Mühlbauer
High Tech International

Mühlbauer ID Services GmbH

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Specialized equipment for personalizing passports/travel documents with polycarbonate data page

Technical Data Sheet

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Document History

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1 Compliance Confirmation – Annex "Technical Requirements"

Technical requirements for the specialized equipment (system) for personalizing passports/travel documents with polycarbonate data page

Technical Requirement			Mühlbauer conformity
Equipment and accessories – non-refurbished, produced after 01.01.2025. All requirements are minimum and mandatory.			Compliant
Field of use: Personalization of passports, ID-3 format, having a polycarbonate data page (page 2) using laser engraving technology, applies a full color print on the observation paper page (page 3) using inkjet printing technology, enables the encoding of personal data into the integrated contactless chip and integral inspection of the personalized passports.			Compliant See Chapter 2
General technical requirements for the specialized equipment (system) for personalizing passports/travel documents with polycarbonate data page: **I. The main components of the specialized equipment (system):**			
1.	**Built-in computer with hard disk, licensed operating system on which software from the manufacturer will run for operating the personalizing system and the integrated equipment**		
	1.1	Integrated digital control panel (touchscreen) min.8"(inch);	Compliant See Chapter 2
	1.2	TCP/IP system connection via Ethernet, LAN (1Gbit);	Compliant See Chapter 2
	1.3	Licensed operating system: min. Windows 10;	Compliant See Chapter 2
	1.4	External connectivity: min. HDMI, USB (optional)	Compliant See Chapter 2
	1.5	The parameters of the computer (computing unit) CPU/RAM/Storage must correspond, and have sufficient redundancy, to the minimum cumulative operating requirements of the Windows operating system and the integrated software system set by the manufacturer.	Compliant
2.	**Input unit:** with capacity of hold minimum 30 pre-opened booklets (34 pages passport).		Compliant See Chapter 2.1
3.	**Identification unit:** for reading a barcode printed on a label located at the outside back cover of the booklet or pre-programmed number from the chip.		Compliant See Chapter 2.3.2
4.	**Chip encoding unit:** with programming heads for contactless chip encoding. **NOTE** ** There are no restrictions related to the manufacture of the chip encoding component exclusively by the equipment supplier. This component can be made either by the equipment vendor or by using a third-party integrated component.* *** Regardless of who is the manufacturer of the chip encoding component used in the specialized equipment delivered for the personalization of passports, they must be accompanied by all necessary licenses, if applicable, related to the Intellectual Property Rights throughout the stated lifetime and without any limitations of the number of documents produced (type ID-3) through this equipment.*		Compliant See Chapter 2.3.3
5.	**Laser engraving unit:** for applying photograph, personal data and MRZ onto the polycarbonate data page (page 2 of the passport). This unit should contain a fiber laser, which can automatically apply the MLI security feature. **NOTE** ** There are no restrictions of engineering design and fabrication during manufacturing of the laser engraving component to apply the security features. This component can be made either by the equipment vendor or by using a third-party integrated component.*		Compliant See Chapter 2.5

	*** Regardless of who is the manufacturer of the laser engraving components used in the specialized equipment supplied for the personalization of passport, they must be accompanied by all necessary licenses, if applicable, relating to Intellectual Property Rights for the entire stated life period and without limitation of the number of documents produced (type ID-3) through this equipment.*	
6.	**Inkjet printing unit:** for applying the photograph and personal data onto the observation page (page 3) of the passport. This unit should contain a DoD Inkjet industrial printer, using inks CMYK and UV to print on the observation page (page 3) in full color and full color UV or monochrome UV	Compliant See Chapter 2.3. and 2.4
7.	**Verification of the applied data:** The system should ensure the quality control and assurance of personalization by verification of the personalized data.	Compliant See Chapter 2.5.6
8.	**Output unit:** with capacity of hold minimum 30 pre-opened booklets (34 pages passport).	Compliant See Chapter 2.6
II. Functional technical requirements of personalization equipment:		
•	Automated passport personalization system with a polycarbonate data page using laser engraving technology, full color printing of the observation page using inkjet printing technology, encoding of personal data in integrated contactless chip and full inspection of the personalized passport.	Compliant See Chapter 2
•	Personalization of ID-3 format passports with polycarbonate data pages (ICAO 9303 compliant): Width: 88±0.75 mm, Height 125±0.75 mm. according to ISO/IEC 7810.	Compliant See Chapter 2
•	Markup of textual data (TTF fonts), vector, raster graphics (images, signatures), as well as one- and two dimensional barcodes (including QR codes).	Compliant See Chapter 2.5.3
•	Ensure the precise engrave alignment for the data page (page 2) and the precise print alignment for the observation page (page 3).	Compliant See Chapter 2.5.
•	Standard laser personalization features such as: transparent window, ghost image, tactile elements; advanced security features such as MLI.	Compliant See Chapter 2.5.
•	Coding system for contactless microcircuits according to ISO 14443.	Compliant See Chapter 2.3.3
•	Data transfer rate: up to 424 kBit/sec.	Compliant See Chapter 2.3.3
•	Production capacity: minimum 100 passports per hour.	Compliant See Chapter 2.
•	The data format regarding the personalization and reporting works will be in XML format (min. UTF-8 (mandatory), Unicode (optional)).	Compliant See Chapter 2.8
•	Power supply: 230VAC± 10%, protection min. 10A, frequency 50/60 Hz.	Compliant See Chapter 2
•	Noise level: maximum 70 dB(A).	Compliant See Chapter 2
III. Technical requirements for the Laser system:		
•	Fiber laser with a minimum power of 20W.	Compliant See Chapter 2.5
•	Impulse width and/or power: adjustable.	Compliant See Chapter 2.5
•	Resolution: minimum 600 dpi.	Compliant See Chapter 2.5
•	Cooling: air – air.	Compliant See Chapter 2.5
•	Lifetime: min. 60 000 hours of operation.	Compliant See Chapter 2.5
•	Compliance with environmental conditions: room temperature min. 20 °C to 26 °C; humidity: min. 40% to a maximum of 60%.	Compliant See Chapter 2.5
IV. Technical requirements for the Inkjet Printer system:		
•	Type: Drop on Demand printer (DoD).	Compliant See Chapter 2.3 and 2.4
•	Resolution: minimum 600 dpi.	Compliant

