LIGNUM.
MARIAUD CONSULTING

BARREL ASSEMBLY



Our PROGRAM

01 Introduction

02 Definition of Barrel Assembly

03 Prerequisites

04 The Method

Barrel Assembly

01 Introduction

Definition of Barrel Assembly

Barrel assembly, also known as raising the barrel (**mise en rose**), is the process of assembling the staves to form **the barrel shell**, in other words, **the body of the barrel**.

This stage takes place immediately after stave matching and layout. The staves, which were previously arranged flat, are gradually positioned vertically and held together using **temporary assembly hoops.**

Barrel assembly has several objectives:

- **Maintain the stave order established** during the layout process, preserving the planned distribution of stave widths and any potential defects.
- **Position each stave correctly,** preventing excessive tilting or misalignment with adjacent staves.
- **Achieve a uniform, round barrel shell,** without flat areas or significant deformation.
- **Ensure proper contact between the stave edges,** creating consistent joints.
- **Secure the barrel shell sufficiently with the hoops,** ensuring the assembly remains stable during handling and subsequent operations.



02 Definition of Barrel Assembly

Why is the quality of barrel assembly important?

The quality of barrel assembly directly affects **the geometry of the barrel and the smooth execution of subsequent operations.**

An error at this stage can have consequences all the way through to finishing.

Poor stave alignment
If the stave ends are significantly misaligned, the barrel is not properly levelled. This can subsequently result in uneven or crooked crozing.

Uneven stave distribution
An uneven distribution of staves around the circumference can affect the barrel's behaviour during bending.

The barrel may then develop **asymmetrical curvature** (porter la hotte): one side bends more than the other, while the opposite side remains straighter. As a result, the curvature is no longer uniform around the entire circumference.

Uneven distribution of stresses
When the staves are poorly distributed or incorrectly positioned, some may be subjected to greater stresses during heating and bending. This increases **the risk of stave breakage.**

Misalignment between staves
Differences in stave height or incorrect positioning require additional corrections during subsequent operations, **resulting in more finishing work.**

Poorly fitted joints
The edges of the staves must make proper contact with one another. Poorly fitted joints increase the risk of leaks in the barrel.

Key takeaway: Consistent barrel assembly produces a straight, balanced and uniform barrel, makes bending and crozing easier, and reduces stave breakage, finishing rework and the risk of leaks.

03 Prerequisites

Prerequisites Before Stave Matching and Layout

1. Check Barrel Traceability

Before starting, the operator must ensure that all the information required for production is available and corresponds to the barrel being assembled:

- Barrel number or production order
- Wood origin and batch
- Barrel type and size
- Planned toasting level
- Customer-specific or production requirements

The bung stave and any markings made during stave matching and layout must remain clearly identifiable.

2. Check the Stave Layout

Barrel assembly must follow the preparation work carried out beforehand.
Before starting, check that:

- The stave layout is complete.
- All staves belong to the same matched set.
- The original stave order has been maintained.
- The markings made during stave matching are visible.
- No staves have been mixed up, reversed or replaced.
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The objective is to reproduce on the assembled barrel **the stave distribution established during the matching and layout process.**

3. Prepare the Appropriate Hoops

The hoops required for assembly must be available before starting.
Depending on the process used in the cooperage, these may include:

- Assembly hoop
- Heating hoops
- Bilge hoop
- Quarter hoop

The diameters and positions of the hoops must be suited to the size and type of barrel being manufactured.

03 Prerequisites

Prerequisites Before Stave Matching and Layout

4. Check the Assembly Equipment

Depending on whether assembly is manual or mechanized, prepare and inspect the necessary equipment: **stave assembly tool, hammer, hoop driver, assembly station or assembly machine,** as well as the equipment used for tightening.

The workstation must be clean, clear of obstacles, and allow the staves to be handled without mixing them up.

04 The Method

ÉStep 1 — Positioning the Assembly Hoop

After stave matching and layout, **arrange all the staves in a row and vertically,** maintaining their original order**.**

Then take the assembly hoop and position the assembly tool, also known as the servante, against the hoop rivets. The rivets act as stops, keeping the tool in position during the initial stage of raising the barrel.

