NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Aviation Engineering Division
Washington, DC 20594

December 5, 2003

ADDENDUM NUMBER 12 TO THE STRUCTURES GROUP CHAIRMAN'S FACTUAL REPORT

DCA02MA001

A. ACCIDENT

Location:	Belle Harbor, NY
Date:	November 12, 2001
Time:	09:16:14 EST
Aircraft:	American Airlines Flight 587, Airbus Model A300-605R, N14053 Manufactures Serial Number (MSN) 420

B. STRUCTURES GROUP

Chairman:	Brian K Murphy National Transportation Safety Board Washington, DC

C. AIRBUS REPORT

1. "A300/A310, Rear Fin Box Attachment – Sub-component Test Summary"

AIRBUS	Technical Note	

Report Nr.: TN – ESGE – 0003/03

Author:
Department.:

Title

AAL 587 Airbus Structure Investigation

A300 / A310 Composite Fin Box

Rear Fin Box Attachment - Subcomponent Test Summary

Date: 08.12.2003

Summary:

Public Docket	Issue	Date	No. of page	Revised pages	Valid from/for
	1	02.12.2003	14		
	2	08.12.2003	14		

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1. Introduction

The A310/A300 composite fin box is attached to the rear fuselage by six main lugs which are integrated into the lower ends of the LHS and RHS skin panels and three lateral load fittings at the lower ends of the front, center and rear spar webs.
The main lugs are designed to carry the loads resulting from aerodynamic -, mass forces and thermal loads from CTE – effects between the fuselage and the fin.
As part of the certification test program for the A310 composite fin box, two rear attachment lugs were manufactured from alternative materials and tested for static strength in tension and compression.

2. Description of the test part

The test parts are 2 RHS rear mail lugs which were manufactured from HEXCEL F550 and CIBA 913 material.
The material designations are listed in the following table.

	tape	fabric
Test part no. 1	T6T 262 F550 - 40	F3T 584 F550 - 40
Test part no. 2	913C – TS – 10 - 40	913C – 815 – 40

The dimensions of both parts are identical and are shown on figure 1.
The edges (forward of stringer 5, behind the rear spar web attach angle and above rib 4) of the parts have been reinforced by several layers of carbon fiber fabric for clamping in the test rig by bolts.

