6 Conformance requirements

Conformance to this part of ISO 10303 includes satisfying the requirements stated in this part, the requirements of the implementation method(s) supported, and the relevant requirements of the normative references.

An implementation shall support at least one of the following implementation methods:

— ISO 10303-21.

Requirements with respect to implementation methods-specific requirements are specified in annex C.

The Protocol Implementation Conformance Statement (PICS) proforma lists the options or the combinations of options that may be included in the implementation. The PICS proforma is provided in annex D.

This part of ISO 10303 provides for a number of options that may be supported by an implementation. These options have been grouped into the following conformance classes:

— CNC-independent tool paths (CC1);

— Intelligent setup (CC2);

— Conditional programming (CC3);

— Generative programming (CC4).

These conformance classes have been defined so that each class includes all the options specified by the preceeding class. Support for a particular conformance class requires support of all the options specified in that class.

EXAMPLE CC2 contains everything in CC1, plus additional options. CC3 contains everything in CC2, plus additional options. CC4 contains everything in CC3, plus all remaining options.

Conformance to a particular class requires that all AIM elements defined as part of that class be supported. Table 15 defines the classes to which each AIM element belongs. The conformance classes are described in detail by the following sections:

6.1 Conformance Class for CNC-independent tool paths (CC1)

This conformance class supports the description of machining programs containing a single sequence of operations, each of which is described using the machine-independent path of the tool center point, using a simplified set of curves types, as well as tool requirements, management information about the program, and all technology-specific process parameters.

This conformance class includes all application objects from the management, measure, operation, project, workpiece, process data for milling, cutting tools for milling, process data for turning, and cutting tools for turning UoFs.

NOTE Since this conformance class requires a toolpath for every operation, any additional strategy or operation information is simply advisory. In the absence of any other useful information, it is recommended that the machining operation be specified as a Freeform_operation with no associated strategies.

This conformance class includes the following application objects and their supertypes from the executable UoF:

— Machining_tool and the supporting objects Cutting_tool, Cutting_component, Cutting_edge_technological_data, and Tool_body;

— Machining_workingstep;

— NC_function, the subtypes Display_message, NC_legacy_function, Optional_stop, Program_stop, Set_mark, Wait_for_mark, and the supporting object Channel;

— Rapid_movement and the subtype Return_home;

— Setup and the supporting objects Workpiece_setup and Setup_instruction;

— Workplan.

This conformance class includes the following application objects and their supertypes from the toolpath UoF:

— Cutter_location_trajectory;

— Feedstop;

— Toolpath_speed.

In addition, the following apply to use of the application objects in this conformance class:

— the its_toolpath shall be specified for each Operation object;

— the its_feature need not be specified for a particular Machining_workingstep object;

— the final_features shall not be specified for any Machining_workingstep object;

— the dataset shall contain exactly one Workplan object;

— the basiccurve, its_toolaxis, and surface_normal for each Cutter_location_trajectory object shall be described using only polylines, composite or trimmed curves based upon lines or conics;

— no geometric shape information shall be specified for Machining_workingstep its_effect, Manufacturing_feature explicit_representation, Workpiece its_geometry or its_bounding_geometry, Workpiece_setup its_restricted_area, or Workplan its_effect.

6.2 Conformance Class for intelligent setup (CC2)

This conformance class extends the previous conformance class to support the description of machining programs with the full range of toolpath specifications as well as full shape information for the workpiece, rawpiece and restricted areas on the setup.

This conformance class includes everything specified by CC1, plus all remaining application objects from the toolpath UoF and the Parallel application object from the executable UOF.

In addition, the following apply to use of the application objects in this conformance class:

— the dataset may contain multiple, nested Workplan objects;

— the basiccurve, its_toolaxis, and surface_normal for each Cutter_location_trajectory object may be described by any bounded_curve type;

— geometric shape information may be specified for Machining_workingstep its_effect, Workpiece its_geometry or its_bounding_geometry, Workpiece_setup its_restricted_area, or Workplan its_-effect.

6.3 Conformance Class for conditional programming (CC3)

This conformance class extends the previous conformance class to support the description of machining programs using the full range of executable constructs and manufacturing process features defined by implicit parameters.

This conformance class includes everything specified by CC2, plus all application objects from the manufacturing feature and manufacturing feature for turning UOFs and all remaining application objects from the executable UoF.

