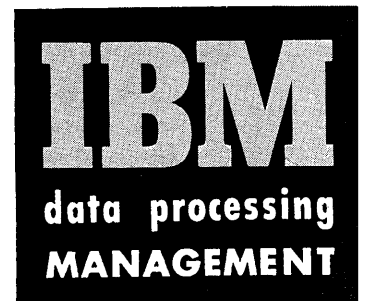


The Design of IBM Cards



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Form 22-5526-4

THE DESIGN OF IBM CARDS

THE APPLICATION of IBM Accounting, and especially the design of the IBM cards around which the principle has been developed, afford a wide range for the use of ingenuity. The various accounting and statistical records which are compiled by means of the IBM Accounting principle reach into practically every phase of modern business and governmental activity. The cards themselves reflect this wide variety of business applications, and rarely are two identical card forms used by different companies, regardless of the similarity of their jobs.

In order to be able to design the most effective card for a particular procedure, it is essential:

To have a complete knowledge and understanding of the accounting and managerial reports to be made from the card and the use that is to be made of each.

To understand that the card is a tool in the hands of operators and clerks who will produce the desired reports.

To have a thorough knowledge of the procedure and machines through which the card is to be processed.

To know the rules and principles of good card design.

Although there are many basic principles governing the designing of card forms, it must always be remembered that common sense and practical experience will contribute much to the selection of the one best way to do the work.

DETERMINATION OF CARD DATA

THE FIRST step in card design is to determine the data which will be needed from the card in order to meet the requirements of the contemplated procedure. In order to accomplish this, all of the fol-

lowing factors must be considered, in the order presented.

Report Requirements

Of all the factors affecting card design the most important are the requirements of the finished reports that are to be prepared. These reports should be kept in mind constantly so that all necessary information may be included in the card and arranged to facilitate their final preparation. The factors so determined may be considered as the desired or ideal card requirements. Certain modifications may then be required to conform with any of the limiting conditions discussed later.

Availability of Data

The factors next in importance are determined by the sources of the original information. These must be studied to see whether all the desired data are available on the original documents to be used in punching. If not, or if too much labor is required to get them on these documents, it will be necessary to revise the list of card data, or substitute other data which will accomplish a similar purpose. A study of the source records will also determine whether a dual card can be used advantageously to replace these records. It will further show whether certain available data can be conveniently included in the card and a new use devised which was not originally planned, or which may be needed in the future. At this point, also, a study of reference punching should be made so that the card may be identified with the original record from which it is punched, if this is necessary. Dual cards will frequently need no reference punching because they are also the original records.

Summarizing Card Data

After the above studies have been completed, the final results should be prepared in list form. This list will serve in assigning the proper number of columns to each field.

CARD DESIGN AID										Form 22-6214-1 Printed in U. S. A.	
TYPE OF CARD:			CARD NAME:			SOURCE DOCUMENT:					
Information Available and Required for Reports	Columns in other Cards	Sequence on Source Documents	Method of Punching	R-Reference C-Classification Q-Quantitative	Card Field Size		Final Design		Interpretation		
					Trial	Final	Field	Sequence	Field	Size	Sequence
TOTALS →											

FIGURE 1. A WORKSHEET FOR CARD DESIGN

PRELIMINARY WORK FOR CARD DESIGN

A WORK sheet similar to the Card Design Aid illustrated in Figure 1 should be used to list the information which must be placed on the card and to record the results or decisions made in the preliminary work of designing cards.

Information Available and Required for Reports

This list of information is made by studying the reports and documents. Information which is to appear on the reports (except calculated, emitted, and summarized data) must be punched in the card. The sequence of this listing is of minor importance at this point.

Columns in Other Cards

One of the most important factors to be decided in assigning card fields to the information is the alignment principle. A given item of information in the new card should be placed in the same columns previously assigned to it in other cards.

An IBM card designed to be used in various IBM accounting machine operations with other types of cards (such as a customer name card used with accounts receivable cards to list a Statement of Account, a daily time ticket used with labor distribution cards to obtain zero balance, or a labor distribution card with material distribution cards for cost analysis) must be aligned with these cards in the common control fields, and any other common types of information in the several cards should be placed in corresponding columns. This assures that fields for sorting and controlling will be placed in the same columns on all cards to be used together. Control panel wiring is facilitated when quantitative fields are placed in the same columns on all cards used together.

Figure 2 is a convenient layout form for planning several cards so that the alignment principle can be followed. After the major outlines of the card design have been planned, a separate form should be used for designing each card form in detail.

Sequence on Source Documents

The fields of the card to be manually written or key punched should be arranged so that information can be read from left to right or from top to bottom on the original document. The key punch operator's task is greatly speeded if the information to be punched into the card is in the same order in which it appears on the source document.

Method of Punching

Assign to each field the method by which it will be punched, i.e., key punched, duplicated, summary punched, gang punched, or calculated. All like punching operations should be grouped together to simplify wiring, and to eliminate interspersed skipping on the key punch.

Types of Information

All information will be one of these three types:

Reference—to identify the original source (date, invoice number, batch number).

Classification—to cross index and classify the transaction to produce the desired summaries (state, department, part number).

Quantitative—To be added, subtracted, multiplied or divided (quantity on hand, unit price, sales amount).

After each item of information is so classified, consideration may be given to the following arrangement: reference information should be placed to the left of the card; classification information should be placed in the center of the card; quantitative information should be placed to the right of the card.

These four important considerations have been discussed in the order of their importance in determining the position of information on cards. It is evident that frequently there will be conflicts among these requirements, and when such conflicts arise, it is necessary to use good judgment in resolving them on a priority basis. To summarize, the usual priority is as follows:

1. Columns in other cards
2. Sequence on source documents
3. Method of punching
4. Type of information

Size of Fields

The number of columns required to record each type of information should be added to the memorandum list previously mentioned. For reference and controlling fields, this is determined by the largest single number to be recorded, as indicated by the codes which have been devised for the machine application. Thus, two columns might be left for month (twelve being the largest number), two for day, four for invoice number if the number series is repeated after 9,999 is reached, and two for branch if there are 99 branches or less.

With the quantitative fields, the problem becomes more difficult. In the first place, the space needed to record the largest amount may not be known, and in the second place, this amount may be very unusual. It is a good plan to provide columns enough to take care of all except the unusual cases, and to handle these by punching extra cards or by using the class selection device. For example, the amount \$67,265.80 may be recorded in a six-column field by punching six cards of \$9,999.99 and one card for \$7,265.86 (or any combination of six-digit numbers totaling \$67,265.80).

Attention should be given at this time to the possibility of consolidating certain fields on the card. The original list may include several types of information which can be carried in a single field if they do not occur simultaneously. Successive cards may be used where a spread of the data fields is not desired. This applies more particularly to quantity and amount fields.

