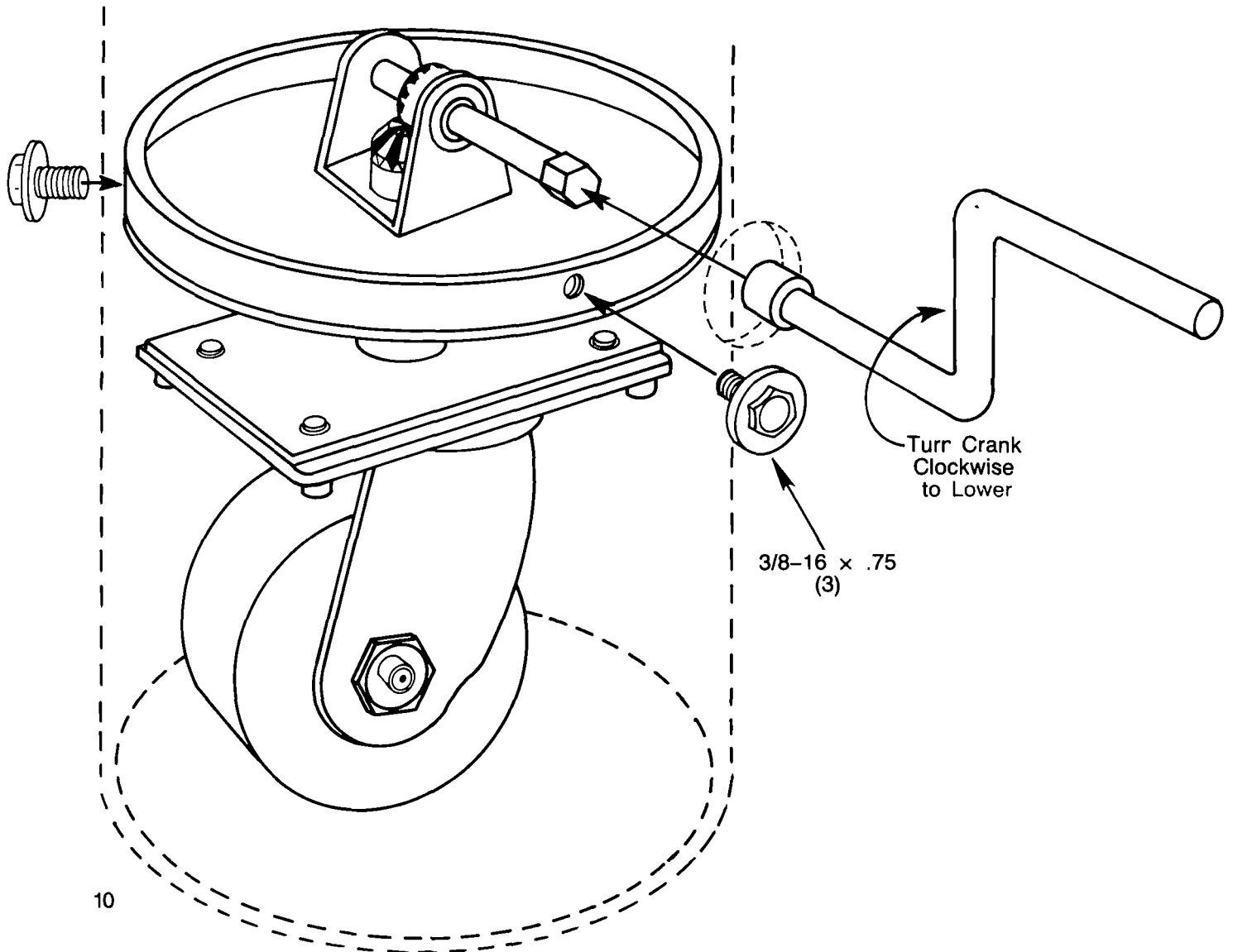
Remove Upper
Split Rubber
Washer



Align Jack Nut



Insert Jack Nut (3)
Between Upper
Stop & Restraint
Plate



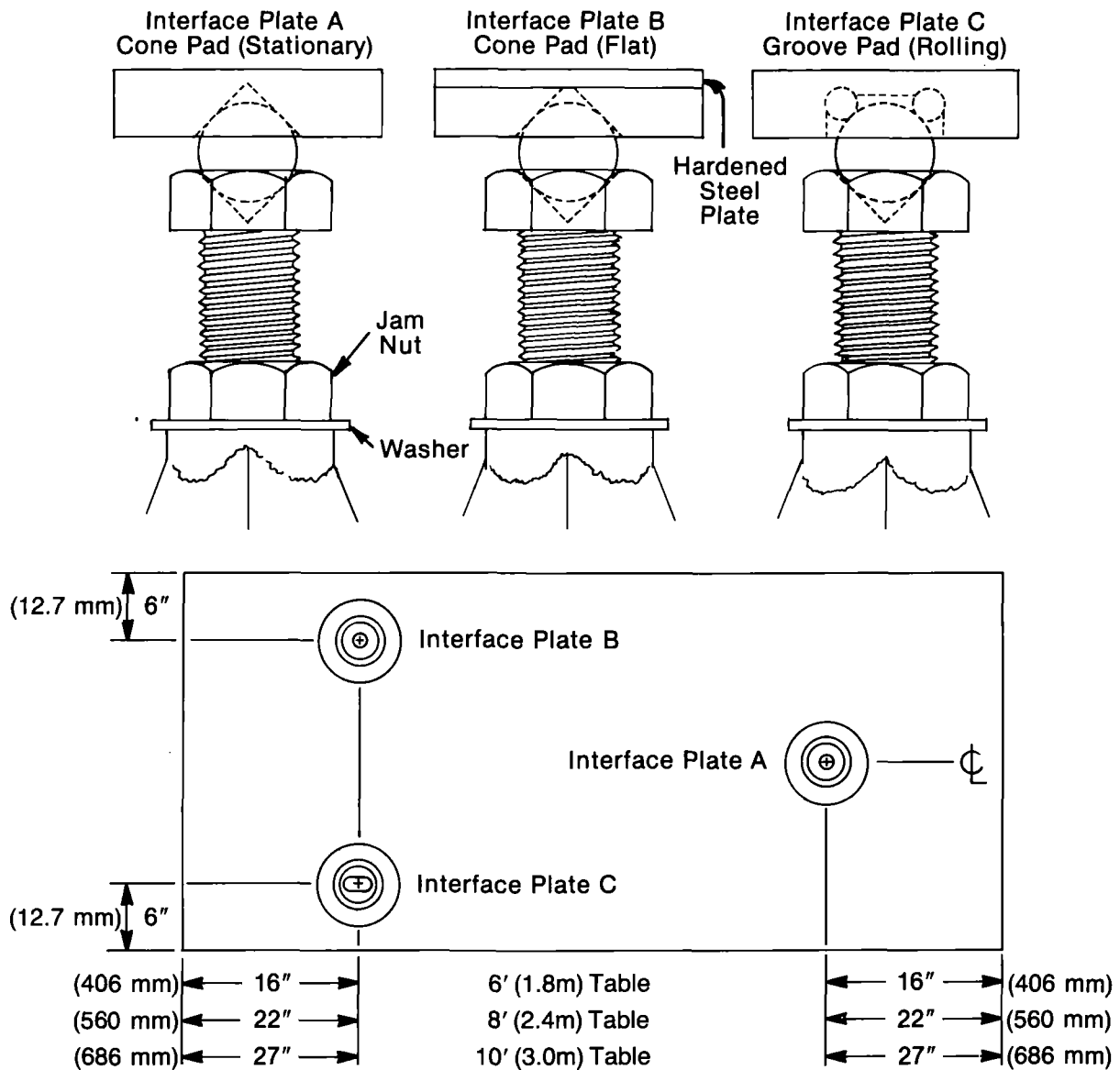
Turn Crank
Clockwise
to Lower

3/8-16 x .75
(3)

Installation of Rigid Kinematic Supports

1. Refer to the first section on handling of the table top.
2. Bolt the 12" (305 mm) diameter steel plate to the bottom of the table, in the orientation as shown. Please note the orientation of interface plate C.
3. Place the hardened steel balls on top of each leg and position the legs under the interface plate. The one placed under the flat (interface plate B) requires a spacer plate as shown below.
4. With the table resting on the balls, leveling is achieved by rotating the adjustment bolts on top of the three legs. Once adjusted, the jam nut should be tightened against the washer.

Figure 5— Rigid Kinematic Supports



Installation of Tables with Doubler

1. Check for damage in shipping. Try to inspect for obvious damage when the shipment arrives, so that if such exists it can be noted on the bill of lading, which allows an insurance claim to be filed.
2. Uncrate the table tops and the air mounts, noting the fact that the orientation of tables is marked on the outside of the crates. After uncrating the tables, carefully check the doubler faces for anything which might prevent them from bolting tightly together. Each bolt on the doubler plate should be greased with machine grease thoroughly.
3. Locate the packages containing the leveling valves. These have been removed from the air mounts to avoid damage in shipment. For each air mount system there are three valves, independent of the number of legs. Cut and attach the required length of hose from the valve to the cylinder as per Figure 1 on page 5.
4. The next step is to place each of the two table tops on a minimum of three air mounts, making sure that the pins engage their respective holes in the table top. (If you have less than six air mounts per table system, the tables may be joined together on the floor prior to being placed on top of the air mounts. In this case, the joining of the tables is carried out with the tables resting on blocks of wood padded with sponge rubber to minimize undue stress on the doubler fasteners. The adjoining doubler surfaces should be adjacent, and as close together as practical. The two alignment dowel pins and protruding bolts will prevent bringing the two surfaces much closer than 1" (25 mm)).
5. Before attempting to engage the alignment dowel pins and the bolts with their respective holes, it is necessary to "float" each table independently. This permits the two tables to be brought into exact alignment with minimal effort, and prevents undue stresses on the doubler bolts and alignment pins during the process of bringing them together. The easiest way to float the two tables is to adjust the pressure in each leg separately through the valve, adding or exhausting air until the table floats midway between the restraint stops. It will take between 50-100 (4 – 7 kg/cm²) in each of the legs to float the tables, depending upon the size of the table.
6. Now, with both tables "floating," push the tables together, allowing the taper pins to mate with their corresponding holes.
7. Check the coupling bolts to be certain they are all aligned with their corresponding holes. Note that there may be a slight difference in the thread lengths of the bolts.
8. Each bolt has a predetermined amount of free play. Starting with the longest bolt (first to contact threads), begin tightening with the enclosed $\frac{7}{8}$ " open end wrench.
9. Tighten the first bolt only to where another comes in contact with the threaded hole. Continue this process until all mounting bolts have been started.
10. Carefully begin tightening bolts in sequence as per Fig. 7. Tighten only to the point where free play is taken up, but other bolts have not been put into a bind (see Fig. 8). Binding will occur when hexhead comes into contact with the doubler plate, indicating zero free play.
11. Continue Step No. 10 until all bolts are snug.
12. Following the tightening sequence in Step No. 10, apply a final tightening force of 60 pounds-feet (80 N-m) to all of the doubler bolts.

13. The air mounts may now be positioned and bolted to the predrilled holes below the table after letting the air out of each air mount. Fine positioning of the legs can be achieved either by lifting the whole table at one time or by raising each corner.
14. Refer to the standard table installation instructions for hook-up of the air mounts.

Figure 6 — Doublor Bolt Tightening Sequence

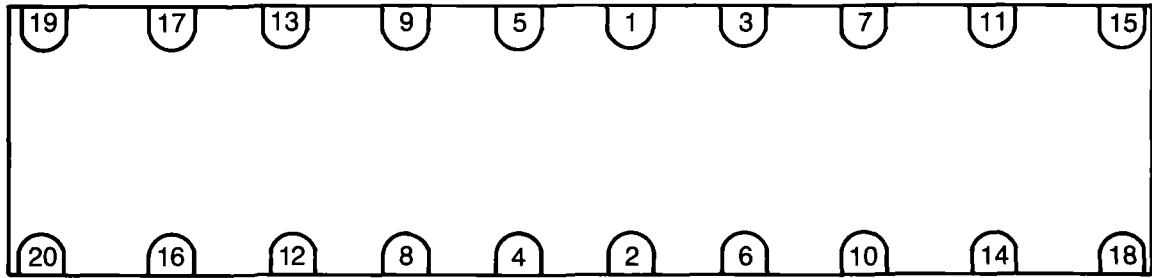
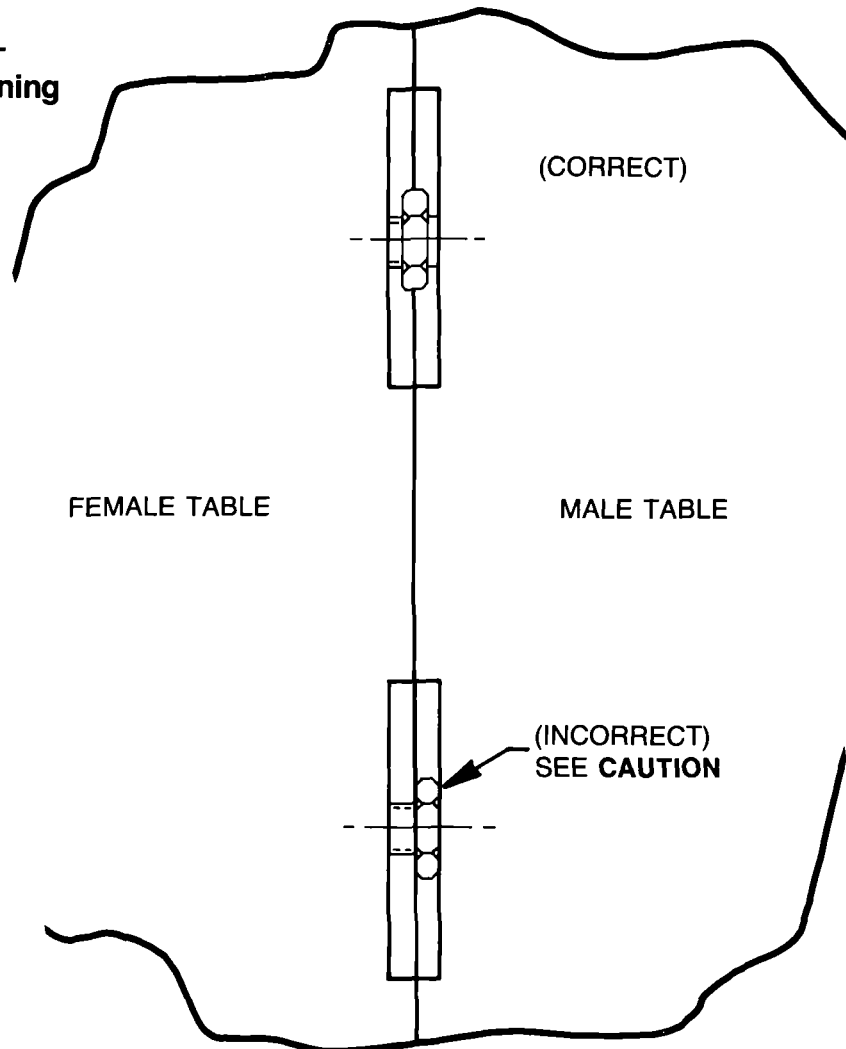


Figure 7 — Bolt Tightening Procedure



CAUTION

DO NOT ALLOW THE BOLTS TO CONTACT THE MALE DOUBLER PLATE SURFACE DURING ASSEMBLY. THE BOLTS WILL BIND AND DAMAGE THE THREADS.

Installation of Table Yoke

1. Orient both tables at 1.00" gap. Make certain table tops are parallel and co-planar.
2. Attach coupler plate to top of tables. Do not tighten $\frac{1}{4}$ " bolts. Install finger-tight only!
3. Install $\frac{5}{8}$ " ϕ bolts through holes in coupler plate. Thread into mating holes on 1" thick brace plates. Adjust bolts so there is a $\frac{1}{2}$ " gap between top of brace plate and bottom of tables. Orient brace plate at 90° to gap between tables.
4. Bolt angle braces to brace plate. Tighten bolts loosely. Transfer mark and drill and tap $\frac{1}{4}$ -20 holes in bottom of tables. Install $\frac{1}{4}$ -20 bolts through angles into bottom of table. Tighten securely.
5. Tighten bolts attaching angles to brace plates.
6. Tighten $\frac{5}{8}$ " ϕ bolts through coupler plate.
7. Tighten bolts attaching coupler plate to table tops.

