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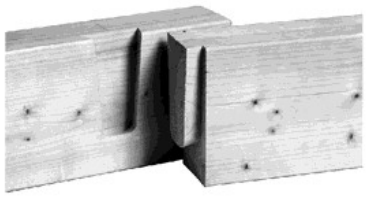

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WARNUNG
Lesen Sie alle Sicherheitshinweise und Anweisungen. Versäumnisse bei der Einhaltung der Sicherheitshinweise und Anweisungen können elektrischen Schlag, Brand und/oder schwere Verletzungen verursachen. **Bewahren Sie alle Sicherheitshinweise und Anweisungen für die Zukunft auf.**

WARNING
Please read all safety instructions and directions. Failure to comply with the safety instructions and directions can cause electric shock, fire and/or serious injuries. **Please retain all safety instructions and directions for future reference.**

AVERTISSEMENT
Veuillez lire toutes les consignes de sécurité et instructions. Tout non-respect des consignes de sécurité et instructions risque d'être à l'origine de décharges électriques, d'incendies et/ou de blessures graves. **Conservez toutes les consignes et instructions pour pouvoir les relire à tout moment.**

AVVERTENZA
Leggere tutte le avvertenze di sicurezza e le istruzioni. La mancanza del rispetto delle avvertenze di sicurezza e delle istruzioni possono causare scossa elettrica, incendio e/o gravi lesioni. **Conservare tutte le avvertenze di sicurezza e le istruzioni per il futuro.**

WAARSCHUWING
Lees alle veiligheidsaanwijzingen en instructies. Nalatigheid bij het naleven van de veiligheidsinstructies en aanwijzingen kan elektrische schok, brand en/of ernstige letsels veroorzaken. **Bewaar alle veiligheidsaanwijzingen en instructies voor later gebruik.**

ADVERTENCIA
Lea todas las indicaciones de seguridad e instrucciones. Si no se cumplen las indicacionesde seguridad e instrucciones, se pueden producir descargas eléctricas, incendios y/o lesiones graves. **Guarde todas las indicaciones de seguridad e instrucciones para el futuro.**

Table of Contents

1 Signs and symbols

This symbol appears at places where you will find instructions for your own safety.

Non-compliance with these instructions may result in very serious injuries.

This symbol indicates a potentially hazardous situation.

If this situation is not avoided, the product or objects in its vicinity may get damaged.

This symbol indicates tips for the user and other useful information.

2 Product information

in respect of devices with item No. 91A701, 91A702, 91A703, 91A704, 91A705, 91A706, 91A707, 91A708, 91A711, 91A712, 91A713, 91A714, 91A715, 91A716, 91A717 or 91A718

2.1 Manufacturer´s data

MAFELL AG, Beffendorfer Straße 4, D-78727 Oberndorf / Neckar, Phone +49 (0)7423/812-0, Fax +49 (0)7423/812-218

2.2 Device identification

All information required for device identification is available on the attached rating plate.

To reduce the risk of injury, please read the operating instructions.

2.3 International patent

The Arunda "jigs for producing dovetail joints" are protected by patent EP1812213 B1.

3 Arunda material

3.1 Description of the jigs

The Arunda jigs make it possible to produce dovetail joints in roof trusses (Fig. 1).

3.2 Types of Arunda jigs

Two types and several models of Arunda jigs are available (Fig. 2+3):

- Type B with 90° stops (non-pivoting, Fig. 2).
- Type N with pivoting stops (+50°/90°/-50°, Fig. 3).

Each jig model (models 50, 80, 120 and 160) can be used to process different timber widths. The larger the jig, the wider the joint and the higher its strength.

On our homepage **www.arunda.ch** you can obtain detailed information about the different types of jigs.

3.3 Recommended router

The recommended router for the Arunda system is the LO 65 Ec (Fig. 4) with the following technical features:

Output	2600 Watt
Cutter adapter	Solid conical adapter M12 x 1 mm.
Base plate	Possibility to install the expansion plate and to insert the guide ring accurately centred.
Safety devices	3 possibilities to lock the cutting depth and to ensure safe working: Lateral knob handle 1, knurled nut 2 above the guide column, depth stop 3 (Fig. 4).

If another router than the router recommended by Mafell is used, Mafell cannot guarantee the faultless function.

3.4 Expansion plate

When used with the jigs, the Arunda expansion plate 5 (Fig. 6) provides sufficient support for the machine. Corresponding expansion plates are available for the different jigs.

