Automotive Skills Development Council

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QUALIFICATIONS PACK - OCCUPATIONAL STANDARDS FOR AUTOMOTIVE INDUSTRY

Contents

What are Occupational Standards (OS)?

- OS describe what individuals need to do, know and understand in order to carry out a particular job role or function
- OS are performance standards that individuals must achieve when carrying out functions in the workplace, together with specifications of the underpinning knowledge and understanding

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Introduction

Qualifications Pack- Test Engineer Product / Vehicle

SECTOR: AUTOMOTIVE

SUB-SECTOR:R&D

OCCUPATION: TESTING

JOB ROLE: TEST ENGINEER

REFERENCE ID: ASC/Q8403

ALIGNED TO : NCO -2004/Nil

Test Engineer: This role is largely responsible to conduct testing of vehicles and aggregates in an internal laboratory environment and outdoor on road testing environment to ensure fulfilment of performance parameters for the final product.

Brief Job Description: This role is responsible for conducting various indoor tests on automobile aggregates like engines, transmission system, braking system, fuel handling system, electrical and electronic components, body frames etc. as well as testing of built up vehicle prototypes in a simulated laboratory environment and on road setup, ensuring proper setup of test apparatus, documenting test results and presenting first level analysis report to the test manager

Personal Attributes: The individual should have passions for automobiles &driving and should be willing to work in a testing environment of long hours and doing repetitive work. The individual should possess coordination and interpersonal skills, demonstrate analytical reasoning, technology savvy, customer orientation, oral and written communication skills, good observations skills, ability to plan and prioritize work, quality consciousness, sensitivity to problem solving, quick decision making, safety orientation, dexterity and high precision

Job Details

Qualifications Pack Code	**ASC/Q/8403**		
Job Role	**Test Engineer**		
Credits(NSQF)	**TBD**	**Version number**	**1**
Industry	**Automotive**	**Drafted on**	**15/12/2013**
Sub-sector	**R&D**	**Last reviewed on**	**30/12/2013**
Occupation	**Testing**	**Next review date**	**30/12/2015**

Job Role	**Test Engineer**
Role Description	This role is responsible for conducting various indoor and outdoor testing of vehicle aggregates and prototype vehicles, recording observations and analysing the outcomes of these tests
NSQF level	6
Minimum Educational Qualifications	B.E/ B. Tech.(Mechanical /Automobile/ Electrical & Electronics/ Instrumentation)
Maximum Educational Qualifications	M.E/ M. Tech. (Mechanical /Automobile/ Electrical & Electronics/ Instrumentation)
Training (Suggested but not mandatory)	• Latest automobile and aggregate testing methods • Testing apparatus setup and instrumentation • Automotive industry regulations and standards • Problem Solving Techniques • Quality Management Systems • Stress management techniques • Team management skills • IT and ERP Awareness • 5S and Safety aspects
Experience	2-3 years in automotive testing
Occupational Standards (OS)	**1.** ASC/N8405: Arrange for engine test apparatus and test the engine as per the internal process standards and external regulations **2.** ASC/N8406: Conduct various indoor tests in various System Evaluation Laboratories to test mechanical, metallurgical and operating performance of the aggregates 3. ASC/N8407: Conduct Vehicle Performance tests in a controlled internal/ on road test setup

	4. ASC/N8408: Testing vehicle dynamics and vehicle performance during outdoor testing of prototype vehicles 5. ASC/N0006C: Maintain a safe and healthy working environment at the work place 6. ASC/N0022: Ensure implementation of 5S activities at the shop floor and the office area
Performance Criteria	As described in the relevant NOS units

Definitions

Keywords /Terms	Description
Core Skills/Generic Skills	Core Skills or Generic Skills are a group of skills that are key to learning and working in today's world. These skills are typically needed in any work environment. In the context of the NOS, these include communication related skills that are applicable to most job roles.
Function	Function is an activity necessary for achieving the key purpose of the sector, occupation, or area of work, which can be carried out by a person or a group of persons. Functions are identified through functional analysis and form the basis of NOS.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organization.
Knowledge and Understanding	Knowledge and Understanding are statements which together specify the technical, generic, professional and organizational specific knowledge that an individual needs in order to perform to the required standard.
National Occupational Standards (NOS)	NOS are Occupational Standards which apply uniquely in the Indian context
Occupation	Occupation is a set of job roles, which perform similar/related set of functions in an industry.
Organisational Context	Organisational Context includes the way the organization is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Performance Criteria	Performance Criteria are statements that together specify the standard of performance required when carrying out a task.
Qualifications Pack(QP)	Qualifications Pack comprises the set of NOS, together with the educational, training and other criteria required to perform a job role. A Qualifications Pack is assigned a unique qualification pack code.
Qualifications Pack Code	Qualifications Pack Code is a unique reference code that identifies a qualifications pack.
Scope	Scope is the set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on the quality of performance required.
Sector	Sector is a conglomeration of different business operations having similar businesses and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.

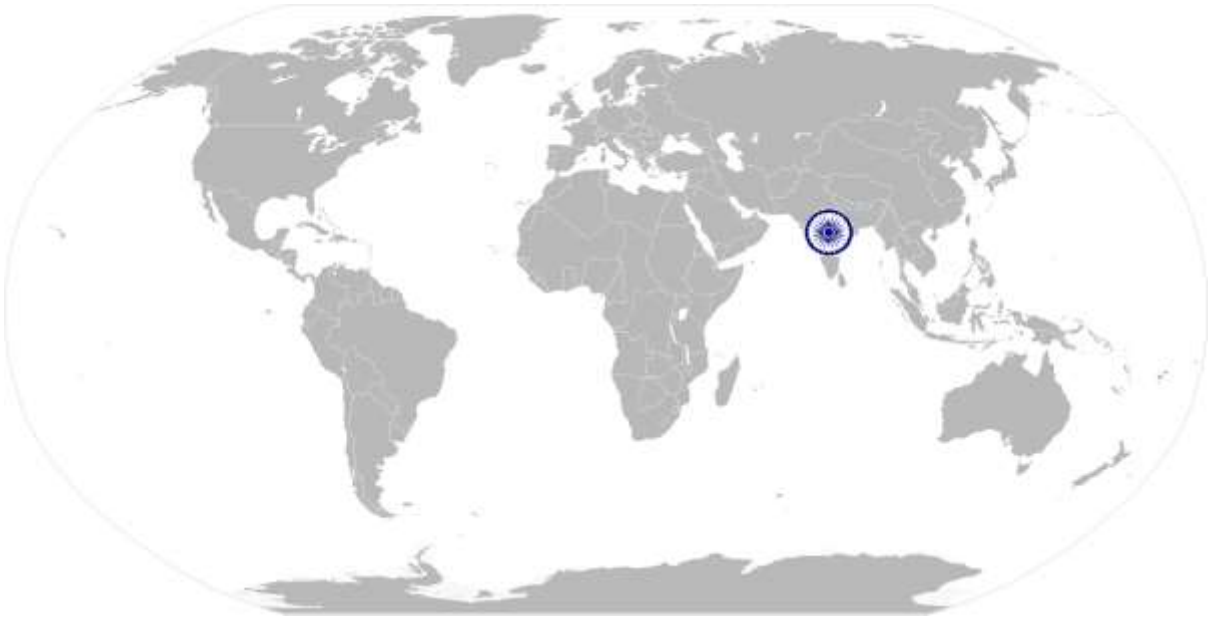
Sub-Sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Sub-functions	Sub-functions are sub-activities essential to fulfil the achieving the objectives of the function.
Technical Knowledge	Technical Knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Unit Code	Unit Code is a unique identifier for a NOS unit, which can be denoted with an '**N**'
Unit Title	Unit Title gives a clear overall statement about what the incumbent should be able to do.
Vertical	Vertical may exist within a sub-sector representing different domain areas or the client industries served by the industry.

Acronyms

Keywords /Terms	Description
NOS	National Occupational Standard(s)
NVEQF	National Vocational Education Qualifications Framework
NVQF	National Vocational Qualifications Framework
NSQF	National Skills Qualifications Framework
OEM	Original Equipment Manufacturer
OS	Occupational Standard(s)
QP	Qualifications Pack
CFD	Computational Flow Diagram
FMEA	Failure Mode Effect Analysis
CAE	Computer Aided Engineering
NVH	Noise, Vibrations and Harshness

ASC/N8405: Arrange for engine test apparatus and test the engine as per the internal process standards and external regulations

National Occupational Standards



Overview

This unit is about arranging the engine testing apparatus and setting up of the vehicle engine on the test bench/ test platform to validate the performance on mechanical output and emissions as against norms and regulations

ASC/N8405: Arrange for engine test apparatus and test the engine as per the internal process standards and external regulations

National Occupational Standard

Unit Code	ASC/N8405
Unit Title (Task)	**Arrange for engine test apparatus and test the engine as per the internal process standards and external regulations**
Description	This NOS is about arranging the testing apparatus, conducting mechanical testing the prototype engine using the dynamometer test, emission test and other techniques for testing the performance of the engine
Scope	The role holder will be responsible for: • Understanding the testing requirement and the process • Conducting dynamometer testing, swirl testing and emissions testing on the engine This NOS will be applicable to all types of automobiles i.e. 2 wheelers, 3 wheelers , 4 wheelers and heavy vehicles
Performance Criteria (PC) w.r.t. the Scope	
Element	**Performance Criteria**
Understanding the testing requirement and the process	PC1. Ensure that the team members understand and follow all the does and don'ts of the testing process as defined in SOPs/ Work Instructions or defined by supervisors/ master technicians PC2. Understand the engine testing requirements (based on the type of engine to be tested) as mentioned in the testing instructions sheets/ work instructions/ testing control plan PC3. Understand the testing methodology, equipment and process required as per the process manuals/ Work Instructions/Standard Operating Procedures PC4. Ensure that the correct testing document containing the specified setup drawing, testing schedules, testing parameters, test specifications and test outcome ranges are mentioned PC5. Ensure all tools and equipment required for testing are present near the engine testing platform/test bench/ test chamber/ dynamometer PC6. Ensure that the testing platform/ test bench/ test chamber/dynamometer is clean and free of any external factors which may impact the test results
Conduct the dynamometer test for the engine	PC7. Prepare the dynamometer test platform and the prototype engine for testing PC8. Ensure that the engine is mounted on the testing bench/ testing platform and is securely clamped PC9. Connect the engine to the dynamometer as per the instructions mentioned in the testing instruction manual/ Work Instructions/ Control Plan PC10. Ensure that all the dynamometer test auxiliaries like starters, air intake fans, exhaust systems, air and oil filters, wire connections, instrumentation connections, fuel supply connections etc. are connected as per the testing instructions/ Standard Operating

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	Procedures PC11. Ensure that the connections checklist is cross checked to complete the test setup PC12. Ensure that the specified modules are selected from the test computer controls in order to execute the test and record the observations PC13. Ensure that the engine is filled with the specified quantity of oil and fuel as mentioned in the instruction manual before starting the testing PC14. Start the engine, ensure that it starts within the correct time period. Keep the engine in the start mode and then turn it off. Ensure that the engine start and turn off time is as per the test performance range PC15. Start the engine again and carry out the remaining tests PC16. Ensure that the start sequence of the engine is as per the specifications given in testing manual PC17. Increase throttle (power) application on the engine to observe performance on different stages of throttle and output of the engine PC18. Ensure completion of the Full Throttle Performance (FTP) / Part Throttle Performance (PTP) test to understand the engine performance under different loading conditions PC19. Record the observations of stationary power, torque output and roll of the engine and conduct first level performance analysis PC20. Check the flow of air, oil, fuel through the engine as per the required performance standards mentioned in the testing manual PC21. Check for any leakages in air, oil and fuel, temperature and pressure of the fuel and oil in the engine combustion chamber using the test instrumentation and observation displays on the computer controlled dynamometer test apparatus PC22. Check the fuel and oil flow during various stages of power application as per the testing checklist PC23. Check the engine piston displacement, fuel injection system and the ignition system parameters as per the testing checklist PC24. Check the physical components of the engine like filters, pumps, gaskets etc. to determine any kind of leakage and physical damage/ deformations PC25. Shut down the engine after running it for the prescribed time limit PC26. Again restart the engine after the pre decided time interval (10 – 15 minutes) to repeat the tests and record observations PC27. Shut down the engine and remove the engine accessories like pumps and filters to check for any impurities and contaminations PC28. Ensure safe demounting of engine and accessories from the

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	dynamometer test platform
Conduct emission testing for the engines	PC29. Ensure proper connections of the engine and engine accessories to the dynamometer testing platform PC30. Addition to the dynamometer, connect the engine exhaust to the exhaust gas analysis system and the Data Acquisition system and Data loggers for recording and analysing the gas and smoke exhaust PC31. Run the engine at different power levels and note the observations on the exhaust gas analysis system PC32. Observe the displays on the gas analyser/ infrared analysers/ gas chromatograph to measure the exhaust levels of Hydrocarbons (HC), Carbon Monoxide (CO), Carbon Dioxide (CO_2), Nitrogen Oxide(NO) and Nitrogen Dioxide/ Trioxide (NO_X) PC33. Compare the levels of HC and gases with the Standards/ Environmental Regulations for the type of the engine and vehicle PC34. For diesel engines conduct the dilution tunnel test for measuring the particulate matter in diesel engines PC35. Ensure the dilution tunnel test apparatus is connected to the engine and the test procedure is as per the testing process manual PC36. Ensure the measurement of Fuel Combustion rate and analysis of Fuel Combustion process to meet the required Air/ Fuel ratio as specified in the testing instructions/ testing manual
Conduct the Swirl Test on the engine	PC37. Prepare the test apparatus for the swirl test as per the testing procedure established for the particular engine PC38. Ensure connection of surge tank, pressure monitoring devices, swirl meters and the required valves as per the procedure given in the testing manual/ testing instructions PC39. Conduct swirl test on diesel engines. Ensure measurement by mean flow coefficients and mean swirl values for the input port of the engine PC40. Calculate the mean flow coefficients at the output port of the engine PC41. Ensure first level comparison of the Swirl Test results with the CFD test conducted using Paddle wheel methodology PC42. Record observations of any deviations from the standard values and inform the concerned teams
Analysis of test results	PC43. Collate all the test results in the required formats as prepared by the core R&D team PC44. Compare the test results with the standard values recommended by the cross functional engine design team and highlight any deviations PC45. Compare the test results with the regulatory norms especially on emissions and ensure that the engine design team is informed of the results in order to take corrective steps

