Weighting:100%					
Minimum Scorerequired:80%					
Required evidence provided= 2					
Partial evidence provided=1					
No evidence provided= 0					
Criteria	**Sub-Criteria**	**Technical Requirement**	**Required Evidence**	**Means of Compliance (Evidence provided)**	**Score (0-2)**
Technical Compliance	Locomotive Design and Purpose	Heavy-haul freight capability.	Provide designs and technical specifications for heavy-haul locomotives demonstrating high tractive effort and load-pulling capacity.		
		Robust design for narrow-gauge operations (1,067mm).	Submit axle and bogie designs showing durability and stability for narrow-gauge operations under high loads.		
		Capability to handle environmental challenges.	Evidence of locomotive performance in extreme conditions (e.g., high temperatures, humidity, salinity, and dust) through operational data or test results.		
		Expertise in lifecycle cost analysis.	Submit lifecycle cost analysis documentation from past projects, including operating costs, maintenance schedules, and component replacement plans.		

		Advanced vibration damping systems.	Provide designs and testing data for vibration damping systems implemented in other projects.		
		Experience in multi-region locomotive design and delivery.	Submit a portfolio of projects demonstrating locomotive designs delivered and adapted for operations in multiple regions (e.g., Asia, Africa, Europe, North America) with regional adaptations for varying track gauges, voltage systems, and environmental conditions.		
		Proven capacity in delivering locomotive systems and components globally.	Provide case studies of successfully delivered locomotive systems or components to clients in diverse global regions, highlighting challenges and how they were overcome (e.g., logistics, customs regulations, regional compliance).		
Safety and Standards Compliance	Compliance with international standards.	Compliance with SANS 3000, EN 50121, EN 50155, IEC 60571, and IEC 61373 standards.	Provide copies of certifications, test reports, or audit results proving adherence to the specified standards.		
		System redundancy for critical operations.	Submit designs and test results demonstrating fault recovery and redundancy for braking, traction, and communication systems.		

		Advanced crashworthiness standards.	Provide designs and certifications demonstrating compliance with crashworthiness standards and impact testing data.		
		Environmental compliance standards (ISO 14001 or equivalent).	Submit ISO 14001 certification or documentation demonstrating compliance with similar environmental standards.		
		Adherence to regional safety and regulatory standards.	Provide evidence of compliance with specific regional standards for delivered locomotives and components (e.g., AAR for North America, UIC for Europe, RSR for South Africa).		
Dual Voltage Capability	Voltage efficiency and power conversion.	Optimized transformer designs for high efficiency and minimal energy loss.	Include technical data on transformer efficiency and performance under dual-voltage conditions from past projects.		
		Heat management systems for transformers.	Provide designs and performance data showing effective heat dissipation mechanisms under high-load conditions.		
		Seamless voltage transition systems.	Provide technical documentation on transition systems, including examples of successful voltage transitions in similar projects.		

Axle Control and Traction System	Enhanced traction systems.	Real-time power distribution to axles for optimized traction.	Submit system documentation showing dynamic axle power management and optimization algorithms.		
		Regenerative braking integration.	Provide technical documentation and test results demonstrating regenerative braking performance under different conditions.		
		Advanced axle monitoring.	Include examples of systems that provide predictive analytics for axle maintenance and fault detection.		
		Energy efficiency enhancements for traction systems.	Submit energy efficiency calculations and data for traction systems implemented in other projects.		
Digital Connectivity and DCS	Advanced communication systems.	Real-time data diagnostics and location tracking.	Submit system architecture diagrams demonstrating data transfer capabilities, including real-time tracking and diagnostics.		
		Fault tolerance and redundancy mechanisms.	Provide designs and case studies showing redundancy measures and fault recovery mechanisms.		
		Integration with centralized fleet management systems.	Provide architecture designs and operational data from fleet management systems integrating digital connectivity and diagnostics.		