3.5 Burr bit and blades

The Arunda burr bit 7 (Fig. 6) is specifically designed for use with the jigs. It has an M12 x 1 mm internal thread and is equipped with reversible blades made of carbide (cannot be resharpened).

3.6 Blade change

Danger

Pull the power plug during all service work.

Firmly hold the machine and lock the arbor. Using the screwdriver included in the scope of delivery of the Arunda cutter, unfasten the fixing screws of the first blade. Turn the blade around or replace it. Make sure that you insert the blade correctly into the cutter adapters by pushing it down and inwards. Proceed in the same manner with the second blade.

3.7 Guide ring (copy ring)

The Arunda guide ring 6 (Fig. 6) is used to guide the router along the jigs. The guide ring is screwed onto the router's base plate.

3.8 Gauge

The Arunda gauge 8 (Fig. 6) is used to set the cutting depth. It is a reference and setting tool with three different positions: Mini, Midi and Maxi. The three positions correspond to the respective clamping force that can be achieved at the complete pin/pin socket joint. Mini = low clamping force, Midi = medium clamping force, Maxi = high clamping force. However, to achieve a certain clamping force, the cutting depth can also be set to any position between Mini and Maxi (Chapter 4.2.4 and 7.2).

3.9 Lever clamps

At least two lever clamps 10 (Fig. 7) are required to work with the Arunda jigs. They must be at least 40 cm long and have a throat depth of 14 cm. We recommend the use of Arunda quick-acting all-steel lever clamps.

4 Preparation of the material

4.1 The jigs

4.1.1 Jig B with 90° stops

Type B jigs are equipped with 90° stops (non-pivoting). The male and female jig are each equipped with a 90° stop that is set to the desired pin/pin socket height (Fig. 7). The male jig 9 is additionally equipped with a bottom sliding stop that can be adjusted to the height of the timbers (Fig. 8). The scale divisions in mm or inches indicate the desired joint height.

4.1.2 Jig N with pivoting stops

Type N jigs are equipped with pivoting stops (+50°/90°/-50°). The male and female jig are each equipped with a groove-guided pivoting stop that is set to the desired pin/pin socket height. The male jig 9 is additionally equipped with a bottom sliding stop that can be adjusted to the height of the timbers (Fig. 8). The scale divisions in mm or inches indicate the joint height.

4.2 Preparation of the router

4.2.1 Installation of the guide ring

The base plate of router LO65 Ec is equipped with a rectangular plate of brown synthetic material, which must not be removed!

If the centre part is equipped with a circular plate 4 made of the same material, it must be removed (only the centre part!). (Fig. 5).

Place the Arunda guide ring 6 into the adapter under the router's base plate and screw it on tightly with the M5 x 12 mm screws included in the scope of delivery (Fig. 6).

4.2.2 Assembly of the expansion plate

Screw on the expansion plate 5 under the base plate with the four M5 x 12 mm screws (Fig. 6).

4.2.3 Assembly of the cutter

Insert the conical Mafell adapter M12 x 1 in the router arbor and moderately tighten the nut (Fig. 13, 14 and 15). Lower the engine block towards the base plate, lock the arbor with the locking button and tighten the cutter moderately with the fork wrench.

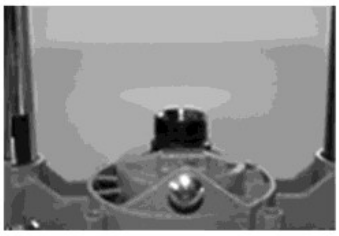

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Fig. 13 Router arbor

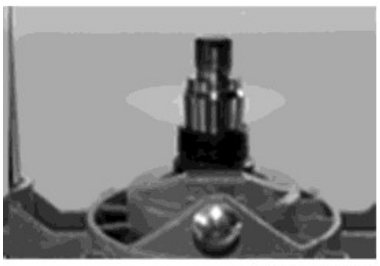

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Fig. 14 Conical adapter M12 x 1 mm, inserted

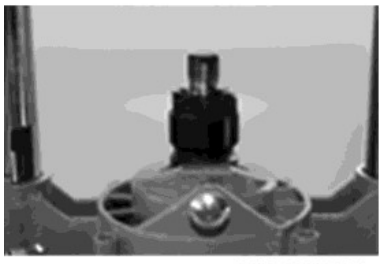

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Fig. 15 Conical adapter M12 x 1 mm, nut tightened

4.2.4 Positon of cutter

Set the cutter 7 to the desired height with the Arunda gauge 8 (Fig. 6). The gauge must rest on the expansion plate 5 and the blades must touch the inside of the gauge (Fig. 6). Firmly tighten the knob handle 1 of the machine (Fig. 4).

