Don’t lap just yet...

Red Wing
Guide

The perfect valve/casing repair ensures

- The valves go up and down smoothly and lightly
  - No matter how off-centered it is pushed down
- Tolerances are maintained
- Bearing surfaces are either maintained or improved upon
Lapping is too often used to compensate for overlooked problems on incomplete repairs

- Scaled/stained casings and pistons
- Incomplete casing dent removal
- Bent or untrue pistons
- Casings warped by
  - misaligned slides
  - bent bells/chassis stressing knuckles
Our Rules

- **Maintain tolerances**
  - Don’t make casings bigger or pistons smaller

- **Maintain good bearing surfaces**
  - Improve bad bearing surfaces if possible
We hate to lap

- Tolerance compromise
- Clean-up
Lapping often not necessary

- **Focus on fundamentals**
  - **Knowing all problems**
    - Clean, stain-free parts
    - Round/true casings
      - No dents, bends, stresses
    - Round/true pistons
    - Good bearing surfaces
This Clinic

1. Steps to take before lapping
   - Ensuring repairs are as complete as possible
   - Burnishing techniques to manage marginal surfaces

2. Applications for lapping
Piston/Casing Tolerances

Professional
- 0.0006” – 0.001”

Student
- 0.001” - .0015”

Shot = Needs Valve Job
- 0.0015” and up

Shot – Needs Valve Job, but Customer Chooses Not
- 0.0015” and up
Fixing Casings and Pistons

- If repairs are thorough...no lapping necessary
Instrument inspection

- Bent stem?
- Bent bell/slide/branch?
- Bent/twisted body/parts?
- Something stuck in the port?
  - Pencil, paperclip, toothpick, other?
- Plier damage?
- Obvious dents
- Is the problem the piston or casing?
  - Swap pistons around to find out
Before removing the piston

- Remove obstructions
- If the piston is really stuck...
  - Straighten and align stuff first
  - Bell/body/slides
First: Straighten & align stuff

- Bell bow/tail
  - Traditional
  - Loose vise
First: Straighten & align stuff

- Bell bow/tail
  - “The Frushour snap”
First: Straighten & align stuff

- Bell bow/tail
- Trick: heat ferrules and tubes
First: Straighten & align stuff

- **Slides**
  
  Total slide resistance should be sum of each individual tube’s resistance
First: Straighten & align stuff

- Slides
  - #2 slide on trumpets/cornet
    - Traditional method
First: Straighten & align stuff

- Slides
  - #2 slide on trumpets/comet
  - If the knuckle is collapsed

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First: Straighten & align stuff

- Body
Now, get the pistons out!

- Chuck stem in bench motor
- Piston drivers
  - Allied
  - Make your own
    - BUT match piston outer diameter!
  - Mouthpiece puller
    - Wayne Tanabe/Kevin Blodgett
- Do not use another piston
Clean

- Casings and pistons gunk and stain-free

Cleaning Rods:
T5047 and T5048
Stained Monel® or Nickel silver

1. Remove stain chemically
2. Mechanically treat surface
3. Oil often
   - Kerosene-based oils seem to work well
   - Synthetics too
Clean

- Casings and pistons gunk and stain-free
Removing casing dents

Rules:

- Work with a clean instrument
  - Part of the estimate
- Casing is dent and obstruction free
Typical order

1. Ferree’s ground casing mandrel

Then if necessary:

2. Sharpened solder scraper or Badger State slotted mandrel

3. Votaw/Allied casing laps
   - Used as a burnisher at bad spot only
The ground casing mandrel
## BRASSWIND TOOLS

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The whole shebang
The ground casing mandrel

- Step one: rough out the dent
The ground casing mandrel

- **Step two: visual inspection**
  - Go to plastic mallet combination if necessary
The ground casing mandrel

- **Step three:** Visual inspection again
  - If necessary: light steel hammer tap
The ground casing mandrel

- Step four: visual inspection again
The ground casing mandrel

- Step five: inspect with the piston
The ground casing mandrel

- **This method...**
  - Removes dents more thoroughly
  - Less chance of warping casing
  - Less chance of driving knuckles/braces into adjoining casings
Usually we’re done...but not always

- Sometimes there’s a little bit left
  - Option 2: Shave what’s left
    - Slotted rod (Badger State)
Usually we’re done...but not always

- Sometimes there’s a little bit left
  - Option 3: Spot burnish the area
    - Allied or Votaw burnishers
      - Barrel laps
      - Sized laps work best
Knuckles and spanner braces

- Can be pushed into casing wall
  - Through bell/slide/body mis-alignment
  - Through extreme stress
    - Instruments dropped, stepped or sat upon
Knuckles and spanner braces

- Edge Tapping
  - Ground casing mandrel
  - Steel dent hammer
  - Taper delrin/nylon stick
  - Casing Burnisher
Pistons: Three typical problems

- Bent
- Out-of-round
- Displaced from dents or other damage

- Pistons can bend when casings are dented
- Pistons can bend/dent/warp when removed from damaged casings

