LIGNUM.

REPAIR

OF AN UNCROZED STAVE

Our PROGRAM

01 Introduction

02 Definition

03 The method

04 Tip

05 Workshop memo

Repair of an uncrozed stave

01 Introduction

Prerequisites

1.Barrel inspection

Before any action:

- Identify leaks, breaks, or defects,
- Understand the cause (not just the consequence),
- Identify both sides of the barrel.

2. Material

- Compatible new stave (grain / wood species / behavior)
- Intentionally oversized width

👉 **Always allow for adjustment.**

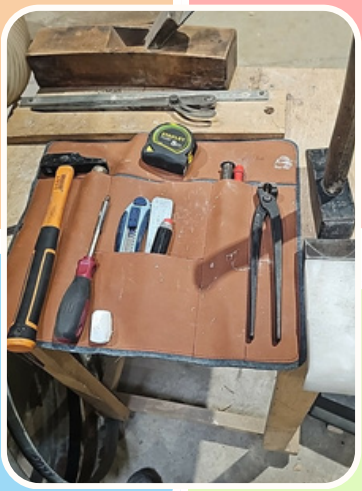
3. Standard toolbox (used barrel repair)

Disassembly / tightening tools

- Hammer
- Hoop driver
- Small hammer
- Pincers
- Head puller or pull hook
- Repair hoop
- Utility knife

Cutting and adjustment tools

- Straight plane
- Adze or jigsaw
- Croze tool or router
- Stockolm scraper or adze



Marking / inspection tools

- Chalk
- Marker
- Measuring tape
- Compass

Specific repair tools

- Hoop sections (~5 cm)
- Tool or hoop section for scraping tartar deposits
- Wooden pegs
- Wooden dowels / stainless steel pins
- Reed
- Claw tool

Replacement parts

- New stave (oversize mandatory)
- Head piece (if necessary)
- Water + flour paste

01 Introduction

Repairing a used barrel is **one of the most revealing exercises of a cooper's true skill level.**

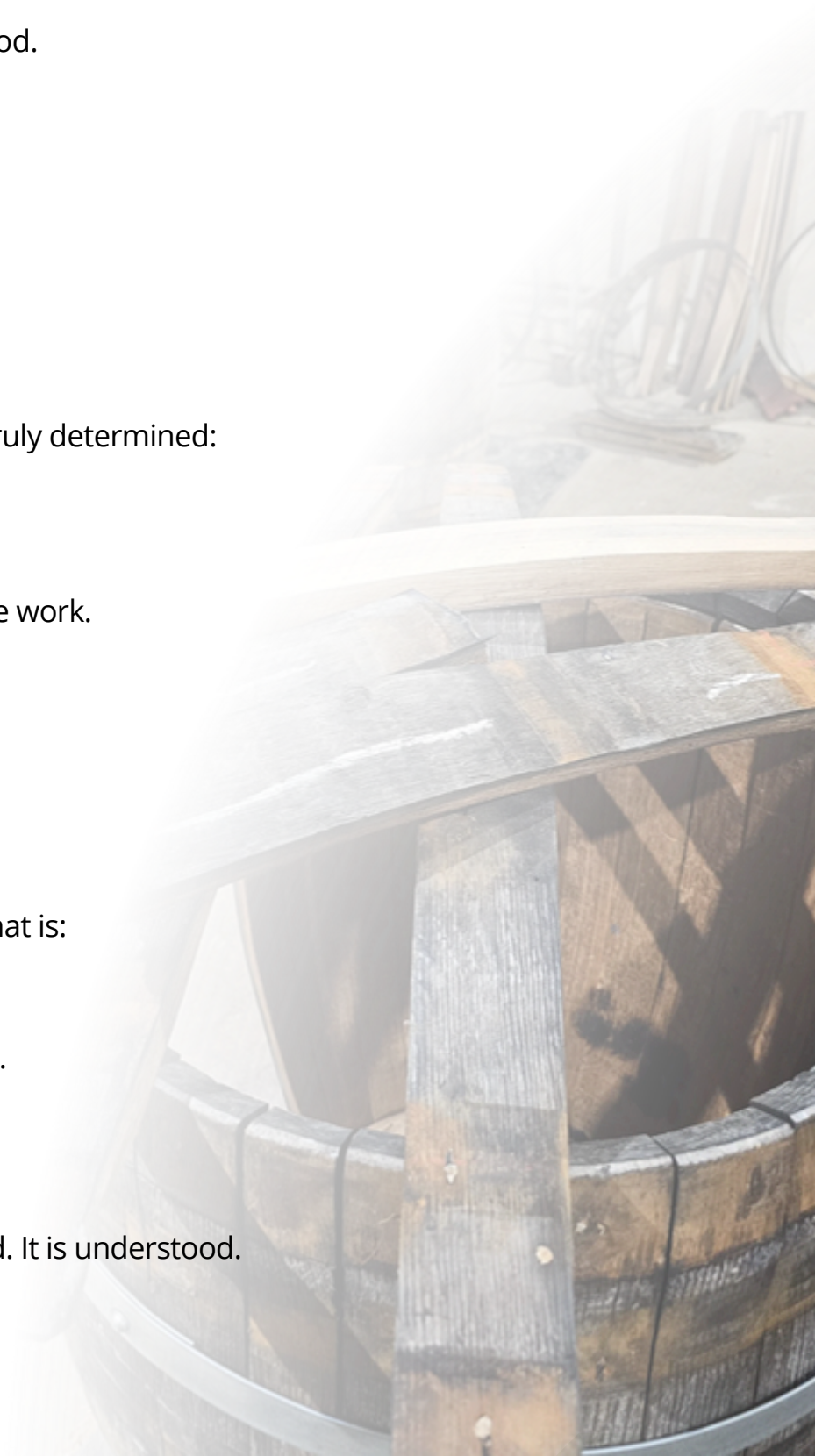
In production, you apply a method.

