Technical Recommendations for Milling, Gluing and Finishing of Lyptus

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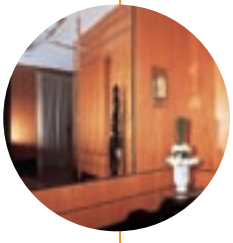
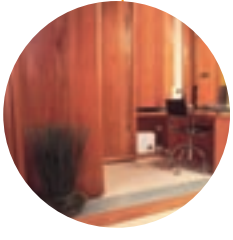
Introduction

Lyptus® is a new concept in high quality hardwood, produced in Brazil in a sustainable way using advanced environmental technology. Lyptus® is grown in renewable plantations interspersed with native species forest reserves that ensure a balance between ecosystems and protection of the environment. To obtain a higher quality product, Lyptus is produced from carefully selected trees, assuring the characteristics you want: beauty, durability and good yield.



The production of high quality wood must meet top standards and quality requirements such as dimensional stability, uniform moisture content, good milling characteristics, as well as good gluing and finishing properties. The importance of each of these requirements depends on the specific application, conditions of use and the environmental conditions to which the product will be submitted. To obtain the best performance of Lyptus®, it is necessary to know the basic properties of the wood and the most appropriate process to assure the quality and durability for each final use.

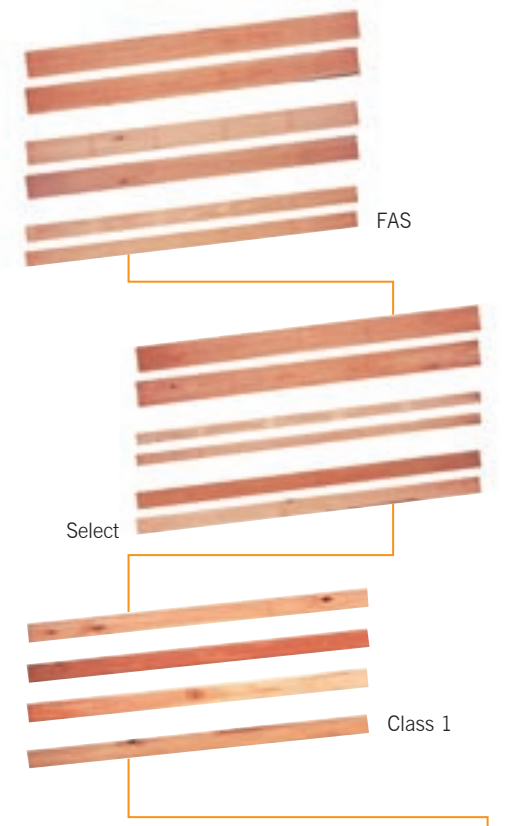
As with any other type of wood, Lyptus® may present variations in grain and color, surface imperfections, slight warping or shrinking that can be easily corrected or minimized through the appropriate processing, milling and finishing techniques. By working the wood properly, you can avoid undesirable defects such as torn fiber; charring, blade marks, chipping, lifting or crushing of fibers; surface roughness, uneven color and the appearance of cracks after applying final coatings.



This manual was prepared to be a reference source for industrial users of Lyptus and contains technical recommendations and hints for the solution of problems and the best use of the wood. Practical in nature, it includes recommendations for the adjustment of work tools for the ideal milling parameters of Lyptus®.

Lyptus® Products

Lyptus® is marketed in three distinct grades: **FAS, Select and Class 1**. It is manufactured in different thickness, lengths and widths. The lumber is kiln-dried, with a moisture content of 6% to 8%. All Lyptus is surfaced on two faces and packaged with special care that ensure the highest quality standards. The grades follow a group of stringent specifications that meet the main domestic and international market guidelines.



Care in Storage of Lyptus® Products

The products are sold in packages to facilitate handling by forklift trucks and are wrapped in waterproof packing to maintain their high quality standard. Some basic care must be taken when received to store the wood properly to maintain the quality until it is processed. It is recommended that the packages be stored in dry covered warehouses, preferentially 30 cm above floor level.

Technical Recommendations

1) Cross Cutting

Recommendations:

Use saws made with carbide teeth, with at least 32 teeth. Best results are obtained using 60-tooth saws, with rotation of the saw axis of 3,500 RPM that will cut the wood without bending the fibers. The cutting angle for wood of medium and high density should be 0° to 10° and the clearance angle 15° to 18°.

