INTERNATIONAL STANDARD 4343

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Numerical control of machines — NC processor output — Minor elements of 2000-type records (post-processor commands)

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4343 was developed by Technical Committee ISO/TC 97, *Computers and information processing*, and was circulated to the member bodies in April 1976.

It has been approved by the member bodies of the following countries :

Australia	Japan	South Africa, Rep. of
Belgium	Korea, Rep. of	Turkey
Brazil	Mexico	United Kingdom
Czechoslovakia	Netherlands	U.S.A.
France	New Zealand	U.S.S.R.
Germany	Poland	
Hungary	Romania	

No member body expressed disapproval of the document.

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Numerical control of machines – NC processor output – Minor elements of 2000-type records (post-processor commands)

0 INTRODUCTION

0.1 The output of a general purpose numerical control processor is information used as input to a post-processor. This information is called CLDATA, which is derived from the term "centre line data".

0.2 The logical structure of CLDATA records and the listing and definition of major words are given in ISO 3592.

0.3 This International Standard defines, in the context of major word, the minor elements that can be associated in a post-processor statement with each of these major words (for an example of major and minor portions of a processor input statement, see the footnote to clause 1).

0.4 Although this International Standard defines the CLDATA processor output of post-processor statements, there is usually a one-to-one correspondence between the minor elements of a post-processor statement in the input language and the words of the corresponding 2000-type record in CLDATA. In consequence, the symbolic input language has been chosen to describe the representation of the CLDATA records in this International Standard.

0.5 Therefore, unless otherwise stated, the syntax and semantic definitions contained in this International Standard apply to both the input language statements and the corresponding CLDATA output.

0.6 This International Standard is intended to define, in general terms, the elements of the set of post-processor statements that are commonly used. The writer of a post-processor is expected to use this International Standard for the selection of post-processor statements. The user of the input language (i.e. the part programmer) is expected to use the documentation of the appropriate post-processor that he intends to execute.

0.7 The existing numerical control processors allow minor elements of post-processor statements in any order without restriction. Post-processors usually check the validity of particular element strings. The syntax definitions given in this International Standard are examples of common usage.

0.8 The syntax, semantics and minor elements given under the heading of each major word are the result of several years' study of documents representing existing practice.

0.9 The integer code numbers (IC)[1] given in this International Standard are the code numbers that are used to represent the input language vocabulary key words in CLDATA.

1 SCOPE

1.1 This International Standard defines the elements of a set of post-processor statements that are commonly used in numerical control software.

It utilizes

a) the syntax and semantics of the major and minor elements[2] of the input language of this set,

and specifies

b) the syntax and semantics of the corresponding CLDATA processor output of type 2000, W4 to W245,

c) the rules governing the interpretation of the syntax of CLDATA.

1.2 This International Standard does not prescribe

a) the mechanism by which the statements are processed and the CLDATA developed;

b) the medium on which the input language statements or the CLDATA are recorded;

c) the order of statements within a part program.

1.3 The rules used for the syntax definitions are shown in annex A.

1) A register of keywords and their associated integer codes is maintained by the Secretariat of TC 97/SC 9 (as at June 1977, AFNOR, Paris). The TC 97/SC 9 Secretariat should be consulted for the possible assignment of codes for vocabulary not included in this International Standard.

2) The following example indicates the major and minor portions of a processor input statement and of the corresponding CLDATA record :

SPINDL/RPM, 5000, RANGE, 2

The major word is SPINDL
The minor element list is "RPM, 5000, RANGE, 2"
The minor elements are "RPM, 5000" and "RANGE, 2"

2 FIELD OF APPLICATION

2.1 Each processor using one of the ISO numerical control programming languages shall be capable of producing CLDATA minor elements as defined in this International Standard, possibly by means of some interface routine.

2.2 Each post-processor shall be capable of using as its input at least a sub-set of the minor elements specified in this International Standard.

