

CHAPTER 3 - MANUFACTURE OF HINGES



3-1 SAFETY RECOMMENDATIONS:

Before starting the manufacture of the hinges of the control surfaces (aileron, flap, rudder, elevator and tab) the assembler shall observe the safety conditions:

USE **PERSONAL PROTECTIVE EQUIPMENT - PPE**, safety glasses and boots and gloves;



CHECK if the workshop has adequate lighting and ventilation.

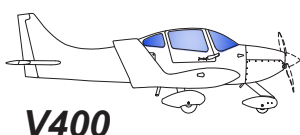
PROVIDE a bench of suitable height for this type of work, power or pneumatic tools, and manuals in conditions of use;

DO NOT start any operation without these preparations for safety.

3-2 INTRODUCTION:

The manufacture of the hinges of the control surfaces, should be planned with due attention to the above drawings, and PROVIDE:

1. A bench with a superior length of 80 inches (2.0 m) and width above 40 inches (1.0 m), for a good distribution of parts and tools, avoiding accidents;
2. Power tools (cord or cordless, by battery) or pneumatic;





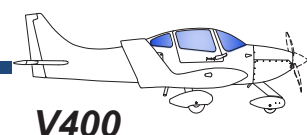
- 3. Manual tools;
- 4. Metrology instruments.

Quantity and length of hinge sets to be manufactured for each control surface:

| control surface | quantity (unit) | length (inch) |
|-----------------|-----------------|---------------|
| Flaps | 06 | 8 |
| Airelons | 04 | 8 |
| Elevators | 04 | 8 |
| Rudder | 03 | 8 |
| Tab Elevator | 02 | 5 |
| Tab Aileron | 02 | 5 |

3-3 MATERIAL:

- 03 Continuous Hinge (bar) with 6 feet of length (72 inches = 1.82 m)
- MS20257 P4 (figure 3-1), where each Continuous Hinge is composed of two parts with ½ Hinge Bar in anodized aluminum and steel Pin;
- 100 Anchor Nuts MS169L08 (figure 3-2);
- 200 solid rivets AN426AD-3-4 or MS20426AD-3-4;
- drill with capacity up to 5/16", which can be electric, battery or pneumatic;
- 01 caliper of 6 inches (150 mm) (figure 3-3);
- 01 steel scale 12 inches (300 mm) (figure 3-4);
- 01 precision square (figure 3-5);
- 01 puncture of 2 mm in diameter (∅ 2 mm);



