

Exhibit D: Project Execution and Administration

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1 General

Id	Requirement	Referring to
D:1.a	<p>C This exhibit specifies the requirements for Project Execution and administrative provisions for the Contract covering:</p> <ul style="list-style-type: none"> • Administrative routines • Project Management • Quality Management • Configuration Management • Verification and Validation process • Engineering Management including design process and requirement management • Authority Approval Process <p>For some areas there are requirements for the Contractor to deliver processes or plans.</p>	
D:1.b	<p>C The Contractor shall ensure that the realisation of the Works is executed within Project targets and administered in a way that secures effective and orderly management of the Works and gives NT insight into the development of the Works throughout all project phases.</p>	
D:1.c	<p>C It is the Contractor's obligation to establish and maintain a Project Execution process and administrative routines that comply with the regulations set out in the Contract. This obligation shall be in force for the duration of this Contract, including possible extensions of time.</p>	
D:1.d	<p>C If the Contractor obviously fails to establish and/or maintain such administrative routines, then the parties shall agree upon an independent third party to establish satisfactory routines. All direct cost, except NT's own costs in connection with the engagement of such third party shall be borne by the Contractor.</p>	
D:1.e	<p>C All changes between preliminary plans/processes and updated/final plans/processes shall be identified and justified by the Contractor, and delivered to NT for review and acceptance.</p>	

2 NT's Postal Address

Id	Requirement	Referring to
D:2.a	<p data-bbox="369 323 1809 470">C Norske tog AS PB 1547 Vika, 0117 Oslo Norway</p> <p data-bbox="369 502 1809 542">Internet address: www.norsketog.no</p> <p data-bbox="369 574 1809 614">Telephone No. (+47) 412 62 664</p>	

3 The Contractor's Postal Address

Id	Requirement	Referring to
D:3.a	C To be filled in by Contractor	

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4 Project management and project governance

Id	Requirement	Referring to
D:4.a	I As basic principle the Contractor's standard processes and procedures are followed for the execution of the Contract. The objective of this chapter is to ensure well-structured and well-defined project management and project governance and give NT good understanding of the project status throughout the project.	

4.1 Project Management Plan

Id	Requirement	Referring to
D:4.1.a	<p>C The Contractor shall develop and apply a Project management plan for the execution and administration of the project and its deliverables. The project management plan shall be based on the Contractor's standard processes and procedures for project execution. The Project management plan shall be aligned with the Contractor's Contract schedule (Appendix C2) and the Milestone Plan (Appendix C1).</p> <p>The project management plan shall include, but not be limited to:</p> <ul style="list-style-type: none"> • How the Contractor's standard project management process is applied, including any necessary modifications of project specific processes and procedures for the execution of the project, and how the Contractor will ensure that the risk of these modifications is managed throughout the execution of the project. • Project organization, including role description and responsibility, function for all roles and name of key personnel • Communication plan, including description of how the two parties shall communicate • Status and progress reporting process including meeting structure and reports • Risk management • Change management process, including Variation order • Cost management • Time/schedule management • Considerations to requirements in chapter 4.2-4.8 • Hierarchy and interdependencies, and insuring alignment between all plans in the project 	Appendix C1, Appendix C2
D:4.1.b	<p>E The project management plan shall be well-structured, robust, realistic, sufficiently detailed and adapted to the deliveries of the project as stated in Exhibit O and all other relevant documents.</p> <p><i>The tenderer shall present how they provide added value by submitting a preliminary project management plan in the tender.</i></p>	Exhibit O
D:4.1.c	<p>C The Contractor shall submit a detailed and final version of the project management plan for review and acceptance prior to Milestone MS 1.4 in Appendix C1, based on the preliminary project management plan in Exhibit O.</p>	Appendix C1, Exhibit O

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4.2 Communication

Id	Requirement	Referring to
D:4.2.a	<p>C This chapter describes requirements to ensure an effective and controlled communications between the Parties. A successful communication process is proven in use, has a structured traceability, involves enough information regarding progress and dispatches to NT and involves enough required input from NT for Contractor to execute the project.</p>	
D:4.2.b	<p>K The contractor shall develop and apply a communication plan to be used for the duration of the project. The plan shall at least include, but not be limited to; what information shall be covered by official communication and how the official communication shall be performed and documented.</p> <p><i>The tenderer shall demonstrate compliance by submitting a preliminary communication plan as part of the preliminary project management plan in the tender.</i></p>	
D:4.2.c	<p>C All matters affecting the Contract shall be notified in writing. Unless otherwise agreed, the Parties have a deadline of 5 business days to reply to correspondence when a reply is required. If a reply is required, this shall be noted explicitly.</p>	
D:4.2.d	<p>C The Contractor shall inform NT immediately of all dispatches made and shall in writing give necessary information to enable NT to trace the dispatch. This shall apply to dispatching of all deliveries, including but not limited to Trainsets, high cost components, documentation, and all other relevant goods.</p>	
D:4.2.e	<p>C All formal correspondence between the parties shall be addressed to appointed recipient/s.</p>	
D:4.2.f	<p>C NT's appointed recipients Att.: Project manager (TBD) CC: Technical manager (TBD)</p>	
D:4.2.g	<p>C Contractor's appointed recipients</p> <p>Attn: (name of project manager)</p> <p>E-mail: (To be filled in) Phone: (To be filled in)</p>	

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4.3 Visits/Inspections

Id	Requirement	Referring to
D:4.3.a	C NT has the right to make visits/inspections without prior notice. In case of visits/inspections at Subcontractors' premises, the Contractor will be notified in advance and may attend such visits.	
D:4.3.b	C It is the Contractor's responsibility to provide NT with information of significance for judging the progress and quality of the Works.	
D:4.3.c	C NT shall have access to all of the Contractor's locations at which the Works are in progress for NT, including Subcontractor's premises.	
D:4.3.d	C Upon visits/inspections the Contractor shall, at the request of NT, submit all reports and all required documentation relating to the Works.	

4.4 Reporting

Id	Requirement	Referring to
D:4.4.a	C The Contractor is responsible for the process of communicating status and progress during the project. The progress and status will be presented by the Contractor in monthly reports and during monthly meetings between NT and the Contractor.	
D:4.4.b	K The Contractor shall establish and maintain a process for reporting of status and progress during the project. The process shall include content of the monthly report, how and when the monthly report shall be sent to NT, how the monthly meeting shall be conducted. <i>The tenderer shall demonstrate compliance by submitting a status and progress reporting process in the preliminary project management plan in the tender.</i>	

4.4.1 Monthly status and progress meetings

Id	Requirement	Referring to
D:4.4.1.a	C Monthly meetings between NT and the Contractor are to be conducted at the Contractor's or NT's premises, or as a digital meeting, in order to discuss progress, actions and possible deviations to the plan and take necessary decisions. Travelling costs are covered by the travelling Party. The Contractor is responsible for conducting the monthly meetings and the chairman of the meeting is the Contractor's Project Manager or whoever appointed by him/her.	

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Id	Requirement	Referring to
D:4.4.1.b	K The Contractor shall send out an Agenda prior to the monthly meeting. <i>The tenderer shall demonstrate compliance by submitting a draft for a Monthly meeting agenda in the preliminary Project management plan in the tender.</i>	
D:4.4.1.c	C The Contractor shall record the MoM. It shall be based on the agenda of the meeting, be detailed and indicate the persons responsible for actions in addition to the according deadlines. The MoM shall be submitted for NT's approval as soon as possible and not later than 3 business days after the meeting.	
D:4.4.1.d	C Sub-contractors shall attend all meetings if requested by NT.	

4.4.2 Monthly Report

Id	Requirement	Referring to
D:4.4.2.a	C The official cut-off day for accumulation of data is the last day of each month.	
D:4.4.2.b	C The information in the monthly report shall be grouped in accordance with the agenda for the monthly meeting.	
D:4.4.2.c	K The monthly report shall be well-structured and clearly demonstrate the progress of the Works in all relevant <i>The tenderer shall demonstrate compliance by submitting a draft of the monthly report including a table of content in the preliminary Project management plan in the tender.</i>	
D:4.4.2.d	C Should circumstances arise which have consequences for progress or costs, the Contractor must notify NT immediately, outside the agreed reporting routines.	