Possible problems, causes and corrections:

- If the surfaces appear charred after cutting, the causes may be a dull saw, saw misalignment or insufficient feed rate.
- For parts with reverse grain, the feed rate should be lower.
- Keep the feed rate constant to obtain a smoother cut.
- Avoid jerking movements when using manual equipment.

2) Gang Ripping

Recommendation:

Use saws with hardened metal teeth, with at least 48 teeth and a cutting width not greater than 3.2 mm and saw axis rotation of 3,500 RPM. The cutting angle for medium and high-density wood should be 15° to 20° and the clearance angle 15°.

Possible problems, causes and corrections:

- When the rotation used is below 3,500 RPM, bending of the fibers or charring may occur that could adversely affect subsequent operations, such as edge gluing;
- The charring of the cutting edges can also be caused by misalignment of the saw.

3) Jointing

Recommendation:

Use 4 high-speed steel or carbide knives, with axis rotation of the knife head between 4,000 and 5,000 RPM.

Possible problems, causes and corrections:

Without major problems. This type of equipment is being gradually replaced with different machinery, such as moulder.

4) Planing / Surfacing

Recommendation:

Use high-speed steel or ideally, carbide tools with 4 or more blades, at 5,000 RPM, with a feed rate of 10m/min and cutting depth of 1.6 mm. The cutting angle should be between 10° to 25°; the clearance angle between 7° to 20° and the sharpening angle between 45° to 73° . Adjust the feed rate to obtain 16-20 knife marks per inch.

Possible problems, causes and corrections:

– The quality of the surface depends on three factors: cutting angle, pitch of cut and depth of cut. The pitch or distance that the stock advances per knife mark is a function of the number of blades, the feed rate of the stock and the RPM of the cutter head. Therefore, smaller the pitch (distance that the stock advances per knife mark), the better the quality. However, a small pitch value will cause the knives to dull quickly. The acceptable values for the pitch are 1.5 to 1.7mm. The smaller the depth, the better the quality of the cut; thus a depth of 0.03 to 0.005mm will produce a medium quality cut (for frames) and 0.003 to 0.0005 mm a high quality cut, for furniture.

– The sharpness of the tool is essential to ensure planing quality.

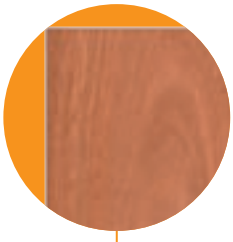
– For pieces with reverse grain, reduce stock feed rate.

– When the blades become dull, the medium and low-density pieces present more problems pertaining to raised fibers.

– When raised fiber occurs after planing, it is recommended that the surfaces be sanded immediately.

5) Sanding

Recommendation:



For calibration after planing or framing, the use of 60 and 80 grit sandpaper is recommended, in this order. Depending on the quality of the surface, 120 grit sandpaper may be required. For surfaces that will receive sealants or staining, 150, 220 and at times 320 grit sandpapers, in this order, are used. To obtain the next finer sandpaper grain, multiply the last grain by 1.5 and use the next lower standard.

Possible problems, causes and corrections:

– In manual sanding raised fiber or scratches can be removed through use of a very sharp blade, or the wood may be moistened slightly causing the fibers to rise, and then remove them in the next processing step.

– Always sand in the direction of the grain to obtain a good surface finish.

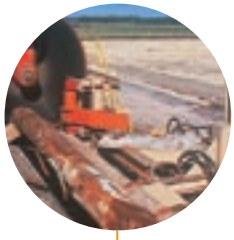
– The surface of wood that is to be glued should not be sanded.

– The more care taken in the preparation of the surface will result in a better quality finishing job and will reduce the consumption of sealants, primers, varnish, paint, etc.

6) Moulding

Recommendation:

Follow the direction of the wood grain. The most suitable cutting tool is one with a helical head cutting surface with 4-8 carbide blades or high-speed steel, with axis rotation of 6,000 RPM. Adjust the feed rate to obtain 16 to 20 knife marks per inch. The cutting angle should be between 14° to 18° and a sharpening angle of about 40°.



