



**Test Suite
CAX Implementor Forum
Round 2J**

July - October 1999

August 31st, 1999

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1.0 Introduction

This document describes the suite of test cases to be used for the second round of testing of the CAx implementor forum. The CAx implementor forum is a joint platform of the organisations and vendors previously engaged in the ProSTEP CAD Round Table and the PDES, Inc. STEPnet.

The test rounds of the CAx Implementor Forum continue the tradition of the Test Rallies and STEPnet test rounds in testing STEP processor conformance and interoperability.

The test rounds will in general combine testing of synthetic models and production models. Production models will in most cases be provided by the member companies of the organizations PDES, Inc. and ProSTEP.

This test suite includes synthetic models for testing the capabilities form features (round_hole), model viewing, dimensions & drawing organization, 3D annotation and validation properties.

Production models are provided for solid assemblies. The basis for the production test cases is native CAD models. Each test case is therefore originating from a single CAD system, and the set of test cases to be preprocessed (converted to STEP) is unique for each CAD system. After preprocessing, the resulting STEP files are then to be read in by all participants

1.1 Functionality tested in this round

Concerning new functionality to date untested the test round focuses on form features and the presentation of (non-associative) dimensions on drawing views.

Functionality addressed before relates to 3D annotation/associative text, validation properties and model viewing functionality.

Associative text is the capability to associate to text notes in 3D model space with portions of the model.

Validation properties (in AP214 named shape_dependent_properties) is a mechanism to allow the exchange of geometric properties and their assignment to geometric representations for the purposes of data exchange validation. Considered properties are volume, surface area and centroid.

The model viewing and drawing organisation capability has been tested in round 1J. The testing is continued in round 2J with an extension towards the presentation of dimensions.

1.2 General test instructions for this round

The general procedures for communication of models and stats etc. are outlined in a separate document 'General Guidelines for the CAx Implementor Forum'. The general instructions can be retrieved from CAx Implementor Forum web sites.

Specifically for this round of testing it is recommended in general to write STEP files in respect to AP214 DIS. Nevertheless vendors can send AP203 + modular extension files in.

1.3 Schedule

Date	Action
August 24 th	CAx Implementor Forum conference call
September 10 th	STEP files and native stats due (initial)
September 24 th	STEP files and native stats frozen
October 8 th	Target stats due
October 26 th	Review meeting for test round
October 27 th , 28 th	CAx Implementor Forum meeting

1.4 Copyrights on test cases

Not all of the production test cases which were provided by the PDES, Inc. and ProSTEP member companies are fully released for any purpose. The least common denominator is that the test cases can be freely distributed among the ProSTEP/PDES, Inc. Round Table participants and can be used for any purposes that are related to CAx Implementor Forum testing (i.e. testing, documentation of testing efforts), as long as a reference to the originating company is made.

The test cases must not be used for any purposes other than the CAx Implementor Forum testing.

2.0 Synthetic test case specifications

2.1 Model d2 'draughting of block with dimensions'

2.1.1 Motivation

This synthetic model represents basic draughting capability. It involves the projection of a simple 3D solid onto a view which is then placed on a sheet. The sheet is organised in a drawing. In this second test of this model the test case is extended by adding dimension information to the views.

2.1.2 Approach

See the approach described in the CAx Implementor Forum Recommended Practices for *Model Viewing, Drawing structure and Dimensions* (see <http://www.cax-if.org/public>).

2.1.3 Testing Instructions

Please note that system vendors that do not support this basic draughting capability should not submit STEP files for this test case.

2.1.3.1 Model construction

The figures below indicate the construction of the draughting test case. The basic steps are:

1. construct the solid geometry. The dimensions for the solid are given in the figure 1 below.
2. define views of the solid and place it onto a sheet. The projection related to the views can be extracted from the figure 2.
3. add the dimensions to the views as shown in figure 2.

