

JIS

JAPANESE INDUSTRIAL STANDARD

**Numerical Control Processor
Output-Minor Elements of
2000-Type Records**

JIS B 6326—1980

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the original Standard in Japanese is to be final authority.

JAPANESE INDUSTRIAL STANDARD

J I S

Numerical Control Processor Output-
Minor Elements of 2000-Type RecordsB 6326-1980
(Reaffirmed: 1986)1. Scope

This Japanese Industrial Standard defines the logical structures and contents of the commonly used numerical control processor output minor elements of 2000-type records⁽¹⁾.

Note ⁽¹⁾: See JIS B 6325

2. Semantic Definition

The syntax and semantics of terms contained in this standard are defined in JIS B 0181, JIS B 6325 and JIS C 6230 mainly and furthermore defined as follows:

- (1) minor element Unit element forming the information added to the major word in the minor part of statement.
- (2) item of minor element Consisting unit of minor element corresponding to CLDATA word.
- (3) minor element list Information added to the major word indicating the function of the statement in the minor part of statement.
- (4) minor word Reserved word for numerical control processor which has special meaning and is used in minor part.

3. Logical Structure of 2000-Type Records

3.1 Records 2000-type records carry post-processor instructions and are formed of words as follows:

Word No. 1 (W 1)	Integer	Record sequence number
Word No. 2 (W 2)	Integer	2000
Word No. 3 (W 3)	Integer	<i>n</i> (integer code number representing major word)
Word No. 4 (W 4)	Integer, real number or character	Item
⋮		
⋮		
Word No. <i>n</i> (W <i>n</i>)		

Applicable Standards and Corresponding International Standard: See page 64.



Documents

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3.2 Minor Element A minor element can consist of one or more items.

3.3 Items Each item is contained in one logical word and can be one of the following:

- (1) Integer data representing a key vocabulary minor word:
- (2) Real number data:
- (3) Character data

Remark: Character data consist of six characters or less. The character string is the row or characters consisting of six characters. If the number of characters contained in the character string of input statement are less than the integer multiple of six, the space shall be inserted in the end position and make the number the integer multiple of six.

3.4 Word If the logical word represents character data, the six left-hand positions of the physical representations shall be used. If character data in the equivalent input part program statement consist of less than six characters, on numerical processor output, the data shall be right-justified within the first six characters.

4. Minor Element List

4.1 Minor Element Minor elements are listed in Annex 1 at every major word, and the rules used for the syntax definitions are shown in Annex 2.

The following is the description style of Annex 1.

- (1) Description of the minor element list using the logical structure of CLDATA records should be too lengthy, and it should result in making the difficulty for understanding.
Therefore, the list shall be defined in the form of a statement of one-to-one corresponding input language.
- (2) Major word and minor word are described in capital letters and integer codes of minor word are shown at the next positions from them.
- (3) Scalar values, represented by real numbers in CLDATA are shown by the symbols of small letters a, b, c, d and the like.
- (4) Where an alternative, but non-standard, order of the item within a minor element is known to be frequently used, the non-standard order is shown in parenthesis in the minor element definitions. These orders of the items shall be understood to be non-preferred.

Example: The following examples are shown in Annex 1 (II)
The integer code and semantic of minor element in CYCLE, those which are shown here in parentheses are the examples to be non-preferred.

MMPM, d	315
(d, MMPM)	
BRKCHP	288
(STEP)	92

4.2 Minor Word The integer code numbers and definitions of minor words are shown in alphabetical order in Annex 3-1 and the integer code numbers of minor word are shown in numerical order in Annex 3-2.

Annex 1. Minor Element List

This Annex shows the minor elements arranging the major words in alphabetical order. The major word, English name, integer code number, meaning, syntax and integer code number and meaning of minor element are indicated in every major word.

(1) AIR

English air

Integer Code No. 1011

Meaning Provides function to controls the supply of air.

Syntax

AIR/ON
OFF [, a]

Minor element definitions and integer code numbers

ON 71 Specifies air is on.

OFF 72 Specifies air is off.

a Specifies the time in seconds during which air is on.

(2) AUXFUN

English auxiliary function

Integer Code No. 1022

Meaning Provides facilities to insert miscellaneous function (M) code numbers on control tape.

Syntax

AUXFUN/a %[, a]

Minor element definitions

a Specifies miscellaneous function (M) code number to be output in a single block.

(3) CHUCK

English chuck

Integer Code No. 1073

Meaning Specifies the chuck to be used.

