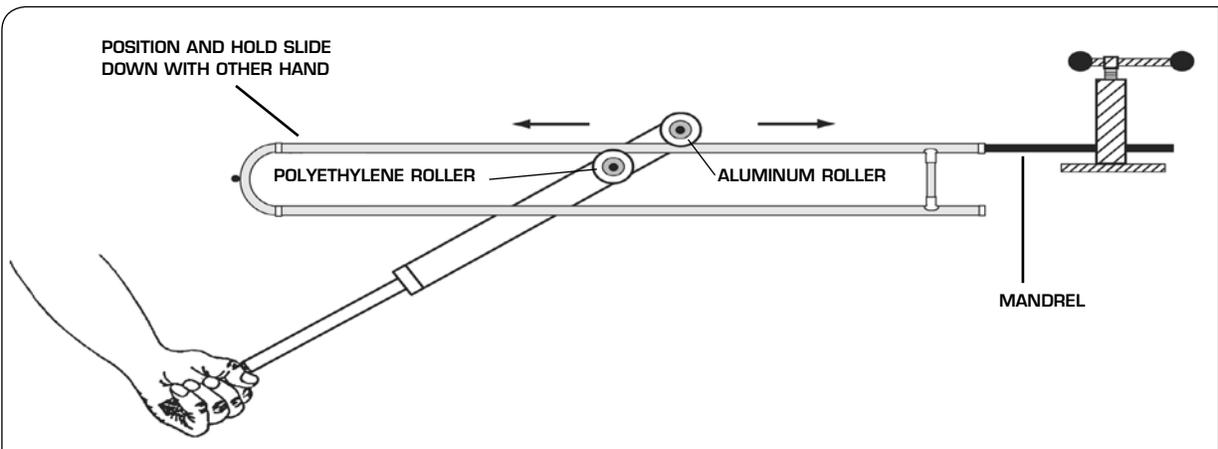


## TROMBONE HANDSLIDE REPAIR GUIDELINE

The following includes instructions for the **#2070 Lever Action Dent Roller** and is followed by suggestions and tips for working on handslides that may supplement your own repair procedures. If you are new to handslide repair you may wish to jump directly to page 2 '*TIPS FOR HANDSLIDE REPAIR*'.

In order to use the **Lever Action Dent Roller** it is necessary to use a slide mandrel with a diameter that is within approximately .015" of the inside diameter of the slide pipe being worked on. To cover the wide range of pipe diameter sizes found in different model instruments a set of 12 mandrels (see our **#2080 Mandrel Set**) is recommended that range in diameters from .4219" through .5938" and is graduated in sizes by approximately .015". We also offer some in-between sizes that come even closer to matching many popular trombone models (see our **#2082 - 0.539"**, **#2083 - 0.585"**, and **#2084 - 0.524"** mandrels).

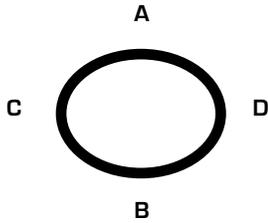
To begin, select the largest mandrel that will fit inside the slide pipe. For example, a pipe with an inside diameter of .520" will take a mandrel with a diameter of .515". If the next smallest size mandrel, .500", is used, damage to the pipe will occur. Install the mandrel in a vise (our **#2227 Votaw Mandrel Vise** works great for securely and safely holding mandrels). Make sure the mandrel is completely clean and free of grease, dirt, moisture etc. Also avoid using mandrels that have been nicked or bent. Position the slide all the way onto the mandrel and locate the dent area.



Grasp the pipe (the one with the mandrel inside it) out towards the crook end with one hand and rotate the pipe so that the dent faces upwards. With your other hand position the dent roller on the pipe as shown in the illustration. Grasp the tool towards the end of its handle and pull upwards as you roll the tool back and forth over the dent area. Your other hand is still holding the end of the slide and exerting a downward pressure to counteract the upward pull of the dent roller. While rolling the dent out keep the aluminum roller as confined to the dent area as possible. Short, even strokes work best. If you reach an area of the pipe where the opposite slide pipe interferes with the dent roller simply switch the tool to your other hand and apply the tool to the pipe from the opposite side.