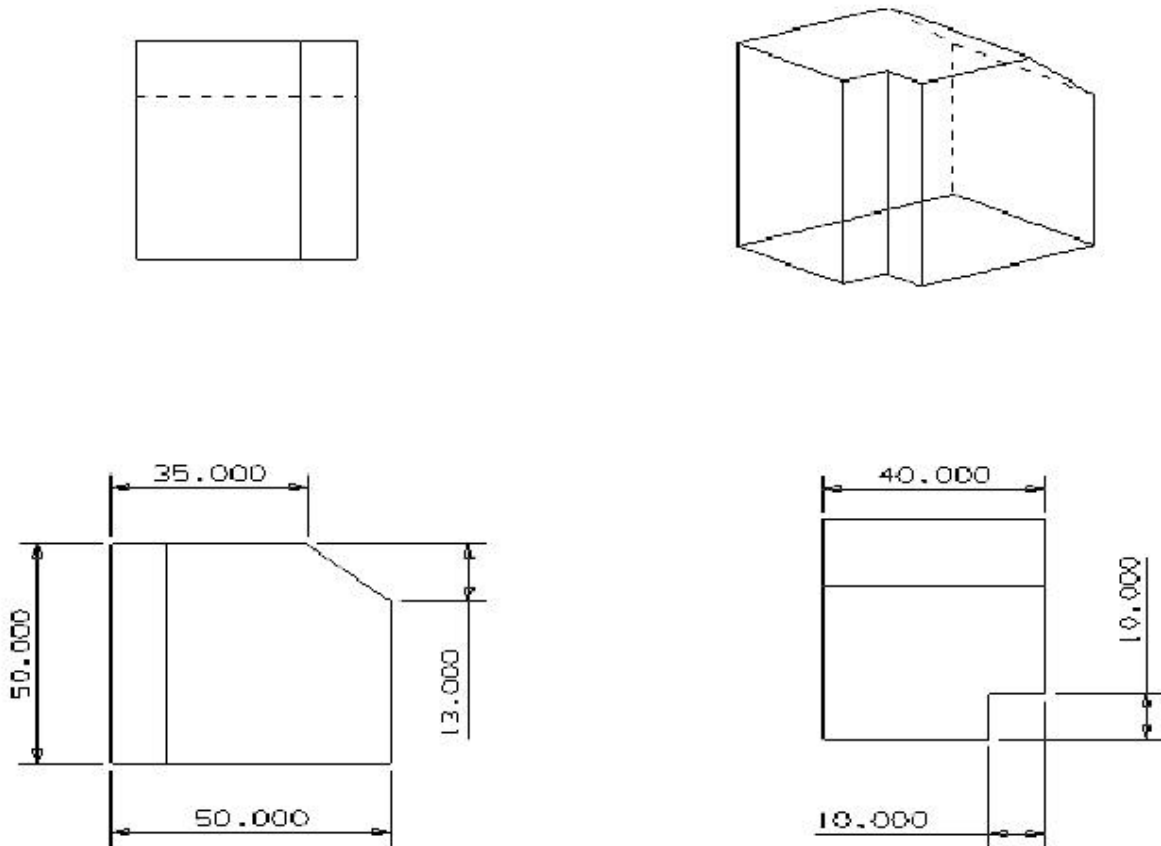


Figure 1: dimensions for solid for d1 (dimensions in mm)