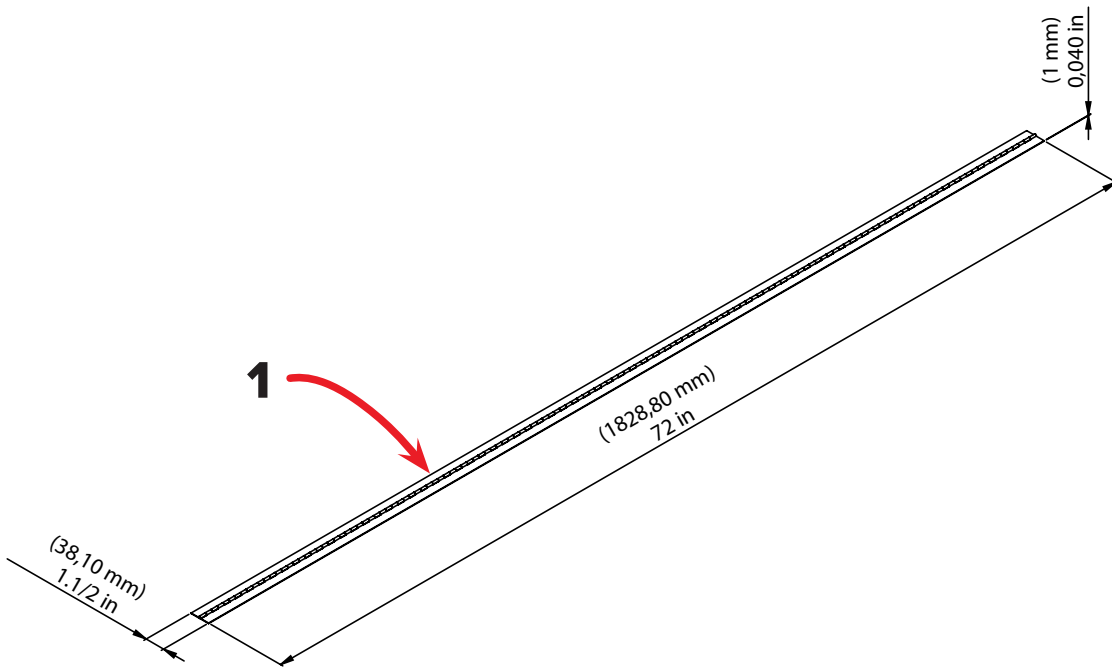


FIGURE 3-1 - CONTINUOUS HINGE

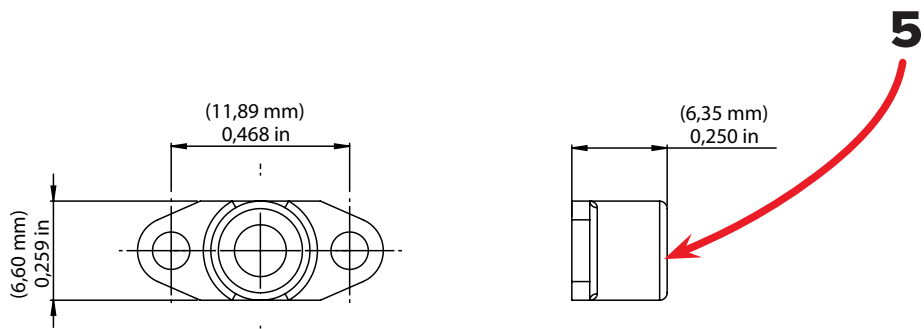


FIGURE 3-2- ANCHOR NUTS

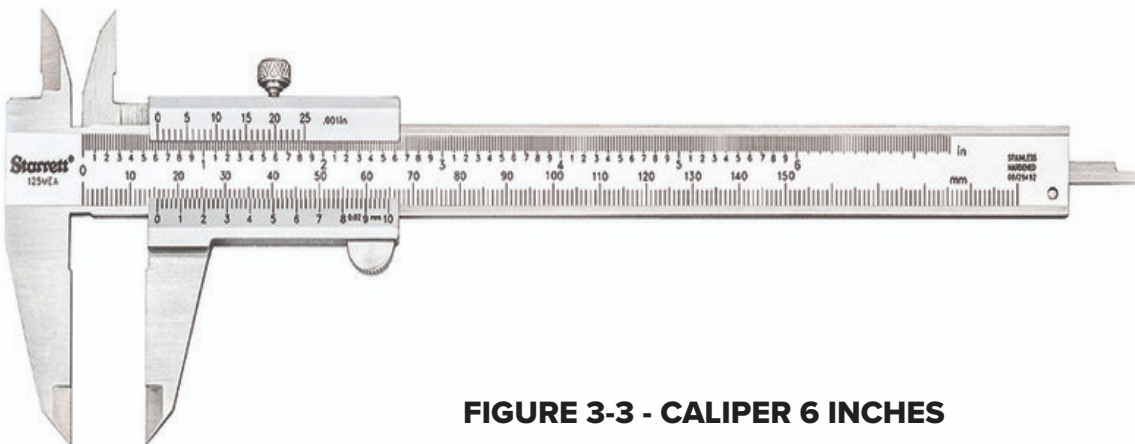
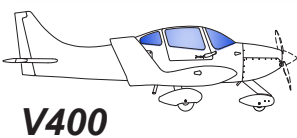
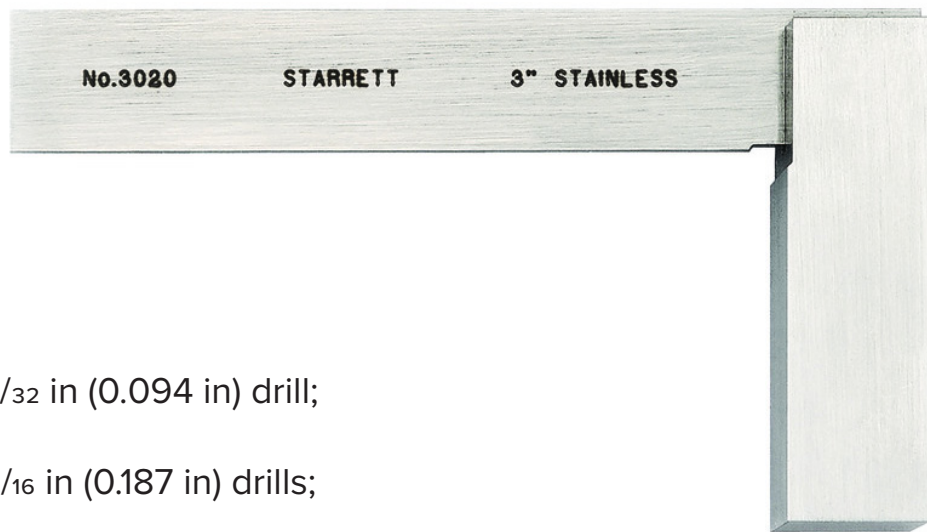


FIGURE 3-3 - CALIPER 6 INCHES



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FIGURE 3-4- STEEL SCALE 12 INCHES


- 04 new $\frac{3}{32}$ in (0.094 in) drill;
- 02 new $\frac{3}{16}$ in (0.187 in) drills;
- 01 drills of $\frac{3}{8}$ in (0.375 in) new to dig the holes;


FIGURE 3-6- COUNTERSINK DRILL 100 DEGREE

- 01 countersink drill with 100 degree, as shown in figure 3-6;
- 10 threaded screws #8-32 UNJC in length $\frac{3}{8}$ inches
- 01 sandpaper weight 100;
- 01 lime;

- 02 hacksaw blades 12 x ½ x 0.025 of bi-metal unique 32 teeth per inches;
- 01 hacksaw frame;
- 01 adjustable rivet spacer (figure 3-7);

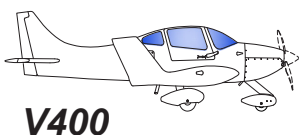


FIGURE 3-7- ADJUSTABLE RIVET SPACER



FIGURE 3-8- CRIVET SQUEEZE

- 01 Rivet Squeeze (figure 3-8).
- 01 vise with smooth jaws



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3-4 PROCEDURES:

1. OBSERVE with care the drawings **VOPR0008** and **VOPR0008**;
2. PLAN all sequence of operations with care;

PREPARATION OF THE HINGE CUTTING

3. POSITION the Continuous Hinges **MS 20257-4** (1) on the bench, keeping them open;
4. MARK the **CUTTING LINE C** on the Continuous Hinges **MS 20257-4** (1) with a pen or pencil according to figure 3-9A:

| quantity of Hinge Set (8) | length A (SEE figure 3-9A) | |
|---------------------------|----------------------------|------|
| | (inch) | (mm) |
| 17 | 8 | 203 |
| 04 | 5 | 127 |

5. IDENTIFY with the pen each pair of $\frac{1}{2}$ Hinge (4) (before cutting operation), as indicated in figure 3-9B, to avoid exchange of components and allow the correct subsequent assembly;
6. REMOVE Pin (2) from the Continuous Hinges **MS 20257-4** (1) with the aid of a 2 mm punch, if necessary;

ATTENTION! RISK OF DAMAGE IN THE PARTS



OBSERVE closely at figure 3-9 and Drawings **VOPR0008** and **VOPR0008**.

NEVER CUT the Knuckle of the Hinge.

TIGHTEN the $\frac{1}{2}$ Hinge Bar (3) in the vise with smooth jaws carefully as shown in figure 3-10, to avoid marking these part.