The total of the columns assigned to all fields will indicate whether the data are within the capacity of the card, or exceed it. When the columns total less than about 100 columns, the decision must be made whether to use two cards or to reduce the number of columns to 80. If the total num-

ber of columns reaches 100 or more, it is evident that more than one card is needed. This requires separating or classifying the desired information to determine what information is to be placed in which cards. Such a division may be based upon any one of several schemes:

1. Place repetitive or recurring information in one card and temporary or non-repeating information in the second card, as in the case of master cards and detail cards.

2. Use different cards for different source documents, or make one of the new cards a dual card to be used as a source document.

3. Use different cards for different degrees of detail, or as "double entry" cards each of which affects two different accounts. Examples are accounts payable and payables distribution cards, accounts receivable and sales cards, payroll and labor distribution cards.

4. Use separate cards to produce the desired form of report. A billing job may contain heading cards, miscellaneous data card, and detail commodity cards, for the reason that such arrangement gives the simplest procedure and the best form of invoice.

In those cases where the preliminary draft of column requirements shows a need for a few columns more than the capacity of a card, some of the following expedients may be used to bring the requirements within the range of the card capacity without dropping any fields.

1. Reducing the size of reference or controlling fields by having these fields serve as sub-classifications of other fields. Thus, invoice numbers may start with "1" each month instead of being numbered separately; or a separate series of salesmen's numbers may be used for each branch, instead of one series for all branches.

2. Reducing the size of reference or controlling fields by recoding to eliminate one or more digits.

3. Reducing the size of reference or controlling fields by ignoring one or more digits which may not be essential. Thus, it may be possible to punch only four digits of a six-digit invoice number and preserve positive identification.

4. Reducing the size of quantitative fields where amounts seldom exceed the capacity of the reduced field.

5. Recording in the 11th and 12th positions information which is never used for printing. This can best be used where the information to be punched is the same for large groups of cards.

6. Using multiple-punching in certain columns to reduce the number of columns required. This practice should be avoided where fields are to be listed or added, but may be very desirable in fields which are to be sorted only.

7. Using the class selector to distribute a carry-over amount which has been punched as a second card. Thus, a card punched 7,265.80 and one punched 000006 can be selected to produce 67,265.80 as the desired result, saving one column in the amount field.

8. The group sorting device may be used to eliminate common information from detail cards.

Interpretation

Determine the fields to be interpreted. Arrange them according to the method of filing the cards, with the most important information in a prominent location for easy reference.

If the total of the fields to be interpreted exceeds 60 characters, eliminate unnecessary fields to be interpreted; or, interpret the remainder on the second line.

MACHINE CONSIDERATIONS IN CARD DESIGN

A FEW basic restrictions must be observed in designing cards if all the advantages of IBM ac-

counting are to be obtained. Actually, the rules are not limitations of the accounting routine, but they are standards that have been generally accepted so that uniform machines could be designed to perform the task of accounting more automatically.

Card design rules which are based upon machine specifications are grouped under the names of the machines to which they apply.

Key Punches

1. When less than the full number of columns of a card are to be punched on machines in which cards are manually fed, the punched fields should be placed at the right-hand end of the card.

2. Card visibility is also an important factor to consider. The degree of visibility in Card Punches, Types 24-26, is illustrated in Figures 3 and 4.

3. Fields to be duplicated should be grouped together and placed at the left end of the card.

4. Manually punched fields should not be interspersed among duplicated, gang punched, reproduced, or summary punched fields.

5. Fields that are always skipped, or X-skipped, should be as uniformly placed on various card forms as conditions will allow.

6. As a general rule the left side of a tumble card should be inverted when using manually fed punches; the right side should be inverted when using automatically fed punches.

7. On printing punches, the printing appears at the top of each column and requires $\frac{3}{16}$ " from the top edge of the card.

8. On alphabetic punches, locate numerical fields together so that operator need not change from one keyboard to another more than once during the punching of the card.

The key punching operation is the only step in the IBM machine method of accounting which is not fully automatic. It is, therefore, the only

phase in which the rate of production is subject to variation. Anything which can be done to simplify the work of the operator will tend to increase the rate of punching and consequently reduce the time required for the preparation of management reports.

The value of early reports makes it necessary to take every precaution in the design of cards to avoid any factors which will retard punching speed. Careful consideration should be given to these factors:

Provide for the use of the duplicating punch and master code cards, or other automatic punches, whenever possible.

The sequence of punched fields should be the same as that of the data to be punched from the original document.

Eliminate the punching of unnecessary zeros by keeping the size of fields down to the number of columns that are absolutely essential for efficient handling of the majority of transactions.

Do not have fewer columns in the field than are required to handle most of the transactions.

Proper use of indicating cards and group-sorting cards will frequently eliminate the necessity for providing for some of the punched fields on detail cards.

Provide for most legible records, especially in the design of dual cards.

Give consideration to the use of prepunched cards.

Sorters

1. Whenever a card is to be used for statistical analysis, it is advisable to combine several classes of statistical data in a single column. This is especially true of alternative responses on questionnaires.

