QUALITY ASSURANCE

PRACTICAL HINTS

This chapter examines the practical issues of quality assurance for elastic adhesive and sealant applications

The proposals outlined here should be viewed as a general checklist to be adapted to the specific requirements of each marine manufacturing environment.

Particular attention needs to be paid to establishing an effective system of quality assurance for adhesive connections.

Testing of the adhesion, and therefore the reliability, is only possible by destructive means.

Visible inspection is only effective to a limited degree, so the quality of the bond line has to be assured by the following:

- Ensure the constance of the surface quality of the substrates to be bonded
- Correctly prepare the surfaces to be bonded
- Select the correct adhesive (as specified by the manufacturer)
- Apply (and cure) the adhesives correctly
- Respect engineering rules such as joint dimensions, etc.

If these parameters are maintained within the prescribed limits, then the quality, strength and durability of the adhesive bond is ensured.

In addition, there is little or no need to supplement these measures with time-consuming and costly destructive testing.

The following table (Quality Assurance Programme) shows that quality assurance begins at the project stage and continues throughout construction, right up to the final rollout of the product. It outlines a typical quality management programme for adhesive applications. This model has been adopted with very satisfactory results in many areas of OEM ship building and in the subcontractor segment of the marine industry.

QUALITY ASSURANCE PROGRAMME

PROJECT STUDY	CONSTRUCTION OF PROTOTYPE	END OF TEST PHASE	SERIAL PRODUCTION
Design and construction adapted to adhesive technology and assembly methods	Checking and specifying correct method of substrate preparation in consultation with adhesive and paint suppliers	Evaluation of test phase, making any design changes that may be indicated	Implementation of a quality assurance system
Dimensioning and configuration of adhesive joints based on existing codes of practice and design data	Construction of prototype based on design criteria for adhesive bonding. Adhesive supplier (applications engineer) to advise where necessary	Preparation of a production and quality assurance manual for adhesive bonding applications, taking into account the key application parameters of temperature and humidity	Periodic refresher courses and further training for personnel
Appointment of an in-house adhesives specialist to liaise between departments on all aspects of adhesive usage	Specifying type and scope of repair works	Training of assembly personnel in the use of adhesives	Introduction of activities aimed at raising quality standards (e.g. quality awareness groups)

In commercial enterprises that use adhesives in serial production, the sound working knowledge of adhesive technology needed is generally confined to a few individuals in technical departments. The policy of training one technician as an in-house adhesives specialist has proven to be an effective solution to making this information available on the production floor.

The trained person is also able to coordinate all aspects of adhesive usage for marine projects as a whole and acts as a neutral adviser to the individual departments concerned.

The following table highlights the main issues that need to be addressed.

MAIN POINTS OF CONSIDERATION FOR THE INTRODUCTION OF ADHESIVE TECHNOLOGY

ADHESIVE	Selected to suit the requirements of the production cycle and the service stresses to which the finished assembly will be subjected
SUBSTRATE	Consistent and sound composition and surface condition
SURFACE PREPARATION	Selected to suit the requirements of the production cycle and the service stresses to which the finished assembly will be subjected and to accommodate variances in unstable substrates (mould release in GRP, wood)
APPLICATION PARAMETERS	Working within the specified time limits (open time), taking account of temperature and relative humidity levels
JOINT DESIGN	Adhesive-friendly joint design, dimensioning of joints to suit functional requirements of finished assembly in accordance with manufacturers engineering rules. Think about a possible repair solution
STAFF TRAINING	External or internal training courses organized in conjunction with adhesive suppliers

The following table is a guide to the preparation of a quality assurance concept. The scope and frequency of the test regime will need to be adjusted to the scale of the project and to the availability of technical and manpower resources.

A GUIDE TO THE PREPARATION OF A QUALITY ASSURANCE CONCEPT

AREA OF RESPONSIBILITY	CHECKS AND CONTROLS	DEPARTMENT / PERSON RESPONSIBLE
ENSURING CONSISTENT QUALITY OF SUBSTRATE	Specification (name, brand, grade, supplier, chemical composition, manufacturing processes, details on mould release systems used, etc.) Release system (open mould, infusion)	Design and engineering
	Contractual agreements specifying quality and condition of substrate (duty to inform in event of changes)	Purchasing
	Checks on incoming deliveries (name, brand, grade, product characteristics) with adhesion tests (see Pre-Treatment Chart)	Quality assurance
	Correct storage (temperature, humidity, prevention of soiling, first-in first-out stock rotation)	Quality assurance / Logistics
PREPARATION OF SUBSTRATE	Specification (mechanical surface preparation, chemical products, type of application, processing schedule)	Design and engineering / Adhesives technician / Adhesive supplier
	Checks on incoming deliveries (name, brand, grade, visual inspection of packaging, labelling, product characteristics)	Quality assurance
	Correct storage (temperature, humidity, prevention of soiling, use of stock by expiry date)	Quality assurance / Logistics
	Subjective checks for visible defects in primers, etc. (E.g. cloudiness, sedimentation, thickening, smell), plus checks on expiry date	Quality assurance / Foreman
	Periodic checks on the correct application procedures (method of application, observation of recommended drying times, correct handling of primed components prior to assembly, etc.)	Quality assurance / Adhesive technician Adhesive specialist
APPLICATION OF ADHESIVE	Checks on incoming deliveries (name, brand, grade product characteristics, visual inspection of packaging, labelling, periodic adhesion tests[1)])	Quality assurance
	Correct storage (temperature, humidity, conditioning of stock to room temperature, use of stock by expiry date)	Quality assurance / Logistics
	Subjective checks for visible defects in adhesives (changes in consistency, flow behaviour, etc.), plus checks on expiry date	Quality assurance / Foreman
	Periodic checks on correct application procedures (method of application, observance of specified open times, correct joint assembly sequence, waiting times prior to further processing, etc.)	Quality assurance/ Adhesive technician Adhesive specialist

[1)] Adhesion tests are based on DIN 54457

Nowadays, bonding technology is a well accepted and proven practical assembly method. However if the correct application procedures are neglected, the bonded or sealed object will not comply with expectations. In fact the correct use of adhesives and sealants in marine applications should not be regarded any differently from other traditional industrial skills such as welding or painting. The only real difference is that applications use a wide range of different materials and subsequently this requires personnel with specialist skills and training.

This manual supplies all of the information necessary for the correct application of adhesives and sealants. However, should there be any doubt regarding materials, methods or applications, support and advice can be obtained from the Marine expert at the nearest Sika Industry organisation.

PRODUCT DATASHEETS AND SAFETY DATASHEETS

PRODUCT DATASHEETS (PDS)

The Product Datasheet describes the product characteristics as well as information about the area of application, advantages and application descriptions.

Before using Sikaflex® or other Marine products we recommend to download the actual Product Datasheets from the Internet.

As the legal part depends on the country of application, the Product Datasheet has to be downloaded from the national internet site. Choose worldwide and click on the respective country.

SAFETY DATASHEETS (SDS)

The Safety Datasheet helps to work safely with chemical products. This document has to be available to everyone which is in direct and indirect contact with chemical products.

The content of the SDS

- Identification
- Composition
- Hazards
- First-aid measures
- Fire-fighting measures
- Accidental release measures
- Handling and storage
- Exposure controls
- Personal protection
- Physical / chemical properties
- Stability and reactivity
- Toxicological information
- Ecological information
- Disposal considerations
- Transport regulatory information

Most up-to-date Safety Datasheet are available through the local sales organisation, or on www.sika.com.

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