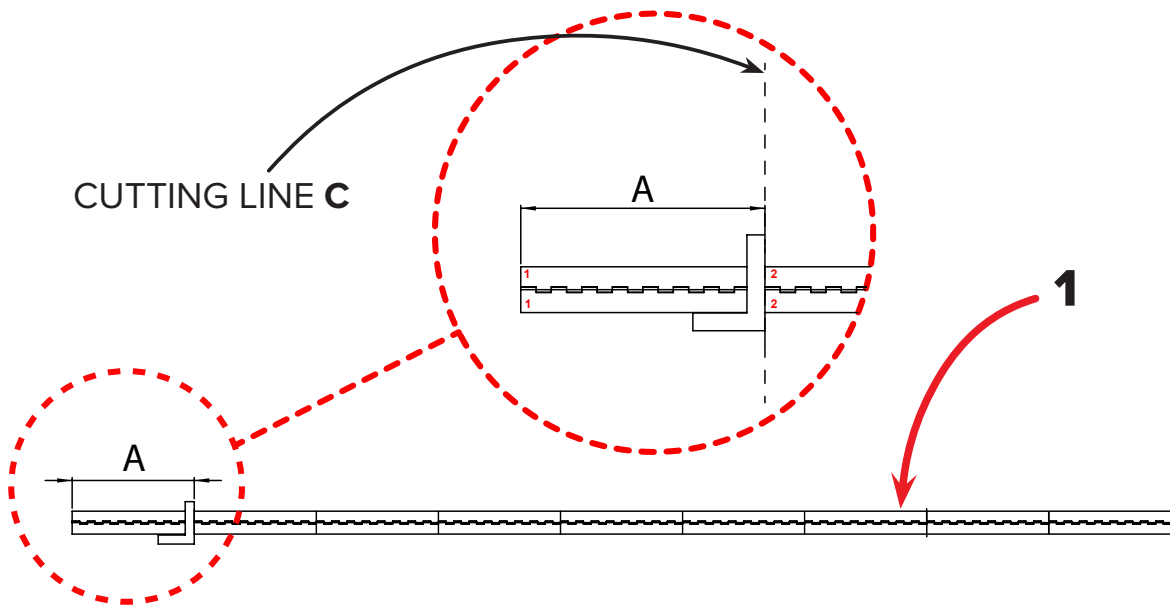


FIGURE 3-9A- CONTINUOUS HINGES

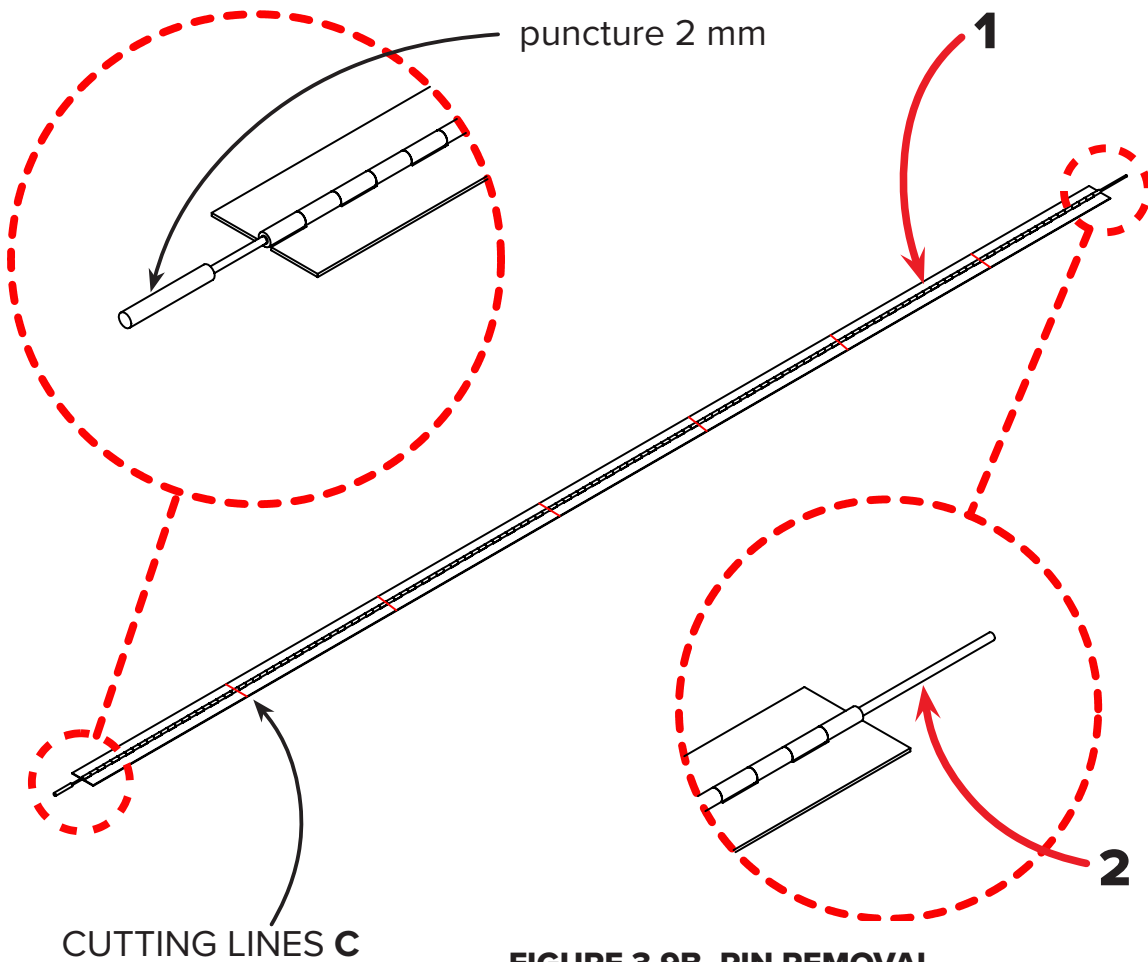
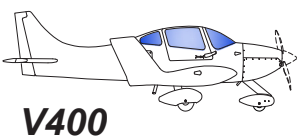


FIGURE 3-9B- PIN REMOVAL





HINGE CUTTING OPERATION

7. FIX on a vise with smooth jaws a ½ Hinge Bar (3) (figure 3-10);
8. CUT the ½ Hinge Bar (3) in the **CUTTING LINE C** (SEE item 4) with a hacksaw frame with a blade of 32 teeth;
9. MAKE the cut on the **CUTTING LINE C** carefully, attentively and slowly, thus generating a part called ½ Hinge (4);

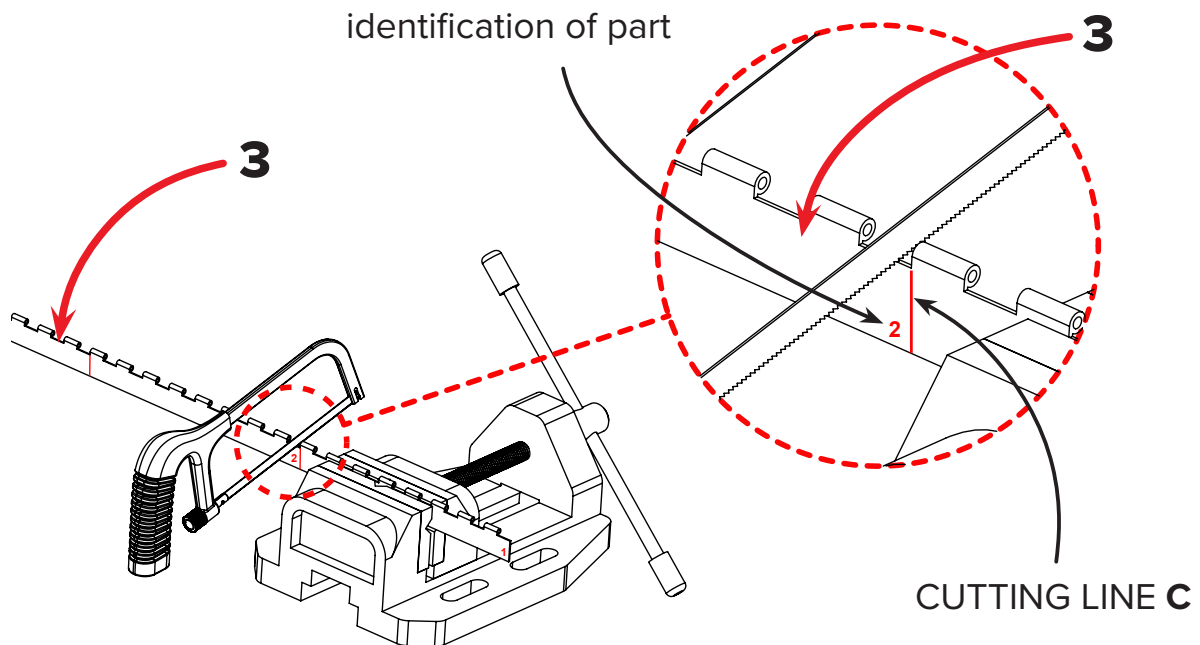


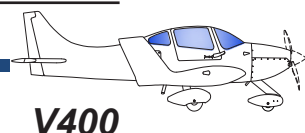
FIGURE 3-10- CUT OF ½ HINGE BAR

10. REMOVE the burrs from the cut with a lime tool, finishing with a sandpaper, weight 100, only in the region of the cut in each ½ Hinge (4);