Syntax

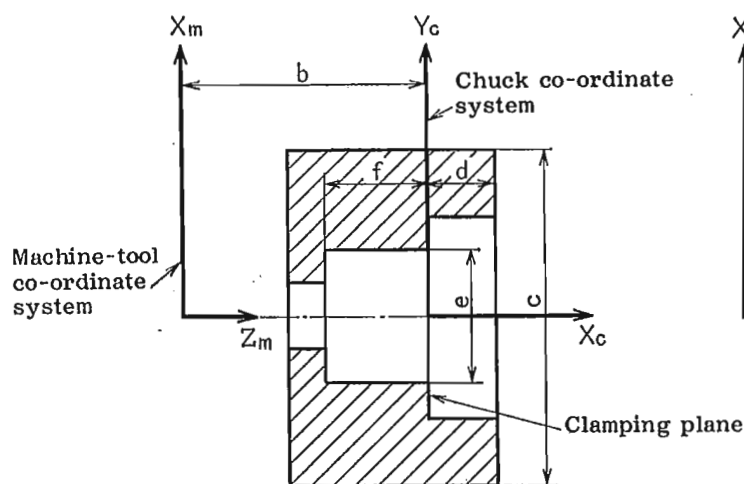
CHUCK/a , b , c , d [, e , f]

CHUCK/a , g

Minor element definitions (see Annex 1 Figures 1 and 2)

- a Specifies the identity number of the chuck.
- b Specifies the position of the clamping plane of the chuck in terms of the machine-tool co-ordinate system.
- c Specifies the maximum outer diameter of the chuck.
- d Specifies the position of the outer plane surface of the chuck in terms of the chuck co-ordinate system.
- e Specifies either the diameter of the hole of an external clamping chuck (if f has a negative value) or the diameter of a mounting arbor (if f has a positive value).
- f Specifies either the depth of the hole of an external clamping chuck (if negative), or the length of a mounting arbor (if positive), in terms of the chuck co-ordinate system.
- g Specifies the position on the X -axis of the part co-ordinate origin in terms of the machine-tool co-ordinate system.

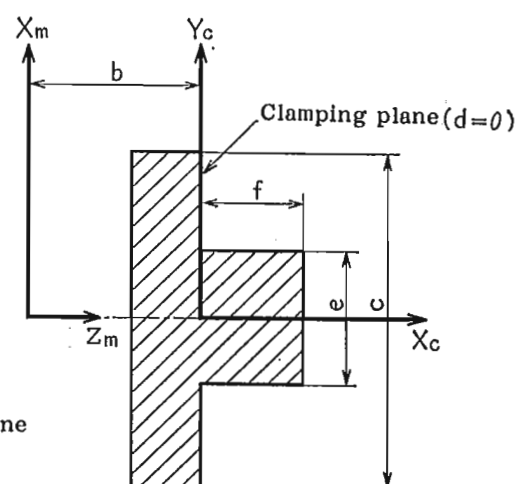
Annex 1 Figure 1. External Clamping Chuck



CHUCK/a, b, c, d, e, f

For example: CHUCK/11, 240, 300, 60, 120, 100

Annex 1 Figure 2. Mounting Arbor



CHUCK/a, b, c, d, e, f

For example: CHUCK/12, 240, 300, 0, 120, 100

(4) CLAMP

English clamp

Integer Code No. 1060

Meaning Specifies the slide of machine, mounting device, clamp and unclamp of main spindle and the like.

Syntax

CLAMP $\begin{matrix} \text{ON} \\ \text{OFF} \end{matrix}$
 $a \left[\begin{matrix} \text{ON} \\ \text{OFF} \end{matrix} \right]$

CLAMP $\begin{matrix} \text{ALL} \\ \text{COLLET} \\ \text{PALLET} \\ \text{RAIL} \\ \text{SADDLE} \\ \text{TABLE} \end{matrix} \left[\begin{matrix} \text{ON} \\ \text{OFF} \end{matrix} \right]$

CLAMP $\begin{matrix} \text{XAXIS} \\ \text{YAXIS} \\ \text{ZAXIS} \\ \text{AAXIS} \\ \text{BAXIS} \\ \text{CAXIS} \end{matrix} \left[\begin{matrix} \text{ON} \\ \text{OFF} \end{matrix} \right]$

Minor element definitions and integer code numbers

ON	71	Initiates the operation.
OFF	72	Terminates the operation.
a		Specifies the clamping device with numbers.
ALL	51	Specifies all holding devices.
COLLET	139	Specifies a collet device.
PALLET	239	Specifies a pallet device.
RAIL	93	Specifies a rail device.
SADDLE	150	Specifies a saddle device.
TALBE	177	Specifies a table device.
XAXIS	84	Specify the control axis to clamp and unclamp
YAXIS	85	
ZAXIS	86	
AAXIS	140	
BAXIS	141	
CAXIS	142	

(5) CLDIST

English clearance distance

Integer Code No. 1071

Meaning Indicates a clearance envelope for collision avoidance at the given distance from the surface.

