INTERNATIONAL STANDARD ISO 10303-109:2004

TECHNICAL CORRIGENDUM 2

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Industrial automation systems and integration — Product data representation and exchange —

Part 109:

Integrated generic resource: Kinematic and geometric constraints for assembly models

TECHNICAL CORRIGENDUM 2

Systèmes d' automatisation industrielle et intégration – Représentation et échange de données de produits -

Partie 109: Ressources génériques intégrées: Contraintes cinématiques et géométriques pour les modèles

d'assemblage *RECTIFICATIF TECHNIQUE 2*

Technical Corrigendum 2 to International Standard ISO 10303-109:2004 was prepared by Technical Committee ISO/TC 184, *Automation systems and integration,* Subcommittee SC 4, *Industrial data.*

The purpose of the modification is to the text of ISO 10303-109:2004 is to correct editorial issues.

ICS 25.040.40 **Ref. No. ISO 10303-109:2004/Cor.2:2014(E)**

Published in Switzerland

Modifications to the text of ISO 10303-109:2004

Page 2, Clause 2, Normative references

Add the following to the list of normative references:

ISO 10303-59, *Industrial automation systems and integration — Product data representation and exchange — Part 59: Integrated generic resource — Quality of product shape data*

Page 5, 4.1

Remove the existing EXPRESS specification and NOTE 1 and replace them with the following new EXPRESS specification and NOTE 1:

EXPRESS specification:

```
*)
SCHEMA assembly_feature_relationship_schema;

  REFERENCE FROM assembly_constraint_schema; -- 10303-109
  REFERENCE FROM geometry_schema; -- 10303-42
  REFERENCE FROM kinematic_motion_representation_schema; -- 10303-105
  REFERENCE FROM kinematic_structure_schema; -- 10303-105
  REFERENCE FROM product_definition_schema; -- 10303-41
  REFERENCE FROM product_property_definition_schema; -- 10303-41
  REFERENCE FROM product_property_representation_schema; -- 10303-41
  REFERENCE FROM product_structure_schema; -- 10303-44
  REFERENCE FROM representation_schema; -- 10303-43
  REFERENCE FROM support_resource_schema; -- 10303-41
  REFERENCE FROM shape_data_quality_inspection_result_schema
     (using_product_definition_of_shape_representation); -- 10303-59
(*
```

NOTE 1 The schemas referenced above can be found in the following parts of ISO 10303:

assembly_constraint_schema ISO 10303-109 geometry_schema
ISO 10303-42 kinematic_motion_representation_schema ISO
10303-105 kinematic_structure_schema ISO 10303-105
product_definition_schema ISO 10303-41
product_property_definition_schema ISO 10303-41
product_property_representation_schema ISO 10303-41
product_structure_schema ISO 10303-44 representation_schema
ISO 10303-43 support_resource_schema ISO 10303-41
shape_data_quality_inspection_result_schema ISO 10303-59

Pages 22 to 24, 4.5.10, 4.5.11 and 4.5.12

Delete the whole of subclause 4.5.10 and renumber subclauses 4.5.11 and 4.5.12 as 4.5.10 and 4.5.11.

Page 46, Index

Remove the line "Using product definition of shape representation".