4.4.3 Cost Reporting

Id	Requirement	Referring to
D:4.4.3.a	C The Contractor shall on a monthly basis report actual cost for the following items: <ul style="list-style-type: none"> • The cost of the Delivery • Approved budget • Approved Variation Orders • Current budget 	

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Id	Requirement	Referring to
D:4.4.3.b	C The Contractor shall report cost broken down to the budget items for the Contract. The reports shall be presented in format of a table as well as graphic presentation and shall show planned and actual for this period and accumulated. A total for the project including approved VO's and forecast shall also be presented.	
D:4.4.3.c	C The following shall be reported in the monthly report: <ul style="list-style-type: none"> • A cost summary report • S-curve for actual cost development 	

4.4.4 Final Report

Id	Requirement	Referring to
D:4.4.4.a	C Prior to the completion of the Delivery, the Contractor shall upon request prepare a final report. The contents of this report are to be agreed with NT.	

4.5 Cost Control

4.5.1 General

Id	Requirement	Referring to
D:4.5.1.a	C The Contractor shall establish and maintain a system for the following up of personnel, man-hours and cost in a coherent way through the period of the Contract.	

4.5.2 Reimbursable Work

Id	Requirement	Referring to
D:4.5.2.a	C To ensure a correct tracking of man-hours for reimbursable work, the Contractor shall establish a man-hour registry as follows: <ul style="list-style-type: none"> • Resource name • Numbers of man-hours worked on each activity per resource throughout the reporting period • Dates (The registry shall report actual man-hours per day) • Man-hour per approved variation per day per resource and activity. • Reports on reimbursable work 	

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4.5.3 Variation Order

Id	Requirement	Referring to
D:4.5.3.a	<p>C The Contractor shall establish a protocol for Variation Orders. The protocol shall contain information on all Variations to the Delivery, approved or rejected. The protocol shall display the following information as a minimum:</p> <ul style="list-style-type: none"> • Variation Order (VO) number • Status on VO (requested, approved, rejected) • Date of VO (requested, approved, rejected) • Duration of the work • Quantity and cost effects of the VO 	

4.6 Time Control

4.6.1 Revision of the Contractor's Contract Schedule

Id	Requirement	Referring to
D:4.6.1.a	<p>C Should the Work develop in such a way that the Contractor's Contract schedule on level 2 no longer reflect the way the Work is carried out, the Contractor's contract schedule shall be revised. Such revisions are to be agreed with NT. The revised Contractor's contract schedule shall not be implemented as basis for monthly progress reporting until agreed with NT.</p>	

4.6.2 Special Time Schedules (ad hoc Schedules)

Id	Requirement	Referring to
D:4.6.2.a	<p>C NT may require that the Contractor shall prepare ad hoc time schedules in special cases, without this providing the right for the Contractor to make any extra charges.</p>	

4.6.3 Resource Plan

Id	Requirement	Referring to
D:4.6.3.a	<p>C The Contractor shall on a regular basis, upon NTs request, submit updated resource plan(s) for the project showing the number of persons within each skilled trade per month for the complete period of the project.</p>	
D:4.6.3.b	<p>E The resource plan(s) shall clearly demonstrate the manpower dedicated for the project execution.</p> <p><i>The tenderer shall submit draft resource plan(s) for the project from Effective date to end of production phase in the tender as part of the Project management plan.</i></p>	

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4.6.4 Contractor's production capacity

Id	Requirement	Referring to
D:4.6.4.a	<p>C The Contractor shall on a regular basis, upon NTs request, submit updated documentation of production capacity by means of, but not limited to:</p> <ul style="list-style-type: none"> • Covered production area in m2 on all Contractor's chosen sites. • Number of tracks in metres on all Contractor's chosen sites sorted by: <ol style="list-style-type: none"> a) Covered tracks b) Outdoor tracks (available for production) • Contractor's production capacity on all chosen sites in number of coaches for final assembly (typical EMU size), number of carbodies, number of bogies and number of propulsion systems per month. 	
D:4.6.4.b	<p>K The documentation shall clearly demonstrate the contractor's production capacity dedicated to the project execution.</p> <p><i>The tenderer shall submit a draft documentation of production capacity in the tender, as part of the Project management plan.</i></p>	

4.7 Organization

Id	Requirement	Referring to
D:4.7.a	<p>C The Contractor shall establish and maintain a project team that carry out the day to day work of the execution of the deliverables. The project team shall comprise of the key personnel as specified in Exhibit O, as well as all other personnel involved in the day to day work. NT shall be notified in advance of any changes within the project team. For changes to the key personnel, see Contract Conditions clause 3.10.</p>	Exhibit O, Contract Conditions
D:4.7.b	<p>C NT's approval of the Contractor's organisation charts does not exempt contractor from the full responsibility for the quality and capacity in contractor's organisation.</p> <p>The Contractor shall on its own initiative and for its own account arrange the replacement of any personnel acting in a reprehensible manner or who have proved to be unsuitable for the execution of their duties.</p> <p>Should NT detect reprehensible behaviour on the part of the Contractor's personnel, or should NT be of the opinion that certain personnel are unsuitable for the execution of the work assigned to them, NT may after submitting the reasons in writing, demand such personnel to be removed from the current assignment. The costs of such replacement shall be borne by the Contractor.</p>	

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Id	Requirement	Referring to
D:4.7.c	<p>E The Contractor’s project organisation shall be well-structured and otherwise suited for an effective and correct contract execution. Additionally, the project organisation shall describe how the Work will be organised, divided by the project phases. The key personnel shall have the same role titles as stated in requirement D:4.8.a.</p> <p><i>The Tenderer shall submit an organisation chart displaying sufficient number of relevant and defined roles. The organisation chart shall also display the Tenderer’s key personnel (to be marked with an asterisk) as included in Exhibit M. Clear communication lines within the organisation chart shall be visible including communication lines between the project’s organisation and top management, and other areas if applicable.</i></p> <p><i>In addition to the organisation chart, a description of how the Work shall be organised, divided by the projected phases, shall be included. Above deliverables shall be included in the preliminary Project plan.</i></p>	Exhibit M D:4.8.a
D:4.7.d	<p>C If the Contractor does any significant adjustments to its organisation the Contractor’s organisation chart shall also be adjusted.</p>	

4.8 Key personnel

Id	Requirement	Referring to
D:4.8.a	<p>C Key personnel shall include the Contractor’s appointed project manager, technical project manager, contract manager, quality manager and ILS manager.</p> <p>The Contractor shall appoint the permanent project manager as a part of the negotiation team. The project manager shall participate in the negotiations of the Contract. All key personnel must be proficient in English, both written and verbal.</p>	

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Id	Requirement	Referring to
D:4.8.b	<p>E The Key Personnel shall have solid competency and experience with similar deliveries.</p> <ul style="list-style-type: none"> - The key personnel shall have extensive relevant experience with similar projects, and other relevant experience. - The key personnel shall have formal education relevant for their respective roles. <p><i>The Tenderer shall present how they provide added value by submitting updated CVs for each of the key personnel in the tender, describing the education and relevant experience for:</i></p> <ul style="list-style-type: none"> • <i>Project manager</i> • <i>Technical project manager</i> • <i>Contract manager</i> • <i>Quality manager</i> • <i>ILS manager</i> <p><i>Each role shall be filled by one person only. The CVs shall not exceed 2 A-4 pages each. The Tenderer's overview of Key Personnel shall be included in the preliminary project management plan.</i></p>	

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5 Quality

Id	Requirement	Referring to
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D:5.a	C The purpose of this document is to describe the requirements regarding the quality taking in to account different aspects for this contract.	
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Quality Management is an integral part of all aspects of the Deliveries. Quality Management consist of quality planning, quality assurance, quality control and quality improvement and relates to Traffic safety, working condition, environment impact, information to stakeholders and the quality of the final product in relation to reliability, availability and maintainability.