Syntax CLDIST/a

Minor element definitions

a specifies thickness of the clearance envelope.

(6) CLEARP

English clearance plane

Integer Code No. 1004

Meaning Specifies a clearance plane to which the tool tip will be moved when RETRACT⁽¹⁾ is encountered.

Syntax

CLEARP/symbol , a , b , c , d , e⁽²⁾

CLEARP/b , c , d , e

CLEARP/[XYPLAN ,] f
YZPLAN , g
ZXPLAN , h

Note (2): The first type of CLDATA, there is no one-to-one correspondence between the statement in the input language and CLDATA.
The following is the input language corresponding to this CLDATA

CLEARP/symbol [(a)]

Minor element definitions and integer code numbers

Symbol, a	Optionally inserted by the processor where the symbolic plane is previously defined. a is either a subscript.
b, c, d	Specify the X, Y, Z components of the plane normal unit vector.
e	Specifies the distance of the plane from the part co-ordinate origin in the direction of the plane normal unit vector.
XYPLAN, f	33 Defines the position of a plane normal to the Z-axis in the part co-ordinate system.

YZPLAN, g 37 Defines the position of a plane normal to the X-axis in the part co-ordinate system.

ZXOKAN, h 41 Defines the position of a plane normal to the Y-axis in the part co-ordinate system.

(7) CLRSRF

English clearance surface

Integer Code No. 1057

Meaning Specifies a clearance surface to which the tool tip will be moved when RETRACT⁽¹⁾ is encountered.

Syntax

CLRSRF/PLANE, symbol, a, b, c, d, e⁽³⁾

CLRSRF/b, c, d, e

Note ⁽³⁾ The first type fo CLDATA, there is no one-to-one correspondence between the statement in the input language and CLDATA.

The following is the input language corresponding to this CLDATA.

CLRSRF/symbol [(a)]

Minor element definitions and integer code numbers

PLANE, symbol, a 3003 Inserted by the processor when the symbolic plane is previously defined.
a is either a subscript.

b, c, d Specify the X, Y, Z components of the plane normal unit vector.

e Specifies the distance of the plane from the part co-ordinate origin in the direction of the plane normal unit vector.

(8) COOLNT

English coolant

Integer Code No. 1030

Meaning Specifies the output of the function to control the coolant flow.

COOLNT/ $\begin{matrix} \text{ON} \\ \text{OFF} \\ \text{FLOOD} \\ \text{MIST} \\ \text{TAPKUL} \end{matrix} \left[\begin{matrix} a \\ \\ \\ 0 \end{matrix} \right], a$

Minor element definitions and integer code numbers

ON	71	Initiates coolant.
OFF	72	Terminates coolant.
FLOOD	89	Initiates flood coolant.
MIST	90	Initiates mist coolant.
TAPKUL	91	Initiates tapping coolant.
a		Specifies the required delivery pipe.

(9) COUPLE

English couple

Integer Code No. 1049

Meaning Commands the synchronization of feedrate and spindle speed for threading operations.

Syntax COUPLE/ON
OFF

Minor element definitions and integer code numbers

ON	71	Initiates the synchronization of feedrate and spindle speed.
OFF	72	Cancels the synchronization of feedrate and spindle speed.

(10) CUTCOM

English cutter compensation

Integer Code No. 1007

Meaning Commands the inclusion of cutter compensation information on the control tape and optionally specifies the relationship of workpiece to cutter, the plane of compensation and the cutter compensation register to be used.