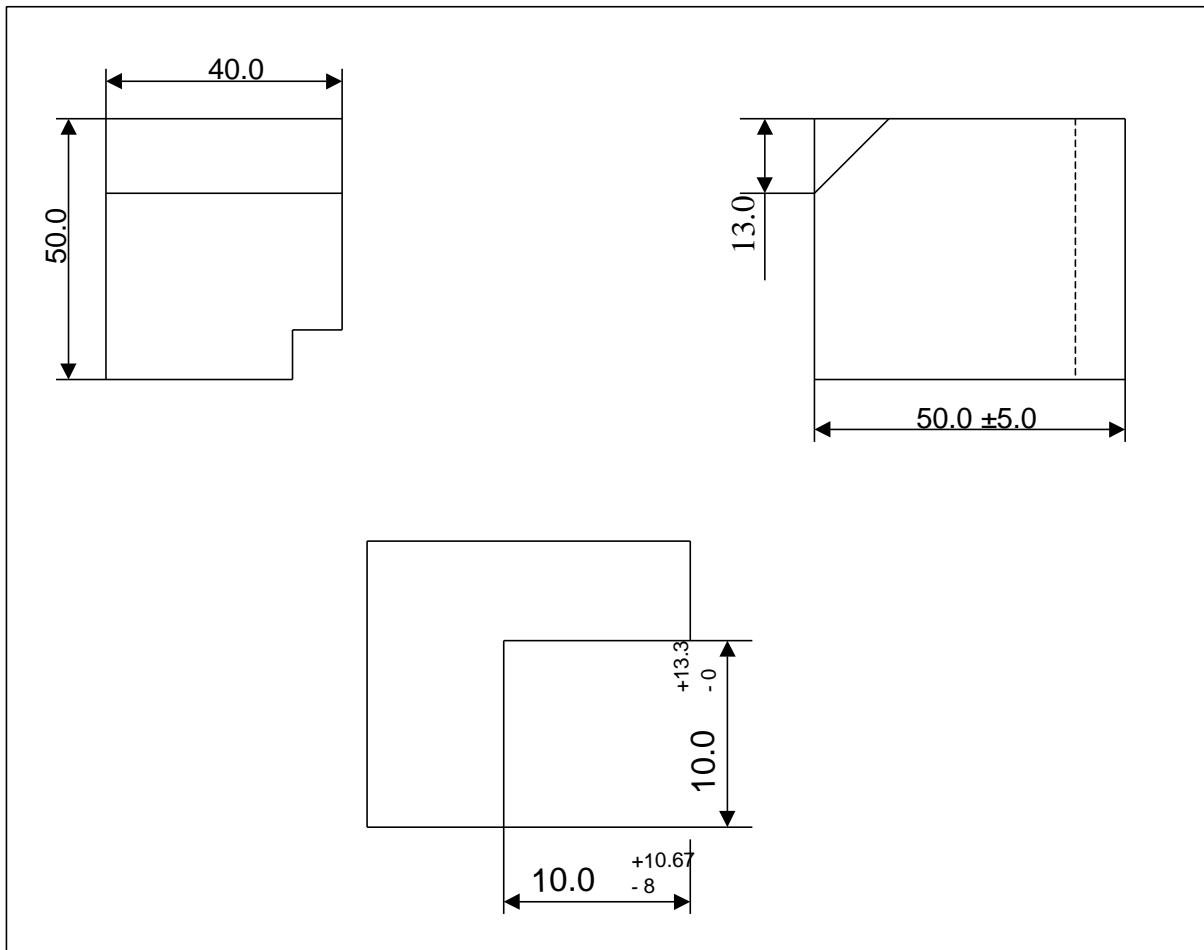


Figure 2: views on the drawing sheet with dimensions

The layout of the views on the sheet should be indicated as above, i.e.:

- TOP and LEFT are horizontally aligned
- TOP and LEFT are placed on the top of the sheet
- the DETAIL TOP is horizontally centred
- DETAIL TOP is placed on the bottom of the sheet

To the views the dimensions shall be added as shown in figure 2.

2.1.3.2 Statistics

The statistics that must be associated with each STEP file submitted for the d2 test case are designed to represent the results for the following criteria and validations:

- check the views: placement on the sheet and orientation
- move the views on the sheet in order to test the association of the model to the view
- check if the dimension text and symbology fits with the specification of the test case. Note: the dimensions are not supposed to be associative, i.e. linked with the geometrical dimensions of the solid. Tolerance information is only presented and not complemented by information in the 3D model.

model	d2
system_n	<i>native system code</i>
system_t	<i>target system code (for native statistics use 'stp' for system_t)</i>
views	<i>all/partial/none - whether the views appear on the sheet in the target system</i>
view_layout	<i>all/partial/none - whether the views appear with right placement and orientation in the target system</i>
pres_dim	<i>all: if the presentation information of all dimensions received corresponds to the test case specifications partial: if the presentation of the dimensions is incomplete or not completely as specified in this test case none: if no dimensions are presented or all of them do not fit with the specifications</i>
valid_associativity	<i>pass/fail – whether modifications of the shape result in an appropriate update of the views (check with new dimension)</i>
valid_sm	<i>pass/fail - whether target system considers target model valid</i>
date	<i>date submitted</i>
issues	<i>short description of issues</i>

Note: In case a vendor (native/target) is not testing a particular functionality (e.g. pres_dim) 'na' must be used as code for that statistic.

2.2 as1 - model

2.2.1 Motivation

as1 is a model already known from previous testing activities of STEPnet and ProSTEP. The model is re-used to test validation properties with a well known model.

2.2.2 Approach

See the approach described in the CAx Implementor Forum Recommended Practices for *Geometric Validation Properties* (see <http://www.cax-if.org/public>).

2.2.3 Testing Instructions

Please note that system vendors that do not support validation properties capability should not submit STEP files for this test case.

2.2.3.1 Model construction

Below a plot of the assembly as well as of the components is given. Note: this model may have been constructed with slightly differing dimensions in the past by some vendors. These models can also be re-used.

