MAKING AND SETUP GUIDE

#3DSmallpipes

Printing, leatherwork, assembly and first setup



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Lindstruments

OR2-C2 - 19 October 2026

GETTING STARTED

Using this guide

This guide provides full build instructions for #3DSmallpipes, a bellows-blown set of Scottish smallpipes in D with a chanter and three drones. The original Lindstruments design has historical-style drone & chanter bores and chanter scale layout. Use the core parts on pages 36-38 and matching laser patterns. Bought reeds are an option (page 30); as is making OR2 drone reeds (pages 42-45). Reedmaking requires experience or practical tuition.

Print the parts and have the leather and 6 mm plywood pieces laser-cut, then assemble the set with hand tools. Power tools are not needed. The stainless screw can gently form its thread in the PLA reed body; a separate tap is optional. Check each assembly before gluing joints or tying stocks into the bag.

The dimensions in this guide are those of the digital files. Inspect your printed parts for damage, check their size and fit, and test each assembly for leaks. The fitting instructions distinguish glued joints from joints that seal with hemp and remain movable.

Read through the guide before starting. Have an experienced leatherworker assemble the leather items: see the safety warning on page 4. Gather the materials and tools on page 8, and practise any unfamiliar skills with the resources on pages 4-5. Choose reeds using page 30; tuning notes are on page 33.

Test the bag, bellows, rigid joints and reeds separately before bringing the instrument together. A small fault is much easier to locate in one assembly than in a complete instrument.

PICTURES AND PATTERNS

The photographs show construction methods and earlier completed sets. Use the numbered illustrations to identify the supplied parts. For cutting, use the full-size pattern files and check their dimensions; the illustrations in this guide are reduced.

WORKING SAFELY

Use a well-lit, stable table. Support cutting and piercing work on a cutting mat or backing block, keeping your free hand out of the blade or point's path. Practise unfamiliar stitches and cuts on scrap.

Follow the adhesive maker's instructions for ventilation, skin and eye protection, drying and curing. Keep flammable products away from ignition sources. Keep sharp tools, chemicals and loose small parts away from children. [5]

NAVIGATION

Contents

Learning the making skills 4

Playing and further study 5

The complete project 6

Parts, materials and tools 7

Printing, fitting and finishing 9

Stocks and chanter 12

The three drones 14

Air fittings 18

Bag pattern and leatherwork 19

Stitching and stock tie-in 23

Bellows construction 26

Valves, hose and reeds 29

Air tests and first setup 31

Tuning, troubleshooting and care 33

Exact-file index 36

References, build record and licences 39

Making OR2 drone reeds 42

ORDER OF WORK

Check the parts and patterns; print and fit a mating pair; finish and dry-fit the rigid assemblies; make and test the air supply; then fit the reeds and tune the instrument.

BEFORE YOU START

Learn the making skills

Leatherworking experience. Making the bag and bellows requires experience in leatherworking and safe use of hand tools. The guide includes bagpipe-specific assembly instructions and safety precautions.

Assembly of the leather items involves sharp tools and needles and should be undertaken by an experienced leatherworker. These instructions assume safe working knowledge of those tools. Give the leatherworker this guide; all other safety directions still apply.

Leatherwork references

These references support the experienced leatherworker; they do not replace safe tool-handling experience. Practise unfamiliar techniques before working on the set.

The leatherworker must know how to support leather safely, handle an awl and needles, and make a firm two-needle saddle stitch. Practise on offcuts of your chosen leather. Make the bag-seam sample described on page 21, including cementing, light hammering and stitching. If you cannot make it confidently, seek practical instruction from an experienced leatherworker.

Al Stohlman, The Art of Hand Sewing Leather: start here for illustrated hand-stitching and seam preparation.

Valerie Michael, The Leatherworking Handbook: a broader reference for materials, tools, cutting, gluing and hand stitching.

Tandy Leather Education: free lessons on threading needles, hand stitching and saddle stitching. Use these for the general techniques; follow this guide for the set's leather, artificial sinew and seam construction.

Beginner 3D printing

Prusa Research, Basics of 3D Printing: an introduction to materials, slicing, perimeters and infill. The publisher offers a printed book and an e-book with newsletter signup.

Use your own printer's manual and the Prusa Knowledge Base for further study. Learn how to import files in millimetres, orient a part, set up the first layer and inspect the slicer preview. Read the layers and perimeters guide, then check your first prints for size, clear passages, airtightness and mating fit before printing the full set. Settings must suit your actual printer and filament.

LEARNING AND SUPPORT

Playing and further study

Start with the bellows-piping tutor

The Lowland and Border Pipers' Society (LBPS) publishes More Power to Your Elbow, a tutor for bellows-blown Scottish smallpipes and Border pipes. Study it alongside this guide for playing and setup; it also provides reedmaking guidance. Sources for bought reeds are on page 30.

If you are new to bellows pipes, seek tuition from a Scottish smallpipes teacher. Work on the wearing position, coordinated bellows and bag pressure, tuning and fingering. A teacher can watch your setup and help identify a playing or reed problem before you alter the instrument.

Further resources from the LBPS

Pipe maintenance and reedmaking: articles on general care, tuning joints and reeds. Read these as background across several pipe types; use this guide for the #3DSmallpipes dimensions and construction, and follow your reed maker's adjustment advice.

Common Stock: the Society's journal includes technical advice, repertoire and history. Older issues are available to all; recent issues require membership.

Teaching events: look for current workshops and tuition listings. The LBPS website also provides routes to tuition videos and piping resources.

LBPS publications: explore tune books as your playing develops. Teachers may also find *The Wind in the Bellows*, the Society's teaching manual, useful. Choose material for Scottish smallpipes in D.

Adhesives, patterns and practical help

Before buying Barge cement or epoxy, read the exact product's label and safety data sheet. Your workspace must meet its ventilation and protection requirements; otherwise arrange the adhesive work elsewhere or have it done for you. Practise on offcuts and follow its drying and curing directions.

With the laser-cutting service, check the full-size millimetre dimensions and cut/engrave layers described on page 20. For construction questions, the 3D Bagpipe & Whistle Builders forum can provide discussion and examples; identify the part and this file edition when asking for help.

01 / THE PROJECT

From files to a complete set



Rory's set, an earlier iteration of #3DSmallpipes. Current printed parts are shown in the numbered illustrations.

The chanter makes the melody. The three drones fit into the common stock. The bellows supplies the bag through a flexible hose and inlet stock. The bag holds air while the playing arm controls its pressure.

Keep the chanter parts, each drone and the air fittings in separate labelled trays. Assemble and check each group in turn so that leaks or fitting problems are easy to find.

Use the file index on pages 36-38 as a checklist. Mark each part as you print, inspect and assemble it.

02 / PREPARATION

Parts in the set

Assembly	File numbers	Count
Chanter and its stock	01-06	6
Common stock and ferrule	07-08	2
Tenor drone	09-18	10
Baritone drone	19-28	10
Bass drone	29-38	10
Outlet, inlet and hose fittings	39-48	10

The set uses the 48 printed parts listed above. The download also includes three optional plain receivers (page 50) and 36 OR2 reed-body and tongue files (pages 42-49). Filenames are listed on pages 36-38. The words wood and ivory in filenames identify shapes: print these parts in your chosen material.

You will also need leather, plywood, hose, reeds, joint hemp, artificial sinew, thongs, adhesive and finishing supplies. The laser-cutting patterns are separate from the STL files; have the leather and plywood pieces laser-cut from the supplied patterns.

Use the numbered file index on pages 36-38 when laying out the parts.

CHOOSE DRONE REEDS

You can buy drone reeds (page 30) or make OR2 reeds from the supplied files (pages 42-45). For OR2, choose one matching body and tongue for each drone. The other sizes let you try a different response.



48 core STLs

Match core file index.



3 plain chambers

Optional alternatives.



36 reed options

Choose three reeds.

02 / PREPARATION

Materials and hand tools





Leather, bellows plates and fittings laid out before assembly.

Printed parts and finishing: PLA or another material that gives airtight prints and well-fitting joints; epoxy; calipers, ruler, small hand files, abrasive paper and cleaning supplies.

Leatherwork: the original assemblies used 1.5 mm automotive leather, with the same leather for bag and gusset and the valves cut from the bag leather. Check airtightness before buying: some automotive leather is perforated. Barge cement was used for leather seams; check the exact formulation and workspace requirements before buying (page 5). Also have marking tools, an awl, two needles and artificial sinew; a knife, cutting mat and straightedge for local trimming or hand-cutting leather as a fallback; a smooth-faced hammer and firm, protected backing surface for the cemented bag seam.

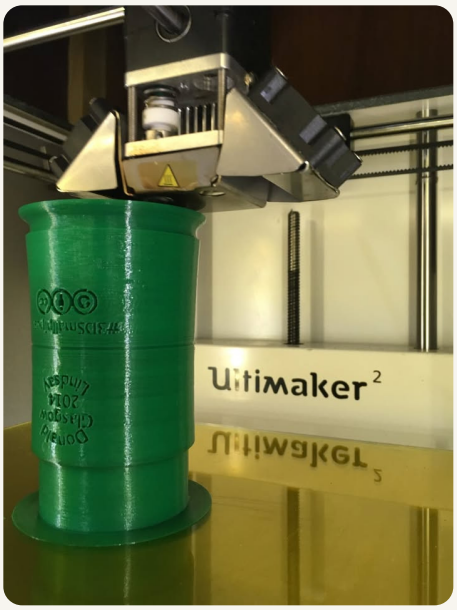
Bellows and connections: 6 mm plywood cheeks; leather outlet gasket and valve flaps; 3 mm square leather thongs; two double-thickness automotive-leather belt loops; arm anchor; screw eye; flexible hose and optional zip ties; four small brass round-head outlet screws; and short brass slotted round-head loop screws with cup finishing washers; a suitable hand screwdriver.

