# Test Project

## Module B – Aircraft Metal Structure Repair

## *Aircraft Maintenance*

Submitted by:

Zhikuan Luo – Zhengzhou Jiean Hi-tech Co., Ltd., Independent Test Project Designer
Fang Fen – China Eastern Airlines, Independent Test Project Designer
Poh Ghee Lim, Independent Test Project Designer

Ng Chung Hwee Edmund – Bombardier, Independent Test Project Validator
Bai Quanwei – Jiean Hitech, Independent Test Project Validator
Fredrik Glanrup – Repaircraft Sweden AB, Independent Test Project Validator
Yann Roux – Airbus, Independent Test Project Validator

WSC2026_TP14_en

# Contents

**Introduction to Test Project** ..... **3**
Importance of Structural Repair ..... 3
**Description of project and tasks** ..... **3**
**Marking Scheme** ..... **3**
**Instructions to the Competitor** ..... **4**
**Computations** ..... **6**
Bend Allowance Calculation using Empirical Formula ..... 6
Flat Layout Caculations ..... 7
Rivet Length "L" Calculation ..... 8
**Drawings** ..... **9**
**Procedures** ..... **14**
Preparation ..... 14
Manufacture ..... 14
Drill ..... 14
Dry assembly ..... 14
Final assembly ..... 14
**Others/Materials** ..... **15**
Tooling ..... 15
Consumables ..... 15
Materials ..... 15


© WorldSkills International

# Introduction to Test Project

The satisfactory performance of an aircraft requires continuous maintenance of its structural integrity. It is important that the metal structural repairs be made according to the approved techniques without compromising safety. The reliability of an aircraft depends on the quality of the design, as well as the workmanship used in making the repairs.

## Importance of Structural Repair

The design of an aircraft metal structural repair is complicated by the requirement that an aircraft be as light as possible. If weight were not a critical factor, repairs could be made with a large margin of safety. In actual practice, repairs must be strong enough to carry all of the loads with the required factor of safety, but they must not have too much extra strength. For example, a joint that is too weak cannot be tolerated, but a joint that is too strong can create stress risers that may cause cracks in other locations.

# Description of project and tasks

This Test Project fully simulates the floor beam and seat track structures of an aircraft. Competitors shall fabricate two (2) patches and complete the repair of the seat track.

# Marking Scheme

| MODULE B – AIRCRAFT METAL STRUCTURE REPAIR | MARKINGS |
|---|---|
| B1. Working Safety, housekeeping and certification | **20** |
| B2. Calculation | |
| B3. Fabrication and Assembly | |
| B4. Fasteners Installation | |


© WorldSkills International

# Instructions to the Competitors

This task requires creation of sheet metal assembly. The assembly consists of two patches riveted to the aircraft seat track and floor beam bench to fabricate a repair. All patches must be shaped, bent and riveted by the competitor.

In accordance with drawing supplied, manufacture the patches and assemble.

| **INTRODUCTION TO TEST PROJECT MODULE B** | | | |
|---|---|---|---|
| **NAME** | **(FIRST)** | | **(LAST)** |
| **COUNTRY** | | **START TIME** | |
| **Objective** | To test the Competitor's ability to interpret drawings, bend sheet metal with a high degree of accuracy, layout fastener and install solid shank rivets in accordance with the supplied drawings and AC 43.13-1B. | | |
| **Time allotted** | 3 hours 30 mins | | |
| **Process:** | | | |
| **1** | Each contestant will receive the following:<br>• Sheet Metal Tool Kit<br>• Drawings<br>• Two Aluminium (2024 series): 10in x 10in x 0.047in (250 mm x 250 mm x 1.2 mm)<br>• Rivets<br>• Hi-Loks<br>• Collars<br>• Aircraft seat track bench | | |
| **2** | Calculate bend allowances using empirical formula. | | |
| **3** | Calculate the dimensions for the flat layouts. | | |
| **4** | Form the patches. | | |
| **5** | Stop drilling – using 3/16 in (4.76 mm) drill. | | |
| **6** | Layout the fasteners. Drill and countsink holes. Ream holes. | | |
| **9** | Submit it to the expert to inspect the diameter and quality of the ream hole. | | |
| **10** | Determine the required rivets' and hilok lengths. Inform Experts. | | |
| **11** | Assemble two patches (parts 1 and 2) as shown in the drawing. | | |
| **12** | Restore workplace and perform housekeeping. | | |


© WorldSkills International

Notes:

1. All dimensions: Tolerance of + 0.02 in (0.5 mm).
2. All edges to be smooth and nick free.
3. All corners radius to be rounded to 0.079 in (2 mm).
4. Use fasteners specified in the drawings.
5. Countersunk rivet's flushness (degree of smoothness): +0.0059 in to 0 (+0.15 mm to 0 mm)
6. All surface damage will be documented by two judges prior to the beginning of the task.