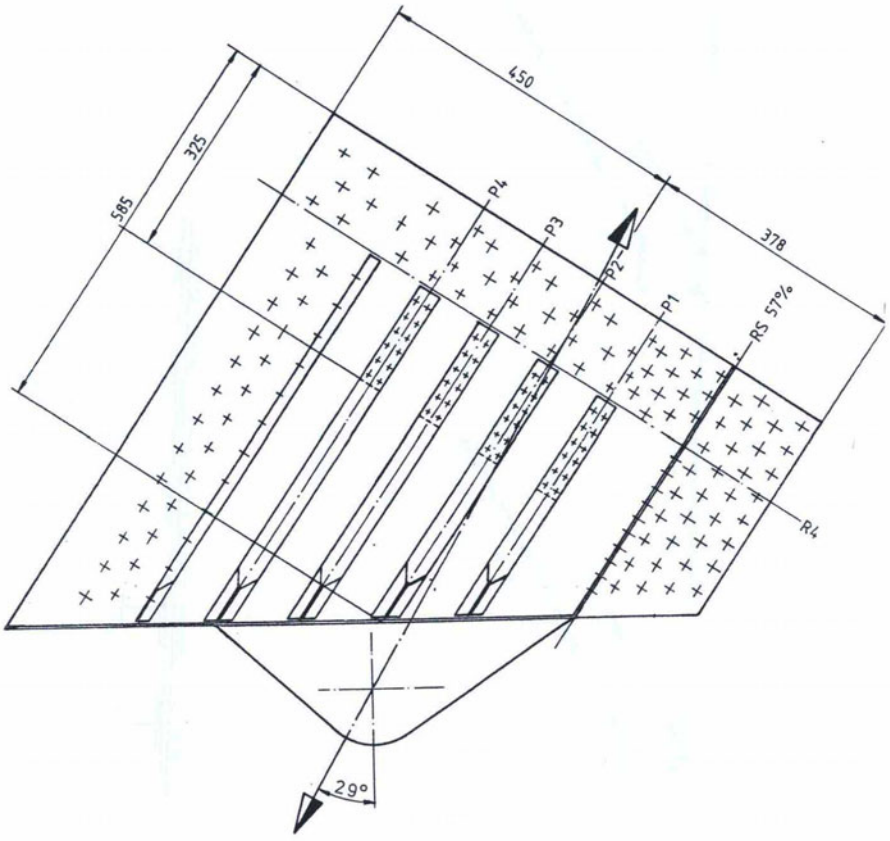

Figure 1

3. Description of the test setup

The test parts are fixed with their inboard surface to a curved steel plate with a cut-out by several rows of fasteners at the reinforced edges (see figure 2).
The rear spar angle and the web of stringer 5 are attached to sheet metal straps, which are welded to the steel plate and along the forward and rear edges of the cut-out.
The inboard flanges of stringers 1 to 4 are riveted to T-sections, which are welded to a steel frame (see section B2 – B2 of figure 2).