In repair work, you face reality:

- **warped wood,**
- **existing stresses,**
- **irregular geometry,**
- **unknown history.**

This is where the following are truly determined:

- **real watertightness,**
- **long-term durability,**
- **the perceived quality** of the work.



Course objective

To provide you with a method that is:

- clear,
- repeatable,
- adaptable to all used barrels.

To remember from now on:

👉 A used barrel is not corrected. It is understood.

02 Définition

Definition of repair work

Barrel repair, also called reworking, consists of:

replacing one or several defective parts (staves and/or head pieces) in order to restore a barrel that has become unusable due to leaks, breakage, or deformation.

But in practice, repair work is not limited to a simple replacement.

It is an operation that consists of:

- **analyzing** the origin of the defect,
- **dismantling** without deforming the existing structure,
- **fitting a** new part into an already stressed assembly,
- **rebuilding** the barrel while respecting its actual geometry.

Repairing a barrel is not about replacing a part.
It is about rebalancing an entire structure.

03 The method

Step 1 — Precisely identify the problem

- Locate the leak or the breakage,
- Check whether the defect is:
  - local (one stave),
  - structural (several areas),
- Mark the area.

Step 2 — Full barrel identification

Before any disassembly, it is essential to secure all barrel reference points.

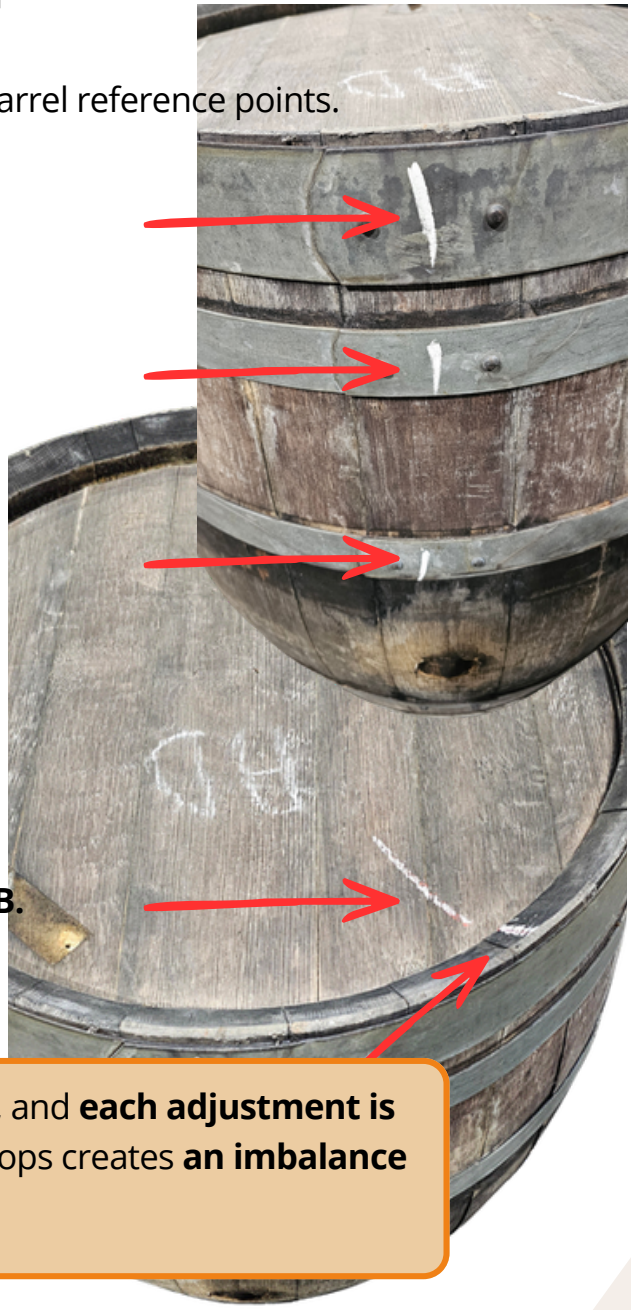
To identify:

- The two sides of the barrel:
  - **Head A**
  - **Head B**
- The hoops associated with each side:
  - **hoops on side A**
  - **hoops on side B**

Simple and reliable method

- Make a **visible mark** (for example a cross) on:
  - **Head A and bevel A,**
  - **the hoops on the Head A side.**

The remaining side automatically becomes Side B.



Why is this essential?

On a used barrel, the two sides are **never identical**, and **each adjustment is specific to its own side**: reversing a head or the hoops creates **an imbalance and leads to leakage.**

Step 3 — Rosing (controlled barrel opening)

The objective is to open the barrel without losing its structure.

1. **1. Removing the head hoop**

- Remove the nails or hoop nails holding the hoop in place,
- Remove the head hoop.

After removal:

- Inspect the inside of the hoop,
- Identify the burrs left by the nails,
- these burrs mark the wood,
- Place the hoop on the anvil,
- Hammer the inside of the hoop to remove the burrs.

This operation must be carried out on all hoops, without exception.
It must become a systematic reflex.

Step 3 — Rosing (controlled barrel opening)

The objective is to open the barrel without losing its structure.

