

Exhibit A05-1: Reliability, Availability, Maintainability

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1 RAM

1.1 RAM Program

Id	Requirement	Referring to
A05-1:1.1.a	K The Contractor shall prepare a project specific RAM program using proven practice and the guidelines in EN 50126 -1 and -3. A typical RAM program is described in EN 50126-3 section 5.5.3	EN 50126-1 EN 50126-3
A05-1:1.1.b	E The preliminary RAM program shall include the following information as a minimum: <ol style="list-style-type: none"> 1. Introduction describing the purpose and scope of the program 2. References to standards and other documents 3. Definitions and acronyms used in the program 4. System description includes general description of the system and reference to the applicable system breakdown structure 5. RAM project specific requirements: <ol style="list-style-type: none"> a) description of how the Contractor plans to conduct the RAM process according to the standard EN 50126 b) the Contractor's RAM and LCC organisation with roles and responsibilities and description of relevant interfaces to other areas of the project organization c) a plan for all RAM and LCC activities and analyses to be conducted in different project phases and aligned with the milestone plan d) a list of all RAM and LCC documents to be developed and when they are scheduled to be delivered e) the procedure for continuously updating of the RAM and LCC program throughout the project execution f) the procedures for analyse of RAM and LCC performance and the related procedures to handle deviation from the commitments. g) procedure and functions on the Trainsets for the identification, recording, registration and possibly handling of failures <p><i>The Tenderer shall demonstrate compliance by delivering a preliminary RAM program</i></p>	EN 50126-1 EN 50126-3

1.2 RAM Traceability

Id	Requirement	Referring to
A05-1:1.2.a	K The project specific product breakdown structure shall be used in all RAM analysis and documents, safety documents, technical documentation, documentation for maintenance and spare part breakdown	A05-1-3
A05-1:1.2.b	K The RAM information shall be supplied in an easily accessible electronic format with traceability and search capabilities	

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1.3 RAM Requirements

Id	Requirement	Referring to
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A05-1:1.3.a **K** The Contractor shall design and manufacture the Trainsets in a way that the frequency per fault categories 1 to 3 shall not exceed the reliability requirements

Failure Category	Failure per million km	Definition	Description	Or delay
1	1,5	Significant fault	Failures causing the unit to stop on the line without the possibility to restart within 30 minutes	Cancellation
2	15	Major fault	Failures causing the unit must to be taken out of operation at the first station.	Delay > 6 min
3	200	Minor fault	All failures where the unit can continue operation for the rest of the day before investigation and correction has to be done. The failure does not influence performance or safety level for the trainset the rest of the day.	4min < delay < 6 min
4	.	Insignificant fault	All failures where the unit can continue operation until next planned maintenance visit.	

A05-1:1.3.b **E** The Tenderer shall specify the warranted reliability values aligned with the functional requirement list.

Appendix A05-1-2 "Functional requirement list",
Appendix B-1 Payment and Price Schedule

The tenderer shall demonstrate the reliability by calculation of the aggregated reliability for the respective fault categories on system level. The tenderer shall complete the functional requirement list as applicable to demonstrate the achievement of the reliability on system level and provide the warranted reliability values in Appendix B-1.

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Id	Requirement	Referring to
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A05-1:1.3.c **E** All reliability data on system level shall be indicated with data source and compensating factors/calculations as applicable to adjust for intended use:

Source code	Description	Required information
A	FMEA/RCM workshop experience.	Analysis group participants
B	Engineering and design experience.	Analysis group participants
C	On-line failure data from customers MMS system	Statistical population and utilization (km and age)
D	Experience from reference systems. Other trains	Statistical population and utilization (km and age)
E	Vendor data. Knowledge of type of population needed.	Statistical population and utilization (km and age)
F	Generic failure data. Mil HDBK 217 or equivalent NPRD/EPRD	Compensation measures

The tenderer shall deliver a reliability data dossier indicating the data source at a minimum on a sub-system level.

1.4 Availability Requirements

Id	Requirement	Referring to
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A05-1:1.4.a **K** The Contractor shall commit to warranted values for the Fleet availability, AF, and the availability for each Trainset, AT. AT should not be less than 98.5% as an average over the verification period and AF cannot be less than AT.

The committed values shall be provided in Appendix B-1 (Payment and Price Schedule)

