UDC 681.327.44 : 681.323 : 621.9–52

Ref. No. : ISO/R 1059-1969 (E)

Transformed

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 1059

PUNCHED TAPE FIXED BLOCK FORMAT FOR POSITIONING AND STRAIGHT-CUT NUMERICALLY CONTROLLED MACHINES

1st EDITION

April 1969

For each individual country the only valid standard is the national standard of that country.

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

BRIEF HISTORY

The ISO Recommendation R 1059, *Punched tape fixed block format for positioning and straight-cut numerically controlled machines,* was drawn up by Technical Committee ISO/TC 97, *Computers and information processing,* the Secretariat of which is held by the American National Standards Institute (ANSI).

Work on this question led to the adoption of a Draft ISO Recommendation.

In August 1967, this Draft ISO Recommendation (No. 1319) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Israel	Spain
Belgium	Italy	Sweden
Czechoslovakia	Japan	Switzerland
Denmark	Netherlands	Turkey
France	New Zealand	U.A.R.
Germany	Poland	United Kingdom
Iran	Portugal	U.S.A.

No Member Body opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in April 1969, to accept it as an ISO RECOMMENDATION.

ISO Recommendation	R 1059	April 1969

PUNCHED TAPE FIXED BLOCK FORMAT FOR POSITIONING AND STRAIGHT-CUT NUMERICALLY CONTROLLED MACHINES

1. SCOPE

1.1 This ISO Recommendation applies to fixed block format punched tapes, with or without tabulation and without word address, for positioning and straight-cut machining; it is intended to

(*a*) recommend application of the rules providing a minimum of uniformity in the manufacture of input media;

(*b*) inform users of numerically controlled machines on the potentialities of control systems.

1.2 Compliance with the conditions expressed in this ISO Recommendation does not guarantee interchangeability of media between machines of compatible features. The choice of the codes corresponding to "feed function", "spindle speed function", "preparatory function", "miscellaneous function" and "tool function" is free. Nevertheless, when it is justified by the complexity of functions, it is recommended to comply as far as possible with ISO Recommendation R 1058, *Punched tape variable block format for positioning and straight-cut numerically controlled machines.*

1.3 The format characteristics are specified in section 3 and in Annexes C and D.

1.4 The technical terms used in this ISO Recommendation are based on the data processing vocabulary of ISO Recommendation R ... [1].

1.5 Tape dimensions, character codes and nomenclature of axes conform respectively to ISO Recommendations

R ... [2], *Dimensions for punched paper tape for data interchange;*

R 840, *Code for numerical control of machines (compatible with the ISO 7-bit character set);*

R ... [3], *Representation of six and seven bit coded character sets on punched tape;*

R 841, *Axis and motion nomenclature for numerically controlled machines.*

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1) Now being drafted within Sub-Committee ISO/TC 97/SC 1, *Vocabulary*.

2) At present, Draft ISO Recommendation No. 1671.

3) At present, Draft ISO Recommendation No. 1418.

2. FORMAT MAKE-UP

2.1 Blocks

A fixed format block has a constant length. Consequently, no word can be omitted, even if there is no change in the data with respect to the preceding block. The meaning of a character is defined by its position in the block, The block shall contain no alphabetic character.

2.1.1 A block consists of the following :

2.1.1.1 The "sequence number" word (optional).
2.1.1.2 The "block address" word (optional).
2.1.1.3 The data words.
2.1.1.4 The "end of block" character, showing the end of each block. In addition, the "end of block" character must precede the first block of the programme.

2.1.2 The data words must not be repeated within the same block. Only words corresponding to a function provided by the machine are used; their order should be as follows :

2.1.2.1 The "preparatory function" word. [1)]
2.1.2.2 The "dimension" words.
These words should be arranged whenever possible in the following sequence :
X, Y, Z, U, V, W, P, Q, R, A, B, C, D, E, as defined in Annex B.
2.1.2.3 The "feed function" word or words.
2.1.2.4 The "spindle speed function" word.
2.1.2.5 The "tool function" word.
2.1.2.6 The "miscellaneous function" word. [1)]

2.2 Words

2.2.1 The length of each specific word and the position of the implicit decimal point, as defined in the format specification, shall remain constant. Hence, to keep up the afore-mentioned length, the relevant number of zeros must be included.

2.2.2 There is no address for the words. Optionally, the "tab" character may be used to facilitate the reading of the manuscript.

2.2.3 The "block address" word shall consist of one (1) digit.

2.2.4 The "dimension" words shall be either co-ordinate dimension words (absolute dimension) or incremental dimension words (relative dimension) according to format specification, and shall contain digital data as follows :

2.2.4.1 The most significant digit of the dimension shall be first.

2.2.4.2 *Units*

2.2.4.2.1 All linear dimensions shall be expressed in millimetres or inches and decimal fractions thereof.

2.2.4.2.2 All angular dimensions shall be expressed in decimal parts of a revolution or in degrees and decimal parts of a degree; decimal parts of a revolution is recommended practice.

