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# PRECISION INSTRUMENTATION



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CBT Curriculum

National Vocational Certificate Level 3

Version 1 - November, 2019



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## **Introduction**

### **Definition/ Description of the training program for *Precision Instrumentation Lev-3***

Precision instrument technicians maintain and repair delicate equipment and need to have a steady hand and excellent eyes to work with the tiny gears and parts of these instruments. Instrumentation can be broadly defined as any automated machine used to facilitate industries related to science and technology, such as engineering, medicine, or scientific laboratory research. Instrument technicians maintain and repair these devices, as well as ensure that they comply with industry standards. Technicians often are on call or work overtime.

### **Purpose of the training program**

The core purpose of this qualification is to produce employable Instrumentation Technicians who could perform Precision Instrumentation according to national and international standards. In addition, this qualification will prepare unemployable youth to be employed in the light engineering sector.

### **Overall objectives of training program**

The overall objectives of the precision instrumentation program are to enable students to:

- Work in jobs where precision instrumentation is required
- Select tools and equipment used to install, commission and calibrate instruments
- Select tools, equipment's and consumables accurately according to Job specification
- Sequence the different stages of preparation, installation, calibration and reporting
- Work safely and professionally

### **Competencies gained after completion of the course**

At the end of the course, the trainee must have attained the following competencies:

1. Ensure Health, hygiene and safety of other individuals at work
2. Perform benchwork

3. Fabricate Piping & Tubing System
4. Install & Commission Instruments
5. Calibrate Instruments
6. Communicate at workplace

### **Possible available job opportunities available immediately and later in the future**

Skilled personnel in the field of precision instrumentation usually get hired in areas pertaining to the light engineering sector. They can become:

- Calibration Technician
- Instrumentation Technician
- Lead Technician
- Instrument Supervisor
- Entrepreneur

Some experienced personnel in the field of precision instrumentation achieve a highly respected level of salaries. There are good prospects for securing employment both within Pakistan and abroad. The employment outlook in this occupation will be influenced by a wide variety of factors including:

- Trends and events affecting overall employment (especially in the Construction industry)
- Location in Pakistan
- Employment turnover (work opportunities generated by people leaving existing positions)
- Occupational growth (work opportunities resulting from the creation of new positions that never existed before)
- Size of the industry
- Flexibility of the applicant (concerning location and schedule of work)

### **Trainee entry level**

Middle with Qualified in Level 2 in comparable qualifications like: Industrial Electrician or General Electrician or Machinist or Level 2 RPL qualified in: Industrial Electrician or General Electrician or Machinist

**Minimum qualification for trainer**

Level 4 qualified in Precision Instrumentation or DAE (Instrumentation/ Electrical/ Electronics/ Mechanical) with at least 2 years of working experience in a related field.

**Recommended trainer: trainee ratio**

The recommended maximum trainer: trainee ratio for this program is 1 trainer for 20 trainees

**Medium of instruction i.e. language of instruction**

Instructions will be in Urdu/ English /Local language.

**Duration of the course (Total time, Theory & Practical time)**

This curriculum comprises 6 modules. The recommended delivery time is 680 hours. Delivery of the course could therefore be full time, 5 days a week, for 6 months. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.

The full structure of the course is as follows:

Module	Theory hours	Workplace hours	Total hours
Module 1: Ensure Health, hygiene and safety of other individuals at work	10	30	40
Module 2: Perform Bench work	18	72	90
Module 3: Fabricate piping & tubing system	30	120	150
Module 4: Install & commission instruments	30	150	180
Module 5: Calibrate instruments	30	150	180
Module 6: Communicate at workplace	10	30	40

### Sequence of the modules

This qualification is made up of 6 modules. A suggested distribution of these modules is presented overleaf. This is not prescriptive and training providers may modify this if they wish.

Module 1: Ensure Health, hygiene and safety of other individuals at work, covers various aspects related to occupational health & safety that are required for the students to understand in order to work in a safe environment. 1 module covers basic benchwork which allows students to revise basic practices pertaining to the workshop. 1 module related to the fabrication of piping & tubing system which gives insights to students into systems on which instrumentation technicians work.

2 modules cover installation, commissioning and calibration of precision instruments and systems while one module aims to enable students to communicate at workplace.

Each module covers a range of learning components. These are intended to provide detailed guidance to teachers (for example the Learning Elements component) and give them additional support for preparing their lessons (for example the Materials Required



component). The detail provided by each module will contribute to a standardized approach to teaching, ensuring that training providers in different parts of the country have clear information on what should be taught. Each module also incorporates the industrial demand of Pakistan that make this qualification unique to Pakistan’s industry needs.

