**The hot stamping foil with Diffractive Optically Variable Image Devices (DOVIDs) for commemorative banknote**

Technical specification

ANNEX 1 to the Purchase Contract for supply the hot stamping foil with diffractive optically variable image devices for the commemorative banknote

Ref. No. of the Buyer 097/OS/2020

1. **Technical requirements**
   1. Subject of the Contract

Two variants of Diffractive Optically Variable Image Devices (DOVIDs) for the banknote. It is a commemorative banknote that will be adjusted in a package with numismatic handling and will never be used in circulation. Design templates for the DOVIDs elements were processed by the final customer. The required designs are followings:

1. DOVID with the motif of the Order of T.G. Masaryk - Motif 1(Attachment No.2).
2. DOVID with the motif of a Heraldic Silesian eagle - Motif 2 (Attachment No. 3).

Subject of performance:

1. Two DOVIDs designs processed according submitted design template from the final customer (approved by STC and the final customer).

2. Two Master shims (approved by STC and the final customer).

3. Two holographic hot stamping foils delivered in rolls with required DOVIDs and registration marks (Pilot DOVIDs has to be approved by STC and the final customer).

The required volumes are:

1. Pilot DOVIDs - **500 pcs** of Motif 1 and **500 pcs** of Motif 2,
2. **36000 pcs** of DOVIDs with Motif 1 and **36000 pcs** of DOVID with Motif 2.

STC main requirements:

1. Metalized (Aluminium) hot stamping foil suitable for application on the 100% cotton banknote paper.

2. During the approval of Master and Pilot DOVIDs, the high emphasis will be placed on the sophistication and effects of DOVID, preservation of the finest details even after application, preservation of the brightness of the foil after application.

* 1. Design of DOVIDs

STC will provide to the supplier a design of the banknote, which includes the design templates for DOVIDs parts (see Attachment No. 1). STC will provide to the supplier a picture of the Motif 1 and drawing of the Motif 2 from the author of the banknote. The supplier must process the submitted designs (Motif 1 and Motif 2) into a functional holographic form of the security element.

Required DOVIDs should include some of following holographic features or their combination:

a) full 3D image in different colours (like laser hologram e.g. Eagle on VISA cards),

b) element with bass relief effect with suppressed colour or coloured,

c) Flip flop effect – „animation“(different images visible under different angle of view),

d) kinetic effect.

Motif 1

* Size: 36 x 36 mm (stamp size: 32 x 32 mm)
* Has to include a partial demetallization in the area of „blue rays“, the intensity of demetallization parts will increase from the centre to the edge (Attachment No. 2)

Motif 2

* Size: 53,5 x 78 mm (stamp size 53,5 x 74 mm) – please see the Attachment No.3
* Has to include a partial demetallization in the area of feathers on the wings (marked in Attachment No. 3)
  1. Technical requirements for the hot stamping foil with DOVIDs
* Description: embossing holographic banknote foil, hot stamping foil
* Metallization: 99,5% Aluminium

Partial demetallization

* Optical density: 1,65 O.D.
* Workability of the foil: easiest release
* Carrier thickness: high clarity 19 - 23µm polyester film
* Glue inside
* Roll size:

Outer diameter of the roll: max. 75 mm

Inner diameters of the core: one inch (paper or plastics)

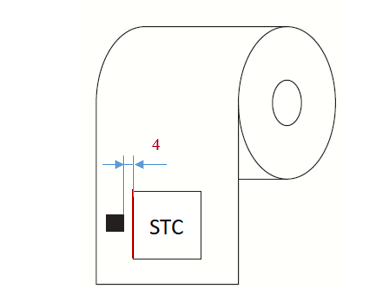
* Splice: without splices
* Vertical distance between two elements on the foil applied in one step: 90 – 109 mm (ideally 94 mm). STC can adjust the distance between productions on the paper within this range. The supplier should specify the repeating step according its technical possibilities in the offer.
* Register marks:

1. Motif 1 - Size of mark: 5x5mm, diffractive 360° (optical effect).

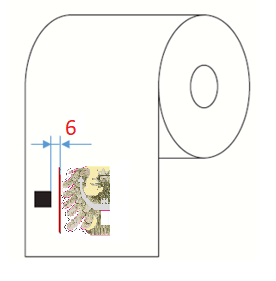
Distance between the registration mark and the reference edge of the motif: 4 mm (see the layout below).