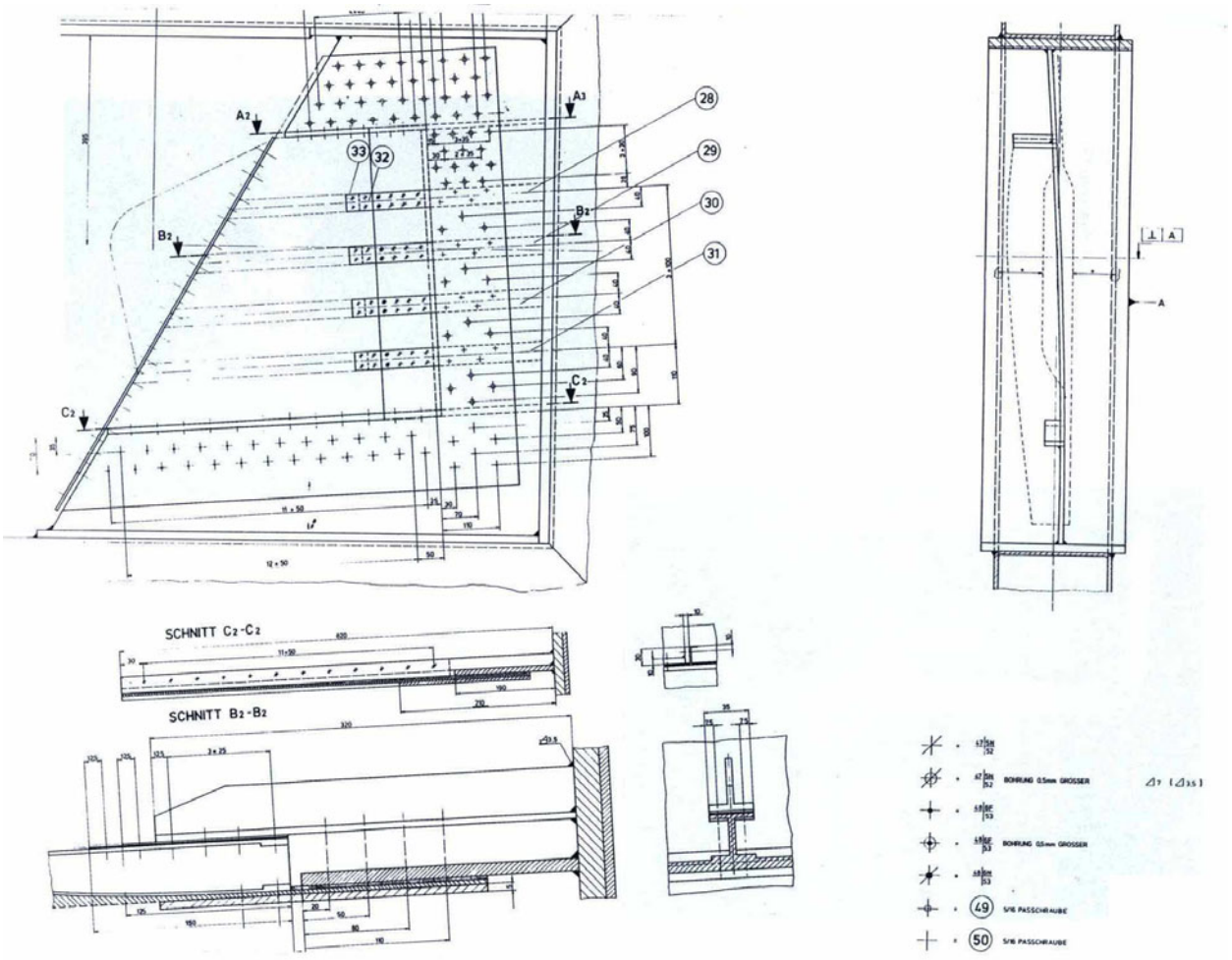

Figure 2

The angle for assembly with the bottom closure rib is riveted to a dummy rib made out of sheet metal to provide support between rear spar and stringer 5.
The test parts are installed upside down in a rectangular frame of square steel tube (see figure 3 and 4).

