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1. Basic principles

The cap device allows ready-made baseball and other caps to be embroidered on a ZSK tubular system embroidery machine.

1.1 Baseball caps

Embroidering caps is made difficult by the curvature of the cap, which prevents the embroidery material from being placed flat on the stitch plate. Provided that you observe the basic rules of cap embroidery, you can overcome this problem and obtain satisfactory embroidery quality.

The stiffness of the cap material, especially in the embroidery area (the backing), is an important factor in achieving a pleasing embroidery effect.

Material that is flimsy and easily creased should be reinforced before embroidering with non-woven stiffening and/or by pressing.

Special presses are available for pressing caps. Existing backings made from coarse gauze are to be supplemented by a layer of non-woven material.

If the sides of the cap are to be embroidered, a layer of non-woven material must be added here as well, to prevent puckering. Include backing stitches in the design in order to enhance the stiffness of the area being embroidered (see Notes on punching).

The maximum size of the design depends on the height of the front area.

Height of cap front (mm) - 30 mm = Embroidery field

When embroidering the side of a cap, deduct 5 - 10 mm from the height (at the top) to allow for the rounded shape of the side panels.
Clamping

Exercise great care when clamping the caps in order to avoid creases and bulges, and to prevent misalignment when embroidering.

NOTE

As a general rule with a 135 mm frame, attach non-woven material behind the area being embroidered before clamping the cap. With a 360 mm frame, non-woven material is to be attached behind the side of the cap if this area is being embroidered.

Clamp the cap by working gradually from left to right (360 mm cap frame) or from right to left (135 mm cap frame) as appropriate.

Needle and embroidery speed

Select a suitable needle and embroider with a moderate speed. Observe the following basic rule: the stiffer the embroidery area, the stronger the needle and the lower the embroidery speed.

Design

Use designs created specifically for caps or adapt other existing designs accordingly. Also observe the Notes on punching at the end of this manual.

Cap shape

Caps are available in a wide variety of different shapes. The ZSK cap devices are designed for the following two basic shapes:
a) Five-panel cap

The five-panel cap consists of four equal-size sections covering the back of the head and one larger section for the front of the cap. The front section either has no seam or has a half-seam that stops near the crown.

Owing to the absence of a center seam, five-panel caps are ideal for embroidering large designs. The front area is tall and large and generally reinforced with non-woven fabric, foam or gauze.

The sweatband on the inside edge can pose problems, however, if it protrudes too far into the embroidery area. Avoid positioning the design too low so that the sweatband is not stitched down when embroidering and to avoid puckering.

**CAUTION**

The quality of the embroidery depends on how carefully the cap is clamped.
b) Six-panel cap

The six-panel cap consists of six equal-size sections. The front section has a center seam that can pose problems when embroidering, especially if it is double-stitched or very thick. The center seam demands the use of a stronger needle and must be taken into account when punching (see *Notes on punching*).

Six-panel caps generally have a short peak. The front area is smaller and rounder than on five-panel caps, which makes clamping more difficult. The additional seam on six-panel caps also requires the frame to be adjusted to the thickness of the material.

**NOTE**

As a general rule, adjust the cap frame to suit the thickness of the material.  
Adjust the frame to suit the cap material

- by adjusting the frame tension with the wing screws on the left

or

- by altering the position of the catch on the opposite side.
1.2 Other caps

The most popular other cap designs are flat caps, circular knit caps and stocking caps made of coarse knitted material.

Flat caps have a very small peak and are generally embroidered on the back because of the difficulty of clamping the rather low front section in conventional frames.

Stocking caps and circular knit caps, on the other hand, can be embroidered all round within the permissible embroidery field.

The embroidery is usually applied to the turned-up edge of the cap. The motif is applied upside down on the wrong side of the cap (Fig. 1.7) so that it appears the right way round when the edge is turned up (Fig. 1.8).

The cap material is generally soft and must be stiffened with non-woven material for embroidering purposes.
NOTE

To hold caps that are not baseball caps firmly in place, make the fasteners on the cap frame tighter than usual.