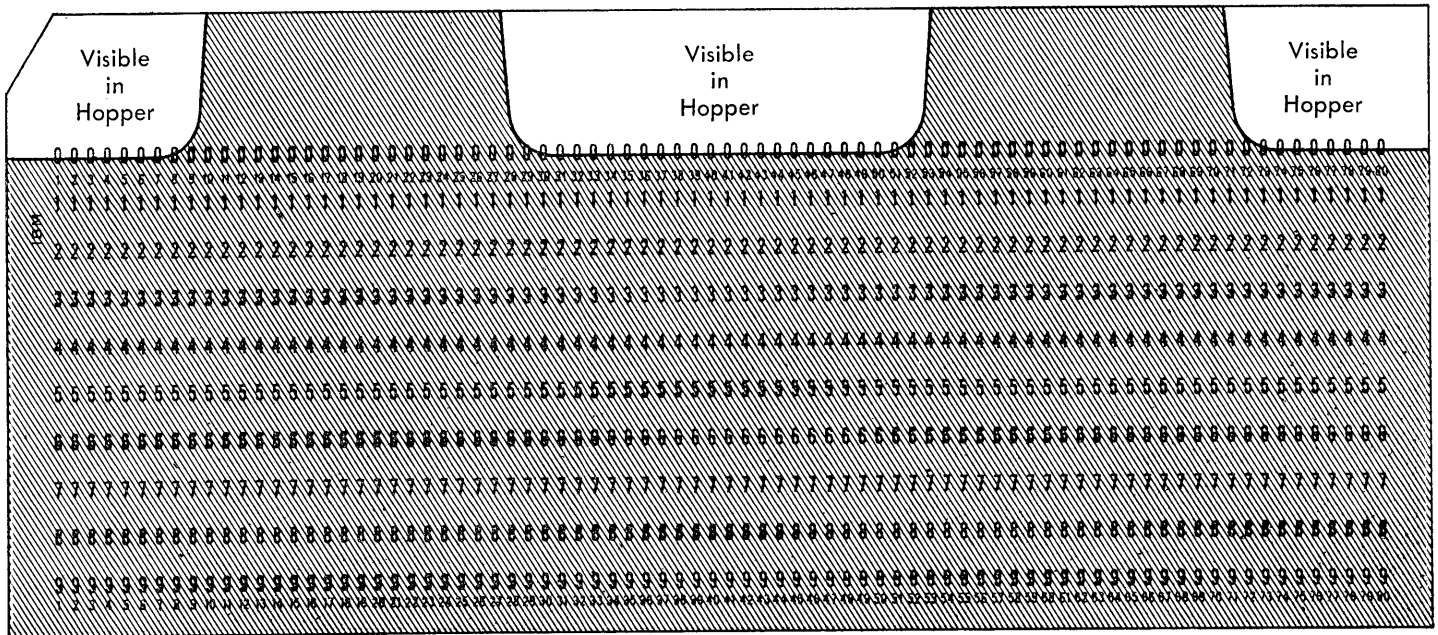


FIGURE 3. CARD VISIBILITY IN THE HOPPER, CARD PUNCHES, TYPE 24-26

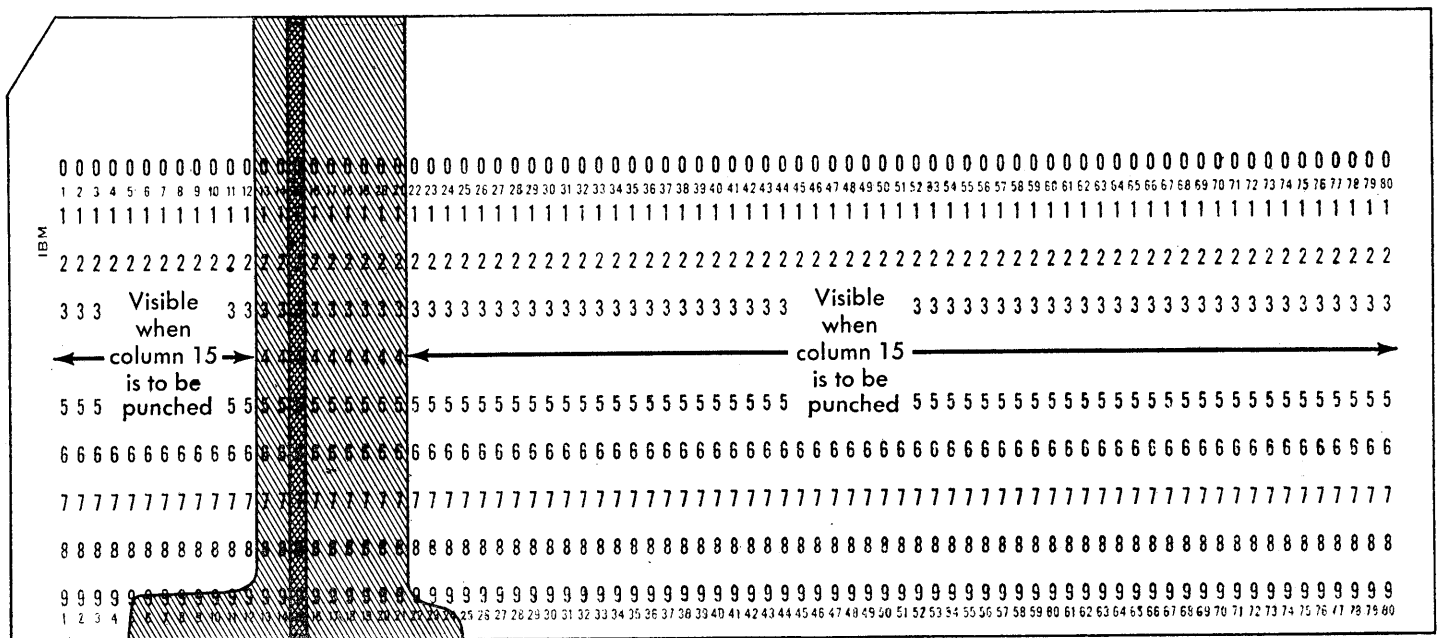


FIGURE 4. CARD VISIBILITY AT THE PUNCHING STATION, CARD PUNCHES, TYPE 24-26

The whole card is visible before it is registered, and at least 71 columns are visible after punching has started

2. The eleventh and twelfth punching positions can be utilized for recording reference data to be sorted but never printed.

3. If the multiple column selection device is to be used to select simultaneously a group of cards from two or more small fields, they should be adjacent in order that they will appear under the ten adjacent brushes.

Accounting Machines

1. Control fields must not be skipped. Zeros must be punched in columns if other digits do not appear.

2. The eleventh position (X) punching which governs class selection or subtraction should never be placed over fields used for automatic control or alphabetic printing.

Auxiliary Machines — Interpreter

If there are several changes of machine setups in the interpretation of 80-column cards, the changes in setups will be simplified by indicating the type bar numbers in the printing spaces.

Calculating Punch

1. Fields for the products of multiplications or results of other calculating operations should be placed as near to the right-hand end of the card as possible.

2. Constant factors may be eliminated entirely from detail cards and read either from master cards or emitted from the machine.

3. The factors to be calculated may appear in any columns of the card.

Summary Punch

1. Fields to be duplicated, pre-indicated, or manually punched in cards that are being summary punched should appear to the left of the columns reserved for counter totals.

2. Fields to be punched from counter totals should be as near the right-hand end of the card as possible.

BASIC TYPES OF CARDS

THE CHOICE of the type of card to be designed frequently can be made only after making the preliminary study of reports, procedures, and machine operations discussed in the previous sections. IBM cards are generally of four basic types:

Transcript Cards are punched from information previously recorded on another document.

Dual Cards are punched from information recorded on the card itself, that is the card serves a dual purpose as source document and card.

Mark Sensed Cards are automatically punched from pencil marks recorded in significant positions on the face of the card.

Summary Cards are automatically punched with totals resulting from accumulated results in the Accounting Machine or Calculating Punch.

Transcript Cards

The following pointers apply specially to the design of transcript cards:

1. Perhaps the most important rule of transcript card design is the one governing the sequence of punched fields. It is absolutely essential to place punched fields in the same sequence as the data being transcribed from the original document. This facilitates key punching and, consequently, speeds up the entire procedure.