Figure 8a — Side View

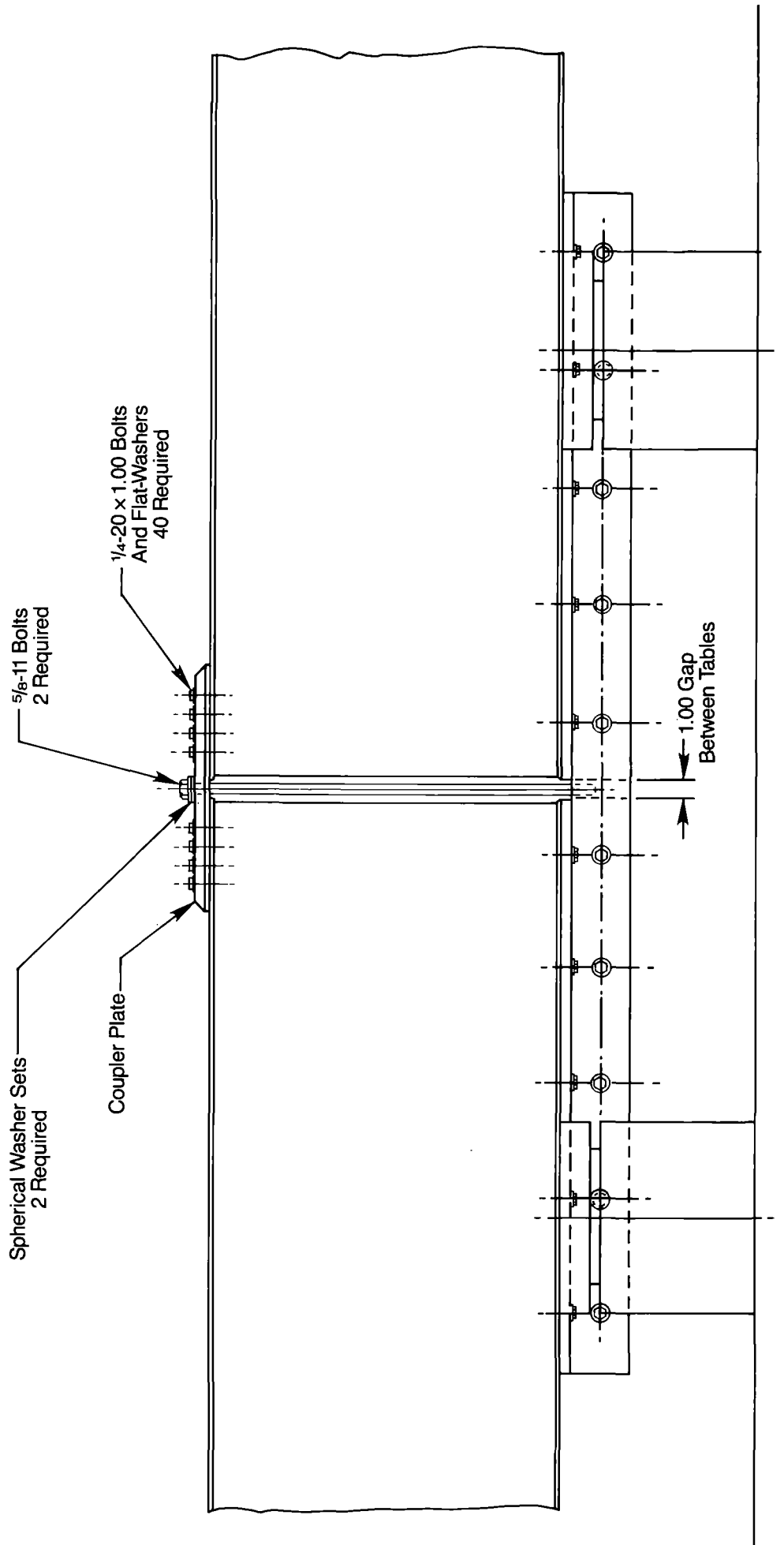


Figure 8b — End View

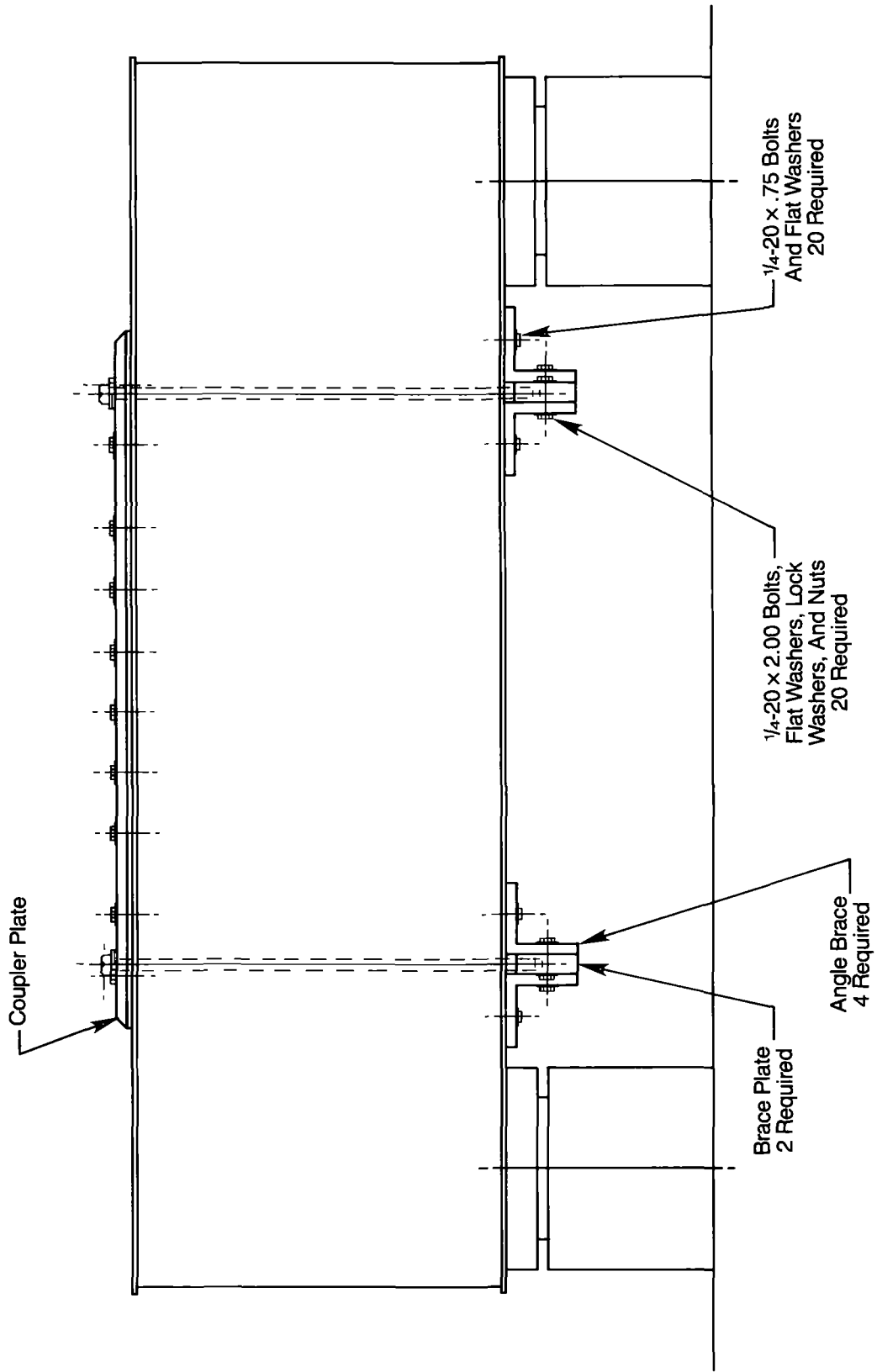
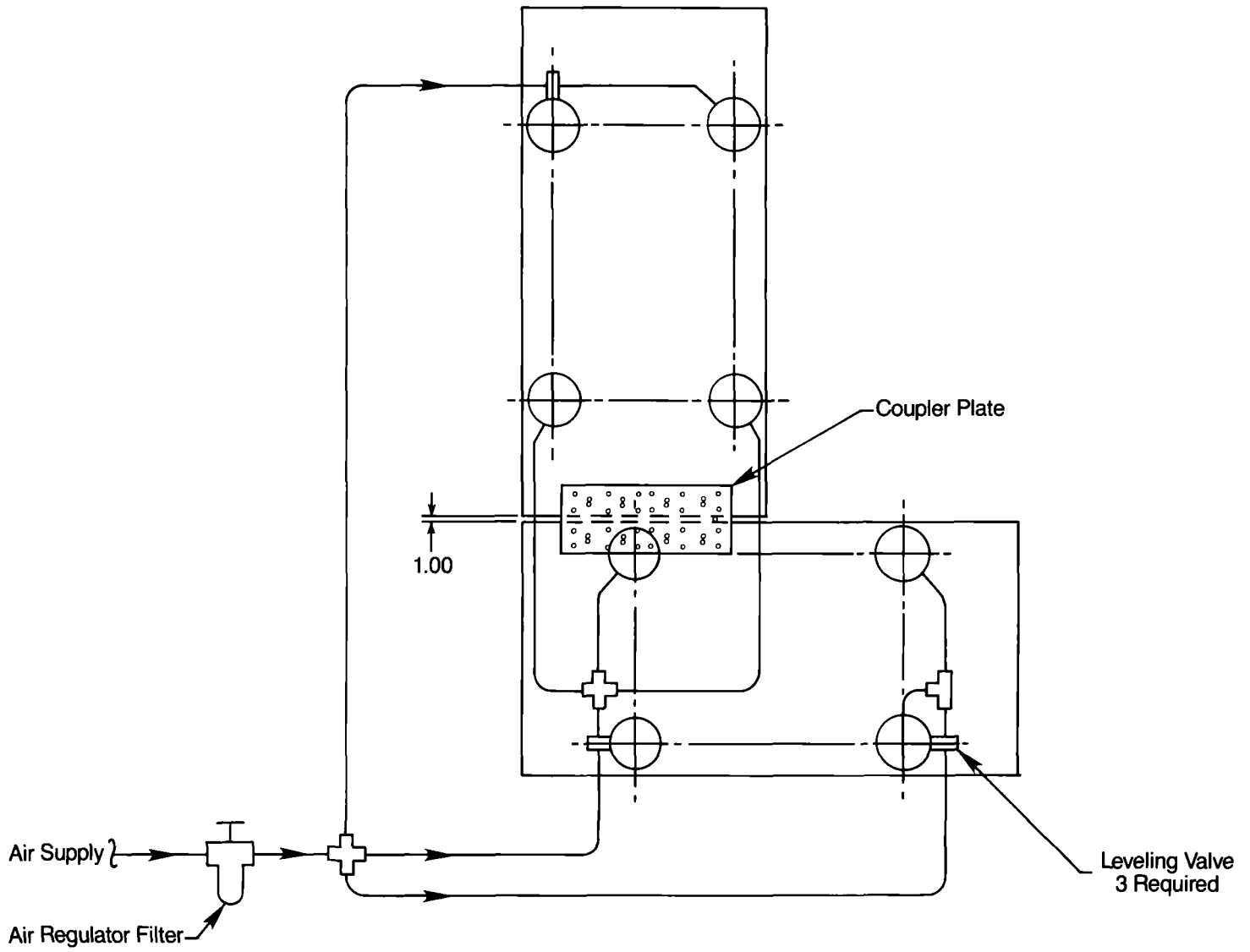


Figure 8c — Top View



Installation of Accessory Shelf

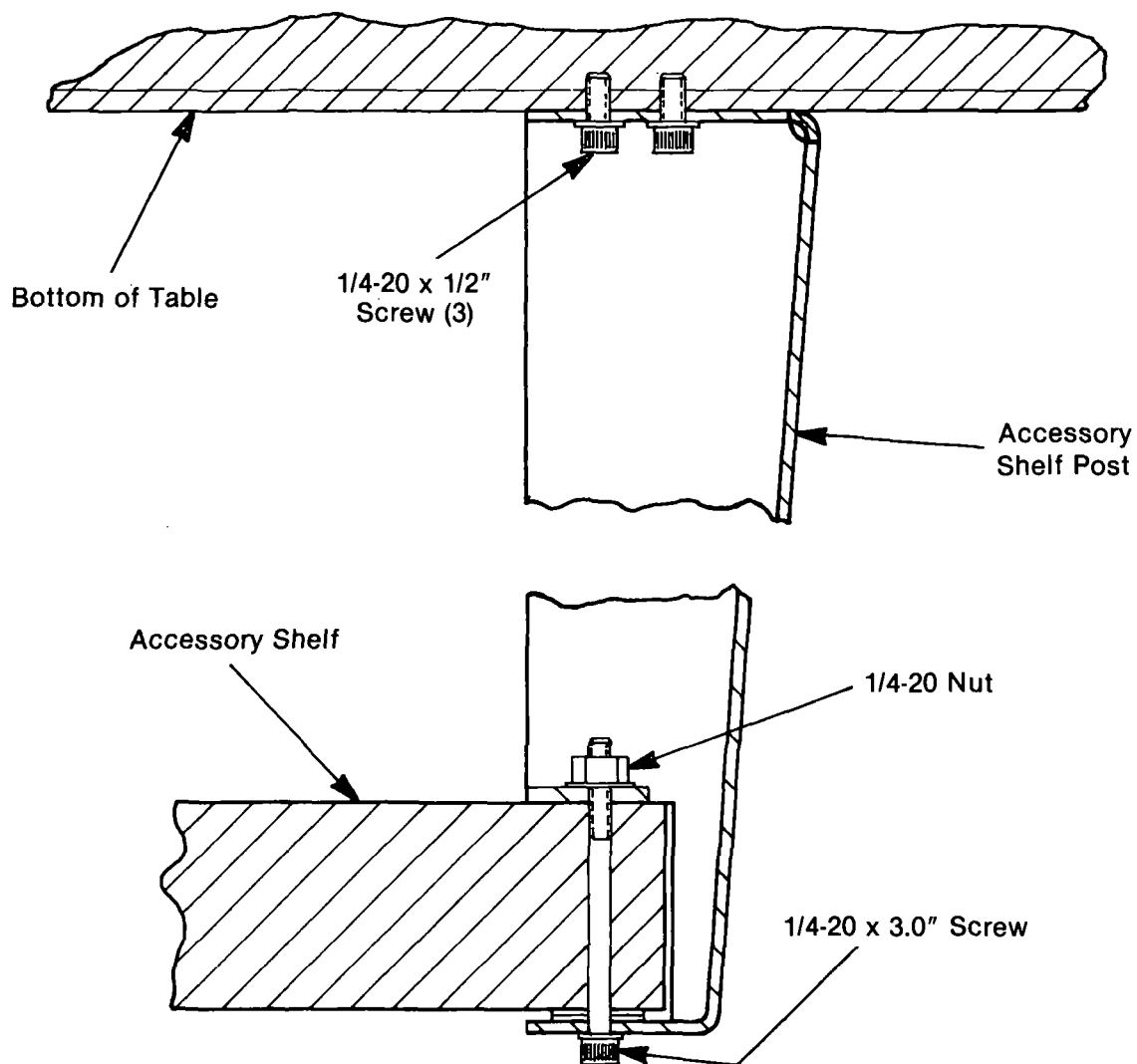
1. Attach the accessory shelf to the four brackets until the enclosed $\frac{1}{4}$ -20 bolts are snug. **Do not** tighten the bolts at this point.
2. Bolt the whole assembly to the bottom of the table.
3. Tighten all the bolts with an allen wrench.

CAUTION:

Avoid putting more than 100 pounds (45 kg) on the shelf.

Do not put heat source, such as a power supply, on the shelf. Temperature differences between the top and bottom skins of the table would cause the table to bow.