*continued*

If the dent is an especially sharp crease do not be afraid to pull up really hard on the tool while rolling. Maximum pressure can be applied by grasping the dent roller at the very end of its handle. Continue rolling until dent is removed. Next check the pipe for roundness at the area where the dent was removed. The most accurate method is to use a micrometer (calipers will work but they are not as easy to use and also may scratch the finish).



DENT WAS AT POINT **A**.  
DISTANCE BETWEEN **A**  
AND **B** IS LESS THAN  
BETWEEN **C** AND **D**.

Adjust the micrometer to the pipe at the dent area. Without changing the setting on the micrometer, rotate the pipe 90° and see how the micrometer fits. It is not necessary to take a reading off the micrometer, just work with a GO/NO GO principle in mind. If when the pipe is rotated you find there is play between the micrometer and the pipe than you know that the pipe is out of round with it being narrower at this point than at the first position 90° away. If, on the other hand, the micrometer fits in one position but does not fit over the pipe after a 90° rotation than the pipe is narrower at the first position. Generally, the pipe will be narrower between the area where the dent was located, point **A** in illustration, and the opposite side, point **B**, than the 2 points 90° away, points **C** and **D**.

To get the pipe back into round apply the dent roller to points **C** and **D**. Very little pressure is needed while rolling over these areas - much less than was used for removing the dent. Grasping the dent roller higher up on the handle will allow easier control. Briefly roll on point **C**, rotate slide 180°, and roll on point **D**. Check pipe at different points with micrometer and repeat rolling as necessary. Experience will quickly help in determining how much rolling is needed for varied amounts of distortion. Check entire lengths of pipes for dents and roundness and correct as necessary.

**TIPS FOR HANDSLIDE WORK**

The following guide is set up in a series of 'TESTS' and 'PROCEDURES' outlined in the order with which our shop usually goes about repairing slides.

**TEST**

Insert one of the inner slide pipes into its corresponding outer slide pipe. Repeat with the other pipe. If one or both sides of the handslide do not work than one or more of the pipes are either dirty, dented, out of round, bent, or any combination of these. Go to **Procedure 1 - Cleaning**.

If each side of the slide works properly by itself and a visual inspection inside the tubes shows that they are clean than go to **Procedure 4 - Alignment**.

**PROCEDURE 1**

**CLEANING**

Unless the handslide is brand new it has been the experience of this shop that almost all jobs require a thorough cleaning. The importance of this first step *cannot be stressed enough* as only a small amount of dirt, oil, etc. can cause slide pipes to hang up. Whether you follow the cleaning instructions below or have your own method for cleaning, if the pipes are not absolutely clean than proceeding with further repairs can be a waste of time.

Dirt and other foreign substances found in a handslide generally consist of petroleum based oils, built up mineral deposits from saliva, and particles of dirt, lint, dust etc. Two solutions are needed to fully clean the slide: detergent for the oils and an oxidizer for the mineral deposits. Dish washing detergent, hot water and a brush will work fine for the first stage of cleaning (see **#3511** and **#3512** trombone brushes). Be sure to clean the entire length of the pipes as well as the crook and outer surfaces of the inner pipes.

For the second cleaning stage, various oxidizers are available. A solution of 10% hydrochloric (muriatic) acid and 90% water works fine. **BE SURE TO ABIDE BY ALL NECESSARY SAFETY AND ENVIRONMENTAL PRECAUTIONS.** The instructions supplied with most cleaners generally recommend a maximum submersion time of 10 minutes - longer than this and the lacquer may begin to soften. It is not unusual, however, for slide pipes to require 2 and sometimes 3 times this length of time to get fully clean, thus the following procedure is recommended.