Next, position the assembly **hoop over the stave ends.**

The first stave is placed against the assembly tool or servante. It serves as the starting point for assembly, allowing all the remaining staves to be positioned one after another around the hoop.



04 The Method

Step 2 — Securing and Rotating the First Staves

Once several staves have been positioned side by side inside the assembly hoop, the assembly must **be secured before continuing to raise the barrel.**
The number of staves positioned before performing this operation depends on each cooper's method: some work after assembling approximately one **quarter of the barrel**, while others prefer to wait until almost half of the barrel has been assembled.

Grasp the first and last staves of the group while holding the assembly hoop.
Firmly compress the staves against one another **to secure them inside the hoop.**
Once the assembly is firmly held:

- Lift the staves and the hoop simultaneously.
- Rotate the entire assembly approximately a **quarter turn.**
- Set the partially assembled barrel back down in a position that allows assembly to continue easily.

This operation allows the cooper **to progressively raise the barrel** around the hoop while keeping the previously assembled staves properly tightened and secured.





04

The Method

Step 3 — Continue Positioning the Staves

Once the assembly has been rotated, continue assembling the barrel by placing the staves side by side, one after another, inside the hoop.

Progress gradually around the hoop, making sure to:

- Maintain the stave order established during the matching and layout process.
- Keep the previously assembled staves properly tightened.
- Position the staves as straight as possible.
- Avoid significant misalignment between the staves.

Continue until reaching the final stave, which will allow the barrel shell to be completely closed.



04 The Method

ÉStep 4 — Inserting the Final Stave

The final stave allows **the barrel shell to be completely closed.**

To insert it, gradually remove **the assembly tool** (servante) while maintaining pressure on the two adjacent staves.

This pressure is essential to **maintain tension within the hoop** and prevent the previously assembled staves from loosening.

Once the assembly tool has been removed, insert the final stave into the available space. It should **fit snugly to ensure the entire assembly remains sufficiently tight.**

The barrel shell is now closed and ready for the next stage: **stave alignment and tightening the barrel.**

Important: Do not release the pressure when removing the assembly tool, as this could cause a loss of tension and disturb the positioning of the previously assembled staves.



04 The Method

Step 5 — Positioning the Hoops and Preparing for Stave Alignment

Once the barrel shell has been assembled, **position the heating hoops corresponding to the barrel size:**

- The bilge hoop
- The quarter hoop

Before tightening the hoops, it is important to **adjust the position of the staves.**

To do this, work your way around the barrel, kicking the lower part of the staves to gradually push them upwards.

The objective is to give the staves **as uniform an angle as possible**, thereby levelling the upper end of the barrel.
This operation helps reduce differences in height between the stave ends before tightening.

The more accurately the staves are positioned at this stage, **the less misalignment will need to be corrected during the levelling process**, once the barrel has been tightened.





04 The Method

Step 6 — Tightening the Barrel and Correcting Stave Misalignment

Once the staves have been positioned, **carry out an initial round of hoop tightening** to secure the barrel shell.

Next**, correct stave misalignment** (ballots), meaning the differences in position between the staves along the barrel body.

Identify the staves that are recessed the most and raise them using a hammer. **Work from the inside out**: start with the most recessed stave, then progressively raise the surrounding staves.

The objective is to achieve a uniform and consistent barrel shell, without significant misalignment between the staves





Check Hoop Tightness During Stave Alignment

During this operation, hammer blows and vibrations can **gradually loosen the barrel.**

A good indicator is how the staves react when struck:
If the staves begin to bounce back and no longer stay in position, the barrel is not tight enough.

In this case, stop the alignment process, **retighten the hoops**, then continue correcting the stave misalignment.

