

AFERA CONFERENCE

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Quality Assurance in Adhesive Bonding Technology

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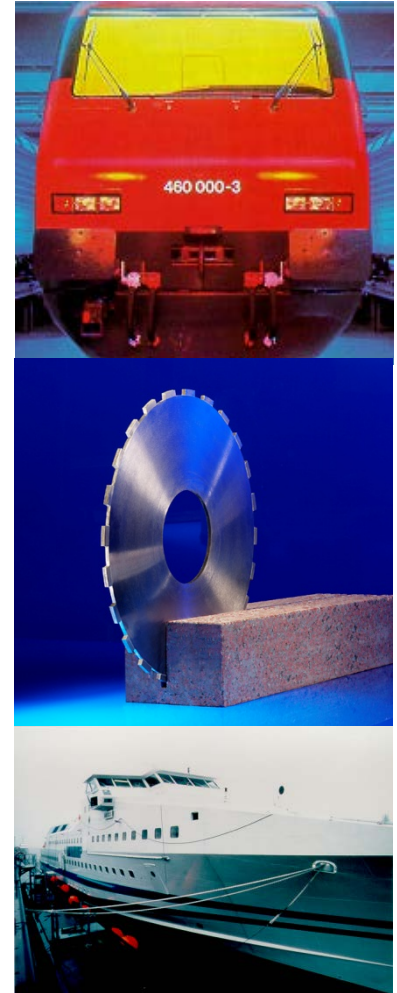
**Quality assurance
is
absolutely vital
in
adhesive bonding technology!**

Quality assurance measures in the bonding process

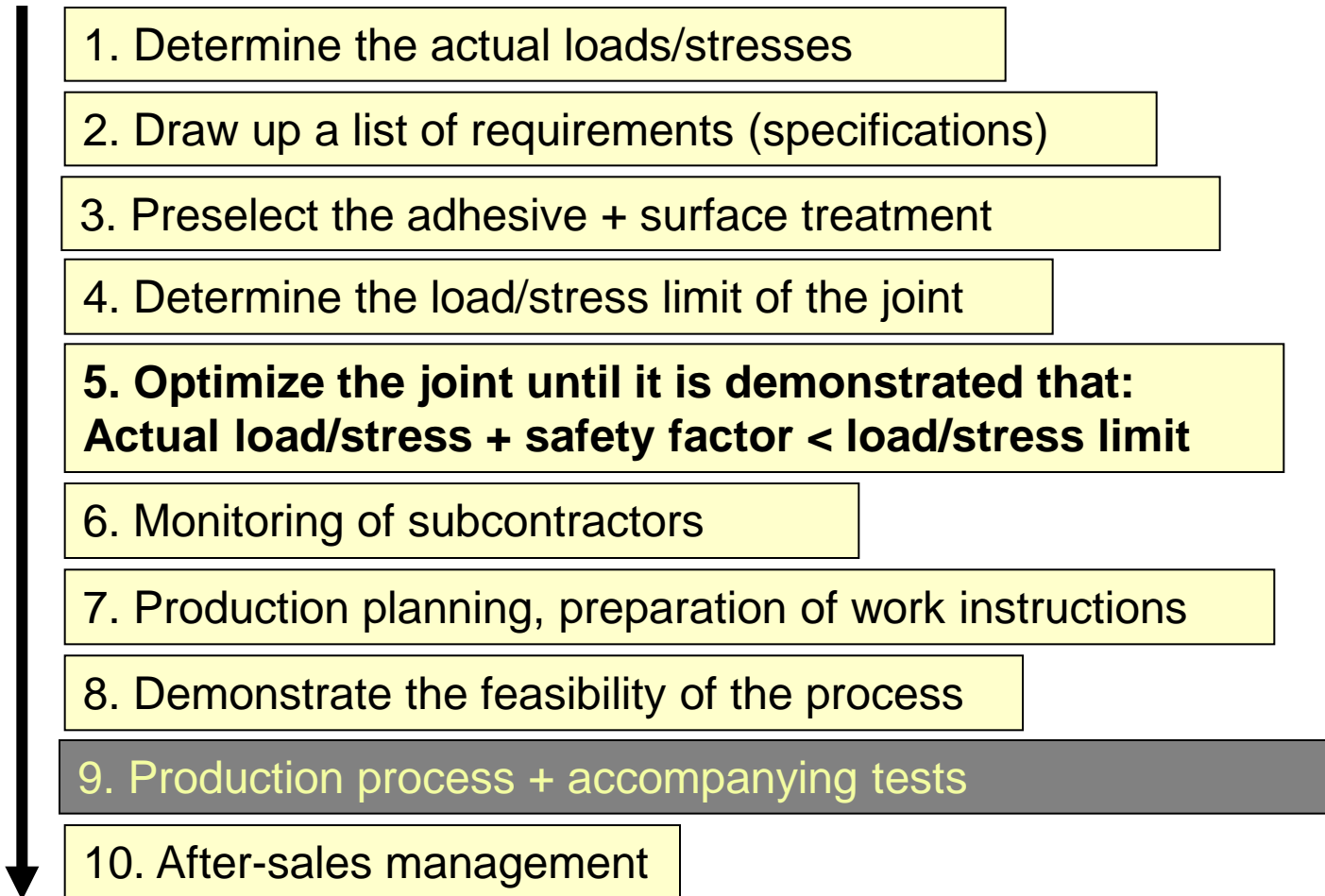
Concept: Split the bonding process into individual process steps.