Possible problems, causes and corrections:

- Usually the use of headstock with 4 to 8 blades does a very good job. However if fiber tearing occurs, check to see if the knives are dull or an inadequate sandpaper grain is being used. If the problem persists, it is recommended that the number of knives be increased;
- Uneven surface may be caused by a low axis rotation speed;
- A better quality moulding can be obtained with slow, constant feed rate;
- Make sure cutting edges are always sharp, for better quality and to avoid surface charring.

7) Shaping / Routing

Recommendation:

Follow the direction of the fiber grain. Carbide tools are recommended, running at 6,000 RPM, with maximum feed rate of 10.4 m/min, and 2.2 mm cutting depth. The use of tools made of standard steel is not recommended. In case of longitudinal or traverse milling, an axis speed above 8,000 RPM produces the best results.
For portable shapers, carbide milling equipment is also recommended, with a rotation speed of 25,000 RPM.

Possible problems, causes and solutions:

– Raising or tearing of fibers as well as chipping and charring of surfaces can get worse when the operation is carried out on the ends of pieces, perpendicular to the fibers;

– Begin cutting on the end of the board, that is perpendicular to the fibers, and always finish on the longitudinal side (the side that is parallel to the fibers) for smoother edges;

– For rounding edges, a minimum rotation speed of 23,000 RPM is recommended.

8) Turning

Recommendation:

Carry out this operation in stages, and at different points along the glued board, removing the excess before the final turning procedure. When cutting tools are used, they should be made of high-speed steel.

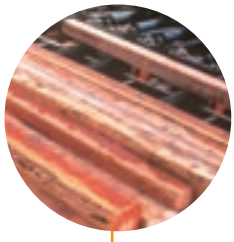
Possible problems, causes and solutions:

– Never turn pieces that contain cracks, knots, weak gluing joints or other defects.

9) Drilling / Boring

Recommendation:

Use carbide or high-speed steel drills, with a rotation of 8,000 RPM. The diameter of the holes should not exceed 1/3 of the thickness of the board. For holes of larger diameter or those that require better edge finishing quality, high-speed drills are recommended with two escape grooves. The diameter of the hole should be 0.2 mm larger than the thickness of the dowel it receives.



Possible problems, causes and solutions:

– Accumulation of shavings at the bottom of the hole, especially when the tool becomes dull;

– Cracks along the borders can be avoided by using drills with two cutting spurs.

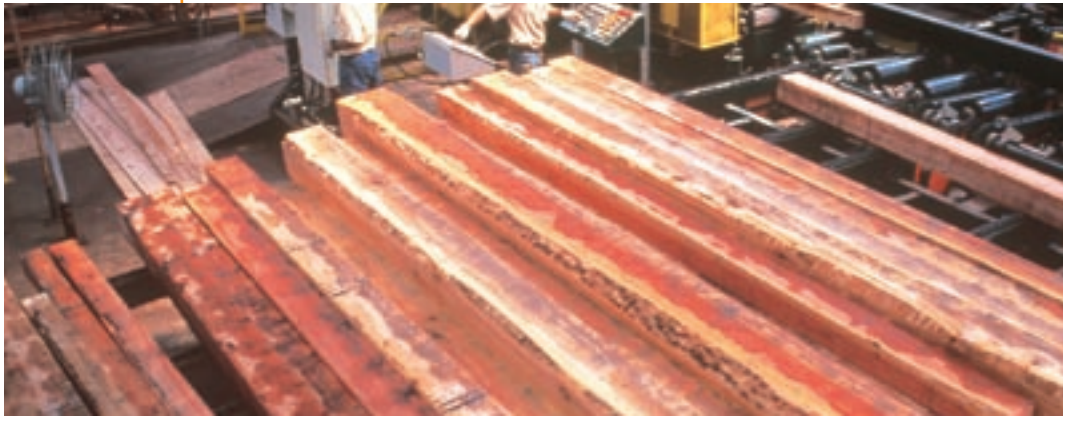
10) Doweling

Recommendation:

Use carbide tools or high-speed steel of the helical type with a rotation of 6,000 RPM. Do not use dowel diameters exceeding 1/3 of the thickness of the board. In case of dowels with larger diameters or that require better finishing quality of the edges, high-speed steel milling is recommended.