04 The Method

POOR STAVE ALIGNMENT
Misaligned staves between the hoops



- Visible edges between the hoops
- Misalignment between staves (inside / outside)
- Uneven and rough barrel shell
- Compromised appearance and quality

GOOD STAVE ALIGNMENT

Smooth and uniform barrel shell



- No protruding edges or steps between the hoops
- Properly aligned staves (inside / outside)
- Smooth and uniform barrel shell
- Optimized appearance and quality

04 The Method

Step 7 — Tightening and Levelling the Barrel

Before starting the levelling process, carry out another **round of tightening on the bilge hoop and quarter hoop, if necessary.**

The barrel must be sufficiently tight to ensure that the staves remain in position during adjustments.

The next step is **levelling the barrel.**

This operation consists of bringing **all the stave ends to the same height at the head of the barrel.**

Using a hammer, progressively adjust any staves that still show differences in height until **the upper edge is even and uniform around the entire circumference.**

This step is essential for preparing subsequent operations, particularly crozing: **a poorly levelled barrel can result in uneven or crooked crozing.**



04 The Method

POOR STAVE LEVELLING
Misaligned stave ends





- Visible steps between the staves
- Risk of uneven crozing

GOOD STAVE LEVELLING
Aligned stave ends





- Aligned stave ends
- Straight and even crozing

04 The Method

Step 8 — Final Tightening and Inspection Before Heating
Once the stave levelling is complete, carry out a **final tightening of the barrel** to ensure the staves remain securely in position before heating.

Use this final stage to perform a thorough inspection of the barrel shell.
If any **stave misalignment** (ballots) remains at the stave ends, correct it to achieve the most uniform assembly possible.

Then carry out a final visual inspection, paying particular attention to:

- **The jointing angles** between the staves.
- Any joints that are not properly closed.
- Any remaining **stave misalignment** (ballots).
- Wood defects that may have gone unnoticed during stave matching and layout.
- Defects that were correctly identified but have ended up in an unsuitable position on the barrel.

Last Opportunity to Make Corrections
The wood must be carefully monitored throughout the entire manufacturing process. Stave matching and layout provide an initial inspection, but **barrel assembly allows the staves to be examined in their actual position on the barrel.**
If a stave has a problematic defect or a poorly fitted joint, it is better to replace it at this stage.



04 The Method

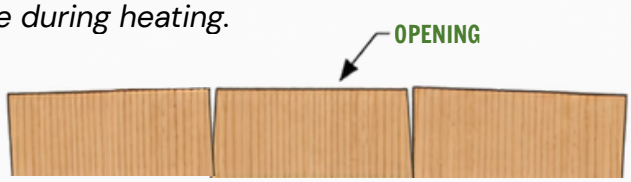
STAVE JOINT ANGLE: JOINT OPENING

The orientation of the joint affects barrel tightness and how the staves behave during heating.



1) POOR

Opening Towards the Inside



- Joint open on the inside
- The opening will increase during heating

2) ACCEPTABLE

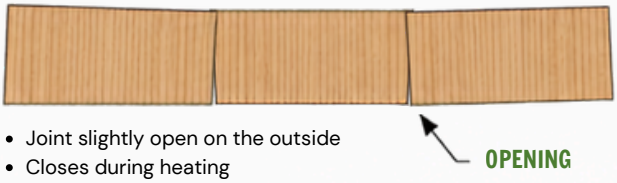
Stave Edges in Full Contact



- Joint closed during assembly
- May open during heating

3) IDEAL

Slight Opening Towards the Outside



- Joint slightly open on the outside
- Closes during heating
- Better leak resistance
- More uniform and durable barrel shell
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KEY TAKEAWAY

Aim for a slight joint opening towards the outside rather than an opening towards the inside.

04 The Method

BARREL HANDLING

Avoid dragging the barrel across the floor — Roll it instead.



NO!

Do not drag the barrel across the floor.
This causes damage to the lower ends of the staves!

Consequences:

- Cracks at the bottom of the staves
- Stave replacement
- Increased wood consumption



YES!

Roll the barrel.
The barrel rolls on its edge without damaging the staves.

Advantages:

- Staves remain intact
- Less physical effort
- Better final appearance and finish quality

KEY TAKEAWAY: Never drag the barrel across the floor. Always roll it.
A simple action to preserve the quality of the barrel.

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The quality of a barrel starts with its assembly. Every stave matters.

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