2.2.4.3 *Decimal point*

Decimal point shall not be used, its implicit position being defined by the format specification.

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1) For preferred coding of preparatory and miscellaneous functions, see ISO Recommendation R 1056, *Punched tape block formats for the numerical control of machines – Coding of preparatory functions G and miscellaneous functions M.*

2.2.4.4 *Sign of linear and angular dimensions*

2.2.4.4.1 When the control system allows using absolute dimensions either positive or negative with respect to the origin of the co-ordinate system, the algebraic sign (+ or −) is part of the "dimension" word and shall precede the first digit.

2.2.4.4.2 When the control system only permits use of positive absolute dimensions, the algebraic sign shall be omitted from the "dimension" words.

2.2.4.4.3 When the control system uses incremental dimensions, the algebraic sign (+ or −) is compulsory and shall precede the first digit of each dimension in order to show the direction of motion.

2.2.5 Digital data contained in the non-dimension words are unrestricted. However, it is recommended to comply as much as possible with the following indications :

2.2.5.1 The "sequence number" should consist of three (3) digits.

2.2.5.2 The "preparatory function" should be expressed by a two (2) digit coded number. For designation, see footnote [1] on page 6.

2.2.5.3 The "feed function or functions" should be expressed by a coded number, the composition of which is described in Annex A.

2.2.5.4 The "spindle speed function" should be expressed by a coded number, the composition of which is described in Annex A.

2.2.5.5 The "tool function" should be expressed by a coded number, the number of digits being specified in the format specification.

2.2.5.6 The "miscellaneous function" should be expressed by a two (2) digit coded number. For designation, see footnote [1] on page 6.

3. FORMAT SPECIFICATION

This consists of three sections, as follows :

– format classification shorthand, in accordance with Annex C;

– format classification detailed shorthand, in accordance with Annex D;

– itemized data of the format contents, which are not subject to standardization. An explanatory note is attached for guidance of users (Appendix Z).

NOTE. – Appendix Y shows an example of a tab fixed block format.

ANNEX A

EXAMPLE OF FEED AND SPINDLE SPEED CODING

It is recommended to comply as much as possible with one of the three following systems of coding. The codes used and the units which are employed are specified in the format specification.

A.1 ARITHMETIC PROGRESSION
(Three (four or five) digit code)

A.1.1 Number

The number is composed of three, four or five digits, the significance of which is as follows :

- the first digit is a decimal multiplier, and has a value three (3) greater than the number of digits to the left of the decimal point of the feed or speed value;
- the subsequent digits are the feed or spindle speed rounded to two, three or four digit accuracy.

When there are no digits to the left of the decimal point, then the number of zeros immediately to the right of the decimal point is subtracted from three (3) to provide the value of the first digit.

Example

Feed or spindle speed	Coding
1728	717
150.3	615
15.25	515
7.826	478
0.1537	315
0.01268	213
0.008759	188
0.0004624	046

NOTE. – The second digit can never be zero unless all digits are zero.

If the three digit coded number does not satisfy the degree of control necessary for the process, this number may be expanded to a four (4) or five (5) digit number, as necessary, to meet the requirement. This coded number for the "feed function" or the "spindle speed function" is rounded to three (3) digit accuracy for a four (4) digit code and rounded to four (4) digit accuracy for a five (5) digit code. This must be defined in accordance with format classification detailed shorthand. (See Annex D.)

Example

Feed or spindle speed	4 digit coding	5 digit coding
1728	7173	71728
150.3	6150	61503
15.25	5153	51525
7.826	4783	47826
0.1537	3154	31537
0.01268	2127	21268
0.008759	1876	18759
0.0004624	0462	04624

NOTE. – The second digit can never be zero unless all digits are zero.

A.1.2 Units

Units employed are as follows :

A.1.2.1 *Feeds*

- For linear motions independent of spindle speed : inch/min or mm/min;
- For linear motions dependent on spindle speed : inch/rev or mm/rev;
- For threading, tapping or chasing, in the "inch" system : rev/inch;
- For threading, tapping or chasing, in the metric system : mm/rev.

A.1.2.2 *Spindle speeds*

- For rotary table motion and spindle speed : rev/min.

A.2 GEOMETRIC PROGRESSION
(Two digit code)

A.2.1 Number

Feed and spindle speed shall be given by a two (2) digit code with increasing values of feed and spindle speed represented by increasing code numbers. In general, the ratio of any two feeds or spindle speeds in the table represented by two successive code numbers is constant. It is recommended that the coding shown as follows be used.

