



Brass Instrument Maintenance



A survival guide for band directors

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Table of Contents

Piston Valves	pg. 4
Instrument Finishes	pg. 13
Dent Work	pg. 19
Trombone	pg. 21
French Horn & Rotary Valves	pg. 25
Large Brass	pg. 32
The Instrument Case	pg. 35
Band Instrument Repair.....	pg. 36



"...gee, it worked last night when I practiced my usual hour..."



PREFACE

The care and maintenance of brass instruments has long been a subject of discussion and there are many successful approaches to a given task.

What follows is an attempt to "de-mystify" brass instrument maintenance by offering clear, concise answers to common questions posed by music educators and students.

The focus will be on student level instruments, as these are more plentiful, the least cared for, and have less variance between brands.

A professional has a distinct advantage over a beginning or advancing student in both experience and equipment: A professional instrument will be more sturdy, made from superior materials, and be much more precise in the fitting of moving parts. In contrast, a student level instrument will be, on average, not as strong, have fewer selected metals and be much looser in the fitting of moving parts. These are mere realities of mass production.

Manufacturers around the globe make every effort to produce the best student instrument for the lowest cost. However, it is the responsibility of repair technicians, instructors, and performers to maintain musical instruments to their highest performance standards.

A student can hardly overcome the shortcomings of any instrument with the same ease as a professional, therefore her/his instrument must have every possible advantage in its care and maintenance to offer the student the highest possible potential for rapid and consistent learning. It is in this spirit that this text is written.



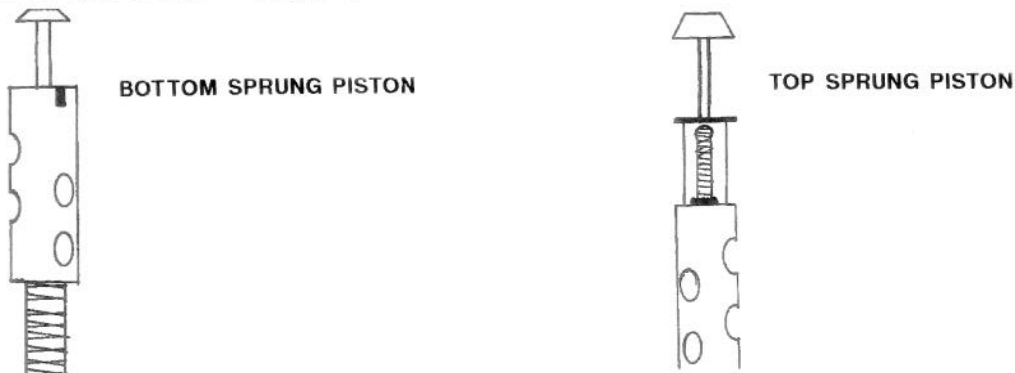
"...I thought we were supposed to use Crisco on the valves..."



PISTON VALVES

First introduced in the mid-nineteenth century, the piston valve has been dominant in brass instrument manufacture. While there is some cross-over between rotary and piston valves with tubas and euphoniums made in Europe, manufacturers in the United States have preferred the piston valve for all instruments except, of course, the french horn.

A piston valve will be either top sprung or bottom sprung (see below). Top sprung will be found nearly exclusively on trumpets, while bottom sprung pistons are common on baritones, euphoniums and tubas. A flugelhorn will have either.



The reason a top sprung piston is used for trumpets and cornets is the length factor--the bearing surface can be maintained while housing the spring, valve guide, and stem. With larger brasswinds, where the valve stroke must be kept similar to that of the trumpet/cornet, a bottom sprung piston is a necessity. Otherwise, using a top sprung valve on a large instrument would be heavy, clumsy and impractical.

Piston valves will be either made of monel or nickel-plated brass.

Monel, a very hard, non-staining metal is common on professional trumpets, cornets, flugelhorns and some euphoniums. Some manufacturers are now using monel on student-line instruments as a selling point. A monel piston is identified by its brass ports.

A nickel-plated piston is also very durable and stain resistant, but can often lack the precision in tolerances common with monel, not because it is inferior to monel, but because it costs less to manufacture and is used on student level instruments where extreme precision is not a priority. Nickel-plated pistons are also common on large brass instruments where the use of monel is not cost effective. A nickel-plated valve will be plated over its entire valve surface, including the ports.

1. Which is preferable, monel or nickel-plated pistons?

The most important factor is in the fitting of the piston, not necessarily the material.

Originally used almost exclusively for professional instruments, monel is now used as a selling point for both student and professional model brasswinds. There are advantages of monel over nickel plating: it is more wear resistant, resists staining and can be honed to closer tolerances than a nickel-plated valve. But, like a car's engine, if the pistons are too loose, no matter the material, the performance and overall life of the instrument will suffer. On student line instruments, pistons can't always be fitted to the same tightness as on



professional instruments. Therefore make sure the valves are as tight as possible from the factory, no matter the material or plating.

2. How often should piston valves be oiled?

With petroleum-based oils, it is best to oil piston valves a minimum of three times per week, preferably every day, regardless of instrument use.

The judgement on oiling doesn't lie in how easily the valves move but by how much oil remains present over a given length of time. Oil serves as a lubricant as well as a means of carrying dirt and debris down to the bottom valve caps.

Most petroleum valve oils can dissipate and evaporate in one or two days, leaving condensation and player-introduced moisture to lubricate. This remaining moisture causes premature wear, no matter the perceived smoothness of the valve action. Most professionals oil their pistons every day because constant use also contributes to dissipation. The biggest clue when looking for lack of oiling is the brownish-green staining of the piston material, particularly monel.

Students will often wait to oil until the valve is not running smoothly, or has excessive grit noise. This only aids in wearing the casing prematurely, causing looseness. On the opposite end, it is impossible to over-oil a piston valve. Any excess will simply drain through the waterkey.

3. What is the best valve oil to use?

Because piston valves are fit to varying degrees of tightness, choose the oil that works best for the instrument. Do not use any oil containing silicone.

Valve oils come in both petroleum based and synthetic forms, both offering sufficient lubrication. The only problem of synthetic oils is the expense for young students and the inability of some to mix with petroleum products-- a particular problem when students share everything during band.

The expensive synthetic and pro-line oils may offer slicker action, but are best left for tighter valves found on professional level instruments where the true difference can be appreciated. However, do stay away from oils and greases with silicone added. They are great for trombone handslides but cause moisture build-up and promote excessive corrosion on piston casings and tuning slides.

Home concocted lubricants are also out. These include olive oil, mineral oil, pure kerosene, WD-40, and spray silicone lubricants. These are bad news for brass instruments.

While there is a difference in oils available, the oils provided by manufacturers will, by and large, work very well on student line piston valves. When the student reaches the point where a difference is discernible, the synthetic and more expensive oils can be experimented with.



4. What is the best way to oil piston valves?

Placing the oil directly on the piston valve surface (see explanation D).

There are four common ways to oil valves:

A. Through the bottom valve caps.

This is a widespread practice but is not good for two reasons:

1. The oil will generally fall inside the hollow valve, not really lubricating as it should.
2. The bottom caps will release all the dirt and grime they are intended to collect from the sheeting action of the valve oil. This debris serves as an abrasive and can loosen the valves over time.

