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# Overview of the test criteria examined in the approval tests of cleaning and washing agents

– Sheet-fed offset printing machines –

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## Overview of the test criteria examined in the approval tests of cleaning and washing agents – Sheet-fed offset printing machines

### Introduction

Since DRUPA 1990, low-emission cleaning and washing agents are available on the market. They are composed of very low-volatile hydrocarbon compounds, vegetable oils, esters of these oils or mixtures of these three material substances. At the launch of these products in the early nineties, technical problems regarding the compatibility of the cleaning agent with some printing machine parts like rubber rollers, machine paintwork, tubes or seals, etc. arose. To be able to lessen the emissions caused by volatile cleaning and washing agents in offset printing and to limit the risk of machine damage at the same time, printing machine manufacturers along with Fogra, the "Berufsgenossenschaft Druck und Papierverarbeitung" [German institution for statutory accident insurance and prevention in the printing and paper processing industry], the Bundesverband Druck und Medien [The German Printing and Media Industries Federation] and the trade union "IG Medien" [since 2001 part of ver.di] initiated the formation of a voluntary undertaking: The 'industry initiative for the reduction of solvent emissions in offset printing'.

The participants in this initiative have agreed upon the following recommendations for the use of cleaning and washing agents, based on the current state of safety engineering and environmental protection:

- Flash point over 55 °C
- Benzene content < 0,1 %
- Toluene and xylene content < 1 %
- Aromatic content [from C9] < 1 %

The following substances may not be used:

- Halogenated hydrocarbons
- Terpenes
- n-Hexane
- Secondary amines or amides
- Nonyphenol and its derivatives
- Ingredients whose use is linked with unacceptable health risks based

on the current state of knowledge regarding occupational health and toxicology.

Blanket and roller cleaning and washing agents that are employed on sheet-fed offset printing machines must be tested for their compatibility with the most important materials from the machine. These compatibility tests mainly include 3 areas:

1. Physical and chemical properties of the cleaning agent such as flash point, iodine number, non-volatile portions, viscosity, stability of the formulation, emulsification characteristics with water, miscibility with organic solvents and the water content of the cleaning agent.
2. Compatibility with elastomeric materials from the machine. These include ink, wash-up and dampening rollers, rubber blankets, as well as elastomeric machine parts like seals and rubber pipes.
3. Compatibility with metallic materials in the machine. These include durability tests on machine paintwork, printing plates and metal parts.

*The following document supplies a detailed description of critical test criteria. Washing and cleaning agents that do not obtain approval, often fail to fulfil one or more of the critical testing criteria. Other test criteria from the aforementioned overview do not usually present a problem.*

### Universally valid characteristics for every washing and cleaning agent formulation

#### A. Flashpoint

The flashpoint FP of the washing and cleaning is determined according to Pensky-Martens [DIN EN 22179 Issue1993/12 or ISO 2719].

The test is aborted in the case of non-compliance with the minimum flash point of FP > 55 °C.

#### B. Iodine number

The Iodine number [IZ] as the measured value for saturation of a compound gives information about the stability of the product [-> shelf life] and about the tendency towards auto-ignition. It is determined according to DIN/ISO 3961. The permissible maximum tolerance value for the IZ is 20.

## Critical testing criteria

### 1. Physical and chemical properties of the cleaning agent

#### 1.1 Stability of the cleaning agent formulation

Problems can arise in storage or in practical use in the washing system below certain temperatures or at room temperature/operating temperature due changes in the cleaning agents [e.g. flocculation of components or variations in concentration in the containers]. Solid components can cause blockages in automatic washing systems and thus make the use of the cleaning agent impossible.

##### *Test method: 'Stability at room temperature'*

To test the stability of the formulation, the cleaning agent is centrifuged twice for 20 min at 4000 revolutions/min. It is examined whether drops of slimy matter have collected on the base of the test tube or whether other visible changes such as precipitation have occurred.

##### *Centrifuge data:*

Hettich Centrifuge Universal 16 A  
Swinging bucket rotor with centrifuge tubes [filling capacity: 40 – 50 ml]  
Distance centre–centrifuge tube base during rotation: ca 132 mm

##### *Test method: 'Stability at lower temperatures'*

To test whether flocculation occurs in cleaning agents through cooling, 40 ml of cleaning agent is kept for 4 h at a temperature of -5 °C [Cryostat]. The cleaning agent is immersed in a cryostat bath [IPA–water solution] in a sealable test tube and the test tube is filled almost completely with cleaning agent. After 4 h it is examined visually whether changes, especially flocculation or phase separations, have occurred. It is recorded whether these changes are reversible at 10 °C [cleaning agent is stored at 10 °C for about 18 h] or at room temperature [20 °C].

#### 1.2 Emulsification characteristics with water and miscibility with organic solvents

The mixing behaviour with water is of particular importance in case of washing processes on printing machines. Emulsions can be formed, which can differ sharply in their viscosity characteristics from the undiluted product. Highly viscous or even solidifying aggregates can cause major problems in automatic washing systems. Similarly, possible changes in the fluid characteristics of the product or precipitation in contact with other organic solvents can take place. This can occur while replacing the cleaning agent in the washing system. Appearance of solids and changes in colour and viscosity are of particular importance. In case of products with such effects, use in washing systems cannot be recommended. The duration for which the emulsion [cleaning agent and water] remains stable is also recorded.

##### *Test method:*

The cleaning agent is mixed in appropriate mixing ratios [1:1, 1:9, 9:1] with water [water with a hardness of ca. 6 to 10° dH]. The mixtures are prepared in test tubes [20 ml] and thoroughly shaken by hand for 5 seconds. The mixture should be closely observed. The elapsed time must also be accurately recorded, along with observations regarding changes in colour, emulsification, changes in viscosity, stability of the mixture, etc. A final check and assessment is carried out after 24 h.