Syntax

CUTCOM/ON
OFF [, LENGTH[, a]
LENGTH[, a]

CUTCOM/ON
OFF
RIGHT [, XCOORD , b] [, YCOORD , c] [, ZCOORD , d]
LEFT

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B 6326-1980

CUTCOM $\begin{matrix} \text{ON} \\ \text{OFF} \\ \text{RIGHT} \\ \text{LEFT} \end{matrix}$ $\left[\begin{matrix} , \text{XYPLAN} \\ , \text{YZPLAN} \\ , \text{ZXPLAN} \end{matrix} \right] \left[[, \text{OSETNO}] , e [, f] \right]$

CUTCOM $\begin{matrix} \text{ON} \\ \text{OFF} \\ \text{RIGHT} \\ \text{LEFT} \end{matrix}$ $[, \text{RADIUS} , g]$

Minor element definitions and integer code numbers

ON	71	Causes cutter compensation information to be output.
OFF	72	Causes cancellation of the last CUTCOM command.
RIGHT	24	} Specifies position of the cutter in relation to the workpiece in accordance with JIS B 6310.
LEFT	8	
LENGTH	9	Specifies tool length compensation.
LENGTH, a	9	Specifies a cutter compensation register to be used with length compensation.
XYPLAN	33	} Specifies the plane of compensation.
YZPLAN	37	
ZXPLAN	41	
OSETNO, e, f	508	Specifies the cutter compensation register to be used.
XCOORD, b	116	Specifies a cutter compensation register to be associated with the X-axis.
YCORD, c	117	Specifies a cutter compensation register to be associated with the Y-axis.
ZCOORD, d	118	Specifies a cutter compensation register to be associated with the Z-axis.
RADIUS, g	23	Specifies a cutter compensation register to be associated with the radius.

(11) CYCLE

English	cycle
Integer Code No.	1054
Meaning	Specifies or identifies operations to be carried out at each point of a 5000-type motion record.

General Syntax

The syntax is of the following general form.

CYCLE/operation, depth, feedrate, clearance, modifier

where

operation defines the type of machining cycle,

depth defines the distance(s) from the point⁽⁴⁾ along the spindle axis over which the machining operation will be performed,

feedrate defines the feedrate to be used in the cycle,

clearance defines a distance above the point(s)⁽⁴⁾ to which the tool will first be positioned at rapid,

and modifier allows the modification of the basic machining cycle.

Note ⁽⁴⁾ Each point of the 5000-type motion record at which the cycle is to be performed.

Syntax

DRILL
FACE
TAP IPM, b
CYCLE / REAM, a, IPR, c
BORE, d [, f] [, RAPTO, g] [, DWELL [, h]] [, ORIENT [, o]]
BORE 7 MMPM, d
BORE 8 MMPR, e
BORE 9

CYCLE / DEEP
BRKCHP $\left[\begin{array}{l} \text{IPM, b} \\ \text{IPR, c} \\ \text{MMPM, d} \\ \text{MMPR, e} \end{array} \right] [, f [, n]] [, RAPTO, g] \text{ ¥}$
[, DWELL [, h]] [, TIMES, p]

CYCLE / DEEP
BRKCHP, a, INCR $\left[\begin{array}{l} \text{IPM, b} \\ \text{IPR, c} \\ \text{MMPM, d} \\ \text{MMPR, e} \end{array} \right] [, f [, n]] [, RAPTO, g] \text{ ¥}$
[, DWELL [, h]] [, TIMES, p]

CYCLE / THRU, a, i, a, $\left[\begin{array}{l} \text{IPM, b} \\ \text{IPR, c} \\ \text{MMPM, d} \\ \text{MMPR, e} \end{array} \right] [, f] [, DWELL [, h]]$

CYCLE / CSINK, k, l, m, $\left[\begin{array}{l} \text{IPM, b} \\ \text{IPR, c} \\ \text{MMPM, d} \\ \text{MMPR, e} \end{array} \right] [, f [, n]] [, RAPTO, g] [, DWELL [, h]]$