Therefore, all documents regarding quality should be derived from an overall contract quality plan (CQP). Documents that is derived from the CQP must be send to NT for acceptance. All further changes to the documents shall be accepted by NT

5.1 General

Id	Requirement	Referring to
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D:5.1.a	C Quality management is an integral part of all aspects of the Deliverables. Quality Management consists of quality planning, quality assurance, quality control and quality improvement	
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D:5.1.b	C The Contractor shall maintain a certified quality management system during the term of the Contract, in accordance with ISO 9001 or equivalent standard.	
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D:5.1.c	C The Contractor shall be responsible for all quality management activities of the Deliveries.	
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D:5.1.d	C NT shall, without undue delay, have access to quality records i.e. all relevant information from the Contractor and its Subcontractors related to quality management activities within the Contract.	
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5.2 Contract Quality Plan (CQP)

Id	Requirement	Referring to
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D:5.2.a	C A structured and planned quality management work is vital to NT. The CQP should describe how all documents and reports are related with necessary mapping, milestones, and process charts.	
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D:5.2.b	C The Contractor shall prepare and present within 10 weeks after Effective Date, a first draft of contract quality plan (CQP) to NT for acceptance.	
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Id	Requirement	Referring to
D:5.2.c	<p>E The Tenderer shall submit a preliminary Contract Quality Plan according to ISO 10005 or equivalent standard. The preliminary CQP shall at least describe and be coordinated with the intended project organization, the specific project delivery plan, Safety plan with Validation & verification plan as well as Authority approval process plan according to NT's contract requirements and special Norwegian authorities.</p> <p>Evaluation of the CQP will be on the following focus areas, but not strictly bound to these:</p> <ul style="list-style-type: none"> • Quality project organization, with key personnel • An audit plan including external audits of the main sub-contractors aligned with Exhibit K • Procedures for Quality Review and Reporting to NT • Description of change management- and configuration management processes • Description of NTs involvement and collaboration with the Tenderer <p><i>The Tenderer shall present how they provide added value by submitting a preliminary Contract Quality Plan.</i></p>	
D:5.2.d	<p>C The Contractor shall update and maintain the CQP and documents included therein in the entire contract period.</p>	

5.3 Quality Review and Reporting

Id	Requirement	Referring to
D:5.3.a	<p>C NT, or any third-party NT has appointed, reserves the right to inspect products and verify Contractors and Subcontractors quality systems at all stages of the Contract including design and development, production and testing.</p>	
D:5.3.b	<p>C It shall be possible to carry out such quality audits after a notification period of at least ten (10) Business Days</p>	
D:5.3.c	<p>C NT shall be given the opportunity to participate in the Contractor's quality audits of its Subcontractor's and have access to the results of such audits.</p>	
D:5.3.d	<p>C NT shall receive a notification from the Contractor no later than ten (10) Business Days prior to the Contractor's audit.</p>	
D:5.3.e	<p>C NT shall receive audit reports/protocols after a performed audit at the Contractor or at its Subcontractor.</p>	
D:5.3.f	<p>C Quality meetings shall be held on a monthly basis, if not otherwise agreed.</p>	
D:5.3.g	<p>C The Contractor is responsible for minutes of meetings.</p>	

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Id	Requirement	Referring to
D:5.3.h	C The Contractor shall ensure suitable office facilities at all involved Contractor's manufacturing premises to NT's quality assurance personnel free of charge.	
D:5.3.i	C NT shall have the possibility to carry out quality- and safety audits and verifications of all relevant matters relating to Contractor's and any Subcontractor's part of the Works as part of the Tender process.	

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Id	Requirement	Referring to
D:5.3.j	<p>C The Contractor shall ensure that the following areas will be prepared and presented during such an audit, although not limited to these:</p> <ul style="list-style-type: none"> - Certification/Certificates - Development department processes focusing on SIL level <ul style="list-style-type: none"> o Software - Subcontractors <ul style="list-style-type: none"> o Follow up process o Documentation (examples) - Fault statistics – Trainset level (and possibly major components) - References <ul style="list-style-type: none"> o Competence matrix o Key positions in production such as Welders etc. (Welding robot vs. Welders) o Language Challenge - Environment, HSE at the factory (visual) <ul style="list-style-type: none"> o Entrance control o Discarded components (process) - Environmental accountability, a 5-year plan. <ul style="list-style-type: none"> o Review a strategy plan - Environmental plan for the future <ul style="list-style-type: none"> o Review the plan for external vendors - Vendor audit plan incl. example <ul style="list-style-type: none"> o Performance o Error statistics o Test equipment 	
D:5.3.k	<p>C The Contractor shall facilitate for the personnel to obtain all the necessary insight in order to make a correct assessment of the quality of the Works.</p>	

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Id	Requirement	Referring to
D:5.3.l	C The Contractor shall provide NT personnel with all necessary testing and measuring instruments available in the relevant production facilities, as well as all necessary assistance for the audit, free of charge, where and when applicable.	

5.4 Vehicle History Book

Id	Requirement	Referring to
D:5.4.a	C As part of the quality assurance process, the Contractor shall create and maintain a vehicle history book for each individual Trainset which include certificates, document tests result to document conformity for all systems of the Trainset according to EN 13460.	
D:5.4.b	C The Contractor shall present within 10 weeks after contract award a vehicle history book template to NT for acceptance.	
D:5.4.c	C The vehicle history book shall be presented to NT for review and acceptance as part of PTO documentation for each individual Trainset.	
D:5.4.d	C One electronic copy and one paper copy, of the accepted vehicle history book shall accompany each individual Trainset delivered and be forwarded to NT as part of the PTO, including copies of the signed vehicle history book acceptance document.	
D:5.4.e	C One copy of an authorized vehicle history book for each individual Trainset delivered is to be retained by Contractor for a minimum period of 5 years upon conclusion of the FTO of the last Trainset delivered under the Contract.	

6 Configuration Management

Id	Requirement	Referring to
D:6.a	I This chapter is under development.	

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7 Verification and Validation

Id	Requirement	Referring to
D:7.a	C The overall purpose of the verification and validation plan is to show how the contractor will ensure and prove that the deliverables are fit for purpose and how requirements will be verified, validated and documented.	

7.1 General

Id	Requirement	Referring to
D:7.1.a	C Validation and verification work shall be carried out in accordance with EN 50126 and EN 50657 or equivalent standard(s).	
D:7.1.b	C The Contractor shall prepare and present a final version of the verification and validation plan, including planned type tests to NT for acceptance, within 10 weeks after Effective Date.	
D:7.1.c	<p>E The Contractor shall develop a Verification and Validation Plan describing the management and execution of all Verification and Validation activities from the Effective Date up to the point at which all the Trainsets have been delivered and finally accepted by NT at FTO.</p> <p>The Verification and Validation Plan shall as a minimum include, but not limited to:</p> <ul style="list-style-type: none"> - Clearly identify which parts of the standard platform/product design will be kept, and which parts will require new or updated design, and which parts will be covered by new verification and validation activities - Include the location for each Verification and Validation activity, e.g. at the Contractor, Contractor's Sub-Supplier, in Norway etc. - Description of NT's participation in verification and validation activities - Include when the Verification and Validation will be conducted, before which Milestone. <p><i>The Tenderer shall present how they provide added value by submitting a preliminary Verification and Validation Plan. The preliminary Verification and Validation Plan shall contain a sample of a Verification and Validation Matrix.</i></p>	

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7.2 Verification and Validation Matrix

Id	Requirement	Referring to
D:7.2.a	C The verification and validation matrix is intended as a tool to facilitate a systematic, structured and transparent verification and validation work by demonstrating the linkage between a certain requirement or performance criteria and its verification and validation.	
D:7.2.b	C The Contractor shall develop and maintain a verification and validation matrix to continually demonstrate traceability of each requirement, and possible derived requirements in the Contract.	
D:7.2.c	C The verification and validation matrix, including all requirements and methods for verification and validation, shall be submitted for approval ten (10) business days prior to Final Design Approval (FDA). All requirements in the matrix do not need verification and validation approval before FDA.	
D:7.2.d	C The verification and validation matrix shall be available for NT at all time during the period of the Contract.	
D:7.2.e	C The verification and validation matrix shall include, but not limited to: <ul style="list-style-type: none"> - Requirement reference in line with the Contract - The requirement text - Reference to milestones and date for each verification and validation activity - The method(s) by which the requirements will be verified and validated, e.g. reference to established design evidence, test, demonstration, analysis, simulation, modelling, review, audit, etc. - Reference to the verification and validation authorization procedure for each requirement - Reference to verification and validation document with evidence of fulfilment of each requirement (K) 	

7.3 Methods of Verification and Validation

7.3.1 Testing

Id	Requirement	Referring to
D:7.3.1.a	C The Contractor shall issue an invitation(s) to test at least ten (10) business days in advance to such activity. A verification and validation specification shall also be part of the invitation for review and approval by NT.	
D:7.3.1.b	C If NT does not attend the test/Inspection, the Contractor may, unless NT instructs Contractor not to do so, proceed with the test. If NT wishes to carry out additional inspections and/or tests, all measuring tools and equipment necessary for inspection and/or test shall be at the disposal of the inspector, free of charge from the Contractor.	

