International Standard 6582

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Shipbuilding — Numerical control of machines — ESSI format

Construction navale — Commande numérique des machines — Format ESSI

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (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 authorized 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 6582 was developed by Technical Committee ISO/TC 8, *Shipbuilding and marine structures*, and was circulated to the member bodies in August 1981.

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

Austria	Italy	Poland
Belgium	Japan	Portugal
Brazil	Korea, Dem. P. Rep. of	Romania
Czechoslovakia	Korea, Rep. of	Spain
Egypt, Arab Rep. of	Mexico	Sweden
Germany, F.R.	Netherlands	United Kingdom
India	Norway	USSR

No member body expressed disapproval of the document.

Printed in Switzerland

Shipbuilding — Numerical control of machines — ESSI format

0 Introduction

"The ESSI format" originally developed by the Central Institute for Industrial Research (SI), Oslo, Norway, is widely used for NC drawing and flame cutting machines. It has also been adopted by other manufacturers of drawing machines, flame cutting machines and controllers. The technical progress of this equipment has led to an enlarged table of machine functions, but the lack of coordination between the various manufacturers has resulted in different, incompatible "ESSI formats" being adopted. Difficulties in data transfer and communication between different users have been the result of these individual developments.

In order to avoid faults in the data transfer, the normal practice is to use the same physical control tape (paper tape, magnetic tape etc.) for both the NC drawing machine and the NC production machine. As the tape must contain the operational codes for both machines, care has to be taken to ensure that codes or machine functions not required for a particular machine will be ignored by its controller. As this problem also applies to control systems other than those using the "ESSI format", it will not be covered by this International Standard.

As communication and the interchange of data become more and more important in the future of shipbuilding, this International Standard will create a common basis for the control of those NC machine tools that use "ESSI format".

This International Standard will guarantee compatibility of programs and controllers of different origin and lead to better communication between hardware manufacturers, program originators and users of numerical control (NC) machine tools.

"The ESSI format" may be used in connection with any data code for punched cards, punched tapes, magnetic tapes etc. Use of standardized data codes is however strongly recommended.

Revisions of this International Standard will be proposed as technical progress warrants, or as future standards are adopted which conflict with this standard.

Annexes A and B form integral parts of this International Standard.

1 Scope and field of application

This International Standard specifies the ESSI format. It serves as a guide in the co-ordination of system design, to minimize the variety of programs required, to promote uniformity of programming techniques, and to foster interchangeability of programs between NC drawings and flame cutting machines used in the shipbuilding industry.

2 References

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

ISO 2806, *Numerical control of machines — Vocabulary.*

The definitions of terms and the nomenclature used in this International Standard are in accordance with the above mentioned Standards.

3 Words

3.1 The length of each specific word as assigned by the format classification is not specified.

3.2 For three-axis machines only, address characters shall be the first characters of a word.

3.3 Dimension words shall be incremental (although absolute coordinates can be introduced by means of functions 81 and 82) and shall contain digital data as follows :

3.3.1 All linear increments shall be expressed in digits preceded by an algebraic sign indicating direction.

3.3.2 Each block shall have digits for each increment except that if the digits for any axis are all zeroes, only the algebraic sign need be inserted for that word.

3.4 Non-dimension words shall contain data as follows :

3.4.1 Machine functions (auxiliary functions) shall consist of at most three (3) unsigned digits. (For designations, see annex B.)

4 Blocks

4.1 The maximum number of characters per block for any particular case may be derived from the format details found in annex A.

4.2 The end of each block of information shall be indicated by one of the following :

a) LF (Line Feed) character;

b) CR (Carriage Return) character;

c) both LF and CR.

To cater for control tapes using both characters (LF and CR), controllers needing only one should have the facility to ignore the other. In addition the first block of information shall be preceded by this (these) character(s).

4.3 If an initialisation block is present, for example in the case of facilitating an automatic rewind or an automatic code detection, it should be a special sign (% in ISO, EOR in EIA-punching code).

5 Addresses

5.1 In the variable block format the axis address consists of an unsigned digit (see annex B).

Annex A

Format description

A.1 The number of dimension words in a block determines the type of curve, as follows :

a) two (2) words give a straight line;

b) five (5) words give a circular arc;

c) six (6) words give a parabolic arc.