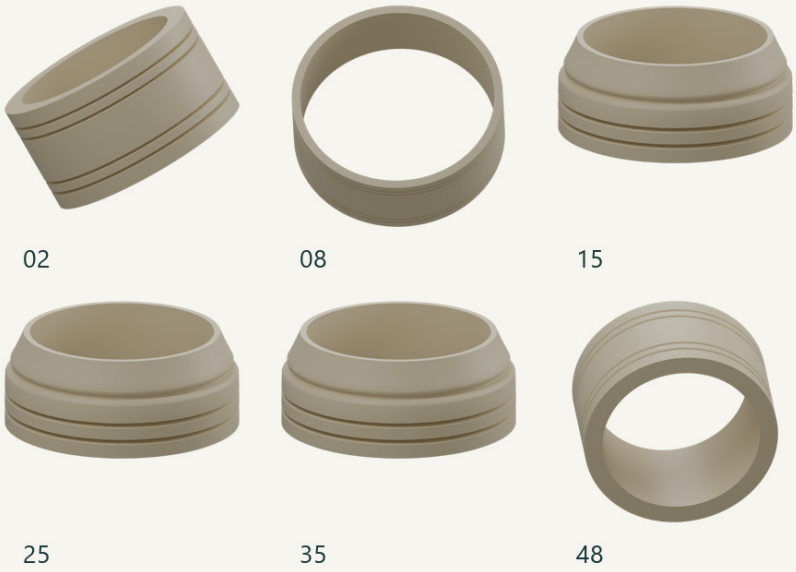
Setup: one chanter reed, three drone reeds, joint hemp, binding sinew and removable stoppers for air tests.

> **CHOOSE HARDWARE FOR THE MATERIAL**
>
> Use 6 mm plywood cheeks. Measure the plywood and leather together before choosing screw lengths. Screw tips must not emerge through the plywood.

03 / PRINTED PARTS

Set up the printing process





Left: printing the common stock. Right: numbered ferrules.

PLA has been used most frequently and most successfully for these parts. Other materials can work if the prints are airtight and the joints fit properly.

Import the files in millimetres without rescaling. Both the chanter stock and common stock are 100 mm tall in the files; use those dimensions to detect an inch/mm import error.

Print the drone bodies with their bores vertical and the supplied Z=0 face on the bed. Print ferrules with the widest face down, except parts 15, 25 and 35, which use their supplied Z=0 face. Inspect the slicer preview for clear bores, continuous walls and complete beads, collars and hemp grooves.

Print and check a mating pair before printing the full set. Adjust the settings for your printer and filament, then record those that give clean, airtight parts with the required fit. [3]

Follow the printer and filament makers' ventilation instructions. Keep hands clear of moving parts, and let the nozzle, bed and print cool before handling or removing parts. [7]

> **HEMPED JOINT: PARTS 43 AND 45**
>
> The short blowpipe tenon is 15 mm and the tube-end socket is 16.2 mm, leaving 0.6 mm radial space for hemp. Wrap the combed band only; keep the bevel and shoulder clear.

03 / PRINTED PARTS

Check the fit

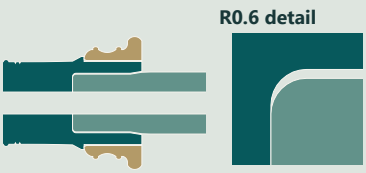
Measure the first pieces after they have cooled. Check the bores, joint surfaces, shoulders and thin edges. Look through each passage for strings, displaced layers or blockages. The table gives the nominal dimensions.

Joint or fitting	Nominal diameters
Chanter tenon / stock bore	13.5 mm / 16 mm; space for hemp
Drone tenon / stock socket	12.75 mm / 13.95 mm; space for hemp
Inlet tenon / stock bore	14.3 mm / 16 mm; space for hemp
Small ferrule / stock land	21.1 mm / 20.9 mm
Short joint, parts 43 / 45	15 mm / 16.2 mm; 0.6 mm radial hemp space
Bag tie lands	26 mm small stocks; 58 mm common stock

Try each mating pair without adhesive. Identify fixed splices, removable hemped joints and tuning slides before taking material off a surface.

Inspect rims, ridges and collars for damage. The chanter sole and its joint are drawn to the same diameter. Remove rough edges and check the fit; adjust the slicer settings if needed rather than forcing the parts together.

Lower glued lap



Pin fitted into lower socket.

Upper glued lap



Fit ferrule, then glue.

Tuning slide



Hemp for a sliding fit.

Sections through the tenor joints. Hemp is omitted so the joint surfaces can be seen.

03 / PRINTED PARTS

Finish before permanent assembly





Left: the drone joint before gluing. Right: fitting a stock ferrule.

Remove loose print residue from the bores and joint surfaces. Preserve the shoulders, reed seats and grooves that grip the hemp. A clean printed exterior needs no further finishing.

Lay out a complete subassembly and dry-fit every joint. Check the piece order, where each shoulder seats and which parts must remain movable. Align the chanter fingerholes before joining its sections.

Epoxy has most often been used for the permanent printed joints. Test it on spare printed material and follow the maker's preparation, mixing, application and curing directions. Apply it to the mating surfaces, join the parts fully and hold them in alignment until cured. Keep it out of bores, reed seats and tuning joints.

Remove squeeze-out while access is available. After curing, inspect the full passage again before fitting mounts or enclosing a joint.

04 / STOCKS AND CHANTER

Prepare the stocks





Completed stocks, and a common stock with its separate ferrule.

1. Chanter stock 01-02. Try ferrule 02 over the narrow mouth end of stock 01. Seat it against the shoulder, with its end flush with the stock mouth, then glue it in place.

2. Common stock 07-08. Fit ferrule 08 over the end of stock 07 containing the three drone sockets. Seat it on its shoulder and glue it in place, keeping all three sockets clear.

3. Inlet stock 47-48. Fit ferrule 48 over the narrow mouth end of stock 47, up to its shoulder, then glue it in place.

Use the epoxy and joint-preparation method on page 11. Let it cure before handling the stocks. Smooth any sharp print residue on the bag-contact surfaces, preserving the retaining beads and tie grooves.

Tie stocks 07 and 47 into the bag as described on page 24, and stock 01 into the neck as described on page 25. The removable chanter, drones and blowpipe are fitted with hemp.

04 / STOCKS AND CHANTER

The D chanter parts



1. Fit ferrule 02 to stock 01 as described on page 12.

2. Try reed end 03 on the top of upper chanter 04. Check the passage through the joint, then glue the two pieces together.

3. Fit upper chanter 04 to lower chanter 05. Align the fingerholes in one line and glue the joint.

4. Fit sole 06 over the foot of lower chanter 05, up to its shoulder, and glue it in place.

5. Let the glue cure. Remove loose residue and check that the passage is clear from the reed seat to the foot.

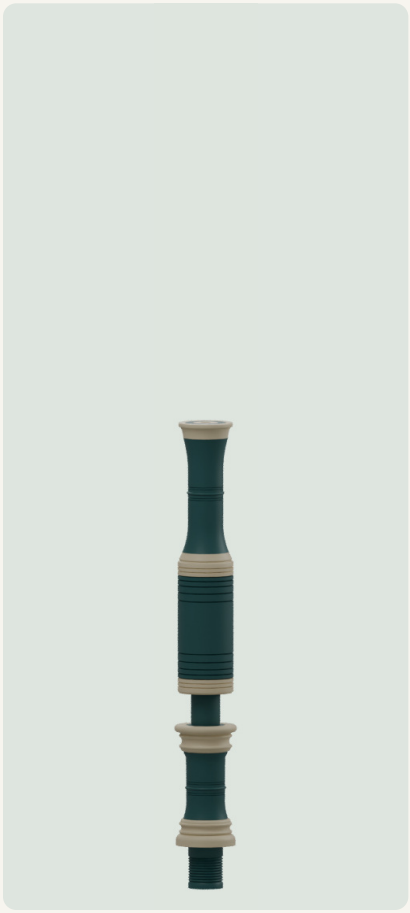
6. Wrap hemp around the grooved tenon on 03. Try it in stock 01 until it fits securely and can be removed by hand.

7. Fit the chanter reed into the small socket at the top of 03, using hemp as needed for a secure, airtight seat. Check that the reed clears the stock before inserting the chanter. Reed choices are on page 30.

Chanter parts, numbered to match the file index. Use epoxy for the fixed joints; hemp the removable tenon and reed seat.

05 / DRONES

The three drones



TENOR - D4



BARITONE - A3



BASS - D3

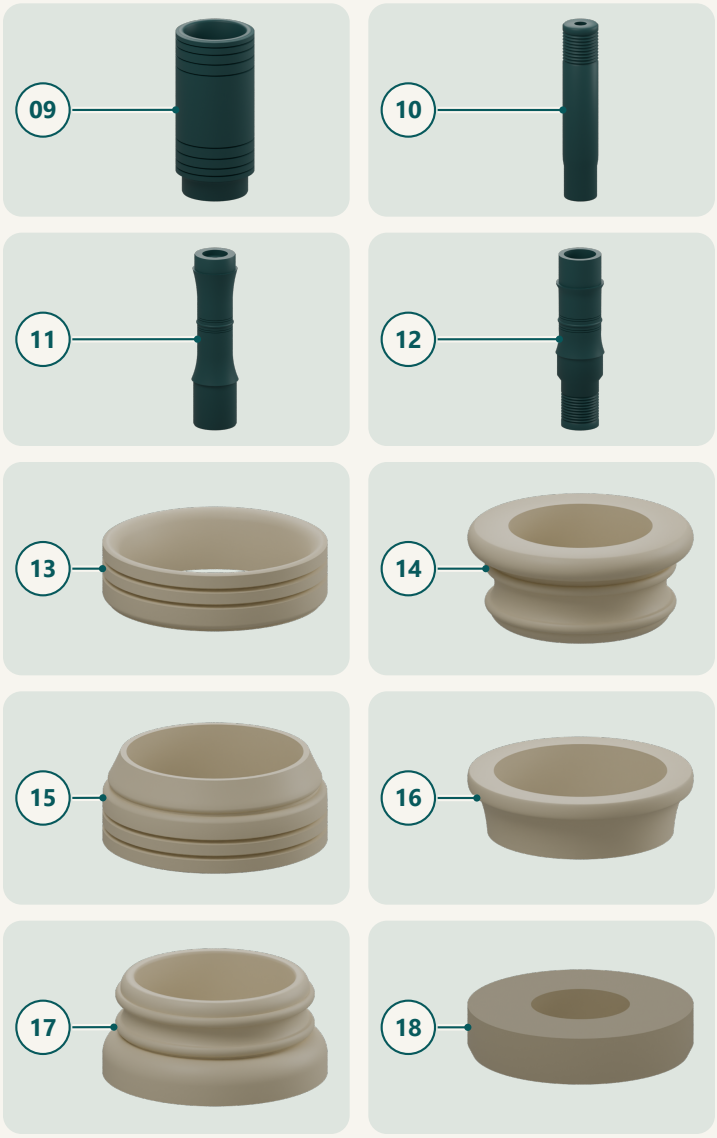
This is a three-drone set in D. Each drone has four body pieces and six mounts or inserts. Keep the matching numbered parts together.