B. Through the mouthpipe.

Also common, oiling through the mouthpipe is popular because it is said that oil on the inside tubing of the instrument can protect against grime build-up.

However, as an instrument is played over time, grime, salts, and calcium deposits are inevitable and, forced into the valve section, serve as excessive debris and grit, eventually slowing and wearing the pistons. There is also the danger of petroleum distillates irritating the player as the oil runs back through the mouthpiece. Not recommended.

C. Through the slide tubing.

Quick and easy, oiling through the slide tubing will too often thin slide grease and thicken valve oil as the two mix together on the way into the valve casing. There is also a good chance of picking up debris along the way. Not recommended.

D. Placing oil directly on the piston valve surface.

Preferred by many repair technicians and professional players. Oiling the pistons from the top to bottom offers a sheeting action which carries dirt and debris down the valve caps and offers a clean coating of oil over the entire piston surface. This properly lubricates and offers the pistons prolonged life.

5. A piston valve is sticking in one spot, or over its entire stroke. What should be done?

Dents can be a serious cause of sticky or slow moving pistons. Often, a stray mouthpiece in the instrument case can severely damage valve casings. However, it is important for the director to examine the piston and casing to determine if dirt and grime build-up is the reason for trouble:

- A. Check the pistons for proper order.
- B. Wipe both pistons and casings with a lint free cloth. This removes any grime that may be contributing to the problem.



- C. If the 2nd piston is sticking, check the valve slide, as the casing ports are often pushed in from improper handling. Use one of the other valve slides to flex the slide ports back to position.
- D. After wiping casing and piston, run piston dry to determine if a dent is indeed present.

DO NOT DO THE FOLLOWING: Use any sort of abrasive on a piston valve or casing. This include cleansers, sandpaper, toothpaste or pumice-based soap. You will ruin or severely damage the pistons. There are very few instances in professional repair where abrasives are needed.

The main purpose is to determine if the slow piston is gummed or stressed (see letter C). If the casing or piston is dented or bent, consult your local repair technician for proper repair.

6. Should students stretch their valve springs if the pistons are running slow?

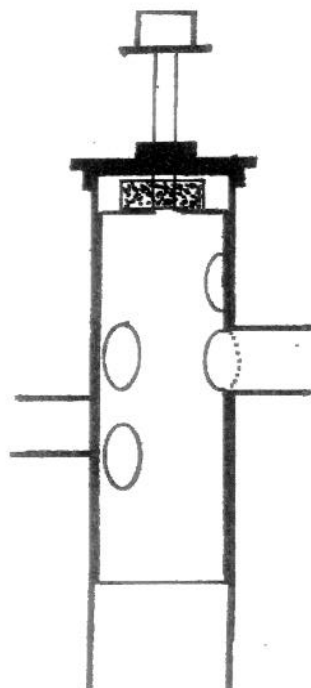
No. Students should not tamper with the instrument. Stretching only makes the student work harder in moving the pistons, and contributes to premature wearing of the piston and casing.

As in #5 above, the real cure for slow piston valves is usually a good chemical cleaning or a simple wiping. It is recommended to wipe the casings and pistons a minimum of once every 3 months to remove excess grime and buildup.

Stretching the valve springs will only ruin a set of springs and make the player work much too hard in moving the valves.

7. What is the purpose of felts on the valve stem and valve cap?

The purpose is to regulate and quiet both the up and down stroke of the piston.



Both up and down stroke regulation is critical to proper instrument performance. If the felt bumpers are not correctly selected, there is a mis-alignment between the piston valve and the tubing passing through and out of the valve casing. Any mis-alignment and the instrument can play stuffy and out of tune.

Each instrument brand will have their own felt thicknesses for proper regulation. If in doubt, seek your qualified repair technician. But never replace a stem or cap felt without being positive of proper alignment.

Also, never allow a felt to become wet by immersing in water. It will fray and fall apart, sending endless debris into the casing and piston.



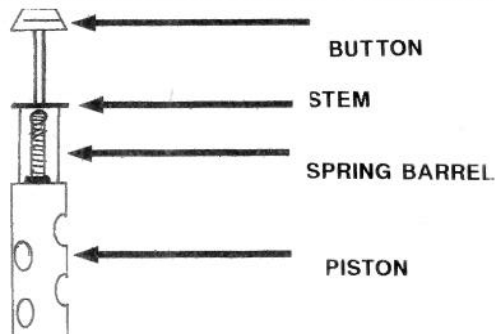
8. What is the best way to loosen a stuck aluminum valve stem?

Prevention is the best cure. Use tuning slide grease on all threaded parts of a brass instrument to prevent sticking by corrosion.

Don't try to grab any round instrument part with pliers--you will create a repair job. The stem is probably fusing with the brass and should be removed by a qualified repair technician.

Manufacturers have long used aluminum in the valve stems on top-sprung piston valves (trumpet/cornet). There is a weight advantage translating into improved valve action.

The main difficulty with aluminum valve stems is the tendency to fuse with the brass spring barrels (see below). Moisture trapped between the two metals is a catalyst--often making valve stems next to impossible to remove. The best remedy is prevention when the instrument is new or when corrosion is not a problem by dabbing some tuning slide grease on the stem threads.



9. What is the best grease to use on main tuning slide and valve slides?

Use a grease from a reputable manufacturer. Do not use petroleum jelly or lanolin on any brass instrument part. Also, never use any lubricants containing silicone on piston or rotary brass instruments.

For years, band directors and repair shops have recommended petroleum jelly or lanolin as a lubricant for valve slides. Silicon has also been recommended. These products serve to hasten the corrosion and gradual sticking of all the slides on a brass instrument. It is very easy to determine if a student is using these products: the brass tubing is dark, corroded, and often sticking in the outer slide.

There is a myriad of grease choices available from both the manufacturers and auto parts store. For young students, the convenience of manufacturer's grease sold in small containers easily outweighs lugging around 1/2 and 1 pound tubs of grease found in department and auto stores. A small bottle or container of grease should last a minimum of one year and be very convenient for student and parent.

Of course, some greases will break down sooner than others and some lubricate better as well. The choice is up to the consumer, but again, do not use petroleum jelly, lanolin, or silicone on any piston or rotary brass instrument part.



10. The third valve slide is too sticky to use effectively for tuning. What can be done?

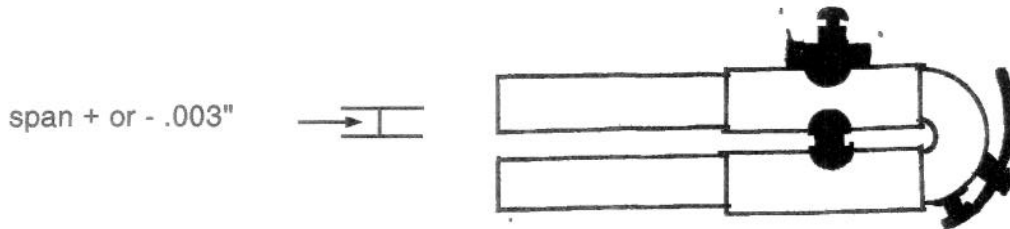
Have the slide properly aligned and fit by a professional.