		Cybersecurity resilience for connected systems.	Submit cybersecurity strategy documentation, penetration testing results, and certifications (e.g., ISO 27001 or NIST compliance).		
		AI-enhanced CCTV systems for safety and track inspection.	Include evidence of AI-powered CCTV features for obstacle detection and track monitoring, with examples of integration in past projects.		
Enhanced Adhesion Control	Advanced re-adhesion algorithms.	Real-time adjustments based on load and track conditions.	Provide evidence of implemented algorithms and operational data demonstrating effective re-adhesion under variable loads and gradients.		
		Long-term durability of adhesion systems.	Submit data from durability tests and maintenance records showing minimal wear over extended operations.		
		Real-time operator feedback.	Include operator interface designs and examples of feedback systems for monitoring slip and traction performance.		
Documentation and Transparency	Transparent system design.	Full documentation of interoperability with other OEM systems.	Submit interoperability matrices and system integration plans from past projects.		
		Open-source or flexible licensing for software components.	Provide licensing agreements and usage terms demonstrating flexibility in software ownership and modification rights.		

		Comprehensive fault logs and analytics.	Include examples of fault logging systems and analytics reports used for diagnostics in previous projects.		
Spares and Obsolescence Management	Innovative obsolescence strategies.	Transition plans for components nearing obsolescence.	Provide documentation of phased transition strategies for obsolete components implemented in comparable projects.		
		Local sourcing initiatives for spare parts.	Submit examples of partnerships with local suppliers to ensure sustainable spare part availability.		
Training	Comprehensive skill transfer.	Long-term training programs integrated with operational requirements.	Include training schedules, curricula, and feedback metrics demonstrating alignment with long-term operational needs.		
		Use of simulation tools in training.	Submit evidence of training simulation tools and their effectiveness in enhancing staff readiness and performance.		
Governance, Quality, and Performance Management	Advanced project management systems.	Evidence of integrated project management tools (e.g., Primavera, MS Project).	Submit detailed project management plans and examples of successful tool implementation in comparable projects.		
		Long-term service agreements with performance guarantees.	Provide examples of service agreements, including KPIs and performance metrics, from past projects.		

		Stakeholder engagement frameworks.	Include stakeholder analysis plans and engagement reports from previous complex projects.		
Experience in Locomotive Design	Design Life and Durability	Proven track record in designing locomotives with a minimum lifecycle of 30 years under demanding conditions.	Provide technical documentation of delivered locomotives, including lifecycle assessments, durability testing, and operational data.		
	Axle Load and Weight Standards	Capability to design locomotives with axle loads compliant to < 22 tonnes per axle.	Submit design specifications and certifications demonstrating adherence to axle load standards for freight applications.		
	Dual Voltage Capability	Experience delivering dual-voltage (AC/DC) locomotives for mixed operations with seamless "on-the-fly" transitions.	Provide technical specifications and operational data for dual-voltage locomotives previously delivered.		
Operational Versatility	Interoperability	Ability to design locomotives capable of multiple-unit operation across various classes (electric and diesel).	Include interoperability test reports and examples of multi-class operational deployments.		
	Distributed Power Systems	Experience in designing locomotives with compatibility for ECP, WDP, and RDP systems for long-haul operations.	Submit system architecture diagrams and case studies showing integration of distributed power systems.		
Climatic and Environmental Design	Extreme Climatic Conditions	Proven performance of locomotives under diverse conditions (e.g., extreme temperatures, humidity, and dust).	Provide operational data or test results for locomotives deployed in similar challenging environments.		

