## TSC Category
Manufacturing and Operations

## TSC
Precision Measurement

## TSC Description
Perform precision measurements with relevant techniques and equipment to meet requirements for product conformity

### TSC Proficiency Description

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
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</thead>
<tbody>
<tr>
<td>Select, clean and check the measuring equipment to determine and check for dimensional and geometric conformance of components, equipment and machines against desired standards</td>
<td>PRE-MPR-1034-1.1</td>
<td>PRE-MPR-2034-1.1</td>
<td>PRE-MPR-3034-1.1</td>
<td>PRE-MPR-4034-1.1</td>
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<tr>
<td>Set up and operate coordinate measuring machines (CMM)</td>
<td>Manage hands-on practical and measuring techniques using various types of precision metrology equipment</td>
<td>Review measurements and conduct error analyses to correct inaccuracies</td>
<td>Assess the need for, and utilise, advanced measurement systems to achieve measurement requirements</td>
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### Knowledge

- Technical and engineering drawings
- Calculation techniques for measurements
- Types and specifications of precision measuring equipment
- Limits and tolerances of precision measuring equipment
- Correct usage of precision measuring equipment
- Reference temperature for high accuracy measurement
- Causes of measuring errors and common faults and defects in precision measuring equipment
- Safe practices in using precision measuring equipment
- Proper maintenance and storage of precision measuring equipment
- Standard operating procedures (SOP) for marking of faulty and/or unsafe precision measuring equipment
- Technical and engineering drawings
- Principles and application of CMM
- Procedures for setting CMM
- Types of tools and fixtures
- Types and application of probes
- Methods and techniques of measurement
- Use of equipment, machines, protective clothing and eyewear, in accordance with safety and health procedures
- Potential hazards and their relevant minimisation and control methods
- Quality assurance procedures at the workplace
- Procedures for documentation and maintenance of measurement records
- Technical and engineering drawings
- Metrology standards and terminologies
- Types of measuring errors
- Interpretation of geometric dimensioning and tolerancing (GD&T)
- Methods of inspection using coordinate measuring machines (CMM)
- Measurement techniques for roundness
- Measurement techniques for surface textures
- Statistical methods relevant to precision measurements
- Concept of process capability index
- Principles of precision engineering
- Types of precision metrology technology
- Types of precision measurement errors
- Methods of error analysis
- Principles and applications of precision measurement instruments
- Principles and applications of surface roughness measurement instruments
- Precision measurement and calibration of machine tools
- Principles of precision engineering
- Types of precision metrology technology
- Principles and applications of scanning electron microscopes, electron microprobes, atomic force microscopy, and other forms of advanced metrology systems
<table>
<thead>
<tr>
<th>Abilities</th>
<th>Interpret drawing and component specifications</th>
<th>Plan work activities and requirements in accordance with organisational procedures</th>
<th>Select and set up appropriate precision measuring equipment according to work specifications</th>
<th>Calibrate measuring equipment and record in reports in accordance with organisational procedures</th>
<th>Anticipate possible failure of measuring equipment and measures to take corrective actions</th>
<th>Read results from measuring equipment and compare results against component requirements</th>
<th>Report dysfunctional equipment for repair or replacement, where appropriate</th>
<th>Maintain good housekeeping and compliance with workplace safety and health (WSH) practices</th>
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<tr>
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<td>Define metrology standards for length measurement according to quality requirements</td>
<td>Interpret measurement terminologies for the field of calibration and measurement</td>
<td>Analyse measuring errors to evaluate calibration and measurement capabilities</td>
<td>Interpret GD&amp;T symbols on technical drawings for conformity in measurements</td>
<td>Perform layout inspections using CMM for product conformity</td>
<td>Measure and analyse cylindrical parts using roundness measuring machines, for verification of product quality</td>
<td>Measure surface finishes of parts for verification of surface conformity</td>
<td>Document processes using basic statistical methods for measurement reports and quality assurance (QA) records</td>
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<td>Review measurement results to identify sources of error</td>
<td>Conduct error analyses to identify system errors, random errors, measurement repeatability and/or uncertainties</td>
<td>Determine potential methodologies for reducing measurement errors</td>
<td>Select proper instruments to measure precision engineering components</td>
<td>Calibrate precision measurement machines</td>
<td>Measure component dimensions using coordinate measurement machines (CMM)</td>
<td>Measure surface primary forms, roughness and surface profiles using stylus-based contact instruments</td>
<td>Propose alternative measurement methods to optimise measurement activities’ values in different situations</td>
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<td>Analyse measurement requirements to determine need to utilise advanced metrology systems</td>
<td>Review technologies for scanning electron microscopes, microprobes and/or atomic force microscopy, to evaluate suitability of applications to meet measurement requirements</td>
<td>Develop plans to implement advanced metrology systems in manufacturing processes to meet measurement requirements</td>
<td>Propose alternative measurement methods to optimise measurement activities’ values in different situations</td>
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