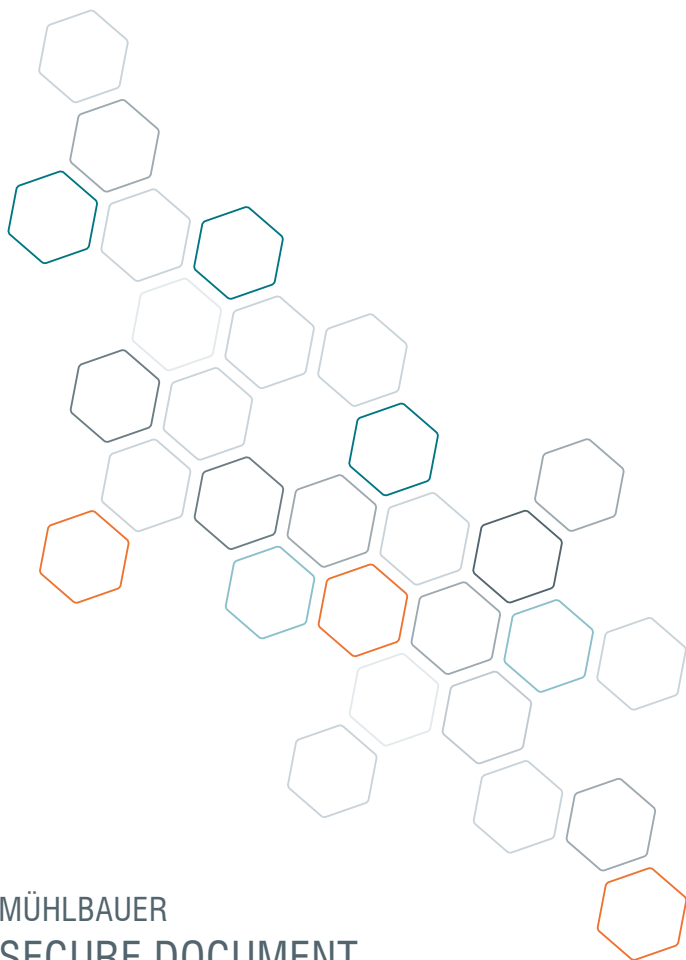




Mühlbauer
High Tech International



MÜHLBAUER SECURE DOCUMENT GUIDELINE

MÜHLBAUER SECURE DOCUMENT GUIDELINE

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PREFACE

JOSEF MÜHLBAUER

It's about our future! That is why the topic sustainability becomes increasingly important – for us as a company and employer, but also for our markets and the world.

From the very beginning, the Mühlbauer Group has been committed to sustainability. Our corporate strategy is based on combining economic necessity, ecological reason and social responsibility in all processes and decisions to create a solid foundation that our customers, business partners and employees can rely on at all times. This is also testified by the exceptionally high level of vertical integration, which guarantees short distances, fast delivery times and the highest quality and makes us unique on the world market.

With our highly competent employees and 35 locations worldwide, we are world market leader in many of our markets; and, every day, we work hard to further develop our technologies and meet tomorrow's needs today. In a world in which the speed of innovation is higher than ever before and changes are an essential part of everyday life, the values reliability, speed and entrepreneurial responsibility have become even more relevant.

Our dedicated employees, as well as all the people around the globe who trust in our technologies are our key to success. We are all the more aware of our responsibility to society. When dealing with innovations, especially in the digital domain, the focus should not be on short-term profit maximization; our goal must be to use the latest technologies to make our lives easier and safer – and we look forward to continue going this course together with our employees, customers and business partners.



Josef Mühlbauer

TRUSTED ID MATTERS

TRUSTED IDENTIFICATION



A VERIFIED IDENTITY FOR EVERYONE

How can we improve citizen services, how do we realize government applications, increase security, efficiency, transparency? How can we achieve shared prosperity? Comprehensive Identification systems enable us to put these issues into practice. It doesn't matter if we are talking about the healthcare sector, education, finance, economy or traveling: a trusted identification is the key to neatly organize and regulate these fields.

We need a verified identity to access financial and social services. The ability to prove our identity or particular attributes is also essential to exercise fundamental rights such as voting, formal employment, property and residence rights.



REMEMBER AND REUSE

A self-contained system like the TRUSTED IDENTIFICATION SYSTEM from Mühlbauer TECURITY® paves the way to summarize all steps of establishing an identity, officially confirming it in the form of a document and checking this document for authenticity at various points of contact. Using only one system instead of many different schemes provides an enormous temporal advantage, minimizes sources of errors and also requires less employees in a long-term view. Self-contained solutions ensure that government services reach the people they are intended for. Cash transfers, wages and subsidies, visa permits, residence rights

and much more Government to Person (G2P) transfers are particularly at risk of becoming the target of fraud attempts. Secure physical and digital ID systems ensure a low attack surface and thus make misuse more difficult. Direct service transfers or collaboration with e-government services save resources, increase efficiency, and reduce costs. Another advantage of these self-contained systems is the minimization of inertia to change and to be able to transfer and use solutions for later problems as well.

IMPROVED SERVICE

Given the fundamental need for secure online identification and authentication, digital ID – like e-signatures or e-payment – is a core element for successful digital economies. Commercial and governmental platforms are thus able to offer more facile and user convenient services and can expand their range at the same time thanks to automation and artificial intelligence without having to resort to more personnel. The combination of electronic payment and identification more and more substitutes the need to go to the municipality, to the bank or to other authorities. On the one hand, barriers such as transport routes and time requirements are broken down. On the other hand, digital solutions also create new obstacles. In order to be able to identify oneself digitally, a device and the routine handling of it are indispensable. However, we cannot assume that everyone has access to these requirements. This case inevitably shows that we cannot simply eliminate physical systems like ID cards, driver licenses and travel documents, but that virtual identification and verification systems complement physical solutions.

INCLUSION

Physical in combination with digital identification and authentication facilitates the inclusion across social and national barriers. Being officially identified or not could be the difference between being allowed to vote, open a bank account or for example to register a SIM card for a smartphone or being forced to register the SIM illegally. To obtain official identification, it is vital that a sufficient and future-prove infrastructure is developed, which accommodates the issuance of physical and electronic documents. Digital IDs, driver licenses and travel documents shall be designed, produced and issued according to international standards, to be recognized across countries, ensuring trusted transactions across borders.

CONFIDENCE

The COVID-19 pandemic challenged the entire travel and in particular the aviation industry. To improve and stabilize the situation it is vital to restore confidence. Governments and service providers, such as Airlines, must effectively mitigate the risk of infection. This requires having accurate information on passengers and their health status. Contactless verification solutions with high-tech passports and corresponding verification kiosks, as well as e-Passports in combination with self-registration Kiosk Systems, e-Gates and Mobile Verification play hereby a vital role and can ensure a secure, convenient, seamless and privacy-respecting approach to identify and verify a person's identity as well as the required visa and vaccination status.

SECURITY

Whether it's a physical or an electronic document, it's the trustworthiness of the document that counts. Creating a new identification system means thinking about which security attributes are needed to be integrated and how are these attributes going to be proved – either manually or electronically. Secure and seamless end-to-end solutions that address both physical and electronic applications must include secure processes as well as secure functions. The implemented identification and verification solutions, systems and products should be future-proof, meaning scalable and adaptable to future requirements and challenges.

MÜHLBAUER AT A GLANCE

Founded in 1981 in the heart of Bavaria, the Mühlbauer Group has ever since grown to a leading global player in the fields of Parts & Systems, Advanced Energy Solutions, Semiconductor Related Products, Document Solution Related Products and TECURITY® Solutions.

With more than 4,000 employees, technology centers in Germany, Malaysia, Slovakia, the U.S. and Serbia, and 35 sales and service locations worldwide, Mühlbauer created a strong competence network around the globe. We continuously invest in the latest technologies and innovative processes to enhance our competences and to provide you with optimized solutions.

Our in-house precision part production – MPS – Mühlbauer Parts & Systems – guarantees unlimited flexibility and highest customer satisfaction.

Our youngest division MB ATECH – Advanced Energy Technologies – brings unique machinery requirements to serial production. For the eMobility industry, the company offers highly efficient production lines for the manufacture of pouch- and prismatic cells

for lithium-ion batteries, as well as MEA's & stacks for fuel cells.

Our business unit AUTOMATION does not only develop and assemble individually customized production systems, but also provides matching software solutions for the production process of Document and Solution Related Products.

Vision inspection technologies as well as semiconductor and RFID applications complete our comprehensive portfolio.

Our business unit TECURITY® is established as a competent partner for the implementation of security systems for identifying and verifying both documents and individuals.

Our clients benefit from more than three decades of experience which we have gained in the realization of over 300 ID projects worldwide.

COMPREHENSIVE SOLUTIONS

Providing high secure documents is an essential part of counteracting worldwide threats of criminal and terrorist activities. The positive identification of persons by means of secure documents – and therefore the confirmation of the document validity – is crucial.

Mühlbauer TECURITY® offers individual and modular end-to-end solutions and eID and Travel documents. As a reliable partner, Mühlbauer supports every phase and aspect of the solution process.

- Conception
- Enrollment
- Data Management
- Production
- Personalization
- Verification



LEVEL 1:

The security features can be verified without further tools



LEVEL 2:

(Handheld) devices are needed for verification



LEVEL 3:

The security features are verified by using forensic testing methods

CONCEPTION

Comprehensive planning is the key to every successful project. The client's individual requirements combined with our extensive know-how determine the outline of the solution's architecture. After in-depth consultation, we develop a detailed project plan which includes every step of the process – from the first design idea to the production and issuance and to the verification of the personalized document. Furthermore, the hardware and software infrastructure, the administration and logistics, the cooperation with local suppliers and staff, as well as further service and maintenance options are all essential subdivisions which have to be taken into consideration. Our specialists from a

variety of departments cooperate closely. They accompany the project right from the beginning and thus ensure an efficient and reliable planning so that the optimal customized solution is achieved.

Our job does not end when the passports are printed and our customer is satisfied – we are your long-term partner and help with questions and problems whenever needed.

ENROLLMENT

Every human being is unique. An individual's biometric combination is defined by 260 optical characteristics of the iris, the face pattern, so-called minutiae features of the fingerprint, and multiple attributes of the personal signature. The use of this biometric data has made it possible to identify and verify any arbitrary person. The enrollment process of sensitive data requires comprehensive know-how and utmost care to ensure that the collected data serves the project's requirements. The flexible design of the Mühlbauer GET-ID systems allows us to customize the enrollment step. We can capture the data via form or live, in a centralized or decentralized enrollment-station, depending on our project's structure. If needed, our GET-ID system also allows us to implement in our process that the respective authority has to approve the application request before proceeding. Next steps are the recording of payments and eventually the delivery of the personalized document to the final holder. Regardless of which form the client chooses, data security is guaranteed at any time while the person's personal attributes are captured.

DATA MANAGEMENT

Personal data is one of the most valuable goods. Since the use of personal and biometric attributes for any form of identification or verification has become increasingly common, secure management and processing of the captured data is crucial. Our effective software solutions ensure optimal handling of the enrolled and verified datasets during each step of their life cycle. A standardized interface to the biometric identification and verification system supports the identification process, comprising fingerprint (AFIS), iris (IRS) and face recognition (FRS). This enables highest interoperability with any sensor technology on the market. Most importantly, our data management structure sets highest security standards by using the latest encryption technologies. It reliably protects the datasets from any form of abuse, counterfeit or even identity theft.

PRODUCTION

The complexity of ID documents constantly increases. Growing security needs as well as organized document fraud demand the continuous enhancement of secure documents. As one of only a few chosen companies worldwide, we are certified as security printer and security supplier by INTERGRAF and consequently hold significant expertise in the development of customized ID solutions. Our document and forensic specialists create documents which are fully equipped for future demands. They commence with comprehensive consulting to define the document solution design, but also take into consideration all the prospective requirements. Working with equipment generated by ourselves, we continuously monitor and enhance the quality and security features of our products. Additionally, we have developed high-end materials which merge all the advantages of document production and personalization with document security. Our core competence is to provide our customers with optimized solutions and documents that are perfectly protected from manipulation and fraud.

With regard to the production process of ID documents, MB PALAMAX®, our in-house Smart Factory Production & Process Management Software, allows the acquisition of complete production data in real time. MB PALAMAX® makes the production process completely transparent. It provides an interface for process monitoring and statistical analysis of the production process. Thus, it supports the production planning to optimize and control the cost drivers during the production process. MB INCAPE is Mühlbauer's proven software solution for the management of production processes for ID documents. It covers the complete organization of production, job, data and material handling. With MB PALAMAX® and MB INCAPE, Mühlbauer has laid the groundwork for a comprehensive Manufacturing Execution System (MB MES), which takes manufacturing execution to the next level.

VERIFICATION

International traveler volumes rise on a daily basis. A multiplication of airport arrivals and departures, illegal migration and organized crime leads to greater challenges in the globalized world. Reliable verification systems become essential to cope with these trends. Our innovative access and border control solutions offer the highest level of security and accuracy with regard to the identification of the individual and the verification of the personal data which are captured by means of MB ABIS (Automated Biometric Identification System). After sensors have captured the biometric attributes, these are matched with the datasets which have been identified with Mühlbauer's modular and scalable enrollment platform MB GET-ID in advance. The highly flexible system design allows for a tailor-made solution according to the client's requirements. It combines different types of fingerprint sensors, face or iris cameras. Automatic quality assessments guarantee maximum matching accuracy in our solutions so that national interests are preserved and overall security is increased. By means of standard mobile devices such as smartphones or tablets, our new mobile application, MB STEEL READER MOBILE, even allows for a secure mobile verification of the passenger's travel document at any time and in any place.

PERSONALIZATION

A personalized ID document is the key to identify an individual. By transferring both the personal and the biometric data to the blank document, the ID card, the passport or the license becomes unique. This is the only way to achieve a reliable verification. Depending on the individual requirements, a comprehensive portfolio of the latest technologies, including high-end printing, laser engraving and lamination systems, guarantees the efficient application of the visible attributes on the medium's surface. The secure and encrypted transfer of the personal and biometric data to the embedded storage chip is supported by a production management solution with interfaces to the latest Public Key Infrastructure (PKI) and background systems. During the personalization process, all material movements are controlled by large material management systems. Constant and thorough quality checks ensure the complete and correct registration of the prepared datasets, thus making sure that only authenticated data is transferred from the central database. With regard to your personalized documents, we are committed to the highest international security standards.

ePASSPORT SOLUTIONS



Patented production technologies, in-house developed materials, high-quality personalization techniques, customized security features, as well as our unique hinge technology form the key elements of our ePassport solutions. In compliance with our customers' individual requirements, we provide high-end solutions for fraud-resistant documents.

Our flexible solutions enable the secure issuance of citizens' ePassports worldwide. Embassies

abroad act as decentralized enrollment sites which are connected to the high-secure data infrastructure. The enrolled datasets are securely transferred to the central data management site in the home country for registration and further processing. Before the ePassports are issued at the respective embassies, production and personalization are carried out in a centralized location. We also guarantee highest flexibility for the citizens living abroad applying for ePassports and for the replacement of traveler documents.

eID CARD SOLUTIONS



We excel in providing innovative eID Card solutions. Customized design, security elements meeting the latest standards, constant enhancements and in-house developed high-end materials and technologies guarantee the production of optimized, highly durable and unforgeable documents.

The customized design of our solution allows for the setup of an individual infrastructure for the personalization and issuance of ID

cards. A decentralized enrollment of the applicant's data followed by the data management at a central site enables the most flexible and efficient process handling. Afterwards, the blank document is personalized in a decentralized location so that the finished eID Card can be issued locally. Decentralized enrollment and issuance simplifies not only the access to ID documents for the whole population, but also the complete capturing of the citizens' data.

BAVARIA – HISTORY & FUTURE

WELCOME TO THE WORLD OF MÜHLBAUER!

Let us invite you on a captivating journey: our security document will lead you across Bavaria – the home state of our Mühlbauer Group!