	Corrosion Resistance	Ability to design locomotives suitable for coastal and humid environments with anti-corrosion features.	Submit materials specifications and examples of solutions used to mitigate corrosion risks.		
Traction and Braking Systems	Advanced Traction Control	Experience delivering locomotives with optimized axle control, AC traction motors, and dead-notch-free braking.	Provide traction performance data, including axle control algorithms and braking force curves.		
	Regenerative Braking	Integration of regenerative braking systems to improve energy efficiency.	Submit documentation showing regenerative braking designs and performance results.		
Digital Communication Systems	Inter-Locomotive Communication	Expertise in designing communication systems compliant with international standards (e.g., IEC protocols).	Include compliance certifications and examples of interoperable communication solutions.		
	Data Transfer and Remote Diagnostics	Proven capability in integrating data transfer systems for real-time diagnostics and remote monitoring.	Provide examples of real-time monitoring systems deployed on locomotives.		
Painting and Marking	Environmental Paints	Use of environmentally friendly, water-based paints for locomotive painting.	Submit documentation of paint specifications and examples of past compliance with eco-friendly standards.		
Innovation and Modular Design	Modular Sub-Systems	Capability to offer locomotives with modular components for ease of maintenance and upgrades.	Provide technical details of modular systems used in previous locomotive designs.		
Radio Frequency Identification	RFID Integration	Experience in implementing RFID systems for locomotive tracking and asset management.	Submit examples of RFID systems deployed, including case studies and results of operational improvements.		

Technical Expertise	Locomotive Design	Proven track record of designing locomotives meeting operational requirements.	Portfolio of delivered locomotives, technical specifications, test results.		
	Traction and Braking Systems	Expertise in advanced traction, dynamic braking, and regenerative braking systems.	Documentation of implemented systems, efficiency data, and performance logs.		
	Energy Efficiency	Integration of energy-saving systems such as regenerative braking and energy meters.	Examples of locomotives with energy-efficient features and results.		
Operational Flexibility	Dual Voltage Capability	Experience with dual-voltage locomotives and automatic AC/DC changeover systems.	Case studies of dual-voltage locomotives and performance data.		
	Climate Adaptability	Operability in extreme conditions (heat, humidity, dust, salinity).	Operational performance data from extreme environments.		
	Modular Design	Ability to deliver modular systems for maintenance and upgrades.	Detailed design documentation and examples of modular system implementations.		
Safety and Compliance	Compliance with Standards	Adherence to international safety and operational standards.	Certifications and audit reports for compliance with relevant standards.		
	Fault Detection and Recovery	Proven ability to integrate fault detection and recovery systems.	Examples of fault recovery systems and supporting documentation.		
	Advanced Safety Systems	Integration of safety systems like vigilance and fire detection.	Examples of safety system implementations.		
Digital and Communication	Real-Time Data Logging	Deployment of systems for real-time fault/event logging and diagnostics.	Sample logs and documentation of deployed systems.		

	Driver Display Units (DDU)	Development of ergonomic and durable display units.	Specifications of DDUs and operator feedback.		
	Remote Connectivity	Expertise in integrating remote diagnostics and connectivity systems.	Case studies of remote connectivity features.		
Maintenance and Longevity	Lifecycle Management	Long-term support and parts availability for locomotives.	Lifecycle management plans and examples.		
	Maintenance Optimization	Predictive maintenance and condition monitoring systems.	Maintenance schedules and predictive analytics tool documentation.		
Innovation and Sustainability	Advanced Technology	Integration of cutting-edge technologies like IoT and AI-based diagnostics.	Project documentation showcasing innovative solutions.		
	Environmental Sustainability	Eco-friendly design practices and energy-efficient systems.	Environmental impact assessments and case studies of green design projects.		
Track Record	Global Deployment	Successful delivery of locomotives in diverse regions.	Case studies of projects across different geographical regions.		
	Client References	Positive references from previous clients.	Client testimonials and performance reviews.		
	Service Proven Components	Use of components/sub-systems with proven performance in similar operating conditions.	Evidence of at least two years of operational reliability and availability.		
Design	Traction and Auxiliary Systems	Use of AC traction motors and auxiliary motors with appropriate characteristics.	Graphs for voltage, current, tractive effort, and speed; life cycle cost analysis.		
	Ventilation and Cooling	Effective forced ventilation and air filtration for rotating machines.	Details of air filtration system and airflow tests.		
	Mechanical Design	Robust and maintainable design for rotating machines and auxiliary systems.	Evidence of compliance with ISO standards for balance and vibration testing.		