In addition, the following apply to use of the application objects in this conformance class:

— the its_toolpath need not be specified for a particular Operation object;

— the its_feature shall be specified for all Machining_workingstep objects;

6.4 Conformance Class for generative programming (CC4)

This conformance class extends the previous conformance class to support the description of geometric dimension and tolerance information sufficient to compute optimal speeds and feeds, manufacturing features appearing on the final product shape, and features with linkage to explicit geometry.

This conformance class includes everything specified by CC3, plus all application objects from the geometric dimensioning and tolerancing UOF and all remaining application objects from other UoFs.

In addition, the following apply to use of the application objects in this conformance class:

— the final_features may be specified for any Machining_workingstep object;

— the explicit_representation may be specified for any Manufacturing_feature object.

Table 15 — Conformance class elements

AIM element	Conformance class			
	1	2	3	4
action	X	X	X	X
action_method	X	X	X	X
action_method_relationship	X	X	X	X
action_method_with_associated_documents	X	X	X	X
action_property	X	X	X	X
action_property_representation	X	X	X	X
action_relationship			X	X
action_resource	X	X	X	X
action_resource_relationship	X	X	X	X
action_resource_requirement	X	X	X	X
action_resource_requirement_relationship	X	X	X	X
action_resource_type	X	X	X	X
address	X	X	X	X
advanced_brep_shape_representation		X	X	X
advanced_face		X	X	X
and_expression			X	X
angular_location			X	X
angular_size			X	X
angularity_tolerance			X	X
apex				X
application_context	X	X	X	X
application_context_element	X	X	X	X
application_protocol_definition	X	X	X	X
applied_approval_assignment	X	X	X	X
applied_area			X	X
applied_date_and_time_assignment	X	X	X	X
applied_document_reference	X	X	X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
applied_document_usage_constraint_assignment	X	X	X	X
applied_identification_assignment				X
applied_person_and_organization_assignment	X	X	X	X
applied_security_classification_assignment	X	X	X	X
approval	X	X	X	X
approval_assignment	X	X	X	X
approval_date_time	X	X	X	X
approval_person_organization	X	X	X	X
approval_relationship	X	X	X	X
approval_role	X	X	X	X
approval_status	X	X	X	X
axis1_placement	X	X	X	X
axis2_placement_2d	X	X	X	X
axis2_placement_3d	X	X	X	X
b_spline_curve		X	X	X
b_spline_curve_with_knots		X	X	X
b_spline_surface		X	X	X
b_spline_surface_with_knots		X	X	X
back_boring_operation	X	X	X	X
bezier_curve		X	X	X
bezier_surface		X	X	X
binary_boolean_expression			X	X
binary_generic_expression			X	X
block		X	X	X
block_shape_representation		X	X	X
boolean_expression			X	X
boring_operation	X	X	X	X
boss			X	X
boss_top			X	X
bottom_and_side_milling_operation	X	X	X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
boundary_curve		X	X	X
bounded_curve	X	X	X	X
bounded_pcurve		X	X	X
bounded_surface		X	X	X
bounded_surface_curve		X	X	X
brep_with_voids		X	X	X
calendar_date	X	X	X	X
cartesian_point	X	X	X	X
cartesian_transformation_operator	X	X	X	X
cartesian_transformation_operator_3d	X	X	X	X
centre_of_symmetry				X
chamfer			X	X
chamfer_offset			X	X
characterized_object	X	X	X	X
circle	X	X	X	X
circular_closed_profile			X	X
circular_pattern			X	X
circular_runout_tolerance				X
classification_role			X	X
closed_path_profile			X	X
closed_shell		X	X	X
coaxiality_tolerance				X
common_datum				X
comparison_equal			X	X
comparison_expression			X	X
comparison_greater			X	X
comparison_greater_equal			X	X
comparison_less			X	X
comparison_less_equal			X	X
comparison_not_equal			X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
composite_curve	X	X	X	X
composite_curve_on_surface		X	X	X
composite_curve_segment	X	X	X	X
composite_hole			X	X
composite_shape_aspect			X	X
compound_feature			X	X
compound_representation_item			X	X
concentricity_tolerance				X