Assure quality by:

- Carrying out all the required steps
- Observing the correct sequence of steps
- Verification of each step by carrying out suitable QA measures
- Additional supra-process QA measures
- Controlled information flows (in the process direction and backwards)



Quality management for the development of bonded products



Bonding in shipbuilding: High-speed ferry Lürssen Werft, Lemwerder, Germany

Source:
Lürssen Werft,
Lemwerder

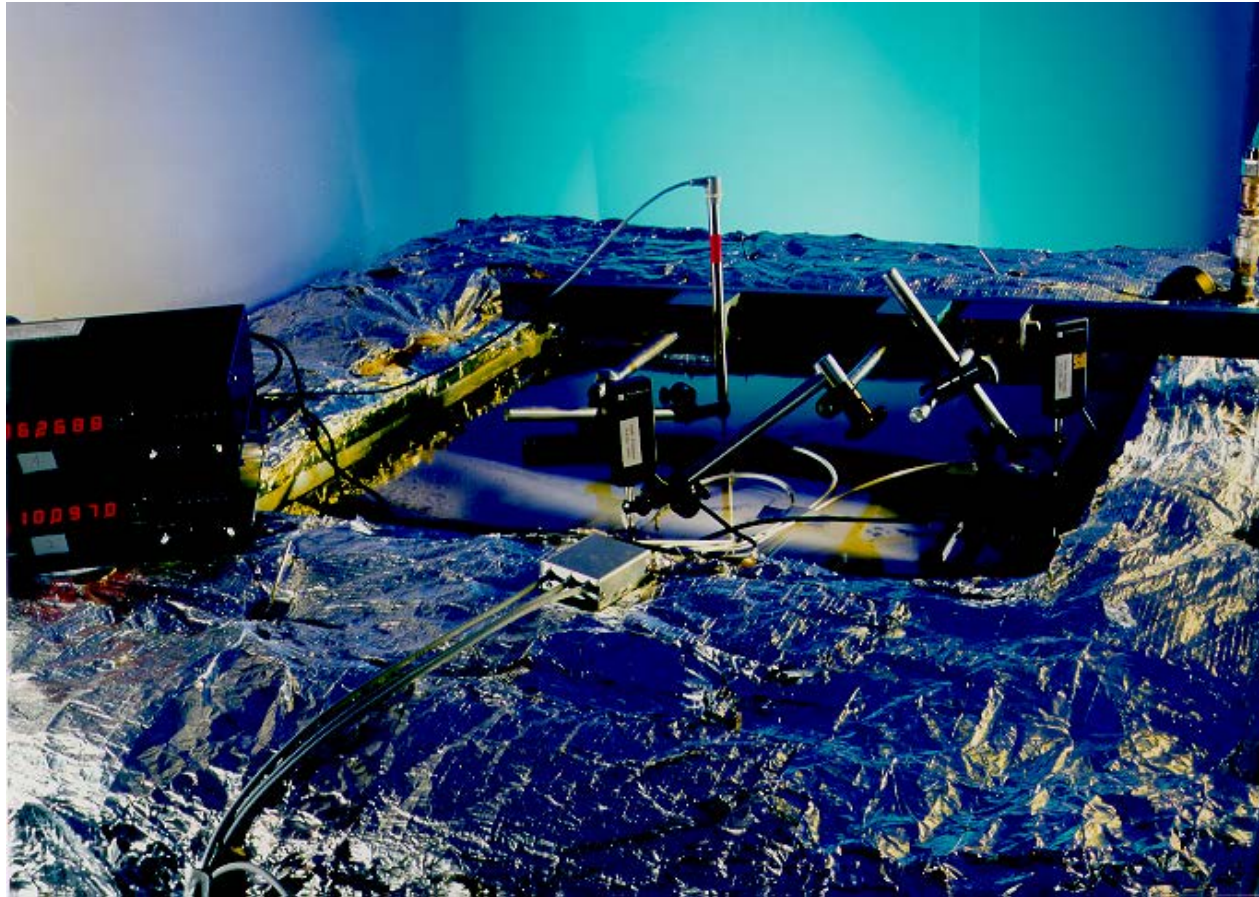


Bonding in shipbuilding: High-speed ferry Lürssen Werft, Lemwerder, Germany



Source:
Lürssen Werft,
Lemwerder

Specific quality assurance measures in the planning and development phase

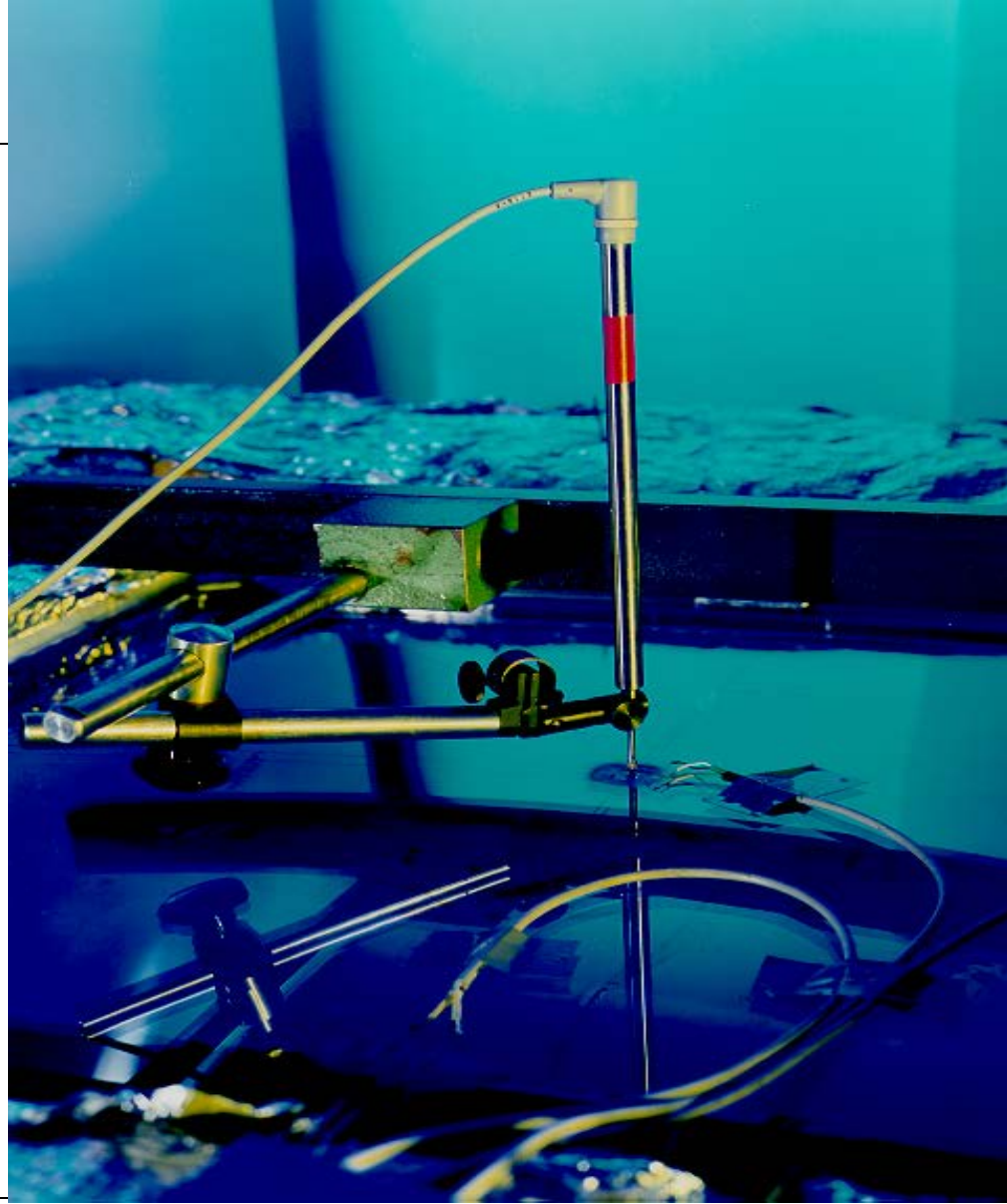


Evaluation of the load limit on a bonded window in a ship to demonstrate usage safety

