

Bridging Traditional and Digital Printing Standards

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Abstract

The printing industry has been a craft-based industry. Printers work closely with their clients to meet their quality requirements. The approach to quality has been primarily defect-detection based, i.e., customers visually evaluate print quality for defects, e.g., hickies, text readability, color variation, extraneous marks, etc. If the severity of print demerit exceeds a pre-determined threshold, then the print shipment is rejected. Such quality assurance by attributes has been practiced at the Government Printing Office.

Existing printing standards, e.g., ISO 2846, ISO 12647, specify process ink standards and process control aim points. These standards of the International Organization of Standardization help foster material conformance and process consistency for conventional printing processes. They do not however address the quality dimension of visual demerits. Two printing standards, e.g., ISO 13660 and ISO 19751, being developed by engineers from digital printing equipment manufacturers, have begun to standardize the method of evaluating printing systems. These new breed of standards allow for quantifying the visual significance of a print demerit. In theory the implementation of these standards will facilitate the shift the image quality assessment from defect-detection to defect-prevention.

The goal of this article is to examine these standards as a whole and to explore how quality assurance practices may be handled differently as the printing industry moves toward a manufacturing modeled industry.

Introduction

A discussion of print quality needs to be prefaced by a definition of quality. ISO 9000 standards define quality as the achievement of all those inherent features and characteristics of a product or service, which are required by a customer. The printing industry traditionally has been a craft-based industry. Within the printing industry, an expected level of quality is determined by a customer; for a business to succeed, this level of quality has to be met.

The printing industry is very similar to many other consumer-driven industries. There are varying degrees of expected quality for different products. When discussing image quality, the degree of image quality for a grocery bag (a commodity) can be expected to be lower than the degree of image quality for the packaging of a perfume bottle (a high-value item). Failure to meet a customer's level of expected quality will result in the printer initiating a correction. This may mean a reprint of the entire/portions of the job or a repair of the nonconforming product.

Expected Quality

The rigor of quality can be classified into three categories as shown in Figure 1. Inferred, expressed but not documented, or expressed and documented. Inferred quality levels are quality levels for which no explicit requirements have been articulated. The customer in this scenario relies on the expertise and experience of the printer to craft a product which the printer believes is best tailored to the customers needs.

There are three outcomes for inferred levels of quality. The first and most ideal outcome is that the product meets the customer's expectations. The second is that the product exceeds the customer's expectations, and the third is that the product fails to meet the expectations of the customer. While exceeding the customer's expectations sounds positive, the cost of maintaining higher than required levels of quality will be absorbed by the manufacturer. Failure to meet expectations will result in the reject or rerun of a job.

When quality levels are expressed but not documented, the requirements expressed by the customer are either met or not met. Failure to meet any undocumented requirements opens the door for renegotiations of a previously agreed upon compensation.




QUALITY REQUIREMENTS	OUTCOME
<p>INFERRED and EXPRESSED BUT NOT DOCUMENTED QUALITY EXPECTATIONS</p> 	<p>EXCEEDS VENDOR ABSORBES COST</p>
	<p>MEETS VARIATION IN REPEATABILITY OF EXPECTED QUALITY EXISTS</p>
	<p>FAILS TO MEET REJECT OR REWORK OF JOB VENDOR ABSORBES COST</p>
<p>EXPRESSED AND DOCUMENTED QUALITY EXPECTATIONS</p> 	<p>QUALITY EXPECTATIONS ARE MET DOCUMENTATION IS PROVIDED THAT CERTIFITES THAT QUALITY EXPECTATIONS HAVE BEEN MET IS PROVIDED.</p> 

Figure 1: The expectation of image quality and what is delivered can lead to various outcomes

Expected Quality Expanded

The Quality Assurance Through Attributes Program (QATAP) instituted by the Government Printing Office (GPO) is a good example of the third category of expected quality levels. The third category represents a situation where quality is expressed and documented. The GPO is an agency within the legislative branch whose mission is to produce and distribute information products and services using both traditional and digital printing processes. Approximately 70% of the work being printed is purchased from commercial sources. In the late seventies, the GPO initiated a program aimed at setting, defining, and assessing the quality of the products that were being purchased. (United States Government Printing Office, 1998).

In an effort to assure the quality of the products being produced, the GPO instituted the QATAP. The primary purpose of the QATAP is to identify and communicate the attributes that will be inspected for quality prior to the production of the contracted product. The QATAP describes quality in terms of definable and measurable attributes.

The evaluation of image quality traditionally has been one of visual defect detection, as assessed by the customer. The presence or absence of undesired visual print attributes within a final product (e.g., hickies, poor text readability, excessive color variation, extraneous marks) would lead to the rejection or acceptance of a job. A model such as the QATAP, which defines attributes and measurement procedures, allows the use of a demerit system to determine if a job meets the required quality levels. In practice, a print demerit is assigned to attributes of the printed product that are inadequate, unacceptable, or which fail to meet definitive requirements. As seen in Table 1, there are three categories of a defect.

Table 1: The minor, major, and critical defects define how samples of a product will be assessed for quality.