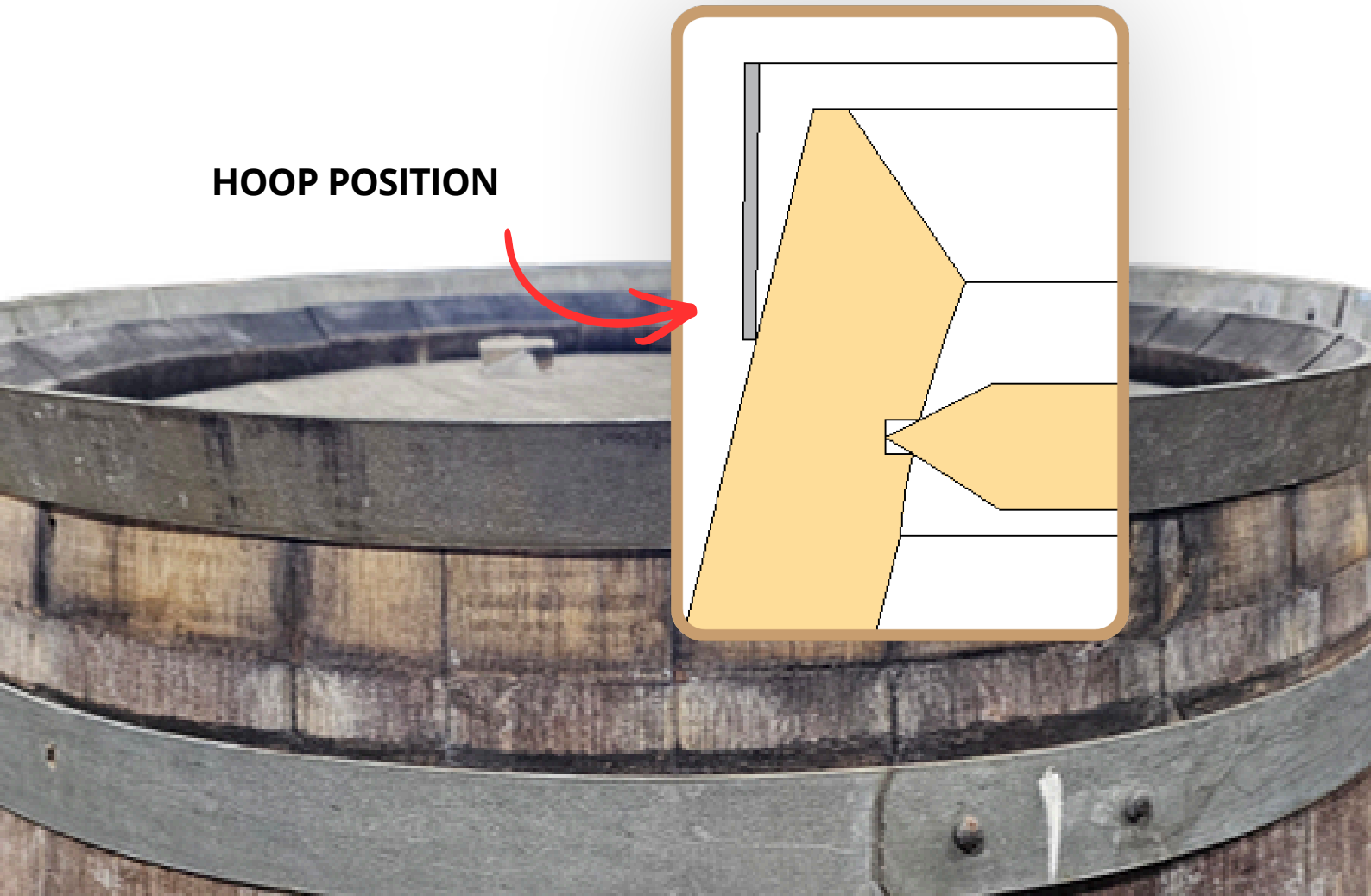
2 - Installing the repair hoop

- Position an inverted hoop slightly above the croze,
- It is possible to use a wooden hoop to provide more flexibility.

Tightening adjustment

The tightening must be correct:

- tight enough to keep the barrel in place,
- flexible enough to allow the staves to be removed.



Step 3 — Rosing (controlled barrel opening)

The objective is to open the barrel without losing its structure.

3 — Removal of the bilge hoop and quarter hoop (Side A)

- Remove the nails or hoop nails,
- Remove:
  - the bilge hoop,
  - the quarter hoop,
  - Flatten the nail burrs on each hoop

→ anvil required.

Set up:

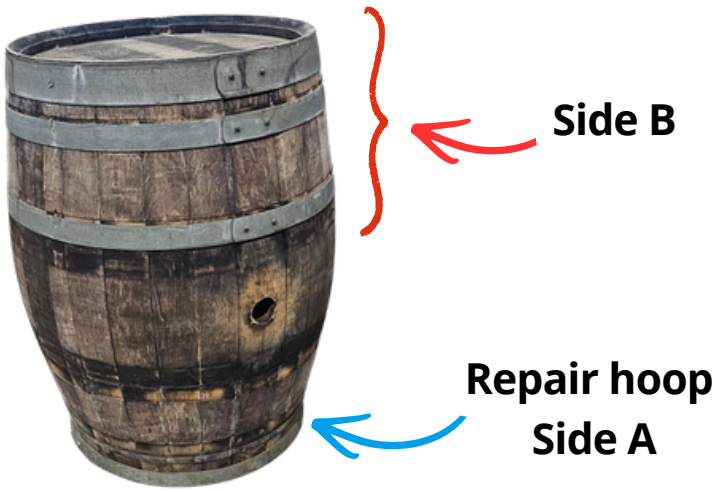
- a **storage area for Side A**,
- a **storage area for Side B**,

And place there:

- the hoops,
- the associated components.

4 — Turning the barrel over

- Carefully turn the barrel over (with the inverted hoop still in place).



Step 3 — Rosing (controlled barrel opening)

The objective is to open the barrel without losing its structure.

5 — Work on Side B (after turning the barrel over)

- **Remove the nails from all hoops,**
- **Remove:**
  - the bilge hoop,
  - the quarter hoop,
  - Flatten the nail burrs on each hoop

→ anvil required.

- **Reposition on the barrel:**
  - the bilge hoop,
  - the quarter hoop.

- **Removal of the head hoop**
  - Remove the nails,
  - Remove the head hoop,
  - Flatten the burrs,
  - Place the hoop in the Side B storage area.