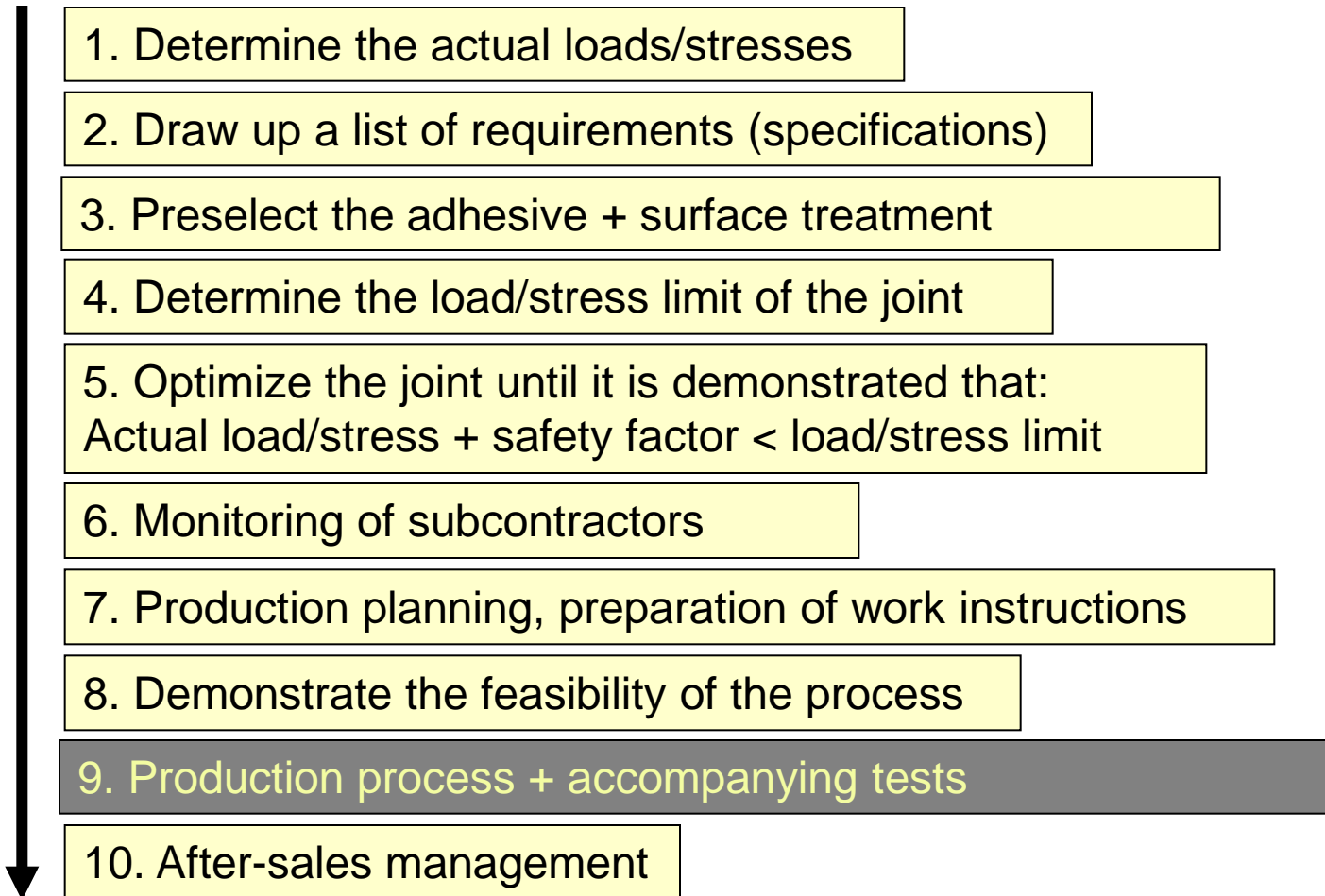


Specific quality assurance measures in the planning and development phase

Source: Lürssen-Werft, Bremen /
Henkel Teroson



Quality management for the development of bonded products



Quality assurance for existing production processes

Objectives:

- ◆ Zero-fault production
(prevent faults rather than have to rectify faults!)
- ◆ Customer satisfaction
- ◆ Quality statements to the marketplace
- ◆ Deliberate and controlled actions of employees
- ◆ Traceability / fault analysis

Quality management for existing production processes

Inspection of incoming tapes

Storage and transport at the company

Work environment/conditions

Preparation of substrate materials

Preparation of the adhesive and primer

Tape application

Joining and positioning/securing

Final quality inspection of the bonded joints

Maintenance and repairs

Final product inspection



Inspection of incoming tapes:

As-supplied state

- Checking delivered goods for their identity, any transport damage, completeness
- Reference samples
- Labeling of the tapes (date of receipt, expiry date)
- Visual inspection and tests

Quality assurance for existing production processes

Tests:

- Tack tests
- Peel tests
- Shear tests
- Wedge test
- Thickness
- several AFERA standards
- ...

Transport and storage at the company:

- Monitoring during transport (e.g. temperature sensors, data-logger)
- Storage management system (first in - first out principle)
- Monitoring during storage (data-logger, for example for temperature, humidity)
- Ban sources of contamination

Quality assurance for existing production processes

Production environment:

- Monitoring of the ambient conditions
- Restrict access for unauthorized persons and protect against contaminants

Preparation of substrate materials and tapes:

- Acclimatization (specify place, duration, temperature; monitoring)
- Inspection (damage, geometry, etc.)
- Accuracy of fit (specify; monitor using for example a test template)
- Surface treatment

Tape application:

- Use application aids
- Ambient conditions (e.g. time, temperature, humidity; monitoring)
- Optical inspection of the applied tape
- Take production samples

Quality assurance for existing production processes

Joining + positioning/securing:

- Specify the joining pressure and monitor this
- Check the position
- Use a suitable positioning device to secure the substrates in position
- Protect against any undesired loads after positioning

Testing of samples taken during the production:

- Destructive test methods (characterisation on original materials)
- Non-destructive test methods (...we have to think about...)

