



**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**

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TECHNICAL CORRIGENDUM 2

[ISO/DIS 10303-239](https://standards.iteh.ai/catalog/standards/sist/a06fe7b8-ac27-4110-b740-77aa6139f058/iso-dis-10303-239)

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*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*.

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

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**ICS 25.040.40**

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## ISO 10303-109:2004/Cor.1:2010(E) (Only Reference)

### *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

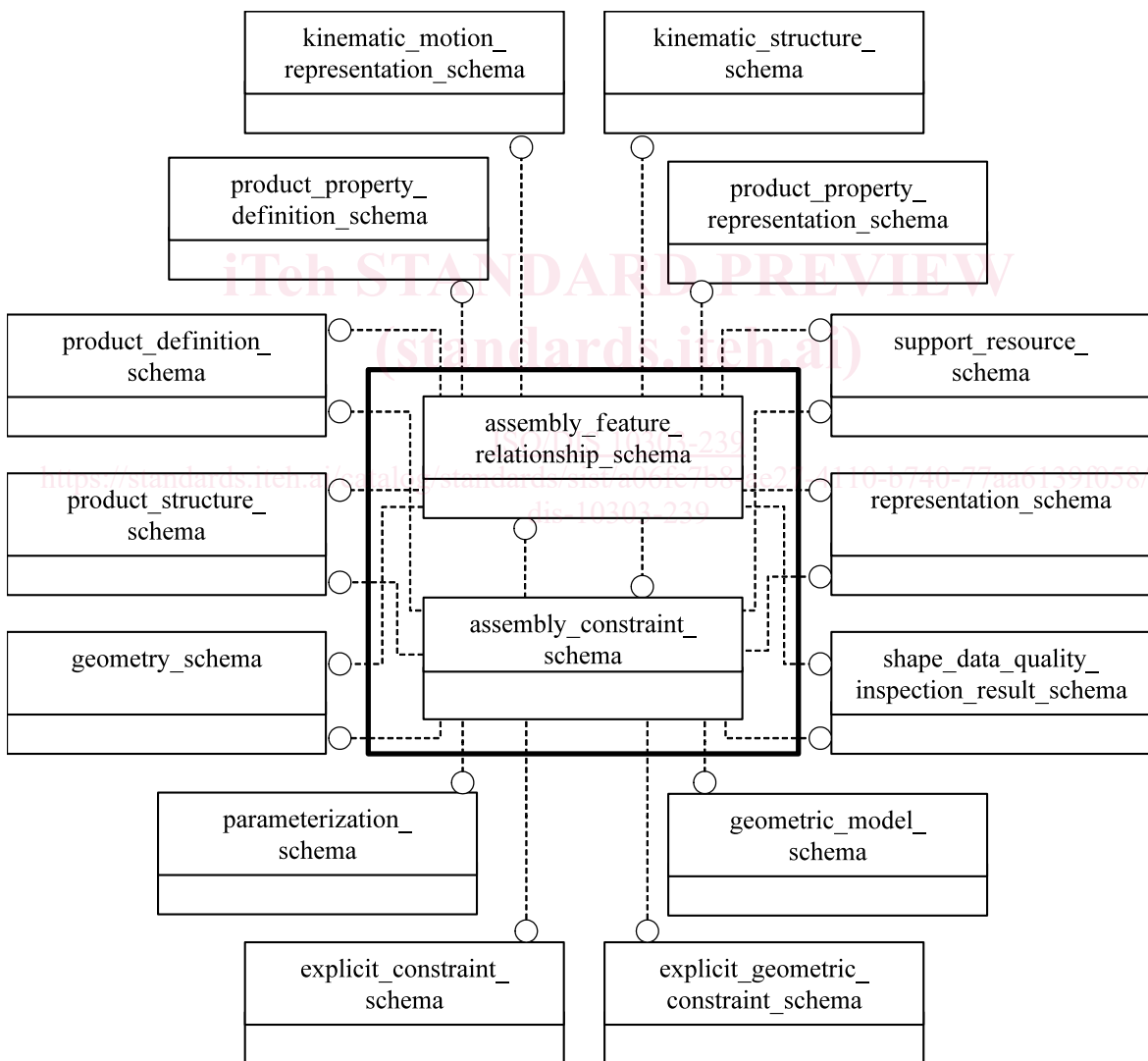
## Page vii, Introduction

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



## 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.relate_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.relate_shape_aspect)).  
  context_of_items) :=:  
  (find_representative_shape_representation_of_shape_aspect  
  (represented_shape_aspect_relationship.relate_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.relateing_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.relateing_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*

**EXPRESS specification:**

```

*)
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
(*)

```

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
(*

```

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;
END_IF;
```

```

RETURN ([]);
END_FUNCTION;
(*)

```

**Page 16, 4.5.3**

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

**EXPRESS specification:**

```

*)
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*

**EXPRESS specification:**

```

*)
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*

EXPRESS specification:

```

*)
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*

EXPRESS specification:

```

*)
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;
(*)

```

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;
(*)

```

[ISO/DIS 10303-239](https://standards.iteh.ai/catalog/standards/sist/a06fe7b8-ae27-4110-b740-77aa6139f058/iso-dis-10303-239)

<https://standards.iteh.ai/catalog/standards/sist/a06fe7b8-ae27-4110-b740-77aa6139f058/iso-dis-10303-239>

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;
(*)

```