



**Test Suite for the
CAX Implementor Forum
Round 10J**

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1.0 Introduction

This document describes the suite of test cases to be used for the tenth round of testing of the CAx Implementor Forum (CAx-IF). The CAx-IF is a joint testing forum organized by PDES, Inc. and ProSTEP. The test rounds of the CAx-IF concentrate on testing the interoperability and conformance of STEP processors based on AP 203 and AP 214.

The test rounds in general combine testing of synthetic and production models. Production models will in most cases be provided by the member companies of the organizations PDES, Inc. and ProSTEP. When production models are not available from the member companies, “production-like” models will be solicited from the various CAx-IF participants.

This test suite includes synthetic models for testing the following capabilities: solid geometry exchange, AP214-IS migration, AP210 and AP209 interoperability, and PDM-TDM/CAD integration.

Production models are provided for assemblies and piece parts. The basis for the production test cases is native CAD models. Each test case therefore originates from a single CAD system, and the set of test cases to be pre-processed (converted to STEP files) is unique for each CAD system. After pre-processing, the resulting STEP files are then to be imported/post-processed/read in by the rest of the participants

1.1 Functionality tested in this round

Functionality tested in this round relates to: solid geometry exchange, AP214-IS migration, AP210 and AP209 interoperability, and PDM-TDM/CAD integration.

Solid geometry exchange aims for validation and improvement of the results of the 7th ProSTEP processor benchmark, using the same single piece part. The part should be exported in AP214-IS format in order to keep track of processor migration and interoperability with AP214-DIS.

For AP210 interoperability, the goal is to import an AP210 in order to extract the included geometry, e.g. for collision testing when putting a circuit board into its casing.

Post-processing AP209 files also mainly aims for extracting the contained geometry. The test provides the opportunity to work on the issues identified during the Round9J tests and review meeting.

PDM-TDM/CAD integration uses external references, which are a mechanism for specifying external “documents” that are associated with objects defined within a STEP file. The external documents may be digital documents such as CAD native models, STEP files, WORD documents, or NC programs, OR non-digital documents such as technical drawings on paper, or hand-written documents. With respect to the CAx-IF, external references will be used to split a single STEP file into one file containing the part identification and assembly structure and several STEP files containing the component geometry. In Round 10J of testing, CAx vendors will be processing files from the PDM Implementor Forum (PDM-IF), for a joint CAx/PDM-IF testcase (see Section 2.2) which has been defined in Round8J.

In addition to synthetic models for the above capabilities, production models are included in this round of testing.

1.2 General test instructions for this round

The general procedures for communication of models and statistics are outlined in a separate document 'General Testing Instructions'. The general instructions can be retrieved from CAx Implementor Forum web sites. The latest version is v1.2, dated November 2001.

1.3 Preliminary testing schedule

Date	Action
May 21	Test Suite available / 1 st CAx Implementor Forum conference call
July 1	Initial STEP files and native stats due, Production Models released
July 22	STEP files and native stats frozen
August 19	Target stats due, 2 nd conference call
September 5	Target stats frozen
September 16	Pre-release of final stats / 3 rd conference call
October 8	Review meeting for test round
October 9 - 10	CAx Implementor Forum meeting, Darmstadt, Germany

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-IF 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-IF testing or outside of PDES, Inc. and ProSTEP.

2.0 Synthetic test case specifications

2.1 Model B2 : Benchmark model 'pump housing'

2.1.1 Motivation

As a result of the presentation of the results from the ProSTEP Processor Benchmarks, it has been agreed to re-test the latest test model used there in the CAx-IF with the latest processor versions. This is the first round of testing the model from the 7th Benchmark.

Note: Those vendors who like to re-test the 'classic' validation properties functionality as tested in the previous rounds may do this informally (i.e. no stats reported) with this model.

2.1.2 Approach

No new capability involved.

2.1.3 Testing Instructions

All vendors testing this model are encouraged to export the file in **AP214-IS** format. Due to the minor changes in AP214 CC2 and the successful test in Round9J, AP214-DIS should only be used if the IS version is not yet supported.

2.1.3.1 Construction of the benchmark model

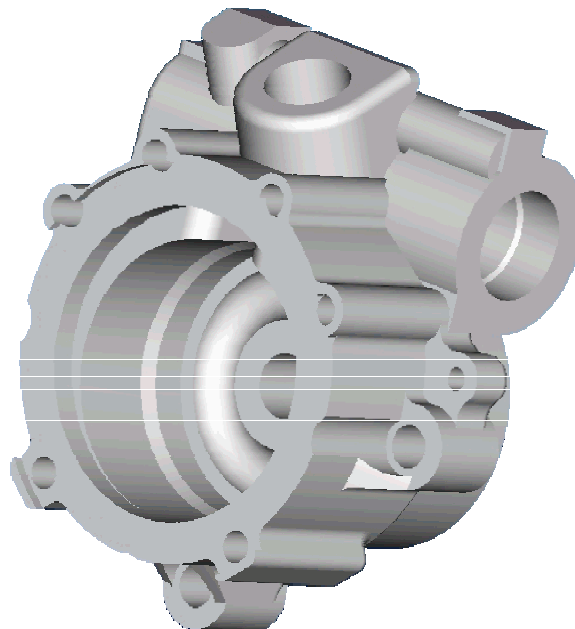


Figure 1: Shape of the B2 model (pump housing)

Those vendors who participated in the ProSTEP benchmark should re-use the pump housing model which has been constructed for that purpose. The modeling instructions may be found in the secure area of the CAx-IF web sites, <http://www.cax-if.org/secure/> and <http://www.cax-if.de/secure/>, under 'Information on Round9J of Testing'.