The distribution table is shown below:

<p><b>Module 2:</b></p> <p><b>Perform Benchwork</b></p> <p>90 hours</p>	<p><b>Module 4:</b></p> <p><b>Install &amp; commission instruments</b></p> <p>180 hours</p>	<p><b>Module 5:</b></p> <p><b>Calibrate instruments</b></p> <p>180 hours</p>	<p><b>Module 1:</b></p> <p><b>Ensure Health, hygiene and safety of other individuals at work</b></p> <p>40 hours</p>
<p><b>Module 3:</b></p> <p><b>Fabricate piping &amp; tubing system</b></p> <p>150 hours</p>			<p><b>Module 6:</b></p> <p><b>Communicate at workplace</b></p> <p>40 hours</p>

## Summary – overview of the curriculum

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
<p><b>Module 1: Ensure Health, hygiene and safety of other individuals at work</b></p> <p><b>Aim:</b> The aim of this module is to develop advanced knowledge, skills and understanding to ensure health, hygiene &amp; safety of the trainee and others at work</p>	<p>LU1 Identify what can harm people in your workplace</p> <p>LU2 Identify who might be harmed</p> <p>LU3 Ensure health, hygiene and safety of individuals at work</p>	10Hrs	30Hrs	40 Hrs
<p><b>Module 2: Perform Benchwork</b></p> <p><b>Aim:</b> The aim of this module is to develop knowledge, skills and understanding to perform bench work.</p>	<p>LU1 Perform sawing</p> <p>LU2 Perform filing</p> <p>LU3 Perform drilling</p> <p>LU4 Perform hand tapping</p> <p>LU5 Perform hand reaming</p> <p>LU6 Perform counter boring</p> <p>LU7 Perform countersinking</p>	18 Hrs	72 Hrs	90 Hrs

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
<p><b>Module 3: Fabricate piping &amp; tubing system</b></p> <p><b>Aim:</b> The aim of this module is to develop knowledge, skills and understanding to fabricate piping &amp; tubing system</p>	<p>LU1 Interpret drawings/ layouts</p> <p>LU2 Prepare work area</p> <p>LU3 Bend/ Cut pipes &amp; tubes</p> <p>LU4 Perform threading</p> <p>LU5 Braze pipes</p> <p>LU6 Make welded joints through arc welding</p> <p>LU7 Install pipelines</p>	30 Hrs	120 Hrs	150 Hrs
<p><b>Module 4: Install &amp; Commission Instruments</b></p> <p><b>Aim:</b> The aim of this module is to develop knowledge, skills and understanding to install &amp; commission instruments.</p>	<p>LU1 Install &amp; commission temperature instruments</p> <p>LU2 Install &amp; commission pressure instruments</p> <p>LU3 Install &amp; commission level instruments</p> <p>LU4 Install &amp; commission flow instruments</p> <p>LU5 Recommission process loop</p>	30 Hrs	150 Hrs	180 Hrs
<p><b>Module 5: Calibrate Instruments</b></p> <p><b>Aim:</b> The aim of this module is to develop knowledge, skills and understanding to calibrate instruments.</p>	<p>LU1 Calibrate Temperature Instruments</p> <p>LU2 Calibrate Pressure Instruments</p> <p>LU3 Calibrate Level Instruments</p> <p>LU4 Calibrate Flow Instruments</p>	30 Hrs	150 Hrs	180 Hrs

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
<p><b>Module 6: Communicate at workplace</b></p> <p><b>Aim:</b> The aim of this module is to develop knowledge, skills and understanding to communicate at workplace</p>	<p>LU1 Communicate within the organization</p> <p>LU2 Communicate outside the organization</p>	<p>10 Hrs</p>	<p>30 Hrs</p>	<p>40 Hrs</p>

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Module-1  
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## Modules

### Module 1: Ensure health, hygiene and safety of other individuals at work

**Objective of the module:** The aim of this module is to develop knowledge, skills and understanding needed to ensure health, hygiene & safety of other others at work.

**Duration:** 40 Hrs

**Theory:** 10Hrs

**Practical:** 30Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<p><b>LU1:</b> Identify what can harm people in your workplace</p>	<p><b>The trainee will be able to:</b></p> <p>Check manufacturers' instructions or data sheets for chemicals &amp; equipment</p> <p>Look back at your accident and ill-health records</p> <p>Identify any potential risk to others' health, hygiene and safety</p> <p>Deal with resolvable problems according to prescribed procedures</p> <p>Report unresolvable problems to immediate supervisor</p>	<p>Knowledge and understanding of PPE'S</p> <p>Knowledge and understanding about how to handle issues</p> <p>Knowledge and understanding about how to monitor accident records.</p> <p>Knowledge and understanding about how to monitor ill health records.</p> <p>Knowledge and understanding of training and documents sheet for chemicals and equipment's.</p> <p>Knowledge and understanding of possible risk to maintain cleanliness and safety.</p> <p>Knowledge and understanding to resolve difficulties within standards define.</p> <p>Maintaining impartible issues list for</p>	<p><b>Total</b> 13 Hrs</p> <p><b>Theory:</b> 03 Hrs</p> <p><b>Practical:</b> 10 Hrs</p>	<p>Pen/ Pencils</p> <p>Papers</p> <p>Printers</p> <p>Notebook/ note pads</p> <p>Computer</p> <p>Multimedia</p> <p>Projectors</p> <p>USB</p> <p>White board</p> <p>Markers</p> <p>Dusters</p> <p>PPE'S</p>	<p>Classroom</p> <p>Training workshop</p>

