ISO/TC 184/SC 4/WG 15
Digital manufacturing

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ISO CD 23247-3 Collated Comments Final Response LA

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Template for comments and secretariat observations

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MB/ NC[1]	Line number	Clause/ Subclause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Observations of the secretariat
DE-001	199			ge	All OPC UA companion specifications provide a specification for special manufacturing domains.	Add paragraph w.r.t. OPC UA Companion Specifications.	**Accepted**
DE-002	237			ge	Mention ISO 13854-42?	Extend with: eCl@ss can be used to define classes and properties for manufacturing elements conformant to IEC 61360 and ISO 13854-42	**Accepted**
DE-003	237			ed	eClass	eCl@ss (correct typo)	**Accepted**
FR 01-004				ge	The documents of the ISO 23247 series circulated as CD do not reflect the outline of the proposed project NWIP (ISO/TC 184/SC 4/WG 15 N 17). The intended scope of the project as stated in the NWIP was "The Digital Twin is a virtual representation of manufacturing elements such as personnel,products, assets and process definitions."	Align the project on the NWIP.	**Accepted in principle** ***Identical to Part 1-003.*** Assets are not specifically mentioned, however equipment and facility are included as types of assets.
FR 02-005				ge	The documents of the ISO 23247 series circulated as CD do not reflect the outline of the proposed project NWIP (ISO/TC 184/SC 4/WG 15 N 17). The NWIP standards gap analysis listed and summarized: - IEC 62264 Enterprise-control system integration, - IEC 62832 Digital factory framework - ISO 16400 Equipment behaviour catalogues for virtual production system. These standards are not considered in documents of the ISO 23247 series circulated as CD.	Consider the current normative landscape.	**Resolved** ***Identical to Part1-004.*** IEC 62264 is informatively referenced and listed in bibliography of this part. IEC 62832 and ISO 16400 have been determined not to be referenced in ISO 23247, however they can be listed in bibliography during DIS development if necessary.

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FR 03-006				te	Many standards and consortia specifications already specify information for personnel, equipment, material, processes, facility, environment and product. This document does not provide any requirement on such informartion but only examples.	Analyse the current standards and consortia specifications and provide usefull provisions.	**Acknowledged** Analysis of the current standards and consortia specifications are described in Annex A. For the requirement, see JP04 (K.D)-008, 2).
KR 01-007		1		te	Update the scope.	Change to read: This document defines the attributes of static and dynamic information to represent observable manufacturing elements.	**Accepted in principle** The scope has been improved.
JP04 (K.D)-008	103	1		ge	The scope is not consistent with the following scope text stated in ISO/TC 184/SC 4 N 3224 (NWIP). Part 3: Digital representation of physical manufacturing elements Mapping of externally defined manufacturing elements including product, process and resources definitions with their characteristics to provide digital representations for manufacturing twinning; "Mapping" and "identifying" have different meanings. The original scope in the NWIP implies that the document spefifies requirements for mapping physical manufacturing elements into a Digital Twin, but the scope in CD means only listing types of manufacturing elements to be included in Digital Twins.	1) Make the scope text consistent with the scope text in the NWIP. 2) Provide requirements for mapping physical manufacturing elements into a Digital Twin in terms of information structure.	**1) Accepted in principle** Scope has been improved. See KR01-007. **2) Accepted** "shall" will be added for requirements in corresponding text.
KR 04-009	118-129	4		te	Use a consistent term with other parts and update the explanation of Figure 1	Change to read: Digital Twin is digital representation of observable manufacturing element. Figure 1 shows Digital Twin of observable manufacturing elements (DTME) managed by Digital Twin Representation entity (DTRE) in Digital Twin manufacturing reference	**Accepted with modification** One of the Digital Twin functions is digital representation of observable manufacturing element.

