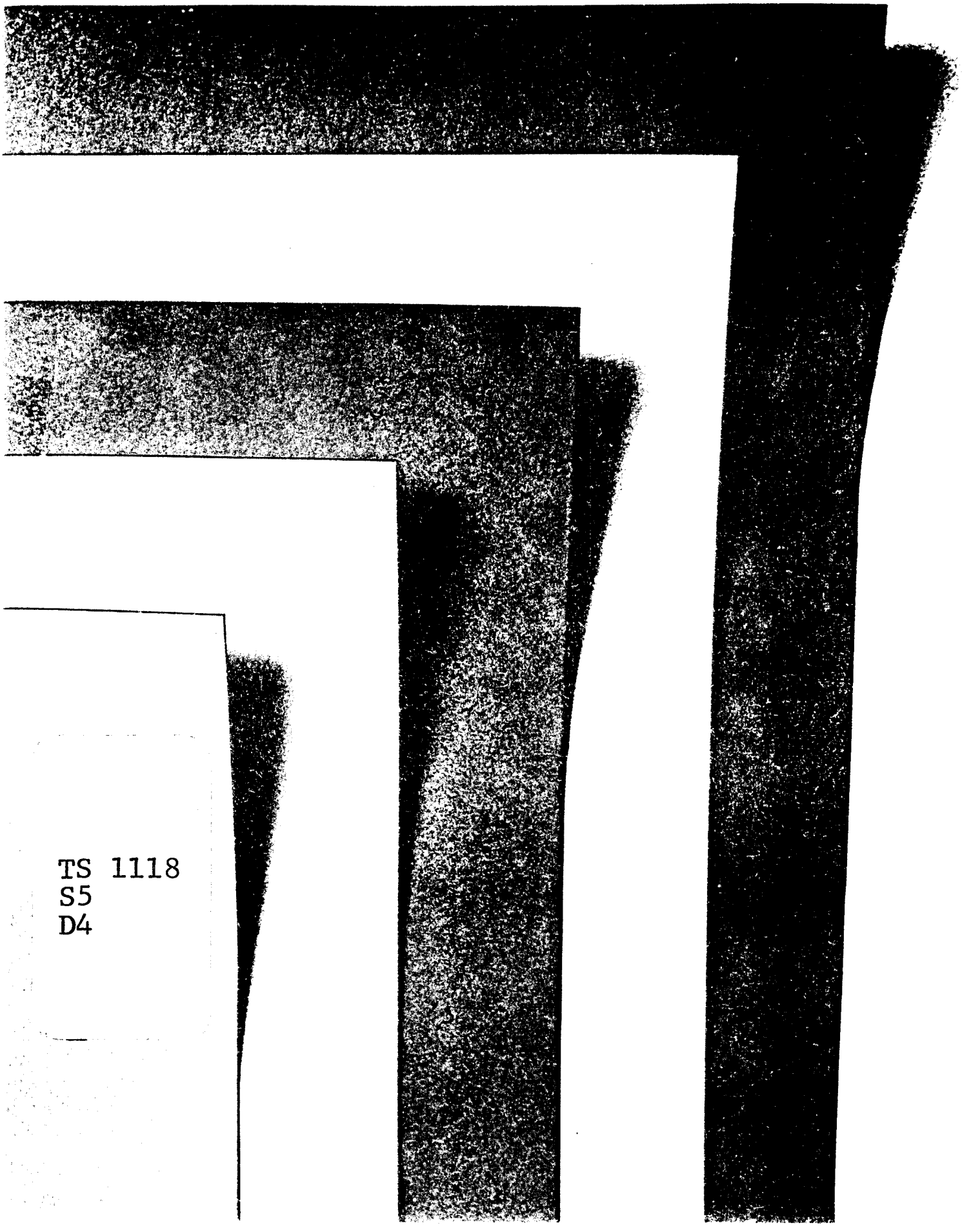
NOTES ON THE STANDARDIZATION OF PAPER SIZES

by A. D. DUNN



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The entire text of this booklet was produced on the Linotron 505 phototypesetting installation in the Composing Room of The London Free Press Printing Company Limited, London, Ontario, Canada. The Linotron 505 is a third generation phototypesetter which combines the use of a computer system and cathode ray tube techniques to produce true typographic quality at high speeds. This was the second installation in all Canada of this type of equipment.

IS THIS THE ORIGIN OF STANDARD PAPER SIZES?

In the early days of the city of Bologna in Italy very careful consideration was given to the use of paper because of the expense and importance of the information contained on paper. Documents of greatest importance were recorded on parchment and instructions were given to municipal officials that only hand-made paper would be used for municipal documents. The cheaper, or normal papers, as they were called, were presumably only used for working papers and, after use, were burned to ensure that only the important papers were kept. The reason for this form of disposal was not known and its origin, evidently decided from an earlier administration, reflects the experience of years, probably from the date of the first making of paper in Bologna, believed to be one of the first cities to produce paper in Europe. Because of this discriminatory move by the municipal officials of Bologna, much of the papers that could relate to the history of Bologna no longer exist. However, there is a great number of parchment documents on which the laws of a community were outlined.

Around the year 1398, a marble tablet was placed in a public place in Bologna and this tablet is now in the medieval section of the Civic Museum of Bologna.

The inscription on the marble reads, "These are the sizes of the molds of the community of Bologna corresponding to the sizes of paper noted which must be manufactured in Bologna and district, and are indicated here below."

BOLOGNESE SIZES IN 1398		MODERN SIZES	
Recute (small)	315 x 450 mm	Protocollo	320 x 440 mm
Mecane (medium)	345 x 515 mm	Arispetto	340 x 460 mm
Realle	445 x 615 mm	Reale (1)	460 x 620 mm
		Imperiale	580 x 780 mm
Imperialle	500 x 740 mm	Imperialino	530 x 700 mm

It has been the standard practice for historians in the paper industry in most countries for many years to refer, early on in their writing, to this marble document which was formerly enclosed in the Palazzo degli Anziani and later at the Merlani Printing House in the Via Accuse which has since disappeared.

(1) This size is very similar to ISO size A2 (430 x 610 mm).

This marble slab, which is reproduced here, summarizes a statute of 1398 which was discussed in a publication by Andrea Gasparinetti in 1963 in a paper called, "Document on the Manufacture of Paper in Emilia" and indicates how far the paper industry in Bologna had developed at that time. It would be impossible to issue such precise regulations unless the Bolognese had a lot of experience in the production and use of paper.

The myth of the standardization of sizes, contributed generously to the French emperor, Napoleon, and to the German, Ostwald, broke down in 1961 when the International Congress of Historians of the Paper Industry in Holland recognized that the statute of Bologna of 1398 and the famous marble inscription pertaining to it showed the first time that paper sizes were standardized and regulated. After six centuries, it will be noted that some names and sizes remain unchanged.

REPRODUCTION OF MARBLE DOCUMENT
ENGRAVED WITH STANDARD PAPER SIZES
SET UP IN BOLOGNA IN 1398

PREFACE

This booklet was last revised in March 1969 since which it has been printed in facsimile and as articles in periodicals and has had an estimated circulation of well in excess of 1,000,000 copies. Because of the increasing interest in the use of international standard paper sizes within the Canadian Government and elsewhere and because of its increasing importance in international documentation, it is becoming necessary to adopt these sizes to ensure that Canadian documentation aligns with other documents in the international field.

Paper standardization is by no means new and we now find that the first record of attempts at standardization of paper occurred back in the 14th century. The pressures, however, of international societies growing closer and closer together tends to force us into the position where we must adopt compatible paper sizes if we are going to survive in a world where the mechanization of paper is becoming of increasing importance. Failure to do otherwise can well be disastrous to us, particularly in the field of international trade in which the processing of paperwork is becoming more and more one of the greater impediments to the fast turn-around of trading vehicles.

The relationship of paper to other media in the information handling system is also beginning to become of increasing importance, particularly in the storage of information when high speed electronic data processing equipment is now capable of producing prodigious amounts of information.

When we consider that, many times in the last few years, it has been suggested that the amount of information recorded on paper per annum is a relatively small percentage of information recorded in total, our concern must also be increased.

The success of the dissemination of the information on standard paper sizes has been largely due to the understanding and helpful co-operation of Mr. J. E. Hanna, Secretary of the Canadian Government Specifications Board who has provided the environment in which it was possible to pursue the necessary research and exploratory work necessary to ensure the dissemination of this information.

The Paperwork Problem

Over the past twenty to thirty years, and largely since World War II, due to the increasing complexity of government, management and technology, there has been a growth in the use of paper that is, to say the least, phenomenal. This phenomenon is well-known and is often referred to as the "information" or the "paperwork" explosion. That this paperwork explosion demands attention is increasingly being impressed upon those who are aware of the tremendous progress that is being made in the many fields of technology concerned with the transmission of information and data, and this is particularly apparent to those who are trying to keep up-to-date with the state-of-the-art of any particular phase of technology.

It has often been stated that there are some 50,000 technical journals published during the period of one year, and much time is being spent in trying to ensure that the information they contain is available to those who need it, with noticeably little success. The difficulty that surrounds the use of paper for other forms of records also presents an equally serious problem.

The increasing complexity of government and business has added to this paperwork because of the need to collect, collate and record information and data needed to carry out their respective functions in a highly social-technological society.

In the Federal Government these records, already large, continue to grow at an unprecedented pace, and at a rate which presently represents some 150,000 cubic feet per year; anything that can alleviate this problem can therefore be considered potentially advantageous. This volume of paper increases yearly despite efforts to weed out useless paper from these records.

Adding to the chaotic situation caused by the volume of paper is another factor that tends to increase the storage volume and decrease the efficiency of storage; this is the lack of standardization of paper sizes.

Whether we are dealing with correspondence, pamphlets, text books or other forms of printed material, it has generally been the practice to select the paper size most suitable to the user. The problem commenced, as all problems do, by each user deciding that a different size was most suited to his requirements, and often this size was based on sizes that were readily available.

In North America sizes came into being by reason of their being traditional, and these basic sizes differed according to the type of paper or paper-like material being produced. In addition, in a desire for prestige, or to gain the attention of the receiver, correspondence, envelopes, books and other items of paper were produced in many odd and diverse sizes (and colors).

The resultant confusion from the receiver's or user's viewpoint is one that is unique indeed. It is not easy, with present North American paper standards, to compare one paper with another without carrying out a series of calculations. Files for correspondence have to accommodate the largest sheets (in correspondence this is usually 8 1/2 x 14 inches), and more often than not, only 50 per cent of the volume of the filing cabinet is used. Shelves have to be provided for an irregular size of books, and collating and mail handling devices must be adaptable to the various sizes of sheets and envelopes used. Under such conditions, optimum storage or machine design is impossible and with it uneconomical and inefficient equipment.

This diversity, though it might have some advantages to the originator, can be most costly to the handler and recipient. The Federal Government, which generates, transmits and stores paper in all forms, can obtain some obvious advantages by the standardization of paper sizes.

The Glassco Commission recognized this and has shown in a very detailed manner the immensity of the problem of handling paper that exists within the Federal Government. It states that "the creation, handling and

filing of correspondence is among the most costly and time-consuming processes in modern governments. At least 50,000,000 letters and memoranda (in the Canadian Federal Government) are written every year," which is equivalent to some 30,000 letters each working hour. It goes on to say that "such a volume of correspondence demands special attention" in order to substantially improve the quality and cost of production. In addition to the production of letters, many hundreds of thousands of forms are used throughout the Federal Government, few of which are standardized in shape or form. A check showed that some two hundred different sizes of forms at least existed.

All this paperwork has to be handled through the necessary business machines and mailing systems and most of this material ends up in the form of records and needs to be stored.

The Treasury Board's recommendation some two or three years ago that paper sizes be standardized was an initial step in the right direction. It has not, however, had the impact it should have had, neither has the suggestion borne too much fruit in the form of equipment to handle this paperwork.

This recommendation was based on a sampling of correspondence in one department of the government which showed that 96 per cent of the correspondence could have been contained on 8 1/2 x 11 inch paper. A further sampling of orders of smaller size sheets suggested that the difference in cost between the smaller sizes of correspondence sheets and an 8 1/2 x 11 inch sheet was so minimal that there were obvious advantages to the use of a sheet of paper approximately 8 1/2 x 11 inches in size.

The introduction of modular steel shelving, and a recent Management Improvement Branch directive, have created a demand for a new approach to filing, and have suggested by inference that if we are going to be successful in the development of standards that are in any way meaningful, we should first concern ourselves with the basic paper size, and upon this construct a series of standards that are meaningful and relevant.

The tremendous changes that are taking place in the field of technology will have an effect on this whole problem and must be considered while we are concerned with the derivation of these basic standards. The fact that equipment is now capable of producing automatically 50,000 lines of typescript per minute has to be faced today, and the effect that this will have on the resultant paper sizes will be most important.

If the Canadian Government Supply system is to carry out its function in an effective manner as the central supply system for the whole organization of the Federal Government, then it is essential that we construct our standards upon a base that is both sound and amenable to the changes of modern technology, and one that can provide rational interchangeability of information between one medium and another with a minimum of difficulty.

On what basis should we make our selection of a standard size—on those that are now existent, or on some new basis? An investigation of the existing sizes reveals the lack of any basic factors that can provide a

consistent and continuing series of dimensions. The essence of standardization should be that all sizes of paper, paper products and derivatives have some fundamental relationship which should also have similar characteristics to other media.

In passing, it is interesting to know the basis upon which one of the paper sizes, the 8 1/2 x 11 inch standard letter size, was derived. As far as can be determined, the use of this size commenced in the United States during or shortly after the first World War. It should be noted that although 8 1/2 x 11 inch letterheads are standard in U.S. industry, the standard for the U.S. Federal Government is 8 x 10 1/2 inches. Why two different sizes? It is rather interesting to note that both standards originated about the same time. In 1921 General Dawes, the first Director of the Bureau of the Budget, with the then President's approval, established an interagency advisory group called the Permanent Conference on Printing. On September 14, 1921 the Permanent Conference on Printing established the present 8 x 10 1/2 inch standard for U.S. Government letterheads. This action of the Conference alone seems to have been regarded as binding upon all agencies of the U.S. Government.

In adopting an 8 x 10 1/2 inch standard letterhead, the Conference seems simply to have extended an earlier action by former President Hoover, then Secretary of Commerce, who on March 28, 1921 established 8 x 10 1/2 inch letterheads as the standard throughout his department. There appear to be no records to show the basis upon which this standard was developed, and it is suggested that the then Bureau of Efficiency may have had some influence on the decision, but as far as we are aware, no actual analysis is in existence to show why 8 x 10 1/2 inch was selected.

It is also of interest to note that on August 30, 1921, about the same time as the 8 x 10 1/2 inch size paper was adopted, a Committee on the Simplification of Paper Sizes was appointed to work with the Bureau of Standards as a part of President Hoover's program for the Elimination of Waste in Industry. This Committee, which was largely made up of representatives from the printing, paper and related industries, was to concern itself with the standardization of sizes and types of paper used in books, magazines, forms, envelopes, newspapers, advertising leaflets, etc., as well as in bond paper and letterheads. The Committee recommended the following standard basic sizes for bond and writing papers for general printing and lithography: 17 x 22, 17 x 28, 19 x 24, 22 x 34, 28 x 34 and 24 x 36 inches; these sizes, which we understand were common to the industry at that time, are also in common use today in Canada.

It does not appear, even in the selection of 8 1/2 x 11 inch size paper, that any special analysis was made to prove that this provided an optimum size for a commercial letterhead. The purpose was merely to reduce inventory requirements for paper into sizes which would cut from a minimum number of basic sizes of paper stocks, with minimum trimming waste, and the Committee apparently concentrated its attention on this problem alone.

Eventually the Permanent Conference on Printing, which had established the 8 x 10 1/2 inch standard, and the Committee on Simplification of

Paper Sizes which had established the 8 1/2 x 11 inch standard for letterheads, learned about one another. In 1923 the Permanent Conference was invited to have representatives attend proceedings of the Simplification Committee. The two groups could not, however, agree upon a single standard for both commercial and governmental letterhead. In other words, they agreed to differ. So from that time on we have been plagued in all our operations with standards based on unknown and questionable basic data.