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	PC46. Compare the test results with benchmarked values for engine performance, emissions, fuel consumption PC47. Ensure plotting of Power Curves and Torque Curves to analyze engine performance
Knowledge and Understanding (K)w.r.t. the scope	
Element	**Knowledge and Understanding**
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. relevant manufacturing standards and procedures followed in the company KA2. new products manufactured by the company KA3. internal product standards finalized within the organization KA4. functional processes like Procurement, Store management, inventory management, quality management and key contact points for query resolution KA5. quality norms and standards prescribed in the Quality Manual by the organization KA6. 5S and Safety norms practiced in the organization
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. the working of the internal combustion engine (Petrol/ Diesel)/ CNG engines KB2. different parts of the engine and related accessories – injection, ignition, piston, cylinder block, inlet & outlet valve KB3. fundamentals of instrumentation and usage of flow meters for checking fuel and lubrication flow, smoke meters, power transducers, temperature sensors, particle sensors KB4. process for setting up of test benches, test platforms and test apparatus KB5. different parameters used to evaluate the performance of the engine KB6. various national and international regulations, norms and standards on vehicles and engine performance – regulations related to emissions (gases & smoke), engine output, Bharat Stage norms for 2 wheeler, 3 wheeler and 4 wheelers KB7. various defects related to engines and potential impact on the working of the final vehicle KB8. relationship of engine performance with other operating parameters in an automobile KB9. different instruments and tools used for engine testing – dynamometer (fixed and chassis dynamometer), eddy current dynamometers, swirl testing equipment KB10. different instruments used for emissions analysis like gas analyser, chromatographs KB11. basic working of Data Acquisition Systems and Data Loggers KB12. analytical tools like Histogram analysis, Pareto Analysis, Why Why analysis, Process Mapping, Ishikawa (

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	Fishbone) analysis KB13. basic laws of physics, chemistry. metallurgy &mathematics KB14. basic laws of geometry and product design KB15. the methods of using instruments like Vernier callipers, micrometres, rulers and other inspection tools KB16. how to read and interpret sketches and engineering drawings KB17. potential health and safety hazards and related safety precautions
Skills (S)w.r.t. the scope	
Elements	**Skills**
A. Core Skills/ Generic Skills	**Writing and reading skills**
	The user/ individual on the job needs to know and understand how to: SA1. document information from the manuals,discussion notes, process charts etc. SA2. create small notes/ work documents/ diagrams for operators and helpers to help them understand the process SA3. write inter departmental notes/ memos or make suitable entries in the online system SA4. use emails and other business correspondence methods (internal memos, circular etc.) for communicating with other team members/ vendors/ suppliers etc. SA5. read equipment manuals and process documents to understand the equipment and processes better SA6. read internal information memos send by internal customers (other functions within the organization)
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA7. discuss task lists, schedules, and work-loads with the operative team members SA8. answer the queries raised by the operative team as well as intercompany departments SA9. effectively communicate with the operators and helpers and make them aware of work expectations, targets, policies, processes etc. SA10. attentively listen with full attention the queries and grievances raised by the operative team and comprehend the information given by the speaker
B. Professional Skills	**Analytical Thinking**
	The user/individual on the job needs to know and understand how to: SB1. break the problem into smaller issues and tasks to arrive at a solution SB2. understand inter process relationship and establish relationship between various parts of the problem

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	SB3. leverage experience to find effective solutions to problems SB4. use basic analytical tools to arrive at solutions
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB5. plan, organize and prioritize the work order and jobs received from the manager SB6. manage the schedule plan for the operators and helpers on the line/shift SB7. validate all process/ equipment manuals so that the final process selected is correct SB8. organize information, tools, manuals etc. so that sorting becomes easy SB9. reorganize resources on the line/ shift in case of change of plans
	Judgment and Critical Thinking
	The user/individual on the job needs to know and understand how to: SB10. use common sense and make judgments during day to day basis SB11. use reasoning skills to identify and resolve problems SB12. use intuition to detect any potential problems which could arise during operations
	Ownership
	The user/individual on the job needs to know and understand how to: SB13. accept additional responsibility for self and the team SB14. encourage self and other to take greater responsibilities SB15. ensure that the work allocated to the team is completed as per timelines and quality norms SB16. identify obstacles and bottlenecks in the process and on own find basic level solutions for removing these obstacles
	Quality Consciousness
	The user/individual on the job needs to know and understand how to: SB17. identify faulty/ flawed part and processes by comparing new designed pieces with the work standard SB18. link the fault observed with the overall impact on the performance of the component/ automobile SB19. support and contribute in monitoring and delivering high quality output from self and others SB20. train team members on maintaining quality standards set by the organization
	Problem solving and decision making
	The user/individual on the job needs to know and understand how to: SB21. gather information skilfully from multiple sources SB22. analyse information in depth and identifies the problem in a timely manner SB23. develop alternate solutions and resolves problems in early

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	stages SB24. Work tireless in spite of repeat activities in a diligent manner to resolve problems on a day to day basis SB25. use previous experience in resolving problems and taking decisions SB26. make timely and independent decisions within the boundaries of the delegation matrix of the organization
	Initiative taking
	The user/ individual on the job needs to know and understand how to SB27. clearly establish a goal for self or others to accomplish SB28. without instructions from the manager, self-manage the work SB29. Take additional responsibilities to make sure that the work is completed on time
	Customer Orientedness
	The user/ individual on the job needs to know and understand how to SB30. identify the needs of the customer SB31. ensure that the product designed meets the expectation of the customer SB32. understands importance of customer feedback and drives customer focus
	Out of Box thinking
	The user/ individual on the job needs to know and understand how to: SB33. familiarise with leading practices available in the market SB34. think independently on new approaches to manufacturing process, material management, data management and team management SB35. represent any new ideas/ approaches on process improvement and productivity improvement to the seniors in the team
	Team work and collaboration
	The user/ individual on the job needs to know and understand how to: SB36. contribute to building a positive team spirit SB37. identify individual strengths & maximize team performance SB38. exhibit objectivity & openness to others' views SB39. collaborate with stakeholders to achieve the desired state of final result

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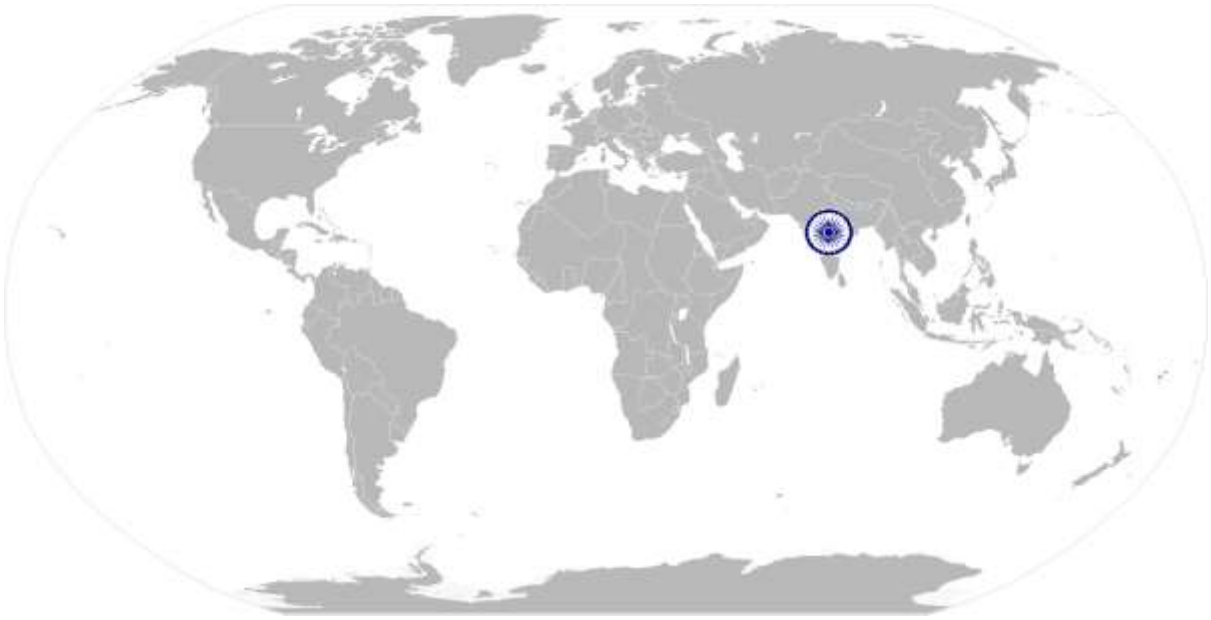
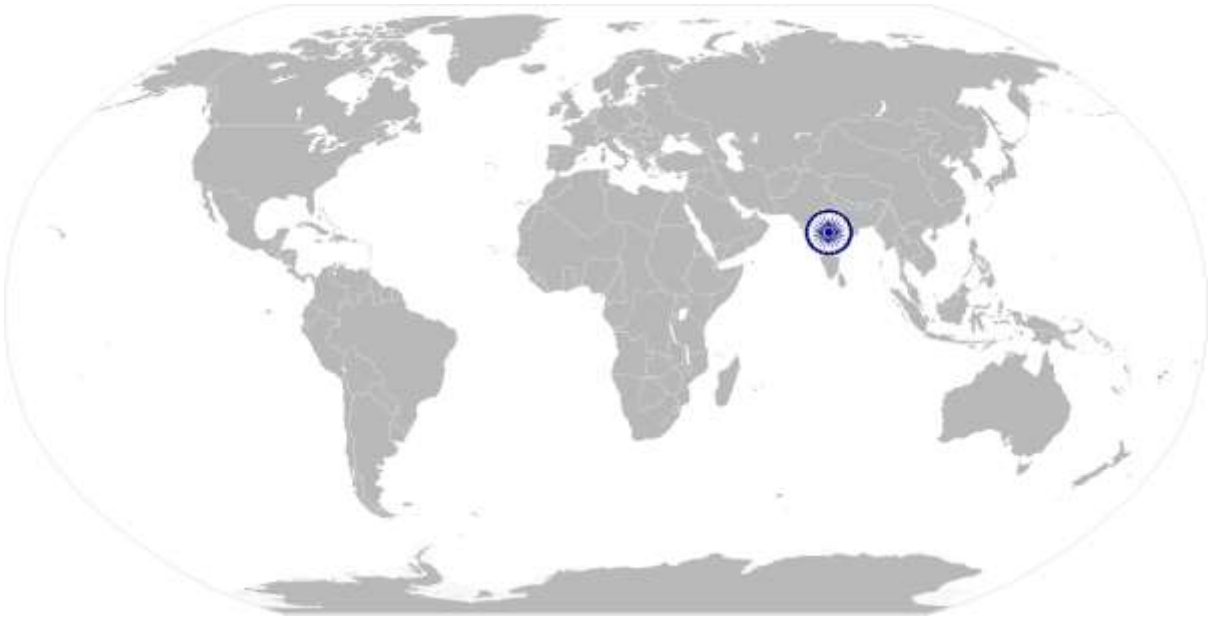
NOS Version Control

NOS Code	**ASC/N8405**		
Credits(NSQF)	**TBD**	**Version number**	**1**
Industry	**Automotive**	**Drafted on**	**15/12/2013**
Industry Sub-sector	**R & D**	**Last reviewed on**	**30/12/2013**
Occupation	**Testing**	**Next review date**	**30/12/2015**



ASC/N8406: Conduct indoor tests in various System Evaluation Laboratories to test mechanical, metallurgical and operating performance of the aggregates

National Occupational Standard



Overview

This unit is about the understanding all the required processes, ensuring implementation of the same and providing basic inputs for its improvement

ASC/N8406: Conduct indoor tests in various System Evaluation Laboratories to test mechanical, metallurgical and operating performance of the aggregates

National Occupational Standard

Unit Code	**ASC /N8406**
Unit Title (Task)	**Conduct indoor tests in various System Evaluation Laboratories to test mechanical, metallurgical and operating performance of the aggregates**
Description	This NOS is about conducting various indoor tests in different System Evaluation Laboratories to test the mechanical, metallurgical and operating performance parameters of the individual aggregates, collate the test results and analyse the same
Scope	The role holder will be responsible for: • understanding the testing requirement and the process • measuring the Noise, Vibrations and Harshness of the engine and aggregates • measurement of fatigues levels and testing of material strength This NOS will be applicable to all types of automobiles i.e. 2 wheelers, 3 wheelers , 4 wheelers and heavy vehicles

Performance Criteria(PC) w.r.t. the Scope

Element	Performance Criteria
Understanding the testing requirement and the process	PC1. Understand the component testing requirements (based on the type of component to be tested) as mentioned in the testing instructions sheets/ work instructions/ testing control plan PC2. Understand the testing methodology, equipment and process required as per the process manuals/ Work Instructions/Standard Operating Procedures PC3. Ensure that the correct testing document containing the specified setup drawing, testing schedules, testing parameters, test specifications and test outcome ranges are mentioned PC4. Ensure all tools and equipment required for testing are present near the testing platform/test bench/ test chamber PC5. Ensure that the testing platform/ test bench/ test chamber is clean and free of any external impurities which may impact the test results
Measurement of Noise, Vibration and Harshness (NVH)at the Noise and Acoustic Testing Laboratory	PC6. Ensure that the Engine and component semi Anechoic Chamber is clean and free from any dust and external impurities PC7. Ensure that the Semi Anechoic Chamber has all the required equipment and tools for conduction the Noise, Vibration and Harshness test of the engine and other components PC8. Connect the engine with the dynamometer as per the instructions mentioned in the testing instruction manual/ Work Instructions/ Control Plan PC9. Ensure that all the dynamometer test auxiliaries like starters, air intake fans, exhaust systems, air and oil filters, wire connections, instrumentation connections, fuel supply connections etc. are connected as per the testing instructions/ Standard Operating Procedures

ASC/N8406: Conduct indoor tests in various System Evaluation Laboratories to test mechanical, metallurgical and operating performance of the aggregates