Modifications to the text of ISO 10303-109:2004

Page iii, Contents

Removal of the line regarding Using product definition of shape representation

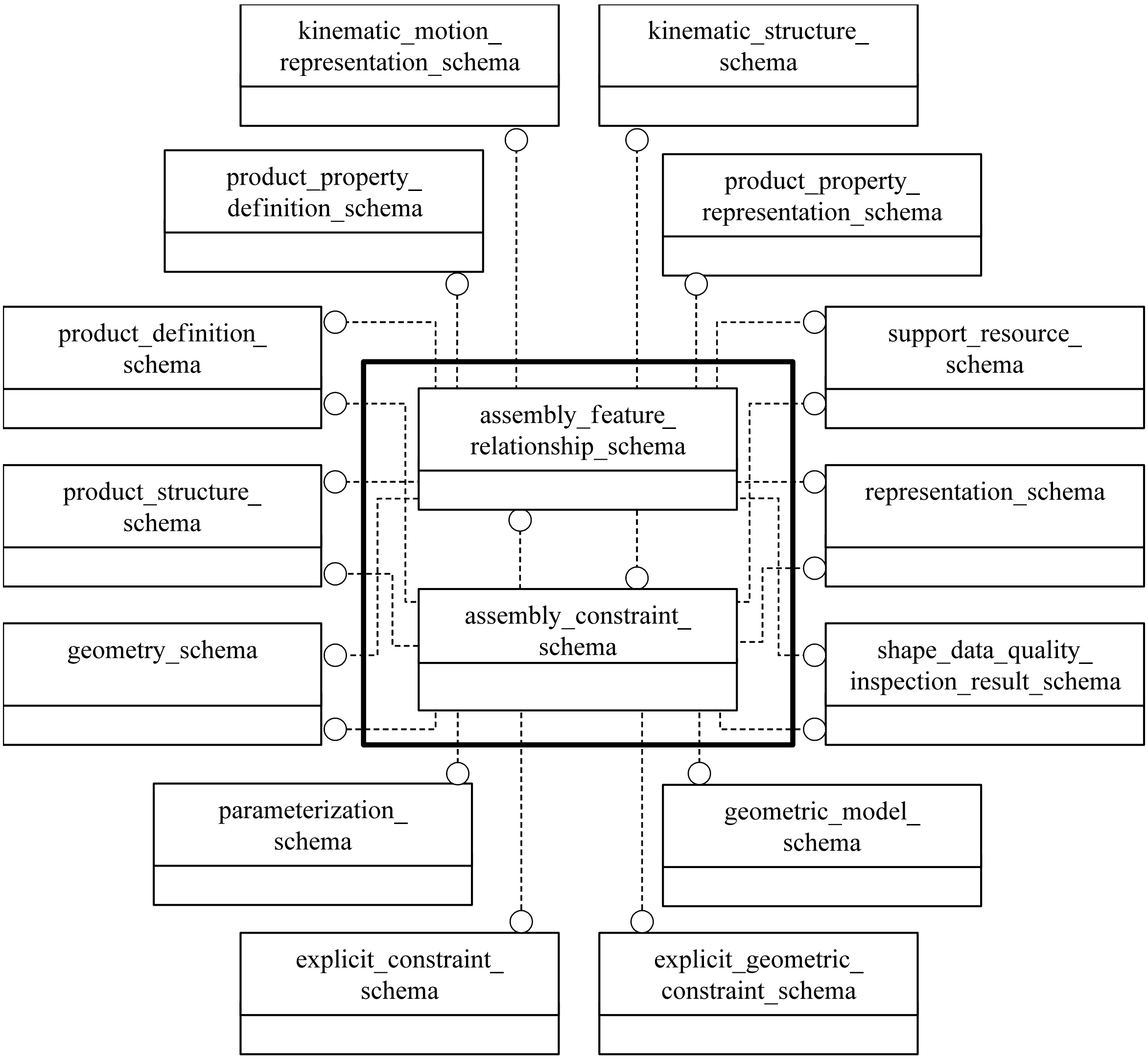
Page vii, Introduction

Addition of the following two lines at the end of the page

`shape_data_quality_inspection_result_schema`	ISO 10303-59
`support_resource_schema`	ISO 10303-41

Page viii, Figure 1

Remove Figure 1 and replace it with the following new Figure


kinematic_motion_ representation_schema
kinematic_structure_ schema
product_property_ definition_schema
product_property_ representation_schema
product_definition_ schema
support_resource_ schema
assembly_feature_ relationship_schema
product_structure_ schema
representation_schema
assembly_constraint_ schema
geometry_schema
shape_data_quality_ inspection_result_schema
parameterization_ schema
geometric_model_ schema
explicit_constraint_ schema
explicit_geometric_ constraint_schema

Page 5, 4.1

Remove the existing EXPRESS specification and Note 1, and replace them with the following new EXPRESS

EXPRESS specification:

```
*)
SCHEMA assembly_feature_relationship_schema;
    REFERENCE FROM assembly_constraint_schema; --10303-109
    REFERENCE FROM geometry_schema; -- 10303-41
    REFERENCE FROM kinematic_motion_representation_schema; -- 10303-105
    REFERENCE FROM kinematic_structure_schema; -- 10303-105
    REFERENCE FROM product_definition_schema; -- 10303-41
    REFERENCE FROM product_property_definition_schema; -- 10303-41
    REFERENCE FROM product_property_representation_schema; -- 10303-41
    REFERENCE FROM product_structure_schema; -- 10303-44
    REFERENCE FROM representation_schema; -- 10303-43
    REFERENCE FROM shape_data_quality_inspection_result_schema; -- ISO 10303-59
    REFERENCE FROM support_resource_schema; -- 10303-41
(*
```

NOTE 1 The schemas referenced above can be found in the following parts of ISO 10303:

assembly_constraint_schema	ISO 10303-109
geometry_schema	ISO 10303-42
kinematic_motion_representation_schema	ISO 10303-105
kinematic_structure_schema	ISO 10303-105
product_definition_schema	ISO 10303-41
product_property_definition_schema	ISO 10303-41
product_property_representation_schema	ISO 10303-41
product_structure_schema	ISO 10303-44
representation_schema	ISO 10303-43
shape_data_quality_inspection_result_schema	ISO 10303-59
support_resource_schema	ISO 10303-41

Page 7, 4.4.1

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

EXPRESS specification:

```
*)
ENTITY shape_aspect_relationship_representation_association;
  represented_shape_aspect_relationship: shape_aspect_relationship;
  representing_representation_relationship : representation_relationship;
WHERE
WR1: ('ASSEMBLY_FEATURE_RELATIONSHIP_SCHEMA.REPRESENTATIVE_SHAPE_REPRESENTATION'
     IN TYPEOF(representing_representation_relationship¥representation_relationship.
     rep_1)) AND
     ('ASSEMBLY_FEATURE_RELATIONSHIP_SCHEMA.REPRESENTATIVE_SHAPE_REPRESENTATION'
     IN
     TYPEOF(representing_representation_relationship¥representation_relationship.
     rep_2));
WR2: (represented_shape_aspect_relationship.relating_shape_aspect IN
      using_shape_aspect_of_shape_representation
       (representing_representation_relationship.rep_1)) AND
      (represented_shape_aspect_relationship.related_shape_aspect IN
      using_shape_aspect_of_shape_representation
       (representing_representation_relationship.rep_2));
WR3: ((find_representative_shape_representation_of_product_definition
     (using_product_definition_of_shape_aspect
     (represented_shape_aspect_relationship.relating_shape_aspect)).
      context_of_items)  :=:
     (find_representative_shape_representation_of_shape_aspect
     (represented_shape_aspect_relationship.relating_shape_aspect).
      context_of_items)) AND
     ((find_representative_shape_representation_of_product_definition
     (using_product_definition_of_shape_aspect
     (represented_shape_aspect_relationship.related_shape_aspect)).
```

```
      context_of_items) :=:
     (find_representative_shape_representation_of_shape_aspect
     (represented_shape_aspect_relationship.related_shape_aspect).
      context_of_items));
WR4: using_product_definition_of_shape_aspect
     (represented_shape_aspect_relationship.relating_shape_aspect) :<>:
     using_product_definition_of_shape_aspect
     (represented_shape_aspect_relationship.related_shape_aspect);
WR5: find_assembly_root ([using_product_definition_of_shape_aspect
     (represented_shape_aspect_relationship.relating_shape_aspect)]) :=:
     find_assembly_root ([using_product_definition_of_shape_aspect
     (represented_shape_aspect_relationship.related_shape_aspect)]);
END_ENTITY; -- shape_aspect_relationship_representation_association
(*
```

