
Cutting tool data representation and exchange —

Part 70: Graphical data layout — Layer setting for tool layout

*Représentation et échange des données relatives aux outils
coupants*

*Partie 70: Disposition des données graphiques — Disposition en
couches des paramètres des outils*

PROOF/ÉPREUVE



iTeh STANDARD PREVIEW
(standards.iteh.ai)

Full standard:
<https://standards.iteh.ai/catalog/standards/sist/06e84239-9f5c-4d1a-b8b4-73f686ab2171/iso-ts-13399-70-2016>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	iv
Introduction	vi
1 Scope	1
2 Terms and definitions	1
3 Layer concept	4
4 Structure of the layers	5
4.1 General.....	5
4.2 Colouring of the layers.....	5
4.3 Grouping and definition of the layers.....	6
4.3.1 Grouping.....	6
4.3.2 Basic layer.....	6
4.3.3 Tool drawing (main view — function number 3.0.1).....	6
4.3.4 NC-Geometry (CUT, NOCUT — function number 3.0.2).....	8
4.3.5 Extended tool drawing (further views — function number 3.0.3).....	9
4.3.6 Multilingual (global drawing — function number 3.0.4).....	10
4.3.7 Tool reconditioning (supplier specific information — function number 3.0.5).....	12
4.3.8 Machine equipment layout (machining processes — function number 3.0.6).....	13
4.3.9 Drawing frame (multilingual and drawing space — function number 3.0.7).....	15
4.4 Determination of the layer properties.....	15
4.5 Rules of the layer concept.....	27
5 Data concept	28
5.1 Origin points and mating points.....	28
5.1.1 Rotationally symmetric cutting tool assembly.....	28
5.1.2 Non-rotationally symmetric cutting tool assembly.....	29
5.2 Rules for the Layer CUT and NOCUT.....	30
5.3 Rules for the concept of dimensioning.....	32
5.3.1 General.....	32
5.3.2 Cutting tool component.....	32
5.3.3 Cutting tool combination.....	33
Annex A (informative) Examples of the layer structure	34
Bibliography	49

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 29, *Small tools*.

ISO 13399 consists of the following parts, under the general title *Cutting tool data representation and exchange*:

- *Part 1: Overview, fundamental principles and general information model*
- *Part 2: Reference dictionary for the cutting items* [Technical Specification]
- *Part 3: Reference dictionary for tool items* [Technical Specification]
- *Part 4: Reference dictionary for adaptive items* [Technical Specification]
- *Part 5: Reference dictionary for assembly items* [Technical Specification]
- *Part 50: Reference dictionary for reference systems and common concepts* [Technical Specification]
- *Part 60: Reference dictionary for connection systems* [Technical Specification]
- *Part 70: Graphical data layout — Layer settings for tool layout* [Technical Specification]
- *Part 71: Graphical data layout — Creation of documents for the standardized data exchange: graphical product information* [Technical Specification]
- *Part 72: Creation of documents for the standardized data exchange — Definition of properties for drawing header and their XML-data exchange* [Technical Specification]
- *Part 80: Creation and exchange of 3D models — Overview and principles* [Technical Specification]
- *Part 100: Definitions, principles and methods for reference dictionaries* [Technical Specification]
- *Part 150: Usage guidelines* [Technical Specification]
- *Part 201: Creation and exchange of 3D models — Regular inserts* [Technical Specification]

- *Part 202: Creation and exchange of 3D models — Irregular inserts* [Technical Specification]
- *Part 203: Creation and exchange of 3D models — Replaceable inserts for drilling* [Technical Specification]
- *Part 204: Creation and exchange of 3D models — Inserts for reaming* [Technical Specification]
- *Part 301: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Modelling of thread-cutting taps, thread-forming taps and thread-cutting dies* [Technical Specification]
- *Part 302: Concept for the design of 3D models based on properties according to ISO/TS 13399-3: Modelling of solid drills and countersinking tools* [Technical Specification]
- *Part 303: Creation and exchange of 3D models — Solid end mills* [Technical Specification]
- *Part 304: Creation and exchange of 3D models — Solid milling cutters with arbor hole* [Technical Specification]
- *Part 307: Creation and exchange of 3D models — End mills for indexable inserts* [Technical Specification]
- *Part 308: Creation and exchange of 3D models — Milling cutters with arbor hole for indexable inserts* [Technical Specification]
- *Part 309: Creation and exchange of 3D models — Tool holders for indexable inserts* [Technical Specification]
- *Part 311: Creation and exchange of 3D models — Solid reamers* [Technical Specification]
- *Part 312: Creation and exchange of 3D models — Reamers for indexable inserts* [Technical Specification]
- *Part 401: Creation and exchange of 3D models — Converting, extending and reducing adaptive items* [Technical Specification]
- *Part 405: Creation and exchange of 3D models — Collets* [Technical Specification]