The tuning pin fits 12 mm into the lower body and is glued there. The upper glued joints overlap by 9 mm on the tenor and baritone, and 10 mm on the bass. Slide upper ferrules 15, 25 and 35 into place from below before gluing the upper pieces into their receivers. Keep tuning slides and stock tenons free of glue.

Fit the lower mounts 14, 24 and 34 above the small supporting lips on the lower bodies, in the orientation shown. The ends of the lower sockets and tuning pins have matching 0.6 mm radii. Hemp the tuning joints and removable stock tenons. Optional plain receivers are described on page 50.

05 / DRONES

Tenor drone



1. Lower mounts. Fit and glue stock-end mount 17 around lower body 12, above its stock tenon. Fit and glue mount 14 over the other end, resting on the small supporting lip as shown on page 14.

2. Tuning pin. Check pin 10 in the socket at the top of 12, then glue it in place with 12 mm of overlap. Keep the bore clear.

3. Upper section. Fit and glue collar 13 around the open lower end of chamber 09. Slide ferrule 15 onto upper body 11 from below. Glue 11 into 09 with 9 mm of overlap; seat 15 against the shoulder and glue it in place.

4. Bell. Fit and glue bell mount 16 over the tip of 11, with its broad rim at the open end. Glue insert 18 into the recess in 16, leaving its central opening clear.

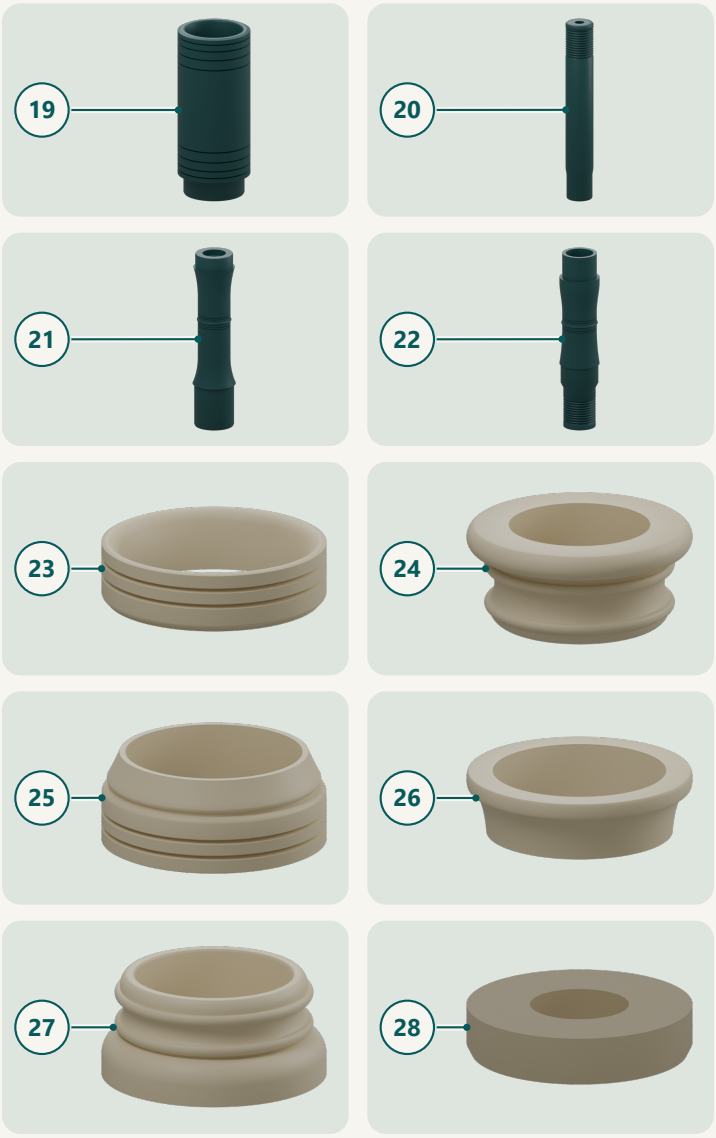
5. Tuning slide. Let the glue cure. Hemp the grooved band on pin 10, then slide chamber 09 over it. Adjust the hemp until the joint seals and moves evenly by hand.

6. Stock and reed. Hemp the stock tenon of 12 to fit common stock 07. Fit the reed securely in the small socket at its end. Once the air system is ready, insert the drone in its stock socket and tune it (pages 30-33).

Standard tenor drone assembly. For the plain-chamber version, see page 50. Keep sliding and removable joints free of glue.

05 / DRONES

Baritone drone



1. Lower mounts. Fit and glue stock-end mount 27 around lower body 22, above its stock tenon. Fit and glue mount 24 over the other end, resting on the small supporting lip as shown on page 14.

2. Tuning pin. Check pin 20 in the socket at the top of 22, then glue it in place with 12 mm of overlap. Keep the bore clear.

3. Upper section. Fit and glue collar 23 around the open lower end of chamber 19. Slide ferrule 25 onto upper body 21 from below. Glue 21 into 19 with 9 mm of overlap; seat 25 against the shoulder and glue it in place.

4. Bell. Fit and glue bell mount 26 over the tip of 21, with its broad rim at the open end. Glue insert 28 into the recess in 26, leaving its central opening clear.

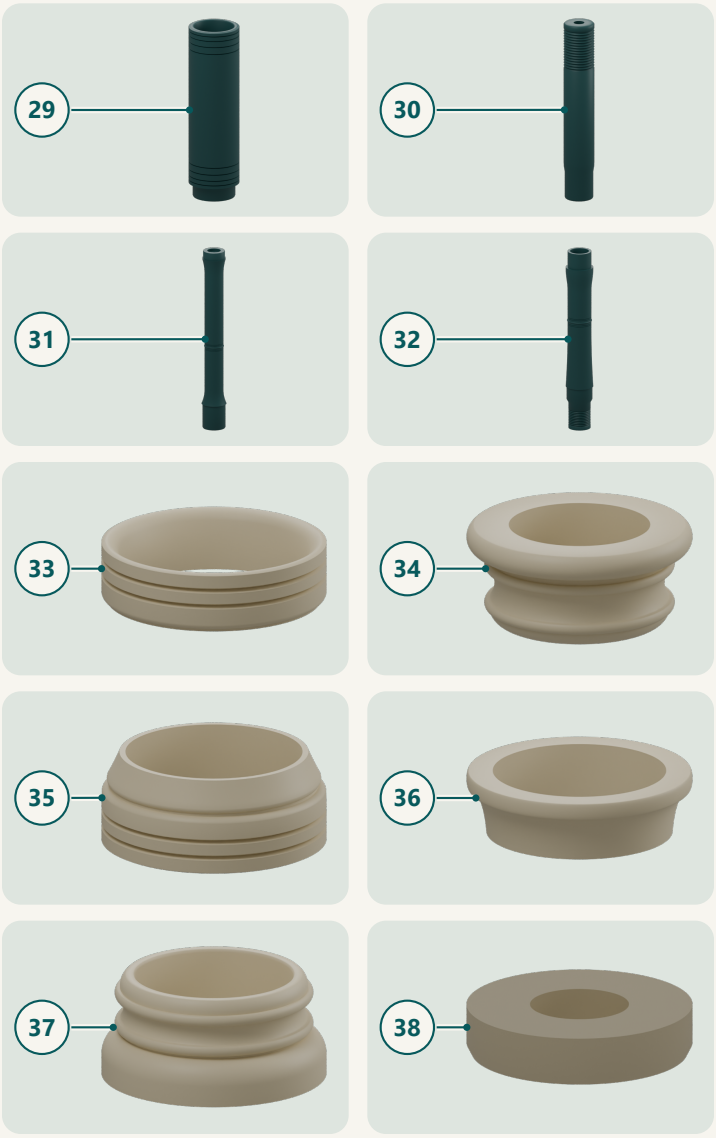
5. Tuning slide. Let the glue cure. Hemp the grooved band on pin 20, then slide chamber 19 over it. Adjust the hemp until the joint seals and moves evenly by hand.

6. Stock and reed. Hemp the stock tenon of 22 to fit common stock 07. Fit the reed securely in the small socket at its end. Once the air system is ready, insert the drone in its stock socket and tune it (pages 30-33).

Standard baritone drone assembly. For the plain-chamber version, see page 50. Keep sliding and removable joints free of glue.

05 / DRONES

Bass drone



1. Lower mounts. Fit and glue stock-end mount 37 around lower body 32, above its stock tenon. Fit and glue mount 34 over the other end, resting on the small supporting lip as shown on page 14.

2. Tuning pin. Check pin 30 in the socket at the top of 32, then glue it in place with 12 mm of overlap. Keep the bore clear.

3. Upper section. Fit and glue collar 33 around the open lower end of chamber 29. Slide ferrule 35 onto upper body 31 from below. Glue 31 into 29 with 10 mm of overlap; seat 35 against the shoulder and glue it in place.

4. Bell. Fit and glue bell mount 36 over the tip of 31, with its broad rim at the open end. Glue insert 38 into the recess in 36, leaving its central opening clear.

5. Tuning slide. Let the glue cure. Hemp the grooved band on pin 30, then slide chamber 29 over it. Adjust the hemp until the joint seals and moves evenly by hand.

6. Stock and reed. Hemp the stock tenon of 32 to fit common stock 07. Fit the reed securely in the small socket at its end. Once the air system is ready, insert the drone in its stock socket and tune it (pages 30-33).

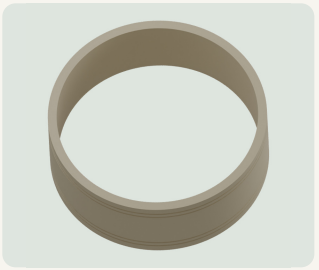
Standard bass drone assembly. For the plain-chamber version, see page 50. Keep sliding and removable joints free of glue.

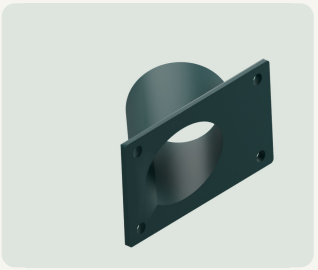
06 / AIR FITTINGS

Inlet and outlet parts

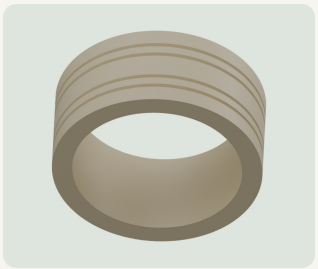


07


08


39


40


41


42


43


44


45


46


47


48

07-08: common stock and ferrule; 39-41: bellows outlet and connector; 42: bellows inlet valve (clack); 43-46: blowpipe and hose-end parts; 47-48: inlet stock and ferrule.