	See Chapter 2.3 and 2.4
• Number of colors: 4 (yellow, magenta, cyan, black) and support of full color UV or monochrome UV printing.	Compliant See Chapter 2.3 and 2.4
V. Work desk support for each specialized equipment:	
• Work desk with integrated slots for cable management,	Compliant See Chapter 2.11
• Mounted on rollers with locking brakes.	Compliant See Chapter 2.11
• Open shelves for rack-mounted device.	Compliant See Chapter 2.11
VI. Commissioning services and support:	
Support services at the Beneficiary's premises and/or remotely (as applicable) for the adjustment and integration of the integrated operating system during the period of equipment preparation for commissioning according to the Beneficiary's requirements, including:	Compliant See Chapter 4.1.4
• Adaptation support with the national document production system at the Buyer's headquarters and remotely (if applicable) at the equipment commissioning stage;	Compliant See Chapter 4.1.4
• Supply of spare parts kit (both tools and spare parts) which will enable the Buyer's technical team to perform level 1 and 2 interventions to replace any defective items that could stop the equipment from working;	Compliant See Chapter 4.3.6
• Training on the operation of new equipment and interventions for the primary remediation of level 1 and level 2 technical deficiencies, as well as the replacement of spare parts by the technical specialists of the Buyer;	Compliant See Chapter 4.2
• Providing accompanying documentation: - The technical passport, including the manual(s) for the use and maintenance of the equipment in English; - Technical documentation related to the software product used, including equipment interfaces with examples of integration into the personalization system:	Compliant See Chapters 4.2, 2.12 Compliant See Chapter 2.12.
• Configuration and personalization of passport models (polycarbonate data page and personal data onto the observation page (page 3) provided by the Buyer (personalized model for each type of document):	Compliant See Chapter 2
• The Bidder shall include in its bid SDK (software development kit), proper integration documentation and support services for integration with a third-party software developer of the customization system contracted by the contracting authority.	Compliant See Chapter 3
VII. Warranty	
Warranty: min. 36 months (after delivery, commissioning and signing of the act of receiving and handing over the goods). All costs of resolving warranty cases including spare parts are borne by the manufacturer. **For the resolution of warranty cases as well as in the case of receiving technical assistance requests, the following reaction times will be observed:** - *Telephone response time – up to 2 business hours;* *Reaction time for diagnosing the equipment and determining the cause of the malfunction, including remotely (if applicable) - up to 8 working hours;* - *Reaction time for restoring the functionality of the equipment including remotely (if applicable) with the use of spare parts available in stock - up to 5 working days;* - *Reaction time for restoring the functionality of the equipment with the use of spare parts not available in stock - up to 15 working days, except for the time used for customs procedures;* ***Working hours - from 8.00 a.m. to 5.00 p.m., according to the time zone of the Republic of Moldova. Working days - according to the calendar of the Republic of Moldova.***	Compliant See Chapter 4.3.

The supplier shall present a statement that the equipment will be maintained and repaired for a period of at least 10 years with the assurance of the availability of parts during this period.	Please refer to attached documentation in our bid: #09.1_OEM_Confirmation of Equipment Warranty.pdf and #09.2_Bidder_Statement of Use.pdf

2 IDENTIFIER 60 NOVUS

Picture: Sample configuration IDENTIFIER 60 NOVUS

The IDENTIFIER 60 NOVUS is a new and optimized modular solution for the personalization of passports. Optimization of the system dimensions and weight have been performed with this system generation as well. A further benefit is the extension capability with additional personalization processes like inkjet printing or laser engraving.

Every IDENTIFIER 60 NOVUS will be provided with CE declaration certificate upon delivery.

The passbook is fed in opened format into the machine system. From here the booklet is guided to the machine`s internal personalization processes. The machinery can be configured with several options to enable a high quality personalization result. After all processes are completed the personalized passport booklet is forwarded to the output slot of the machine system - checked and ready for issuance.

Specification of Material

- Passbook with Paper Data Page or PC Data Page, suitable for personalization
- Booklet dimensions according ID-3 format (ICAO 9303 compliant)
  Other dimensions on request
  Sizes closed: Width: 88 ±0,75 mm Height: 125 ±0,75

- For Electronic Passports:
  - microprocessor modules
    ISO 14443 conform chips for contactless biometric applications
    Special adaptation to other applications possible upon request

System Operation

Power Supply	▪ Voltage 110 /230V, ± 10%, external protection 16A
	▪ Frequency 50/60 Hz
Sound Level	▪ approx. 66 dB(A)

System Connection	▪ TCP/IP via Ethernet, LAN External connectivity: HDMI, USB
Operator Interface	▪ User friendly integrated colored touch screen for system operation ▪ 10.1” touch monitor, 1280 x 800 pixels)
Signal Light	▪ LED technology ▪ Fits perfectly to the innovative machine design ▪ Smoothly integrated in machine housing for easy machine status observation

Performance
Based on an ICAO layout the machine is able to produce up to 120 PP/h.

Layouts
For personalization and verification application the installation of three (3) different layouts is included in the IDENTIFIER 60 NOVUS. These layouts have to be provided before training and FAT in the delivering factory. Additional layouts or readjustments during or after installation at the customer’s site will be billed based on working time, travel expense and material.

Production Environment Recommendation
Clean and dust-free card production area during production and downtime
Stable and continuous environment temperature with favorable working point between 23°C ± 3°C
Stable and continuous environment humidity with favorable working point between 50% ± 10%
For high quality production results an atmospheric overpressure inside the production room is recommended
Removal of exhausted air out of the production room by appropriate building installations and/or facilities

Quality Assurance Recommendation
Mühlbauer highly recommends a system configuration with an integrated booklet verification unit. This integrity check supports the general manufacturing quality assurance processes in a significant way. It does not replace the general quality control processes of the production including manual quality assurance. These are still part according customer and product individual operations and have to remain.

2.1 Magazine Input Module

The input module is a combination of a lift system and a booklet magazine. All booklets are filled into a magazine. A lift system picks the booklets out of the compartments of the magazine and delivers it to the machine transport.

This magazine handling enables a secure, protected handling of the passbooks. It also enables a quick loading of the personalization system with passbooks.

Magazine quantity is listed separate in the offer. Additional magazines are available for extra charge to be able to fill the additional magazine during the run of the first magazine.

2.2 Magazine for Passports

The minimum need is one magazine to operate the machine. This magazine must be placed inside of the machine for correct machine operating.

Benefit of additional magazine can be filled outside of the machine and then easy exchanged with the empty magazine inside of the machine.
That simplifies the support of continuous production.

The magazines, which is delivered for the machine is equipped with 30 compartments to store 30 booklets with 32 visa pages for personalization.

To process booklets with another quantity of visa pages (96, 64 etc.) the magazines are adjusted from Mühlbauer on separate request. This can mean that less than 30 booklets can be stored in the magazine.
The filled magazines are placed in the input module of the personalization system, which guides them to the work position to single the booklet and to bring the booklet into the transport system of the machine.

2.3 Combined Process Frame Inkjet Printing

2.3.1 Basic Combined Process Frame Inkjet Printing

The Combined Process Frame Inkjet Printing is an extension frame of Mühlbauer's IDENTIFIER 60 NOVUS booklet personalization system for the optical personalization of the holder page (also known as page #2) and the opposite site of the opened document (page #3) by high quality inkjet printing technology.
This frame element can be equipped with further functional processing units as option, such as:

- Booklet serial number capturing by vision system
- Electronic chip programming
- Precise print alignment for holder page (page #2) by vision system
- Precise print alignment for opposite site of the holder page (page #3) by vision system
- Quality control and assurance of personalization by verification of the personalized data

2.3.2 Extension Booklet Serial Number Detection by Vision System

For the personalization process it can be necessary to give the serial number of a passport booklet to the machine control system.

In the case of a pre-numbered booklet (pre-printed number on visa page or perforated number on the visa pages), the module enables the detection and reading of the serial number by an OCR Vision System.

General Technical Demands

OCR
(**O**ptical **C**haracter **R**ecognition)

The goal of OCR is to recognize a character sequence (e.g. serial number) in order to prevent data mismatch or for Data matching; OCR requires a non-proportional font (e.g. OCR-B), a font height > 2,50 mm and a character line width > 0,20 mm. Background of text must be homogenous with good contrast to foreground.