The following parts are under preparation:

- *Part 305: Creation and exchange of 3D models — Modular tooling systems with adjustable cartridges for boring* [Technical Specification]
- *Part 310: Creation and exchange of 3D models — Turning tools with carbide tips* [Technical Specification]
- *Part 315: Creation and exchange of 3D models — Modelling of machine operated feed out tools* [Technical Specification]

Introduction

This part of ISO 13399 defines the terms, properties and definitions of the layers of a computer-aided design. The purpose of this part of ISO 13399 is to provide a reference layer setting to support the use of CAD-designs of tool graphics to be used for simulation and documentation of cutting tool components and assemblies. The base of this part of ISO 13399 is the common layer structure of the production facility graphic — better known as BMG layer structure. Mainly, this concept was used and will be used for the graphical layout of cutting tools and their components within the 2D area. Examples of the layer structure are given in Annex A.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Full standard:
<https://standards.iteh.ai/catalog/standards/sist/06e84239-9f5c-4d1a-b8b4-73f686ab2171/iso-ts-13399-70-2016>

Cutting tool data representation and exchange —

Part 70:

Graphical data layout — Layer setting for tool layout

1 Scope

This part of ISO 13399 is intended to be used for the design of tool layouts for the simulation and the documentation of cutting tool components and cutting tool assemblies. This part of ISO 13399 can be used in connection and correlation with other parts of the ISO 13399 series.

The main purpose of this layer structure is the graphical layout of cutting tool components and cutting tool assemblies to be used within tool pre-setting, NC programming and the simulation of processes, as well as for the design of the machining equipment layout.

The common concept of the BMG layer structure has been extended with more layer definitions for universal use. This part of ISO 13399 is applicable for a new layout; old, existing data files are not updated to this level. The use of this part of ISO 13399 in terms of change management of existing cutting tool layout is at the manufacturer's discretion.

The extent of the dimensioning is limited to the number of dimensions that are also populated within manufacturer's or distributor's catalogues. The manufacturer determines the level of details and is understood as tool specific.

As the 3D-simulation systems proceed with stock removal, it is differentiated between cutting and non-cutting tool components. Also, the data concept includes the rules of zero points and mounting points for non-rotating tools (lathe tools).

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1

assembled tool

AT

tool components (also single parts and spare parts) that are arranged to an assembled tool to be able to run a computer-aided application

2.2

centre line

line that defines the axis of a rotational body or the symmetric axis of a feature

EXAMPLE Axis of a hole.

2.3

cladding contour

continuous line built from single lines which describes the outer contour of a complete tool or tool component that is relevant for collision purposes

2.4

colour index DXF

numerical value of a colour within the application of data transmission under the drawing exchange format DXF

Note 1 to entry: All CAx-systems interpret uniformly this colour index.

**2.5
complete tool**

illustration of single-tool components as in an assembled tool that is applicable to be used in simulation processes, machining equipment layout and for the development of NC-programs

**2.6
connection (workpiece side/machine side)**

transition from one tool component to the other seen in the respective direction of the transition, while mounting both adjacent components

Note 1 to entry: Machine side means that the connection is seen in the direction of the machine spindle, workpiece side calls a connection on the side of the component which points in the direction of the workpiece.

**2.7
cutting contour**

outer contour of an object that describes the part of a cutting tool that actively takes part in a cutting process and if revolved around the axis of the tool will change to a three-dimensional object

Note 1 to entry: Anomaly exists on drilling tools, where the lateral area is to be shown up to the maximum usable (drilling) depth, while if necessary, a cone exists, and this cone is non-cutting.

**2.8
data exchange format (DXF)**

basic version of the graphical data exchange

**2.9
dimensioning**

representation of the spatial expansions of an object

Note 1 to entry: In this part of ISO 13399, dimensioning is performed according to ISO standards, e.g. ISO 16792.

