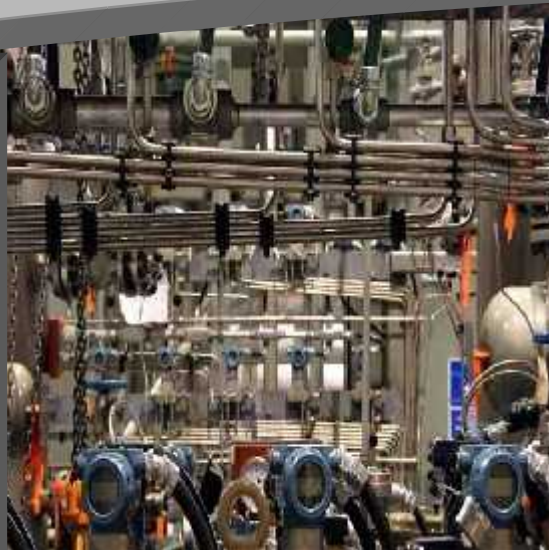


QUALIFICATIONS PACK - OCCUPATIONAL STANDARDS FOR INSTRUMENTATION AUTOMATION SURVEILLANCE AND COMMUNICATION INDUSTRY



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- Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

SECTOR: INSTRUMENTATION AUTOMATION SURVEILLANCE & COMMUNICATION

SUB-SECTOR: Instrumentation

OCCUPATION: Testing & Calibration

REFERENCE ID: IAS/Q5012

ALIGNED TO: NCO-2015/ NIL

Brief Job Description: Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow) is responsible for performing calibration of instruments / devices used for measurement of Pressure, Vacuum and Flow of Water using authorized calibration setup and procedure in accordance with ISO/IEC 17025:2005 or equivalent standards.

Personal Attributes: This job requires the individual to be disciplined, assertive, team player, possess analytical skills and problem solving ability, effective communicator and have the ability to work under pressure.

Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

Job Details	Qualifications Pack Code	IAS/Q5012		
	Job Role	Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)		
	Credits(NSQF)	TBD	Version number	1.0
	Sector	Instrumentation, Automation Surveillance and Communication	Drafted on	30/09/2017
	Sub-sector	Instrumentation	Last reviewed on	30/09/2017
	Occupation	Testing & Calibration	Next review date	30/09/2019

Job Role	Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)
Role Description	Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow) is responsible for performing calibration of mechanical instruments used for Mass, Balance, Volume, Density and Viscosity measurements using authorized calibration setup and procedure in accordance with ISO/IEC 17025:2005 or equivalent standards
NSQF level	4
Minimum Educational Qualifications	B.Sc.(with Physics as a subject), Diploma in Mechanical, Instrumentation/ Electrical/Electronics. Final year students eligible for On Job Training and Certification Assessment.
Maximum Educational Qualifications	NA
Training (Suggested but not mandatory)	Practical hands-on training in Basics of Pressure and Flow Metrology and Pressure, Vacuum, Water Flow Calibration in a calibration laboratory.
Minimum Job Entry (Age)	19 Years
Experience	No prior experience required
Applicable National Occupational Standards (NOS)	<p>Mandatory:</p> <ol style="list-style-type: none"> IAS/N5033 Ensure Work Place Readiness - Mechanical (Pressure, Vacuum, Water Flow) Calibration IAS/N5034 Perform Calibration of Pressure and Vacuum Indicating Devices IAS/N5035 Perform Calibration of Water Flow measuring devices IAS/N5036 Preventive Maintenance of Pressure, Vacuum, Water Flow Calibration Setup IAS/N0204 Reporting of Task Performed -Calibration IAS/N2105 Work Effectively with Teams

Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

Performance Criteria	As described in relevant OS units

Definitions	Keywords /Terms	Description
	Calibration	Calibration is the process of determining and verification of the physical characteristics of a system with reference to an established primary or secondary standard for that physical quantity, as prescribed by a national or international standard. Calibration assures the integrity and accuracy of a measurement device or system. Calibrations are performed according to accepted international standards so that there is global uniformity in dealing with physical quantities and their technical, trade and economic consequences.
	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 OS these include communication related skills that are applicable to most job roles.
	Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a data base to verify that this is the appropriate OS they are looking for.
	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 group of persons.
	Instrumentation	Instrumentation is the variety of measuring instruments to monitor and control a process. It is the art and science of measurement and control of process variables within a production, laboratory, or manufacturing area.
	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 statements which together specify the technical, generic, professional and organizational specific knowledge that an individual needs in order to perform to the required standards.
	National occupational standards	NOS are occupational standards which apply uniquely in the Indian context.
	Occupation	Occupation is a set of job roles under which role holders perform similar/related set of functions in an industry.
	Organizational context	Organizational context includes the way the organization is structured and how it operates, including the operative knowledge managers have of their relevant areas of responsibility.

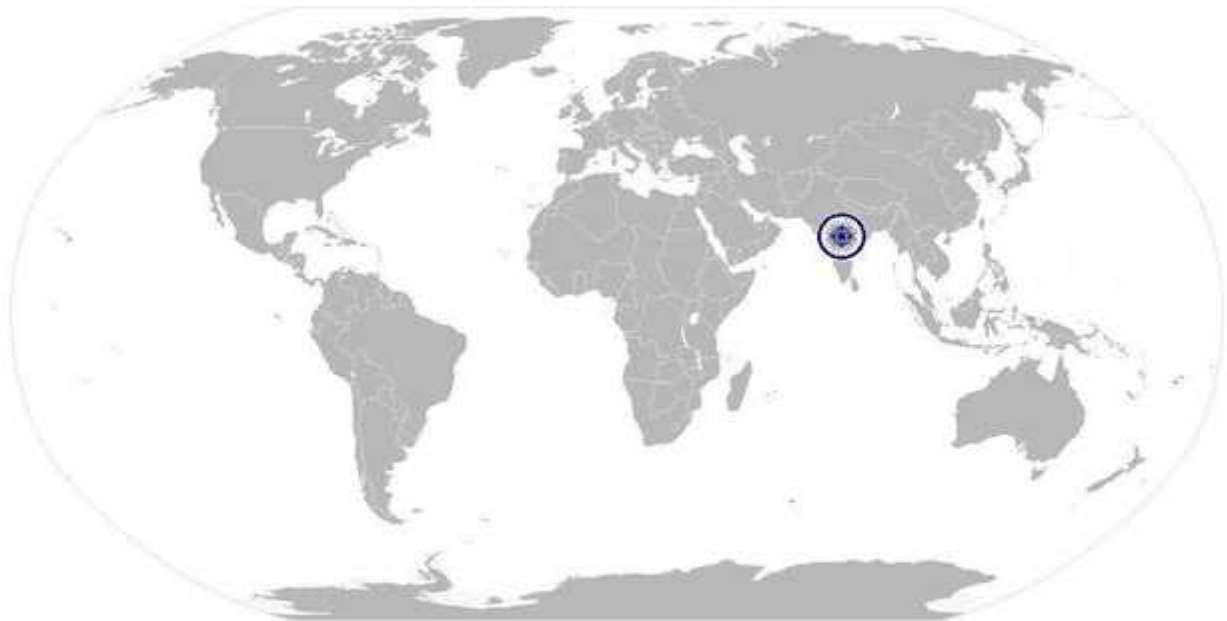
Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

OS (Occupational Standards)	OS specify the standards of performance an individual must achieve when carrying out a function in the work place together with the knowledge and understanding they need to meet that standard consistently. Occupational standards are applicable both in Indian and global contexts.
Performance Criteria	Performance criteria are statements that together specify the standards of performance required when carrying out a task.
Qualification pack code	Qualification pack code is a unique reference code that identifies a qualification pack.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with, carrying out the function which has a critical impact on the quality of performance required.
Sector	Sector is a conglomeration of different business operation 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.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Traceability	Ability to correlate calibration of equipment to national and international standards - ultimately to secondary and primary standards.
Unit Code	Unit code is a unique identifier for an 'OS' unit which can be denoted with either 'O' or 'N'.
Unit title	Unit title gives clear overall statement about what the incumbent should be able to do.

Acronyms	Keywords /Terms	Description
	PM	Preventive Maintenance
	SOP	Standard Operating Procedures
	UUC	Unit Under Calibration
	Metrology	HFHHGH
	Reference Instrument	In the context of this document, the Reference Instruments are those used for calibration. These are in fact Working Standards, with calibration traceability.
	Environmental Accommodation	HGHGHGG

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National Occupational Standard



Overview

The OS unit is about ensuring calibration environment and the Readiness and Usability of calibration system and Safety at the workplace.

IAS/N5033

Ensure Work Place Readiness - Mechanical (Pressure, Vacuum, Water Flow) Calibration

National Occupational Standard

Unit Code	IAS/N5033
Unit title (Task)	Ensure Work Place Readiness - Mechanical (Pressure, Vacuum, Water Flow) Calibration
Description	The OS unit is about ensuring the calibration environment; the Readiness and Usability of calibration systems together with the Safety at the workplace as mandated by the organization. The individual follows organization specified handling methods and keeps the calibration equipment and setup in good order.
Scope	<p>The unit/task covers THE following:</p> <ul style="list-style-type: none"> Clean and Uncluttered Workplace Vibration Acoustic Noise Illumination Environmental Conditions - temperature, humidity and barometric pressure Availability and Quality of Power Supply Dust and external air pressure Safety Precautions Availability and Usability of calibration instruments and system Workplace Operational Guidelines
Performance Criteria (PC) with respect to the scope	
Element	Performance Criteria
Maintain Workplace Cleanliness	<p>To be competent, the user/ individual on the job must be able to:</p> <p>PC1. Check workplace for cleanliness of work area and equipment</p> <p>PC2. Ensure an uncluttered workplace</p> <p>PC3. Use prescribed checklist. Note any deviations and report to supervisor</p>
Ensure Vibration norms	<p>To be competent, the user/individual on the job must be able to:</p> <p>PC4. Check / Feel for any abnormal vibrations generated by central air-conditioning plants, vehicular traffic and other sources.</p> <p>PC5. If any vibration is felt which is unusual, then try to locate the source of vibration. Check if special/ protective devices like vibration free tables and pillars etc., isolating the equipment from the floor, are affected in any way.</p> <p>PC6. Report any deviations and findings to the Supervisor and the concerned department.</p> <p>PC7. If the vibration level is above specified limits, Calibration operation may be suspended. Refer to organization SOP for the quantitative</p>

IAS/N5033

Ensure Work Place Readiness - Mechanical (Pressure, Vacuum, Water Flow) Calibration

	<p>measurement of vibration and relation guidelines.</p>
<p>Ensure Acoustic Noise norms</p>	<p>To be competent, the user/ individual on the job must be able to:</p> <p>PC8. Check / Listen for any abnormal noise in the calibration area. Refer to SOP for acceptable noise level - usually less than 60dBA.</p> <p>PC9. If any noise is felt which is unusual, then try to locate the source of noise.</p> <p>PC10. Report any deviations and findings to the Supervisor and the concerned department.</p> <p>PC11. If the noise level affects the Calibration process, then the operation may be suspended. Refer to organization SOP for the quantitative measurement of noise and related guidelines.</p>
<p>Ensure Lighting Environment norms</p>	<p>To be competent, the individual must be able to:</p> <p>PC12. Check for lighting / associated electricals at Pressure, Vacuum, Water Flow Calibration Installation. Report any deviations to electrical department.</p> <p>PC13. Check for adequate lighting and working of associated electrical fittings in the Calibration area. The recommended level of illumination is 250-500 Lux on the working table, or as specified in the SOP.</p> <p>PC14. Check for temporary/unsafe electrical wiring</p>
<p>Ensure Environment norms</p>	<p>To be competent, the individual must be able to:</p> <p>PC15. Check for ambient temperature and humidity in the Calibration area. Refer to organization SOP for the quantitative measurement of temperature, humidity and barometric pressure and the related guidelines.</p> <ol style="list-style-type: none"> a. The reference standards shall be maintained at temperatures specified in order to ensure their conformance to the required level of operation. b. The relative humidity shall be maintained within the required levels. c. Barometric pressure shall be measured with the required accuracy using approved instruments for the correction of experimental pressure/flow as needed. d. The local value of 'g' shall be measured or calculated with the required accuracy using approved instruments / method for the correction of experimental pressure/flow for 'g' as needed. Ensure that the reference standards are maintained at temperatures specified in order to ensure their conformance to the required level of operation.