Code	Feed or spindle speed	Code	Feed or spindle speed	Code	Feed or spindle speed	Code	Feed or spindle speed	Code	Feed or spindle speed
00	0 Stop	20	10.0	40	100	60	1000	80	10000
01	1.12	21	11.2	41	112	61	1120	81	11200
02	1.25	22	12.5	42	125	62	1250	82	12500
03	1.40	23	14.0	43	140	63	1400	83	14000
04	1.60	24	16.0	44	160	64	1600	84	16000
05	1.80	25	18.0	45	180	65	1800	85	18000
06	2.00	26	20.0	46	200	66	2000	86	20000
07	2.24	27	22.4	47	224	67	2240	87	22400
08	2.50	28	25.0	48	250	68	2500	88	25000
09	2.80	29	28.0	49	280	69	2800	89	28000
10	3.15	30	31.5	50	315	70	3150	90	31500
11	3.55	31	35.5	51	355	71	3550	91	35500
12	4.00	32	40.0	52	400	72	4000	92	40000
13	4.50	33	45.0	53	450	73	4500	93	45000
14	5.00	34	50.0	54	500	74	5000	94	50000
15	5.60	35	56.0	55	560	75	5600	95	56000
16	6.30	36	63.0	56	630	76	6300	96	63000
17	7.10	37	71.0	57	710	77	7100	97	71000
18	8.00	38	80.0	58	800	78	8000	98	80000
19	9.00	39	90.0	59	900	79	9000	99	Rapid

A.2.2 Units

Units employed are as follows :

A.2.2.1 *Feeds*

– For linear motions independent of spindle speed : inch/min or mm/min;

– For linear motions dependent on spindle speed : inch/rev or mm/rev;

– For threading, tapping or chasing, in the "inch" system : rev/inch;

– For threading, tapping or chasing, in the metric system : mm/rev.

A.2.2.2 *Spindle speeds*

– For rotary table motion and spindle speed : rev/min.

A.3 SYMBOLIC
(one digit code)

Feed and spindle speed shall each be given by a one (1) digit code. This code selects a spindle speed or feed from those available on the machine.

The value of the spindle speed or feed appropriate to each code shall be detailed in the itemized data.

ANNEX B

SYMBOLS FOR THE WORDS USED IN FORMAT SPECIFICATION

Symbol	Meaning
A	Angular dimension about X axis
B	Angular dimension about Y axis
C	Angular dimension about Z axis
D	Angular dimension about special axis or : third feed function [1]
E	Angular dimension about special axis or : second feed function [1]
F	Feed function
G	Preparatory function
H	Block address word
I	Unassigned — Not to be used in positioning and straight-cut systems
J	Unassigned — Not to be used in positioning and straight-cut systems
K	Unassigned — Not to be used in positioning and straight-cut systems
L	Permanently unassigned
M	Miscellaneous function
N	Sequence number
O	Do not use
P	Tertiary motion dimension parallel to X [1]
Q	Tertiary motion dimension parallel to Y [1]
R	Rapid traverse dimension in the Z axis, or : tertiary motion dimension parallel to Z [1]
S	Spindle speed function
T	Tool function
U	Secondary motion dimension parallel to X [1]
V	Secondary motion dimension parallel to Y [1]
W	Secondary motion dimension parallel to Z [1]
X	Primary X motion dimension
Y	Primary Y motion dimension
Z	Primary Z motion dimension

[1] When D, E, P, Q, R, U, V, and W are not used as indicated above, they become unassigned, and may be used as necessary for special application.

ANNEX C

FORMAT SPECIFICATION

Format classification shorthand

The format classification shorthand shall consist of groups of characters defined as follows :

C.1 The first group of characters shall contain letters selected as follows :

C.1.1 F for the fixed block format where applied to a positioning system either allowing or not straight-cut machining. [1)]

C.1.2 T when using "tab" characters.

C.1.3 M for linear dimensions expressed in millimetres and decimal fractions thereof

or

I for linear dimensions expressed in inches and decimal fractions thereof.

C.1.4 If need be :

R for angular dimensions expressed in decimal fractions of a revolution

or

D for angular dimensions expressed in degrees and decimal fractions thereof.

C.2 The next group, comprising three digits, denotes the geometrical characteristics of both machine and control system, as follows :

C.2.1 The first digit shows the number of motions either digitally or symbolically (i.e. stop-dogs) controlled.

C.2.2 The second digit shows the number of motions controlled by the "dimension" words (and not by marks denoting a stop-dog, an indexed setting, etc.).

C.2.3 The third digit shows the number of simultaneously controlled motions.

TYPICAL EXAMPLE

The format of a control-system for a machine featuring

– a vertical-spindle head moving on vertical slideways,

– a moving quill in the afore-mentioned head,

– a cross-slide table,

will be written thus : FTM322.

This denotes fixed block format positioning (F) control system with tabulation (T), the linear motions of which are expressed in millimetres (M), there being no angular motion.

This machine has three (3) motions controlled by the system (cross-slide, work-table, quill), the head being positioned on the upright by the operator; a table position is digitally defined while the quill's is secured by selecting a preset stop-dog; both (2) table motions are provided by "dimension" words, the system controlling the two (2) motions at the same time.

1) This possibility is pointed out among the itemized characteristics of the format (see Appendix Z).