Make sure the water key on the outer slide is properly sealing and ladle the cleaning solution (a cup and funnel work fast) into the slide until full. Take the inner slide, plug the stocking end of each pipe (stockings are the flared sections at the ends of the inner pipes) with a cork, and fill each pipe in a similar manner. With water, rinse off any solution that may have gotten on the outer surfaces of the pipes and suspend the slides from a hangar or stand them upright. After 20 minutes drain all of the solution back into the tanks and brush the slides out once again with detergent and water.

Completely dry the insides and outside of the slides. Compressed air works best for this (be sure your system is equipped with adequate filters or water and oil from the airline may end up inside the slide). Swabbing the pipes with clean clothes and a cleaning rod (see [#2363 Cleaning Rod](#)) will also work, however make sure the cloth is lint free.

Hold the mouthpiece side of the inner slide up to a light source and inspect the inside of the pipe. A mirror finish should be evident. If blotches or spots are present you might want to run the pipes back through the acid solution for another 10 minutes but it is likely that the blotches are evidence of the corrosive effect of acid in the player's saliva on the metal. Care should be taken later on if the pipe needs to be straightened as it may be quite weak in the rotten area and prone to cracking or collapsing.

## TEST

Again try each inner slide pipe in its corresponding outer pipe. If one or both sides of the handslide do not work than one or more of the pipes are either dented, out of round, bent, or any combination of these. Go to **Procedure 2 - Dents and Out of Round Pipes**.

If each side of the slide works properly by itself than try both pipes together. If the handslide does not work at this point than go to **Procedure 4 - Alignment**.

NOTE ABOUT WORN PLATING: if the inner pipe stockings have some of the plating worn off some scratchiness may be evident during the slide's operation. Light buffing on these worn areas may temporarily help the situation but replating or replacing the pipe is the only permanent solution. (Be sure to clean inner pipe and remove all polishing compound before again testing!) Also, it sometimes happens that the inside of an outer pipe has gotten scratched or scored in some manner from careless use of a cleaning rod or some other foreign object, in which case honing of the pipe or replacement may be necessary.

## PROCEDURE 2

### DENTS AND OUT OF ROUND PIPES

See instructions for **Lever Action Dent Roller** on page 1.

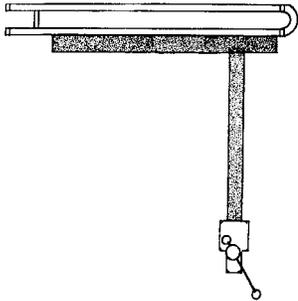
**TEST**

Try each inner slide pipe in its corresponding outer pipe. If one or both sides of the handslide do not work than one or more of the pipes are bent. Go to **Procedure 3 - Bent Pipes**.

If each side of the slide works properly by itself try both pipes together. If the handslide does not work at this point proceed to **Procedure 4 - Alignment**.

**PROCEDURE 3****BENT PIPES**

There are various methods for gauging the manner in which a pipe is bent. It has been our experience that the most reliable and quickest method is holding the pipe along a straight edge and looking for the gap(s) between the pipe and the straight edge. (See our [#2075 Straight Edge](#).)



Hold the pipe along the straight edge and carefully inspect the relationship between them. It is very helpful to have a good light source behind the straight edge, such as a window or lamp, to better locate gaps between the pipe and straight edge. Rotate the pipe so that different sides of it contact the straight edge. When inspecting the inner pipes, keep in mind that the pipe may sometimes be bent at the area where the pipe flares out at the beginning of the stocking. Also keep in mind that a pipe may be swelled out at some point along its length, a condition usually resulting from the misuse of a hammer or expander. This raised area on the pipe will create a gap between the pipe and straight edge making diagnosis of the pipe's straightness difficult.

When you have determined the location and direction of bend in the pipe, straightening can be achieved by various means. Presented here are two commonly used methods.