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Ensure Work Place Readiness - Mechanical (Pressure, Vacuum, Water Flow) Calibration

	<p>PC16. Report any deviations to the concerned department.</p> <p>PC17. If the environment parameters are likely to adversely affect the required accuracy of measurement, then report to the Supervisor and seek guidance about performing calibration.</p>
<p>Ensure Quality of Power Supply</p>	<p>To be competent, the individual must be able to:</p> <p>PC18. Ensure that the power supply of right quality (voltage, frequency, transients, regulation etc.) as specified in SOP is available - usually from a UPS. Check that any isolation transformers and filters etc. installed are not tampered with and the hum interference is within limits.</p> <p>PC19. Ensure that operation of heavy loads in the premises or nearby locations does not cause any dip in voltage or transient currents.</p> <p>PC20. Report any deviations to the concerned department.</p>
<p>Ensure Dust and External Air Pressure norms</p>	<p>To be competent, the individual must be able to:</p> <p>PC21. Ensure that the laboratory is free from dust and external air pressure. Positive air pressure is normally maintained inside the laboratory to avoid ingress of dust.</p> <p>PC22. Report any deviations to the concerned department.</p>
<p>Ensure Safety Precautions</p>	<p>To be competent, the individual must be able to:</p> <p>PC23. Ensure availability of suitable fire extinguishing equipment for possible fire hazards in the laboratory, per SOP.</p> <p>PC24. Ensure familiarity with method of giving the treatment in case of electric shock. Wall chart showing the procedure should be placed near the power supply switchgear and at other prominent places as prescribed under Indian Electricity Rules 1956.</p> <p>PC25. Ensure familiarity with pressure generating devices (compressors) and vacuum pumps and safety precautions to be observed.</p> <p>PC26. Ensure familiarity with various gases used in calibration of pressure measuring instruments and safety precautions relating to these.</p> <p style="padding-left: 40px;">a. Observe precautions for Pressure Gauges to use with oxygen & Acetylene</p> <p>PC27. Report any deviations to the concerned department.</p>
<p>Ensure Availability and Usability of calibration</p>	<p>To be competent, the individual must be able to:</p> <p>PC28. Check for availability of instruments in the pressure, Vacuum and Water</p>

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Ensure Work Place Readiness - Mechanical (Pressure, Vacuum, Water Flow) Calibration

instruments and system	Flow Metrology calibration setup. PC29. Check availability of electrical power and the quality (whether UPS backed, voltage and frequency) as specified in the SOP
Maintain Workplace Operational Guidelines	To be competent, the individual must be able to: PC30. Handle equipment in recommended and safe manner. PC31. Uses hand gloves of specified material for handling the UUC and Reference so that these are not soiled and to avoid heat transfer to Reference equipment or UUC during Calibration which may otherwise drastically affect the results.
Knowledge and Understanding (K)	
A. Organizational context (Knowledge of the company / organization and its process relevant to areas of responsibilities)	The individual on the job needs to know and understand: KA1. The requirements of maintaining environment and cleanliness of the workplace for Calibration operation and how it impacts the organization process and business. KA2. The role of calibration in the organization (whether part of the end user Production and Quality Assurance process or of a calibration service provider) KA3. The impact of calibration quality on the company business
B. Technical Knowledge	The individual on the job needs to know and understand: KB1. The Calibration Technician knows and understands Pressure, Vacuum, Water Flow Metrology process and its impact on calibration accuracy.
Skill(S) [Optional]	
A. Core Skills / Generic Skills	Writing skills
	The individual on the job needs to know and understand: SA1. Use Formats and check list for workplace readiness SA2. Write emails and messages about site related issues
	Reading Skills
	The user/individual on the job needs to know and understand: SA3. Read product literature and manuals relevant for the job SA4. Read the company information about working practices at the site SA5. Read the information displayed at the workplace
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand:

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Ensure Work Place Readiness - Mechanical (Pressure, Vacuum, Water Flow) Calibration

	<p>SA6. Describe site conditions and issues to co-workers and supervisor</p> <p>SA7. Communicate to the management in meetings about site issues to get their support</p> <p>SA8. Interact with coworkers and gather information related to process and site conditions</p>
<p>B. Professional Skills</p>	<p>Decision Making</p>
	<p>The individual on the job needs to know and understand:</p> <p>SB1. Make decisions pertaining to the concerned area of</p>
	<p>Plan and Organize</p>
	<p>The individual on the job needs to know and understand:</p> <p>SB2. Prioritize daily activities for the upkeep of calibration operation through ensuring availability of the calibration setup and its</p>
	<p>Customer Centricity</p>
	<p>The user/individual on the job needs to know and understand:</p> <p>SB3. Real needs of the customer and suggest most appropriate solution</p> <p>SB4. Support customer when they need help</p>
	<p>Problem Solving</p>
	<p>The user/individual on the job needs to know and understand:</p> <p>SB5. Think through the problem, evaluate the possible solution(s) and suggest an optimum /best possible solution(s)</p> <p>SB6. Identify immediate or temporary solutions to resolve delays</p>
	<p>Analytical Thinking</p>
	<p>The user/individual on the job needs to know and understand:</p> <p>SB7. Use the existing information to arrive at actionable decision points</p> <p>SB8. Use the existing information for improving the customer satisfaction</p>
<p>Critical Thinking</p>	
<p>The user/individual on the job needs to know and understand:</p> <p>SB9. Apply, analyze, and evaluate the information gathered from observation, experience, reasoning, or communication, as a guide to thought and action</p> <p>SB10. Anticipate problems, risks and opportunities and utilize these for mitigation and business optimization</p>	

IAS/N5033 Ensure Work Place Readiness - Mechanical (Pressure, Vacuum, Water Flow) Calibration

NOS Version Control

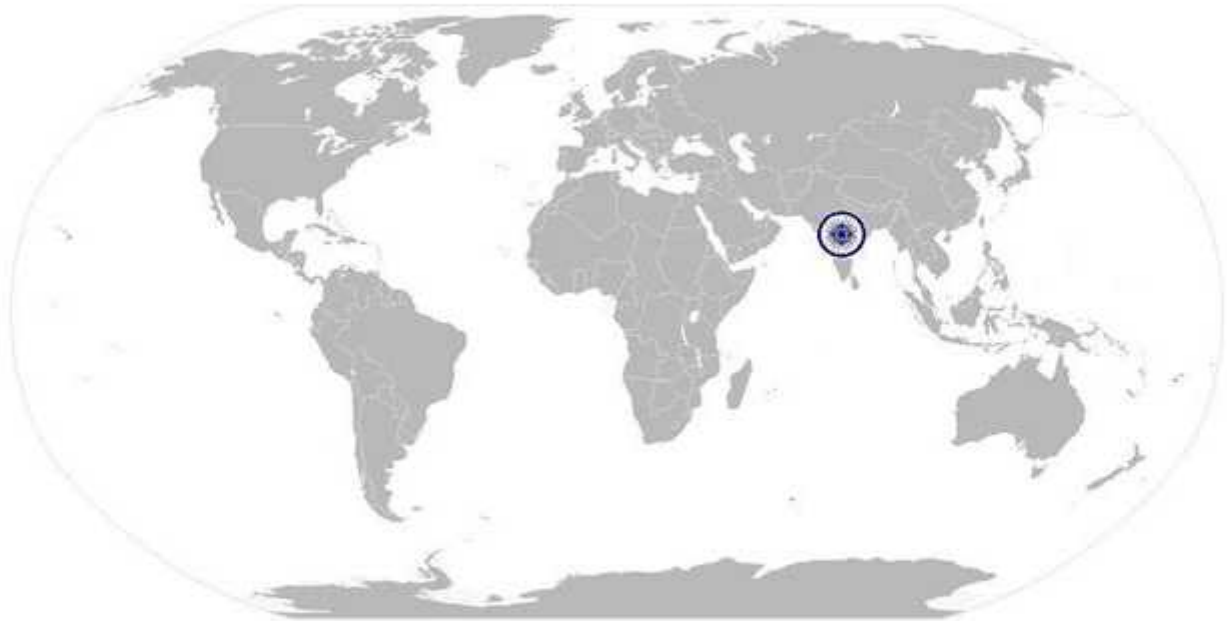
NOS Code	IAS/N5033		
Credits(NSQF)	TBD	Version number	1.0
Sector	Instrumentation, Automation Surveillance and Communication	Drafted on	30/09/2017
Sub-sector	Instrumentation	Last reviewed on	30/09/2017
Occupation	Testing & Calibration	Next review date	30/09/2019



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IAS/N5034 Perform Calibration of Pressure and Vacuum Indicating Devices

National Occupational Standard



Overview

This unit is about Calibration of a range of Pressure and Vacuum Indicating Devices according to industry standards and organization SOP.


IAS/N5034 Perform Calibration of Pressure and Vacuum Indicating Devices

National Occupational Standard	Unit Code	IAS/N5034
	Unit title (Task)	Perform Calibration of Pressure and Vacuum Indicating Devices
	Description	To Perform Calibration of a range of Pressure and Vacuum Indicating Devices according to according to industry standards and organization SOP
	Scope	<p>The unit/task covers the following:</p> <ul style="list-style-type: none"> • Plan and prepare for calibration • Select Pressure Reference Standard / Working Standard and Weights (for dead Weight Testing) • Ensure Metrological Requirements • Ensure Environmental Requirements • Choose Measurement Method • Perform Measurements • Perform Calibration of Industrial Pressure Gauges by using Dead Weight Tester • Perform Calibration of Industrial pressure gauges by using Dead Weight Tester and Reference Pressure Value • Perform Calibration of Pressure Gauges using Digital Pressure Calibrator or Reference Pressure Gauge and Pressure Generating Pump • Perform Calibration of Vacuum Gauges • Perform Calculations, including Uncertainty calculations • Prepare Calibration Report • Restore the Reference instruments and UUC to their respective condition and places
	Performance Criteria (PC) with respect to the scope	
Element	Performance Criteria	

IAS/N5034 Perform Calibration of Pressure and Vacuum Indicating Devices

<p>Plan and prepare for calibration</p>	<p>To be competent, the individual must be able to:</p> <p>PC1. Prepare Observation Sheet (use a standard form/format as specified in the SOP)</p> <p>PC2. Note in the Observation Sheet the details of the UUC (requesting company, lab reference number, type, make, model, serial number, date, time, technician's name etc.)</p> <p>PC3. Verify that the UUC is in good shape (i.e. no physical damage, readable markings, clean, no loose parts etc.)</p> <p>PC4. Note all parameters to measure for the requested calibration</p> <p>PC5. Note the number of readings to be taken for each parameter</p> <p>PC6. Note the Reference Instruments to use for the parameters</p> <p>PC7. Wear gloves while handling instruments</p> <p>PC8. Verify that the Reference Instruments are available and are in good shape (i.e. usable for calibration, have valid certificates)</p> <p>PC9. Verify that the measurement environment is appropriate for the reference instruments and for the requested calibration, as specified in the SOP</p> <p>PC10. Record readings of ambient temperature, relative humidity and atmospheric pressure, with required precision using recommended devices</p> <p>PC11. Ensure Thermal Stabilization time are met for Dead Weights, per SOP. This will need to be reported. As a practical guideline, a waiting time of 24 hours is recommended.</p>
<p>Select Reference Weights and Comparator/Balance</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC12. Follow the SOP guidelines and consult the Supervisor for selection of Reference Instruments and Weights. The following general considerations apply:</p> <p>PC13. Make sure that the reference equipment used for calibration of pressure gauges or electro manometer should be such that, its accuracy including uncertainty better than 1/3 of the accuracy class of the device under calibration.</p> <p>PC14. The reference equipment for calibration can be selected from below list based on the required accuracy class of the DUC.</p> <ol style="list-style-type: none"> Hydraulic or Pneumatic Dead Weight Tester Digital Pressure calibrators with built-in hydraulic/pneumatic/vacuum pressure generating pump. Analog Master gauge or Pressure transducer with Digital display along with hydraulic/ pneumatic/vacuum pressure generating pump. <p>PC15. Ensure that the Transmitter /Transducers are calibrated as a whole unit with indicator and power supply</p>

IAS/N5034 Perform Calibration of Pressure and Vacuum Indicating Devices

<p>Ensure Metrological Requirements are met</p>	<p>To be competent, the individual must be able to:</p> <p>PC16. Follow SOP guidelines regarding Metrological requirements.</p> <p>PC17. Observe requirements for Pressure Gauges to use with oxygen & Acetylene</p> <ol style="list-style-type: none"> a. Oxygen under pressure forms an explosive mixture with oil or grease, and a serious explosion may result if the two are brought together. When Oxygen gauges are calibrated Oil and grease should not be allowed to touch or enter the gauge. They should be tested only with dry and clean air and used for that purpose alone, and no other gauges should be calibrated on this equipment to avoid the risk of oil contamination (refer appendix C clause 9.1.5 of IS 3624: 1987, RA 2004). b. Acetylene in conjunction with copper form an explosive compound. Care shall be taken during calibration. c. SI Unit of measurement of pressure is Pascal, (Pa). Pressure gauges, vacuum gauges, Pressure-Vacuum gauges are to be calibrated in Pa, kPa, MPa, GPa, as per SI units. However, Units like bar and mbar, may also be used. 
<p>Ensure Environmental Requirements are met</p>	<p>To be competent, the individual must be able to:</p> <p>PC18. Follow SOP guidelines for environmental conditions. The following norms are generally applicable.</p> <p>PC19. Ensure that for Pneumatic and Hydraulic Pressure Measurements, during calibration temperature is within 18°C to 28°C. Preferably 23°C ±1.5°C and should not change more than 1°C during calibration.</p> <p>PC20. Ensure that for Vacuum Pressure (as per Standard ISO 27893:2011), during calibration temperature is within 20°C to 26°C. Preferably 23°C ±1.5°C and should not change more than 1°C during calibration.</p> <p>PC21. Ensure Temperature measuring instrument has an expanded uncertainty ≤ 0.5°C at k=2.</p> <p>PC22. Ensure 'g' value is known to sufficient accuracy, per SOP.</p> <p>PC23. Account for effect of gravity "g" on calibration when Dead weight</p>

IAS/N5034 Perform Calibration of Pressure and Vacuum Indicating Devices

	<p>testers are used.</p> <ol style="list-style-type: none"> a. It is recommended that, the Pressure calibration laboratory establishes local value of gravity (g) and use weights that have been calibrated at that gravitational constant. b. For measurement uncertainty of applied force, 'g' value shall be known. For realization of applied force more than 0.01%, 'g' value shall be calculated using appropriate formula, as specified in the SOP. <p>PC24. Estimation of Air Density is to be made to sufficient accuracy depending on the required uncertainty of the applied force by measuring temperature, RH & barometric pressure. Use appropriate formula as specified in the SOP.</p>
<p>Choose Measurement Method</p>	<p>To be competent, the individual must be able to:</p> <p>PC25. Method used for calibration is required to be mentioned in the calibration certificate issued to the customer.</p> <p>PC26. Pressure gauges can be calibrated with one of the following methods.</p> <ol style="list-style-type: none"> a. Using Dead weight tester by calculating the actual pressure generated with the help of area of the piston, local 'g' and applied known mass while comparing. b. Using Dead weight tester by comparison method using the nominal pressure values mentioned on the pressure weights of the Dead weight tester.
<p>Perform Measurements and Calculations</p>	<p>To be competent, the individual must be able to:</p> <p>PC27. Follow the measurement procedure for the method chosen per SOP.</p> <p>PC28. Make measurements using the Reference Weights, the Comparator instrument and the UUC, following the prescribed measurement sequence.</p> <p>PC29. Perform the recommended calibration sequences, per SOP.</p> <p>PC30. Wait for steady-state conditions to be reached for each step.</p> <p>PC31. Observe a waiting time of five minutes for bourdon pressure gauges. For quasi-static calibrations (piezoelectric sensor principle) the waiting time is reduced. Follow SOP guidance.</p> <p>PC32. Record the number of readings, as prescribed in the SOP.</p> <p>PC33. Record readings of ambient temperature and relative humidity and the air pressure at the beginning and end of measurements using recommended devices.</p>