Quality management for existing production processes

Supra-company measures:

- ◆ Workforce training
- ◆ Documentation of quality-related data and processes and their relevance for a particular product
- ◆ Inspection of tools and test equipment
- ◆ Management of defective products
- ◆ Communication
- ◆ Specification of areas of responsibility
- ◆ Work organization

Adhesive bonding as a "special process": also valid for tapes

Special processes (DIN EN ISO 9000 ff.):

These are processes where subsequent monitoring, measurement or testing of the product using non-destructive methods does not allow the quality of the product to be fully verified (checked).

→ Process errors are only discovered during product usage.

Consequence:

- ☐ High production quality is a requirement of companies.
- ☐ The quality must be produced. It cannot be "tested".
This is why quality management is essential.
- ☐ The use of adhesive bonding puts new demands on employees.

Workforce training system for adhesive bonding technology



DVS®-EWF European Adhesive Bonder - EAB

Duration: 40 hours

Target group: Technical employees (production level)

Objectives: To understand and properly carry out work instructions

DVS®-EWF European Adhesive Specialist - EAS

Duration: 120 hours

Target group: Technical managers, supervisors

Objectives: To prepare and explain work instructions, to instruct and supervise employees



DVS®-EWF European Adhesive Engineer - EAE

Duration: 320 hours

Target group: Technical decision-makers

Objectives: Interdisciplinary thinking, decision-making, and actions for effective use of adhesive bonding technology