It must not be construed that North America is alone in this difficulty. If anything, the European practices, and those countries that derived their standards from that source, were in an even worse situation. In most cases the sizes were based on traditions that had their foundations hundreds of years earlier.

If then such an anomalous situation exists, has anything been done to alleviate the situation, or has concern been expressed about this problem elsewhere in the world?

From information to hand, many countries have been concerned about the inconsistency of paper sizes over the past one hundred years or so, but the first serious attempt to do anything about it appears to have originated in Germany shortly after World War I. To be factual, it is believed that the premises on which these standards were based originated in France during the revolution of 1789, possibly because of its desire to universalize the metric system.

These standards have been based on the unique relationship of the diagonal of a square to one of its sides related to a piece of paper. This ratio is $\sqrt{2}$ or 1:1.414. There is no magic in this proportion any more than there is in the outline of a circle. But just as the circle is the unique shape that includes in itself the maximum area for the minimum perimeter, so there is no rectangle of any other proportion than that which bears the width/length ratio of 1:1.414 that can be halved and halved and halved again without changing the proportions of its two sides. (See illustrations 1 and 2, pages 8 and 9).

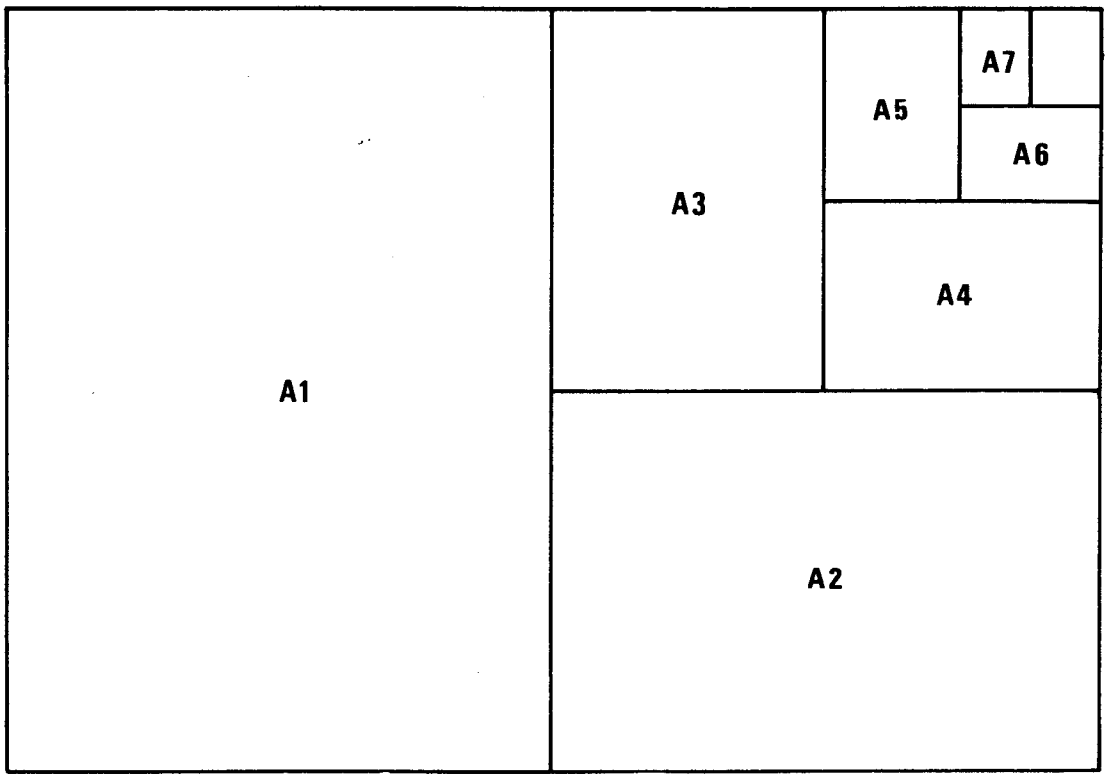
The original proposals were naturally based on the use of the metric system. There is nothing to prevent using this ratio with the inch system of measurements, although with the decision of the Federal Government to shortly legislate the adoption of the use of metric systems and measurements it might be desirable to adopt directly the metric sizes, and indeed there are some advantages to so doing, particularly since the letter size sheets closely correspond to existing letter sizes.

These paper standards were originally adopted as a German national standard and were often referred to as the DIN sizes (from Deutsche Industrie Normen, the name of the German standardization group).

The advantages of these sizes were soon recognized by other European countries, and one by one they adopted them. Eventually it was proposed that these standard sizes should receive international acceptance by being incorporated into the ISO (International Organization for Standardization) system, and from that time on the standards have been adopted by an increasing number of nations outside of Europe.

Illustration 1

INTERNATIONAL STANDARD PAPER SIZES



THE BASIC AO SIZE CUTS INTO ALL SUB-SIZES WITHOUT SCRAP

Illustration 2

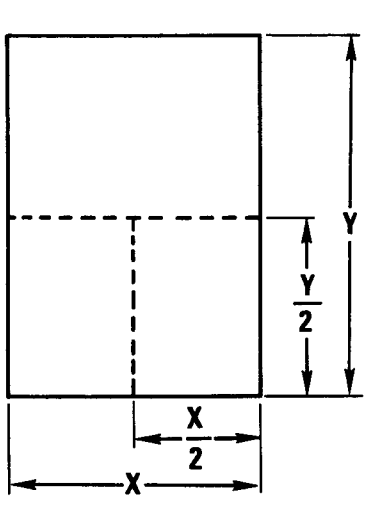


ILLUSTRATION OF THE HALVING PRINCIPLE

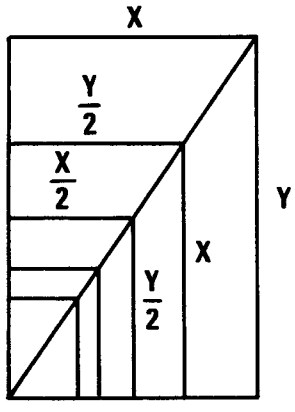


ILLUSTRATION SHOWING GEOMETRICAL SIMILARITY OF SIZES

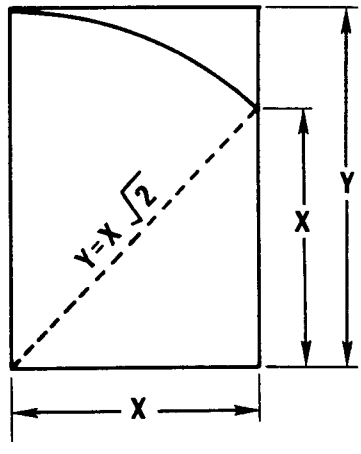


ILLUSTRATION SHOWING THE RATIO BETWEEN THE SIDES EQUALS THE RATIO BETWEEN THE SHORTER SIDE AND THE DIAGONAL OF A SQUARE

ILLUSTRATION OF BASIC PRINCIPLES OF PAPER SIZES

Today, these standards are being used in the following countries. Those underlined will be recognized as major industrial and trading nations. It is surprising that despite its early interest, France, only late in 1969, announced its official acceptance of these standards.

Argentina, Australia, Austria, Belgium, Brazil, Britain, Bulgaria, Czechoslovakia, Denmark, Finland, France, Germany, Greece, Hungary, India, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, South Africa, Spain, Sweden, Switzerland, Turkey, U.S.S.R., Yugoslavia.

It should be noted that in Japan, Switzerland and at least three other countries, these sizes are now mandatory.

It will be noted that the only major nations not included are the United States and Canada, and there are clear indications that the more advanced U.S. industry is seriously interested, and, in some cases, actively manufacturing. Although the U.S. Federal Government has turned down proposals to change for the present, at least two U.S. Federal Government departments have indicated more than just passing interest and are even pressing for their international adoption.*

It should be obvious that since the basic premise of international standard paper sizes is the use of the metric system, and since 90 per cent of the world's nations have adopted the metric system, evolving world trade and its attendant correspondence will undoubtedly be increasingly on paper to the metric standards. (See illustration 3, page 11).

What are the Intrinsic Merits and Advantages of the Use of International Standard Paper Sizes?

To reply effectively to this question we have to concern ourselves with the origins and many uses of paper as it affects us in the Federal Government, together with its economic impact upon the whole paperwork system and ancillary equipment, and its relationship to other media of information generation, transmission, storage and retrieval.

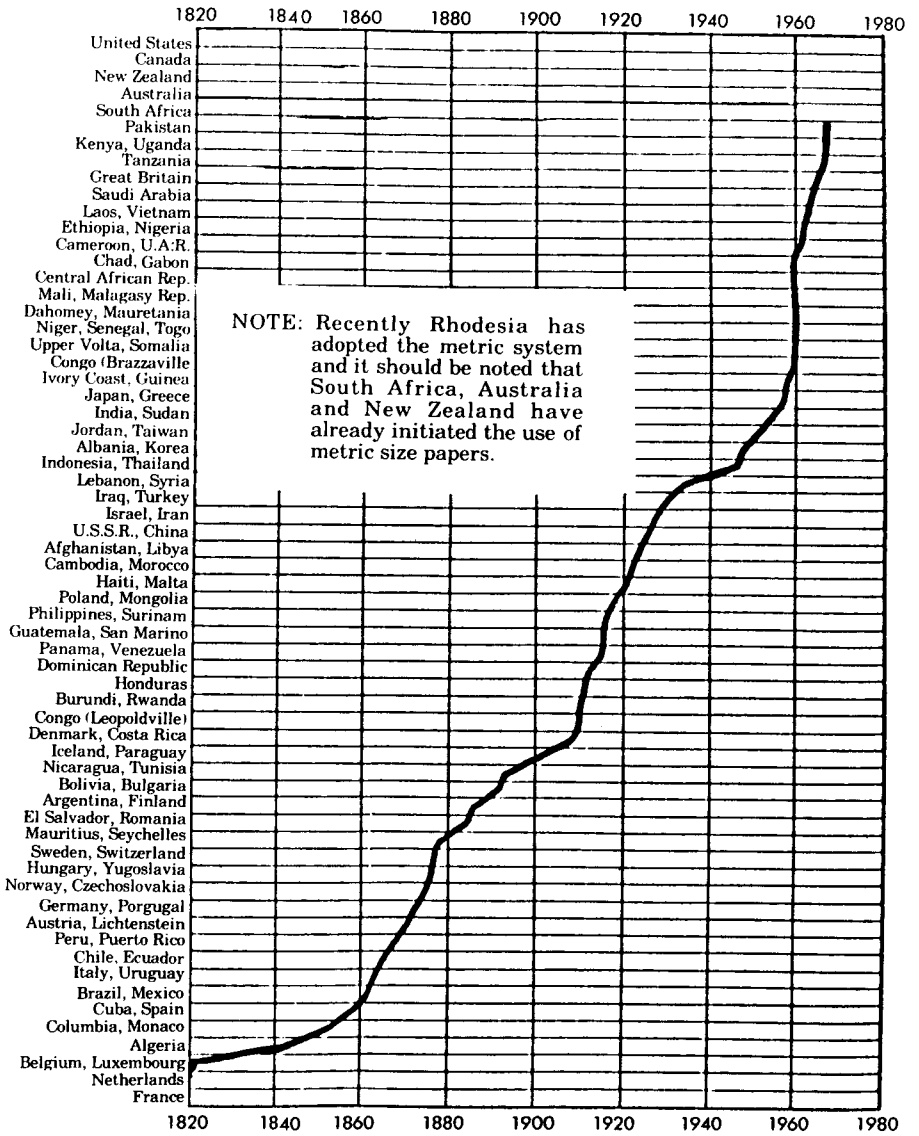
To do this it might be best to consider the following areas:

(a) Existing basic paper sizes
(b) Correspondence
(c) Engineering and architectural drawing
(d) Forms
(e) Envelopes
(f) Printing and publishing
(g) Graphic arts
(h) Relationship to other media
(i) Ancillary equipment

* U.S. Patent Office and Department of Transportation

ILLUSTRATION 3

Advance of Metric Usage In the World



(a) Existing Basic Paper Sizes

The best way to appreciate the complexity of existing paper sizes is to discuss the matter with a paper manufacturer. To try and explain this in abbreviated form here does not adequately demonstrate the problem that is involved.

Some of the traditional sizes (in inches) used in North America are:

Commercial Papers:		Printing Papers:	
22 x 34	21 x 32	25 x 38	35 x 45
17 x 22	28 x 34	22 x 32	36 x 48
17 x 28	32 x 42	32 x 44	38 x 50
19 x 24		28 x 42	41 x 54

The relationships between these sizes are minimal, and to confuse the situation, the basic size upon which the basis weight (weight per 1,000* sheets) of paper is compared is not always the same. The basis weight of a 'bond' paper, for example, is always in relation to its basic size, i.e. 17 x 22" - 32M which, simply expressed, means that 17 x 22 inch sheets of bond paper in quantities of 1,000 weigh 32 pounds. Since the weight of paper bears some relationship to thickness, and since other papers such as 'offset' or 'ledger' have a different basic size and correspondingly different basic weight for approximately the same thickness of material, the comparison between the thicknesses of say bond paper and its equivalent offset is, to say the least, not easy.

The international standard paper sizes overcome this problem by simply referencing all basis weights to one standard size, that which is known as the AO size and which has an area of 1 square meter, or dimensions of approximately 44 1/4 x 33 1/8 inches (841 x 1189 mm). Under these circumstances, weights (and consequently thicknesses) of paper can be** compared rationally and rapidly. While this is often referred to as the "substance" of the paper, this is also traditional, and with modern technological methods this does not necessarily apply.

There is an obvious advantage in the use of grams per square meter as a means of expressing the substance of the paper since it is simple, unambiguous and much less complex and it requires no calculation to compare the substance of papers of different sizes as we do at present.

While at the moment Canadian manufacturers are tending to relate their present range of products in the metric method and are obviously anticipating the use of the metric system, we can not only satisfy the foreign market, but also simplify our present production and stocking system and thus gain even more economies and advantages by using a standard weight reference system associated with the international standard sizes.

*Paper is not always based on 1,000 but also on 500 and 480 sheets, see page 18.

**Weights and thicknesses of today's papers are not necessarily relative.

In any range of substance there has been shown by experience that certain sizes provide the greatest frequency of sale. Both experience and logic show that size requirements are most economically met if consecutive sizes follow a geometrical progression rather than an arithmetic progression. In other words, each succeeding size is bigger than its predecessor by a percentage rather than by a constant amount. For example, one, two, four, eight, sixteen is a geometric progression, whereas, one, two, three, four, five is an arithmetic progression.

On this basis, a French engineer by the name of Col. Charles Renard proposed a simple system in which the largest size in a series should be ten times that of the smallest, and that therefore the intermediate sizes would be determined by a common ratio, $\sqrt[n]{10}$ where 'n' is the number of intermediate sizes. Thus, if the first size is 1 (one), the last size will be 10 (ten), and if four intermediate sizes are required, then the common ratio will be $\sqrt[5]{10}$ or approximately 1.58.

It will be seen that if we take the ratio 1.58 precisely and calculate the intermediate values accurately, unwieldy and impractical figures result. So, sensible 'rounding' of these figures is usually implied. These 'preferred' numbers have been adopted by a number of countries and series of numbers based on the ratios $\sqrt[5]{10}$ (R5), $\sqrt[10]{10}$ (R10), $\sqrt[20]{10}$ (R20), $\sqrt[40]{10}$ (R40), which approximate to 1.58, 1.26, 1.12 and 1.06 respectively have been developed from the basis of what is now an International Organization for Standardization recommendation.

Illustration 4 provides series based on the four ratios referred to above.

In some countries, the use of the preferred series has been applied to the substance of papers and the range of weights in grams per square meter have been laid down on the basis of the R20 and R40 series respectively. These series relate to the twentieth and fourtieth root of ten as referred to above. Illustration 5 shows a range of substances based on an initial weight of 20 grams/sq. meter for the R20 range with the North American approximate equivalents, and a similar and complementary substance in the R40 range can easily be computed.