Do not use sand paper or any other abrasive to make the slide work better.

On student and mass produced professional instruments the inner and outer slide tubing is fit for free movement of the individual tubes (upper and lower) and usually has enough clearance to accommodate the inaccuracies in the assembly of the tuning slide (misalignment).

When any slide on a brass instrument is sluggish, the first step is to check each tube individually for drag. If each works freely separately but poorly together, the problem will be in the alignment of the slide.

Any valve slide must be absolutely parallel. The tolerances for a well made slide can vary + or - .003" in the parallel span of the slide tubes (see Illustration below).

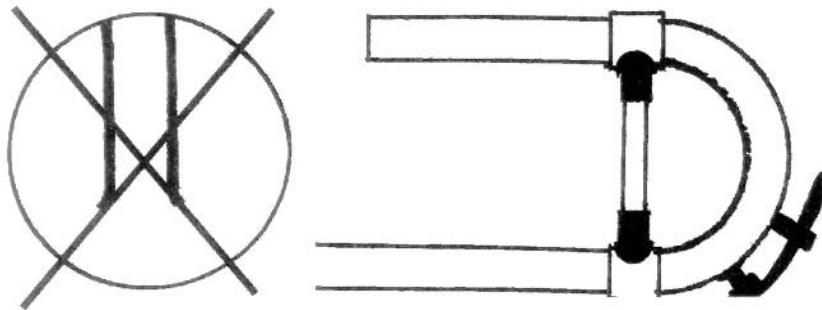


Have the slide properly aligned by a professional repair technician. It does not take long and is generally inexpensive. Lapping is sometimes involved, but does not risk air leakage if selected and used properly.

Too many professionals and students alike choose to use sandpaper to make the inner slide tubes smaller. This only adds leaks in an instrument--very detrimental to an instrument's proper performance over time. In addition, most student line instruments have looser tolerances to begin with, only serving to make a bad situation worse.

11. The valve or main tuning slide is too loose and falls out. What should be done?

Take it to a repair technician to have the tubing properly expanded. This repair is inexpensive and quick.



Do not flare the end of the loose tube with a plier or screwdriver and do not bend the slide out of proper alignment. Flaring the end of a slide tube reduces the working surface of the tubing to no more than 1/32", causing it to wear quickly and necessitate repeating the procedure soon after. Flaring also has acoustical ramifications.

There are tools made to properly fit loose tubing where the entire tube is enlarged to fit over its length. It is the same procedure used to fit loose flute head joints.



12. The slides are stuck and can't be pulled by hand. What now?

Apply a few drops of penetrating oil and let stand over night. Then attempt to pull by hand once again. If this fails, take to a qualified repair shop. Do not use cloth or ropes to jerk-pull slides.

The purpose of penetrating oil is to break down the corrosion and galvanizing that freeze slides shut. These oils can be found at auto supply stores. Give the penetrating oil time to work: A minimum of 3 or 4 hours but preferably over night. The corrosion must be dealt with first.

Certainly do not tap the stuck tubing, or pry with a screwdriver. Also, tugging on a brass instrument generally serves to break braces and stress the bell and body of the instrument. While some can claim numerous successes with tugging, stress damage can be hidden and take time to be evident.

Even if the penetrating oil doesn't allow pulling by hand, it makes the job much easier for the repair technician and should cost much less to the player.

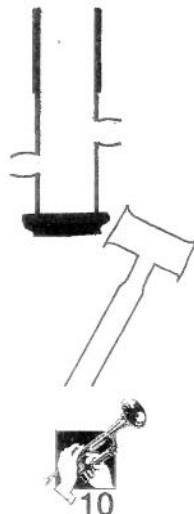
13. Is there a quick repair for stuck valve caps?

Determine if the cap is cross threaded or corroded. If cross threaded, loosen with cloth or leather covered pliers. If corroded, tap the cap with a rawhide mallet to break the corrosion.

As common as stuck slides, valve caps are less troublesome to loosen. It is vital, however, that the person determine the cause of the problem, as tapping on a cross threaded valve cap can severely damage threads adding dollars to an inexpensive repair technique. A cross threading example is below.

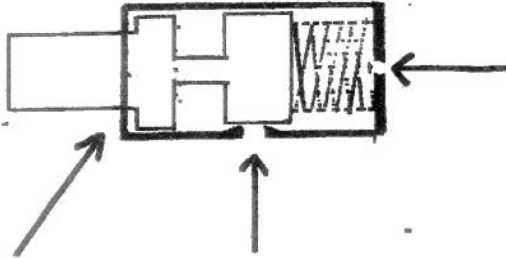


With corroded valve caps, tapping with a rawhide mallet is preferred. Any material harder than rawhide can damage both the cap and the valve casing. Rawhide mallets are generally used on chimes. Tap with firm but not hard strokes. It is best to tap a stuck cap numerous times rather than with one hard whack. See below.



14. What is the best way to care for AMADO waterkeys?

For proper maintenance lubricate with valve oil every time the pistons are oiled (minimum three times per week or daily).



The AMADO has been popular for years and is now used by many major manufacturers. It offers an acoustical benefit and performance enhancement by smoothing out the waterkey vent on slide crooks.

The AMADO waterkey is a precision-made product with very close tolerances between the moving steel piston and brass casing. Because it is so well fit, any debris or corrosion will cause the AMADO to stick. On student instruments, this is a common headache for directors.

The AMADO, if oiled as shown three times per week, should not stick nearly as often.

15. How often should an instrument be chemically cleaned?

An instrument should be chemically cleaned once a year.

Commonly termed an "acid bath," chemically cleaning will greatly prolong the useful life of brass instruments. Basically, the instrument is taken through a three stage process:

- A) **DETERGENT:** Industrial detergents breakdown the build-up of oil and grease.
- B) **PICKLE:** Pickles remove the lime and scale that is very damaging to brass. This step is important in the prevention of dezincification (redrot).
- C) **BRIGHTENING:** Brighteners leave the instrument interior in a state where corrosion and scale build-up are inhibited for the future. There is also color enhancement.

This once a year maintenance will allow for replacement of waterkey corks and piston valve felt bumpers, as well as be an opportunity for dent removal. Many repair shops are equipped to perform this service, though large brasswinds (tubas/sousaphones) may be excluded. Check with your qualified technician for the services offered.



"...I think it fell off the chair...but I'm not sure..."



INSTRUMENT FINISHES

Brasswinds will most often have one of two finishes: lacquer and silver plating.

LACQUER: Clear lacquers are the most common student-line instrument finish chosen for its durability and low cost. Basically a clear paint, most lacquers used today are epoxies, an extremely hard lacquer that is baked on. Other lacquers include cellulose, common on most older instruments but still in use today by some manufacturers and repair shops. Cellulose lacquer is best known through its tendency to strip in hot water. The thickness of most lacquers today is similar to that of rice paper.

SILVER PLATING: More common on step-up and professional instruments, plating can best be described as a thin film that is bonded to the brass through an electro-chemical process. While only microns in thickness, plating offers more durability and abrasion resistance than lacquers, though epoxy lacquers used today are not far behind in durability.