	Durability	Use of high-quality materials and components to ensure longevity (e.g., bearings, lubricants).	Certification of materials, lubricant details, and bearing life cycle analysis.		
Maintainability	Ease of Maintenance	Design allows for efficient maintenance, interchangeability of components, and minimal special adjustments.	Maintenance and overhaul plans, documentation on component interchangeability.		
	Durability of Materials	Use of durable and corrosion-resistant materials (e.g., insulated bearings, resilient seals).	Details on material specifications and life expectancy under operational conditions.		
	Local Adaptability	Utilization of local suppliers and materials where possible.	Evidence of supply chain localization.		
Safety	Safety Features	Integration of safety lugs, theft prevention measures, and secure mounting of components.	Design and test details for safety features.		
	Environmental Protection	Measures to prevent environmental contamination (e.g., lubricant leakage).	Design and operational details for sealing and containment systems.		
Testing	Type Tests	Adherence to type test requirements for traction motors and auxiliary systems.	Comprehensive testing for vibration, temperature rise, and overload conditions.		
	Routine Tests	Regular testing of traction motors and components to ensure compliance.	Documentation of routine test protocols.		
	Vibration Testing	Long-term vibration testing to ensure durability of internal and external components.	Baseline vibration data and comparative test results.		

Maintenance Manuals	Maintenance Manuals	Provision of user and maintenance manuals in English.	Manuals covering all components and maintenance processes.		
International Standards	Compliance to IEC Standards	Adherence to IEC standards, such as IEC 60076, 60310, 60850, and 61133.	Documented compliance with IEC standards for design, testing, and construction.		
Design Information	Transformer Ratings	Rated power, voltage, current, and other critical parameters.	Submission of technical specifications aligned with IEC definitions.		
Transformer Construction	Core Design	Use of core-type transformer construction.	Confirmation of core-type design with detailed construction plans.		
Insulation & Temperature	Insulation Levels	Basic insulation level of at least 190kV (peak value).	Test data confirming compliance with insulation standards.		
	Temperature Rise	Compliance with maximum temperature rise limits (e.g., winding < 80K, oil < 65K).	Submission of temperature rise characteristic curves and ambient condition evaluations.		
Materials	Conductor and Insulation Materials	Use of copper conductors and Nomex insulation.	Specifications for conductor material and insulation material properties.		
Positioning & Mounting	Mounting Location	Preference for transformer placement within locomotive body.	Detailed mounting plans showing placement and protective measures for external placement.		
Transformer Type	Oil Cooling System	Use of oil-immersed transformers with an oil-conservator system.	Design details and operational guidelines for cooling systems.		
Transformer Auxiliary Equipment	Safety Mechanisms	Explosion vent, oil level indicators, temperature gauges, and alarms.	Documentation of auxiliary equipment design and integration with safety and protection systems.		