© WorldSkills International

# Computations

## Bend Allowance Calculation using Empirical Formula

**Name:** _____ **Country:** _____

Bend Allowance (BA) = [(0.01743 x BR) + (0.0078 x MT)] x Degree of Bend (90°)

BR = Bend Radius MT = Metal Thickness

Correct to three decimal places. (In minimeter)

| Patch (P/N 5) |
| --- |
| |


© WorldSkills International

# Flat Layout Caculations

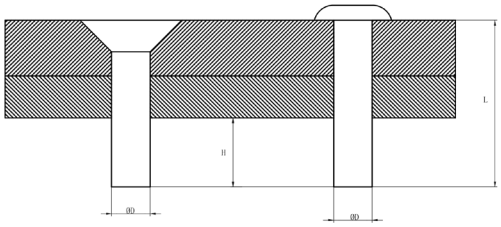
Name: _____ Country: _____

Correct to three decimal places. (In minimeter)

| Patch (P/N 5) |
| --- |
| |

# Rivet Length “L” Calculation

Name: _____ Country: _____



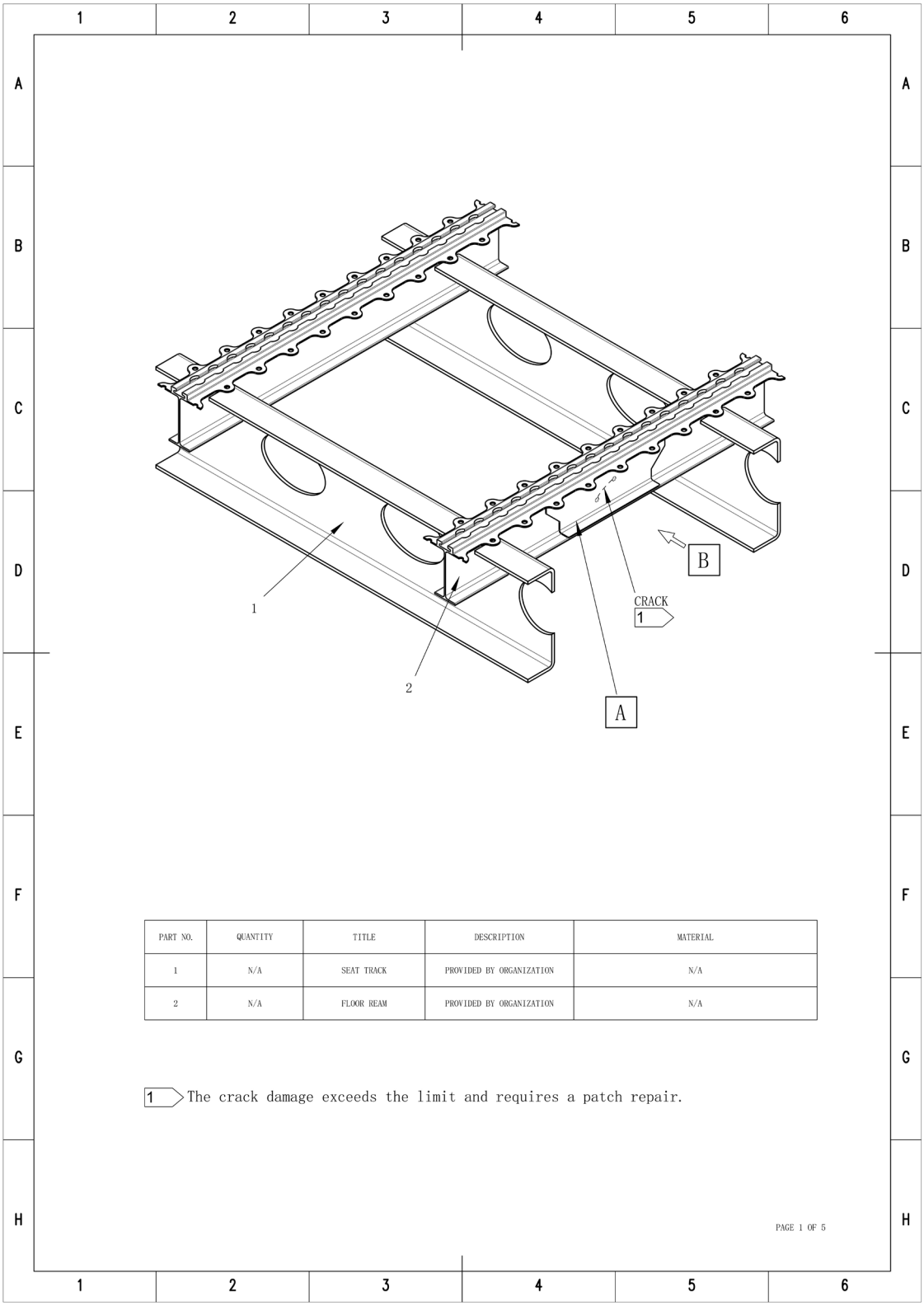

Calculate rivet length (L) for bottom fasteners and broadside fasteners.

The theoretical length obtained with the formula is rounded to three decimal places. (In minimeter)