A.2 For three-axis machines, the dimension words in a block are to be preceded by an address in that block.

A.3 For a straight line, the two (2) dimension words will consist of the signed numerical values of DX, DY in that order (figure 1) (see A.7 for definitions).

A.4 For a circular arc, the five (5) dimension words will consist of the signed numerical values of DX, DY, XC, YC, TC in that order (figure 2).

A.5 For a parabolic arc, the six (6) dimension words will be the signed numerical values of DX, DY, XP, YP, TC, TP in that order (figures 3 and 4).

A.6 All the numerical values mentioned in A.3 to A.5 are expressed in unit increments; this unit increment being the property of any particular contouring numerical controlled machine.

A.7 The symbols used in this annex are defined in the list below. The description refers to a cartesian coordinate system.

Symbol	Definition
X	Longitudinal axis of the reference system (right handed)
Y	Transverse axis of the reference system (right handed)
DX	Longitudinal coordinate of end point
DY	Transverse coordinate of end point
XC	Longitudinal coordinate of circle centre
YC	Transverse coordinate of circle centre
XP	Distance from starting point to axis of parabola (parabola axis parallel to transversal axis). Alternatively radius of curvature at the vertex; calculated from vertex (parabola axis parallel to longitudinal axis)
YP	Distance from starting point to axis of parabola (parabola axis parallel to longitudinal axis). Alternatively radius of curvature at the vertex; calculated from vertex (parabola axis parallel to transverse axis)
TC	Rotation direction of circle or parabola (+ when CCW rotation and − when CW rotation)
TP	Type of parabola (+ when axis of parabola is parallel with transverse axis − when axis of parabola is parallel with longitudinal axis)