PIN CUTTING

11. MARK the position of the cut of Pin (2) with a pen for quantities and lengths:

| quantity of Pin (2) | length (inches) |
|---------------------|-----------------|
| 17 | 8 |
| 04 | 5 |



12. FIX on a vise with smooth jaws the Pins (2), as in Figure 3-10;
13. CUT the Pins (2) in the line marked in item 11, with a hacksaw frame with a blade of 32 teeth;
14. REMOVE the burrs from the cut with a lime tools;

DRILLING IN THE HINGES

15. MARK with a pen the **LINE L** of the holes, at the distance of $\frac{3}{8}$ inch (9.5 mm) from the edge of each part of the $\frac{1}{2}$ Hinge (4), as shown in figure 3-11, using a caliper and a scale;
16. MARK the 2 **LINE E** at the ends each $\frac{1}{2}$ Hinge (4), at the $\frac{9}{16}$ inch (14,3 mm) with the aid of a caliper and/or square (figure 3-11);

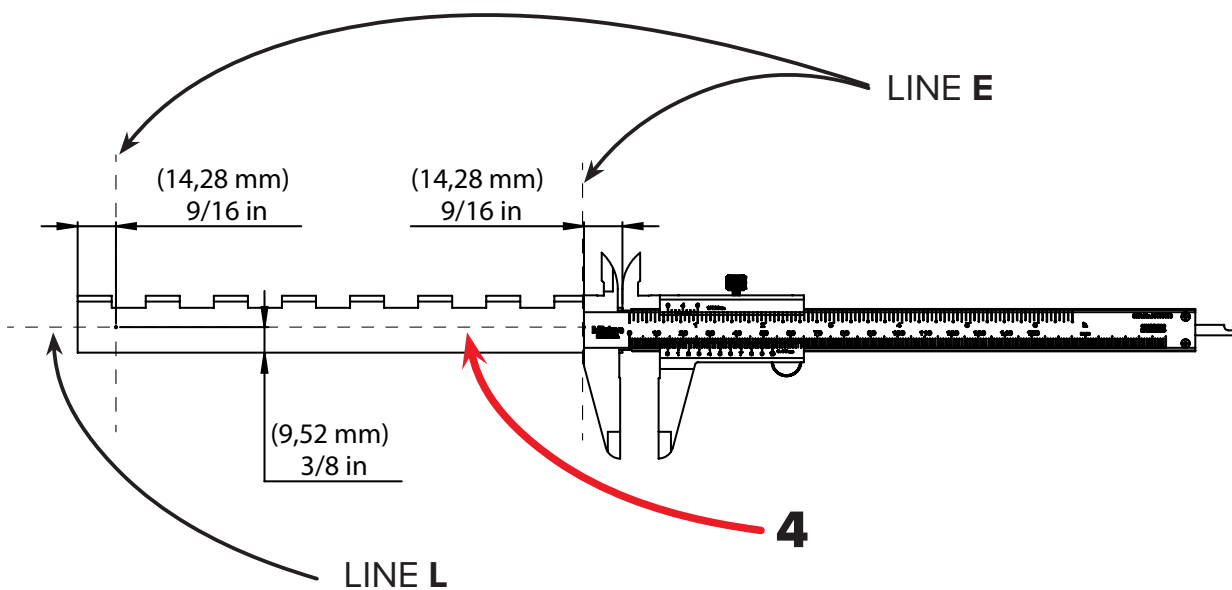
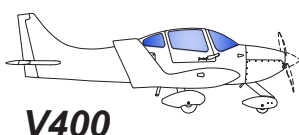


FIGURE 3-11- MARKING OF LINES E AND L ON 1/2 HINGE (4)

17. MARK the 2 holes **G** of the ends, by the intersection of the **L** and **E** lines (figure 3-12A);
18. MARK the intermediate holes **H** with the aid of the adjustable rivet spacer, as illustrated in figure 3-12B:



| quantity of H holes | to 1/2 Hinge (4) with length |
|---------------------|------------------------------|
| 04 | 8 |
| 02 | 5 |