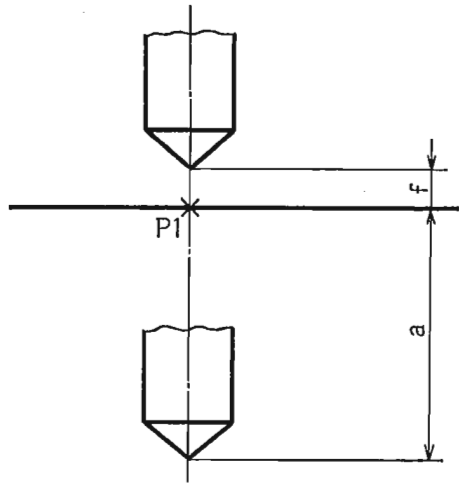
CYCLE / ON
OFF
MANUAL

Minor element definitions and integer code numbers

ON	71	Re-establishes the sequence of operations carried out at each point.
OFF (NOMORE)	72 53	Suppresses the sequence of operations in the manner of the G80 in JIS B 6314.
MANUAL	158	Specifies that the tool is to stop at each point to allow the operator to perform a non-tape operation.
DRILL	163	Specifies a sequence of operations equivalent to the G81 fixed cycle in JIS B 6314 (see Annex 1 Figure 3 for example).
FACE	81	Specifies a sequence of operations equivalent to the G82 fixed cycle in JIS B 6314 (see Annex 1 Figure 4 for example).
TAP	168	Specifies a sequence of operations equivalent to the G84 fixed cycle in JIS B 6314 (see Annex 1 Figure 5 for example).
REAM	262	Specifies a sequence of operations equivalent to the G85 fixed cycle in JIS B 6314 (see Annex 1 Figure 6 for example).
BORE	82	Specifies a sequence of operations equivalent to the G86 fixed cycle in JIS B 6314 (see Annex 1 Figure 7 for example).
BORE 7	211	Specifies a sequence of operations equivalent to the G87 fixed cycle in JIS B 6314 (see Annex 1 Figure 8 for example).
BORE 8	212	Specifies a sequence of operations equivalent to the G 88 fixed cycle in JIS B 6314 (see Annex 1 Figure 9 for example).
BORE 9	213	Specifies a sequence of operations equivalent to the G 89 fixed cycle in JIS B 6314 (see Annex 1 Figure 10 for example).
DEEP	153	Specifies a sequence of operations equivalent to the G83 fixed cycle in JIS B 6314 (see Annex 1 Figures 11 to 14 for examples). The sequence includes retraction at rapid to the clearance <i>f</i> after each peck.
BRKCHP (STEP)	288 92	Specifies a sequence of operations equivalent to the G83 fixed cycle in JIS B 6314 (see Annex 1 Figure 15 for example). The sequence includes a dwell or a small retraction between each peck of the operation.

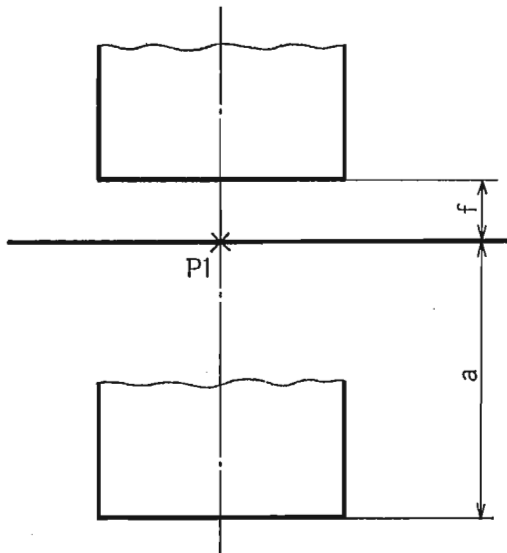
THRU	152	Specifies a feed-in, rapid-in, feed-in, rapid-in operation with a final rapid-out, used for drilling multiple walls separated by air spaces (see Annex 1 Figure 16 for example).
CSINK	256	Specifies a sequence of operations equivalent to the G 82 fixed cycle in JIS B 6314 (see Annex 1 Figures 17 and 18 for example).
a		Specifies the distance from the point along the spindle axis over which the machining operation will be performed.
IPM, b (b, IPM)	73	Specifies magnitude of velocity of feed movement to be used during cycle, in inches per minute.
IPR, c (c, IPR)	74	Specifies magnitude of velocity of feed movement to be used during cycle, in inches per revolution.
MMPM, d (d, MMPM)	315	Specifies magnitude of velocity of feed movement to be used during cycle, in millimetres per minute.
MMPR, e (e, MMPR)	316	Specifies magnitude of velocity of feed movement to be used during cycle, in millimetres per revolution.
f		Specifies a distance above the point to which the tool will first be positioned at rapid.
RAPTO, g	280	Specifies a rapid movement which modifies the basic cycle (see Annex 1 Figures 19 to 21 for example).
DWELL, h	279	Specifies in seconds a period of no tool motion.
i		Specifies the distance from the point along the spindle axis over which the machining operation will be performed.
k		Specifies the diameter of countersink.
l		Specifies the included angle of the countersink.
m		Specifies the diameter of the pilot hole. Used to calculate the secondary rapid distance from the point (see Annex 1 Figure 18 for example).
n		Specifies a distance above the point to which the tool will be positioned at rapid after second times.
ORIENT, o	246	Specifies an index position at which the spindle may be stopped in boring cycles.
TIMES, p	28	Specifies a rapid retraction to f above the point every p pecks.
INCR, q	66	Specifies that the values of q are successive incremental distances rather than absolute from the point.