Page 10, 4.4.3

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

<u>EXPRESS specification:</u>

```
*)
ENTITY free_kinematic_motion_representation
  SUBTYPE OF (representation_relationship_with_transformation);
SELF¥representation_relationship.rep_1:
   representative_shape_representation;
SELF¥representation_relationship.rep_2:
   representative_shape_representation;
motion : kinematic_path;
WHERE
WR1: 'REPRESENTATION_SCHEMA.ITEM_DEFINED_TRANSFORMATION' IN TYPEOF
     (SELF¥representation_relationship_with_transformation.
      transformation_operator);
WR2: ('GEOMETRY_SCHEMA.GEOMETRIC_REPRESENTATION_ITEM' IN TYPEOF
     (SELF¥representation_relationship_with_transformation.
      transformation_operator¥item_defined_transformation.transform_item_1)) AND
     ('GEOMETRY_SCHEMA.GEOMETRIC_REPRESENTATION_ITEM' IN TYPEOF
     (SELF¥representation_relationship_with_transformation.
      transformation_operator¥item_defined_transformation.
transform_item_2));
WR3: ((dimension_of
     (SELF¥representation_relationship_with_transformation.
      transformation_operator¥item_defined_transformation.
      transform_item_1) = 3 ) AND
     (dimension_of
     (SELF¥representation_relationship_with_transformation.
      transformation_operator¥item_defined_transformation.
      transform_item_2) = 3 ));
WR4:(SELF¥representation_relationship.rep_1 IN
     (using_representations
     (SELF¥representation_relationship_with_transformation.
     transformation_operator¥item_defined_transformation.transform_item_1) +
      using_representation_with_mapping
     (SELF¥representation_relationship_with_transformation.
     transformation_operator¥item_defined_transformation.transform_item_1)))
     AND
     (SELF¥representation_relationship.rep_2 IN
     (using_representations
     (SELF¥representation_relationship_with_transformation.
     transformation_operator¥item_defined_transformation.transform_item_2) +
      using_representation_with_mapping
     (SELF¥representation_relationship_with_transformation.
    transformation_operator¥item_defined_transformation.transform_item_2)));
END_ENTITY; -- free_kinematic_motion_representation
(*
```

Page 12, 4.4.4

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

EXPRESS specification:

```
*)
ENTITY constrained_kinematic_motion_representation
  SUBTYPE OF (representation_relationship_with_transformation);
SELF¥representation_relationship.rep_1:
    representative_shape_representation;
SELF¥representation_relationship.rep_2:
    representative_shape_representation;
WHERE
WR1: ('GEOMETRY_SCHEMA.AXIS2_PLACEMENT_3D' IN TYPEOF
      (SELF¥representation_relationship_with_transformation.
     transformation_operator¥item_defined_transformation.transform_item_1)) AND
      ('GEOMETRY_SCHEMA.AXIS2_PLACEMENT_3D' IN TYPEOF
      (SELF¥representation_relationship_with_transformation.
     transformation_operator¥item_defined_transformation.transform_item_2));
WR2: ((dimension_of
      (SELF¥representation_relationship_with_transformation.
     transformation_operator¥item_defined_transformation.
     transform_item_1) = 3 ) AND
      (dimension_of
      (SELF¥representation_relationship_with_transformation.
     transformation_operator¥item_defined_transformation.
     transform_item_2) = 3 ));
WR3:(SELF¥representation_relationship.rep_1 IN
      (using_representations
      (SELF¥representation_relationship_with_transformation.
     transformation_operator¥item_defined_transformation.transform_item_1) +
     using_representation_with_mapping
      (SELF¥representation_relationship_with_transformation.
     transformation_operator¥item_defined_transformation.transform_item_1))) AND
      (SELF¥representation_relationship.rep_2 IN
      (using_representations
      (SELF¥representation_relationship_with_transformation.
     transformation_operator¥item_defined_transformation.transform_item_2) +
     using_representation_with_mapping
      (SELF¥representation_relationship_with_transformation.
    transformation_operator¥item_defined_transformation.transform_item_2)));
WR4: 'KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_PAIR' IN TYPEOF
      (SELF¥representation_relationship_with_transformation.
       transformation_operator);
END_ENTITY; -- constrained_kinematic_motion_representation
(*
```