Basic Configuration

Standard camera for image processing
Special LED illumination with white and IR (850nm) light

Remark:

If the machine is equipped with the Alfresco® process module than the serial number detection is only for page 3 available. Additional will be recommended that that the serial number (mostly perforated) is located to the spine with a distance of minimum 10 mm.

2.3.3 Extension Electronic Chip Programming - MB 1301 Reader

For the electrical personalization of ePassports, one (1) multifunctional contactless chip encoding system is integrated and secured in the encoding unit.
The system is designed to perform the chip encoding via coding DLLs. Specific DLLs can be developed to perform BAC, SAC or EAC. Note: DLLs are not part of the machine itself.

Technical Data of Reader

Type:	Mühlbauer standard contactless reader - MB 1301
Transponder frequency:	13.56 MHz
Transfer rate:	Up to 424 kBit/s
Supplied protocols:	ISO 14443 type A and B ISO 15693, Mifare, Mifare+

2.3.4 Extension Print Alignment – Page #3 by Vision System

For the positioning of the print on the opposite site of the Holder Page (Page #3), the printing system gets extended with an extended vision system.

2.3.5 DOD Inkjet Printing Unit - Standard

The Standard DOD Inkjet Printing Units consists of an inkjet system using drop on demand technology (DOD), for printing of “full color” images and text data onto the holder page and the opposite site of the already opened booklet.

Printer Characteristics

Type:	Drop-On-Demand printer
Typical Print Resolution:	600 DPI
Number of Colors	4 (yellow, magenta, cyan, black)
Expected Life Span	approx. 150.000 passports

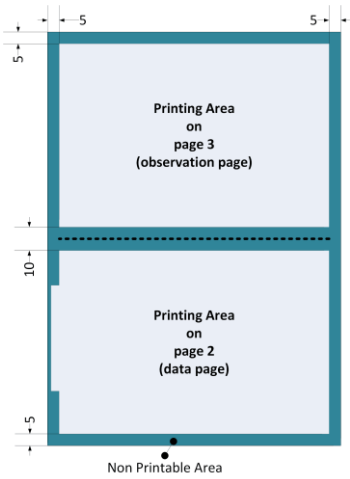
Inks for Passbooks with pure Paper Page(s):

- MB-Ink-yellow
- MB-Ink-magenta
- MB-Ink-cyan
- MB-Ink-black

Notes:
If the printer won't be used, it's necessary to clean the printing system and the dedicated print head. Print tests are required to check the print head functionality. A general cleaning procedure is recommended on daily base, explained on documentation.

Printing Areas

Sample booklet opened in format



Printing areas and restrictions on pages #2 and #3

Notes:
The printing areas are wider than defined by ICAO 9303 so that this system fulfills the optical personalization demands for standard passports.

Throughput
The performance of the Standard DOD Inkjet Printing Unit depends on the specific application process time based on the document material quality.

2.4 PF Injekt Printing Special Ink

2.4.1 Basic Combined Process Frame Inkjet Printing

The Combined Process Frame Inkjet Printing is an extension frame of Mühlbauer's IDENTIFIER 60 NOVUS booklet personalization system for the optical personalization of the holder page (also known as page #2) and the opposite site of the opened document (page #3) by high quality inkjet printing technology.
This frame element can be equipped with further functional processing units as option, such as:

- Precise print alignment for opposite site of the holder page (page #3) by vision system

2.4.2 Extension Print Alignment – Page #3 by Vision System

For the positioning of the print on the opposite site of the Holder Page (Page #3), the printing system gets extended with an extended vision system.

2.4.3 DOD Inkjet Printing Unit - RGB UV

The RGB DOD Inkjet Printing Units consists of an inkjet system using drop on demand technology (DOD), for printing of “UV” images and text data onto page 3 of the booklet.

Page 3 in RGB UV under UV Light

Printer Characteristics

Type:	Drop-On-Demand printer
Typical Print Resolution:	600 DPI
Number of Colors	3 (RGB UV)
Expected Life Span	approx. 150.000 passports

Notes:
If the printer won't be used, it's necessary to clean the printing system and the dedicated print head. Print tests are required to check the print head functionality. A general cleaning procedure is recommended on daily base, explained on documentation.

2.5 Combined Process Frame Laser Engraving

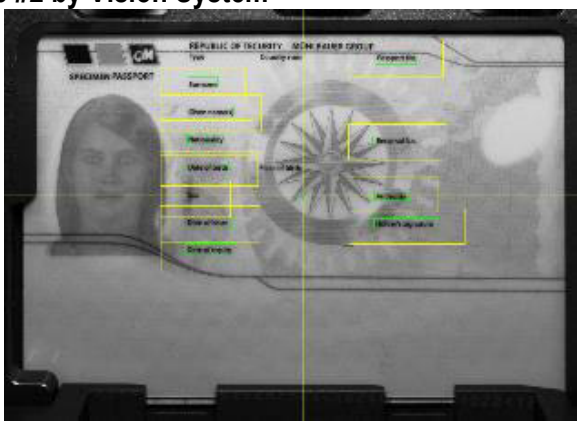
2.5.1 Basic Combined Process Frame Laser Engraving

The Combined Process Frame Laser Engraving is an extension frame of Mühlbauer's IDENTIFIER 60 NOVUS booklet personalization system for the optical personalization of the holder page (also known as page #2) and the opposite site of the opened document (page #3) by high quality inkjet printing technology.
This frame element can be equipped with further functional processing units as option, such as:

- Booklet serial number capturing by vision system
- Electronic chip programming
- Precise print alignment for holder page (page #2) by vision system
- Precise print alignment for opposite site of the holder page (page #3) by vision system
- Quality control and assurance of personalization by verification of the personalized data

2.5.2 Extension Print Alignment – Holder Page/Page #2 by Vision System

For the positioning of the print on the Holder Page each printing system is equipped with a vision system for a precise the alignment.
According the ICAO requirements the MRZ is orientated to the edges of the Passport while the optical personalization data like text and the picture will be aligned according to the preprint of the data page with this system.
The print position correction gets performed by dedicated off-set values for X and Y direction as well as by rotation (angle).



Technical Data of Camera

Illumination:	Special LED illumination
Software:	MB Vision Software

2.5.3 Process Unit Laser Engraving

This process unit can be used for the optical personalization of the data page (page #2) by laser engraving technology for standard data elements (photo, text data, numbers and MRZ).
The selected Laser (Laser Class 1) is integrated in a shielded laser box to avoid any injuries and a fume exhaust system with active carbon filter is integrated in this unit.
The unit is designed that the data fields as defined by ICAO DOC 9303, part 4 can be laser engraved.
For special feature(s) such as MLI dedicated extensions have to be chosen as extension option.