		superior.			
<b>LU 2:</b> Identify who might be harmed	<p><b>The trainee will be able to:</b></p> <p>Check for workers with special needs</p> <p>Check for people who might not be in the workplace all the time, such as visitors, contractors and maintenance workers</p> <p>Take members of the public into account if they could be hurt by your activities</p> <p>Consider how your work affects others</p> <p>Ask your workers if there is anyone you may have missed</p>	<p>Knowledge and understanding about how to maintain logbook for visitors, contractors and workers.</p> <p>Maintaining worker exceptional needs.</p> <p>Maintaining public account as per standard define on manual.</p> <p>Identification of hazards that might be cause to others</p> <p>Brief others (contractors and supervised Staff of health hazards</p> <p>Identification of missing personnel</p>	<p><b>Total</b> 13 Hrs</p> <p><b>Theory:</b> 03 Hrs</p> <p><b>Practical:</b> 10 Hrs</p>	<p>Pen/Pencils</p> <p>Papers</p> <p>Printers</p> <p>Notebook/ note pads</p> <p>Computer</p> <p>Multimedia</p> <p>Projectors</p> <p>USB</p> <p>White board</p> <p>Markers</p> <p>Dusters</p> <p>PPE'S</p>	<p>Classroom</p> <p>Training workshop</p>
<b>LU 3:</b> Ensure health, hygiene and safety of individuals at work	<p><b>The trainee will be able to:</b></p> <p>Comply the duties regarding Health, hygiene and safety</p> <p>Support individuals at work to make sure that risks to their Health, hygiene and safety are</p>	<p>Knowledge and understanding about hygienic environment.</p> <p>Brief others (contractors and supervised Staff of health hazards</p> <p>Finalizing your work according health safety requirement.</p>	<p><b>Total</b> 14 Hrs</p> <p><b>Theory:</b> 04 Hrs</p> <p><b>Practical:</b> 10 Hrs</p>	<p>Pen/ Pencils</p> <p>Papers</p> <p>Printers</p> <p>Notebook/ note pads</p> <p>Computer</p> <p>Multimedia</p>	<p>Classroom</p> <p>Training workshop</p>

	managed	Maintaining each person health and safety and risk assessment		Projectors USB White board Markers Dusters PPE'S	
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## Module 2: 0714001033 Perform bench work

**Objective of the module:** The aim of this module is to develop advanced knowledge, skills and understanding to perform benchwork.

**Duration:** 90 Hrs      **Theory:** 18 Hrs      **Practical:** 72 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1:</b> Perform sawing	<p><b>The trainee will be able to:</b></p> <p>Select appropriate blade according to the material and set in hacksaw frame</p> <p>Perform marking as per drawing</p> <p>Clamp the work piece properly</p> <p>Perform sawing as per standard procedures</p> <p>Verify the final job with the given drawing</p>	<p>Identify different types of hacksaw blades and its uses.</p> <p><b>Types:</b> High Carbon Steel, high speed steel</p> <p>Interpret basic engineering drawings</p> <p>Understand the types &amp; application of clamping devices</p> <p><b>Types:</b> bench vice, machine vice, parallel clamp, C-clamp</p> <p>Understand types &amp; properties of material (M.S,S.S,BRASS,COPPER etc)</p> <p>Standard procedure for Sawing i.e. gesture, griping, stroking etc.</p>	<p><b>Total</b> 10 Hrs</p> <p><b>Theory:</b> 02 Hrs</p> <p><b>Practical:</b> 08 Hrs</p>	<p>MS flat / Round</p> <p>Vernier caliper (0-150mm)</p> <p>Steel rule (0-300mm)</p> <p>Tri square (0-100mm)</p> <p>Scriber</p> <p>Marking ink</p> <p>Hacksaw blades (18-24 TPI)</p> <p>Hacksaw frame</p> <p>Bench vices 4 inches</p> <p>Divider</p> <p>Computer</p>	<p>Classroom or demonstration room</p> <p>Workshop/drawing Lab</p>