3 REFERENCES

ISO 841, *Numerical control of machines — Axis and motion nomenclature.*

ISO 1056, *Numerical control of machines — Punched tape block formats — Coding of preparatory functions G and miscellaneous functions M.*

ISO 3592, *Numerical control processor output — Logical structure.*

4 LOGICAL STRUCTURE OF 2000-TYPE RECORDS

4.1 2000-type records carry post-processor instructions and are formed of words as follows :

Word W1 (integer) = record sequence number

Word W2 (integer) = 2000

Word W3 (integer) = *n* (integer code number representing major word)

Words W4 onwards may contain a minor element list as defined in clause 5 of this International Standard.

4.2 A minor element can consist of one or more items.

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

a) an integer representing a key vocabulary minor word;

b) a real number;

c) a character item.

4.4 If the logical word represents a character item, the six left-hand positions of the physical representations shall be used, any remaining positions being filled with the space character.

If character data in the equivalent input part program statement consist of less than six characters, on numerical control processor output the data shall be right-justified within the first six characters, with leading space characters inserted as necessary.

5 MINOR ELEMENT LISTS

5.1 In this International Standard, a separate logical page is used for each major word.

5.2 On each of the following logical pages, major words and key vocabulary minor words are shown in capital letters. Its integer code number is shown alongside each word.

5.3 Scalar values, represented by real numbers in the logical words of CLDATA, are shown by the symbols *a, b, c, d,* etc.

5.4 Character items are represented by "character item" (see 4.4).

5.5 Where an alternative, but non-standard, order of the items within a minor element is known to be frequently used, the non-standard order is shown in parentheses in the minor element definitions. These orders of the items shall be understood to be non-preferred.

5.6 The key vocabulary minor words, their integer code numbers and brief definitions are listed in alphabetical order and in numerical order in annex B.

5.7 Cross-references between the minor words and the major words that use them are given in annex C.

5.8 The major words utilized in this International Standard are listed in annex D for reference purposes. The standard definition of major words is embodied in ISO 3592.

A I R

[Integer code $n = 1011$]

Air. Controls the supply of air.

Syntax

AIR / ON / OFF [, *a*]

Minor element definitions and integer code numbers

ON	IC = 71	Specifies air is on.
OFF	IC = 72	Specifies air is off.
a		Specifies the time in seconds during which air is on.

A U X F U N [Integer code $n = 1022$]

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

Syntax

AUXFUN / $a\begin{matrix}n\\0\end{matrix}$ [, a]

Minor element definitions

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

C H U C K

[Integer code $n = 1073$]

Chuck. Specifies the chuck to be used.

Syntax

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

CHUCK/*a*, *g*

Minor element definitions (see 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.

C L A M P

[Integer code n = 1074]

Clamp. Controls a holding operation.

Syntax

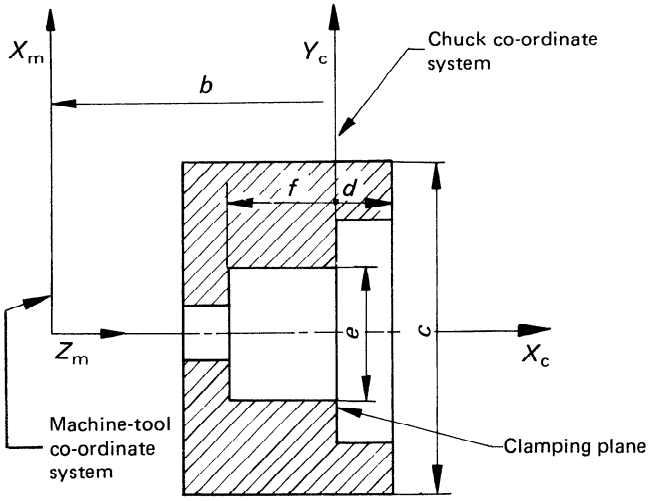
CLAMP/*a* [, INVERS]

CLAMP/ 1 [ALL, COLLET, PALLET, RAIL, SADDLE, TABLE,] [ON, OFF]

0 [*b*,]