Body Chemistry

Both lacquer and silver plate offer ample resistance to skin contact wear and the elements, though each can react differently to a persons body chemistry.

Perspiration can be either alkaline or acidic in nature. These conditions vary from individual to individual and also vary with diet, stress, and general health. These generalities apply in regard to body chemistry and instrument finishes:

- A. Alkaline perspiration (from the hands) will attack and, over time, strip lacquers.
- B. Acidic perspiration will attack and, over time, strip silver plating.

The choice of instrument finish should somewhat reflect the above when purchasing step-up and professional instruments.

These are common questions asked about instrument finishes:

1. Which is better acoustically for a brass instrument, lacquer or silver plate?

This has long been a debate among brass instrument manufacturers and performers. It is discussed by both Vincent Bach and Reynold Schilke in their own publications.

The general consensus seems to be the lacquers will produce a slightly darker sound than either silver plate or bare brass.

This has to do with the speed of sound through the finish as well as the overall weight of the finish on the instrument. For example, because lacquer is denser and heavier than silver plate, it would have a darkening effect on the sound. The effect also has much to do with the strength and absorption of reflected soundwaves within the bell flare.

The debate is further confused when the two different lacquer types are discussed. Cellulose lacquer is thicker and denser than the very hard baked on epoxy lacquers, thus having a different effect on the instrument sound color.



The Bottom Line

Many persons, when choosing an instrument, negate the quality of an instrument due to its finish, often preferring silver plate because it supposedly "plays better."

Any instrument choice should reflect the response, projection, and tone quality desired by the player. No two instruments are exactly alike, even within models. Therefore, it is best to choose that which offers the player the desired results, regardless of finish.

2. What is the best way to care for lacquered finishes?

The term "polish" would imply that the luster of lacquers can be enhanced by abrasive polishes. While somewhat true for certain lacquer types, with band instruments, the main problem is the accumulation of dirt and film from the player's hands. This film will make the lacquer appear cloudy and dull.

Oil impregnated polishing cloths work very well to remove this dirt and film, thus allowing the luster of the lacquer to show through. Other useful products include furniture polish and glass cleaner.

Never use abrasives of any kind on any lacquered surface no matter the claims. These include brass polish, sand paper, baking soda, toothpaste, and scouring powders.

In addition, never expose any lacquered finish to hot water as some lacquers will strip off immediately.

3. What is the best way to care for silver plating?

This is very different than lacquers as silver plate is bare metal.

Tarnish is the black staining of the silver caused by exposure to air and moisture. This tarnish is best removed by using rouge-impregnated silver polishing cloths. They do a great job, and with limited use, do not harm the metal finish.

The most common problem, like lacquers, is the residual dirt and film left behind from daily playing. This dirt and film can contain the acids destructive to plating. A soft, lint free, 100% flannel cloth is perfect for daily wiping an instrument after handling and is recommended. This will absorb and wipe away the dirt and film without removing the silver. Another option is a tanning-oil-free chamois.

Polishing cloths are great for tarnish removal but are not necessary for daily use. They often contain a mild abrasive that can begin to remove the silver over time. Use the soft flannel cotton cloth. Save polishing cloths for tarnish removal.

Liquid silver polishes will work well but are dusty and chalky when wiped away. This can play havoc with piston valves, tuning slides, and hinge rods on woodwind instrument keys. This is a particular problem when young players attempt to polish their instruments.

If you must use a silver polish, use a polish designed specifically for silver. Do not use polishes for multiple metal types such as brass, chrome & silver.



4. If a student needs a valve casing guard to protect the instrument finish, which type is best?

An all-leather guard. Stay away from vinyl and clear plastic casing guards.

Valve casing guards are very good to use, especially when the student's perspiration is seriously affecting the finish on the casings.

Leather provides a means of absorbing moisture from the players hands as well as offering a soft scratch-free surface against the valve casings. Least desirable are the plastics--it is rare to find an instrument finish that didn't suffer from plastic casing guards.

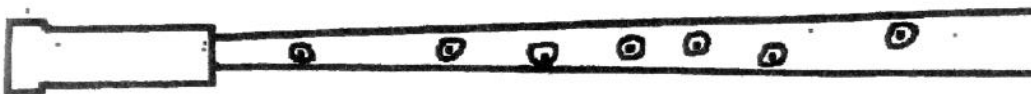
5. There are pink spots under the lacquer on some mouthpipes and main tuning slide crooks. What is it and what can be done about it?

The condition is called DEZINCIFICATION or more commonly, RED ROT. Not a lot can be done to stop it.

Red Rot is a very common problem that has plagued most manufacturers at one time or another. Briefly described, it is a gradual catalytic breakdown of the zinc in brass leaving behind copper. This copper shows as visible pink spots under the lacquer. Under silver plating, Red Rot will appear as small bumps.

On a majority of instruments Red Rot will occur first on the inside of the tube and move outward. Moisture can be a catalyst but not the sole cause. It could be in the brass itself, it could be caused by acids used to dissolve excess solders used in manufacture, it could be caused by the rinse waters used. But the player should know that Red Rot is generally not caused by carelessness or neglect.

Some solutions have been to use rose or red brass (higher copper content) or nickel-silver for areas affected by Red Rot. However, once the instrument reaches the player, if Red Rot occurs, simply wait for the tube to crack or pin-hole and replace with a new part.



"...my dad said he could fix it no sweat..."

6. How should a stuck mouthpiece be pulled?

With a mouthpiece puller. These pull the mouthpiece straight out as opposed to twisting.

Many mouthpieces are sent to the scrap heap because of improper pulling. The best rule to keep in mind is that a tapered object is best released by pulling straight out.

Too often, pliers, door frame wedging, and drawer smashing are used to steady the mouthpiece while the instrument is twisted. This often results in bent or completely destroyed mouthpieces.

A mouthpiece puller is an inexpensive investment and should be owned by every educator and repair technician. Gently tap the receiver with a rawhide mallet if necessary.

7. When should a mouthpiece be replaced?

When there is no plating left on the rim and bowl. When the rim is badly dented from repeated abuse.

If there is no remaining plating on a mouthpiece, the student is exposed to bare brass. This brass contains more lead than brass tubing to allow shaping of both exterior and interior dimensions. This same leaded brass is also used on the valve casings and coined (stamped) parts.

While in small amounts, the addition of lead can serve to irritate the player's skin, often responsible for a light rash or acne. In addition, bare brass does not have the same texture as plating, being more slippery on the player's mouth.

Another problem is damage to the rim and bowl. A smooth rim and bowl is vital for proper embouchure growth. A rough rim and bowl serve only to cause inconsistencies in a player's development. Generally if a rim and bowl are damaged, the shank, or small end, of the mouthpiece is also damaged or cracked. While the shank can be rounded, the rim and bowl cannot without considerable expense.

A new mouthpiece is not a large expense and certainly worth the investment when the above conditions are present.

8. Are mouthpieces dishwasher safe?

No, there is no band instrument finish, silver or lacquer, that can withstand harsh detergents and extreme temperatures.

A brass instrument mouthpiece should be cleaned once a week using a mouthpiece brush and soapy water. But do avoid dishwashers. The temperatures are so hot that the silver will burn.