Further, the product is mixed in appropriate mixing ratios [1:1, 1:9, 9:1] with an organic solvent [white spirit – boiling range 145 °C to 200 °C and flash point of ca 35 °C]. The mixtures are prepared in test tubes [20 ml] and thoroughly shaken by hand for 5 seconds. The mixture should be closely observed. The elapsed time of the happenings must be recorded accurately, along with observations regarding changes in colour, emulsification, changes in viscosity, stability of the mixture, etc. A final check and assessment is carried out after 24 h.

#### 1.3 Determination of non-volatile residues and impurities

Sticky and/or non-volatile residues in the cleaning agent, which – particularly in the past – have repeatedly given rise to problems in printing machines [e.g. clogging of nozzles and pipes], are determined in this test.

##### *Test method:*

To determine sticky, non-volatile residues in the cleaning agent, the volatile components are eliminated in the drying cabinet for at least 24h by means of evaporation at 80 °C and atmospheric pressure. For this, a drying cabinet UFE 500 from Memmert is used. The air flap on the air slide valve is open to the maximum [fresh air regulation] and the ventilator speed [air circulation regulation] is set to 100 %.

3–5 drops [ca. 100 mg–150 mg] of the cleaning agent are placed on the lower plate of a previously weighed glass disc [Heidbrink flat weighing glasses] and covered with the top plate. The two plates are rubbed together to make the sample spread into a thin film. The mass of the applied cleaning agent is determined. Caution is needed that cleaning agent does not drip from the glass disc, as this can lead to deviations in measurement. The glass disc is placed in the drying cabinet at 80 °C [the top plate is lifted on to the hook of the cradle]. The testing time is 24 h. Weighing is done after cooling down to room temperature. The glass discs should be thoroughly cleaned between the different samples.

##### *Tolerances:*

The residues should not exceed 5 % for white spirits and high-boiling substances. The amount of cleaning agent that is left on the glass disc after attaining weight constancy is described as residue.

The residue values are separately evaluated for cleaning and washing agents which contain vegetable oils or which are designed as micro emulsions and water-based products with a high amount of surfactants.

## 2. Durability of non-metallic materials

### Durability of elastomeric machine parts

The durability of elastomeric pipe and sealing materials is tested according to DIN 53521 [Test of rubber and elastomers: determination of performance in the presence of fluids, vapours and gases]. The specimens are different material samples from pipes, cables and seals used in printing machines, which come or could come into contact with the cleaning agent.

The swelling tests are carried out in the undiluted cleaning agent.

Work is in progress currently to determine suitable reference materials that make a pre-test possible for the manufactures of washing and cleaning agents.

## 3. Durability of metallic materials

### Durability of machine paintwork and printing plates with respect to washing and cleaning agents

It is recommended to test the durability of machine paintwork and printing plates beforehand. Commercially available conventional as well as ctp printing plates should be tested to assess the durability of printing plates.

The criterion for durability is that the paint surface or the plate layer should not be attacked by the cleaning agent. Sheet samples with the appropriate machine paint can be obtained from the machine manufacturers.

#### *Test method 'Machine paintwork':*

Undiluted cleaning agent acts as the test medium if not otherwise specified by the manufacturer.

A cellulose pad, 1 cm x 1 cm in size, is placed on the machine paintwork sample sheet and soaked with cleaning agent [max. 10 drops]. The cellulose pad deters a lateral flowing of the test substance. One must pay attention that the cleaning agent is able to evaporate [the cellulose pads should not be covered!] during the test period of 4 weeks. The cleaning agent is not to be replenished.

The sample sheet is rinsed with water after 4 weeks and subsequently dried off with a lint-free cleaning cloth.

It should be monitored weekly, whether or not the cleaning agent has evaporated already. If it has evaporated, the test is to be terminated and assessed at this juncture, otherwise the condition of the sheet is examined after 4 weeks exposure time.

The evaluation takes place on the basis of an optical assessment in 4 categories:

Category 0:

no visible changes

Category 1:

light, visible changes

Category 2:

strong, visible changes

Category 3:

machine paintwork destroyed

A preliminary report is sent to the machine manufacturer in case of assessment in categories 2 and 3. The machine manufacturer then decides about the continuation or abortion of the test. Similarly, all changes in colour and form and other unexpected defect patterns are to be listed under 'Others'.

#### *Test method 'Printing plate durability':*

Fogra carries out a collective plate test for all machine manufacturers and types. The plates to be tested are selected by the plate manufacturers, updated when required and delivered. The selection was/will be complemented through products chosen by the machine manufacturers.

The plate test is generally carried out under yellow light. When testing UV cleaning and washing agents, the printing plates when provided for this treatment are first baked for 5 min at 230 °C – if they are designed for such treatment. Test strips of standard negative and positive printing plates [conventional as well as ctp] are exposed briefly with UV light [ca. 5 sec] – this simulates the influence of daylight in the printroom – and subsequently immersed in the cleaning agent for 10 min.

The cleaning agent is wiped off 3 times with a cleaning cloth applying a standard force of 12.5 N [adjustable with the Fogra 'Fiwi']. The magnitude of the staining of the ink-accepting layers on the cleaning cloth is a qualitative measure for the durability of the image on the printing plate.

The assessment is visual, based on the following criteria:

Category 0:

no staining or only very light staining on the cleaning cloth and no alterations or only very light visually noticeable alterations of the plate image.

Category 1:

Staining on the cleaning cloth and/or smudging of the plate image.

Category 2:

strong staining on the cleaning cloth and/or strong smudging of the plate image.

Category 3:

Destruction of the plate image



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