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Id	Requirement	Referring to
D:7.3.1.c	<p>C Each individual test activity shall be described in detailed verification and validation specifications, which shall include at least:</p> <ul style="list-style-type: none"> - Test item/-s and their configuration/-s - Related requirement/-s in the verification and validation matrix - Safety requirements - Functional requirements - System requirements - RAM and LCC requirements - Test environment e.g. lab, workshop, track, etc. - Verification/ validation method - Test equipment and any relevant equipment certification - Acceptance criteria - Test procedure and test program, including a step-by-step description of how the test should be performed and what results are expected. Test procedures should include normal as well as non-normal processes, and both correct and incorrect user commands. - Documentation requirements - References to relevant documents 	
D:7.3.1.d	<p>C After tests are carried out, the results shall be documented in a test report, which shall include at least:</p> <ul style="list-style-type: none"> - Conditions for the test - Aim of the test - ID of equipment used for the test - Description of test/-s carried out - Results - Conclusion - Participants in the test - If the test is passed or failed any not completed or else remaining activities 	
D:7.3.1.e	<p>C The test reports shall be made available to NT within maximum ten (10) business days after the tests have been carried out.</p>	

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7.3.2 Inspection

Id	Requirement	Referring to
D:7.3.2.a	C The Contractor shall issue invitations to inspection at least ten (10) business days in advance	
D:7.3.2.b	C The Contractor shall communicate a complete list of inspections to NT no later than the final design review.	
D:7.3.2.c	C The complete list of inspection shall cover inspections for, but not limited to: <ul style="list-style-type: none"> - Carbody Shell - Bogie - Vehicle - Trainset - Commissioned Trainsets (before shipment to NT) - Delivered Trainsets (after shipment to NT) 	
D:7.3.2.d	C The Contractor shall also propose relevant documentation for each inspection, including Vehicle History Book, bogie history book, certificates etc., for NT acceptance	
D:7.3.2.e	C The Contractor has the full responsibility to administrate and document the inspections and the documentation shall at least include: <ul style="list-style-type: none"> - Conditions for the inspection - ID of equipment used for the inspection - Description of inspections/-s carried out - Results - Participants in the inspection - If the inspection is passed or failed and any not completed or else remaining activities 	
D:7.3.2.f	C The Contractor shall prepare and present the procedure and acceptance criteria for inspections for NT's review and acceptance in conjunction with the design documentation submittal for the applicable design reviews.	

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Id	Requirement	Referring to
D:7.3.2.g	<p>C Each individual inspection activity shall be described in a specification, which shall include at least:</p> <ul style="list-style-type: none"> - Test item/-s and their configuration/-s - Related requirement/-s in the verification and validation matrix - Related requirements in the specification of the inspected object(s) - Inspection purpose, procedure and inspection program, including a step-by-step description of how the inspection should be performed. - Documentation requirements - References to relevant documents 	
D:7.3.2.h	<p>C After inspection is carried out, the results shall be documented in an inspection report, which shall include at least:</p> <ul style="list-style-type: none"> - Conditions for the inspection - Aim of the inspection - ID of equipment used for the inspection - Description of inspection/-s carried out - Results of the inspection - Conclusion - Participants in the inspection 	
D:7.3.2.i	<p>C The Contractor shall take necessary steps to remedy remarks or objection upon which NT may address based on review of documentation and / or inspections.</p>	

7.4 Verification and Validation - RAM & LCC

Id	Requirement	Referring to
D:7.4.a	<p>C Norske tog will conduct verification and validation activities of RAM and LCC requirements. They will be comprised of both theoretical and practical verification and validation activities. In Contract Conditions and the Milestone Plan it is stated when such activities shall be conducted. To clarify, in Norske togs view;</p> <ul style="list-style-type: none"> - Verification is if the product is built the right way, that is, that the product meets the requirements during practical tests. - Validation is if the right product is built, that is, that the product is built according to specifications. This is normally handled during the design reviews 	

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7.5 Verification of LCC

Id	Requirement	Referring to
D:7.5.a	<p>C The evaluation and follow-up of LCC is transferred between the following statuses;</p> <p>Contractual LCC status The Contract's contractual LCC status is based on Appendix B-1, sheet 3. LCC Model.</p> <p>Current LCC status Before Final LCC status is achieved, the current LCC status is the LCC status at any time in-between after Effective Date. Updates of the current LCC status are based on e.g. in-depth analyses, predictions, testing, lessons learnt and best practices from other projects and incorporated and approved changes in the design.</p> <p>Final LCC status The Final LCC status is achieved when the theoretical verification is passed, see requirement X.X.</p> <p>Verified LCC status When the Contractor has got approval of all the elements included in the practical verifications by Norske tog Verified LCC status is achieved. This is done by replacing the verified values with the corresponding values in the Final LCC status.</p>	
D:7.5.b	<p>K The Contractor's LCC model shall at any time comply with the LCC statuses described in requirement D:7.5.a</p> <p><i>The Tenderer shall provide the Contractor's LCC model as part of the tender.</i></p>	D:7.5.a

7.5.1 Theoretical verification of LCC

Id	Requirement	Referring to
D:7.5.1.a	<p>C The theoretical verification of LCC is comprised of the following elements;</p> <ul style="list-style-type: none"> - Investment costs - Maintenance costs - Operational costs 	

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Id	Requirement	Referring to
D:7.5.1.b	<p>C The Contractor shall as part of the theoretical verification of LCC provide proofs that the values in the Contractual LCC model will be met by the latest Current LCC status through the following elements;</p> <ul style="list-style-type: none"> - Investment costs (LCC-INV-Total), which is verified by: <ul style="list-style-type: none"> o Present all the approved costs changes due to changes and additions within the frame of, or as a function of, changes in the Contract Conditions. Any such deviation shall replace the corresponding values in the Contractual LCC status; - Maintenance costs (LCC-MAI-Total), which is verified by: <ul style="list-style-type: none"> o Perform the RAM program according to the specification in Exhibit A5-1 (SoW RAM) to identify and quantify all features and parameters affecting the maintenance costs of the Delivery; o Proof that the costs of maintenance for both the Operator and the Contractor will be met; o Present all agreed and, by Norske tog approved, RCM analyses. - Operating costs (LCC-OPE-Total), which is verified by: <ul style="list-style-type: none"> o Conduct all necessary updates of simulations and calculations of energy consumption according to prerequisites stated in requirement D:7.9.b o Provide proofs that the values for Significant Faults and Major Faults stated in the Contractual LCC status each will be met; o Provide proof that the values for Fleet availability and the availability for individual Trainsets will be met. 	D:7.9.b
D:7.5.1.c	<p>C If the Final LCC status after the theoretical verification is higher for any sub-category stated in Contract Conditions, clause 18, the Contractor must to Norske tog pay the delta amounts to commence with the practical verification of LCC.</p>	

7.5.2 Practical verification of LCC

Id	Requirement	Referring to
D:7.5.2.a	<p>C The practical verification of the LCC is based on the conducted practical;</p> <ul style="list-style-type: none"> - Verification of Reliability requirements; - Verification of Availability requirements; - Verification of Maintainability; - Verification of Energy costs. 	
D:7.5.2.b	<p>C The Contractor shall perform all practical verifications and replace all affected values in the Final LCC status with the verified values to achieve Verified LCC Status.</p>	

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Id	Requirement	Referring to
D:7.5.2.c	C If the Verified LCC status after all elements building up the verified LCC status are conducted and at least one of them does not fulfil the requirements in Exhibit B, the Contractor shall pay the stated penalties.	
D:7.5.2.d	C In case the configuration of the Trainset changes during the practical verification of the Final LCC status, for example by an approved Variation Order, a new Final LCC status must be calculated which at any time during the practical verification of LCC fulfils the requirements stated for the theoretical verification of LCC.	
	In case the Final LCC status is larger than the Contractual LCC Status, the Contactor must update the calculations of penalties as stated in the Contract Conditions, clause 18.	