	PC10. Ensure that the fitter connects all the data logging devices/ Sound absorption devices& microphones as mentioned in the Work Instructions/ Standard Operating Principle manual PC11. Ensure that the connections checklist is cross checked to complete the test setup PC12. Ensure proper connections of the sound meter, vibration meters and other Data Acquisition System for recording noise and vibrations present during the engine run process PC13. Switch on the dynamometer and apply various levels of throttle PC14. Ensure that any unwanted noises like squeaks, rattles and other engine noises are captured during the test and recorded PC15. Ensure that the various noise and vibration producing components like gear box, transmission shafts, wheels, silencer, exhaust pipes, radiators, compressors etc. are connected to the Acoustic Holography equipment, Sound Level Meters and Vibration Meters to measure the noise and vibration levels of these components during the engine run on no load/ on load and full load conditions PC16. Ensure that other than the noise and vibration produced, the acoustic testing equipment also captures the sound absorption potential and damping potential of the components (and material used in the components) PC17. Ensure that other than the engine operation noise and vibrations, noise related to intake and exhaust are also correctly captured. PC18. Correctly connect test component and the acoustic meters and ensure measurement of source sound and capability of the material to absorb the noise by testing the components in the Reverberation room PC19. Conduct Advanced Modal Analysis (using electromagnetic shakers), Operational Modal analysis, Transfer path analysis, Frequency analysis, sound quality analysis and sensitivity analysis and represent findings to the testing manager PC20. Conduct damping ratio analysis, Sound intensity mapping and Noise Contribution Analysis for all tested components PC21. Ensuring recording and reporting procedures and systems are in place at the time of conducting the NVH tests PC22. Ensure correctness in data capturing and data recording for all sources of noise PC23. Collate all the test results in the required formats as prepared by the core R&D team PC24. Compare the test results with the standard values recommended by the cross functional design team and highlight any deviations PC25. Compare the test results with the regulatory norms especially Central Motor Vehicle Regulations on NVH and ensure that the engine design team is informed of the results in order to take corrective steps PC26. Compare the test results with benchmarked values for Noise, Vibration and Harshness and with the previous test results

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Measurement of Fatigue levels and structural dynamics in the Stress/ Fatigue testing laboratory	PC27. Ensure regular cleaning and maintenance of Fatigue Lab equipment like Fatigue Testing Machines, Servo Hydraulic Actuators, Material testing machine, impact testing machine, bending machines, torsional machines PC28. Ensure development of the test bogey for conducting the structural durability tests/ fatigue test/ stress test to be conducted in the Structure Durability Laboratory PC29. Ensure design and fabrication of the fixtures for conducting the durability tests PC30. Ensure test setup for components undergoing repeated vibrations and subjecting to frequent stresses like fuel tank, fuel system, crankshaft, connecting rods, suspension, powertrain and axle system PC31. Ensure proper connection of instruments like strain gauge, load cell and other servo hydraulics machines to induce and measure stress levels on the components PC32. Ensure that the laboratory fitter is making the required connections with stress inducing equipment and data logger/ Data Acquisition System as mentioned in the Standard Operating Procedure manual/ Work Instructions PC33. Make sure that the correct testing parameters are selected and accordingly test positions are defined for the process PC34. Conduct performance and durability tests on various types of suspension springs like coil spring, leaf spring and various shock absorbers . Ensure measurement and recording of key data points like application of force, test cycle, deformation etc. PC35. Conduct resonance testing for critical automotive components like chassis frame, cross member, gears, transmission rods, crankshafts etc. to detect cracks, breaks and related metallurgical damage and also ensure durability of these components under repeated high stress environment PC36. Conduct strength test for various automobile components like door frames, door latches, windows, clutch pedals, brake shoe & pedal, accelerator pedals, steering wheel & column etc. PC37. Conduct measurement of bending strength of the crankshafts, transmission rods, gear teeth by conducting the bending and distortion strength test rig PC38. Setup the strain and shearing test apparatus for testing of brake lines. Conduct testing of brake discs, brake lining, brake calipers and brake systems PC39. Conduct durability and strength tests for belts, straps and buckles of the safety system PC40. In case of durability tests done under different controlled environment conditions, ensure that the dust shower apparatus, mist chamber, environment chamber and water spray booth are regularly cleaned and maintained

ASC/N8406: Conduct indoor tests in various System Evaluation Laboratories to test mechanical, metallurgical and operating performance of the aggregates

	PC41. Ensure setting up of dust shower, mist chamber, environment chamber and water shower apparatus and selection of spray parameters like test cycle time, velocity and angle of spray, temperature and humidity inside the test chamber PC42. Collate all the test results in the required formats as prepared by the core R&D team PC43. Compare the test results with the standard values recommended by the cross functional conceptualization and design team and highlight any deviations PC44. Compare the test results with the regulatory norms on vehicle structures, metallurgical strength parameters, life cycle durability and ensure that the design and prototyping team is informed of the results in order to take corrective steps PC45. Compare the test results with benchmarked values for stress, fatigues and durability tests and the previous tests conducted. Compare test results for performance before and after the durability test cycles and highlight deviations if any. PC46. Conduct first level FMEA and Root Cause Analysis post comparison of test results. Ensure that the first level analysis is timely shared with the testing manager
Testing of materials used in components and vehicle manufacturing	PC47. Ensure selection of specified type of material testing process as indicated in the testing manual/ Work instructions PC48. Connect the component under test to the respective material testing PC49. Device as per the standard operating procedures PC50. Ensure testing of all metallic & non metallic components, fluids, oils and lubes used in the components and automobiles PC51. Ensure testing of components as per the national and international standards defined for automobile industry performance PC52. Conduct component surface analysis and component failure analysis using spectroscopy technique PC53. Ensure loading of the test component in the Universal Testing Machine (UTM) as per the instructions defined in the testing manual/ SOP manual PC54. Conduct the tensile and compression tests on the components as per the process mentioned in Work Instructions/ Control Plan PC55. Analyze various stress related parameters like elasticity, Poisson Ratio (Stress/ Strain), Stress Strain Curves and share first level results with the Test manager PC56. Conduct Spectrometer test and Viscosity test on polymer products, oils and lubricants as per the test instructions given in the SOP manual PC57. Verify the hardness of various material using the Rockwell Hardness Test as per the test instructions given in the SOP manual
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of	The user/individual on the job needs to know and understand: KA1. relevant manufacturing and testing standards and procedures followed in the company

ASC/N8406: Conduct indoor tests in various System Evaluation Laboratories to test mechanical, metallurgical and operating performance of the aggregates

the company / organization and its processes)	KA2. new products manufactured by the company KA3. internal product standards finalized within the organization KA4. functional processes like Procurement, Store management, inventory management, quality management and key contact points for query resolution KA5. quality norms and standards prescribed in the Quality Manual by the organization KA6. 5S and Safety norms practiced in the organization
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. the working of various automobile components KB2. fundamentals of testing instruments like UTMs, hardness testing machines spectrometers, spectroscopes, microstructure analysers, refractrometers, PH meters, Humidity Analysers, fatigue testing machines and impact testing machines KB3. fundamentals of servo hydraulics, acoustics holography, sound meters, vibration meters KB4. working of load cells and strain gauges and connecting them for test process KB5. fundamental structure and working of anechoic chambers and reverberation chambers KB6. fundamentals of instrumentation and usage of flow meters for checking fuel and lubrication flow, smoke meters, power transducers, temperature sensors, particle sensorsprocess for setting up of test KB7. benches, test platforms and test apparatus various types of tests used to evaluate the design and performance of various automotive components different parameters used to evaluate the performance of the components KB8. various national and international regulations, norms and standards on vehicles and engine performance – regulations related to noise, vibrations, durability, reliability factors for 2 wheeler, 3 wheeler and 4 wheelers under normal and difficult environmental conditions KB9. various defects related to reliability and durability of the component and impact of the defect on the final component and vehicle performance KB10. basic working of Data Acquisition Systems and Data Loggers analytical tools like Histogram analysis, Pareto Analysis, Why Why analysis, Process Mapping, Ishikawa (Fishbone) analysis KB11. basic laws of physics, chemistry. metallurgy and mathematics KB12. basic laws of geometry and product design KB13. the methods of using instruments like Vernier callipers, micrometres, rulers and other inspection tools KB14. how to read and interpret sketches and engineering drawings KB15. potential health and safety hazards and related safety precautions
Skills (s) [optional]	
A. Core Skills/ Generic	**Writing and reading skills**

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Skills	The user/ individual on the job needs to know and understand how to: SA1. document information from the manuals, discussion notes, process charts etc. SA2. create small notes/ work documents/ diagrams for operators and helpers to help them understand the process SA3. write inter departmental notes/ memos or make suitable entries in the online system SA4. read equipment manuals and process documents to understand the equipment and processes better SA5. read internal information memos send by internal customers (other functions within the organization)
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA6. discuss task lists, schedules, and work-loads with the operative team members SA7. answer the queries raised by the operative team as well as intercompany departments SA8. effectively communicate with the operators and helpers and make them aware of work expectations, targets, policies, processes etc. SA9. attentively listen with full attention the queries and grievances raised by the operative team and comprehend the information given by the speaker
B. Professional Skills	**Team Leadership**
	The user/individual on the job needs to know and understand how to : SB1. communicate effectively to the team members SB2. identify conflicts in the team and try to resolve them at the earliest SB3. interact and engage with the team members on a day to day basis SB4. counsel and coach the operators and help them resolve issues SB5. timely highlight to the management about any good work/ achievement by the operators and helpers
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB6. break the problem into smaller issues and tasks to arrive at a solution SB7. understand inter process relationship and establish relationship between various parts of the problem SB8. leverage experience to find effective solutions to problems SB9. use basic analytical tools to arrive at solutions
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB10. plan, organize and prioritize the work order and jobs received from the production manager SB11. manage the schedule plan for the operators and helpers SB12. validate all process/ equipment manuals so that the final process

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	selected is correct SB13. organize information, tools, manuals etc. on the shop floor so that sorting becomes easy SB14. reorganize resources on the line/ shift in case of change of plans
	Judgment and Critical Thinking
	The user/individual on the job needs to know and understand how to: SB15. use common sense and make judgments during day to day basis SB16. use reasoning skills to identify and resolve problems SB17. use intuition to detect any potential problems which could arise during operations
	Ownership
	The user/individual on the job needs to know and understand how to: SB18. accept additional responsibility for self and the team SB19. encourage self and other to take greater responsibilities SB20. ensure that the work allocated to the team is completed as per timelines and quality norms SB21. identify obstacles and bottlenecks in the process and on own find basic level solutions for removing these obstacles
	Team Work
	The user/individual on the job needs to know and understand how to: SB22. motivate and provide support for the team SB23. encourage collaboration between team members SB24. resolve team issues and grievances to manage conflicts within the team SB25. create an environment of approachability, trust and openness within the team SB26. ensure role clarity for all operators and helpers on the line/ shift SB27. escalate any team related issues to the concerned person at the right time
	Quality Consciousness
	The user/individual on the job needs to know and understand how to: SB28. identify faulty / flawed part and processes by comparing new designed pieces with the work standard SB29. link the fault observed with the overall impact on the performance of the component/ automobile SB30. support and contribute in monitoring and delivering high quality output from self and others SB31. train team members on maintaining quality standards set by the organization
	Problem solving and decision making
	The user/individual on the job needs to know and understand how to: SB32. gather information skilfully from multiple sources SB33. analyse information in depth and identifies the problem in a timely manner

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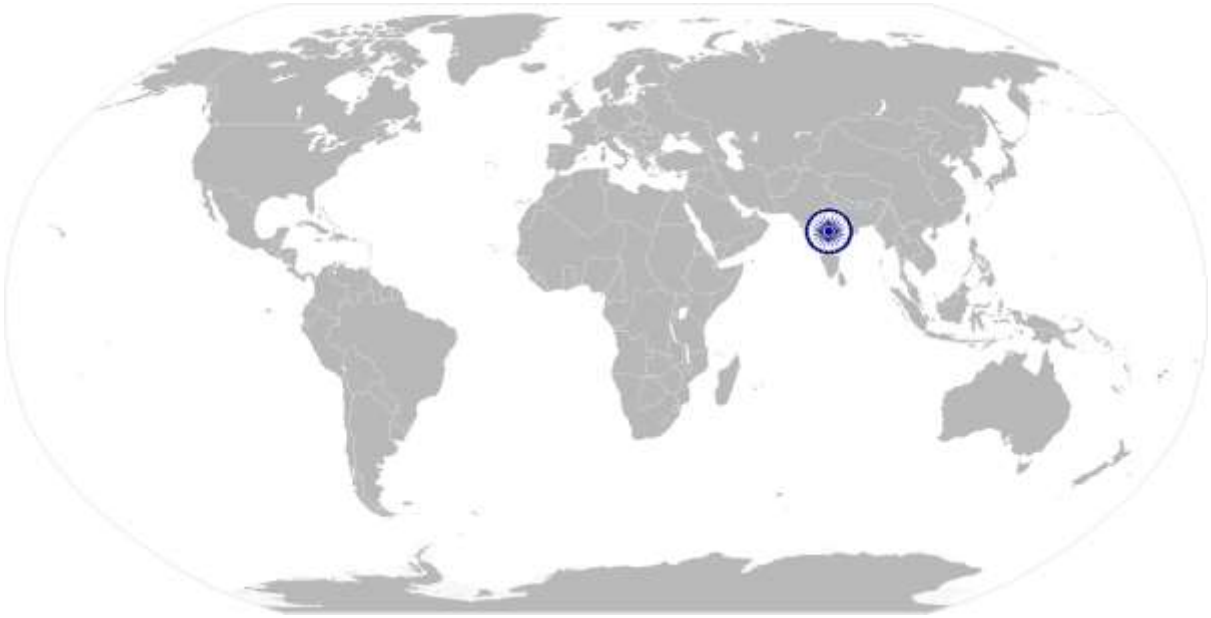
	SB34. develop alternate solutions and resolves problems in early stages SB35. Work tireless in spite of repeat activities in a diligent manner to resolve problems on a day to day basis SB36. use previous experience in resolving problems and taking decisions SB37. make timely and independent decisions within the boundaries of the delegation matrix of the organization
	Initiative taking
	The user/ individual on the job needs to know and understand how to SB38. clearly establish a goal for self or others to accomplish SB39. without instructions from the manager, self-manage the work SB40. take additional responsibilities to make sure that the work is completed on time
	Out of Box thinking
	The user/ individual on the job needs to know and understand how to: SB41. familiarise with leading practices available in the market SB42. think independently on new approaches to manufacturing process, material management, data management and team management SB43. represent any new ideas/ approaches on process improvement and productivity improvement to the seniors in the team
	Collaboration
	The user/ individual on the job needs to know and understand how to: SB44. exhibit objectivity & openness to others' views SB45. collaborate with stakeholders to achieve the desired state of final result

NOS Version Control

NOS Code	**ASC/N8406**		
Credits(NSQF)	**TBD**	**Version number**	**1**
Industry	**Automotive**	**Drafted on**	**15/12/2013**
Industry Sub-sector	**R & D**	**Last reviewed on**	**30/12/2013**
Occupation	**Testing**	**Next review date**	**30/12/2015**

National Occupational Standard



Overview

This unit is about conducting the vehicle performance tests in a controlled manner within an indoor laboratory/ controlled road test conditions

National Occupational Standard

ASC/N8407: Conduct Vehicle Performance tests in a controlled internal/ on road test setup

