Polycarbonate Datapage Security: Hinge Construction

Introduction

Over the last two decades, polycarbonate (PC) has grown in use as a substrate for identification documents and become the performance material of choice for their production. With more than 25% of datapages issued in 2017 using a PC construction, passport issuers too are seeing the benefits of PC. Several drivers are behind this trend including some advantages that PC has over paper datapages in terms of security and durability, as well as the reduction in cost — and increase in sophistication — of both the polymer material and the laser systems that engrave it.

However a PC datapage is neither durable nor secure if it is not designed well, and a fundamental component of the passport datapage is the hinge that binds it to the passport. The chemistry and construction of the hinged-page solution is critical to the overall performance of the PC passport.

There are essentially two approaches a manufacturer can take when incorporating a PC datapage:

1. Taking a page-sized piece of PC and using an additional piece of hinge material to stick it into the passport.

2. The fully integrated hinge within the PC datapage supports and enhances the security, durability and performance in use of the page and of the entire passport.

HID Global uses a holistic approach in the design of its datapages, giving careful consideration to the security, durability and flexibility of the end product. That is why HID Global’s hinge is integrated across the whole datapage and fused during lamination, providing the necessary page-opening flexibility and tear-resistance that is not matched by other PC hinges on the market today.

Figure 1: Example of fully integrated HID Global hinge and datapage.
By 100% integration of the hinge throughout the page, the HID Global datapage structure is enhanced to form a durable and secure “datapage block”, rather than simply sticking hinge material on the outside of a PC page where it is visible and potentially vulnerable.

As this white paper demonstrates, the integrated hinge design is based on considerable data from the field, and from decades of experience in the manufacture of high performance e-IDs. The hinge has been proven superior time and time again, in the laboratory and in real world use.

**Attack of the Datapage**

Any polymeric material – even 100% polycarbonate constructions – may be sliced, cut, abraded or chemically weakened. HID Global has close links with immigration departments and specialist document examiners globally to better understand these threats, and from these sources comes data that reveal typical datapage tamper methods, counterfeiting trends, and regional variations of criminal attack on travel documents.

It is important to ensure that the datapage is designed and constructed to defend against all known threats, as the criminal only needs to identify and exploit one weakness in order to access and manipulate the data contained therein. It would not be appropriate to detail here the more sophisticated attacks employed to attack datapages, however the following summary serves to illustrate that there are multiple methods in criminal use, requiring strong and integrated defenses.

One type of fraudulent attack is the cutting of the hinge so as to remove and replace the datapage. Having the hinge fused inside the datapage makes the criminal’s task of re-attaching the hinge and page together even more challenging, far more so than if the hinge has been stuck on the outside of the page.

Mechanical abrasion of the page – typically from the back – has been used by fraudsters for many years to reveal and alter personalization data. In this case, an effective defense depends upon the layers of security features and their design within the datapage, rather than the material used for the hinge itself.

PC is susceptible to softening by certain organic chemicals, and a combination of mechanical and chemical methods can be utilised by criminals to access and alter data, more or less invisibly.

The question is not whether datapages are attacked by mechanical or chemical means, but rather if such attacks enable compromise of the document by:

- Allowing access to the holder’s personalization data
- Allowing harvesting and re-use of secure elements such as the chip
- Allowing the removal and replacement of the datapage

In the case of HID Global’s polycarbonate datapage the answer is emphatically no – we have an effective defense and have proven that focused attacks on the hinge do not compromise the document in the ways listed above. HID Global has proved this through multiple comprehensive adversarial tests of its datapage construction in-house, with external partners and customers, and with independent third-parties, such as Smithers-Pira.
Laboratory Validation

The extensive lab science included (but were not limited to):

- Excessive page turning to determine any weakness along the passport spine
- Temperature and solvent vapour exposure tests
- Attempts to delaminate using extreme heat, cold and adhesive tape
- Attempts to remove material using abrasion, incision and chemical softening
- Extended exposure to extremes of temperature and humidity
- Exposure to acetone and toluene vapour, as well as water vapour

In all cases, the test results indicated HID Global’s datapage construction was such that it was not possible to gain access to the datapage or chip module without evidence of tampering. Additionally, the variable data could not be removed by the chemical or physical attacks without clear evidence of damage to the print or surrounding security features.

Real World Validation

HID Global’s datapage is fully ICAO-compliant for durability, and HID Global’s own testing has been backed up by independent results that show it to be compliant to ISO/IEC 18745-1:2014.

Perhaps even more significant, the HID Global datapage and hinge solution have stood the test of time. Over the last ten years, more than 25 million passports have been issued using this hinge construction without any reports of durability issues or any reported incidence of successful tampering.

In fact, feedback from passport issuers has indicated that externally bonded hinges have exhibited numerous examples of real world failure. This further underscores the concern that externally bonded hinges demonstrate far less durability than integrated hinge and datapage solutions.

Integral Hinge Design

So how does the HID Global datapage achieve such strong security?

First, the chemistry of the HID hinge material has been tailored to match the thermal properties of the PC that it fuses with, defending against attempts to separate the page using heat. Furthermore, the personalization data is further protected by a network of security features, built-in to the page and the hinge, to ensure that any attempt to tamper with the hinge or datapage is readily apparent.

The defenses include traditional print and personalisation features as well as embossing, applied diffractive devices and transparent windows. A network of security features on offer from
HID Global is extensive and beyond the scope of this paper, however they constitute an important part of the overall defense of the passport and details may be found by reference here.

Even if it were possible to split the page, the result would be two separate pieces, each encapsulating and protecting the personalisation within the fused polycarbonate blocks and beneath a network of security features. One page would now be two with no advantage to the criminal in their attempts to access the data and with the additional challenge of reconstructing the datapage without any indication of tampering.

It has been suggested in the industry that a PC document must be constructed of 100% PC in order to perform at the highest level. However, it should be remembered that datapages that claim to be 100% PC typically contain several components that are not made of PC, for example multiple ink layers and diffractive devices. In fact the hinge itself is not, in most cases, PC either as this was found to fail when it was used in the first PC passports 20 years ago. So the “100% PC monoblock” is a strong theoretical concept, but unrealistic in the design and manufacture of most PC datapages.

**Flexibility**

Figure 2: Example of HID Global’s new thin datapage (620 microns) and integrated hinge.

HID Global’s hinge construction is probably the most flexible available. When HID Global’s thin datapage is selected, the combination of hinge and datapage is exceptionally user-friendly, allowing the passport to open and close easily and to remain closed with minimal gaping.

At just 620 microns, the page is the thinnest available and still enables inclusion of ICAO-compliant RFID functionality, as well as a network of the latest security features, can be found in our HID Passport Technology Datapage brochure here.

Regardless of whether a customer selects a standard or thin HID Global datapage, the proven hinge design is the same and it is built to the same high specification of quality and performance.
Conclusion

Polycarbonate datapages have been around for more than 20 years and criminals have adapted to attack them. As for any document of value, the key to defense is in a holistic document design and the regular development of new security features.

HID Global has long been the market leader in designing and delivering secure e-Identification and e-passport solutions, and brings this deep expertise to the manufacture of its polycarbonate datapages. The HID combination of hinge and datapage is a proven technology and highly secure combination, both in the laboratory and in the field, making it the most robust, sophisticated, and innovative passport solution in the industry today.

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* Results may be made available upon request.

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