Page 13, 4.5.1

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

EXPRESS specification:

```
*)
FUNCTION assembly_root
  (item: product_definition) : BOOLEAN;
-- extraction of related assembly_component_relationships --
IF (SIZEOF(QUERY(pdr <* USEDIN (item,
   'PRODUCT_DEFINITION_SCHEMA.PRODUCT_DEFINITION_RELATIONSHIP.' +
   'RELATED_PRODUCT_DEFINITION') |
    'PRODUCT_STRUCTURE_SCHEMA.ASSEMBLY_COMPONENT_USAGE' IN
    TYPEOF(pdr)))
    = 0) THEN RETURN(TRUE);
ELSE RETURN (FALSE);
END_IF;
```

```
END_FUNCTION;
(*
```

Page 14, 4.5.2

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

EXPRESS specification:

```
*)
FUNCTION find_assembly_root
  (constituent: SET OF product_definition) : SET OF product_definition;
LOCAL
  local_relation: SET OF assembly_component_usage := [];
  local_relation2: BAG OF assembly_component_usage := [];
  local_parent: SET OF product_definition := [];
  root : SET OF product_definition;
  i : INTEGER := 0;
  j : INTEGER := 0;
END_LOCAL;
-- Is constituent root ? --
IF ((SIZEOF (constituent) = 1) AND assembly_root (constituent[1]))
  THEN RETURN ([constituent [1]]);
-- ERROR constituent is vacant --
  ELSE IF (SIZEOF (constituent) = 0 ) THEN RETURN ([]);
-- extraction of related assembly_component_relationships --
    ELSE
      REPEAT j:= 1 TO HIINDEX(constituent);
      local_relation2 := local_relation2 + QUERY(pdr <* USEDIN (constituent[j],
      'PRODUCT_DEFINITION_SCHEMA.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') |
      'PRODUCT_STRUCTURE_SCHEMA.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr));
      END_REPEAT;
      local_relation := bag_to_set (local_relation2);
      IF (SIZEOF(local_relation) = 0) THEN
        IF (SIZEOF(constituent) = 1) THEN RETURN ([constituent[1]]);
          ELSE RETURN ([]);
        END_IF;
      ELSE
-- extraction of a set of parents --
        REPEAT i :=1 TO HIINDEX(local_relation);
          REPEAT j := 1 TO HIINDEX(constituent);
          IF (local_relation[i].relating_product_definition <>
              constituent[j]) THEN
            local_parent := local_parent +
                            local_relation[i].relating_product_definition;
          END_IF;
          END_REPEAT;
        END_REPEAT;
        IF ((SIZEOF (local_parent) = 1 ) AND
             assembly_root (local_parent[1]))
          THEN RETURN ([local_parent[1]]);
          ELSE IF (SIZEOF (local_parent) = 0) THEN RETURN ([]);
-- try again --
            ELSE
              root := find_assembly_root(local_parent);
              IF (SIZEOF (root) =1) THEN RETURN (root);
                ELSE IF (SIZEOF (root) = 0) THEN RETURN ([]);
                END_IF;
              END_IF;
          END_IF;
        END_IF;
      END_IF;
  END_IF;
END_IF;
```

```
RETURN ([]);
END_FUNCTION;
(*
```

Page 16, 4.5.3

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

<u>EXPRESS specification:</u>

```
*)
FUNCTION find_shape_representation_of_product_definition
    (item:product_definition) : SET OF shape_representation;
LOCAL
  local_p_d_s: SET OF product_definition_shape := [];
  local_p_d_s2: BAG OF product_definition_shape := [];
  local_s_d_r: SET OF shape_definition_representation := [];
  local_s_d_r2: BAG OF shape_definition_representation := [];
  local_s_r: SET OF shape_representation := [];
  i : INTEGER;
END_LOCAL;
-- find product_definition_shape representing the product_definiton
  local_p_d_s2 := local_p_d_s2 + QUERY(pd <* USEDIN (item,
  'PRODUCT_PROPERTY_DEFINITION_SCHEMA.PROPERTY_DEFINITION.DEFINITION') |
  'PRODUCT_PROPERTY_DEFINITION_SCHEMA.PRODUCT_DEFINITION_SHAPE' IN
    TYPEOF(pd));
  local_p_d_s := bag_to_set(local_p_d_s2);
-- find shape_definition_representations refereing to the local_p_d_s
  REPEAT i := 1 to HIINDEX (local_p_d_s);
    local_s_d_r2 := local_s_d_r2 + QUERY(pdr <* USEDIN (local_p_d_s[i],
  'PRODUCT_PROPERTY_REPRESENTATION_SCHEMA.' +
  'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
  'PRODUCT_PROPERTY_REPRESENTATION_SCHEMA.SHAPE_DEFINITION_REPRESENTATION' IN
      TYPEOF(pdr));
  END_REPEAT;
  local_s_d_r := bag_to_set (local_s_d_r2);
  REPEAT i := 1 to HIINDEX (local_s_d_r);
    IF('PRODUCT_PROPERTY_REPRESENTATION_SCHEMA.SHAPE_REPRESENTATION'
        IN TYPEOF (local_s_d_r[i].used_representation)) THEN
        local_s_r := local_s_r + local_s_d_r[i].used_representation;
    END_IF;
  END_REPEAT;
  RETURN (local_s_r);
END_FUNCTION;
(*
```