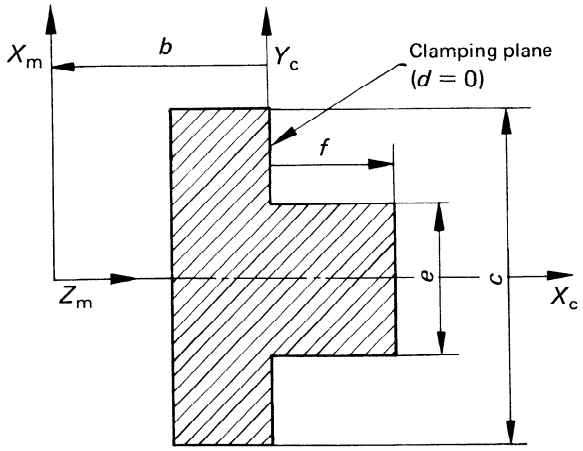
Minor element definitions and integer code numbers (See figures 3 and 4)

a		Specifies the position of the clamping plane in terms of the part co-ordinate system.
INVERS	IC = 6	Specifies rotation of the part by 180° in the *XY* plane before clamping.
ALL	IC = 51	Specifies all holding devices.
COLLET	IC = 139	Specifies a collet device.
PALLET	IC = 239	Specifies a pallet device.
RAIL	IC = 93	Specifies a rail device.
SADDLE	IC = 150	Specifies a saddle device.
TABLE	IC = 177	Specifies a table device.
b		Specifies a device by number.
ON	IC = 71	Initiates the operation.
OFF	IC = 72	Terminates the operation.



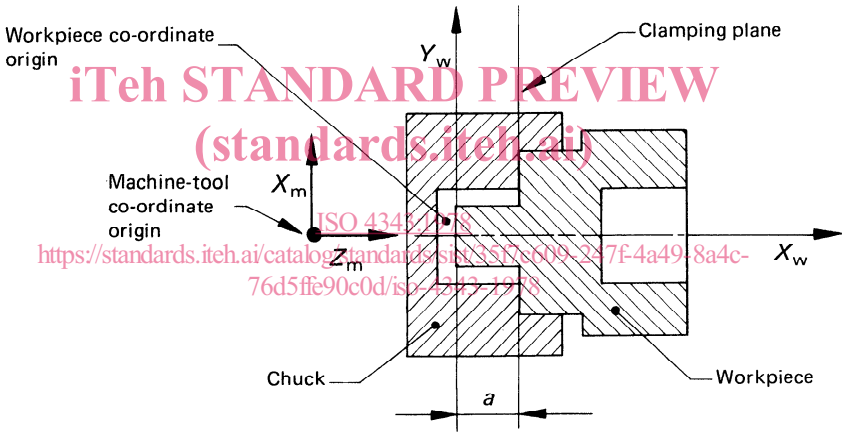
CHUCK/*a, b, c, d, e, f*
for example : CHUCK/11, 240, 300, 60, 120, – 100

FIGURE 1 – **Description of an external clamping chuck**



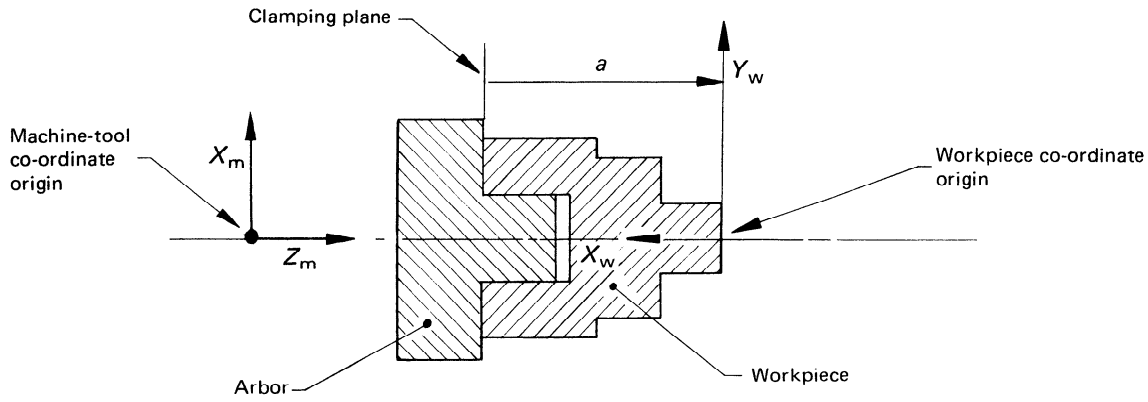
CHUCK/*a, b, c, d, e, f*
for example : CHUCK/12, 240, 300, 0, 120, 100

