

Requirement of Map Digital Printing on Digital Printing Machine

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Abstract

Currently, a mass of digital printing machines emerge in the market, whose brands, norms and types are abundant. Their application in the field of digital printing is increasingly wide. However, after the study on these machines' parameters, the fact that almost no machine can be used in map digital printing is discovered. Therefore, digital printing technique can hardly be used in map digital printing field. This paper analyzes the particularity of map products, pointing out the fact that maps have relatively large breadth and lay rigid requirement on the image-text precision, which should uses high folding strength while low variant paper to print. Current printing machines cannot meet the needs of the above parameters simultaneously, which leads to the blankness in map digital printing field. This paper put forward the needed parameters and chief functions of digital printing machines used in map digital printing, which provides important reference for the printing machine producers and manufacturers to extend the products' application range.

1. Preface

Currently, a mass of digital printing machines emerge in the market, whose brands, norms and types are abundant. Their application in the field of digital printing is increasingly wide. However, after the study on these machines' parameters, the fact that almost no machine can be used in map digital printing is discovered. Therefore, digital printing technique can hardly be used in map digital printing field. Practically, the need of map printing field on digital publishing technology is urgent, which requires merchants to research and develop printing machines and materials to meet the needs of map printing.

2. The particularity of map printing products

2.1 Map and its main purpose

2.1.1 The definition of map

Maps use rules of mathematics which make up maps' mathematical foundation, and comprehensive rules and systems which make up maps' geographical contents foundation to mapping earth surface on the plane. It uses scientific and abstract methods to describe complex geography's spatial structure and relationships, and to reflect various natural and social phenomena's distributing, combination, relationships and alteration as well as development with time. Rigorous mathematical foundation, scientific comprehensive methods and symbol system are maps' most fundamental features.

2.1.2 Maps' purpose

Maps play an important role in science research, national

economy and national defense construction. On science research, maps and their corresponding information are used to research various phenomena's spatial distributing rules, various phenomena's interaction and contradiction relationships. They are also used to project resources exploration. On military affairs, they are used to offer war zones' topographical data. They provide important tools for in-situ exploration, and provide topographical foundation for national defense's project, design and construction. They are the common topographical foundation for composite warfare command and the base maps for plots and works on maps.

On the view of maps, maps have all the characters of common printing products. But on the connotation part, they are not simple works of graphic image.

Since the usage of maps is broad, their producing amount is huge. With the increasing needs of individuality, map printing tends to have more contents and types with less printing amount.

2.2 The particularity of maps

2.2.1 Rigorous classification and expression methods

Maps' contents are expressed according to their classification. Usually, they are classified by the theme, scale, usage and cartography zone.

According to the theme, maps can be classified as general maps and thematic maps, of which general maps can be classified as topographic maps and geographic maps. In them, topographic maps have stated scale groups (1:10000, 1:50000, 1:250000, 1:500000 and 1: 1000000) and uniform compilation rules and schemes. Geographic maps are the general maps whose scale is less than 1:1000000. Their contents are summarized, whose main objects stand out apparently. They emphasize each element's fundamental distributing rules and have no fixed scale system or uniform compilation rules and schemes.

2.2.2 Elaborate symbols

Maps are classified as graphic line maps and image maps, of which graphic line maps are drawn by dot, line and area symbols. The size of symbols, thickness of lines, usage of color, etc. are all precisely designed according to maps' negative loads. If line thickness and color are altered after printing, the whole vision effect of maps will alter greatly to directly decrease scanning and distinguishing effect.

2.2.3 Specific size and standard

Maps with scales over 1:2000000 have stated subdivision and number rules. Therefore, each map's matching range is divided rigorously according to subdivision and number rules. Map size is related to the longitude and latitude location of the map. For example, the edge-frame size of middle latitude maps with scale

1:1000000 is about 550*450mm. With outer border ornaments and paper border, the whole map size is 760*560. The edge-frame size of middle latitude maps with scale 1:50000 is about 430*380mm. With outer border ornaments and paper border, the whole map size is 580*455.