1. Motif 2 - Size of mark: 5x5mm, diffractive 360° (optical effect)

Distance between the registration mark and the reference edge of the motif: 6 mm.

*Pic. No 1: Positions of DOVID design on the foil (demonstration for the Motif 1)*

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*Pic. No 2: Positions of DOVID design on the foil (demonstration for the Motif 2)*

* 1. Specification of the banknote paper
* Paper composition:100 % cotton
* Sheet size: 500 mm × 450 mm
* Size of banknote 194 mm x 84 mm
* Paper weight:100 g/m2

1. **Processing conditions**
   1. Application of the foil and related requirements

The application of the foil on the banknote paper will be process on the hot stamping machine in STC – Cavomit. There will be several passing of the foil through the machine by the application.

Application conditions:

The hot-stamping temperature should be not higher than 155°C.

Vertical distance between two elements on the foil applied in one step: 90 –109 mm (ideally 94 mm).

* 1. Production process

There will be used two kinds of printing for the banknote, which will take place in following

steps:

1. Dry offset printing on the banknote paper

2. Hot stamping of DOVID

3. Intaglio printing on the banknote paper with applied DOVID

Offset printing will be under applied DOVID and Intaglio printing will partly cover the DOVID

element.

**3 Quality requirements of the hot stamping foil and DOVIDs**

3.1 Quality of the hot stamping foil and DOVIDs

All the requirements for the hot stamping foil have to be fulfilled. There are no following defects acceptable with size bigger than 0,5mm: point defects, scratches, defects caused by excess of the Al metallization, defects caused by lack of metallization, impurities.

3.2 Quality of the hot stamping foil and DOVIDs after application

There are no following defects acceptable with size bigger than 0,5 mm: point defects, defects caused by deficient or absent of Al metallization, defects caused by lack of the metallization.

The appearance of the hot-stamped DOVIDs should be clear (glossy). After hot-stamping and gravure printing, there should be no obvious reduction as well as remarkable haze of DOVID image quality and all finest details of the element has to be maintained and visible.

3.3 Chemical resistance

The supplier has to prove that the hot stamping foil meets following parameters, if it will not be proved, STC will perform these tests at Pilot DOVIDs.

These indications are dependent on the type of paper utilized and adhesive material.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **reagent** | **concen.** | **time (min.)** | **temperature (°C)** | **results** | **comments** |
| ethyl alcohol | 96% | 30 | 23 | b | x |
| ethyl acetate | pure | 30 | 23 | c | slight gloss reduction |
| acetone | pure | 5 | 23 | e | slight gloss reduction |
| trichlorethylene | pure | 30 | 23 | b | slight gloss reduction |
| tetrachloroethylene | pure | 30 | 23 | b | x |
| ethylen glycol | 10% | 30 | 23 | b | x |
| toluene | pure | 30 | 23 | b | x |
| xylene | 100% | 30 | 23 | c | x |
| petrol. benzine (mix) | mixture | 30 | 23 | b | x |
| acetic acid | 20% | 30 | 23 | b | x |
| hydrochloric acid | 5% | 30 | 23 | b | x |
| sulfuric acid | 2% | 30 | 23 | b | x |
| sodium hydroxide | 2% | 30 | 23 | b | reduction of gloss |
| sodium hypochlorite | 10% | 30 | 23 | b | x |
| sodim sulfide | saturated | 30 | 23 | b | x |
| sodium sulfide | 10% | 30 | 23 | b | x |
| distilled water | - | 30 | 80 | b | x |
| grained soap | 10% | 30 | 80 | b | x |
| bioactive detergent | 1% | 180 | 23 | b | x |
| indrustrial detergent | 0,5% | 30 | 90 | b | x |
| alkaline sweat | - | 30 | 40 | b | x |

**Evaluation of the test:**a – no change; b – reduction of gloss; c – max. 20% removal; d – 20 until 50% removal; e – 50 until 80% removal; f – 80 until 100% removal.