2.1.3.2 Statistics

With each STEP file submitted for the b2 model, vendors must include a text file with the stats in comma-delimited form (.CSV):

model	<i>b2</i>
system_n	<i>Native system code</i>
system_t	<i>Target system code (for native stats use 'stp' for system_t)</i>
unit	<i>Units</i>
volume	<i>Total volume of all solids</i>
area	<i>Total surface area</i>
cx, cy, cz	<i>Centroid of all solids</i>
date	<i>Date submitted</i>
issues	<i>Short description of issues</i>

2.2 Joint test case with PDM-IF

2.2.1 Motivation

This test case is an extension of the well-known AS1 or S1 model, which has been tested several times before, and it aims for CAD/PDM-TDM interaction. A major usage of external references is the splitting of product data describing assemblies into multiple files representing individual parts. The focus of the actual implementation is to deal with external representations. In the scope of this round of testing, the external representation shall be defined via STEP files.

The test case models a situation where the assembly structures are contained in one file, and the individual parts in a single file each. The file containing the assembly references the model contained in the part file.

In **Round10J**, the PDM Implementor Forum will submit files which include managed documents. The CAX-IF vendors are asked to import these files, then export them again (**'round-trip'**) and send them back to the PDM-IF in order to see which information was maintained and which was lost. The geometry (leaf node) files may not be included.

2.2.2 Approach

See the approach described in the PDM Schema Usage Guide, available on the PDM-IF web-site (http://www.pdm-if.org/pdm_schema/). Recommended Practices for External References with annotated, relevant sections of the Usage is available on the CAx-IF site (http://www.cax-if.org/joint_testing_info.html and http://www.cax-if.de/joint_testing_info.html), and the Joint Test Case "TC_DocMan" which has been defined in Round 8J.

2.2.3 Testing Instructions

Please note that system vendors that do not support the external reference mechanism should not import STEP files from this test case.

2.2.3.1 Model construction

For Round10J, the files will be provided by the PDM vendors, based on the test cases 'TC_DocMan', defined in Round 8J. All CAx-IF vendors supporting external reference capability should roundtrip those files and submit the results they receive.

2.2.3.2 Statistics

There are no formal stats like in the other test cases for the joint testing. All participants are asked to collect their findings for discussion at the joint meeting in October. Also, any input to heike.halkenhausser@prostep.com or pascalhuau@goset.asso.fr is appreciated.

2.3 Joint test case with AP210 (EMT) Group

2.3.1 Motivation

Basis for this common test case is the illustration of a business case, where the shape information of a circuit board should be extracted from an AP210 file and then be converted to an AP203 or AP214 detail/part or assembly, in order to use it for a build-in-test, i.e. checking for collisions when putting the circuit board into its casing, of which the geometry information is available as a STEP solid.

2.3.2 Approach and testing instructions

The AP210 file(s) should be imported and the geometry information should then be excerpted. A test case description will be given by the AP210 group.

2.3.3 Statistics

With each STEP file processed for the AP209 model, vendors must include a text file with the stats in comma-delimited form (.CSV):

model	<i>ap210</i>
system_n	<i>Native system code</i>
system_t	<i>Target system code (for native stats use 'stp' for system_t)</i>
unit	<i>Units</i>
volume	<i>Total volume of all solids</i>
area	<i>Total surface area</i>
cx, cy, cz	<i>Centroid of all solids</i>
date	<i>Date submitted</i>
issues	<i>Short description of issues</i>

In order to help the discussion of the results with the EMT group, it may be helpful to prepare a more detailed (textual) description of the issues found, which may be sent to out via email before the meeting.

2.4 Joint Test case with AP209 (EA) Group

2.4.1 Motivation

Since the number of APs used in every day data exchange is constantly increasing, the subject of AP interoperability is of growing interest. The focus of this test is on extracting the geometry (design shape) from a 209 file and converting it to an AP203 or AP214 detail/part or assembly.

2.4.2 Approach and testing instructions

AP209 file(s) should be imported, and the geometry information should then be excerpted. Of special interest is the interpretation of the product structure (design shape vs. analysis shape) as discussed during the Round9J review meeting. Only the design shape should be extracted.