concurrent_action_method		X	X	X
conic	X	X	X	X
conical_surface		X	X	X
connected_face_set		X	X	X
context_dependent_shape_representation	X	X	X	X
context_dependent_unit	X	X	X	X
contouring_turning_operation	X	X	X	X
conversion_based_unit	X	X	X	X
coordinated_universal_time_offset	X	X	X	X
curve	X	X	X	X
curve_bounded_surface		X	X	X
curve_replica		X	X	X
cylindrical_shape_representation		X	X	X
cylindrical_surface		X	X	X
cylindricity_tolerance				X
data_environment			X	X
date	X	X	X	X
date_and_time	X	X	X	X
date_and_time_assignment	X	X	X	X
date_time_role	X	X	X	X
datum				X
datum_feature				X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
datum_reference				X
datum_target				X
definitional_representation		X	X	X
degenerate_pcurve		X	X	X
degenerate_toroidal_surface		X	X	X
derived_shape_aspect			X	X
derived_unit	X	X	X	X
derived_unit_element	X	X	X	X
description_attribute	X	X	X	X
descriptive_representation_item	X	X	X	X
dimension_related_tolerance_zone_element				X
dimensional_characteristic_representation				X
dimensional_exponents	X	X	X	X
dimensional_location				X
dimensional_location_with_path				X
dimensional_size				X
dimensional_size_with_path				X
directed_dimensional_location				X
direction	X	X	X	X
direction_shape_representation			X	X
document	X	X	X	X
document_file	X	X	X	X
document_reference	X	X	X	X
document_representation_type	X	X	X	X
document_type	X	X	X	X
document_usage_constraint	X	X	X	X
document_usage_constraint_assignment	X	X	X	X
document_usage_role	X	X	X	X
document_with_class	X	X	X	X
drilling_operation	X	X	X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
drilling_type_operation	X	X	X	X
drilling_type_strategy	X	X	X	X
edge		X	X	X
edge_curve		X	X	X
edge_loop		X	X	X
edge_round			X	X
elementary_surface	X	X	X	X
ellipse	X	X	X	X
environment			X	X
evaluated_degenerate_pcurve		X	X	X
expanded_uncertainty			X	X
expression			X	X
expression_representation_item			X	X
extension				X
external_source			X	X
externally_defined_dimension_definition				X
externally_defined_feature_definition			X	X
externally_defined_item			X	X
face		X	X	X
face_bound		X	X	X
face_outer_bound		X	X	X
face_shape_representation			X	X
face_surface		X	X	X
facing_turning_operation	X	X	X	X
feature_component_definition			X	X
feature_component_relationship			X	X
feature_definition			X	X
feature_pattern			X	X
fillet			X	X
flat_face			X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
flatness_tolerance				X
founded_item	X	X	X	X
freeform_milling_operation	X	X	X	X
freeform_milling_strategy	X	X	X	X
freeform_milling_tolerance_representation	X	X	X	X
functionally_defined_transformation			X	X
gear			X	X
generic_expression			X	X
generic_literal			X	X
generic_variable			X	X
geometric_alignment				X
geometric_intersection				X
geometric_representation_context	X	X	X	X
geometric_representation_item	X	X	X	X
geometric_set		X	X	X
geometric_tolerance				X
geometric_tolerance_relationship				X
geometric_tolerance_with_datum_reference				X
geometric_tolerance_with_defined_unit				X
geometrically_bounded_surface_shape_representation			X	X
global_uncertainty_assigned_context	X	X	X	X
global_unit_assigned_context	X	X	X	X
grooving_turning_operation	X	X	X	X
hole_bottom			X	X
hyperbola	X	X	X	X
id_attribute	X	X	X	X
identification_assignment				X
identification_role				X
instanced_feature			X	X
int_literal			X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
int_numeric_variable			X	X
intersection_curve			X	X
item_defined_transformation	X	X	X	X
knurling_turning_operation	X	X	X	X
length_measure_with_unit	X	X	X	X
length_unit	X	X	X	X
limits_and_fits				X
line	X	X	X	X
line_profile_tolerance				X
linear_profile			X	X
literal_number			X	X
local_time	X	X	X	X
location_shape_representation			X	X
loop		X	X	X
machining_adaptive_control_relationship	X	X	X	X
machining_approach_retract_strategy	X	X	X	X
machining_cutting_component	X	X	X	X
machining_dwell_time_representation	X	X	X	X
machining_feature_process			X	X
machining_feature_relationship			X	X