4.2.5 Safety locks of the router

Danger

Lock the top (2) and bottom (3) router stops (Fig. 4) so that these cannot be moved by vibrations or an inadvertent release of the height locking device. The cutter may not touch the guide ring.

5 Dimensioning of joints

5.1 Height of pin/pin socket

Depending on the cross section of the timbers to be joined, the Arunda jigs can be used to create pins and pin sockets with different heights.

5.2 Dimensioning of pin/pin socket

A dovetail joint (pin and pin socket) is dimensioned in accordance with the height of the timbers to be joined.

Example joist/main girder:

A base of at least 1/6 to 2/6 of the height of the main girder must be determined. The base "a" (Fig. 1 and 16) is the section between the baseline of the pin socket and the lower edge of the timber.

Danger

For safety reasons, a base (a) of at least 1/6 of the height of the main girder must always be given, it must never be smaller!

The control rule is: Pin height x 1.2 = minimum height main girder (hmaing min = 1.2 h pin).

Example 1

Height joist/main girder 180 mm

(Base 1/6 to 2/6 height main girder 180 mm)

minimum height 1/6: 30 mm = pin 150 mm

Base: 40 mm = pin 140 mm

Base: 50 mm = pin 130 mm

Base 2/6: 60 mm = pin 120 mm

Example 2

Height joist 180 mm / main girder 220 mm

(Base 1/6 to 2/6 height main girder 220 mm)

minimum height 1/6: (36.6 mm) rounded upwards =: 40 mm = pin 180 mm

Base: 50 mm = pin 170 mm

Base: 60 mm = pin 160 mm

Base ~2/6: 70 mm = pin 150 mm

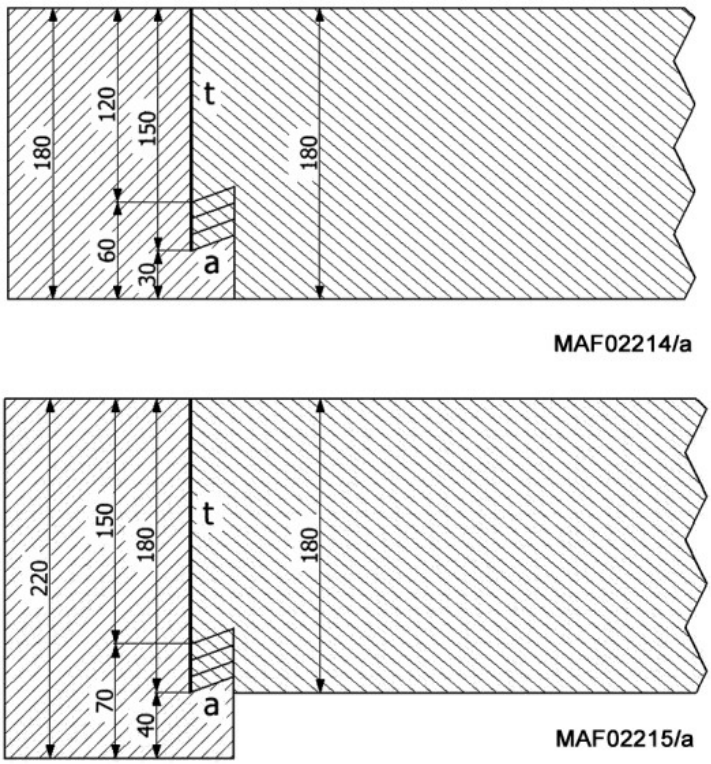

Fig. 16

1 a = height of base / t = height of pin

Example 1: The calculation results in the following possible values for a joist/main girder of 180 mm:

- Pin height 150 mm with a base of 30 mm
- Pin height 140 mm with a base of 40 mm
- Pin height 130 mm with a base of 50 mm
- Pin height 120 mm with a base of 60 mm

Example 2: The calculation gives a base of at least 36.6 mm (1/6) and at most 73.2 mm (2/6) for a joist/main girder of 220 mm. On the type B jigs, the stops can be set at 10 mm intervals. The numbers are therefore rounded down or up to a full 10 mm respectively. In order to maintain the minimum value of 1/6, the calculated base (1/6 = 36.6 mm) in this example is rounded up to the next higher value of 10 and thus results in 40 mm. The maximum base (2/6 = 73.2 mm) is 70 mm.