Illustration 4

BASIC SERIES OF PREFERRED OR RENARD NUMBERS				
Serial Number	R5	R10	R20	R40
0	1.00	1.00	1.00	1.00
1				1.06
2			1.12	1.12
3				1.18
4		1.25	1.25	1.25
5				1.32
6			1.40	1.40
7				1.50
8	1.60	1.60	1.60	1.60
9				1.70
10			1.80	1.80
11				1.90
12		2.00	2.00	2.00
13				2.12
14			2.24	2.24
15				2.36
16	2.50	2.50	2.50	2.50
17				2.65
18			2.80	2.80
19				3.00
20		3.15	3.15	3.15
21				3.35
22			3.55	3.55
23				3.75
24	4.00	4.00	4.00	4.00
25				4.25
26			4.50	4.50
27				4.75
28		5.00	5.00	5.00
29				5.30
30			5.60	5.60
31				6.00
32	6.30	6.30	6.30	6.30
33				6.70
34			7.10	7.10
35				7.50
36		8.00	8.00	8.00
37				8.50
38			9.00	9.00
39				9.40
40	10.00	10.00	10.00	10.00

Illustration 5

CURRENT TRADITIONAL NORTH AMERICAN SIZES AND WEIGHTS RELATED TO THE R20 SERIES

R20 SERIES	BOOK LITHO & OFFSET	BONDS ENVELOPES ETC.	PRINTING BRISTOLS	INDEX BRISTOLS	TAG.	COVER STOCK	TARIFF PAPER	BLOTTING PAPERS
GRAMMES PER SQ. M.	25 x 38	17 x 22	22 1/2 x 28 1/2	25 1/2 x 30 1/2	24 x 37	20 x 26	33 x 45	19 x 24
20								
22.4								
25								
28								
31.5								
35.5		20 M						
40.0								
45.0	60 M						91 M	
50.0	70 M	26 M						
56.0							125 M	
63.0	80 M	32 M						
71.0	90M/100M	36M					156 M	
80.0		40 M						
90.0	120 M	48 M						
100.0	140 M	56 M						
112.0	160 M							
125.0								
140.0	200 M	72 M			180 M	100 M		
160.0		80 M		180 M	200 M			
180.0	240 M					130 M		120 M
200.0	280 M		180 M	220 M	250 M			
224.0			200 M					
250.0			240 M	280 M	300 M			160 M
280.0					350 M			
315.0			280 M	340 M	400 M			200 M
355.0								
400.0								

THE TRADITIONAL SIZES SHOWN ABOVE HAVE BEEN TAKEN FROM THE E. B. EDDY HANDBOOK OF PRINTING PRODUCTION

It is not suggested or recommended that all of these substances should be manufactured or indeed stocked,* and one country has suggested that in due course paper merchants might well only stock a minimum number of substances after a study of paper usage has been made which would provide most of the requirements for general usage throughout the country.

It will be obvious from inspection of this range of substances that they provide and satisfy the actual needs of printers and manufacturers in that it provides a greater choice of substances at the lighter end of the scale.

While proposals to use this series of substances are intended primarily to choose any substance within this particular range, the limitation of substances can not only decrease the cost of the paper by permitting the manufacturers to produce greater amounts of any particular substance at any one time, but will also provide the opportunity for merchants to reduce their inventory and thus give greater service to the printing industry and other paper converters, with resultant overall cost reductions.

The paper manufacturers and merchants in Canada have provided extremely fast service in the past, but the economy in the 1970's obviously will require even more rapid response to customers than we have provided in the past. It is not rational to expect paper manufacturers or merchants to produce or hold stocks on the 'off chance' that some printer might require them in the future. By requesting paper of the substances most in demand, which can move quickly and be as quickly replaced, not only will this increase the economy and efficiency of the manufacturer, but that of the merchant and printer as well.

If paper buyers will be satisfied to order only a limited number of rationally related standard substances, stocks can be provided that will move quickly and be just as quickly replaced. This can only increase the economy and efficiency of both the merchant and the printer.

Conversion of North American Basis Paper Weights to the Metric System

Illustration 5 shows the approximate relationship of a number of North American standard paper basis weights related to the R20 series of paper substances. Conversion from present basis weights to the metric system is fairly simple and a conversion equation has been developed to make this even easier.

*Substances suggested for stock purposes in other countries are the 28, 31.5, 45, 63, 71, 100, 140, 180 and 200 g/m2 in the R20 range and 85 and 118 g/m2 in the R40 range.

For specific uses: 25 g/m2 is suggested for light weight papers
50 g/m2 for continuous stationery
160 g/m2 for data processing cards

The present basis weight is largely quoted on the basis of a unit of 1,000 sheets usually referred to as a ream. However, since 500 and 480 sheet reams are also used in North America, conversion factors for these are also provided.

The general equation for conversion from the present system to the metric system is as follows:

(Basis Weight in Lbs.) x (Constant): (Sq. In. Per Sheet) = (Grams/M2).

For a Ream of:	Constant to be used:
1000	703
500	1406
480	1465

As an example, if we wish to determine the substance weight in metric terms of 17 x 22 - 20M paper, we get:

$$\frac{20 \times 703}{17 \times 22} = 35.79 \text{ g/sq. m.}$$

At present the papermaking industry in North America is inclined to resist the use of international standard paper sizes claiming that their equipment does not lend itself to the manufacture of these sizes. When pressed, these objections largely disappear and they will agree that there is no problem in the supply of whatever sizes of paper the customer needs. Naturally there will be some adjustments to be made, but reactions from users suggest that considerable economies will result from the use of standard paper sizes. The use of sizes capable of repeated halving until the appropriate size is obtained and the use of a unified substance formula obviously provides opportunities for reduction of stock and storage facilities on cut sheets.

(b) Correspondence

It is obvious from the sampling to date of paper sizes used for correspondence that the current 8 1/2 x 11 inch approximately optimizes the sheet size to be used as referred to earlier. It is interesting to note that the international standard paper sizes sheet size A4 (8 1/4 x 11 3/4 inches) obtained by four repeated halvings of the basic size (AO) approximates very closely to the 8 1/2 x 11 inch size used at present in Canada, and there would be little problem in its adoption. Indeed, the A5 size (half A4, 8 1/4 x 5 7/8 inches) makes an ideal half size sheet for a short letter or memo.

Since these sizes are within the tolerance of the currently used sheets, no difficulties may be expected with the normal office machines such as typewriters and copiers. Indeed many copiers, both European and U.S. manufactured, have made provision for the use of these sizes. They do provide advantages when transition to microforms are required and this will be referred to later.

Obviously the standardization of paper sizes will have its effect on other pieces of equipment used in the handling and storage of paper records; it would mean that file folders could be standardized as well as filing cabinets, filing baskets, etc., and would at the same time provide greater density of storage and considerable reduction of space used for storage.

Modular Steel Shelving (CGSB Standard 44-GP-7) is readily adaptable to the storage of A4 size paper. The use of a 13-inch shelf, and its associated file folder, can easily satisfy the needs for the storage of documents on this size of paper.

The use of A4 size paper implies the need for envelopes to suit. These are discussed later, but it is interesting to note that with the repeated halving or folding, when dealing with correspondence, the ratio 1:1.414 is retained. The provision of envelopes is therefore simplified.

(c) Engineering and Architectural Drawings

As with paper in general, papers for engineering and architectural drawings have a North American standard size. These sizes, generally referred to as sizes A to E (A being the smallest), are in general use in industry and government. Other sizes for roll size drawings and other supplementary sizes are available.

These sizes are covered in CSA Standard B78.1 - 1967 and approximate to multiples of the 8 1/2 x 11 inch standard correspondence size sheet; they are as follows (in inches):

A	8 1/2 x 11	Trimmed size
B	11 x 17	Trimmed size
C	17 x 22	Trimmed size
D	22 x 34	Trimmed size
E	34 x 44	Trimmed size

They approximate very closely to the international standard paper size system, as will be seen from the following:

A4	8 1/4 x 11 3/4	Trimmed size
A3	11 3/4 x 16 1/2	Trimmed size
A2	16 1/2 x 23 3/8	Trimmed size
A1	23 3/8 x 33 1/8	Trimmed size
A0	33 1/8 x 46 3/4	Trimmed size

The international standard paper sizes are also included in the above CSA standard, and are already adopted by some Canadian industries at present where it is in the interest of their export business.

Here again the ratio of 1:1.414 becomes of importance to microforms such as aperture cards, since microforms have internationally adopted the same ratio for the reduced document size, and thus loss of space on both film and paper, in retranslation to hard copy, becomes ultimately of important economic interest.

In recent years there has been a return to the 105mm size engineering drawing microform because of limitations in the recovery of full size hard copy from aperture card. This film size is 105 x 148mm or the A6 size.

It should be noted that at the same time the suggested standardization of paper for engineering and other drawings would reduce the optical reduction ratios to a minimum of three, and make possible a single printout ratio, with still further economies in time and material. (See illustration 6, page 20).

(d) Forms

Standardization of the sizes of paper used in the more common forms, and in many less common forms, is attracting more attention than ever before. This is appropriate since today we are increasingly turning to the use of forms to collect, handle, collate and store data. It is becoming increasingly apparent that the relationship of forms in size and in the location of key data is most important, and various international bodies are studying this matter to achieve some consonance on the more widely used forms.

Apart from the need for international forms, particularly those used in the systematic handling of data, to have a harmonious relationship to one another and thus be standard, not only in size, but also in other aspects, there is a generally acknowledged need to standardize the less sophisticated forms. Samples of forms studied have indicated that numerous forms, differing in size and weight, do exist in the government and provide identical functions. One particular sampling shows that more than fifty items existed to serve a single function; in another series of forms designed to satisfy filing needs, thirty-seven different sizes of paper are used for the eighty-five forms in the series. Some of these forms have now been standardized in format.

It appears obvious that the standardization of paper sizes would have some economic benefits to the government, not only by rationalizing and reducing the number of items catalogued and presumably stocked, with attendant administration costs, but also in the ability of the purchasing staff to order in larger quantities and at a more economic cost, with potentially shorter acquisition periods.

If the forms can be of such standard sizes that they can be conveniently and harmoniously filed, where necessary, with correspondence, further advantages in ease of access are possible. Frequently small forms can be over-looked in a mass of correspondence. Also, where mechanized systems are involved, small forms intermixed with large forms can create considerable, and sometimes impossible to solve, problems.

As we look to the future, some widely used forms may need to be designed specifically for the newer computer technologies. Magnetic character recognition (MICR) and optical character recognition (OCR), as noted earlier, have developed rapidly and are now a part of the analytical equipment available.

Illustration 6

An Analysis of the Advantages of the International Paper Sizes

Prepared by the Single Supply Point for Technical Data, Quality Assurance Branch, Materiel Command.

International Paper Sizes have many advantages

In no field do the Europeans show their ability and absorption in systematization better than in the field of standardization. In this field one of the best examples is their series of paper sizes for printing, writing and draughting. These paper sizes called the "International Paper Sizes" have been in use for years in countries committed to the "Systeme International (Metric)". In 1966 they were recommended by the International Organization for Standardization (ISO) as the international standard (Recommendations R478 and R479 of 1966). Britain has adopted two of the sizes, the A-4 and A-5 for governmental use. The British Standards Institution published a national standard BS 3176 in 1959.

What are the oustanding features and advantages of the International Paper Sizes?

Firstly, the ratio of width to length remains constant for every size, viz:

$$\frac{\text{Width}}{\text{Length}} = \frac{1}{\sqrt{2}} \text{ or } \frac{1}{1.414} \text{ approx.}$$

Since this is the same ratio as the D aperture in the unitized 35mm microfilm frame, the advantages are apparent (See Figures 3 and 4).

Secondly, the choice of $\sqrt{2}$ as the length is nothing short of magic! If you cut a sheet in half, that is, if you cut the $\sqrt{2}$ length in half, the two halves still retain the constant width to length ratio of $\frac{1}{\sqrt{2}}$! (See Figures 1 and 2). No other ratio could do this.

Thirdly, most of our economical print-out equipment in Canada is based on the 18" x 24" module. The A-2 international paper size fits very well into this module. All other international paper sizes form a constant geometric series where each size is related to this size. (See Figure 1 and notes thereto). The "blow-up" ratio common to most print-out equipment is 14 1/2X. This ratio is ideal for microfilming since it results in the A-O international size completely filling the camera frame (D aperture) by using only two other ratios for microfilming, 29X and 20 1/2X all the original international sizes are converted only to international sizes. (See Figure 3). How simple!

Lastly, all international sizes (See Figures 1 and 2) are created from the A-O size by single cuts without waste. In storing or stacking they fit together like parts of a jigsaw puzzle . . . without waste.

Should we be considering the adoption of these sizes?

THE ELEVEN SIZES OF SERIES "A" OF THE INTERNATIONAL PAPER SIZES		
INTERNATIONAL PAPER SIZE DESCRIPTION	SIZES	
	IN MILLIMETRES	APPROXIMATE IN INCHES AND FRACTIONS
A-0	841 X 1189	$33\frac{1}{8}$ X $46\frac{3}{4}$
A-1	594 X 841	$23\frac{3}{8}$ X $33\frac{1}{8}$
A-2	420 X 594	$16\frac{1}{2}$ X $23\frac{3}{8}$
A-3	297 X 420	$11\frac{3}{4}$ X $16\frac{1}{2}$
A-4	210 X 297	$8\frac{1}{4}$ X $11\frac{3}{4}$
A-5	148 X 210	$5\frac{7}{8}$ X $8\frac{1}{4}$
A-6	105 X 148	$4\frac{1}{8}$ X $5\frac{7}{8}$
A-7	74 X 105	$2\frac{7}{8}$ X $4\frac{1}{8}$
A-8	52 X 74	2 X $2\frac{7}{8}$
A-9	37 X 52	$1\frac{1}{2}$ X 2
A-10	26 X 37	1 X $1\frac{1}{2}$

FIGURE 1

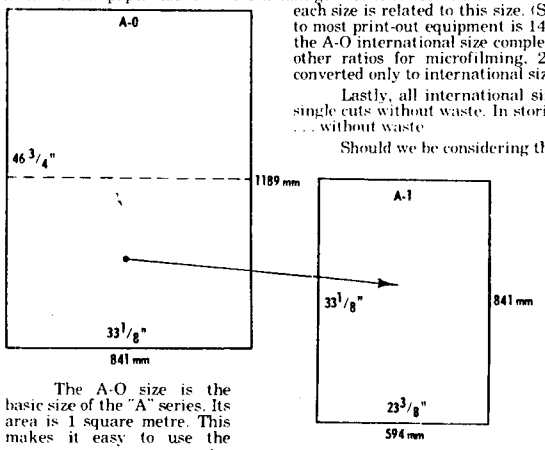
Alternative Methods of Microfilming and Producing Prints

From the "A" Series of International Paper Sizes

PAPER SIZE OF ORIGINAL	TRIMMED SIZE OF ORIGINAL (PAPER SIZE)	SUGGESTED MAXIMUM SIZE INSIDE BORDER OF ORIGINAL	* REDUCTION TO MICROFILM	NUMBER UP POSSIBLE ON 18" X 24" PLATE	* PRINTOUT ENLARGEMENT RATIO	RESULTING COPY SIZE
A-0	33 1/8" X 46 3/4"	31 1/2" X 44 1/2"	29 X	1	14 1/2 X	(A-2)
A-1	23 3/8" X 33 1/8"	22 1/4" X 31 1/2"	29 X 20 1/2 X	2 or fewer 1	14 1/2 X 14 1/2 X	(A-3) (A-2)
A-2	16 1/2" X 23 3/8"	15 3/4" X 22 1/4"	29 X 20 1/2 X 14 1/2 X	4 or fewer 2 or fewer 1	14 1/2 X 14 1/2 X 14 1/2 X	(A-4) (A-3) (A-2)
A-3	11 3/4" X 16 1/2"	11 1/8" X 15 1/2"	29 X 20 1/2 X 14 1/2 X	8 or fewer 4 or fewer 2 or fewer	14 1/2 X 14 1/2 X 14 1/2 X	(A-5) (A-4) (A-3)
A-4	8 1/4" X 11 3/4"	7 7/8" X 11 1/8"	29 X 20 1/2 X 14 1/2 X	16 or fewer 8 or fewer 4 or fewer	14 1/2 X 14 1/2 X 14 1/2 X	(A-6) (A-5) (A-4)
A-5	5 7/8" X 8 1/4"	Usually no border	29 X 20 1/2 X 14 1/2 X	32 or fewer 16 or fewer 8 or fewer	14 1/2 X 14 1/2 X 14 1/2 X	(A-7) (A-6) (A-5)
A-6	4 1/8" X 5 7/8"	Usually no border	29 X 20 1/2 X 14 1/2 X	64 or fewer 32 or fewer 16 or fewer	14 1/2 X 14 1/2 X 14 1/2 X	(A-8) (A-7) (A-6)
A-7 to A-10	etc.	etc.	etc.	etc.	etc.	etc.