2.5.4 Greyscale Laser 20 W (Mühlbauer - Type LES 20 FP)

Mid-range Performance Greyscale Engraving System

Characteristics	
Type:	Fiber Laser
Medium:	Ytterbium
Wavelength:	~ 1.064 nm
Output Power:	20 W
Pulse Width:	Adjustable
Resolution:	300 - 1.200 dpi
Cooling:	Air - Air
Expected Lifetime of Laser Light Source:	> 75,000 operating hours
Suitable Materials:	PC, PVC, PET, ABS, other materials available upon request
Markings:	Text data (TTF fonts), vector-, rastergraphics (pictures, signatures); Common 1D and 2D barcodes (incl. PDF417 and QR-Codes); Standard laser security features such as clear window, ghost image, tactile elements; Extended security features like MLI*
Graphical Layout Editor:	MB layout designer

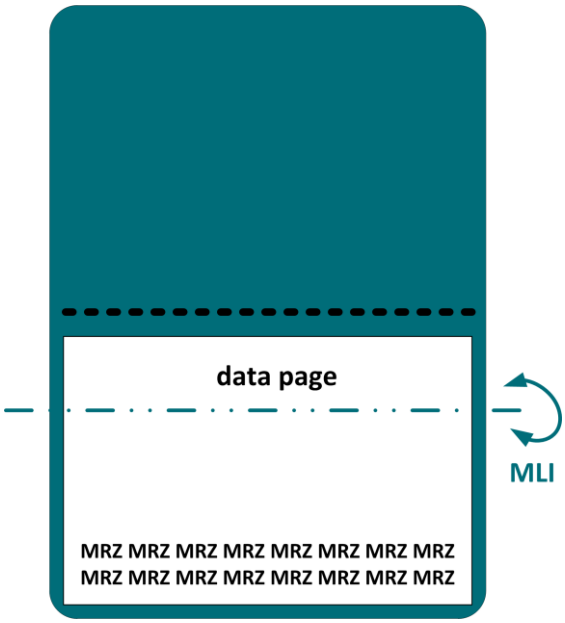
Note:

The optimum environment temperature for operation with laser marking process is 23°C in order to achieve stable laser power and marking results. An operation outside this temperature can be processed with moderate impact to the laser characteristics (range: 23°C ± 3°C). Therefore temperature changes should not exceed 1°C per hour in order to keep smooth internal temperature control and adjustment by the laser itself.

* Depending on machine type, there is additional mechanical hardware necessary for MLI engraving.

2.5.5 Extension - MLI Swivel Unit

This mechanical unit makes it possible to personalize the special MLI-system by laser engraving. The angle alignment will be processed by mechanical angle swiveling of the opened passport. The positions are will be stored in the GUI for Z-axis and angle.
The MLI element must be integrated inside of the polycarbonate data page during previous processes.



2.5.6 Extension Optical Quality Control Page 2 and 3 with RFID

For data verification, a chip reader and a vision system are installed in the inline data check unit to accomplish a Personalization Quality Assurance function. It allows the printed / engraved information written in Latin characters. This information can be compared with the data coming from the machine database. If an error in the data personalized on the data page compared against the data from the database is detected, the passport will be sorted out into the reject box.

General Technical Demands

OCV
(**O**ptical **C**haracter **V**erification)

The goal of OCV is to verify the current printing / engraving in order to prevent data mismatch; OCV requires a non-proportional font (e.g. OCR-B), a font height > 1,70 mm and a character line width > 0,20 mm. Background of text must be homogenous with good contrast to foreground.

Basic Configuration

- Standard camera for image processing with special LED illumination with white and IR (850nm) light
- Mühlbauer MB 1301 chip reader unit
- MB Standard Data Verification Software

Functionality Optical Verification

- For data page (page 2)
- Visual verification of the of the Machine Readable Zone (MRZ)
- Visual verification of textual information in Latin characters (surname, name, etc.)
- Visual verification of the picture (needs to be tested)

Functionality RFID Verification

- Verification of the encoded information in the chip

2.6 Passport Output Stacker

After all personalization processes are completed successfully, the passports are stored in an output stacker. In case of a failure, the document will be transferred into a separate reject bin.

Picture: Output Stacker with separate reject bin

2.7 Operating System Windows 10

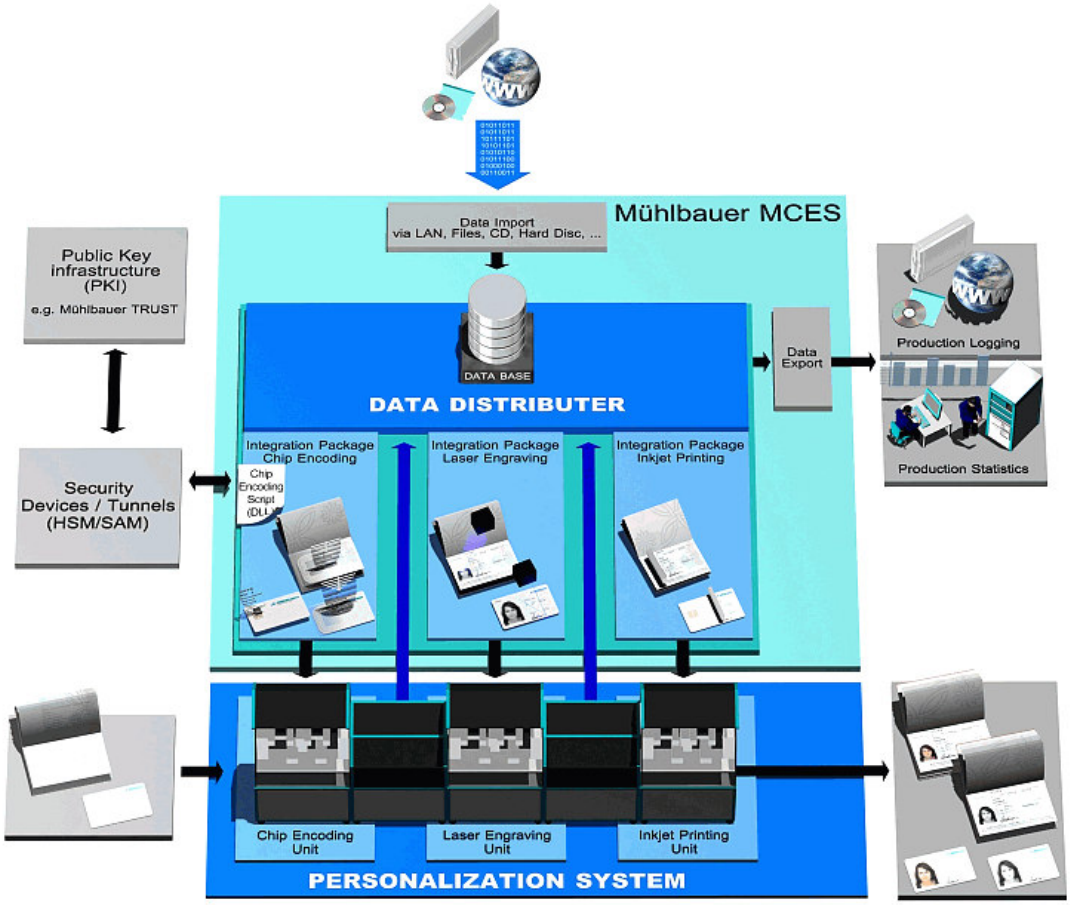
Operating System Windows 10

2.8 MCES - Mühlbauer Personalization Platform

Mühlbauer MCES is deliberately designed to fulfill perfectly the needs of our customers in the management of all card- and job-data for a personalization machine of any kind - from Implanters over Table Top Personalization equipment to high throughput machines.