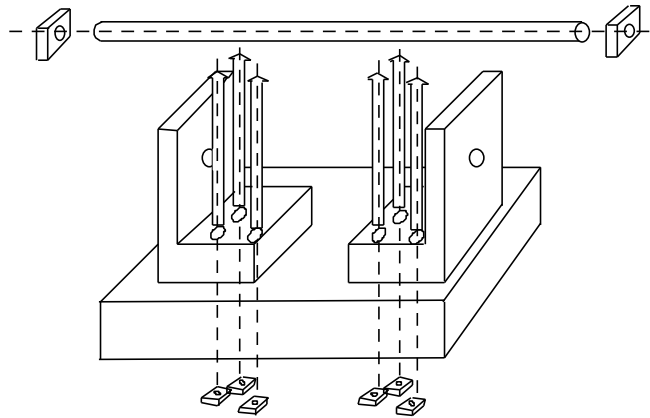


Figure 3: as1 shape

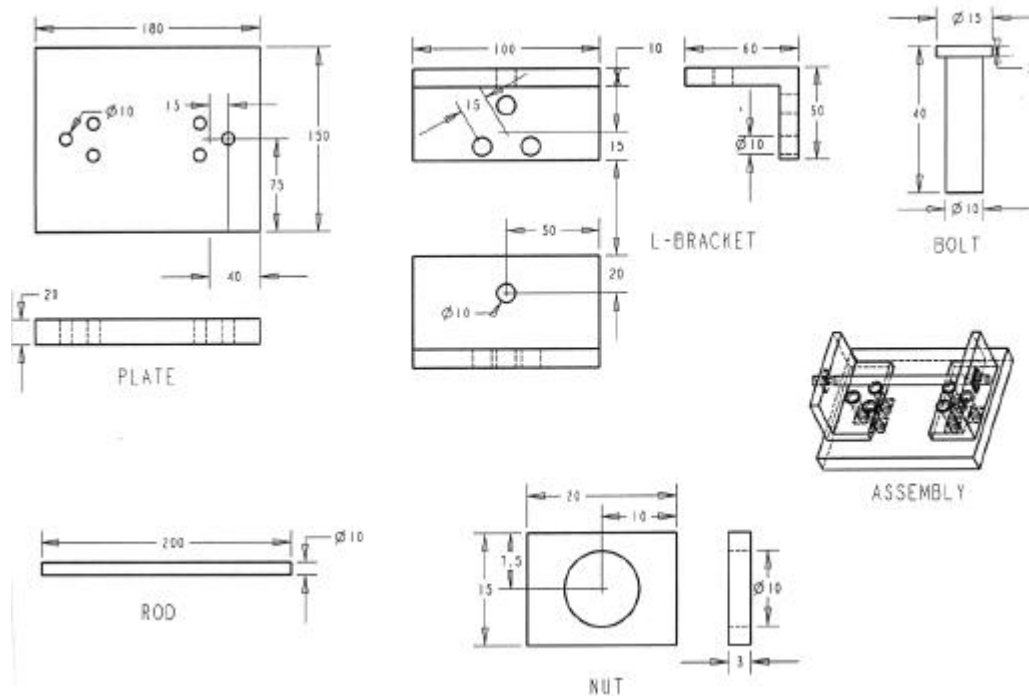


Figure 4: dimensions as1 (dimensions in mm)

Part names:

- Assembly:
 - as1
- Sub-Assemblies:
 - l-bracket assembly,
- Components:
 - plate,
 - l-bracket,
 - bolt,

- nut-bolt assembly,
- rod assembly
- nut,
- rod

Validation properties

The values for the overall volume of the assembly and its centroid as well as the total surface area of the I-bracket solid shall be computed and transferred via the STEP file. The statistics for target systems shall indicate whether these values match those computed in the target systems.

2.2.3.2 Statistics

With each STEP file submitted for model as1 vendors must include a text file with the stats in comma-delimited form:

model	<i>as1</i>
system_n	<i>native system code</i>
system_t	<i>target system code (for native statistics use 'stp' for system_t)</i>
unit	<i>units</i>
solids	<i>number of solid instances (as opposed to components)</i>
volume	<i>total volume of all solids</i>
validation_ volume	<i>total volume of all solids as received via the validation property capability</i>
area	<i>total surface area of all solids</i>
cx cy cz	<i>centroid of all solids</i>
valid_sm	<i>pass/fail – whether target system considers target model valid</i>
valid_ass_vol	<i>pass/fail, does the volume measure transferred in the STEP file correspond to the computed overall assembly volume in the target system?</i>
valid_area	<i>pass/fail, , does the area measure transferred in the STEP file correspond to the computed surface area of the I-bracket solid?</i>
valid_cent	<i>pass/fail, do cx, cy, cz transferred in the STEP file correspond to the computed centroid of the assembly in the target system?</i>
date	<i>date submitted</i>
issues	<i>short description of issues</i>

Note: In case a vendor (native/target) is not testing a particular functionality, 'na' must be used as code for that statistic.