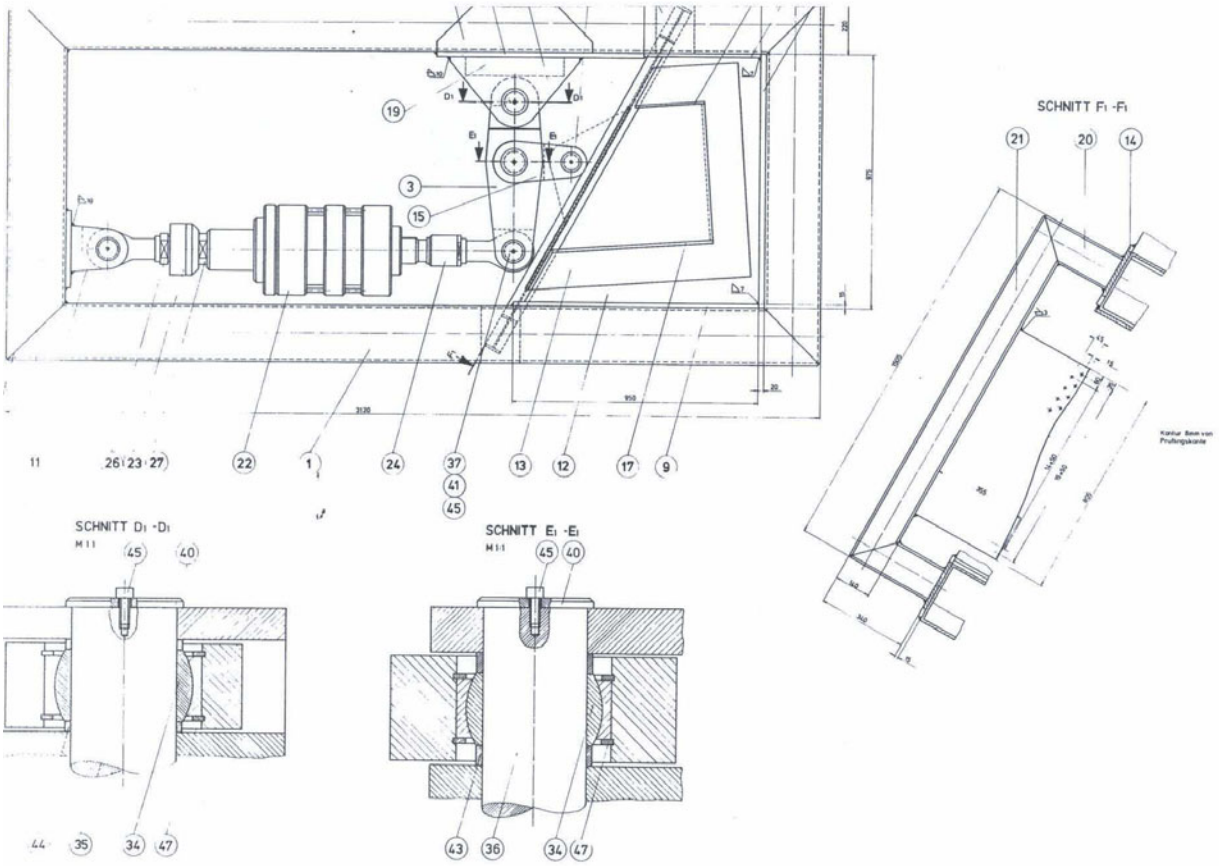

Figure 3

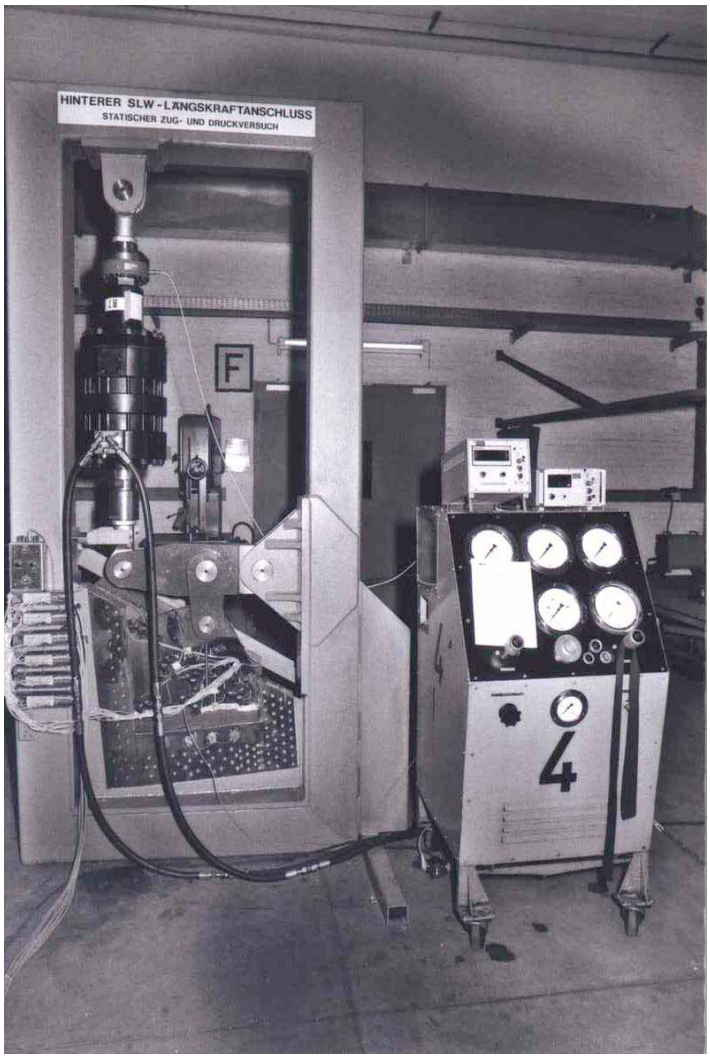

Figure 4

The lateral support for rib 1 is provided by a separate u-shaped bar, which is welded normal to the tubular frame. A 400 kN hydraulic actuator with a load cell is attached to a fitting at the top of the tubular frame. The lower end spherical bearing is guided in a fork to prevent lateral displacement.

The load from the actuator is applied by a lever and a link to the lug. The load at the lug is applied at an angle of 29° inclined to the aircraft z-axis.

4. Load case and test condition

The applied load resultant reflects the design case *lateral gust* in combination with a structural temperature of 70°C.
The load condition at the lug has been calculated by linear FEM analysis (NASTRAN). The load resultant applied to the test part does not include the lateral force F_y. The moments M_x and M_z which develop from the applied load components and constraints in y-direction and the rotational boundary conditions at the pin axis are not measured.
The test is performed at ambient temperature.