Thus handling data and personalizing chips in Mühlbauer machines is easy to schedule and good to extend: once learned – used everywhere. Mühlbauer MCES is a powerful and future proof solution.

Mühlbauer MCES - A Modular Universal Personalization Data Manager



Part of the package also is a special interface module that provides an abstract interface to support the implementation of connections to HSMs, SAMs or a document signer for ICAO documents. There will not be delivered any software or hardware with cryptographic functionality.
The data interfaces for accepting data for personalization jobs and reports after finishing are XML based, but can be adapted or created from scratch to any data exchange format required. And new interface programs can even be designed without intervention of Mühlbauer. The internal data management uses a SQL based database.
But this is just one possibility – we are happy to continuously support our clients with our knowledge in all fields of applications.

Chip-Applications

The flexible approach in Mühlbauer MCES to encode / personalize chips of any kind, contact or contactless, memory or processor, with or without crypto devices, is the use of individually instantiated encoding DLLs per head. This again is open to individual development activities executed either by our clients, or by the professional and experienced engineers and consultants of the Mühlbauer Group.

As a leader in technology, Mühlbauer also provides standard application tools for the leading chip masks and solutions in telecommunications, ID and banking (EMV). For the latter, Mühlbauer also provides data preparation tools to create chip data from standard magstripe data, as used previously for non-chip bank cards.

2.9 MCES Processing Module Chip Contactless

Processing and personalization of individual data stored on contactless memory and processor chips.

- **Supported chip types:**
  - **Memory chips**
    - Mifare Standard
    - Mifare Ultralight
    - Mifare Plus
  - **Processor chips**
    - ISO14443-4 type A
    - ISO14443-4 type B
      ISO 15693
  - **Content**
    - MCES Chip Coding Workstation Software
    - Reader DLL (Interface Software) for Reader Hardware provided by Mühlbauer
    - Basic ATS/UID Chip Test DLL
    - Chip Coding Dummy DLL for Simulation and Testing
    - Reader Tools for setup and maintenance
  - **Not included:**
    - Customized Chip Coding Development
    - Chip Coding Application (DLL) is not part of this module. It can be offered separately or developed by the customer themselves with the MCES Software Development Kit.

2.10 UPS (uninterruptible power supply) - Standard

The integration of an UPS System is used to protect the personalization system with its integrated PC respectively for interruption of the power supply for a standard machine configuration for a short time and with few such occurrences.

If there is a breakdown or a reduction of power supply below the threshold, the UPS is able to recognize the event. This event will be shown by an acoustic signal.
The personalization system stops the separation of new passports and will be finished the started personalization processes and transport the passports to the output system. Finally the integrated PCs shut down including the log of this event and the status of the job as well as of the passports.

2.11 Machine Table with Extension

This kit is required in case the length of the machines exceeds the length of the standard table.

Industrial machine countertop table, ideal suited for Mühlbauer desktop personalization systems, for efficient production and material handling. The table has a suitable height for an adequate working situation.

Through the different sized shelves it's possible to store a large amount of diverse supplies.

The rollers enable to move the table easily to every free location and set it through the breaks on each roller.

An integrated multiple outlet strip for the electrical power supply leads the cables to power outlets, located on the left side of the table. Thus long cable distances are avoided.

Due to the stable materials the table also can carry heavy weight, like this of a machine.

- Work desk with integrated slots for cable management
- Free access to shelves arranged sideways
  - 3 medium shelves on the left side
  - 1 large shelf on the right side
  - 3 compartments, lockable by key
- Integrated multiple outlet strip for electrical power supply with surge protection
- Mounted on rollers with locking brakes
- Dimensions
  - **Height:** 835 mm
    Width: 3100 mm
    Depth: 800 mm

2.12 Documentation

Technical passport, operating instructions (Safety, Operation and Service) and technical documentation related to the software product used, including Equipment interfaces with examples of integration into the personalization system in English language will be provided.

- If the machine is intended for an EU member state, operating instructions in the national language (other than English or German) are available on request, in accordance with the Directive 2006/42/EC on machinery.

2.13 Accessories

2.13.1 MCES ID Chip Coding Application – Extended Access Control (EAC) Coding Application

Electronic ID documents following the ICAO standard provide high security for the identification and the authentication of the cardholder. Electronic ID cards and passports have a security chip embedded, which stores personal and biometric cardholder data. There exist several security mechanisms to protect the cardholder data against unauthorized access, to ensure the authenticity of the ID document and to protect against forgery.
Extended Access Control (EAC) includes several advanced security protocols like Chip Authentication (detection of cloned chips) and Terminal Authentication.

The EAC Chip Coding Application personalizes the chip application according to the chip personalization specification. It requires an ICAO EAC PKI (Public Key Infrastructure).

- Content:
  - Customized Chip Coding Application for the personalization of one ICAO (International Civil Aviation Organization) ID chip application, which provides either EAC functionality.

- Please note:
  - As a prerequisite, it is necessary that the chip personalization specification will be provided by the customer.

2.13.2 Crypto Framework

2.13.2.1 Key Management System (KMS)

- The Crypto Framework provides software and hardware for generation, exchange, storage, safeguarding, use, vetting and replacement of keys.

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Features

- Provision of basic cryptographic functionality

Specification

- ***Requirements***
  - Personalization system with chip coding module (Initialization or Personalization Application)
    or
  - MCES Software Development Kit

- ***Software***
  - Key Management System (KMS)

- ***Licensing***
  - MCES License Model
  - External HSM License

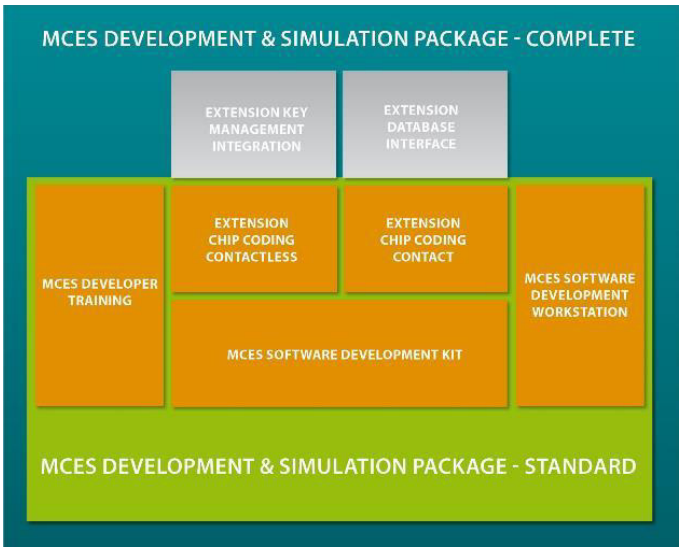
2.13.2.2 HSM ProtectServer External 3 - PL25

- **Hardware Security Modules**
  Hardware Security Modules (HSMs) are cryptographic devices which perform cryptographic algorithms, such as en- or decryption of data with secure keys. These keys are stored in a validated (FIPS 140-2 level 3) secure storage location. This is mandatory for the operation in a secure production environment.