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						architecture. DTME shall consider both static and dynamic information. Information fixed to an OME that does not change during manufacturing is classified as static information, whereas information that continuously changes during manufacturing is classified as dynamic information. For example, the geographical location of a fixed machine is static however the amount or the shape of material during manufacturing processes can be dynamic. For digital modelling of OME, information associated with OME shall be properly identified by Digital Modelling FE.	Figure 1 shows Digital Twin of observable manufacturing elements managed by Digital Twin Entity in Digital Twin framework for manufacturing reference architecture. Digital Twin of observable manufacturing elements shall consider both static and dynamic information. Information fixed to an observable manufacturing element that does not change during manufacturing is classified as static information, whereas information that changes during manufacturing is classified as dynamic information. For example, the serial number of a machine is static. However, the amount or the shape of material during manufacturing processes can be dynamic. For Digital Twin modelling of observable manufacturing elements, information associated with observable manufacturing elements shall be properly identified by Digital Twin Entity.
KR 03-010	118-all	4		te	Change “Physical Manufacturing Element (PME)” and “manufacturing element” as “Observable Manufacturing Element (OME)” to use a consistent term with other parts	Change to read: Observable Manufacturing Element (OME)	**Accepted**
KR	117	4		te	Change clause title	Change to read:	**Accepted**

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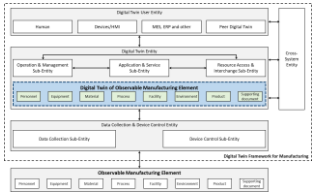
02-011						Digital Twin of observable manufacturing element	
JP05 (K.D)-012	125	4		ge	The following sentence is the only requirement using “shall” in the document. For the digital representation of manufacturing element, it shall be modelled in terms of information associated with manufacturing elements.	Provide valuable requirements for mapping physical manufacturing elements into a Digital Twin in terms of information structure.	**Accepted** See JP04 (K.D)-008, 2).
KR 06-013	130-131	4	Figure 1	ed	Change the title of Figure 1	Change to read: Figure 1 – DTME in Digital Twin manufacturing reference architecture	**Accepted in principle** Figure 1 – Digital Twin of Observable Manufacturing Elements in reference architecture
KR 05-014	130-131	4	Figure 1	te	Update Figure 1 to emphasize to “digital model” and to change “digital model” as “Digital Twin of observable manufacturing element (DTME)” in DTRE according to the definition in Part 1	Change to read: Digital Twin of observable manufacturing element (DTME)	**Accepted in principle** Figure 1 has redrawn as comments. 
US-015	131	4	Figure 1	Ge	“Digital Model” in the DTRE frame should be consist with CD 23247-1 and -2.	Ensure consistency with CD 23247-1 and -2.	**Accepted** See KR05-014.
KR 07-016	133	5		ed	Change the title of clause 5 to express a digital model.	Change to read: **5 Information for DTME**	**Accepted in principle** 5 Information for Digital Twin of Observable Manufacturing Elements
US-	133	5		Te	Section 5 does not provide definitions of information for digital representation. All tables are	Complete the section by providing requirements and/or guidance for information for digital	**Accepted**

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017					"examples." There are no requirements or guidance in Section 5. The section is incomplete.	representation	See JP04 (K.D)-008, 2).
SE-018		5.1		te	The notation of static and dynamic information is confusing, it is obvious that for example information like identification of a manufacturing resource is somehow stable over time, but information is subject for change and that can be addressed using for example the concept of effectivity.	Static information is static for a certain period in time.	**Accepted with modification** Text has been changed to meet the requirements of the comment.
KR 09-019	135-139	5.1		te	Use a consistent term with other parts and editorial enhancement	Change to read: As explained in 4, a DTME of an observable manufacturing element shall consider both static and dynamic features of information. In this document, these features are defined as information attributes. Static information attribute includes identification, characteristics, schedule, and relationship with other observable manufacturing elements. Dynamic information attribute includes status, location, report, and relationship with other manufacturing elements. Figure 2 shows the attributes of information.	**Accepted with modification** As explained in Clause 4, a Digital Twin of an observable manufacturing element shall consider both static and dynamic features of information. In this document, these features are defined as information attributes. The information attributes described in Figure 2 are examples to illustrate the kinds of information that should be represented for a Digital Twin. Many existing standards such as IEC 62264-2 and ISO 10303 contain detailed information models for these attributes. An implementation of the framework should select the information models most appropriate for its use case. Static information attribute includes identification, characteristics, schedule,