FIGURE 2 – **Description of a mounting arbor**



CLAMP/*a*
for example : CLAMP/80

FIGURE 3 – **Clamping with an external clamping chuck**



CLAMP/*a*, INVERS
for example : CLAMP/300, INVERS

FIGURE 4 – **Clamping at a mounting arbor in a position turned through 180°**

C L D I S T [Integer code $n = 1071$]

Clearance distance. 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.

C L E A R P

[Integer code $n = 1004$]

Clearance plane. Specifies a clearance plane to which the tool tip will be moved when RETRCT (7) is encountered.

Syntax

CLEARP/[symbol, *a*,] *b*, *c*, *d*, *e*

[XYPLAN,]*e*
CLEARP/ YZPLAN, *e*
ZXPLAN, *e*

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, if any, or zero.
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, *e*	IC = 33	Defines the position of a plane normal to the *Z*-axis in the part co-ordinate system.
YZPLAN, *e*	IC = 37	Defines the position of a plane normal to the *X*-axis in the part co-ordinate system.
ZXPLAN, *e*	IC = 41	Defines the position of a plane normal to the *Y*-axis in the part co-ordinate system.

C L R S R F

[Integer code $n = 1057$]

Clearance surface. Specifies a clearance surface to which the tool tip will be moved when RETRCT (7) is encountered*.

Syntax

CLRSRF/[[PLANE,] symbol, a,] b, c, d, e

Minor element definitions and integer code numbers

PLANE, symbol, a	IC = 3003	Inserted by the processor when the symbolic plane is previously defined. a is either a subscript, if any, or zero.
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.

* Currently, only planes are defined as clearance surfaces.

C O O L N T [Integer code n = 1030]

Coolant. Specifies coolant flow, or type, or both.

Syntax

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

Minor element definitions and integer code numbers

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

COUPLE

[Integer code $n = 1049$]

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

Syntax

COUPLE / ON / OFF

Minor element definitions and integer code numbers

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

C U T C O M

[Integer code n = 1007]

Cutter compensation. 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 / RIGHT / LEFT } [, LENGTH [, *a*]]

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

CUTCOM / { ON / OFF / RIGHT / LEFT / *e* } [{ , XYPLAN / , YZPLAN / , ZXPLAN }] [[, OSETNO, *e*]]

CUTCOM / { ON / OFF / RIGHT / LEFT } [, RADIUS, *f*]

Minor element definitions and integer code numbers

ON	IC = 71	Causes cutter compensation information to be output.
OFF	IC = 72	Causes cancellation of the last CUTCOM command.
RIGHT	IC = 24	Specifies position of the cutter in relation to the workpiece in accordance with ISO 1056.
LEFT	IC = 8	
LENGTH	IC = 9	Specifies tool length compensation.
LENGTH, *a*	IC = 9	Specifies a cutter compensation register to be used with length compensation.
XCOORD, *b*	IC = 116	Specifies a cutter compensation register to be associated with the *X*-axis.
YCOORD, *c*	IC = 117	Specifies a cutter compensation register to be associated with the *Y*-axis.
ZCOORD, *d*	IC = 118	Specifies a cutter compensation register to be associated with the *Z*-axis.
XYPLAN	IC = 33	Specifies the plane of compensation.
YZPLAN	IC = 37	
ZXPLAN	IC = 41	