7.6 Verification of Reliability requirements

Id	Requirement	Referring to
D:7.6.a	C The verification of Reliability requirements will be conducted by both theoretical verification and practical verification	

7.6.1 Theoretical verification of Reliability requirements

Id	Requirement	Referring to
D:7.6.1.a	K The Contractor shall, at each design review, provide evidence that for each of the fault categories, the contractual requirements will be met.	
	<i>The Contractor shall, in the RAM Plan, describe how this is integrated in the design reviews.</i>	

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7.6.2 Practical verification of Reliability requirements

Id	Requirement	Referring to
D:7.6.2.a	<p>C The practical verification of reliability is conducted as follows;</p> <ul style="list-style-type: none"> - Pre-delivery tests, done individually for selected Trainsets - Pre-PTO tests, done individually for all Trainsets - Test operating period, done individually for all Trainsets - Reliability warranty, done for the Fleet of Trainsets <p>Norske tog shall inform the Contractor in writing about all failures which are related to the reliability performance guarantee. The Contractor will have access to the failure data for the train daily. If the Contractor does not agree with Norske tog's valuation of a failure from Norske tog's maintenance system, the Contractor shall state his reason for the disagreement in writing. In such case representatives of the Contractor and Norske tog will discuss the discrepancy to try to reach an agreement to determine the correct category of the failure. If the Parties are unable to reach an agreement, it is the Contractor's responsibility to provide convincing evidence that will prove his case.</p>	
D:7.6.2.b	<p>C The following type of faults shall not be counted in any practical verification of reliability:</p> <ul style="list-style-type: none"> a) faults in the infrastructure power supply or the infrastructure signaling equipment; or b) faults due to accidental damage caused by circumstances beyond the Contractor's control; or c) faults due to acts of vandalism, abuse by passengers and other on-board personnel or driver error which is not caused by insufficient training; or d) faults as result of maintenance of the Trainset conducted by the Operator or any third party assigned by the Operator which is not caused by insufficient training or faults in the maintenance documentation; or e) faults caused by the Operator or any third party assigned by the Operator not adhering to the maintenance program or the maintenance procedures. 	
D:7.6.2.c	<p>C The Contractor and Norske tog and, as applicable, the Operators shall use of the functional failures list as basis to allocate all failures to the relevant fault category.</p>	
D:7.6.2.d	<p>C For the entire duration of the practical verification of the Reliability Requirements, the Contractor shall propose relevant meetings where appropriate parties shall be invited. The main task on such meeting shall be to allocate the responsible party for each recorded fault</p>	
D:7.6.2.e	<p>C The Contractor shall not be granted any relief in their commitments in case any Trainset must be taken out of service operation due to causes attributable to the Contractor.</p> <p><i>Part of RAM Program</i></p>	

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7.6.2.1 Pre-delivery tests

Id	Requirement	Referring to
D:7.6.2.1.a	<p>C Pre-delivery tests are conducted to ensure that the Trainsets are functioning according to specifications before they are delivered to Norway. Such tests are performed on a limited number of Trainsets, unless there are major problems during these tests.</p>	
D:7.6.2.1.b	<p>C Latest at Milestone 4 the Contractor shall provide the “Pre-delivery test program” to Norske tog for approval. The pre-delivery test program shall contain at least the following;</p> <ul style="list-style-type: none"> - Where the test shall take place and predicted dates for the test. Latest 30 calendar days before the actual dates for the test, these dates shall be confirmed to Norske tog. - How the test shall be performed. Norske tog require that the test <ul style="list-style-type: none"> o For at least 20 % of the distance shall be performed with the top speed of the Trainset o For at least 100 kilometres shall be performed in multiple operation with two (2) Trainsets and that during this part of the test at least ten (10) stops shall be undertaken, where the Trainsets are de-coupled and thereafter coupled. No Trainset is allowed to run more than 200 kilometres in multiple operation. o For at least 40 % of the distance shall be performed in simulated commercial operation using the time tables provided in Exhibit A04 (Mission Profile). - A “Pre-delivery test protocol” shall be included where the Contractor shall state which imperfections, faults, deficiencies and other matters of discrepancies are revealed during the Pre-delivery Tests and when these are scheduled to be remedied. The pre-delivery test protocol shall be signed by both parties. 	
D:7.6.2.1.c	<p>C The pre-delivery tests shall be performed on test tracks outside of Norway allowing a top speed of at least 200 kilometres per hours.</p>	
	<p><i>The test track</i></p>	
D:7.6.2.1.d	<p>C The first Trainset scheduled to be delivered to Norway shall perform at least 2 500 Trainset kilometres (the “Pre-delivery Test”) The second and third Trainset scheduled to be delivered to Norway shall perform at least 1 000 kilometres. The pre-delivery test for a Trainset is approved if zero (0) Significant Faults and zero (0) Major Faults are recorded.</p>	
D:7.6.2.1.e	<p>C If the number of defects on a Trainset during the Pre-delivery Test exceed zero (0) Significant Faults or zero (0) Major Faults, then Norske tog is entitled to extend the Pre-delivery Test until the relevant Trainset has produced a continuous distance of at least 2 500 Trainset kilometres with zero (0) Significant Faults and zero (0) Major Faults.</p>	

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Id	Requirement	Referring to
D:7.6.2.1.f	C If any of the three (3) Trainsets fails to meet the requirements in D:7.6.2.1.d, then Norske tog is entitled to add one addition Trainset to conduct the pre-delivery test of 1 000 kilometres for each Trainset failing to meet the stated requirements. This applies also for added Trainsets on top of the initial three (3) Trainsets. To avoid misunderstanding, all Trainsets, including added Trainsets must meet the requirements stated in D:7.6.2.1.d and, as applicable D:7.6.2.1.d.	D:7.6.2.1.d D:7.6.2.1.e

7.6.2.2 Pre-PTO test

Id	Requirement	Referring to
D:7.6.2.2.a	C Pre-PTO tests are conducted for all Trainsets delivered to Norway. The tests are conducted without passengers but with on-board test personnel. Due to the scheduled operation on the lines in Norway pre-PTO test are generally conducted during nights or other low-traffic periods. The testing possibilities might be further limited during the months June, July and August.	
D:7.6.2.2.b	C The Contractor shall provide the “Pre-PTO test program” latest at Milestone 4. The pre-PTO test program shall be based on the pre-delivery test program and shall in addition include an on-board test program where on-board personnel shall conduct all activities normally conducted by passengers. For every second car there shall be at least one (1) on-board personnel conducting the tests. Norske tog must approve the pre-PTO test program before the pre-PTO tests can commence.	
D:7.6.2.2.c	C The Contractor shall obtain all necessary permits, track access and authorisations before conducting these tests. Norske tog will, as far as the operational situation makes it possible, contribute and make the necessary arrangements for conducting these tests, provided that the Contractor present his needs in due time for planning and implementation.	
D:7.6.2.2.d	C The first Trainset delivered to Norway shall perform at least 15 000 Trainset kilometres in the pre-PTO test. All subsequent Trainsets delivered shall perform at least 5 000 Trainset kilometres in the pre-PTO test. The pre-PTO test for a Trainset is approved if zero (0) Significant Faults and zero (0) Major Faults are recorded. If the number of defects on a Trainset during the Pre-PTO Test exceed zero (0) significant faults or zero (0) major faults, ref. Exhibit A05-1 (SoW RAM), then NT is entitled to extend the Pre-delivery Test until the relevant Trainset has produced a continuous distance of at least 15 000/5 000 Trainset kilometres meeting the stated requirements.	Exhibit A05-1

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Id	Requirement	Referring to
D:7.6.2.2.e	<p>C If the number of defects on a Trainset during the Pre-delivery Test exceed zero (0) Significant Faults or zero (0) Major Faults, then Norske tog is entitled to extend the Pre-delivery Test until the relevant Trainset has produced a continuous distance of at least 5 000 Trainset kilometres with zero (0) Significant Faults and zero (0) Major Faults. For the first Trainset the continuous distance to be produced shall be at least 15 000 Trainset kilometres.</p>	