Use only the 135 mm frame to embroider these caps.
2. Overview

2.1 General view with cap frame

2.2 Clamping aid for cap frames
3. Installation

3.1 Converting machine for cap embroidery

3.1.1 Preparations

The cap device is installed with the machine set up for tubular system (cylinder arm) embroidery, that is to say: The work table has been lowered or dismantled.

**JAF/JAFA series**

**CAUTION**

It is essential to move the cord feet of any double roller cord and cord-loop embroidery devices that are installed to the parked position (also see further information in the accompanying Operator’s Guide).

If a needle that is equipped with a cord foot or a borer is activated using an incorrect setting at the control unit, damage may occur to the machine, cap devices and embroidery material.

**NOTE**

The boring, sequin, double roller cord and cord-loop embroidery devices cannot be used when embroidering caps.
3.1.2 Installing cap drive, determining center position

- Approach the center position of the scales with the control unit.
- Transverse (side to side) alignment (Y axis):
  Set pointer (3.1-2) to position 0 (3.1-1) on the scale.

NOTE

With a head spacing of 495 mm, the side-to-side alignment (Y axis) is marked by a symbol indicating the center position of the cap drive.

3.1.3 Installing cap drive, determining front position

JAF/JAFA series

- Longitudinal (front to back): alignment (X axis):
  Adjust the pantograph drive (3.2-1) to the front by way of the control unit so that the pointer is set to position 0 on the scale (3.2-2).
• Longitudinal (front to back): alignment (X axis):
move the pantograph drive (3.3-1) to the center position of scale (3.3-2) with the control unit.

Figure 3.3:
Determining center position (front-to-back alignment)
Installing cap drive

The illustration below shows a cap drive that was fully installed before leaving the factory.

Figure 3.4: Cap drive, pre-installed at factory

- Slide pre-assembled cap drive (3.5-6) over cylinder arm (3.5-7) towards pantograph (3.5-1).
- Insert fixing bracket (3.5-4) in guide (3.5-2) of the pantograph profile.
- When inserting the bracket, slide its fixing screws (3.5-5) and (3.5-8) into envisaged slots (3.5-3) and (3.5-9) in the pantograph profile.
- At the same time, slide cover plate (3.6-4) of cap drive (3.6-7) underneath carriage support (3.6-1).
- Insert pre-assembled knurled screws (3.6-3) and (3.6-6) into envisaged slots (3.6-2) and (3.6-5) in carriage support (3.6-1).
- Push in fixing bracket (3.5-4) as far as it will go.
- Tighten locking nuts (3.5-5) and (3.5-8) in order to fasten cap drive (3.6-7).
- Tighten knurled screws (3.6-3) and (3.6-6).
Figure 3.5:
Installing cap drive
Figure 3.6: Installing cap drive

3.6-1
3.6-2
3.6-3
3.6-4
3.6-5
3.6-6
3.6-7

Figure 3.7: Installing cap drive (detail, J series)

Protective cover
Knurled screw
Locating rail
Wire
Cover plate
Fixing bracket
Locking nut
Pantograph profile
Cap drive
Mounting
Dismantling cap drive

- Slacken off knurled screws (3.8-3) and (3.8-5) in carriage support (3.8-2).

- Slacken off fixing bracket locking nuts (3.8-4) and (3.8-8) underneath the guide of pantograph profile (3.8-1).

- Pull off complete cap drive (3.8-6) to the front over cylinder arm (3.8-7).

Figure 3.8: Installing cap drive
3.1.4 Exchanging stitch plate inserts

Different stitch plate inserts

As a general rule, use the installed flat stitch plate insert (4.5 mm) when embroidering. In case of frequent thread breaks or severe puckering during embroidery, exchange the stitch plate insert for the higher one (6.5 mm).

NOTE

Figure 3.9: Stitch plate inserts

Flat stitch plate insert (standard):
height 4.5 mm.
Once inserted in the stitch plate, it protrudes by about 1.3 mm.

High stitch plate insert:
height 6.5 mm.
Once inserted in the stitch plate, it protrudes by about 3 mm.