- **Separating the staves from the head**
  - Tap the staves at the bevel area with a hammer,
  - Separate the staves from the head,
  - Release the head.

03 The method

Step 3 — Rosing (controlled barrel opening)

The objective is to open the barrel without losing its structure.

- **Head removal**
  - Remove the quarter hoop,
  - Slightly loosen the bilge hoop,
  - Use a head puller.

Always control the removal in order to:
  - prevent the head from falling,
  - avoid damaging the croze.

The head must come out without forcing.

- **Reposition on the barrel:**
  - the bilge hoop,
  - the quarter hoop.

Special case — Head stuck in the croze

Situation

- Despite loosening and separating the staves:
  - the head does not come out,
  - it remains stuck in the croze.

Solution

  - Insert small hoop sections (~5 cm).
  - Place them between the head and the croze all around the circumference of the head.

Method

  - Position the sections evenly at the junction between two staves,
  - Work progressively all around the barrel,
  - Guide the removal of the head.

Step 4 — Removing the staves

Objective
Remove:

- the defective stave,
- the two adjacent staves in order to remake the joints and properly fit the new stave.

1.Stave identification
Before any removal:

- Locate the defective stave previously marked,
- Mark the two adjacent staves.

Precisely identify which side of each stave must be reworked.

2. Releasing the staves

- Slightly lift **the bilge hoop,**
- Create just enough clearance.

Method

- Slide **the 3 staves outward,**
- Remove them progressively,
- Slide the hoop back in front of the opened space.

Step 4 — Removing the staves

Critical point — Risk of transverse splitting

Transverse splitting corresponds to a loss of barrel alignment.
It occurs when:

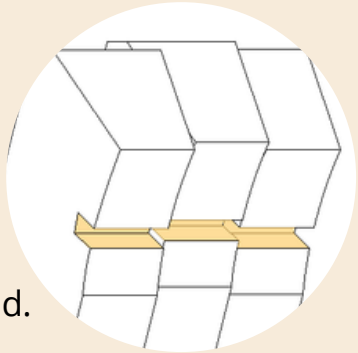
- the support angle is poorly positioned,
- or when the barrel is handled laterally.

Consequences

- the barrel collapses,
- the **croze is no longer aligned.**

The repair then becomes:

- much more complex,
- sometimes impossible without a complete rebuild.



Step 5 — Measuring and selecting the new stave

Objective

Rebuild the dismantled area exactly by:

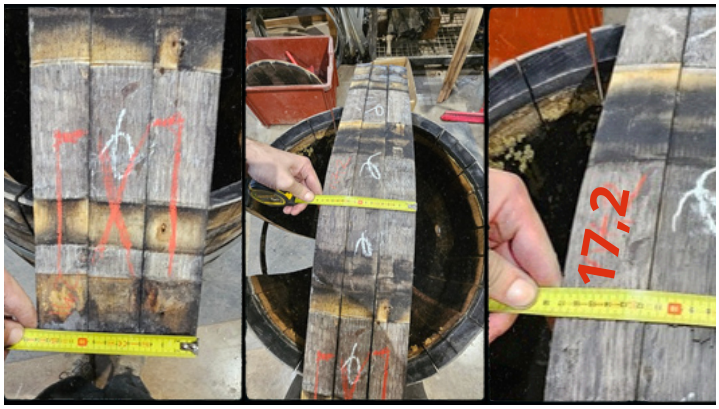
- respecting the barrel dimensions,
- anticipating the jointing,
- preparing a suitable stave.

1.Measuring

Once the three staves have been removed:
measure:

- at the bilge,
- at head 1,
- at head 2.

Record the dimensions on one of the adjacent staves (head / bilge / head).



2. Selecting the new stave

Choose a stave:

- of the same wood species,
- with a consistent grain,
- slightly wider than the stave being replaced.

A stave that is too narrow will reduce the barrel diameter and result in heads that are too tight.

Conversely, a stave that is too wide leads to excessive material consumption, because the excess will be removed by machining and turned into waste.

Step 6 — Jointing the new stave

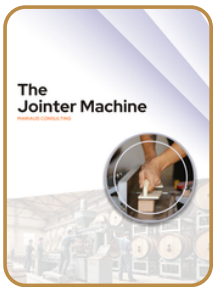
Objective

Prepare the new stave so that it:

- fits into the existing geometry,
- respects the barrel angles,
- allows for a precise joint.

1. **Jointing**

- Pass the stave through **the jointer**,
- **Work safely** (see dedicated course),
- Obtain clean surfaces.



Use a jointing key:

- to adjust the angle,
- to make precise corrections.

(See the dedicated Lignum course on the jointing key.)

The two edges of the new stave, as well as the edge of each adjacent stave in contact with it, are passed again through the jointer.

Step 7 — Reinstalling the staves

Objective

Rebuild the dismantled area by:

- repositioning **the two adjacent staves,**
- fitting the **new stave,**
- respecting the geometry of the barrel.

1.Reinstalling the adjacent staves

- Insert the two adjacent staves from the bottom,
- Reposition them in their original location and place the head back into the croze,
- Slightly lift the bilge hoop to create the necessary clearance,
- Do not hesitate to drive the adjacent staves into the croze with a small hammer.

Step 7 — Reinstalling the staves

2. Tightening the hoops

- Gradually tighten:
  - the bilge hoop,
  - the quarter hoop,
  - the head hoop.

3.Raising the misaligned staves

- Raise the misaligned staves as much as possible by working upward from the bilge toward the head.

Before

After

Step 7 — Reinstalling the staves

4. Turning the barrel over

- Carefully turn the barrel over,
- Position the corresponding bilge hoop on the correct side,
- Remove the inverted hoop,
- Slightly loosen the bilge hoop,
- Remove the head carefully.