2.3 Model io1

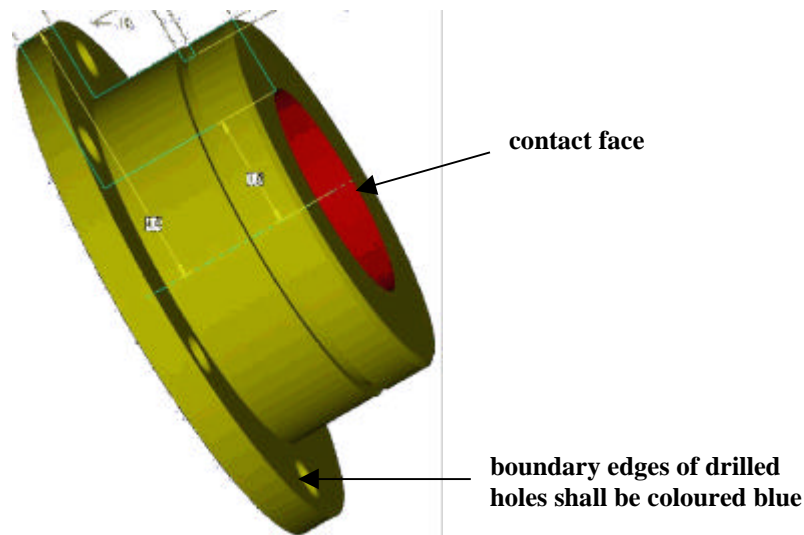


Figure 5: io1 test case

REMARK: the annotation is part of test case.

2.3.1 Motivation

This model has already been tested in round 1J to evaluate color capability, annotation and 203/214 interoperability. Whilst in the last test review the other topics have been considered successfully tested, the topic 'associative text' still needs some work. The re-use of this test case is primarily motivated by the intention to evaluate progress in the implementation of annotation text. To allow those that had problems with color presentation in the last round to consolidate their implementations the color specifications are kept as part of the test case.

The model is a non-assembled single solid model having a color assigned to the solid, for the inner face of the hollow shaft an overriding face color is specified and the edges limiting the drilled holes have another color assigned.

2.3.2 Approach

2.3.2.1 Presentation colors

As defined in AP214 and the colors and layers extension to AP203.

2.3.2.2 Annotation

The systems' support for associative text is strongly varying. The approach recently studied with the Implementor Forum allows for:

- unstyled text in the model
- styled notes in the model
- associative notes in the model
- associativity of notes visually depicted by leader curves

The support for this functionality inside the systems is strongly varying. Further variations are introduced by the target elements to which the notes can be associated in a system.

For the test of 3D annotation a scenario with a styled text associated to a face and a visual depiction of this associativity by a leader curve will be studied. Since the underlying STEP approach is modular, those systems that cannot exactly represent such a scenario are encouraged to use closes-fits, e.g. neglect the associativity when necessary.

The recommended practices for associative text are available at <http://www.cax-if.org/public>.

2.3.3 Testing Instructions

The model as used in round 1J can be re-used.

2.3.3.1 Construction of io1

Shape

Construct the flange as one solid. For dimensions see figures below.