NOTE

Depending on the operating mode (cap/tubular system embroidery) and stitch plate insert, the height of the presser foot may have to be adjusted. Consult the accompanying operator’s guide for instructions on adjusting the presser foot.
Removing stitch plate insert

3.10-1
3.10-2
3.10-3
3.10-4

- Insert tool (3.10-4) by engaging pins (3.10-1) in stitch plate insert (3.10-2).
- Rotate tool (3.10-4) counter-clockwise to its travel limit.
- Remove stitch plate insert (3.10-2) from stitch plate (3.11-3) with tool (3.10-4).

Installing stitch plate insert

3.11-1
3.11-2
3.11-3
3.11-4

- Engage stitch plate insert for cap embroidery (3.11-1) in pins (3.11-2) of tool (3.11-4).
- Insert stitch plate insert (3.11-1) in stitch plate (3.11-3) with tool (3.11-4).
- Rotate tool (3.11-4) clockwise to its travel limit.
4. Clamping the cap

4.1 Choice of caps for 135/360 mm cap frame

The clamping technique is described below for:

- Five-panel caps (without a center seam (4.1-1) at the front)
- Six-panel caps (with a center seam (4.1-2) at the front)

Figure 4.1: Cap styles  
left: Five-panel cap  
right: six-panel cap
4.2 clamping aid

A clamping aid (4.2-2) makes it easier to fit the cap to the cap frame. The cap frame slides onto the clamping aid and the apertures in the frame engage in the three snap locks (4.2-2).

Preparing clamping aid

- Attach clamping aid (4.2-2) to a separate work table (4.2-3) or similar and screw tight with star-shaped knob (4.2-4).

Figure 4.2: Attaching clamping aid to work table
NOTE

Before you can pivot the clamping aid, you have to remove transit screw (4.3-3).

Cap frame with guard

If the cap frame has a guard (4.4-1), remove plastic part (4.3-2) before pivoting the clamping aid upwards. To detach the part, unscrew and remove screw (4.3-1).

NOTE

Use window rest (4.3-4) only with 135 mm cap frames. Before using a 360 mm cap frame (Fig. 4.4), push up the window rest so that it cannot get in the way.
4.3 360 mm cap frame

The quality of the finished embroidery depends on the cap being clamped free from distortion and creases, and reliably secured against slipping. Take particular care to equip and adjust the frame correctly in order to eliminate problems before you start embroidering.

- Slide cap frame (4.5-6) onto clamping aid (4.5-1) (gripping rods facing down). (gripping rods (4.5-9) facing down).
- Align the cap frame so that positioning mark (4.5-2) on clamping aid (4.5-1) coincides with the opening in cap frame (4.5-3).
- Finally slide in the cap frame until it is heard to engage with snap locks (4.5-4).
- Release catch (4.5-7).
- Open window (4.5-5).
- Detach clips (4.5-8) and place to one side.

Push up the guard slide (if the frame has a guard)
NOTE

Figure 4.6: Non-woven backing on cap frame

- Wrap a piece of non-woven material (4.6-2) around clamping aid (4.6-3) and slip it underneath sweatband holder (4.6-1).

NOTE

Figure 4.7: Sliding on cap (five-panel cap with peak cut away)

- Fold down the cap’s sweatband (4.7-1).
- When inserting the cap (peak facing to the top), slip the sweatband underneath sweatband holder (4.7-2).

The non-woven material must be pushed behind the gripping rods otherwise it cannot be properly positioned (sideways).
• Press the inside raw edge (4.8-1) of the cap’s peak into the depression (4.8-2) in the cap frame.

• Pull down the sweatband (4.9-1) at the back of the cap with the middle finger of your left hand.

• Grip the back part of the cap between your index finger and thumb.

• Insert the outside of the cap at the back inside the depression in the cap frame (4.8-1).
• Hold the cap on the left side with the left hand.

• Use your right hand to place the fastening strap that forms part of the window (4.12-1) over the seam of the peak (4.12-2).

**NOTE**

Make certain that the cap is seated vertically.

• Use your left hand to align the window (4.13-1) with the cap, keeping the cap taut.