				Speakers Multimedia projector Logbook Handbooks Design books/ Sheets Pencils Erasers Pencil sharpeners Paper cutter Scissors Color pencils Different tgs and locks WD-40	
<b>LU 2:</b> Perform filing	<b>The trainee will be able to:</b> Select file type according to the job & profile Select marking tool and mark the job as per drawing Clamp the work piece properly	Identify different file types according to length, cross-section, roughness and their uses.  <b>Types:</b> (Roughness) bastard, second cut, smooth (cross-section) Flat, square, round, triangular.  Understand filing operation for different materials.  Standard procedure for filing i.e. gesture, griping, stroking etc.	<b>Total</b> 30 Hrs <b>Theory:</b> 05 Hrs <b>Practical:</b> 25 Hrs	MS flat bar Vernier caliper (0-150mm) Steel rule (0-300mm) Tri square (0-100mm) Bevel protector	Classroom or demonstration room Workshop/Lab

	<p>Perform filing as per standard procedures</p> <p>Verify the final job with the given drawing</p>			<p>Files of different shapes, size, cut and coarseness</p> <p>Scriber</p> <p>Marking ink</p> <p>Bench vices 4 inches</p> <p>Emery paper (200-400)</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/ Sheets</p> <p>Pencils</p> <p>Erasers</p> <p>Pencil sharpeners</p> <p>Paper cutter</p> <p>Scissors</p> <p>Color pencils</p> <p>Different tags and locks</p>	
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				WD-40	
<b>LU 3:</b> Perform drilling	<p><b>The trainee will be able to:</b></p> <p>Select drilling bit according to the material</p> <p>Select marking tool and mark the job as per drawing</p> <p>Clamp the work piece properly</p> <p>Set the machine RPM according to the drill size and work piece material</p> <p>Perform drilling &amp; post drilling operation as per standard procedures</p> <p>Verify the final job with the given drawing</p>	<p>Types of drill machines i.e. bench type, pillar type, column type, radial type etc.</p> <p>Major functional parts of a drill machine.</p> <p><b>Parts:</b> machine head, work table, speed pulley, feed lever, spindle / quill, drill chuck, sleeves etc.</p> <p>Identify Types of metal i.e. Ferrous and non-ferrous.</p> <p>Types of drill bits: straight shank and taper shank.</p> <p>Cutting speed of common engineering materials.</p> <p><b>Materials:</b> aluminum, mild steels, cast iron, carbon steels, copper, brass etc.</p> <p>Calculation method for RPM.</p> <p>Steps to perform drilling.</p> <p>Post drilling operations i.e. chamfering, bur removing etc.</p>	<p><b>Total</b> 18 Hrs</p> <p><b>Theory:</b> 04 Hrs</p> <p><b>Practical:</b> 14 Hrs</p>	<p>MS flat bar</p> <p>Steel rule (0-300mm)</p> <p>Tri square (0-100mm)</p> <p>Centre &amp; dot punch</p> <p>Scriber</p> <p>Marking ink</p> <p>Hammer (ball peen 250gm)</p> <p>Hand vices 4 inches</p> <p>Bench type drill machine</p> <p>Drill chuck</p> <p>Coolant</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p>

				sheets Pencils Erasers Pencil sharpeners Paper cutter Scissors Color pencils Different tags and locks WD-40	
<b>LU 4:</b> Perform hand taping	<b>The trainee will be able to:</b> Select tap according to the job specification Select marking tool and mark the job as per drawing Clamp the work piece properly Perform drilling & taping according to job Verify the final job with given drawing	Knowledge and understanding of thread terminology Identify the types of thread. <b>Types:</b> Metric, British, Withworth, American National, Gas pipe thread, NPT Types of taping: machine taping and hand taping Utility of taps: <ul style="list-style-type: none"> <li>• Internal threading</li> <li>• Cleaning threads</li> <li>• Maintenance of threads</li> <li>• Extraction of tap</li> </ul> Process steps for hand taping.	<b>Total</b> 09 Hrs <b>Theory:</b> 01 Hrs <b>Practical:</b> 08 Hrs	MS flat bar Vernier caliper (0-150mm) Steel rule (0-300mm) Tri square (0-100mm) Centre & dot Punch Scriber Marking ink Hammer (Ball Peen 250gm) Drill bits of different sizes (4-	Classroom or demonstration room Workshop/Lab

