

**CERTIFICATION FOLDER
OF P/V MOUNTING SYSTEM
STATIC ANALYSIS**

Company: **GÜRSAN
ALUMINYUM IMALAT SAN L.T.D.***

Product: **‘ELECTRA II’ Mounting System**

Cert.No: **TÜVR.SP24/2013**

Inspection
Report No: **TÜVR – ALUMINCO AE IR02/2012**

Date of Issue: **21/12/2012**

The Inspector



**Kleanthis Papanikolaou
Dipl. Civil Engineer**

* Aluminco S.A. company cooperates with Gursan L.T.D. in Turkey

TÜV RHEINLAND HELLAS

INSPECTION REPORT
ΕΚΘΕΣΗ ΕΠΙΘΕΩΡΗΣΗΣ

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| Project Έργο | : Certification of P/V mounting system Static Analysis and Study Πιστοποίηση Στατικής Μελέτης Βάσεων Φωτοβολταϊκών |
| TUV-R-PROJECT No Κωδικός Έργου | : - |
| Our Ref.No. | : TUVR – ALUMINCO AE IR02/2012 |
| Owner Κύριος του Έργου | : GÜRSAN LTD* |
| Contractor Ανάδοχος | : - |
| Fabricator Κατασκευαστής | : GÜRSAN LTD* |
| Subject of inspection Αντικείμενο Επιθεώρησης | : Adequacy and completeness check of the structural design and static analysis and study with code name MTML_12-S-03 , referring to the P/V mounting system 'ELECTRA II' of the company GÜRSAN LTD*. |
| Inspection activities Έλεγχοι κατά την Επιθεώρηση | : Adequacy check of the static analysis issue of the aluminum tile type P/V mounting system and compliance check of the overall study with current regulations in force. Elaborate reference of: <ol style="list-style-type: none"> 1. Documentation 2. Basic Assumptions – Specifications 3. Results – Conclusions can be found in <i>Attachment 1: Assessment of competence of static analysis folder</i> |
| Place of inspection Τόπος Επιθεώρησης | : Headquarters of TÜV Rheinland Hellas in Elefsina, Greece. |
| Date(s) of inspection Ημερ. Επιθεώρησης | : 17/10/2012 |
| Requirements / Specifications Απαιτήσεις / Προδιαγραφές | : Standards EN 1990, EN 1991-1-1, EN 1991-1-3, EN 1991-1-4 and the National Anti-seismic Design Regulation (EAK 2000 – amendment of 2003) |
| Attachments Επισυναπτόμενα | : Attachment 1, Assessment of static analysis with code name MTML_12-S-03 |
| Remarks Παρατηρήσεις | : According to the strength results of the static analysis (see Attachment 1) the overall structural study meets the recommendations and provisions of the current regulations in force and also fulfills all structural and assembly requirements for the particular mounting system. |
| Date Ημερομηνία | : 21/12/2012 |

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| Inspector Επιθεωρητής | Kleanthis Papanikolaou |
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| Our Ref.No. | TÜVR – ALUMINCO AE IR02/2012 |
| Attachment 1 | |

ASSESSMENT OF COMPLETENESS OF STATIC ANALYSIS FOLDER

This inspection report includes an assessment of the structural design and static analysis adequacy of the P/V mounting system of the company GÜRSAN L.T.D.*.

1. DOCUMENTATION

The submitted documents for audit and assessment are the following:

- A) Static analysis report of Aluminco P/V mounting system**
- B) Spatial layout plans, parts assembly excluded**
Plan of mounting system of ELECTRA II P/V unit
- Fig.1 3D representation of the overall system, page 3 static analysis issue**
Fig.2 Zoom of the drawing - Picture 2.4 and 2.9, page 8-10 of static analysis issue
Fig.3 Zoom of the drawing - Picture named "sxedia.pdf"
- C) Structural designs of aluminum profiles – mounting elements**
- Section a: Picture 2.1 page 5 static analysis issue**
Section b: Picture 2.2 page 6 static analysis issue
Section c: Picture 2.3 page 7 static analysis issue
- Designs Aluminco:**
Section a: P5301-0913U0100000
Section b: P5301-402
Section c: same with Phaethon II system and code no PF038-007

2. BASIC ASSUMPTIONS – SPECIFICATIONS

Documentation elements A, B and C were subjected to compliance check with the following international standards: EN 1990, EN 1991-1-1, EN 1991-1-3, EN 1991-1-4 and the National Anti-seismic Design Regulation (EAK 2000 – amendment of 2003).

Detailed examination of the study and plans submitted showed the following:

- The static analysis and study with code name **MTML_12-S-03**, conducted by Dipl. Mechanical Engineer Emmanouel Stathatos using Finite Element Analysis, fully complies with the directions of the Eurocode and the EAK.
- The material of the frame is Aluminum alloy **AlMgSi 6063656**. Specifications:
 - Elasticity: E= 69 GPa
 - Poisson ratio: $\nu = 0.3$
 - Specific gravity: $\epsilon = 2.7 \text{ t/m}^3$
 - Yield strength: $f_u = 255 \text{ MPa}$
 - Failure stress: $f_o = 225 \text{ MPa}$
- For the modeling of tiles 3D CAD drawings are imported into the ANSYS Workbench software in the form of parasolid binary and they are displayed with appropriate 3D finite elements (tetrahedral of 10 knots and hexahedral of 20 knots where possible).
- Typical load values:

- **Wind load value:** $q = 1.02 \text{ kPa}$, for 1P that is for wind speed of **33 m/sec**
 $q = 1.23 \text{ kPa}$, for 2P
 $q = 0.94 \text{ kPa}$, for 1L
 $q = 1.11 \text{ kPa}$, for 2L

- **Snow load value:** $s = 1.40 \text{ kPa}$ for ground zone C altitude 100m
- **Dead load** of the P/V panels **0.15 kN/m^2** .
- **Erthquake induced dynamic load**, seismicity zone **III**, ground acceleration $a = 0.36g$, Seismic behavior rate of $q = 1.5$, structure importance factor $\gamma = 1$.

3. RESULTS - CONCLUSIONS

- **In conclusion, the static analysis and overall structural study meets the recommendations and provisions of the current regulations in force.**
- The results of all strengths – stresses for every possible inclination angle and loading condition are presented in detail in the static analysis issue with code name **MTML_12-S-03**.

* Important Note: Testing and certification does not include the verification of the numerical results of the submitted study. The sole responsibility of the correctness and authenticity of the numerical calculations and results of the study lies with the engineer - designer.

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Elefsina 21/12/2012

The inspector: Kleanthis Papanikolaou