• Pull the back part of the cap (4.14-1) taut with your right hand.
Figure 4.15: Clamping the cap

- Insert the outside of the cap at the back inside the depression in the cap frame.
- Apply your left thumb to the fastening strap (4.15-1) at the seam and guide it towards the catch.

Figure 4.16: Engaging the lock

- Engage the lock, but do not close it.

**NOTE**

Make certain that the cap is seated vertically.

Figure 4.17: Aligning the cap

- Align center seam (4.17-2) of the cap with the mark on centering (4.17-1) aid.
Clamping the cap

Figure 4.18: Closing window catch

- Closing the catch (4.18-1)

Fastening clips

NOTE To make it easier to fasten the clips, you are recommended to swing the clamping aid upwards on the hinge.

The gripping rods must extend into the cap.

Figure 4.19: Fastening clips

- Secure cap at both sides by fastening clips (4.19-1), with rings (4.19-2) facing inwards, to gripping rods (4.19-3).
- Swing the clamping aid back down.
Make certain that the cap does not slip while you are clamping it.

The rings that open the clips must face the opening in the back of the cap (size adjuster) to allow the frame to rotate without hindrance during embroidering. If the clips are attached the wrong way round, they can collide with the presser feet.

Pulling cap frame out of clamping aid

Cap frame without guard

- Press down snap locks (4.20-1) with your left thumb and middle finger and your right thumb.
- Then pull the cap frame out of the clamping aid.

Cap frame with guard

- Push slide (4.21-2) of guard (4.21-1) down over the peak and fasten.
- Press down snap locks (4.21-4) with your left thumb and middle finger and your right thumb.
- Then pull cap frame (4.21-3) out of clamping aid (4.21-5).

Before embroidering a different design, use the **framing (contouring)** function to make certain that it fits inside the available embroidery field.
NOTE

4.4 135 mm cap frame

The quality of the finished embroidery depends on the cap being clamped free from distortion and creases, and reliably secured against slipping. Take particular care to equip and adjust the frame correctly in order to eliminate problems before you start embroidering.

Size of hinged window

Choose the window size that best suits the cap. The window height must not exceed the height of the front panel available for embroidering. This is the area above the peak that is curved only horizontally; a surface that also incorporates a vertical curve cannot be clamped without creasing.

The window size defines the available embroidery field. Always choose the smallest possible window for your design. This helps to avoid clamping problems.

<table>
<thead>
<tr>
<th>Window height (x)</th>
<th>62 mm</th>
<th>72 mm</th>
<th>82 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embroidery field</td>
<td>45 mm x 135 mm</td>
<td>55 mm x 135 mm</td>
<td>45 mm x 135 mm</td>
</tr>
</tbody>
</table>

NOTE

Please note that the embroidery field of the windows is restricted in the corners by the corner radii (4.22-2) of the rest (4.22-1) underneath.

Figure 4.22:
Embroidery field
**4.4.1 Mounting the frame**

Adjust the size of the rest.

- The rest (4.23-3) is attached to the cap frame with four screws (4.23-1). The threaded holes (4.23-2) in the rest allow it to be secured in various positions.
- Fasten the rest so that the opening between the rest and the frame corresponds to the selected window size.
- Push up the guard slide (if the frame has a guard).

**Adjusting window size individually**

- Slacken off the four wing nuts (4.24-1).
- Adjust the size of the window (4.24-2).
- Tighten the four wing nuts (4.24-1).

**NOTE**

There are slots in the window mounting. This allows the clearance between the window and the rest to be adjusted to suit the cap material being embroidered.
Clamping the cap

Figure 4.25: Catch
left: closed
right: open

4.25-1

• Open the catch (4.25-1) on the cap frame.

Figure 4.26: Opening cap frame

4.26-1

• Open the window (4.26-1) of the cap frame.

Figure 4.27: Inserting cap in frame
(peak cut away)

4.27-1

• Fold back the cap’s sweatband.

4.27-2

• When inserting the cap (peak upwards), slide sweatband (4.27-2) underneath sweatband holder (4.27-1).

• Stretch the cap over the rest so that it lies flat.