7.6.2.3 Test Operating Period

Id	Requirement	Referring to
D:7.6.2.3.a	<p>C The test operating period (TOP) is conducted for all Trainsets which passed PTO and is a prerequisite for the FTO certificate. The Trainsets are in service operation during the test operating period.</p>	
D:7.6.2.3.b	<p>C During the Test Operating Period, each Trainset shall, individually, demonstrate a continuous period as follows;</p> <ul style="list-style-type: none"> - For the first five (5) Trainset, 4 months and 100 000 km in service operation, where no more than four (4) Major Faults or Significant Faults can be recorded per Trainset. Furthermore, with respect to Significant Faults no more than one (1) can be recorded per Trainset and no more than two (2) can be recorded for these five (5) Trainsets. - For the next five (5) Trainsets, 2 months and 50 000 km in service operation where no more than two (2) Major Faults or Significant Faults can be recorded per Trainset. Furthermore, with respect to Significant Faults no more than one (1) for these five (5) Trainsets. - For any subsequent Trainset, 1 month and 25 000 km in service operation where no more than one (1) Major Faults can be recorded per Trainset. 	
D:7.6.2.3.c	<p>C In case the defects for a Trainset during the Test Operating Period exceeds the levels stated in requirement D:7.6.2.3.b, Norske tog is entitled to extend the Test Operating Period up to six (6) times of one (1) month each where the Test Operation Periods shall have a continuous duration as follows;</p> <ul style="list-style-type: none"> - For the first five (5) Trainset, 4 months and 100 000 km in service operation; - For the next five (5) Trainsets, 2 months and 50 000 km in service operation; - For any subsequent Trainset, 1 month and 25 000 km in service operation. <p>The same levels as stated in requirement D:7.6.2.3.b applies for the extended Test Operating Period.</p> <p>If the requirements are not met for a Trainset after the sixth prolongation of the Test Operation Period, see Draft Contract Conditions, clause 6 for the penalty regime.</p>	D:7.6.2.3.b

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7.6.2.4 Reliability Warranty

Id	Requirement	Referring to
D:7.6.2.4.a	C The reliability warranty is conducted by the Contractor to prove that the Fleet of Trainsets which have passed FTO can meet the contractual requirements for Significant Faults and Major Faults.	
D:7.6.2.4.b	C The Reliability Warranty is individually conducted for the Primary Delivery and any subsequent Trainset Option Delivery. Norske tog reserves the right to cancel the Reliability Warranty for any Trainset Option Delivery.	
D:7.6.2.4.c	C Each Trainset which have been granted the FTO Certificate shall be included in the Reliability Warranty starting the first full months after the date the FTO Certificate was granted until the end of the Reliability Warranty, subject to requirement D:7.6.2.4.b.	D:7.6.2.4.b
D:7.6.2.4.d	C	
D:7.6.2.4.e	C In case the levels in requirement D:7.6.2.4.d are not met; Norske tog is entitled to prolong the Reliability Warranty with up to six (6) additional periods of three (3) months each, keeping the total duration in month equal to the duration in the base period. The same levels as stated in requirement D:7.6.2.4.b must be met to pass the Reliability Warranty. If the requirements are not met after the sixth prolongation, see the Contract Conditions, section 18.	D:7.6.2.4.d

7.7 Verification of Availability requirements

Id	Requirement	Referring to
D:7.7.a	C Availability requirements are measured as part of the Availability Warranty for both for individual Trainsets and separately for each batch of Trainsets, where the Primary Delivery is the first batch.	
D:7.7.b	C The Availability Warranty shall be conducted for all Trainsets in the Primary Delivery and in any subsequent Trainset Option Delivery as described in Exhibit A05-1 (SOW RAM). Norske tog reserves the right to not conduct the Availability Warranty for any Trainset Option Delivery.	Exhibit A05-1
D:7.7.c	C Each Trainset which have been granted the FTO Certificate shall be included in the Availability Warranty from the first full months after the date the FTO Certificate was granted the Trainsets and until the end of the technical warranty subject to requirement D:7.7.b.	D:7.7.b

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Id	Requirement	Referring to
D:7.7.d	C	Exhibit A05-1 Appendix B-1 Contract Conditions, section 18
D:7.7.e	C	Exhibit A05-1 Appendix B-1 Contract Conditions, section 18

7.8 Verification of Maintainability requirements

Id	Requirement	Referring to
D:7.8.a	C The Contractor verification of maintainability requirements are done to show that selected maintenance activities which are to be performed by the Operator can be conducted with the man-hours and resources defined by the Contractor. As applicable man-hours are divided into the duration of the maintenance activity and the average number of maintenance technicians needed to conduct the maintenance activity according to the maintenance documentation. For clarity, any idle or waiting time part of the duration is not counted in the measurement. With resources are meant among other things personnel, competences, Spare Parts, Materials, Special Tools, Test Equipment and Documentation. In case the maintenance activity is broken down in separate sub-tasks, the same shall be provided for each such sub-task.	
D:7.8.b	C For each maintenance activity included in the maintainability verification, the Contractor shall guarantee that; <ul style="list-style-type: none"> - The maintenance documentation is available and complete. If, during the verification, possible detects and omissions are detected which the parties agree will affect the execution of the verification, it is not considered being available and complete. - All necessary special tools and test equipment is provided and functioning. - All Spare Parts and Material needed to conduct the activity is available - All personnel from the Operators side are trained by the Contractor and have the necessary abilities 	
D:7.8.c	C For each maintenance activity referred to in D:7.8.b where any bullet is not fulfilled, the Contactor shall make the necessary corrections within thirty (30) calendar days and a second and final, verification of the maintenance activity in question shall be conducted. In case it is not possible to conduct the maintenance activity in question according to the stated support, see the Contract Condition section 18.	D:7.8.b Contract Conditions section 18

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Id	Requirement	Referring to
D:7.8.d	<p>C Maintenance activities to be included in the verification of maintainability are all maintenance activities allocated to the Operators, irrespective if these are due to Preventive Maintenance, Corrective Maintenance, Fault finding, repairs or overhauls. The selection is done as follows;</p> <p>A. Each Operator and Norske tog shall, from the defined list of maintenance activities, pick out X maintenance activities. B. From the 4*X picked activities all duplicates shall be removed which provides a list of unique maintenance activities is compiled, the net list.</p> <p>C. For each maintenance activity on the net list the frequency of occurrence is provided. That is, based on the quantity in the Delivery and how many times the activity is scheduled to be performed, a number is calculated. The maintenance activities are ordered based on these numbers, where the lowest number is first and the largest number is last. Then the cumulative number for each maintenance activity is calculated.</p> <p>D. All numbers are divided with the largest cumulative number, giving each maintenance activity a number between 0 and 1.</p> <p>E. By some mutually agreed random generator, at least X random numbers between 0 and 1 are produced. Assume that the first maintenance activity has number $m > 0$. In case one of the random numbers are less than m then this activity is chosen. To clarify, an activity cannot be selected more than one time. If this happens, a new random number must be produced.</p> <p>By this procedure, an agreed list of X maintenance activities comprises the basis for the maintainability verification.</p>	
D:7.8.e	<p>C The Contractor shall latest at Milestone X.Y present a protocol template reflecting the requirements on the maintainability verification. The protocol template shall be used for each maintenance activity conducted. Norske tog and the Operators shall have the right to review and approve the protocol template.</p>	
D:7.8.f	<p>C When conducting the verification of maintainability, the net hours shall be verified, that is, no time for fetching tools, special tools, documentation, spare parts, materials etc. shall be counted.</p>	
D:7.8.g	<p>C The verification of maintainability shall include minimum the following personnel categories each time a maintenance activity is verified;</p> <ul style="list-style-type: none"> - Verification manager (Contractor); - Observer (Norske tog); - The stated number of Maintenance technician(s) needed to conduct the maintenance activity (Operator) - The other Operators have the right, but is not obliged, to participate on the verification activity All present persons shall sign the protocol for each conducted maintenance activity. 	