Minor Defect	Minor defects are slight imperfections which if noticed would not be the source of any complaint. A minor defect, e.g. hickies, does not fall outside of any specified numerical tolerances.
Major Defect	Major defects seriously affect the overall visual appearance of the product. Examples of these defects are streaks and mottle. Major defects fall outside of the specified tolerances.
Critical Defect	A serious deviation from specifications which jeopardize the integrity of the product (e.g. the cover of a book tears away from the spine when its laid flat)

When the number of print demerits exceeds a specified level, there is sufficient cause to reject the job.

Offset Print Standards

Offset printing, because of its maturity, has at its disposal a tool box full of standards and practices that allow for the measurement of material conformance to specifications and aim points. As shown in Table 2, these standards and practices enable the printer great control over instituting measures to prevent defects.

Table 2: *Offset print standards afford the printer a great deal of control over the conformance of materials before they enter the production process. Where these standards fail, is in addressing the visual significance of any print defects*

Material Conformance	ISO 1524	Provides procedures for measuring fineness of grind
	ISO 12644	Facilitates the measurement of viscosity
	ISO 12634	Allows for the measurement of ink tack
	ISO 2470	Enables the brightness of a substrate to be measured
	ISO 5626	Provides procedures for measuring folding endurance
	ISO 8254	Specifies how to measure the gloss of a substrate
Process Control	ISO 12647	Specifies colorimetric properties and transparency of process color inks
	ISO 2846	Provides colorimetric specifications for process color printing of major printing processes.

Offset vs Digital Print Standards

Offset printing is based on an open system, where by the printer is allowed to choose the materials and processes necessary to meet the customers requirements. Digital printing is a closed system. Digital printers are at the mercy of the digital press manufactures to provide them with the tools and materials.

The material conformance standards that are applicable to offset printing are not as applicable to digital printing. Many of the digital materials used in the presses are proprietary to the manufacture of the digital press. Substrates running through a digital device will behave differently from digital press to digital press. A Xerox dry toner will not work in a Nexpress device, nor will the gamut of either be the same. There is no standard test for toner conformance. If serious problems arise on press, there is very little an operator can do.

Digital printing when compared to offset printing is a hands-off process. An offset press operator who has tested the inks and substrates can make modifications (e.g., the addition of surfactants, defoamers, primers, etc. or the adjustment of plate pressure, press speed, ink coverage, etc.) either prior to a press run or on the fly to account for any problems that might occur on the press. On the flipside, a digital press operator needs to have new substrates certified by the press manufacture to run properly. And any adjustments that need to be made to the actual press require the intervention of a digital press technician.

Digital Print Standards

Two standards, as summarized in Table 3, with the goal of helping in the assessment of print quality of digital devices, have and are being developed.

Table 3: *ISO 13660 is currently an established standard, while ISO 19751 is still in development.*

ISO 13660	Provides definitions for many print attributes, provides bitmap test patterns, and provides a method for measuring those attributes. For example, attributes such as line width, mottle, and raggedness, now have definitions and methods for measurement.
ISO 19751	Seeks to resolve the shortcomings of ISO 13660. These shortcomings are that some key digital attributes, such as banding and gloss uniformity were not defined and that many of the evaluation methods are difficult to conduct. ISO 19751 will hopefully expand the definition of print attributes which comprise print quality and allow for an easier implementation of the measurement

The primary use of these standards is to allow digital press manufacturers a standardized method for benchmarking their digital presses. As methods for quantifying print attributes are refined and as the thresholds for a given attribute are determined, those attributes can be engineered out of the printing system.

From a print supplier and print purchaser perspective, these new standards could be used to assign levels of visual significance on print attributes. For example, there is no offset method for quantifying text quality; ISO 19751 has the potential to provide a method for quantifying line quality (often associated with text quality).

The manufacturing process and the application of standards

Quality levels that are documented allow the printer to determine, based on their knowledge of their own processes (through Cp and CpK studies), whether or not they are capable of meeting the tolerances set by expanded quality requirements such as those associated with the QATAP.

Conclusion

There are two camps of standards occupying different sides of the pond as illustrated by Figure 2. One camp is developing standards which focus on material conformance and color reproduction. The other camp is developing standards which help establish processes for the quantification of visual attributes. The gap between the two lies in the assessment of visual print attributes. Print attributes are evaluated only at the output, where the only question, from the customer's perspective is: "Has the printer met my image quality expectations and requirements?" There are only two answers: yes or no. The bridge that needs to be built between these two camps is one constructed of material conformance standards for digital printing and visual print attribute standards for offset printing. As the processes for quantifying print attributes becomes established, the ability to isolate the root cause of demerit-worthy attributes and implement preventative procedures becomes available.

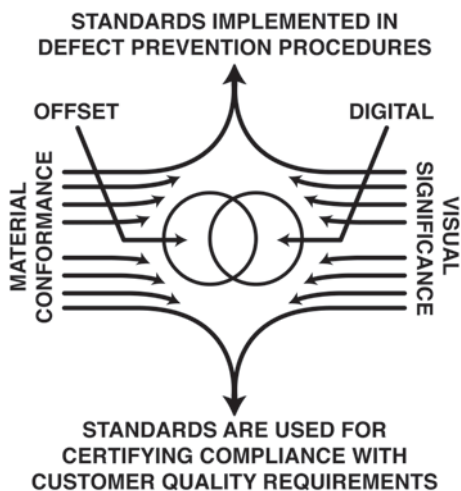


Figure 2: Offset and Digital Standards can be implemented to improve prevention and detection procedures.

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