International workforce training system

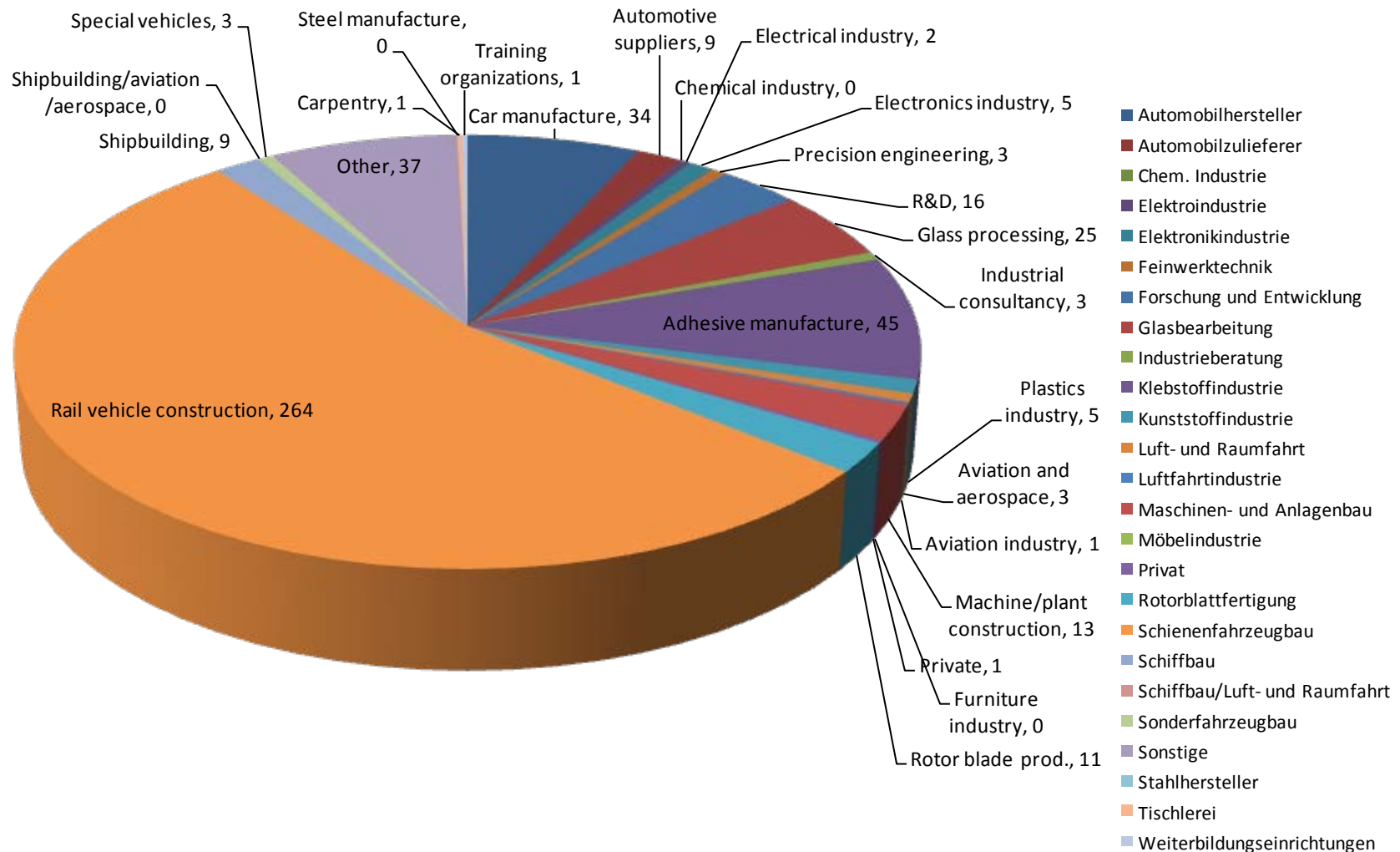
Fraunhofer IFAM

Status: 31.12.2012

**315 courses involving 4,468 successful participants
ca. 400,000 participant-hours**



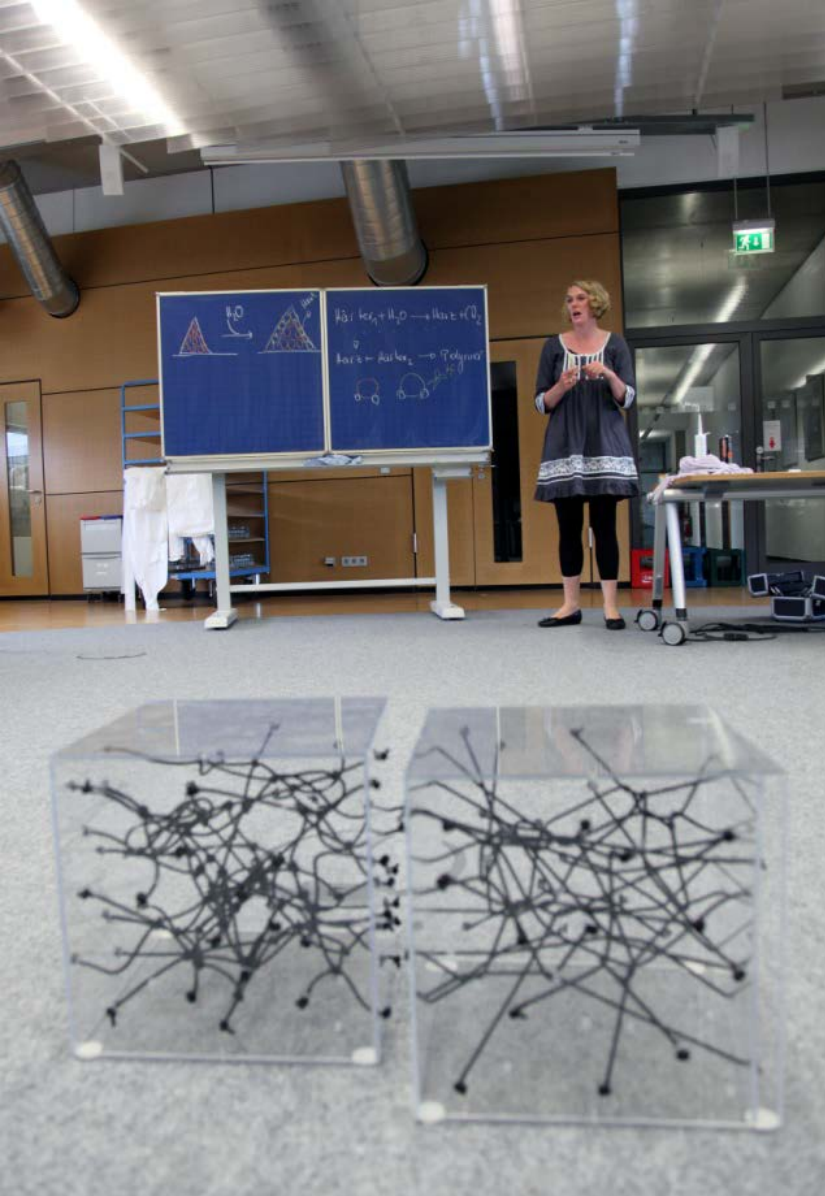
Industrial affiliation of course participants in 2012