Figure 2

*NOTE: Although 29 X, 20.5 X, AND 14 1/2 X ratios have been used to cater to most available equipment, other suitable ratios in the proportions of $2:\sqrt{2}:1$ might have been used, e.g. 30 X, 21 1/4 X, 15 X.



The A-O size is the basic size of the "A" series. Its area is 1 square metre. This makes it easy to use the grammes per square metre (gsm) method of designating paper substance. It also facilitates calculation of area by weighing the paper in rolls or bundles.

This size is ideal for larger drawings which can be reduced photographically to the A-2 size as indicated the tabulation of alternative methods of producing prints.

This A-2 size is ideal since it can be handled by standard 18" x 24" electrostatic and offset equipment.

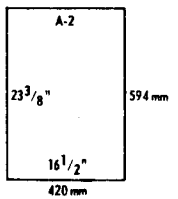
The A-1 size has half the area of the A-0 size. It is ideal for drawings since it can be handled by automatic camera.

By reducing by a factor of $\sqrt{\frac{1}{2}}$ it becomes A-2 size which can be most economically reproduced by standard 18" x 24" electrostatic and offset equipment.

When so miniaturized into the A-2 size it is ideal for compiling into books for tendering purposes.

NOTE: Formula for areas is: area = $a(\frac{1}{2})^n$ where a = 1 sq. metre (approx. 1,550 sq. in.) n = the size number designated in the "A" Series (column 1).

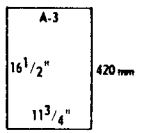
Formula for linear dimension is: linear dimension = $L(\frac{1}{2})^n$ where L = linear dimension on A-0 size n = the size number designated in the "A" Series (column 1).



The A-2 size has half the area of the A-1 size.

It is ideal for drawings, since it can be most economically processed by the standard 18" x 24" electrostatic and offset equipment.

This is the ideal size for compiling drawings into books for tendering purposes.

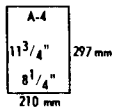


The A-3 size has half the area of the A-2 size.

It is economical for smaller drawings, since up to eight may be stored on one aperture card and reproduced on the standard 18" x 24" offset plate. (Half-size or A-5).

They can also be produced 2-up full size on the 18" x 24" offset.

See tabulation of alternative methods.



The A-4 size lies between foolscap and quarto sizes or stationery and can thus be used for legal documents, commercial letterheads, data sheets, magazines, and illustrated books of larger size.

When larger sheets of the "A" Series are used for drawings or illustrations, they may be miniaturized to fit full page A-4 or half page A-4. (A-5).

Note that up to 16 can be stored on a single aperture card for archival purposes.

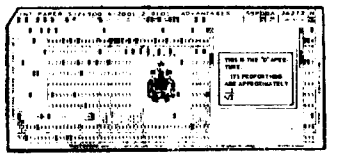
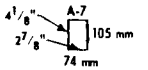
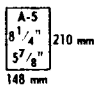


Figure 5

The aperture card, the instrument of economical storage and reproduction of Technical Data.



The A-7 size is internationally widely used for labels, dockets, business cards etc!



The A-5 size is comparable to the octavo sheet. It is useful for short business correspondence, memoranda, invoices, statements, order forms, smaller periodicals, booklets and manuals.

Note that up to 32 may be stored on a single aperture card for archival purposes!

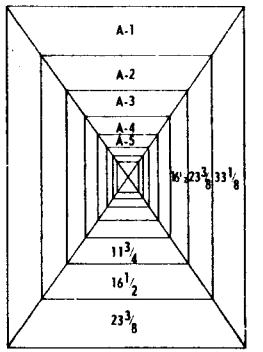
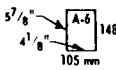


Figure 4

Eight sizes of the "A" Series, superimposed to show their Geometric similarity. This is ideal from the photographic standpoint.



The A-6 size is most suitable for short memoranda, receipt forms, cheques, invitation cards. It has been the internationally accepted post-card size for years.

Up to 64 can be stored on a single aperture card!

One of the original inventors of an optical character recognition machine and many suppliers both of machine and of the forms to be used in these machines have indicated the necessity for the standardization of paper sizes and a preference for the international paper sizes so that true competition can exist and forms designed to be used interchangeably between machines and communities.

The international standard paper sizes are readily adaptable to this need for standardization.

Of these international bodies, probably the most important groups interested in the standardization of forms on standard paper sizes are the Universal Postal Union and the Economic Commission for Europe, a United Nations organization. We will have more to say about the Universal Postal Union in the section referring to envelopes. However, we can say that the majority of the basic forms required by the Universal Postal Union are designed to be used with international standard paper sizes.

The Economic Commission for Europe, on its part, has found a great need to standardize forms for international trade and has developed a series of aligned documents to assist in the rapid handling of information at all ports and terminals where goods are unloaded. While this form of documentation is largely associated with ship borne freight, particularly container vessels, the airlines handling air borne freight are also tending to align their documents to match. The importance of such an alignment is shown when the United States Department of Transport has indicated that the U.S. spends some 5 billion dollars on the processing of paperwork at marine ports per year and that .5 billion dollars can be saved by forms standardization alone. When we further consider the use of optical character recognition as a source data automation input or communication technique, standardization is even more necessary.

The initial contact with international standard paper sizes may tend to suggest some constraints to the proper design of forms. With a more careful assessment of the inherent values of the system, it will become clear that with skilful use of the suggested sizes and their derivatives, almost any type of form can be produced to satisfy most requirements. Graphic artists have been the first to support the use of standard sizes to reduce the number of possibilities available at present and consistently say that consistency provides them with better economic advantages than novelty of shape. (See also under (g) Graphic Arts).

(e) Envelopes

The common basis of correspondence paper, forms and engineering drawings provides for the rationalization of another form, the envelope. The ability to fold in half, repeatedly if necessary, means that a common series of envelopes can be used.

It had been the practice in North America for envelopes to be manufactured in any size required, and this has resulted in an immense variety of sizes being readily available. A recent study of the catalogued items in stock indicated some seventy different sizes in current use in the government, and efforts are being made to standardize on a restricted list of items as a means of economy. Why should we limit ourselves to standard sizes? Why do we need a new series of sizes?. Can these existing standards not satisfy our requirements?

To answer this it is necessary to review some of the duties that the envelope has to perform, or may be called upon to perform in the future. Probably the main duty is that of holding information through the process of mailing and mail handling.

The volume of mail handled today, increasing at the rate of 42% per decade, has called for some action to provide for the sorting of mail accurately and quickly. It is no longer possible, or economic, to hire workers to sort the mail manually; it has therefore been necessary to develop mail sorting and handling devices, and on this basis mail is now classified as machinable, or nonmachinable.

The great preponderance of mail is in the form of correspondence and this mail is, or can be considered, potentially machinable. However, to introduce some order to ensure that this mail is machinable, agreement has generally been reached to standardize the machinable mail to within certain acceptable tolerances. Nonstandard envelopes will be subjected to extra charges, of the order of 50 per cent greater than the normal, or will be subject to the additional delay of manual handling.

At the Universal Postal Union's meeting in Tokyo in 1969 a maximum/minimum size requirement for envelopes for letter mail and postcards became accepted and will become mandatory in October, 1973. These limits are illustrated on page 25 and that for postcard is on page 26.

It might be interesting to note that with the evolving requirements of mechanization of mail handling systems further standardization of envelopes could involve the control of the paper content, the color and the restriction to specific locations of the stamp, the address, the cancelling, the coding and any advertising or address of the originator. The intent of such restrictions is solely to speed the movement of mail by the design of economic machines to carry out the sorting function with greater facility.

The sizes of envelopes used in the international standard systems are shown in illustration 7, which also shows some of the methods of folding standard sized paper for insertion, together with envelopes capable of being stuffed within another, and window envelopes. (Page 24)

Because of the limitations of the Universal Postal Union agreements of October, 1969 and the common need in North America for inserting one envelope within another, an extra envelope, not included in the normal international standard series but acceptable under the UPU limits, has been developed. For the purpose of discussions we have designated this the DL(X) size and this envelope is 235 x 125 mm or 9-1/8 x 4-3/4 inches approximately.

It should be pointed out that the C6 size envelope, intended for use for personal mailing requirements, can accept the maximum size postcard acceptable by the Universal Postal Union which is 105 x 148 mm (4 x 6 inches), or the A6 size, and is identical to what has now become an internationally accepted microfiche standard which is also of U.S. origin.

This series is developed on the 'C' series of paper sizes.

(f) Printing and Publishing

The problems of the existing multivarious paper sizes are probably nowhere more apparent than in the printing and publishing business. It has been the practice in the past to supply a publication of the size and of the paper type specified by the customer. Because of this, the printing industry has always been under constraint by the need to carry large stocks of paper to satisfy the customer's requirements within the minimum delivery time that competition has demanded.

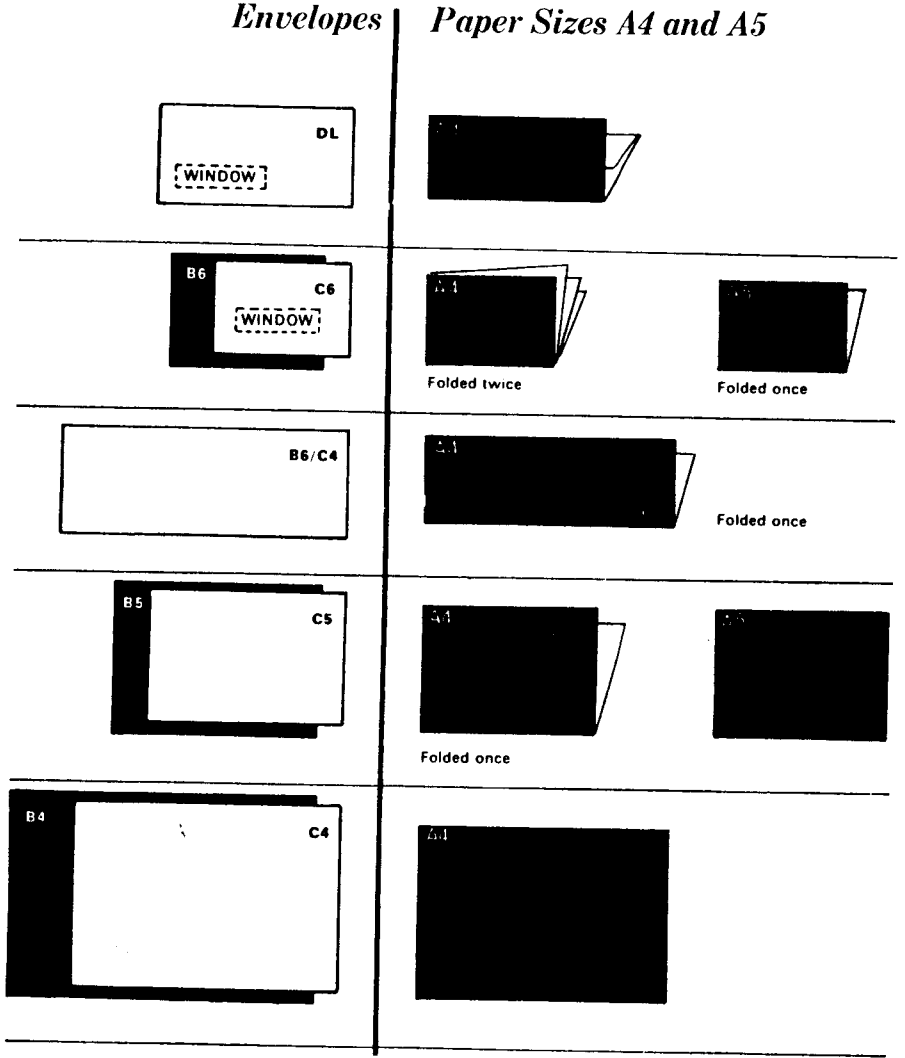
If we could standardize paper sizes and substance (or weight) so that the maximum usable size was stocked, instead of the many sizes that are now required to be stocked, we would obtain considerable economic mobility by a substantial reduction in the quantity and value of paper stored. The use of international standard paper sizes ideally satisfies this condition, since only the maximum size most frequently used needs to be stocked, smaller sizes being obtained by repeated halving of the sheets until the desired size is obtained.

Reports received from Europe and elsewhere indicate that other advantages are obtained in that the international standards, having the ratio of 1:1.414, are aesthetically suited to, and facilitate composition; they also permit typescript, diagrams, photographs, etc. to be quickly and easily arranged. (See also (g) Graphic Arts).

Reports originating from the publishing industry indicate that one of the factors that can increase productivity is that of standardization. It is reasonable to believe that standardization of size and format might well be the most important. Of course, this would apply only to books printed in large quantities, i.e. textbooks, novels, paperbacks, etc. It is of interest to note that some 85% of all the paperbacks produced in North America are printed on machines using webs based on international standards.

Standardization of size and format immediately opens up other possibilities of cost avoidance, which the astute book designer will readily appreciate. It should be understood that these suggestions are made, not with the intent that all works of the printers art should conform to these standards, but rather that economies can be made where this may be essential. The beauty and excellence of the traditional printers crafts it is hoped will long continue to attract the attention of designers, craftsmen, and booklovers everywhere.

Illustration 7



This diagram illustrates how paper sizes A4 and A5 when flat or folded fit into a range of five different envelopes. It also shows how the envelopes C4, C5 and C6 fit into B size envelopes.