				20mm) Bench vices 4 inches Bench type drill machine Drill chuck Wire brush Coolant Tap set with handle (M3-M12) Computer Speakers Multimedia projector Logbook Handbooks Design books/ Sheets Pencils Erasers Pencil sharpeners Paper cutter Scissors Color encils Different tags and locks	
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				WD-40	
<b>LU 5:</b> Perform hand reaming	<p><b>The trainee will be able to:</b></p> <p>Select marking tools and mark the job as per drawing</p> <p>Clamp the work piece properly</p> <p>Perform drilling according to the size of reamer</p> <p>Select reamer and perform reaming as per job</p> <p>Verify the final job with given drawing</p>	<p>Understand drill size for reaming.</p> <p>Understand reaming operation.</p> <p>Types of reamers.</p> <ul style="list-style-type: none"> <li>• <b>Hand Reamer</b></li> <li>• <b>Machine Reamer</b></li> </ul> <p>Purpose of reamers:</p> <ul style="list-style-type: none"> <li>• Size as per tolerance</li> <li>• Roundness of holes</li> <li>• Surface finish of holes</li> </ul> <p>Process steps for hand or machine reaming</p> <p>Knowledge of tolerances and fits.</p>	<p><b>Total</b> 09 Hrs</p> <p><b>Theory:</b> 02 Hrs</p> <p><b>Practical:</b> 07 Hrs</p>	<p>Vernier Caliper (0-150mm)</p> <p>Steel Rule (0-300mm)</p> <p>Inside/ outside caliper</p> <p>Tri Square (0-100mm)</p> <p>Centre &amp; Dot Punch</p> <p>Scriber</p> <p>Marking Ink</p> <p>Hammer (Ball Peen 250gm)</p> <p>Drill bits of different sizes (4-20mm)</p> <p>Bench vices 4 inches</p> <p>Bench type drill machine</p> <p>Drill chuck</p> <p>Hand reamers with handle (8-16mm)</p> <p>Computer</p> <p>Speakers</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p>



				Multimedia Projector Logbook Handbooks Design Books/ Sheets Pencils Erasers Pencil Sharpeners Paper Cutter Scissors Color Pencils Different Tags and Locks WD-40	
<b>LU 6:</b> Perform Counter boring	<b>The trainee will be able to:</b> Select required counter boring tools according to the drawing Select marking tools and mark the job as per drawing Clamp the work piece properly Perform drilling operation	Understand counter boring operation Understand counter boring tools. <ul style="list-style-type: none"> <li>• <b>Counter boring Tool</b></li> <li>• <b>Flat Drill</b></li> </ul> Process steps for counter boring Calculation method for RPM. Steps to perform drilling. Post drilling operations i.e. chamfering, bur removing etc.	<b>Total</b> 07 Hrs <b>Theory:</b> 02 Hrs <b>Practical:</b> 05 Hrs	MS flat/ round bar Vernier Caliper (0-150mm) Micrometer (0-25mm) Steel Rule (0-300mm) Tri Square (0-100mm) Centre & Dot Punch	Classroom or demonstration room Workshop/Lab

	<p>as per drawing</p> <p>Set the machine RPM according to the bore size and work piece material</p> <p>Perform drilling and counter boring as per standard procedures</p> <p>Verify the final job with the given drawing</p>		<p>Scriber</p> <p>Marking Ink</p> <p>Hammer (Ball Peen 250gm)</p> <p>Drill bits of different sizes (4-20mm)</p> <p>Bench vices 4 inches</p> <p>Bench type drill machine</p> <p>Drill chuck</p> <p>Counter boring tools (10-20mm)</p> <p>Coolant</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia Projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design Books/ Sheets</p> <p>Pencils</p> <p>Erasers</p> <p>Pencil Sharpeners</p> <p>Paper Cutter</p>	
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				Scissors Color Pencils Different Tags and Locks WD-40	
<b>LU 7:</b> Perform Countersinking	<p><b>The trainee will be able to:</b></p> <p>Select counter sinking tool according to the drawing</p> <p>Select marking tool and mark the job as per drawing</p> <p>Clamp the work piece properly</p> <p>Set the machine RPM according to the counter sink size and work piece material</p> <p>Perform drilling and counter sinking as per standard procedures</p> <p>Verify the final job with the given drawing</p>	<p>Understand countersinking operation</p> <p>Understand counter sinking tools.</p> <p>Drill Bit with 90 degree lip angle</p> <p>Process steps for counter sinking</p> <p>Calculation method for RPM.</p> <p>Steps to perform drilling.</p> <p>Steps to perform counter sinking.</p> <p>Post drilling operations i.e. chamfering, deburring.</p>	<p><b>Total</b> 07 Hrs</p> <p><b>Theory:</b> 02 Hrs</p> <p><b>Practical:</b> 05 Hrs</p>	<p>MS flat/ round bar</p> <p>Vernier caliper (0-150mm)</p> <p>Steel rule (0-300mm)</p> <p>Tri square (0-100mm)</p> <p>Centre &amp; dot Punch</p> <p>Scriber</p> <p>Marking ink</p> <p>Hammer (ball peen 250gm)</p> <p>Drill bits of different sizes (4-20mm)</p> <p>Bench vices 4 inches</p> <p>Bench type drill machine</p> <p>Drill chuck</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p>

				<p>Countersinking tools (10-20mm)</p> <p>Coolant</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/ Sheets</p> <p>Pencils</p> <p>Erasers</p> <p>Pencil sharpeners</p> <p>Paper cutter</p> <p>Scissors</p> <p>Color pencils</p> <p>Different tags and locks</p> <p>WD-40</p>	
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National Vocational Certificate Level 3

Version 1 - November, 2019

### Module 3: 0714001034 Fabricate piping & tubing system

**Objective of the module:** The aim of this module is to develop advanced knowledge, skills and understanding to join pipes.