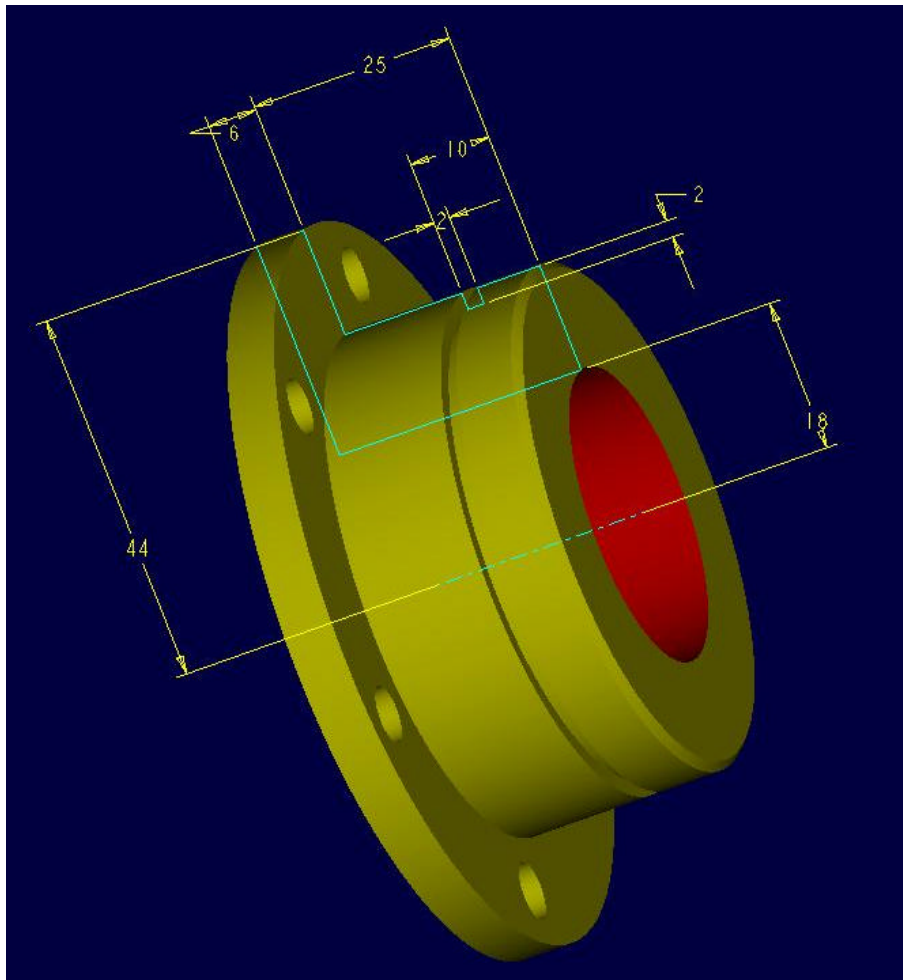


Figure 6: io1 – shape dimensions

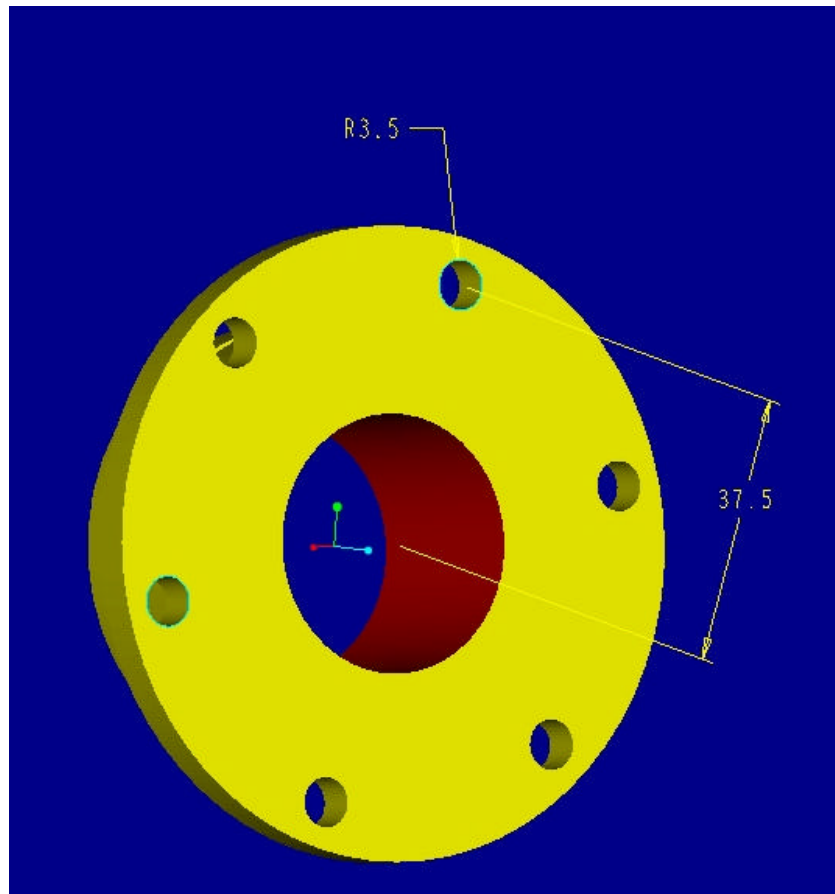


Figure 7: io1 – profile

Presentation

The following colours should be chosen:

- solid colour: yellow
- overriding colour for contact face: red
- overriding colour for profile boundaries: blue

Annotation

Due to the – as above discussed – big variation in annotation related capability of the systems only basic regulations are defined:

- style the two texts with an arbitrary colour
- associate the text "contact ..." to the inner face of the shaft
- associate the text "boundary edges ..." to the edge of an/the drilled hole profile
- define the text "boundary edges ..." as a multi-line text
- select an arbitrary placement of the text

As outlined above, systems not allowing one or the other of the above should try to find the closest work-around (e.g. associate to geometry instead of topology, omit associativity, etc.)

