ANNEXURE B

SPECIFICATION:

FOR SOFTWARE LICENSE RENEWALS AND MAINTENANCE INVOLVING THE PROVISION OF MSC COMPUTER AIDED ENGINEERING (CAE) SOFTWARE CURRENTLY USED BY TRANSNET ENGINEERING (TE)

PD_DM_NAT_SPEC_152

REVISION 0

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CHANGE CONTROL

Control	Name and Designation	Signature	Date
Compiled & Reviewed	Kabelo Nchaupa Technician Mechanical Design Office (MDO)		11-03-2022
Approved	Danie Nieuwoudt Manager Mechanical Design Office (MDO)		2022-03-11

EXTERNAL CLIENT SIGN-OFF

Control	Name and Designation	Signature	Date
Approved	NA		

LIST OF REVISIONS

Rev	Date	Responsible person	Description	Classification

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1.0.   PURPOSE

The MSC computer aided engineering (CAE) software packages are currently utilised throughout Transnet Engineering (TE). TE seeks the following services be provided by either a Software Developer directly, or local resellers appointed by the respective principal software developers for software which has the capability and functionality of the aforementioned software packages concerned:

- Software licenses.
- Annual Software Maintenance Services (SMS).

2.0.   REQUIREMENTS

2.1.   DESCRIPTION OF REQUIRED SOFTWARE PACKAGE

A description of the software package currently in use by Transnet Engineering appears under APPENDIX A: DESCRIPTION OF SOFTWARE PACKAGE.

2.2.   ANNUAL SOFTWARE MAINTENANCE SERVICES

The requirements for annual SMS are detailed under APPENDIX B: SOFTWARE MAINTENANCE SUPPORT.

APPENDIX A: DESCRIPTION OF SOFTWARE PACKAGE

1. MSC - FEA and MBD Software Package

The finite element analysis (FEA) and multi body dynamics (MBD) software packages provided to Transnet Engineering are from MSC Software (http://www.mscsoftware.com/) with the following products, amongst others, being available:

- Adams (http://www.mscsoftware.com/product/adams)
- Marc/Mentat (http://www.mscsoftware.com/product/marc)
- MSC Nastran (http://www.mscsoftware.com/product/msc-nastran)
- Patran (http://www.mscsoftware.com/product/patran)
- Dytran (http://www.mscsoftware.com/product/dytran)
- Easy 5 (http://www.mscsoftware.com/product/easy5)

Each of these products addresses specific types of engineering and simulation related problems. Their combined capability is extensive, as shown by the list capabilities provided below:
- **Structures Linear:**
  Linear Statics, Normal Modes, Perturbation, Buckling and Local Adaptive Mesh Refinement.
- **Structures Nonlinear:**
  Large Strain, Large Displacement, Nonlinear Materials, Damage and Failure, Buckling, Springback, Prestress, Global Adaptive Meshing, Structural Zooming and User Subroutines.
- **Structures Dynamics:**
  Direct or Modal Frequency Response, Direct or Modal Transient Response, Direct or Modal Complex Eigenvalues, Linear or Nonlinear Transient, Random Analysis, Aeroelasticity, Flight Loads and Rotor Dynamics.
- **Structures Explicit:**
  Crash, Drop Test, & Impact, Fluid Structure Interaction (FSI), Explosives, Under Water Explosion, Cavitation, Airbags and Hybrid Dummies.
- **Thermal:**
  Steady State, Transient, Conduction, Convection, Radiation, Thermal Contact, Coupled Advection, Ablation, Pyrolysis, Thermal-electrical Coupling, Thermal Mechanical Coupling, Induction Heating, Welding and Curing.
- **Optimization:**
  Design of Experiment, Sizing, Shape, Topology, Topometry, Topography and Multi Model Optimization.

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- **Assembly:**
Linear Contact, Nonlinear Contact, Glued Contact, Rigid Body Contact, Nonlinearities (Friction, Gap, etc.), Bolt Modelling, Spot Welds, Seam Welds and Gaskets.

- **Composites:**
Laminate, Honeycomb, Textile, Filament and UD Tape, Discontinuous Long Fibre Composites, Short Fibre Reinforced Plastics, Delamination, Failure Criteria (Standard and UD), Fracture Mechanics, Virtual Crack Closure Technique (VCCT), Crack Progression, Progressive Failure Analysis (PFA) and Cohesive Zone Method (CZM).