	Online Monitoring Systems	Integration of dissolved gas analysis (DGA) and other condition monitoring equipment.	Details of monitoring system design and service-proven performance.		
Transformer Oil & Cooling	Oil Quality	Use of transformer oil compliant with SABS 555 or equivalent standards.	Certification of oil quality and evidence of service-proven performance.		
	Radiator Design	Mechanical bonding of core tubes and fins to prevent thermal aging.	Detailed radiator designs and maintenance plans for debris cleaning and air filtration.		
General Brake System	Independent Brake Systems	Compressed air brakes and hand-operated brakes acting independently.	Design compliance, operational independence of braking systems.		
	Simultaneous Air Brake Application	Simultaneous operation of air brakes on all bogies.	Demonstration of uniform application through tests.		
	Equal Brake Block Pressure	Brake blocks exert equal pressure (within 5%).	Test results showing brake pressure uniformity.		
Brake Block Design	Wear Tolerance	Brake blocks should function effectively down to a thickness of 13mm without manual adjustments.	Design compliance to minimum wear tolerance.		
	Block Renewal	Easy renewal without dismantling or special tools.	Practical demonstration of brake block renewal.		
	Slack Adjusters	Automatic slack adjusters maintaining minimum clearance of 8mm.	Design and operational details of slack adjusters.		
Brake Performance	Stopping Distance	Stopping within specified distances under defined conditions (e.g., 1200m at 100km/h).	Compliance with AAR RP-599 standards for stopping distance.		
Hand Brake Design	Stationary Holding Force	Ability to hold stationary on 2.5% gradient without skidding wheels.	Calculated braking force for stationary holding.		
	Exhaust Ventilation	Exhaust air released outside the cab.	Safety design for air exhaust from handbrakes.		

Sanding Gear	Sand Delivery	Delivery of Blastrite or sand to leading wheels in both directions.	System design ensuring consistent sand delivery for traction.		
	Maintenance and Operation	Easy maintenance with watertight lids and drainage prevention.	Demonstration of maintenance ease and functional design.		
Safety Features	Interlock Requirements	Interlocks for independent brake application at specific conditions (e.g., speed = 0, 120kPa pressure).	System compliance with interlock safety requirements.		
Main Power Systems	Definition	The locomotiveÃ¢â‚¬â„¢s main power system comprises all power equipment associated with traction and electric braking, including pantograph, VCB, HSCB, converters, transformers, and traction motors.	Detailed schematic diagrams, technical descriptions, and compliance with IEC 60850 and IEC 61287-1/2 standards.		
	Protective Equipment	Ability to withstand operational voltages and currents while offering protection against overloads and faults.	Technical specifications and test results for protective equipment under fault conditions.		
Auxiliary Systems	Auxiliary Power Supply	Modern IGBT-based auxiliary power supply system with redundancy to support auxiliary machines and future expansion.	System schematics, redundancy documentation, and load capacity tests.		
	Battery Charger	Intelligent battery charger compliant with EN 50272 and integrated into the locomotive control system.	Manufacturer documentation, compliance certificates, and test reports.		

	Cooling and Ventilation	Effective cooling and ventilation systems, ensuring component reliability under harsh operational conditions.	Test results, technical descriptions, and compliance certificates for IEC 60529 and EN 50155 standards.		
Electrical System Design	Standards and Norms	Compliance with international norms (IEC 60077, 61287, 61373, EN 50463, and SANS standards).	Certificates of compliance and deviations justified with documentary evidence.		
	Service Proven Components	Use of components with proven reliability in similar applications worldwide.	Service history, failure analysis reports, and supplier guarantees.		
Testing	Type Testing	Conformance of power converters, transformers, and auxiliary systems to IEC 61287 and 61373 standards.	Test certificates and documentation from certified testing authorities.		
	Routine Testing	Routine stress tests for all major components, eliminating early failures (e.g., IGBT modules).	Factory routine test reports and quality control documentation.		
	Combination Testing	Demonstration of system integration and stability during simulated operational conditions.	Test facility descriptions, combination test results, and simulation data.		
Standards	Compliance with International Norms	Ensure all electric/electronic equipment adheres to Cenelec EN50153, EN50124-1, and EN45545 standards.	Certificates of compliance, detailed equipment standards list, and deviations supported by justifications.		
Hardware	Component Description	Comprehensive details of TCU, ACU, interface cards, and all modules.	Technical descriptions, maintenance schedules, and component datasheets.		
	Network Diagram	Diagram showing all controlled devices, communication interfaces, and descriptions.	Complete TCU network diagram with device descriptions and communication types.		