Figure 9 — Accessory Shelf

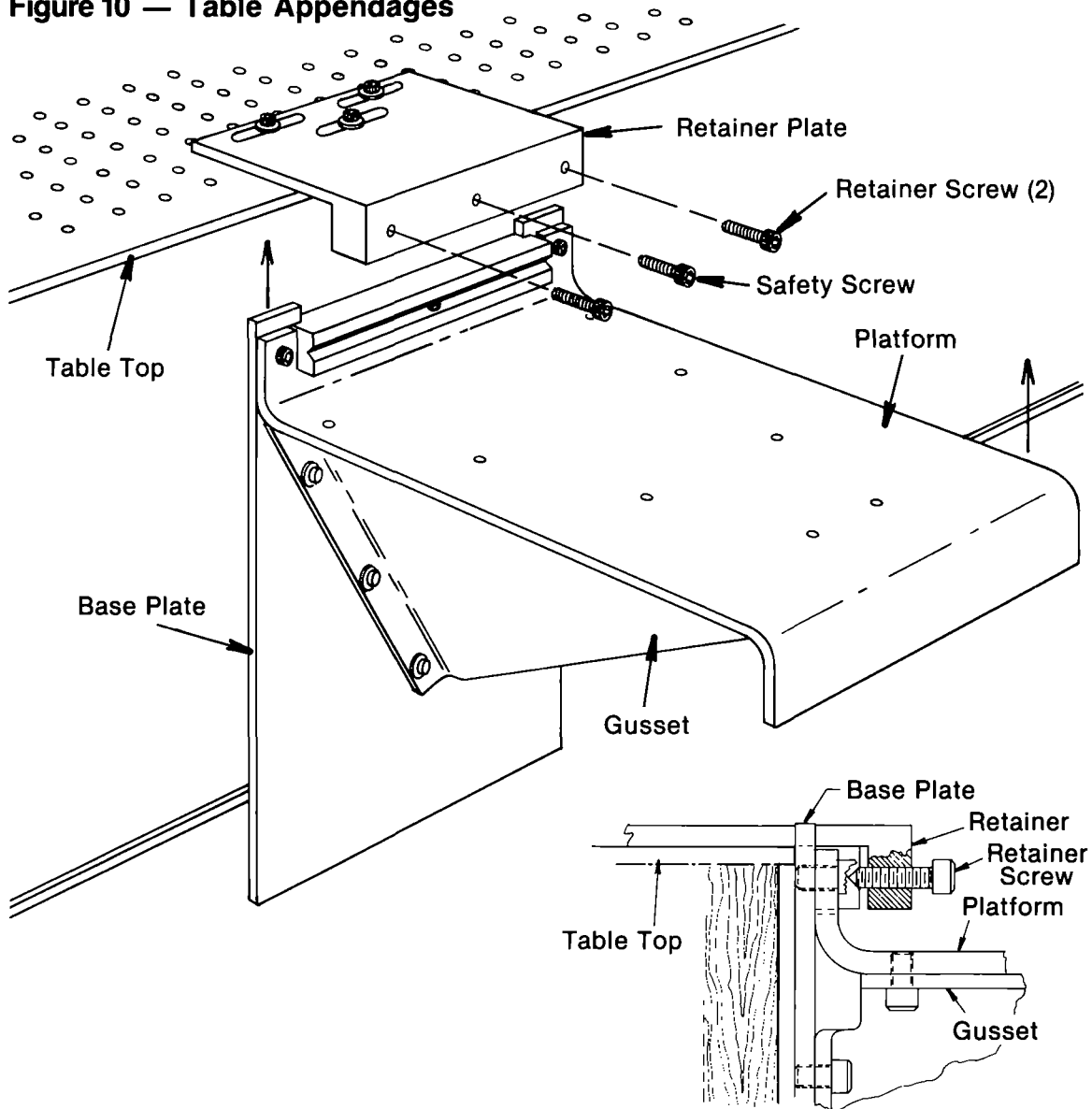


Installation of Table Appendages

1. Secure the retainer plates at the desired location with the washer and the 1/4-20 (M6) SHC screws supplied.
2. Slip the platform into the slot between the retainer and the edge of the table. Tighten the safety screw.
3. Install the retainer screws (2) and secure by wedging the ends of the screws into the vee-groove in the base plate as shown.

CAUTION: The safety screw should always be fully engaged. It should always be removed last, even in the event of removing the appendages from the table.

Figure 10 — Table Appendages



Installation of Table Enclosure

Your enclosure has been shipped to you in semi-kit form. The top has the frame attached with the corner pieces (4) installed. The posts and plex panels are packaged individually along with a package of mounting hardware.

1. Uncrate the enclosure top and remove the four corner pieces. They are retained by No. 8-32 set screw in each end piece.
2. Remove the corner posts from crate and position them on to your table top (see Fig. 12) so that the hole pattern on your table is aligned with the holes (slots) in the bottom flange of the post. Install two 1/4-20 (M6) button head bolts, but do not tighten snugly at this point.
3. Position the enclosure top on to the top flanges of the posts aligning the hole pattern on the post flange with the two holes in each corner of the enclosure top (see Fig. 11). Notice that the holes in the top are 1/2" (13 mm) diameter. This is to accept the feed-thru spacers, which are attached with 1/4-20 (M6) button head bolts and flat washers.
4. Once all pieces are together, all of the mounting bolts may now be secured (see Fig. 12 and Fig. 13).
5. Remove the panel guide pieces from the crate (two short pieces and two long pieces). The shorter pieces are installed on the table ends while the longer ones are for the sides (see Fig. 12 and Fig. 13). Position them as shown in Fig. 13 and drill into the table edge finish thru the existing holes in the lower flange with a 3/32" (2.40 mm) diameter drill using the guide piece as a drill jig. The guide piece may now be attached by using the pan head wood screws you will find in the hardware kit.
6. The plex panels are packaged with protective paper to protect the finish. Do not remove this paper at this time. You will notice that each panel has a letter marked on it, i.e., "A," "B," etc. Refer to Fig. 14 and find the size (in feet) that corresponds to your table size. Notice that the drawing represents the enclosure top view and the relative position of each panel. It also shows you which race to hang the panel in (see Fig. 13). Example: "A" panels go into inner race and "B" panels go into outer race. Also remember that in order to have proper fitting panels, the letter marked on the panel should always be facing outward when installed.
7. Slide all panels into place and reinstall the corner pieces. Retighten the set screws that hold each corner piece. Slide all panels to make sure you have them properly located. If the panels are sticky or hard to slide, apply a small amount of silicone grease onto the lower part of the plex hangers where they ride in the races (see Fig. 13).
8. The protective coating on the plex panels may now be removed. If there is a possibility that the panels will ever be removed all at one time, they should all be marked for their location for ease of re-installation.

NOTE: The end panels do not slide, but if access to the end of the table is required and not practical from the side, the corner piece may be temporarily removed from either end to allow end panel to be slid to one side for access.