Always inspect pistons with casing repairs
Rule

- **Pistons must be straight and true**
  - Inspected as part of casing repair
  - Estimate accommodates repair
Now... pistons

- **Tip:** Site on a back-lit bench block
- What a **bent** piston looks like
  - Cavity and teeter 180° apart
Now. . . pistons

- What an **out-of-round** piston looks like
  - Have either cavity or teeter - but not 180° apart
Now... pistons

- What a *dented/displaced* piston looks like
  - Parts of it are too big from dents like this:

[Image of a dented piston]

[Website: www.redwingmusicrepair.org]
So, if the piston is bent

- Traditional straightening works fastest and best
- **Our rule**: Before checking the piston in the casing, it is as straight as possible (inspected on a flat surface)
If the piston is out-of-round

- Ferree’s casing sleeves
  - Takes piston only so far
  - Do not super-heat then quench
    - Pistons can shrink/sleeve can warp
If the piston is **out-of-round**

- Ferree’s casing sleeves
  - Split works better
  - If it warps, cut it in half
If parts are dented/displaced
Applications for lapping

**Rule:**
- Know what is wrong
Bad Valve Action

- Slow valves
- Occasionally sticky valves
Bad Valve Action

Observe your surfaces first

- good piston surfaces
Bad Valve Action

- Bad piston surfaces

Stains, Missing Plating, Cross-grain, Cross-hatch
Stained Monel® or Nickel silver

1. Remove stain chemically
2. Mechanically treat surface
3. Oil often
   - Kerosene-based oils seem to work well
   - Synthetics too
Missing nickel-plating

- **Spot buff bad areas**
  - To dish exposed base metal
    - and feather edges
- **Return to casing**

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Cross grain = surface scuffs

Usually not a problem

- Cross grain = surface scratches or scuffs
- Can burnish piston if needed
Cross-hatch = surface gouges

Cross-hatched pistons

1. Resurface with Ferree’s sleeve + lapping compound
2. Resurface piston with lapping block + lapping compound
3. Burnish piston/casing together
Lapping Compounds

- Garnet is our choice
  - Ferree’s L58 ultra-smooth (1000 grit)
  - Hetman 1200 grit (Allied)
- BUT 1000 + garnet compounds no longer available
  - Stay tuned...
Cross-hatch = surface gouges

- **Cross-hatched pistons**
  - Resurface with Ferree’s sleeve + lapping compound or
  - Resurface piston with lapping block + lapping compound
  - Burnish piston/casing together

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Cross-hatched casing?

- Casing inspection
- Bad casing wall surfaces
What to do...

- **First**: Burnish casing/piston together
  - Hard piston will burnish soft casing wall

- **Second**: Resurface casing with ground casing mandrel or Allied/Votaw barrel laps + lapping compound
  - Laps sized to casings seem to work best here
  - **BUT** be mindful of tolerances.
Valve sticks off-center

- Common with top-sprung casing walls that start at the valve guide or just below the valve guide

Guide slot
Valve sticks off-center

- **Not** common with this kind of casing
- Likely an issue with the casing/piston surfaces
- Address as discussed earlier
Solution 1 - Burnish First!

- Piston/Casing together
  - With oil
- Pressing firmly into the sticking
- Clean-up!

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Solution 2 - Increase top space

- From Schilke
  - Lap just the top ¾” (preferred)
  - Or burnish just the top ¾” with a brass lap
  - Size laps recommended
Solution 3 - Slightly Bend Piston

- Pull piston up out of casing
- Tap *lightly* into sticking
- Tap other way if too far
Other piston problems

- Valve is getting scratched in the casing
  - Likely cause: burrs from the valve guide slot
  - Cure: de-burr with sharp scraper or small craytex wheel

- Yamaha large brass
  - Can’t remove piston

- Large brass dent removal
  - Offset dent ball option
When a valve job?

Playing evidence:
- Poor response (low and high end)
- Sagging pitches (during crescendos)
- Problems lessen with heavy oil

Our evidence:
- Slop/pressure
- Tolerances exceed 0.0015” or 0.002”

Valve re-fit options:
- Handout p.20
Threads

See handout p. 5
Dent Ball Method
Dent Ball Method
Dent Ball Method
Dent Ball Method
Standard
Standard
Option with lathe
Making the Cap Work
Mushed Threads
Mushed Threads
Ferree’s Thread Mandrel
Ferreé’s Thread Mandrel
Ferreé’s Thread Mandrel
Allied Chaser
Allied Chaser
Allied Chaser
Valve Cap Pliers
Cool Stuff

- Solder Bench Pliers: https://www.youtube.com/watch?v=8AO7mzYvzKs&feature=youtu.be
- Common Lathe Operations
Thank You!

Questions?
- Call us: 877-853-8324
- Email us: bandinstrumentrepair2@southeastmn.edu
Parking Lot

- Solder bench pliers
- Sbrace pliers
- Pitchfinder Prototype
- Throat dent roller
- Bending butter knives

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Last resort

- Burnish the piston round using the lathe
  - A bit dangerous to the piston
  - Yet fun to try