International Envelope Sizes

DL	110x220	4.33x 8.66
C6	114x162	4.49x 6.38
B6	125x176	4.92x 6.93
B6/C4	125x324	4.92x12.76
C5	162x229	6.38x 9.02
B5	176x250	6.93x 9.84
C4	229x324	9.02x12.76
B4	250x353	9.84x13.90
C3	324x458	12.76x18.03

Illustration 8

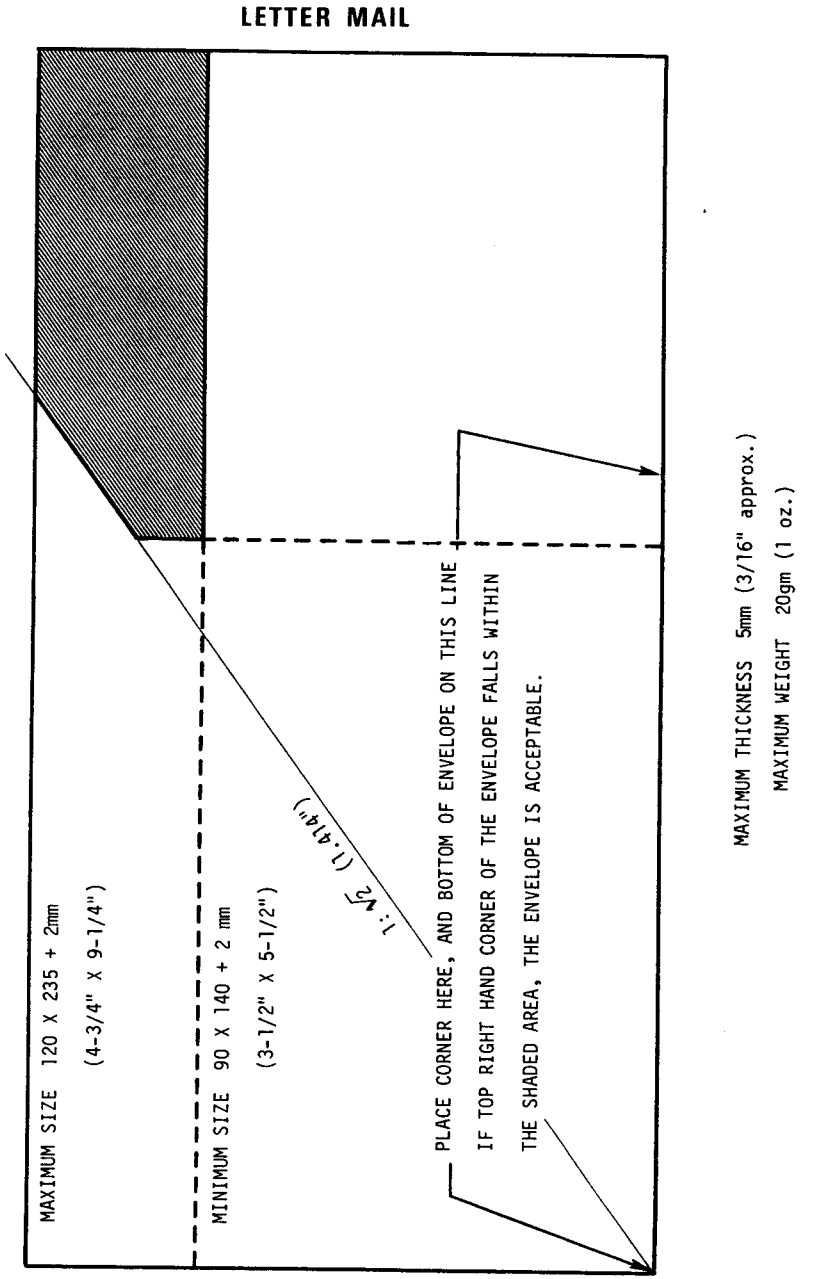
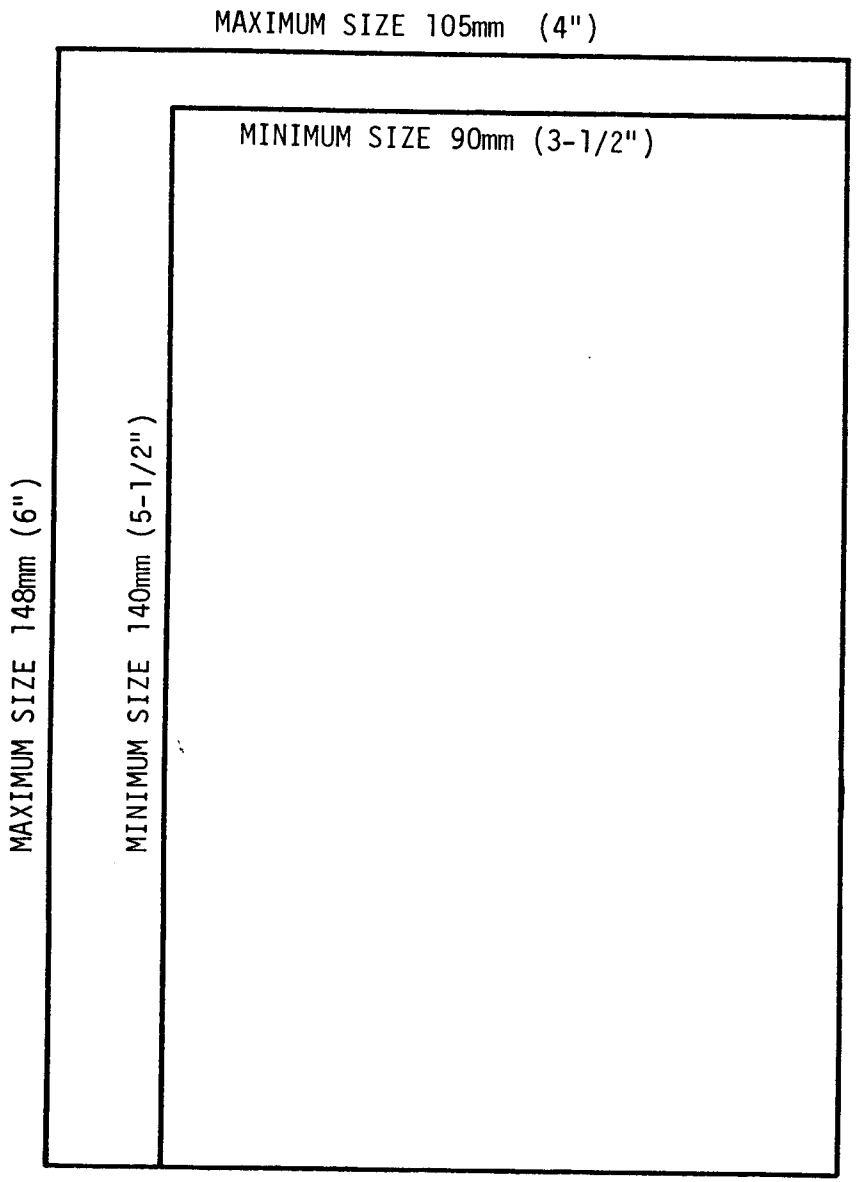


Illustration 9

POST CARD (A6)



The problems existing in the printing and publishing fields in North America are particularly applicable to the printing and publishing activities of the Federal Government. Printing, being based on the existing traditional paper sizes noted earlier, had led to the development of machines specifically designed to use these sizes. Therefore, the use of these machines with international standard paper sizes involves a percentage loss in the effective working area. Here again the loss is largely theoretical since the generally accepted policy of the "customer being always right" means that most of the jobbing shops have, more often than not, to utilize their machines at less than maximum capacity. It is possible, with letterpress and offset printing, to use the international standard paper sizes paper although somewhat inefficiently; and some countries, notably India and Australia, are using presses in this way as an interim measure. With rotary machines this is not possible since the circumference of the cylinder is related to the size of the sheet to be printed. Rotary presses, not being easily modified, present a major obstacle to the change to standard paper sizes. With the smaller type of offset press used to a very great extent for letter and legal size papers, comparable to the A4 and A5 international standard paper sizes, no difficulty exists since this equipment (mostly Multilith units) can easily accept the slightly narrower paper of the international standard paper sizes. (See also appendix re continuous forms).

Since the original paper was written, we have been surprised at the enormous amounts of paper and other documents that are being produced in North America to international sizes. We understand on one hand that quite a number of paper mills are producing A4 sizes of paper to be used as table place mats and that very large numbers are being produced in the U.S. each day. In addition, 85% of the paperbacks produced in North America are being manufactured on machines designed and built in the United Kingdom on the basis of international sizes. The final size of these books can be different from the international sizes as a result of the final guillotining operations. However, it is noted that the only U.S. manufacturer of high speed paperback printing presses has faithfully followed the trend of the United Kingdom.

(g) Graphic Arts

Questions have been asked to a number of people in the graphic arts field who are already using standard sizes of paper and we frankly find some very remarkable reactions. One is that there is an immediate reaction which indicates that a true professional graphic artist appreciates some constraints upon his activity and that the freedom to use any size of paper does not in any way help creativity but rather inhibits it.

One artist states "You ask whether or not standardization of sizes assists the designer in his work. The answer must be yes or it would not have been the designers who started the paper standardization ball rolling in the first place — in this country at any rate (U.K.)".

"There are several points to make. Apart from providing clients with material which their customers can file easily and that the whole rationaliza-

tion aspect expects the designer in starting many kinds of work to be faced with an almost infinite number of possibilities. Experience soon teaches him to limit these himself, first actually in relation to the function of the job and after that arbitrarily if necessary, so he ends up with no more than one or two solutions to each problem. He devises grids by which the presentation of material can be simplified; he usually expects to provide each customer with his own standard style, not something different every time; he generally does not extend his range of specification beyond what occasional novelty requires. In fact, in so much work, consistency pays off better than novelty."

He goes on to say "Having said that standardization and hence the limitation of paper sizes is more a help than a hindrance to the designer", he continues by saying "that even with standardization, the designer is still completely free to produce a job virtually to any size which he requires".

The above statement was quite a revelation as it has become quite normal in North America that where creativity is concerned 'anything goes'. This is obvious to many receiving advertising material in the mail.

The essential motive behind the introduction of the international standard paper sizes is the need to introduce a reasonable order into the current haphazard and chaotic variety of paper sizes. These motives, causing their introduction into Germany in 1920-23, were then, as they should be here in North America, to:

(a) achieve economy (fewer sizes result in longer mill runs, less storage space for paper merchants and printers, with the result in savings of dollars used for warehouse space, inventory and labour servicing that inventory)
(b) ease communication (designation of sizes by the means of unambiguous symbols, instead of archaic traditional practices, consistent with current technology)
(c) provide a constant means of clearly defining the substances (or thickness) of paper
(d) achieve aesthetically satisfactory and invariable proportions in subdivisions or multiples of a given format
(e) provide interrelated sizes for wrapping or other marginal uses of paper.

The basic 'A' sizes or trimmed sizes are used when it is feasible to print directly on such a size of paper, where other problems may be experienced in the printing industry or graphic arts field, then the 'B' sizes, RA or SRA sizes are available to permit 'bled', or other requirements of printing. When considering the 'A' sizes in relation to the graphic artist, the normal upright shape that is with the long edge, vertical, and the short end of the sheet, horizontal, is often referred to as the 'portrait' shape. When used where the long edge is the horizontal and the short edge is the vertical, it is referred to as the 'landscape' format. This, of course, can be indicated in all the series, whether A, B, RA or SRA sizes. When designated as A2, B5, SRA1 or RA1, this indicates the 'portrait' shape, and should the oblong (landscape) shape be required, an additional character, sometimes the letter 'b', is added to the symbol to indicate this requirement. Thus, for an A4 or letter size sheet, the designation A4 will be the portrait format and the A4b would be the landscape format.

Other Formats

For certain special works, such as tickets, receipts, cheques, technical drawings, etc., where it may be expedient or necessary to disregard the established 1:1.4 proportion in favour of other designated shapes, the designation is preceded by a fraction indicating the subdivision of the sheet. In order that the designation is clear, it is a general rule that a fractional division always runs parallel to the vertical divisions, thus one-quarter of A4 would be equal to 297 x 52mm. It is possible, of course, to take one-quarter of A4b, in which case this would be 210 x 74mm approximately.

Half of A4b would be actually the same as an A5. Two-thirds A4b would actually be very nearly square or 210 x 198mm.

When such sizes are adopted, however, it may be very necessary to designate the instructions for folding i.e. an A4 folded twice to one-quarter the length of A4, meaning that two parallel folds, folding the A4 once in the centre and then the second time parallel to the first, folding in half again.

The benefit that international standards offer to the graphic artist is that it aids him to eliminate the dispensable alternatives with a consequent reduction in errors, confusion and doubt, and ensures that he will adapt, if this is a mail piece, to existing standard envelopes without really having to worry about the size of envelope which he will have to prepare for this mailing piece.*

If we consider the standard AO sheet as the basis for all these variations within the standard sizes, the result is quite a wide range of available possibilities in line with standard envelopes and, as a result, provides great economies in the elimination of wasteful time and an unnecessary storage of a vast amount of paper which today is required to satisfy the alternatives demanded by some designers.

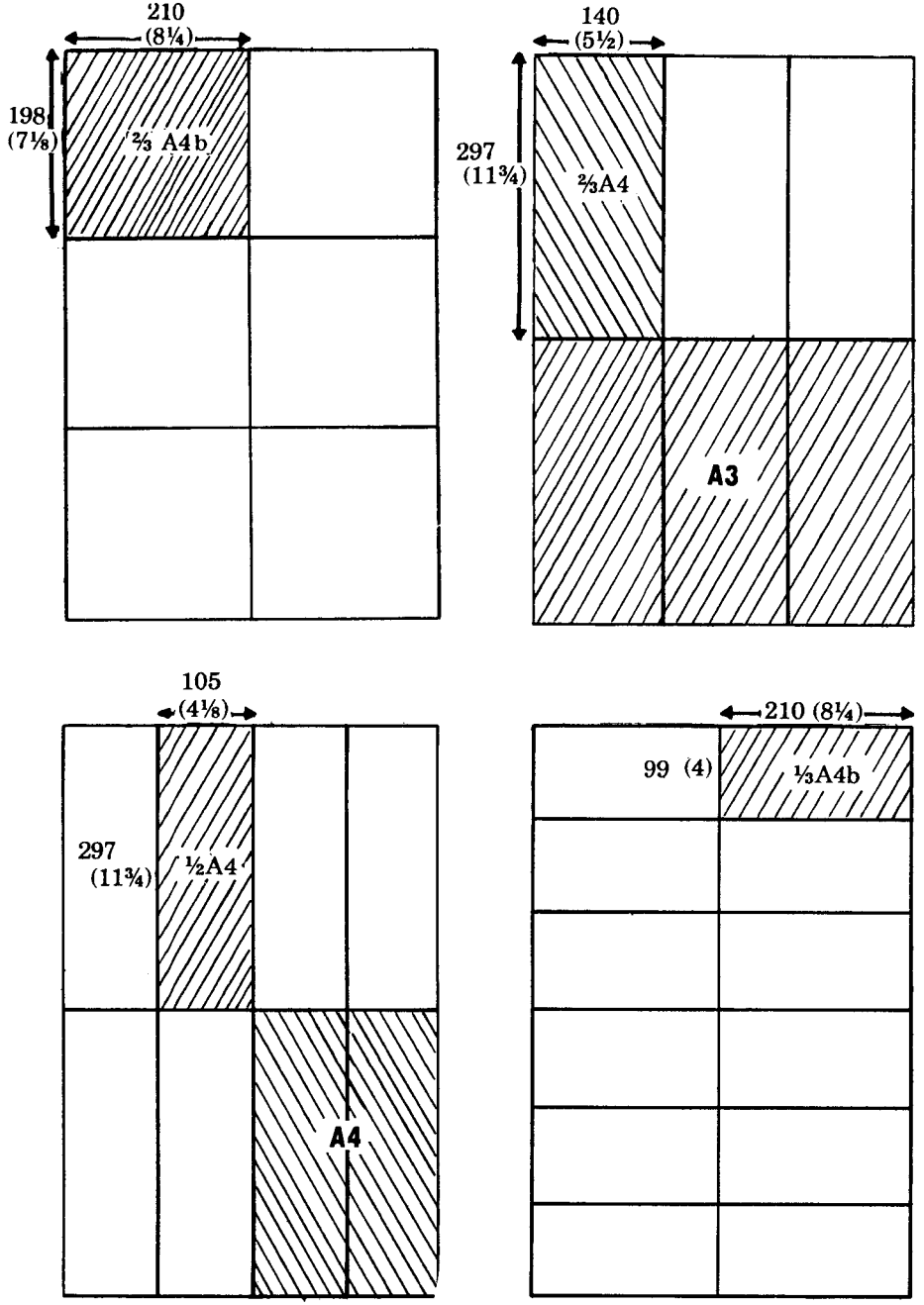
The result is that all will benefit: To the graphic arts customer — optimum economies in paper; to the graphic artist himself — simplified decision making; to the recipient of the product of the graphic arts — ease in filing; to the printer — ease in acquisition of paper and economy in storage; to the paper merchant — optimum storage capacity and to the manufacturer of paper — greater runs of any specific size.

All-around economies are thus achieved.

To those who buy advertising, the A4 sizes provide an immediate advantage since full, half and quarter page displays can be photo reduced to standard sizes as well.

Probably more important in terms of advertising material is the effect which results from the work of graphic artists. The fact that the A4 size in particular after having been standardized as a standard letter size, has now become most suitable for filing shows therefore that any graphic arts work of an advertising nature printed on these sizes can be expected to be retained for a greater length of time than any other size sheet. In fact, some groups

*This booklet therefore being of an A5 size can be mailed in a C5 envelope.



Suggested ways of dividing an A2 size sheet into six, eight, or twelve parts, either by cutting or folding.

make the A4 size obligatory for its technical publications and specifications and this is particularly important in the European architectural area where* the advantages of A4 sizes have been very well put to use. For instance, the patent offices are advocating the mandatory use of the A4 size for all patent documents and some countries have made these sizes mandatory for any publications produced in those countries.

Those who receive advertising material in Europe have found it very easy to discriminate between wanted and unwanted materials by simply referring to the way in which it is presented. If it is an A4 size, then it is most likely that it will be retained for future reference. However, I have been told in many cases that anything differing in size is immediately consigned to the waste paper basket and thus does not achieve the optimum advertising value which normally might be expected of that mailing piece.