Unit Code	ASC /N8407
Unit Title (Task)	**Conduct Vehicle Performance tests in a controlled internal/ on road test setup**
Description	Conduct vehicle performance tests in controlled internal laboratory/ on road testing to ensure that the prototype performance matches the criteria finalized during the conceptualization and design phase of vehicle development
Scope	The role holder will be responsible for: • understanding the testing requirement and the process • measuring the transmission power using the chassis dynamometer test • conducting the safety, homologation and environment test • measure noise and vibration levels of a running vehicle This NOS will be applicable to all types of automobiles i.e. 2 wheelers, 3 wheelers , 4 wheelers and heavy vehicles
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Understanding the testing requirement and the process	PC1. Understand the vehicle testing requirements (based on the type of vehicle to be tested) as mentioned in the testing instructions sheets/ work instructions/ testing control plan PC2. Understand the testing methodology, equipment and process required as per the process manuals/ Work Instructions/Standard Operating Procedures PC3. Ensure that the testing document contains the specified setup drawing, testing schedules, testing parameters, test specifications and test outcome ranges are mentioned PC4. Ensure all tools and equipment required for testing are present near the testing area
Measure the transmission power from the engines to the power train using chassis dynamometer test	PC5. Park the automobile under test in the vehicle testing cell and connect the assembled engine to the chassis dynamometer as per the instructions mentioned in the testing instruction manual/ Work Instructions/ Control Plan PC6. Ensure that the dynamometer drive rolls are correctly aligned with the vehicles tires PC7. Ensure that all the dynamometer data acquisition systems is connected auxiliaries like starters, air intake fans, exhaust systems, air and oil filters, wire connections, instrumentation connections, fuel supply connections etc. are connected as per the testing instructions/ Standard Operating Procedures PC8. Check the completion of safety precautions especially fire fighting safety measures before initiating the dynamometer test as per the safety checklist provided by the safety team PC9. Check the connections of the Air Intake Fan, Heat Exchanged Fan, Exhaust Air Fan as per the testing manual/ Standard Operating Procedures

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	PC10. Measure the tire pressure, engine temperature, coolant temperature before starting the dynamometer. Ensure that the tire distortion due to drive roll pressure is recorded by the system PC11. Start the dynamometer at the defined gear levels and the required engine throttle levels as defined in the testing procedure manual/ testing instructions PC12. Ensure correct measurement of engine air flow, intake air flow, heat exchanger air flow, engine temperature, coolant temperature, fuel flow etc. through the data logging units connected to the computer PC13. Ensure measurement and calculation of Air Fuel ratio, engine RPM, roll speed, engine load, air flow, engine temperature and pressure PC14. Change the gears as per the cycle time mentioned in the testing instruction manual PC15. Conduct the first level analysis of Power (in HP) Vs. Engine Speed in RPM) to validate engine performance against the recommended values by the product conceptualization team PC16. Connect the engine exhaust to the exhaust gas analysis system and the Data Acquisition system and Data loggers for recording and analysing the gas and smoke exhaust PC17. Run the engine at different power levels and note the observations on the exhaust gas analysis system PC18. Observe the displays on the gas analyser/ infrared analysers/ gas chromatograph to measure the exhaust levels of Hydrocarbons (HC), Carbon Monoxide (CO), Carbon Dioxide (CO2), Nitrogen Oxide(NO) and Nitrogen Dioxide/ Trioxide (NOX) PC19. Compare the levels of HC and gases with the Standards/ Environmental Regulations for the type of the engine and vehicle exhaust PC20. Compare the test results with the regulatory norms especially on emissions and ensure that the engine design team is informed of the results in order to take corrective steps PC21. Compare the test results with benchmarked values for engine performance, emissions, fuel consumption PC22. Ensure plotting of Power Curves and Torque Curves to analyse engine performance
Conduct safety and homologation tests as per the regulations	PC23. Ensure that the specification document is received from the prototyping and homologation team with the Project Cross Functional Team structure PC24. Check the version of the information document and also the approval stages from with the information document has passed PC25. Understand the type of regulations existing in the automotive space with respect to the vehicle/ aggregate under test PC26. Verify the required parameters as per the type of vehicle under test and the mandatory regulatory norms as per the checklist provided by the cross functional team PC27. Ensure that vehicle usage type and the geography in which the vehicle is to be deployed is givenin the information document

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	PC28. Setup the test bench/ test platforms as per the homologation tests to be conducted PC29. Conduct the required homologation tests – On Road and lab tests as per the regulation checklist of the given geography PC30. Evaluate engine performance, emissions, vehicle safety, vehicle specifications, vehicle type and weight, load capacity, dimensions, vehicle running stability, braking specifications, mileage and other parameters as per the governing standards of the type/ geography PC31. Evaluate the test results , compare them with internal and external benchmarks & regulatory requirements like Bharat Stage norms, Automobile Industry Standards (AIS), Central Motor Vehicle Regulations, Central Motor Vehicle PC32. Check the endurance and durability of the vehicle doors and latches using PLC based test systems PC33. Test the operations of the lighting systems such as lamps, head lights and fog lamps using the lamp focus test and lamp brightness test as per the safety norms prescribed by the organization PC34. Test the operations of the signalling systems like reflectors and indicators including brightness, visibility, blinking speeds etc. as per the checklist provided for signal testing PC35. Conduct bumper durability test using front and side moving block and record observations PC36. Setup the component impact testing rig as per the safety test requirements mentioned in the testing manual PC37. Conduct the Drop test, Head impact test and the side impact test on vehicle body, impact test on doors, windows, steering columns and engine to validate the effect of any external impact on the overall performance of the vehicle PC38. Check the brake system performance by conducting performance /durability tests & measurements/observations on brake lining, brake shoes, braking fluid and friction material as per the instructions and conditions given in the test manual/ Work Instructions
Conduct environment testing to ensure all weather worthiness of the vehicle	PC39. Setup the vehicle under testing for different controlled environment conditions PC40. Ensure that the dust shower chamber, mist chamber,environment chamber and water spray booth are regularly cleaned and maintained within the respective test chambers PC41. Ensure setting up of dust shower, mist chamber and water shower apparatus and selection of spray parameters like test cycle time, velocity and angle of spray, temperature and humidity inside the test chamber PC42. Check for any leakages of dust, mist and water inside the vehicle to determine any structural flaws with the test vehicle PC43. Check the working of safety measures like windshield wiper movement, rear view and side view mirror visibility while performing the dust, mist and water shower test PC44. Check the durability of the wind shield and side view mirror glass to

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	detect any flaws like cracks, dust/ water accumulation on the glass etc. PC45. Setup the thermal test chamber to conduct the hot weather and cold weather test on the engine performance PC46. Collate all the test results in the required formats as prepared by the core R&D team PC47. Compare the test results with the standard values recommended by the cross functional conceptualization and design team and highlight any deviations
Conduct suitable tests to detect Noise, Vibrations and Harshness (NVH) in a running vehicle	PC48. Setup the NVH testing Pass by Noise test apparatus on the test track for testing the NVH functionality of the vehicle under test PC49. Ensure the microphone is placed as the specified distance and right angle as prescribed in the testing manual to measure pass by noise, engine vibration noise, air conditioning noise, intake/ exhaust noise, transmission vibrations, chassis vibrations, suspension vibrations for 2 wheelers, 4 wheelers and heavy vehicles PC50. Ensure that the data loggers, sound meters, vibration detectors are placed at the correct places to successfully capture any types of squeaks, rattles coming from the test vehicle PC51. Measure the noise levels for various loading conditions of the vehicle and note down the test results PC52. Measure the cabin noise in case of heavy vehicles and passenger compartment noise for cars and buses PC53. Compare the test results with the norms prescribed in the motor vehicle regulations such as Central Motor Vehicle Regulations, Motor Vehicle Act as applicable PC54. Conduct a first level analysis of the NVH test results and present the report to the testing manager for detailed analysis
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. relevant manufacturing and testing standards and procedures followed in the company KA2. new products manufactured by the company KA3. internal product standards finalized within the organization KA4. functional processes like Procurement, Store management, inventory management, quality management and key contact points for query resolution KA5. quality norms and standards prescribed in the Quality Manual by the organization KA6. 5S and Safety norms practiced in the organization
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. the working of various automobile components KB2. general working of automobiles and linkage& impact of one parameter to another KB3. fundamentals of testing instruments like UTMs, hardness testing machines spectrometers, spectroscopes, microstructure analysers, refractometers, PH meters, Humidity Analysers, fatigue testing

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	machines and impact testing machines KB4. fundamentals of servo hydraulics, acoustics holography, sound meters, vibration meters KB5. working of load cells and strain gauges and connecting them for test process KB6. the process of using chassis dynamometers and understanding the results KB7. fundamentals of impact testing and drop testing machine KB8. fundamentals of instrumentation and usage of flow meters for checking fuel and lubrication flow, smoke meters, power transducers, temperature sensors, particle sensors process for setting up of test KB9. benches, test platforms and test apparatus various types of tests used to evaluate the design and performance of various automotive components different parameters used to evaluate the performance of the components KB10. various national and international regulations, norms and standards on KB11. vehicles and engine performance – regulations related to noise, vibrations, durability, reliability factors for 2 wheeler, 3 wheeler and 4 wheelers under normal and difficult environmental conditions KB12. various defects related to reliability and durability of the component and impact of the defect on the final component and vehicle performance KB13. basic working of Data Acquisition Systems and Data Loggers KB14. impact of environmental parameters like rain, mist, dust, sunlight, snow on overall vehicle and aggregate performance KB15. probable sources of vehicle noise and possible impacts KB16. analytical tools like Histogram analysis, Pareto Analysis, Why Why analysis, Process Mapping, Ishikawa (Fishbone) analysis KB17. basic human anatomy and impact of vehicle performance on human body KB18. basic laws of physics, chemistry. metallurgy and mathematics KB19. basic laws of geometry and product design KB20. the methods of using instruments like Vernier callipers,micrometres, rulers and other inspection tools KB21. how to read and interpret sketches and engineering drawings KB22. potential health and safety hazards and related safety precautions
Skills (s) [optional]	
C. Core Skills/ Generic Skills	**Writing and reading skills**
	The user/ individual on the job needs to know and understand how to: SA1. document information from the manuals,discussion notes, process charts etc. SA2. create small notes/ work documents/ diagrams for operators and helpers to help them understand the process SA3. write inter departmental notes/ memos or make suitable entries in the online system SA4. use emails and other business correspondence methods (internal memos, circular etc.) for communicating with other team members/

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	vendors/ suppliers etc. SA5. read equipment manuals and process documents to understand the equipment and processes better SA6. read internal information memos send by internal customers (other functions within the organization)
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA7. discuss task lists, schedules, and work-loads with the operative team members SA8. answer the queries raised by the operative team as well as intercompany departments SA9. effectively communicate with the operators and helpers and make them aware of work expectations, targets, policies, processes etc. SA10. attentively listen with full attention the queries and grievances raised by the operative team and comprehend the information given by the speaker
D. Professional Skills	**Team Leadership**
	The user/individual on the job needs to know and understand how to: SB1. communicate effectively to the team members SB2. identify conflicts in the team and try to resolve them at the earliest SB3. interact and engage with the team members on a day to day basis SB4. counsel and coach the operators and help them resolve issues SB5. timely highlight to the management about any good work/ achievement by the operators and helpers
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB6. break the problem into smaller issues and tasks to arrive at a solution SB7. understand inter process relationship and establish relationship between various parts of the problem SB8. leverage experience to find effective solutions to problems SB9. use basic analytical tools to arrive at solutions
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB10. plan, organize and prioritize the work order and jobs received from the manager SB11. manage the schedule plan for the operators and helpers SB12. validate all process/ equipment manuals so that the final process selected is correct SB13. organize information, tools, manuals etc. on the shop floor so that sorting becomes easy SB14. reorganize resources on the line/ shift in case of change of plans
	Judgment and Critical Thinking

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	The user/individual on the job needs to know and understand how to: SB15. use common sense and make judgments during day to day basis SB16. use reasoning skills to identify and resolve problems SB17. use intuition to detect any potential problems which could arise during operations
	Ownership
	The user/individual on the job needs to know and understand how to: SB18. accept additional responsibility for self and the team SB19. encourage self and other to take greater responsibilities SB20. ensure that the work allocated to the team is completed as per timelines and quality norms SB21. identify obstacles and bottlenecks in the process and on own find basic level solutions for removing these obstacles
	Team Work
	The user/individual on the job needs to know and understand how to: SB22. motivate and provide support for the team on the shop floor SB23. encourage collaboration between team members SB24. resolve team issues and grievances to manage conflicts within the team SB25. create an environment of approachability, trust and openness within the team SB26. ensure role clarity for all operators and helpers on the line/ shift SB27. escalate any team related issues to the concerned person at the right time
	Quality Consciousness
	The user/individual on the job needs to know and understand how to: SB28. identify defective parts in the manufacturing line by comparing SB29. manufactured pieces with the work standard SB30. link the defect observed with the overall impact on the performance of the component/ automobile SB31. support and contribute in monitoring and delivering high quality output from self and others SB32. train team members on maintaining quality standards set by the organization
	Problem solving and decision making
	The user/individual on the job needs to know and understand how to: SB33. gather information skilfully from multiple sources SB34. analyse information in depth and identifies the problem in a timely manner SB35. develop alternate solutions and resolves problems in early stages SB36. work tireless in spite of repeat activities in a diligent manner to resolve problems on a day to day basis SB37. use previous experience in resolving problems and taking decisions SB38. make timely and independent decisions on the line/ shift within the