Bavaria has always combined tradition with innovation, global thinking and acting. This culture has accompanied and left its mark on our company since our beginnings in 1981. Mühlbauer is built up on solidarity, reliability, dynamism, flexibility, pioneering spirit and open-mindedness – these are values our customers, partners and employees can rely on at any time. Think globally – act locally. As an international technology group with 35 subsidiaries and joint ventures Mühlbauer is represented on each continent of the world. The company employs more than 4,000 people, around 2,400 of them in the German headquarter in Roding.

Josef Mühlbauer founded the company in 1981. Starting out as a machine builder, the company quickly specialized in the field of identification and travel documents. Mühlbauer continuously expanded its technologies and gradually developed numerous new business fields, nowadays offering cutting-edge technologies being the world's only full-range solution provider for smart card manufacturing solution.

Investigation and progression earn high priority in the institution's working process. As a high-tech company, Mühlbauer invests a high percentage of sales in research and development. Around 600 employees work across departments on new products and solutions, generating and consistently using synergies. The products generically build on each other, complement each other and make the company extensively independent.

Today we would like to introduce you to our Mühlbauer safety documents, which will guide you through the Bavarian administrative districts of Upper Bavaria, Lower Bavaria, Upper Palatinate, Swabia and Franconia: Find out more about the largest cities as well as the most important technologies and cultural characteristics of each region on the following pages!

The heart of each identity document is the holderpage. This is where our Bavarian journey starts and ends. Let us give you an understanding of our various security features, which can individually be incorporated in your ID document – from state-of-the-art security paper to polycarbonate holderpages, e-inlays and visa pages. Some of the elements are only visible under UV light; discover the hidden security characteristics and get to know the work of our in-house design team.

We hope you enjoy your journey through Bavaria and the exciting world of high-security documents.

UPPER BAVARIA

TRADITIONAL LEDERHOSEN OR GLOBAL TECHNOLOGY BASE?

The cosmopolitan city of Munich is the cultural, political and scientific center of the Free State of Bavaria: Here, Bavaria's history is as vivid as its presence as high-tech and innovation location.

Almost nine million guests from all over the world visit Bavaria's capital city every year, which is known for its special hospitality and warmth – and which has much more to offer besides the world-famous Oktoberfest, the Munich Hofbräuhaus and traditional costumes. Above all, the buildings from different eras characterize Munich's cityscape. Landmarks as diverse as the Frauenkirche and the Olympic Stadium, which you can recognize on pages 2 and 3 of our security document, stand for the harmonious interplay of tradition and modernity.

The Gothic Frauenkirche or also called "Münchener Dom" (Munich Cathedral) with its characteristic towers was built in the 15th century in the Old Town of Munich. In addition to the cathedral building with its valuable paintings, altars and figures, visitors can also see the so-called Cenotaph; the magnificent mock tomb commemorates Ludwig IV, Roman-German king and Holy Roman Emperor, who was excommunicated in 1324 as a result of a conflict with the pope and died in a church ban in 1347.

A contrast to the historic cathedral church poses the Olympic Park, which was created on the occasion of the XX. Olympic Games in 1972 and is still one of the largest and most beautiful green belt in the city. The net-like roof belts, which spans the Olympic Stadium, the Olympic Hall and the Swimming Hall, symbolizes lightness, openness and freedom; already at the



opening, the modern construction was internationally celebrated as an architectural innovation and optical sensation, since then it has been the unmistakable trademark of the Olympic Park. Just 500 meters from the stadium is also the Munich Olympic Tower with a very special highlight: a revolving restaurant at a height of 181 meters, which offers guests a complete 360° panoramic view of the whole of Munich and the surrounding area.

Today, the Olympic Park is a venue for concerts, festivals, trade fairs, exhibitions and many other events. For a long time, the stadium was mainly used for professional soccer matches and other sporting events; now, as Munich's largest stage, it is a popular venue for open-air concerts.

REACHING FOR THE STARS



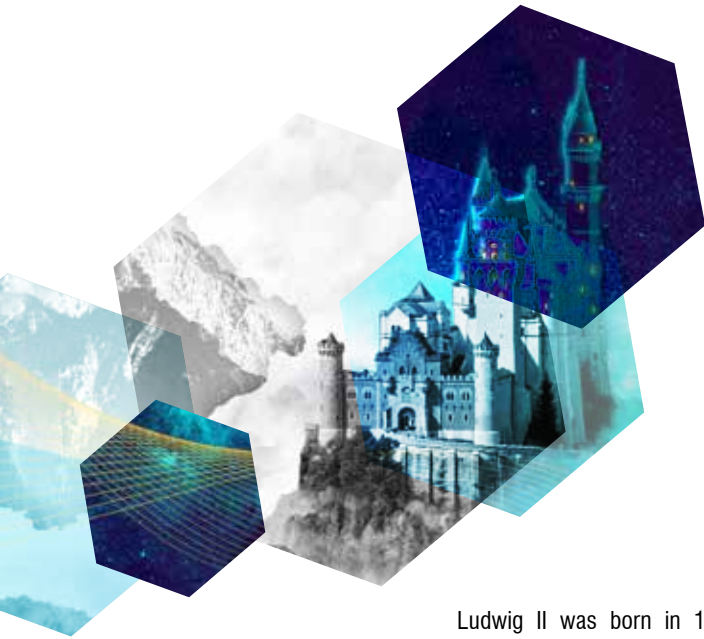
The greater Munich area is one of the most important locations for aerospace in Europe. In addition to global players such as the Airbus Group, numerous small and medium-sized companies have settled in the region. They cover the entire spectrum of aerospace – from the

construction of aircraft engines, landing gears and components for spacecraft and satellites to unmanned systems, helicopters and military aircraft.

A decisive competitive advantage of Munich's aerospace industry is the strong networking of companies with the numerous research and development centers, universities and colleges on site. The German Aerospace Center (DLR), for example, operates one of Germany's largest research centers in Oberpfaffenhofen near Munich; the DLR premises are also home to the control center of the Columbus Space Laboratory, a research laboratory of the European Space Agency (ESA) installed on the International Space Station (ISS). The Technical University of Munich (TUM) and several other renowned institutes such as the Fraunhofer Society, the Max Planck Society and the Helmholtz Zentrum München also conduct research on aerospace technology.

With its international trade fairs and congresses, Munich offers experts from all areas of aerospace a platform for exchanging ideas and presenting the latest innovations in the industry. In this way, the Munich location makes a decisive contribution to the further development of aerospace technology around the world.

DREAM CASTLES AND SELF-COVERING DINING TABLES



Hardly anyone has left such a lasting mark on Upper Bavaria's culture as the "fairy-tale king" Ludwig II: With his visions and the unconditional will to turn his dream and fairy-tale worlds into reality, he let built several castles that were to inspire generations of people. Neuschwanstein, Herrenchiemsee and Linderhof in particular are still internationally famous today and attract visitors from all over the world.

Ludwig II was born in 1845 at Nymphenburg Castle near Munich. However, the young king discovered his love of architecture and literature at Hohenschwangau Castle, where he spent most of his childhood and youth together with his brother Otto. Above all, the medieval heroic sagas depicted in numerous mural paintings in the castle impressed him so much that they were reflected in his later buildings. The best example of this is Neuschwanstein, probably the most famous of Ludwig's

three castles, which lies directly opposite Hohenschwangau Castle – just a few kilometers from the border with Upper Bavaria. The "fairy-tale castle", which can be seen on page 7 of our security document, was designed entirely as an idealized knight's castle from the Middle Ages; throughout the castle, there are numerous references to Richard Wagner's romantic operas "Tannhäuser" and "Lohengrin".

However, Ludwig II was not only a dreamer and romantic, but also a great promoter of the technical innovations of his time. One of the world's first electricity plants was built at Linderhof Palace, which is located in the far southwest of Upper Bavaria and served as a retreat for Ludwig II. The entire castle is designed in the neo-Rococo style and is splendidly furnished, but the highlight of its architecture lies outside the palace walls in the palace park: you can find here the

Venus Grotto, an artificial stalactite cave in which scenes from Richard Wagner's opera "Tannhäuser" and the Blue Grotto of Capri Island are illustrated. In order to stage the Venus Grotto spectacularly, it could be illuminated in different colors – the electricity was generated by 24 dynamos driven by a steam engine; the age of usable electricity had begun.

Another technical innovation can be found at both Herrenchiemsee Palace and Linderhof Palace, which is modeled on the Palace of Versailles. To be undisturbed while dining, a table was installed in the palaces that could be mechanically lowered to the floor below; there, it was set by the servants and finally raised again. Today, this principle is known as "Tischlein-Deck-Dich" in reference to a fairy tale by the Brothers Grimm; in the days of Ludwig II, it was one of the latest technical achievements.

LOWER BAVARIA

ABOUT WEDDINGS AND HOPS

Picturesque and romantic, steeped in history and full of joie de vivre: this is how Lower Bavaria's capital Landshut presents itself to its inhabitants and visitors.

Landshut was founded in 1204 by the Bavarian Duke Louis I. Thanks to its strategic location at the foot of the Isar River, the trade and commerce flourished – and so did the young city, being soon designated the official trade center between the regions of Munich, Regensburg and the Bavarian Forest. Even today, you will find numerous Gothic and Renaissance monuments from the 14th and 15th century in the historic city center, such as the Church of St. Martin, whose impressive tower, at a good 130 meters, is the highest brick church tower in the world and also the highest church tower in Bavaria. The building was completed around 1500 after 120 years of construction; in our security document, the basilica with its extraordinary architecture can be seen on page 8 in the ePassport.

However, not only the various buildings and sights, but also festivals and traditions bear witness to Landshut's eventful history. An impressive highlight is the Landshuter Hochzeit (wedding), which takes place every four years and is one of the largest and most important historical festivals in all of Europe. The festival usually lasts three weeks and commemorates the magnificent wedding of the Bavarian Duke George the Rich to the Polish king's daughter Hedwig Jagiellonica in 1475, which was to seal the alliance of the two houses against the power of the Ottomans. The traditional wedding procession with carriages, historical costumes and medieval instruments attracts every year more than 100,000 visitors from all over the world.



In addition to the historic buildings, modern architecture also has a firm place in Lower Bavaria's cultural landscape. The Kuchlbauer Tower in Abensberg, based on designs by artist Friedensreich Hundertwasser, is the landmark of the famous Lower Bavarian brewery zum Kuchlbauer. You will spot the "Beer Art Tower" on page 9 of our safety document, being a unique visitor magnet and a tribute to Bavarian beer.

The region around Abensberg, about 50 kilometers north of Landshut, is called Hallertau, the largest hop-growing area in the world, from which around 86 percent of German hops and a third of the world's hops come.

THE FUTURE OF MOBILITY

Lower Bavaria is an important center of the European automotive industry: Only in Dingolfing, the largest European location of the car and motorcycle manufacturer BMW, work around 18,000 employees.

The entire automotive industry is currently changing faster and more comprehensively than ever before; technical developments and changing customer demands are leading to completely new trends that offer established global players as well as innovative start-ups the unique opportunity to actively shape the future of mobility.

These future trends will also play a decisive role in the Dingolfing Competence Center: In addition to classic vehicles, bodies and components, electric motors and batteries for up to half a million electric cars per year are built here, which are supplied to all BMW plants worldwide. In particular, the BMW iNEXT is being built



in Dingolfing, the first fully electric SUV that is more automated and connected than ever before; this makes Lower Bavaria the birthplace of the vehicle that is set to revolutionize the future of mobility and usher in the age of autonomous driving.

NAPOLEON'S DEFEAT AND A RIVER THAT CONQUERS ROCKS



Picturesquely situated at the confluence of the Danube and Altmühl rivers, Kelheim was already a popular residence of the high nobility in the Middle Ages; the Wittelsbach dynasty in particular patronized the town, which soon developed into an important trading center for building materials, wine, salt and fish thanks to its ideal location.

Centuries later, King Ludwig I of Bavaria, descendant of the early Wittelsbach dynasty, found the perfect location on the Michelsberg near Kelheim to erect the Hall of Liberation, which to this

day commemorates the victorious battles against Napoleon during the wars of liberation from 1813 to 1815. The structure was built between 1842 and 1863 and is one of the most important national monuments of its time; you can see it in our security document on page 13.

Even the exterior facade is a tribute to the Battle of Leipzig: 18 huge colossal statues made of limestone, resting on pillars a good 16 meters high and two and a half meters thick, symbolize the 18 German tribes that fought side by side in the battle. The number of statues additionally refers to October 18, 1813, when Napoleon's troops were crushingly defeated.

However, Kelheim has not only historical monuments to offer, but also an imposing landscape that has inspired generations of people. A unique natural spectacle can be found between Kelheim and the Weltenburg Monastery: the Danube breakthrough "Weltenburger Enge". Here, the Danube flows between 70-meter-high rock walls, which were formed 200,000 years ago when the primeval Danube made its way through the limestone from the Jurassic period with tremendous force. King Ludwig I was deeply impressed by the landscape, and in 1840 he placed the area – as the first one in all of Bavaria – under nature conservation.

UPPER PALATINATE

THE ENCHANTING CITY ON THE DANUBE

Around 1275, construction began on Regensburg's St. Peter's Cathedral, probably the city's most famous landmark, pictured in our security document on page 14. With its characteristic towers, 32-meter-high ribbed vault in the central nave and medieval stained glass windows, the church is one of the most important Gothic buildings in Bavaria.

In the UNESCO World Heritage City of Regensburg, history is within reach: numerous Romanesque and Gothic buildings still bear witness to the city's former prosperity, but also to battles between ruling houses, destruction and the reconstruction of the strategically important Danube metropolis.

From the 11th century onwards, Regensburg flourished economically and culturally due to its long-distance trade with Paris, Venice and Kiev. The city became one of the largest trading centers in Europe; the powerful patrician families began to build impressive house castles with dynasty towers.

Despite several wars, the medieval Old Town with its picturesque alleys and squares as well as its unique churches, monasteries and residences has been largely preserved. A total of 984 of Regensburg's 1,347 protected architectural monuments are located here; therefore, the Old Town, together with Stadthof (the city district on the other side of the river, linked through the famous Stone Bridge) was recognized by UNESCO as a World Heritage Site in 2006. The historical significance of the site was also a pivotal factor in the decision to select the Old Town as the location for a lighthouse project: the establishment of a state museum for recent Bavarian history.



Even from the outside, the museum, which was ceremonially opened in 2019, is unmistakable. A particular highlight is the 80 m² "cathedral window", which perfectly reflects Regensburg Cathedral with its Gothic towers – creating an impressive bridge between the historical and the modern. In the foyer, the first thing to greet visitors is the symbolic animal of the Free State, a three-meter-high Bavarian lion; the exhibition itself

covers an area of 2500 m² and shows the development of Bavaria from the founding of the kingdom in 1806 to the present day, as well as its cultural characteristics. Find the extraordinary silhouette of the House of Bavarian History in our security document on page 15.

PIONEERS IN MECHANICAL ENGINEERING

Roding, key to the world! Since 1981, state-of-the-art technologies in the fields of smart cards, ePassports, RFID smart labels, flexible solar cells, visions and software have come from the heart of the Upper Palatinate.

The history of the Mühlbauer Group began with a single lathe machine and the production of precision parts, among others for the aerospace industry. Only four years later, the opportunity arose to enter the semiconductor industry; quickly, the Mühlbauer team, with ambitious employees and unconventional ideas, took responsibility for complete production lines, thus securing a firm place in the semiconductor industry to this day.

These experiences eventually also formed the basis for the development of complete solutions for the production of smart cards; and so it came about that a company from the Upper Palatinate at the end of the 1980s – when the still young sector of smart cards was just finding its feet – set international standards and soon supplied up to 90 percent of the world market. Today, the Mühlbauer team works trustfully with governments all over

the world, always with the goal in mind of actively helping to ensure that every person in the world has secure identification documents and thus an identity. This not only makes travel safer and easier for everyone in a globalized world, it also enables people to participate

in social life – because only those who officially exist have access to health care, education and work and can take part in elections, get married or open an account.