- **Advanced Structures:**
Poroelastic Structures, MPCCI Interface, Dynamic Design Analysis Method (DDAM), ACMS, Super Elements, Rezoning (Automatic Remeshing), Adams Integration, Shared Memory Parallel (SMP), Distributed Memory Parallel (DMP), Symmetry (Cyclic, Plane Strain or Stress), 2D Symmetry to 3D Model and Element Activation/Deactivation.

- **Multiphysics:**
Joule Heating, Piezoelectric, Electrostatics, Electrodynamics, Electromagnetics, Electrostatics – Structural and Magnetostatics – Structural.

- **Multibody Dynamics:**
Quasi-Static Analysis, Kinematic Analysis, Transient Analysis, Nonlinearities (Friction, Gap, Backlash, etc.), Linear Analysis (Eigenvalues, State Matrices), Vibration (Requires Adams/View, Adams/Vibration), Rigid Body, Rigid Body Contact, Import Meshing for Flexible Parts, Linear Flexible Body, Geometric Nonlinear Flexible Body, Material Nonlinear Flexible Body, Flexible Body, Flexible Body Contact, Clearance Analysis, Stress Recovery, Durability (Requires Adams/View, Adams/Vibration), Controls, Mechatronics, Mechanism Plant Generation, Easy5 DLL Integration, Simulink DLL Integration, MBD-Nonlinear Co-Simulation (req. Marc and ACSI tool), MBD-Acoustics Integration, Vehicle Dynamics (Road, Tire, etc.), Parametric Vehicle Modelling, Vehicle Model Libraries, Vehicle Event Libraries and Open Architecture for Customization.

- **Systems and Controls:**
FMI Standard Support, Steady State Analysis, Transient Analysis, Linear Analysis (Eigen, FRF, Root-Locus, PSD), Thermal Hydraulic Library, Gas Dynamics Library, Multiphase Fluid Library, Electrical Systems Library, Mechanism Plant Integration, System DLL Generation and Matrix Algebra Tool (Requires Easy5).

- **Pre-Processing:**
Solid Modelling, Geometry Import, Geometry Clean-Up and Simplifications, Geometry Defeaturing, Topology Diagnosis, Mid-Surface Extraction, Automatic Surface Meshing, Free Surfacing Meshing, Mesh-based Surface Meshing, Mesh Quality Check and Repair, Assembly Check and Repair, Analysis Readiness and Solver Validation, Structured Hex Meshing, Mesh Morphing, Field Dependent Boundary Conditions, CFD or Thermal Mapping Loads, Parameterization, Scripting, Template Methods, Interface Customization and Export to Third-Party Solvers.

- **Post-Processing:**
  Contour Displays, Vector Displays, Isosurface Displays, Animations, X-Y Charts, Result Data Probes, Multi-files Attachment, Automatic Report Generation and Import Results from Third Party Solvers.
- **Materials:**
  Structural: Linear Elasticity, Elastoplasticity, Rigid-Plasticity, Hyperelasticity, Foam, Nonlinear Elasticity, Linear Viscoelasticity, Nonlinear Viscoelasticity, Viscoplasticity, Temperature Dependency, Rate Dependency, Frequency Dependency, Creep, Stress Relaxation, Shape Memory, Composites, Low Tension Material, Soil Model, Damage and Failure and User Defined Material.
  Non-structural: Temperature Dependent Conductivity, Temperature Dependent Specific Heat, Emissivity, Porosity (Diffusion), Piezoelectricity, Resistivity, Viscosity, Electric Permittivity and Permeability.
  Acoustics: Poroelasticity.

APPENDIX B: SOFTWARE MAINTENANCE SUPPORT

Annual SMS to be provided to ensure that the subscription CAE software licences currently used by TE:

- is continuously maintained to operate with the latest technical enhancements (i.e., latest updates/revisions, etc.) released by the principal software developer,
- obtains the necessary customer support from the local reseller and principal software developer, as well as
- receives all relevant supporting documentation for any technical enhancements, on an ongoing basis.

The required maintenance must also include 24/7 high-quality support (i.e., so-called Hot Line support) should there be any problems which are experienced whilst users operate the software during the execution for their tasks. This support must include as a minimum:

- Tier 2 support access from the principal software developer.
- Software performance problem corrections.
- Software and hardware configuration and installation assistance.
- Licence management tools which allow the installation, configuration, and de-installation of licences to suit the needs of TE.
- Technical support personnel must be certified by the principal software developer.

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