The traditional paper sizes have become so commonplace in our lives that we find we have a certain amount of sentimental attachment to these sizes, but if any buyer of graphic arts material ever takes his job seriously, he will find the use of the international standard paper sizes overcome the inaccuracy and ambiguity of the traditional sizes by simple precise statements of the requirements. A simple unambiguous decision to buy advertising material on an A4 size having, shall we say, 64 grams per square meter, is very easy to designate when all you have to say is A4-64 or some similarly accepted designation both of the size and weight of the paper required. This is much simpler than the method we currently use.

The designer cannot ignore the validity of the more important points made in favour of international standard paper sizes, and as one man in the forms field in North America said to me, "I have searched for many ways in which to find fault with this system. However, I have utterly failed to find one. The logic of this system is almost unassailable."

The purpose of many printed jobs, apart from the visual appeal, rests in the ultimate use and this is particularly so in the fields of reference material and stationery. The printed design must also provide for convenience in handling, filing and research. On aesthetic grounds alone international standard sizes and their proportions can certainly hold their own against any other of the traditional sizes. As stated earlier, even the limitations of these standard sizes do not imply restrictions.

We show some diagrams on the possible variations in format that can be achieved, for example, from an A2 size. From this you will see that it is possible to produce variations in format or format size to suit multiple purposes based on these standard sizes. (Illustration 10).

We have been largely concerned here with the cut size sheets or 'A' sizes, but similar comments can be made to the 'B', 'RA' or 'SRA' sizes.

We would also note that in the small offset and letterpress printing machines quite large quantities of machines designed on the basis of international paper sizes are being marketed and sold in North America.

* Conseil Internationale de Batiments.

The transition in methods of typesetting from what is known as 'hot type' to 'cold type' can provide quite an aid in the transition to the use of international paper standards. Cold type, which is largely based on the use of phototypesetting by computer, provides us with some options to modify the existing equipment to make it more adaptable.

(h) Relationship to Other Media

One of the most interesting aspects of international standard paper sizes is that they have the same width/length ratio (1:1.414) that is generally used in microforms. Of particular interest is the now internationally accepted standard microfiche which is 105 x 148mm (A6) and is being produced in large quantities in North America today*. This permits the translation of information from one media to the other with standardized focal lengths, reducing to a minimum the time and labour involved in this process. With the increase in use of microfilm in computer output, the use of photocomposition in addition to phototypesetting can be envisaged.

The possibility of optical scanning methods being used to transmit data, whether the originals be photographs, engineering drawings, typescript, etc., by the hard copy — microform — wire or radio — microform — hard copy process being considered today, necessitates the consideration of the interactions between media to ensure compatibility.

> The challenge of the microform and the microfilming industry is not one that should be ignored by the printing industry. The cost of replication of a microfiche of seventy pages is relatively low i.e. a microfiche having the contents of the size of this book. It is also much more easily produced with the possible exception of colored illustrations.
>
> With the mass of knowledge that is in existence today and the need to disseminate it worldwide, microfiche has still further advantages in that it is light in weight, takes little space, and is easily mailable, the very ideal basic requirements for mass world distribution.
>
> There are, however, other disadvantages of a major nature in the short term future that can limit its effectivity so that proponents of such a system should take care to not ignore the advantages of the printing art, although printers may well have to develop new techniques to compete.

*Approximately one million exist in Ottawa as of this date.

(i) Ancillary Equipment

It is natural to expect that the adoption of international standard paper sizes can have an impact on many areas outside those referred to. All forms of equipment and furniture used in handling records can quite easily be affected, and with proper planning can provide sources for economies. Printed matter can be stored under the optimum conditions, and tangible economic possibilities in the human engineering of equipment and furniture becomes increasingly conceivable.

Alternatives

Are there any alternatives to the suggested change to international standard paper sizes? When the original paper was written it was my suggestion that we did have an alternative and that we could stay with our current sizes if we felt so inclined. Today, however, with the increasing need for standards of communication in forms, mail and other forms of documentation between nation and nation, and with the indicated interest of the Canadian Government to move towards the metric or SI system (systeme internationale), it now becomes only a matter of time before these standards are adopted. The only outstanding exception may well be the U.S. However, the interest in earlier editions of this paper has indicated that they too are aware of the economic advantages.

The newly evolving nations, to whom we are in many cases supplying aid, and who have already 'gone metric', can provide an interesting market for our paper products and equipment that is worthy of serious consideration.

Economies of Standard Paper Sizes

What is the cost of changeover? At present this is unknown. The more important question seems to be, "What is going to be the cost if we do not change?"

It appears to be obvious that while there may be some costs to manufacturers in the changeover, the total end result will undoubtedly be the freeing of millions of dollars for better use by the nation. Today it is no longer a matter of trying to define costs as proposed earlier. It is necessary to accept the fact that these standards are inevitable and to plan for their adoption. Costs, there certainly will be, and undoubtedly, on the initial impact, costs may well slightly rise. However, it appears that if the experience of other countries is to be relied upon, the relative costs of paper usage may well drop 20% or more over a period of a few years.

Comments such as these have been recorded:

"Great saving in cost, space and stocking can be obtained".

"We shall find it much more economical from the cost as well as time aspects to distribute 12-14,000,000 pieces once they conform to international standards".

"Two sizes now cope with all requirements in place of the variety of standards and odd sizes formerly necessary".

. . . . . "buying and stocking of binders, files and paper and the storage of stocks of printed matter and filing are simplified".

"There is no doubt that to make the change to international standard sizes at the same time as introducing a new house style shows in the long run to have a tremendous advantage".

"The overall savings were up to 14% of the total stationery budget".

"Tangible savings can be found in buying costs".

"We find it very much easier to scale illustrations for international standard sizes".

"The reduction of the variety, larger ordering, etc. have been such powerful factors on a typical range of supplies that an overall cost reduction in the order of 9% has been achieved".

"In this range of supplies, forty-two items in nine sizes (five of them envelopes) have replaced sixty-two items in fifty-nine sizes (of which sixteen were envelopes)".

"Three 'standard' sizes of foolscap and two of 'quarto' could be replaced by a single ISO A4 size. In fact, twenty-nine different paper sizes could come down to a basic four".

"A 20% space saving in storekeeping is obtainable".

Another company stated that they had reduced their stock holdings by 44%. A further organization stated that of thirty-seven different sizes of extra publications, only four were now required.

This does not mean that we should be using less paper. Rather it will mean that we shall be using at least as much, if not more, paper more efficiently. If we view this change with more apprehension we would well realize that the conversion of the electrical supply in the Toronto/Niagara area from 25 to 60 cycles by the Ontario Hydro Electric Commission was also first looked at with some apprehension. The cost of making that change was enormous but it has certainly proved to be one of the most forward looking changes which has been made in recent years.

What Are International Standard Paper Sizes?

The following pages outline the sizes that are commonly in use, and, as noted earlier, these are based on ISO standards.

INTERNATIONAL STANDARD PAPER SIZES
BASIC TRIMMED SIZES
'A' SERIES

DESIGNATION	APPROXIMATE SIZE IN INCHES	SIZE IN MM
4A0	66 x 93-1/2	1,682 x 2,378
2A0	47 x 66	1,189 x 1,682
A0	33 x 47	841 x 1,189
A1	23-1/2 x 33	594 x 841
A2	16-1/2 x 23-1/2	420 x 594
A3	11-5/8 x 16-1/2	297 x 420
A4	8-1/4 x 11-3/4	210 x 297
A5	6 x 8-1/4	148 x 210
A6	4 x 6	105 x 148
A7	3 x 4	74 x 105
A8	2 x 3	52 x 74
A9	1-1/2 x 2	37 x 52
A10	1 x 1-1/2	26 x 37
A11	3/4 x 1	18 x 26
A12	1/2 x 3/4	13 x 18

NOTE: — It should be noted that the two largest sizes, 4AO and 2AO, and the two smallest sizes, A11 and A12, are sizes that can be extrapolated from the series that is derived from the basic AO size, and can have their own specific uses.

In all cases, comparison of basic weights is made on the AO size, i.e. 1 square meter.

INTERNATIONAL STANDARD PAPER SIZES
TRIMMED SIZES, 'B' SERIES (SUBSIDIARY)

The 'B' series is intended for use in exceptional circumstances only, when a size is needed between any two adjacent sizes of the 'A' series.

DESIGNATION	APPROXIMATE SIZE IN INCHES	EXACT SIZE IN MM
B0	39-3/8 x 55-3/4	1,000 x 1,414
B1	27-7/8 x 39-3/8	707 x 1,000
B2	19-3/4 x 27-7/8	500 x 707
B3	14 x 19-3/4	353 x 500
B4	9-7/8 x 14	250 x 353
B5	7 x 9-7/8	176 x 250
B6	5 x 7	125 x 176
B7	3-1/2 x 5	88 x 125
B8	2-1/2 x 3-1/2	62 x 88
B9	1-7/8 x 2-1/2	44 x 62
B10	1-1/4 x 1-7/8	31 x 44

NOTE — It will be noted in the body of this book that little reference is made to the 'B' Series. The only way that we are aware that they are being used at the present moment is for the production of posters, for which purpose they seem to be ideal. It will be noticed that all of these sheets have one side (at least down to the B5 size) that measures either one, one half, or one quarter of a metre in length.

Printers, of course, may find a use for these sizes for 'bled' printing requirements, or for the many cases that the small printers find it necessary to use a sheet slightly larger than the finished size during the printing process.

INTERNATIONAL STANDARD PAPER SIZES UNTRIMMED SIZES

There is a need in the paper conversion industry for sheets larger than the basic sizes. To suit these requirements, the RA and SRA series have been introduced. They will be trimmed to 'A' sizes finally.

The RA series is used for simple conversion operation. e.g. nonbled printing, and in the following sizes of sheets:

DESIGNATION	APPROXIMATE SIZE IN	EXACT SIZE IN MM
RAO	33-7/8 x 48-1/8	860 x 1,220
RA1	24-1/8 x 33-7/8	610 x 860
RA2	17 x 24-1/8	430 x 610

or rolls of the following widths:

APPROXIMATE SIZE, INCHES	EXACT SIZE MM
48-1/8	1,220
33-7/8	860
24-1/8	610
17	430

The SRA series provides for a greater sheet size to allow for bled printing and is used in the following sizes:

DESIGNATION	APPROXIMATE SIZE, INCHES	EXACT SIZE MM
SRAO	35-1/2 x 50-3/8	900 x 1,280
SRA1	25-1/4 x 35-1/2	640 x 900
SRA2	17-7/8 x 25-1/4	450 x 640

and also in rolls of the following widths:

APPROXIMATE SIZE, INCHES	EXACT SIZE MM
50-3/8	1,280
35-1/2	900
25-1/4	640
17-7/8	450

SUGGESTED SIZES OF THE "A" SERIES FOR COMMERCIAL USAGE

	4A0	2A0	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11
1 Calendar Block (Tear off)								X	X	X				
2 Calendars — Wall					X	X	X							
3 Directories							X	X						
4 Text Books								X						
5 Posters			X	X	X	X	X							
6 Pocket Books									X					
7 Magazines							X	X						
8 Newspapers			X	X	X	X								
9 Maps			X	X	X	X	X							
10 Drawings			X	X	X	X	X							
11 Forms							X	X	X	X	X			
12 Stamps														X
13 Note Book								X	X	X				
14 Card Indexes								X	X					
15 Correspondence							X	X						
16 Carbon Paper							X	X						
17 Post Cards								X						
18 Cheques									X					
19 Labels & Tags									X	X	X			
20 Sandpaper							X	X	X					
21 Business Cards											X			
22 Paper Towels							X							
23 Toilet Paper									X					
24 Paper Serviettes							X							

APPENDIX A

CONTINUOUS FORMS AND INTERNATIONAL STANDARDS

The first continuous forms, using feed holes, were developed by a couple of American specialists in Dayton in 1916 and around the same time the early versions of the DIN standards were being developed in Germany.

We mentioned in the main body of the notes that a little earlier two committees within the U.S. worked on different paper sizes and came to two differing opinions and therefore it is not surprising to expect that two groups who were at war with each other and working thousands of miles apart should be aware of what the other was doing.

Now, however, the problems of international standards (formerly DIN standards) have been brought very close together after a period of some fifty years of considerable concern has taken place as to how these two papers will interact. There is little doubt that, with the mass of equipment already on the market and operating on inch sizes, it is impractical to expect that any change can come about quickly. However, since there is quite a pronounced change away from impact to non-impact printing machines and to other media, we can expect that, in due course, the pin feed drive must eventually be phased out.

The question of international sizes and continuous forms was first taken up in 1961 and since that time considerable progress has been made to adapt international sizes to suit this problem. To do so, however, we must realize the importance of certain inch characteristics which are inherent in nearly all impact machines.

These characteristics are as follows:

(a) The pin feed operates on papers with holes at one-half inch centres.
(b) Most impact machines can print either six or eight lines per inch vertically and the feed is not designed to suit an immediate change to metric dimensions which is impossible, and an adaption has therefore to be provided.

To suit this, the following sizes have been accepted as the approximate equivalents to the international standard 'A' paper sizes.

DEPTH		CORRESPONDING ISO A-SIZES	
mm	inch	Longer side of	Shorter side of
76.2	(3)	A8	A7
101.6	(4)	A7	A6
152.4	(6)	A6	A5
203.2	(8)	A5	A4
304.8	(12)	A4	

For the purpose of standardization it has been suggested that the distance to the centre line of the pin feed holes from the edge of the paper be fixed at approximately 6 mm or 0.236 ± 0.020 inch (A) and the diameter of the holes (B) to be 4 mm or 0.156 ±0.004 inch; the distance between the holes as stated previously will be kept to the metric equivalent of 0.500 inch as is currently in use.

In essence, continuous forms will be of international standard size width or multiples thereof together with a strip of approximately 1/2 inch width which may, or may not, be removable for the purpose of the punching of holes for feed purposes.

For the purpose of width spacing of characters it is suggested that characters be spaced 1/10 inch apart and this is in line with the general move towards the adoption of optical character recognition characters on typewriters.

These notes are preliminary in context only and are provided to show that effort is taking place to co-ordinate the total paper size situation and thus simplify the total problem of paper handling.

APPENDIX B

INTERNATIONAL PAPER SIZES AND HOLE PUNCHING FOR FILING PURPOSES

With the introduction of international standard paper sizes, a size of paper which has quite similar characteristics to the traditional 8 1/2 x 11, we do become involved with a new problem in punching holes for filing which gives us an opportunity not only to have a better filing system, but also to get away from the multitude of hole punching devices that exist in the average office today.

Surveys have indicated that there are 30 or more different standards for punching holes in paper for filing and in many cases these methods can be traced to quite arbitrary decisions made by users complicated with specific designs by industry introduced with the obvious intent of cornering for themselves a larger share of the market.

The Federal Government has also added to this complex system by using a single hole filing system obviously derived from the British Civil Service who today, in many cases, still uses this form of filing.

Figure 1 shows a few of the types of perforated devices that are in use in government offices today. From experiments undertaken by others it appears quite clear that optimum conditions of filing to reduce the load on each perforation in a piece of paper appears to occur with the use of five punched holes and naturally with the reduction in the number of holes, the load per hole in the paper increases and a greater chance of tearing occurs.

Internationally, no specific recommendations have been made for the number of holes to be used for paper filing. However, the distance between the centre of the holes has been recommended as 80 mm (3 1/8 inches approximately). The diameter of holes is 6 mm (1/4 inch approximately) and the distance from the centre of the holes to the nearest edge of the sheet is 12 mm (or approximately 1/2 inch).

From this basic recommendation it appears that, for the standard A4 (210 x 297 mm or 8 1/4 x 11 5/8 inches), it has become the practice to use four holes for filing purposes spaced 80 mm apart and arranged as in Figure 2. This not only provides us with a better and stronger filing system than the traditional 3-hole system presently in use, but also gives us other advantages which we shall show later.

Much of European, and much of North American, filing appears to still be carried out in box files with two holes punched at the top of the sheet and this arrangement follows this general principle as shown in Figure 3 which is totally compatible with the side punching system, i.e. the same punch can be used for both hole punching systems.

The advantages of the international standard paper sizes in relation to filing now become apparent and Figure 4 indicates how it is possible to file A3 folded (see Figure 5) and inserted into an A4 file. It is also possible to file two A5 sheets above one another with minimal interference and good positional retention (Figure 6).

