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TECHNICAL CORRIGENDUM 2

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

Part 105:
Integrated application resource: Kinematics

TECHNICAL CORRIGENDUM 2

Systèmes d'automatisation industrielle et intégration — Représentation et échange de données de produits — Partie 105: Ressource d'application intégrée: Cinématique

RECTIFICATIF TECHNIQUE 21

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Introduction

This document corrects ISO 10303-105:1996, Product data representation and exchange - Part 105: Integrated application resource: Kinematics. The corrected document supersedes ISO 10303-105:1996 as amended by ISO 10303-105:1996/Cor. 1:2000.

The purpose of the modifications to the text of ISO 10303-105:1996 is to correct errors in the EXPRESS definitions likely to cause compilation problems, to replace the URL in the annex for the computer-interpretable EXPRESS, and to replace the object identifier for the document and the modified schema.

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Modifications to the text of ISO 10303-105:1996

Clause 5, p. 6
The EXPRESS specification for the kinematic_structure_schema contained logical errors in the reference from the geometry_schema. Remove the following:

```
REFERENCE FROM geometry_schema
    (axis2_placement_3d,
     cartesian_transformation_operator_3d,
     curve,
     direction,
     geometric_representation_context,
     normalise,
     point,
     point_on_curve,
     point_on_surface,
     surface,
     rectangular_trimmed_surface,
     trimmed_curve);
```

Replace with the following:

```
REFERENCE FROM geometry_schema
    (axis2_placement_3d,
     cartesian_transformation_operator_3d,
     curve,
     direction,
     geometric_representation_context,
     geometric_representation_item,
     normalise,
     point,
     point_on_curve,
     point_on_surface,
     surface,
     rectangular_trimmed_surface,
     trimmed_curve);
```

Clause 5.4.6, p. 17
The EXPRESS specification for mechanism_base_placement had an additional group qualifier for ***WR3:*** *that is not allowed. Remove the EXPRESS specification and replace with the following:*

EXPRESS specification:

```
*)
ENTITY mechanism_base_placement
  SUBTYPE OF (representation_relationship_with_transformation);
  base_of_mechanism         : mechanism;
  SELF\representation_relationship_with_transformation.
    transformation_operator : cartesian_transformation_operator_3d;
DERIVE
  SELF\representation_relationship.rep_2
                  : kinematic_link_representation
                  := representation_of_link (base_of_mechanism.base);
UNIQUE
  UR1: base_of_mechanism;
WHERE
 WR1: ('KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_GROUND_REPRESENTATION' IN
```

```
        TYPEOF (SELF\representation_relationship.rep_1))
      OR
      ('KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_LINK_REPRESENTATION' IN
        TYPEOF (SELF\representation_relationship.rep_1));
  WR2: suitably_based_mechanism (SELF, base_of_mechanism);
  WR3: SELF\representation_relationship_with_transformation.
        transformation_operator IN
      SELF\representation_relationship.rep_1.items;
END_ENTITY;
(*
```

Clause 5.4.12, p. 21

The EXPRESS specification for the kinematic_link_representation had an additional group qualifier for the link_frame attribute that is not allowed. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```
*)
ENTITY kinematic_link_representation
  SUBTYPE OF (representation);
  SELF\representation.context_of_items :
            geometric_representation_context;
DERIVE
  link_frame                  :  geometric_representation_context
                              := SELF\representation.context_of_items;
INVERSE
  link_representation_relation :
        kinematic_link_representation_relation FOR geometric_aspects;
WHERE
  WR1: SIZEOF (QUERY (item <* SELF\representation.items |
               NOT (('KINEMATIC_STRUCTURE_SCHEMA.RIGID_PLACEMENT' IN
                      TYPEOF (item))
                    OR
 ('GEOMETRY_SCHEMA.CARTESIAN_TRANSFORMATION_OPERATOR_3D' IN
                      TYPEOF (item))) )) = 0;
END_ENTITY;
(*
```

Clause 5.4.16, p. 24

The EXPRESS specification for the kinematic_frame_background_representation_association had an additional group qualifier for ***WR3:*** *that is not allowed. Remove the EXPRESS specification and replace with the following:*

EXPRESS specification:

```
*)
ENTITY kinematic_frame_background_representation_association
  SUBTYPE OF (representation_relationship_with_transformation);
  SELF\representation_relationship_with_transformation.
    transformation_operator : kinematic_frame_based_transformation;
WHERE
  WR1: 'KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_LINK_REPRESENTATION' IN
        TYPEOF (SELF\representation_relationship.rep_1);
  WR2:
'KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_FRAME_BACKGROUND_REPRESENTATION'
        IN TYPEOF (SELF\representation_relationship.rep_2);
  WR3: SELF\representation_relationship_with_transformation.
```

```
transformation_operator\kinematic_frame_based_transformation.
          transformator IN
        SELF\representation_relationship.rep_1.items;
END_ENTITY;
(*
```

Clause 5.4.37, p. 43

The EXPRESS specification for the universal_pair had an additional group qualifier for ***WR1:*** *that is not allowed. Remove the EXPRESS specification and replace with the following:*

EXPRESS specification:

```
*)
ENTITY universal_pair
  SUBTYPE OF (kinematic_pair);
  input_skew_angle : OPTIONAL plane_angle_measure;
DERIVE
  skew_angle  : plane_angle_measure := NVL (input_skew_angle, 0.0);
WHERE
  WR1: COS (plane_angle_for_pair_in_radian (SELF, skew_angle))
       > 0.0;
END_ENTITY;
(*
```

Clause 5.4.68, p. 79

The EXPRESS specification for the rack_and_pinion_pair_value had an additional group qualifier for the actual_rotation attribute that is not allowed. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```
*)
ENTITY rack_and_pinion_pair_value
  SUBTYPE OF (pair_value);
  SELF\pair_value.applies_to_pair : rack_and_pinion_pair;
  actual_displacement             : length_measure;
DERIVE
  actual_rotation : plane_angle_measure
                  := convert_plane_angle_for_pair_from_radian
                     (SELF\pair_value.applies_to_pair,
                     (- actual_displacement /
                      SELF\pair_value.applies_to_pair\
                      rack_and_pinion_pair.pinion_radius));
END_ENTITY;
(*
```

Clause 5.5.3, p. 82

The EXPRESS specification for the suitably_based_mechanism had an additional group qualifier for the klrep and the kgrep variables that is not allowed. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```
*)
FUNCTION suitably_based_mechanism (mbp  : mechanism_base_placement;
                                   mech : mechanism) : BOOLEAN;
  LOCAL
    kprop  : kinematic_property_definition;
```

```
    kgrep  : kinematic_ground_representation;
    klrep  : kinematic_link_representation;
    klnk   : kinematic_link;
    kjnts  : BAG OF kinematic_joint;
    nmechs : BAG OF mechanism;
    nmbps  : BAG OF mechanism_base_placement;
  END_LOCAL;

  kprop := mech.containing_property;

  IF ('KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_GROUND_REPRESENTATION' IN
      TYPEOF (mbp\representation_relationship.rep_1)) THEN
      kgrep := mbp\representation_relationship.rep_1;

    IF (kgrep.property\property_definition_representation.definition
        :=: kprop) THEN
      RETURN (TRUE);
    ELSE
      RETURN (FALSE);
    END_IF;
  ELSE
    klrep := mbp\representation_relationship.rep_1;
    klnk   := klrep.link_representation_relation.topological_aspects;
    kjnts  := USEDIN (klnk,
            'KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_JOINT.FIRST_LINK') +
              USEDIN (klnk,
            'KINEMATIC_STRUCTURE_SCHEMA.KINEMATIC_JOINT.SECOND_LINK');
    nmechs := USEDIN (kjnts[1].structure,
         'KINEMATIC_STRUCTURE_SCHEMA.MECHANISM.STRUCTURE_DEFINITION');