IAS/N5034 Perform Calibration of Pressure and Vacuum Indicating Devices

<p>Calibration of Industrial Pressure Gauges by using Dead Weight Tester</p>	<p>To be competent, the individual must be able to:</p> <p>PC34. After noting down the applied mass and temperature at 5 calibration point of the steps and series as per recommended sequence, the pressure generated to balance the UUT can be calculated using the appropriate pressure formula specified in the SOP.</p> <p>PC35. In case of Pressure generated from a pneumatic dead weight tester, Fluid head correction factor may be considered negligible and pressure distortion correction may be considered negligible if not reported in the certificate</p> <p>PC36. In case of absolute pressure measurements, the atmospheric pressure should be added to the generated pressure. The uncertainty component of atmospheric pressure measuring device should also be included while estimating the measurement uncertainty of calibration.</p>
<p>Calibration of Industrial pressure gauges by using Dead Weight Tester and Reference Pressure Value</p>	<p>To be competent, the individual must be able to:</p> <p>PC37. Check the calibration certificate of the Dead weight tester whether pressure value is given for standard 'g' value 9.80665 m/s² or local 'g' value (corrected to the lab 'g' value). If the pressure values mentioned is for standard 'g' value then convert them to the local 'g' value using the following equation for accurate measurements.</p> <p>PC38. Also add the uncertainty components of temperature and 'g' value in terms of pressure to the uncertainty given in the certificate.</p> <p>PC39. Perform pressure correction to the local 'g' value and temperature at which calibration is done using the appropriate equation specified in the SOP.</p> <p>PC40. Estimate uncertainties after noting down the applied pressure at each calibration point of the steps and series as per the defined error. Uncertainty components of the calibration to be considered but not limited to:</p> <p>PC41. Calculate combined uncertainty using equation: $u_c = \sqrt{u_1^2 + u_2^2 + u_3^2 + u_4^2 + u_5^2 + u_6^2}$ </p> <p>PC42. Calculate Expanded uncertainty using equation $U = k \times u_c$ where, k= coverage factor corresponding to the effective degree of freedom.</p>

IAS/N5034 Perform Calibration of Pressure and Vacuum Indicating Devices

<p>Calibration of Pressure Gauges using Digital Pressure Calibrator or Reference Pressure Gauge and Pressure Generating Pump</p>	<p>To be competent, the individual must be able to:</p> <p>PC43. Estimate uncertainties after noting down the applied pressure at each calibration point of the steps and series as per the specified error.</p> <p>PC44. Consider following Uncertainty components of the calibration:</p> <ul style="list-style-type: none"> • Applied pressure as per the calibration certificate of digital pressure calibrator (u1) • Uncertainties associated with DUC • Repeatability (u2) • Reproducibility(u3) -Optional • Resolution (u4) • Zero error (u5) • Hysteresis (u6) <p>If Digital multi meter is used to record values in units other than pressure the associated uncertainty should also be added to the above.</p> <p>PC45. Calculate combined uncertainty using equation: $u_c = \sqrt{u_1^2 + u_2^2 + u_3^2 + u_4^2 + u_5^2 + u_6^2}$</p> <p>PC46. Calculate Expanded uncertainty using equation: $U = k \times u_c$ Where, k= coverage factor corresponding to the effective degree of freedom.</p>
<p>Calibration of Vacuum Gauges</p>	<p>To be competent, the individual must be able to:</p> <p>PC47. Follow recommendations of SOP, based on ISO 27893:2011 & DKD R-6-1.</p>
<p>Perform Calculations</p>	<p>To be competent, the individual must be able to:</p> <p>PC48. Refer to SOP for the equations to use for the type of calibration being performed</p> <p>PC49. Use form/format specified in the SOP for performing calculations</p> <p>PC50. Perform the required calculations using calculator or software as specified, using the equations and procedures specified in the SOP.</p>
<p>Prepare Calibration Report</p>	<p>To be competent, the individual must be able to:</p> <p>PC51. Record the results, including uncertainty, as calculated above, in the specified format</p> <p>PC52. Prepare Report in the format specified in the SOP. The calibration certificates issued to the customer shall be in accordance with clause 5.10 of ISO/IEC/17025:2005. It also includes the following:</p> <ol style="list-style-type: none"> a. Thermal stabilization hours taken before calibration. b. Specific calibration method followed c. Density of Reference weight (whether assumed or measured). d. Density of Test weight (whether assumed or measured). <p>PC53. Store and share report with the designated persons</p>

IAS/N5034 Perform Calibration of Pressure and Vacuum Indicating Devices

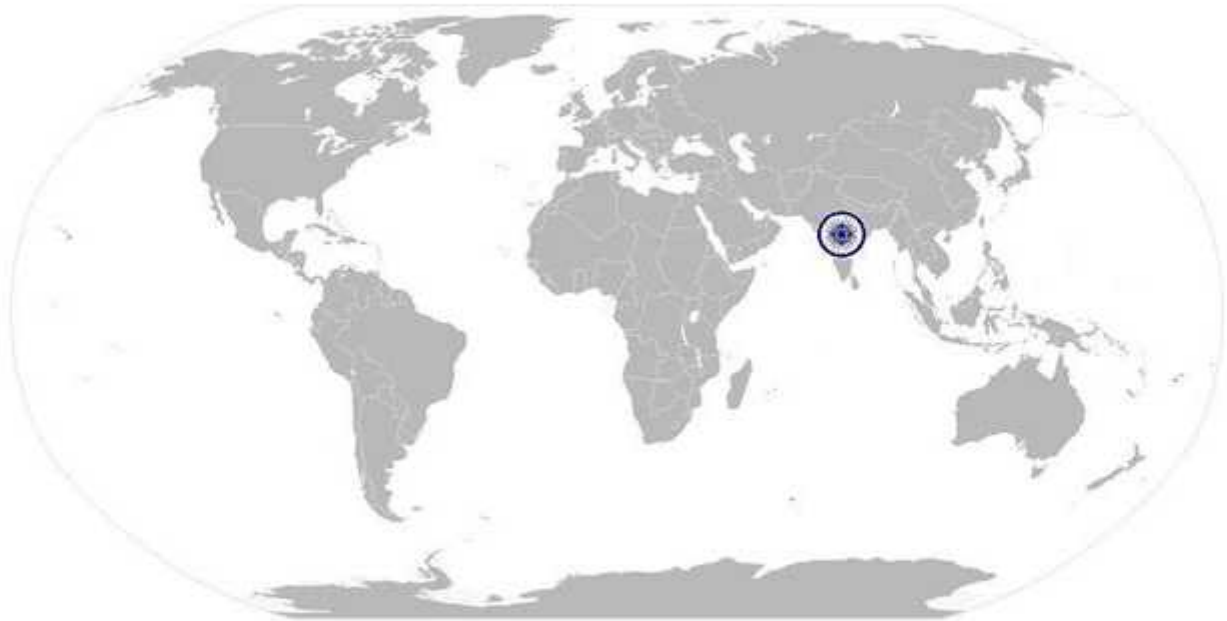
<p>Restore the Reference instruments and UUC to their respective condition and places</p>	<p>To be competent, the individual must be able to:</p> <p>PC54. Return the Reference instruments to their recommended storage position and put in their box/cover</p> <p>PC55. Return the UUC to its recommended storage position and put in its accompanying box/cover</p> <p>PC56. Fix/Attach any recommended tag/markings on the UUC to signify that its calibration has been done</p>
<p>Knowledge and Understanding (K)</p>	
<p>A. Organizational context (Knowledge of the company / organization and its process relevant to areas of responsibilities)</p>	<p>KA1. The requirements of performing Weight Calibration and how it impacts organization process and business.</p> <p>KA2. The role of calibration in the organization (whether part of the end user Production and Quality Assurance process or of a Calibration Service Provider)</p> <p>KA3. The Certification of the organization and their capability to perform calibration tests according to accepted level of standards.</p> <p>KA4. The impact of calibration quality on the company business</p> <p>KA5. Knows about the Standard Operating Procedures and its importance</p> <p>KA6. Follows the SOPs rigorously and takes guidance from the Calibration Supervisor when in doubt.</p> <p>KA7. Records any non-compliance to SOP and reports it to the Calibration Supervisor and takes guidance.</p>
<p>B. Technical Knowledge</p>	<p>KB1. Knows about and understands how Pressure/Vacuum Calibration is performed.</p> <p>KB2. Knows about the sources of errors in the Pressure/Vacuum calibration process, how these are avoided and its impact on calibration accuracy.</p> <p>KB3. Familiar with:</p> <ul style="list-style-type: none"> • What is Pressure / Vacuum Calibration • Why is Pressure/Vacuum calibration needed • Traceability of the calibration of instruments performing the tests • Types of Pressure/ Vacuum gauges, instruments, ranges and applications • Sources of inaccuracies in Pressure measurements and how to avoid / minimize these • Equipment needed for Pressure/Vacuum Calibration • Deriving calibration results - data processing and interpretation
<p>Skill(S)</p>	
<p>A. Core Skills / Generic Skills</p>	<p>Writing skills</p> <p>The individual on the job needs to know and understand how to:</p> <p>SA1. Use Formats and check list for Pressure/Vacuum calibration and reports</p>

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	SA2. Write emails and messages about calibration related issues
	Reading Skills
	The individual on the job needs to read and understand (how to)
	SA3. Company policy related to Pressure/Vacuum calibration
	SA4. Terminology, symbols, codes, standards, methods and common practices related to Pressure/Vacuum Calibration
	SA5. Data processing steps, Uncertainty Calculations and reporting of results related to Pressure/Vacuum calibration.
SA6. Formats and check list for Pressure/Vacuum Calibration	
	Oral Communication (Listening and Speaking skills)
	The individual on the job needs to know and understand how to:
	SA7. Communicate with the Calibration Supervisor for task scheduling, task reporting and exception reporting
	SA8. Communicate to the management in meetings about process or equipment issues which need management attention
B. Professional Skills	Decision Making
	The individual on the job needs to know and understand how to:
	SB1 . Make decisions about what calibration to perform and consult Supervisor if needed
	Plan and Organize
	The individual on the job needs to know and understand how to:
	SB2. Prioritize daily tasks and batches of calibration efficiently and effectively to meet client and company needs
	Customer Centricity
	The user/individual on the job needs to know and understand how to:
	SB3. Real needs of the customer and suggest most appropriate solution
	SB4. Support customer when they need help
Problem Solving	
The individual on the job needs to know and understand how to:	
SB5. Diagnose reasons for any down time in the calibration setup	
SB6. Identify immediate or temporary solutions to resolve delays and discuss with the Supervisor	
Analytical Thinking	

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	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB7. Use the existing information to arrive at actionable decision points</p> <p>SB8. Use the existing information for improving the customer satisfaction</p>
	<p>Critical Thinking</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB9. Apply, analyze, and evaluate the information gathered from observation, experience, reasoning, or communication, as a guide to thought and action</p>



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NOS Version Control

NOS Code	IAS/N5034		
Credits (NSQF)	TBD	Version number	1.0
Sector	Instrumentation, Automation Surveillance and Communication	Drafted on	30/09/2017
Sub-sector	Instrumentation	Last reviewed on	30/09/2017
Occupation	Testing & Calibration	Next review date	30/09/2019