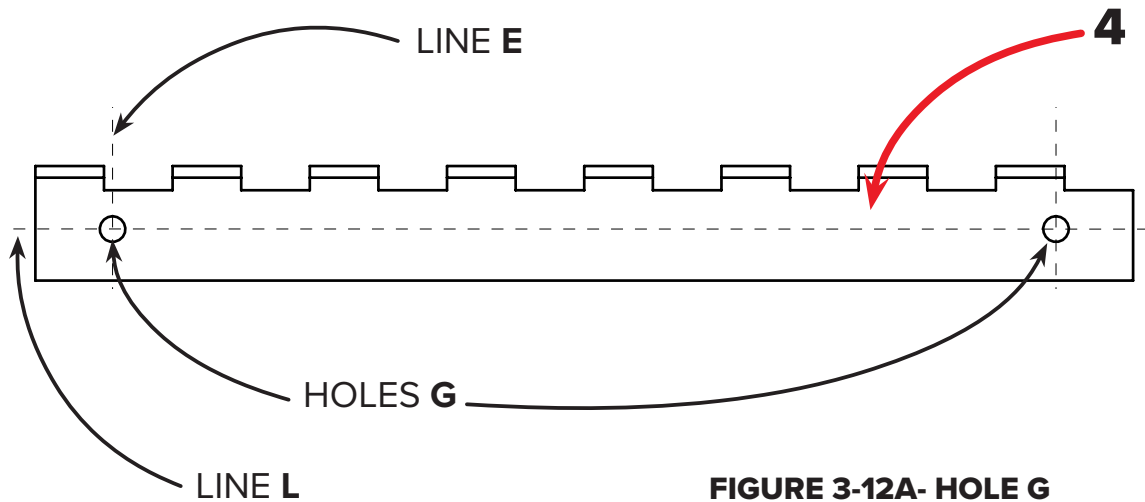


FIGURE 3-12A- HOLE G

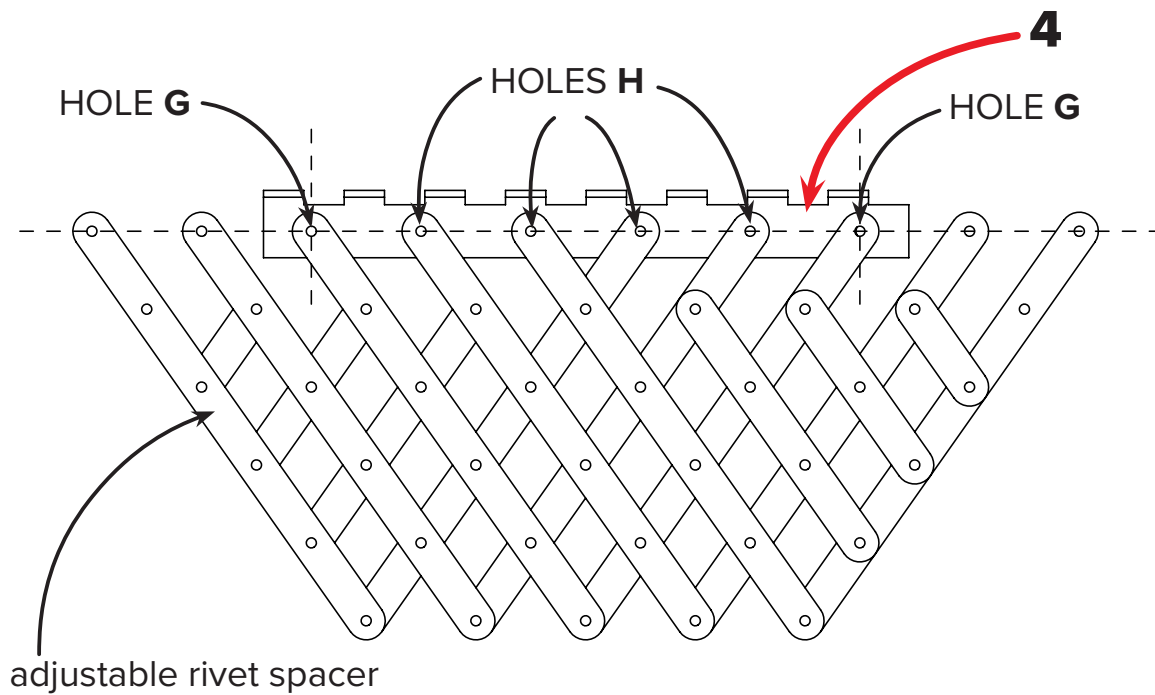
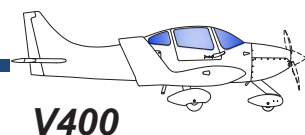


FIGURE 3-12B- INTERMEDIATE HOLES H

19. DRILL with a $\frac{3}{32}$ inch (2.4 mm) drill all these holes (**H** and **G**);
20. OPEN the size these holes (**H** and **G**) with $\frac{3}{16}$ inch (4.7 mm) drill;
21. REMOVE lightly the burrs with a drill $\frac{3}{8}$ inch (9.5 mm);





ATTENTION! RISK OF DAMAGE OF THE PARTS

MAKE the burr removal operation manually, by hand carefully and slowly, with the piece firmly fixed.