Figure 11 — Table Enclosure

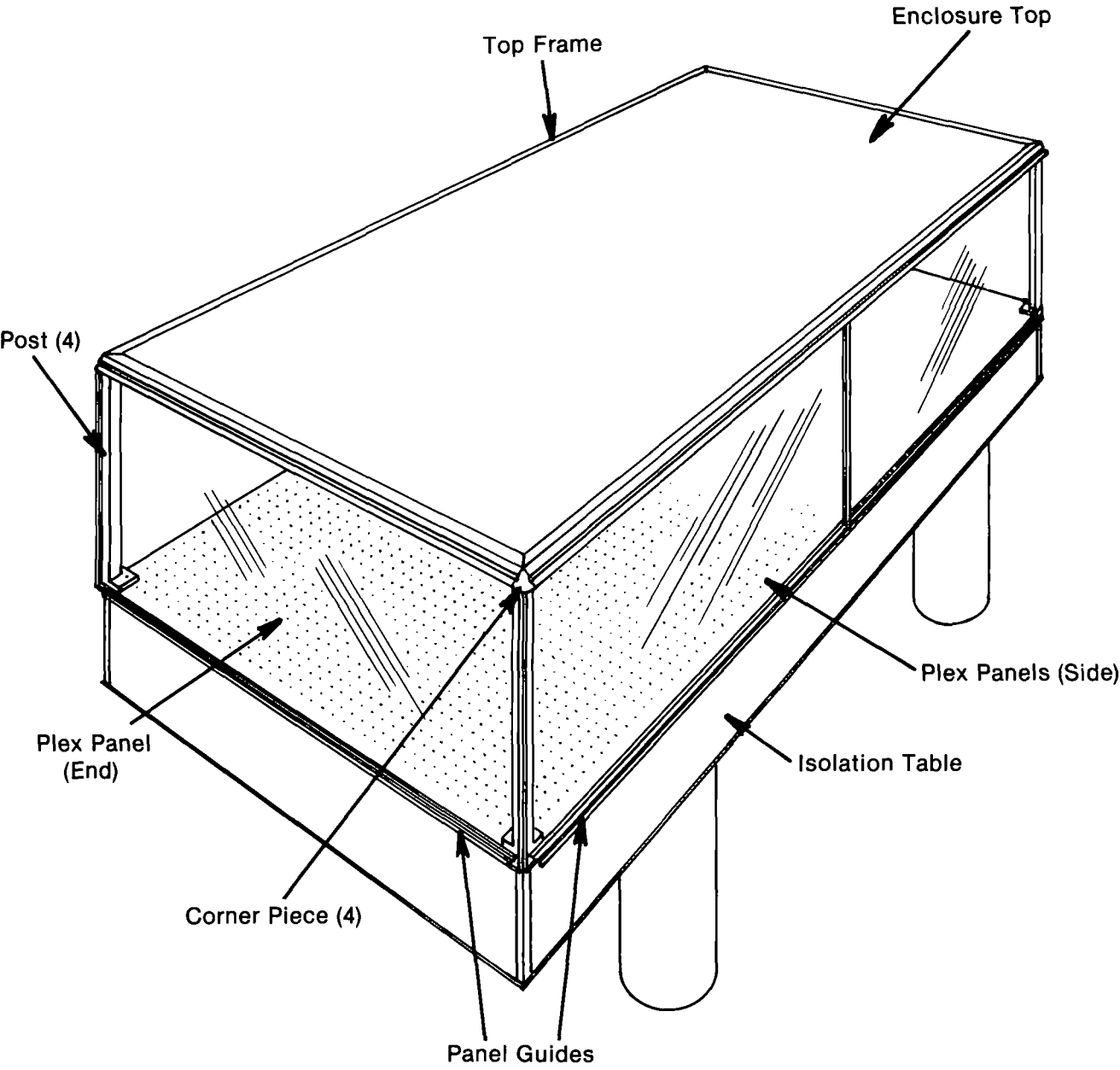


Figure 12 — Corner Assembly Detail

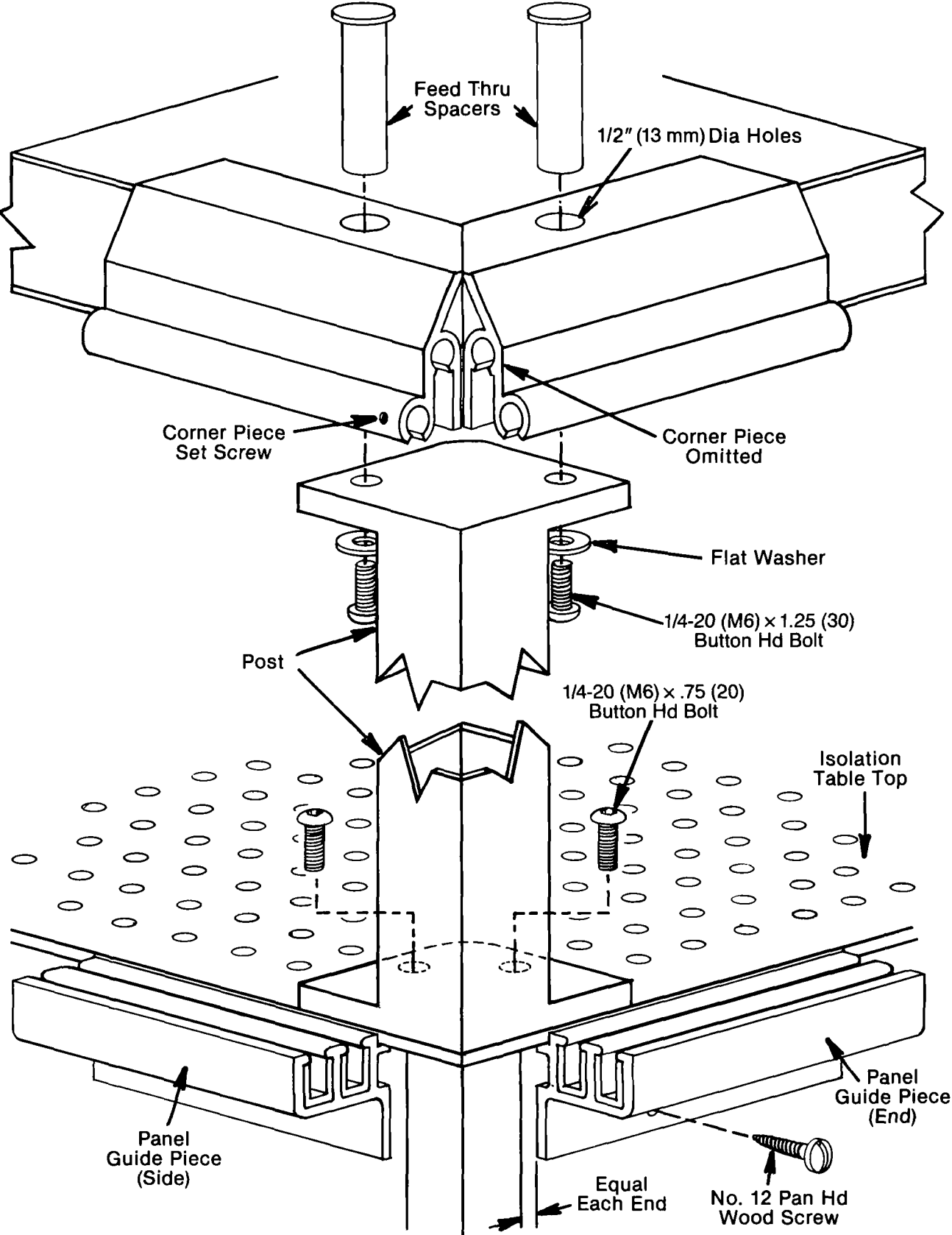


Figure 13 — Corner Cross Section

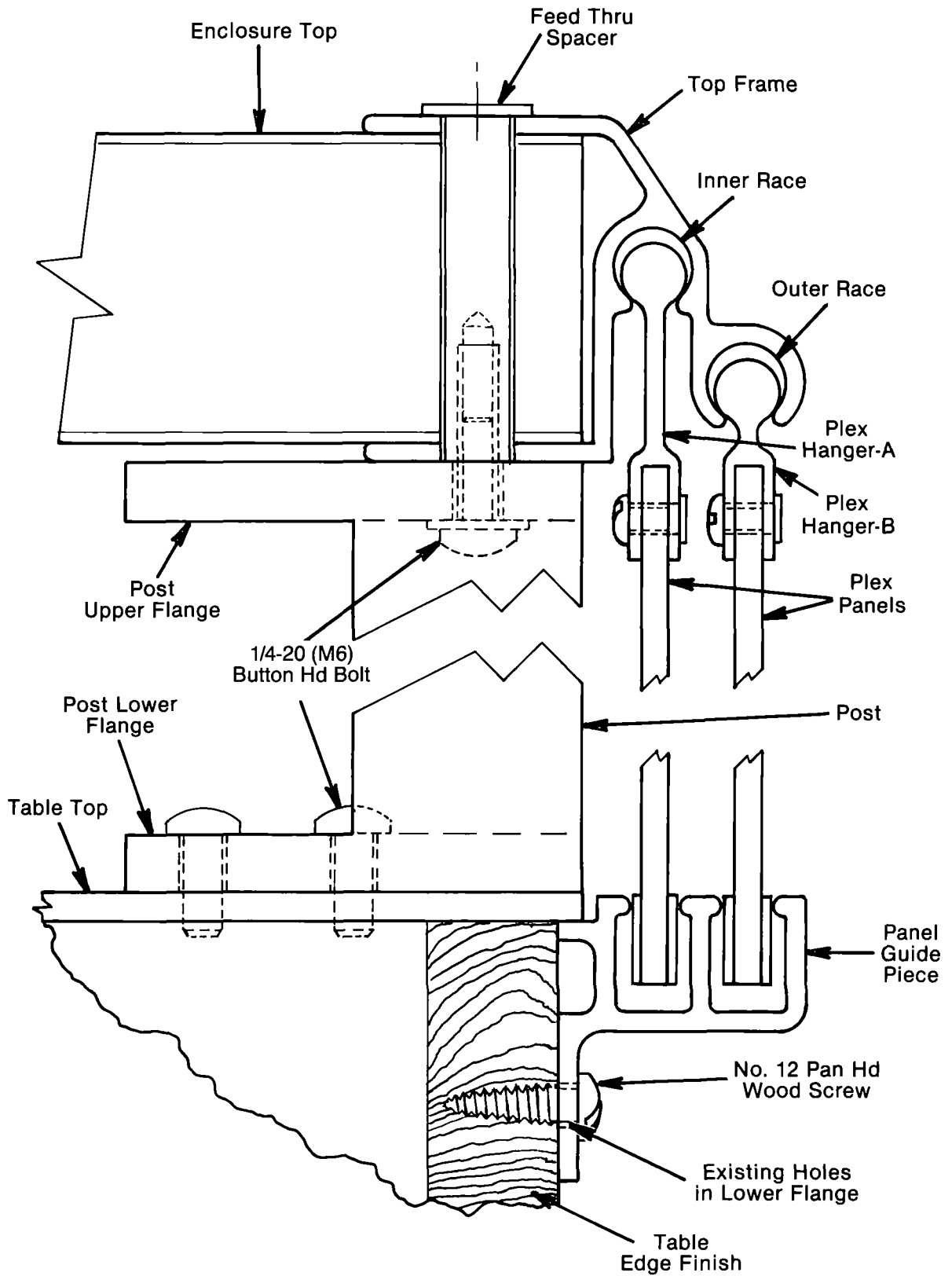
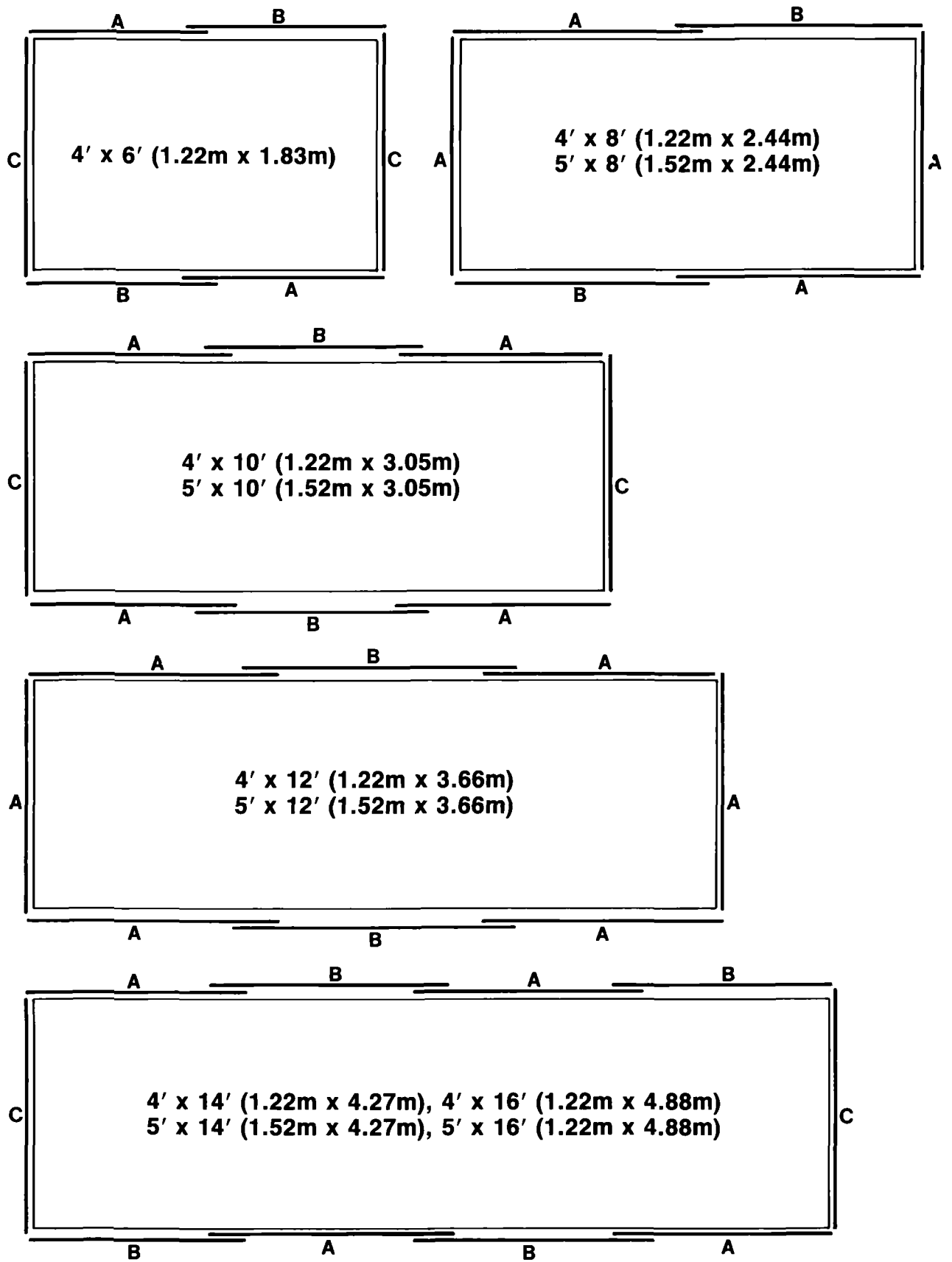


Figure 14 — Panel Location



Special Leg Systems

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D-6100, Darmstadt
West Germany
Ph: 06151-26116

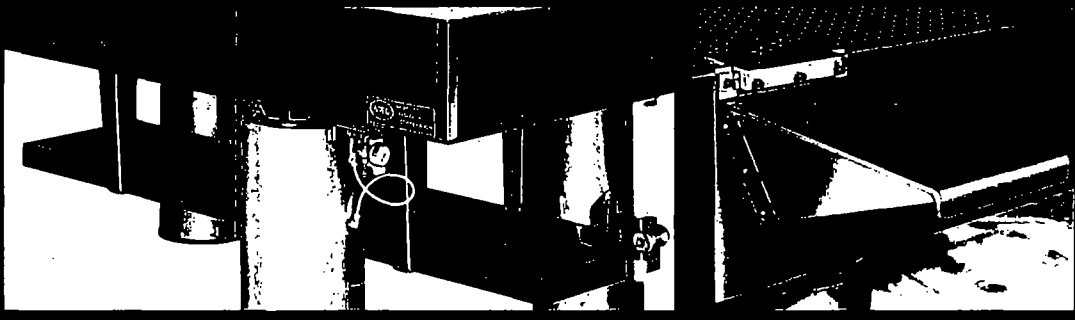
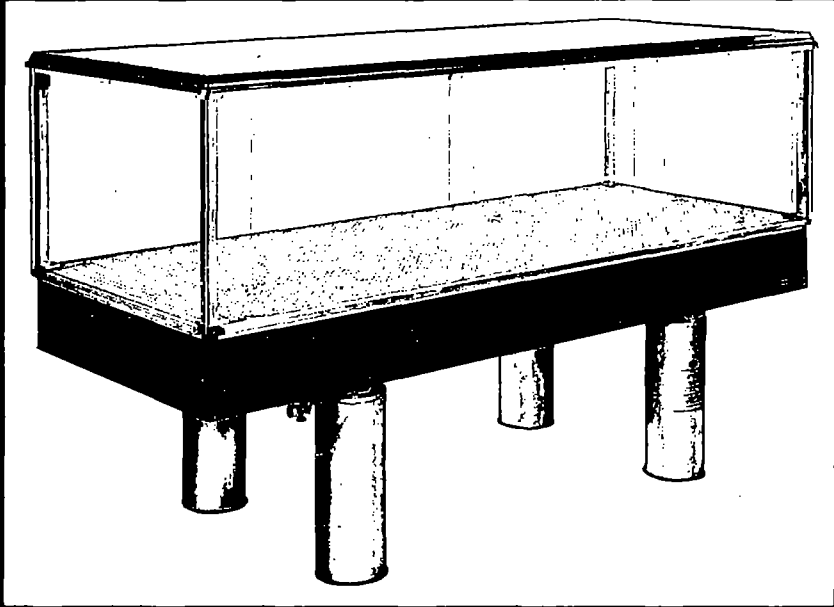
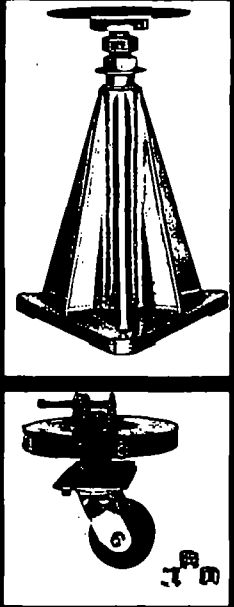
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Newport

TABLE SYSTEM INSTRUCTION MANUAL



(NRC)[®] Newport Corporation

Check for Shipping Damage

Damage does occur occasionally. **Before** beginning assembly, please check carefully for any damage that may have occurred in transit. If there is any damage, please CALL NEWPORT IMMEDIATELY.

Oil from the air mounts indicates the crate was tipped over. Please refer to the troubleshooting section on page 7

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Table System Instruction Manual

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General Information

Safety Considerations

The table top is attached to the air mounts by ¼-20 screws for positioning purposes only. Given enough force, such as in the case of a major earthquake, it is possible to push the table top over. While the likelihood of this happening is small, you may wish to install stands permanently affixed to the floor. The isolation performance is not affected so long as these stands do not touch the table top while the table is floating.

Electrically, the table top is equivalent to a metallic conductive plate. Proper consideration should be given to electrical grounding.

If your load has a high center-of-mass, or is particularly heavy, the table top may oscillate. This problem is intrinsic with any spring-mass system. Please call Newport. The solutions are discussed in entry 15 of the installation instructions on page 4.

The maximum rated operating pressure of the air mounts is 100 psi.

When the table is floating, keep fingers away from the area between the air mount and the bottom of the restraint plate.

Performance

The isolation system operates on the principle of air pistons, which are equivalent to soft springs. The main advantages of the Newport system, in comparison with other designs, are: low vertical resonant frequency with low Q; a horizontal decoupling system that offers effective isolation even for low amplitude vibrations; and a working surface that is rigid statically and yet has high internal damping for high dynamic rigidity.

Standard leveling valves control the height of the table nominally to 0.040" accuracy, which is adequate for most applications. Precision control valves with a leveling accuracy of ±0.01" are also available with XL or XK Leg Systems. These valves can be supplied as retrofit kits, Model PLCV, consisting of 3 precision valves which are compatible replacements for standard valves. Call Newport for other solutions to high precision leveling requirements.

The total excursion of the table can also be reduced, please see entry 11 of the installation instruction on page 4

How the system feels or performs can generally be adjusted to suit your personal preference. There are many parameters at our disposal. Please consult Newport personnel. It is important that you are satisfied with the way our products work.

Cleaning Procedure

The RS, KS and MS Series table tops are made of 400 series ferromagnetic stainless steel. This stainless steel is relatively corrosion resistant and offers you the convenience of mounting with magnetic bases. After uncrating, spray a generous amount of household cleaner, such as "409" or "Fantastik" on the working surface so that some of the fluid drips into the mounting holes. After wiping down, repeat the process.

Unless you are operating in a particularly corrosive environment, an occasional wipedown with these cleaners will keep the table top attractive.

The protective epoxy coating of the KT tops can also be cleaned the same way. Care must be exercised to remove all abrasive material before cleaning to avoid scratching the coated surface.

Mounting Holes

Polishing grits lodged in the mounting holes can only be cleaned by chasing each hole. This is effectively accomplished when you use a mounting hole for the first time by tightening a screw with the use of a screwdriver, or the 3/16" ball driver provided.

All mounting holes are 1/4-20 unless specified to be M-6.

Handling

The table tops are heavy, with a typical 4'x8' table weighing about 1,100 pounds. They can be moved relatively inexpensively by local "machinery movers" listed in the yellow pages of the phone book.

The table top should be moved separately from the air mounts.

Honeycomb table tops are good load bearing structures. Care, however, must be exercised **NOT to apply any force that effectively peels the skins away from the structure.** Also the decorative formica sides are not designed to support heavy loads.

The table top can be tipped on its sides onto a padded dolly to facilitate moving. However the edge of **both** skins must be supported at the same time.

The table top can be lifted with a forklift or a camper jack. It can also be blocked up with the help of a floor jack, such as a "Big Joe." Once the table is placed on the air mounts, the corners can be lifted one at a time with an automobile hydraulic jack to position the legs.

Air Supply

The air supply should be connected during operation. Air is used only when the pressure is automatically adjusted to compensate for load changes. The air supply should be shut off at the end of a day or when there are extensive setup changes.

Use bottled nitrogen, or mechanically compressed air to operate the isolation system. The operating pressure is determined by the total load divided by the diaphragm area, and is typically in the 50 psi range. The maximum rated operating pressure is 100 psi.

Air from a mechanical compressor generally contains water and dirt, which will cause the leveling valves to fail. Please use our model ARF air regulator/filter, for maintenance free operation.

Do not use bottled carbon dioxide, since "icing" can occur during rapid filling of the air mounts.

Installation of Air Mounts

1. Position the air mounts according to Figure 1.
2. Attach the leveling valves to the brackets of the legs and tighten the thumbscrews. Only three leveling valves are supplied for each system, because a plane is defined by three points. Two of the valves have an elbow connector, and one has a tee connector. Turn all the metering valves off clockwise. (See Fig. 2, page 6)

CAUTION: Do not inflate air mounts prior to installation under table.

3. Place the table top on the air mounts. Please refer to an earlier section on "Handling".
4. Use the 1/4-20 screws supplied to bolt the air mount restraint plates to the bottom of the table. The corners can be lifted sequentially with the use of a hydraulic jack.
5. Connect the air lines as shown in Figure 1 and 2. To assure leak-proof connections, cut the air lines to length with a sharp razor blade so that the ends are clean and square. Tighten the fitting nuts snugly, but only with your fingers.
6. Turn on the air supply and set the model ARF air regulator/filter to approximately 50 psi.
7. Check for leaks in the connections.
8. Open the metering valves 2 turns to fill the air mounts.
9. Slowly increase the air supply pressure until the table floats. Ideally, the supply pressure should be 5-10 psi above the pressure reading of any of the leveling valves.
10. Remove the three red plastic shipping clips from the restraint plate on each leg.
11. The leveling valves are factory adjusted. If necessary, the flatness of the floor can be compensated by adjusting knob (L) of the leveling valves (see Fig. 2) so that the restraint plate floats about midway between the restraint stops. Adjustment of all three valves may be necessary to raise any one corner.

CAUTION: Only a small adjustment is required. Too many counterclockwise turns can unscrew the knob, which is difficult to install.

12. Check that the restraint plate does not touch the restraint stops (See Fig. 3). If necessary, translate and rotate the air mounts to free the restraint plate. This can be done relatively easily when the table is floating, especially when you have a smooth and hard floor. The table does not isolate until it floats freely.

Check the height of the restraint stop such that the table rests evenly on all the stops when deflated. This is particularly important for heavy loads.

13. At this point, the table is floating and operational. Push the table top gently to check if the table floats freely both vertically and horizontally.
14. Push down on one end of the table and allow the air legs to fill to the preset air supply pressure. Release the table to check if it returns to the preset position.
15. "Hunting" or oscillation may occur for heavy loads with high center-of-mass. This problem is intrinsic with any soft spring-mass system. The solutions evolve around a combination of increasing the leg spacing, decreasing the load or reducing its center of mass, reducing the Q of the feedback system, or by increasing the spring constant. The feedback loop can be stabilized by restricting the air flow, by decreasing the air supply pressure and also by closing down the metering valve. It is necessary to contact Newport in order to increase the spring constant. Centering of the load can also help stabilize the system.