THE HEROES OF DAYS GONE BY



High on the Bräuberger near Donau-
stau, a plateau with a magnificent
view over the entire Regensburg
Danube valley, enthrones one
of the most important national
memorials of the 19th century:
Valhalla – named after Valhalla, the
final resting place for fallen war-
riors in Germanic mythology.

At the beginning of the 19th century,
Germany was highly fragmented
politically; in 1806, the Holy Ro-
man Empire of the German Nation
broke up. In an effort to restore a
sense of common identity to the
people, Ludwig I had a “Temple
of Glory” built to array busts and
commemorative plaques of de-
serving German-speaking per-
sonalities. The foundation stone was
laid in 1830; twelve years later, the
magnificent building was ceremo-
niously opened.

The building itself, which dates
from the era of classicism and is
based on the Parthenon – the fa-
mous Greek temple on the Acro-
polis in Athen – is impressive.
A total of 52 Doric-style pillars
surround Valhalla; the pediments
depict historical episodes such as
the victory of the Germanic tribes
against the Roman legions in the
Battle of the Teutoburg Forest in
9 AD, or even the “liberation” of
Germany after Napoleon’s abdic-
ation in 1814.

Inside, 131 busts and 65 com-
memorative plaques to dukes,
kings and emperors, army com-
manders and generals, but also
important personalities from sci-
ence, art and culture await the
visitor. Numerous rulers of the past
millennium stand side by side with
people such as Johannes Guten-
berg (inventor of modern printing),
Martin Luther (reformer), Fried-
rich Schiller, Johann Wolfgang
von Goethe and Gotthold Ephraim
Lessing (poet), Wolfgang Amade-
us Mozart, Ludwig van Beethoven
and Richard Wagner (composer),
Albrecht Dürer (painter), Imman-
uel Kant (philosopher), Nicolaus
Copernicus and Johannes Kepler
(astronomers), Paracelsus (phy-
sician and natural philosopher),
Albert Einstein (physicist) and
Sophie Scholl (resistance fighter in
the Third Reich).

SWABIA

CENTER OF TRADE

Augsburg has a long tradition as a “city of peace”: with the signing of the Imperial and Religious Peace in 1555, the foundation was laid for the first time for Catholics and Protestants to live together on equal terms; and even today, events such as the High Peace Festival and the awarding of the Augsburg Peace Prize to personalities who promote tolerance between cultures and religions commemorate this special historical event.

However, the city owes its rise primarily to the economic skills of great trading dynasties such as the Fugger family. Hans Fugger, progenitor of the later “Fugger vom Reh” and “Fugger von der Lilie” lines, made an international name for himself as a weaver and textile merchant as early as the 14th century; at an early stage, he began exporting Bavarian linen as far away as Italy.

One of the most important Renaissance buildings is Augsburg City Hall, which was built between 1615 and 1624 and can be seen in our security document on page 20. At the time of its creation, it was an architectural masterpiece: it is said to be the world’s first building with more than six floors, and with its height of 57 meters, it was also the tallest building in all of Germany for almost 300 years. The centerpiece of the town hall is the “Golden Hall”, which extends over two floors and features magnificent portals, murals and ceiling decorations. In 1944, the building was largely destroyed; after the end of the war, first the facade and later also the Golden Hall were reconstructed in loving detail.



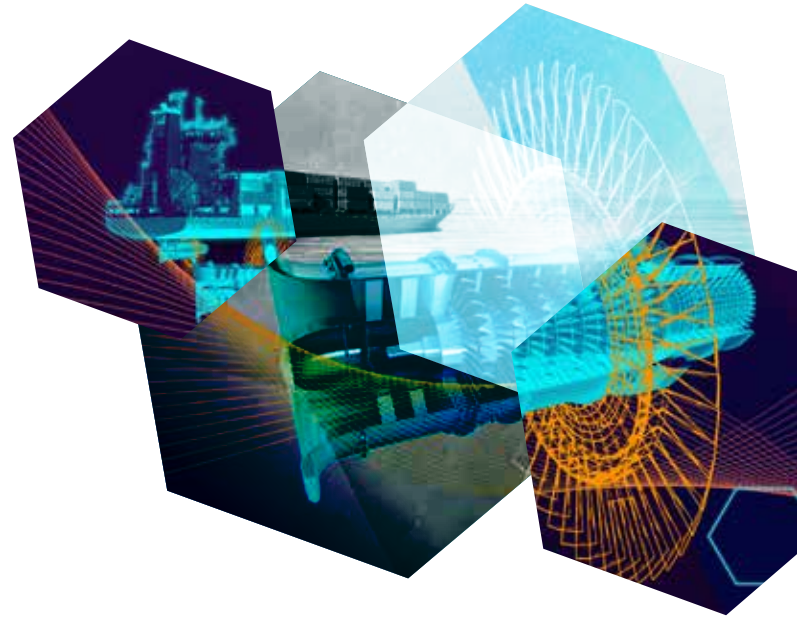
Just a few minutes’ drive south of Rathausplatz, in the city’s university district, you will find another of Augsburg’s highlights: the ultra-modern WWK Arena (page 21 in the security document), home ground of the FC Augsburg soccer club and the world’s first climate-neutral soccer stadium.

In 2017, a completely new exterior façade made of interwoven aluminum and light rods was installed; since then, innovative LED technology has made the building shine in the club colors of red, green and white.

DRIVE FOR SUPER-STEAMERS

Since the 19th century, Augsburg – once the center of the international textile trade – has been one of the most important engineering locations in southern Germany; today, it is home to major industrial companies such as MAN Energy Solutions, which employs around 4,000 people at its Swabian headquarter on the edge of the old town.

Above all, Maschinenfabrik Augsburg-Nürnberg (MAN) is famous for one of the great milestones in the art of engineering: between 1893 and 1897, the German engineering luminary Rudolf Diesel invented the diesel engine with the support of MAN experts. The development process was long and marked by numerous setbacks; many of Diesel's ideas could not be implemented in practice. Nevertheless, he was convinced by the project to design a new type of self-igniting engine that, according to calculations, would have a significantly higher efficiency than the steam engines used up to then. In the end, the hard work paid off: After four years of development, the engine was completed, and the end of steam engines had come.



Today, MAN Energy Solutions is a specialist in diesel engines, which are primarily used in the shipping industry, but also in power plants; highly qualified employees work every day on the production and further development of large engines for cargo and cruise ships, as well as turbomachinery for power generation.

With its 250 years of experience, the Augsburg-based company is relying not only on tradition but also on innovation: In the coming years, MAN Energy Solutions will increasingly offer sustainable energy solutions – and by this actively shape the future of power generation on the world's oceans and on land.

SAFELY NAVIGATING AROUND CLIFFS



In the very southwest of Swabia – on the eastern shore of Lake Constance, which connects Germany, Austria and Switzerland – lies the town of Lindau, which is known worldwide primarily for its dreamlike location on Germany's largest inland lake. Even though 98 percent of its area is actually on the mainland, according to its name it is the "island where linden trees grow".

Anyone who has seen pictures of Lindau will certainly recognize the harbor entrance with its two unmistakable landmarks: the Bavarian Lion, a six-meter-high statue made of Kelheim sandstone and perched on a huge pedestal, and the lighthouse, which is not only the southernmost lighthouse in Germany, but also the only one in all of Bavaria.

Yet today's lighthouse is still comparatively young: for almost 700 years, until the middle of the 19th century, the so-called Mangturm had shown ships the right way. The 20-meter-high square structure, which was once integrated into the city's fortifications and for a long time could only be reached via a drawbridge, can still be seen today on the lake promenade.

Finally, in 1856, not only a new harbor was built, but also a new lighthouse about 36 meters high. In the beginning, a lighthouse keeper was responsible for keeping a blazing fire visible from afar from sunset to sunrise; with advances in technology, the lighthouse has also been modernized, and today the signal is activated by radio signal by the ships themselves when needed.

FRANCONIA

LISTEN TO WHAT THE CHRIST CHILD IS TELLING YOU

If you like the Advent season, the hustle and bustle between festively decorated stalls and the smell of roasted almonds and mulled wine, you will love Nuremberg in December: The city is known far beyond Germany's borders for its traditional Christkindlesmarkt – one of the most famous Christmas markets in the world, attracting more than two million visitors every year. The spectacle always begins on the Friday before the first Advent, when the Nuremberg Christ Child appears high up in the gallery of the Frauenkirche and opens the market with a solemn prologue, and ends on Christmas Eve.

However, the Franconian metropolis has much more to offer than its Christmas market, gingerbread and Nuremberg grilled sausages: As an independent imperial city of the Holy Roman Empire, it really flourished in the 13th century; and even today, numerous historical art and architectural monuments bear witness to that time.

One of the best-known landmarks is Nuremberg Castle: once a fortress, residence of emperors and kings, and scene of power struggles between ruling houses and the bourgeoisie, the castle was badly damaged in World War II and later rebuilt. Also worth seeing is the Old Town Hall, built in the 14th century and later repeatedly rebuilt and enlarged.



For those seeking recreation, northeast of Nuremberg is Franconian Switzerland, which attracts thousands of hikers and nature lovers every year. The “land of mountains and valleys” is characterized by striking limestone and dolomite cliffs, which together form one of the most beautiful climbing areas in the world, countless stalactite caves, romantic rivers and numerous castles, castle

ruins and palaces that invite you to visit. It's no wonder, then, that poets and writers went into raptures in Franconian Switzerland – like Jean Paul, who wrote in 1798 about the unique landscape: “Here the path runs from one paradise through another.”

INNOVATION ON THE RAILS



It was a symbol of power, speed and courage: On December 7, 1835, the “Ludwigseisenbahn” – Germany’s first railway – started, pulled by a locomotive instead of horses; from then on, the rail line connected two important industrial centers of Bavaria, Nuremberg and Fürth, within less than 15 minutes.

The city developed early on into an important hub for rail traffic in Bavaria. Today, in addition to the Munich-Nuremberg Express, Germany’s fastest regional express, various ICEs, ICs and night trains call at the main station.

It is not surprising that the region is still synonymous with innovations in the field of rail vehicles. Erlangen, for example, just 20 km north of Nuremberg, is home to the rail division of the Siemens technology group, where the rail transport of the future is being shaped – for example with ultra-modern intercity and high-speed trains, subways and streetcars, driverless rail vehicles and locomotives. Among others, the dual-power locomotive “Vectron Dual Mode” was devel-

oped here. Depending on whether a track has overhead lines or not, it can be operated classically with diesel power or, alternatively, with electric power; this makes rail transport even more sustainable and economical than before.

SEDUCTIVE VINEYARDS AND A CASTLE ABOVE THE CITY



Franconia has a long tradition of viticulture: as early as the 8th century, Franconian monasteries produced their own altar wine, and in the Middle Ages Franconia was even the largest wine-growing region of the Holy Roman Empire north of the Alps.

Würzburg plays a special role in this: Due to its location in a valley basin – with numerous slopes and a comparatively dry, warm climate – it is predestined above all for the cultivation of white wine. The Bürgerspital, the Juliuspsital and the Staatlicher Hofkeller, three large traditional wineries, are located in the city – which is also reflected in the cultural life: From April to November, the wine city of Würzburg hosts several wine festivals, a Night of Open Wine

Cellars or even the Würzburg Wine Village, where visitors from all over the world can sample more than 100 different Franconian wines in the lovingly designed arbors on the market square.

Marienberg Fortress – probably Würzburg's best-known landmark, which once served as a fortification and also as the residence of the Würzburg prince-bishops – is also idyllically situated amid vineyards. The castle complex enthrones about 100 meters above the Main River; it was built in Gothic style as early as around 1200 and was repeatedly expanded in the following centuries, finally being remodeled into a Renaissance castle and converted into a Baroque fortress after being conquered by the Swedes during the Thirty Years' War.

Later, however, the prince-bishops bid farewell to the vineyards and moved their seat to the Würzburg Residence, a Baroque building on the edge of the city center that was erected from 1720 to 1744 and was larger and more representative than the castle on the Marienberg. As “the most uniform and extraordinary of all Baroque palaces”, “unique for its originality”, which also represented “one of the most radiant princely courts in Europe”, the palace was designated a UNESCO World Heritage Site in 1981, along with the Residenzplatz and the Hofgarten.

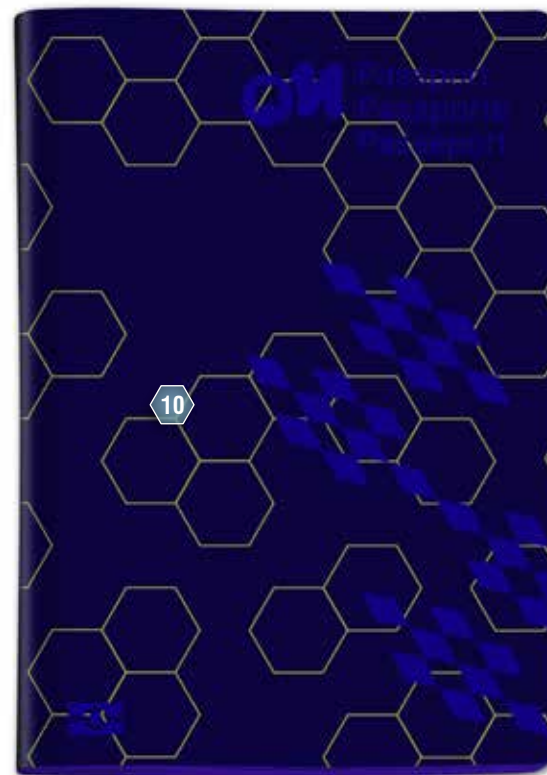
FRONT COVER

NORMAL LIGHT



- 1 HEAT RESISTANT COVER SUBSTRATE
- 2 HOT FOIL EMBOSING

UV-LIGHT



- 10 UV FLUORESCENT COVER PRINTING

BACK COVER

NORMAL LIGHT



3 NEGATIVE RELIEF EMBOSSING

4 LASER PERFORATED SPECIAL SHAPED SERIAL NUMBER

UV-LIGHT



10 UV FLUORESCENT COVER PRINTING

FLYLEAF

NORMAL LIGHT



- | | | | | | | | |
|----|--|----|---|----|---|----|--|
| 6 | VISIBLE SECURITY FIBERS | 39 | BLIND INTAGLIO (INK-LESS IMPRESSION) | 55 | VARIABLE SIZE MICRO-TEXT | 63 | IR SPLIT (INFRARED ABSORBING INK AND INFRARED TRANSPARENT INK) |
| 7 | SECURITY PAPER | 40 | OPTICAL VARIABLE INK (OVI®) | 56 | LINE WIDTH MODULATION | | |
| 8 | ABSORBENCY & PAPER SURFACE CHARACTERISTICS | 41 | RAINBOW PRINTING (IRIS PRINTING) | 57 | ANTI COPY PROTECTION | 81 | DUPLEX DESIGN |
| 19 | CHEMICAL REACTIVE PAPER | 42 | MULTICOLOR GUILLOCHE | 58 | MICRO-TEXT | 84 | UNIQUE MIXED SECURITY INKS |
| 36 | MULTICOLOR INTAGLIO PRINTING | 43 | NEGATIVE GUILLOCHE | 59 | MICRO-TEXT SCREEN | 87 | SERIAL NUMBER LETTERPRESS PRINTING |
| 37 | INTAGLIO PRINTING WITH OPTICAL VARIABLE INK (OVI®) | 44 | RELIEF FINE-LINE PATTERN | 60 | NEGATIVE MICRO-TEXT (INCLUDING DELIBERATE SPELLING MISTAKE) | 88 | LASER PERFORATED SPECIAL SHAPED SERIAL NUMBER |
| 38 | LATENT IMAGE WITHIN INTAGLIO DESIGN | 54 | INTAGLIO MICRO-TEXT (INCLUDING DELIBERATE SPELLING MISTAKE) | 61 | SECURITY BACKGROUND | | |
| | | | | 62 | DELIBERATE DESIGN ERROR | | |