2. All single column fields should have decoding abbreviations placed above each corresponding punching position.

3. Wherever letter type codes are used, the corresponding numerical symbols on the card should be replaced by the alphabetic characters. These should be placed slightly above the punching positions so that they will not be obliterated.

4. Whenever complement fields are used, the digits 1 to 8 should be omitted in the first column at the left of that field.

5. Whenever fraction wheels are placed on the Accounting Machine, the card columns reserved for use in recording fractions should contain only the digits corresponding to the denominator of the fraction less one. For example, if a fourths wheel is used, the column would contain only the numbers 1, 2, 3; if an eighths wheel is used, the column would contain the numbers 1, 2, 3, 4, 5, 6, 7.

6. Field headings should usually be placed along the top of the card, between the zeros and the edge, unless interpretation is provided for.

7. Field headings should be as explicit as possible. Avoid the use of obscure abbreviations.

8. Every transcript card should carry a field for reference punching which will positively identify the punched card with the original document from which it was prepared. A sales card, for example, will usually have the invoice number punched on it, or invoice date and customer may sometimes be used when card capacity is limited; in other cases the date and the last two digits of invoice number may be sufficient.

9. Avoid unnecessary duplication of reference data, such as the use of both order number and invoice number when one would provide adequate reference.

10. Whenever alternative information is to be recorded, one field should be used instead of two. For example, sales reference punching would serve to identify either an invoice or a credit memorandum; therefore a single field heading "Invoice or Cr. Memo. No." would suffice. The use of two fields — one headed "Invoice No." and the other "Cr. Memo. No." would be a waste of valuable

card capacity since only one reference number would ever be punched on any one card.

11. Since no written information appears on the card, any color or striping of cards may be used.

12. Purely reference information which is never to be printed by the machine may be placed in the 11 and 12 positions of a column, or in columns set aside for multiple-punching.

13. Vertical lines used to separate fields should be drawn midway between the columns of numbers and should not reach beyond the line of column numbers at the bottom on the card.

14. Whenever five or more columns appear in a single field, dotted lines should be drawn to mark off the position of the decimal point, where it is involved, and other periods of numbers in groups of three columns.

15. It is absolutely essential that punched classifying information which is to be used for purposes of automatic control on the accounting machines be placed in the same columns on all cards that are to be jointly processed.

16. Alignment of fields which contain data to be accumulated simplifies machine wiring for joint runs.

17. Fields for results of calculations and summary punched totals should be placed at the right-hand end of the card for maximum machine efficiency.

18. Whenever several different card forms are to be processed together, the card form with the greatest volume should be designed for maximum efficiency. The other cards may then be made to conform with the limitations of the card with the greatest volume.

19. Twenty columns for the alphabetic punching of names is sufficient for most work. This should be carefully checked, however, on each individual job. A recent study of the columns required for recording names and addresses re-

LAYOUT FORM — IBM CARD

FORM 12-4049-9
PRINTED IN U.S.A.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

INTERPRETER SPACING
1 60
45
R
X
0
1
2
3
4
5
6
7
8
9
END PRINTING SPACING
1 45
30
15
0

INTERPRETER SPACING
1 60
45
R
X
0
1
2
3
4
5
6
7
8
9
END PRINTING SPACING
1 45
30
15
0

12

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

1st POSITION 2nd POSITION
519 END-PRINTING

DATE _____

BRANCH OFFICE NAME _____ BR. OFF. NO. _____

CUSTOMER NAME _____ CUST. PUR. ORDER NO. _____

MAIL PROOFS TO _____

IMPORTANT — CHECK THE FOLLOWING REQUIREMENTS:

Is this a revision of form in use? YES NO

What is present form number? _____

May we scrap old electro? YES NO

Indicate corners _____

to be cut.

UPPER LOWER

LEFT RIGHT

INTERPRETATION

45-Numerical

60-Alphabetical

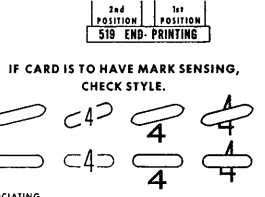
80-Printing punch

Bill Feed five lines per inch

End Printing LEFT RIGHT

Typewriter spacing

If card is to be printed on both sides, check style. BOOK TUMBLE



SHORT CARD LAYOUT INSTRUCTIONS

- DETERMINE SHORT CARD COLUMN NUMBERS BY REFERRING TO GUIDE AND COLUMNS PRINTED BELOW. USABLE COLUMN RANGE IS ESTABLISHED BY THE CAPACITY LOCATION ON EACH SIDE OF GUIDE. EXAMPLE: ON A 30-COLUMN CARD, USABLE COLUMNS ARE 26-35.
- CUT OUT THE STRIP OF COLUMN NUMBERS.
- PASTE THE STRIP ON THE LAYOUT FORM IN DESIRED LOCATION FOR THE SHORT CARD.
- RULE ENDS OF SHORT CARD 1/2 COLUMNS BEYOND THE STRIP OF COLUMN NUMBERS.
- DETERMINE MARK SENSE POSITIONS, IF ANY, BY ASSOCIATING STRIP NUMBERS WITH CARD LAYOUT POSITIONS. EXAMPLE: ON 30-COLUMN CARD, M. S. POSITIONS 9-18 ARE USABLE.

SHORT CARD COLUMN GUIDE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

IBM

FIGURE 5. TRANSCRIPT CARD LAYOUT FORM

veals that 95% of names of individuals can be recorded in 18 columns or less, that 95% of names of companies require 20 columns or less; that 90% of street addresses require 18 columns or less; and that 99% of cities and states (abbreviations) require 20 columns or less.

20. Be sure that the column capacity of each field is sufficient to take care of all recording except the very unusual items.

21. When designing tumble or sectional cards, be sure that the two types of work have approximately the same card volume. For instance, it would be impractical to combine sales analysis and voucher distribution on a tumble card if there were 200,000 sales items and 30,000 voucher items each month. Under such conditions 170,000 cards a month would be unused on the tumble section.

22. The nature of tumble and sectional cards ordinarily does not permit their use as dual or permanent record cards.

23. Every card form should carry the IBM industry classification code of the user. The code number is printed on the bottom center or along the end, depending upon the method of card printing.

Figure 5 is a convenient form for the layout work of designing transcript cards.

Dual Cards

Dual cards incorporate all of the principles involved in the design of transcript punched cards, as well as some additional distinctive features to facilitate their use. The design of dual cards is especially important because of their use in departments other than that in which the accounting machines are actually used. They may be found as requisitions, payroll tickets, and miscellaneous shop records throughout the plant, and therefore simplicity of design becomes one of the most important factors.