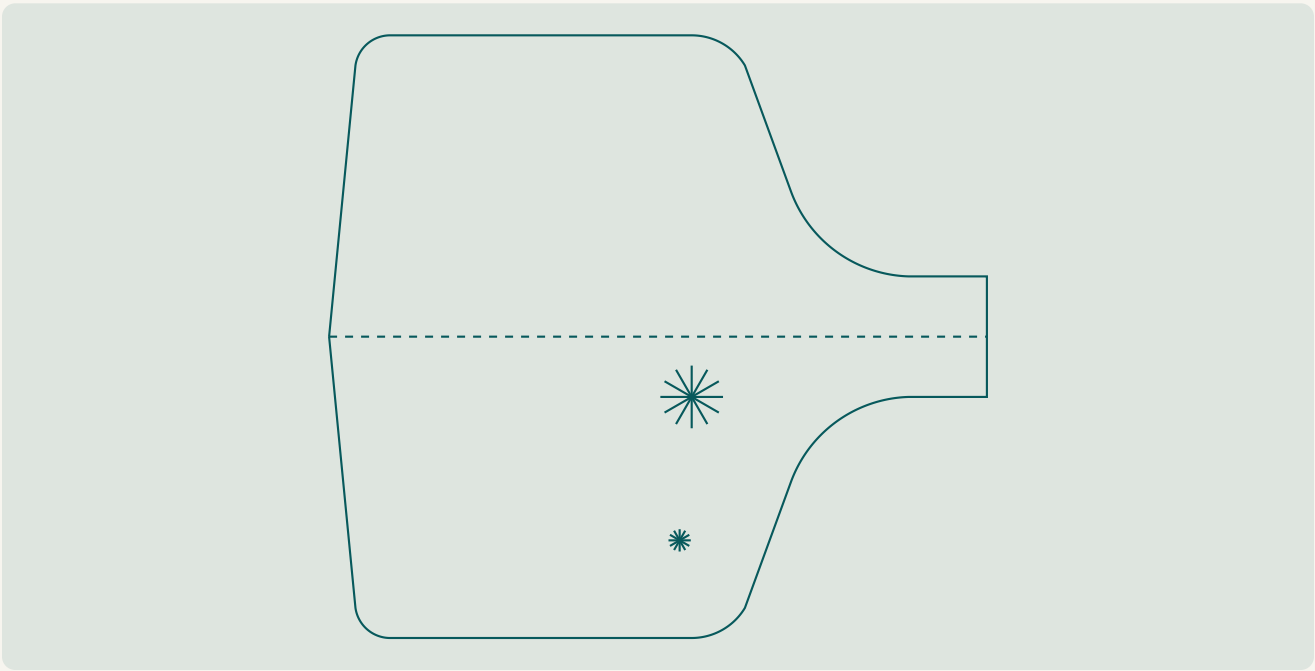
Fit the stock ferrules on page 12. Fit outlet 39 and inlet valve 42 to the bellows cheeks on page 26. Assemble connectors 40-41 and 43-46 using the steps on page 29.

AIR ROUTE

Bellows to outlet 39 to connector 40-41 to hose to connector 45-46 to blowpipe 43-44 to inlet stock 47-48 to bag. Valve 42 admits air as the bellows opens.

07 / THE BAG

The bellows-blown bag pattern



BellowsBlownPipeBag.dxf: reduced view, with stock slits and fold line. Use the full-size file for cutting.

The unfolded blank measures approximately 545.77 x 500.01 mm. Its straight neck is 65 mm long and 100 mm across.

The large stock opening has six slits across a 52 mm diameter; the small one has six across 18.5 mm. Keep the leather points between the slits.

Use BellowsBlownPipeBag.dxf for this set. Before laser cutting, check the full-size drawing against both overall dimensions above.

07 / THE BAG

Laser-cut the leather



Bag blanks with the stock slits marked.

The four supplied DXF patterns are set up for laser cutting. Have the pieces laser-cut by a cutting service. Supply the files at full size in millimetres, without fitting to a page. Check the main bag blank against the dimensions on page 19.

Ask the cutting service to through-cut **TAGLIO - CUT** (blue) and engrave or score **profonda - heavy** (red). Keep the stock openings as slits. The service should choose settings suitable for the leather and its machine.

Inspect the hide for defects and check its face and orientation before laying out the pattern. Arrange the bag suede-side out, with the grain side of the welt showing. The original assemblies used 1.5 mm automotive leather; check airtightness before buying, since some varieties are perforated. Keep offcuts for the seam sample and neck tie.

Hand cutting is a fallback. Trace the full-size pattern onto the leather on a cutting mat. Cut away from your body and supporting hand, keeping fingers out of the blade's possible slip path. Retain the stock-slit positions and points. [5]

> **CHECK WITH THE CUTTING SERVICE**
>
> Confirm that the actual leather, its tanning and any coating are suitable for laser cutting. Unknown materials or PVC must not be laser-cut. Check the layout and make a seam sample with the chosen leathers and sinew before committing the full blank. [9]

07 / THE BAG

Prepare the glued seam



Applying cement, then lightly hammering the joined leather edges.

Make the seam sample first. Check the layer order, folded welt, stitching access and adhesive compatibility before treating the whole blank.

Mark a stitch line on the leather, 9 mm from the bag's cut edge.

Read the label and safety data sheet for your Barge cement. Provide the ventilation and protection it requires, or have the cementing done in a suitable workspace. Keep vapours away from flames, heaters and a hot or operating printer. Keep adhesive clear of stock openings. [6]

Use Barge cement to hold the matching bag edges before stitching. Prepare both surfaces and allow the product's specified drying time before bringing them together. Align the fold and edges without stretching the leather.

Support the joined seam on a firm, flat, protected surface. Lightly hammer along the cemented bag joint with a clean, smooth hammer face to press the leather together. Use light taps, without denting the leather; try this on the seam sample first. [6, 8]

07 / THE BAG

Fit the folded welt





Fitting the contrasting welt around the bag seam.

Run the welt along the full length of the stitched seam, from the back of the bag to the end of the neck. Fold it around both bag layers to form a thick standing seam with a rounded crown. Keep the layers together through the curves. The neck tie has a local flattened section, described on page 25.

Leave about 3 mm of welt beyond the stitch line. Establish the edge on the seam sample before trimming the bag; do not remove the material that holds the stitches.

PipeBagEdging.dxf supplies a 40 mm x 830 mm strip. Check its length along the complete stitch line before fixing the ends, keeping the leather relaxed.

07 / THE BAG

Saddle stitch with artificial sinew





Left: stitching the bellows. Centre and right: the bag seam.

Mark the bag's stitch holes after trying the spacing on your seam sample. About 7 mm is a traditional starting point. Leave enough leather around each hole to hold the stitch, and check the sample before marking the full seam. [1]

Use saddle stitch for both leather assemblies. Make awl holes against a backing block, never a hand or thigh. Secure the seam and keep fingers clear of the point's exit path. If a needle sticks, check the hole rather than forcing it towards your hand.

Use blunt saddler's harness needles with eyes suited to the prepared holes and sinew. If passage is difficult, check the needle size, hole and whether the other strand has been pierced; correct the cause rather than pushing harder. Support the stitching area securely, using a stitching clam or pony where suitable. Try the combination on the seam sample; do not indiscriminately enlarge holes or thin the leather. See Tandy: Saddle Stitching and Mary Savel: Saddle-stitching Technique.

Use two needles on opposite ends of one length of artificial sinew. Pass both through each prepared hole, one from each side, without piercing the other strand. Pull the stitch firm without cutting into the leather. [1]

Use flattened sinew that fills the holes. Keep the stitches continuous and firm on both faces, with a rounded bag seam and exposed welt margin. Check for skipped holes and loose strands.

Finish the bag seam tightly against the leather: one finishing stitch passes over the rounded top and one goes out to the cut edge. Do not leave a standing loop.

07 / THE BAG

Tie in the common and inlet stocks



Common stock tied into the bag, retaining the leather points around the stock.

Use the laser-cut stock slits, keeping the leather points between them. If cutting them by hand, lay the work on a cutting mat, protect the opposite face and keep your hands outside the bag and clear of the blade. [2]

Slide the leather over the stock so the binding can press it into the retaining groove. Leave uncut leather beyond the binding to keep the ends of the slits sealed.

Bind with thick artificial sinew. Do not wind sinew around a finger to pull it tight: it can cut into the skin. Check the stock's orientation before tightening it. In the playing arrangement, the smallest drone occupies the forward socket; the bass occupies the lower of the three sockets, with the two smaller sockets level.

Check that the leather is sound, the stock is secure and the binding sits in its groove. Test for leaks before fitting reeds.

07 / THE BAG

Tie in the chanter stock





Bag neck before binding, and a completed neck tie.

Overlap the chanter stock by about an inch, retaining leather beyond the binding. In the playing position, the neck seam lies on the outside, towards the player's left.

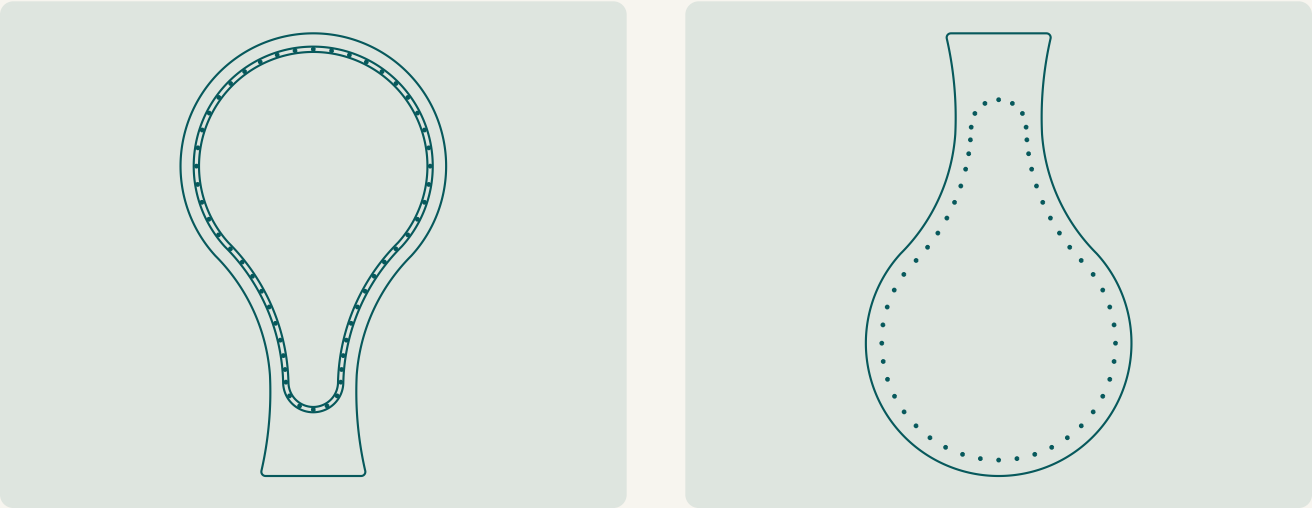
At the binding, lay the thick seam flat around the stock. Let the unbound seam settle naturally. Place one tightly rolled leather offcut in the gap opposite the seam's lean, keeping the roll on the forward side. Match its thickness to the flattened seam stack; it should pack the corner without a hollow centre. [1]

Check that the flattened seam and rolled offcut sit snugly against the stock, then bind the leather firmly into its groove with artificial sinew.