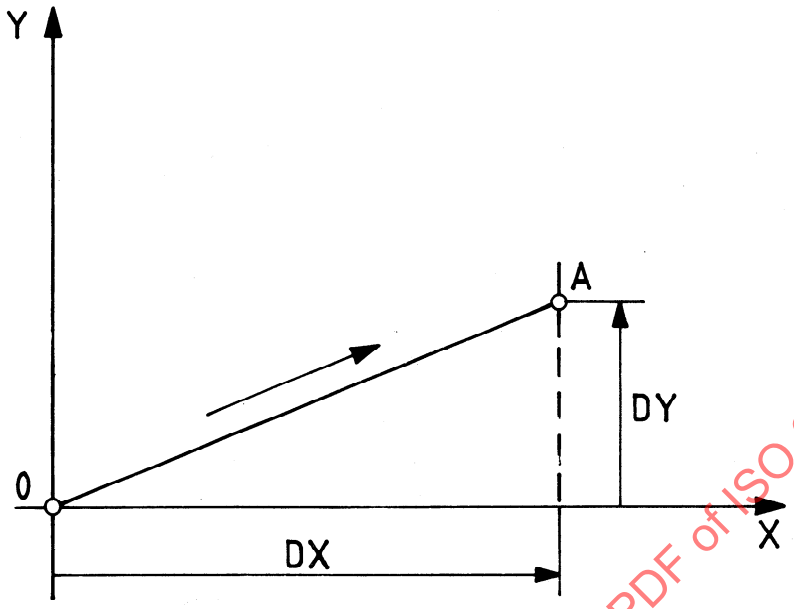


Figure 1

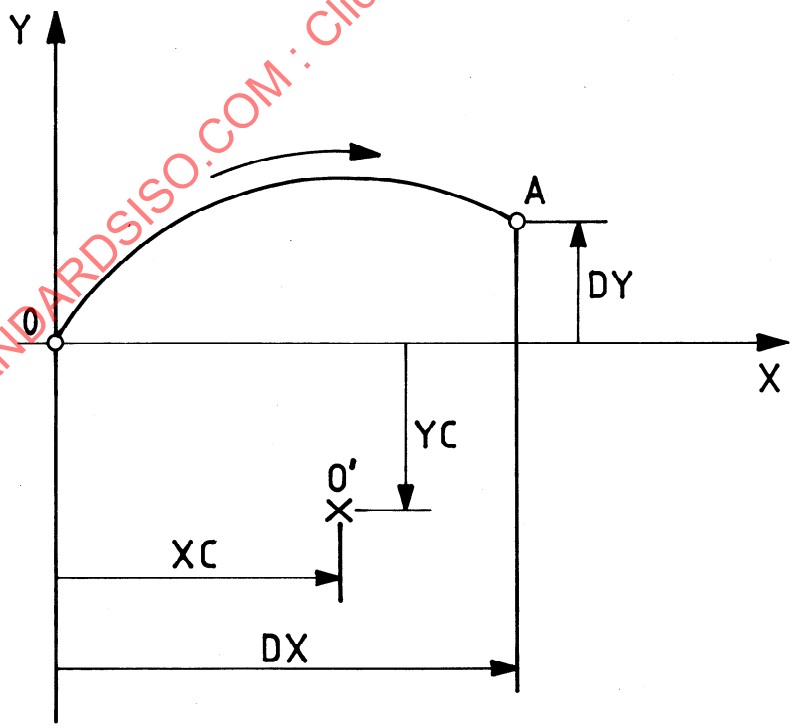


Figure 2

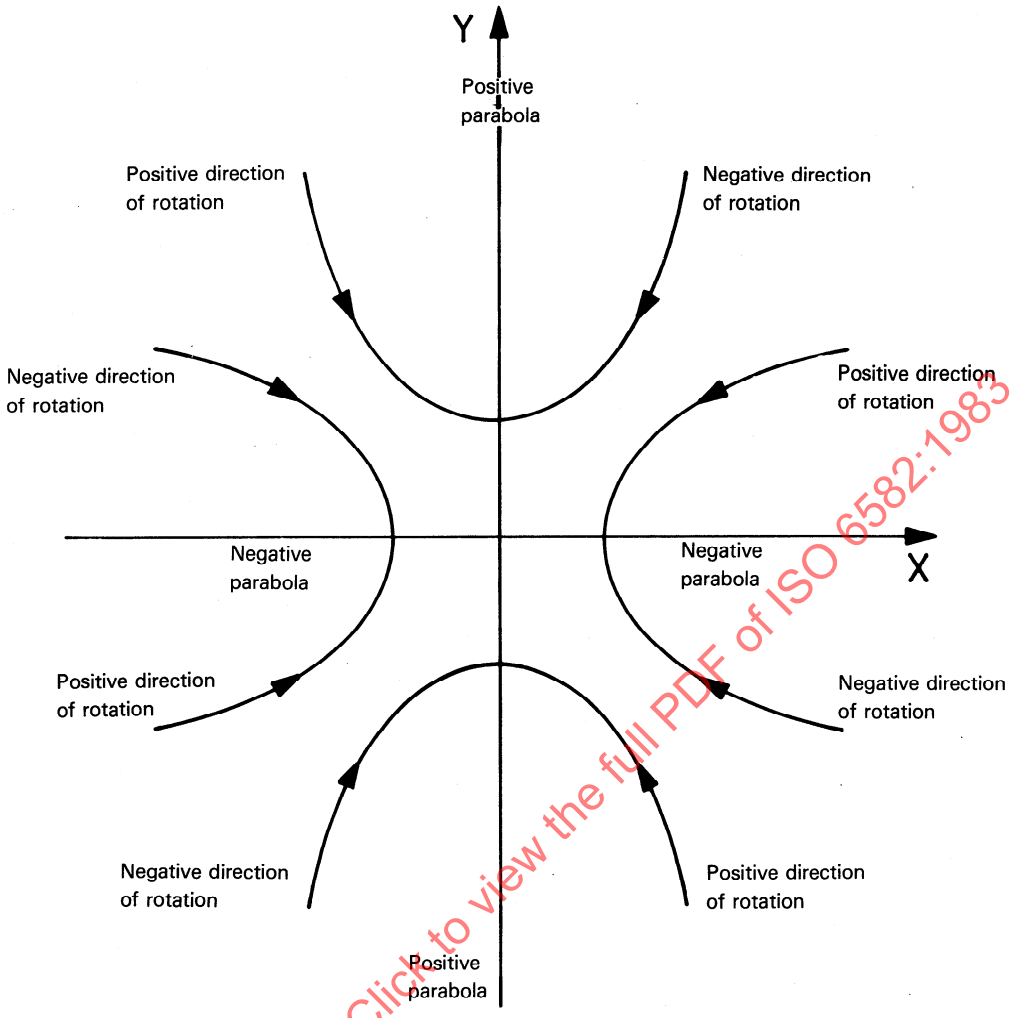