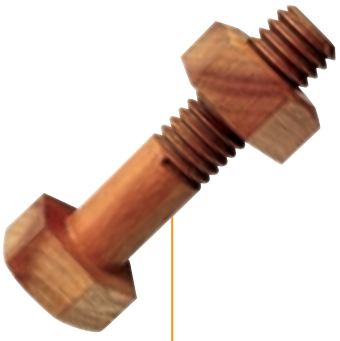
Possible problems, causes and solutions:

– Torn grain or charred surface can be avoided by using hard metal tools, with axis rotation of 6,000 RPM.



11) Applying Screws, Nails and Staples

Recommendation:



Use staples, nails or screws appropriate for the size of the pieces to be joined together. Do not align staples, nails or screws in the same grainline because this could cause splits. Pilot holes should be used for nails and screws in higher density wood or in large pieces, and especially when reverse grain is present. It is recommended that nails be located no closer than 70mm from the edges of the pieces. They can be hammered in manually or with pneumatic pistols, using a working pressure between 80 and 120 psi.

Possible problems, causes and solutions:

– Difficulty in the penetration of staples is normally caused by poor quality staples or poor quality of the staple punch system.

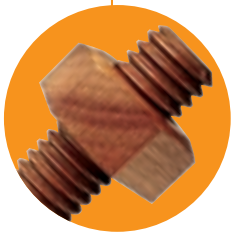
12) Gluing

There are several types of adhesives on the market for different uses and to meet a number of different environmental requirements. The adhesives for wood applications may be classified as follows:

1) **Polyvinyl Acetate (PVA)** adhesives are recommended for indoor use, for pieces that do not require much mechanical strength or resistance to moisture. Curing is at room temperature. PVA glue can also be cured using high frequency energy.

2) **Urea Formaldehyde** adhesives are recommended for indoor use and for pieces that do not require greater mechanical strength. Urea Formaldehyde is normally used for production of veneers and where a clear glue line is desired.

3) **Phenol Formaldehyde** adhesives are waterproof. They use ammonium chloride as a catalyst and require hot curing, This adhesive is recommended for structural pieces.



4) **Resorcinol Formaldehyde** adhesives are waterproof and are recommended for structural pieces. The advantage of Resorcinol Formaldehyde over Phenol Formaldehyde adhesives is that the Resorcinol may be cured at room temperature. Resorcinol Formaldehyde uses ammonium chloride as a catalyst.

Recommendation:

For the indoor use of Lyptus®, use PVA adhesives in dry environments, or urea formaldehyde glues for indoor environments where there is occasional contact with water.

Important factors regarding a good gluing job are:

a) The wood moisture content for gluing should not exceed 12%, with the ideal moisture content ranging from 6% to 8%.

b) Depending upon the temperature, a relative humidity of 30% to 40%, will help to maintain a wood moisture content of 6% to 8%.

c) Atmospheric and press temperatures below the minimum cure temperature may cause improper curing, resulting in a week glue joint.

d) The appropriate amount of adhesive or spread rate varies between 150 to 200 g/m^2.

e) Clamp pressures of 7 to 10.5 kg/cm^2 for Lyptus densities up to 450 kg/m^3. For densities greater than 450 kg/m^3, clamp pressures of 12 to 17.5 kg/cm^2 are recommended. Maximum distance between clamps should be no greater than 20-30cm.

Possible problems, causes and solutions:

– The glue joint may fail if the milled pieces are glued while exposed to dust.

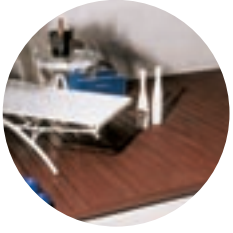
– Glue pieces of similar basic density for the production of panels and try to use pieces of the same moisture content;

– Urea Formaldehyde glue vitrifies after drying and may spoil the visual aspect of a panel's joints;

– When using PVA glue, leave in the press for at least three hours and only conduct further sanding and finishing operations after 24 hours.

13) Finishing

In this section, techniques will be addressed regarding dyeing (staining); wood paste filling; sealing; top coating and varnishing.



Dyeing: Off the shelf aniline-based dyes should be used or can be prepared by dissolving aniline (brown or red) in alcohol. The intensity and hue of a desired color are usually visually obtained by application on the wood.

For wood filling, wood paste is normally used. The application is made manually with a filling spatula, closing the imperfections. For automated processes for panel production, polyester resin can be used, applying the paste by manually filling the pores or mechanically by machine.