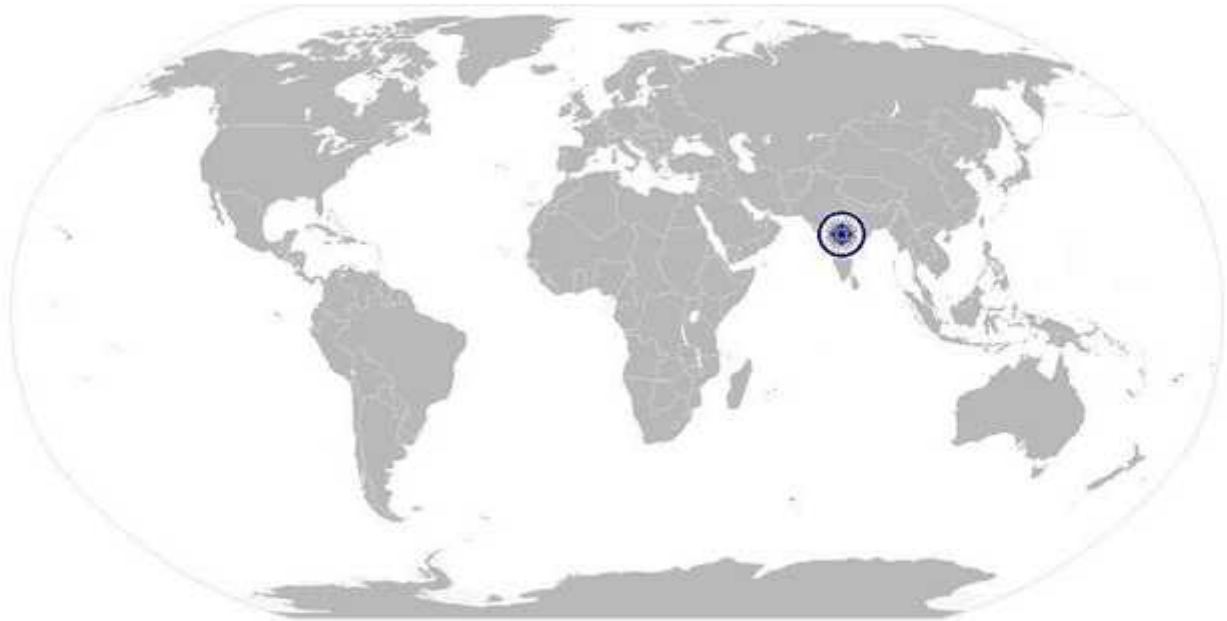


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IAS/N5035

Perform Calibration of Water Flow measuring devices

National Occupational Standard

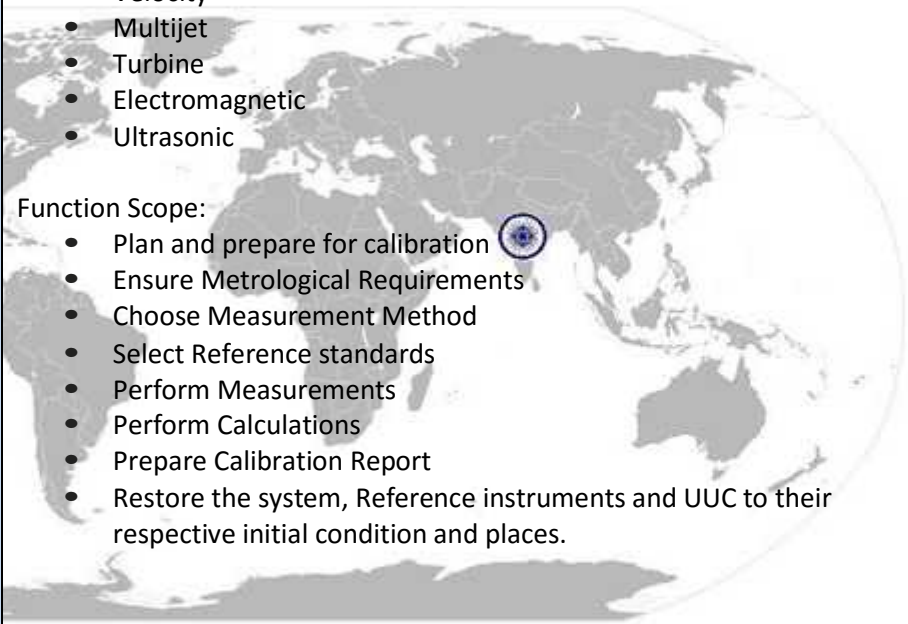


Overview

This unit is about Calibration of Water Flow measuring devices according to the SOP of the organization.

IAS/N5035

Perform Calibration of Water Flow measuring devices

National Occupational Standard	Unit Code	IAS/N5035
	Unit title (Task)	Perform Calibration of Water Flow measuring devices
	Description	The OS unit is about calibration of a range of Water Flow meters according to organization SOP and relevant standards such as ISO17025, ISO 4064/3, OIML R-49 Standards etc.
	Scope	<p>The following meter types are covered:</p> <ul style="list-style-type: none"> • Positive Displacement • Velocity • Multijet • Turbine • Electromagnetic • Ultrasonic <p>Function Scope:</p> <ul style="list-style-type: none"> • Plan and prepare for calibration • Ensure Metrological Requirements • Choose Measurement Method • Select Reference standards • Perform Measurements • Perform Calculations • Prepare Calibration Report • Restore the system, Reference instruments and UUC to their respective initial condition and places. 
	Performance Criteria (PC) with respect to the scope	
Element	Performance Criteria	

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Perform Calibration of Water Flow measuring devices

<p>Plan and prepare for calibration</p>	<p>To be competent, the individual must be able to:</p> <p>PC1. Ensure that the three fundamental components of Water Flow Calibration Facility are in good working order:</p> <ol style="list-style-type: none"> a. Flow generation system: This consists of a storage tank, pumping system, and a flow control system which actuates the control valves. The flow generation system produces the water flow through the test section at a constant rate required for test points required for calibration. b. Test section: Piping system to generate the required flow conditions for the UUT. The purpose is to implement an ideal flow environment for the flowmeter operation. Usually, axis-symmetric filter and flow conditioners (such as tube-bundle and perforated plate) are installed upstream away from the UUT to avoid any flow disturbance that might affect the meter performance. The exact design of flow conditioners may be influenced by manufacturers' recommendations. c. Gravimetric / Volumetric reference system: Weighing system with collection tank and a flow diverting device are required. This device is the part of the calibration system that directs the flowing water into the collection tank while triggering a clock to determine the collection time. The water collected can be determined in terms of volumetric or gravimetric units. <p>PC2. Prepare Observation Sheet (use a standard form/format as specified in the SOP)</p> <p>PC3. Note in the Observation Sheet the details of the UUC (requesting company, lab reference number, type, make, model, serial number, date, time, technician's name etc.)</p> <p>PC4. Verify that the UUC is in good shape (i.e. no physical damage, readable markings, clean, no loose parts etc.)</p> <p>PC5. Note all parameters to measure for the requested calibration</p> <p>PC6. Note the number of readings to be taken for each parameter</p> <p>PC7. Note the Reference Instruments to use for the parameters</p> <p>PC8. Wear gloves while handling instruments</p> <p>PC9. Verify that the Reference Instruments are available and are in good shape (i.e. usable for calibration, have valid certificates)</p> <p>PC10. Verify that the measurement environment is appropriate for the reference instruments and for the requested calibration, as specified in the SOP</p> <p>PC11. Record readings of ambient temperature, relative humidity and atmospheric pressure, with required precision using recommended devices</p>
<p>Ensure Metrological Requirements are met</p>	<p>To be competent, the individual must be able to:</p> <p>PC12. Follow SOP guidelines regarding Metrological requirements.</p>

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Perform Calibration of Water Flow measuring devices

<p>Choose Measurement Method</p>	<p>To be competent, the individual must be able to:</p> <p>PC13. Follow SOP guidelines and applicable standards such as ISO 4064/3, OIML R-49 etc. for choosing the measurement method.</p> <p>PC14. Select principle of measurement for the quantity of liquid in the container by mass or volume.</p> <ol style="list-style-type: none"> a. Gravimetric calibration b. Volumetric calibration <p>PC15. Select flow measurement time control method:</p> <ol style="list-style-type: none"> a. Standing-start-and-finish method b. Flying-start-and-finish method c. Dynamic collection method <p>PC16. Perform steps for setting up the chosen calibration method as specified in the SOP.</p>
<p>Select Reference Standards for Calibration</p>	<p>To be competent, the individual must be able to:</p> <p>PC17. Follow SOP guidelines to ensure that the appropriate reference standards are used for the type of calibration and method chosen.</p>
<p>Perform Measurements</p>	<p>To be competent, the individual must be able to:</p> <p>PC18. Follow the measurement procedure for the method chosen per SOP.</p> <p>PC19. Record readings of the following parameters used for calculations and corrections, using specified instruments or reference data, per SOP:</p> <ol style="list-style-type: none"> a. Ambient temperature, relative humidity and the atmospheric pressure at the beginning and end of measurements b. Kinematic Viscosity of measuring fluid c. Density of measuring fluid d. Diameter of pipe <p>PC20. Set the operating flow conditions and record the recommended sets of readings for the chosen methods, as prescribed in the SOP.</p>
<p>Perform Calculations</p>	<p>To be competent, the individual must be able to:</p> <p>PC21. Refer to SOP for the equations to use for the type of calibration being performed</p> <p>PC22. Use form/format specified in the SOP for performing calculations</p> <p>PC23. Perform the required calculations using calculator or software as specified, using the equations and procedures specified in the SOP.</p> <p>PC24. Determine Uncertainty Components, as prescribed in the SOP, including:</p> <ol style="list-style-type: none"> a. Collected Mass Uncertainty <ul style="list-style-type: none"> • Scale Calibration, Mass Standards Calibration, Long-term Stability, and Sensitivity • Buoyancy Correction • Splashes and Leaks • Storage effects • Water Evaporation

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Perform Calibration of Water Flow measuring devices

	<ul style="list-style-type: none"> b. Collection Time Uncertainty <ul style="list-style-type: none"> • Uni-directional Diverter Tests • Counters and Timers c. Density d. Viscosity e. Temperature <p>PC25. Calculate Overall Uncertainty</p>
<p>Prepare Calibration Report</p>	<p>To be competent, the individual must be able to:</p> <p>PC26. Record the results, including uncertainty, as calculated above, in the specified format</p> <p>PC27. Prepare Calibration Report in the format specified in the SOP.</p> <p>PC28. Store the calibration report in hard/soft copy as required.</p> <p>PC29. Submit the report is to the appropriate authority in the organization, as specified in the SOP, for verification and signature.</p>
<p>Restore the calibration setup, Reference instruments and UUC to their respective condition and places</p>	<p>To be competent, the individual must be able to:</p> <p>PC30. If no more calibrations are to be performed then drain the system, reset controls to the initial conditions, and perform other shut down procedures as recommended in the SOP.</p> <p>PC31. Ensure that the Reference instruments are returned to their recommended storage location / condition.</p> <p>PC32. Return the UUC to its recommended storage position and put in its accompanying box/cover.</p> <p>PC33. Fix/Attach any recommended tag/markings on the UUC to signify that its calibration has been done.</p>
<p>Knowledge and Understanding (K)</p>	
<p>A. Organizational context (Knowledge of the company / organization and its process relevant to areas of responsibilities)</p>	<p>KA1. The requirements of performing Water Meter Calibration and how it impacts organization process and business.</p> <p>KA2. The role of calibration in the organization (whether part of the end user Production and Quality Assurance process or of a Calibration Service Provider)</p> <p>KA3. The Certification of the organization and their capability to perform calibration tests according to accepted level of standards.</p> <p>KA4. The impact of calibration quality on the company business</p> <p>KA5. Knows about the Standard Operating Procedures and its importance</p> <p>KA6. Follows the SOPs rigorously and takes guidance from the Calibration Supervisor when in doubt.</p> <p>KA7. Records any non-compliance to SOP and reports it to the Calibration Supervisor and takes guidance.</p>

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Perform Calibration of Water Flow measuring devices

<p>B. Technical Knowledge</p>	<p>KB1. Knows about and understands how Water Meter Calibration is performed.</p> <p>KB2. Knows about the sources of errors in the calibration process, how these are avoided and its impact on calibration accuracy.</p> <p>KB3. Familiar with:</p> <ul style="list-style-type: none"> • What is Water Meter Calibration • Why is Water Meter calibration needed • Traceability of the calibration of instruments performing the tests • What are Water Meter calibration Equipment • Types of Water Meters, ranges and applications • Types of Water Meter Calibration • Sources of inaccuracies in Water Meter measurements and how to avoid / minimize these • Equipment needed for Water Meter Calibration • Deriving calibration results - data processing and interpretation
<p>Skill(S)</p>	
<p>A. Core Skills / Generic Skills</p>	<p>Writing skills</p> <p>The individual on the job needs to know and understand how to:</p> <p>SA1. Use Formats and check list for Water Meter calibration and reports</p> <p>SA2. Write emails and messages about calibration related issues</p> <hr/> <p>Reading Skills</p> <p>The individual on the job needs to read and understand:</p> <p>SA3. Company policy related to Water Meter calibration</p> <p>SA4. Terminology, symbols, codes, standards, methods and common practices related Water Meter Calibration</p> <p>SA5. Data processing steps, Uncertainty Calculations and reporting of results related to Water Meter calibration.</p> <p>SA6. Formats and check list for Water Meter Calibration</p> <hr/> <p>Oral Communication (Listening and Speaking skills)</p> <p>The individual on the job needs to know and understand how to:</p> <p>SA7. Communicate with the Calibration Supervisor for task scheduling, task reporting and exception reporting</p> <p>SA8. Communicate to the management in meetings about process or equipment issues which need management attention</p>
<p>B. Professional Skills</p>	<p>Decision Making</p>

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Perform Calibration of Water Flow measuring devices

	<p>The individual on the job needs to know and understand how to:</p> <p>SB 1 . Make decisions about what calibration to perform and consult Supervisor if needed</p>
	<p>Plan and Organize</p>
	<p>The individual on the job needs to know and understand how to:</p> <p>SB2 . Prioritize daily tasks and batches of calibration efficiently and effectively to meet client and company needs</p>
	<p>Customer Centricity</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB3. Understand real needs of the customer and suggest most appropriate solution</p> <p>SB4. Support customer when they need help</p>
	<p>Problem Solving</p>
	<p>The individual on the job needs to know and understand how to:</p> <p>SB5. Diagnose reasons for any down time in the calibration setup</p> <p>SB6. Identify immediate or temporary solutions to resolve delays and discuss with the Supervisor</p>
	<p>Analytical Thinking</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB7. Use the existing information to arrive at actionable decision points</p> <p>SB8. Use the existing information for improving the customer satisfaction</p>
	<p>Critical Thinking</p>
<p>The user/individual on the job needs to know and understand how to:</p> <p>SB9. Apply, analyze, and evaluate the information gathered from observation, experience, reasoning, or communication, as a guide to thought and action</p>	

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Perform Calibration of Water Flow measuring devices

NOS Version Control

NOS Code	IAS/N5035		
Credits (NSQF)	TBD	Version number	1.0
Sector	Instrumentation, Automation Surveillance and Communication	Drafted on	30/09/2017
Sub-sector	Instrumentation	Last reviewed on	30/09/2017
Occupation	Testing & Calibration	Next review date	30/09/2019

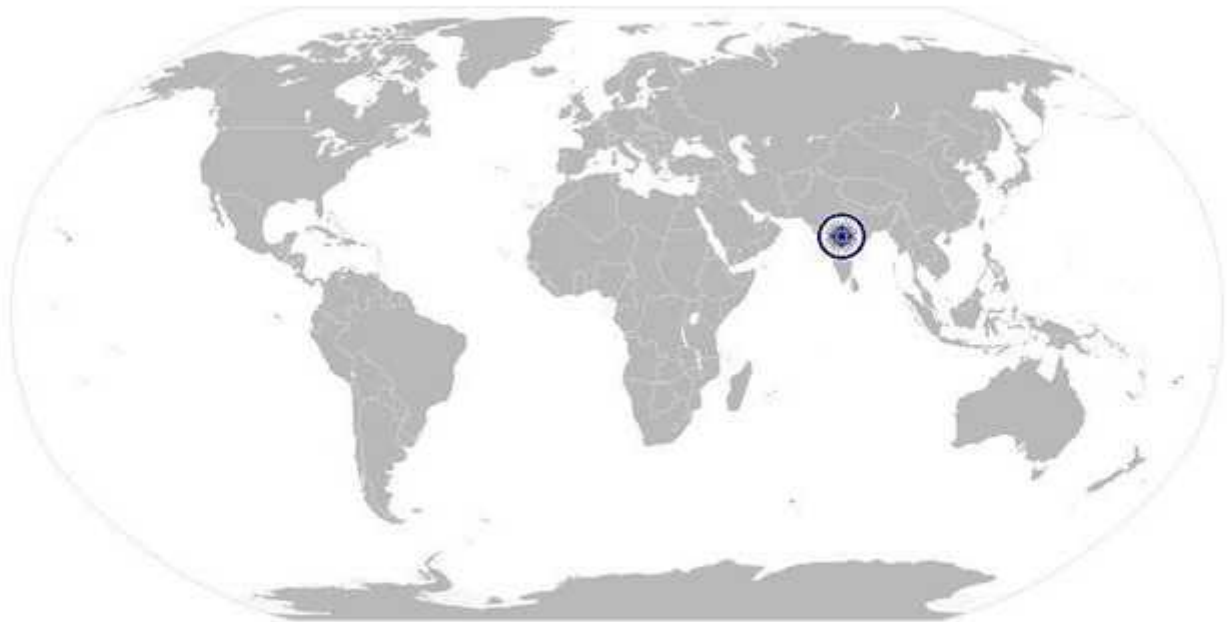


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IAS/N5036

Perform Preventive Maintenance of
Pressure, Vacuum, Water Flow Calibration Setup

National Occupational Standard



Overview

The unit is about conducting regular Preventive Maintenance activities of Pressure, Vacuum, Water Flow Calibration setup.