FLYLEAF

UV- / IR-LIGHT



UV-light



UV-light bi-fluor

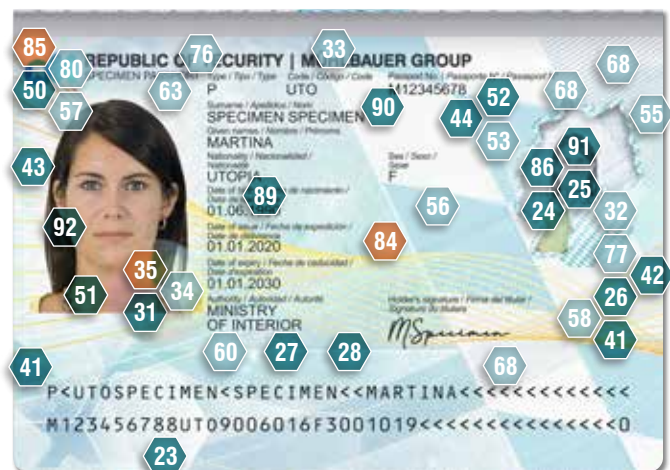


IR-light

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|--|---|
| 14 UV DULL PAPER SUBSTRATE | 66 UV FLUORESCENT SECURITY SCREEN |
| 15 UV FLUORESCENT MULTICOLOR SECURITY FIBERS | 67 UV BI-FLUORESCENT PRINTING (365 nm / 254 nm) |
| 63 IR SPLIT | 95 UV FLUORESCENT LETTERPRESS PRINTING |
| 64 UV FLUORESCENT RAINBOW PRINTING (IRIS PRINTING) | |
| 65 UV FLUORESCENT VARIABLE SIZE MICRO-TEXT (INCL. DELIBERATE SPELLING MISTAKE) | |

DATA PAGE – eHOLDERPAGE

NORMAL LIGHT



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|----|--|----|--|
| 13 | UV DULL POLYCARBONATE SUBSTRATE | 43 | NEGATIVE GUILLOCHE |
| 23 | MULTILAYER CONSTRUCTION | 44 | RELIEF FINE-LINE PATTERN |
| 24 | MB SHIFTING WINDOW | 50 | OPTICAL SHIFTING INK |
| 25 | MB SEGMENTED WINDOW | 51 | SECURITYBACKGROUND MERGED WITH PORTRAIT AREA |
| 26 | SURFACE RELIEF STRUCTURE (POSITIVE / NEGATIVE) | 52 | MB CHROMATIC WATERMARK |
| 27 | MATTE SURFACE RELIEF | 53 | IR DROP OUT |
| 28 | SURFACE RELIEF LATENT IMAGE | 55 | VARIABLE SIZE MICRO-TEXT |
| 31 | EMBEDDED PARTIAL METALLIZED HOLOGRAM | 56 | LINE WIDTH MODULATION |
| 32 | MB SHINING WINDOW | 57 | ANTI COPY PROTECTION |
| 33 | MICRO-TEXT SURFACE RELIEF | 58 | MICRO-TEXT |
| 34 | MICRO-TEXT (INSIDE HOLOGRAM) | 60 | NEGATIVE MICRO-TEXT |
| 35 | NANOTEXT (INSIDE HOLOGRAM) | 63 | IR SPLIT |
| 41 | RAINBOW PRINTING | 66 | UV FLUORESCENT SECURITY SCREEN |
| 42 | MULTICOLOR GUILLOCHE | 67 | UV BI-FLUORESCENT PRINTING (365 nm / 313 nm) |

UV- / IR-LIGHT



UV-light

- 68 MULTIPLE SECURITY SCREENS
- 71 UV FLUORESCENT MICRO-TEXT
- 76 CUSTOMIZED TYPE FONT
- 77 UV FLUORESCENT PIGMENTS
INCORPORATED IN VISIBLE
COLORS
- 78 MULTICOLOR UV FLUORESCENT
PRINTING
- 79 MB VIVID UV
- 80 INFRARED-LUMINESCENT INK
(ANTI-STOKES EFFECT)
- 84 UNIQUE MIXED SECURITY INKS
- 85 MB AURORA
- 86 MULTIPLE LASER IMAGE (MLI)
- 89 LASER ENGRAVING
- 90 TACTILE LASER ENGRAVING
- 91 LASER ENGRAVED GHOST IMAGE
- 92 MB ALFRESCO® PLC



UV-light bi-fluor



IR-light

DATA PAGE – FLEXPAGE

NORMAL LIGHT



- | | |
|---|---|
| 13 UV DULL POLYCARBONATE SUBSTRATE | 44 RELIEF FINE-LINE PATTERN |
| 23 MULTILAYER CONSTRUCTION | 50 OPTICAL SHIFTING INK |
| 24 MB SHIFTING WINDOW | 51 SECURITY BACKGROUND MERGED WITH PORTRAIT AREA |
| 26 SURFACE RELIEF STRUCTURE (POSITIVE / NEGATIVE) | 53 IR DROP OUT (INFRARED TRANSPARENT INK) |
| 27 MATTE SURFACE RELIEF | 55 VARIABLE SIZE MICRO-TEXT |
| 28 SURFACE RELIEF LATENT IMAGE | 56 LINE WIDTH MODULATION |
| 31 EMBEDDED PARTIAL METALLIZED HOLOGRAM | 57 ANTI COPY PROTECTION |
| 33 MICRO-TEXT SURFACE RELIEF | 58 MICRO-TEXT |
| 34 MICRO-TEXT (INSIDE HOLOGRAM) | 60 NEGATIVE MICRO-TEXT (INCLUDING DELIBERATE SPELLING MISTAKE) |
| 35 NANOTEXT (INSIDE HOLOGRAM) | 63 IR SPLIT (INFRARED ABSORBING INK AND INFRARED TRANSPARENT INK) |
| 41 RAINBOW PRINTING (IRIS PRINTING) | 66 UV FLUORESCENT SECURITY SCREEN |
| 42 MULTICOLOR GUILLOCHE | |
| 43 NEGATIVE GUILLOCHE | |

UV- / IR-LIGHT



UV-light

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| 67 UV BI-FLUORESCENT PRINTING (365nm / 254 nm) |
| 68 MULTIPLE SECURITY SCREENS |
| 71 UV FLUORESCENT MICRO-TEXT |
| 76 CUSTOMIZED TYPE FONT |
| 78 MULTICOLOR UV FLUORESCENT PRINTING |
| 79 MB VIVID UV |
| 80 INFRARED-LUMINESCENT INK (ANTI-STOKES EFFECT) |
| 84 UNIQUE MIXED SECURITY INKS |
| 85 MB AURORA |
| 86 MULTIPLE LASER IMAGE (MLI) |
| 89 LASER ENGRAVING |
| 90 TACTILE LASER ENGRAVING |
| 91 LASER ENGRAVED GHOST IMAGE |
| 93 PICTURE IN SHADOW |



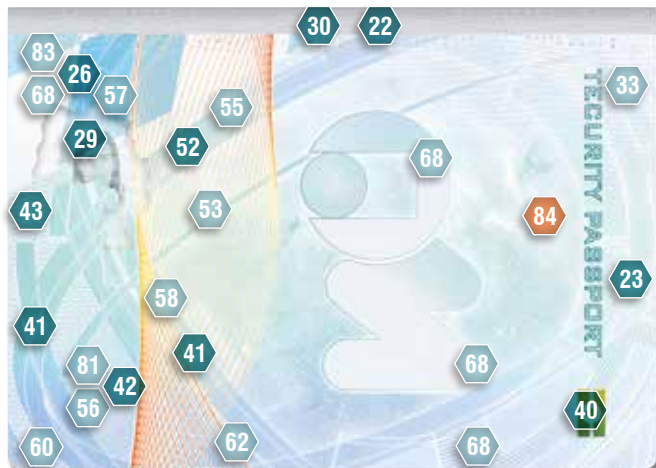
UV-light bi-fluor



IR-light

TITLE PAGE – eHOLDERPAGE

NORMAL LIGHT



- | | |
|--|--|
| 13 UV DULL POLYCARBONATE SUBSTRATE | 43 NEGATIVE GUILLOCHE |
| 22 MB HINGE TECHNOLOGY | 52 MB CHROMATIC WATERMARK |
| 23 MULTILAYER CONSTRUCTION | 53 IR DROP OUT (INFRARED TRANSPARENT INK) |
| 26 SURFACE RELIEF STRUCTURE (POSITIVE / NEGATIVE) | 55 VARIABLE SIZE MICRO-TEXT |
| 29 SECURITY BACKGROUND MERGED WITH MB CLEAR WINDOW | 56 LINE WIDTH MODULATION |
| 30 MB SECURE HINGE WITH SURFACE EMBOSING | 57 ANTI COPY PROTECTION |
| 33 MICRO-TEXT SURFACE RELIEF | 58 MICRO-TEXT |
| 40 OPTICAL VARIABLE INK (OVI®) | 60 NEGATIVE MICRO-TEXT (INCLUDING DELIBERATE SPELLING MISTAKE) |
| 41 RAINBOW PRINTING (IRIS PRINTING) | 62 DELIBERATE DESIGN ERROR |
| 42 MULTICOLOR GUILLOCHE | 64 UV FLUORESCENT RAINBOW PRINTING (IRIS PRINTING) |
| | 68 MULTIPLE SECURITY SCREENS |

UV- / IR-LIGHT



UV-light

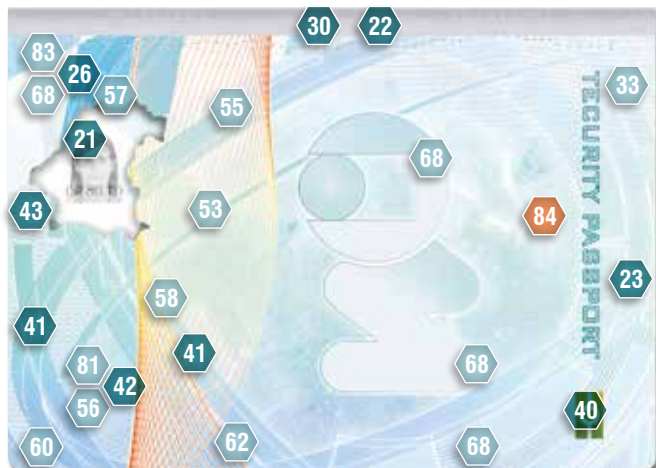
- | |
|---|
| 78 MULTICOLOR UV FLUORESCENT PRINTING |
| 81 DUPLEX DESIGN |
| 82 MB SECURE HINGE WITH UV FLUORESCENT PRINTING |
| 83 INVISIBLE CONSTANT INFORMATION (ICI®) |
| 84 UNIQUE MIXED SECURITY INKS |



IR-light

TITLE PAGE – FLEXPAGE

NORMAL LIGHT



- | | |
|---|--|
| 13 UV DULL POLYCARBONATE SUBSTRATE | 43 NEGATIVE GUILLOCHE |
| 21 MB CLEAR WINDOW | 53 IR DROP OUT (INFRARED TRANSPARENT INK) |
| 22 MB HINGE TECHNOLOGY | 55 VARIABLE SIZE MICRO-TEXT |
| 23 MULTILAYER CONSTRUCTION | 56 LINE WIDTH MODULATION |
| 26 SURFACE RELIEF STRUCTURE (POSITIVE / NEGATIVE) | 57 ANTI COPY PROTECTION |
| 30 MB SECURE HINGE WITH SURFACE EMBOSING | 58 MICRO-TEXT |
| 33 MICRO-TEXT SURFACE RELIEF | 60 NEGATIVE MICRO-TEXT (INCLUDING DELIBERATE SPELLING MISTAKE) |
| 40 OPTICAL VARIABLE INK (OVI®) | 62 DELIBERATE DESIGN ERROR |
| 41 RAINBOW PRINTING (IRIS PRINTING) | 64 UV FLUORESCENT RAINBOW PRINTING (IRIS PRINTING) |
| 42 MULTICOLOR GUILLOCHE | 68 MULTIPLE SECURITY SCREENS |

UV- / IR-LIGHT



UV-light

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|---|
| 78 MULTICOLOR UV FLUORESCENT PRINTING |
| 81 DUPLEX DESIGN |
| 82 MB SECURE HINGE WITH UV FLUORESCENT PRINTING |
| 83 INVISIBLE CONSTANT INFORMATION (ICI®) |
| 84 UNIQUE MIXED SECURITY INKS |



IR-light

1ST VISA PAGE – eHOLDERPAGE

NORMAL LIGHT



- 9 EMBEDDED WINDOW SECURITY THREAD
WITH DYNAMIC MOVEMENT EFFECT
- 94 PERSONALIZATION WITH INKJET PRINTING

UV-LIGHT



UV-light



UV-light bi-fluor

1ST VISA PAGE – FLEXPAGE

NORMAL LIGHT



- 9 EMBEDDED WINDOW SECURITY THREAD WITH DYNAMIC MOVEMENT EFFECT
- 94 PERSONALIZATION WITH INKJET PRINTING
- 96 INVISIBLE PERSONAL INFORMATION (IPI™)
- 97 UV FLUORESCENT HOLDER'S PORTRAIT



IPI™ under lense

UV-LIGHT



UV-light



UV-light bi-fluor

VISA PAGE

NORMAL LIGHT



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|--|-------------------------------------|--|--|
| 6 VISIBLE SECURITY FIBERS | 41 RAINBOW PRINTING (IRIS PRINTING) | 47 FLOATING ELEMENT | 62 DELIBERATE DESIGN ERROR |
| 7 SECURITY PAPER | 42 MULTICOLOR GUILLOCHE | 57 ANTI COPY PROTECTION | 68 MULTIPLE SECURITY SCREENS |
| 8 ABSORBENCY & PAPER SURFACE CHARACTERISTICS | 43 NEGATIVE GUILLOCHE | 58 MICRO-TEXT | 69 ART-SCREEN |
| 17 MULTITONE WATERMARK | 44 RELIEF FINE-LINE PATTERN | 59 MICRO-TEXT SCREEN | 81 DUPLEX DESIGN |
| 18 ELECTROTYPE WATERMARK | 45 PAGE NUMBER WITH SECURITY DESIGN | 60 NEGATIVE MICRO-TEXT (INCLUDING DELIBERATE SPELLING MISTAKE) | 84 UNIQUE MIXED SECURITY INKS |
| 19 CHEMICAL REACTIVE PAPER | 46 UNIQUE VISA PAGE DESIGN | 61 SECURITY BACKGROUND | 88 LASER PERFORATED SPECIAL SHAPED SERIAL NUMBER |

VISA PAGE

UV- / IR-LIGHT



UV-light



UV-light bi-fluor



IR-light

- | | |
|---|--|
| 14 UV DULL PAPER SUBSTRATE | 70 UNIQUE UV FLUORESCENT DESIGN |
| 15 UV FLUORESCENT MULTICOLOR SECURITY FIBERS | 71 UV FLUORESCENT MICRO-TEXT |
| 16 UV FLUORESCENT MULTICOLOR DOTS | 72 UV FLUORESCENT PAGE NUMBER |
| 63 IR SPLIT (INFRARED ABSORBING INK AND INFRARED TRANSPARENT INK) | 73 UV FLUORESCENT FLOATING ELEMENT |
| 64 UV FLUORESCENT RAINBOW PRINTING (IRIS PRINTING) | 78 MULTICOLOR UV FLUORESCENT PRINTING |
| 67 UV BI-FLUORESCENT PRINTING (365nm / 254 nm) | 88 LASER PERFORATED SPECIAL SHAPED SERIAL NUMBER |