| **Bottom Fasteners** | **Broadside (Web) Fasteners** |
|---|---|
| | |


© WorldSkills International

# Drawings

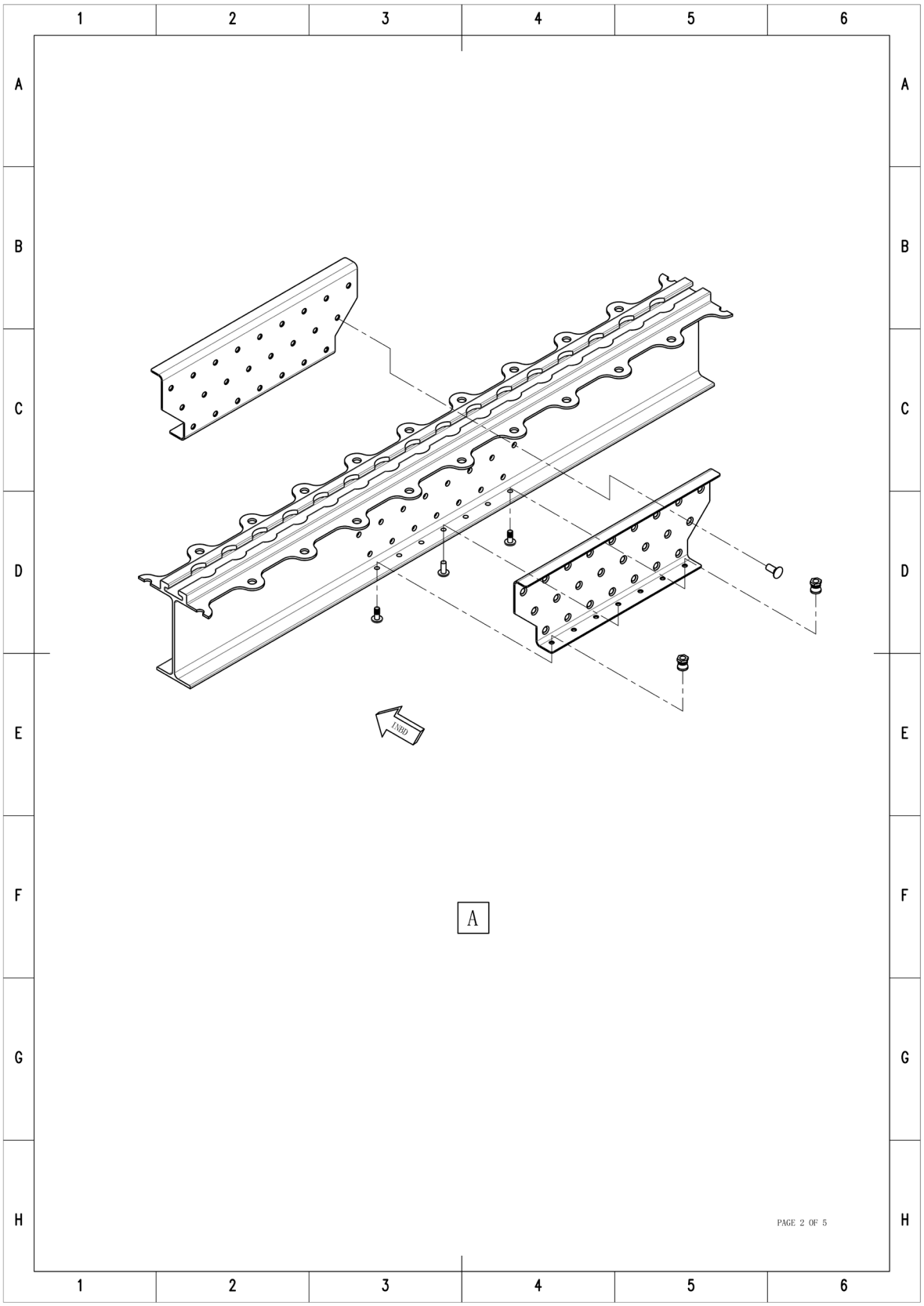


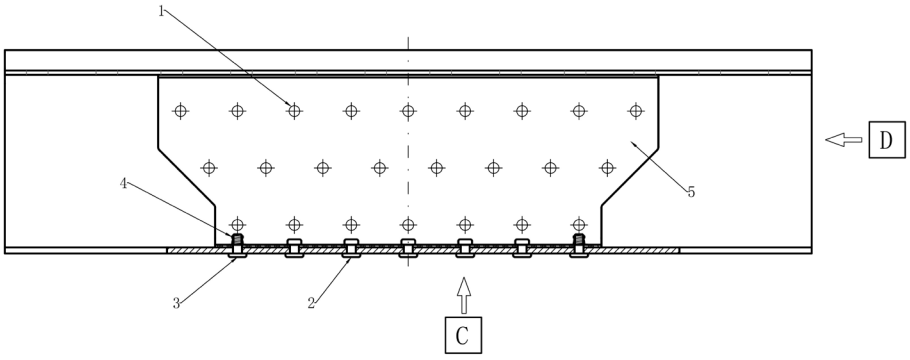

| PART NO. | QUANTITY | TITLE | DESCRIPTION | MATERIAL |
|---|---|---|---|---|
| 1 | N/A | SEAT TRACK | PROVIDED BY ORGANIZATION | N/A |
| 2 | N/A | FLOOR REAM | PROVIDED BY ORGANIZATION | N/A |

