

Owners:

Prof. Dr.-Ing. C. Kramer  
Prof. H.J. Gerhardt, M.Sc.

Partners:

Prof. Dr.-Ing. R. Grundmann  
Prof. Dr.-Ing. Woek

Ingenieur-  
gemeinschaft  
(Association of Engineers  
for Heat Engineering, Aero-  
dynamics Technology and  
Process Technology)

**WSP**

Welkenrather Straße 120  
D-52074 Aachen  
Tel.: 0241/879704-0  
Fax: 0241/872632

**Wind Suction Resistance of  
Aluminium Roofings with  
SM Stainless Steel Fixing Clips**

Official in charge: Dipl.-Ing. J. Gomez

Aachen, 11.10.1998

signed: *Hans J. Gerhardt*  
Prof. H. J. Gerhardt, M.Sc.

Bank account: Commerzbank Aachen

Account No. 3022225

Bank code 390 400 1

## **1.0 Introductory Remark**

Upon commission of the Central Organization Sanitary, Heating, Climate (ZVSHK), the Association of Engineers for Heat Engineering, Aerodynamics Technology and Process Technology (WSP) tested and rated the operational limits of application of metal roofings and exterior wall linings under the exposure of wind. The relevant WSP reports dated 07.18.1998 and 08.13.1998 are available. In conformity with the recommendations outlined in the WSP report of 08.13.1998, the design of the fixing clips for the combination aluminium sheet metal/SM stainless steel fixing clips were re-engineered. The new fixing clips were subjected to dynamic wind load tests performed at the strength testing laboratories of the Aachen Technical College under the direction of Prof. Dr.-Ing. O. Jung. The results are presented subsequently.

## **2.0 Methodology and Test Specimens**

The methodology of the testing is described in great detail in the WSP report of 08.13.1998. There, the test setup and the wind load distribution collective are illustrated. The test setup is displayed in Figure 1 in schematic form.

The test specimens consisted of aluminium sheet metals of a thickness of 0.7 mm provided with the following fixing clips:

- Design 1: Stainless steel extension sheet metal SM-ESe 0.4 thick
- Design 2: Stainless steel extension sheet metal SM-ESe 0.4 thick, with 0.5 mm stainless steel bottom
- Design 3: Stainless steel longitudinal extension sheet metal SM-ESL 0.4 mm thick

Four specimens of each design were examined.

## **3.0 Results**

For the three design types, two tests were performed in each case until the failure of the test specimen was ascertained. The test revealed the following fatigue lives in the case of a fixing clip load of 400 N/fixing clip:

Design 1: 195 or, respectively, 152.5 years  
Design 2: 192.5 or, respectively, 178 years  
Design 3: 165 or, respectively, 150 years

In each case, the failure of the test specimens was attributable to a failure of the seams. Merely the test specimen of design type 1 with a service life of 152.5 years failed owing to the fact that a fixing nail had detached from the cover base because this fixing nail had been inserted in the groove between two sheathings.

In view of the very high service lives of the test specimens, the remaining two test runs - without failure - were terminated for all test setups after a service life of 100 years had been reached in each case.

For all test specimens with aluminium sheet metals and the above-mentioned fixing clips exposed to a maximum load of 400 N/fixing clip, a service life of 100 years and more was to be ascertained. The aspired minimum service life of 40 years, therefore, is guaranteed even under maximum fixing clip load. It is to be assumed that this target is also attained in the case of a maximum load of 500 N/fixing clip. If any higher permissible fixing clip loads were desired, they would have to be proved experimentally during the course of further examinations.

## Sub-construction

## Metal covering of the test specimens

3 fixing clips per sheet metal

Lateral double standing seam  
without fixing clips, edges nailed

2 Points of application of load per sheet metal  
(approximation to a linear application of load)

**Figure 1**