Page 17, 4.5.4

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

<u>EXPRESS specification:</u>

```
*)
FUNCTION find_shape_representation_of_shape_aspect
    (item:shape_aspect) : SET OF shape_representation;
LOCAL
  local_p_d: SET OF property_definition:= [];
  local_s_d_r: SET OF shape_definition_representation := [];
  local_s_d_r2: BAG OF shape_definition_representation := [];
  local_s_r: SET OF shape_representation := [];
  i : INTEGER;
END_LOCAL;
-- find property_definition representing the shape_aspect
  local_p_d := bag_to_set (USEDIN (item,
   'PRODUCT_PROPERTY_DEFINITION_SCHEMA.PROPERTY_DEFINITION.DEFINITION'));
-- find shape_definition_representations refereing to the local_p_d
```

```
  REPEAT i := 1 to HIINDEX (local_p_d);
    local_s_d_r2 := local_s_d_r2 + QUERY(pdr <* USEDIN (local_p_d[i],
    'PRODUCT_PROPERTY_REPRESENTATION_SCHEMA.' +
    'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION') |
    'PRODUCT_PROPERTY_REPRESENTATION_SCHEMA.SHAPE_DEFINITION_REPRESENTATION' IN
    TYPEOF(pdr));
  END_REPEAT;
    local_s_d_r := bag_to_set (local_s_d_r2);
  REPEAT i := 1 to HIINDEX (local_s_d_r);
    IF('PRODUCT_PROPERTY_REPRESENTATION_SCHEMA.SHAPE_REPRESENTATION'
        IN TYPEOF (local_s_d_r[i].used_representation)) THEN
        local_s_r := local_s_r + local_s_d_r[i].used_representation;
    END_IF;
  END_REPEAT;
  RETURN (local_s_r);
END_FUNCTION;
(*
```

Page 18, 4.5.5

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

<u>EXPRESS specification:</u>

```
*)
FUNCTION find_representative_shape_representation_of_product_definition
    (item:product_definition) : shape_representation;
LOCAL
  local_s_r: SET OF shape_representation := [];
END_LOCAL;
-- find representative_shape_representation of the product_definition
  local_s_r := QUERY
    ( z <* find_shape_representation_of_product_definition (item)|
    'ASSEMBLY_FEATURE_RELATIONSHIP_SCHEMA.REPRESENTATIVE_SHAPE_REPRESENTATION'
    IN TYPEOF(z));
  IF (SIZEOF (local_s_r) = 1)
    THEN RETURN (local_s_r[1]);
    ELSE RETURN(?);
  END_IF;
END_FUNCTION;
(*
```

Page 18, 4.5.6

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

<u>EXPRESS specification:</u>

```
*)
FUNCTION find_representative_shape_representation_of_shape_aspect
    (item:shape_aspect) : shape_representation;
LOCAL
  local_s_r: SET OF shape_representation := [];
END_LOCAL;
-- find representative_shape_representation of the shape_aspect
 local_s_r := QUERY ( z <* find_shape_representation_of_shape_aspect (item)|
 'ASSEMBLY_FEATURE_RELATIONSHIP_SCHEMA.REPRESENTATIVE_SHAPE_REPRESENTATION' IN
 TYPEOF(z));
  IF (SIZEOF (local_s_r) = 1)
    THEN RETURN (local_s_r[1]);
    ELSE RETURN(?);
  END_IF;
END_FUNCTION;
(*
```

Page 19, 4.5.7

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

EXPRESS specification:

```
*)
FUNCTION unique_in_product_definition
    (item:representative_shape_representation) : BOOLEAN;
LOCAL
  local_p_d: SET OF product_definition := [];
  local_s_r: SET OF shape_representation := [];
  i : INTEGER;
  j : INTEGER;
END_LOCAL;
-- find product_definitions represented by the input
-- representative_shape_representation
  local_p_d := using_product_definition_of_shape_representation (item);
-- ERROR
  IF (SIZEOF (local_p_d) <> 1) THEN RETURN (FALSE);
    ELSE
-- find shape_representation representing the product_definitions
    REPEAT i := 1 to HIINDEX (local_p_d);
      local_s_r := find_shape_representation_of_product_definition
                   (local_p_d[i]);
      REPEAT j := 1 to HIINDEX (local_s_r);
        IF
  (('ASSEMBLY_FEATURE_RELATIONSHIP_SCHEMA.REPRESENTATIVE_SHAPE_REPRESENTATION'
  IN TYPEOF (local_s_r[j]))
             AND (local_s_r[j] :<>: item)) THEN RETURN (FALSE);
        END_IF;
      END_REPEAT;
    END_REPEAT;
  END_IF;
  RETURN (TRUE);
END_FUNCTION;
(*
```

Page 20, 4.5.8

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

EXPRESS specification:

```
*)
FUNCTION unique_in_shape_aspect
    (item:representative_shape_representation) : BOOLEAN;
LOCAL
  local_s_a: SET OF shape_aspect := [];
  local_s_r: SET OF shape_representation := [];
  i : INTEGER;
  j : INTEGER;
END_LOCAL;
-- find shape_aspects represented by the input
-- representative_shape_representation
  local_s_a := using_shape_aspect_of_shape_representation (item);
-- ERROR
  IF (SIZEOF (local_s_a) <> 1) THEN RETURN (FALSE);
    ELSE
-- find shape_representation representing the shape_aspect
    REPEAT i := 1 to HIINDEX (local_s_a);
      local_s_r := find_shape_representation_of_shape_aspect (local_s_a[i]);
      REPEAT j := 1 to HIINDEX (local_s_r);
        IF
  (('ASSEMBLY_FEATURE_RELATIONSHIP_SCHEMA.REPRESENTATIVE_SHAPE_REPRESENTATION'
  IN TYPEOF (local_s_r[j]))
           AND (local_s_r[j] :<>: item)) THEN RETURN (FALSE);
        END_IF;
      END_REPEAT;
    END_REPEAT;
  END_IF;
  RETURN (TRUE);
END_FUNCTION;
(*
```