Annex 1. Figure 3

CYCLE/DRILL, a , MMPM, d , f 

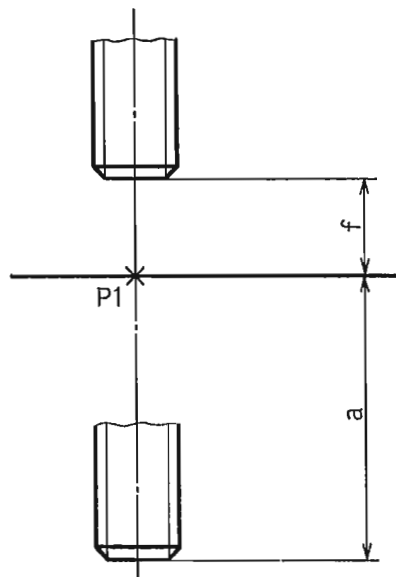
1. Position at rapid to f above the point P1.
2. Feed a distance $f + a$.
3. Rapid retract to a position f above P1.

Annex 1. Figure 4

CYCLE/FACE, a , MMPM, d , f , DWELL, h 

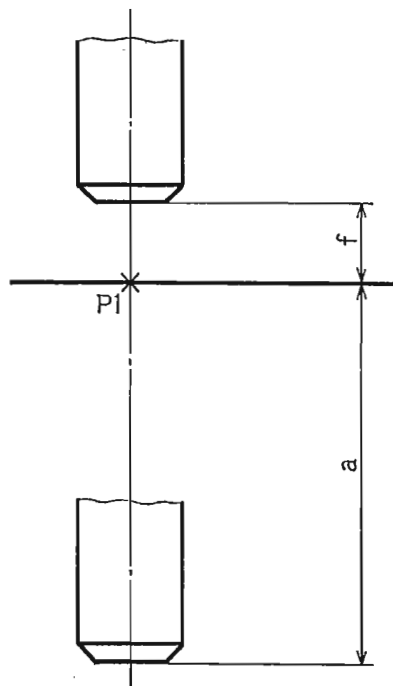
1. Position at rapid to f above the point P1.
2. Feed a distance $f + a$.
3. Dwell
4. Rapid retract to a position f above P1.

Annex 1. Figure 5

CYCLE/TAP, a , MMPM, d , f 

1. Position at rapid to f above the point $P1$.
2. Feed a distance $f + a$.
3. Spindle reverse
4. Retract at feed to a position f above $P1$.
5. Reinstall the initial spindle condition.

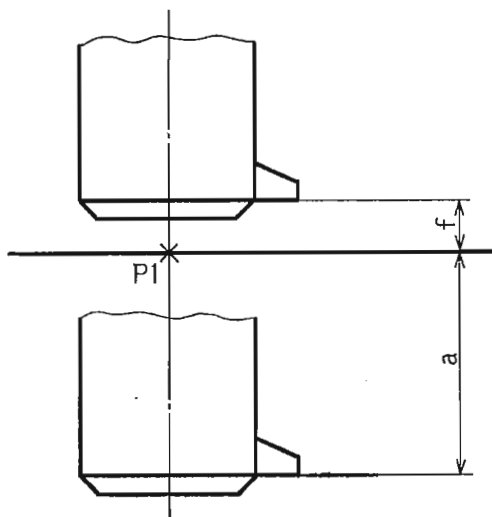
Annex 1. Figure 6

CYCLE/REAM, a , MMPM, d , f 

1. Position at rapid to f above the point $P1$.
2. Feed a distance $f + a$.
3. Retract at feedrate to a position f above $P1$.

Annex 1. Figure 7

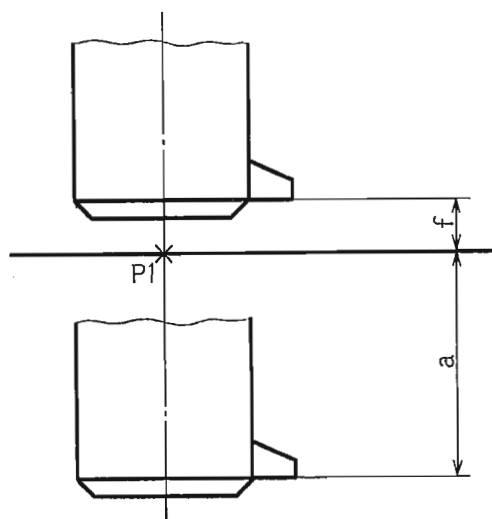
CYCLE/BORE, a, MPM, d, f



1. Position at rapid to f above the point P1.
2. Feed a distance $f + a$.
3. Stop the spindle revolution.
4. Rapid retract to a position f above P1.
5. Reinstate the initial spindle condition.