Figure 1

3-Leg Schematic

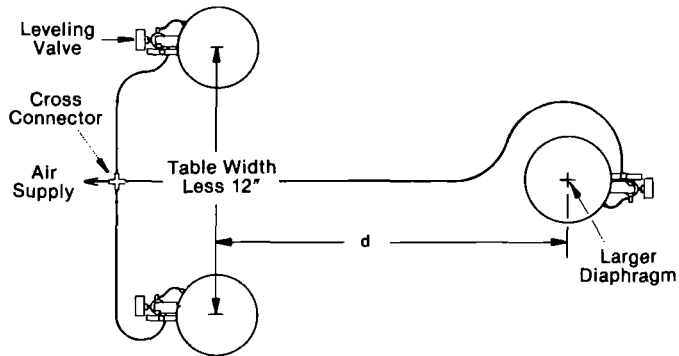
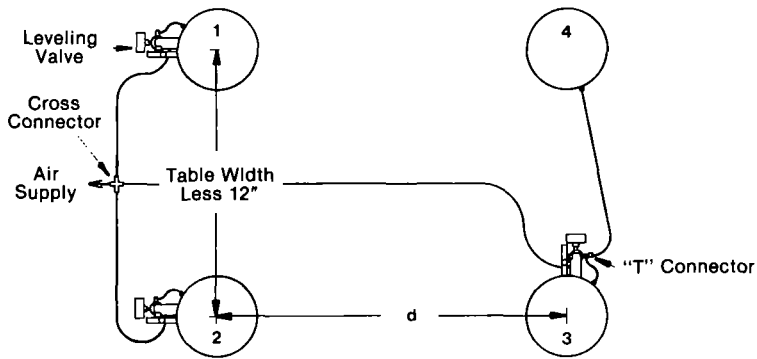
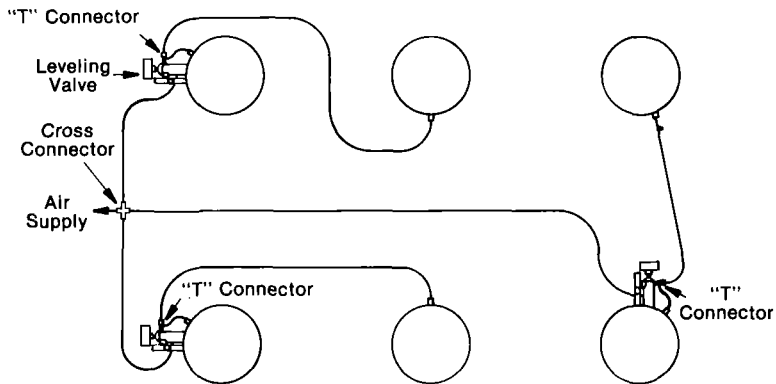


Table Length	Leg Separation "d"
6'	40"
8'	52"
10'	66"
12'	80"
14'	94"
16'	104"

4-Leg Schematic



6-Leg Schematic



8-Leg Schematic

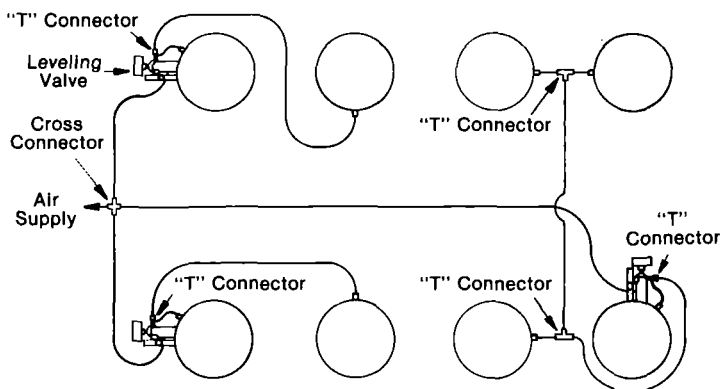


Figure 2
Valve Detail
Shown from below
to show all fittings

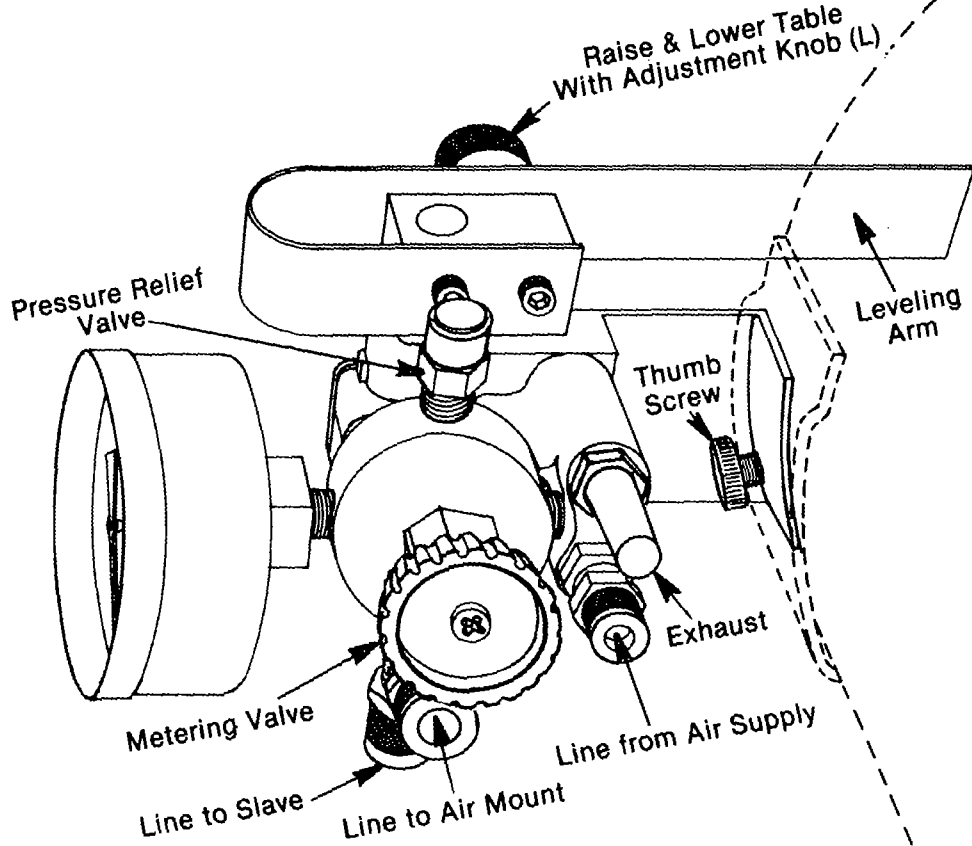
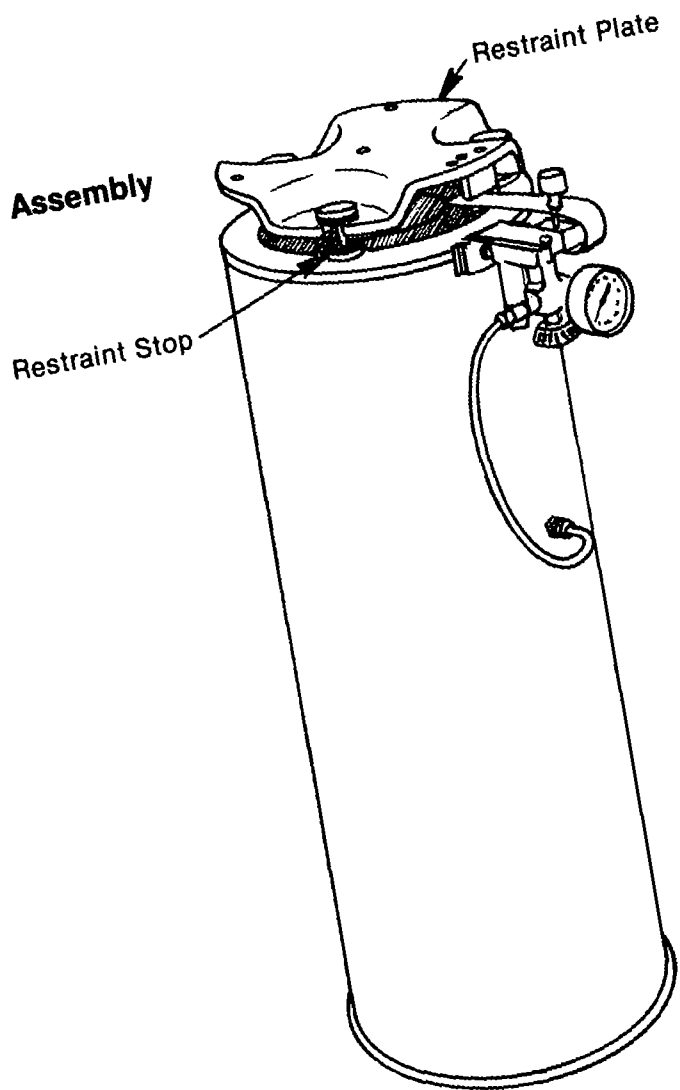


Figure 3
Air Mount Assembly



Troubleshooting

The table does not float

1. The supply pressure should be 5-10 psi above the pressure reading of any of the leveling valves. As the load increases, the supply pressure should be increased.
2. Check to see if all the air lines are connected properly, and the valves are turned on.
3. The valves may be clogged. Always use an *air regulator/filter*, such as our Model ARF, when mechanically compressed air is used.

Poor isolation

1. Vibration may be transmitted to the table due to direct physical contact of the equipment mounted to the table top with the surroundings.
2. The restraint stops are not free-floating. Check each of the three restraint stops on each air mount.
3. The equipment mounted to the table has very low resonant frequency, due to lack of rigidity, or has some very pronounced resonances to drive critical components that have similar resonant frequencies.
4. Air currents may be driving the components mounted on the table. Newport table enclosures are designed specifically to overcome this problem.

Table top oscillates

This is due to the high-center-of-mass instability problem. Please consult Newport and also refer to entry 15 above. Sometimes, the problem is eliminated simply by reducing the air supply pressure to 5-10 psi above the air mount pressure, and by opening the metering valves (V) only a half turn.

Air mounts bleed constantly

The leveling valve is defective. Mechanically compressed air contains dirt, which may lodge in the valves to prevent the seals from seating properly.

Oil leakage from the air mount

Oil will leak from the piston (metal cup above the rubber diaphragm) if the air mounts are tipped over. Loss of more than 1/8 cup should be replaced (call us for the replacement oil) although small losses would not affect the isolation performance.

To add oil to the air mounts:

1. Release air from the mounts.
2. Remove the restraint plate by unscrewing the restraint stops.
3. Grasp the piston, **without** pulling the piston out of the rubber diaphragm, turn the restraint plate counterclockwise to detach the plate from the piston. Tip the piston and fill in about 1/2 cup of the damping fluid (available from Newport). In the event that you have removed the piston from the diaphragm, the piston can be reinserted after pressurizing the air mounts slightly to 5-10 psi.
4. Reverse the above steps.

This oil can be cleaned off with kerosene or gasoline. (DANGER: Flammable fluids.)

Installation of XLC Casters

CAUTION: MOVE TABLE CAREFULLY AND SLOWLY. FOLLOW THESE INSTRUCTIONS TO THE LETTER.

Installation with New Table Systems

1. Air mounts ordered with casters are pre-drilled with three .406" diameter holes, or added, as shown in the diagram. The casters are designed to work with air mounts that are 22" or higher without modifications.
2. Remove all three 3/8"-16 bolts from the circumference of the mounting plate.
3. Remove the rubber damping ring from the bottom of the air leg.

IMPORTANT: Air legs must not be tilted over 30° from vertical.

4. Place the casters in the air mounts. Align the mounting holes and tighten the bolts securely.
5. Replace rubber damping ring.
6. With the casters retracted, proceed to install the air mounts according to the air mount installation instructions.

Installation to an Existing Table System

Follow the instruction above after the air mounts are removed from the table. The table top can be lifted with the use of a die-cart, a camper-jack or the equivalent of a fork lift after the legs are relieved of air pressure and unbolted from the table. A hydraulic automobile jack can also be used to block up one corner at a time.

Procedure to Move the Table System

1. Check that the air mounts are bolted to the bottom of the table.
2. Disconnect air supply and release air from all three leveling valves. Remove the split rubber washer from all three upper restraint stops on each leg. Insert a jack nut between each upper restraint stop and the restraint plate.
3. Extend all jack-nuts until snug. It is **IMPORTANT** to tighten each jack-nut with the use of the two wrenches supplied with the kit to stiffen the air mounts.
4. Insert the crank supplied with the kit through the large diameter access hole in the leg. Lower the caster wheels by turning the crank clockwise until it can no longer be turned.
5. The table can now be moved **CAUTION: MOVE SLOWLY AND WITH CAUTION.**
6. Reverse the above steps before using the table.

Modify standard XL or KL leg as shown here for installation of XLC Caster.

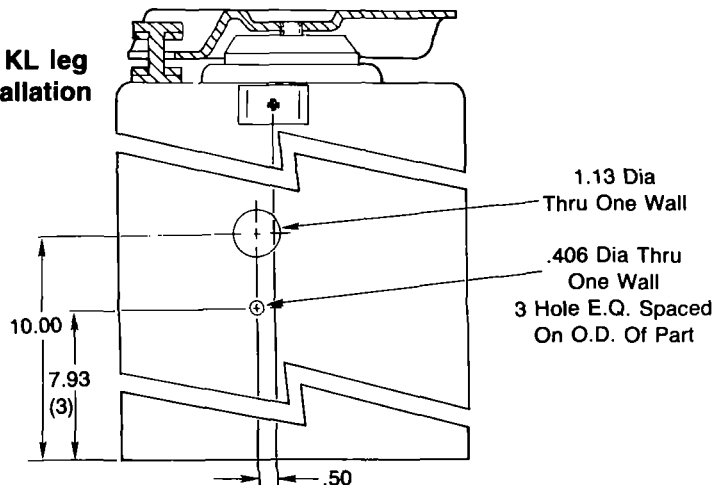
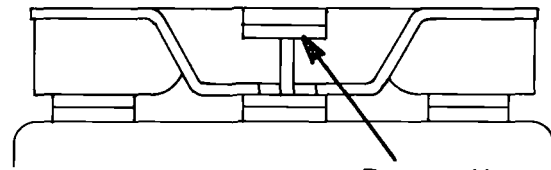
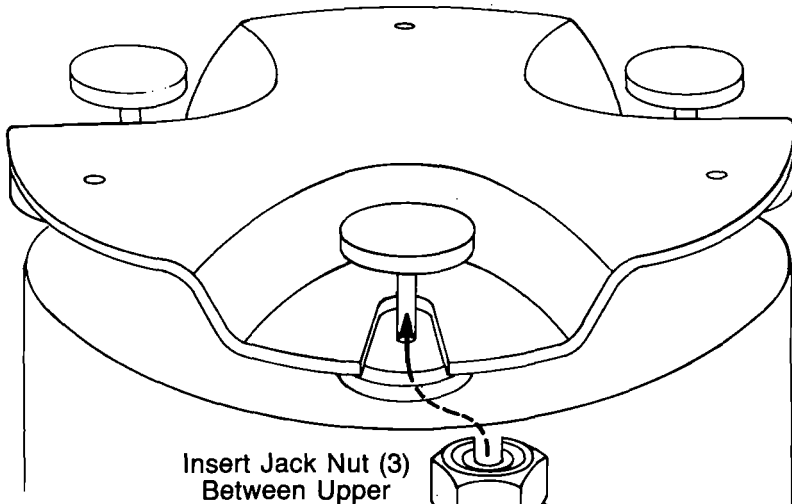


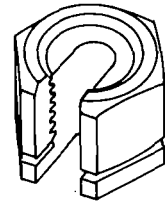
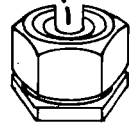
Figure 4—XLC Retractable Casters