The possible pin heights are calculated by subtracting the calculated base (e.g. 40 to 70 mm) from the height of the main girder (e.g. 220 mm):

- Pin height 180 mm with a base of (36.6) 40 mm
- Pin height 170 mm with a base of 50 mm
- Pin height 160 mm with a base of 60 mm
- Pin height 150 mm with a base of 70 mm

The minimum height of the pins for all jigs is 90 mm. This also results in the minimum height of the timbers.

5.3 Permissible loads

An overview table with the permissible loads on the joints can be found on the last page of these operating instructions. The table can also be downloaded from our homepage **www.arunda.ch** . On our homepage **www.arunda.ch** you will also find a load calculator (Calculus).

Once the pin height has been calculated, the permissible load can be read from the table.

Explanations regarding the first three columns:

- *Pin h (mm):* Specifies the pin height
- *hjoist (mm)* Specifies the height of the joist.
- *hmaing (mm):* Specifies the minimum height of the main girder.

The permissible loads *Vd1* and *Vd2* for the individual jig models can be read from the remaining columns.

- Vd1 specifies the dimensioning according to the shearing force of the pin on the joist.
- Vd2 specifies the dimensioning according to the base on the main girder.

The load is calculated using the smallest permissible load.

Danger

Important: The values Vd1 and Vd2 are calculated guide values. They correspond to the actual loads without taking into account the safety coefficient. Mafell assumes no liability for a use in which the values of the table are not taken into account. The permissible loads on the joints must be calculated taking into account numerous criteria of the construction project.

5.4 Pin length

The pin length is 26 mm, but can vary minimally depending on the case and cutter setting (Fig. 1).

6 Preparation and cutting

6.1 Safety

CAUTION:

Wearing safety glasses and hearing protection is mandatory!

6.2 Trial cutting and check before series production

Always carry out a complete trial cutting before starting series production!

(identical with the timber that is going to be used for the series)

Three important points can thus be checked:

- the pin height
- the pin socket depth - similar to the pin height
- an adequate clamping force of the joint (pin in pin socket)

6.3 Setting the stops at the jigs

6.3.1 Height-adjustable stop

Move the depth stop of the male and female jig to the desired position of the scale division in mm or inches and tighten the screws firmly.

6.3.2 Sliding stop

The lower stop of the male jig 9 must remain freely movable so that it can adapt to the beam when the lever clamp is tightened (Fig. 7).

6.4 Positioning the male jig

6.4.1 Male jig fixed with lever clamp

Place the male jig 9 vertically on the end of the beam at which the pin is to be cut (joist) and position it correctly. Centre the step-shaped stop on the width of the timber or the centre line. Move the lower sliding stop upwards. Clamp the timber between the two stops with a lever clamp 10 (Fig. 7).

6.4.2 Male jig fixed with screw

In the case of obliquely cut beams (e.g. rafters), it is possible to fasten the template 9 using two screws (see arrows in Fig. 8).

6.5 Positioning of the female jig

The centre of the pin sockets is marked in the upper part of the main girder. The female jig 11 is centred on the centre line and fastened with two lever clamps (Fig. 9), or in the case of obliquely cut joints with two screws.

6.6 Cutting the pin

Prepare specimens with which you produce a complete joint before starting series production.

Observe the direction of travel of the cutter and cut in the direction of travel of the cutter (Fig. 10).

Place the **- switched off -** router on the male jig, passing the cutter through the hole provided (top left) (Fig. 17).

Cut the pin in one or two passes depending on the width of the timber and the desired cutting quality.

The cutter setting on the router is always the same for the pin and the pin socket.

The jigs are designed in such a way that there is automatically a difference of 2 mm cutting depth between the pin and the pin socket. This ensures a perfect fit.

6.6.1 Cutting the pin in one pass

Cutting the pin in one pass is possible with a narrow collar (the area between the edge of the beam and the pin). When cutting, follow the conical inner edge of the jig by pressing the guide ring of the router against it.

Start cutting at the top left, descend along the jig and end at the top right. **Switch off the machine** and pull it out of the large cut area of the jig.