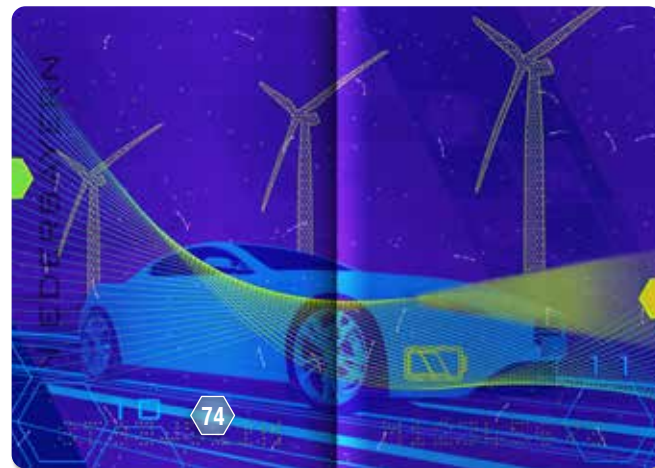
VISA PAGE

NORMAL LIGHT

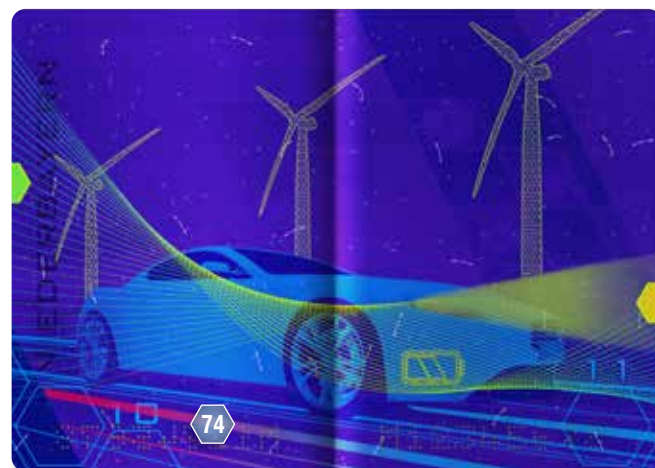


74 UV FLUORESCENT INK WITH COLOR CHANGE

UV-LIGHT



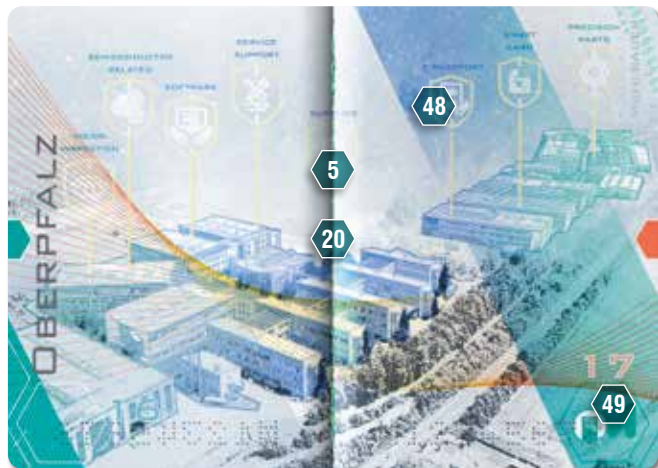
UV-light



special UV-light effect

VISA PAGE

NORMAL LIGHT



- | | |
|--|--|
| 5 MULTICOLOR SEWING THREAD | 20 LOCK STICHING WITH INTERLOCK SEWING |
| 11 MULTICOLOR UV FLUORESCENT THREAD | 48 IRIDESCENT INK |
| 12 UV BI-FLUORESCENT SEWING THREAD (365 nm / 254 nm) | 49 "SEE THROUGH" ELEMENT |

UV-LIGHT



UV-light



UV-light bi-fluor

VISA PAGE

NORMAL LIGHT



Photochromic

75 PHOTOCROMIC INK

83 INVISIBLE CONSTANT
INFORMATION (ICI®)



ICI® under lense

UV-LIGHT



UV-light



UV-light bi-fluor

SECURITY FEATURES – ePASSPORT

SECURITY FEATURES

MATERIAL – SECURITY LEVEL 1

1 HEAT RESISTANT COVER SUBSTRATE



The passport cover is not just to protect the pages on the inside from being damaged, but it also ensures that additional security is given to the passport in the form of hidden or visible features. The cover itself consists of a specially coated material which offers adequate resistance against external influences like heat and tearing and therefore offers perfect protection of the complete passport booklet.

2 HOT FOIL EMBOSSING



Hot foil stamping or embossing is a method of relief printing in which colored or metallized foils are transferred to a passport cover's surface at high temperatures by the usage of specially designed dies.

3 NEGATIVE RELIEF EMBOSSING



Instead of a simple structured cover surface, other tactile elements or contours can be applied to the cover. These negative embossed elements are on the one hand a visual enhancement and on the other hand also increase the security of the booklet. This tactile security element is easy to verify but requires special embossing tools for production.

4 LASER PERFORATED SPECIAL SHAPED SERIAL NUMBER



The entire passport booklet is perforated with a special laser, thus endowing the document with a unique passport number. By numbering all passport pages, the document is reliably protected against page substitution. Every single digit consists of small, conical holes, whose size may vary depending on the page number, making it even harder for counterfeiters to swap pages. With the use of specially shaped holes, e.g. in the form of stars or triangles, the document's security can be enhanced even more.

5 MULTICOLOR SEWING THREAD



The binding of the passport booklet is done by means of thread stitching. To increase the booklet's security and durability, the interlock stitch technique is employed both at the top and at the bottom of the document so that no pages can be removed. The multi-colored sewing threads, which are available for this purpose, can have a variety of characteristics: For example, the sewing thread may include colors which are visible under usual light and/or which fluoresce under UV light. By means of this sophisticated stitching technology, the document's protection against page substitution is further enhanced. If the booklet has been unstitched once, it is impossible to reuse the sewing thread as it is noticeably damaged.

6 VISIBLE SECURITY FIBERS



Security fibers are available in a versatile range of colors: For example, they can be visible or invisible in usual light as well as visible or invisible in UV light. These fibers in form of tiny threads are embedded into the security paper during its manufacturing process. As neither the security paper itself nor the security fibers are available in the commercial market, the integration of security fibers into the document security concept increases the document's counterfeit protection even more.

7 SECURITY PAPER



To maintain an effective defense against the menace of counterfeiting, a document's paper elements need to be given careful consideration. In high-security documents, a special security paper is used. It is endowed with specifically perceptible characteristics which distinguish it from normal, commercial paper at first glance. In general, the security paper is characterized by its special paper composition - with integrated cotton and without optical brighteners. In order to provide the paper substrate with individual customization and make it even more difficult for counterfeiters to copy a legitimate document or compromise a legitimate document, additional security elements can be integrated into the security paper.

8 ABSORBENCY & PAPER SURFACE CHARACTERISTICS



The degree of roughness is a vital part of the paper substrate's composition. By choosing the right composition of paper, the inks and colors applied to it can penetrate the paper substrate instead of only covering its surface. This means that the security paper absorbs part of the ink. Once the high-secure ink is printed onto the paper substrate, document manipulation is extremely complicated. Trials can be easily detected by means of the chemical sensitizers which are included in the paper substrate.

9 EMBEDDED WINDOW SECURITY THREAD WITH DYNAMIC MOVEMENT EFFECT



The window security thread is woven into the paper substrate and alternately visible and then embedded back into the paper. This security feature is already well known and proven from the banknote sector and increases the counterfeit protection of the paper many times over. In addition, the visible part of the security thread contains micro lens structures, which create a unique movement effect, which cannot be copied or imitated.

MATERIAL – SECURITY LEVEL 2

10 UV FLUORESCENT COVER PRINTING



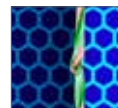
A special coating with UV-fluorescent elements is applied to the passport cover. Only when viewed under UV light, the cover's additional design elements become visible. As these UV-fluorescent elements in the coating cannot be scanned or copied, the passport cover is protected against copying and other attempts of forgery.

11 MULTICOLOR UV FLUORESCENT THREAD



Usually the binding of the passport booklet is done by means of lock stitching and the usage of security threads. The multi-colored sewing threads can have a variety of additional characteristics like different colors which are visible under usual light and additionally fluoresce under UV light. To increase the security the single yarns of the thread fluoresce in different colors, or show no reaction to UV light.

12 UV BI-FLUORESCENT SEWING THREAD (365 nm/254 nm)



In order to make a normal UV fluorescent sewing thread even more secure, a sewing thread with UV bi-fluorescent properties can be used for booklet binding. Depending on the UV wave length under which the sewing thread is examined (313 nm compared to 365 nm), the color reaction of the UV bi-fluorescent changes accordingly.

13 UV DULL POLYCARBONATE SUBSTRATE



Security documents generally consist of UV dull polycarbonate substrate. In contrast to most commercial substrates, which contain optical brighteners and fluoresce under UV light, UV dull security substrates do not emit a visible fluorescence during exposure to ultraviolet light. By means of the UV dull substrate, the authenticity of a document can be easily checked under UV light. Thus, attempts of imitation or manipulation can easily be detected.

14 UV DULL PAPER SUBSTRATE



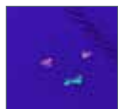
Passport paper pages generally consist of UV dull paper substrate. In contrast to most commercial substrates which contain optical brighteners and fluoresce under UV light, UV dull security substrates do not emit a visible fluorescence during exposure to ultraviolet light. By means of the UV dull substrate, the authenticity of a document can be easily checked under UV light. Thus, attempts of document imitation or manipulation can be detected at first glance.

15 UV FLUORESCENT MULTICOLOR SECURITY FIBERS



The UV fluorescent fibers may be invisible in usual light but visible in different colors under UV light. They are an elementary component of a security paper for passports. These fibers in form of tiny threads are embedded into the security paper during its manufacturing process. When irradiated with UV light, the incorporated fibers glow in different colors. Different fibers can thereby show different colors or one type of fiber can even fluoresce in several colors at once.

16 UV FLUORESCENT MULTICOLOR DOTS



Similar to the security fibers the dots are embedded into the security paper during its manufacturing process. Dots only become visible if the document is exposed to UV light and can then show up in a variety of colors. Additionally, the density of the dots embedded into the paper can be adjusted. The combination of different degrees of density, color and size makes the paper unique and therefore highly tamper-proof.

17 MULTITONE WATERMARK



Watermarking of security paper is an essential element of robust and reliable document production. Commonly used in banknotes and stamps, the watermark is one of the most widely recognized security feature for ID documents available. The individually customizable watermark is incorporated into the security paper during the papermaking process by means of special cylinder mold technology. The watermark is visible to the naked eye. Only if the security paper is held against transmitting light, the watermark will appear as various shades of light and dark which are due to density variations in the paper. The fact that watermarks are integrated into the security paper, makes it impossible to copy them.

18 ELECTROTYPE WATERMARK



The electrotpe watermark represents an ideal additional security feature for security papers endowed with watermarks. It is similar to a brighter colored watermark. As the electrotpe watermark is produced in a more complex manufacturing process, it is possible to produce an even thinner page (thinning of the cross-sectional structure of a page). The resulting electrotpe watermark is much brighter in color and more difficult to forge than the usual Watermark. It is preferably used to endow a passport's pages with consecutive page numbers which are integrated into the passport's security paper during the papermaking process. As all passport pages are numbered consecutively throughout the entire booklet, electrotpe watermarks provide reassurance that pages have not been removed from the booklet to hide or falsify the document holder's travel history. As electrotpe watermarks on high-secure paper are very difficult to counterfeit, any attempt of page removal or substitution can be detected with the naked eye.

19 CHEMICAL REACTIVE PAPER



If a document is manipulated by means of chemical erasure, the chemical sensitizers, which consist of reagents (non-organic acid, non-organic alkali, bleachers, ethyl-alcohol and/or acetone) and are integrated into the security paper, will react. This chemical reaction may result in color changes of the entire security paper or the formation of colored dots all over the sheet. This highly reliable security feature does not only protect documents against forgery but is also used by laboratories to verify a document's authenticity.

BODY / CONSTRUCTION – SECURITY LEVEL 1

20 LOCK STICHING WITH INTERLOCK SEWING



During the booklet binding of a passport, the single paper sheets and the holderpage are sewn together. This sewing is performed by a so-called lock stitch, which generally consist of an upper and a lower binding thread. To increase the booklet's security and durability, the interlock stitch technique is employed both at the top and at the bottom of the document so that no pages can be removed. By means of this sophisticated stitching technology, the document's protection against page substitution is further enhanced. If the booklet has been unstitched once, it is impossible to reuse the sewing thread as it is noticeably damaged.

21 MB CLEAR WINDOW



The Clear Window is a defined document area which is transparent. It is made of polymer and can optionally include further security features or personalized data. As the Clear Window is produced during a sophisticated manufacturing process and embedded into the document body, it is very difficult to reproduce it without noticeably damaging the document's structure.

22 MB HINGE TECHNOLOGY



The hinge is an integral component of the polycarbonate data page layer construction. This small and flexible part is used to sew the data page into the passport booklet. The transition from the hinge to the holderpage is extremely smooth and does not show any sharp edges. The hinge itself does not provide any points of attack for counterfeiters. It is not possible to separate the hinge from the data page layers without destroying the data page. That is why, with the in-house developed MB HINGE TECHNOLOGY, the polycarbonate data page is securely protected against substitution.

23 MULTILAYER CONSTRUCTION



The final identification document consists of several synthetic foils, which together form a multi-layer construction. Each of these foils carries different components of the document, for example the antenna, the printed or the personalized part. During the production the different foils are assembled, collated and laminated together under high heat and pressure – without using any kind of glue. The final result is a mono block of polymer which cannot be separated into the original single foils, anymore. Therefore, this multi-layer construction prevents documents from being copied or imitated: any attempt of separating the different document layers or manipulating the data will damage the other layers so that an immediately recognizable evidence is left on the document.

24 MB SHIFTING WINDOW



MB SHIFTING WINDOW is a sophisticated combination of the Clear Window (a defined transparent area in the document) and a personalized Multiple Laser Image (MLI). Already during the production process, a special lens structure is embossed into the document surface. This lens contains the Multiple Laser Image, a personalized, optically variable security feature which is laser-engraved through the Clear Window and may contain holder-specific information such as the holder's portrait, date of birth or personal number. By changing the viewing angle, the MLI allows switching between two different pictures. By combining the Multiple Laser Image (MLI) with the Clear Window, the document's security is increased to the maximum. As the document structure reaches a very high degree of complexity, any attempt of counterfeiting, imitation or alteration of the holder's portrait is recognizable at first glance.

25 MB SEGMENTED WINDOW



MB SEGMENTED WINDOW is a special transparent window, which consists of two differently shaped transparent windows. Both transparent windows are made of polymer and can include further security features such as security print or personalized data.

As an addition to the traditional transparent windows, the MB SEGMENTED WINDOW reveals areas located within the multilayered document. Overlapping both windows creates a transition between the transparent areas and the inlaying card structure. This transition zone between the segments creates a multilayered window thus improving the resistance against counterfeiting attempts. The MB SEGMENTED WINDOW can be combined with other security features such as a personalized Multiple Laser Image (MLI).

26 SURFACE RELIEF STRUCTURE (POSITIVE / NEGATIVE)



This relief structure on the document's surface is applied during document production by using special engraved lamination plates. The relief consists of perceptible lines or other design elements, which appear either positive or negative embossed on the documents surface. The precise manufacturing process even allows the integration of additional security elements such as a latent image or micro-text. Attempts of separating the document layers or of reproducing the entire document will immediately be recognized, as the document's embossed surface will be visibly damaged in any case.

27 MATTE SURFACE RELIEF



The matte elements on a document's surface are an extension of the standard surface relief feature and provide additional security against fraudulent attacks. By using special lamination plates, matte elements are brought onto the document's surface during document production process. The matte elements remain discreetly in the background and only catch the eye on closer inspection. Together with the other surface relief features, matte elements offer a higher level of document protection, as the imitation of these filigree elements is very demanding.

28 SURFACE RELIEF LATENT IMAGE



A latent image is a feature, which is not visible on a first glance but becomes apparent at particular viewing angles. It is usually known as a security feature for paper substrates but it also can be realized on polymer substrates by means of special arrangements of fine line relief structures, which are applied to the documents surface during the document production process.

29 SECURITY BACKGROUND
MERGED WITH MB CLEAR WINDOW

To further enhance the security of the clear window and make it difficult to imitate, the offset security print overlaps the transparent area. Thus, the security print in the transparent area is visible from both sides and protects this feature additionally.