Figure 3

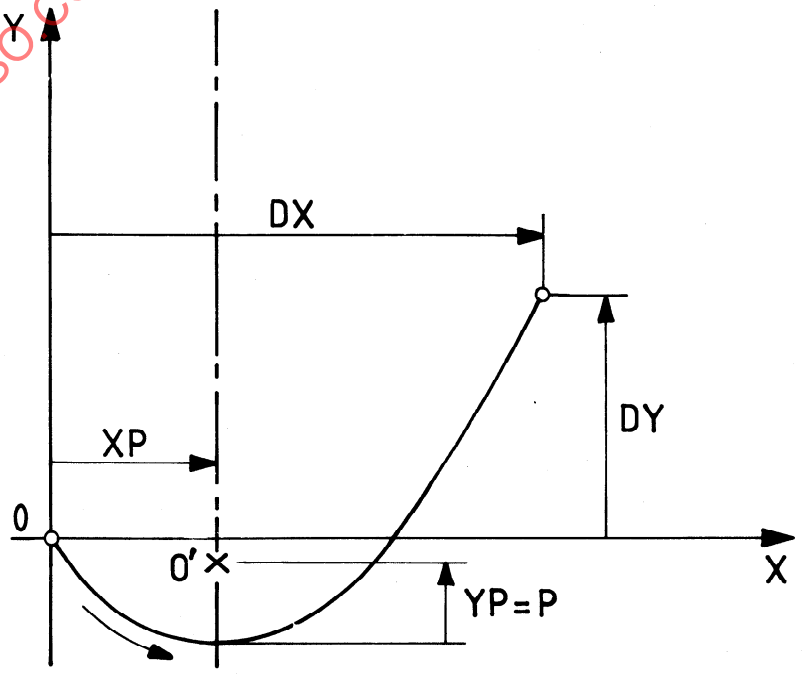


Figure 4

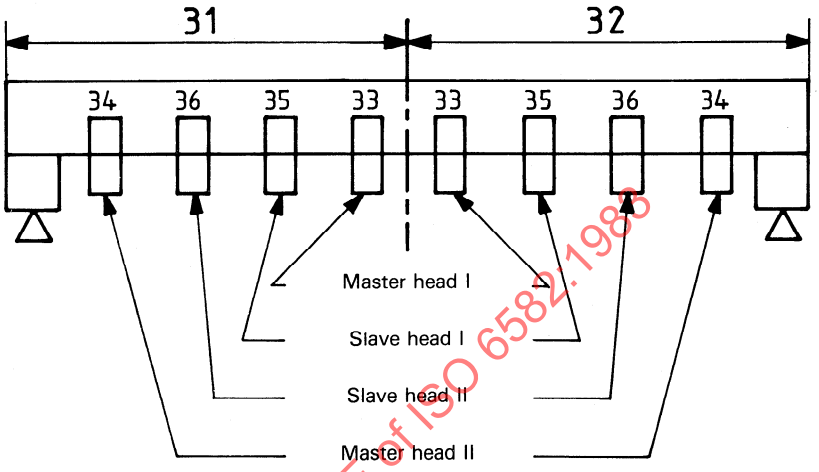
Annex B

Machine functions (auxiliary functions)