5. Strain gauge plan

Both test parts are equipped with strain gauges. The numbering and their location is shown at figures 5 and 6.

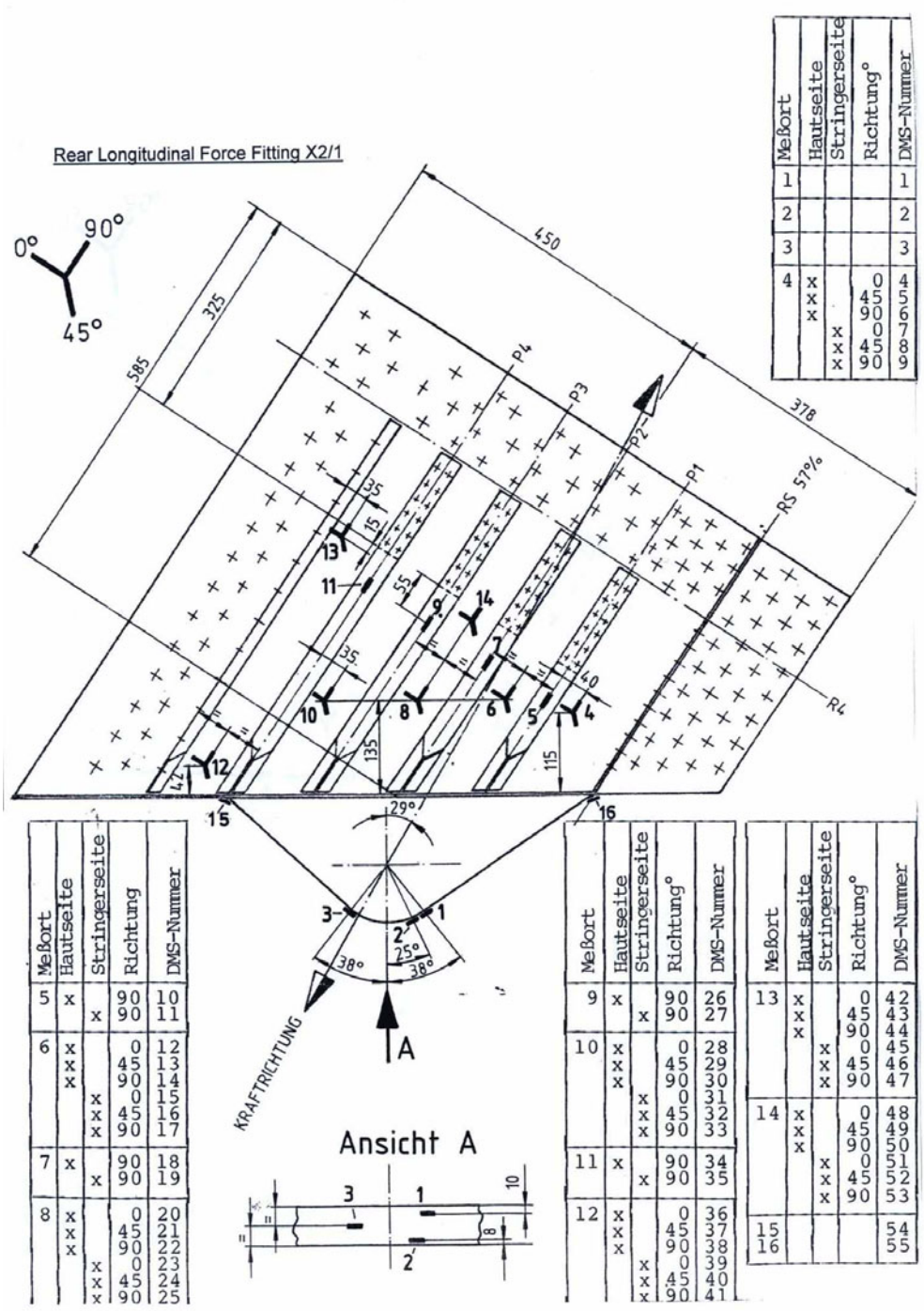

Figure 5

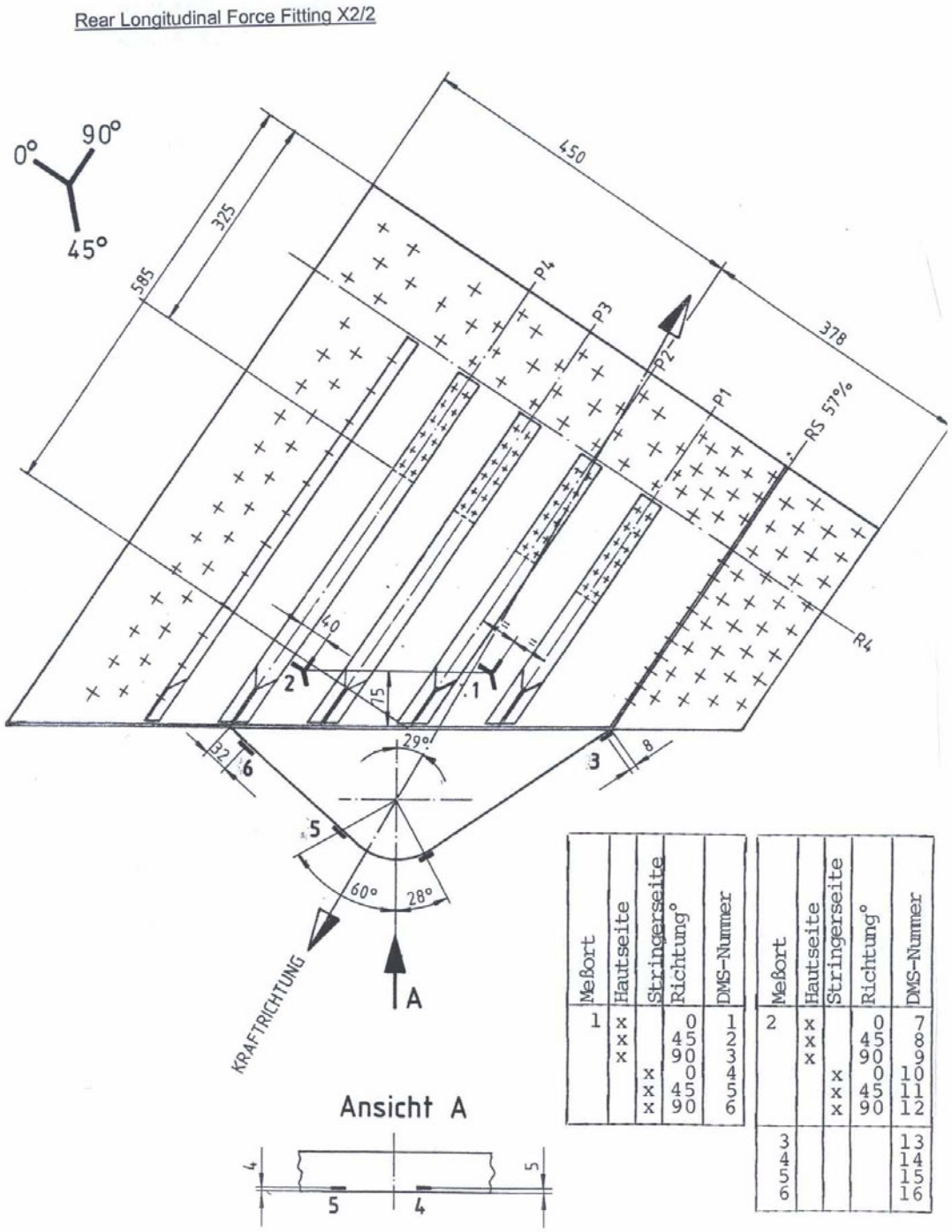
Rear Longitudinal Force Fitting X2/2
0°
90°
45°
585
325
450
378
P4
P3
P2
P1
RS 57%
R4
40
15
2
1
32
6
29°
3
8
5
60°
28°
KRAFTRICHTUNG
A
Ansicht A
4
5
5
4
Meßort
Hautseite
Stringerseite
Richtung°
DMS-Nummer
1
2
3
4
5
6
0
45
90
0
45
90
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