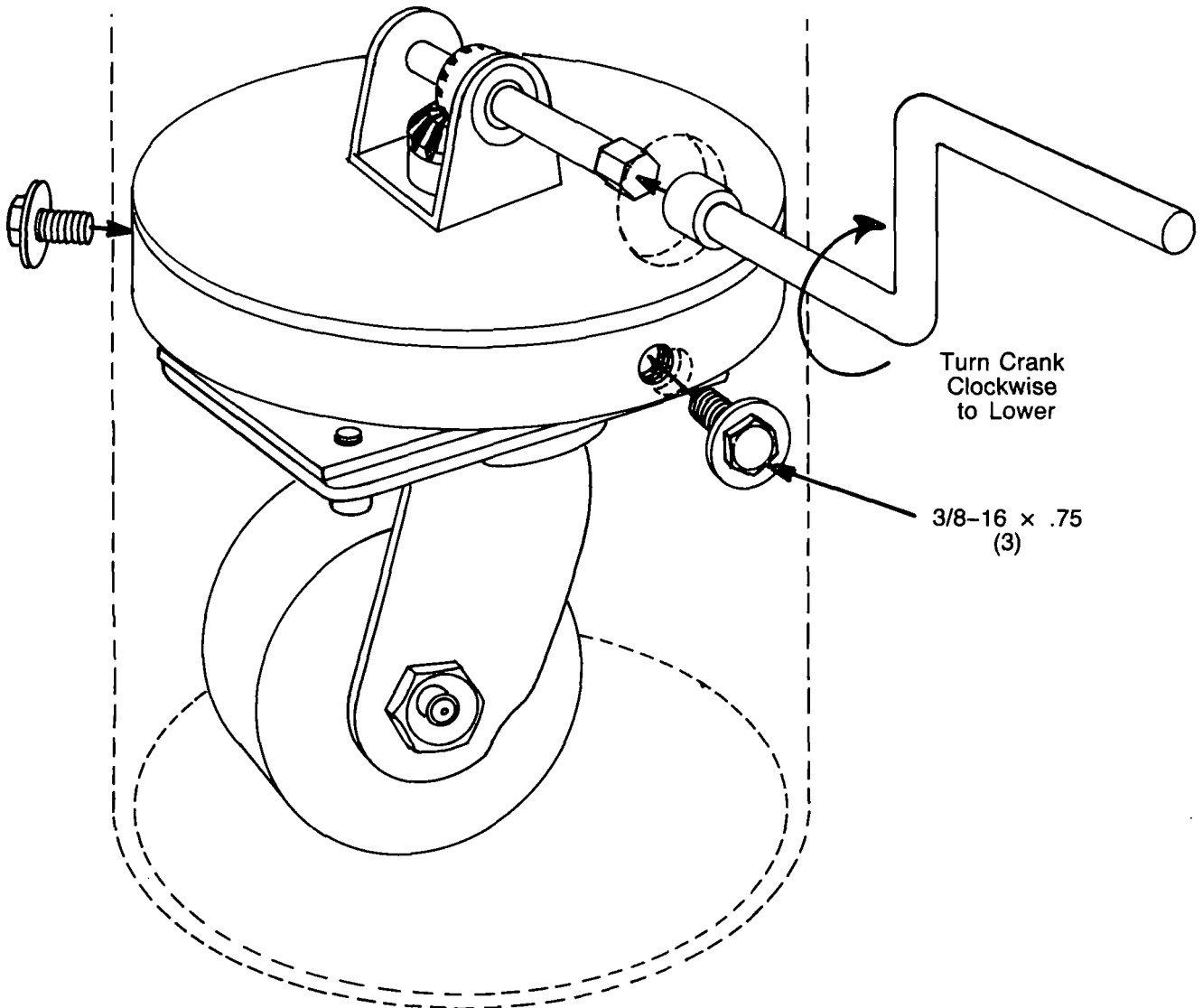
Remove Upper
Split Rubber
Washer



Insert Jack Nut (3)
Between Upper
Stop & Restraint
Plate



Align Jack Nut



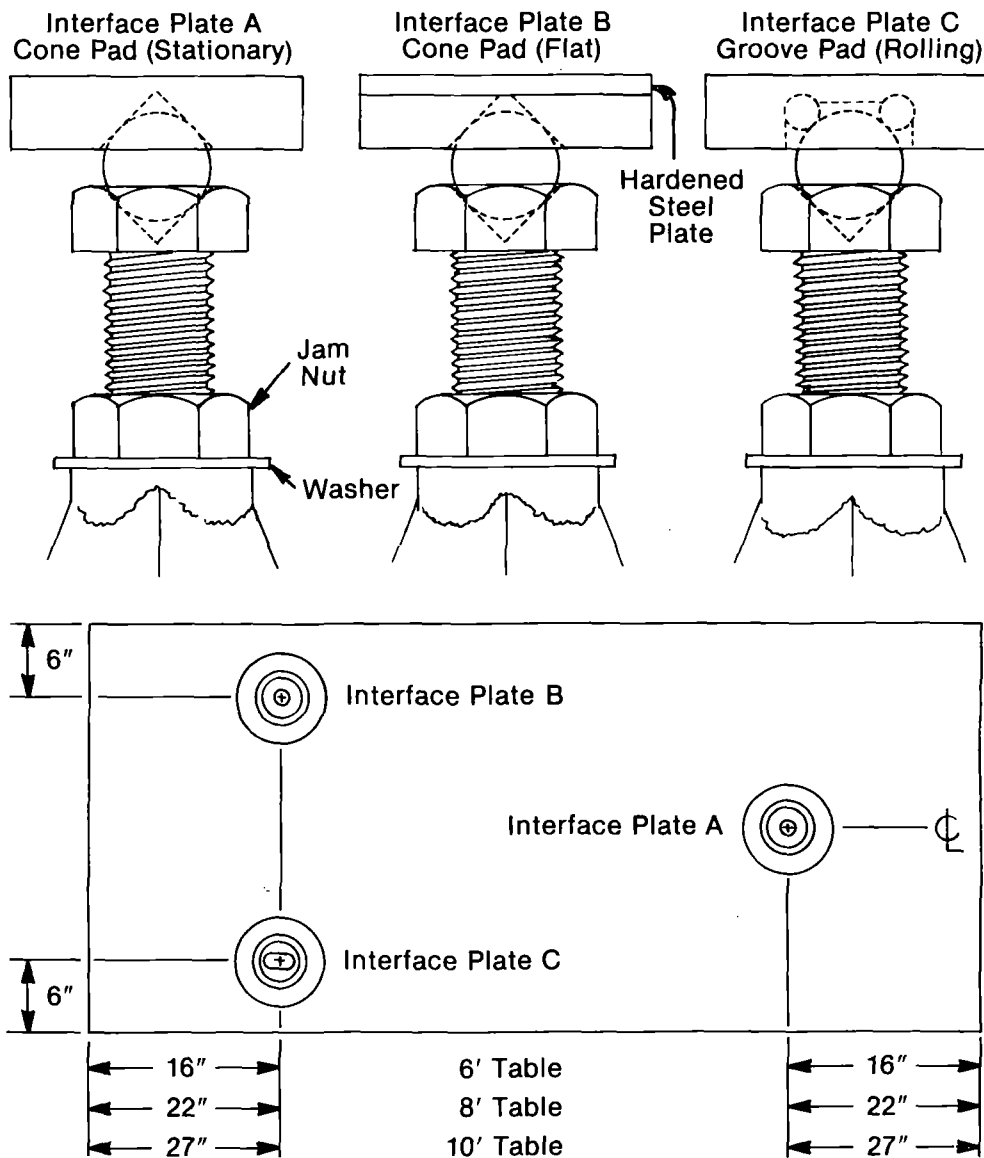
Turn Crank
Clockwise
to Lower

3/8-16 x .75
(3)

Installation of Rigid Kinematic Supports

1. Refer to the first section on handling of the table top.
2. Bolt the 12" diameter steel plate to the bottom of the table, in the orientation as shown. Please note the orientation of interface plate C.
3. Place the hardened steel balls on top of each leg and position the legs under the interface plate. The one placed under the flat (interface plate B) requires a spacer plate as shown below.
4. With the table resting on the balls, leveling is achieved by rotating the adjustment bolts on top of the three legs. Once adjusted, the jam nut should be tightened against the washer.

Figure 5—Rigid Kinematic Supports



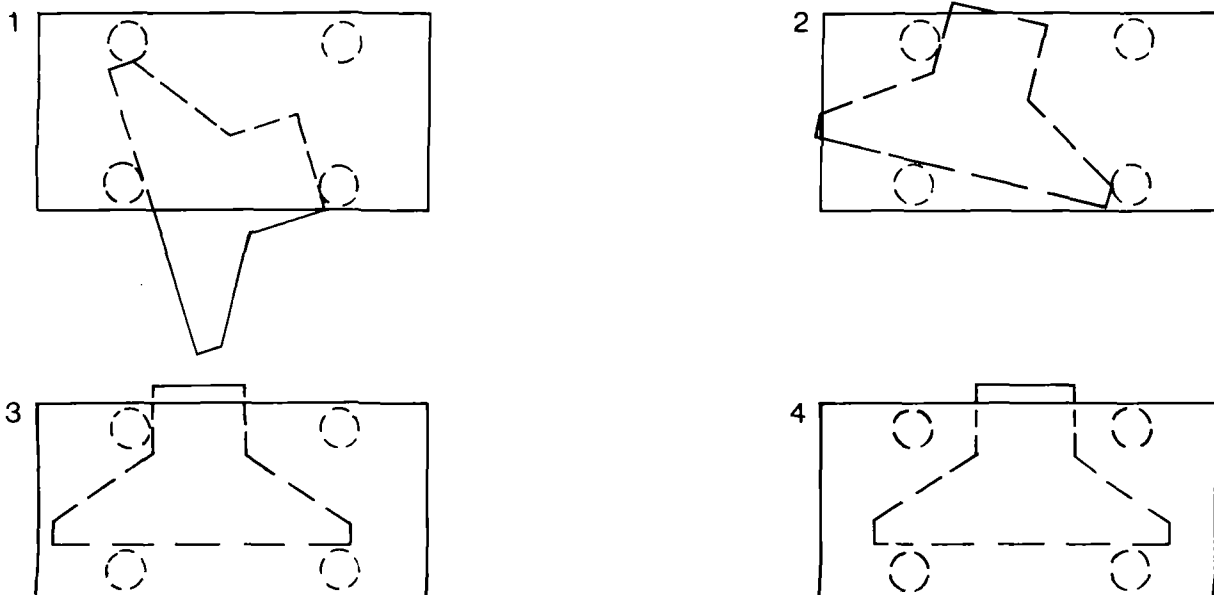
Installation of Clean Table Air System

1. Uncrate the Table Air System and visually inspect it for any damage which might have occurred during shipping. The system consists of three parts—the blower housing, the vertical housing (plenum), and the HEPA filter module.
2. Remove the end cap at the right edge of the blower housing and slide out the wire mesh screen and the pre-filters. This will expose the bolt holes which mate to the vertical housing.
3. Slide the blower housing under a table as shown in the sketches below.
4. The six bolt holes on the back side of the blower housing (opposite the pre-filters) are mating holes for the studs on the vertical housing. Move the vertical housing in position along the back of the table and slide the studs through the mating holes on the blower housing. Install the six nuts. (This is done most conveniently with a 7/16" socket wrench with a magnetic insert on a 3' extension.)
5. Slide the pre-filters back into the blower housing.
6. Slide the wire mesh screen into the blower housing, being careful not to hook the cardboard edge of the pre-filter with the leading edge of the screen.
7. Press the end cap back into position on the right edge of the blower housing.
8. Level the unit as required with the adjustable feet.
9. Install the HEPA filter module by engaging the flange on the bottom edge of the filter module with the lip on the plenum. Do not slide the module along this lip as it will distort the rubber gasket. Tilt the filter module into position against the plenum and lock it in place by snapping the latches across the top.

Tool List

1. 7/16-Socket with a magnetic insert
2. 3-Foot extension
3. Ratchet Wrench

Figure 6 — Blower Housing Positioning Sequence

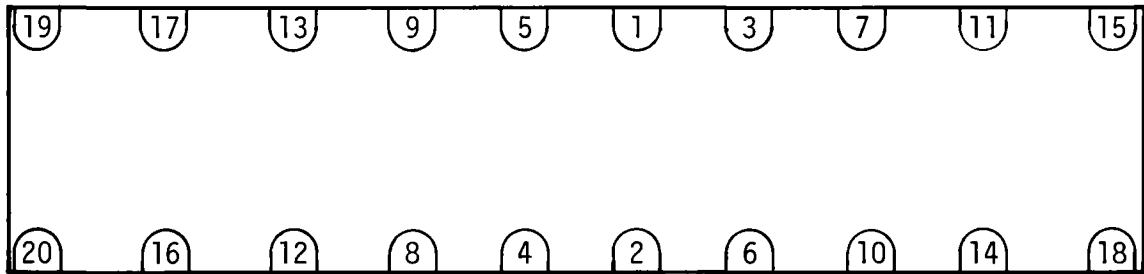


Installation of Tables with Doubler

1. Check for damage in shipping. Try to inspect for obvious damage when the shipment arrives, so that if such exists it can be noted on the bill of lading, which allows an insurance claim to be filed.
2. Uncrate the table tops and the air mounts, noting the fact that the orientation of tables is marked on the outside of the crates. After uncrating the tables, carefully check the doubler faces for anything which might prevent them from bolting tightly together. Each bolt on the doubler plate should be greased with machine grease thoroughly.
3. Locate the packages containing the leveling valves. These have been removed from the air mounts to avoid damage in shipment. For each air mount system there are three valves, independent of the number of legs. Cut and attach the required length of hose from the valve to the cylinder as per Figure 1 on page 5.
4. The next step is to place each of the two table tops on a minimum of three air mounts, making sure that the pins engage their respective holes in the table top. (If you have less than six air mounts per table system, the tables may be joined together on the floor prior to being placed on top of the air mounts. In this case, the joining of the tables is carried out with the tables resting on blocks of wood padded with sponge rubber to minimize undue stress on the doubler fasteners. The adjoining doubler surfaces should be adjacent, and as close together as practical. The two alignment dowel pins and protruding bolts will prevent bringing the two surfaces much closer than 1").
5. Before attempting to engage the alignment dowel pins and the bolts with their respective holes, it is necessary to "float" each table independently. This permits the two tables to be brought into exact alignment with minimal effort, and prevents undue stresses on the doubler fasteners and alignment pins during the process of bringing them together. The easiest way to float the two tables is to adjust the pressure in each leg separately through the valve, adding or exhausting air until the table floats midway between the restraint stops. It will take between 50-100 psi in each of the legs to float the tables, depending upon the size of the table.
6. Now, with both tables "floating," push the tables together, allowing the taper pins to mate with their corresponding holes.
7. Check the coupling bolts to be certain they are all aligned with their corresponding holes. Note that there may be a slight difference in the thread lengths of the bolts.
8. Each bolt has a predetermined amount of free play. Starting with the longest bolt (*first to contact threads*), begin tightening with a 7/8" open end wrench.
9. Tighten the first bolt only to where another comes in contact with the threaded hole. Continue this process until all mounting bolts have been started.
10. Carefully begin tightening bolts in sequence as per drawing. Tighten only to the point where free play is taken up, but other bolts have not been put into a bind. Binding will occur when hexhead comes into contact with the doubler plate, indicating zero free play.
11. Continue Step No. 10 until all bolts are snug.
12. Following the tightening sequence in Step No. 10, apply a final tightening force of 60 foot pounds to all of the mounting screws.

13. The air mounts may now be positioned and bolted to the predrilled holes below the table after letting the air out of each air mount. Fine positioning of the legs can be achieved either by lifting the whole table at one time or by raising each corner.
14. Refer to the standard table installation instructions for hook-up of the air mounts.