Also, never put any instrument, in whole or in part, in any extremely hot water. The finishes are durable in normal temperatures, but cannot withstand the extremes.



"...it must have got dented in the case..."

DENT WORK

More common than other repairs, dents will occur in spite of the best intentions of the student. In young, small hands, a brass instrument is difficult and clumsy to hold making dents inevitable.

When a dent occurs there are acoustical ramifications both relating to interior dimensions and metal hardness. The following should address many questions posed.

1. Do dents seriously effect instrument performance?

Yes. Any change in the interior dimension of any musical instrument will affect its performance. Though there are less critical areas than others on student instruments.

A brass instrument can withstand a few minor dents without seriously changing overall sound and intonation. However, when these dents occur in critical areas such as the mouthpiece shank, leadpipe, and initial bore, intonation and response can change for the worse.

The best example of these changes is at the main tuning slide waterkey. It is not unusual for professional players to change the standard waterkey/vent combination with a waterkey that does not change the bore size such as the AMADO. The small extra space caused by a standard waterkey vent is enough to be a factor in instrument performance. A dent has the same effect.

The other area of consideration is in metal hardness. Some subscribe to the notion that metal is hardened when a dent is present and should remain because removing the dent will harden the brass equally more. While true to an extent, this factor should only be considered on professional instruments, and even then with the knowledge that obstruction of the interior is by far more serious than any metal hardening that may occur.

2. How severe does a dent have to be to seriously affect performance?

If the dent protrudes inward more than 1/3 the diameter of the given part, playability and performance suffer.

A difficult question to answer, as optimally there should be no dents in any instrument at any time. Reality obviously dictates otherwise but there are both acoustical and visual considerations in answering such a question.

It is common to see an instrument neglected or abused if the student receives it with dents already in, or if the instrument is not attended to following an accident. With larger brasswinds dents are unavoidable, but with smaller instruments do your best to insure scheduled maintenance, including dent removal. Easy access to dents makes it a fairly low cost repair.

The 1/3 protrusion rule should apply in a majority of situations. If deeper, intonation on selected notes, as well as an overall flattening of instrument pitch will most likely occur.

3. Why does the lacquer/plating cloud after dent removal?

Both brass and the finish stretch when the dent is put in and when it is removed.

The qualities that make brass ideal for use in music instruments are not only acoustical. Brass is able to be stretched and formed in endless shapes. It is these same qualities that make the brass appear cloudy after a dent is removed.

Both the brass and the lacquer/plating do a certain amount of stretching. Some lacquers are less pliable and will often chip during dent removal but, by and large, the resulting cloudiness is a reality of repair work.



"...I don't know what happened...it just stopped moving..."

TROMBONE

The trombone handslide presents a number of factors differing from piston brass. The materials and finishes vary slightly as does the lubrication. It is not unusual to have many trombone slides in the repair shop since many beginners find the trombone handslide not only cumbersome, but often a convenient weapon.

1. What is the best lubricant for trombone handslides?

For beginners, handslide oil. For advancing students, handslide cream and water.

SLIDE OIL

By far the most common lubricant for beginners, slide oil is the easiest to use. A couple drops on the stockings every other day and the slide will work freely. The advantage of slide oil is its adequacy as a lubricant and the simplicity of application. Slide cream and water is definitely preferred but simply too much responsibility for the beginner.

The main problem with slide oil is that petroleum lubricants dissipate quickly, leaving behind a residue that causes the handslide to run rough and scratchy. This is nearly unavoidable because trombone handslides are much looser in their fit than a piston valve, leaving exposure to air.

Do your best to move your students toward slide cream and water as soon as they show the maturity to handle the proper use of cream and a water spray bottle.

In maintaining any handslide, wipe out the handslide twice a month with a cloth covered cleaning rod.

SLIDE CREAM

Preferred to slide oil, slide cream and water offers a much faster slide and less chance of debris build-up.

Most creams offered by manufacturers contain silicone, ideal for holding the moisture that creates water beads the slide travels on. This is the only application for silicone lubricants on brass instruments.

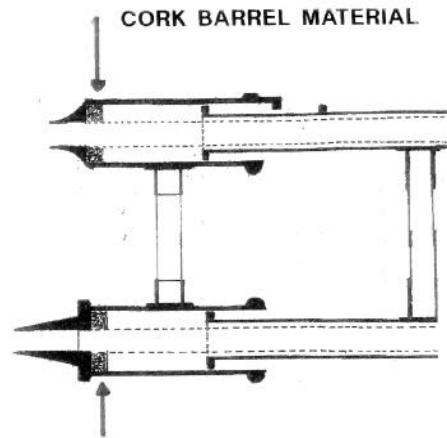
Place a dab of slide cream on each stocking and work into the outer slide. Spray the inner slide stockings with water to create the water beads and work the inner and outer slide together. Spray and re-cream as necessary.

Slide cream and water is best used by advancing, responsible students who can keep a perspective on the amount of cream and water to use.

2. Why does the slide become loose at the slide lock?

The material inside the cork barrel needs replacing.

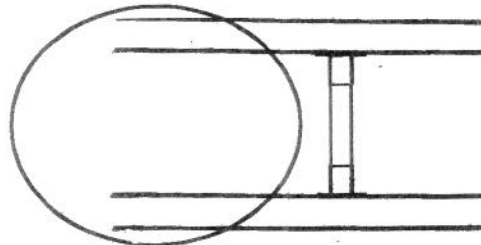




Shown in the drawing above, the material inside the cork barrels is responsible for keeping the outer slide locked tight when the slide is not in use.

Four materials are found in cork barrels: cork, felt, springs (professional), and on occasion, neoprene (rubber).

Most student trombones will require cork in the cork barrels, the exception being those trombones without a reinforcing collar on the open ends of the outer slide (see below).



Cork should be used where possible as this material will last the longest. Those trombones requiring felt are by no means inferior, but will require replacement of barrel bumper material more often.

3. How should a handslide be cared for?

Wipe out the outer handslide at least twice a month to avoid lubricant and dirt build-up.

The biggest problem with trombone handslides is the build-up of grime. Too often a player gets used to a poor running slide thereby losing his/her sensitivity to how a slide should work. Keeping the handslide tubes wiped and free of debris will allow the lubricant of choice to work the best, allowing the student to achieve the best performance and highest sensitivity to a properly maintained slid

4. How bad should a handslide get before the need for repair?

Most handslides can withstand small dents, but those that can be directly felt by the player should be removed as soon as possible. This will encourage proper maintenance by the player and will stave off premature wear on the inner handslide stockings.

Secondly, and certainly significant, the student should learn to handle the handslide with great care. Because of its length a handslide can conveniently be transformed into a sword or a "light sabre", adding great repair expense to an already expensive instrument. Both inner and outer slide tubes are easily bent with the slightest pressure. Therefore a trombone should be carried and held at the braces or by a single handslide tube (not holding both handslide tubes together).

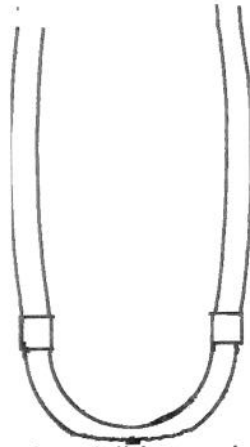
5. The handslide crook has been damaged. When should it be repaired/replaced?