Figure 6

6. Test sequence

6.1 Test part 1

Test no.	Applied load [kN]	Load direction
1	236	Tension
	0	
	118	
	236	
	354	
	472	
	590	
2	236	Compression
	0	
	118	
	236	
	354	
	472	
	590	
3	590	Tension
	649	
	708	
	767	
	826	
	885	
4	590	Compression
	649	
	708	
	767	
	820	
5	944	Tension
6	944	Compression
	1003	

6.2 Test part 2

Test no.	Applied load [kN]	Load direction
1	236	tension
	0	
	118	
	236	
	472	
	590	
	649	
	708	
	767	
	826	
	885	
	944	
	1003	
	1036	

7. Test results

The following failure loads were achieved.

Test part	Kind of loading	Failure load [kN]
1	Compression	1003
2	tension	1036

The failure mode on test part 1 is a compression failure of skin and stringers below rib 4 (see figure 7).

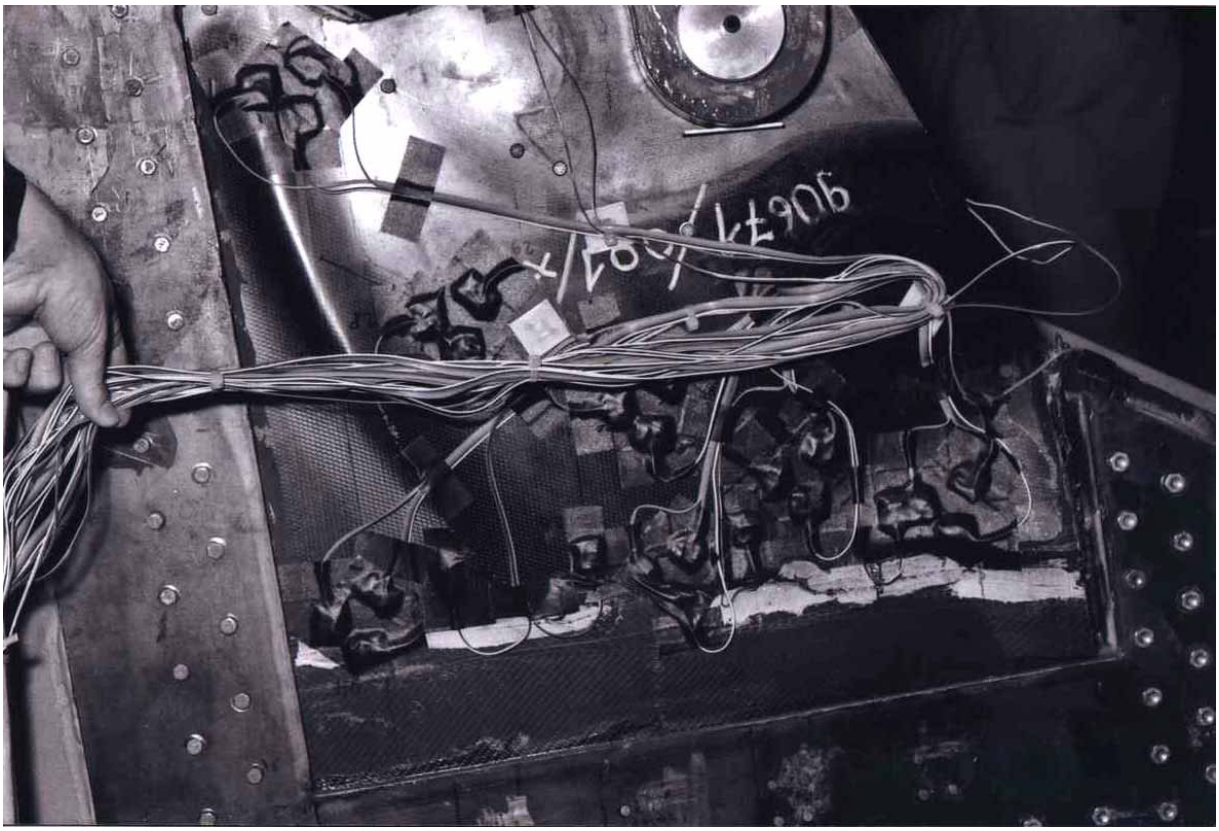

Figure 7

Test part 2 failed in a cleavage mode at the pin hole (see figure 8).

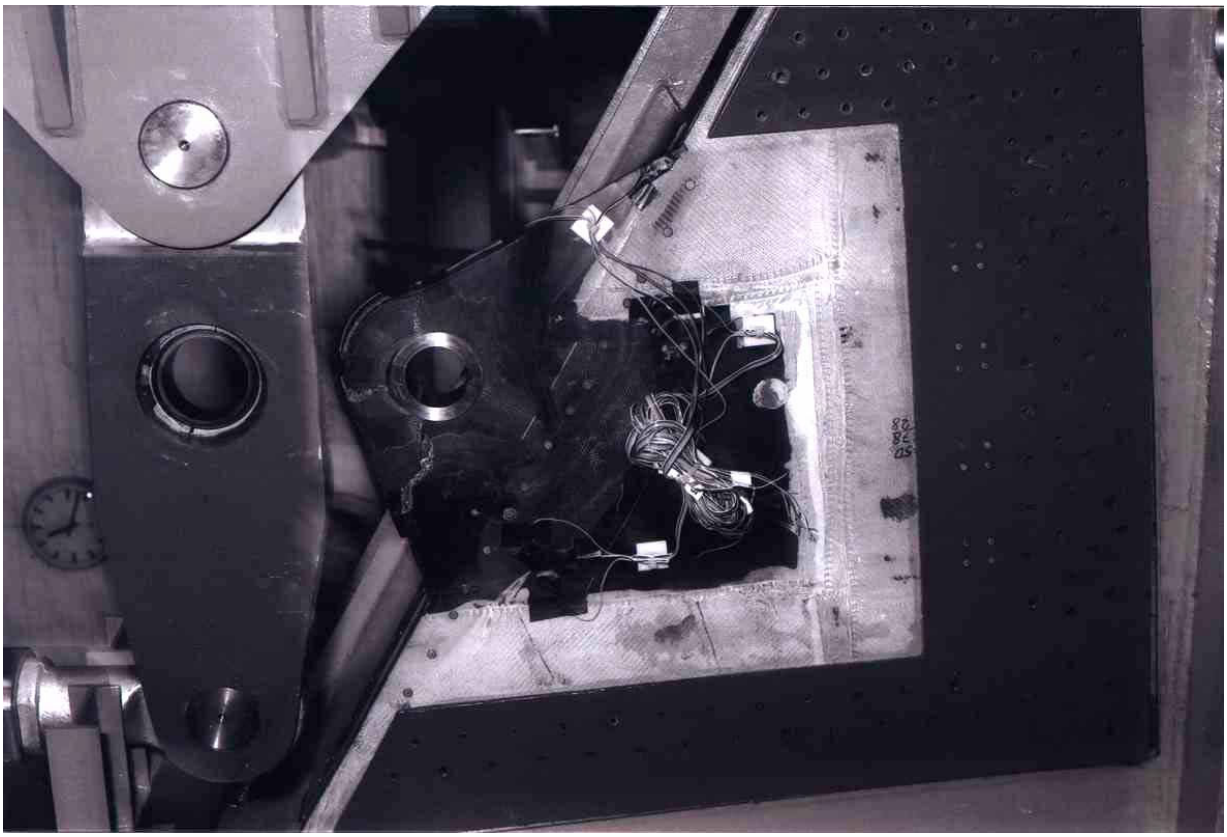

Figure 8