The same punch and punching system can also be extended to provide an A5 binder of a 3-hole variety which can take an A5 sheet (Figure 7) or A4 folded as in Figure 8.

Naturally, it is a simple extension to derive an A6 type pocket loose-leaf unit using two holes (Figure 9) which would also be compatible with the A5 and A4 filing size binder. It should be noted that the A6 size becomes, in 1973, the official internationally accepted postal card size, is currently the internationally accepted microfiche size and in Europe at least seems well on the way to becoming the accepted cheque size.

It should be noted for the interest of companies generating advertising bulletins that for many years in Europe it has been the standard practice that all bulletins to be retained be of an A4 size and punched with four holes and it is recommended that Canadian manufacturers, anxious to get their information retained on European manufacturers' files, should comply if they wish to keep their products on their customers active files.

If we follow this proposed practice we can now find ourselves using only one punch, possibly like Figure 10 which will carry out most of the needs in an office today. Such a system appears to have considerable economic and time saving advantages in the normal office and should recommend this to users.

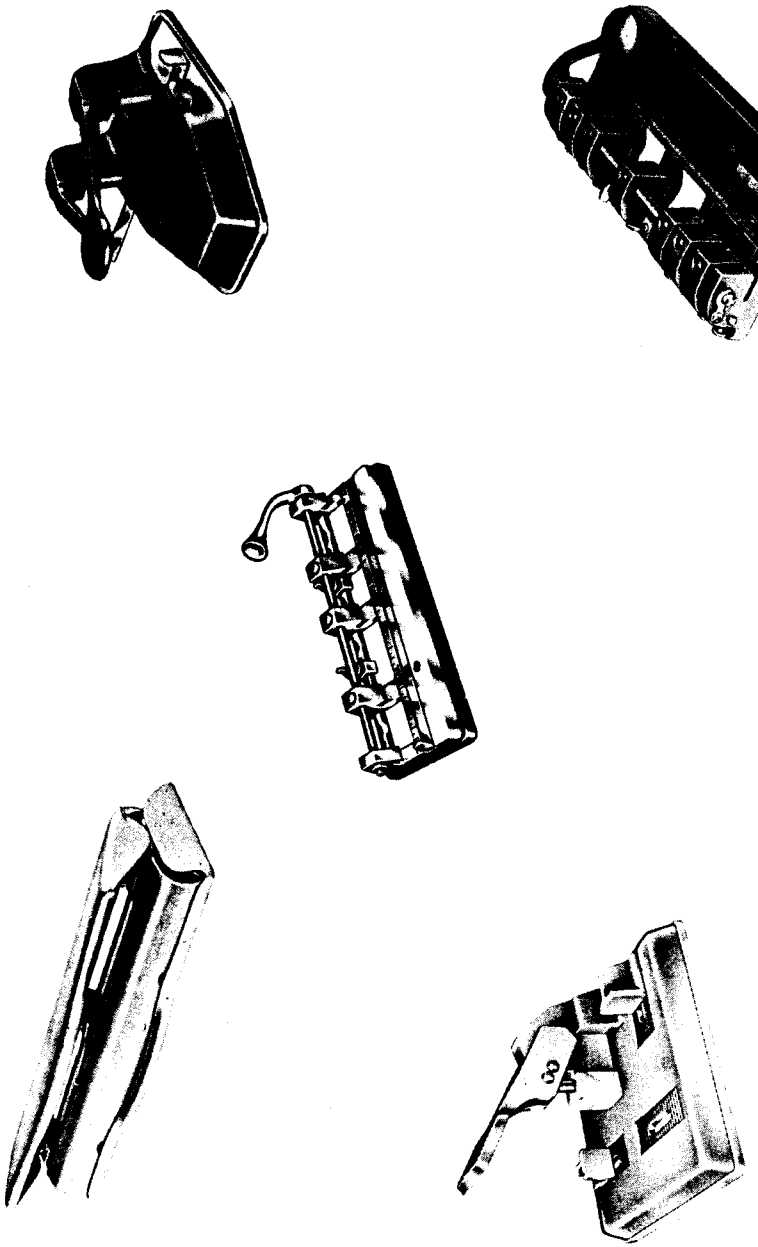


FIGURE 1

SAMPLE OF PERFORATORS PRESENTLY USED