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Id	Requirement	Referring to
D:7.8.h	<p>C Each Operator shall perform the selected maintenance activities in their own workshop using personnel hired by the Operator and trained by the Contractor. The Contractor shall reimburse the costs the Operator has conducting the Maintainability verification, based on the recorded number of hours in the protocol and the hourly rate for maintenance personnel stated in Exhibit B-1.</p>	
D:7.8.i	<p>C In case the Contractor selects to execute their right to perform the maintenance activities, this shall be done in one of the workshops used to maintain the Trainsets. To clarify, the Contractor must perform all maintenance activities on the net list using their own personnel, it is not possible for the Contractor to perform only selected activities. Any costs incurred for the Operator in case a workshop is used which is hired by the Operator shall be taken by the Contractor.</p>	
D:7.8.j	<p>C When the verification of maintainability is conducted and the result is approved by all involved parties, it will not be possible for the Contractor, Norske tog or any current or future Operator to ask for any compensation in case they believe the stated hours and / or number of technicians in the maintenance plan is incorrect.</p>	
D:7.8.k	<p>C When all schedules verification activities as part of the maintainability verification has been conducted, the factor K shall be calculated. It is calculated based on the measured average number of man-hours needed for the selected activities put in relation to the stated number of man-hours according to the following formula. This factor K shall be used to adjust the cost for maintenance man-hours for the Operator and in case the value of K is larger than 1.02, penalties for the Contractor applies according to Exhibit B.</p>	

7.9 Verification of Energy costs

Id	Requirement	Referring to
D:7.9.a	<p>C The energy costs for the three Load Cases are to be verified after the Trainsets are delivered, as stated in the Contract Conditions X.Y. In addition to the verification of consumed and regenerated energy, the energy consumption for the HVAC unit and other auxiliary systems will be verified.</p>	

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Id	Requirement	Referring to
D:7.9.b	<p>C When conducting the verification of Energy costs, the Trainset(s) used for the verification shall be equipped with:</p> <ul style="list-style-type: none"> - New wheels; - Measuring equipment for measuring consumed energy; V1, V2, V3, S1, S2, S3, N1, N2, and N3; - Measuring equipment for measuring theoretical regeneration capability (actual energy fed back to the grid plus regenerated energy not possible to feed back); VR1, VR2, SR1, SR2, NR1, and NR2. <p>In addition, the following conditions apply;</p> <ul style="list-style-type: none"> - All Trainset systems needed to perform the tests shall be active. - Test will be made according to the timetables provided in Exhibit A4 and be done in both directions; - The driver shall drive as energy efficient as possible without inducing delays in the schedule (timetable). The Contractor can educate/instruct the driver before, but not during, the test runs so that the energy-efficiency is maximized; - When performing the tests, the outside temperature must be within +/- 3 degrees Celsius of the nominal temperature values listed in Exhibit A5-2 (SOW LCC), section 5.2. - When performing the tests, the temperature in the passenger compartment and the cab area must be at the setpoint temperatures listed in Exhibit A5-2 (SOW LCC), section 5.2 within the following margins as stipulated in EN14750-1. For scenarios 1 and 3 the margins are -2 to +1 degrees Celsius from the setpoint temperature. For scenario 2 the margins are -2.5 to +2.5 degrees Celsius from the set point temperature. 	

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7.9.1 Verification of Load Case 1

Id	Requirement	Referring to
D:7.9.1.b	<p>C Verification of Load Case 1 shall be conducted based on the scenario selected by Norske tog (Winter, Summer or Normal).</p> <p>Five (5) round trips will be made to verify the energy parameters for the selected scenario where the highest and the lowest values will be removed. The average of the remaining three (3) results is calculated to obtain the verified consumed and regenerated energy parameters for the selected scenario. If, for example, the parameters for the Winter scenario are selected for verification (V1 and VR1), the energy parameters for the other scenarios (S1, SR1, N1 and NR1) will be calculated as follows:</p> <p>A relationship (r1 and r2) between the theoretical verified energy parameters in the Final LCC status (V1Final, VR1Final) and the verified energy parameters (V1Verified and VR1Verified) will be calculated as:</p> $r1 = V1Verified/V1Final$ $r2 = VR1Verified/VR1Final$ <p>These relationships (r1 and r2) will then be used to calculate the verified energy parameters for the remaining scenarios (S1, SR1, N1, NR1) as follows:</p> $S1Verified = S1Final * r1$ $SR1Verified = SR1Final * r2$ $N1Verified = N1Final * r1$ $NR1Verified = NR1Final * r2$ <p>Finally, all the verified values (V1Verified, VR1Verified, S1Verified, SR1Verified, N1Verified and NR1Verified) replaces the corresponding final values in the Verified LCC status and Wm1Verified is calculated.</p>	

7.9.2 Verification of Load Case 2

Id	Requirement	Referring to
D:7.9.2.a	<p>C Verification of Load Case 2 will be made in the same manner as the verification of Load Case 1. If the winter scenario was selected for Load Case 1, Norske tog will select either the Summer scenario or the Normal scenario for Load Case 2. If the winter scenario was not selected for Load Case 1, Norske tog will select the winter scenario for Load Case 2.</p>	

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7.9.3 Verification of Load Case 3

Id	Requirement	Referring to
D:7.9.3.a	C Verification of Load Case 3 will be conducted as part of the climate chamber tests as required and specified in Exhibit A5 (SOW Tests) and detailed in Appendix A5-1 (Climate chamber test).	

7.10 Test plan

Id	Requirement	Referring to
D:7.10.a	I This chapter is under development.	

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8 Engineering Plan and Design Process

8.1 General

Id	Requirement	Referring to
D:8.1.a	C The Contractor is responsible for the engineering solutions and the whole design process, including the established product and the delta for the specific design of this project. Since NT has experience regarding the Norwegian environment and operation, NT will cooperate with the Contractor throughout the design process to ensure a smooth project execution as well as avoiding late and expensive changes.	

8.2 Engineering plan

Id	Requirement	Referring to
D:8.2.a	K The Supplier shall have a project specific Engineering Plan, based on their standard engineering process. The Engineering plan shall at least include but not be limited to the following: <ul style="list-style-type: none"> • General design process • Engineering organization • Requirement management process • Industrial design process • Adaptations for the Deliverables, including descriptions for major changes between standard product design and delivered design for this project. <p><i>The tenderer shall demonstrate compliance by submitting a preliminary Engineering Plan in the tender.</i></p>	
D:8.2.b	E The Engineering plan shall be well structured and aligned with the project management plan, the Contractor's contract schedule and all other relevant documents. The Engineering plan shall clearly show how the Contractor will conduct the design phase and how the engineering is involved in other phases of the project and how it is adapted for the deliverables of the project, as stated in requirement D:8.2.a <p><i>The tenderer shall present how they provide added value by submitting a preliminary Engineering Plan in the tender.</i></p>	D:8.2.a
D:8.2.c	C The Contractor shall submit a detailed and final version of the Engineering Plan for review and acceptance prior to Milestone MS 1.5 in Appendix C1.	Appendix C1

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8.3 Design Process

Id	Requirement	Referring to
D:8.3.a	C The Contractor shall apply a design process for the design of all the Deliverables in accordance with the Contract. The process shall be based on EN 50126 and EN 50657, or equivalent.	EN50126, EN50657
D:8.3.b	E The Contractor shall use their standard design process, with adaptations to the deliverables of the project. The design process shall be clearly structured and specify all needed input from NT regarding design, cover all areas of the trainset and take into consideration all project phases including but not limited to: Production phase, testing and homologation phase. <i>The tenderer shall present how they provide added value by presenting their design process, how it has been used in previous project, how it is based on EN 50126 and EN 50657, and what adaptation have been made to the process for the deliverables of this project in the tender.</i>	EN50126, EN50657

8.3.1 Approval Process

Id	Requirement	Referring to
D:8.3.1.a	C NT acknowledges that the Contractor will need regular acceptance of various design solutions from NT in order to progress with the design process.	
D:8.3.1.b	K The Contractor shall establish and maintain an approval and acceptance process plan for the complete deliverables, as part of the engineering plan. The approval and acceptance process plan shall clearly indicate when and how the Contractor expects an approval or a response from NT. The plan shall include the entire process, from the Contractor's presentation of plans to final approved Contract. <i>The tenderer shall demonstrate compliance by submitting a preliminary approval and acceptance process plan in the tender, as part of the preliminary engineering plan</i>	
D:8.3.1.c	C Documents and solutions accepted by NT prior to formal approvals mean that the Supplier may continue with the project execution. It does, however, not in any way relieve the Supplier of its overall responsibilities for the Deliverables. Any comments from NT prior to the formal approvals do not relieve the Supplier of its overall responsibility for the Trainset's design.	