5.Reinstalling and tightening the hoops

Once the head has been removed:

- Retighten the bilge hoop,
- Immediately rebalance the stave so that it is centered,
- Reposition the quarter hoop and tighten it,
- Reposition the head hoop,
- Gradually raise the misaligned staves,
- Proceed in the same way as on the first side.

Before the final tightening, tap the stave lightly to rebalance it so that it protrudes evenly on both sides.

03 The method

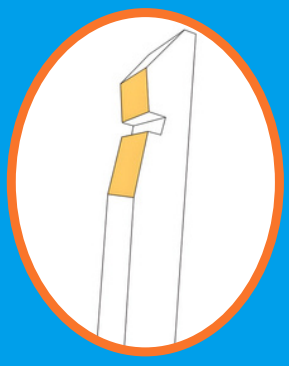
Step 8 — Crozing

Crozing can be carried out:

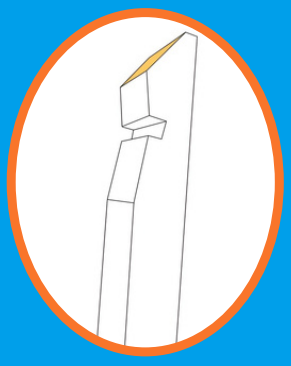
- with **traditional tools,**
- or with **power tools**.

What matters is not the tool, but the quality of the result.

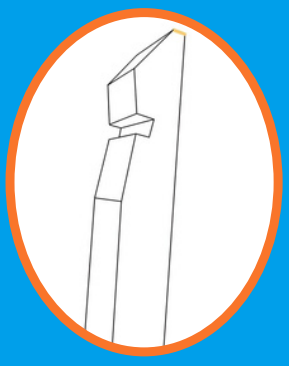
Traditional method



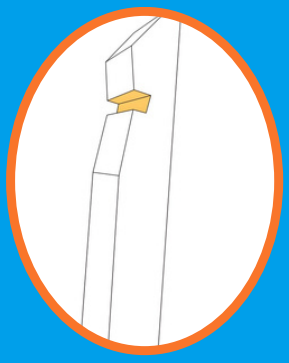
Step 1:
The chime angle



Step 2:
The bevel

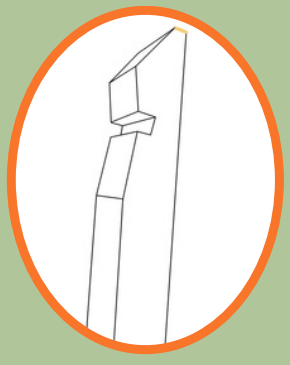


Step 3:
The fillet

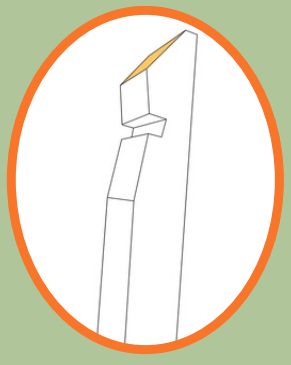


Step 4:
The croze

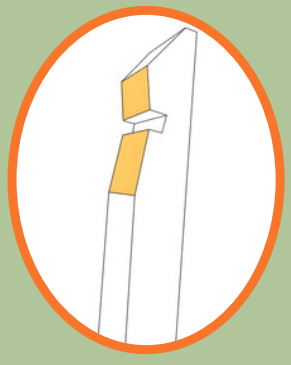
Method using power tools



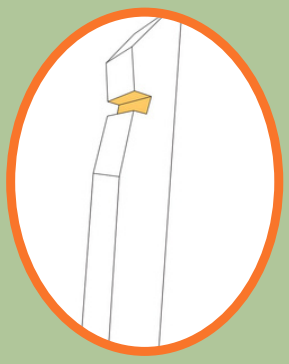
Step 1:
The fillet



Step 2:
The bevel



Step 3:
The chime angle

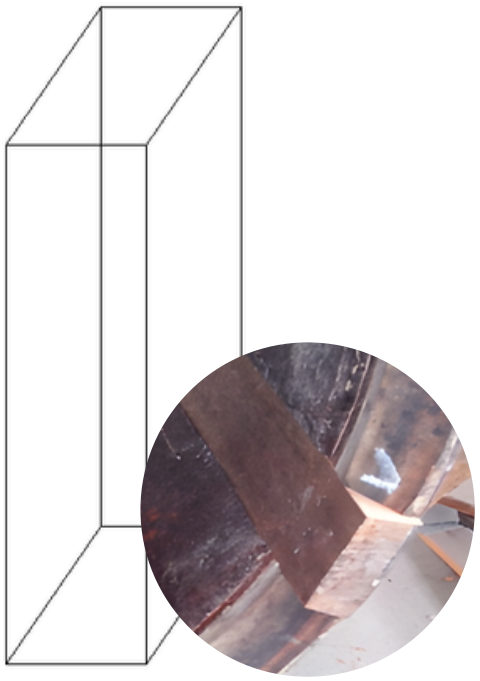


Step 4:
The croze

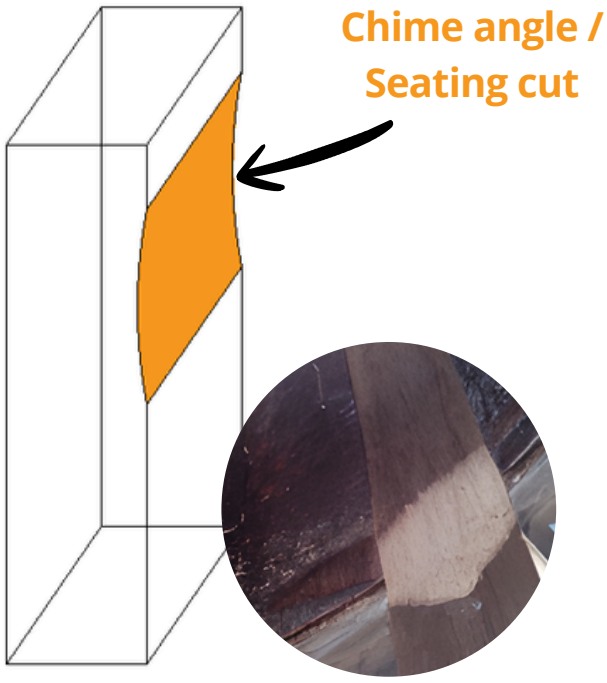
03 The method

Step 8 — Crozing

The **chime angle** (or seating cut) is a **circular concave machining** operation carried out at the location of the future head, creating a uniform support surface and defining the base of the croze.