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							relationship with other manufacturing elements, and description. Dynamic information attribute includes status, location, report, relationship with other manufacturing elements, and description.
KR 08-020	134	5.1		ed	Change the title of subclauses of 5 to express attribute of information.	Change to read: **5.1 Attributes of information**	**Accepted in principle** 5.1 Information attributes
KR 11-021	141	5.1	Figure 2	ed	Change the title of Figure 2.	Change to read: Figure 2 – Information attributes for DTME (if KR03 is accepted)	**Accepted in principle** Figure 2 – Information attributes for Digital Twin Observable Manufacturing Element
KR 10-022	140-141	5.1	Figure 2	Te	Change the Figure 2 for the clear meaning	Change to read: Observable Manufacturing Element (OME) Information #N Observable Manufacturing Element (OME) Information #2 Observable Manufacturing Element (OME) Information #1 **Static Information** Attribute / Value / Mandatory / Optional Identification / A unique identification of the attribute / M Characteristics / Additional information and description of the attribute / M Schedule / Manufacturing schedule for the attribute / M Relationship / Static relationship among the OME and other OMEs / M ... / ... / ... **Dynamic Information** Attribute / Value / Mandatory / Optional Status / Status of the attribute / M Location / Geographical or relative location information / M Report / Work report related to the dynamic information / M Relationship / Dynamic relationship among the OME and other OMEs / M ... / ... / ...	**Accepted with modification** Information attributes for Observable Manufacturing Element #N Information attributes for Observable Manufacturing Element #2 Information attributes for Observable Manufacturing Element #1 **Static Information** Attribute / Value / Mandatory / Optional Identification / A unique identification of the attribute / M Characteristics / Additional information and description of the attribute / M Schedule / Manufacturing schedule for the attribute / M Relationship / Static relationship among the OME and other OMEs / M Description / Additional static information about the observable manufacturing element / O ... / ... / ... **Dynamic Information** Attribute / Value / Mandatory / Optional Status / Status of the attribute / M Location / Geographical or relative location information / M Report / Work report related to the dynamic information / M Relationship / Dynamic relationship among the OME and other OMEs / M Description / Additional dynamic information about the observable manufacturing element / O ... / ... / ...
KR 12-	150	5.2	NOTE 2	ed	Use a consistent term with other parts and editorial enhancement.	Change to read: Various kinds of devices are available to detect	**Accepted with**

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023						identifier, location, motion, and image of observable manufacturing elements.	**modification** Various kinds of devices are available to detect the identifier, location, motion, and image of observable manufacturing elements.
KR 13-024	152	5.2	NOTE 3	ed	Use a consistent term with other parts and editorial enhancement.	Change to read: Key performance indicator (KPI) including performance and defective rate may be calculated and represented for observable manufacturing elements.	**Accepted in principle** KPI will be replaced by performance. See US-025.
US-025	152	5.2	Table 2	Ed	NOTE3: KPI? No definition, or a typo.	Define KPI	**Accepted in principle** KPI will be replaced by performance.
KR 14-026	165	5.4	Table 5	ed	In relationship, material shall be managed by person with Skill #2.	Change to read: Material #1 shall be managed person with Skill #2.	**Accepted with modification** Material #1 shall be managed by a person with Skill #2.
KR 15-027	173	5.5	Table 7	ed	In relationship, process shall be managed by person with Skill #3.	Change to read: ManufacturingProcess #1 shall be managed by person with Skill #3.	**Accepted with modification** ManufacturingProcess #1 shall be managed by a person with Skill #3.
KR 16-028	180	5.6	Table 9	ed	In relationship, facility hall be managed by person with Skill #3.	Change to read: Facility #1 shall be controlled by person with Skill #3 when the temperature exceeds the limits.	**Accepted with modification** Facility #1 shall be controlled by a person with Skill #3 when the temperature exceeds the limits.

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JP03(A.O)-029		A comment common to four proposed documernts		Ge	It is very hard to imagine how to effectively use proposed standards, which is a key requirement to stimulate manufacturing industry.	It is recommended to include real-life examples on how to effectively use proposed standards/	**Resolved** This standard gives high-level aspect of Digital Twin manufacturing including reference architecture, therefore it is beneficial to show real implementation of Digital Twin manufacturing in further document, for example, additional TR for guidelines for implementing Digital Twin manufacturing.
JP02(A.O)-030		A comment common to four proposed documernts		Ge	The title of the series of standards is digital twin manufacturing framework but no manufacturing specific terms appear. There are many types of manufacturing including removal machining for creating automotive dies. What types of manufacturing is in scope and what types are not shall be clearly described.	Clear statements required.	**Accepted in principal** ***Identical to Part 1-003.*** Following has been added to introduction for clarification: All types of manufacturing should be supported including discrete and continuous manufacturing for individual parts, assemblies or continuous processes. However, the actual types of manufacturing that can be supported by an instance of the framework will depend on the technologies selected to implement its functional elements.
JP01(A.O)-031		A comment common to four proposed documernts		Ge	To say “Digital Twin”, consistency management between physical objects and their digital representations shall be a core concern. In other words, how to relate a physical object with its digital representation and how to keep consistency between the two in the circumstances where the physical object is constantly changing	Regenerate the document from scratch.	***Identical to Part 1-006.*** The Digital Twin framework for manufacturing describes **framework** how to relate physical object to digital representation.