**Duration:** 150 Hrs      **Theory:** 30 Hrs      **Practical:**120 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1:</b> Interpret Drawings/ Layout	<p><b>The trainee will be able to:</b></p> <p>Interpret symbols from the given drawing/ layout</p> <p>Read scale of the given drawing/ layout</p> <p>Interpret different types of abbreviations from the given drawing/ layout</p> <p>Take measurements from the given drawing/ layout</p> <p>Determine material from the given job specification/ drawing/ layout</p> <p>Interpret different section views/ coordinated sections from the given drawing/ layout</p> <p>Interpret revisions in</p>	<p>Interpret basic engineering drawings</p> <p>Interpret P&amp;ID.</p> <p>Interpret different drawing views.</p> <p><b>Views:</b> Isometric, orthographic</p> <p>Interpret drawing projections</p> <p><b>Projections:</b> 1<sup>st</sup> angle, 3<sup>rd</sup> angle</p>	<p><b>Total</b> 23 Hrs</p> <p><b>Theory:</b> 10 Hrs</p> <p><b>Practical:</b> 13 Hrs</p>	<p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Printer</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/ sheets</p> <p>Pencils</p> <p>Erasers</p> <p>Pencil sharpeners</p> <p>Paper cutter</p> <p>Scissors</p> <p>Color pencils</p> <p>Different tags and locks</p> <p>WD-40</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p>

	drawings/ layouts				
<b>LU 2:</b> Prepare work area	<p><b>The trainee will be able to:</b></p> <p>Inspect work area for potential hazards</p> <p>Arrange material according to the given drawing/ specifications</p> <p>Arrange the required tools/ equipment to perform fabrication of piping system</p> <p>Ensure electrical &amp; water supply to the work area, if required</p> <p>Disconnect/ remove previously existing <b>services</b> from the work area if required</p> <p>Coordinate with coworkers according to the job requirements</p>	<p>Understand potential hazards in work area.</p> <p><b>Hazards:</b></p> <ul style="list-style-type: none"> <li>• Fire</li> <li>• Inflammable material</li> <li>• Explosive gases</li> <li>• Toxic chemicals</li> </ul> <p>Understand the selection of power &amp; utilities supply to the work area.</p> <ul style="list-style-type: none"> <li>• Compressed air</li> <li>• Electric power</li> <li>• Natural gas</li> </ul>	<p><b>Total</b> 11 Hrs</p> <p><b>Theory:</b> 01 Hrs</p> <p><b>Practical:</b> 10 Hrs</p>	<p>Cotton gloves/ leather gloves</p> <p>Goggles</p> <p>Safety mask</p> <p>Helmet</p> <p>Safety belt</p> <p>Safety shoes</p> <p>Ear plug / earmuff</p> <p>Measuring tape</p> <p>Combination pliers</p> <p>Vernier caliper</p> <p>Cold chisel</p> <p>Ball peen hammer</p> <p>Pipe wrench 12” to 24”</p> <p>Pipe vise 6” with tripod</p> <p>Hand hack saw</p> <p>Adjustable wrench 8” to 12”</p> <p>Phillips screwdriverset</p> <p>Flat screwdriver Set</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p>

				<p>Allen key set</p> <p>Pipe cutter 1/2" to 2"</p> <p>Combination spanner set (metric)</p> <p>Hand drill machine</p> <p>Twist drill set</p> <p>Masonry drill set</p> <p>Gas cutter set with torch, pipe and cylinders</p> <p>Magnet sprit level</p> <p>Soldering machine</p> <p>Flaring tool set</p> <p>Swaging tool set</p> <p>Tube cutter</p> <p>Bench vise 6"</p> <p>Tri square 12", 24"</p> <p>A ladder</p> <p>Chalk linerGrinder 4"</p> <p>Grip pliers</p> <p>Laser level</p> <p>Computer</p>	
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				Speakers Multimedia projector Logbook Handbooks Design books/ sheets Pencils Erasers Pencil sharpeners Paper cutter Scissors Color pencils Different tags and locks WD-40	
<b>LU 3: Bend/ Cut pipes &amp; tubes</b>	<b>The trainee will be able to:</b>  Perform measurement of pipe according to the drawing/ job specification  Mark the job piece according to the drawing/ job specification	Understand types of pipe/tube joints <b>Types:</b> <ul style="list-style-type: none"> <li>• Welded pipes</li> <li>• Seamless pipes</li> </ul> Understand the purpose and necessity of pipe/tube joints' application according to the material  Understand joining methods of pipe/tube according to the pipe specification.	<b>Total</b> 29 Hrs  <b>Theory:</b> 06 Hrs  <b>Practical:</b> 23 Hrs	Cotton gloves Goggles Safety shoes Measuring tape Vernier caliper Hand hack saw Pipe Cutter 1/2" to 2"	Classroom or demonstration room  Workshop/Lab