Observe the direction of travel of the cutter and cut in the direction of travel of the cutter (Fig. 10). Always press the guide ring correctly against the jig.

6.6.2 Cutting the pin in two passes

Cutting the pin in two passes is necessary as soon as the collar is wider and/or perfect cutting quality is required.

At the first pass, cut 5 to 10 mm from the outside of the beam. Start cutting at the top left, descend along the jig and end at the top right. Return to the starting point and make sure that you follow the same path as on the way in (on the outside of the beam), otherwise cutting in the opposite direction poses a danger to the operator and the material.

Observe the direction of travel of the cutter and cut in the direction of travel of the cutter (Fig. 10).

In the second pass, cut along the conical inner edge of the jig. Start cutting at the top left, descend along the jig and end at the top right (Fig. 18).

Switch off the machine and pull it out of the large area of the jig that has been cut free (Fig. 17).

6.7 Cutting the pin socket

Observe the direction of travel of the cutter and cut in the direction of travel of the cutter (Fig. 10).

Place the **- switched off -** router on the female jig, passing the cutter through the hole provided.

Switch on the machine. Starting from the entry hole, cut 2-3 cm up the right edge of the jig to avoid tearing out the timber and return to the starting point.

Slide the machine to the right (opposite the entry hole), move along the conical inner edge of the jig, then cut the lower part of the dovetail (Fig. 19).

Remove the remaining timber while observing the correct cutting direction (Figs. 10 and 19).

Switch off the machine and pull it out of the centre of the jig.

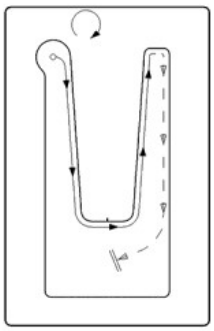

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Fig. 17 Male jig: Cutting path when cutting out the pin in one pass

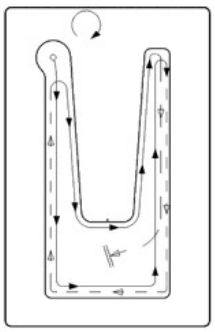

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Fig. 18 Male jig: Cutting path when cutting out the pin in two passes: starting on the outside, ending on the inside.

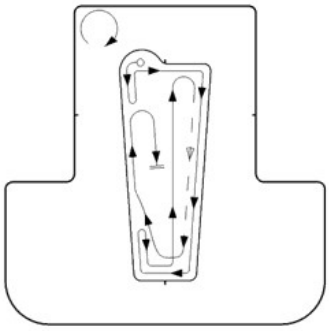

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Fig. 19 Female jig: Cutting path when cutting out the pin socket

7 Cutting result and corrections

7.1 Cutting result

Insert the pin by hand into the pin socket. The pin should slide in easily, but it should only be possible to drive in the last 3 to 10 mm by applying force (depending on the timber used and the joint size). A dovetail joint must fit tightly and may have no play. Use a tool (mallet) for the last few millimetres (Fig. 11).

7.2 Adjusting the clamping force

Danger

The mains cable of the machine must be disconnected when making any adjustments to the cutter.

To increase the **clamping force of the joint, increase the distance between the cutter and the router base plate**. Use the gauge to set the cutter to the Maxi or Midi position or between Maxi and Midi (Fig. 6). After each change of the cutter height, you must also carry out a fine adjustment!

To decrease the **clamping force of the joint, decrease the distance between the cutter and the router base plate**. Use the gauge to set the cutter to the Mini or Midi position or between Mini and Midi (Fig. 6). After each change of the cutter height, you must also carry out a fine adjustment!

Summary:

The further the cutter protrudes from the base plate of the router **(+)** (Maxi position on the gauge), the greater the clamping force of the joint: **Maxi = high clamping force**.

On the other hand, the further the cutter is towards the base plate of the router **(-)** (Mini position on the gauge), the lower the clamping force of the joint: **Mini = low clamping force**.

Once you have changed the cutter setting, lock all locking handles and stops of the machine.

The changes in the cutter setting affect both the pin and the pin socket.

7.3 Clamping force depending on the material

To determine the required clamping force of the joint, the properties of the timbers to be joined and the moisture content of the timber must be taken into account.