2.2.4 Relatively high measuring accuracy

According to different scales, maps have different usage, especially large scale and medium scale maps, they are frequently used in precise distance measuring. For example, on 1:250000 scale maps, 1mm corresponds to 250m on land. Usually, margin length error required cannot exceed 0.2mm.

2.2.5 Relatively tough endurance

Maps are usually used outdoors, and they must be adapted to various kinds of bad weather, such as rainstorm, typhoon and solarization. Usually, the capacity of map paper and ink is required rigidly, for example, relatively tough anti-damp and folding strength paper, tough light resistance and water resistance ink, etc.

2.2.6 Convenient disposition capacity

Maps are classified to different secret levels according to their contents. As to maps with the secret level and higher levels, the disposition for them is rigid. Usually, pulping and burning are used to dispose these maps. Therefore, it requires these kinds of paper can be pulped and have low ash content.

3. Printing machines' parameters and problems

Currently, printing machines sold in the market include three types, they are printing machines with electric ink type such as HP Indigo, printing machines with toner type, they have many brands and models, printing machines with ink jet type, and they also have many brands and models.

3.1 printing machines with electric ink type

This type of printing machines can realize excellent color and tone reproduction, and its printing quality is as good as offset point printing. But they are not used in map printing, and the main reason for that is printing breadth problem.

Currently, many types of single paper digital printing machines, such as HP Indigo 3550/7000/7500, etc, have the breadth A3+. The size of the image is 317*464, the utmost paper size is 330*482. Web printing machines such as HP Indigo W7200/6000, the utmost image size is 310*980. The HP Indigo 10000 printing machine shown in the 2012 DRUPA has utmost image size 740*510 and the utmost paper size 750*530.

The breadth size of printing machines mentioned above cannot meet the needs of map printing size 760*560.

3.2 Printing machines with toner type

This type of printing machines can realize good color and tone reproduction, however, compared with printing machines with electric ink type, the consistency of printing quality before and after printing process. Another problem is, the utmost size of this type is A3+. Recently, MGI brings out METEOR DP8700XL digital printing machine, whose utmost printing breadth is 321*1011 mm, and it has a narrow and long breadth structure. If it

is used in map printing, breadth size will fall short of the requirement.

3.3 Printing machines with ink jet type

The brands of this type are plentiful, and many of them can meet the needs of printing breadth. But the most serious problem for this type of machine is line quality. Experiment shows that, the line breadth expands apparently. If a map is printed by ink jet way, the figure and image effect on the map alter greatly because of the alteration of line breadth, which cannot accord with map symbol rules and map design purpose.

4. The requirement for printing paper and ink's technology parameters

Because of the particularity of map usage, the requirement on paper and ink is particular, too.

4.1 Map printing paper

It requires that paper should have relatively tough endurance, and high retention rate of tensile strength after soaked in water, while it should have low ash content and flexibility. The figures are shown in tab.1. Digital printing machine must have the capacity to print extractive image and text on paper.

Tab.1 Special requirement on map printing paper

Item		Units	Index
Fix quantity		g/m ²	80±2.0
Tightness ≥		g/m ³	0.8
Tough endurance, horizontal and vertical on average ≥		time	70
Brightness ≥		%	83
Smoothness	Front side ≥	S	50
	Reverse side ≥	S	50
Retention rate of tensile strength after soaked in water ≥		%	15
Ash content		%	12±1.5
Flexibility	Horizontal ≤	%	0.3
	Vertical ≤		2.2

4.2 Map printing ink

Map printing ink must have high water proof and light proof characters. Image and text are not faint. Insolated in the sun, it will not fade.

5. Conclusion

Map printing is similar to the common printing in some aspects. As to the particularity of map content and usage, the requirement of map printing on facilities and materials are special. Currently sold digital printing machines cannot meet the needs of map printing. It is hoped that manufacturers can refer to this paper's technology parameters, design and research new facilities to bring digital printing technology into the field of map printing as soon as possible.

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