	<p>Select tools/ equipment according to the given material</p> <p>Bend/ Cut the pipe as per job requirement</p>	<p>Identification of different pipe/tube joints</p> <p>Understand use of cutting &amp; bending tool.</p> <p><b>Tools:</b> Pipe cutter, hacksaw, pipe bender, tube cutter</p>		<p>PVC tape</p> <p>Tube cutter</p> <p>Tube bender</p> <p>Cable tie</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/ sheets</p> <p>Pencils</p> <p>Erasers</p> <p>Pencil sharpeners</p> <p>Paper Cutter</p> <p>Scissors</p> <p>Color pencils</p> <p>Different tags and Locks</p> <p>WD-40</p>	
<p><b>LU 4:</b> Perform threading</p>	<p><b>The trainee will be able to:</b></p> <p>Perform measurement of pipe according to the</p>	<p>Understand types of thread.</p> <p><b>Types:</b></p> <ul style="list-style-type: none"> <li>• Metric,</li> </ul>	<p><b>Total</b></p> <p>23 Hrs</p> <p><b>Theory:</b></p>	<p>Goggles</p> <p>Safety shoes</p> <p>Measuring tape</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p>

	<p>given drawing/ job specification</p> <p>Mark the work piece according the given drawing/ job specification</p> <p>Select tools/ equipment to bend the given pipe.</p> <p>Perform threading of pipes as per standard</p>	<ul style="list-style-type: none"> <li>• Wit worth,</li> <li>• American National</li> <li>• Gas pipe thread</li> <li>• NPT</li> </ul> <p>Understand thread nomenclature.</p> <p>Understand application of thread plug gauge and ring gauge.</p>	<p>03 Hrs</p> <p><b>Practical:</b></p> <p>20 Hrs</p>	<p>Pipe vise 6" with tripod</p> <p>Ratchet die set ½" to 2"</p> <p>Hand hack saw</p> <p>Pipe cutter ½" to 2"</p> <p>Multi-purpose grease</p> <p>Tube Cutter</p> <p>Bench vise 6"</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/ sheets</p> <p>Pencils</p> <p>Erasers</p> <p>Pencil sharpeners</p> <p>Paper cutter</p> <p>Scissors</p> <p>Color pencils</p> <p>Different tags and</p>	
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				locks WD-40	
<b>LU 5: Braze pipes</b>	<p><b>The trainee will be able to:</b></p> <p>Arrange tools/ equipment/ material as per job requirement</p> <p>Ensure safety precautions</p> <p>Measure, mark, cut and clean surface of pipe as per job requirement</p> <p>Perform brazing according to standard</p>	<p>Understand selection of tool for brazing operation.<b>i.e.</b> Acetylene cylinder, Oxygen cylinder, welding torch, filling material etc.</p> <p>Set of Gas welding equipment including oxygen, DA filled cylinders.</p> <ul style="list-style-type: none"> <li>• Wire brush</li> <li>• Chip hammer</li> <li>• PPEs</li> <li>• Tong</li> </ul> <p>Understand preparation of metal surface for brazing.</p> <ul style="list-style-type: none"> <li>• Emery paper</li> <li>• Wire brush</li> <li>• Chipping hammer</li> </ul> <p>Setting up brazing equipment</p>	<p><b>Total</b> 18 Hrs</p> <p><b>Theory:</b> 03 Hrs</p> <p><b>Practical:</b> 15 Hrs</p>	<p>Leather gloves</p> <p>Goggles</p> <p>Safety mask</p> <p>Helmet</p> <p>Safety shoes</p> <p>Face shield and holder with cable</p> <p>Measuring tape</p> <p>Cold chisel</p> <p>Straight peen hammer 2 lbs</p> <p>Brass &amp; Copper rods for brazing</p> <p>Gas welding set with torch, pipe and cylinders</p> <p>Pin grinder</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p>

				Sheets Pencils Erasers Pencil sharpeners Paper cutter Scissors Color pencils Different tags and locks WD-40	
<b>LU 6:</b> Make welded joints through arc welding	<b>The trainee will be able to:</b> Arrange tools/ equipment/ material as per job requirement Ensure safety precautions & use PPEs Measure, mark and cut pipe as per job requirement Ensure bevel on pipe edges as per standard Align pipes & pipefittings as per standard Adjust electric current	Describe the requirements of a workplace for welding specific job Understand types & importance of electric arc welding <b>i.e.</b> MIG, TIG and SMAW etc. Describe the preparation of welding machine including <ul style="list-style-type: none"> <li>• Type of current (AC/DC)</li> <li>• Current polarity</li> </ul> Describe the importance of joint preparation, cleaning and tacking Understand joint types for welding <ul style="list-style-type: none"> <li>• Butt joint</li> <li>• Angle joint</li> <li>• Corner joint</li> <li>• Lap joint</li> </ul>	<b>Total</b> 23 Hrs <b>Theory:</b> 04 Hrs <b>Practical:</b> 19 Hrs	Leather Gloves Goggles Safety Shoes Overall Face Shield and Holder with cable Welding Gloves Measuring tape Combination pPliers Pointing chisel Insulation tape Cold chisel Straight peen	Classroom or demonstration room Workshop/Lab