IAS/N5036

**Perform Preventive Maintenance of
Pressure, Vacuum, Water Flow Calibration Setup**

National Occupational Standard	Unit Code	IAS/N5036
	Unit title task	Perform Preventive Maintenance of Pressure, Vacuum, Water Flow Calibration Setup
	Description	The OS unit is about performing Preventive maintenance for Pressure, Vacuum, Water Flow Calibration setup.
	Scope	This Unit/ Task covers the following : <ul style="list-style-type: none"> • PM- Visual checks and action • Completion of preventive maintenance schedule
	Performance Criteria (PC) with respect to the scope:	
	Element	Performance Criteria
	Perform PM-Visual Checks and action	<p>The individual on the job needs to be able to:</p> <p>PC1. Check operation of Reference Instruments, Dead Weights, Volumetric References etc. and accessories for proper operation over their range</p> <p>PC2. Check operation of Digital Reference Calibration Instruments, Equipment and Gauges for proper operation over their range</p> <p>PC3. Check condition of Reference Weights for cleanliness, surface condition, rusting or any other environmental effects. Perform cleaning and conditioning per SOP directions.</p> <p>PC4. Check condition of tanks, piping, valves, diverters, timers and other accessories of water meter test setup. Look for any leaks or corrosion. Perform tightening, cleaning and conditioning per SOP directions.</p> <p>PC5. Check condition and operation of pressure creating devices (compressors), piping, safety valves and other accessories per SOP directions. Look for any leaks and take appropriate action.</p> <p>PC6. Check condition and operation of Vacuum creating devices (vacuum pumps), piping, valves, gauges and other accessories per SOP directions. Look for any vacuum leaks and take appropriate action.</p> <p>PC7. Check for any damaged cable, broken plug/socket and leakage current in all electrical/electronic instruments.</p> <p>PC8. Check validity of calibration certificate for all Reference Instruments, Equipment and Gauges</p> <p>PC9. Check operation of environmental parameter monitoring equipment are in working order. This includes:</p>

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Perform Preventive Maintenance of Pressure, Vacuum, Water Flow Calibration Setup

	<ul style="list-style-type: none"> a. Temperature, b. Humidity, c. Barometric pressure, d. Dust, e. Electrical power quality, f. Vibration, g. Noise <p>PC10. Check operation of environments conditioning systems and ensure that the environmental parameters are in the specified limits.</p> <p>PC11. Check condition and operation of fire safety equipment.</p> <p>PC12. Check condition and operation of security monitoring and access control systems.</p>
<p>Perform Completion of Preventive Maintenance Schedule.</p>	<p>The individual on the job needs to be able to:</p> <p>PC13. For the listed items, perform corrective action such as cleaning, greasing, tightening of screws etc. following recommended procedure in the SOP.</p> <p>PC14. Use authorized cleaning solvents and greases in the right amount. Use approved cleaning tissues or cloth.</p> <p>PC15. If the recommended maintenance does not restore the device to the required condition, add this to the Corrective Maintenance list and report.</p> <p>PC16. Complete preventive maintenance schedule list of Pressure, Vacuum, Water Flow Calibration setup and accessories. Close any issues in the list.</p>
<p>Knowledge and Understanding</p>	
<p>A. Organizational context (Knowledge of the company organization and its process relevant to area of responsibilities)</p>	<p>Needs to know and understand :</p> <p>KA1. PM norms as defined by the company</p> <p>KA2. Production targets and production loss figures for the month and contribution of Pressure, Vacuum, Water Flow Calibration towards it.</p> <p>KA3. Maintenance Policy of the company with respect to Pressure, Vacuum, Water Flow Calibration strategy</p>
<p>B. Technical Knowledge</p>	<p>Needs to Know and understand:</p> <p>KB1. Trouble Shooting of:</p> <ul style="list-style-type: none"> • Pressure instruments and gauges • Pressure creating equipment • Pressure calibration setup

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**Perform Preventive Maintenance of
Pressure, Vacuum, Water Flow Calibration Setup**

	<ul style="list-style-type: none"> • Vacuum instruments and gauges • Vacuum creating equipment • Vacuum calibration setup • Water meter calibration setup • Water meter connections • Piping leaks and air bubble removal <p>KB2. Use of Calibration Manuals when required</p>
Skill(s)	
A. Core Skills / Generic Skills	Writing skills
	The individual on the job needs to know how to:
	SA1. Use Formats and check list for Preventive Maintenance planning and reports
	SA2. Write emails and messages about maintenance related issues
	Reading Skills
	The individual on the job needs to know and understand:
	SA3. Company policy related to Preventive Maintenance
	SA4. Down time in terms of production loss
SA5. Formats for Preventive Maintenance check sheets	
Oral Communication (Listening and Speaking skills)	
The individual on the job needs to know and understand how to:	
SA6. Describe condition of control valves and accessories and issues to co-workers and supervisor	
SA7. Communicate to the management in meetings about maintenance issues which need management attention	
SA8. Interact with coworkers and gather information related to process and control valve conditions	
B. Professional Skills	Decision Making
	The individual on the job needs to know and understand how to:
	SB1. Make decisions about timing and extent of preventive maintenance, in consultation with the Supervisor
	Plan and Organize

IAS/N5036

**Perform Preventive Maintenance of
Pressure, Vacuum, Water Flow Calibration Setup**

	<p>The individual on the job needs to know and understand how to:</p> <p>SB2. Prioritize daily tasks to conduct Preventive Maintenance effectively</p>
	<p align="center">Customer Centricity</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB3. Real needs of the customer and suggest most appropriate solution</p>
	<p align="center">Problem Solving</p>
	<p>The individual on the job needs to know and understand how to:</p> <p>SB4. Diagnoses reasons for down time due to calibration setup failure SB5. Identify immediate or temporary solutions to resolve delays and discuss with the Supervisor</p>
	<p align="center">Analytical Thinking</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB6. Use the existing information to arrive at actionable decision points SB7. Use the existing information for improving the customer satisfaction</p>
	<p align="center">Critical Thinking</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB8. Apply, analyze, and evaluate the information gathered from observation, experience, reasoning, or communication, as a guide to thought and action SB9. Anticipate problems, risks and opportunities and utilize these for mitigation and business optimization</p>

IAS/N5036

**Perform Preventive Maintenance of
Pressure, Vacuum, Water Flow Calibration Setup**

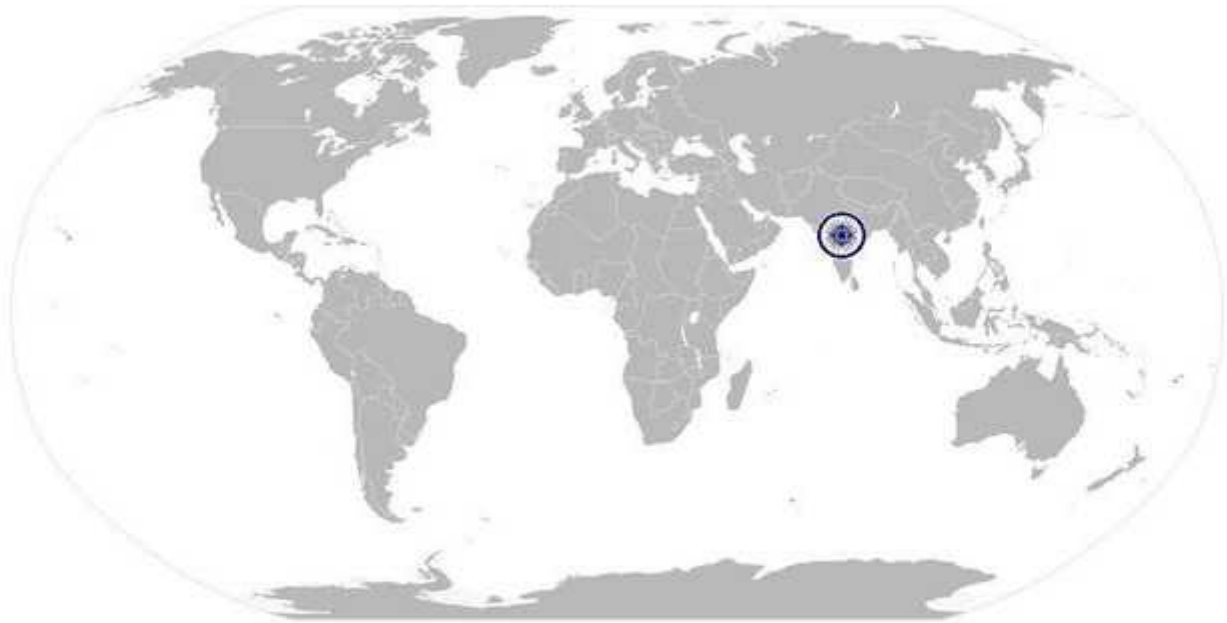
NOS Version Control

NOS Code	IAS/N5036		
Credits(NSQF)	TBD	Version number	1.0
Sector	Instrumentation, Automation Surveillance and Communication	Drafted on	30/09/2017
Sub-sector	Instrumentation	Last reviewed on	30/09/2017
Occupation	Testing & Calibration	Next review date	30/09/2019



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National Occupational Standard



Overview

This unit is about reporting and record keeping of calibration processes as per company processes.

IAS/N0204

Reporting of Task Performed-Calibration

National Occupational Standard	Unit Code	IAS/N0204
	Unit title task	Reporting of Task Performed -Calibration
	Description	This OS unit is about reporting and record keeping as per company processes and job description for Calibration Technician.
	Scope	<p>This Unit /Task covers performing the following:</p> <ul style="list-style-type: none"> • Task Reporting - Normal • Task reporting - faults • Task reporting - PM • Task reporting – unusual occurrence • Task reporting - theft • Task reporting – security breach
	Performance Criteria (PC) with respect to the scope:	
	Element	Performance Criteria
	Perform Task reporting- normal	<p>PC1. Report completed task per organization process.</p> <ul style="list-style-type: none"> • Record the completed task in log book or other document as defined by the SOP
	Perform Task reporting- faults	PC2. Report faults/issues to immediate supervisor
	Perform Task reporting - PM	PC3. Perform entry of preventive maintenance check lists/reports
	Perform Task reporting-unusual occurrence	PC4. Report on noticing any visible changes in of Pressure, Vacuum, Water Flow Calibration setup or its accessories. Report for immediate attention of supervisor
Perform Task reporting- theft	PC5. Report any theft in Pressure, Vacuum, Water Flow Calibration setup to supervisor	
Perform Task reporting-security breach	PC6. Report suspicious movement of new persons near of Pressure, Vacuum, Water Flow Calibration setup to security and supervisor	
Knowledge and Understanding (K)		
(A) Organizational context (Knowledge of the company organization and its process relevant to area of responsibilities)	KA1. How Pressure, Vacuum, Water Flow Calibration is performed in the organization and the impact of it on the business.	