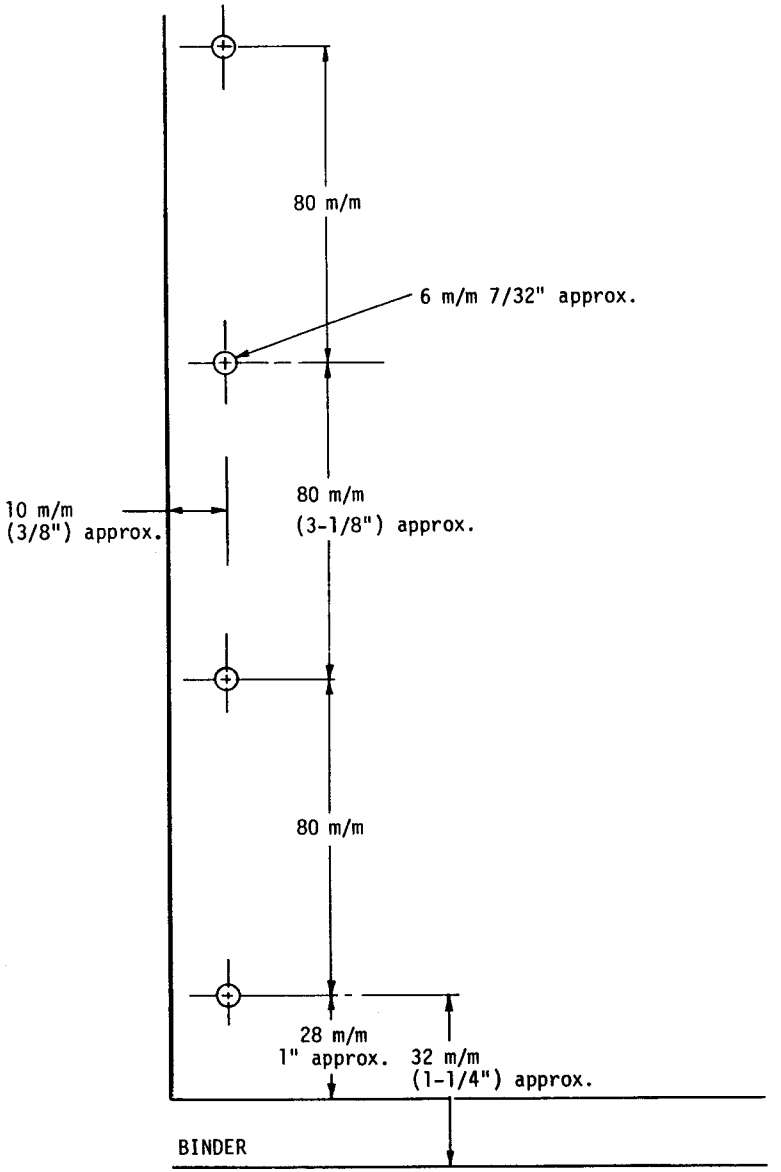


FIGURE 2

BACKHOLE PUNCHING FOR INTERNATIONAL STANDARD A4 SIZE PAPER

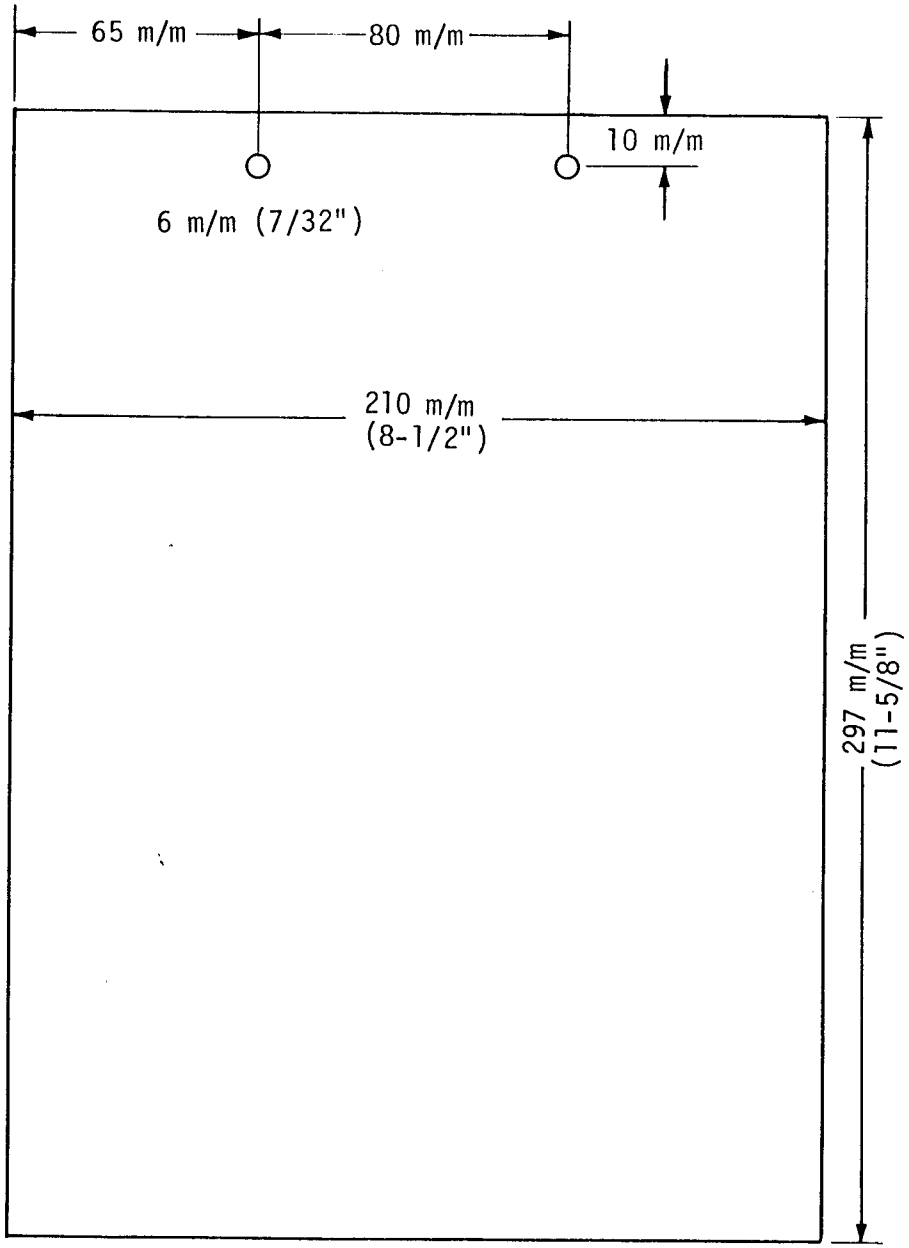


FIGURE 3

METHOD OF HOLE PUNCHING FOR TOP EDGE FILING
INTERNATIONAL A4 SIZE PAPER

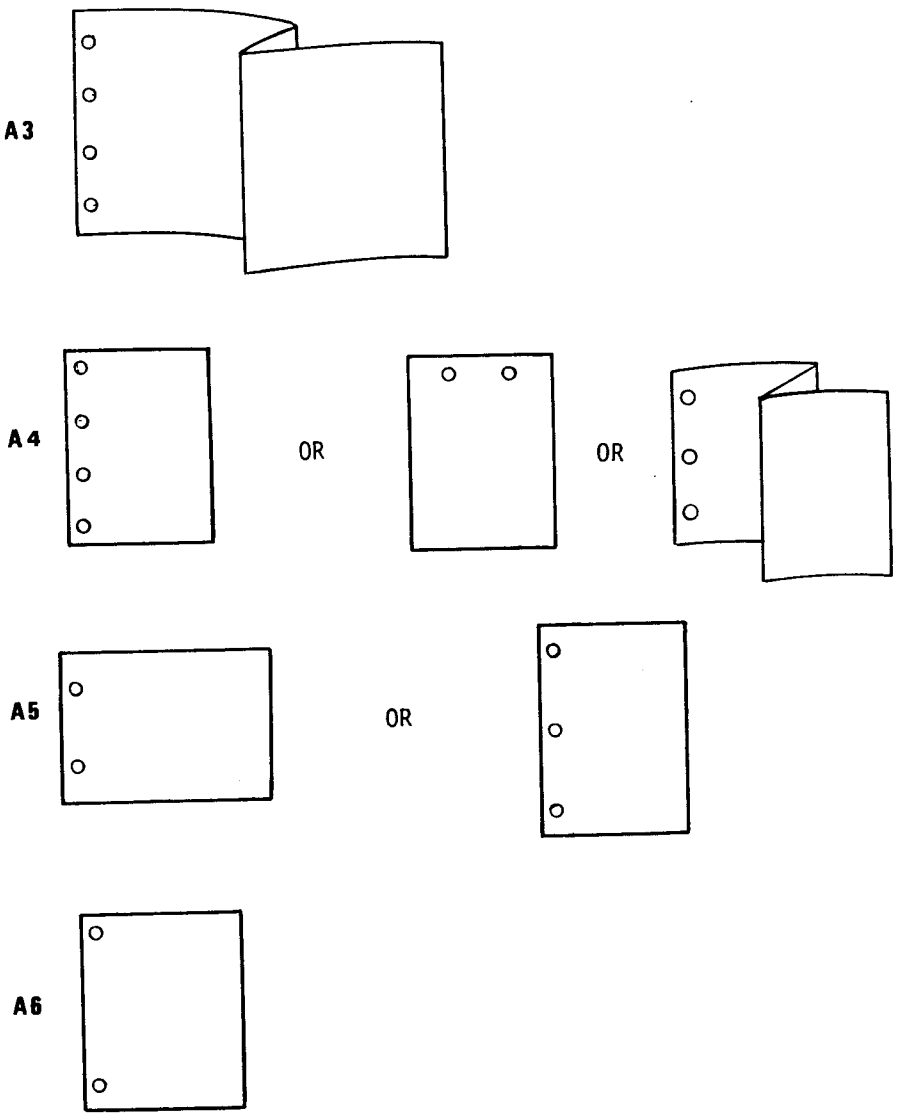


FIGURE 4

METHODS OF FOLDING AND PUNCHING INTERNATIONAL SHEET SIZES A3 TO A6
TO SUIT A STANDARD SERIES OF BINDERS

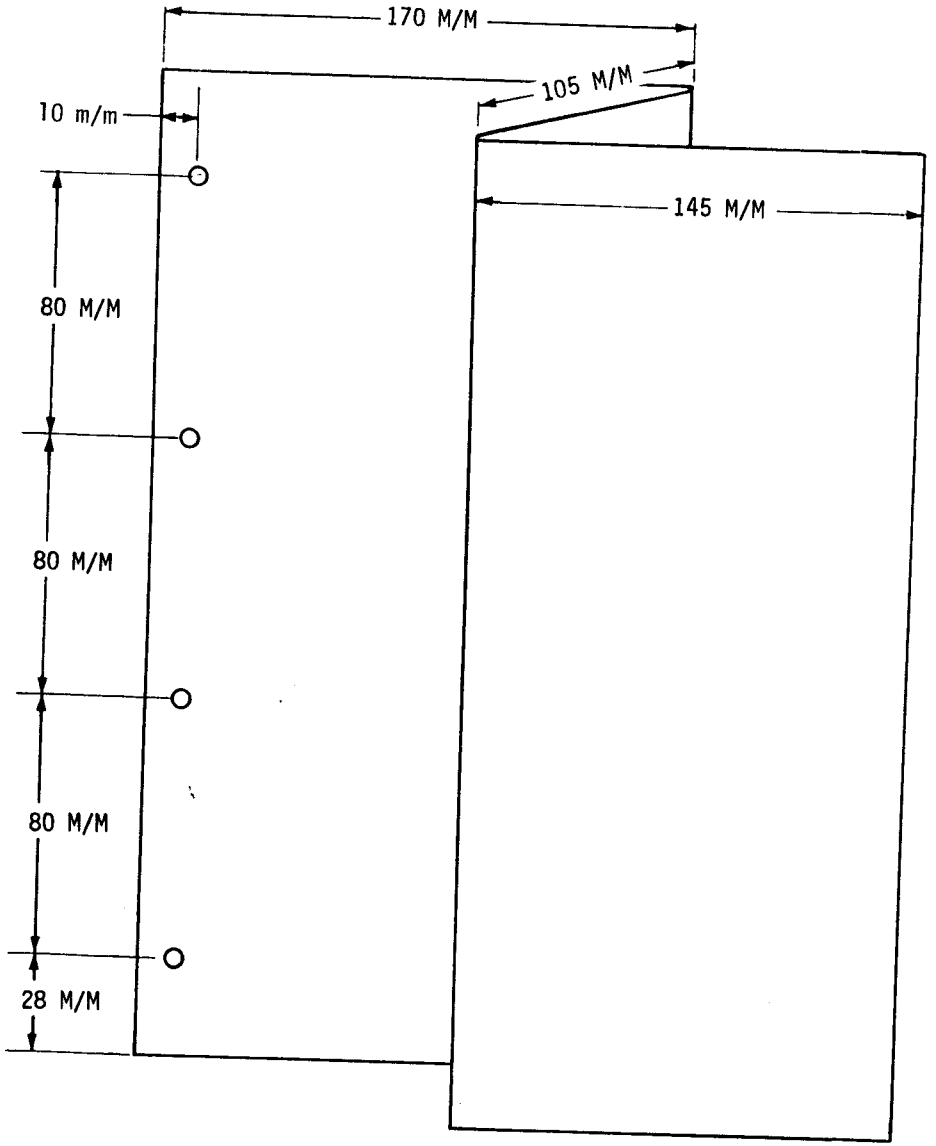


FIGURE 5

HOLE PUNCHING AND FOLDING FOR INTERNATIONAL A3 SIZE PAPER FOR ENGINEERING DRAWINGS AND AUDIT SHEETS

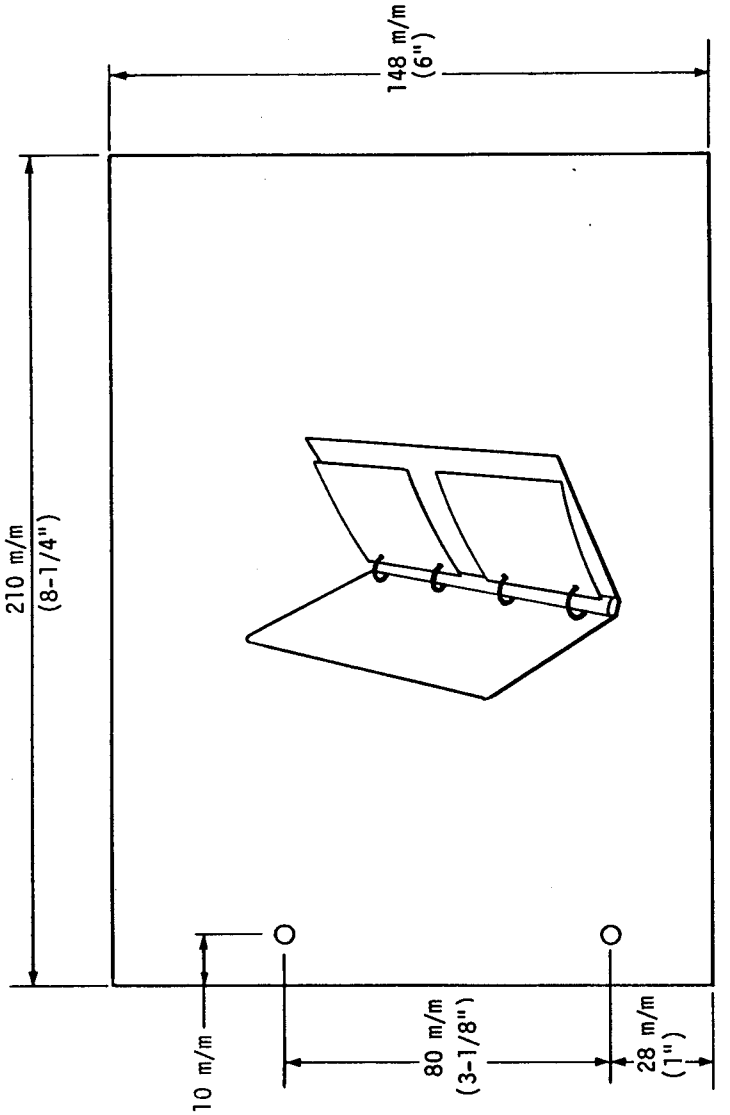


FIGURE 6

SUGGESTED HOLE PUNCHING FOR INTERNATIONAL A5 SIZE PAPER (FILING 2 IN A4-4 HOLE BINDER)

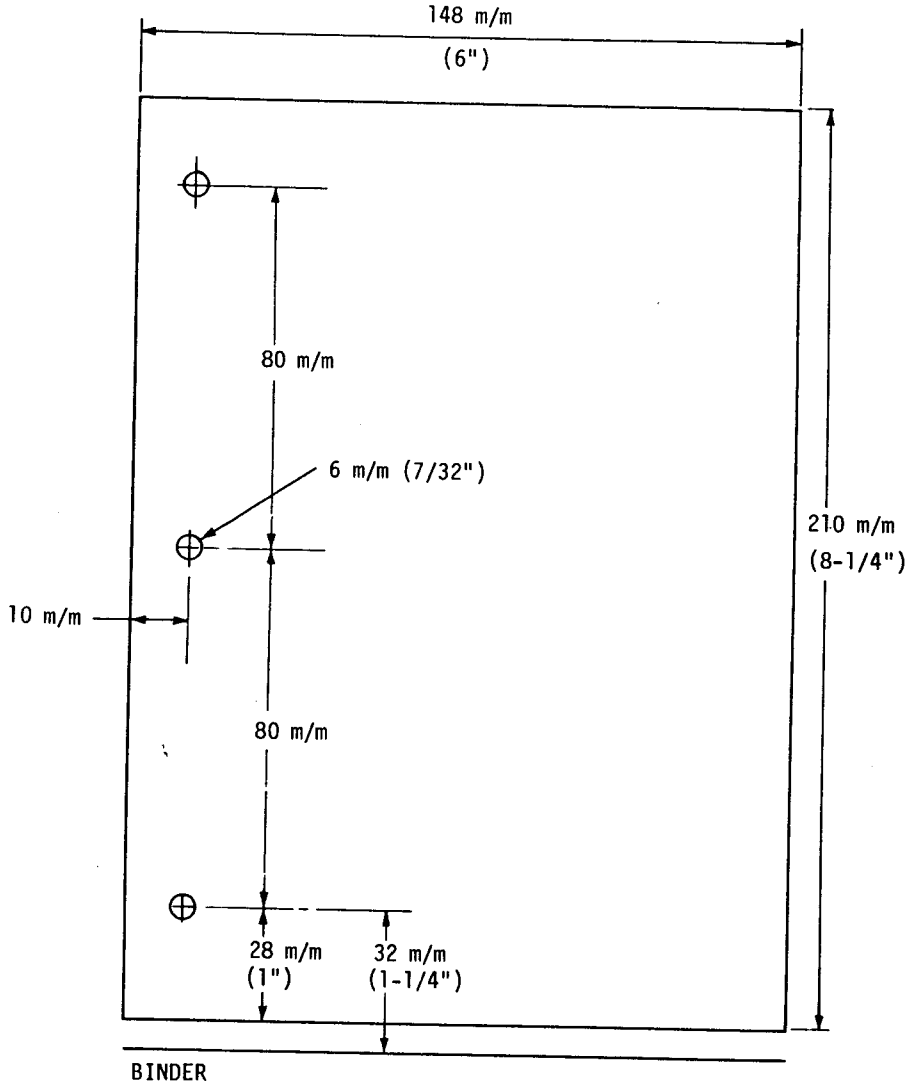


FIGURE 7

HOLE PUNCHING FOR INTERNATIONAL A5 SIZE PAPER
(FOR POCKET BOOKS)

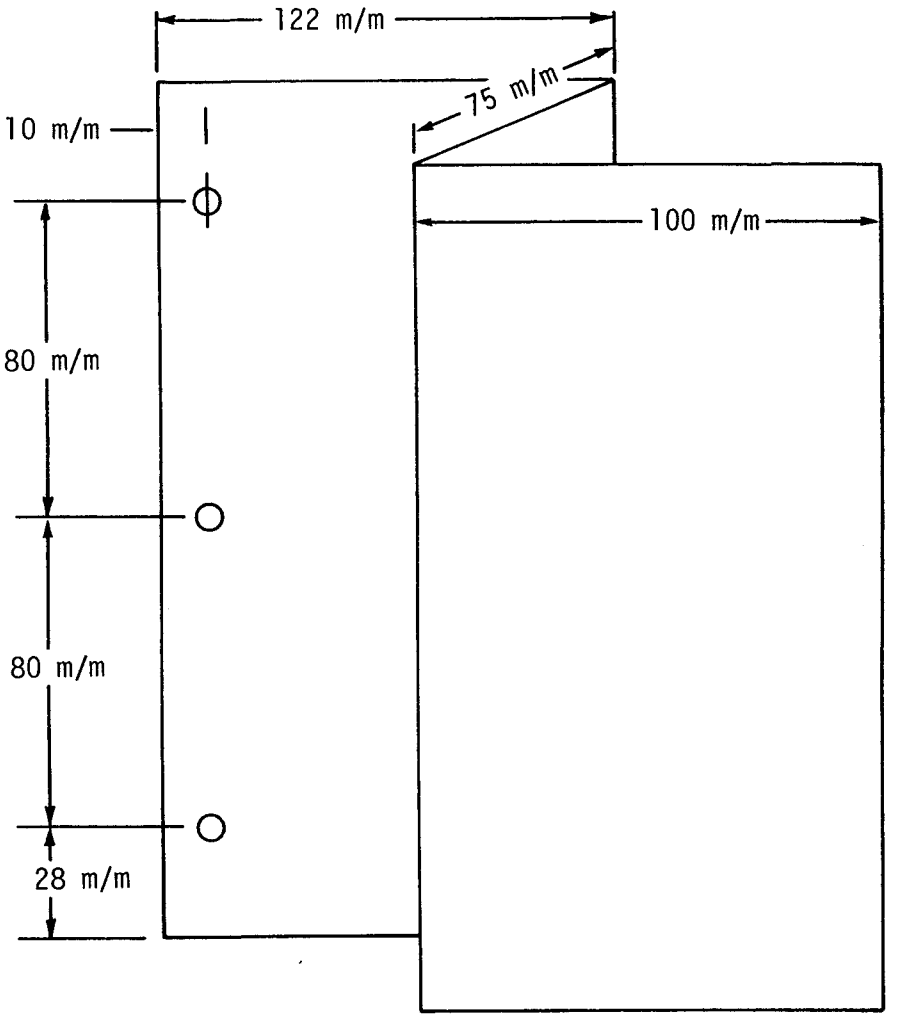


FIGURE 8

HOLE PUNCHING FOR INTERNATIONAL A4 SIZE PAPER
FOLDED FOR INSERTION INTO SUGGESTED A5 BINDER

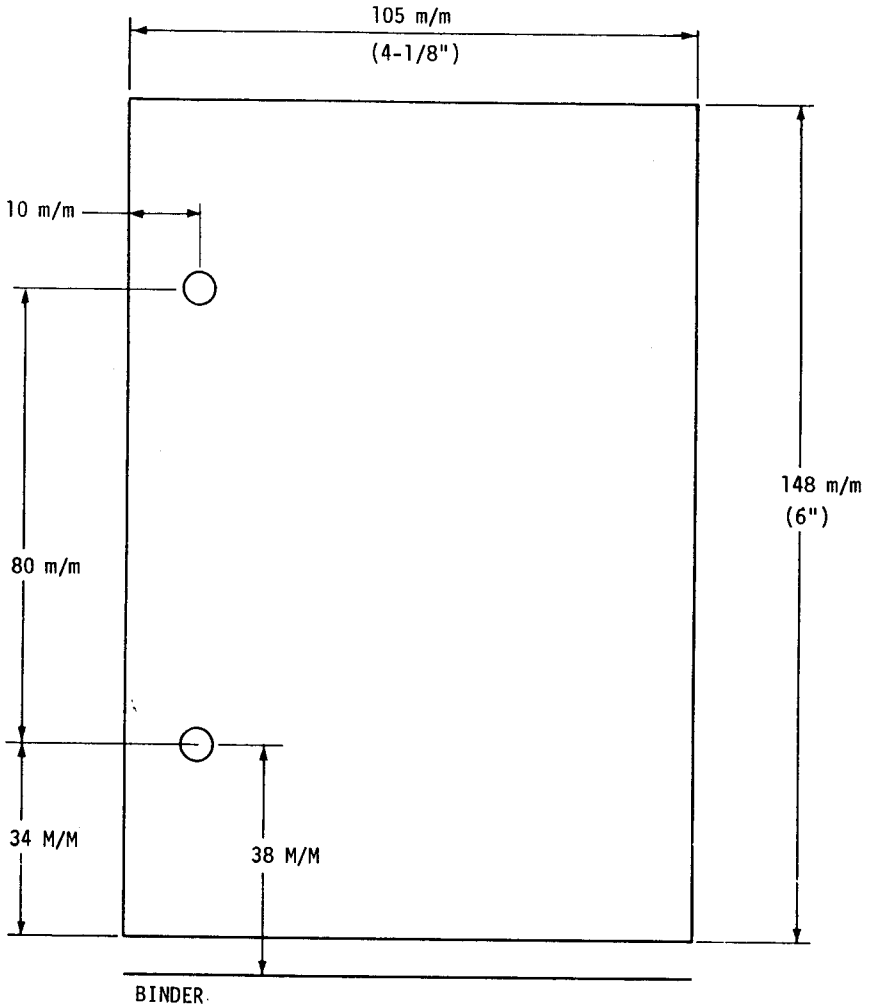


FIGURE 9

SUGGESTED HOLE PUNCHING
FOR INTERNATIONAL A6 SIZE PAPER
(FOR POCKET BOOKS)

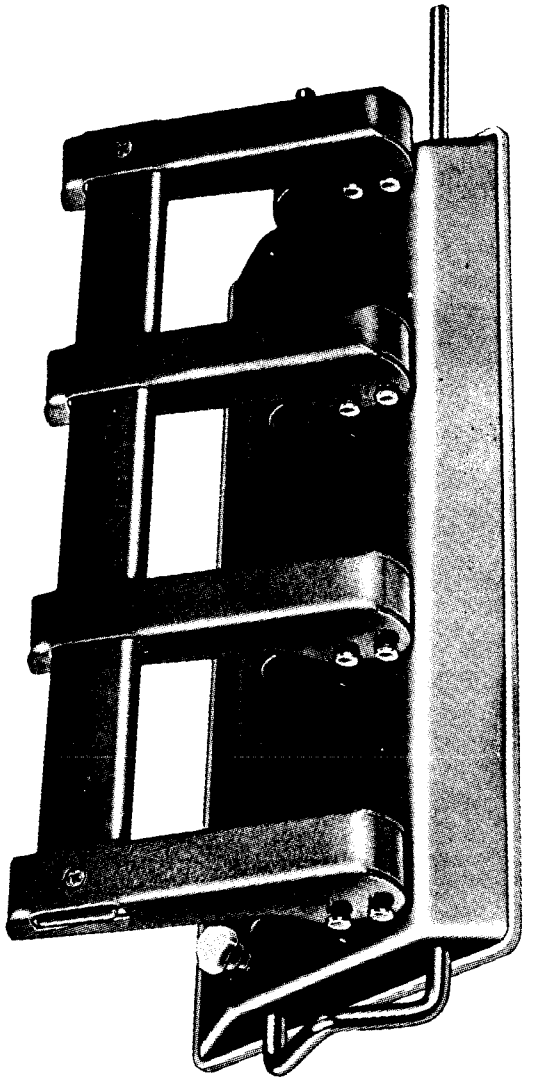


FIGURE 10

PROPOSED UNIVERSAL PERFORATOR
TO BE INTRODUCED WITH METRIC
PAPER SIZES

Further information and advice can be obtained by communicating with the author:

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NOTES

NOTES

This booklet has been printed on
International Standard A5 size paper