1 The crack damage exceeds the limit and requires a patch repair.

PAGE 1 OF 5


© WorldSkills International

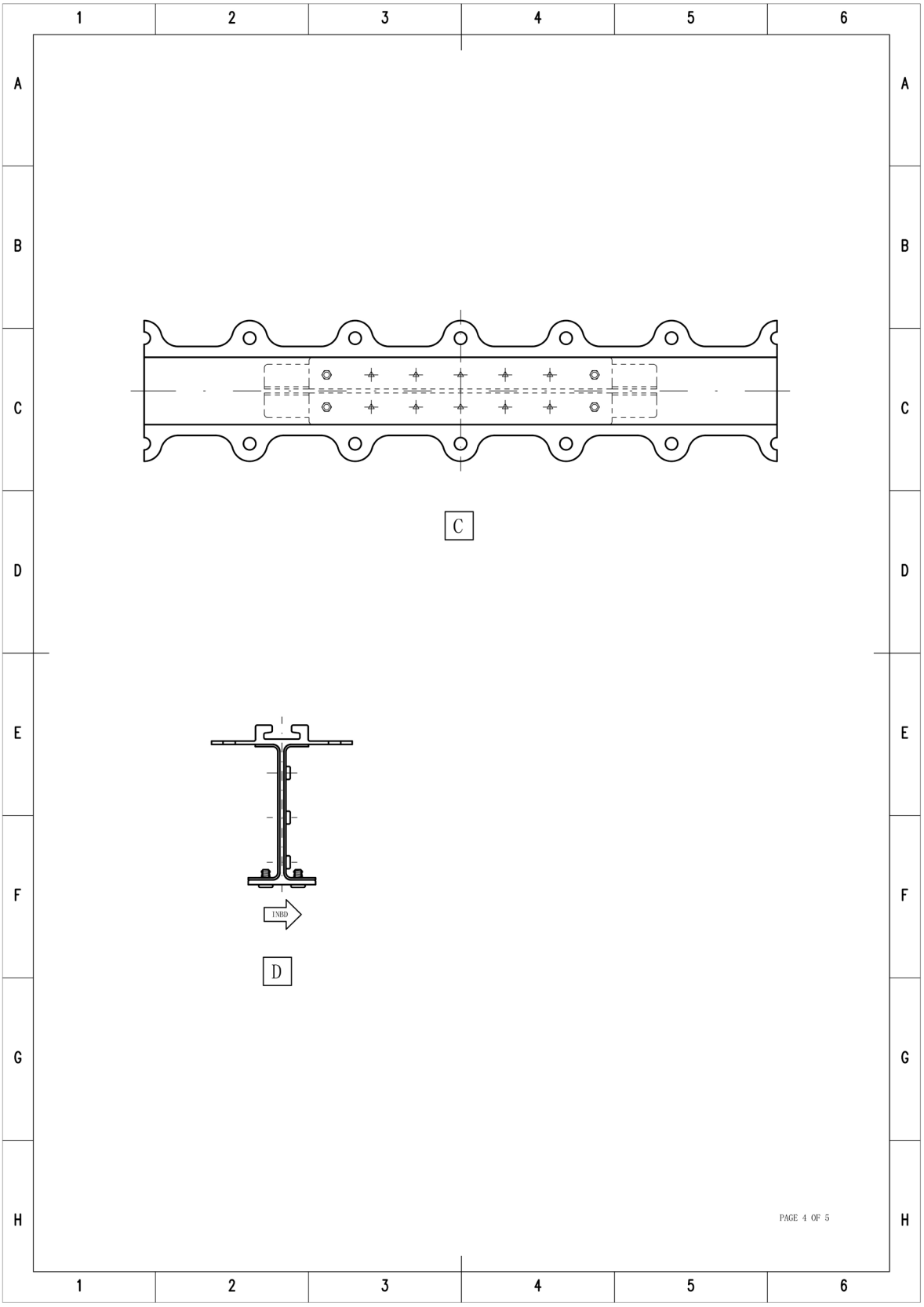

1
2
3
4
5
6
A
B
C
D
E
F
G
H
INBD
A
PAGE 2 OF 5




B

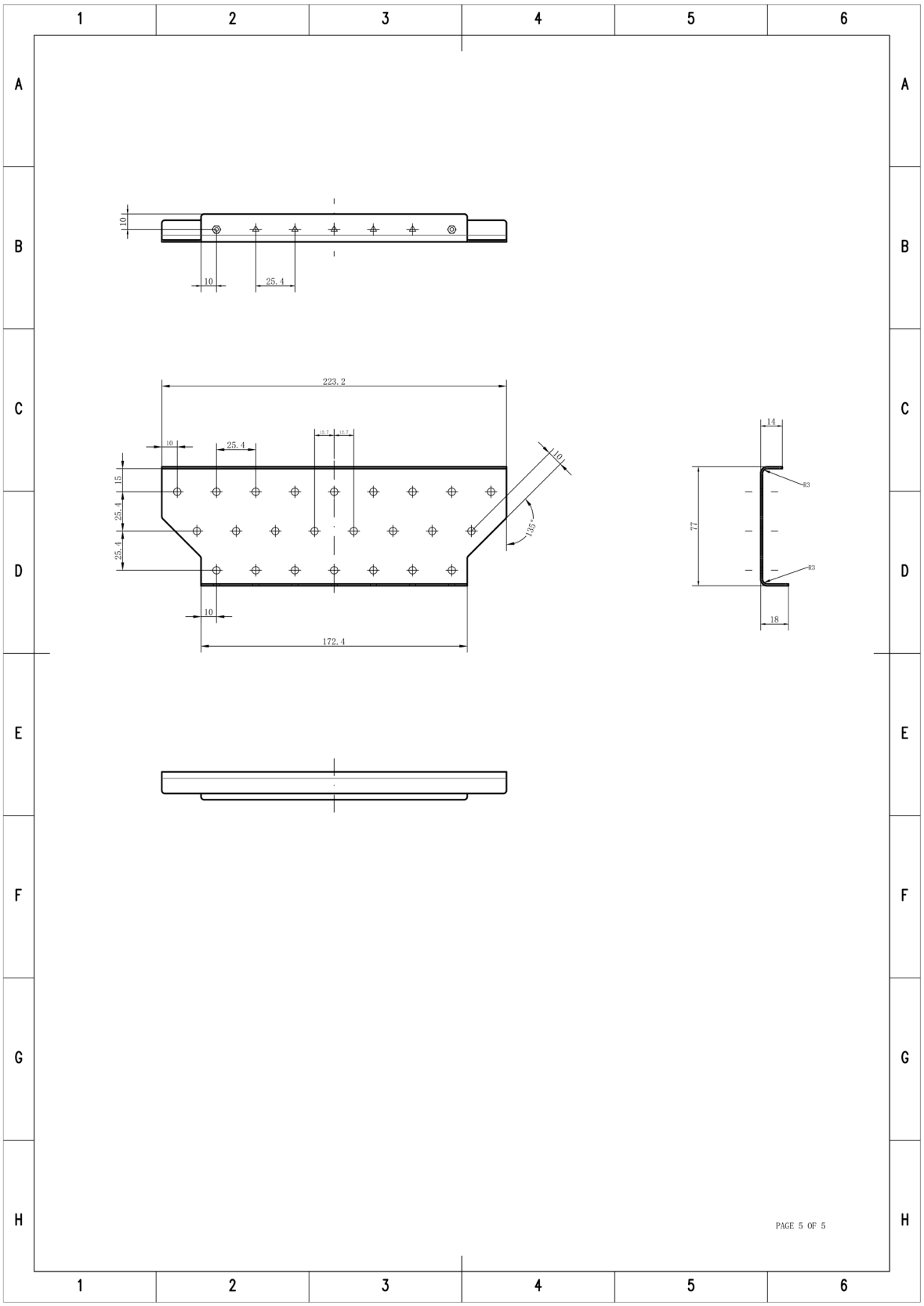
| PART NO. | QUANTITY | TITLE | FASTENER SYMBOL | MATERIAL |
|---|---|---|---|---|
| 1 | 24 | RIVET | ⊕ | BACR15GF6AD* |
| 2 | 10 | RIVET | ⊕ | BACR15BB5AD* |
| 3 | 4 | HI-LOK | ⬡ | BACB30VT5K* |
| 4 | 4 | COLLAR | N/A | BACC30BL5 |
| 5 | 2 | PATCH | N/A | ALUMINUM 1.2MM(2024SERIES) |