❌ Missing chime angle



✅ Chime angle completed

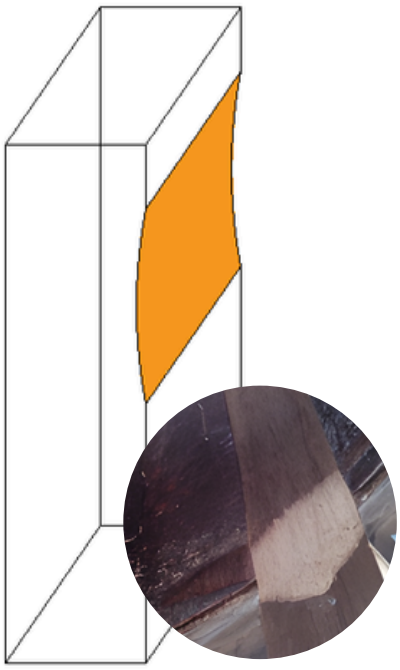
The chime angle must be worked while strictly following **the direction of the wood grain**. The cutting edge of the tool must **remain parallel to the fibers**, with a slight angle created by a **controlled rotational movement of the handle.** This angled positioning allows **the fibers to be sheared rather** than torn out, ensuring a clean cut and a uniform surface.

The use of the small adze is preferred, because **the Stockholm** scraper requires the bevel and the chime angle to already be completed **in order to work properly.**

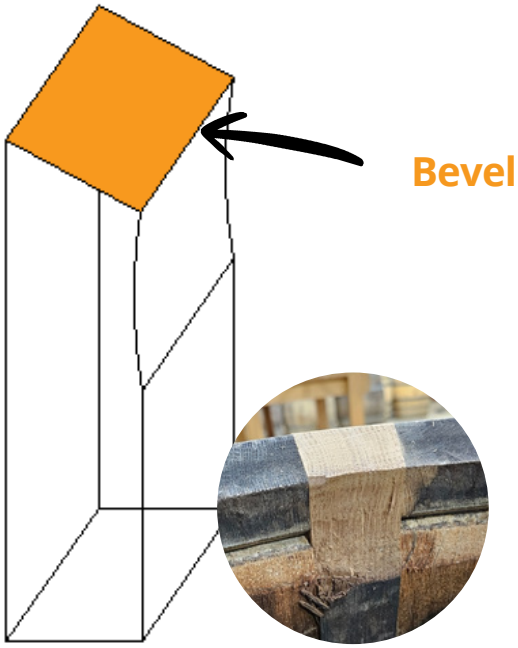
03 The method

Step 8 — Crozing

Bevelling consists of machining the end of **the staves at an angle in order to create a bevel** around the entire circumference of the barrel.



✅ Chime angle completed
❌Missing bevel



✅Chime angle completed
✅Bevel completed

The resulting bevel must be uniform, without breaks or angle variations, in order to **facilitate handling**, allow **water runoff** in case of exposure to weather conditions, and **reduce the risk of splintering** at the ends of the staves.

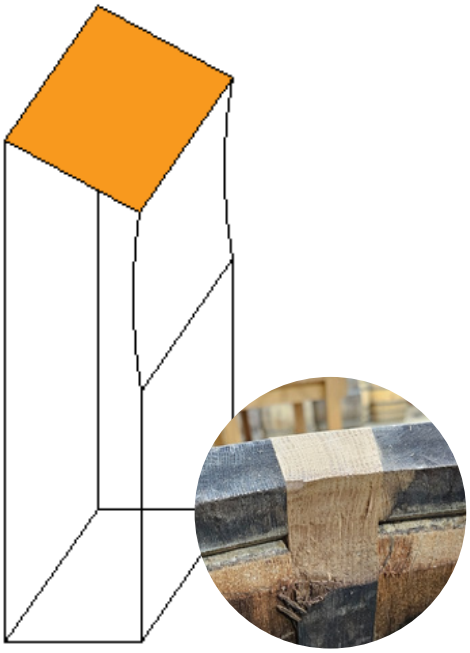
- **Traditionally,** the bevel is made with an **adze**, allowing precise and **controlled work while respecting the wood grain.**

- **Today,** it can also be carried out using power tools such as a jigsaw or a **reciprocating saw**, provided that the movement remains controlled and the angle consistent.

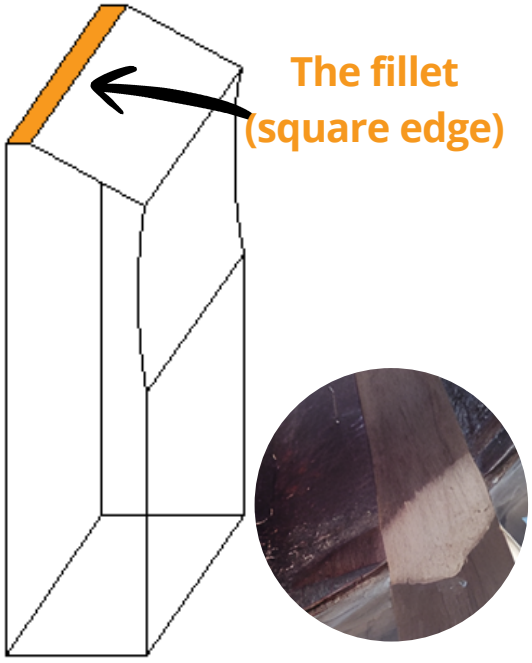
A finishing pass with a scraper will then be necessary.