The samples after test are compared with the standard sample. Alkali sweat is composed according to ISO 105-E04 alkaline sweat.

Hot stamping foil used for DOVID elements production has to fulfil chemical-physical conditions in paragraph 3.3 and chapter 4.

The Seller shall provide the written confirmation of compliance of the supplied hot stamping foil with chemical-physical conditions referred in paragraph 3.3. and chapter 4.

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The Buyer can undertake any test according to paragraph 3.3 or chapter 4 and verify compliance with the obligations hereof. If the hot stamping foil delivered by the Seller proves non-compliance with chemical-physical conditions according to paragraph 3.3. or with tests in chapter 4, the Buyer shall have the right to claim.

**4 Testing methods of the hot stamping foil**

4.1 Size measurement and appearance control

* Size: measure with a ruler.
* Thickness will be measured with micrometre.
* Image will be checked with the naked eyes.

4.2 Washing machine test

Test is carried out after the gravure printing.

Washing machine: All domestic washing machines

Washing time: 30 min (standard mode), 23°C

Detergent: All domestic detergents can be used.

How to insert the sample into the washing machine: Insert the samples and the banknotes with detergent with the cloth case which has the sample and the detergent 1g/l into the washing machine and then compare with the standard sample.

4.3 Freezing test

Test is carried out after the gravure printing. The samples put in the freezer box for 30 minutes at -18°C. The samples must be on the rubber pad without silicone and then compare with the standard sample.

4.4 Heat resistance

Test is carried out after the gravure printing. The samples put at the driers for 30 minutes at 135°C. The hot air must be circulated in the driers and then compare with the standard sample.

4.5 Xenon test

After the host-stamp application and gravure printing, put the sample at the lightfastness tester for 160 hours and the compare with the standard sample (ČSN EN ISO 105-B02).

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4.6 Crumpling test

Dry: after the hot-stamp application and gravure printing, crumple the 4 times with crumpling tester and then compare with standard sample.

4.7 Abrasion teat

After the hot-stamping and gravure printing, rub the sample with an ink rubber tester (use the 900 g weight) and then compare with the standard sample.

4.8 Tape test

After the hot-stamp application and gravure printing, conduct according to ASTM 3359 and then compare with standard sample.

4.9 Evaluation of the test

5: no change (less than 5% changed)

4: minor change (less than 20% changed)

3: considerable change (less than 50% changed)

2: major change (more than 50% changed)

1: element disappeared

|  |  |  |
| --- | --- | --- |
| **Durability Test** | **Test condition** | **Requirement** |
|  |  |  |
| Washing machine test | standard mode, 30 min | **2** |
| Freezing test | 30 min; -18°C | **5** |
| Heat resistance | 30 min; 135°C | **4** |
| Xenon test | ČSN EN ISO 105-BO2 | **4** |
| Crumpling test | dry testing | **3** |
| Abrasion teat | Rubber tester 900 g | **3** |
| Tape test | ASTM 3359 | **4** |

**5 Storage conditions**

The rolls of hot stamping foil with DOVIDs will be packed in boxes, marked with a label with basic description of the product, a batch number, a number of rolls, a date of production.

1. **Attachments**

6.1 Attachment No.1: Design of the banknote

A picture containing whiteboard

Description automatically generated

6.2 Attachment No. 2: Design of the Motif 1

Diagram

Description automatically generated

* DOVID border and size - red marked; stamp border (die contour) and size – black marked

6.3 Attachment No. 3: Design of the Motif 2

Diagram

Description automatically generated

* DOVID border and size - red marked; stamp border (die contour) and size – black marked
* Grey part – whole holographic or partial demetallized
* Yellow part - Gold toned printed background