**2.10
expansion of the main view
INFMAINVIEW**

maximum needed space of the main view, which is determined by two of each horizontal and vertical lines and its distances

Note 1 to entry: Either the two corner points in diagonal distance, lower left and upper right $[(x_1, y_1)/(x_2, y_2)]$, or the corresponding lines are indicated.

**2.11
expansion of the total drawing
INFTOTAL**

maximum needed space of the entire graphic images including any additional information, but without a drawing frame and its variable content, which is determined by two of each horizontal and vertical lines and its distances

Note 1 to entry: Either the two corner points in diagonal distance left lower and right upper $[(X_1, Y_1)/(X_2, Y_2)]$ or the corresponding lines are indicated.

**2.12
font size**

standardized size of the letters within technical drawings

Note 1 to entry: The font size also controls the corresponding thickness of the lines and is defined in ISO 6428.

**2.13
font type**

definition of the style of lettering within the CAx-systems

2.14**inner contour**

illustration of object elements placed inside the object body and are therefore not visible

Note 1 to entry: These elements are shown as invisible contours in a defined line style.

2.15**line type**

characteristic of lines to differentiate the meaning within a technical drawing

Note 1 to entry: The definition and application of the line types is defined in ISO 128-20.

2.16**machining equipment layout**

representation of the sequence of the work routines which are likely to produce a workpiece within a process cycle

Note 1 to entry: The work routine can follow mechanically by means of chipping working steps in the mechanical manufacture or by means of working steps without chipping in the assemblies.

Note 2 to entry: Machining equipment layouts are designed only by means of bilateral agreements between a supplier and an end user.

2.17**main view****MV**

view of an object showing the function and where the main dimensions (functional dimensions) are attached to

2.18**non-cutting contour**

outline contour of an object describing the area of a cutting tool, which does not take part in the active cutting process and therefore can collide with the workpiece

Note 1 to entry: Anomaly on drilling tools (see 3.7).

2.19**outer contour**

visible contour of an object

2.20**RECON**

determination of layers solely used to illustrate contours and dimension to exchange information for the recondition of cutting tools only

2.21**RGB-values**

red, green and blue numerical values of a colour to illustrate this colour explicit within the different CAx-systems

2.22**single part****SP**

component of an assembled tool that is needed to show the function and the collision-relevant devices

2.23**SK-layer (single component)**

determination of layers, which are intended to show only features that are used for cutting tool components, and will be blank if an assembled tool is shown

2.24

SKVIEW

determination of layers, applied only, if it is sufficient to show the functional application on the main view

Note 1 to entry: All of the necessary views, cross sections and details have to be filed within this layer grouping.

2.25

tool axis (rotational axis)

imaginary line on rotational tools where the tool revolves to actively take part in a machining process

2.26

tool component

single cutting tool or tool holder (adaptor) that can form an assembled cutting tool, if mounted

2.27

tool contour

whole visible outline of a tool

3 Layer concept

The layer structure shall be designed in a way that all requirements of the layout of cutting tool assemblies and their components shall be fulfilled. This is mainly feasible for the tool pre-setting to be used as information for the tool procurement and tool management.

The interface contours of the cutting tool components, which become invisible in the assembly, shall be filed at the SK-layers. Therefore, it is guaranteed that these contours are not shown on tool assemblies because of the confusing views.

On the other hand, it is very reasonable to show coolant channels, for example, in the tool assembly, as well as in the tool component. Therefore, Layer 3 shall be arranged to file the hidden contours contained in tool assemblies and tool components.

The same principle shall apply to the dimensioning. Here, the dimensions shall be on Layer 2 if they are visible in the assembled tool.

Layer 6, correspondingly layer SK6, shall be used for text which is independent from any language. This information shall be filed here and shall not be translated into a foreign language (e.g. catalogue number or ordering number of the tool component or of the assembled tool, and so on. Textual information that has to be interpreted in another language for better understanding shall be filed in the respective layers of the grouping "multilingual."

If, beside the main view, other views, details, and cross sections, etc. are required to the designated and functional use of graphic data, the layer from the grouping, SKVIEW shall be used.