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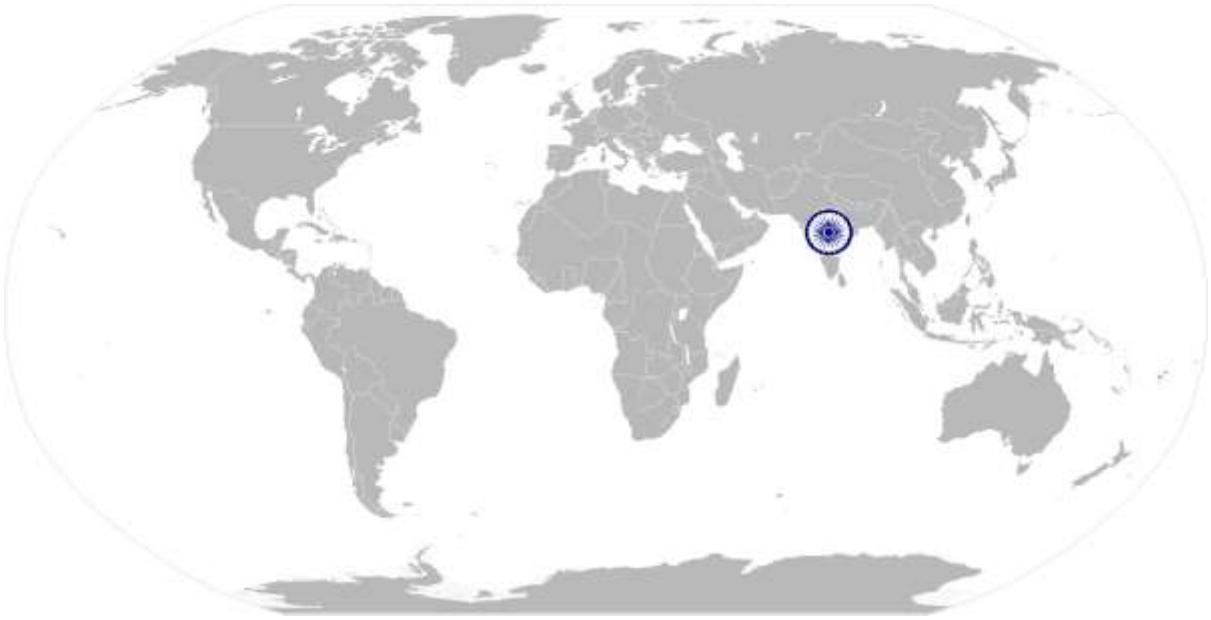
	boundaries of the delegation matrix of the organization
	Initiative taking
	The user/ individual on the job needs to know and understand how to SB39. clearly establish a goal for self or others to accomplish SB40. without instructions from the manager, self-manage the work SB41. take additional responsibilities to make sure that the work is completed on time
	Out of Box thinking
	The user/ individual on the job needs to know and understand how to: SB42. familiarise with leading practices available in the market SB43. think independently on new approaches to manufacturing process, material management, data management and team management SB44. represent any new ideas/ approaches on process improvement and productivity improvement to the seniors in the team
	Collaboration
	The user/ individual on the job needs to know and understand how to: SB45. exhibit objectivity & openness to others' views SB46. collaborate with stakeholders to achieve the desired state of final result

NOS Version Control

NOS Code	**ASC/N8407**		
Credits(NSQF)	**TBD**	**Version number**	**1**
Industry	**Automotive**	**Drafted on**	**15/12/2013**
Industry Sub-sector	**R &D**	**Last reviewed on**	**30/12/2013**
Occupation	**Testing**	**Next review date**	**30/12/2015**

ASC/N8408: Testing vehicle dynamics and vehicle performance during outdoor testing of prototype vehicles.

National Occupational Standard



Overview:

This unit is about validation of the vehicle performance parameters on on- road running test and ensuring that the performance meets the set standards

ASC/N8408: Testing vehicle dynamics and vehicle performance during outdoor testing of prototype vehicles.

National Occupational Standard

Unit Code	ASC /N8408
Unit Title (Task)	**Testing vehicle dynamics and vehicle performance during outdoor testing of prototype vehicles**
Description	This NOS is about conducting various types of external on road test to validate the vehicle performance and vehicle dynamics using different endurance, stress tests, hardship tests and environmental stress test to ensure that the performance meet the set standards
Scope	The role holder will be responsible for: • understanding the testing requirement and the process • conducting out door testing of vehicles • recording observations from test drivers and data loggers This NOS will be applicable to all types of automobiles i.e. 2 wheelers, 3 wheelers , 4 wheelers and heavy vehicles
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Conduct Out Door Testing of vehicles to ensure durability, reliability and high performance	PC1. Understand the vehicle specifications of the test vehicle and the test specifications PC2. Confirm with the test manager, the test procedure to be applied for conducting the various types of outdoor testing of vehicles PC3. Confirm with the test manager, the various data points which need to be captured and analysed during the running test of the vehicle PC4. Ensure that the right instruments as mentioned in the testing manual are used to capture the vehicle performance data PC5. Ensure that the test driver has the complete briefing of the various types of tests to be performed on a running vehicle PC6. Ensure complete testing of vehicle manoeuvrability, durability, vehicle performance, structural durability, ride comfort, NVH and vehicle safety PC7. Ensure that the drivers have a clear understanding of each type of parameter to be tested on a running vehicle PC8. Check the connections of the various data capturing meters and instrumentation such as load cells, pneumatic/ PLC testing gauges, strain gauges, displacement transducers, accelerometers, GPS data collection devices and data loggers to capture the data points during the vehicle running condition PC9. Confirm that all the safety features required for the vehicle under running condition are working and are checked as per the vehicle safety check list provided PC10. Ensure that the fitter checks of fuel level, oil/ lubricant level, cooling water level, tyre pressure etc. are checked before starting the on road testing of the vehicle prototype PC11. Ensure that any type of system warning indicators showing system failures, loose connections, malfunctioning etc. are addressed before

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	starting the various types of road tests PC12. Ensure that the test drivers completes all the tests to be performed to test the performance of the vehicle under stress conditions PC13. Ensure that the test driver as well as the data logging system captures vehicle performance parameters like torque, braking, vibrations, pickup, overall vehicle handling, driver comfort etc. on various torture tracks like rough stone track, corrugated tracks, bumpy tracks, potholed tracks, sand & mud tracks etc. PC14. Ensure that the test driver as well as the data logging system captures vehicle performance parameters like torque, braking, vibration, acceleration/ deceleration, driver comfort, tyre grip etc. on paved road tracks with different loading conditions PC15. Ensure that the test driver as well as the data logging system captures vehicle performance parameters like torque, vibrations, pickup, water seepage, ease of tyre movement, engine stalling etc. during the water trough wading test and ensure that the various levels of water depth/ vehicle depth in water are recorded PC16. Ensure that the vehicle performance is measured at various slope levels by performing the vehicle gradient test. Ensure that the performance is captured by the data loggers at all incline slope angles PC17. Ensure that the test driver and the data loggers are capturing the parameters during the running of vehicles on steering pads, flat straight roads and serpentine tracks to collect data for analysing manoeuvrability, steering comfort, braking power, acceleration/ deceleration, pass by noise, vibrations, tyre grip, turning radius durability, reliability and vehicle handling ability at different loading conditions PC18. Ensure that the test driver completes the 80 km/hour speed braking test, low speed braking test and short distance breaking test to validate the braking distance, vehicle performance, driver comfort, durability and vehicle stability during various braking conditions under various environment conditions like dry roads, wet roads, muddy tracks etc. as well as setting conditions viz. one circuit, half worn condition, brake fluid levels as specified. PC19. Ensure that the driver and the data logging systems capture relevant data such as driving comfort, vehicle milage, engine performance etc. during long distance endurance testing of vehicles on cross country drives PC20. Ensure that all types of Noise and Vibrations in the running vehicle are captured by the data logging system and the test drivers especially engine noise & vibration, cabin noise, noise & vibration due gear changing/ transmission, noise from intake and exhaust system during different running on road tests PC21. Check the completion of other vehicle performance tests like Tilting test, crash test and aerodynamic test by ensuring correct fitment of data

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	logging devices and required drive testing/ stationary testing as per the instruction mentioned in the testing procedure manual PC22. Ensure individual and collective meetings with the test drives to take inputs on their overall vehicle driving experience and experience related to various tests performed PC23. Analyse all the information collected by the various data logging devices and compare the same with the regulatory norms and internal/ external benchmarks PC24. Ensure timely preparation of the first level test report and share the same with the test manager
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. relevant manufacturing and testing standards and procedures followed in the company KA2. new products manufactured by the company KA3. internal product standards finalized within the organization KA4. functional processes like Procurement, Store management, inventory management, quality management and key contact points for query resolution KA5. quality norms and standards prescribed in the Quality Manual by the organization KA6. 5S and Safety norms practiced in the organization
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. the working of various automobile components KB2. general working of automobiles and linkage & impact of one parameter to another KB3. fundamentals of servo hydraulics, acoustics holography, sound meters, vibration meters KB4. working of load cells and strain gauges and connecting them for test process KB5. basic road driving skills and fundamentals of vehicle movement in various conditions KB6. impact of various types of roads, gradient, sand etc. on the performance of the vehicle KB7. impact of wind, water flow, hot & cold conditions, pressure on the performance of the vehicle KB8. fundamentals of instrumentation and usage of flow meters for checking fuel and lubrication flow, smoke meters, power transducers, temperature sensors, particle sensors process for setting up of test KB9. benches, test platforms and test apparatus various types of tests used to evaluate the design and performance of various automotive components different parameters used to evaluate the performance of the components KB10. various national and international regulations, norms and standards on vehicles and engine performance – regulations related to noise,

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	vibrations, durability, reliability factors for 2 wheeler, 3 wheeler and 4 wheelers under normal and difficult environmental conditions KB11. various driving rules and difference from country to country KB12. various defects related to reliability and durability of the component and impact of the defect on the final component and vehicle performance KB13. basic working of Data Acquisition Systems and Data Loggers KB14. impact of environmental parameters like rain, mist, dust, sunlight, snow on overall vehicle and aggregate performance KB15. probable sources of vehicle noise and possible impacts KB16. analytical tools like Histogram analysis, Pareto Analysis, Why Why analysis, Process Mapping, Ishikawa (Fishbone) analysis KB17. basic human anatomy and impact of vehicle performance on human body KB18. basic laws of physics, chemistry. metallurgy and mathematics KB19. basic laws of geometry and product design KB20. the methods of using instruments like Vernier callipers, micrometres, rulers and other inspection tools KB21. how to read and interpret sketches and engineering drawings KB22. potential health and safety hazards and related safety precautions during driving KB23. first aid methods at the time of accidents during road testing
Skills (s) [optional]	
A. Core Skills/ Generic Skills	**Writing and reading skills**
	The user/ individual on the job needs to know and understand how to: SA1. document information from the manuals,discussion notes, process charts etc. SA2. create small notes/ work documents/ diagrams for operators and helpers to help them understand the process SA3. write inter departmental notes/ memos or make suitable entries in the online system SA4. use emails and other business correspondence methods (internal memos, circular etc.) for communicating with other team members/ vendors/ suppliers etc. SA5. read equipment manuals and process documents to understand the equipment and processes better SA6. read internal information memos send by internal customers (other functions within the organization)
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA7. discuss task lists, schedules, and work-loads with the operative team members SA8. answer the queries raised by the operative team as well as intercompany departments SA9. effectively communicate with the operators and helpers and make the

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	SA10. aware of work expectations, targets, policies, processes etc. SA11. attentively listen with full attention the queries and grievances raised by the operative team and comprehend the information given by the speaker
B. Professional Skills	**Out of Box thinking**
	The user/ individual on the job needs to know and understand how to: SB1. familiarise with leading practices available in the market SB2. think independently on new approaches to manufacturing process, material management, data management and team management SB3. represent any new ideas/ approaches on process improvement and productivity improvement to the seniors in the team
	Team Leadership
	The user/individual on the job needs to know and understand how to: SB4. communicate effectively to the team members SB5. identify conflicts in the team and try to resolve them at the earliest SB6. interact and engage with the team members on a day to day basis SB7. counsel and coach the operators and help them resolve issues SB8. timely highlight to the management about any good work/ achievement by the operators and helpers
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB9. break the problem into smaller issues and tasks to arrive at a solution SB10. understand inter process relationship and establish relationship betweenvarious parts of the problem SB11. leverage experience to find effective solutions to problems SB12. use basic analytical tools to arrive at solutions
	Judgment and Critical Thinking
	The user/individual on the job needs to know and understand how to: SB13. use common sense and make judgments during day to day basis SB14. use reasoning skills to identify and resolve problems SB15. use intuition to detect any potential problems which could arise during operations
	Ownership
	The user/individual on the job needs to know and understand how to: SB16. accept additional responsibility for self and the team SB17. encourage self and other to take greater responsibilities SB18. ensure that the work allocated to the team is completed as per timelines and quality norms SB19. identify obstacles and bottlenecks in the process and on own find basic level solutions for removing these obstacles
	Team Work
	The user/individual on the job needs to know and understand how to: SB20. motivate and provide support for the team on the shop floor

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	SB21. encourage collaboration between team members SB22. resolve team issues and grievances to manage conflicts within the team SB23. create an environment of approachability, trust and openness within the team SB24. ensure role clarity for all operators and helpers on the line/ shift SB25. escalate any team related issues to the concerned person at the right time
	Problem solving and decision making
	The user/individual on the job needs to know and understand how to: SB26. gather information skilfully from multiple sources SB27. analyse information in depth and identifies the problem in a timely manner SB28. develop alternate solutions and resolves problems in early stages SB29. work tireless in spite of repeat activities in a diligent manner to resolve problems on a day to day basis SB30. use previous experience in resolving problems and taking decisions SB31. make timely and independent decisions on the line/ shift within the boundaries of the delegation matrix of the organization
	Collaboration
	The user/ individual on the job needs to know and understand how to: SB32. exhibit objectivity & openness to others' views SB33. collaborate with stakeholders to achieve the desired state of final result

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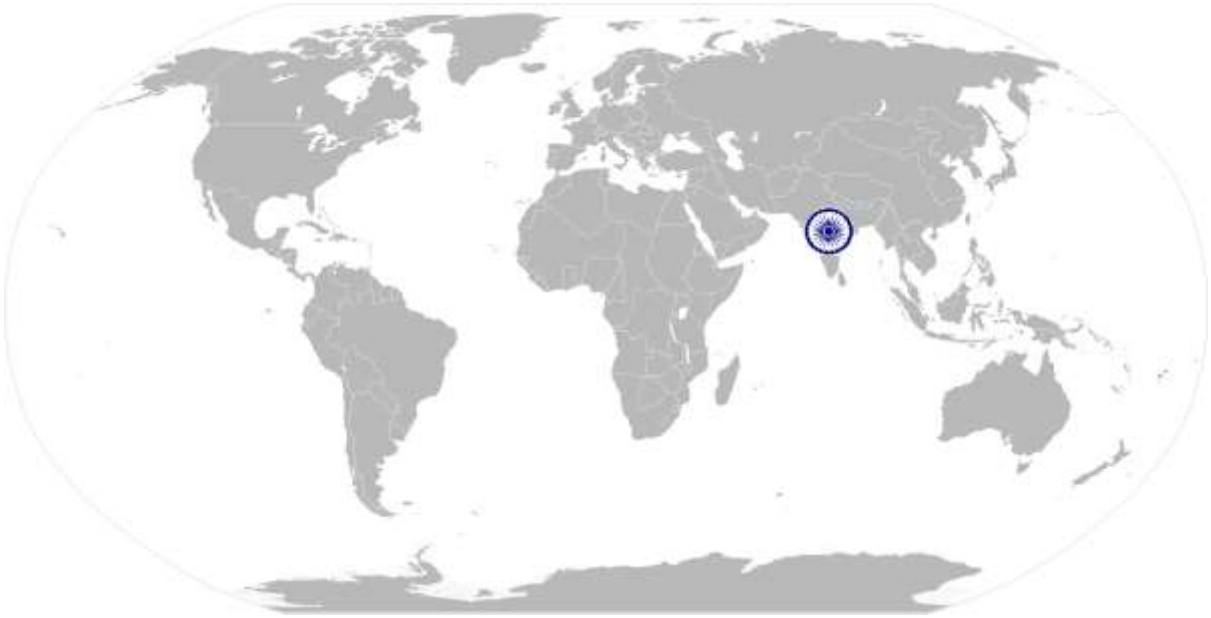
NOS Version Control