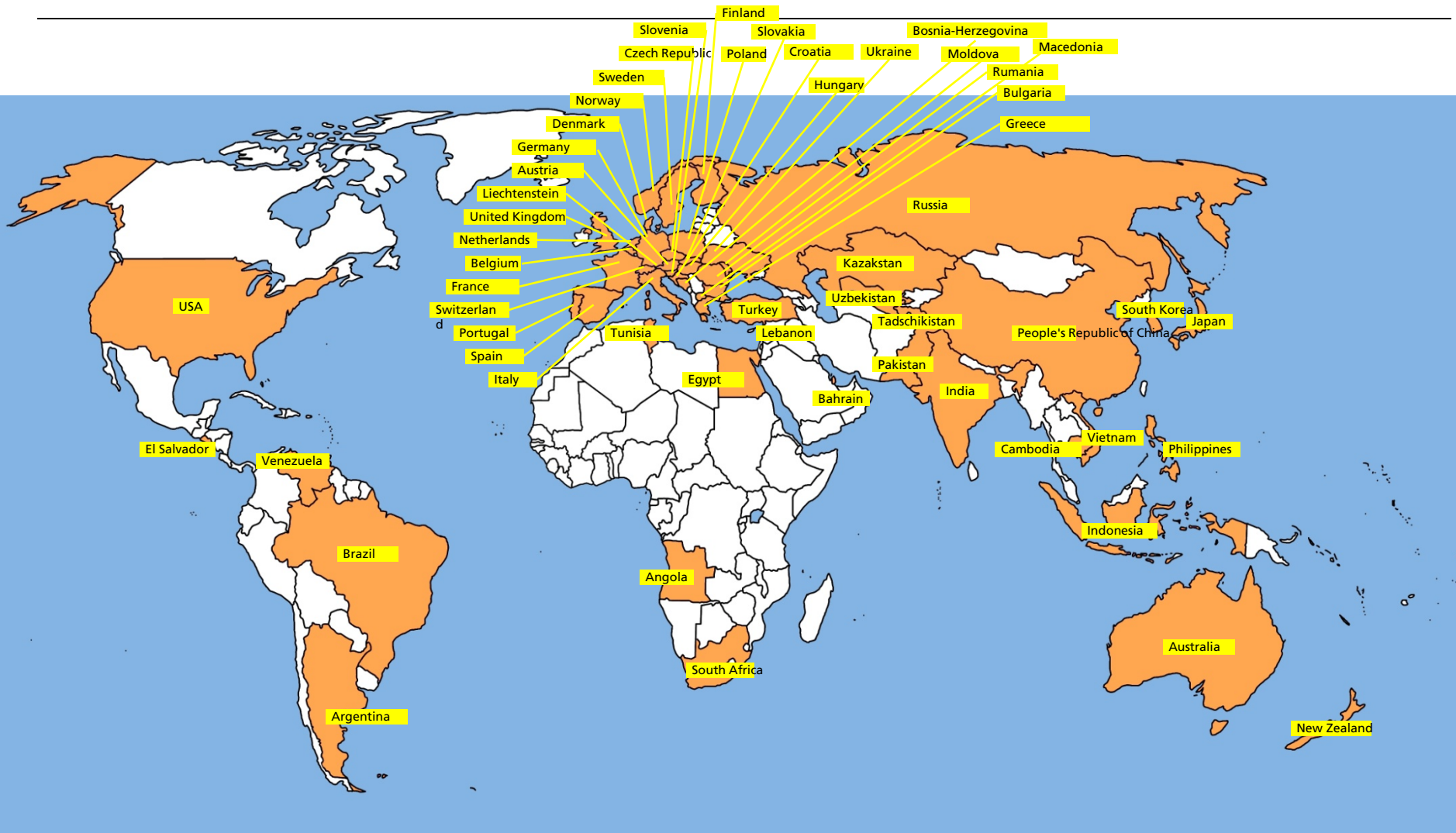
International partners

Partners abroad:

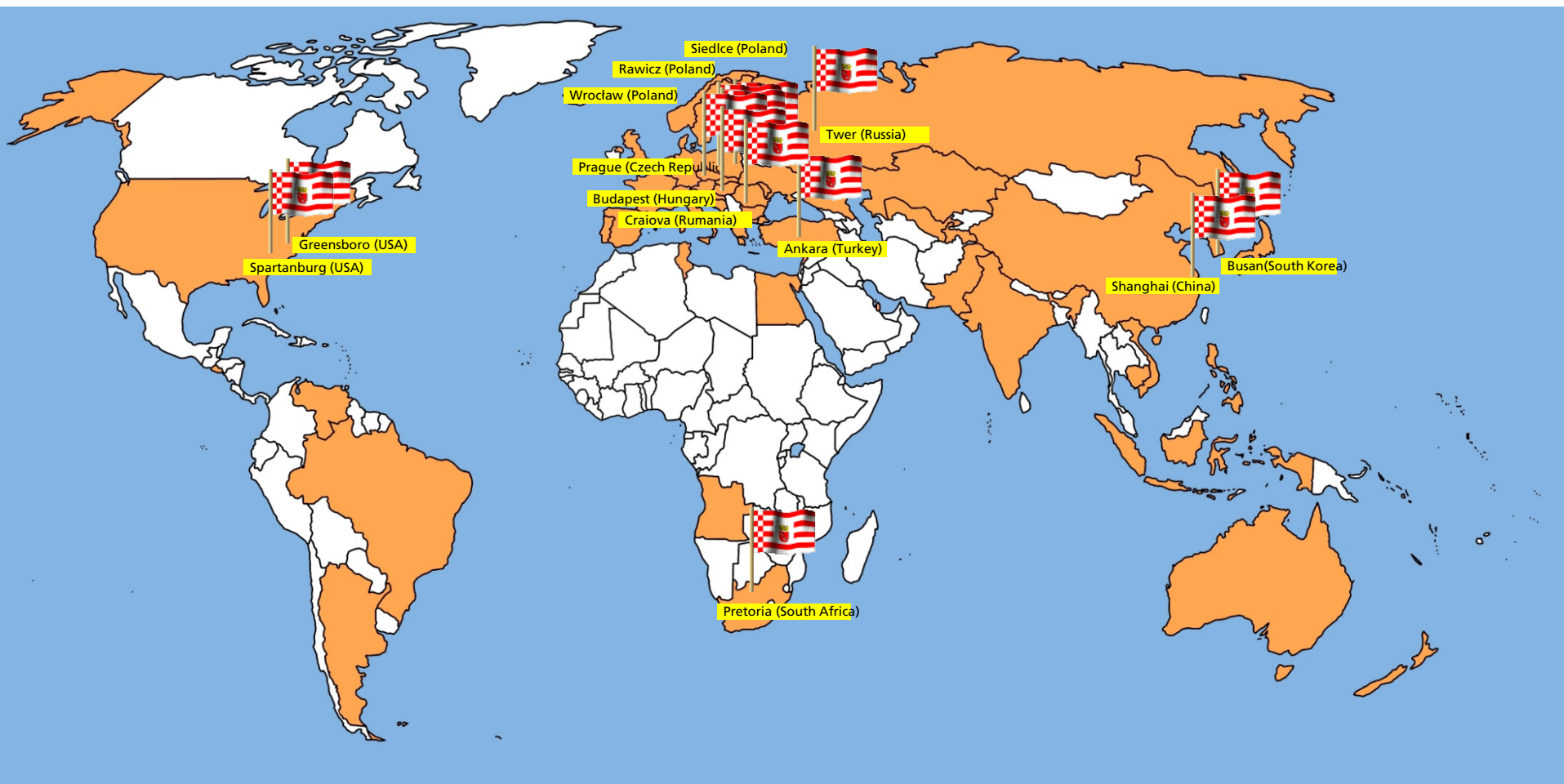
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Countries of origin of participants