Page 23, 4.5.10

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

EXPRESS specification:

```
*)
FUNCTION using_shape_aspect_of_shape_representation
    (item: shape_representation) : SET OF shape_aspect;
LOCAL
  local_s_d_r: SET OF shape_definition_representation := [];
  local_s_d_r2: BAG OF shape_definition_representation := [];
  local_s_a: SET OF shape_aspect := [];
  i : INTEGER;
END_LOCAL;
-- find shape_definition_representations
  local_s_d_r2  := local_s_d_r2 + QUERY(pdr <* USEDIN (item,
  'PRODUCT_PROPERTY_REPRESENTATION_SCHEMA.' +
  'PROPERTY_DEFINITION_REPRESENTATION.USED_REPRESENTATION') |
  'PRODUCT_PROPERTY_REPRESENTATION_SCHEMA.SHAPE_DEFINITION_REPRESENTATION'
   IN TYPEOF(pdr));
  local_s_d_r := bag_to_set (local_s_d_r2);
-- find shape_aspects
REPEAT i := 1 TO HIINDEX (local_s_d_r);
   IF ('PRODUCT_PROPERTY_DEFINITION_SCHEMA.SHAPE_ASPECT' IN TYPEOF
     (local_s_d_r[i]¥property_definition_representation.
     definition¥property_definition.definition))
   THEN local_s_a := local_s_a +
    local_s_d_r[i]¥property_definition_representation.
    definition¥property_definition.definition;
   END_IF;
END_REPEAT;
RETURN (local_s_a);
END_FUNCTION;
(*
```

Page 26, 5.1

Remove the existing EXPRESS specification and Note 1, and replace them with the following new EXPRESS

EXPRESS specification:

```
  *)
 SCHEMA assembly_constraint_schema;

   REFERENCE FROM assembly_feature_relationship_schema; -- ISO 10303-109
   REFERENCE FROM explicit_constraint_schema; -- ISO 10303-108
   REFERENCE FROM explicit_geometric_constraint_schema; -- ISO 10303-108
   REFERENCE FROM geometric_model_schema; -- ISO 10303-42
   REFERENCE FROM geometry_schema; -- ISO 10303-42
   REFERENCE FROM parameterization_schema; -- ISO 10303-108
   REFERENCE FROM product_definition_schema; -- 10303-41
   REFERENCE FROM product_structure_schema; -- ISO 10303-44
   REFERENCE FROM representation_schema; -- ISO 10303-43
   REFERENCE FROM shape_data_quality_inspection_result_schema
      (using_product_definition_of_shape_representation)-- ISO 10303-59
   REFERENCE FROM support_resource_schema; -- 10303-41
   (*
```

NOTE 1 The schemas referenced above, unless otherwise stated, can be found in the following parts of ISO 10303:

assembly_feature_relationship_schema	ISO 10303-109
explicit_constraint_schema	ISO 10303-108
explicit_geometric_constraint_schema	ISO 10303-108
geometric_model_schema	ISO 10303-42
geometry_schema	ISO 10303-42
parameterization_schema	ISO 10303-108
product_definition_schema	ISO 10303-41
product_structure_schema	ISO 10303-44
representation_schema	ISO 10303-43
shape_data_quality_inspection_result_schema	ISO 10303-59
support_resource_schema	ISO 10303-41

Page 31, 5.3.3

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

<u>EXPRESS specification:</u>

```
*)
ENTITY fixed_constituent_assembly_constraint
SUBTYPE OF (assembly_geometric_constraint,
            fixed_element_geometric_constraint);
    fixed_constituent: representative_shape_representation;
WHERE
WR1: SELF¥explicit_constraint.
constrained_elements[1]¥geometric_representation_item.dim = 3;
WR2: (assembly_leaf (using_product_definition_of_shape_representation
      (fixed_constituent)[1]));
WR3: (SIZEOF(SELF¥explicit_constraint.constrained_elements) = 1) AND
      (SIZEOF(SELF¥explicit_constraint.reference_elements) = 0);
WR4: fixed_constituent IN
      (using_representations(SELF¥explicit_constraint.constrained_elements[1]) +
     using_representation_with_mapping(SELF¥explicit_constraint.
     constrained_elements[1]));
END_ENTITY;-- fixed_constituent_assembly_constraint
(*
```

Page 36, 5.4.1

Remove the existing EXPRESS specification, and replace it with the following new EXPRESS