NOS Code	**ASC/N8408**		
Credits(NSQF)	**TBD**	**Version number**	**1**
Industry	**Automotive**	**Drafted on**	**15/12/2013**
Industry Sub-sector	**R & D**	**Last reviewed on**	**30/12/2013**
Occupation	**Testing**	**Next review date**	**30/12/2015**

National Occupational Standards



Overview

This unit is about maintaining a Safe and Healthy working environment

National Occupational Standard

ASC/N0006C: Maintain a safe and healthy working environment at the work place

Unit Code	ASC/N0006C
Unit Title (Task)	**Maintain a safe and healthy working environment at the work place**
Description	This NOS unit is about creating a Safe and Healthy work place, adhering to the safety guidelines in the working area, following practices which are not impacting the environment in a negative manner and training team members on health and safety related issues
Scope	The role holder will be responsible for: • identifying and reporting risks • creating and sustaining a safe, clean and environmental friendly work place This NOS will be applicable to all Automotive sector manufacturing job roles
Performance Criteria (PC) w.r.t. the Scope	
Element	**Performance Criteria**
Display awareness to the potential safety risks	PC1. Display understanding of the activities which can cause potential injury through sharp objects, burns, fall, electricity, gas leakages, radiation, poisonous fumes, chemicals ,loud noise PC2. Be aware of the areas in the plant/ lab facility which are potentially hazardous/ unhygienic in nature PC3. Understand all risk involving and hazardous areas near the work place are marked/ tagged in order to caution the users of the work area/ machinery PC4. Attend awareness drives held amongst other on sharing information on the identified risks. PC5. Attend periodic awareness sessions are conducted
Display awareness towards maintaining a Safe, clean and environment friendly work place	PC6. Wear the recommended Personal Protective Equipment (PPE) and also ensure self-usage of the required PPEs when entering the plant premises PC7. Display awareness of the instructions given on the equipment manual describing the operating process of the equipment to prevent any hazard PC8. Be aware of the first aid safety kit at the work place/ shop floor location and the requisite items to respond to minor injuries. PC9. Attend all safety and fire drills to be self-aware of safety hazards and preventive techniques and ensure that the team participate in all the required safety and fire drills PC10. Participate in all safety related initiatives like Safety Committee participations, Safety Day Celebrations etc. PC11. Maintain high standards of personal hygiene at the work place PC12. Inform the medical officer/ HR in case of self or an employee's illness of contagious nature so that preventive actions can be planned for others
Knowledge and Understanding (K)w.r.t. the scope	

ASC/N0006C: Maintain a safe and healthy working environment at the work place

Element	Knowledge and Understanding
A. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. relevant standards, procedures and policies related to Health, Safety and Environment followed in the company KA2. emergency handling procedures & hierarchy for escalation
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. basic knowledge of Safety procedures(fire fighting, first aid) within the organization KB2. knowledge of various types of PPEs and their usage KB3. basic knowledge of risks/hazards associated with each occupation in the organization KB4. how to safely operate various tools and machines and risks associated with the tools/ equipment KB5. knowledge of personal hygiene and how an individual an contribute towards creating a highly safe and clean working environment
Skills (S)w.r.t. the scope	
Element	**Skills**
A. Core Skills/ Generic Skills	**Writing Skills**
	The user/ individual on the job needs to know and understand how to: SA1. write basic level notes and observations SA2. note down observations (if any) related to the process SA3. write information documents to internal departments/ internal teams
	Reading Skills
	The user/individual on the job needs to know and understand how to: SA4. read safety instructions put up across the plant premises SA5. read safety precautions mentioned in equipment manuals and panels to understand the potential risks associated
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA6. effectively communicate information to team members SA7. Inform employees in the plant and concerned functions about events, incidents & potential risks observed related to Safety, Health and Environment. SA8. question the process head/ safety team in order to understand the safety related issues SA9. attentively listen with full attention and comprehend the information given by the speaker during safety drills and training programs
B. Professional Skills	**Judgmental Thinking**
	The user/individual on the job needs to know and understand how to:

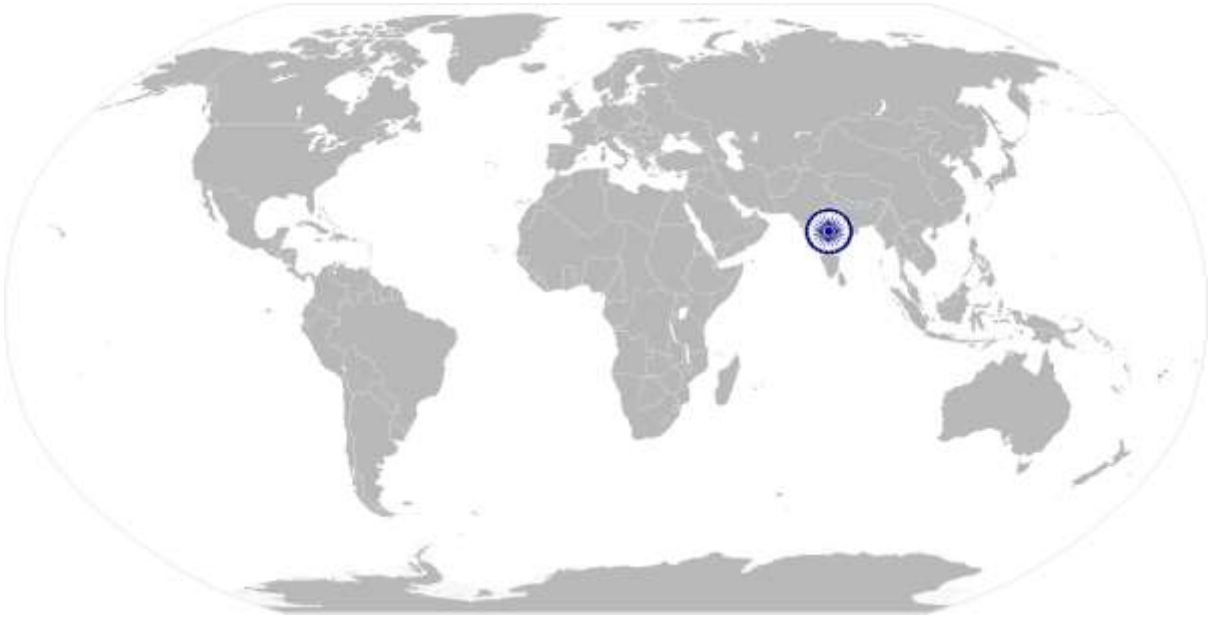
ASC/N0006C: Maintain a safe and healthy working environment at the work place

	SB1. use common sense and make judgments during day to day basis SB2. use reasoning skills to identify and resolve basic problems
	Persuasion skills
	The user/ individual on the jobs needs to know and understand how to: SB3. persuade team members to wear Personal Protective Equipment as per requirement SB4. ensure that the team understands the importance of using various machines and equipment without creating any risk to human/ machine SB5. train team members on various risks identified
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB6. break the problem into smaller issues and tasks to arrive at a solution SB7. understand inter process relationship and establish relationship between various parts of the problem SB8. leverage experience to find effective solutions to problems SB9. use basic analytical tools to arrive at solutions

NOS Version Control

NOS Code	**ASC/N0006C**		
Credits(NSQF)	**TBD**	**Version number**	**1**
Industry	**Automotive**	**Drafted on**	**20/12/2013**
Industry Sub-sector	**R & D**	**Last reviewed on**	**25/12/2013**
Occupation	**All**	**Next review date**	**25/12/2015**

National Occupational Standard



Overview

This unit is about the implementing the various principles of 5S and ensure that the given guidelines are followed to ensure a clean and efficient working environment in the organization

National Occupational Standard

ASC/N0022: Ensure implementation of 5S activities at the shop floor and the office area

Unit Code	ASC/N0022
Unit Title (Task)	**Ensure implementation of 5S activities at the shop floor & the office area**
Description	This NOS is about overseeing the implementation of all 5 S activities both at the shop floor and the office area by the team members and training the team in implementation of the 5S principles
Scope	The individual needs to • Ensure sorting, streamlining/ organizing, storage and documentation, systematic cleaning, standardization and sustenance across the plant and office premises of the organization as given in the organization guidelines
Performance Criteria (PC) w.r.t. the Scope	
Element	**Performance Criteria**
Ensure proper sorting of items at the work place	PC1. Ensure all recyclable materials are put in designated containers PC2. Ensure no Tools, fixtures & jigs are lying on workstations unless in use and no un-necessary items is lying on workbenches or work surfaces unless in use PC3. Ensure that the operators and other team members are segregating the waste in hazardous/ Non Hazardous waste as per the sorting work instructions PC4. Ensure that all the operators are following the technique of waste disposal and waste storage in the designated bins PC5. Segregate the items which are labelled at red tag items for the process area and keep them in the correct places PC6. Ensure that all the tools/ equipment/ fasteners/ spare parts are arranged as per specifications/ utility into proper trays, cabinets, lockers as mentioned in the 5S guidelines/ work instructions PC7. Check for return of any type of extra material and tools to the designated sections and make sure that no additional material/ tool is lying near the work area PC8. Oversee removal of unnecessary equipment, storage, furniture, unneeded inventory, supplies, parts and material PC9. Ensure that areas of material storage areas are not overflowing PC10. Ensure proper stacking and storage of the various types of boxes and containers as per the size/ utility to avoid any fall of items/ breakage and also enable easy sorting when required
Ensure proper documentation and storage – streamlining & organizing the workplace	PC11. Ensure that the team follows the given instructions and checks for labelling of fluids, oils. lubricants, solvents, chemicals etc. and proper storage of the same to avoid spillage, leakage, fire etc. PC12. Make sure that all material and tools are stored in the designated places and in the manner indicated in the 5S instructions PC13. Ensure that organizing the workplace takes place with due considerations to the principles of wasted motions, ergonomics, work & method study .

ASC/N0022: Ensure implementation of 5S activities at the shop floor and the office area

Ensure cleaning of self and the work place	PC14. Ensure that the area has floors swept, machinery clean and is generally neat and tidy. In case of cleaning, ensure that correct displays are maintained on the floor which indicate potential safety hazards PC15. Ensure workbenches and work surfaces are clean and in good condition PC16. Ensure adherence to the cleaning schedule for the lighting system to ensure proper illumination PC17. Ensure self-cleanliness - clean uniform, clean shoes, clean gloves, clean helmets, personal hygiene
Ensure standardization	PC18. Ensure that daily cleaning standards and schedules to create a clean working environment are followed across the plant PC19. Oversee that various cleaning and organizing tasks have been developed and assigned for the work area PC20. Ensure logical and user friendly documentation and file management for all activities across the plant and create guidelines around standardization of processes PC21. Ensure timely creation and sharing of the 5S checklists PC22. Ensure that the 5S manual are available as per the timelines
Ensure sustenance	PC23. Ensure team cooperation during the audit of 5 S activities PC24. Ensure that workmen are periodically trained to address challenges related to 5S PC25. Participate actively in employee work groups on 5S and encourage team members for active participation PC26. Oversee that the staff/operators are trained and fully understand 5s procedures PC27. Ensure that all the guidelines for What to do and What not to do to build sustainability in 5S are mentioned in the 5S check lists/ work instructions and are easily searchable PC28. Ensure continuous training of the team members on 5S in order to increase their awareness and support implementation PC29. Ensure that all visual controls, notice boards, symbols etc. at the manufacturing place are created, working and are put up as per the requirement
Knowledge and Understanding (K) w.r.t. the scope	
Element	**Knowledge and Understanding**
C. Organizational Context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA3. relevant standards, procedures and policies related to 5S followed in the company
D. Technical Knowledge	The user/individual on the job needs to : KB6. have basic knowledge of 5S procedures KB7. know various types 5s practices followed in various areas

ASC/N0022: Ensure implementation of 5S activities at the shop floor and the office area

	KB8. understand the 5S checklists provided in the department/ team KB9. have skills to identify useful & non useful items KB10. have knowledge of labels , signs & colours used as indicators KB11. Have knowledge on how to sort and store various types of tools, equipment, material etc. KB12. know , how to identify various types of waste products KB13. understand the impact of waste/ dirt/ dust/unwanted substances on the process/ environment/ machinery/ human body KB14. have knowledge of best and environment protective ways of cleaning & waste disposal KB15. understand the importance of standardization in processes KB16. understand the importance of sustainability in 5S KB17. have knowledge of TQM process KB18. have knowledge of various materials and storage norms KB19. understand visual controls, symbols, graphs etc.
Skills (S)w.r.t. the scope	
Element	**Skills**
C. Core Skills/ Generic Skills	**Writing Skills**
	The user/ individual on the job needs to know and understand how to: SA10. write basic level notes and observations SA11. note down observations (if any) related to the process SA12. write information documents to internal departments/ internal teams
	Reading Skills
	The user/individual on the job needs to know and understand how to: SA13. read 5S instructions put up across the plant premises
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA14. effectively communicate information to team members inform employees in the plant and concerned functions about 5S SA15. question the process head in order to understand the 5S related issues SA16. attentively listen with full attention and comprehend the information given by the speaker during 5S training programs
D. Professional Skills	**Judgmental Thinking**
	The user/individual on the job needs to know and understand how to: SB10. use common sense and make judgments during day to day basis SB11. use reasoning skills to identify and resolve basic problems using 5S
	Persuasion

ASC/N0022: Ensure implementation of 5S activities at the shop floor and the office area