NOTE

The sweatband holder (4.27-1) can be unscrewed to make it easier to clamp caps that have an extremely large sweatband.
Cap frame without guard

• Close the window.
• Closing the catch (4.28-1)
• The material should now be clamped inside the window without any creases.

Cap frame with guard

• Close the window.
• Push slide (4.29-2) of guard (4.29-1) down over the peak and fasten.
• Close catch (4.29-3).
• The material should now be clamped inside the window without any creases.
NOTE

The cap frame must close easily. If the material is very thick, adjust the window accordingly. It is essential that the cap is not forced into the frame.

Figure 4.30:
Left: Cap clamped correctly

Figure 4.31:
Right: Incorrect clamping: the cap is not straight

If it proves difficult to clamp the cap or close the frame, one of the following faults is usually the cause:

• The window (rest) is too large.
• The adjusted clearance between the window and rest is too small.

Before embroidering a different design, use the framing (contouring) function to make certain that it fits inside the available embroidery field.
5. Inserting cap frame

The method described here for inserting the cap frame is a common procedure that applies to both sizes, 135 mm and 360 mm.

**NOTE**

Figure 5.1: Placing cap frame on cap drive.

- Before placing the cap frame on the drive, rotate it so that the peak (5.1-4) is horizontal (5.1-7) and facing to the right.
- Place cap frame (5.1-6) on cap drive (5.1-1).
- Rotate the cap frame counter-clockwise through 90°.
- Align locating recess (5.1-3) on the cap frame with mating piece (5.1-2) on the cap drive.
- Slide in cap frame (5.1-6) until it engages in fasteners (5.1-5).

**CAUTION**

Check that the cap frame has properly engaged in all three snap locks.
5.1 Preparing for embroidering

5.1.1 Selecting the needle

The stiffer the material at the area being embroidered, the stronger the needle that you require. In particular, stronger needles are required for caps that have a center seam.

As a general rule, do not embroider caps with needles smaller than size 80.

Consult the accompanying Operator’s Guide for further information on the choice of needle.

5.1.2 Loading a design - JAF/JAFA series

Before selecting the design, check that the cap drive is located in the center position.

*Each time you convert the machine for a different mode, change the pantograph configuration to suit the application (e.g. ZSK cap attachment ’99) by way of the control unit.*

Checking center position of cap drive

- Transverse (side to side) alignment (Y axis):
  Pointer set to position 0 on the scale.

- Longitudinal (front to back) alignment (X axis):
  Adjust the pantograph drive to the front by way of the control unit so that the pointer is set to position 0 on the scale.
NOTE

With a head spacing of 495 mm (example: JAF 0411-495), the side-to-side alignment (Y axis) is marked by a symbol indicating the center position of the cap drive.

The procedures for Load design, Framing (contouring) and Embroider design are described in detail in the manual accompanying the relevant control unit.

5.1.3 Loading design - SPRINT 2/SPRINT 4

Before selecting the design, check that the cap drive is located in the center position.

Each time you convert the machine for a different mode, change the pantograph configuration to suit the application (e.g. ZSK cap attachment ’99) by way of the control unit.

Checking center position of cap drive

- Longitudinal (front to back) alignment (X axis):
  Move the pantograph drive to the center of the scale with the control unit.

The procedures for Load design, Framing (contouring) and Embroider design are described in detail in the manual accompanying the relevant control unit.

6. Notes on punching

As a general rule, cap embroidery is made difficult by the curvature of the cap, which prevents the area being embroidered from being placed flat on the stitch plate. An additional problem is caused by the center seam of six-panel caps, which infringes the embroidery area.

To counteract these problems, observe the basic rules described here when punching cap designs. Edit existing designs intended for “conventional” embroidering before using them on caps. The use of suitable designs not only enhances the quality of the embroidery, but also helps to avoid malfunctions, such as thread breaks, so that machine productivity is improved.

6.1 Choice of design

If possible, choose a symmetrical design when embroidering caps. Besides giving rise to puckering while embroidering, designs that are one-sided look unbalanced on caps.

The curvature of the cap can make circular motifs appear oval. This optical illusion can be corrected by making the design slightly wider.