22.FIX the Anchor Nuts (5) by the $\frac{3}{16}$ inch holes with the threaded Screws (6) #8-32 UNJC, according to figure 3-13:

| quantity Anchor Nuts (5) | to $\frac{1}{2}$ Hinge (4) with length |
|--------------------------|--|
| 06 | 8 |
| 04 | 5 |

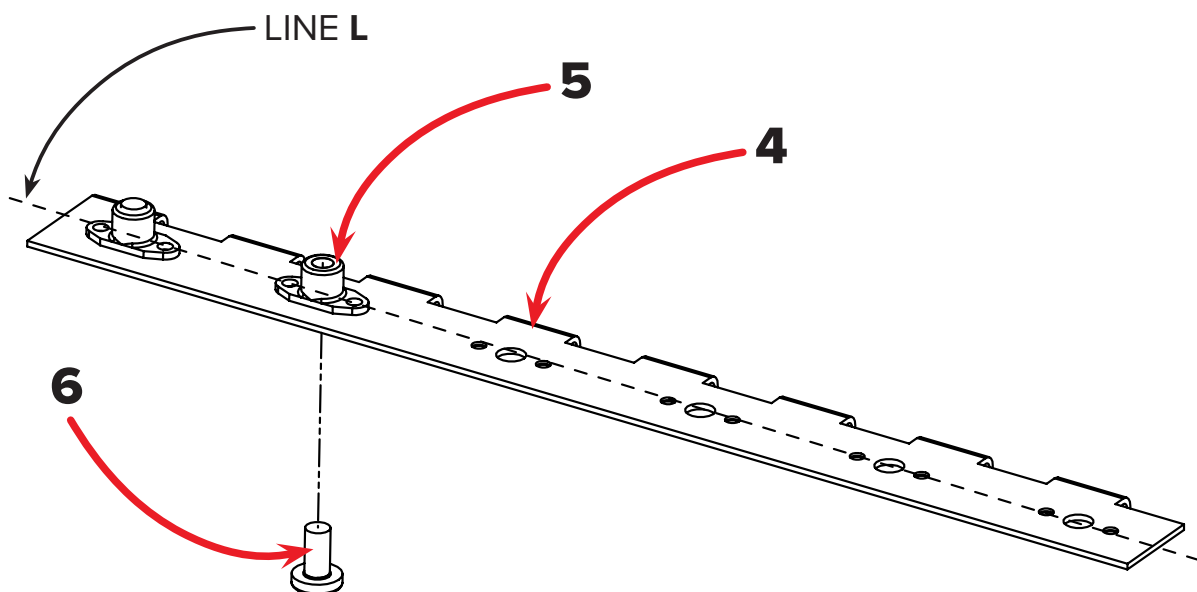
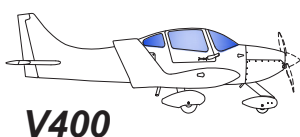


FIGURE 3-13- ANCHOR NUTS POSITIONING TO DRILL





23. ALIGN all $\frac{3}{32}$ inch (2.4 mm) holes of each Anchor Nut (5) on the **LINE L** (figure 3-13);

24. DRILL the $\frac{3}{32}$ inch drill through the end holes of the Anchor Nuts (5) by drilling the $\frac{1}{2}$ Hinge (4), in the following quantities:

| quantity of $\frac{1}{2}$ Hinge (4) | length |
|-------------------------------------|--------|
| 17 | 8 |
| 04 | 5 |

25. REMOVE the Screws (6);

26. REMOVE burrs from the holes made as recommended in item 21, manually;

27. COUNTERSINK the $\frac{3}{32}$ inch holes drilled, according to figure 3-14, using a countersink drill (9) with an angle of 100 degree;



ATTENTION! RISK OF DAMAGE OF PARTS

PERFORM the operation of countersinking following the instructions and dimensions of figure 3-14, handling the drill carefully and slowly, fixing the $\frac{1}{2}$ Hinge (4).

OBSERVE all dimension of figure 3-14.

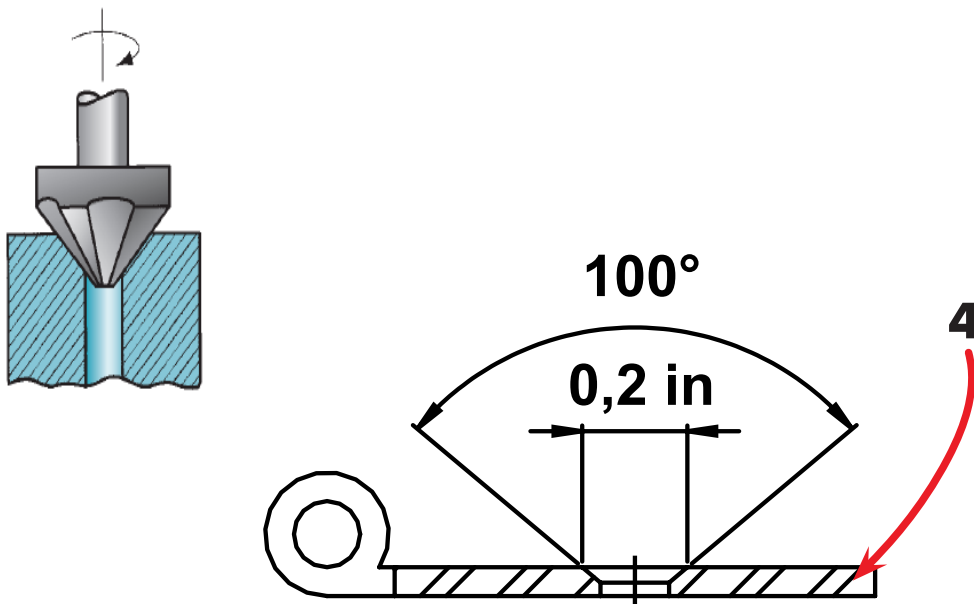
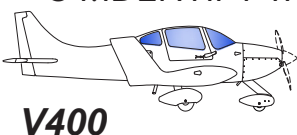