When the damage protrudes more than 1/3 the diameter of the crook.
Replacing handslide crooks is fairly common for repair technicians.

Two things can happen when the crook is badly dented:

1. The playability of the instrument suffers. Any obstruction in the bore of any instrument can significantly affect the acoustical performance of the horn. This can be evidenced by poor intonation, response, and a general stuffiness in the sound.

2. The handslide tubes will spread at the bottom. This will cause the handslide to grab or drag in first and second position. The expansion of the crook span from the denting will easily distort the handslide tube alignment. See below.



Many repair shops prefer to replace a handslide crook instead of repairing it. It costs less in the long run by eliminating a lot of the alignment and dent removal problems caused by severely damaged crooks.

The above rule allows for fairly severe dents. This falls under the discussion in the preface: a student cannot overcome the inadequacies of any instrument whether they be inherent in instrument design or the result of damage.

"...the next thing I knew, it was at the bottom of the stairs..."

FRENCH HORN

The French Horn seems to be a mystery among many performers and educators. There is an endless inquiry as to what lubricants to use, how to apply them, what string to use, and how to install them. In addition, many performers and educators are reluctant to attempt rotary valve removal and maintenance out of fear or ignorance.

What follows is a "crash course" on how a rotor works, how a rotor wears, and the proper care and maintenance of rotary valves and the French Horn.

ROTARY VALVES

A rotary valve is a flow valve that, by turning 90 degrees (a Bb - F rotor may only move 45 degrees), adds and subtracts slide tubing in a french horn.

The action of the rotor presents certain wear characteristics that need to be addressed. Proper and timely lubrication are critical to instrument performance because, as rotors wear, playability rapidly declines.

The oil used on piston valves serves as a lubricant between two bearing surfaces - similar to a cars engine. This lubricant reduces friction and drag, hence providing faster valve action and longer useful life. On the other hand, the lubricants used on rotary valves actually hold the rotor in suspension, acting as both a lubricant and a seal, functioning as a fluid. This is why noisy rotors can be quieted by lubricating.

Below are questions relating to rotary valves, lubrication, stringing and general french horn maintenance.

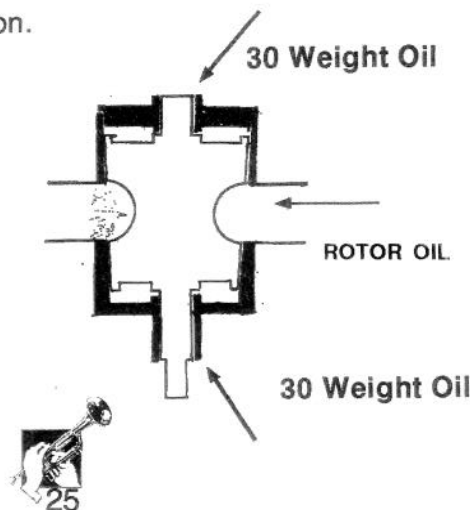
1. What oils work best on french horn rotors?

Use a 30wt. oil for the spindles and a standard rotor oil for the rotor face.

A common myth among musicians is that the lighter grade rotor oils are to be used universally on all rotor parts. As above, the rotor is held in suspension inside the rotor casing. The heavy viscosity of 30 weight oil (10W - 30 will do) on the spindle bearings is vital to reduce wear on the rotor. Generally, twice a month with spindle oil and standard rotor oil will keep rotors lasting many years.

As with piston valves and tuning slides, avoid any lubricant containing silicone. It's use is only applicable with trombone handslides.

See the drawing below for proper lubrication.



2. Should the rotor oil (for the valve face) be dropped through the mouthpipe?

No, it only serves to carry debris into the valve section.

Oil the rotor face by placing a few drops of oil in the valve slide and channeling the oil into the casing from there.

3. When a rotor seizes, what should be done?

It is best to lubricate as normal, and wait for the rotor to give. Attempt to turn the rotor by hand at the stop arm. Do not force it with pliers or tap with a mallet.

Common when instruments sit over the summer, many horn players will subject their seized rotors to abrasives such as cleanser, toothpaste, or pumice-type soaps. These are inappropriate, only serving to prematurely wear a tightly fit rotor.

Oiling the rotors and waiting is best. Following that, if they will not move with hand pressure, take the instrument to your qualified repair technician for service. Like a stuck tuning slide, this is not the time to take expensive chances.

4. How often should rotors be lubricated?

Rotors should be lubricated twice a month with spindle oil (30 weight) and rotor oil. This is a minimum lubrication schedule, but can be performed more often in the player chooses.

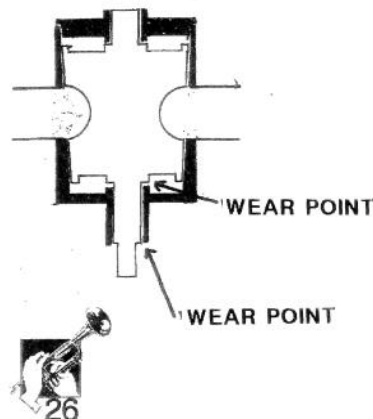
Many brass players hesitate to lubricate their instruments because of a fear of over-lubrication. This is especially true among french horn players. Wherever there are moving parts on any instrument, lubrication can be applied as often as necessary as long as there is little or no visible excess.

Like your car's engine, a music instrument will welcome lubrication at any time. Lubrication will prevent parts from wearing by reducing friction and resultant noise. While there is a point where lubricants are wasted, there is no need to back away from lubricating any moving part on any musical instrument out of fear of possible damage.

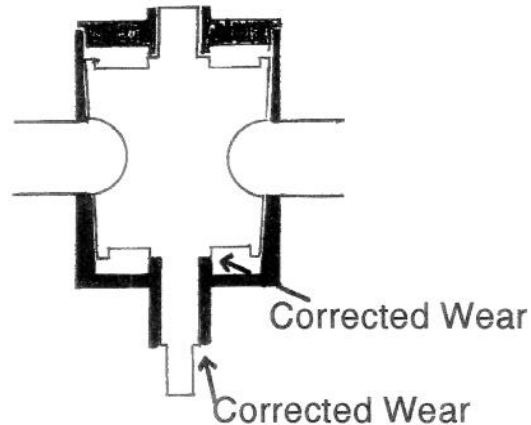
5. Can noisy rotary valves be quieted?

Yes. A lack of oiling, age, and wear characteristics can cause rotors to start "clacking." When oiling no longer helps, a properly equipped repair facility should be able to take care of the problem. The process is not expensive, goes well beyond simple lubrication, and should be performed to keep rotors from wearing further.

As above, the rotor is held in suspension by the lubrication. Because a rotor is subjected to lateral force when spun, the spindle and shoulder bearings can wear quickly (See below).



The process of quieting noisy rotors involves shrinking (swedging) the portion of the casing that houses the spindle bearings. This should allow a rotor to function quite well for years. (see below)



Of course as with any repair, it is only as good as the maintenance following the procedure. Regular lubrication is a must!