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					shall be a keen concern. Imagine the case of removal machining for creating a die. There are many physical objects including work piece, machining tool, etc. During machining, the shape and material characteristics of the work piece will constantly change. It is the same for the machining tool caused by fatigue. How to capture those changes and how to reflect the changes into their digital counterparts shall be a core concern for digital twin manufacturing. But, no specification is defined in the proposed four documents concerning how to relate a physical object and its digital representation, and how to keep consistency between the two. The phrases " detailed modelling" and "dynamic modelling" appear with no clear definitions、which is extremely inappropriate.. There will be changes which can be captured and those which are difficult to capture. Therefore, it is understood that clear statements of in scope issues and out of scope issues should be possible. But, current scope statement says almost nothing. In order to get support from industries, clear answers to the issues raised above is critically important.		Specific technologies that are to be used to perform the synchronization are not prescribed by this standard and left by users' to select. Use cases are to be developed in future reports and they will recommend technologies to achieve the qualities described by the framework in the context of specific processes.
SE-032		ANNEX A		te	Missing reference to relevant ISO 10303 standard	ISO 10303-239 specifies an information model that defines what information can be exchanged and represented to support a product through life. The modelling scope of AP 239 covers: Histories as well as Design, Individuals as well as Designs, Fleets as well as Individuals, Equipment and Resources as well as Product, States as well as Faults/Failures, Schedules and Plans as well as Tasks, Change process across all, Allow for Why?, Enable feedback & traceability.	**Accepted in principle** ISO 10303-239 specifies the application protocol for product life cycle support. The scope of ISO 10303-239 includes information for defining and maintaining a complex product, and information required for through life configuration change management of a

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							product and its support solution. Also, it includes representation of product assemblies, product through life, specification and planning of activities for a product, the activity history of a product and product history.
DE-033	229	Annex A		ge	The asset administration shell is a generic digital model for twins. It provides different serializations and mappings. One is for AutomationML , another for OPC UA. Besides there are also serializations for xml, JSON and RDF. (AML, OPC and RDF will be published in V1.1)	Consider adding a paragraph for asset administration shell. E.g. The asset administration shell is part of the I4.0 component as introduced in IEC PAS 63088. It provides a technology neutral information model and several serializations and mapping. The asset administration shell is one possible concept and specification that can used to implement twins. Serializations and mappings are provided for xml, JSON, RDF, AutomationML and OPC UA. One of its key features is the separation of the digital representation into a set of so-called submodels. Each submodel represents a specific aspect of the asset the twin is representing.	**Accepted**
US-034	246	Annex B		Ge	“MTConnect Assets”	Add reference of MTConnect	**Accepted**
US-035	62	Introduction		Ge	Duplicated text from CD 23247-1 is not consistent.	Ensure consistency between CD 23247-1 and -3 Introductions.	**Accepted in principle** Introduction has been copied from Part 1.
US-036	0	TITLE		Ge	The title is not clear nor grammatically correct.	Change title to, "Automation systems and integration – Digital twin framework for manufacturing – Part 3: Digital representation of manufacturing elements"	**Accepted**

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US-037	0	WHOLE DOCUMENT		Ge	See US-01.	Change "digital twin manufacturing framework" to "digital twin framework for manufacturing" throughout entire document.	**Accepted** See US-036.
US-038	0	WHOLE DOCUMENT		Ge	"Digital twin manufacturing" is not a defined term.	Change to, "Digital twin" throughout entire document	**Accepted in principle** “Digital twin manufacturing" has been changed to “Digital Twin for manufacturing”. See US-036.
US-039	0	WHOLE DOCUMENT		Ge	See CD 23247-1 Comment US-08 to remove "Digital Twin Representation"	Change "digital twin representation" to "digital twin" throughout entire document	**Accepted** See US-036.

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