Figure 6.1: Asymmetrical design on cap

Figure 6.2: Circular design on cap
left: unchanged (appears oval)
right: widened slightly (appears circular)
6.2 Cap designs in general

Always start and finish the design in the middle. Embroidering from one side to the other has a negative effect: the material is pressed to the side and the motif shifts in the same direction. For this reason, always start embroidering lettering in the center. Start from the center in one direction and then go back to the center before embroidering in the opposite direction.

Where possible, underlay step stitch sections with backing stitches running at an angle of approx. 45° degrees to the step stitches. These backing stitches help to stiffen the cap material and counteract “bulging”.

When defining the backing stitches, bear in mind the type of material that is to be embroidered. Design elements (e.g. monograms) that are being applied to existing embroidery (a step stitch section) do not require backing in a separate operation.
Do not divide the embroidering into several separate operations; in other words, do not apply all the backing stitches (6.4-2) first, followed by all the step stitch sections (6.4-1) and finally the outlines. This approach causes puckering in the design. Instead, complete small sections of the design one after the other. Begin at the center and work outwards, first to one side. Then return to the center and work out towards the other side.

Figure 6.5: Embroidery sequence, successive completion of design sections

Stages 1 and 2:
Backing stitches, step stitch section and outline completed

3. Stage:
Backing stitches completed, step stitch section started

Sequence:
1a) Backing stitches
1b) Step stitch section
1c) Outline
2a) Backing stitches
2b) Step stitch section
2c) Outline
3a) Backing stitches

Avoid unnecessary color changes and thread trimming. Most caps are made of stiff material so that, compared with conventional applications, the needle encounters greater resistance when penetrating. Since each special function (thread trimming, color change) is associated with an appreciable speed reduction, problems can often arise when the needle next enters the material.

Avoid high stitch density and very short stitches. Instead, it is better to match the stitches (including backing stitches) to the cap material, which tends to be very stiff and strong.

Make circular designs wider beforehand, when punching (cf. Choice of design).

Caps are clamped with the peak towards the rear. To obtain the design correctly on the cap, therefore, it must be displayed upside down on the screen. If necessary, rotate the design through 180° before saving.
6.3 Designs for six-panel caps

Six-panel caps have a center seam in the area being embroidered. Often this has been stitched two or three times and is extremely hard. This must be borne in mind when punching and preparing designs for six-panel caps.

Avoid thread trimming and color changes in the vicinity of the seam because these operations can give rise to problems when embroidering recommences on the seam.

If the seam is to be embroidered with step stitches, it is sensible to include backing stitches in the design underneath the step stitch area, running at an angle of about 45° to the step stitches. If the step stitches follow the direction of the seam, a “furrow” (6.6-1) can otherwise be created alongside the seam.

Figure 6.6: Furrow alongside center seam

Sequence:
1) Backing stitches
2a) Step stitch section from center to left
2b) Step stitch section from center to right
3) Outline

Designs for caps other than baseball caps

When punching designs for embroidering woolen caps, bear in mind that the cap material is very soft and requires special stiffening with backing stitches.
## 7. Troubleshooting

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible cause/remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread break</td>
<td>The selected machine speed is too high. Embroider at a slower speed.</td>
</tr>
<tr>
<td></td>
<td>Incorrect ramp setting. T8: call <em>Select pantograph configuration</em>. Select ZSK 99 cap attachment in the selection menu.</td>
</tr>
<tr>
<td></td>
<td>The rotary hook was damaged by a preceding needle break. Install a new rotary hook.</td>
</tr>
<tr>
<td></td>
<td>The design contains too many stitches. Reduce the stitch density.</td>
</tr>
<tr>
<td></td>
<td>The cap has a coarse gauze backing in the area being embroidered. Place non-woven material behind the gauze.</td>
</tr>
<tr>
<td></td>
<td>The yarn quality is poor. Use a stronger yarn (e.g. polyester).</td>
</tr>
<tr>
<td></td>
<td>The upper thread tension is too high.</td>
</tr>
<tr>
<td></td>
<td>Incorrect needle size.</td>
</tr>
<tr>
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