6. What string works best on a rotary valve?

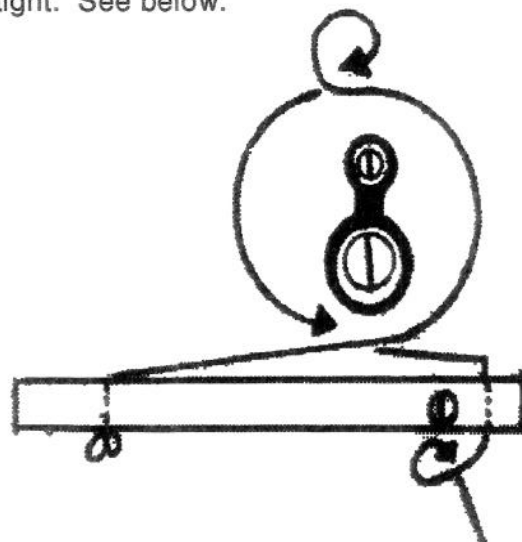
A braided nylon fishing line, 40 - 80 lb. test. Mono-filament fishing line is too spring-like and not recommended.

Fishing line has long been used by manufacturers and repair shops. Some of these lines are solid core, some not. If strung properly, the braided nylon line will last up to a year or longer without stretching or breaking.

7. How does one string a rotor valve?

See the drawing below. Be patient and learn so you can string a rotor in under two minutes. This is a handy skill to have immediately preceding a concert.

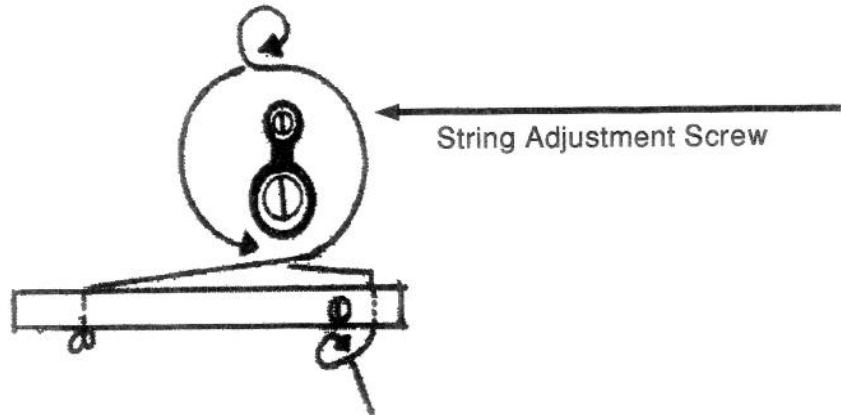
Stringing a rotor need not be difficult. One rule to keep in mind is that whenever the string crosses, the head or lead of the string will cross underneath in the loop. This allows the screw heads to lock the string tight. See below.



8. How does one adjust the height of the rotor levers?

Make the adjustment at the stop arm string adjustment screw (see below).

A simple adjustment that can be done without completely re-stringing. The spatulas (or lever paddles) should either be level or stair-stepping downward from valve #1 to valve #3. This is easily accomplished at the stop arm string adjustment screw.

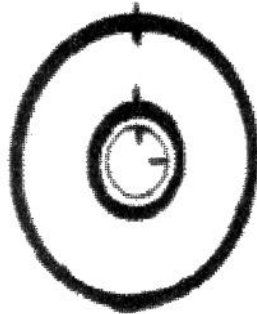


9. What is the purpose of the cork or neoprene bumpers on the french horn?

The purpose of the bumpers is to regulate and align the rotor with the tubing knuckles.

Like a piston valve, precise valve alignment is vital if the instrument is to play in tune and with proper response.

To determine if your instruments have proper rotor porting, remove the rotor valve cap and inspect the witness marks. If the marks do not line up exactly, the valve is mis-aligned.



10. Why do my rotary strings break five minutes before a concert?

A loose string will fray and weaken and eventually break. Keeping the strings tight will avert this problem.

As above, a string can be tightened greater than normal by allowing for a small amount of slack at the lever screw and turning the screw down extra tight. This will keep the string as tight as possible without sacrificing valve movement.

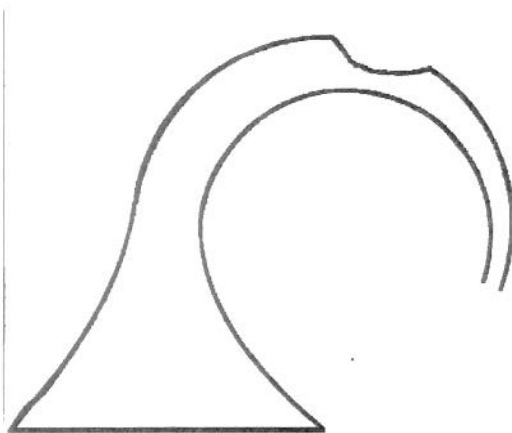
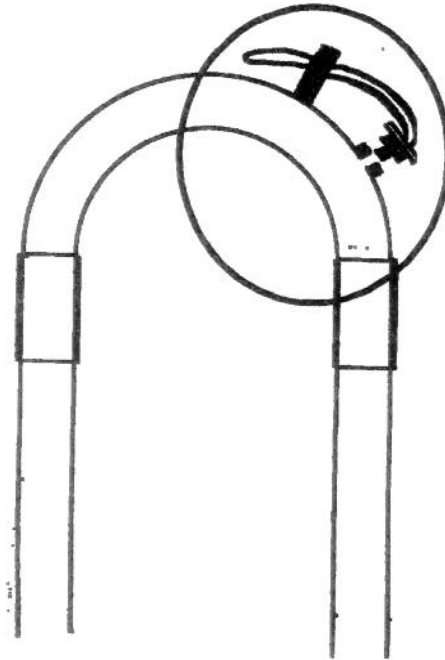
Another problem could be with the screws that anchor the string. Small burrs under the screw head may gradually cut the string. If the string habitually breaks at a screw head, a burr is the most likely cause.



11. Why don't french horns have waterkeys?

The main reason is tradition, though some manufacturers are adding waterkeys as dictated by demand.

There are obvious acoustical effects that waterkeys have on brasswinds, some are detrimental and some not. But on french horns, the main reason for a lack of water vents is more tradition. Waterkey installation is also expensive and manufacturers want to keep their prices as low as possible. But until there is enough demand to manufacturers, a director will have to either custom order instruments with waterkeys or have them installed at a repair shop. If a player insists on a waterkey on the french horn mouthpipe, one consideration could be the AMADO, or a waterkey with a neoprene vent plug (see below).



12. When should dents on french horn curved branches be removed?

As with trombone crooks, a dent should be removed when the dent protrudes inward more than 1/3 the diameter of the given part.

Dents in french horns are common. Two realities of manufacture contribute to french horns denting easily:

1. The thin gage of the metal. French Horns bells are especially thin--an acoustical necessity.

2. The metal is heat treated. During shaping and bending, the bell and preceding branches (mouthpipes too) are annealed. This is a heat treating process that makes the metals ductile enough to bend into curves. Often the metal is annealed again after bending to remove support agents. This explains why the metals used on french horns are generally softer than other instruments.