Step 8 — Crozing

Dressing consists of making the end of the barrel **perfectly flat and uniform**. This surface serves as the base for the next operation, the croze. If it is not uniform, the croze will not be uniform either, meaning the head will not seat correctly, resulting in **watertightness defects**.



✅ Chime angle completed
✅ Bevel completed
❌ Missing fillet



✅ Chime angle completed
✅ Bevel completed
✅ Fillet completed

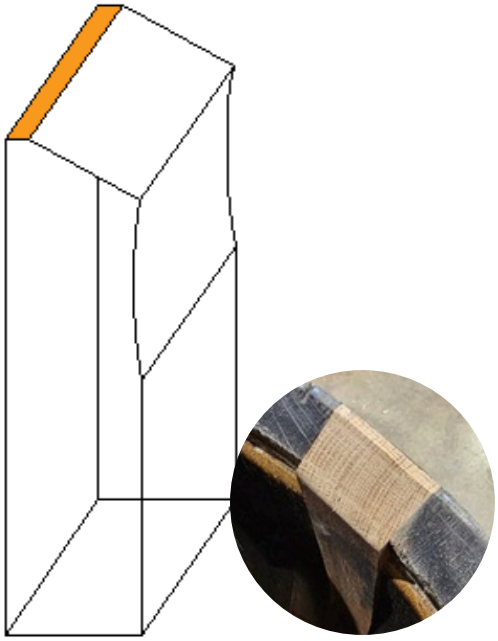
Dressing is carried out after the bevel and the chime angle, and aims to obtain a perfectly flat surface perpendicular **to the axis of the staves.**

- **Traditionally,** dressing is carried out with **a straight plane** or a **jointer plane,** allowing precise and controlled work.
- **Today,** especially in repair work, it can also be performed using power **tools such as a jigsaw or an electric planer,** provided that the surface remains perfectly flat and uniform.

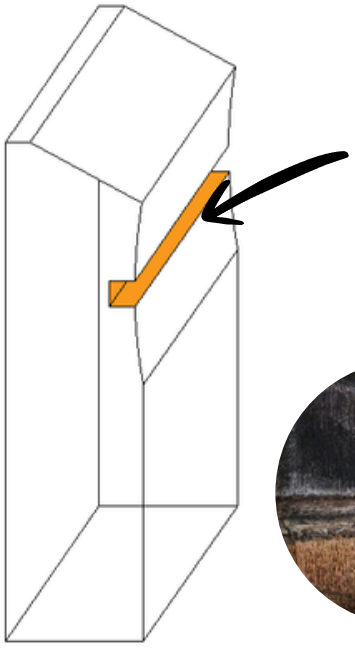
03 The method

Step 8 — Crozing

Crozing consists of **machining the groove** into which **the barrel head** will fit. This groove must be **uniform, continuous**, and of **constant depth** to ensure proper seating of the head and guarantee watertightness.



✅Chime angle completed
✅Bevel completed
✅ Fillet completed
❌Missing croze



✅Chime angle completed
✅Bevel completed
✅ Fillet completed
✅ Croze completed

Crozing consists of machining a circular groove, **generally 5 to 6 mm deep**, at a precise distance from the end of the staves according to the barrel format. A groove that is too **deep weakens** the stave and **increases the risk** of **breakage and leakage.**

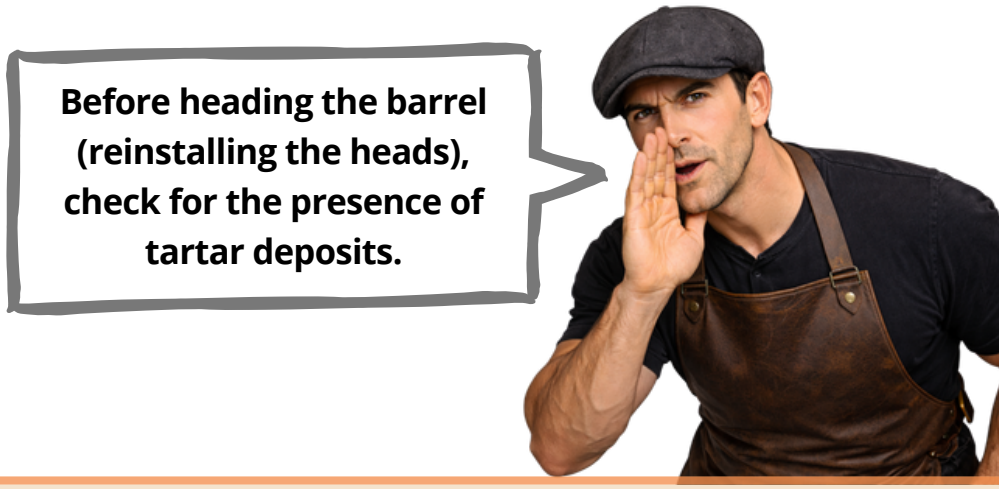
- **Traditionally,** crozing is carried out with **a croze tool.**
- **Today,** it can also be performed using a router fitted with **a bearing-guided cutter bit.**

Step 9 — Heading and finishing

Reinstalling the heads consists of **repositioning them into the croze while** ensuring **proper watertightness** and **uniform barrel stability**. This step finalizes the reconstruction and completely closes the structure.