1) The chest muscles make for an good fulcrum against which to rest the pipe while bending, providing firm yet distributed and cushioned support. Place the peak of the bend against the chest, grasp the pipe on each side of the bend, and pull back. To help control the amount of bending and deter from bending too far and snapping the pipe, keep both elbows tucked in close and locked against your sides.

2) Place one end of the pipe on the workbench, resting it on a cushion of some sort to prevent damage to the end of the pipe. Position the pipe at an approximate 45° angle to the bench with the peak of the bend facing up. Holding the upper end of the pipe in position with one hand use the other hand to apply downward pressure to the peak of the dent. Rather than simply pressing down on the pipe, run your hand along the pipe beginning 6-8" before the peak of the bend and ending 6-8" after the peak, starting with a little downward pressure, increasing pressure as you reach the peak, and then slacking off as you go past. A rag wrapped around the hand will provide a smooth controlled motion.

Neither one of these bending methods will work by itself in all situations but together they will cover most bends. Careful improvising on the technician's part will be necessary at times. During any bending operation we recommend inserting our [#2090 Ronny's Safety Rod](#) into the pipe to provide reinforcement and to help prevent snapping. On severely bent pipes or ones that have corroded on the inside it is a good idea to warn the customer that a break may occur when trying to straighten and that replacement may be necessary.

**TEST**

Try each inner slide pipe in its corresponding outer pipe. Each side should slide *absolutely* free with no hint of drag or roughness. Again remember that if the inner pipe stockings have some of the plating worn off some scratchiness may be evident - see **NOTE ABOUT WORN PLATING** on Page 3.

If at this point the pipes do not slide freely by themselves, than one of the previous procedures was not executed thoroughly or correctly. Start with running a cleaning rag through the outer pipes to remove dirt that may have been picked up from a mandrel and proceed from there. When each side of the slide works by itself try them together. If they do not work together than proceed to **Procedure 4 - Alignment**.

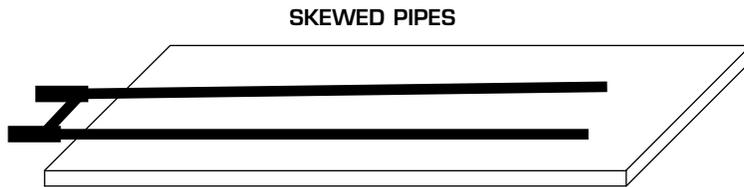
**PROCEDURE 4**

**ALIGNMENT**

Alignment has to do with how each of the four pipes sets in relation to the others. To correct a handslide that is out of alignment there are *three* factors to consider.

**1) SKEWED PIPES**

A set of pipes are skewed if they do not lie on the same geometric plane. To demonstrate, grasp the crook of an outer slide in one hand and the brace in the other hand and twist. This will cause the pipes to point off in different directions or skew. Likewise, set an inner slide down on a level surface as shown below and while holding one pipe down pull directly upward on the other. Again, this will cause the pipes to point off in different directions and become skewed.



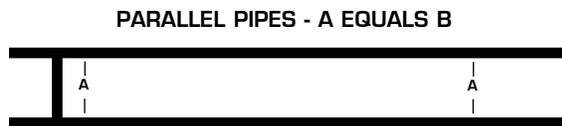
**2) PARALLEL PIPES**

**OUTER SLIDE**

The distance between the pipes at the crook end should match the distance at the receiver end.