International course venues



Standards and guidelines on quality assurance

DVS guideline 3310: Quality Management in Adhesive Bonding Technology

DIN 6701: Manufacture of Adhesive Bonds on Rail Vehicles and Parts of Rail Vehicles

Technical Bulletin of Germanischer Lloyd for Elastic Adhesives and Bonded Joints

DVS-EWF Guidelines for Workforce Training

DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E.V.	Klebpraktiker	Richtlinie DVS®/EWF 3305 (August 2001)	DVS®
DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E.V.	DVS®-EWF-Lehrgang European Adhesive Engineer – EAE	Richtlinie DVS®-EWF 3309 (September 2001)	DVS®
DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E.V.	Klebfachkraft	Richtlinie DVS®/EWF 3301 (August 2001)	DVS®
DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E.V.	Planung und Einrichtung von DVS®-Kursstätten für die Klebtechnik	Richtlinie DVS® 3306 (August 2001)	DVS®
DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E.V.	DVS®-Bildungseinrichtungen auf dem Gebiet der Klebtechnik Zulassung – Schulung – Überwachung	Richtlinie DVS® 3308 (März 1999)	DVS®
DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E.V.	DVS®-Bildungseinrichtungen auf dem Gebiet der Klebtechnik Zulassung – Schulung – Überwachung Gebührenordnung	Richtlinie DVS® 3308 Beiblatt 1 (März 1999)	DVS®



DIN 6701

- The DIN 6701 series of standards lay down the requirements for the special process of adhesive bonding.
These requirements are derived from the base standards for adhesive bonding technology, with consideration being given to the special requirements for rail vehicle construction.
- These standards apply for manufacturing bonded joints for the production and maintenance/repair of rail vehicles and parts of rail vehicles.
- DIN 6701 also valid for tapes

Objectives

- To make adhesive bonding for rail vehicle construction more efficient.
- To adapt bonding processes at companies to technological needs.
- To enable companies to better utilize the full potential of adhesive bonding technology.
- To give companies which comply with DIN 6701 a competitive advantage.

DIN 6701: Adhesive bonds on rail vehicles and parts of rail vehicles

Content:

Part 1: Key terms and rules

Part 2: Accreditation of user companies, evaluation of the compliance of parts/products

Part 3: Design guidelines and verification

Part 4: Rules for practical execution and quality assurance

A-Z compendium of the work group:

“Accreditation in accordance with DIN 6701-2”

DIN 6701: Adhesive bonds on rail vehicles and parts of rail vehicles

Class	Description	Definition Safety requirement
A1	Bonded joints of high relevance for safety	Failure poses a risk to life and limb or a risk to safe operation
A2	Bonded joints of average relevance for safety	Failure may pose a risk to operation, with injury to people, or to impairment of the overall functioning
A3	Bonded joints of low relevance for safety	Failure leads at most to reduced comfort / personal injury unlikely
A4	No own use of adhesives in production, no bonded parts/components are constructed, sold, or assembled	As A1 and A2

DIN 6701: Key issue - verification

A bonded joint must be sized such that the **load** it bears is smaller than the **load limit of the joint**.

It is the responsibility of the **SUPERVISOR IN CHARGE (SIC)** to ensure this is the case.

Construction and design principles and **construction methods** assist the verification.



**Quality assurance
is
absolutely vital
in
adhesive bonding technology –
Tapes are no exception!**