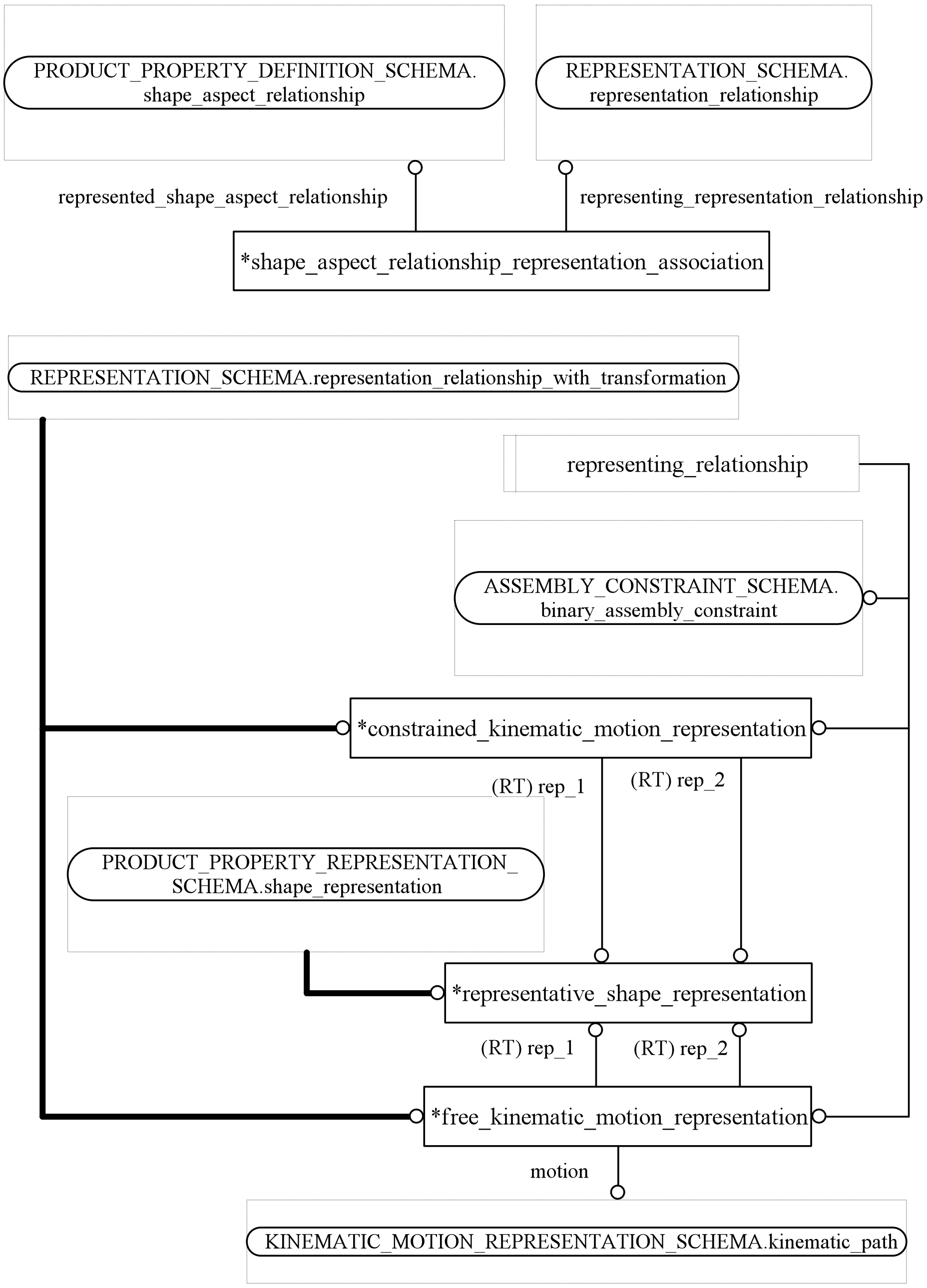
<u>EXPRESS specification:</u>

```
*)
FUNCTION assembly_leaf
  (item: product_definition) : BOOLEAN;
LOCAL
  local_relation: SET OF assembly_component_usage := [];
  local_relation2: BAG OF assembly_component_usage := [];
END_LOCAL;
-- extraction of related assembly_component_relationships --
local_relation2 := local_relation2 + QUERY(pdr <* USEDIN (item,
    'PRODUCT_DEFINITION_SCHEMA.PRODUCT_DEFINITION_RELATIONSHIP.' +
    'RELATING_PRODUCT_DEFINITION') |
    'PRODUCT_STRUCTURE_SCHEMA.ASSEMBLY_COMPONENT_USAGE' IN
      TYPEOF(pdr));
local_relation := bag_to_set (local_relation2);
IF (SIZEOF (local_relation) = 0) THEN RETURN (TRUE);
  ELSE RETURN (FALSE);
END_IF;
```

```
END_FUNCTION;
(*
```