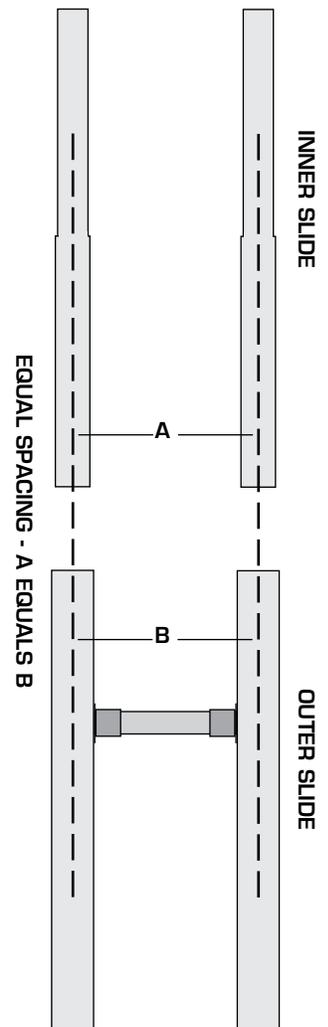
**INNER SLIDE**

The distance between the pipes just before the stockings should match the distance by the brace.



**3) EQUAL SPACING**

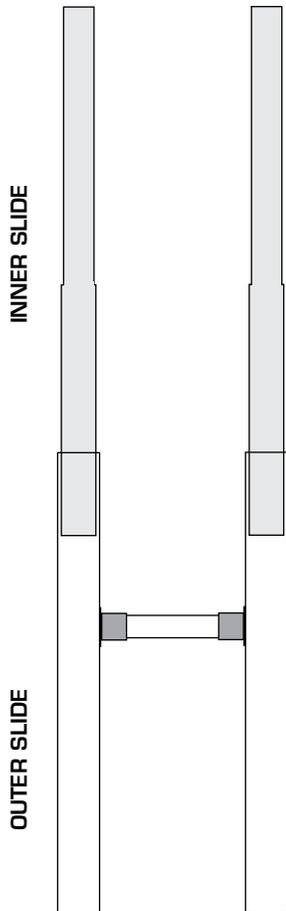
The distance between the inner pipes must correspond to the distance between the outer pipes. Picture imaginary lines running down the centers of the inner slide pipes. The distance between these lines must be the same as the distance between imaginary center lines in the outer slide pipes. See illustration right: **A** must equal **B**.



With an understanding of these three alignment factors we can now start with the alignment procedure. Set the outer slide on the risers of our **#2076 Leveling Block** (or other suitable flat surface).

Check to see that each pipe is making contact with each of the risers. If not, than the pipes are skewed. Grasp the crook in one hand and the brace in the other hand and twist the pipes in the necessary direction.

Set the inner slide on the risers and check for skewed pipes as done for the outer slide. If these pipes are skewed, clamp one of the **#2077 Bending and Holding Mandrels** in a vise and slide the corresponding pipe onto it. Place the other mandrel into the other pipe and bend as necessary.



**#2077 BENDING AND HOLDING MANDRELS**

The final alignment procedure involves checking that the inner pipes are parallel and also that the inner and outer pipes are equally spaced. Time spent in getting the inner slide pipes parallel without also making sure that they are evenly spaced with the outer slide pipes may be time wasted; therefore both these aspects of alignment are dealt with in one procedure.

With one hand grasp one of the inner slide pipes just above the stocking. Grasp the outer slide with the other hand, and holding both slides in a vertical position, place the inner slide just inside the outer slide (see illustration at left). Look closely to determine if both of the inner pipes are freely centered inside both of the outer pipes - each inner pipe should fit inside each outer pipe without making contact with it. If they do not center up, use the bending and holding mandrels to bend the inner slide pipes in the necessary direction. After bending it is a good idea to check the inner slide on the leveling block again to make sure the pipes have not been skewed. Once the inner and outer pipes are centered as outlined above bring the inner slide to 2nd position. Again look closely to determine if the inner pipes are centered in relation to outer pipes. If not, lay the handslide on the risers with the inner slide still in 2nd position and heat up the inner slide brace. (To prevent the torch from damaging the **Leveling Block** position the handslide so that the inner slide brace extends a few inches beyond the end of the **Leveling Block**.) Readjust inner pipes as necessary and check spacing again as done at the beginning of this paragraph.

The handslide should work perfectly at this point. As different players use different types of lubricants it is usually recommended that no slide oil or cream be applied by the technician; the slide should operate absolutely free in a vertical position without lubricant.