In the following cases, a low to medium clamping force is required = position Mini to Midi on the gauge:

- Jig: small to medium model (models 50 and 80)
- Small cross section of timbers
- Short dovetail
- Dry timber
- Glued laminated timber

In the following cases, a medium to high clamping force is required = position Midi to Maxi on the gauge:

- Jig: medium to large model (models 80-120-160)
- Medium or large cross section of timbers
- Medium or long dovetails
- Moist to wet timber
- Solid timber

If the pin is inserted by hand into the pin socket, resistance will be felt before the joint is assembled flush. The pin is then not yet at the bottom of the pin socket and protrudes upwards by a few millimetres. This projection is called the "K" value and corresponds to the clamping force (Fig. 11).

On the basis of our practical experience, we were able to determine the following guide values in this respect, which can vary depending on the working method and situation and do not replace trial cuttings.

Jig model →	**Small** jig models **No. 50**	**Medium** jig models **No. 80**	**Large** jig models **No. 120 - 160**
↓ Type of material	**"K" value in mm = projection of the pin inserted in the pin socket by hand** (prior to driving in under exertion of force)		
Glued laminated timber (spruce/fir) Timber moisture approx. 12 %	~2 to ~4 mm	~3 to ~7 mm	~5 to ~8 mm
Duo/trio beam (made of 2 or 3 layers of glued spruce/fir) Timber moisture approx. 15 %	~2 to ~5 mm	~2 to ~8 mm	~2 to ~9 mm
Solid timber (spruce/fir) Timber moisture equal to or less than 15 %	~3 to ~6 mm	~4 to ~8 mm	~5 to ~10 mm
Solid timber (spruce/fir) Timber moisture between 15 % and 30 %	~3 to ~6 mm	~4 to ~9 mm	~5 to ~12 mm

7.4 Clamping force with moist timber (green timber)

It is possible to anticipate the shrinkage of fresh timber and thus influence the clamping force of the joint. In this case it is sufficient to increase the clamping force (see **"K"** value above). If the timber is stored for a few days/weeks, the moisture content of the timber decreases and the joint can be more easily assembled flush during the installation on site.

7.5 Dry timber exposed to the weather

If the joints are made of dry timber (glued laminated timber, beams of two or three layers of dry timber, etc.), the material must be covered when stored outdoors or exposed to the weather. The assembly of joints that have expanded under the influence of moisture can prove difficult or even impossible.

8 Troubleshooting

Danger

Determining the causes for existing defects and eliminating these always requires increased attention and caution.

If the machine switches off automatically, the electronic system has activated self-protection mode. Despite this protective function, overload and as a consequence damage to the machine may occur during certain applications.

Some of the most frequent defects and their causes are listed in the following chart. If case of other defects, please contact your dealer or the MAFELL customer service.

Defect	Cause	Remedy
The joint has too much play: the pin sits too loosely in the pin socket.	The clamping force of the joint is inadequate.	Increase the distance (+) between the cutter and the router base plate *(Chapter 7.2: Adjusting the clamping force).*
The joint is too tight: it is too difficult to insert the pin in the pin socket.	The clamping force of the joint is too high. The pin is jammed and cannot be driven in flush.	Decrease the distance (-) between the cutter and the router base plate *(Chapter 7.2: Adjusting the clamping force).*
	The pin is difficult to insert and seems to jam in the pin socket. The pin and/or the pin socket have irregularities on the milled surfaces.	Cut the pin or pin socket a second time, this time pressing the guide ring of the router correctly against the jig. (Chapter 6.6. and 6.7.)
The pin is not sitting flush in the pin socket.	The stop of the male and/or female jig did not rest properly on the timbers.	Make sure that the stops are always carefully positioned.
The router vibrates intensely, it is not possible to produce a suitable joint.	The guide ring is no longer perfectly round and/or the cutter no longer runs concentrically and/or the conical adapter has suffered an impact.	Replace the damaged parts and start a new attempt.

9 Different roof truss joints

The corresponding information on the various roof truss joints can be found in Fig. 12.

10 Optional accessories

- Angle stop, female 50/b — Order No. 093774
- Angle stop, female 80 B — Order No. 093775
- Angle stop, female 120 B — Order No. 093776
- Angle stop, female 160 B — Order No. 093777
- Angle stop, female 50 N — Order No. 093778
- Angle stop, female 80 N — Order No. 093779
- Angle stop, female 120 N — Order No. 093780
- Quick-action lever clamp 40x14cm — Order No. 093786

11 Exploded drawing and spare parts list

The corresponding information in respect of spare parts can be found on our homepage: www.mafell.com