  Therefore the Protect Server External 3 includes a cryptographic module performing secure cryptographic processing in a high assurance fashion. The appliance features a heavy-duty steel case with tamper-protected security that safeguards against physical attacks and delivers the highest level of physical and logical protection to the storage and processing of highly sensitive information, such as cryptographic keys, PINS, and other data. Secure storage and processing means cryptographic keys are never exposed outside the Hardware Security Module (HSM) in clear form, offering customers a level of security unavailable from software alternatives, while providing a certified level of confidentiality and integrity that meets the security demands of industry organizations.

3 MCES Software Development Kit

Overview



MCES Software Development Kit

3.1 MCES Software Development Kit

The MCES Software Development Kit is a software package which provides the tools and libraries for an easy and independent development of MCES basic software components for the Mühlbauer personalization system.

Workstation applications and interface extensions, like Monitoring-DLLs, Exchange-DLLs, DataMatching-DLLs and Reporting-DLLs as well as XML-Jobs can be created, enhanced and tested.

Features

- Independent development
  - Workstation applications
  - Interface extensions
    (Monitoring DLLs, Exchange-DLLs, DataMatching-DLLs, Reporting DLLs)
- Instant reaction to system and requirements changes
- Easy debugging and testing

Specification

- **Requirements**
  - Level of knowledge
    - Microsoft Windows 7®
    - Software Developer: VisualStudio, C/C++, C#, object oriented design
    - Extensible Markup Language (XML)/Extensible Stylesheet Language (XSL)
    - Relational database, Structured Query Language (SQL)
  - Hardware
    - PC / Notebook with Microsoft Windows 7® or higher
  - Software
    - Microsoft Visual Studio 2010® or higher
    - SQL based Database

- **Deliverables - Software**
  - MCES Core Library
  - MCES Reporting Library
  - MCES Templates
    - MCES Plugin DLL (Monitoring-DLL, Exchange-DLL, Reporting-DLL)
  - Database Library Scripts

- SQL Database Scripts
- Test- und Configuration-Tools
- Documentation

- **Compatibility**
  - Compatible with the software of the appropriate personalization system

- **Licensing**
  - MCES license model
  - SQLAPI++ Library License Agreement

3.2 MCES Development Workstation

The MCES-Development Workstation is fully-functional simulation software system for the Mühlbauer personalization systems.
The system allows simulating the complete personalization process without interrupting the production.

Features

- Prepare job setups
- Create layout files
- Run test procedures offline without affecting production
- Simulate interfaces to production management software
- Validating updates and upgrades
- Installation according to existing or future personalization systems
- New personalization systems capable to be integrated

Specifications

- **Requirements**
  - Level of knowledge:
    - Windows Operating System (Microsoft Windows®)
    - VisualStudio, C/C++, C#, object oriented design
    - Extensible Markup Language (XML)/Extensible Stylesheet Language
    - Relational database, Structured Query Language (SQL)

- **Deliverables - Hardware**
  - System-PC:
    - Notebook - Intel® chipset (default)

      or
    - Desktop PC - Intel® chipset (on request)
    - Drivers and Documentation
- **Deliverables - Software**
  - **Operating System:** Windows 10® or Mirosoft Windows 7®
  - **SQL Server:** SQL based Database
  - **Development Environment:** Microsoft Visual Studio®
  - MCES Simulation Framework:
    - Mühlbauer Graphical User Interface
    - Master System application
    - Workstation-Simulator applications
    - MCES Database (ArchiveSCP1)
    - XMLDataAcquisition application
    - MCES Tools
    - Customer-related software and files (software developed for the customer)
  - MCES Documentation

- **Compatibility**
  - Compatible with the software of the appropriate personalization system

- **Licensing**
  - MCES license model
  - Microsoft ® Licenses

3.3 Extension Chip Coding MB1301 (TCP/IP)

The Extension Chip Coding MB1301 is an extension package for the MCES Software Development Kit. It provides the software and hardware for an easy and independent development of Chip-Coding-DLLs for encoding of contact and contact less interfaced SmartCards with the MCES personalization system.

Features

- Independent development
  - Chip Coding Extension Modules (DLLs) for contact and contact less interfaced SmartCards
- Instant reaction to system and requirements changes
- Easy debugging and testing
- SmartCard Reader Selection

Specification

- **Requirements**
  - MCES Software Development Kit
  - Level of knowledge
    - Windows Operating System (Microsoft Windows®)
    - VisualStudio, C/C++, C#, object oriented design
    - Extensible Markup Language (XML)/Extensible Stylesheet Language (XSL)
    - Relational database, Structured Query Language (SQL)
    - Smartcard / Chip Coding Knowledge
    - Cryptographic Basics

- **Hardware**
  - SmartCard Reader contact:
    - MB1301 Chip Coding Contact and Contact less Reader (TCP/IP)

Picture: Reader System Sample Configuration

- **Software**
  - MCES Templates
    - Chip-Coding-DLL
    - Reader-DLL
  - Test- and Configuration Tools
  - Documentation

- **Compatibility**
  - Compatible with the software of the appropriate personalization system

- **Licensing**
  - MCES license model

3.4 MCES Developer Training

The MCES Developer Training is the ideal start into the independent development of Mühlbauer MCES software components. It is also the best opportunity to fresh up the knowledge of the latest software features the system is providing.

Features

- Experienced trainers
- Detailed insight into MCES software components and workflows
- Builds the knowledge to do independent developments
- Customizable schedule and training programs
- In factory (at Mühlbauer) or in-house (at customer - price is excl. Travel Expenses)
- Possibility to perform the training online using remote connection, video conference or other communication means
- Up to 5 participants per training
- Startup with your development during the training

Specification

- **Requirements**
  - Up to 5 participants per training
  - Level of knowledge:
    - Microsoft Windows ®
    - Software Developer: VisualStudio, C/C++, C#, object oriented design

- **Content**
  - MCES Overview
  - MCES XML Job and Database
  - MCES Data- and Processing-Workflow
  - Depending on customer needs optional in-depth discussion of:
    - Development of Monitoring-DLL
    - Development of Exchange-DLL / DataMatching-DLL
    - Development of Reporting-DLL
    - Development of Chip-Coding-DLL
    - Development of Data Acquisition Application

3.5 Documentation

A User Manual will be provided in English language.

4 Services

4.1 Implementation Services

The implementation phase includes all required activities to realize the project according to the agreed scope of supply. As the most important part of the Implementation Services, the Commissioning is done within this phase to assure that all Systems and Equipment are designed, installed, tested and operated according to the design objectives or operational specifications of the client.

4.1.1 Pre-Commissioning at Mühlbauer Facility

Pre-Commissioning activities ensure the readiness of the Equipment prior to the installation, commissioning and future operations.

Pre-Commissioning activities are:

- Check for design / specification conformity
- Process adjustments to final production product - configuration of sample document models and personalization on polycarbonate data pages based on data provided by the Buyer for each type of document

The Equipment and the used Buyer`s material define the process. With tests close to actual production conditions, Mühlbauer experts evaluate the Buyers's application during the implementation phase for the Equipment and adjust the processes to the defined requirements. This makes the process reliable and as efficient as possible.

4.1.2 Factory Acceptance Test (FAT)

A Factory Acceptance Test (FAT) is a major project milestone and attended by Mühlbauer and the Buyer or a suitable representative.