Cellulose nitrate sealer is used for beautifying the wood as well as a preparation for sanding, because it raises the fibers that are to be sanded. It should not be used outdoors or in moist indoor environments (kitchens, bathrooms, etc.) since it is not impermeable to moisture and dries by evaporation.

For applying a final, resistant coat of paint, the use of PU (polyurethane) or polyester paints are recommended, either as sealer or as top varnish with glossy or opaque finish. These materials have greater resistance to mechanical (against scratches) and chemical (against cleaning products, solvents and dirt) damage in addition to having waterproofing characteristics. These materials may be applied manually or by machine. Machine applications may be accomplished using spray guns, roll coaters, or flow coaters.

For final finishing of furniture PU paints are recommended, both for a lacquer-type finish or when either a transparent varnish is used.

Recommendation:

After sanding it is recommended that one coat of diluted sealant be applied for better visualization of fissures and to fill in small fissures or holes by using paste or a mixture of sawdust with glue. In case of presence of sapwood or sticker stain, apply one coat of a brown or red aniline solution to make the color uniform. Afterwards apply one coat of sealant; then sand using 220 grit paper. In case of color change, use one coat of colored

oil paint and then three layers of varnish or lacquer. When a color change is not desired, after sanding apply three coats of lacquer. Finally, polish with oil.

Possible problems, causes and solutions:

– For elimination of light shadows such as sticker stain, first sand with 120 to 150 grit sandpaper, fill any pores and then apply a solution of brown aniline diluted in alcohol to the lighter areas using a paint gun (the mixture and the amount to be applied to the surface to be dyed should be made aiming to obtain a more uniform color of the wood). Next apply a coat of sealant, followed by sanding with 220-grit sandpaper and finish with three coats of lacquer.

– To equalize the color of sapwood with heartwood, use a paint gun containing a solution of red aniline diluted in alcohol (this solution should also be prepared as to obtain uniform coloration between sapwood and heartwood). This procedure is carried out after the application of filler.

– Primers and finishers with cellulose nitrate do not fill surface openings.

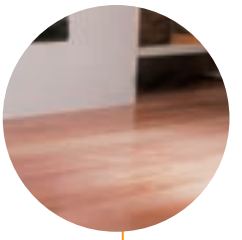
– After sanding and before filling it is recommended that you apply one coat of diluted sealant for better visualization of the pores.

Furniture design: Sérgio Rodrigues

– The oxidation (darkening) of the natural wood pigmentation is usually caused by ultraviolet radiation (UV). This can be minimized with the use products that contain UV filters.

– Polyester sealants with synthetic, PU or polyester finish can be used.

– For light colored wood, acrylic paint is recommended, which presents resistance against yellowing.

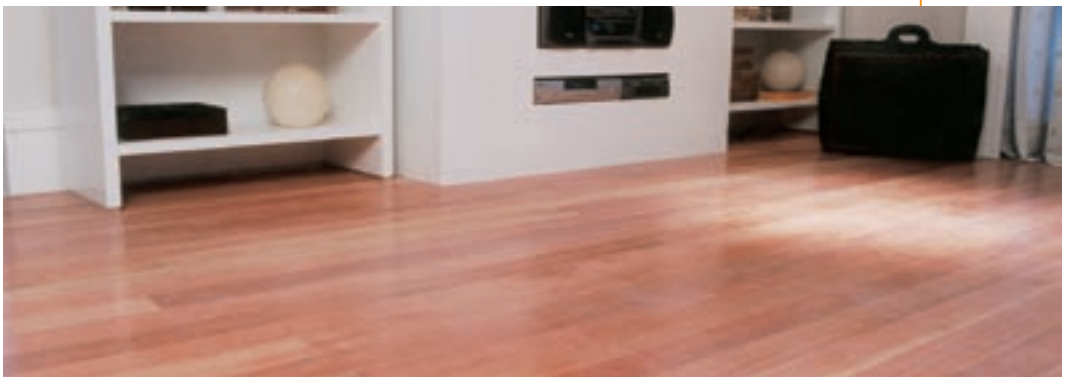


14) Assembling

Recommendation:

Check the pressure on the pieces to be assembled, avoiding surface checks and crevices as well as rupture due to excessive pressure. One aspect that strongly influences the quality of the assembly is the correct positioning of the angles on the edges to be pressed. Observe and consider the clearances of the pieces, to compensate for natural wood contraction due to relative humidity and temperature variations at the factory and at the destination where the product will be used.