30 MB SECURE HINGE WITH SURFACE EMBOSSED



The hinge, as well as the smooth transition between hinge and data page can be made even more secure by applying additional security elements such as surface embossing. These tactile relief structures are easily verifiable without further tools and provide additional protection against counterfeiting.

31 EMBEDDED PARTIAL METALLIZED HOLOGRAM



Holograms are security devices which contain a wide range of additional security features such as micro-text, nanotext, spectral colors, guilloches, three-dimensional effects or special holographic elements. Depending on the illumination or viewing angle, the appearance of the holograms change with regard to color and design.

The partially metallized hologram combines a metallized and a transparent hologram into one single hologram with perfect registration. This type of hologram is embedded inside the card body. The fact that the hologram is protected by numerous, inseparably laminated layers makes it extremely difficult to manipulate the document without visibly damaging its structure. Thus, the partially metallized hologram reaches the highest security level for ID documents.

BODY / CONSTRUCTION – SECURITY LEVEL 2

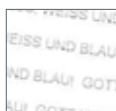
32 MB SHINING WINDOW



MB SHINING WINDOW is a defined document area which consists of the MB SEGMENTED WINDOW in combination with a security printing layer.

The transition zone between both windows reveals the security print and generate a unique design impression combined with the added benefit of an additional security feature to enhance the security of the transparent window. The MB SHINING WINDOW is a highly customizable feature and can be combined with further security features, security print or personalized data such as a personalized Multiple Laser Image (MLI).

33 MICRO-TEXT SURFACE RELIEF



The micro-text surface relief is an extension of the standard surface relief feature and provides additional security against fraudulent attacks. Not just lines, but tiny texts are brought onto the document's surface during document production process by using special lamination plates. The micro-text relief elements can be easily verified by using a magnifying glass but increases the security of the document as this text is hard to imitate and to reproduce.

34 MICRO-TEXT (INSIDE HOLOGRAM)



Diffraction or non-diffraction micro-text, up to 175 microns small, is invisible to the naked eye. It can only be seen by means of a magnifying glass and a directed light source. Special holographic production processes are necessary for the creation of micro-text. That is why this security feature is very hard to copy or imitate by means of ordinary printing equipment.

BODY / CONSTRUCTION – SECURITY LEVEL 3

35 NANOTEXT (INSIDE HOLOGRAM)



Diffraction or non-diffraction nanotext, with the size of 40 to 175 microns, is invisible to the naked eye. It can only be seen by means of a high-powered microscope. A special holographic production process is required for the creation of nanotext. That is why this security feature is almost impossible to copy or imitate by means of ordinary printing equipment.

PRINTING – SECURITY LEVEL 1

36 MULTICOLOR INTAGLIO PRINTING



Intaglio Printing is a special high-secure printing method which is very well known from banknote printing. In contrast to relief printing, the ink is brought onto the paper with high pressure by means of specially engraved high-resolution printing plates. The final result of the Intaglio Printing process is very high ink coverage and a tactile, relief-like embossing which is immediately recognizable. This sophisticated combination of high ink coverage and high-resolution print is very difficult to replicate, especially not with common, commercial printing technologies.

37 INTAGLIO PRINTING WITH OPTICAL VARIABLE INK (OVI®)



To make the existing Intaglio feature even more secure, the highly pigmented standard ink can be replaced by an ink with optically variable properties. The Intaglio elements printed with this ink show an additional color change effect, depending on the viewing angle.

38 LATENT IMAGE WITHIN INTAGLIO DESIGN



The Intaglio Printing technology allows the creation of a latent image within the document's Intaglio design. In contrast to the customary Intaglio-printed image, the latent image within the Intaglio design is a composition of line structures which vary in direction and profile. The shadows of these relief structures form the latent image, which becomes visible under a certain angle of visual observation. It is impossible to copy or imitate this latent image without using the Intaglio printing technology.

39 BLIND INTAGLIO (INK-LESS IMPRESSION)



Intaglio printing without using ink leads to certain paper deformation in the respective printing area. This "blind Intaglio printing" results in a kind of embossing effect and an inkless latent image effect can be generated.

40 OPTICAL VARIABLE INK (OVI®)



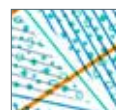
As soon as the viewing angle changes, optical variable ink elements switch between two different colors. Well known from banknotes printing and other security documents, these optical variable inks are only supplied to certified high-security printers. As the ink's color-shifting effect cannot be copied or imitated, any attempts by forgers to tamper with the document will be immediately visible.

41 RAINBOW PRINTING (IRIS PRINTING)



Rainbow Printing is one of the oldest, but still most effective and well-proven security printing technologies. A color separation of the background design is printed on the same printing unit in two colors (A-B-A) or three colors (A-B-C). Similar to a rainbow in the sky, the different colors merge seamlessly without leaving any gaps between them. This continuous change of color cannot be copied without a clearly visible screening effect. Therefore, this high-secure printing process protects the document against imitation and counterfeiting.

42 MULTICOLOR GUILLOCHE



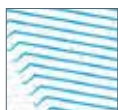
Guilloches are customized, continuous, typically fineline objects (single lines or rosettes), which follow a traditional appearance. Printed with one or more colors, they can either be part of the background design object or form a design element themselves. Controlled by mathematical formulas, the guilloches' appearance is unique; thus, the document design is hard to imitate and the document holder's facial image is securely protected against substitution. The guilloche's security can be increased by enhancing the guilloche pattern to a three-dimensional representation. Additionally, this state-of-the-art security feature can be combined with Duplex Pattern and Line Width Modulation.

43 NEGATIVE GUILLOCHE



The negative guilloches follow the same rules as the normal printed guilloches, except that their shape is not created by printing lines, but by deliberate recessing the surrounding colored design, thus creating a negative image of guilloches lines, which appear as white lines.

44 RELIEF FINE-LINE PATTERN



In general, relief objects consist of a complex web of fine lines which form a three-dimensional impression of text elements, logos or graphical elements. This security feature can simply be validated with the naked eye or by means of a magnifying glass. Like an Anti-Scan-Pattern, the Three-Dimensional Design Relief has an anti-copy effect. Furthermore, due to its complex structure, the three-dimensional design relief is very hard to imitate.

45 PAGE NUMBER WITH SECURITY DESIGN



The page numbers of the passport visa pages do not consist of simple printed numbers, but are also integrated into the overall security design. The page numbers therefore are realized by using security features such as line width modulation or printed screens.

46 UNIQUE VISA PAGE DESIGN



Instead of using the same design for all passport visa pages, a unique design for each page not only provides a visually appealing effect, but also serves to make the design much more difficult to counterfeit.

47 FLOATING ELEMENT



This dynamic visual element has its origin in the book-binding industry and has been incorporated into travel documents because it provides a firm protection against page substitution or page removal.

The security of this feature can be enhanced even further, by combining the floating element with UV fluorescent inks or by implementing the respective page numbers into the element.

48 IRIDESCENT INK



Iridescent inks contain semi-transparent pigments which cause interference with the incident light. This creates shiny, pearl-like shimmering effects which become visible or invisible when the angle of view or illumination changes. This shimmering effect cannot be copied which makes a further contribution to the forgery protection of the document.

49 “SEE THROUGH” ELEMENT



In this security feature, a selected document design object will be divided into two parts: One part of this object is printed on the pages front side, whereas the counterpart object is printed on the back side; the two prints are mutually complementary. The entire interlocking image only becomes visible when the document is held against transmitting light. It is almost impossible to impeccably copy a design object printed in see-through register technique, as this printing process does not only require highest precision, but also special security printing equipment.

50 OPTICAL SHIFTING INK



As soon as the viewing angle changes, color-shifting elements switch between two different colors. Well known from banknotes printing and other security documents, these color-shifting inks are only supplied to certified high-security printers. As the ink's color-shifting effect cannot be copied or imitated, any attempts by forgers to tamper with the document will be immediately visible. By adding special forensic markers, which can only be detected with special forensic equipment, this security feature can be upgraded to the highest possible security level.

51 SECURITY BACKGROUND
MERGED WITH PORTRAIT AREA

The offset printed security background overlaps and merges with the portrait area and therefore offers additional protection against holder's photo substitution and alteration of data on the identification document.

52 MB CHROMATIC WATERMARK



MB CHROMATIC WATERMARK integrates the highly sophisticated and known watermark, which was commonly used for security paper products, into the world of polymer ID documents. An additional hidden printing layer is integrated within the multilayered structure of the document. If an attempt is made to separate the individual layers of the document from one another, the MB CHROMATIC WATERMARK is irreversibly damaged. Furthermore, the feature is easy to verify if held against a transmitting light source, revealing the inlaying multicolored fully customizable design elements.

PRINTING – SECURITY LEVEL 2

53 IR DROP OUT



When examining the document by means of an infrared (IR) camera, the majority of the background becomes invisible. Only objects which are printed with a special IR ink or which are laser engraved remain visible. Since the properties of IR inks cannot be scanned or copied, the duplicated version of the document does not display the elements printed in IR ink, anymore.

Additionally, the document's security can be further enhanced by combining special high-secure inks with IR ink.

54 INTAGLIO MICRO-TEXT
(INCLUDING DELIBERATE SPELLING MISTAKE)

The Intaglio printed micro-text is an extension of the standard Intaglio printing technology and provides additional security against fraudulent attacks. The Intaglio printed micro-text elements are very small printed letters that are barely perceptible with the naked eye, but become visible at magnification. The security of this feature can even be enhanced by integration of an intentional spelling mistake inside the micro-text.

55 VARIABLE SIZE MICRO-TEXT



To make imitation or forgery even more difficult, the micro-text is not printed in a uniform size, but varies within.

56 LINE WIDTH MODULATION



This security feature is characterized by the fact that the width of the lines continuously changes. This technique can be employed to improve the security of numerous design features (e.g. guilloche or fractal), as well as to add a tonal effect to screens or three-dimensional reliefs. As these width-modulated lines are hard to re-engineer or reproduce they significantly contribute to increase the document's counterfeit protection.

57 ANTI COPY PROTECTION



An Anti-Copy Protection usually consists of a web of fine lines of varying angular displacement or radial arrangement which is embedded in the document's background design. For the human eye, the Anti-Scan Pattern appears as a smooth surface. Whenever a document is scanned or photocopied, the duplicate indicates multiple irregularities and visibly differs from the original document design. This is how this security feature provides a fundamental protection against document reproduction and counterfeit.

58 MICRO-TEXT



Micro-texts are very small printed letters or numbers which are barely perceptible with the naked eye, but become visible at magnification. They are an elementary security feature and an essential part of the security concept of ID documents.

59 MICRO-TEXT SCREEN

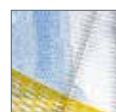


A micro-text screen consists of micro-text elements. The different tonal gradation is formed by the micro letters' different levels of thickness (varying thickness). To further increase the document's security level, this screening technique can be combined with intended spelling mistakes.

60 NEGATIVE MICRO-TEXT
(INCLUDING DELIBERATE SPELLING MISTAKE)

The negative micro-text follows the same rules as the normal printed micro-text and consists out of small letters, which are barely perceptible with the naked eye, but become visible at magnification. The negative micro-text is printed not as letters, but by deliberately omitting the surrounding colored design, creating a negative image of letters that appear as white text.

61 SECURITY BACKGROUND



Security background printing serves as a protection against counterfeiting and manipulation of data. It forms the basis of any secure identity document and consists of a variety of individual printed security elements such as guilloches, fine line patterns or iris print (rainbow). Security backgrounds are usually created with a special security design software and printed with high resolution security offset printing equipment.

62 DELIBERATE DESIGN ERROR



To further increase document security, intentional errors are also integrated into the design. For example, shapes or contours of design elements are intentionally changed at selected points. These errors are not obvious to the naked eye and only become apparent with magnification.

63 IR SPLIT (INFRARED ABSORBING INK AND INFRARED TRANSPARENT INK)



By viewing the document with an infrared camera, the main part of the background becomes invisible. Only elements which are laser engraved or printed with IR absorbent inks remain visible. This provides protection against copying and imitation since IR inks cannot be scanned or copied. Security can even be enhanced by using a combination of IR transparent and IR absorbent inks within the same printed element. With this so called IR split effect, some parts of the same element are visible while other parts become invisible under IR light.

64 UV FLUORESCENT RAINBOW PRINTING (IRIS PRINTING)



This feature is equal to the visible rainbow printing, but offers additional security as UV fluorescent colors are used. A color separation of the UV design elements is printed with the same printing unit in two or more UV fluorescent colors. The different UV fluorescent colors merge seamlessly without leaving any gaps between them. This continuous change of color cannot be copied without a clearly visible screening effect. The combination of visible and UV-fluorescent rainbow printing significantly increases the counterfeit protection of ID documents.

65 UV FLUORESCENT VARIABLE SIZE MICRO-TEXT (INCL. DELIBERATE SPELLING MISTAKE)



UV fluorescent micro-text is only visible when illuminated with an UV light source and viewed with a magnifying device. The micro printed text is not printed in a uniform size, but varies within the text. The security of this feature can even be enhanced by integration of an intentional spelling mistake inside the micro-text.

66 UV FLUORESCENT SECURITY SCREEN



A screen is a technique used to simulate continuous tone imagery. A security screen consists of special, non-commercial objects which form, depending on arrangement and line thickness, different color tones. These screening techniques are only available in special security design software. UV fluorescent security screens even increase the security of documents, as the feature is only visible under UV light.

67 UV BI-FLUORESCENT PRINTING



Depending on the UV wave length under which the document is examined (313 nm compared to 365 nm), the color of the bi-fluorescent UV ink (365 nm paper & polycarbonate / 254 nm paper / 313 nm polycarbonate) changes accordingly.

68 MULTIPLE SECURITY SCREENS



The use of multiple security screens increases the complexity of the overall security design compared to a single screen and therefore enhances resistance against forgery.

69 ART-SCREEN



Compared to micro-text screens, an Art Screen consists of unique characters, signs and objects like logos or symbols which, in combination with thickness modulation, form the different tones. To increase document security even more, intended mistakes can also be included in the Art Screen.

70 UNIQUE UV FLUORESCENT DESIGN



Instead of using the same UV design for all passport pages, an unique UV design for each page not only provides a visually appealing effect, but also serves to make the design much more difficult to counterfeit.

71 UV FLUORESCENT MICRO-TEXT



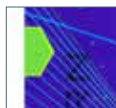
UV fluorescent micro-text elements consist of very small printed letters or numbers, which are barely perceptible with the naked eye, but become visible when illuminated with a UV light source and viewed with a magnifying device.

72 UV FLUORESCENT PAGE NUMBER



The visible page number, which is already integrated into the security design, is additionally printed with UV fluorescent ink.

73 UV FLUORESCENT FLOATING ELEMENT



This dynamic visual element has its origin in the book-binding industry and has been incorporated into travel documents because it provides a firm protection against page substitution or page removal.

The security of this feature is enhanced even further, by combining the floating element with UV fluorescent inks.

74 UV FLUORESCENT INK WITH COLOR CHANGE



This special ink initially fluoresces in conventional simple blue color under long-wave UV light. On closer inspection and by a special dynamic movement of the UV light source, an additional brief red UV fluorescence can be verified. Since this additional red fluorescence is not immediately apparent and rather a single conventional blue UV fluorescence is expected, the security against counterfeiting attempts is increased.

75 PHOTOCROMIC INK



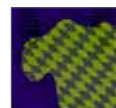
Photochromic inks are reactive inks, which are colorless under normal light, but which promptly change their color when exposed to UV light. This effect is reversible and the ink becomes colorless again after a short time, as soon as the exposure to UV light has ended.

76 CUSTOMIZED TYPE FONT



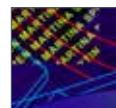
In order to endow the document with a distinctive recognition symbol and a unique appearance, a customized font is designed. The fact that this special, non-standard font is not available on the commercial market, makes it even more difficult to imitate the document: The use of standard fonts reveals a forgery at first glance.

