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STRUCTURAL ADHESIVES - GUIDELINES FOR SURFACE PREPARATION OF METALS AND PLASTICS PRIOR TO ADHESIVE BONDING

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Strukturklebstoffe - Leitlinien für die Oberflächenvorbehandlung von Metallen und Kunststoffen vor dem Kleben

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Foreword

This document (EN 13887:2003) has been prepared by Technical Committee CEN /TC 193, "Adhesives", the secretariat of which is held by AENOR.

This. European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2004, and conflicting national standards shall be withdrawn at the latest by February 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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Introduction

Historically, surface preparation has required the use of solvents and reactive chemicals. However, it should be noted that the use of such materials is now generally deprecated and individual identified substances are becoming progressively banned throughout the EU. For these reasons, traditional procedures using, for example, chromic acid are – with one exception - not provided in this standard. In addition, such chlorinated solvents, as may be allowed by the Montreal Protocol and National laws, should only be used in enclosed systems. Even so, the use of these solvents is not generally supported by this standard. See also EU Regulation (EC) No 2037/2000 [1].

In order to achieve the optimum environmental durability from a bonded joint, the traditional preparative approach usually, though not necessarily, consists of three sequential steps:

— the removal of contaminants;

— physically induced modification of the surface;

— chemical treatment.

However, legislative pressure is driving development and with that the introduction of new methods. In these latter, the more hazardous oxidative treatments, and their associated disposal problems, are avoided. The corresponding introduction of less aggressive oxidising techniques, or the use of coupling agents, often allows the separate steps of the foregoing sequence to be advantageously combined. These new processes are largely proprietary and, where used, the coupling agents tend to be based upon silane chemistry. However, whatever the process, it is important to realise that while the effectiveness of the new techniques (presented here) is well established, general utility cannot be assumed. Consequently, it is necessary to demonstrate that any method selected is appropriate for the intended purpose and that the optimal conditions for the production process itself have been correctly established.

Some materials will bond far better than others and some will not bond at all without special treatment. The suitability of a surface for bonding depends upon the degree of surface preparation, the joint’s design, its function (joining, sealing, etc.) and the environment in which it has to perform.

Prior to bonding, some degree of surface preparation is required for most adhesives - but not all. Material surfaces that are particularly prone to weak or loose surface-layers, stress cracking or solvent attack usually require special treatment.

Following appropriate preparation, most engineering metals, or their alloys, can be bonded satisfactorily. However, the optimisation of the durability of a metal-based joint usually requires the introduction of progressively more complex and specific treatments.

The majority of both thermoset and thermoplastics materials can be prepared by commonly applicable techniques. Were it not for contamination and residual mould release agents, the thermoset plastics (e.g. polyepoxy and polyester composites) would bond well without any preparation at all. By contrast, most thermoplastics require careful preparation because of their low surface energy. However, while the techniques required are generally applicable there will often be differences in the process detail.

Some paints - especially the cataphoretic, water-based primers used by the vehicle industries, can provide an excellent surface for bonding. Nevertheless, a check of the stability of the interface below the paint is recommended. Sometimes the surface of the paint, even if fresh, can require treatment in order to raise its free energy and thus facilitate wetting.

Certain adhesives possess the ability to dissolve light oils and some polymeric materials. Consequently, for joints that are not "safety-critical" some surfaces do not require any preparation at all prior to bonding.

The various methods provided for cleaning and modifying surfaces are drawn from current and developing practice. The techniques described can be used in a variety of combinations to create the basis of a practical, preparative process that will provide enhanced environmental durability.

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