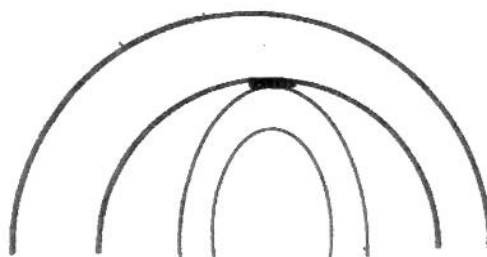
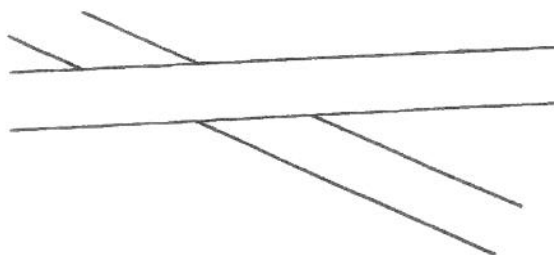


Like other brass instruments, any obstruction in the sound passageway is going to have ramifications on the instrument playability. The 1/3 rule is acceptable on most instruments, another standard is used for professional instruments.

13. Why do solder joints on french horns break so easily?

Solder joints break because french horns require the use of small braces or "contact" solder joints.

Because of the way it is wound, the french horn does not leave much room for bracing. A contact joint is where two tubes or branches are joined with a small bead of solder where they contact together. (see below)



Repair technicians do their best to insure broken solder joints do not break again by increasing the joint surface area, adding extra braces, or by using stronger soft solders. Despite these efforts, a french horn must be handled with greater care than other brasswinds to avoid this damage.

14. What is the best grease to use on french horn slides?

A good, proven lubricant from a manufacturer or supplier is recommended. Do not use any lubricants containing silicone. Also avoid lanolin and petroleum jelly because of corrosive action on brass and nickel-silver. A lubricant must be able to allow for proper movement but also not have any adverse effect on the metal it is lubricating.

Silicone, petroleum jelly and lanolin, while seemingly good lubricants, corrode the slide tubing at an accelerated rate by holding moisture in suspension. This trapped moisture acts as a catalyst for excessive galvanization and dezincification.

Synthetics seem to work well, but insure they are able to mix completely with petroleum based lubricants.



"...when I left the bleachers it was still there..."



LARGE BRASS

From a repair standpoint, large brasswinds (marching brass, baritones, euphoniums, tubas etc.) present difficulties simply by virtue of size. Where a trumpet may have a brace a certain size, a tuba may not have a proportionately larger brace. In addition, the tubing thicknesses of large brasswinds may not be much greater than small brass. Using more braces or heavier tubing would make a large brasswind nearly impossible to pick up at all.

Manufacturers do their very best to make large brasswinds that are a) dent resistant (through the use of moldings and guards), b) durable (through brace placement at high flex areas), and c) sound correct with proper intonation. Unfortunately, making an instrument with all three characteristics will sacrifice a certain amount of playability. Reality dictates equal consideration of each.

1. Should a broken brace be taped or glued to get the instrument through a performance?

Neither. The adhesives for both are too difficult to remove. If you must get an instrument through a performance, wrap french horn string tightly around the affected area, and get the instrument immediately to a repair shop. Leaving a broken brace unattended will place too much stress on the rest of the instrument, resulting in more damage.

This occurs too often: The sousaphone has a broken brace because the solder joint gave way. The student, parent, or instructor grabs a roll of masking or duct tape, super glue or epoxy, and does a quick fix on the instrument. One month later, the instrument makes it to the repair shop. Not only is the original brace still broken, but two or three others have broken along with it. It is also probable that a curved branch has dented or collapsed.

A simple repair has skyrocketed into an extensive and expensive repair. Many repair shops also charge extra for the removal of glues and tape adhesives.

The bracing on all music instruments works collectively. Together the instrument is sturdy and can absorb and resist forces from many angles. When one brace separates, it will make the instrument and remaining braces vulnerable to further damage. Often a neglected broken brace can escalate into monstrous repair problems.

Do your best to repair your instruments as soon as possible and work with your qualified repair technician to get the most mileage out of all your instruments.

2. How does one care for fiberglass sousaphones?

Keep the fiberglass clean with mild detergents or glass cleaner. The brass section is just like any other brasswind.

The fiberglass used on sousaphones is similar to that on boats, though lighter and thinner. Sousaphones are painted with either a speckle-type paint, or flat acrylic enamel. Mild detergents like dishwashing liquid or glass cleaners work well in dirt removal. If need be, it is possible to have your sousaphones painted.

If you need to hang a fiberglass sousaphone for storage, do not hang it on the brass section. It is easily crushed. Set your well-padded hooks or brackets such that they catch the more durable fiberglass branches, not the brass section.



3. How should instruments be stored over summer?

Brasswinds should be lubricated as suggested above and stored in a cool, dry place. Using heavier lubricants only causes trouble later.

The key in instrument storage is avoiding moisture. With the sheeting action of oils on pistons and grease on slides, these lubricants should serve the purpose.

With trombones, it is best to store the handslide dry. Handslides are too loose in their fitting to keep air out thus allowing lubricants to dry too readily offer any protection.



"...my folks backed over it with the car..."

THE INSTRUMENT CASE

The case is an often-neglected aspect of instrument care and can contribute significantly to instrument damage. As a case ages and wears, hinges will begin to pull out of the shell, the latch springs may break, and the interior blocking or supports will loosen. Below are some things to look for on your student instrument cases.

The shell: Made of plastic or wood, the shell absorbs the impacts of daily use. Any cracks or tears in the shell itself allow water to enter and significantly reduce impact resistance. Pay particular attention to the lid corners near the hinges. If broken, have the corners strengthened with angle braces.

Hinges: Inspect hinges for loose rivets and missing hinge pins. When students sit on their instrument cases, the hinges must withstand tremendous force.

Latches: The main problem with latches is broken springs. These springs cannot be repaired. Fortunately, latches are very inexpensive and easily replaced. Also, inspect for loose rivets.

Interior blocking: Any loose interior blocking must be repaired immediately as the instrument and accessories must be held fast in the case. Loose blocking will also mean exposed nails (brads) and screws coming inward through the outer shell. Be particularly attentive to the mouthpiece holder or compartment, as stray mouthpieces cause extensive damage.

Interior tabs: Tabs are used primarily in trombone cases to support the bell section in the base and the handslide in the case lid. The rivets used to secure the tabs pull out very easily often resulting in serious damage to both bell and handslide. Inspect trombone cases often and have the case repaired immediately if the tabs pull.



BAND INSTRUMENT REPAIR

The Band Instrument Repair Program at Red Wing Technical College is a forty-eight credit comprehensive course devoted to the training of professional band instrument repair technicians.

Founded in 1976, the program has grown to include approximately thirty students housed in three fully equipped labs. Gaining an international reputation, Band Instrument Repair is drawing and placing students from the United States and Canada as well as from Europe and Asia.

This text has grown from the many questions asked by music educators over many years. Generation of this booklet has been greatly aided by both students and staff from the Band Instrument Repair program and Red Wing Technical College. These include

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JH

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