2.4.3 Statistics

With each STEP file processed for the AP209 model, vendors must include a text file with the stats in comma-delimited form (.CSV):

model	<i>ap209</i>
system_n	<i>Native system code</i>
system_t	<i>Target system code (for native stats use 'stp' for system_t)</i>

unit	<i>Units</i>
volume	<i>Total volume of all solids</i>
area	<i>Total surface area</i>
cx, cy, cz	<i>Centroid of all solids</i>
date	<i>Date submitted</i>
issues	<i>Short description of issues</i>

In order to help the discussion of the results with the EMT group, it may be helpful to prepare a more detailed (textual) description of the issues found, which may be sent to out via email before the meeting.

2.5 Solid Model Construction History

2.5.1 Motivation

Solid Model Construction History has been identified as a major field of interest in future test activities of the CAx-IF. Several aerospace, computer, and automotive companies have identified requirements to exchange solid model construction history using STEP to enable design modification in the receiving system while maintaining parametric relationships. That capability is discussed in this Implementor's Guide for Solid Model Construction History. This version includes procedural or history-based modelling constructs and operations, which can be used to extend capabilities of existing APs.

Since implementations in that field still are on a pilot level with only few vendors participating and a limited scope, it has been agreed the Construction History is not yet to be run as a full-blown CAx-IF test case. However, any vendor interested in that field is greatly welcome and encouraged to join the activities in that direction.

2.5.2 Approach

See the approach described in the 'Implementor's Guide for Solid Model Construction History', available on the CAx-IF sites (http://www.cax-if.org/joint_testing_info.html and http://www.cax-if.de/joint_testing_info.html), as well as the EXPRESS schema and the Part21 file example, also available from the above mentioned location. Any questions about testing this functionality should be directed to Dr. Bill Anderson (anderson@aticorp.org).

2.5.3 Testing Instructions

All information on construction of the model and implementation of the construction history functionality may be found in the Implementor's Guide mentioned above.

2.5.4 Statistics

With each STEP file processed for the CH1 model, vendors must include a text file with the stats in comma-delimited form (.CSV):

model	<i>ch1</i>
system_n	<i>Native system code</i>
system_t	<i>Target system code (for native stats use 'stp' for system_t)</i>
unit	<i>Units</i>
volume	<i>Total volume of all solids</i>
area	<i>Total surface area</i>
cx, cy, cz	<i>Centroid of all solids</i>
conhist	<i>'all' / 'partial' / 'none' of the construction history information has been successfully transferred.</i>
date	<i>Date submitted</i>
issues	<i>Short description of issues</i>

3.0 Production models: PM8

3.1 Motivation

In an attempt to test the STEP processors on real world models, the CAx Implementor Forum will be testing production parts in this round and future rounds of CAx-IF testing. These production models are characteristic for components and assemblies that are encountered in the aerospace and automotive industries. PDES, Inc. and ProSTEP member companies and vendors have supplied these models.

3.2 Approach

STEP files provided by member companies and vendors have been analysed for quality of (solid and/or surface) geometry as well as syntax and structure. The model quality issues (if any) have been documented in a README file which accompanies the STEP files. In this round of testing production models, simple comparison of mass property data (volume, surface area, Centroid) will be used as a basis for validating success/failure of the exchange.

3.3 Testing Instructions

3.3.1 Models being tested

In this round of testing, the following production models are being tested. The table below contains information on the models. An archive <r10j_pm8.zip> / <r10j_pm8.tar.gz> containing the STEP files is available from the member area of the CAx-IF web sites.

Model name	Originating system	File schema	Comments
Ed's Activity Tray	I-DEAS (id)	214-IS	Model from R9J, new STEP file
Mold Tooling	CATIA V5 (ct)	214-DIS	New model
Multi Tool	Mechanical Desktop (ac)	214-DIS	New model
Single Stroke Engine	Inventor (in)	214-IS	New model
Turbine Blade	Unigraphics (ug)	214-DIS	Model from R9J, new STEP file

The file names in the archive are as usual 'pm8-(system code)-214.stp'.

3.3.2 Statistics

As discussed briefly in the previous section (Section 3.2, Approach), the statistics that will be associated with each production model are aimed at determining if the production models are exchanged "successfully". As in past testing, change in volume, surface area, and centroid will be used as a basis for determining "pass/fail". For each production model, a set of native statistics have been collected from the respective system vendors.

For each STEP file (production model) being tested, vendors must send in target statistics in comma-delimited form (.csv): The naming convention for target stats is explained in the 'General Testing Instructions' document available on the CAx-IF sites, under the 'Joint Testing Information' link off the CAx-IF home page.

model	<i>pm8</i>
system_n	<i>Native system code (use the native system code for each model listed in the table in Section 3.3.1)</i>
system_t	<i>Target system</i>
unit	<i>Units</i>
volume	<i>Total volume</i>
area	<i>Total surface area</i>
cx cy cz	<i>Centroid</i>

date	<i>Date submitted</i>
issues	<i>Short description of issues</i>