2.3.3.2 Statistics

With each STEP file submitted for io1 vendors must include a text file with the stats in comma-delimited form:

model	<i>io1</i>
system_n	<i>native system code</i>
system_t	<i>target system code (for native statistics use 'stp' for system_t)</i>
unit	<i>units</i>
solids	<i>number of solids</i>
volume	<i>total volume of all solids</i>
area	<i>total surface area of all solids</i>
cx cy cz	<i>centroid of all solids</i>
valid_sm	<i>pass/fail - whether target system considers target model valid</i>
color_t1	<i>text colour used for the annotation text "contact face"</i>
color_t2	<i>text colour used for the annotation text "boundary edges"</i>
color_sd	<i>all/partial/none - if solid colors in the model are totally correct, partially correct, or lost completely.</i>
color_f	<i>all/partial/none - if overriding face colour in the model is totally correct, partially correct, or lost completely.</i>
color_e	<i>all/partial/none - if overriding edge colour in the model is totally correct, partially correct, or lost completely.</i>
valid_txt	<i>all/partial/none – whether the specified texts appear in the model</i>
valid_txt_as soc	<i>all/partial/none – whether the association of the text to the elements of the geometric model as described above is correct</i>
date	<i>date submitted</i>
issues	<i>short description of issues</i>

Note: In case a vendor (native/target) is not testing a particular functionality (e.g. pres_dim) 'na' must be used as code for that statistic.

2.4 Model f1 'round holes'

2.4.1 Approach

This test case is specified as a first test for feature capability. It is deliberately kept simple in order to test basic functionality. It does not reflect a production model.

The usage scenario for the features capability is currently focussed at the integration of the CAD/CAM process chain and the generation of STEP based data repositories including geometry associated with feature and machining information. In such business scenarios round-trips do not necessarily need to be supported.

In consequence – in contrast to usual test round practice – this test model will possibly not be read and as well written by all participants testing feature capability. To support this scenario the CAx-IF testing team will visually inspect the geometry with viewers and manually check the feature parameters in the files in order to assess result statistics data where not available.

2.4.2 Approach

See the approach described in the CAx Implementor Forum Recommended Practices for Form Features: round_hole. The recommended practices are available from <http://www.cax-if.org/public> (item 'joint testing information').

2.4.3 Testing Instructions

Please note that systems vendors that do not support the scope of feature functionality related to this test case should not provide STEP files for it.

Since manual inspection of the files might be necessary, the participants are requested to closely follow the instructions resp. dimensions described to ease that process of checking.

2.4.3.1 Model construction

The figures below indicate the construction of the form features test case.