    IF (nmechs[1] :=: mech) THEN
      RETURN (FALSE);
    ELSE
      IF (nmechs[1].containing_property :<>: kprop) THEN
        RETURN (FALSE);
      ELSE
        nmbps := USEDIN (nmechs[1], 'KINEMATIC_STRUCTURE_SCHEMA.'+
                         'MECHANISM_BASE_PLACEMENT.BASE_OF_MECHANISM');

        IF (SIZEOF (nmbps) = 0) THEN
          RETURN (FALSE);
        ELSE
          RETURN (suitably_based_mechanism (nmbps[1], mech));
        END_IF;
      END_IF;
    END_IF;
  END_IF;
END_FUNCTION;
(*
```

Clause 5.5.6, p. 90

The EXPRESS specification for the frame_associated_to_background had an additional group qualifier for the ass_bag and trm_bag variables that is not allowed in the FUNCTION REPEAT and an additional group qualifier in the definition of the rep_bag variable within the FUNCTION. The ass_bag variable constructor did not ensure that the REPRESENTATION_RELATIONSHIP was of type KINEMATIC_FRAME_BACKGROUND_-REPRESENTATION_ASSOCIATION. The rep_bag had the USEDIN replaced with a QUERY to ensure that the background was in the correct schema. Remove the EXPRESS specification and replace with the following:

EXPRESS specification:

```
*)
FUNCTION frame_associated_to_background
  (frame      : rigid_placement;
   background : kinematic_frame_background) : BOOLEAN;
  LOCAL
    rep_bag : BAG OF kinematic_frame_background_representation;
    trf_bag : BAG OF kinematic_frame_based_transformation;
    trm_bag : BAG OF kinematic_frame_based_transformation;
    ass_bag : BAG OF
              kinematic_frame_background_representation_association;
    rep     : kinematic_frame_background_representation;
    ass     : kinematic_frame_background_representation_association;
  END_LOCAL;

  rep_bag := QUERY ( bg <* USEDIN (background,
                     'KINEMATIC_STRUCTURE_SCHEMA.' +
                     'REPRESENTATION.ITEMS')|
                     'KINEMATIC_STRUCTURE_SCHEMA.'+
                     'KINEMATIC_FRAME_BACKGROUND_REPRESENTATION'
                      IN TYPEOF (bg) );

  IF SIZEOF (rep_bag) = 0 THEN
    RETURN (FALSE);
  END_IF;

  trf_bag := USEDIN (frame,
                     'KINEMATIC_STRUCTURE_SCHEMA.' +
                     'KINEMATIC_FRAME_BASED_TRANSFORMATION.' +
                     'TRANSFORMATOR');

  IF SIZEOF (trf_bag) = 0 THEN
    RETURN (FALSE);
  END_IF;

  REPEAT i := 1 TO HIINDEX (rep_bag);
    rep := rep_bag[i];

ass_bag := QUERY ( kfbra <* USEDIN ( rep,
             'KINEMATIC_STRUCTURE_SCHEMA.' +
             'REPRESENTATION_RELATIONSHIP.REP_2') |
             'KINEMATIC_STRUCTURE_SCHEMA.'+
             'KINEMATIC_FRAME_BACKGROUND_REPRESENTATION_ASSOCIATION'
             IN TYPEOF ( kfbra ) );

    IF SIZEOF (ass_bag) > 0 THEN
      REPEAT j:= 1 TO HIINDEX (ass_bag);
        ass := ass_bag[j];

        trm_bag := QUERY (trm <* trf_bag |
          (trm :=:
           ass\representation_relationship_with_transformation.
           transformation_operator));

        IF SIZEOF (trm_bag) > 0 THEN
          RETURN (TRUE);
        END_IF;
```