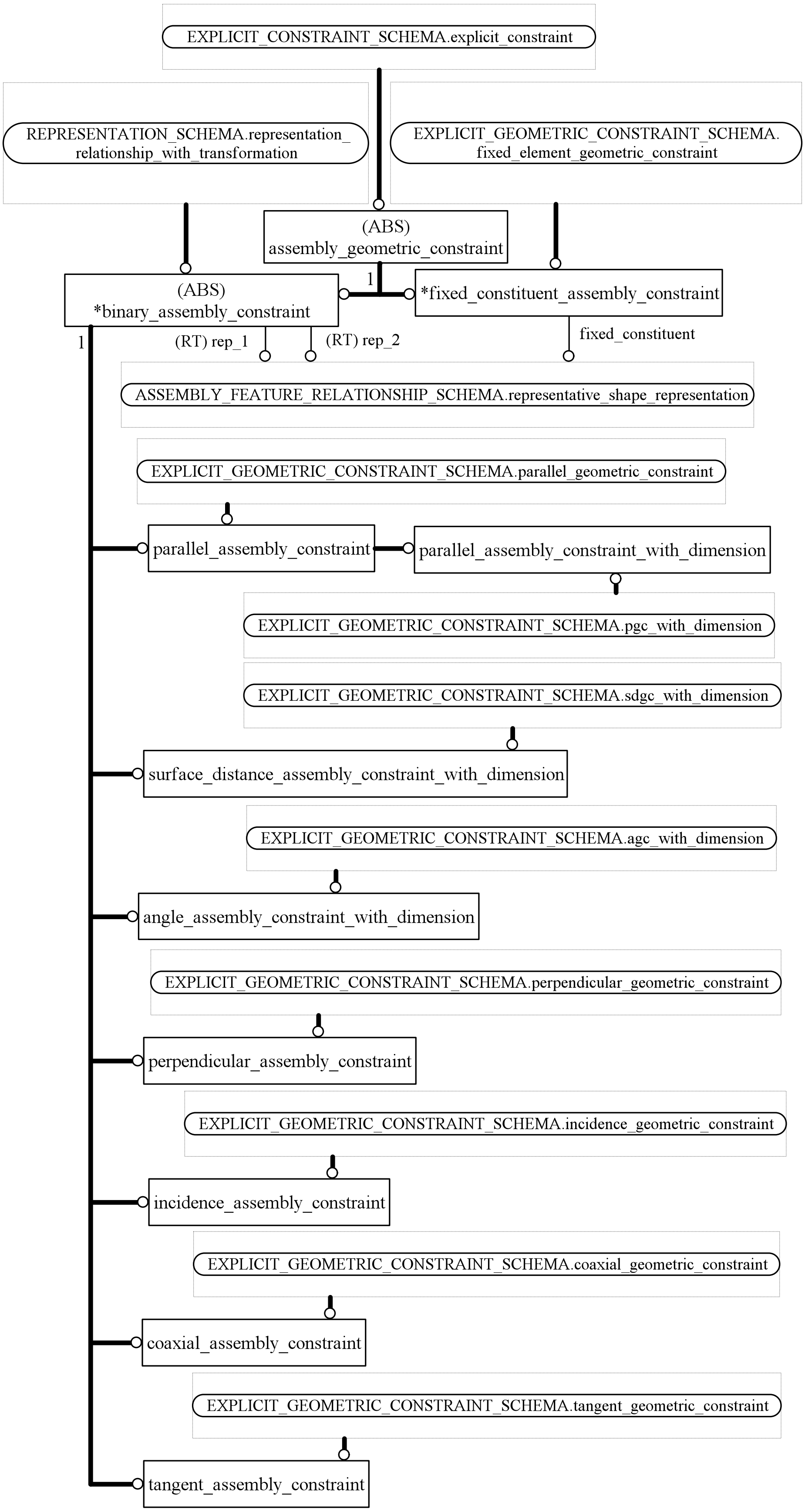
Page 42, Figure D.1

Remove Figure D.1 and replace it with the following new Figure


PRODUCT_PROPERTY_DEFINITION_SCHEMA.
shape_aspect_relationship
REPRESENTATION_SCHEMA.
representation_relationship
represented_shape_aspect_relationship
representing_representation_relationship
*shape_aspect_relationship_representation_association
REPRESENTATION_SCHEMA.representation_relationship_with_transformation
representing_relationship
ASSEMBLY_CONSTRAINT_SCHEMA.
binary_assembly_constraint
*constrained_kinematic_motion_representation
(RT) rep_1
(RT) rep_2
PRODUCT_PROPERTY_REPRESENTATION_
SCHEMA.shape_representation
*representative_shape_representation
(RT) rep_1
(RT) rep_2
*free_kinematic_motion_representation
motion
KINEMATIC_MOTION_REPRESENTATION_SCHEMA.kinematic_path

Page 43, Figure D.2

Remove Figure D.2 and replace it with the following new Figure



EXPLICIT_CONSTRAINT_SCHEMA.explicit_constraint
REPRESENTATION_SCHEMA.representation_relationship_with_transformation
EXPLICIT_GEOMETRIC_CONSTRAINT_SCHEMA.fixed_element_geometric_constraint
(ABS) assembly_geometric_constraint
1
(ABS) *binary_assembly_constraint
*fixed_constituent_assembly_constraint
1
(RT) rep_1
(RT) rep_2
fixed_constituent
ASSEMBLY_FEATURE_RELATIONSHIP_SCHEMA.representative_shape_representation
EXPLICIT_GEOMETRIC_CONSTRAINT_SCHEMA.parallel_geometric_constraint
parallel_assembly_constraint
parallel_assembly_constraint_with_dimension
EXPLICIT_GEOMETRIC_CONSTRAINT_SCHEMA.pgc_with_dimension
EXPLICIT_GEOMETRIC_CONSTRAINT_SCHEMA.sdgc_with_dimension
surface_distance_assembly_constraint_with_dimension
EXPLICIT_GEOMETRIC_CONSTRAINT_SCHEMA.agc_with_dimension
angle_assembly_constraint_with_dimension
EXPLICIT_GEOMETRIC_CONSTRAINT_SCHEMA.perpendicular_geometric_constraint
perpendicular_assembly_constraint
EXPLICIT_GEOMETRIC_CONSTRAINT_SCHEMA.incidence_geometric_constraint
incidence_assembly_constraint
EXPLICIT_GEOMETRIC_CONSTRAINT_SCHEMA.coaxial_geometric_constraint
coaxial_assembly_constraint
EXPLICIT_GEOMETRIC_CONSTRAINT_SCHEMA.tangent_geometric_constraint
tangent_assembly_constraint