machining_feature_sequence_relationship			X	X
machining_feed_speed_representation	X	X	X	X
machining_final_feature_relationship				X
machining_functions	X	X	X	X
machining_functions_relationship	X	X	X	X
machining_nc_function	X	X	X	X
machining_offset_vector_representation			X	X
machining_operation	X	X	X	X
machining_operation_relationship	X	X	X	X
machining_operator_instruction	X	X	X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
machining_operator_instruction_relationship	X	X	X	X
machining_process_body_relationship	X	X	X	X
machining_process_branch_relationship			X	X
machining_process_concurrent_relationship		X	X	X
machining_process_executable	X	X	X	X
machining_process_model	X	X	X	X
machining_process_model_relationship	X	X	X	X
machining_process_sequence_relationship	X	X	X	X
machining_project	X	X	X	X
machining_project_workpiece_relationship	X	X	X	X
machining_rapid_movement	X	X	X	X
machining_setup	X	X	X	X
machining_setup_workpiece_relationship	X	X	X	X
machining_spindle_speed_representation	X	X	X	X
machining_strategy	X	X	X	X
machining_strategy_relationship	X	X	X	X
machining_technology	X	X	X	X
machining_technology_relationship	X	X	X	X
machining_tool	X	X	X	X
machining_tool_body_representation	X	X	X	X
machining_tool_dimension_representation	X	X	X	X
machining_tool_direction_representation	X	X	X	X
machining_toolpath	X	X	X	X
machining_toolpath_sequence_relationship	X	X	X	X
machining_toolpath_speed_profile_representation	X	X	X	X
machining_touch_probing			X	X
machining_workingstep	X	X	X	X
machining_workplan	X	X	X	X
make_from_usage_option	X	X	X	X
manifold_solid_brep		X	X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
manifold_surface_shape_representation			X	X
mapped_item		X	X	X
marking			X	X
material_designation	X	X	X	X
material_designation_characterization	X	X	X	X
material_property	X	X	X	X
material_property_representation	X	X	X	X
measure_qualification			X	X
measure_representation_item	X	X	X	X
measure_with_unit	X	X	X	X
milling_type_operation	X	X	X	X
milling_type_strategy	X	X	X	X
modified_geometric_tolerance				X
modified_pattern			X	X
multiple_arity_boolean_expression			X	X
multiple_arity_generic_expression			X	X
name_attribute	X	X	X	X
named_unit	X	X	X	X
ngon_closed_profile			X	X
ngon_shape_representation			X	X
not_expression			X	X
numeric_expression			X	X
numeric_variable			X	X
object_role	X	X	X	X
offset_curve_3d		X	X	X
offset_surface		X	X	X
open_path_profile			X	X
open_shell		X	X	X
or_expression			X	X
ordinal_date	X	X	X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
organization	X	X	X	X
organizational_address	X	X	X	X
oriented_closed_shell		X	X	X
oriented_edge		X	X	X
oriented_face		X	X	X
oriented_open_shell		X	X	X
oriented_path		X	X	X
outer_boundary_curve		X	X	X
outer_round			X	X
outside_profile			X	X
parabola	X	X	X	X
parallel_offset				X
parallelism_tolerance				X
parametric_representation_context		X	X	X
partial_circular_profile			X	X
path		X	X	X
path_feature_component			X	X
path_shape_representation			X	X
pattern_offset_membership			X	X
pattern_omit_membership			X	X
pcurve		X	X	X
perpendicular_to				X
perpendicularity_tolerance				X
person	X	X	X	X
person_and_organization	X	X	X	X
person_and_organization_assignment	X	X	X	X
person_and_organization_role	X	X	X	X
personal_address	X	X	X	X
placed_datum_target_feature				X
placement	X	X	X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
planar_shape_representation			X	X
plane	X	X	X	X
plane_angle_measure_with_unit	X	X	X	X
plane_angle_unit	X	X	X	X
plane_milling_operation	X	X	X	X
plus_minus_tolerance				X
pocket			X	X
pocket_bottom			X	X
point	X	X	X	X
point_on_curve		X	X	X
point_on_surface		X	X	X
polyline	X	X	X	X
position_tolerance				X
precision_qualifier	X	X	X	X
process_product_association	X	X	X	X
process_property_association			X	X
product	X	X	X	X
product_category			X	X
product_category_relationship			X	X
product_context	X	X	X	X
product_definition	X	X	X	X
product_definition_context	X	X	X	X
product_definition_formation	X	X	X	X