Due to the temperature and relative humidity variations, the lumber can shrink or swell until it reaches the equilibrium moisture content (EMC) at the new environment. Then, for very distinct climatic conditions it is recommended:



Allow the lumber to acclimate at the new environment by placing it on sticks with a weight on the top to avoid any warping, placed at 30cm above a level floor in a dry lumber shed, until it reaches the local EMC or, design the products with space that will allow for movement of the wooden components, compensating for the natural shrinkage of wood using the following equation:

$$[(Z \cdot W) : 30] / [A - B]$$

W: width of lumber

A: moisture of lumber at EMC at the factory

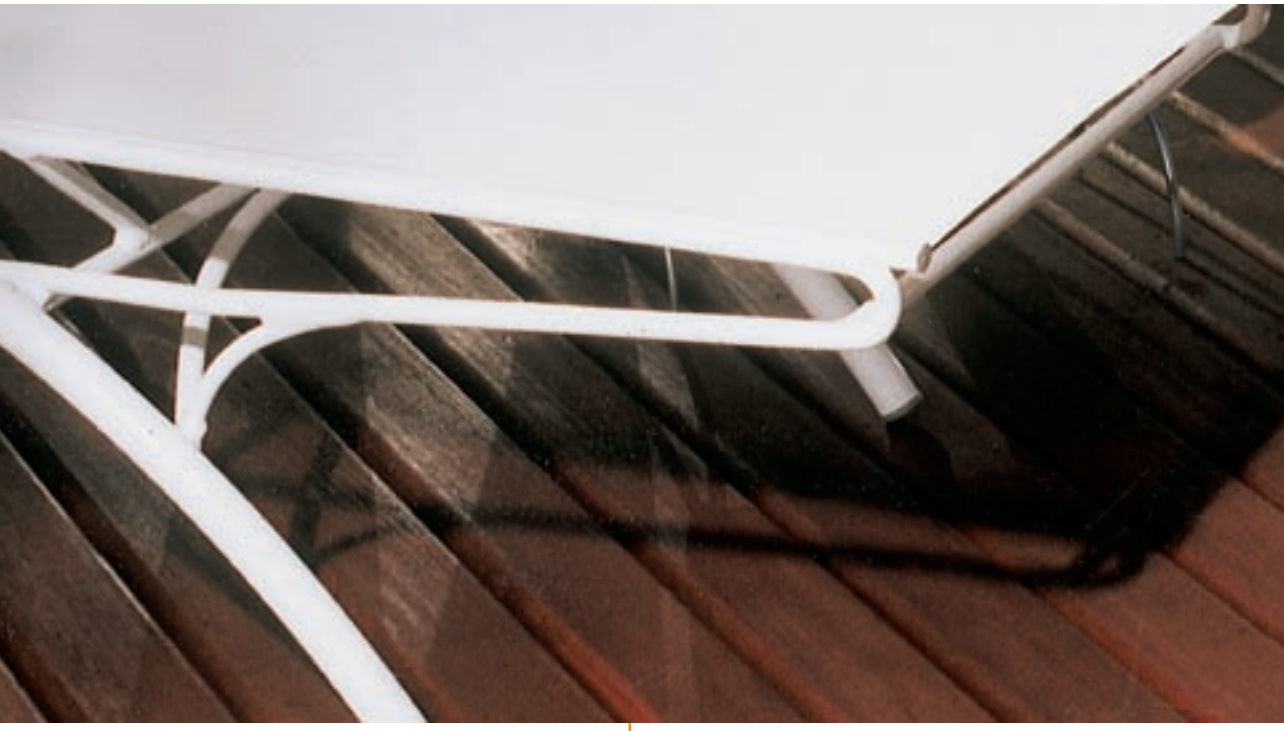
B: moisture of lumber at EMC at the destination

Z: tangential shrinkage of the lumber

30: moisture content of wood at Fiber Saturation Point (FSP)

For example, a board 50mm wide, with shrinkage of 9.4%, with 15% **MC** at the sawmill, was shipped to a location with a 5% **EMC**. It will be necessary to allow space for movement as follows:

(0.094 x 50) / 30 (15-5) = **1.567mm**, in the tangential direction. To obtain the necessary allowance for the radial direction, divide the value by 2. (1.567mm / 2) = 0.783mm.



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