Parts of this layer concept do not meet the generally admitted exchange of graphical data, but are limited to special areas, which shall be stipulated bilaterally between the tool manufacturer, or tool supplier and the user. This applies to the area of sensitive data, e.g. the reconditioning ("RECON") of cutting tools, or also the provision of complete machine equipment layouts (Layer 100 to Layer 200).

DXF version 2000 with its code AC1015 shall be determined as the basic version for the graphical data exchange. It shall not be allowed to transfer blocks (except frames, headers, and logos), external references and OLE objects. The point of origin shall be located onto the main view, which has to be in scale 1:1.

4 Structure of the layers

4.1 General

By the explicit structure of the layers, seven main functions can be defined and shall be as given in [Table 1](#).




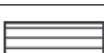


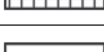
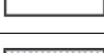

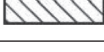
Table 1 — Grouping of the layers with their main functions

Function number	Description of the function	Grouping of the function
3.0.1	Tool drawing	Main view
3.0.2	NC-geometry	CUT, NOCUT
3.0.3	Extended tool drawing	Further views, cross sections, details, references
3.0.4	Multilingualism	Global drawings with lingual information
3.0.5	Tool reconditioning	Supplier internal information for reconditioning
3.0.6	Machine equipment layouts	Machine spindle, workpiece, fixture, operation path
3.0.7	Drawing frame	Drawing frame – multilingual and drawing space

4.2 Colouring of the layers

To make it possible to show the colours of the layers in this part of ISO 13399, patterns are assigned to the colours. The patterns are depicted in [Table 2](#).

Table 2 — Allocation of the colours to RGB values and patterns

Colour	RGB-value			Colour index DXF	Pattern
	R	G	B		
Red	255	0	0	1	
Yellow	255	255	0	2	
Green	0	255	0	3	
Cyan	0	255	255	4	
Blue	0	0	255	5	
Magenta	255	0	255	6	
White	255	255	255	7	
Grey	192	192	192	9	
Orange	255	127	0	30	
Olive	0	127	0	96	

4.3 Grouping and definition of the layers

4.3.1 Grouping

The grouping of the layers is divided into three main groups:

- M = mandatory;
- C = conditional (depending on requirements);
- O = optional (upon request).

4.3.2 Basic layer

Each graphical file imported into another system via DXF interface shall have the basic layers according to [Table 3](#).

Table 3 — Basic layers

Main group	Designation	Layer name	Layer number	Layer description	Definition
0	Basic layer	0	0	System layer	Layer 0 is optional. For autocad system, layer 0 is mandatory.
0	Basic layer	Defpoints ^a	0	System layer	Compulsory needed in the CAD system; no further relevance for the drawing layout.

^a Layer is determined mainly in the 3D design mode and is not compulsory for DXF files, therefore, only optional.

4.3.3 Tool drawing (main view — function number 3.0.1)

Within the tool drawing, Layers 1 to 4, 6, 7, and 11 for assembled tools shall be as defined in [Table 4](#) and Layers SK1 to SK4, SK6, and SK7 for tool components shall be as defined in [Table 5](#).

Table 4 — Layers for the main view for assembled cutting tools

Main group	Designation	Layer name	Layer number	Layer description	Definition
M	Main view of assembled tools and visible tool components	1	1	Contour	Outer contours that describe the contour of an assembled tool if tool components are mounted virtually.
		2	2	Dimensioning	Dimensions that are shown if different tool components are mounted virtually. Attention: The dimensions may not be drawn across the outer contour of Layer 1 because of the possible collision of the dimensions. There is also no associativity between the dimensions and the related geometrical features.
		3	3	Reference line/ inner contour	Reference lines and inner contours (invisible lines) that are displayed if an assembled tool is mounted virtually.
		4	4	Centre line	Centre lines of the single components, which create the entire centre line of the assembled tool, if mounted virtually. This centre line always starts at the first visible contour edge of the tool component and ends always at the last contour edge. It is not allowed to extend the centre line across the body contour.
		6	6	Text assembled tools (language independent)	Language-independent texts of the single components, which contain information for the assembled tool, if the components are mounted virtually. The positions of these texts should be located as accurate as possible above or below the tool component.
		7	7	Hatching	Hatching of cross sections or half cross sections, which has to be illustrated at the assembled tool, if mounted virtually.
		11	11	Additional line	Thin solid line for the illustration of thread root, imaginary line, bending line or similar drawing features.