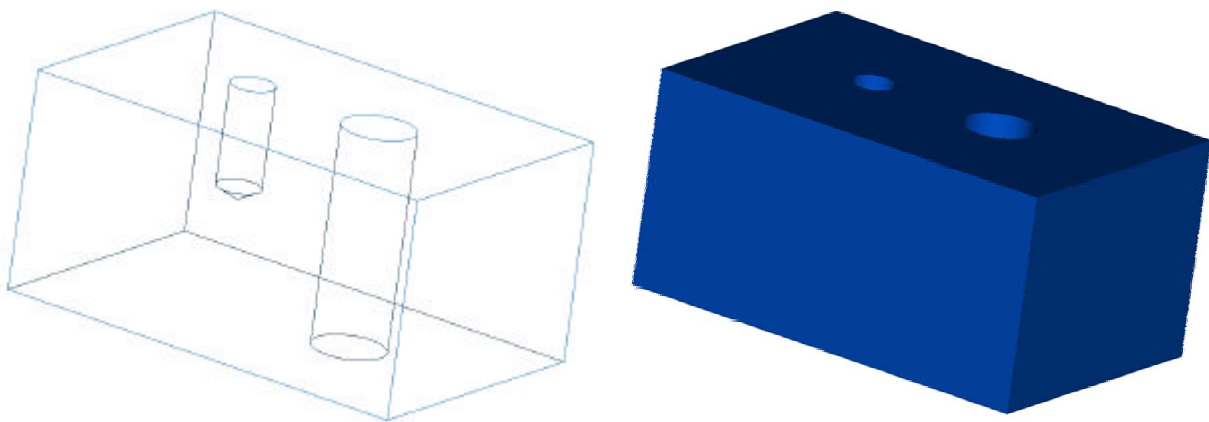


Figure 8: shape of test case with features

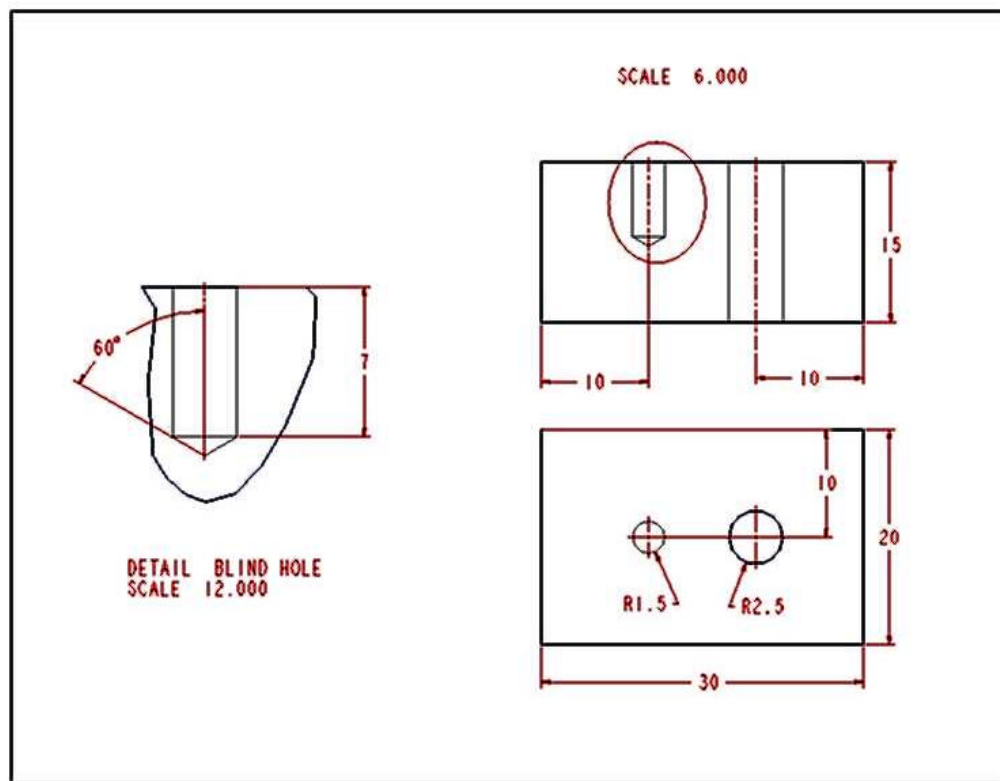


Figure 9: dimensions for f1 test case

2.4.3.2 Statistics

The statistics that should be associated with each STEP file submitted for the f1 test case are designed to represent the results for the following criteria and validations:

- check if the identification of the geometric portions of the part shape that establishes the two round hole features is correct.
- check if explicitly defined feature parameters represent the correct values (in accordance to their geometric representation)
- check if the end conditions for the holes are represented correctly.
- check if the overall resulting geometry fits in the sending and receiving systems. The model deliberately uses very simple geometry, in order to isolate the feature capability testing from other side effects related to geometry testing. Nevertheless the volume shall be computed to verify if the application of the features indeed results in the anticipated solid geometry.

Model	<i>f1</i>
system_n	<i>native system code</i>
system_t	<i>target system code (for native statistics use 'stp' for system_t)</i>
Unit	<i>units</i>

Volume	<i>total volume of solid</i>
Identification	<p><i>enter:</i></p> <ul style="list-style-type: none"> - <i>'fail', if there is no identification of the portions of geometry given /received to which the hole features relate, i.e. the boundary face / surfaces'</i> - <i>'partial', if there is an association of the feature definition to portions of geometry, but these do not fully/correctly reflect the feature geometry</i> - <i>'pass', if the given/received structure correctly identifies the hole features on the part shape</i> <p><i>Remark: the recommended practices currently advise to mark the face that constitutes the boundary of the hole feature for that purpose. Systems – possibly not able to do this – might choose other reasonable approaches as e.g. identifying a removal volume. The successful exchange of such alternative solutions can also be considered as a 'pass'.</i></p>
Parameters	<p><i>enter:</i></p> <ul style="list-style-type: none"> - <i>'fail', if parameters for the implicit representation of the feature geometry (profile diameter, placement, depth, ..) are not at all given resp. correct</i> - <i>'partial', if not all of the parameters are consistently wrong / missing resp. correct</i> - <i>'pass' if the parameters for the implicit geometric representation of the hole features matches</i>
end_cond	<p><i>enter:</i></p> <ul style="list-style-type: none"> - <i>'fail', the end conditions of the holes are not given/received</i> - <i>'partial', end conditions for the holes are given / received but not completely correct</i> - <i>'pass', end conditions are given / received correctly</i>
valid_sm	<i>pass/fail – whether target system considers target model valid</i>
Date	<i>date submitted</i>
Issues	<i>short description of issues</i>

Note: In case a vendor (native/target) is not testing a particular functionality, 'na' must be used as code for that statistic.

3.0 Production models

TO BE SPECIFIED LATER