	The user/ individual on the jobs needs to know and understand how to: SB12. persuade team members to follow 5 S SB13. ensure that the team members understand the importance of using 5 S tool
	Creativity
	The user/individual on the job needs to know and understand how to : SB14. use innovative skills to perform and manage 5 S activities at the work desk and the shop floor SB15. exhibit inquisitive behaviour to seek feedback and question on the existing set patterns of work emerge, techniques in CA/CI around 5 S work practices
	Self -Discipline
	The user/individual on the job needs to know and understand how to: SB16. do what is right, not what is a popular practice SB17. follow shop floor rules& regulations and avoid deviations SB18. lead by example in the plant premises while performing activities related to 5S SB19. ensure self-cleanliness on a daily basis SB20. demonstrate the will to keep the work area in a clean and orderly manner
	Ownership
	The user/individual on the job needs to know and understand how to: SB21. accept additional responsibility for self and the team SB22. encourage self and other to take greater responsibilities for managing 5S SB23. identify obstacles and bottlenecks in the process and find basic level solutions for removing these obstacles
	Decision making
	The user/individual on the job needs to know and understand how to: SB24. use previous experience in resolving problems and taking decisions SB25. make timely and independent decisions on the line/ shift within the boundaries of the delegation matrix of the organization

NOS Version Control

NOS Code	**ASC/N0022**		
Credits(NSQF)	**TBD**	**Version number**	**1**
Industry	**Automotive**	**Drafted on**	**1/03/2014**
Industry Sub-sector	**Manufacturing/ R&D**	**Last reviewed on**	**15/03/2014**
Occupation	**All**	**Next review date**	**15/03/2016**

Criteria for assessment of Trainees

JOB ROLE	Test Engineer : Product, Vehicle L5
Qualification Pack	ASC/Q 8403
No. Of NOS	4 Role specific ,2 generic

NOS Title/ NOS Elements	NOS & Performance Criterion Description	Marks allocation	
ASC/N 8405	**Set up and conduct engine test**	**Viva**	**Practical**
Understanding the testing requirement and the process	PC1. Ensure that the team members understand and follow all the does and don'ts of the testing process as defined in SOPs/ Work Instructions or defined by supervisors PC2. Understand the engine testing requirements (based on the type of engine to be tested) as mentioned in the testing instructions sheets/ work instructions/ testing control plan PC3. Understand the testing methodology, equipment and process required as per the process manuals/ Work Instructions/Standard Operating Procedures PC4. Ensure that the correct testing document containing the specified setup drawing, testing schedules, testing parameters, test specifications and test outcome ranges are mentioned PC5. Ensure all tools and equipment required for testing are present near the engine testing platform/test bench/ test chamber/ dynamometer PC6. Ensure that the testing platform/ test bench/ test chamber/dynamometer is clean and free of any external factors which may impact the test results	20	30
Conduct the dynamometer test for the engine	PC7. Prepare the dynamometer test platform and the prototype engine for testing PC8. Ensure that the engine is mounted on the testing bench/ testing platform and is securely clamped PC9. Connect the engine to the dynamometer as per the instructions mentioned in the testing instruction manual/ Work Instructions/ Control Plan PC10. Ensure that all the dynamometer test auxiliaries like starters, air intake fans, exhaust systems, air and oil filters, wire connections, instrumentation connections, fuel supply connections etc. are connected as per the testing instructions/ Standard Operating Procedures PC11. Ensure that the connections checklist is cross checked to complete the test setup PC12. Ensure that the specified modules are selected from the test computer controls in order to execute the test and record the observations	20	40

	PC13. Ensure that the engine is filled with the specified quantity of oil and fuel as mentioned in the instruction manual before starting the testing PC14. Start the engine, ensure that it starts within the correct time period. Keep the engine in the start mode and then turn it off. Ensure that the engine start and turn off time is as per the test performance range PC15. Start the engine again and carry out the remaining tests PC16. Ensure that the start sequence of the engine is as per the specifications given in testing manual PC17. Increase throttle (power) application on the engine to observe performance on different stages of throttle and output of the engine PC18. Ensure completion of the Full Throttle Performance (FTP) / Part Throttle Performance (PTP) test to understand the engine performance under different loading conditions PC19. Record the observations of stationary power, torque output and roll of the engine and conduct first level performance analysis PC20. Check the flow of air, oil, fuel through the engine as per the required performance standards mentioned in the testing manual PC21. Check for any leakages in air, oil and fuel, temperature and pressure of the fuel and oil in the engine combustion chamber using the test instrumentation and observation displays on the computer controlled dynamometer test apparatus PC22. Check the fuel and oil flow during various stages of power application as per the testing checklist PC23. Check the engine piston displacement, fuel injection system and the ignition system parameters as per the testing checklist PC24. Check the physical components of the engine like filters, pumps, gaskets etc. to determine any kind of leakage and physical damage/ deformations PC25. Shut down the engine after running it for the prescribed time limit PC26. Again restart the engine after the pre decided time interval (10 – 15 minutes) to repeat the tests and record observations PC27. Shut down the engine and remove the engine accessories like pumps and filters to check for any impurities and contaminations PC28. Ensure safe demounting of engine and accessories from the dynamometer test platform	30	50
Conduct emission testing	PC29. Ensure proper connections of the engine and engine		

for the engines	accessories to the dynamometer testing platform PC30. Addition to the dynamometer, connect the engine exhaust to the exhaust gas analysis system and the Data Acquisition system and Data loggers for recording and analysing the gas and smoke exhaust PC31. Run the engine at different power levels and note the observations on the exhaust gas analysis system PC32. Observe the displays on the gas analyser/ infrared analysers/ gas chromatograph to measure the exhaust levels of Hydrocarbons (HC), Carbon Monoxide (CO), Carbon Dioxide (CO_2), Nitrogen Oxide(NO) and Nitrogen Dioxide/ Trioxide (NO_X) PC33. Compare the levels of HC and gases with the Standards/ Environmental Regulations for the type of the engine and vehicle PC34. For diesel engines conduct the dilution tunnel test for measuring the particulate matter in diesel engines PC35. Ensure the dilution tunnel test apparatus is connected to the engine and the test procedure is as per the testing process manual PC36. Ensure the measurement of Fuel Combustion rate and analysis of Fuel Combustion process to meet the required Air/ Fuel ratio as specified in the testing instructions/ testing manual	20	40
Conduct the Swirl Test on the engine	PC37. Prepare the test apparatus for the swirl test as per the testing procedure established for the particular engine PC38. Ensure connection of surge tank, pressure monitoring devices, swirl meters and the required valves as per the procedure given in the testing manual/ testing instructions PC39. Conduct swirl test on diesel engines. Ensure measurement by mean flow coefficients and mean swirl values for the input port of the engine PC40. Calculate the mean flow coefficients at the output port of the engine PC41. Ensure first level comparison of the Swirl Test results with the CFD test conducted using Paddle wheel methodology PC42. Record observations of any deviations from the standard values and inform the concerned teams	10	30
Analysis of test results	PC43. Collate all the test results in the required formats as prepared by the core R&D team PC44. Compare the test results with the standard values recommended by the cross functional engine design team and highlight any deviations PC45. Compare the test results with the regulatory norms especially on emissions and ensure that the engine	20	30

	design team is informed of the results in order to take corrective steps PC46. Compare the test results with benchmarked values for engine performance, emissions, fuel consumption PC47. Ensure plotting of Power Curves and Torque Curves to analyze engine performance		
	subtotal	**120**	**220**
ASC/N 8406	**Carrying out various indoor tests**	**Viva**	**Practical**
Understanding the testing requirement and the process	PC1. Understand the component testing requirements (based on the type of component to be tested) as mentioned in the testing instructions sheets/ work instructions/ testing control plan PC2. Understand the testing methodology, equipment and process required as per the process manuals/ Work Instructions/Standard Operating Procedures PC3. Ensure that the correct testing document containing the specified setup drawing, testing schedules, testing parameters, test specifications and test outcome ranges are mentioned PC4. Ensure all tools and equipment required for testing are present near the testing platform/test bench/ test chamber PC5. Ensure that the testing platform/ test bench/ test chamber is clean and free of any external impurities which may impact the test results	30	40
Measurement of Noise, Vibration and Harshness (NVH)at the Noise and Acoustic Testing Laboratory	PC6. Ensure that the Engine and component semi Anechoic Chamber is clean and free from any dust and external impurities PC7. Ensure that the Semi Anechoic Chamber has all the required equipment and tools for conduction the Noise, Vibration and Harshness test of the engine and other components PC8. Connect the engine with the dynamometer as per the instructions mentioned in the testing instruction manual/ Work Instructions/ Control Plan PC9. Ensure that all the dynamometer test auxiliaries like starters, air intake fans, exhaust systems, air and oil filters, wire connections, instrumentation connections, fuel supply connections etc. are connected as per the testing instructions/ Standard Operating Procedures PC10. Ensure that the fitter connects all the data logging devices/ Sound absorption devices& microphones as mentioned in the Work Instructions/ Standard Operating Principle manual PC11. Ensure that the connections checklist is cross checked to complete the test setup PC12. Ensure proper connections of the sound meter, vibration	20	40

	meters and other Data Acquisition System for recording noise and vibrations present during the engine run process PC13. Switch on the dynamometer and apply various levels of throttle PC14. Ensure that any unwanted noises like squeaks, rattles and other engine noises are captured during the test and recorded PC15. Ensure that the various noise and vibration producing components like gear box, transmission shafts, wheels, silencer, exhaust pipes, radiators, compressors etc. are connected to the Acoustic Holography equipment, Sound Level Meters and Vibration Meters to measure the noise and vibration levels of these components during the engine run on no load/ on load and full load conditions PC16. Ensure that other than the noise and vibration produced, the acoustic testing equipment also captures the sound absorption potential and damping potential of the components (and material used in the components) PC17. Ensure that other than the engine operation noise and vibrations, noise related to intake and exhaust are also correctly captured. PC18. Correctly connect test component and the acoustic meters and ensure measurement of source sound and capability of the material to absorb the noise by testing the components in the Reverberation room PC19. Conduct Advanced Modal Analysis (using electromagnetic shakers), Operational Modal analysis, Transfer path analysis, Frequency analysis, sound quality analysis and sensitivity analysis and represent findings to the testing manager PC20. Conduct damping ratio analysis, Sound intensity mapping and Noise Contribution Analysis for all tested components PC21. Ensuring recording and reporting procedures and systems are in place at the time of conducting the NVH tests PC22. Ensure correctness in data capturing and data recording for all sources of noise PC23. Collate all the test results in the required formats as prepared by the core R&D team PC24. Compare the test results with the standard values recommended by the cross functional design team and highlight any deviations PC25. Compare the test results with the regulatory norms especially Central Motor Vehicle Regulations on NVH and ensure that the engine design team is informed of the	20 20	50 60

	results in order to take corrective steps PC26. Compare the test results with benchmarked values for Noise, Vibration and Harshness and with the previous test results		
Measurement of Fatigue levels and structural dynamics in the Stress/ Fatigue testing laboratory	PC27. Ensure regular cleaning and maintenance of Fatigue Lab equipment like Fatigue Testing Machines, Servo Hydraulic Actuators, Material testing machine, impact testing machine, bending machines, torsional machines PC28. Ensure development of the test bogey for conducting the structural durability tests/ fatigue test/ stress test to be conducted in the Structure Durability Laboratory PC29. Ensure design and fabrication of the fixtures for conducting the durability tests PC30. Ensure test setup for components undergoing repeated vibrations and subjecting to frequent stresses like fuel tank, fuel system, crankshaft, connecting rods, suspension, powertrain and axle system PC31. Ensure proper connection of instruments like strain gauge, load cell and other servo hydraulics machines to induce and measure stress levels on the components PC32. Ensure that the laboratory fitter is making the required connections with stress inducing equipment and data logger/ Data Acquisition System as mentioned in the Standard Operating Procedure manual/ Work Instructions PC33. Make sure that the correct testing parameters are selected and accordingly test positions are defined for the process PC34. Conduct performance and durability tests on various types of suspension springs like coil spring, leaf spring and various shock absorbers . Ensure measurement and recording of key data points like application of force, test cycle, deformation etc. PC35. Conduct resonance testing for critical automotive components like chassis frame, cross member, gears, transmission rods, crankshafts etc. to detect cracks, breaks and related metallurgical damage and also ensure durability of these components under repeated high stress environment PC36. Conduct strength test for various automobile components like door frames, door latches, windows, clutch pedals, brake shoe & pedal, accelerator pedals, steering wheel & column etc. PC37. Conduct measurement of bending strength of the crankshafts, transmission rods, gear teeth by conducting the bending and distortion strength test rig	40	100

	PC38. Setup the strain and shearing test apparatus for testing of brake lines. Conduct testing of brake discs, brake lining, brake calipers and brake systems PC39. Conduct durability and strength tests for belts, straps and buckles of the safety system PC40. In case of durability tests done under different controlled environment conditions, ensure that the dust shower apparatus, mist chamber, environment chamber and water spray booth are regularly cleaned and maintained PC41. Ensure setting up of dust shower, mist chamber, environment chamber and water shower apparatus and selection of spray parameters like test cycle time, velocity and angle of spray, temperature and humidity inside the test chamber PC42. Collate all the test results in the required formats as prepared by the core R&D team PC43. Compare the test results with the standard values recommended by the cross functional conceptualization and design team and highlight any deviations PC44. Compare the test results with the regulatory norms on vehicle structures, metallurgical strength parameters, life cycle durability and ensure that the design and prototyping team is informed of the results in order to take corrective steps PC45. Compare the test results with benchmarked values for stress, fatigues and durability tests and the previous tests conducted. Compare test results for performance before and after the durability test cycles and highlight deviations if any. PC46. Conduct first level FMEA and Root Cause Analysis post comparison of test results. Ensure that the first level analysis is timely shared with the testing manager		
Testing of materials used in components and vehicle manufacturing	PC47. Ensure selection of specified type of material testing process as indicated in the testing manual/ Work instructions PC48. Connect the component under test to the respective material testing PC49. Device as per the standard operating procedures PC50. Ensure testing of all metallic & non- metallic components, fluids, oils and lubes used in the components and automobiles PC51. Ensure testing of components as per the national and international standards defined for automobile industry performance PC52. Conduct component surface analysis and component failure analysis using spectroscopy technique PC53. Ensure loading of the test component in the Universal	20	60