Annex 1. Figure 8

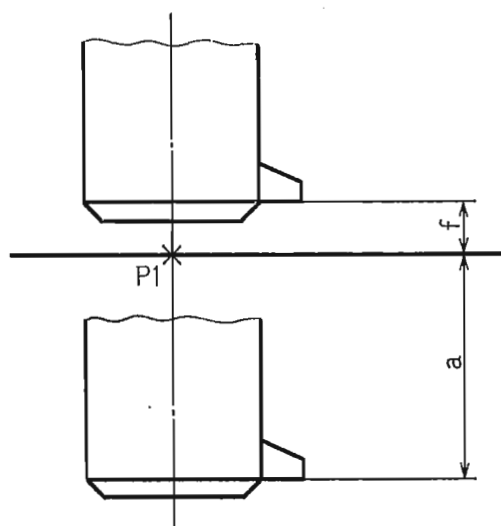
CYCLE/BORE 7, a, MPM, d, f



1. Position at rapid to f above the point P1.
2. Feed a distance $f + a$.
3. Stop the spindle revolution.
4. Retract at hand feed to a position f above P1.
5. Reinstate the initial spindle condition.

Annex 1. Figure 9

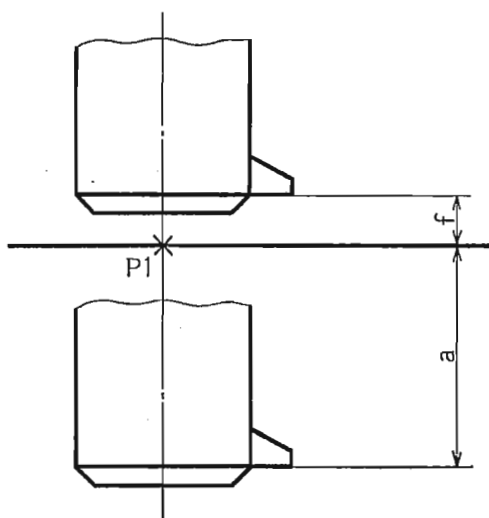
CYCLE/BORE 8, a, MMPM, d, f, DWELL, h



1. Position at rapid to f above the point P1.
2. Feed a distance $f + a$.
3. Dwell
4. Stop the spindle revolution.
5. Retract at hand feed to a position f above P1.
6. Reinststate the initial spindle condition.

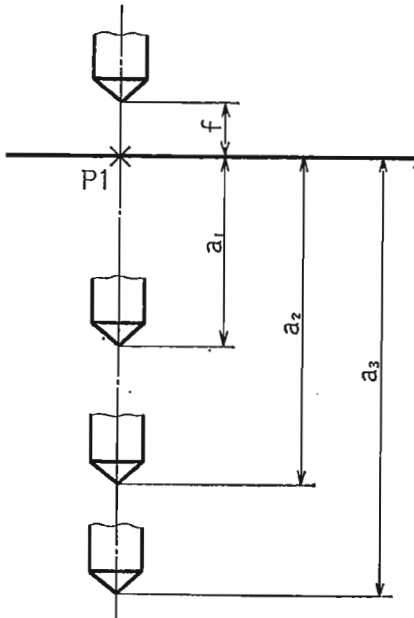
Annex 1. Figure 10

CYCLE/BORE 9, a, MMPM, d, f, DWELL, h



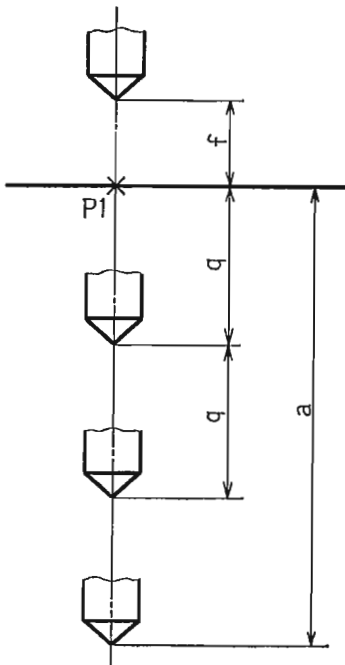
1. Position at rapid to f above the point P1.
2. Feed a distance $f + a$.
3. Dwell
4. Retract at feedrate to a position f above P1.