Check for gaps beneath the seam and tears in the leather. Make sure enough leather remains beyond the binding. Test for leaks before fitting the chanter and reed.

08 / BELLOWS

Prepare the plywood cheeks



BellowsPlatesLaserCut.dxf: reduced view. Give the full-size file to the laser-cutting service for the outlines, holes and fitting positions.

1. Check the cheeks. Have them laser-cut in 6 mm plywood using the supplied pattern. Smooth rough cut edges or stitching holes gently by hand, preserving their positions.

2. Fit outlet 39. Place the laser-cut leather gasket between its flange and the cheek at the marked outlet position. Align the four holes and fit the small brass round-head screws with a hand screwdriver. Choose lengths that hold the fitting securely without emerging through the plywood.

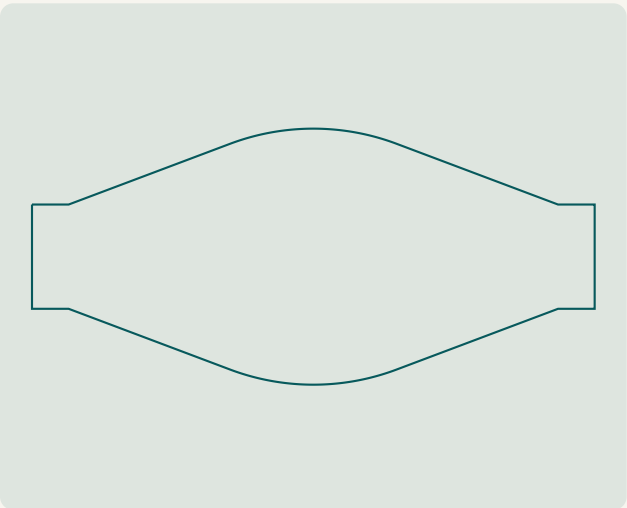
3. Fit inlet valve 42. Prepare its leather flap and retaining wrap as described on page 29. Wrap hemp around the grooved shank to fit the large inlet hole in the other cheek. Push it into place with the flap inside the bellows and its hinge at the top. Adjust the hemp for a secure, airtight fit.

4. Fit the screw eye. Screw it by hand into the marked position on the clack-valve cheek. Choose a shank short enough to remain within the plywood. The arm thong passes through this eye (page 28).

Check that the inlet flap opens freely into the bellows and lies back over the inlet. Check the outlet, gasket and screws for a secure fit before stitching on the gusset.

08 / BELLOWS

Fit the leather gusset



BellowsLeathers.dxf: reduced view, approximately 545 x 248 mm. Use the full-size file for laser cutting.



Stitching the leather to the bellows cheek: the leather meets the edge.

Use the same leather as the bag for this lightweight bellows; the originals used 1.5 mm automotive leather. Have the gusset laser-cut from the supplied pattern.

To find the end overlap, measure a line 10 mm in from the gusset's long edge. From that length, subtract the distance all the way around the cheek through the centres of its stitching holes. The difference is the overlap.

Align both long edges with the cheek stitching lines before joining the ends. Overlap the short ends by the amount calculated above, glue them and saddle-stitch through both layers. The gusset folds outward at the sides and inward at the front and rear.

Bring the gusset leather to the cheek edge and saddle-stitch through the prepared holes, as shown. Firm, airtight stitching needs no glue. A little curl beyond the stitch line is harmless.

Complete the continuous, airtight seam beneath the arm anchor. Curve the leather arm-anchor strip into a loop, with an end tab against the cheek on each side. Stitch each tab separately over the completed seam, with the gusset between the tabs and the plywood.

08 / BELLOWS

Hinge and arm thongs



Completed bellows. The attachment arrangement described below uses paired leather thongs.

Use 3 mm square leather for both thongs. Pass the hinge thong through the four hinge holes and tie both free ends together in one compact overhand knot beneath the cheeks.

For the arm thong, pass a loop of leather through the underside anchor. Bring the two free ends forward together through the screw eye. Take them around the cheeks at the hinge end, one above and one below, and tie them together in one compact overhand knot beside the hinge knot.

Tighten the knots so the leather grips itself. Put on the bellows and check that the thong passes around both cheeks, leaving the inlet clear and the hose free to move. Keep fingertips clear of the hinge and closing cheek edges.

Pair the four 65 x 20 mm leather strips from the pattern to make two double-thickness belt loops. Curve each pair into a loop and align its end holes with the marked fixing positions on the rear/inside cheek. Fit a cup finishing washer under each short brass screw head, then screw through both leather layers into the plywood. Check that the tips remain inside the plywood.

09 / AIR AND REEDS

Valves and hose

VALVE LEATHER

The laser-cut pattern includes the valves. Use supple leather that lets each flap move freely and seal reliably; the 1.5 mm bag leather can work.

1. Prepare both leather valves. On inlet valve 42 and blowpipe 43, turn the flat for the valve stem upwards. Trim the leather stem to fit the flat. Support it on a cutting surface with fingers clear of the blade, then make a partial-depth slit at the stem/flap junction, leaving the hinge intact.

2. Bind the valves. Secure each stem with hemp. Lay one straight strand of hemp across the flap, 1 mm below the hinge cut. Take it over the circular edges and tuck both ends beneath the main wrap. Each flap must lift freely and close over its inlet.

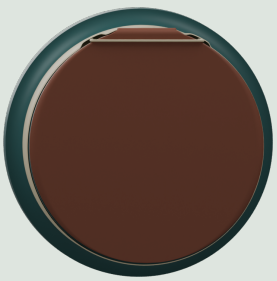
3. Bellows-end connector 40-41. Fit and glue ferrule 41 over the collar seat on 40, keeping the grooved tenon clear. When cured, hemp that tenon to fit outlet 39 securely and airtight. Fit valve 42 into its cheek as described on page 26.

4. Bag-end connector 43-46. Fit and glue mount 44 at the shoulder beside the long stock tenon of 43. Glue ferrule 46 around the socket mouth of 45. Let the glue cure. Hemp the short tenon of 43 to fit socket 45, and its long tenon to fit inlet stock 47. Keep the valve free to move.

5. Connect the hose. Choose flexible hose that fits the beaded ends of 40 and 45 securely; their spigot diameter is nominally 21.5 mm. Put on the bellows to find a length and route that allow free movement without kinking. Cut to length and push both ends over the beads. Zip ties can help secure them.

Check the air direction: valve 42 admits air as the bellows opens; the valve on 43 lets air enter the bag and prevents its return. Test the completed air supply before fitting reeds (page 31).

Bellows inlet clack 42



Leather flap over the inlet.

Hose-end joint 43 / 45



Hemped tenon fits the hose-end socket.

09 / AIR AND REEDS

Fit hemp and reeds

The set needs one chanter reed and three drone reeds. You can buy reeds or make your own; the supplied OR2 files are for making drone reeds.

Chanter: use a Northumbrian smallpipes-style reed of the kind commonly used in modern Scottish smallpipes. Reeds from several sources have worked successfully. Adjust the reed and tape the chanter holes as needed to bring the notes into tune. Iain Allen supplies reeds through bagpipereeds.co.uk.

OR2 drone reeds: use the supplied body and tongue files, with an M5 screw, two O-rings and seating wrap for each reed. The making and adjustment instructions begin on page 42. Reedmaking requires experience or practical tuition.

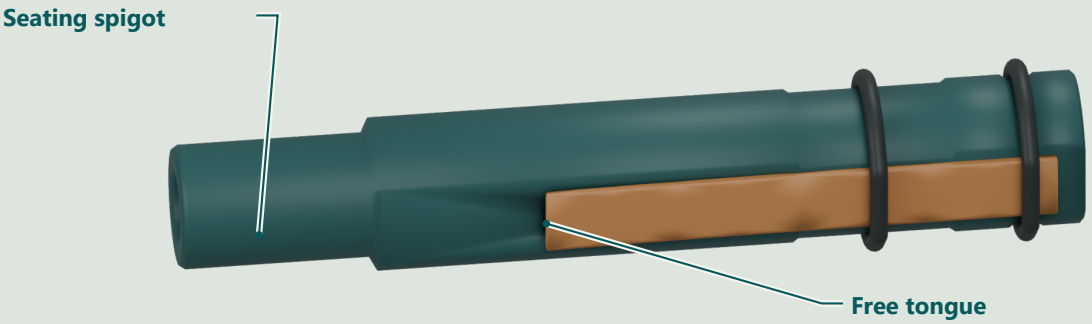
Bought drone reeds: Pipe Dreams supplies Ezeedrone Scottish smallpipe reeds. Identify the three-drone Lindstruments set in D to the supplier so they can select suitable reeds.

Further reedmaking: the LBPS tutor *More Power to Your Elbow* includes reedmaking guidance (see page 5). Use those general skills alongside the OR2-specific dimensions here.

Wrap joint hemp around the grooved bands, keeping bevels, bores and reed tongues clear. Fit each reed securely and airtight, with room around its tongue and enough access to remove it.

Once the air system is airtight, adjust one reed at a time. Note the reed, its seating depth and each adjustment so you can return to an earlier setting. [4]

The OR2 assembly



Seal the spigot; leave the free tongue clear.

Reed with its tongue fitted. For making and adjustment, see pages 42-45.

10 / TESTING THE SET

Test the air system without reeds

Test the bag, bellows and connections before fitting reeds, and again after any stock or hose adjustment.

1. Inspect. Check every fixed splice, seam, binding, hose connection and bellows joint. Remove loose fragments that could reach a reed.