Dual cards have attained a rather wide use not

only because of the part they play in the actuation of the accounting machines to prepare final reports automatically, but also because of the fact that original records may be automatically sorted in any desired sequence. In this manner the actual original document can be analyzed for any specific detail without the necessity of preparing a complete report. The dual IBM card presents the only automatic means of sorting original documents.

A dual card, as an original record, must satisfy accounting requirements. To do this it must contain all the data relative to a given transaction so that pertinent facts may be reconstructed without the aid of memory. Because of the limitations of the size of the card, care must be exercised to provide ample room to meet this requirement and still not permit the possible obliteration of the data in subsequent punching operations.

One of the factors most frequently overlooked in the designing of dual cards is the incorporation of radical changes in what is to be the new original document. If the maximum efficiency of all clerical departments using the record is to be attained, the form of the IBM cards should resemble as closely as possible the original form which it is about to displace. Only in those instances where definite operating advantages are going to be obtained should the design be varied from the accustomed form.

The following pointers apply to the design of dual cards:

1. Generally the written information should be placed on the left end of the card to obtain visibility of recorded data while punching. This degree of visibility is discussed and illustrated under *Key Punches*, pages 8 and 9.

2. Punched fields should be placed at least 14 columns on an 80 column card to the right of the written data to be punched. This is also modified by the visibility factor mentioned above.

3. Dual cards, generally, should not be designed as multiple-use cards,

4. Written descriptive information should be placed in the portion of the card reserved for punched fields. This information may be readily reconstructed even though part of it may be obliterated by punching.

5. Horizontal lines should be drawn through the mid-points of the regularly printed digits. This will cause the writing to be located in such a position that it will not be obliterated by punching.

6. The card may serve multiple uses. One form may serve for several related records.

7. Retain as many as possible of the column digits which show the positions of punching. This facilitates the reading of the punched holes wherever it may be necessary.

8. Filing information should be placed across the top or end of the card, depending upon the method of filing to be used.

9. Field headings for dual cards may be placed at either top or bottom of card.

10. Follow as closely as possible the appearance and arrangement of previously used forms to reduce to a minimum confusion in record-keeping due to changes.

11. The design of the section of the card reserved for punching should follow the rules for transcript cards.

12. Printed headings of spaces for written information should be placed so that the writing will be forced into the desired location.

13. Information to be checked visually should be placed at the left end for convenience in fanning.

14. Related information should be grouped for efficiency in recording, and ease in performing any manual calculations.

15. Adequate space should be allowed for writing. Leave ample space for remarks and descrip-

tions. Horizontal lines for descriptive writing may be drawn in the section of the card later key-punched. Provide space for authorizations or auditing information.

16. Provide for automatic printing when possible by means of addressing plates or time stamps. Measure the spacing accurately.

Figure 6 illustrates the layout form that facilitates the design of dual cards. IBM checks, which are a special kind of dual card, have special requirements for effective design. These requirements are explained in a special aid, the IBM Check Layout Form, Form Number 12-3867-2, available at all IBM branch offices.

Mark Sensed Cards

The increasing use of cards as source documents has caused mark sensing to be used to an increasing extent. Whenever clerks or other employees can be trained to mark cards properly, key punching can be reduced or eliminated. It is well to bear the following pointers in mind in designing mark sensed cards:

1. Place marking fields on the right side of the card. This allows the operator to hold the card conveniently while marking it.

2. A marking position is three-columns wide, starting with columns 1-3, 4-6, 7-9 for 27 three-column fields ending with 79-81. The marking fields must be designed over the correct card columns; the right-hand column of any mark sensing field will always be divisible by three. Each marking position is located immediately above the punching positions so that punched holes will not obliterate the marks.

3. Arrange marking fields in sequence for easy marking.

4. The marking field may be designed over punched fields.

5. The marked information may be punched in any columns on the card.

LAYOUT FORM - IBM CARD (DUAL)

FORM 12-4555-6
PRINTED IN U.S.A.

1 2 3 4 5	6 7 8 9	10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80	81 82 83 84 85 86 87 88 89 90	91 92 93 94 95 96 97 98 99 100
INTERPRETER SPACING	END PRINTING SPACING	R X 0 1 2 3 4 5 6 7 8 9	INTERPRETER SPACING	END PRINTING SPACING

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1st POSITION	2nd POSITION																							2nd POSITION	1st POSITION	
519 END-PRINTING	DATE																							519 END-PRINTING	DATE	
BRANCH OFFICE NAME					BR. OFF. NO.															IF CARD IS TO HAVE MARK SENSING, CHECK STYLE.						
CUSTOMER NAME					CUST. PUR. ORDER NO.															<input type="checkbox"/> 45-Numerical <input type="checkbox"/> 60-Alphabetical <input type="checkbox"/> 80-Printing punch <input type="checkbox"/> Bill Feed <input type="checkbox"/> 5th Inset <input type="checkbox"/> 6th Inset <input type="checkbox"/> End Printing <input type="checkbox"/> LEFT <input type="checkbox"/> RIGHT <input type="checkbox"/> Typewriter spacing <input type="checkbox"/> If card is to be printed on both sides, check style. <input type="checkbox"/> UPRR <input type="checkbox"/> LOWER <input type="checkbox"/> TUMBLE						
MAIL PROOFS TO																				SCALE APPROXIMATELY DOUBLE SIZE, ACTUAL CARD SIZE 3-1/4" X 7-3/4"						

IMPORTANT - CHECK THE FOLLOWING REQUIREMENTS

Is this a revision of form in use? YES NO

What is present form number? _____

May we scrap old electro? YES NO

Indicate corners UPPER LOWER LEFT RIGHT

to be cut.

SHORT CARD LAYOUT INSTRUCTIONS

1) DETERMINE SHORT CARD COLUMN NUMBERS BY REFERRING TO GUIDE AND COLUMNS PRINTED BELOW. USABLE COLUMN RANGE IS ESTABLISHED BY THE CAPACITY LOCATION ON EACH SIDE OF GUIDE. EXAMPLE: ON A 30-COLUMN CARD, USABLE COLUMNS ARE 26-55.

2) CUT OUT THE STRIP OF COLUMN NUMBERS.

3) PASTE THE STRIP ON THE LAYOUT FORM IN DESIRED LOCATION FOR THE SHORT CARD.

4) RULE ENDS OF SHORT CARD 1/2 COLUMNS BEYOND THE STRIP OF COLUMN NUMBERS.

5) DETERMINE MARK SENSE POSITIONS, IF ANY, BY ASSOCIATING STRIP NUMBERS WITH CARD LAYOUT POSITIONS. EXAMPLE: ON 30-COLUMN CARD, M. S. POSITIONS 9-18 ARE USABLE.