IAS/N0204
Reporting of Task Performed-Calibration

(B) Technical Knowledge	<p>The individual has the knowledge and understanding to be:</p> <p>KB1. Able to write daily log and failure reports</p> <p>KB2. Able to furnish basic data to supervisor related to specifications of Pressure, Vacuum, Water Flow Calibration setup</p> <p>KB3. Able to send internal mails related to supervisor or co-workers</p> <p>KB4. Familiar with basic computer work to type simple reports and use of e-mail. Records Maintenance history</p>
Skill(s)	
A. Core Skills / Generic Skills	<p>Writing skills</p> <p>The individual on the job needs to know and understand how to:</p> <p>SA1. Use Formats and check list for calibration and reports</p> <p>SA2. Write emails and messages about calibration related issues</p> <p>Reading Skills</p> <p>The individual on the job needs to read and understand:</p> <p>SA3. Company policy related to calibration and reporting</p> <p>SA4. Formats and check list for Calibration</p> <p>SA5. Terminology, symbols, codes, standards and common practices related to sensors that are calibrated</p> <p>SA6. Terminology, data processing steps and reporting process</p> <p>Oral Communication (Listening and Speaking skills)</p> <p>The individual on the job needs to know and understand how to:</p> <p>SA7. Communicate issue / fault with complete details to the supervisor</p> <p>SA8. Communicate with the Calibration Supervisor for task scheduling, task reporting and exception reporting</p> <p>SA9. Communicate to the management in meetings about process or equipment issues which need management attention</p>
B. Professional Skills	<p>Decision Making</p> <p>The individual on the job needs to know and understand:</p> <p>SB1. What data is to be recorded</p> <p>SB2. What reports are to be made</p> <p>Plan and Organize</p> <p>The individual on the job needs to know and understand how to:</p> <p>SB3. Prioritize and schedule reporting tasks</p> <p>SB4. Cooperates with his/her team and offers assistance on a regular basis SB5.</p> <p>Communicate with the Calibration Supervisor for task scheduling, task reporting and exception reporting</p>

IAS/N0204

Reporting of Task Performed-Calibration

	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB6. Real needs of the customer and suggest most appropriate solution
	Problem Solving
	The individual on the job needs to know and understand how to: SB7. Investigate reasons for any anomalous report and correct it
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB8. Use the existing information to arrive at actionable decision points SB9. Use the existing information for improving the customer satisfaction
	Critical Thinking
The user/individual on the job needs to know and understand how to: SB10. Apply, analyze, and evaluate the information gathered from observation, experience, reasoning, or communication, as a guide to thought and action SB11. Anticipate problems, risks and opportunities and utilize these for mitigation and business optimization	



IAS/N0204

Reporting of Task Performed-Calibration

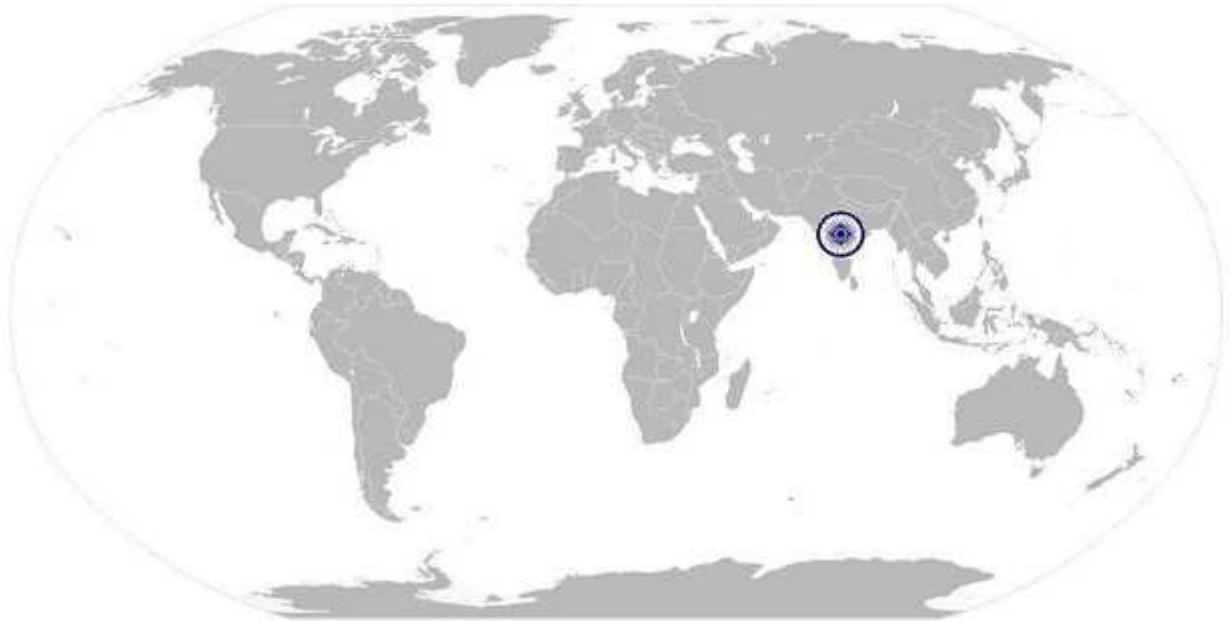
NOS Version Control

NOS Code	IAS/N0204		
Credits(NSQF)	TBD	Version number	1.0
Sector	Instrumentation, Automation Surveillance and Communication	Drafted on	30/09/2017
Sub-sector	Instrumentation	Last reviewed on	30/09/2017
Occupation	Testing & Calibration	Next review date	30/09/2019



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National Occupational Standard



Overview

This unit is about working effectively with colleagues, in own work group and in other work groups within the organization.

IAS/N2105

Work Effectively With Teams

National Occupational Standard	Unit Code	IAS/N2105
	Unit Title (Task)	Work Effectively With Teams
	Description	This NOS unit is about building relationships and working with people and groups inside and outside the organization, using skills and habits, to achieve the team goals and objectives.
	Scope	<p>This unit/task covers the following:</p> <ul style="list-style-type: none"> • Creating team environment • Communicating - giving and receiving • Working cooperatively • Participating in team decision making • Demonstrating Sense of Responsibility • Showing respect for opinions, customs and preferences
Performance Criteria(PC) w.r.t. the Scope		
Element	Performance Criteria	
Create Team Environment	<p>To be competent, the individual on the job must be able to:</p> <p>PC1. Know and understand the team objectives and goals</p> <p>PC2. Know team members by name. Greet them appropriately and respond to their greetings.</p> <p>PC3. Know the roles and responsibilities of team members. Ensure others know about you and your role in the team</p> <p>PC4. Learn about the culture and preferences of team members – especially if they belong to other organizations or nationalities</p> <p>PC5. Follow organization’s policies and procedures for working with team members within and outside the organization – especially relating to privacy, confidentiality and security.</p> <p>PC6. Create an environment of trust and mutual respect</p>	
Communicate – Give and Receive	<p>To be competent, the individual on the job must be able to:</p> <p>PC7. Use appropriate mode of communication – verbal, written, mail, phone or text and clearly articulate your message to ensure that the recipient understands the message.</p> <p>PC8. Listen to team members and try to understand what they are wanting to say. Seek or provide clarifications if you see any gap in understanding</p> <p>PC9. Communicate professionally and follow organization protocols. Do not overload the team members with unnecessary and unsolicited information</p> <p>PC10. Share important information with the team timely.</p> <p>PC11. Respond to communications promptly.</p>	

IAS/N2105

Work Effectively With Teams

<p>Work Cooperatively</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC12. Perform own role and produce output in time for other team members to consume</p> <p>PC13. Receive inputs from others and work upon it per role requirement</p> <p>PC14. Make adjustments within the permissible rules so that work flows smoothly.</p> <p>PC15. Help team members to perform their role effectively and provide any clarifications and support they need</p> <p>PC16. Share tools and common resources fairly, taking cognizance of others' needs and schedules</p> <p>PC17. Resolve any contentious issues amicably, involving the team lead or the supervisor if needed</p> <p>PC18. Let team members know in good time if you cannot carry out your commitments, explaining the reasons and alternate solutions, if any. Let the team lead know about this.</p>
<p>Participate in Team Decision making</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC19. Think positively and make constructive suggestions to meet the goals</p> <p>PC20. Accept and give suggestions with open mind</p> <p>PC21. Take initiatives and volunteer to contribute</p> <p>PC22. Help team members with facts and figures to arrive at workable decisions</p> <p>PC23. Accept decisions professionally and support these, even if these do not match your suggestions and personal views</p>
<p>Demonstrate Sense of Responsibility</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC24. Act in the interest of the team and the organization to ensure that things do not 'fall through the gap' and team goals are achieved.</p> <p>PC25. Take initiative to correct the situation if something seems to be going wrong.</p> <p>PC26. Seek help or escalate if the situation demands</p>
<p>Show Respect for Opinions, Customs and Preferences</p>	<p>To be competent, the individual on the job must be able to:</p> <p>PC27. Follow organization's and statutory guidelines about making references or comments to social customs or preferences</p> <p>PC28. Refrain from making any comments to hurt sentiments</p> <p>PC29. Accommodate team members' preferences to the extent feasible. If these come in the way of fulfilling team goals, discuss with the supervisor/ team leader.</p> <p>PC30. Seek information and clarifications from others if you do not Understand any custom</p>
<p>Knowledge and Understanding (K)</p>	

IAS/N2105

Work Effectively With Teams

<p>A. Organizational Context (Knowledge of the company / organization and its processes)</p>	<p>The user/individual on the job needs to know and understand:</p> <p>KA1. The organization’s policies and procedures for working with colleagues, roles and responsibilities in relation to this</p> <p>KA2. The importance of effective communication and establishing good working relationships with colleagues</p> <p>KA3. Different methods of communication and the circumstances in which it is appropriate to use these</p> <p>KA4. The importance of creating an environment of trust and mutual respect</p> <p>KA5. The implications of own work on the work and schedule of others</p>
<p>B. Technical Knowledge</p>	<p>The user/individual on the job needs to know and understand:</p> <p>KB1. Different types of information that colleagues might need and the importance of providing this information when it is required</p> <p>KB2. The importance of helping colleagues with problems, in order to meet quality and time standards as a team</p>
<p>Skills (S) [Optional]</p>	
<p>A. Core Skills/ Generic Skills</p>	<p>Writing Skills</p>
	<p>The user/ individual on the job need to know and understand how to:</p> <p>SA1. Complete written work with attention to detail</p>
	<p>Reading Skills</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SA2. Read instructions, guidelines/procedures</p>
<p>B. Professional Skills</p>	<p>Oral Communication (Listening and Speaking skills)</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SA3. Listen effectively and orally communicate information</p> <p>SA4. Ask for clarification and advice from the concerned person</p>
	<p>Decision Making</p>
	<p>The user/individual on the job needs to know and understand how to:</p> <p>SB1. Make decisions on a suitable course of action or response keeping in view resource utilization while meeting commitments</p>
<p>Plan and Organize</p>	<p>The user/individual on the job needs to know and understand:</p> <p>SB2. Plan and organize work to achieve targets and deadlines</p>

IAS/N2105

Work Effectively With Teams

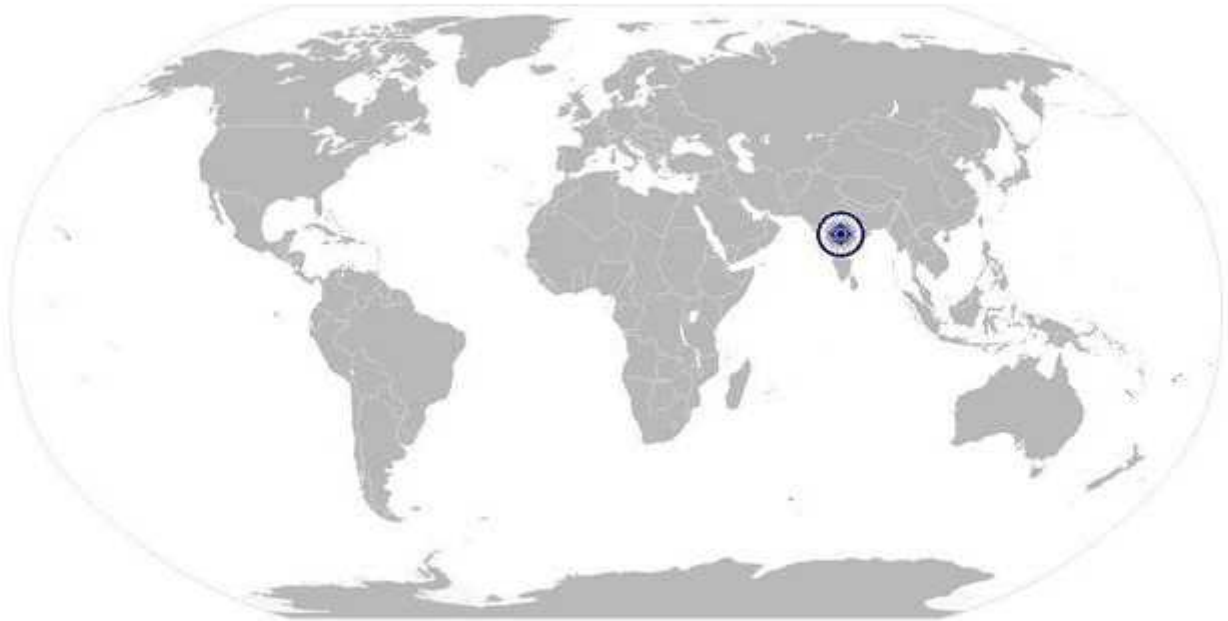
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB3. Real needs of the customer and suggest most appropriate solution SB4. Support customer when they need help
	Problem Solving
	The user/individual on the job needs to know and understand how to: SB5. Apply problem solving approaches in different situations
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB6. Use the existing information to arrive at actionable decision points SB7. Use the existing information for improving the customer satisfaction SB8. Use the existing information to optimize solution and company business SB9. Analyze problems and identify causes and possible solutions
Critical Thinking	
The user/individual on the job needs to know and understand how to: SB10. Apply balanced judgments to different situations	

IAS/N2105

Work Effectively With Teams

NOS Version Control

NOS Code	IAS/N2105		
Credits(NSQF)	TBD	Version number	1.0
Industry	Instrumentation Automation Surveillance & Communication	Drafted on	30/09/2017
Industry Sub-sector	Instrumentation	Last reviewed on	30/09/2017
Occupation	Testing and Calibration	Next review date	30/09/2019



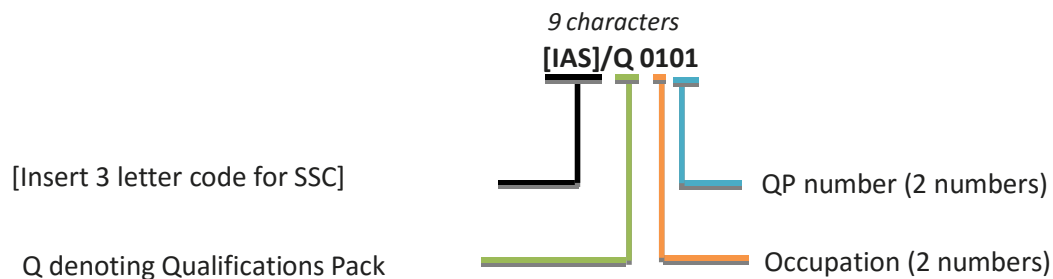
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Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