FIGURE 3-14 - COUNTERSINKING OPERATION

RIVETING OPERATION OF ANCHOR NUTS

28. FIX the Anchor Nuts (5) on the $\frac{1}{2}$ Hinge (4), with the solid Rivet (7) **AN426AD-3-4** or **MS20426AD-3-4**, with the rivet squeeze (SEE figure 3-8);
- 29.INSPECT the riveting operation of the Rivets (7) is in accordance with figure 3-15;
- 30.JOIN by means of Pin (2) to $\frac{1}{2}$ Hinge (4) with the Anchor Nuts (5), with the respective $\frac{1}{2}$ Hinge (4), this only with the $\frac{3}{16}$ inch hole;
31. USE 2 mm puncture, if necessary;
- 32.INSPECT the Hinge Sets (8), according to Drawings **VOPR0008** and **VOPR0008**;
- 33.CHECK if your movements are soft;
- 34.IDENTIFY with the number of the respective Drawings;



35. PACK all Hinge Set (8), if necessary for future installation of the **V400** aircraft.

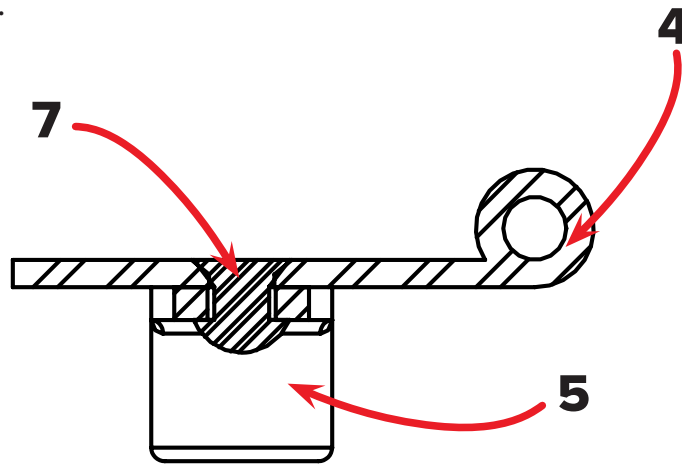


FIGURE 3-15- ANCHOR NUTS RIVETED ON THE 1/2 HINGE

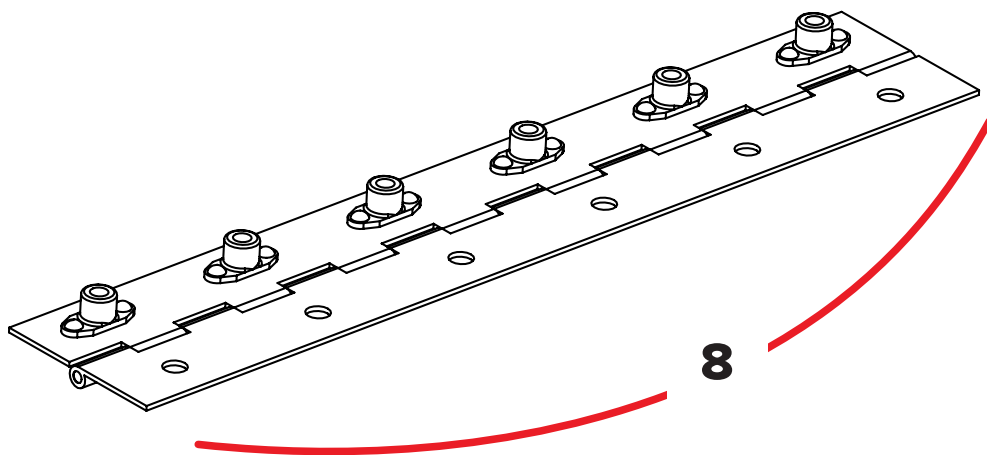


FIGURE 3-16A- VOPR0008 HINGES SETS 8 INCHES

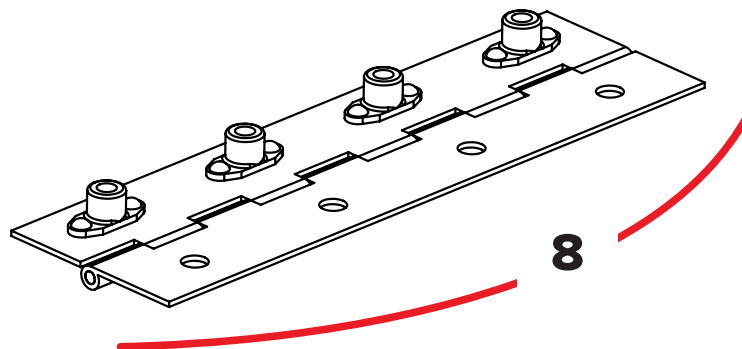
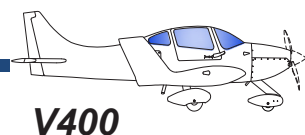


FIGURE 3-16B- VOPR0009 - HINGES SETS 5 INCHES



3-5 RECOMMENDABLE BIBLIOGRAPHIC REFERENCE

- Sheet metal Building Basics (EAA How-To Series)

By Jack Dueck