Figure 7 — Double Bolt Tightening Sequence



Installation of Accessory Shelf

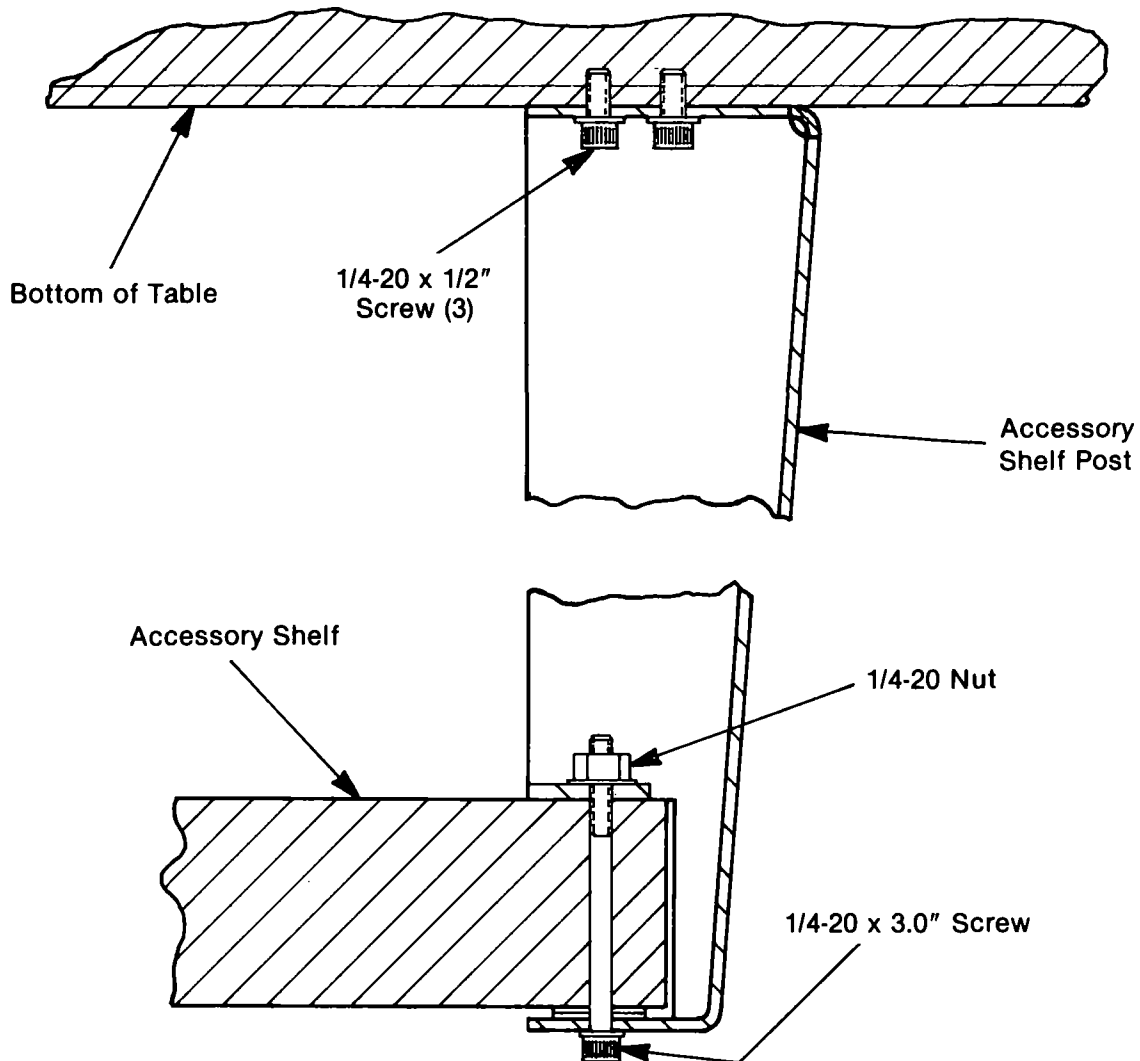
1. Attach the accessory shelf to the four brackets until the 1/4-20 bolts are snug. **Do not** tighten the bolts at this point.
2. Bolt the whole assembly to the bottom of the table.
3. Tighten all the bolts with an allen wrench.

CAUTION:

Avoid putting more than 100 pounds on the shelf.

Do not put heat source, such as a power supply, on the shelf. Temperature differences between the top and bottom skins of the table would cause the table to bow.

Figure 8—Accessory Shelf

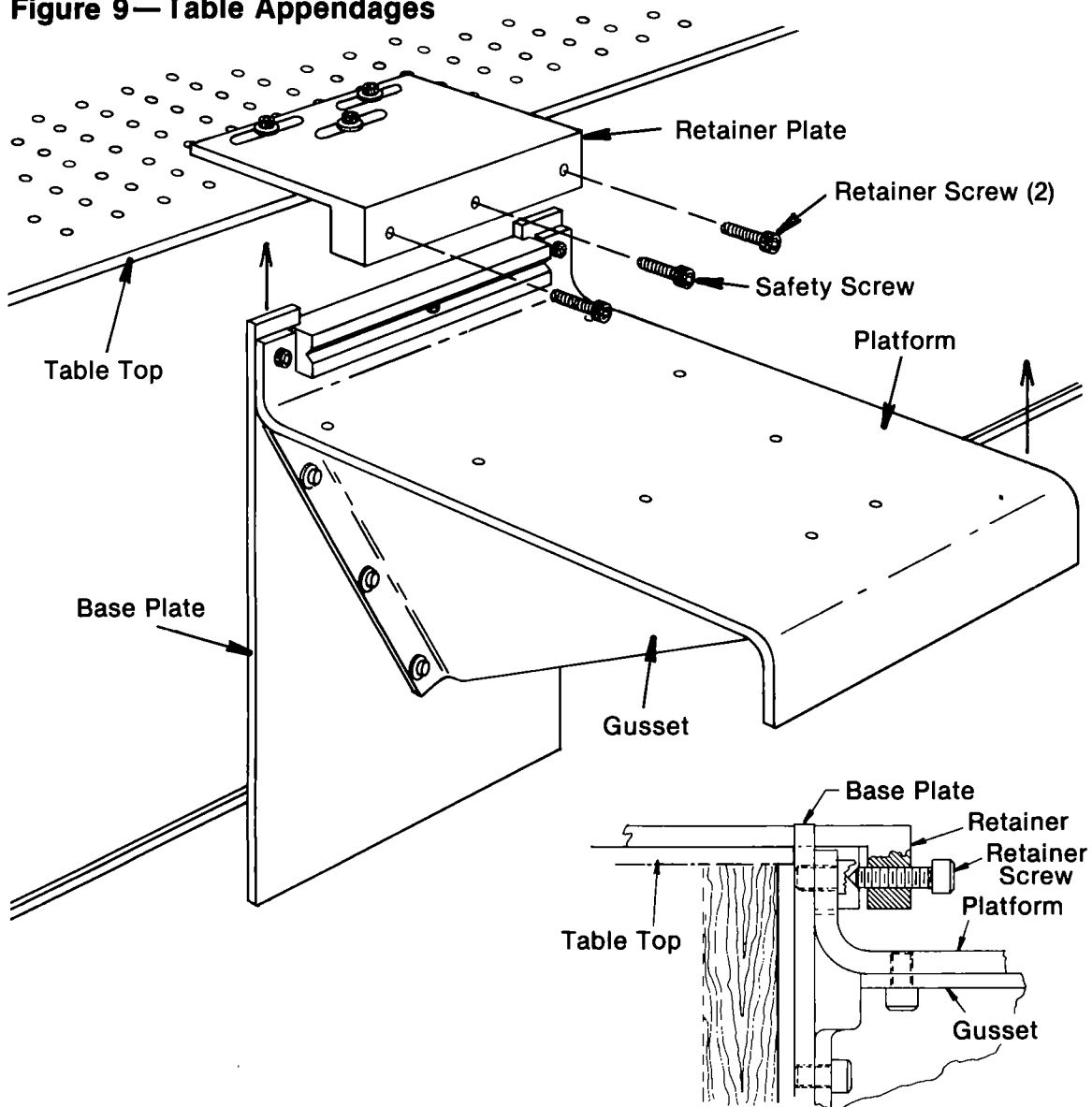


Installation of Table Appendages

1. Secure the retainer plates at the desired location with the washer and the 1/4-20 SHC screws supplied.
2. Slip the platform into the slot between the retainer and the edge of the table. Tighten the safety screw.
3. Install the retainer screws (2) and secure by wedging the ends of the screws into the vee-groove in the base plate as shown.

CAUTION: The safety screw should always be fully engaged. It should always be removed last, even in the event of removing the appendages from the table.

Figure 9—Table Appendages



Installation of Table Enclosure

Your enclosure has been shipped to you in semi-kit form. The top has the frame attached with the corner pieces (4) installed. The posts and plex panels are packaged individually along with a package of mounting hardware.

1. Uncrate the enclosure top and remove the four corner pieces. They are retained by No. 8-32 set screw in each end piece.
2. Remove the corner posts from crate and position them on to your table top (see Fig.11) so that the 1/4-20 hole pattern on your table is aligned with the holes in the bottom flange of the post. Install two 1/4-20 button head bolts, but do not tighten snugly at this point.
3. Position the enclosure top on to the top flanges of the posts aligning the hole pattern on the post flange with the two holes in each corner of the enclosure top (see Fig.11). Notice that the holes in the top are 1/2" diameter. This is to accept the feed-thru spacers, which are attached with 1/4-20 button head bolts and flat washers.
4. Once all pieces are together, all of the mounting bolts may now be secured (see Fig.11 and Fig.12).
5. Remove the panel guide pieces from the crate (two short pieces and two long pieces). The shorter pieces are installed on the table ends while the longer ones are for the sides (see Fig. 11 and Fig. 12). Position them as shown in Fig. 12 and drill into the table edge finish thru the existing holes in the lower flange with a 3/32" diameter drill using the guide piece as a drill jig. The guide piece may now be attached by using the pan head wood screws you will find in the hardware kit.
6. The plex panels are packaged with protective paper to protect the finish. Do not remove this paper at this time. You will notice that each panel has a letter marked on it, i.e., "A," "B," etc. Refer to Fig.12 and find the size (in feet) that corresponds to your table size. Notice that the drawing represents the enclosure top view and the relative position of each panel. It also tells you which race to hang the panel in (see Fig.12). Example: "A" panels go into inner race and "B" panels go into outer race. Also remember that in order to have proper fitting panels, the letter marked on the panel should always be facing outward when installed.
7. Slide all panels into place and reinstall the corner pieces. Retighten the set screws that hold each corner piece. Slide all panels to make sure you have them properly located. If the panels are sticky or hard to slide, apply a small amount of silicone grease onto the lower part of the plex hangers where they ride in the races (see Fig.12).
8. The protective coating on the plex panels may now be removed. If there is a possibility that the panels will ever be removed all at one time, they should all be marked for their location for ease of re-installation.

NOTE: The end panels do not slide, but if access to the end of the table is required and not practical from the side, the corner piece may be temporarily removed from either end to allow end panel to be slid to one side for access.