Before installation, **a sealing paste** (flour + water) is applied into the croze to ensure proper contact and compensate for any irregularities. The barrel is then **partially loosened** by removing or loosening the necessary hoops (bilge, quarter, head) to **allow insertion of the head.**

The head is positioned using a **head puller**, then progressively brought into the croze. Once correctly seated, the hoops are gradually tightened in order to place the barrel back under tension. This operation is **carried out identically for both heads.**



Tartar deposits present on the inner surfaces of a barrel constitute a **real reservoir for microorganisms**. As they accumulate, they trap dust, spores, and molds, promoting the development of germs responsible for wine spoilage.

Simple washing or brushing is not sufficient to remove them. Descaling must therefore **be carried out by mechanical scraping**, ensuring that the tartar is removed without damaging the wood. This operation can be completed with **hot water washing** or, ideally, **steam treatment** in order to fully sanitize the barrel.

Step 9 — Heading and finishing

There are **two possible** approaches for finishing a repaired barrel.
The choice is between a more **traditional**, precise, and localized method, and a more **production-oriented** method focused on speed and overall barrel uniformity.

Method 1 — Localized finishing

- Scraping only the replaced stave

Advantages:

- fast,
- economical.

Method 2 — Global finishing

- Sanding of the entire barrel

Objective:

- homogenize the appearance,
- visually integrate the repair.

Step 9 — Heading and finishing

Retightening the hoops is not a systematic operation. It depends on the actual condition of the barrel after repair.

✅ If the hoops are still functional and properly positioned, they can be kept as they are.

❌ However, if the hoops are found to sit too low or no longer properly maintain the structure, retightening becomes necessary.

❌ In cases where the hoops are too damaged, deformed, or weakened, it is preferable to replace them.

Hoop reworking

On the hoop, it is necessary to:

- remove **the rivets,**
- properly **hammer the hoop** ends at **the location of the old rivets**,
- **flatten them as much** as possible to recover a clean surface.

Then:

- resize the **hoop directly on the barrel,**
- **drill the hoop** ends again,
- then **re-rivet** the hoop.

A head hoop that is too tight can cause deformation of the head.

03 The method

METHOD SHEET – REPAIR OF AN UNCROZED STAVE

Replace a defective stave while preserving the geometry of the barrel and ensuring watertightness.

1.🔍 DIAGNOSIS & PREPARATION

- Identify the leak / breakage and its cause
- Identify both sides of the barrel (very important)
- Mark:
  - the defective stave,
  - the 2 adjacent staves
- Prepare:
  - new stave (always oversized),
  - tools + clean workstation

2.🔓 OPENING THE BARREL (ROSING)

- Loosen the barrel (keep one bilge hoop in place for support)
- Remove:
  - head hoop,
  - nails
- Separate the staves from the head (hammer on the bevel)

3.🪵 REMOVING THE HEAD

- Slightly loosen the bilge hoop + quarter hoop
- Use a head puller
- Always control the removal:
  - avoid dropping the head,
  - avoid damaging the croze

⚠️ If the head is stuck:

- insert hoop sections all around,
- work progressively.

03 The method

METHOD SHEET – REPAIR OF AN UNCROZED STAVE

Replace a defective stave while preserving the geometry of the barrel and ensuring watertightness.

4. 🔧 REMOVING THE STAVES

- Slightly lift the bilge hoop
- Remove:
  - the damaged stave,
  - the 2 adjacent staves

⚠️ MAJOR RISK:
transverse splitting = barrel misalignment → repair compromised

5.✏️ FITTING / JOINTING

- Rework the joints of the 3 staves
- Check bilge + head dimensions
- Maintain the original geometry

👉 The new stave should be slightly wider for adjustment.

6.🔄 REASSEMBLING

- First reinstall the original staves
- Then fit the new stave
- Check:
  - alignment,
  - levels,
  - length distribution
- Gradually retighten the barrel

7.🧼 WHITENING (IF NECESSARY)

- Slightly remove the new stave,
- Clean without touching the others.

03 The method

METHOD SHEET – REPAIR OF AN UNCROZED STAVE

Replace a defective stave while preserving the geometry of the barrel and ensuring watertightness.

8.🔪 CROZING (MANDATORY ORDER)

- Chime angle
- Bevel
- Dressing (flat surface)
- Croze

👉 The dressing must be perfectly flat, otherwise:
➡️ poor croze → leakage

9.🧱 HEADING & FINISHING

- Apply sealing paste (flour + water) into the croze
- Reinstall the head
- Gradually tighten the hoops

Finishing:

- localized (fast),
- or global (visual appearance).

⚠️ CRITICAL POINTS (DISPLAY CLEARLY)

❌ Never lose the barrel alignment
❌ Never force the removal of the head
❌ Never croze before proper fitting
❌ Never neglect stave identification and marking

Correcting stave bending

If the new staves do not have **enough bending** compared to the barrel:

- place small **shims between the hoop and the adjacent staves**,
- during the raising of the misaligned staves, before crozing.

The shims are kept in place:

- during tightening,
- until the finishing stage.

The ideal solution is to make a **repair shell** (sleeve or repair frame) with **slightly over-bent curvature**, in order to obtain repair staves with **slight over-bending.**

Deux approches possibles :

1.By design

- modify the head / bilge ratio during machining
- to naturally create more bending.

2. By reworking

pass the stave through the jointer from the quarter toward the head

- on an already machined barrel
- (make a quarter taper cut).

06 Workshop memo

⚡ ULTRA SHORT VERSION (workshop memo)

Workshop memo

1. **Diagnose + mark**
2. **Open (rosing)**
3. **Remove the head**
4. **Remove 3 staves**
5. **Joint / adjust**
6. **Reassemble**
7. **Croze**
8. **Head the barrel**
9. **Check watertightness**

MARIAUD
Consulting

Wood is a noble material because it comes from a long natural cycle. It is up to us to respect it.

LIGNUM.