The Factory Acceptance Test (FAT) will be performed at the Supplier's premises and will include functionality, completeness and performance tests. The equipment shall be capable of performing all processes and performance specified in the tender documentation. Material required for testing will be provided by the Buyer. The Factory Acceptance will be confirmed by signing the Factory Acceptance Report (FAT) by both Parties.

Prior to the execution of the FAT, a Test Plan and Schedule is provided in time by Mühlbauer to the Buyer for approval.

4.1.3 Delivery

After the Equipment is accepted for delivery, the components will be packed in a proper way to prevent damages. All technical units will be gathered to boxes in a reasonable way to perform the logistical requirements for shipment under INCOTERMS 2020 - DAP Republic of Moldova, Chisinau municipality, 42, Aleksandr Pușkin street, as effective as possible.

4.1.4 Installation and Commissioning at Buyer`s Premises

The Installation and Commissioning of the Equipment is performed by an experienced team Mühlbauer experts and comprises typically the following activities:

- Unpacking and Positioning of the Equipment to the final production area
- Equipment Installation - the physical installation of the Equipment at Buyer`s facility, including the connection to the necessary infrastructure, such as power supply, compressed air or communication networks
- Commissioning - Equipment is powered up and tested in a standalone environment.
- Support services at the Buyer's premises and/or remotely (as applicable) for the adjustment and integration of the integrated operating system during the period of Equipment preparation for

commissioning according to the Buyer's requirements, including adaptation support with the national document production system at the Buyer's headquarters and remotely (if applicable) at the Equipment Commissioning Stage. Test the Equipment with the procedure that has already been approved and agreed during the Project Initiation

The main objective of commissioning is to ensure the safe and orderly handover of the Equipment from Mühlbauer to the Buyer and to guarantee its operability in terms of performance, reliability, safety and information traceability.

Position	Short Description of proposed configuration	Units	Comment
1	Installation, Commissioning and Integration at Buyer`s Premises  **Installation & Commissioning:** • 1x Machine Service Engineer • 8x Days (8 hours per day ) • Done at Buyer`s premises **Integration of the integrated operating system during the period according to the Buyer's requirements, including adaptation support with the national document production system at the Buyer's premises:** • 1x Software Service Engineer • 5x Day (8 hours per day) • Done at Buyer`s premises	1	Implementation schedule according to tender requirements

4.1.5 Site Acceptance Test (SAT)

Once the Equipment is commissioned and its correct operation has been tested and confirmed, the Commissioning process is considered complete and the solution is formally handed over to the Buyer.
In practice, the on-site acceptance process includes inspection and testing of every operational component of the Equipment, from individual functions to complex interactions including the final product of manufacturing or personalization processes.

Prior to the execution of the SAT, a Test Plan and Schedule is provided in time by Mühlbauer to the Buyer for approval.

The acceptance of the Equipment will be recorded within a Site Acceptance Protocol, which is signed by the authorized representatives of the Buyer and Mühlbauer.

Position	Short Description of proposed configuration	Units	Comment
1	Site Acceptance Test (SAT) • 1x Machine Service Engineer • 1x Day (8 hours per day) • Done at Buyer`s premises • Documentation	1	Implementation schedule according to tender requirements

4.2 Training

This training program is designed for operators and maintenance personnel involved in the handling of Equipment used for personalization of the document with polycarbonate data pages.

4.2.1 Operator and Daily Maintenance Training

Operator and Daily Maintenance Training is a path to operational excellence and enables learning how to operate Equipment and Systems effectively. Trainees will gain essential knowledge and practical skills to efficiently operate the Equipment, ensuring high-quality output and optimal performance.

Position	Short Description of proposed configuration	Units	Comment
1	Operation and Daily Maintenance Training • 1x Machine Service Engineer • 1x Day (8 hours per day) • Done at Buyer`s premises • Documentation	1	Implementation schedule according to tender requirements

4.2.2 Maintenance Training

Corrective and preventative maintenance tasks are separated by levels of complexity. Mühlbauer offers the Buyer individualized Corrective and Preventative Maintenance Training to successfully perform interventions for the primary remediation of Level 1 and Level 2 technical deficiencies, as well as the replacement of spare parts by the technical specialists of the Buyer.

Position	Short Description of proposed configuration	Units	Comment
1	Maintenance Training • 1x Machine Service Engineer • 3x Days (8 hours per day) • Done at Buyer`s premises • Documentation	1	Within 36 months after delivery, commissioning and signing of the act of receiving and handing over the Equipment.

4.3 Maintenance and Support Services

The Maintenance and Support Services will start after delivery, commissioning and signing of the act of receiving and handing over the Equipment and will last for 36 months.

4.3.1 Service Support Levels

When it comes to Incident Management Mühlbauer handles the incidents using the following support levels sequentially:

- Mühlbauer 1st Level Support: Technical Support Group (TSG)
- Mühlbauer 2nd Level Support Specialist Support Group (SSG)
- Mühlbauer 3rd Level Support Research and Development (R&D). Software Maintenance Basic
- Mühlbauer Field Service Support (Global Service Network)

Mühlbauer 1st Level Support: Technical Support Group (TSG)
If Buyer`s technical specialists could not solve the incident, it wil be escalated to Mühlbauer 1st Level Support team, the Technical Support Group (TSG). Embedded in the Mühlbauer Central Service Organization, the TSG takes care of the internal coordination for further support. The 1st Level Support is provided remote via phone and email.

Mühlbauer 2nd Level Support Specialist Support Group (SSG)
If the 1st Level Support efforts could not solve the incident, it is escalated to the Mühlbauer 2nd Level Support team, the Specialist Support Group (SSG), The Central Service Organization takes care of the internal coordination for further support. The relevant internal departments are involved in order to provide clarification to the inquirer via phone / email or remote desktop support.

Mühlbauer 3rd Level Support Research and Development (R&D). Software Maintenance Basic
If the 2nd Level Support efforts could not solve the incident, it is escalated to the Mühlbauer 3rd Level Support provided by the Software Development and / or R&D teams. The relevant internal departments are involved in order to provide clarification to the inquirer via phone / email or remote desktop support.
The software and its functionality are subject to fast and innovative modification. Software maintenance assures that a software installation can be updated at any given time. The user of the software installation preserves the guarantee on actuality, updates and support. Software Maintenance helps to ensure that software remains functional, up to date and secure.

Mühlbauer Field Service Support (Global Service Network)
The Mühlbauer Field Service is a global network. Qualified and committed specialists on all continents provide the necessary proximity to the Buyer and ensure shortest lead times.

Corrective Maintenance tasks for incidents which couldn't be resolved by the means of the central support levels are forwarded to the Field Service Network. Depending on the nature of the incident, dedicated specialist (s) is (are) then dispatched in close consultation with the Buyer.