2. Test separately. Use removable stoppers to test the bag, bellows and hose separately. Make sure air reaches the section you are testing; a closed one-way valve can hide a leak.

3. Locate. Apply modest hand pressure. Listen and feel around one seam or joint at a time while supporting the assembly. Keep your face clear of stoppers and fittings. Do not use compressed air.

4. Repair. Repair the leaking joint, binding or seam, then test the same section again before adding more parts. Rebind a loose stock and restitch a failed seam rather than covering the fault with sealant. [1]

5. Recheck. Test after each repair and note the result. Continue assembly only when the section holds air reliably.

> **SEASONING**
>
> Check whether the leather needs seasoning before applying a treatment. Use one compatible with the leather and keep it away from valves, stocks and reeds.

Bellows



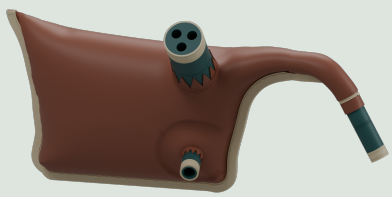
Check seams, valve and outlet.

Hose and joints



Check fittings and hose movement.

Bag and bindings



Check seam and all stock ties.

Isolate and test each assembly before adding the reeds.

10 / TESTING THE SET

First assembly and sound



The complete set. Adjust the wearing position to suit you.

Assemble the air system in a comfortable wearing position. Check that the bellows opens freely and the hose does not pull the inlet stock. Check the chanter angle and that the fingers can close the holes naturally.

Start with the chanter alone. Fit and adjust its reed, then play at a steady, comfortable pressure, with the drones stopped.

Try each drone separately, checking that its joints seal and its reed sounds steadily. Then play all three together.

If a drone stops at normal playing pressure, check the air supply, the reed's fit and its response. [4]

10 / TESTING THE SET

Tune and balance the instrument

Use A = 440 Hz as the tuning reference. Tune the bass drone to D3, baritone to A3 and tenor to D4. Establish steady playing pressure before tuning, and keep it steady for every comparison.

Tune one drone at a time with a tuner or a sounded reference note. With a reference note, listen for beating and reduce it with small movements of the tuning slide. Lengthening the drone lowers its pitch; shortening it raises the pitch. Keep enough of the tuning pin inside the upper section for a secure, airtight joint.

Add the other drones, then check them with the chanter. If adding a reed changes the balance, check air demand and reed response before altering printed parts.

The chanter may need reed adjustment and tape to bring its notes into tune. Make one change at a time and recheck at steady playing pressure.

Follow the reed maker's instructions for any bridle adjustment. Make small changes and retest; do not adjust several reeds together.

Record each reed, its seating depth and its tuning-slide setting. Check that the tuning remains steady during comfortable, sustained playing. Check again after playing and whenever you change a joint or reed. [4]

Moving the upper section along the tuning pin



Drone targets: bass D3 / baritone A3 / tenor D4

Tenor tuning slide in section. Keep enough overlap for a secure joint. A = 440 Hz.

11 / TROUBLESHOOTING

Find the cause before altering a part

Symptom	First checks
Joint will not seat	Part identity, printing scale, residue, shoulder and correct hemp band. Do not force.
Joint rocks or leaks	Mating pair, damage, hemp fit and socket condition.
Air loss with reeds removed	Isolate bag, bellows and hose; inspect seams, bindings and fixed joints.
Drone stops during playing	Air supply, reed seating and response at normal pressure.
Pitch will not settle	Steady pressure, secure reed, clear bore and sealing tuning joint.
Hose pulls or kinks	Wearing position, route, length and spigot fit.
Leak at the chanter neck	Contact beneath the flat seam and roll; leather overlap; binding in the groove.
Gusset pulls cheeks out of line	Fold direction, edge registration, lap and hinge route.

Change one thing at a time and test again. Check the air supply and joint fit first. For OR2 reeds, follow the adjustment instructions on pages 42-45. Note each change so you can return to an earlier setting.

11 / CARE

Care for your set

After playing, check the bag, hose, thongs and joints. Store the instrument without a load on the chanter, drones or flexible connection. Follow the material and reed makers' care advice.

Check for tears near the ends of the leather slits and around bindings, and for worn or loose sinew. Check whether plywood edges or fixing holes are rubbing through the leather or thongs.

Keep loose hemp and debris out of the bores. Replace worn hemp around the grooved band. If a tenon is cracked or distorted, replace the part before wrapping it.

Keep the STL files, patterns, guide and build record together. Record repairs and setup changes so a replacement part or earlier reed setting can be identified.

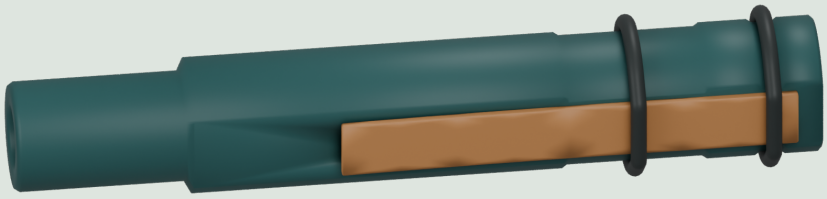
For help, include the guide date, part number or filename, printing material and process, a description of the problem and a clear photograph. Questions about fitting and setup are welcome.

Inspection points



Hemp band and bevel

Check the band and bevel before replacing hemp. Keep loose fibres out of the bore.



Tongue, rings and screw

Recheck retention, opening and airtightness after playing.

12 / FILE INDEX

Core parts 01-16

No.	STL filename	Qty	Z mm
01	01_Chanter_stock.stl	1	100.00
02	02_Chanter_stock_ferrule.stl	1	14.00
03	03_Chanter_reed_end.stl	1	38.48
04	04_D_chanter_upper.stl	1	97.65
05	05_D_chanter_lower.stl	1	100.00
06	06_D_chanter_sole.stl	1	8.00
07	07_Common_stock.stl	1	100.00
08	08_Common_stock_ferrule.stl	1	19.95
09	09_Tenor_wood_0.stl	1	44.04
10	10_Tenor_wood_1.stl	1	55.27
11	11_Tenor_wood_2.stl	1	65.96
12	12_Tenor_wood_3.stl	1	61.00
13	13_Tenor_ivory_0.stl	1	5.55
14	14_Tenor_ivory_1.stl	1	10.00
15	15_Tenor_ivory_2.stl	1	8.45
16	16_Tenor_ivory_3.stl	1	5.64

All dimensions are in millimetres. Z is the height of the part as saved in the STL file; see page 9 for printing orientation. Part numbers match the illustrations.

12 / FILE INDEX

Core parts 17-32

No.	STL filename	Qty	Z mm
17	17_Tenor_ivory_4.stl	1	9.85
18	18_Tenor_ivory_5.stl	1	2.00
19	19_Baritone_wood_0.stl	1	49.04
20	20_Baritone_wood_1.stl	1	73.27
21	21_Baritone_wood_2.stl	1	71.96
22	22_Baritone_wood_3.stl	1	72.00
23	23_Baritone_ivory_0.stl	1	5.55
24	24_Baritone_ivory_1.stl	1	10.00
25	25_Baritone_ivory_2.stl	1	8.45
26	26_Baritone_ivory_3.stl	1	5.64
27	27_Baritone_ivory_4.stl	1	9.85
28	28_Baritone_ivory_5.stl	1	2.00
29	29_Bass_wood_0.stl	1	74.04
30	30_Bass_wood_1.stl	1	66.27
31	31_Bass_wood_2.stl	1	135.96
32	32_Bass_wood_3.stl	1	111.00

All dimensions are in millimetres. Z is the height of the part as saved in the STL file; see page 9 for printing orientation. Part numbers match the illustrations.

12 / FILE INDEX

Core parts 33-48

No.	STL filename	Qty	Z mm
33	33_Bass_ivory_0.stl	1	5.55
34	34_Bass_ivory_1.stl	1	10.00
35	35_Bass_ivory_2.stl	1	8.45
36	36_Bass_ivory_3.stl	1	5.64
37	37_Bass_ivory_4.stl	1	9.85
38	38_Bass_ivory_5.stl	1	2.00
39	39_BellowsOutletPipe.stl	1	26.52
40	40_BellowsOutletWood.stl	1	49.00
41	41_BellowsOutletIvory.stl	1	11.00
42	42_ClackValve.stl	1	18.00
43	43_BellowsBlowpipeWood.stl	1	70.45
44	44_Bellows_blowpipe_mount.stl	1	6.00
45	45_TubeEndWood.stl	1	48.00
46	46_TubeEndIvory.stl	1	14.00
47	47_BlowstickStock.stl	1	50.00
48	48_BlowstickStockFerrule.stl	1	14.00

All dimensions are in millimetres. Z is the height of the part as saved in the STL file; see page 9 for printing orientation. Part numbers match the illustrations.

13 / REFERENCES

References and acknowledgements

Instrument design, construction photographs and instructions: Donald WG Lindsay, Lindstruments.

The sources below cover leatherwork, printing, maintenance and safe working. Reed suppliers and further learning resources are listed on pages 4-5 and 30.

1 / Mike Nelson
Making the Bag

2 / Andrew T. Lenz Jr.
Bagpipe Bag Tie-In

3 / Prusa Research
Modeling with 3D printing in mind

4 / Donald WG Lindsay
3DDrones: Making the Set

General fitting, reed and setup methods. Instrument-specific dimensions and notes differ.

5 / Canadian Centre for Occupational Health and Safety
Working Safely with Sharp Blades or Edges

6 / Barge
Product guidance and safety data sheets

7 / National Institute for Occupational Safety and Health
Safe 3D Printing is for Everyone, Everywhere

8 / Jamie Hartling, Leathersmith Designs
Leather Working Hammer

9 / Trotec Laser
Materials unsuitable for laser cutting and engraving

Reed suppliers and the LBPS reedmaking manual are linked on page 30.

14 / BUILD RECORD

Keep a record of your set

Use this page to keep the printing, material and setup choices together. Record changes as they are made, particularly where a replacement part or reed may need to match the earlier setup.

Item	Your setup
Build date / maker	
File set / guide date	
Printer / material	
Layer height / walls / infill	
Orientation / brim / supports	
Adhesive / curing time	
Bag / welt / gusset leather	
Plywood thickness / screws	
Hose / valve leather	
Chanter reed / seat / reference	
Drone reeds / notes / settings	
Air tests / repairs	

Before playing: check secure joints, clear bores, freely moving valves, an airtight bag and bellows, and reeds that sound steadily at comfortable pressure. Recheck after any repair or adjustment.