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Id	Requirement	Referring to
A05-1:1.4.b	<p>E The committed values shall be calculated based on the reliability data documented following the procedure: The availability for each trainset AT (scheduled adherence) is calculated according to the formula and conditions in equation 1, where</p> <p>F_s = number of journeys running to schedule F_{ns} = number of journeys not running to schedule due to causes concerning rolling stock F_{tot_s} = total number of scheduled journeys</p> <ul style="list-style-type: none"> - If a Significant Fault or Major Fault occur, the remaining journeys for the day, including the current journey, is included in F_{ns} - All scheduled journeys for subsequent days are included in F_{ns} until the Trainset is repaired and resume operation - For any individual Significant- or Major Fault, the sub-cap number of scheduled journeys not running to schedule is set to 6 <p>The Fleet availability AF is the weighted average of all Trainset availability values for the batch in question. A batch consist of either the Primary Delivery or any subsequent options. The Fleet availability for each batch is calculated according to equation 2, where</p> <p>n = number of Trainsets in the current batch</p> $AT_i = \frac{F_s}{F_{tot_s}} = \frac{F_{tot_s} - F_{ns}}{F_{tot_s}} \geq 0,985 \quad \text{Equation 1}$ $AF = \frac{\sum_{i=1}^n F_{tot_s_i} \cdot AT_i}{\sum_{i=1}^n F_{tot_s_i}} \quad \text{Equation 2}$ <p><i>The tenderer shall deliver an availability calculation based on the delivered reliability data dossier and fault categories according to the functional requirement list.</i></p>	EN 50126-3 ch. 5.3.4 Appendix A05-1-2 "Functional requirement list"

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1.5 Maintainability Requirements

Id	Requirement	Referring to
A05-1:1.5.a	<p>K Individual planned maintenance activity in the maintenance plan taking more than 3 hours MTTM shall be listed separately</p> <p><i>Any such activity shall be provided in Appendix B-1 (Payment and Price Schedule) as part of the tender.</i></p>	
A05-1:1.5.a	<p>K The lowest interval for maintenance shall not be less than 30 000 km</p>	
A05-1:1.5.b	<p>K Individual corrective repair activity taking more than 3 hours MTTR shall be listed separately. Do not include damages caused by unexpected external factors. E.g. impact with animals or other unexpected objects.</p> <p><i>Any such activity shall be provided in Appendix B-1 (Payment and Price Schedule) as part of the tender.</i></p>	
A05-1:1.5.c	<p>K The interval for replacement of bogies for planned maintenance shall be set by the most restrictive components which cannot be replaced with any bogie mounted on the Trainset. The most restrictive component shall be identified by the RCM analysis.</p>	
A05-1:1.5.d	<p>K The Contractor shall identify all special tools and test equipment needed to conduct all defined maintenance activities up to and including maintenance level 2.</p> <p><i>All such special tools and test equipment shall be provided in Appendix B-1 (Payment and Price Schedule) as part of the tender.</i></p>	

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2 Maintenance Concept

Id	Requirement	Referring to
A05-1:2.a	K All new rolling stock for Norske tog is to be supplied with a fully developed maintenance program which forms the maintenance specification including the RCM analysis, maintenance instructions and schedule of intervals based on RCM analysis. The RCM analysis shall be based on a recognized standard.	IEC 60300-3-11, S4000P, or equivalent.
A05-1:2.b	E The maintenance program shall be developed based on the project specific approach shown in Appendix A05-1-1 "Project specific RCM method requirements".	Appendix A05-1-1 "Project specific RCM method requirements"
<i>The tenderer shall deliver a RCM method description including NT project specific requirements</i>		
A05-1:2.c	K Codes for task definition in the RCM analysis shall be according to the codes defined in the Appendix, "Project specific RCM method requirements"	Appendix A05-1-1 "Project specific RCM method requirements"
A05-1:2.d	E The RCM analysis shall have a special focus on CBM (Condition-Based Maintenance) in the process of developing the planned maintenance program.	
<i>The tenderer shall, as part of the RCM method description, deliver a RCM method decision and approach with focus on the process of developing CBM. The CBM strategy shall also include monitoring and diagnostics systems.</i>		
A05-1:2.e	K Maintenance shall be defined on the following levels: 1) 0th (zero) level of maintenance is the corrective maintenance the conductor or the driver can do on the Trainset while in traffic so the Trainset can perform the planned traffic until the next visit to a 1st level maintenance workshop or the action necessary for the Unit to perform its route to the end station (avoiding a long stop on line) 2) 1st level of maintenance is the maintenance performed directly on the Trainset by 1st level maintenance crew. 3) 2nd level of maintenance is the maintenance performed on the dismantled LRU's. The LRU's are removed from the Trainset on 1st level of maintenance and sent to 2nd level of maintenance for restore or overhaul activities. 4) 3rd level of maintenance is the maintenance performed on the dismantled LRU's. The LRU's are removed from the Trainset on 1st level of maintenance and sent to the component supplier or other external facility for restore or overhaul activities.	
A05-1:2.f	E The number of LRU's which exclusively only can be maintained on 3rd level of maintenance shall be as low as possible.	

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Id	Requirement	Referring to
A05-1:2.g	<p data-bbox="371 264 1693 335">E The maintenance plan is the assembly of the maintenance program and maintenance production planning information as defined in Appendix A05-1-4 "Minimum requirements to the RCM plan export".</p> <p data-bbox="423 386 1809 421"><i>The Tenderer shall deliver an example on a maintenance plan based on the RCM plan export.</i></p>	Appendix A05-1-4 "Minimum requirements to RCM plan export".