product_definition_process	X	X	X	X
product_definition_relationship	X	X	X	X
product_definition_shape		X	X	X
product_definition_usage	X	X	X	X
product_definition_with_associated_documents	X	X	X	X
product_related_product_category			X	X
profile_floor			X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
projected_zone_definition				X
property_definition	X	X	X	X
property_definition_representation	X	X	X	X
property_process			X	X
protrusion				X
qualified_representation_item	X	X	X	X
qualitative_uncertainty	X	X	X	X
quasi_uniform_curve		X	X	X
quasi_uniform_surface		X	X	X
ratio_measure_with_unit	X	X	X	X
ratio_unit	X	X	X	X
rational_b_spline_curve		X	X	X
rational_b_spline_surface		X	X	X
real_literal			X	X
real_numeric_variable			X	X
rectangular_closed_profile			X	X
rectangular_composite_surface		X	X	X
rectangular_pattern			X	X
rectangular_trimmed_surface		X	X	X
referenced_modified_datum				X
removal_volume			X	X
reparametrised_composite_curve_segment		X	X	X
replicate_feature			X	X
representation	X	X	X	X
representation_context	X	X	X	X
representation_item	X	X	X	X
representation_item_relationship	X	X	X	X
representation_map	X	X	X	X
representation_relationship	X	X	X	X
representation_relationship_with_transformation	X	X	X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
requirement_for_action_resource	X	X	X	X
resource_property	X	X	X	X
resource_property_representation	X	X	X	X
resource_requirement_type	X	X	X	X
revolved_profile			X	X
rib_top			X	X
rib_top_floor			X	X
right_circular_cylinder		X	X	X
role_association	X	X	X	X
round_hole			X	X
rounded_end			X	X
rounded_u_profile			X	X
roundness_tolerance				X
runout_zone_definition				X
runout_zone_orientation				X
runout_zone_orientation_reference_direction				X
seam_curve		X	X	X
security_classification	X	X	X	X
security_classification_assignment	X	X	X	X
security_classification_level	X	X	X	X
sequential_method	X	X	X	X
serial_action_method	X	X	X	X
shape_aspect			X	X
shape_aspect_deriving_relationship			X	X
shape_aspect_relationship			X	X
shape_defining_relationship			X	X
shape_definition_representation		X	X	X
shape_dimension_representation				X
shape_representation		X	X	X
shape_representation_relationship		X	X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
shape_representation_with_parameters			X	X
shell_based_surface_model		X	X	X
si_unit	X	X	X	X
side_milling_operation	X	X	X	X
simple_generic_expression			X	X
simple_numeric_expression			X	X
slot			X	X
slot_end			X	X
solid_angle_measure_with_unit	X	X	X	X
solid_angle_unit	X	X	X	X
solid_model		X	X	X
spherical_cap			X	X
spherical_surface		X	X	X
square_u_profile			X	X
standard_uncertainty	X	X	X	X
step			X	X
straightness_tolerance				X
surface		X	X	X
surface_curve		X	X	X
surface_of_linear_extrusion		X	X	X
surface_of_revolution	X	X	X	X
surface_patch		X	X	X
surface_profile_tolerance				X
surface_replica		X	X	X
surface_texture_representation	X	X	X	X
swept_surface		X	X	X
symmetric_shape_aspect				X
symmetry_tolerance				X
tangent				X
taper			X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
tapping_operation	X	X	X	X
tee_profile			X	X
thread			X	X
threading_turning_operation	X	X	X	X
time_measure_with_unit	X	X	X	X
time_unit	X	X	X	X
tolerance_value				X
tolerance_zone				X
tolerance_zone_definition				X
tolerance_zone_form				X
topological_representation_item		X	X	X
toroidal_surface		X	X	X
total_runout_tolerance				X
transition_feature			X	X
trimmed_curve	X	X	X	X
turned_knurl			X	X
turning_type_operation	X	X	X	X
turning_type_strategy	X	X	X	X
type_qualifier	X	X	X	X
unary_boolean_expression			X	X
unary_generic_expression			X	X
uncertainty_measure_with_unit			X	X
uncertainty_qualifier			X	X
uniform_curve		X	X	X
uniform_surface		X	X	X
value_range	X	X	X	X
variable			X	X
variable_semantics			X	X
vector	X	X	X	X
vee_profile			X	X

Table 15 — Conformance class elements (continued)

AIM element	Conformance class			
	1	2	3	4
vertex		X	X	X
vertex_loop		X	X	X
vertex_point		X	X	X
week_of_year_and_day_date	X	X	X	X
xor_expression			X	X