77 UV FLUORESCENT PIGMENTS INCORPORATED IN VISIBLE COLORS



Invisible pigments, which only fluoresce under UV light, are added to the visible offset ink. Elements printed with this mixed ink appear in visible light as well as under UV light.

78 MULTICOLOR UV FLUORESCENT PRINTING



This security feature is a sophisticated extension to the Single UV-Fluorescent Ink. A minimum of two or more single fluorescent color inks are printed on one of the document's inner layers. When examining the document under a UV light source, each UV-fluorescent ink glows in a different color.

79 MB VIVID UV



During the security offset printing process, several UV inks (based on three fluorescent colors: red, green and blue) are mixed together in order to create the UV picture's full color spectrum. MB VIVID UV COLOR PICTURE is only visible when exposed to an UV light source. The picture excels through its vivid appearance, shiny colors and attractive design.

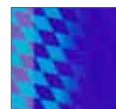
80 INFRARED-LUMINESCENT INK
(ANTI-STOKES EFFECT)

In this security feature, the Infrared-Luminescent Ink is applied to one of the inner layers of the document by means of a state-of-the-art security printing technology. During the verification process, the Infrared-Luminescent Ink's activating energy is supplied by a special infrared laser. The color absorbs photons in near-infrared wavelength (980 nm) and emits various colors in the visible spectrum. Thus, the laser beam, which normally is invisible to the naked eye, becomes visible. In addition to this visible verification method, the Infrared-Luminescent Ink can also be verified acoustically by using an appropriate verification tool.

81 DUPLEX DESIGN



Security design elements such as guilloche or fractal are created by using two or more different color segments which are printed closely to each other (close register). The security offset printing technique used has a resolution of 4.000 dpi and higher. For this very reason, the document cannot be reproduced with commercial printing equipment without visibly changing the document design's visual appearance and integrity.

82 MB SECURE HINGE
WITH UV FLUORESCENT PRINTING

The hinge, as well as the smooth transition between hinge and data page can be made even more secure by applying additional security elements such as customizable UV fluorescent security prints. In this way, the polycarbonate data page is even more securely protected against substitution.

83 INVISIBLE CONSTANT INFORMATION (ICI®)



This printed covert security feature is providing hidden information in the screen structure of the offset design. The hidden information is invisible to the human eye and can be verified with a simple decoding device.

PRINTING – SECURITY LEVEL 3

84 UNIQUE MIXED SECURITY INKS



A document's background design is printed without the commercial CMYK color selection or standard spot colors. Instead, all of the security colors used are individually mixed. The composition of these special inks is strictly confidential, known only by the customer and the producer. The security ink's authenticity can be verified by means of laboratory equipment.

85 MB AURORA



When illuminated with a specific UV light, MB AURORA's high-secure pigments generate a unique wavelength pattern in the UV spectrum. This in turn creates a unique spectroscopic fingerprint which has specifically been developed for the respective country and customer. Compared to most other level 3 security features, MB AURORA offers the most comprehensive and forgery-proof security concept available on the market. In order to reproduce this feature, very special know-how and expertise is required. The special reading devices needed for verification are available in different formats – either as mobile device or as USB device (with Windows support).

PERSONALIZATION – SECURITY LEVEL 1

86 MULTIPLE LASER IMAGE (MLI)



The MLI technology is a personalized optically variable security feature. Already during the production process, an array of cylindrical lenses is embossed into the document surface. These lenses contain the MLI which is personalized by means of laser engraving and may contain holder-specific information (e.g. holder's portrait, date of birth, personal number). Since the MLI is engraved into several layers of the document body, it is forensically detectable during a laboratory analysis. As the inclusion of a MLI into a security document requires a lot of expertise and know-how (e.g. in terms of lens angles, laser settings etc.), it is extremely difficult to counterfeit or imitate it.

87 SERIAL NUMBER LETTERPRESS PRINTING



The document's serial number is pressed into the security paper by means of a special letterpress printing technique. The printed number is visible under daylight and additionally fluoresces when exposed to UV light. The security level can be enhanced even more by arranging the single digits in a special stepped order. As the Letterpress Numbering can only be carried out with special security printing equipment which is not available on the free market, this feature is very hard to replicate.

88 LASER PERFORATED SPECIAL SHAPED SERIAL NUMBER



The entire passport booklet is perforated with a special laser, thus endowing the document with a unique passport number. By numbering all passport pages, the document is reliably protected against page substitution. Every single digit consists of small, conical holes, whose size and diameter vary depending on the page number, making it even harder for counterfeiters to swap pages. Specially shaped holes, e.g. in the form of stars or triangles, enhance the document's security.

89 LASER ENGRAVING



Laser Engraving is one of the most secure personalization techniques for documents. Visual personalization features in the form of greyscale images, black text and barcodes are laser-engraved into one of the document's inner layers. In terms of document security, Laser Engraving offers many advantages: For example, it does not only provide a very high resolution, which in turn provides a superb picture quality and shows utmost details, but also guarantees a long lifetime of the personalized, engraved data. The inseparably laminated layers cannot be dismantled without irreversibly damaging the entire document structure.

90 TACTILE LASER ENGRAVING



Perceptible (tactile) elements such as personalized text, numbers or symbols can be applied to the document surface by means of state-of-the-art laser-engraving. As this security feature is irreversible, it reliably prevents the alteration of visually personalized information.

91 LASER ENGRAVED GHOST IMAGE



A ghost image or secondary holder's portrait is a semi-transparent reproduction of the personalized holder image. Typically, this image is located on the same card side as the primary holder's portrait or – even more secure – on the reverse side of the primary holder's portrait. The semi-transparent image interacts directly with the document's security background elements and thereby prevents manipulation or substitution of the facial image.

92 MB ALFRESCO PLC®



Mühlbauer's highly sophisticated MB ALFRESCO® Color Picture Technology smartly combines color picture personalization with laser engraving. To achieve the high-secure personalization result, the image of the holder is split into two parts by using special image processing algorithms. This means the holder's image is separated into one greyscale image, which contains all black color components and one color image, which consists out of all remaining color components. During the personalization process, the greyscale image, which contains all black components, is laser-engraved in the polycarbonate body's inner layer. The remaining color parts of the image are inkjet-printed onto the document, using special security inks, which penetrate the card surface and leaving parts of the security offset printing visible, which enhances the security of the personalization tremendously and allows identifying counterfeiting attempts, which try to overprint the holder's images.

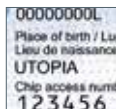
The final result is a high-resolution color picture, which shows utmost details and has the same long-lasting durability characteristics (10+ years) as a pure laser-engraved picture. To further increase the security, the holder's image is secured by an additional protective layer, which is made out of a special security varnish, the so-called "Liquid Coating". The Liquid Coating protective layer can be equipped with holder specific personalized information and UV fluorescent properties, which in turn once again enhance the overall security of the document and the security of the MB ALFRESCO® color picture personalization technology.

93 PICTURE IN SHADOW



The Mühlbauer laser perforation system is designed to laser-engrave a special security feature called MB PICTURE IN SHADOW into an ePassport's holderpage or a smart-card. Tiny holes are lasered through the body of the document using a special laser. In the process, any images or personalized information can be realized. This security feature can be identified by the naked eye – without any auxiliary devices necessary. The feature can be detected by simply holding the document into the light.

94 PERSONALIZATION WITH INKJET PRINTING



Using inkjet printing technology, additional personal data such as another picture of the passport holder or further information can be personalized on the first paper page of the passport booklet. This additional personalized information now offers further verification possibilities and links the paper pages of the passport even more strongly with the data page. This also contributes to increasing the security of the passport against forgery.

PERSONALIZATION – SECURITY LEVEL 2

95 UV FLUORESCENT LETTERPRESS PRINTING



The document's serial number which is applied by means of letterpress printing additionally fluoresce under UV light.

96 INVISIBLE PERSONAL INFORMATION (IPI™)



The holder's portrait contains invisible personal information (IPI™), e.g. the holder's name, date of birth or personal number. The individual holder information cannot be verified with the naked eye, but only by means of a special IPI™ decoding lens or a document-checking device. The Invisible Personal Information cannot be scanned or copied. In combination with additional security features, the IPI™ feature does not only protect the holder's portrait against substitution, but also the entire document against counterfeiting or imitation.

97 UV FLUORESCENT HOLDER'S PORTRAIT



The image of the passport holder is printed with UV fluorescent ink in addition to the normally visible image. This additional image is invisible under normal light, but can be easily verified with a standard UV light source. The UV image of the passport holder on the first paper page thus also contributes to increased security at various levels.

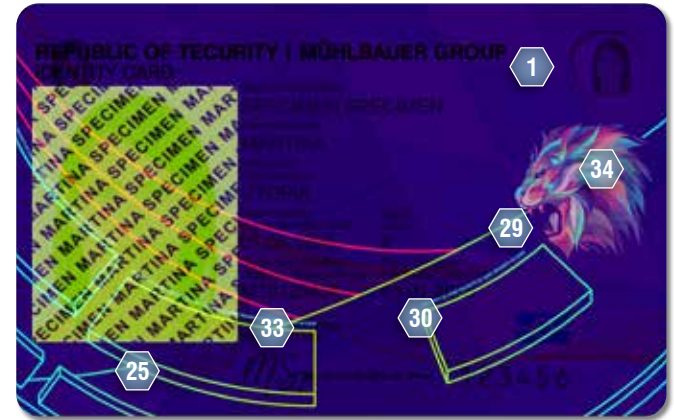
eID CARD – DUAL INTERFACE – FRONTSIDE

NORMAL LIGHT



- | | |
|--|--|
| 1 UV DULL POLYCARBONATE SUBSTRATE | 16 IR DROP OUT |
| 2 MULTILAYER CONSTRUCTION | 17 VARIABLE SIZE MICRO-TEXT |
| 4 SURFACE RELIEF STRUCTURE (POSITIVE / NEGATIVE) | 18 LINE WIDTH MODULATION |
| 5 MATTE SURFACE RELIEF | 20 MICRO-TEXT (INCL. DELIBERATE SPELLING MISTAKE) |
| 6 EMBEDDED PARTIAL METALLIZED HOLOGRAM | 21 MICRO-TEXT SCREEN |
| 8 MICRO-TEXT (INSIDE HOLOGRAM) | 22 NEGATIVE MICRO-TEXT (INCL. DELIBERATE SPELLING MISTAKE) |
| 9 NANOTEXT (INSIDE HOLOGRAM) | 23 SECURITY BACKGROUND |
| 10 RAINBOW PRINTING | 24 IR SPLIT |
| 12 NEGATIVE GUILLOCHE | 25 UV FLUORESCENT RAINBOW PRINTING (IRIS PRINTING) |
| 13 RELIEF FINE-LINE PATTERN | 27 MULTIPLE SECURITY SCREENS |
| 14 OPTICAL SHIFTING INK | 28 ART-SCREEN |
| 15 SECURITYBACKGROUND MERGED WITH PORTRAIT AREA | 29 UNIQUE UV FLUORESCENT DESIGN |

UV- / IR-LIGHT



UV-light

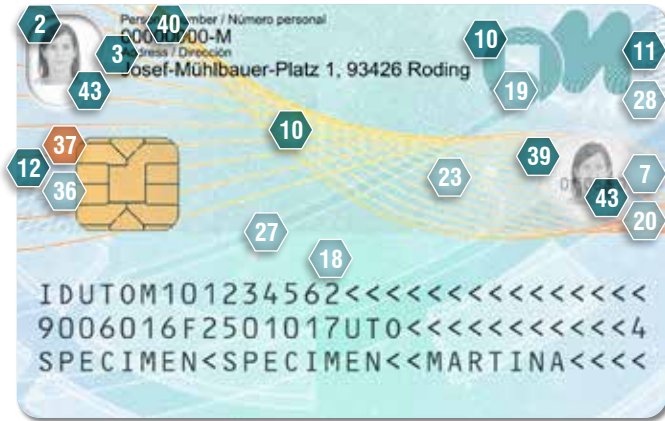
- | |
|--|
| 30 UV FLUORESCENT MICRO-TEXT |
| 31 CUSTOMIZED TYPE FONT |
| 33 MULTICOLOR UV FLUORESCENT PRINTING |
| 34 MB VIVID UV |
| 35 INFRARED-LUMINESCENT INK (ANTI-STOKES EFFECT) |
| 37 UNIQUE MIXED SECURITY INKS |
| 38 MB AURORA |
| 40 LASER ENGRAVING |
| 41 TACTILE LASER ENGRAVING |
| 42 MB ALFRESCO® PLC |
| 43 LASER ENGRAVED GHOST IMAGE |



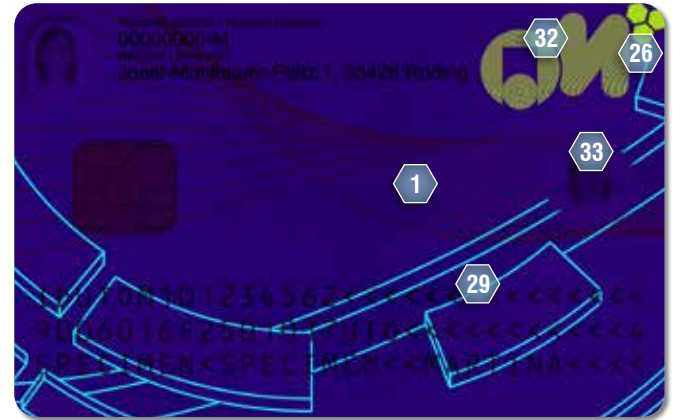
IR-light

eID CARD – DUAL INTERFACE – BACKSIDE

NORMAL LIGHT

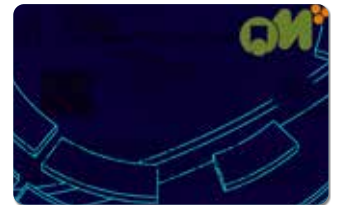


UV-LIGHT



UV-light

- | | |
|---|---|
| 1 UV DULL POLYCARBONATE SUBSTRATE | 27 MULTIPLE SECURITY SCREENS |
| 2 MULTILAYER CONSTRUCTION | 28 ART-SCREEN |
| 3 MB SEGMENTED WINDOW | 29 UNIQUE UV FLUORESCENT DESIGN |
| 7 MICRO-TEXT SURFACE RELIEF | 32 UV FLUORESCENT PIGMENTS INCORPORATED IN VISIBLE COLORS |
| 10 RAINBOW PRINTING | 33 MULTICOLOR UV FLUORESCENT PRINTING |
| 11 MULTICOLOR GUILLOCHE | 36 DUPLEX DESIGN |
| 12 NEGATIVE GUILLOCHE | 37 UNIQUE MIXED SECURITY INKS |
| 18 LINE WIDTH MODULATION | 39 MULTIPLE LASER IMAGE (MLI) |
| 19 ANTI COPY PROTECTION | 40 LASER ENGRAVING |
| 20 MICRO-TEXT (INCL. DELIBERATE SPELLING MISTAKE) | 43 LASER ENGRAVED GHOST IMAGE |
| 23 SECURITY BACKGROUND | |
| 26 UV BI-FLUORESCENT PRINTING (365 nm / 313 nm) | |



UV-light bi-fluor

SECURITY FEATURES – eID CARD

SECURITY FEATURES

MATERIAL – SECURITY LEVEL 2

1 UV DULL POLYCARBONATE SUBSTRATE



Security documents generally consist of UV dull polycarbonate substrate. In contrast to most commercial substrates, which contain optical brighteners and fluoresce under UV light, UV dull security substrates do not emit a visible fluorescence during exposure to ultraviolet light. By means of the UV dull substrate, the authenticity of a document can be easily checked under UV light. Thus, attempts of imitation or manipulation can easily be detected.

2 MULTILAYER CONSTRUCTION



The final identification document consists of several synthetic foils, which together form a multi-layer construction. Each of these foils carries different components of the document, for example the antenna, the printed or the personalized part. During the production the different foils are assembled, collated and laminated together under high heat and pressure – without using any kind of glue. The final result is a mono block of polymer which cannot be separated into the original single foils, anymore. Therefore, this multi-layer construction prevents documents from being copied or imitated: any attempt of separating the different document layers or manipulating the data will damage the other layers so that an immediately recognizable evidence is left on the document.