59 57 55 53 51 49 47 45 43 41 39 37 35 33 31 29 27 25 23															23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59														
60 58 56 54 52 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22															22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60														

CUT-OUTS FOR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
PASTING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

FIGURE 6. DUAL CARD LAYOUT FORM

6. Include headings for all marked fields.
7. Indicate cents, decimals and commas by broken or hair lines.
8. Signatures and other writing should be placed as far from the marking fields as possible.

Figure 7 illustrates a convenient layout form for designing the mark sensed portion of a card. Sections of this layout are usually cut out and pasted on a layout form for dual cards or transcript cards.

Summary Cards

It is frequently necessary to design separate summary cards to allow for the larger quantitative figures which will appear as summary totals. It is often necessary to add other information such as year-to-date figures, balance-forward, and certain indicative information. The quantitative fields should align as nearly as possible with similar fields in the detail cards so as to simplify procedures and machine operations.

DRAWING THE DESIGN

IN PROCESSING newly designed cards, a great many delays and misunderstandings may be avoided if the card drafting on the layout form is done in a clear and concise manner.

A primary principle to remember as a guide in designing the card is to keep in mind who will read the printed information on the card. Machines cannot read the printing on cards. Such printing is provided as a convenience to the machine operators and clerks who will be handling the cards.

General Pointers

The following general pointers will be helpful to the designer of IBM cards, in drafting the final layout form.

1. The name of the company should appear on all of its record forms, and its trademark should be printed on all documents which reach outside organizations or individuals.

2. All essential reference information should be placed at or near the top of unbound forms to facilitate the filing and locating of permanent records.

3. Headings or titles of spaces for written information should be placed so that the actual writing will be forced into the desired position.

In Figure 8 one of the cards shows how a violation of this rule results in inconvenience. The other, a more desirable arrangement, forces the writing closer to the top. When block headings are printed at the top of a space, reference information is forced down below the point of ready visibility.

4. Information to be checked visually should be placed near the right or left margin of the card for convenience in fanning.

5. All related information should be grouped and placed in the position which will promote efficiency in recording. For example, on a job time record, hours should be in position for convenient notation after subtraction of start and stop time. All data recorded by shop clerks or workers should be placed together for convenience. Time registration at margin should be in sequence to facilitate visual subtraction. Rate should be located between hours and pieces to facilitate either calculation.

6. Adequate space should be provided for large writing where records are to be made by workers and not by regular shop clerks. The average machine worker is not a skilled penman and may frequently use a thick lead pencil which will necessitate provision for two or three times the minimum amount of space required by a regular clerk.

7. Ample space should be furnished for recording additional miscellaneous remarks and descrip-

ORDER NO.		SYMBOL		MAN NO.	
SUPERVISION		DETAILS		HOLIDAY VACATION	
STUDY OR INVESTIGATION		ASSEMBLING OR TESTING		PERSONAL	
DESIGN OR LAYOUT		CHECKING OR CATALOG		SICKNESS	
CHECKING SECTION 4					

Wrong

PART NO.			ORDER NO.		
MAN NO.			PART NAME		
DEPT.	JHG.	CODE	OPER.	REMARKS	
QUAN ON OPER.					

Right

FIGURE 8. DESIGN OF BLOCK HEADINGS

tions. Several lines may frequently be required, and therefore a large portion of the unused space may be devoted to this purpose.

8. Essential written information should be reduced to a minimum of manual recording by providing for automatic printing (such as time stamps, addressing plates, etc.) and by marking preprinted descriptions whenever practical.

9. Company slogans should appear on record forms which have wide circulation in several departments. Safety warnings to factory workers are most common.

10. Titles or descriptive headings should always be the same for like items whether they appear on various documents or at different places on the same document.

11. All duplication of items which must be recorded manually or semi-automatically should be eliminated.

12. The limitations of mechanical recording equipment such as typewriter spacing, clock registration, serial numbering machines, addressing machines, stamps, etc., should be checked carefully, in order to provide the proper position and ample room for printing.

13. When large numbers are to be written, make provision for guide lines or dots to designate the position of digits or periods of numbers. This corresponds in principle to the pen-ruling of amount fields on journal and ledger sheets.

14. The color for paper stock upon which the

form is to be printed should be one that will not interfere with the utility of the record. Plain white or yellow is satisfactory and economical, but if colored paper is used to facilitate the segregation of various kinds of documents, the light colors should be used to increase the legibility of written information.

15. Care should be taken to place essential permanent information in such a position that it will not be obliterated or destroyed by stamps or punches, or torn off with detachable stubs.

16. The possibility of multiple uses should be considered. Make one document serve as a standard form for as many related records as possible. For example, a material requisition can usually be designed to provide for recording returns to stock.

17. New documents which are to replace others should be as similar to the old document as possible in order to reduce clerical confusion.

18. In procedures where cards are handled by clerks and operators performing clerical functions, it is advisable to provide distinguishing features on each type of card. For instance, it is common practice to distinguish heading cards from body cards by opposite corner cuts. Colored stripes on cards are particularly useful in distinguishing between similar cards of different use or routing.

19. When the document is completely drawn up it should have a good symmetrical appearance.

20. A color stripe can be used to emphasize special instructions printed in that space.

Drawing the Design

Drawing the design of a given card may require the use of several layout forms: A basic transcript card form, with a section of the dual card form pasted on, and also a section of the mark sensed layout form. Using the necessary layout forms, draw the lines and write in the headings in accordance with the preliminary work sheet or card design aid. In drawing the design, the following details should be kept in mind.

1. Indicate accurate start and stop points for each line by lines (horizontal as well as vertical) that terminate at an even distance from the edge of the card. Neatness is obtained by eliminating unnecessary lines around the edges of cards.

2. Indicate heavy or light lines as desired.

3. Indicate dotted or broken lines as desired. Amount fields should indicate the decimal point between dollars and cents by means of a dotted line or a very thin line drawn vertically between columns. Large fields should indicate the comma positions between hundreds and thousands.

4. In printing the desired headings, use correct spelling and abbreviations. Avoid obscure abbreviations. Headings should be similar to like items as they appear on other documents.

5. Indicate the correct position of printed words, printing horizontally when space permits. Avoid hyphens if possible. Avoid vertical printing, one letter underneath the other.

6. Indicate relative size of printed headings.

7. Indicate punctuation if needed.

8. Include decoding information for one-column code fields if possible. Letters or abbreviations may be printed directly above the punching positions and the number may be omitted.

9. Use headings across the body of the card to specify the type of punching required: duplicating, gang punching, key punching, etc.

10. Consider placing many headings on the same card for multiple use of a single card form. Be sure the heading to be used for a given purpose is clearly identified, preferably by a digit punch opposite the desired headings.