	Testing Machine (UTM) as per the instructions defined in the testing manual/ SOP manual PC54. Conduct the tensile and compression tests on the components as per the process mentioned in Work Instructions/ Control Plan PC55. Analyze various stress related parameters like elasticity, Poisson Ratio (Stress/ Strain), Stress Strain Curves and share first level results with the Test manager PC56. Conduct Spectrometer test and Viscosity test on polymer products, oils and lubricants as per the test instructions given in the SOP manual PC57. Verify the hardness of various material using the Rockwell Hardness Test as per the test instructions given in the SOP manual		
	subtotal	**150**	**350**
ASC/N 8407	**Conduct Vehicle performance tests**	**Viva**	**Practical**
Understanding the testing requirement and the process	PC1. Understand the vehicle testing requirements (based on the type of vehicle to be tested) as mentioned in the testing instructions sheets/ work instructions/ testing control plan PC2. Understand the testing methodology, equipment and process required as per the process manuals/ Work Instructions/Standard Operating Procedures PC3. Ensure that the testing document contains the specified setup drawing, testing schedules, testing parameters, test specifications and test outcome ranges are mentioned PC4. Ensure all tools and equipment required for testing are present near the testing area	30	10
Measure the transmission power from the engines to the power train using chassis dynamometer test	PC5. Park the automobile under test in the vehicle testing cell and connect the assembled engine to the chassis dynamometer as per the instructions mentioned in the testing instruction manual/ Work Instructions/ Control Plan PC6. Ensure that the dynamometer drive rolls are correctly aligned with the vehicles tires PC7. Ensure that all the dynamometer data acquisition systems is connected auxiliaries like starters, air intake fans, exhaust systems, air and oil filters, wire connections, instrumentation connections, fuel supply connections etc. are connected as per the testing instructions/ Standard Operating Procedures PC8. Check the completion of safety precautions especially fire fighting safety measures before initiating the dynamometer test as per the safety checklist provided by the safety team PC9. Check the connections of the Air Intake Fan, Heat	20	50

	Exchanged Fan, Exhaust Air Fan as per the testing manual/ Standard Operating Procedures PC10. Measure the tire pressure, engine temperature, coolant temperature before starting the dynamometer. Ensure that the tire distortion due to drive roll pressure is recorded by the system PC11. Start the dynamometer at the defined gear levels and the required engine throttle levels as defined in the testing procedure manual/ testing instructions PC12. Ensure correct measurement of engine air flow, intake air flow, heat exchanger air flow, engine temperature, coolant temperature, fuel flow etc. through the data logging units connected to the computer PC13. Ensure measurement and calculation of Air Fuel ratio, engine RPM, roll speed, engine load, air flow, engine temperature and pressure PC14. Change the gears as per the cycle time mentioned in the testing instruction manual PC15. Conduct the first level analysis of Power (in HP) Vs. Engine Speed in RPM) to validate engine performance against the recommended values by the product conceptualization team PC16. Connect the engine exhaust to the exhaust gas analysis system and the Data Acquisition system and Data loggers for recording and analysing the gas and smoke exhaust PC17. Run the engine at different power levels and note the observations on the exhaust gas analysis system PC18. Observe the displays on the gas analyser/ infrared analysers/ gas chromatograph to measure the exhaust levels of Hydrocarbons (HC), Carbon Monoxide (CO), Carbon Dioxide (CO2), Nitrogen Oxide(NO) and Nitrogen Dioxide/ Trioxide (NOX) PC19. Compare the levels of HC and gases with the Standards/ Environmental Regulations for the type of the engine and vehicle exhaust PC20. Compare the test results with the regulatory norms especially on emissions and ensure that the engine design team is informed of the results in order to take corrective steps PC21. Compare the test results with benchmarked values for engine performance, emissions, fuel consumption PC22. Ensure plotting of Power Curves and Torque Curves to analyse engine performance	20	50
Conduct safety and homologation tests as per the regulations	PC23. Ensure that the specification document is received from the prototyping and homologation team with the Project Cross Functional Team structure		

	PC24. Check the version of the information document and also the approval stages from with the information document has passed PC25. Understand the type of regulations existing in the automotive space with respect to the vehicle/ aggregate under test PC26. Verify the required parameters as per the type of vehicle under test and the mandatory regulatory norms as per the checklist provided by the cross functional team PC27. Ensure that vehicle usage type and the geography in which the vehicle is to be deployed is given in the information document PC28. Setup the test bench/ test platforms as per the homologation tests to be conducted PC29. Conduct the required homologation tests – On Road and lab tests as per the regulation checklist of the given geography PC30. Evaluate engine performance, emissions, vehicle safety, vehicle specifications, vehicle type and weight, load capacity, dimensions, vehicle running stability, braking specifications, mileage and other parameters as per the governing standards of the type/ geography PC31. Evaluate the test results , compare them with internal and external benchmarks & regulatory requirements like Bharat Stage norms, Automobile Industry Standards (AIS), Central Motor Vehicle Regulations, Central Motor Vehicle PC32. Check the endurance and durability of the vehicle doors and latches using PLC based test systems PC33. Test the operations of the lighting systems such as lamps, head lights and fog lamps using the lamp focus test and lamp brightness test as per the safety norms prescribed by the organization PC34. Test the operations of the signalling systems like reflectors and indicators including brightness, visibility, blinking speeds etc. as per the checklist provided for signal testing PC35. Conduct bumper durability test using front and side moving block and record observations PC36. Setup the component impact testing rig as per the safety test requirements mentioned in the testing manual PC37. Conduct the Drop test, Head impact test and the side impact test on vehicle body, impact test on doors, windows, steering columns and engine to validate the effect of any external impact on the overall performance of the vehicle PC38. Check the brake system performance by conducting	20	50

	performance /durability tests & measurements/observations on brake lining, brake shoes, braking fluid and friction material as per the instructions and conditions given in the test manual/ Work Instructions		
Conduct environment testing to ensure all weather worthiness of the vehicle	PC39. Setup the vehicle under testing for different controlled environment conditions PC40. Ensure that the dust shower chamber, mist chamber, environment chamber and water spray booth are regularly cleaned and maintained within the respective test chambers PC41. Ensure setting up of dust shower, mist chamber and water shower apparatus and selection of spray parameters like test cycle time, velocity and angle of spray, temperature and humidity inside the test chamber PC42. Check for any leakages of dust, mist and water inside the vehicle to determine any structural flaws with the test vehicle PC43. Check the working of safety measures like windshield wiper movement, rear view and side view mirror visibility while performing the dust, mist and water shower test PC44. Check the durability of the wind shield and side view mirror glass to detect any flaws like cracks, dust/ water accumulation on the glass etc. PC45. Setup the thermal test chamber to conduct the hot weather and cold weather test on the engine performance PC46. Collate all the test results in the required formats as prepared by the core R&D team PC47. Compare the test results with the standard values recommended by the cross functional conceptualization and design team and highlight any deviations	30	60
Conduct suitable tests to detect Noise, Vibrations and Harshness (NVH) in a running vehicle	PC48. Setup the NVH testing Pass by Noise test apparatus on the test track for testing the NVH functionality of the vehicle under test PC49. Ensure the microphone is placed as the specified distance and right angle as prescribed in the testing manual to measure pass by noise, engine vibration noise, air conditioning noise, intake/ exhaust noise, transmission vibrations, chassis vibrations, suspension vibrations for 2 wheelers, 4 wheelers and heavy vehicles PC50. Ensure that the data loggers, sound meters, vibration detectors are placed at the correct places to successfully capture any types of squeaks, rattles coming from the test vehicle PC51. Measure the noise levels for various loading conditions of the vehicle and note down the test results	20	50

	PC52.Measure the cabin noise in case of heavy vehicles and passenger compartment noise for cars and buses PC53.Compare the test results with the norms prescribed in the motor vehicle regulations such as Central Motor Vehicle Regulations, Motor Vehicle Act as applicable PC54.Conduct a first level analysis of the NVH test results and present the report to the testing manager for detailed analysis		
	subtotal	**130**	**270**
ASC/N 8408	**Testing Vehicle performance**	**Viva**	**Practical**
Conduct Out Door Testing of vehicles to ensure durability, reliability and high performance	PC1. Understand the vehicle specifications of the test vehicle and the test specifications PC2. Confirm with the test manager, the test procedure to be applied for conducting the various types of outdoor testing of vehicles PC3. Confirm with the test manager, the various data points which need to be captured and analysed during the running test of the vehicle PC4. Ensure that the right instruments as mentioned in the testing manual are used to capture the vehicle performance data PC5. Ensure that the test driver has the complete briefing of the various types of tests to be performed on a running vehicle PC6. Ensure complete testing of vehicle manoeuvrability, durability, vehicle performance, structural durability, ride comfort, NVH and vehicle safety PC7. Ensure that the drivers have a clear understanding of each type of parameter to be tested on a running vehicle PC8. Check the connections of the various data capturing meters and instrumentation such as load cells, pneumatic/ PLC testing gauges, strain gauges, displacement transducers, accelerometers, GPS data collection devices and data loggers to capture the data points during the vehicle running condition PC9. Confirm that all the safety features required for the vehicle under running condition are working and are checked as per the vehicle safety check list provided PC10. Ensure that the fitter checks of fuel level, oil/ lubricant level, cooling water level, tyre pressure etc. are checked before starting the on road testing of the vehicle prototype PC11. Ensure that any type of system warning indicators showing system failures, loose connections, malfunctioning etc. are addressed before starting the various types of road tests PC12. Ensure that the test drivers completes all the	30	30

	tests to be performed to test the performance of the vehicle under stress conditions PC13. Ensure that the test driver as well as the data logging system captures vehicle performance parameters like torque, braking, vibrations, pickup, overall vehicle handling, driver comfort etc. on various torture tracks like rough stone track, corrugated tracks, bumpy tracks, potholed tracks, sand & mud tracks etc. PC14. Ensure that the test driver as well as the data logging system captures vehicle performance parameters like torque, braking, vibration, acceleration/ deceleration, driver comfort, tyre grip etc. on paved road tracks with different loading conditions PC15. Ensure that the test driver as well as the data logging system captures vehicle performance parameters like torque, vibrations, pickup, water seepage, ease of tyre movement, engine stalling etc. during the water trough wading test and ensure that the various levels of water depth/ vehicle depth in water are recorded PC16. Ensure that the vehicle performance is measured at various slope levels by performing the vehicle gradient test. Ensure that the performance is captured by the data loggers at all incline slope angles PC17. Ensure that the test driver and the data loggers are capturing the parameters during the running of vehicles on steering pads, flat straight roads and serpentine tracks to collect data for analysing manoeuvrability, steering comfort, braking power, acceleration/ deceleration, pass by noise, vibrations, tyre grip, turning radius durability, reliability and vehicle handling ability at different loading conditions PC18. Ensure that the test driver completes the 80 km/hour speed braking test, low speed braking test and short distance breaking test to validate the braking distance, vehicle performance, driver comfort, durability and vehicle stability during various braking conditions under various environment conditions like dry roads, wet roads, muddy tracks etc. as well as setting conditions viz. one circuit, half worn condition, brake fluid levels as specified. PC19. Ensure that the driver and the data logging systems capture relevant data such as driving comfort, vehicle mileage, engine performance etc. during long distance endurance testing of vehicles on cross country drives PC20. Ensure that all types of Noise and Vibrations in the running vehicle are captured by the data logging	50	100

	system and the test drivers especially engine noise & vibration, cabin noise, noise & vibration due gear changing/ transmission, noise from intake and exhaust system during different running on road tests PC21. Check the completion of other vehicle performance tests like Tilting test, crash test and aerodynamic test by ensuring correct fitment of data logging devices and required drive testing/ stationary testing as per the instruction mentioned in the testing procedure manual PC22. Ensure individual and collective meetings with the test drivers to take inputs on their overall vehicle driving experience and experience related to various tests performed PC23. Analyse all the information collected by the various data logging devices and compare the same with the regulatory norms and internal/ external benchmarks PC24. Ensure timely preparation of the first level test report and share the same with the test manager	40	10
	subtotal	**120**	**140**
ASC/N 0006	**Maintain safe , healthy environment friendly workplace**	**Viva**	**Practical**
Identify and report the risks identified	PC1. Identify activities which can cause potential injury through sharp objects, burns, fall, electricity, gas leakages, radiation, poisonous fumes, chemicals ,loud noise PC2. Inform the concerned authorities about the potential risks identified in the processes, workplace area/ layout, materials used etc. PC3. Inform the concerned authorities about machine breakdowns, damages which can potentially harm man/ machine during operations PC4. Create awareness amongst other by sharing information on the identified risks	20	50
Create and sustain a Safe, clean and environment friendly work place	PC5. Follow the instructions given on the equipment manual describing the operating process of the equipment PC6. Follow the Safety, Health and Environment related practices developed by the organization PC7. Operate the machine using the recommended Personal Protective Equipment (PPE) PC8. Maintain a clean and safe working environment near the work place and ensure there is no spillage of chemicals, production waste, oil, solvents etc. PC9. Maintain high standards of personal hygiene at the work place PC10. Ensure that the waste disposal is done in the designated area and manner as per organization SOP. PC11. Inform appropriately the medical officer/ HR in case of self or an employee's illness of contagious nature so that	50	40

	preventive actions can be planned for others		
	subtotal	**70**	**90**
ASC / N 0021	**Maintain 5 S activities at the workplace**	**Viva**	**practical**
Ensure sorting	PC1. Follow the sorting process and check that the tools, fixtures & jigs that are lying on workstations are the ones in use and un-necessary items are not cluttering the workbenches or work surfaces. PC2. Ensure segregation of waste in hazardous/ non Hazardous waste as per the sorting work instructions PC3. Follow the technique of waste disposal and waste storage in the proper bins as per SOP PC4. Segregate the items which are labelled as red tag items for the process area and keep them in the correct places PC5. Sort the tools/ equipment/ fasteners/ spare parts as per specifications/ utility into proper trays, cabinets, lockers as mentioned in the 5S guidelines/ work instructions PC6. Ensure that areas of material storage areas are not overflowing PC7. Properly stack the various types of boxes and containers as per the size/ utility to avoid any fall of items/ breakage and also enable easy sorting when required PC8. Return the extra material and tools to the designated sections and make sure that no additional material/ tool is lying near the work area PC9. Follow the floor markings/ area markings used for demarcating the various sections in the plant as per the prescribed instructions and standards	10 10	20 20
Ensure proper documentation and storage (organizing , streamlining)	PC10. Follow the proper labeling mechanism of instruments/ boxes/ containers and maintaining reference files/ documents with the codes and the lists PC11. Check that the items in the respective areas have been identified as broken or damaged PC12. Follow the given instructions and check for labelling of fluids, oils. lubricants, solvents, chemicals etc. and proper storage of the same to avoid spillage, leakage, fire etc. PC13. Make sure that all material and tools are stored in the designated places and in the manner indicated in the 5S instructions	10	20
Ensure sustenance	PC14. Follow the daily cleaning standards and schedules to create a clean working environment PC15. Attend all training programs for employees on 5 S PC16. Support the team during the audit of 5 S PC17. Participate actively in employee work groups on 5S and encourage team members for active participation PC18. Follow the guidelines for What to do and What not to do to build sustainability in 5S as mentioned in the 5S check lists/ work instructions	20	30

	Sub total	**60**	**130**
	Total	**650**	**1200**