3 MB SEGMENTED WINDOW



MB SEGMENTED WINDOW is a special transparent window, which consists of two differently shaped transparent windows. Both transparent windows are made of polymer and can include further security features such as security print or personalized data.

As an addition to the traditional transparent windows, the MB SEGMENTED WINDOW reveals areas located within the multilayered document. Overlapping both windows creates a transition between the transparent areas and the inlaying card structure. This transition zone between the segments creates a multilayered window thus improving the resistance against counterfeiting attempts. The MB SEGMENTED WINDOW can be combined with other security features such as a personalized Multiple Laser Image (MLI).

4 SURFACE RELIEF STRUCTURE (POSITIVE / NEGATIVE)



This relief structure on the document's surface is applied during document production by using special engraved lamination plates. The relief consists of perceptible lines or other design elements, which appear either positive or negative embossed on the documents surface. The precise manufacturing process even allows the integration of additional security elements such as a latent image or micro-text. Attempts of separating the document layers or of reproducing the entire document will immediately be recognized, as the document's embossed surface will be visibly damaged in any case.

5 MATTE SURFACE RELIEF



The matte elements on a document's surface are an extension of the standard surface relief feature and provide additional security against fraudulent attacks. By using special lamination plates, matte elements are brought onto the document's surface during document production process. The matte elements remain discreetly in the background and only catch the eye on closer inspection. Together with the other surface relief features, matte elements offer a higher level of document protection, as the imitation of these filigree elements is very demanding.

6 EMBEDDED PARTIAL METALLIZED HOLOGRAM



Holograms are security devices which contain a wide range of additional security features such as micro-text, nanotext, spectral colors, guilloches, three-dimensional effects or special holographic elements. Depending on the illumination or viewing angle, the appearance of the holograms change with regard to color and design.

The partially metallized hologram combines a metallized and a transparent hologram into one single hologram with perfect registration. This type of hologram is embedded inside the card body. The fact that the hologram is protected by numerous, inseparably laminated layers makes it extremely difficult to manipulate the document without visibly damaging its structure. Thus, the partially metallized hologram reaches the highest security level for ID documents.

BODY / CONSTRUCTION – SECURITY LEVEL 2

7 MICRO-TEXT SURFACE RELIEF



The micro-text surface relief is an extension of the standard surface relief feature and provides additional security against fraudulent attacks. Not just lines, but tiny texts are brought onto the document's surface during document production process by using special lamination plates. The micro-text relief elements can be easily verified by using a magnifying glass but increases the security of the document as this text is hard to imitate and to reproduce.

8 MICRO-TEXT (INSIDE HOLOGRAM)



Diffraction or non-diffraction micro-text, up to 175 microns small, is invisible to the naked eye. It can only be seen by means of a magnifying glass and a directed light source. Special holographic production processes are necessary for the creation of micro-text. That is why this security feature is very hard to copy or imitate by means of ordinary printing equipment.

BODY / CONSTRUCTION – SECURITY LEVEL 3

9 NANOTEXT (INSIDE HOLOGRAM)



Diffraction or non-diffraction nanotext, with the size of 40 to 175 microns, is invisible to the naked eye. It can only be seen by means of a high-powered microscope. A special holographic production process is required for the creation of nanotext. That is why this security feature is almost impossible to copy or imitate by means of ordinary printing equipment.

PRINTING – SECURITY LEVEL 1

10 RAINBOW PRINTING (IRIS PRINTING)



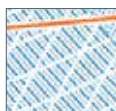
Rainbow Printing is one of the oldest, but still most effective and well-proven security printing technologies. A color separation of the background design is printed on the same printing unit in two colors (A-B-A) or three colors (A-B-C). Similar to a rainbow in the sky, the different colors merge seamlessly without leaving any gaps between them. This continuous change of color cannot be copied without a clearly visible screening effect. Therefore, this high-secure printing process protects the document against imitation and counterfeiting.

11 MULTICOLOR GUILLOCHE



Guilloches are customized, continuous, typically fineline objects (single lines or rosettes), which follow a traditional appearance. Printed with one or more colors, they can either be part of the background design object or form a design element themselves. Controlled by mathematical formulas, the guilloches' appearance is unique; thus, the document design is hard to imitate and the card holder's facial image is securely protected against substitution. The guilloche's security can be increased by enhancing the guilloche pattern to a three-dimensional representation. Additionally, this state-of-the-art security feature can be combined with Duplex Pattern and Line Width Modulation.

12 NEGATIVE GUILLOCHE



The negative guilloches follow the same rules as the normal printed guilloches, except that their shape is not created by printing lines, but by deliberate recessing the surrounding colored design, thus creating a negative image of guilloches lines, which appear as white lines.

13 RELIEF FINE-LINE PATTERN



In general, relief objects consist of a complex web of fine lines which form a three-dimensional impression of text elements, logos or graphical elements. This security feature can simply be validated with the naked eye or by means of a magnifying glass. Like an Anti-Scan-Pattern, the Three-Dimensional Design Relief has an anti-copy effect. Furthermore, due to its complex structure, the three-dimensional design relief is very hard to imitate.

14 OPTICAL SHIFTING INK



As soon as the viewing angle changes, color-shifting elements switch between two different colors. Well known from banknotes printing and other security documents, these color-shifting inks are not available on the free market and only supplied to certified high-security printers. As the ink's color-shifting effect cannot be copied or imitated, any attempts by forgers to tamper with the document will be immediately visible. By adding special forensic markers, which can only be detected with special forensic equipment, this security feature can be upgraded to the highest possible security level.

15 SECURITY BACKGROUND
MERGED WITH PORTRAIT AREA

The offset printed security background overlaps and merges with the portrait area and therefore offers additional protection against holder's photo substitution and alteration of data on the identification document.

PRINTING – SECURITY LEVEL 2

16 IR DROP OUT



When examining the document by means of an infrared (IR) camera, the majority of the background becomes invisible. Only objects which are printed with a special IR ink or which are laser engraved remain visible. Since the properties of IR inks cannot be scanned or copied, the duplicated version of the document does not display the elements printed in IR ink, anymore.

Additionally, the document's security can be further enhanced by combining special high-secure inks with IR ink.

17 VARIABLE SIZE MICRO-TEXT



To make imitation or forgery even more difficult, the micro-text is not printed in a uniform size, but varies within.

18 LINE WIDTH MODULATION



This security feature is characterized by the fact that the width of the lines continuously changes. This technique can be employed to improve the security of numerous design features (e.g. guilloche or fractal), as well as to add a tonal effect to screens or three-dimensional reliefs. As these width-modulated lines are hard to re-engineer or reproduce they significantly contribute to increase the document's counterfeit protection.

19 ANTI COPY PROTECTION



An Anti-Copy Protection usually consists of a web of fine lines of varying angular displacement or radial arrangement which is embedded in the document's background design. For the human eye, the Anti-Scan Pattern appears as a smooth surface. Whenever a document is scanned or photocopied, the duplicate indicates multiple irregularities and visibly differs from the original document design. This is how this security feature provides a fundamental protection against document reproduction and counterfeit.

20 MICRO-TEXT
(INCLUDING DELIBERATE SPELLING MISTAKE)

Micro-texts are very small printed letters or numbers which are barely perceptible with the naked eye, but become visible at magnification. They are an elementary security feature and an essential part of the security concept of ID documents.

21 MICRO-TEXT SCREEN



A micro-text screen consists of micro-text elements. The different tonal gradation is formed by the micro letters' different levels of thickness (varying thickness). To further increase the document's security level, this screening technique can be combined with intended spelling mistakes.

22 NEGATIVE MICRO-TEXT
(INCLUDING DELIBERATE SPELLING MISTAKE)

The negative micro-text follows the same rules as the normal printed micro-text and consists out of small letters, which are barely perceptible with the naked eye, but become visible at magnification. The negative micro-text is printed not as letters, but by deliberately omitting the surrounding colored design, creating a negative image of letters that appear as white text.

23 SECURITY BACKGROUND



Security background printing serves as a protection against counterfeiting and manipulation of data. It forms the basis of any secure identity document and consists of a variety of individual printed security elements such as guilloches, fine line patterns or iris print (rainbow). Security backgrounds are usually created with a special security design software and printed with high resolution security offset printing equipment.

24 IR SPLIT (INFRARED ABSORBING INK AND INFRARED TRANSPARENT INK)



By viewing the document with an infrared camera, the main part of the background becomes invisible. Only elements which are laser engraved or printed with IR absorbent inks remain visible. This provides protection against copying and imitation since IR inks cannot be scanned or copied. Security can even be enhanced by using a combination of IR transparent and IR absorbent inks within the same printed element. With this so called IR split effect, some parts of the same element are visible while other parts become invisible under IR light.

25 UV FLUORESCENT RAINBOW PRINTING (IRIS PRINTING)



This feature is equal to the visible rainbow printing, but offers additional security as UV fluorescent colors are used. A color separation of the UV design elements is printed the same printing unit in two or more UV fluorescent colors. The different UV fluorescent colors merge seamlessly without leaving any gaps between them. This continuous change of color cannot be copied without a clearly visible screening effect. The combination of visible and UV-fluorescent rainbow printing significantly increases the counterfeit protection of ID documents.

26 UV BI-FLUORESCENT PRINTING



Depending on the UV wave length under which the document is examined (313 nm compared to 365 nm), the color of the bi-fluorescent UV ink changes accordingly.

27 MULTIPLE SECURITY SCREENS



The use of multiple security screens increases the complexity of the overall security design compared to a single screen and therefore enhances resistance against forgery.

28 ART-SCREEN



Compared to micro-text screens, an Art Screen consists of unique characters, signs and objects like logos or symbols which, in combination with thickness modulation, form the different tones. To increase document security even more, intended mistakes can also be included in the Art Screen.

29 UNIQUE UV FLUORESCENT DESIGN



Instead of using the same UV design for all passport pages, a unique UV design for each page not only provides a visually appealing effect, but also serves to make the design much more difficult to counterfeit.

30 UV FLUORESCENT MICRO-TEXT



UV fluorescent micro-text elements consist of very small printed letters or numbers, which are barely perceptible with the naked eye, but become visible when illuminated with a UV light source and viewed with a magnifying device.

31 CUSTOMIZED TYPE FONT



In order to endow the document with a distinctive recognition symbol and a unique appearance, a customized font is designed. The fact that this special, non-standard font is not available on the commercial market, makes it even more difficult to imitate the document: The use of standard fonts reveals a forgery at first glance.

32 UV FLUORESCENT PIGMENTS
INCORPORATED IN VISIBLE COLORS

Invisible pigments, which only fluoresce under UV light, are added to the visible offset ink. Elements printed with this mixed ink appear in visible light as well as under UV light.

33 MULTICOLOR UV FLUORESCENT PRINTING



This security feature is a sophisticated extension to the Single UV-Fluorescent Ink. A minimum of two or more single fluorescent color inks are printed on one of the document's inner layers. When examining the document under a UV light source, each UV-fluorescent ink glows in a different color.

34 MB VIVID UV



During the security offset printing process, several UV inks (based on three fluorescent colors: red, green and blue) are mixed together in order to create the UV picture's full color spectrum. MB VIVID UV COLOR PICTURE is only visible when exposed to an UV light source. The picture excels through its vivid appearance, shiny colors and attractive design.

35 INFRARED-LUMINESCENT INK
(ANTI-STOKES EFFECT)

In this security feature, the Infrared-Luminescent Ink is applied to one of the inner layers of the document by means of a state-of-the-art security printing technology. During the verification process, the Infrared-Luminescent Ink's activating energy is supplied by a special infrared laser. The color absorbs photons in near-infrared wavelength (980 nm) and emits various colors in the visible spectrum. Thus, the laser beam, which normally is invisible to the naked eye, becomes visible. In addition to this visible verification method, the Infrared-Luminescent Ink can also be verified acoustically.

36 DUPLEX DESIGN



Security design elements such as guilloche or fractal are created by using two or more different color segments which are printed closely to each other (close register). The security offset printing technique used has a resolution of 4.000 dpi and higher. For this very reason, the document cannot be reproduced with commercial printing equipment without visibly changing the document design's visual appearance and integrity.

PRINTING – SECURITY LEVEL 3

37 UNIQUE MIXED SECURITY INKS



A document's background design is printed without the commercial CMYK color selection or standard spot colors. Instead, all of the security colors used are individually mixed. The composition of these special inks is strictly confidential, known only by the customer and the producer. The security ink's authenticity can be verified by means of laboratory equipment.

38 MB AURORA



When illuminated with a specific UV light, MB AURORA's high-secure pigments generate a unique wavelength pattern in the UV spectrum. This in turn creates a unique spectroscopic fingerprint which has specifically been developed for the respective country and customer. Compared to most other level 3 Security Features, MB AURORA features offer the most comprehensive and forgery-proof security concept available on the market. In order to reproduce this feature, very special know-how and expertise is required.

The special reading devices needed for verification are available in different formats – either as mobile device or as USB device (with Windows support).

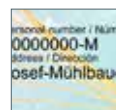
PERSONALIZATION – SECURITY LEVEL 1

39 MULTIPLE LASER IMAGE (MLI)



The MLI technology is a personalized optically variable security feature. Already during the production process, an array of cylindrical lenses is embossed into the document surface. These lenses contain the MLI which is personalized by means of laser engraving and may contain holder-specific information (e.g. holder's portrait, date of birth, personal number). Since the MLI is engraved into several layers of the document body, it is forensically detectable during a laboratory analysis. As the inclusion of a MLI into a security document requires a lot of expertise and know-how (e.g. in terms of lens angles, laser settings etc.), it is extremely difficult to counterfeit or imitate it.

40 LASER ENGRAVING



Laser Engraving is one of the most secure personalization techniques for documents. Visual personalization features in the form of greyscale images, black text and barcodes are laser-engraved into one of the document's inner layers. In terms of document security, Laser Engraving offers many advantages: For example, it does not only provide a very high resolution, which in turn provides a superb picture quality and shows utmost details, but also guarantees a long lifetime of the personalized, engraved data. The inseparably laminated layers cannot be dismantled without irreversibly damaging the entire document structure.

41 TACTILE LASER ENGRAVING



Perceptible (tactile) elements such as personalized text, numbers or symbols can be applied to the document surface by means of state-of-the-art laser-engraving. As this security feature is irreversible, it reliably prevents the alteration of visually personalized information.

42 MB ALFRESCO PLC®



Mühlbauer's highly sophisticated MB ALFRESCO® Color Picture Technology smartly combines color picture personalization with laser engraving. To achieve the high-secure personalization result, the image of the holder is split into two parts by using special image processing algorithms. This means the holder's image is separated into one greyscale image, which contains all black color components and one color image, which consists out of all remaining color components. During the personalization process, the greyscale image, which contains all black components, is laser-engraved in the polycarbonate body's inner layer. The remaining color parts of the image are inkjet-printed onto the document, using special security inks, which penetrate the card surface and leaving parts of the security offset printing visible, which enhances the security of the personalization tremendously and allows identifying counterfeiting attempts, which try to overprint the holder's images.

The final result is a high-resolution color picture, which shows utmost details and has the same long-lasting durability characteristics (10+ years) as a pure laser-engraved picture. To further increase the security, the holder's image is secured by an additional protective layer, which is made out of a special security varnish, the so-called "Liquid Coating". The Liquid Coating protective layer can be equipped with holder specific personalized information and UV fluorescent properties, which in turn once again enhance the overall security of the document and the security of the MB ALFRESCO® color picture personalization technology.

43 LASER ENGRAVED GHOST IMAGE



A ghost image or secondary holder's portrait is a semi-transparent reproduction of the personalized holder image. Typically, this image is located on the same card side as the primary holder's portrait or – even more secure – on the reverse side of the primary holder's portrait. The semi-transparent image interacts directly with the document's security background elements and thereby prevents manipulation or substitution of the facial image.

PUBLISHED BY

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