11. Print the name of the card and the name of the company across the end of the card. Trade-marks or slogans may be included.

12. Give the design a symmetrical appearance.

13. For a card used with the printing punch, continue the vertical lines that divide punching fields to the top edge of the card in order to facilitate reading of interpretation.

14. In interpretation blocks, print decimal points in "amount" fields and commas where large numbers are to be read.

15. Design the card for the interpretation of only the essential fields.

16. Place the most important reference number at the upper left corner of the card for ease in filing and locating the card.

17. Place interpreting field headings across the top of the card just beneath the printed interpretations and the punched field headings across the bottom of the card.

18. Print interpreter type-bar numbers beneath interpreting field to indicate first and last type-bar for each field.

Upon completion of the new design, answer all questions at the bottom of the layout form.

TYPICAL DESIGN OF A CARD

IT HAS BEEN determined that the information necessary for labor distribution reports, which can be obtained from the daily time ticket (Figure 9) is as follows:

Order Number
 Employee Number (Department and Clock No.)
 Regular Rate
 Overtime Rate
 Part or Account Number
 Pieces
 Operation Number
 Machine Group
 Department Charged
 Kind of Labor
 Amount
 Hours
 Date (Month and Day)

GENERAL MANUFACTURING COMPANY										DAILY TIME TICKET									
DEPT.	CLOCK	NAME	KIND	NO.	DAY	HOURS	AMOUNT												
TYPE BARS	1 5 7		22	24	26	29	31	33	35	38	MARK		TOT. HRS.						
COLUMNS	4 68 48		63	34	60	63	69	71	72	75									
	HOURS	PIECES	PART ACCT NO.	OR	OPER	ORDER NO.	MACH. GRP.	DEPT. TO CHG.											
8									0	0	0	0	0	0	0	0	0	0	0
7		7							1	1	1	1	1	1	1	1	1	1	1
6		6							2	2	2	2	2	2	2	2	2	2	2
5		5							3	3	3	3	3	3	3	3	3	3	3
4		4							4	4	4	4	4	4	4	4	4	4	4
3		3							5	5	5	5	5	5	5	5	5	5	5
2		2							6	6	6	6	6	6	6	6	6	6	6
1		1							7	7	7	7	7	7	7	7	7	7	7
TOTAL HOURS																			
RING JOB TIME ABOVE IN SEQUENCE FROM BOTTOM UP		SIGNATURE OF FOREMAN																	
		29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54																	
		MO. DATE		KIND		REG. RATE		OVERTIME RATE		NAME		DEPT. CLOCK		HRS.		AMT.			
		EMP. NO.																	
		PREPUNCH FROM MASTER CARDS										M.S.		MULT.					

FIGURE 9. DAILY TIME TICKET

This information is listed in the left column of the Card Design Aid (Figure 10).

From the daily time ticket, it is found that certain items in this list of information are punched in the time ticket card. These columns are recorded in the next column headed "Columns in Other Cards."

The information to be key punched in the distribution card is as follows:

- Order Number
- Employee Number
- Part or Account Number
- Pieces
- Operation Number
- Machine Group
- Department Charged
- Hours

The sequence in which this information appears on the time ticket in printed or written form is indicated in the next column headed "Sequence on Source Documents."

From the proposed procedure it has been determined that the following information can be gang punched:

- Date
- Kind of Labor
- Regular Rate
- Overtime Rate

"Amount" is to be punched on the Calculating Punch. The remaining information must be key punched. This information is recorded in the next column headed "Method of Punching."

To classify information, indication is made in the next column as to whether each item is reference, classification, or quantitative information.

A study of the coding system used for classification information and experience with the number of digits needed to record quantitative information determines the card field size. This totals 47 columns, which is well within the capacity of one card, and no consideration need be given to the use of a second card. The same numbers are therefore repeated in the "final" column.

The final design columns indicating the correct number of columns in each field and the correct sequence of these fields can now be completed.

From past experience and from the proposed procedure, it is believed that visual reference will possibly be made to the cards in connection with the following items of information:

- Order Number
- Part or Account Number
- Operation
- Machine Group

two items, Employee No. and Hours, have already been assigned for the sake of column alignment. At this point there are several choices:

1. Re-assign these fields according to sequence.
2. Re-design the daily time ticket card for alignment with the re-assigned sequence.
3. Compromise for the sake of alignment.

If the last one is chosen, the fields are assigned in sequence (with the exception of the two items) as shown in Figure 12.

Upon checking the method of punching it is found that the gang punched fields are located together, key punched fields are together, and the calculating punch field is at the right where it belongs. The method of punching should be so indicated on the card.

Referring to the interpretation data on the work sheet, interpretation headings and blocks are drawn in, using the scales and guides on the layout form to determine the location of the blocks. Dividing lines between blocks are drawn to split a type bar for more legible interpretation; periods and commas are inserted as desired; first and last type

bar numbers are shown; card columns from which the information is read are indicated if desired.

With the addition of card names and trademark symbols, the design of the card is completed (Figure 13). When the questions at the bottom of the layout form have been answered, the design is ready to submit for a proof to be made.

SHORT CARD FORM DESIGN

INSTRUCTIONS for designing short cards are contained in the lower section of IBM Card Layout Forms.

A short card is any card designed for 22 to 60 columns of punching. Cards of 51-column capacity may be processed through Types 77, 80, 82, 402, 403, 419, 514, 519, or 523, provided they are equipped with interchangeable feeds. All other short cards can be processed only through Types 514, and 519 equipped with interchangeable short-card read feed devices.

Since the position of the cards in the hopper is predetermined, it is advisable in designing short