Software	Axle Control	Dedicated traction control unit per axle with sufficient control capacity for speed range 0Ã¢â‚¬â€œ110 km/h.	System architecture diagram, software specifications, and proof of capabilities.		
	Performance under Line Voltage	Traction performance vs. line voltage curve for AC/DC territories; guaranteed performance under specified voltage ranges.	Performance curves, voltage deration policies, and testing results.		
Traction and Braking	Tractive Effort	Compliance with mandatory tractive effort (TE) requirements under varied weather conditions; minimize load-sharing imbalances between axles and bogies.	TE curves, detailed system description, and maximum allowable wheel diameter differences.		
	Electric Braking	Fully combined regenerative and rheostatic braking system with tolerances specified under adverse weather conditions.	Braking effort curves, system failure design documentation, and compliance certificates.		
Sensors	Speed Sensor	Minimum of two probes per axle, accurate direction detection, failure detection, and axle-specific traction cut-out during speed probe failure.	Sensor specifications, fault detection logic documentation, and maintenance logs.		
	Doppler Radar	Service-proven two-channel Doppler Radar Sensor with protective design and accurate ground speed measurement.	IP rating certificates, test results, and failure handling documentation.		

Control and Monitoring	Reference Speed	Use Doppler Radar as reference speed; resilient calculations in case of failures considering all axial speed sensors and synchronous wheel slip/slide scenarios.	Control logic documentation, calculation methodologies, and validation results.		
	Re-Adhesion Control	Fast-acting re-adhesion control scheme with creep optimization; robust performance under undulated rail tracks and adverse conditions.	Re-adhesion control algorithm details, testing results under varying conditions, and energy efficiency metrics.		
	Acceleration and Axle Lock Detection	Accurate axle acceleration monitoring and locked axle detection in powering, braking, and coasting modes.	Control logic, performance thresholds, and axle condition detection reports.		
Documentation	Traction Control Unit	Detailed hardware and software architecture, interface descriptions, and key functional specifications.	Comprehensive documentation including function descriptions, input/output signals, and operation principles.		
	Transient Recorder	Real-time monitoring, data logging, and accessible transient recorder outputs for diagnostics.	Specifications, sample outputs, and descriptions of logging functions.		
	Comprehensive Information	Submission of detailed technical data for brake systems.	Comprehensive and accurate technical documents for evaluation.		
	Detailed Design Data	Submission of all necessary technical details, drawings, and performance curves.	Detailed design documents, including technical specifications.		
Technical Compliance	Standards and Norms	Compliance with international and local standards.	Certificates of compliance, documented deviations.		

	Functional Requirements	Adherence to functional specifications.	Technical descriptions, test reports.		
	Reliability	Proven reliability of components and systems.	Service history, failure analysis reports.		
Design and Innovation	Simplicity of Design	Ease of maintenance and operational simplicity.	Design philosophy documents, maintenance manuals.		
	Future-Proofing	Scalability and adaptability to future needs.	Documentation on expandability and upgrades.		
Performance	Efficiency	System efficiency under various operating conditions.	Efficiency curves, test data.		
	Robustness	Performance under extreme conditions.	Stress test results, environmental compliance.		
Safety and Compliance	Safety Measures	Implementation of safety protocols and measures.	Safety audits, risk assessments.		
	Environmental Compliance	Adherence to environmental standards.	Compliance certificates, environmental impact studies.		
Testing and Validation	Type Testing	Comprehensive testing of components and systems.	Certified test results, validation reports.		
	Routine Testing	Ongoing validation and quality assurance.	Routine test data, quality control records.		
Total Score					

There are 144 questions in total, which adds up to a score of 248 . A bidder will be required to score 80% of the total scores which will be calculated in the following manner: x/y*100= percentage score obtained. i.e if a bidder scores 144 out of the 248 questionnaire, it will be interpreted as 144/248*100= 50%					