15 / RIGHTS AND PERMISSIONS

Licences and use

Design files and illustrations

Donald WG Lindsay developed the original #3DSmallpipes designs in 2014. This 2026 edition includes OR2 drone reeds. All 87 STL files (including three optional plain receivers), 13 DXF files and nine SVG cutting patterns in this edition are licensed by Donald WG Lindsay / Lindstruments under Creative Commons Attribution-ShareAlike 4.0 International (CC BY-SA 4.0). This edition retains permissions granted under earlier licences.

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The new guide and construction photographs

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16 / OR2-C2 REED PLATFORM

Make and voice your drone reeds

Choose one body and a matching tongue for each drone. These instructions assume reedmaking experience or practical tuition. Learn forming and voicing with an experienced maker and the resources on page 5. Bought reeds are an option (page 30).

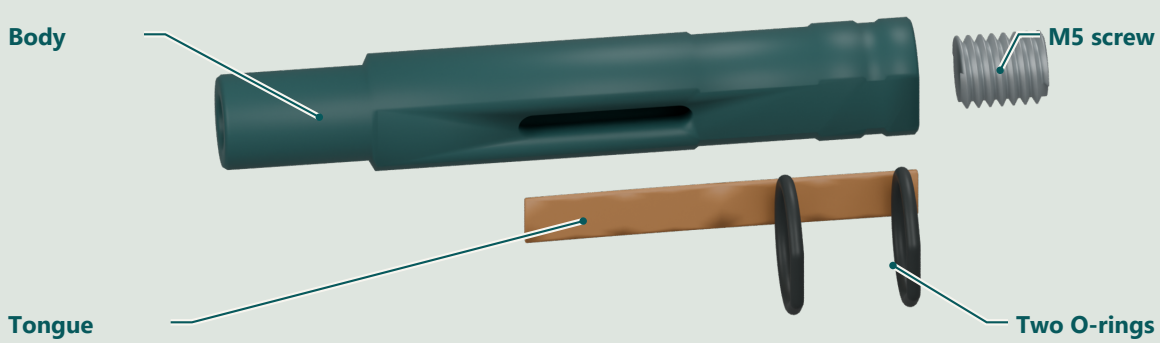
For each reed you will need: one M5 x 0.8 x 6 mm flat-point stainless socket grub screw, two 7.5 mm ID x 1 mm section NBR 70 Shore A O-rings, and seating wrap. Use a 2.5 mm Allen key. A separate M5 x 0.8 cutting tap is optional; a 3.5 mm hand tool can clean the working bore from the screw end.

L is the nominal geometric free tongue span at the starting bridle setting. Start with Tenor-L17 for D4, Baritone-L21 for A3 and Bass-L27 for D3, with A = 440 Hz. Adjust each reed in its drone. Nine matching DXF/SVG pairs are supplied for cut tongues.

Drone	Nominal L, mm	Starting size	Body, mm
Tenor	14 / 17 / 20	L17	47.55
Baritone	18 / 21 / 24	L21	52.45
Bass	23 / 27 / 31	L27	64.45

Match body and tongue voice/L labels. Tongues are 3.4 mm wide and L + 10 mm long; thickness options are 0.3, 0.4 and 0.5 mm.

Reed components



Reed components shown apart. The tongue is shown with a formed opening.

16 / OR2-C2 REED PLATFORM

Print and finish the reed body

Print in millimetres with the continuous flat face down; the spigot projects 0.05 mm below it. Check the slicer preview. Printing several bodies together, layer by layer, gives each more cooling time. Tune temperature, retraction and travel for your PLA and printer to avoid strings in the openings. Inspect the first small batch and its wall paths.

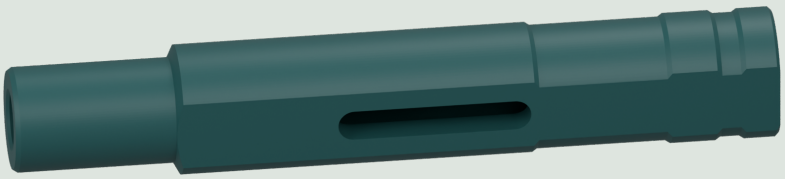
Sand the flat lightly on a flat abrasive. Preserve the heel groove, bridle bed, slot, shoulder and spigot bevel; remove dust. The tongue must cover both slot edges. If the 3.5 mm passage needs hand-cleaning, remove the screw and approach from the screw end with a 3.5 mm tool. Support the body and work gently, without loading the free tenon.

Work the M5 stainless screw gently and squarely into the nominal 4.2 mm PLA pilot by hand; back it out to clear debris. A separate M5 x 0.8 cutting tap is optional. Do not open the chamber to the 5 mm major diameter. If a print splits or strips, discard it and retry at a fractionally increased scale, then recheck screw grip, ring fit and seating wrap.

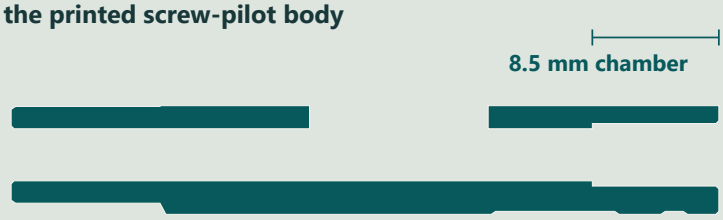
Use the M5 x 0.8 x 6 mm flat-point screw and 2.5 mm key. Start 1 mm recessed; keep the accessible end within a 0-2 mm recess. The inner tip is then 6-8 mm from the screw end, inside the 8.5 mm chamber. The 3.5 mm passage begins at 8.48 mm. Keep the screw in its threaded chamber; never advance it into that smaller passage.

Remove debris and check screw friction, retention and sealing before voicing. The straight tenon wall is nominally 1.5 mm and the combined bevel lip 1.1 mm. The finished M5 thread envelope leaves about 0.77 mm under the flat, at a separate location. Inspect your print; these dimensions are not a universal PLA strength rating.

External flat face



Axial section through the printed screw-pilot body



4.2 mm screw pilot; 3.5 mm passage. Clean by hand from the screw end.

16 / OR2-C2 REED PLATFORM

Cut or print a matching tongue

Use the matching OR2 body and tongue voice/L labels. Each blank is 3.4 mm wide and L + 10 mm long: 3 mm longer than OR1. Do not substitute the shorter OR1 blank. Use SVG at 100% scale or DXF in millimetres; check the dimensions before cutting.

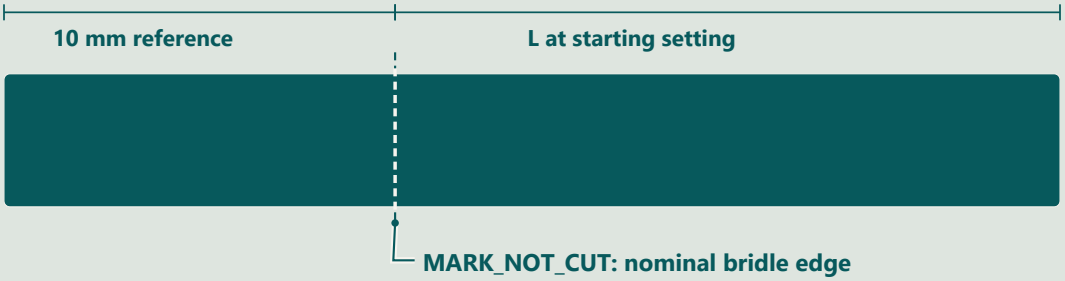
Cut around the closed outline on the DXF CUT layer. MARK_NOT_CUT is 10 mm from the heel: it identifies the nominal forward bridle edge at the starting setting. It is not a cut line or a fixed heel boundary. Keep the rounded corners and remove burrs.

Thickness options are 0.3, 0.4 and 0.5 mm. Print the flat PLA blanks or cut tongues from sheet material. At 0.1 mm layer height, the blanks are nominally 3, 4 and 5 layers thick. Measure each one and reject layer separation, cracks or rough edges.

Form the flat blank's opening and adjust its response in the drone. The assembled illustration shows a 0.25 mm opening as an example; no heat-setting recipe is specified. PLA stiffness, durability and retained opening depend on the material and print.

For careful sanding, remove the tongue, work in small steps and preserve the heel and slot coverage. Clean it, refit and listen after each change. Compare materials, lengths and thicknesses one change at a time. Replace a tongue that flakes, cracks or stays distorted. Record the material and measured thickness.

Flat tongue: nominal bridle reference



Use the full-size SVG or DXF to cut the outline on the CUT layer.

Width 3.4 mm | thickness options 0.3 / 0.4 / 0.5 mm

Form the flat blank's opening when voicing the reed.

16 / OR2-C2 REED PLATFORM

Set and adjust the movable bridle

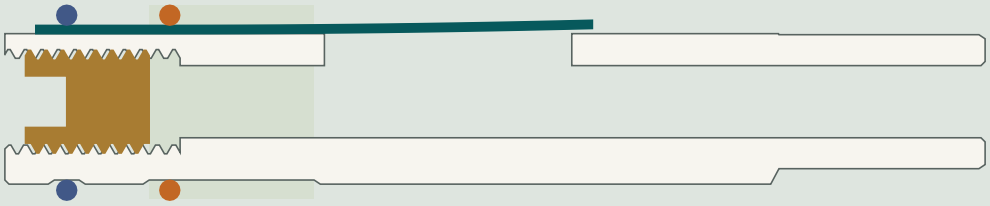
Fit the fixed heel ring in its groove, centred 3 mm from the screw end. Centre the tongue with its heel 1.5 mm from that end. Start the movable bridle centre at 11 mm on its continuous 7-15 mm bed. Protect both rings from sharp edges and twists.

Leave the heel anchor fixed. Move only the bridle, keeping its centre within 8-14 mm. Screwward lengthens the free geometric span; tipward shortens it. The span changes from L + 3 to L - 3 mm, not a guaranteed acoustic length or pitch.

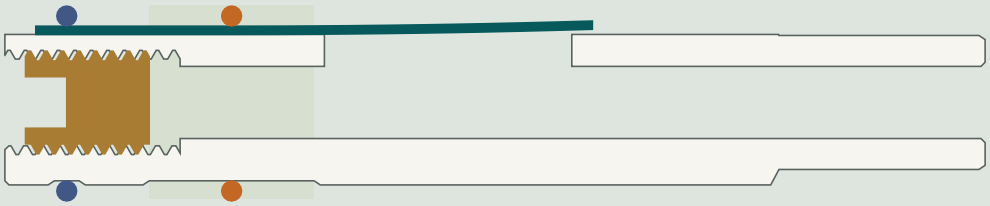
Do not move the bridle over the slot or off its bed. Make small changes, listen in the actual drone, then check all three together. Recheck ring grip, tongue opening, screw setting and airtightness after playing. Digital clearances do not establish actual friction or musical response.