Annexure

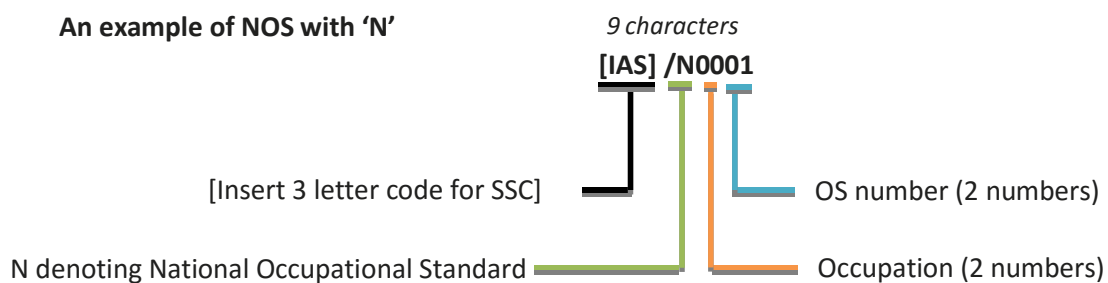
Nomenclature for QP and NOS

Qualifications Pack



Occupational Standard

An example of NOS with 'N'



Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

The following acronyms/codes have been used in the nomenclature above:

Sub-sector	Range of Occupation numbers
Installation and Commissioning	01-29
Operation and Maintenance	30-49
Calibration	50-55
Design, Fabrication / Manufacturing	56-79
Design, Fabrication, Installation & Commissioning	80-89
General	90-99

Sequence	Description	Example
Three letters	Industry name	IAS
Slash	/	/
Next letter	Whether QP or NOS	Q
Next two numbers	Occupation code	01
Next two numbers	OS number	01

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Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

CRITERIA FOR ASSESSMENT OF TRAINEES

Job Role Qualifications Pack- Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

Qualification Pack IAS/Q5012

Sector Skill Council Instrumentation Automation Surveillance & Communication

Guidelines for Assessment

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.
4. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below).
5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criterion.
6. To pass the Qualification Pack, every trainee should score a minimum of 70% of aggregate marks to successfully clear the assessment.
7. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Relative Weight of NOSs in the Assessment			
Sl. No	NOS no.	NOS Name	% Weightage
1	IAS/N5033	Ensure Work Place Readiness - Mechanical (Pressure, Vacuum, Water Flow) Calibration	20
2	IAS/N5034	Perform Calibration of Pressure and Vacuum Indicating Devices	20
3	IAS/N5035	Perform Calibration of Water Flow measuring devices	20
4	IAS/N5036	Perform Preventive Maintenance of Pressure, Vacuum, Water Flow Calibration Setup	20
5	IAS/N0204	Reporting of Task Performed-Calibration	10
6	IAS/N2105	Work Effectively with Teams	10
			100%

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Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

Assessment Outcomes	Assessment Criteria for Outcomes	Total Marks (160 +300 +165+ 80 + 100 +275)	Out of	Theory	Skills Practical
1. IAS/N5033 Ensure Work Place Readiness - Mechanical (Pressure, Vacuum, Water Flow) Calibration	PC1. Check workplace for cleanliness of work area and equipment		5	2	3
	PC2. Ensure an uncluttered workplace		5	2	3
	PC3. Use prescribed checklist. Note any deviations and report to supervisor		5	2	3
	PC4. Check / Feel for any abnormal vibrations generated by central air-conditioning plants, vehicular traffic and other sources.		5	2	3
	PC5. If any vibration is felt which is unusual, then try to locate the source of vibration. Check if special/ protective devices like vibration free tables and pillars etc., isolating the equipment from the floor, are affected in any way.		5	2	3
	PC6. Report any deviations and findings to the Supervisor and the concerned department.		5	2	3
	PC7. If the vibration level is above specified limits, Calibration operation may be suspended. Refer to organization SOP for the quantitative measurement of vibration and relation guidelines.		5	2	3
	PC8. Check / Listen for any abnormal noise in the calibration area. Refer to SOP for acceptable noise level - usually less than 60dBA.		5	2	3
	PC9. If any noise is felt which is unusual, then try to locate the source of noise.		5	2	3
	PC10. Report any deviations and findings to the Supervisor and the concerned department.		5	2	3
	PC11. If the noise level affects the Calibration process, then the operation may be suspended. Refer to organization SOP for the quantitative measurement of noise and related guidelines.		5	2	3
	PC12. Check for lighting / associated electricals at Pressure, Vacuum, Water Flow Calibration Installation. Report any deviations to electrical department.		5	2	3

Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

<p>PC13. Check for adequate lighting and working of associated electrical fittings in the Calibration area. The recommended level of illumination is 250-500 Lux on the working table, or as specified in the SOP.</p>		5	2	3
<p>PC14. Check for temporary/unsafe electrical wiring</p>		5	2	3
<p>PC15. Check for ambient temperature and humidity in the Calibration area. Refer to organization SOP for the quantitative measurement of temperature, humidity and barometric pressure and the related guidelines.</p> <ol style="list-style-type: none"> a. The reference standards shall be maintained at temperatures specified in order to ensure their conformance to the required level of operation. b. The relative humidity shall be maintained within the required levels. c. Barometric pressure shall be measured with the required accuracy using approved instruments for the correction of experimental pressure/flow as needed. d. The local value of 'g' shall be measured or calculated with the required accuracy using approved instruments / method for the correction of experimental pressure/flow for 'g' as needed. Ensure that the reference standards are maintained at temperatures specified in order to ensure their conformance to the required level of operation. 		5	2	3
<p>PC16. Report any deviations to the concerned department.</p>		5	2	3
<p>PC17. If the environment parameters are likely to adversely affect the required accuracy of measurement, then report to the Supervisor and seek guidance about performing calibration.</p>	160	10	5	5
<p>PC18. Ensure that the power supply of right quality (voltage, frequency, transients, regulation etc.) as specified in SOP is available - usually from a UPS. Check that any isolation transformers and filters etc. installed are not tampered with and the hum interference is within limits.</p>		5	2	3
<p>PC19. Ensure that operation of heavy loads in the premises or nearby locations does not cause any dip in voltage or transient currents.</p>		5	2	3
<p>PC20. Report any deviations to the concerned department.</p>		5	2	3
<p>PC21. Ensure that the laboratory is free from dust and external air pressure. Positive air pressure is normally maintained inside the laboratory to avoid ingress of dust.</p>		5	2	3
<p>PC22. Report any deviations to the concerned department.</p>		5	2	3

Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

	PC23. Ensure availability of suitable fire extinguishing equipment for possible fire hazards in the laboratory, per SOP.		5	2	3
	PC24. Ensure familiarity with method of giving the treatment in case of electric shock. Wall chart showing the procedure should be placed near the power supply switchgear and at other prominent places as prescribed under Indian Electricity Rules 1956.		5	2	3
	PC25. Ensure familiarity with pressure generating devices (compressors) and vacuum pumps and safety precautions to be observed.		5	2	3
	PC26. Ensure familiarity with various gases used in calibration of pressure measuring instruments and safety precautions relating to these. a. Observe precautions for Pressure Gauges to use with oxygen & Acetylene		5	2	3
	PC27. Report any deviations to the concerned department.		5	2	3
	PC28. Check for availability of instruments in the pressure, Vacuum and Water Flow Metrology calibration setup.		5	2	3
	PC29. Check availability of electrical power and the quality (whether UPS backed, voltage and frequency) as specified in the SOP		5	2	3
	PC30. Handle equipment in recommended and safe manner.		5	2	3
	PC31. Uses hand gloves of specified material for handling the UUC and Reference so that these are not soiled and to avoid heat transfer to Reference equipment or UUC during Calibration which may otherwise drastically affect the results.		5	2	3
		Total	160	65	95
2. IAS/N5034 Perform Calibration of Pressure and Vacuum Indicating Devices	PC1. Prepare Observation Sheet (use a standard form/format as specified in the SOP)	300	5	2	3
	PC2. Note in the Observation Sheet the details of the UUC (requesting company, lab reference number, type, make, model, serial number, date, time, technician's name etc.)		5	2	3
	PC3. Verify that the UUC is in good shape (i.e. no physical damage, readable markings, clean, no loose parts etc.)		5	2	3
	PC4. Note all parameters to measure for the requested calibration		5	2	3
	PC5. Note the number of readings to be taken for each parameter		5	2	3
	PC6. Note the Reference Instruments to use for the parameters		5	2	3

Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

	PC7. Wear gloves while handling instruments	5	2	3
	PC8. Verify that the Reference Instruments are available and are in good shape (i.e. usable for calibration, have valid certificates)	5	2	3
	PC9. Verify that the measurement environment is appropriate for the reference instruments and for the requested calibration, as specified in the SOP	5	2	3
	PC10. Record readings of ambient temperature, relative humidity and atmospheric pressure, with required precision using recommended devices	5	2	3
	PC11. Ensure Thermal Stabilization time are met for Dead Weights, per SOP. This will need to be reported. As a practical guideline, a waiting time of 24 hours is recommended.	5	2	3
	PC12. Follow the SOP guidelines and consult the Supervisor for selection of Reference Instruments and Weights. The following general considerations apply:	5	2	3
	PC13. Make sure that the reference equipment used for calibration of pressure gauges or electro manometer should be such that, its accuracy including uncertainty better than 1/3 of the accuracy class of the device under calibration.	5	2	3
	PC14. The reference equipment for calibration can be selected from below list based on the required accuracy class of the DUC. <ul style="list-style-type: none"> a. Hydraulic or Pneumatic Dead Weight Tester b. Digital Pressure calibrators with built-in hydraulic/pneumatic/vacuum pressure generating pump. c. Analog Master gauge or Pressure transducer with Digital display along with hydraulic/ pneumatic/vacuum pressure generating pump. 	5	2	3
	PC15. Ensure that the Transmitter /Transducers are calibrated as a whole unit with indicator and power supply	5	2	3
	PC16. Follow SOP guidelines regarding Metrological requirements.	5	2	3

Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

<p>PC17. Observe requirements for Pressure Gauges to use with oxygen & Acetylene</p> <ol style="list-style-type: none"> Oxygen under pressure forms an explosive mixture with oil or grease, and a serious explosion may result if the two are brought together. When Oxygen gauges are calibrated Oil and grease should not be allowed to touch or enter the gauge. They should be tested only with dry and clean air and used for that purpose alone, and no other gauges should be calibrated on this equipment to avoid the risk of oil contamination (refer appendix C clause 9.1.5 of IS 3624: 1987, RA 2004). Acetylene in conjunction with copper form an explosive compound. Care shall be taken during calibration. SI Unit of measurement of pressure is Pascal, (Pa). <p>Pressure gauges, vacuum gauges, Pressure-Vacuum gauges are to be calibrated in Pa, kPa, MPa, GPa, as per SI units. However, Units like bar and mbar, may also be used.</p> <ol style="list-style-type: none"> 'g' value shall be known with sufficient accuracy either by Geological Survey of India or any other relevant source specified in SOP, such as calculating 'g' value from latitude and height as per the specified equation. Air buoyancy correction shall be applied if the weights are calibrated either by conventional basis or by true mass basis. Knowing the true mass, piston cylinder area value and 'g' value, Pressure value will be determined after applying buoyancy correction. The reference equipment used for calibration of pressure gauges or electro manometer should be such that, its accuracy including uncertainty is better than 1/3 of the accuracy class of the device under calibration. 		10	5	5
<p>PC18. Follow SOP guidelines for environmental conditions. The following norms are generally applicable.</p>		5	2	3
<p>PC19. Ensure that for Pneumatic and Hydraulic Pressure Measurements, during calibration temperature is within 18°C to 28°C. Preferably 23°C ±1.5°C and should not change more than 1°C during calibration.</p>		5	2	3
<p>PC20. Ensure that for Vacuum Pressure (as per Standard ISO 27893:2011), during calibration temperature is within 20°C to 26°C. Preferably 23°C ±1.5°C and should not change more than 1°C during calibration.</p>		5	2	3

Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

PC21. Ensure Temperature measuring instrument has an expanded uncertainty $\leq 0.5^{\circ}\text{C}$ at $k=2$.	5	2	3
PC22. Ensure 'g' value is known to sufficient accuracy, per SOP.	5	2	3
PC23. Account for effect of gravity "g" on calibration when Dead weight testers are used. a. It is recommended that, the Pressure calibration laboratory establishes local value of gravity (g) and use weights that have been calibrated at that gravitational constant. b. For measurement uncertainty of applied force, 'g' value shall be known. For realization of applied force more than 0.01%, 'g' value shall be calculated using appropriate formula, as specified in the SOP.	5	2	3
PC24. Estimation of Air Density is to be made to sufficient accuracy depending on the required uncertainty of the applied force by measuring temperature, RH & barometric pressure. Use appropriate formula as specified in the SOP.	5	2	3
PC25. Method used for calibration is required to be mentioned in the calibration certificate issued to the customer. Pressure gauges can be calibrated with one of the following methods.	5	2	3
PC26. Pressure gauges can be calibrated with one of the following methods. a. Using Dead weight tester by calculating the actual pressure generated with the help of area of the piston, local 'g' and applied known mass while comparing. b. Using Dead weight tester by comparison method using the nominal pressure values mentioned on the pressure weights of the Dead weight tester. c. Using Digital Pressure Calibrator. d. By comparison method using a Digital /analog pressure gauge and pressure generating system. i. Method I: Reading as per set on DUC ii. Method II: Reading as per set on standard	5	2	3
PC27. Follow the measurement procedure for the method chosen per SOP.	5	2	3
PC28. Make measurements using the Reference Weights, the Comparator instrument and the UUC, following the prescribed measurement sequence.	5	2	3
PC29. Perform the recommended calibration sequences, per SOP.	5	2	3

Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

PC30. Wait for steady-state conditions to be reached for each step.	5	2	3
PC31. Observe a waiting time of five minutes for bourdon pressure gauges. For quasi-static calibrations (piezoelectric sensor principle) the waiting time is reduced. Follow SOP guidance.	5	2	3
PC32. Record the number of readings, as prescribed in the SOP.	5	2	3
PC33. Record readings of ambient temperature and relative humidity and the air pressure at the beginning and end of measurements using recommended devices.	5	2	3
PC34. After noting down the applied mass and temperature at 5 calibration point of the steps and series as per recommended sequence, the pressure generated to balance the UUT can be calculated using the appropriate pressure formula specified in the SOP.	5	2	3
PC35. In case of Pressure generated from a pneumatic dead weight tester, Fluid head correction factor may be considered negligible and pressure distortion correction may be considered negligible if not reported in the certificate	5	2	3
PC36. In case of absolute pressure measurements, the atmospheric pressure should be added to the generated pressure. The uncertainty component of atmospheric pressure measuring device should also be included while estimating the measurement uncertainty of calibration.	5	2	3
PC37. Check the calibration certificate of the Dead weight tester whether pressure value is given for standard 'g' value 9.80665 m/s ² or local 'g' value (corrected to the lab 'g' value). If the pressure values mentioned is for standard 'g' value then convert them to the local 'g' value using the following equation for accurate measurements.	5	2	3
PC38. Also add the uncertainty components of temperature and 'g' value in terms of pressure to the uncertainty given in the certificate.	5	2	3
PC39. The pressure corrected to the local 'g' value and temperature at which calibration is performed using the appropriate equation specified in the SOP.	5	2	3

Qualifications Pack For Calibration Technician - Mechanical (Pressure, Vacuum, Water Flow)

<p>PC40. Estimate uncertainties after noting down the applied pressure at each calibration point of the steps and series as per the defined error. Uncertainty components of the calibration to be considered but not limited to:</p> <ul style="list-style-type: none"> • Applied pressure uncertainty (after correction if required) (u1) Uncertainties associated with DUC • Repeatability (u2) • Reproducibility(u3) - Optional • Resolution (u4) • Zero error (u5) • Hysteresis (u6) 		10	5	5
<p>PC41. Calculate combined uncertainty using equation: $uc = \sqrt{u1^2 + u2^2 + u3^2 + u4^2 + u5^2 + u6^2}$</p>		5	2	3
<p>PC42. Calculate Expanded uncertainty using equation $U = k \times uc$ where, k= coverage factor corresponding to the effective degree of freedom.</p>		5	2	3
<p>PC43. Estimate uncertainties after noting down the applied pressure at each calibration point of the steps and series as per the specified error.</p>		5	2	3
<p>PC44. Consider following Uncertainty components of the calibration:</p> <ul style="list-style-type: none"> • Applied pressure as per the calibration certificate of digital pressure calibrator (u1) • Uncertainties associated with DUC • Repeatability (u2) • Reproducibility(u3) -Optional • Resolution (u4) • Zero error (u5) • Hysteresis (u6) <p>If Digital multi meter is used to record values in units other than pressure the associated uncertainty should also be added to the above.</p>		5	2	3
<p>PC45. Calculate combined uncertainty using equation: $uc = \sqrt{u1^2 + u2^2 + u3^2 + u4^2 + u5^2 + u6^2}$</p>		5	2	3
<p>PC46. Calculate Expanded uncertainty using equation: $U = k \times uc$ Where, k= coverage factor corresponding to the effective degree of freedom.</p>		5	2	3
<p>PC47. Follow recommendations of SOP, based on ISO 27893:2011 & DKD R-6-1.</p>		5	2	3
<p>PC48. Refer to SOP for the equations to use for the type of calibration being performed</p>		5	2	3
<p>PC49. Use form/format specified in the SOP for performing calculations</p>		5	2	3

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	PC50. Perform the required calculations using calculator or software as specified, using the equations and procedures specified in the SOP.		10	5	5
	PC51. Record the results, including uncertainty, as calculated above, in the specified format		5	2	3
	PC52. Prepare Report in the format specified in the SOP.		10	5	5
	PC53. Store and share report with the designated persons		5	2	3
	PC54. Return the Reference instruments to their recommended storage position and put in their box/cover		5	2	3
	PC55. Return the UUC to its recommended storage position and put in its accompanying box/cover		5	2	3
	PC56. Fix/Attach any recommended tag/markings on the UUC to signify that its calibration has been done		5	2	3
		Total	300	124	176
3. IAS/N5035 Perform Calibration of Water Flow measuring devices	PC1. Ensure that the three fundamental components of Water Flow Calibration Facility are in good working order: a. Flow generation system b. Test section c. Gravimetric / Volumetric reference system	165	5	2	3
	PC2. Prepare Observation Sheet (use a standard form/format as specified in the SOP)		5	2	3
	PC3. Note in the Observation Sheet the details of the UUC (requesting company, lab reference number, type, make, model, serial number, date, time, technician's name etc.)		5	2	3
	PC4. Verify that the UUC is in good shape (i.e. no physical damage, readable markings, clean, no loose parts etc.)		5	2	3
	PC5. Note all parameters to measure for the requested calibration		5	2	3
	PC6. Note the number of readings to be taken for each parameter		5	2	3
	PC7. Note the Reference Instruments to use for the parameters		5	2	3
	PC8. Wear gloves while handling instruments		5	2	3
	PC9. Verify that the Reference Instruments are available and are in good shape (i.e. usable for calibration, have valid certificates)		5	2	3

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PC10. Verify that the measurement environment is appropriate for the reference instruments and for the requested calibration, as specified in the SOP	5	2	3
PC11. Record readings of ambient temperature, relative humidity and atmospheric pressure, with required precision using recommended devices	5	2	3
PC12. Follow SOP guidelines regarding Metrological requirements.	5	2	3
PC13. Follow SOP guidelines and applicable standards such as ISO 4064/3, OIML R-49 etc. for choosing the measurement method.	5	2	3
PC14. Select principle of measurement for the quantity of liquid in the container by mass or volume. a. Gravimetric calibration b. Volumetric calibration	5	2	3
PC15. Select flow measurement time control method: a. Standing-start-and-finish method b. Flying-start-and-finish method c. Dynamic collection method	5	2	3
PC16. Perform steps for setting up the chosen calibration method as specified in the SOP.	5	2	3
PC17. Follow SOP guidelines to ensure that the appropriate reference standards are used for the type of calibration and method chosen.	5	2	3
PC18. Follow the measurement procedure for the method chosen per SOP.	5	2	3
PC19. Record readings of the following parameters used for calculations and corrections, using specified instruments or reference data, per SOP: a. Ambient temperature, relative humidity and the atmospheric pressure at the beginning and end of measurements b. Kinematic Viscosity of measuring fluid c. Density of measuring fluid d. Diameter of pipe	5	2	3
PC20. Set the operating flow conditions and record the recommended sets of readings for the chosen methods, as prescribed in the SOP.	5	2	3
PC21. Refer to SOP for the equations to use for the type of calibration being performed	5	2	3
PC22. Use form/format specified in the SOP for performing calculations	5	2	3

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	PC23. Perform the required calculations using calculator or software as specified, using the equations and procedures specified in the SOP.		5	2	3
	PC24. PC24. PC24. Determine Uncertainty Components, as prescribed in the SOP, including: a. Collected Mass Uncertainty b. Collection Time Uncertainty c. Density d. Viscosity e. Temperature		5	2	3
	PC25. Calculate Overall Uncertainty		5	2	3
	PC26. Record the results, including uncertainty, as calculated above, in the specified format		5	2	3
	PC27. Prepare Calibration Report in the format specified in the SOP.		5	2	3
	PC28. Store the calibration report in hard/soft copy as required.		5	2	3
	PC29. Submit the report is to the appropriate authority in the organization, as specified in the SOP, for verification and signature.		5	2	3
	PC30. If no more calibrations are to be performed then drain the system, reset controls to the initial conditions, and perform other shut down procedures as recommended in the SOP.		5	2	3
	PC31. Ensure that the Reference instruments are returned to their recommended storage location / condition.		5	2	3
	PC32. Return the UUC to its recommended storage position and put in its accompanying box/cover.		5	2	3
	PC33. Fix/Attach any recommended tag/markings on the UUC to signify that its calibration has been done.		5	2	3
		Total	165	66	99
4. IAS/N5036 Preventive Maintenance of Pressure, Vacuum, Water Flow Calibration Setup	PC1. Check operation of Reference Instruments, Dead Weights, Volumetric References etc. and accessories for proper operation over their range	80	5	2	3
	PC2. Check operation of Digital Reference Calibration Instruments, Equipment and Gauges for proper operation over their range		5	2	3
	PC3. Check condition of Reference Weights for cleanliness, surface condition, rusting or any other environmental effects. Perform cleaning and conditioning per SOP directions.		5	2	3

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	PC4. Check condition of tanks, piping, valves, diverters, timers and other accessories of water meter test setup. Look for any leaks or corrosion. Perform tightening, cleaning and conditioning per SOP directions.		5	2	3
	PC5. Check condition and operation of pressure creating devices (compressors), piping, safety valves and other accessories per SOP directions. Look for any leaks and take appropriate action.		5	2	3
	PC6. Check condition and operation of Vacuum creating devices (vacuum pumps), piping, valves, gauges and other accessories per SOP directions. Look for any vacuum leaks and take appropriate action.		5	2	3
	PC7. Check for any damaged cable, broken plug/socket and leakage current in all electrical/electronic instruments.		5	2	3
	PC8. Check validity of calibration certificate for all Reference Instruments, Equipment and Gauges		5	2	3
	PC9. Check operation of environmental parameter monitoring equipment are in working order. This includes: Temperature, Humidity, Barometric pressure, Dust, Electrical power quality, Vibration, Noise		5	2	3
	PC10. Check operation of environments conditioning systems and ensure that the environmental parameters are in the specified limits.		5	2	3
	PC11. Check condition and operation of fire safety equipment.		5	2	3
	PC12. Check condition and operation of security monitoring and access control systems.		5	2	3
	PC13. For the listed items, perform corrective action such as cleaning, greasing, tightening of screws etc. following recommended procedure in the SOP.		5	2	3
	PC14. Use authorized cleaning solvents and greases in the right amount. Use approved cleaning tissues or cloth.		5	2	3
	PC15. If the recommended maintenance does not restore the device to the required condition, add this to the Corrective Maintenance list and report.		5	2	3
	PC16. Complete preventive maintenance schedule list of Pressure, Vacuum, Water Flow Calibration setup and accessories. Close any issues in the list.		5	2	3
		Total	80	32	48
5. IAS/N 0204 Reporting of Task Performed- Calibration	PC1. Report completed task per organization process.	100	20	10	10
	PC2. Report faults/issues to immediate supervisor		20	5	15

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	PC3. Perform entry of preventive maintenance check lists/reports		20	10	10
	PC4. Report on noticing any visible changes in of Pressure, Vacuum, Water Flow Calibration setup or its accessories. Report for immediate attention of supervisor		20	5	15
	PC5. Report any theft in Pressure, Vacuum, Water Flow Calibration setup to supervisor		10	5	5
	PC6. Report suspicious movement of new persons near of Pressure, Vacuum, Water Flow Calibration setup to security and supervisor		10	5	5
		Total	100	40	60
6. IAS/N2105 Work Effectively With Teams	PC1. Know and understand the team objectives and goals	275	3	1	2
	PC2. Know team members by name. Greet them appropriately and respond to their greetings.		2	1	1
	PC3. Know the roles and responsibilities of team members. Ensure others know about you and your role in the team		2	1	1
	PC4. Learn about the culture and preferences of team members – especially if they belong to other organizations or nationalities		5	1	4
	PC5. Follow organization’s policies and procedures for working with team members within and outside the organization – especially relating to privacy, confidentiality and security.		2	1	1
	PC6. Create an environment of trust and mutual respect		3	1	2
	PC7. Use appropriate mode of communication – verbal, written, mail, phone or text and clearly articulate your message to ensure that the recipient understands the message.		2	1	1
	PC8. Listen to team members and try to understand what they are wanting to say. Seek or provide clarifications if you see any gap in understanding		3	1	2
	PC9. Communicate professionally and follow organization protocols. Do not overload the team members with unnecessary and unsolicited information		4	1	3
	PC10. Share important information with the team timely.		3	1	2
	PC11. Respond to communications promptly.		3	1	2
	PC12. Perform own role and produce output in time for other team members to consume		3	1	2

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PC13. Receive inputs from others and work upon it per role requirement	2	1	1
PC14. Make adjustments within the permissible rules so that work flows smoothly.	2	1	1
PC15. Help team members to perform their role effectively and provide any clarifications and support they need	2	1	1
PC16. Share tools and common resources fairly, taking cognizance of others' needs and schedules	2	1	1
PC17. Resolve any contentious issues amicably, involving the team lead or the supervisor if needed	2	1	1
PC18. Let team members know in good time if you cannot carry out your commitments, explaining the reasons and alternate solutions, if any. Let the team lead know about this.	2	1	1
PC19. Think positively and make constructive suggestions to meet the goals	2	1	1
PC20. Accept and give suggestions with open mind	2	1	1
PC21. Take initiatives and volunteer to contribute	2	1	1
PC22. Help team members with facts and figures to arrive at workable decisions	2	1	1
PC23. Accept decisions professionally and support these, even if these do not match your suggestions and personal views	4	1	3
PC24. Act in the interest of the team and the organization to ensure that things do not 'fall through the gap' and team goals are achieved.	4	1	3
PC25. Take initiative to correct the situation if something seems to be going wrong.	2	1	1
PC26. Seek help or escalate if the situation demands	2	1	1
PC27. Follow organization's and statutory guidelines about making references or comments to social customs or preferences	2	1	1
PC28. Refrain from making any comments to hurt sentiments	2	1	1
PC29. Accommodate team members' preferences to the extent feasible. If these come in the way of fulfilling team goals, discuss with the supervisor/ team leader.	2	1	1

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	PC30. Seek information and clarifications from others if you do not understand any customs.		2	1	1
		Total	275	30	45

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