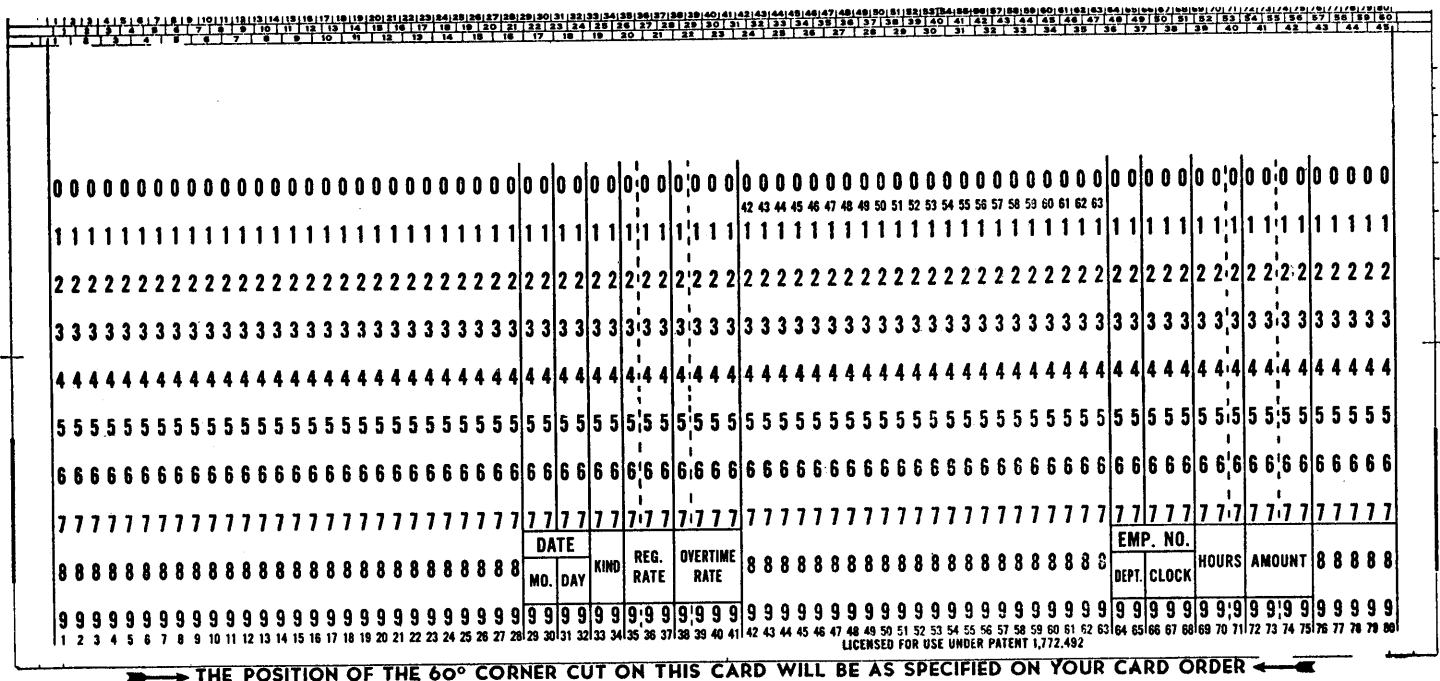


FIGURE 11. HEADINGS OF INFORMATION PUNCHED IN DAILY TIME TICKET

cards that the column numbers on the card coincide with the brushes to be used to read the punched information. For example, the first column punched in a 22-column card will be read by brush 30, and the 22nd column will be read by brush 51. Cards designed for 51-column operation are read by brushes 15 through 65.

If the columns of short cards are numbered to agree with brush readings, sorting operations and control panel wiring will be greatly facilitated. If the whole card is to be processed through machines before the stubs are detached, it may also be desirable to show the standard 80-column numbers, as well as those determined by the short card layout.

Figure 14, page 25, shows a 28-column short card on the left, a 30-column short card on the right, and a stub in between. The first 28 columns are numbered 27 to 54; the last 30 columns are

numbered 26 to 55. Thus, when wiring control panels for either short card, the column numbers preprinted on the bottom of the form correspond to the brushes that must be used.

The example shown is for demonstration purposes only and does not imply that both a 30-column and a 28-column short card can be handled by the same card read feed device.

Two short card sections in an 80-column card must be separated by a stub at least one-half inch wide.

When short cards are designed for mark sensing, it is important to remember that three card columns are required for each mark sensed position, and that the units card column for each mark sensed position is divisible by 3. For example, a mark sensed position that is to be read by mark sense brush 12 must cover card columns 34 to 36.

LAYOUT FORM - IBM CARD

FORM 12-4049-9
PRINTED IN U.S.A.

R 60 45	MEG. NO. STYLE DEPT. CLASS. FABRIC COLOR SEAS. W.HSE.	MEG. NO. STYLE NO. DEPT. NO.	MEG. NO. STYLE DEPT. CLASS. FABRIC COLOR SEAS. W.HSE.
X 60 45	SIZE SEASON CL. PRICE	CUSTOMER'S MERCHANDISE IDENTIFICATION TICKET	
0	6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80	
1	SIZE	SHIPPING TICKET	
2	PRICE	TEAR OFF BEFORE SHIPPING	
3	SALES TICKET	STYLED BY REPRESENTATIVE STORE	
4	TEAR OFF WHEN SALE IS MADE	CITY STATE	
5	STYLE - QUALITY - VALUE	W.HSE. DEPT. STYLE MFG. NO. SIZE PRICE CL. FAB. COL. SEAS. CODE	
6	27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54	26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55	

1st POSITION **2nd POSITION**
519 END-PRINTING

DATE _____

BRANCH OFFICE NAME _____ BR OFF. NO. _____

CUSTOMER NAME _____ CUST. PUR. ORDER NO. _____

IMPORTANT - CHECK THE FOLLOWING REQUIREMENTS:

Is this a revision of form in use? YES NO

What is present form number? _____

May we scrap old electro? YES NO

Indicate corners: UPPER LOWER LEFT RIGHT

to be cut.

INTERPRETATION

45-Numerical

60-Alphabetical

80-Printing punch

Bill Feed five lines six lines

End Printing LEFT RIGHT

Typewriter spacing

If card is to be printed on both sides, check style BOOK TUMBLE

IF CARD IS TO HAVE MARK SENSING, CHECK STYLE.

SHORT CARD LAYOUT INSTRUCTIONS

1) DETERMINE SHORT CARD COLUMN NUMBERS BY REFERRING TO GUIDE AND COLUMNS PRINTED BELOW. USABLE COLUMN RANGE IS ESTABLISHED BY THE CAPACITY LOCATION ON EACH SIDE OF GUIDE. EXAMPLE: ON A 30-COLUMN CARD, USABLE COLUMNS ARE 26-55

2) CUT OUT THE STRIP OF COLUMN NUMBERS

3) PASTE THE STRIP ON THE LAYOUT FORM IN DESIRED LOCATION FOR THE SHORT CARD

4) RULE ENDS OF SHORT CARD 2 1/2 COLUMNS BEYOND THE STRIP OF COLUMN NUMBERS

5) DETERMINE MARK SENSE POSITIONS, IF ANY, BY ASSOCIATING STRIP NUMBERS WITH CARD LAYOUT POSITIONS. EXAMPLE: ON 30-COLUMN CARD, M'S POSITIONS 9-18 ARE USABLE.

59 57 55 53 51 49 47 45 43 41 39 37 35 33 31 29 27 25 23 21 19 17 15 13 11 9 7 5 3 1	23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59	22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60
60 58 56 54 52 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22	22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60	55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

CUT-OUTS FOR PASTING: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

FIGURE 14. SHORT CARD FORM DESIGN