Annex 1. Figure 11

CYCLE/DEEP, a_1 , a_2 , a_3 , MMPM, d , f , n 

1. Position at rapid to f above the point $P1$.
2. Feed a distance $f + a_1$.
3. Retract at rapid to a position f above $P1$.
4. Rapid a distance $f + a_1$ less specified (n) clearance.
5. Feed to a position a_2 below $P1$.
6. Retract at rapid to a position f above $P1$.
7. Rapid a distance $f + a_2$ less specified (n) clearance.
8. Feed to a position a_3 below $P1$.
9. Retract at rapid to a position f above $P1$.

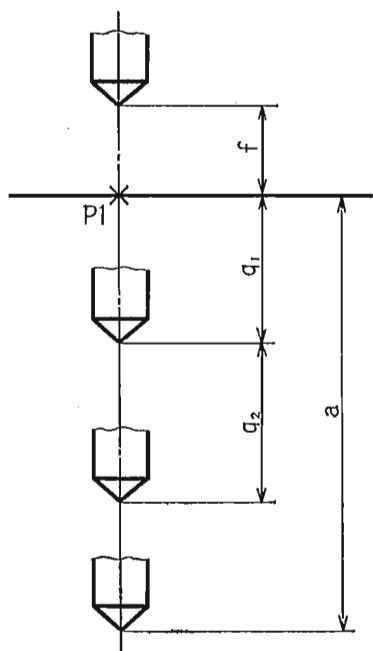
Annex 1. Figure 12

CYCLE/DEEP, a , INCR, q , MMPM, d , f
where a is less than $3q$ 

1. Position at rapid to f above the point $P1$.
2. Feed a distance $f + q$.
3. Retract at rapid to a position f above $P1$.
4. Rapid a distance $f + q$ less some fixed clearance.
5. Feed to a position $2q$ below $P1$.
6. Retract at rapid to a position f above $P1$.
7. Rapid a distance $f + 2q$ less some fixed clearance.
8. Feed to a position a below $P1$.
9. Retract at rapid to a position f above $P1$.

Annex 1. Figure 13

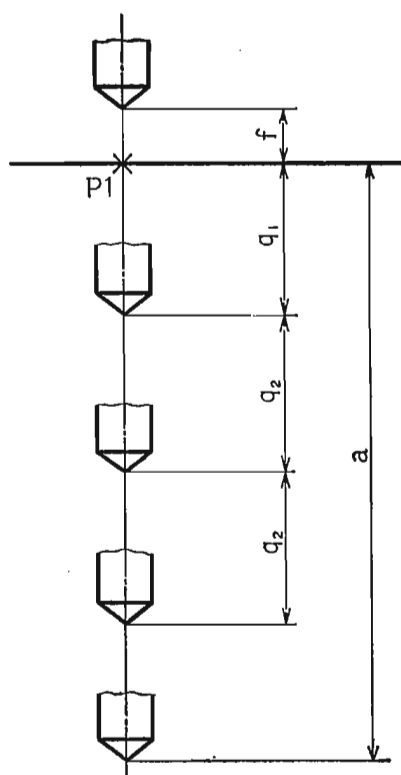
CYCLE/DEEP, a , INCR, q_1 , q_2 , MMPR, e , f
 where a is less than $q_1 + 2q_2$



1. Position at rapid to f above the point $P1$.
2. Feed a distance $f + q_1$.
3. Retract at rapid to a position f above $P1$.
4. Rapid a distance $f + q_1$ less some fixed clearance.
5. Feed to a position $q_1 + q_2$ below $P1$.
6. Retract at rapid to a position f above $P1$.
7. Rapid a distance $f + q_1 + q_2$ less some fixed clearance.
8. Feed to a position a below $P1$.
9. Retract at rapid to a position f above $P1$.

Annex 1. Figure 14

CYCLE/DEEP, a , INCR, q_1 , q_2 , MMPR, e , f
 where $q_1 + 2q_2 < a < q_1 + 3q_2$



1. Position at rapid to f above the point $P1$.
2. Feed a distance $f + q_1$.
3. Retract at rapid to a position f above $P1$.
4. Rapid a distance $f + q_1$ less some fixed clearance.
5. Feed to a position $q_1 + q_2$ below $P1$.
6. Retract at rapid to a position f above $P1$.
7. Rapid a distance $f + q_1 + q_2$ less some fixed clearance.
8. Feed to a position $f + q_1 + q_2 + q_2$ below $P1$.
9. Retract at rapid to a position f above $P1$.
10. Rapid a distance $f + q_1 + q_2 + q_2$ less some fixed clearance.
11. Feed to a position a below $P1$.
12. Retract at rapid to a position f above $P1$.