Figure 10-Table Enclosure

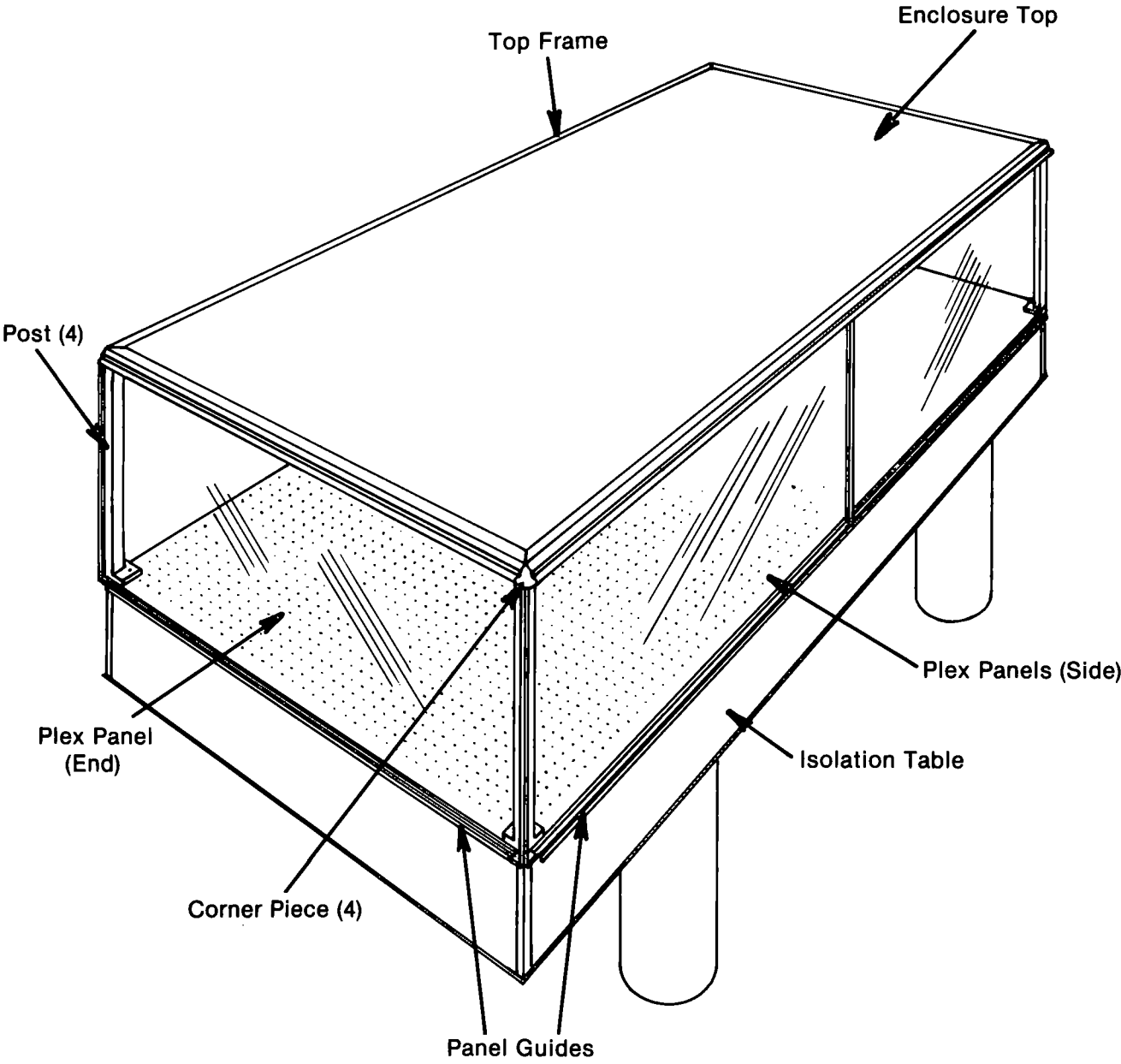


Figure 11—Corner Assembly Detail

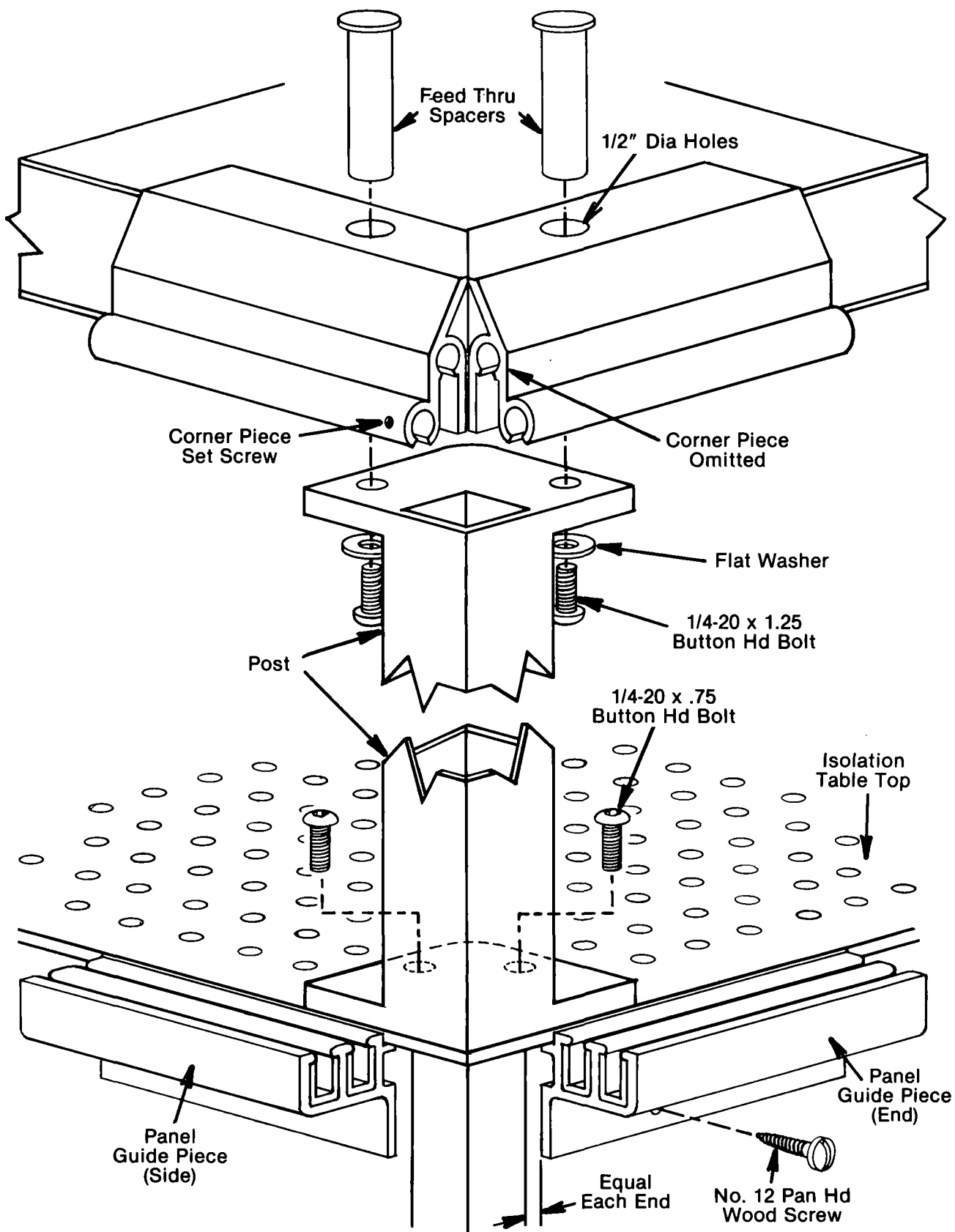


Figure 12-Corner Cross Section

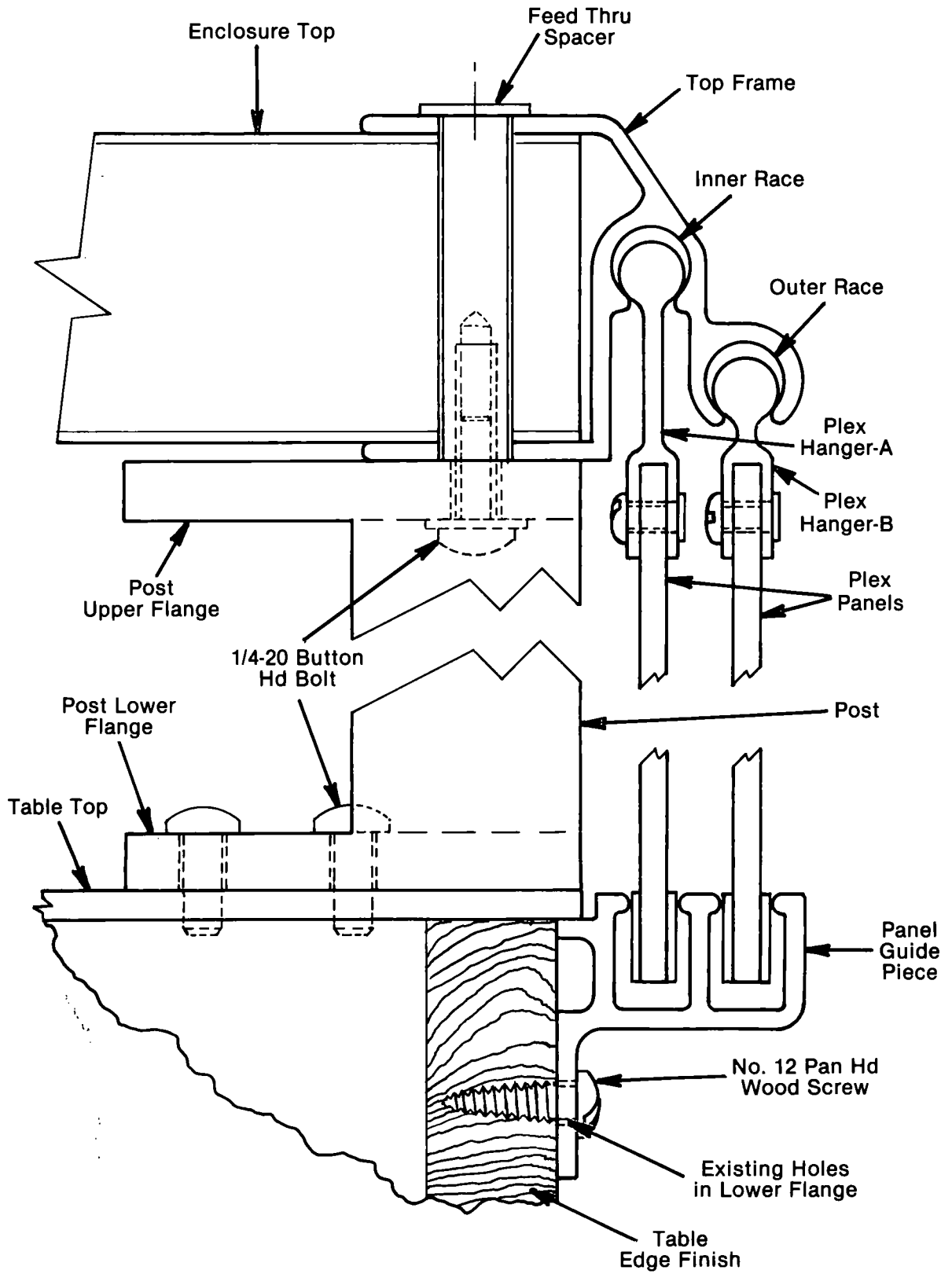
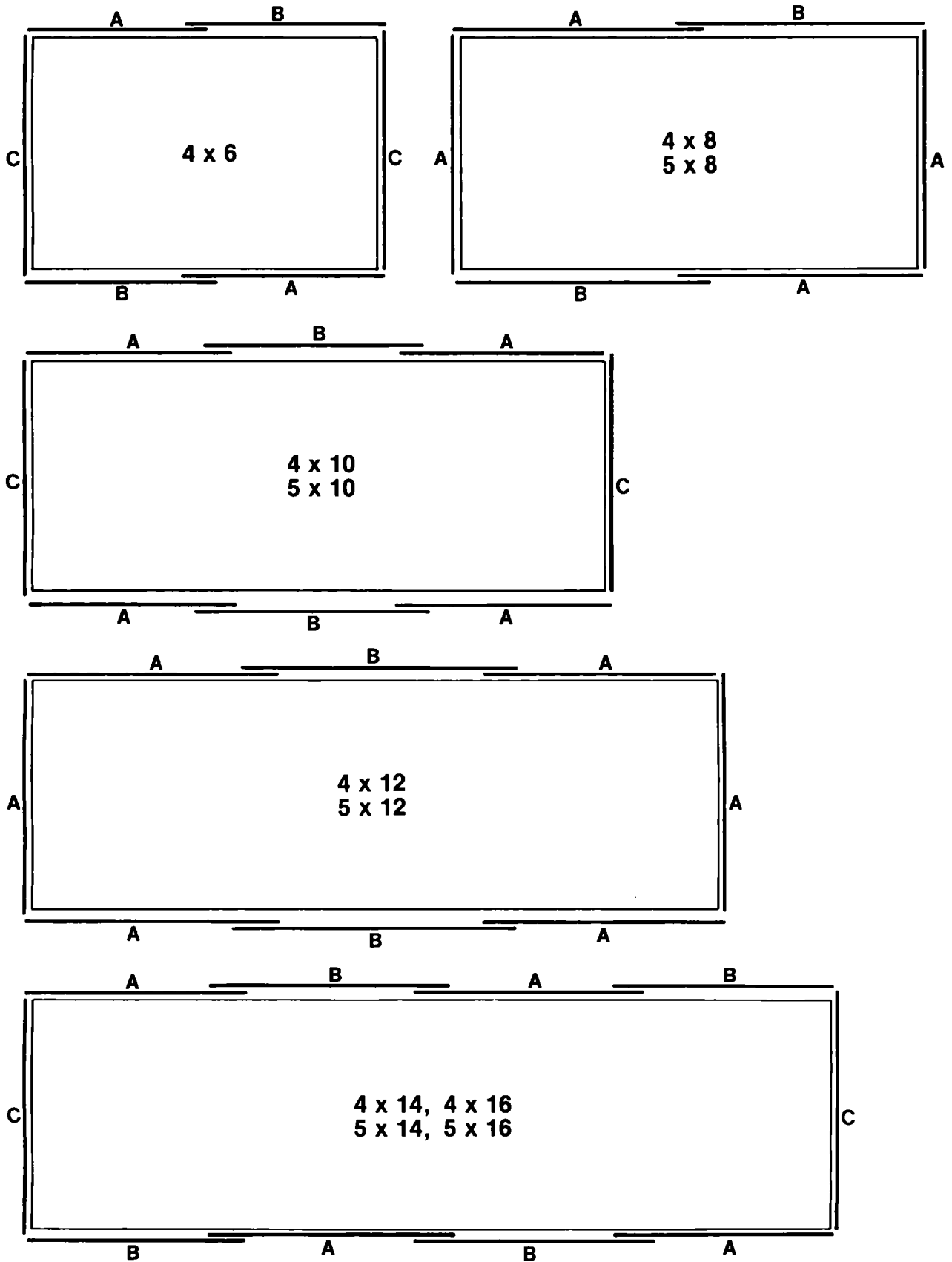


Figure 13—Panel Location



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High Precision Steering Lens Fiber Coupler F-1015 and F-1015LD Operating Instructions

Introduction

When focusing a laser beam and launching its power into a single mode optical fiber, the coupling efficiency is maximized by matching the electromagnetic field profile of the focused beam to that of the fiber mode. This is achieved by accurately centering the fiber core at the focus of the coupling lens and matching the size of the focused spot (the beam waist diameter) to the mode field diameter of the fiber's single propagating mode.

Knowing the fiber core radius, a , and its V number (where $V = 2 \frac{\pi}{\lambda} a \text{ NA}$), we can easily calculate the mode field diameter (MFD):

$$\text{MFD} = 2a(0.65 + 1.619/V^{1.5} + 2.879/V^6)$$

NA, the numerical aperture, is typically 0.1 for single mode fibers.

In the model F-1015 High Precision Steering Lens Fiber Coupler, fine translation and centering of the focused beam on the fiber end-face with 0.1 μm resolution is obtained with negligible change in the angle between the focused optical beam and the fiber axis. Figure 1 illustrates its principle of operation, which is based on the Optical Lever-Arm effect. The steering lens of the F-1015 is an AR-coated long-focal-length (254 mm) negative lens and is positioned near the back focal plane of the objective lens, so an input laser beam focuses at the fiber end-face. A transverse translation of the steering lens, D , effectively tilts the input beam entering the objective lens, causing a much smaller translation of the focused spot, d . The translation reduction is equal to the ratio of the focal lengths of the two lenses; for our M-20X objective lens, the ratio is approximately 32:1. Hence, when the steering lens moves 3.2 microns, the focused spot moves only 0.1 microns.

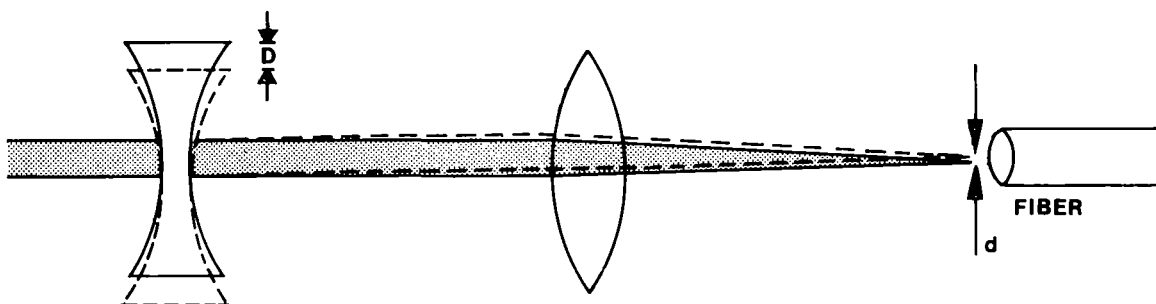


Fig. 1

Using the F-1015/F-1015LD

1) For maximum coupling efficiency, it's important that the fiber end-face is flat, clean and perpendicular to the fiber axis. We recommend our models F-BK1 or F-BK2 fiber breakers for cleaving the fiber, and our models F-IM1 or F-IM2 Fiber Microinterferometer are useful for evaluating the quality of the cleaved fiber end-face.

2) The diameter of the focused laser beam, b , is determined by the effective focal length, F , of the F-1015, which is 7.4 mm (12 mm for the F-1015LD) and the laser beam diameter, B , at the back focal plane of the lens:

$$b = 4 \lambda F / \pi B$$

The value of b may be adjusted to equal the mode field diameter (MFD) given earlier by changing the distance between the laser and the F-1015 (which changes the input beam diameter, B , due to the small beam divergence present in all laser beams).

3) Begin by centering the beam in the objective lens. The F-1015 has a built-in iris diaphragm on the input end of the coupler to assist you. Close the iris diaphragm down and align the coupler so the beam enters the iris center and runs parallel to the optical axis.

4) The XY adjustment knobs (see Fig. 2) on the fiber holder, (A,B), can now be used as coarse adjustments to locate the fiber in the focused beam. Adjust the knobs so that some light is emitted from the output side of the fiber. (A pellicle beam splitter may be temporarily inserted between the laser and the entrance lens to help fine tune the focus Z-adjustment, (C). Insert the pellicle to direct the light reflected off the fiber end face onto a distant viewing screen. Adjust C until the reflected spot on the screen has its smallest diameter. Readjust knobs A and B).

5) Optimize the coupling efficiency with the fine position controls for the steering lens, (D,E), adjusting to maximize the output power. A quick way to tell if the alignment is optimum is to observe the light scattered out to the side off the fiber input end. A minimum of scattering corresponds to optimum coupling efficiency.

6) Any cladding modes present at the output end of the fiber may be removed by mode stripping methods (e.g. a few drops of glycerol).

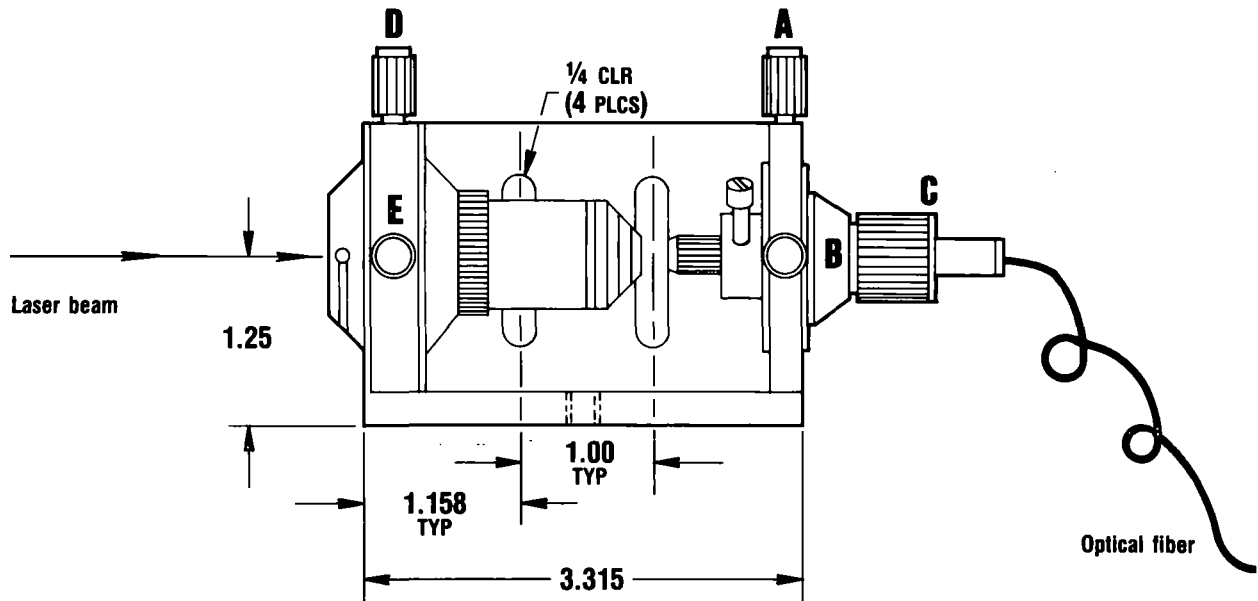


Fig. 2

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