Seat the 6.5 mm spigot 10 mm into the drone socket (7 mm bore). Start with about 0.25 mm of uncompressed seating wrap and adjust it for a secure, airtight fit. Keep the bore and inlet bevel clear; do not force the joint.

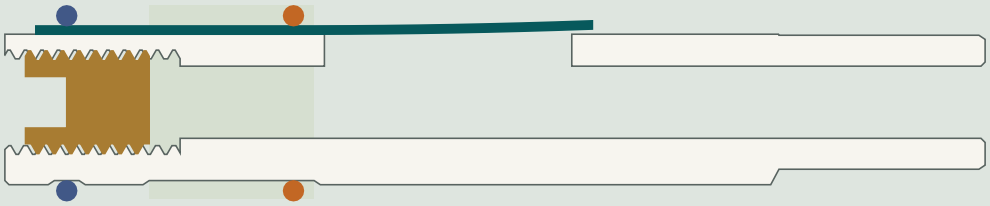
Centre 8 mm: screwward limit / longer free span



Centre 11 mm: starting position



Centre 14 mm: tipward limit / shorter free span



Blue: fixed heel anchor at 3 mm. Orange: movable bridle. Shaded bed: 7-15 mm.

Exact Tenor-L17 sections, equal axial/vertical scale. Dimensions from screw end.

16 / OR2-C2 REED PLATFORM

Drone internals and matching files

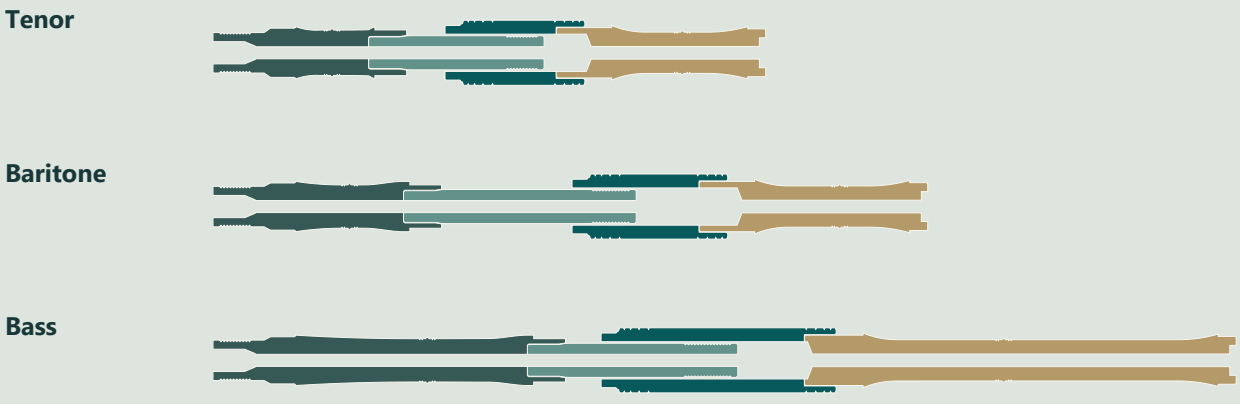
OR2-C2 retains the archived pre-OR1 tongue-tip to socket-mouth spacing: approximately 9.08 / 9.98 / 15.98 mm for tenor / baritone / bass. The plain body land retains that spacing. C2 uses a 3.5 mm working bore and M5 screw chamber; tongues, slot positions and bridle travel are unchanged. The longer internal passage may require retuning; the copied spacing is not an airflow or acoustic guarantee.

Dimensions below are in tenor / baritone / bass order. Lower sounding bores are 3.8 mm; upper bores 4 mm; tuning chambers 11.75 mm; reed sockets 7 mm. Tuning pins measure 10.75 mm across comb crests and nominally 9.75 mm at rounded groove roots. Outside waist-groove minima are 13.79 / 13.14 / 13.14 mm.

Lower sounding lengths are 91 / 120 / 152 mm; upper sounding lengths 55 / 58.498 / 133.498 mm. These are acoustic section lengths. Lower glued joints overlap 12 mm, pin into lower-body socket. Upper glued joints overlap 9 / 9 / 10 mm, with 15.85 mm tenons and 16.15 mm sockets: nominally 0.15 mm radial glue space. The tapered bore lies inside the upper piece; its exterior is straight beneath the shoulder ferrule. Fit that curved ferrule from below before gluing.

Plain tuning chambers are on page 50; reed files on pages 47-49; core parts on pages 36-38. See parts.csv, Reeds/size-schedule.csv and checksums.sha256 in the download. Page 41 and GUIDE-USE-TERMS.txt explain design, illustration, prose and photograph permissions.

Drone cross-sections at the same scale



Colours distinguish the four body pieces; white areas show the air passages.

Bores, tuning chambers and glued joints.

16 / OR2 FILE INDEX

Tenor reed files

STL option	Use
Tenor-L14-body-tap-ready.stl	Body / screw pilot
Tenor-L14-tongue-0p3.stl	Flat tongue blank
Tenor-L14-tongue-0p4.stl	Flat tongue blank
Tenor-L14-tongue-0p5.stl	Flat tongue blank
Tenor-L17-body-tap-ready.stl	Body / screw pilot
Tenor-L17-tongue-0p3.stl	Flat tongue blank
Tenor-L17-tongue-0p4.stl	Flat tongue blank
Tenor-L17-tongue-0p5.stl	Flat tongue blank
Tenor-L20-body-tap-ready.stl	Body / screw pilot
Tenor-L20-tongue-0p3.stl	Flat tongue blank
Tenor-L20-tongue-0p4.stl	Flat tongue blank
Tenor-L20-tongue-0p5.stl	Flat tongue blank

16 / OR2 FILE INDEX

Baritone reed files

STL option	Use
Baritone-L18-body-tap-ready.stl	Body / screw pilot
Baritone-L18-tongue-0p3.stl	Flat tongue blank
Baritone-L18-tongue-0p4.stl	Flat tongue blank
Baritone-L18-tongue-0p5.stl	Flat tongue blank
Baritone-L21-body-tap-ready.stl	Body / screw pilot
Baritone-L21-tongue-0p3.stl	Flat tongue blank
Baritone-L21-tongue-0p4.stl	Flat tongue blank
Baritone-L21-tongue-0p5.stl	Flat tongue blank
Baritone-L24-body-tap-ready.stl	Body / screw pilot
Baritone-L24-tongue-0p3.stl	Flat tongue blank
Baritone-L24-tongue-0p4.stl	Flat tongue blank
Baritone-L24-tongue-0p5.stl	Flat tongue blank

16 / OR2 FILE INDEX

Bass options and cutting templates

STL option	Use
Bass-L23-body-tap-ready.stl	Body / screw pilot
Bass-L23-tongue-0p3.stl	Flat tongue blank
Bass-L23-tongue-0p4.stl	Flat tongue blank
Bass-L23-tongue-0p5.stl	Flat tongue blank
Bass-L27-body-tap-ready.stl	Body / screw pilot
Bass-L27-tongue-0p3.stl	Flat tongue blank
Bass-L27-tongue-0p4.stl	Flat tongue blank
Bass-L27-tongue-0p5.stl	Flat tongue blank
Bass-L31-body-tap-ready.stl	Body / screw pilot
Bass-L31-tongue-0p3.stl	Flat tongue blank
Bass-L31-tongue-0p4.stl	Flat tongue blank
Bass-L31-tongue-0p5.stl	Flat tongue blank

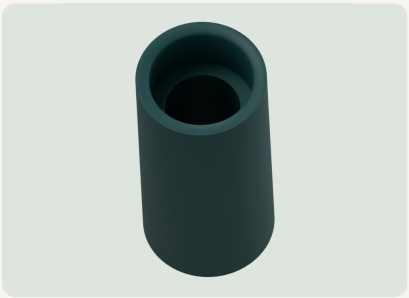
Each voice/L size has a DXF and SVG cutting template: nine of each. Use these full-size files with the reedmaking instructions on pages 42-45.

17 / OPTIONAL PARTS

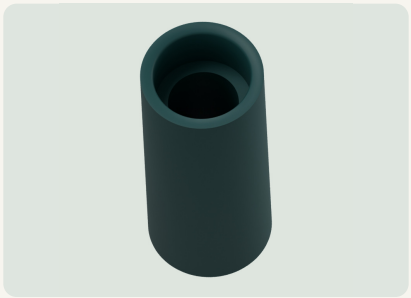
Plain tuning-chamber alternatives

The Alternatives/ folder contains one plain tuning chamber for each drone. These fit the standard drone parts and have the same bores. Their parallel exterior replaces the shaped lower section and its ferrule; the upper shoulder ferrule is still used.

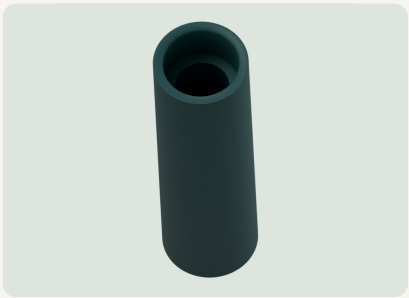
If the bore of a standard tuning-chamber print narrows near the lower ferrule, try the matching plain version. Its simpler exterior may print more evenly. Check the bore and fit, and carefully remove any first-layer lip at the entrance. Preserve the bore dimensions and avoid forcing the joint.



TENOR



BARITONE



BASS

Optional STL in Alternatives/	Replaces / omit
ALT_09_Tenor_tuning_chamber_plain.stl	09 / omit 13
ALT_19_Baritone_tuning_chamber_plain.stl	19 / omit 23
ALT_29_Bass_tuning_chamber_plain.stl	29 / omit 33

Use upper ferrules 15 / 25 / 35. Fit them from underneath before gluing the upper pieces into the tuning chambers. Assemble the remaining parts as described on pages 15-17.

Compare the two versions using Standard drones and No-bottom-ferrule drones in the viewer. Choose either the standard or plain chamber for each drone.

FIRST-PRINT INSPECTION

The upper-ferrule edge is about 0.53 mm thick and the outlet lip about 2.63 mm. Inspect these printed edges for damage and check the glued joints for strength and airtightness. Check tuning with the chosen reed.