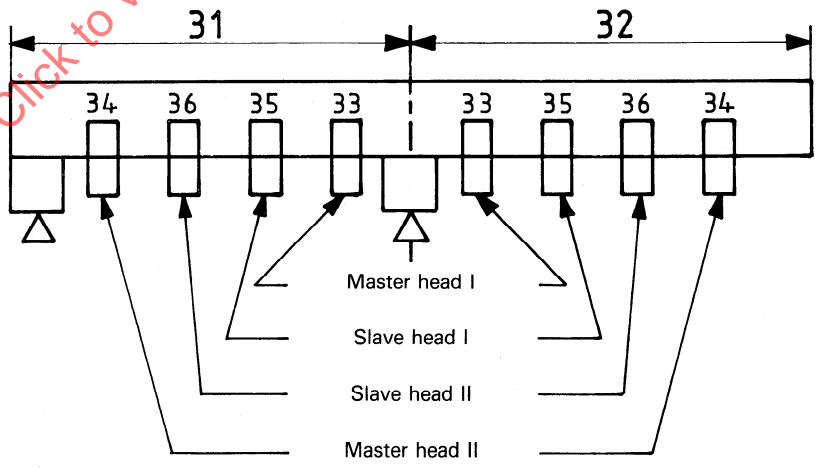
(The minimum set of machine functions is listed at the end of this table.)

Code	Function	Explanation
0	Programmed stop	Enables the programmer to stop the flame cutter operation via tape.
1	Address of head No. 1	On a 3-axis machine with code 19 in operation, data with this address is directed to head No. 1.
2	Address of head No. 2	On a 3-axis machine with code 19 in operation, data with this address is directed to head No. 2.
3	Ignore ON	Used to allow additional information on the tape, i.e. identification, part No., instructions for telex transmissions, etc.
4	Ignore OFF	All information between "3" and "4" will be ignored by the controller.
5	Rapid traverse ON	The machine will move with rapid traverse speed until this is cancelled by machine function 6. If for reasons of simplicity, machine function 6 is not installed, then machine function 5 is applicable only to the end of the first data block following it.
6	Rapid traverse OFF	This machine function cancels function 5.
7	Oxygen ON	Cutting oxygen ON (tool No. 1 ON).
8	Oxygen OFF	Cutting oxygen OFF (tool No. 1 OFF).
9	Punch marking ON	Punch marking ON (tool No. 2 ON) } See also codes 110, 111
10	Punch marking OFF	Punch marking OFF (tool No. 2 OFF) }
11	Punching marking offset ON	Moves marking tool (tool No. 2) to the previous position of centre torch (tool No. 1).
12	Tool offset OFF	Reverses the movement by moving the centre torch (tool No. 1) to its original position.
13	Left bevel torch ON	The cutting oxygen is turned ON at the left bevel torch. This torch is on the left hand side of the head looking in the direction of the head movement.
14	Left bevel torch OFF	Left bevel torch cutting oxygen OFF.
15	Right bevel torch ON	The cutting oxygen is turned ON at the right bevel torch. This torch is on the right hand side of the head looking in the direction of the head movement.
16	Right bevel torch OFF	Right bevel torch cutting oxygen OFF.
17	Acceleration control	The machine will decelerate at the end of, and accelerate at the beginning of, the data blocks following this machine function until it is cancelled by machine function 18. If for reasons of simplicity, machine function 18 is not installed, the machine will decelerate at the end of the next data block and accelerate at the beginning of the subsequent block.
18	Acceleration control OFF	This function cancels function 17.
19	3-axis control	System set for 3-axis mode.
20	2-axis control	System set for 2-axis mode.
21	+ X + Y (normal)	Coordinate rotation and mirror image positioning.
22	+ X − Y	
23	− X − Y	
24	− X + Y	
25	− Y − X	
26	+ Y − X	
27	+ Y + X	
28	− Y + X	
29	Left kerf width compensation ON	Compensation of the torch diameter ON.
30	Right kerf width compensation ON	

Code	Function	Explanation
31	Left hand (portal side)	The use of the head addressing functions 31-36 allows appropriate commands to be addressed to a selection of heads according to the illustration below :
32	Right hand (cantilever) side	
33	Master head set I (inside)	
34	Master head set II (outside)	
35	Slave head set I (inside)	
36	Slave head set II (outside)	
37	Unassigned	
38	Kerf width compensation OFF	Compensation of the torch diameter OFF. Cancels codes 29 or 30.
39	Unassigned	
40	Unassigned	
41	Dwell	This function starts the delay timer causing a delay and thus improving corners of thick plates.
42	Burner bridge	Burners will be turned off and the machine will continue along the next programmed contour for a fixed distance before the burners are turned on again.
43	Unassigned	
44	Unassigned	



Portal machine facing to the front



Cantilever machine facing to the front