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8.3.2 Design Review

Id	Requirement	Referring to
D:8.3.2.a	<p>C Design reviews are formal meetings where the product design and supporting documents are presented by the Contractor to NT, for review and acceptance of continued design process.</p> <p>The design phase is divided into the following sub-phases:</p> <ul style="list-style-type: none"> - Initial design phase - Conceptual design phase - Preliminary design phase - Final design phase <p>The design reviews per phase are finalized when NT gives their formal design approval for corresponding phase. The purpose of the initial design phase is to align the expectations of the design between NT and the Contractor.</p>	
D:8.3.2.b	<p>C During the design phase, NT shall continuously be able to review and follow up the Contractor's work for the product design through recurrent design reviews. Such reviews shall at least comprise the following steps but should also include intermediate reviews as needed for an efficient and successful design process.</p>	

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Id	Requirement	Referring to
D:8.3.2.c	<p>C In each of the following design phases the product design shall be evaluated with respect to fulfilment to given requirements.</p> <ol style="list-style-type: none"> 1. Initial design review (IDR) <ol style="list-style-type: none"> a. Review and alignment of the design documentation in the contract, which parts of the standard platform/product design will be kept, and which parts will require new or updated design. b. Presentation of industrial design visualizations and alternatives for the complete Trainset c. Identification of design activities which includes mock-up and/or VR models. d. Review of conceptual verification and / or validation method and conceptual acceptance criteria for each requirement. 2. Conceptual design review (CDR) <ol style="list-style-type: none"> a. Review of the Trainset concept, how requirements are derived and how the concept meets these requirements. b. Review of other deliverables, concepts, how requirements are derived and how the concept meets these requirements. c. Review of preliminary verification and / or validation method and preliminary acceptance criteria for each requirement. 3. Preliminary design review (PDR) <ol style="list-style-type: none"> a. Review of the preliminary design of the Trainset, in-depth system and function descriptions and interfaces between system concepts and system design, how requirements are derived and how the preliminary design meets these requirements. b. Review of other parts of the Delivery, in-depth solutions and interfaces, how requirements are derived and how the preliminary design meets these requirements. c. Review of final verification and / or validation method and final acceptance criteria for each requirement. 4. Final design review (FDR) <ol style="list-style-type: none"> a. Review of the final design of the Trainset, detailed drawings/specifications of hardware and software, how requirements are derived and how the final design meets these requirements. b. Review of other parts of the Delivery, final design, how requirements are derived and how the final design meets these requirements. 	

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Id	Requirement	Referring to
D:8.3.2.d	C Documents and solutions presented at each design review shall be demonstrated to, reviewed and approved by NT. NT's approval means that the Contractor may continue in the design process but does not in any way relieve the Contractor of its overall responsibility for the design of the Trainset or any other parts of the Delivery. Any comments from NT during the review process do not relieve the Contractor of its overall responsibility for the Trainset's design.	
D:8.3.2.e	C The Contractor shall deliver an agenda and all necessary supporting documents at the latest two (2) weeks before each design review. If adequate documentation is not delivered, or otherwise if the criteria set by NT for a successful design review are not met, NT has the right to postpone the design review.	
D:8.3.2.f	C Each design phase shall end with a formal design approval from NT; Initial Design Approval (IDA), Conceptual Design Approval (CDA), Preliminary Design Approval (PDA) and Final Design Approval (FDA).	
D:8.3.2.g	C All changes required after FDA shall be handled through Variation Order.	

8.4 Engineering Organization

Id	Requirement	Referring to
D:8.4.a	K The engineering organization shall be aligned with the project organization, contain sufficient and qualified resources for the design process and be available for NT during the project time. The roles of the engineering shall at least include, but not be limited to: <ul style="list-style-type: none"> • Engineering project manager • Requirement manager <p><i>The tenderer shall demonstrate compliance by submitting the engineering organization as part of the preliminary engineering plan in the tender.</i></p>	
D:8.4.b	E The engineering organization shall be aligned with the Contractor's Contract schedule and demonstrate how the assigned organization will manage to deliver the design according to the engineering plan and other deliverables during the time of the project. <p><i>The tenderer shall present how they provide added value by submitting the engineering organization as part of the preliminary engineering plan in the tender.</i></p>	

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8.5 Requirement Management

Id	Requirement	Referring to
D:8.5.a	 This chapter is under development.	

8.6 Industrial Design Plan


Id	Requirement	Referring to
D:8.6.a	 This chapter is under development. The purpose is to establish a process for verification of visual impression/design, specific functionality, derive and assess requirements for ergonomics, health and safety, passenger experience, serviceability and cleanability.	

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9 Authority Approval Process

9.1 General

Id	Requirement	Referring to
D:9.1.a	<p>C This document describes the requirements for the Contractor in the approval process. The contractor shall develop an Approval Process Plan fulfilling these requirements. The 4th Railway package was decided by the Norwegian Parliament 11 of June 2021 and planned implemented third quarter of 2021. At the point of implementation a new revision of the Norwegian Railway Authority, NRA, vehicle regulation will be put into force regulating the approval process for transportation in Norway and test period by applying directly to NRA and the final approval (APIS/APIM) will be through the One Stop Shop (OSS).</p>	

9.2 Authority Approval Process Plan

Id	Requirement	Referring to
D:9.2.a	<p>E The Contractor shall develop, apply and maintain an Authority Approval Process Plan describing how the Contractor will secure all necessary documentation for the pre-engagement and authority approvals. NT will be the applicant and the application for transportation and test will be directly to the Norwegian NRA according to the national vehicle regulation (Kjøretøyforskriften). The final APIS will be through the OSS and ERA.</p> <p><i>The Tenderer shall submit a preliminary Authority Approval Process Plan demonstrating the process and how they will prepare the documentation for transport/test application and final APIS in OSS.</i></p>	NRA, Vehicle regulation (Kjøretøyforskriften)

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Id	Requirement	Referring to
D:9.2.b	<p>E The authority approval process plan shall be well structured, be aligned with and respect inter-dependencies with relevant activities in the Contract Schedule, and involvement of assessment bodies and third parties. The plan shall include, but not be limited to, the following areas:</p> <ul style="list-style-type: none"> • An overview of the whole process including preparation of necessary documentation for pre engagement with the authority • A timeline with milestones with relation to the project plan, including all train configurations. • Identify responsibility of sub tasks within own organization with necessary resources and competency needed including quality control and communication regarding the approval process. • Preparation of all necessary documentation for required application for transportation and on track test in Norway • Describe necessary detail the engagement and acceptance process of independent assessors including: Notified Body (NoBo), Assessment Body (AsBo), Designated Body (DeBo) and 3rd party IV&V. • Overview of key document and deliverables in relation to the approval processes such as but not limited to safety plan, quality plan, EC declaration and conformity reports <p><i>The Contractor shall document how they provide added value by submitting a preliminary Authority approval process plan in the tender.</i></p>	
D:9.2.c	<p>C The Contractor shall submit a detailed and released version of the authority approval process plan to NT no later than at Conceptual Design Review (CDR) Approval.</p>	
D:9.2.d	<p>C The Contractor is fully responsible for producing the necessary documentation in a format equal and in accordance with ERATV. In addition, the Contractor shall include references to technical documentation for each requirement in step 2 (technical characteristics) and step 3 (TSI conformity) of ERATV application guide.</p>	

9.3 Involvement of NT in the Approval Process

Id	Requirement	Referring to
D:9.3.a	<p>I NT will assist with the communication between the Contractor, Infrastructure Manager and Railway Undertaker.</p>	

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Id	Requirement	Referring to
D:9.3.b	E Contractor shall describe necessary assistance needed from NT within the following areas: <ul style="list-style-type: none"> • Access to test on tracks in Norway • Participation in risk assessment for test operation on Norwegian tracks. Required by Kjøretøyforskriften/NRA vehicle regulation. • Driver for the test runs in Norway • Operation of the Trainset for experience-gathering operation 	

9.4 Independent Assessors

Id	Requirement	Referring to
D:9.4.a	C Independent assessors are applicable to the project: <ul style="list-style-type: none"> • NoBo (Notified Body) who will check and confirm that all relevant TSI requirements are adhered to. • DeBo (Designated Body) who check and confirm that notified national technical requirements are fulfilled. • AsBo (Assessment Body) who will check and ensure that the safety process is carried out according to the safety plan and CSM-RA requirements and that the Trainset is safe within the limitations according to the intended use and the Contract. 	
D:9.4.b	C The Contractor shall no later than maximum one (1) calendar month after the Effective Date submit the names of the selected NoBo, DeBo, and AsBo, with proven experience from northern Europe, for NT's review.	
D:9.4.c	C The Contractor shall together with the AsBo create a first version of a safety review plan.	
D:9.4.d	C The Contractor shall submit a detailed and released version of the AsBo safety review plan to NT for acceptance no later than conceptual design review approval.	