Position	Short Description of proposed configuration	Units	Comment
1	Service Support • Service Support Levels 1st, 2nd, 3rd • Field Service Support (if needed)	1	Implementation schedule according to tender requirements

4.3.2 Reaction Times

For the resolution of warranty cases as well as in the case of receiving technical assistance requests, the following reaction times will be observed:

- Telephone response time – up to 2 business hours;
- Reaction time for diagnosing the equipment and determining the cause of the malfunction, including remotely (if applicable) - up to 8 working hours;
- Reaction time for restoring the functionality of the equipment including remotely (if applicable) with the use of spare parts available in stock - up to 5 working days;
- Reaction time for restoring the functionality of the equipment with the use of spare parts not available in stock - up to 15 working days, except for the time used for customs procedures;

Working hours - from 8.00 a.m. to 5.00 p.m., according to the time zone of the Republic of Moldova. Working days - according to the calendar of the Republic of Moldova.
Provided within 36 months after delivery, commissioning and signing of the act of receiving and handing over the Equipment.

4.3.3 Mühlbauer ServiceDesk Platform

The main purpose of the ServiceDesk Platform is to establish an effective communication interface between Mühlbauer and its customers' users. The Mühlbauer ServiceDesk Platform is a single point of contact issue tracking system used to record, respond to and archive incidents and other service requests transmitted by phone or e-mail. The ServiceDesk Platform provides centralized access to the system via a web interface that can be used by both agents and customers. Users can be registered on the platform and linked to their company. Each user can create and manage their own incident reports and service requests via the web interface at any time - 24/7. The Mühlbauer ServiceDesk Platform receives real-time information about the ticket status and its progress. With already integrated and well-structured incident reports, the Mühlbauer support team can immediately start the support process.
Within the ServiceDesk Platform a reporting function and a tracking of incidents including the creation of weekly/monthly reports is included for incidents that have occurred in relation to the Systems and Equipment.

Position	Short Description of proposed configuration	Units	Comment
1	ServiceDesk: • ServiceDesk availability for 4x IDENTIFIER 60 NOVUS	1	Within 36 months after delivery, commissioning and signing of the act of receiving and handing over the Equipment.

4.3.4 Preventive Equipment Maintenance

Preventive Maintenance aims to maintain Equipment and keep it in the best possible operating condition. Preventive Maintenance is performed by qualified personnel.

Preventive Maintenance allows the Equipment to run much more efficiently. In turn, Buyer`s benefits from having Equipment and Systems running at peak performance and increasing the mean time between failures.

Preventive Maintenance includes the following tasks:

- Early detection of damage and wear, minimizing the risk of unplanned Equipment downtime
- Exchange of information between engineers
- General check of Equipment's software and hardware
- Sensor and actuator tests including adjustment, if necessary
- Inspection of all moving parts, pin joints, guides, etc. including adjustment, if required
- Check of process stations, such as coding / laser / vision / printers
- Check for early detection of defects, replacement of wear parts, minor repairs

Position	Short Description of proposed configuration	Units	Comment
1	Annual Preventive Maintenance • 4x Days (8 hours per day) • 1x Machine Service Engineer	1	Within 36 months after delivery, commissioning and signing of the act of receiving and handing over the Equipment.

4.3.5 Warranty

Mühlbauer provides warranty for the Equipment within 36 months after delivery, commissioning and signing of the act of receiving and handing over the Equipment. All costs of resolving warranty cases including spare parts covered.

4.3.6 Spare Parts Kit

Spare Parts Kit (both tools and spare parts) will enable the Buyer's technical team to perform Level 1 and 2 interventions to replace any defective items that could stop the Equipment from working.

Position	Short Description of proposed configuration	Units	Comment
1	Spare Part Kit • Initial Spare Part Package for machines • Tools	1	

5 Deliverables

Position	Proposed Configuration	Units

1	**IDENTIFIER 60 NOVUS**
	• Magazine Input Module
	• Magazine for Passports (2pcs)
	• Combined Process Frame Inkjet Printing
	  ▪ Basic Combined Process Frame Inkjet Printing
	  ▪ Extension Booklet Serial Number Detection by Vision System
	  ▪ Extension Electronic Chip Programming - MB 1301 Reader
	  ▪ Extension Print Alignment – Page #3 by Vision System
	  ▪ DOD Inkjet Printing Unit - Standard
	• PF Injekt Printing Special Ink
	  ▪ Basic Combined Process Frame Inkjet Printing
	  ▪ Extension Booklet Serial Number Detection by Vision System
	  ▪ Extension Print Alignment – Page #3 by Vision System
	  ▪ DOD Inkjet Printing Unit - RGB UV
	• Combined Process Frame Laser Engraving
	  ▪ Basic Combined Process Frame Laser Engraving
	  ▪ Extension Print Alignment – Holder Page/Page #2 by Vision System
	  ▪ Process Unit Laser Engraving
	  ▪ Greyscale Laser 20 W (Mühlbauer - Type LES 20 FP)
	  ▪ Extension - MLI Swivel Unit
	  ▪ Extension Optical Quality Control Page 2 with RFID
	• Passport Output Stacker
	• Operating System Windows 10
	• MCES - Mühlbauer Personalization Platform
	• MCES Processing Module Chip Contactless
	• UPS (uninterruptible power supply) - Standard
	• Machine Table with Extension
	• Documentation
		4

2	**MCES ID Chip Coding Application** • Extended Access Control (EAC) Coding Application	1
3	**Crypto Framework** • Key Management System (KMS) • HSM ProtectServer External 3 - PL25	1
4	**MCES Software Development Kit** • MCES Software Development Kit • MCES Development Workstation • Extension Chip Coding MB1301 (TCP/IP) • MCES Developer Training (3 days) • Documentation	1
5	**Pre-commissioning at Mühlbauer Facility** • 4x IDENTIFIER 60 Novus	1
6	**Factory Acceptance Test (FAT)** • 1x Day at Mühlbauer's HQ, together with PSA	1
7	**Delivery** Solution components: • 4x IDENTIFIER 60 NOVUS • MCES ID Chip Coding Application • Crypto Framework • MCES Software Development Kit • INCOTERMS 2020 - DAP, 42 A. Pushkin str., Chisinau municipality, Moldova.	1

8	**Installation and Commissioning at Customer Facility** • 1x Machine Service Engineer 8x Days (8 hours per day) • 1x Software Service Engineer 5x Days (8 hours per day) • Done at place of installation	1
9	**Site Acceptance Test:** • 1x Machine Service Engineer • 1x Day (8 hours per day) • Done at place of installation	1
10	**Operation and Daily Maintenance Training** • 1x Machine Service Engineer • 1x Day (8 hours per day) • Done at place of installation • Documentation	1
11	**Maintenance Training** • 1x Machine Service Engineer • 3x Days (8 hours per day) • Done at place of installation • Documentation	1
12	**Spare Part Packages and Tools** • Initial Spare Part Package for machines • Tools	1
13	**Service Support** • 1st , 2nd & 3rd Level Support (remote) • Field Service Support (when applicable)	1
14	**Reaction times** • Reaction times as specified	1
15	**ServiceDesk** • ServiceDesk availability for 4x IDENTIFIER 60 NOVUS	1
16	**Preventive Maintenance** • Once per year • 1x Machine Service Engineer • 4x Days (8 hours per day) • Done at place of installation	1
17	**Warranty 36 months** • For 4x IDENTIFIER 60 NOVUS	1

We hope that this **Response** related to **Tender No. 21379102 (ocds-b3wdp1-MD-1741850123796)** will meet your approval. If you have any question, please do not hesitate to contact us.

We are looking forward to your reply and remain

With our best regards

Mühlbauer ID Services GmbH

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