PAGE 3 OF 5





© WorldSkills International


1
2
3
4
5
6
A
B
C
D
E
F
G
H
10
10
25.4
223.2
10
25.4
15.7
15.7
10
15
25.4
25.4
135°
10
172.4
14
R3
77
R3
18
PAGE 5 OF 5

# Procedures

## Preparation

1. Read and understand drawing.
2. Wear and use appropriate PPE.
3. Check tools and material.

## Manufacture

4. Manufacture patches in accordance with size and shape indicated on drawing.
5. Mark bend lines on patches in accordance with drawing.
6. Bend patches.

## Drill

7. Stop drilling 3/16 in (4.76 mm) on the track bench.
8. Mark rivet positions on the track bench as indicated on drawing.
9. Pilot drill 1/8 in (3.18 mm) on the track bench.
10. De-burr throughout.

## Dry assembly

11. Assemble using clamps.
12. Transfer pilot holes from track bench onto patch 1 and patch 2.
13. Drill holes final size.
14. Ream holes for Hi-loks.
15. Countersink holes.
16. De-burr throughout.

## Final assembly

17. Dry Reassembly components using location pins.
18. Rivet patches and bench with countersunk rivet heads in a methodical and logical manner.
19. Install patches and bench with universe rivet heads and Hi-loks installation tools.
20. Return tooling to toolboxes.
21. Clean work area.


© WorldSkills International

# Others/Materials

## Tooling

Standard Sheet Metal Toolbox containing a varied and suitable selection of:

- Measuring equipment
- Cutting equipment
- Filing equipment
- Marking equipment
- Clamping equipment
- Riveting equipment
- Drilling equipment
- Finishing equipment
- Illuminating equipment
- PPE (goggles and safety boots, gloves)
- Vice (inc. soft jaws)
- Bending machine with a 0.118 in (3 mm) bend radius

## Consumables

- Various wooden blocks
- Drill Bits: 1/8in(3.18mm), 5/32 in (3.97 mm), NO.20(4.09 mm), 3/16 in (4.76 mm), NO.11 (4.85 mm)
- Reamer: 0.161 in (4.09 mm)
- Grit papers
- Masking tape
- Gloves
- Cleaning wipes and cleaning roll

## Materials

- Aluminium sheet 0.047 in (1.2 mm) thickness, standard 2024 T3
- Countersink rivet
- Universe rivet
- Hi-loks and collars


© WorldSkills International