	<p>for welding plant</p> <p>Perform welding</p>	<ul style="list-style-type: none"> <li>• Tee-joint</li> <li>• Edge joint</li> </ul> <p>Understand importance of alignment of pipes and pipefittings</p>	<p>hammer 2 lbs</p> <p>Pipe vise 6" with tripod</p> <p>Portable welding machine 3 Phase 300 Amps.</p> <p>Electrodes of different specifications</p> <p>Pipe cutter 1/2" to 2"</p> <p>Tube cutter</p> <p>Bench vise 6"</p> <p>Baby grinder 4"</p> <p>Grip pliers</p> <p>Fusion machine (PE Pipe Set) butt fusion</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/sheets</p> <p>Pencils</p> <p>Erasers</p>	
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				Pencil sharpeners Paper cutter Scissors Color pencils Different tags and locks WD-40	
<b>LU 7: Install pipelines</b>	<b>The trainee will be able to:</b> Obtain drawing for given task Adopt necessary PPEs according to the task Select tools/equipment/material as per given task Figure out the placement of pipes (hot & cold) as per drawing Locate and mark anchor/ support points as per requirement Cut and clean pipe as per requirement Thread the pipe and apply seal tape Fix accessories in loop	Define different types of flanges i.e. <ul style="list-style-type: none"> <li>Slip-on flanges</li> <li>Lap joint flanges</li> <li>Welded neck flanges</li> </ul> Explain procedure to make flange joint. State use of angle grinder <ul style="list-style-type: none"> <li>Right angle cut-off wheel</li> <li>Depressed center wheel</li> <li>Small diameter reinforced</li> <li>Chop saw reinforced</li> </ul> Explain procedure to perform grinding of pipe Interpret pipe drawing Understand types of thread. <p><b>Types:</b></p> <ul style="list-style-type: none"> <li>Metric,</li> <li>Wit worth,</li> </ul>	<b>Total</b> 23 Hrs <b>Theory:</b> 03 Hrs <b>Practical:</b> 20 Hrs	Cotton gloves Goggles Helmet Safety shoes Measuring tape Insulation tape Combination pliers Vernier caliper Cold chisel Ball peen hammer Pipe wrench 12" to 24" Pipe vise 6" with tripod Ratchet die set 1/2" to 2" Hand hack saw	Classroom or demonstration room Workshop/Lab

	<p>as per given drawing</p> <p>Ensure installed pipeline loop for being leveled and plumbed</p> <p>Clean &amp; store work area &amp; tools to ensure good housekeeping</p>	<ul style="list-style-type: none"> <li>• American National</li> <li>• Gas pipe thread</li> <li>• NPT</li> </ul> <p>Understand thread nomenclature.</p>		<p>Adjustable wrench 8" to 12"</p> <p>Phillips screwdriver set</p> <p>Cable tie</p> <p>Flat screwdriver set</p> <p>Allen key set</p> <p>Pipe cutter 1/2" to 2"</p> <p>Combination spanner set (Metric)</p> <p>Combination spanner set (imperial)</p> <p>Hand drill machine</p> <p>Twist drill set</p> <p>Masonry drill set</p> <p>Magnet sprit level</p> <p>Water level 12 meter</p> <p>Soldering machine</p> <p>Flaring tool set</p> <p>Swaging tool set</p> <p>Tube cutter</p>
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				Bench vise Tri square 12", 24" Grinder 4" Computer Speakers Multimedia projector Logbook Handbooks Design books/ sheets Pencils Erasers Pencil sSharpeners Paper cutter Scissors Color pencils Different tags and locks WD-40	
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# PRECISION INSTRUMENTATION



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Module-4  
CBT Curriculum  
National Vocational Certificate Level 3

Version 1 - November, 2019

## Module 4: 0714001035 Install & Commission Instruments

**Objective of the module:** The aim of this module is to develop advanced knowledge, skills and understanding to install & commission instruments.

**Duration:** 180 Hrs      **Theory:** 30Hrs      **Practical:** 150Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1:</b> Install & commission temperature instruments	<p><b>The trainee will be able to:</b></p> <p>Perform site inspection as per drawing.</p> <p>Prepare process instrument to be installed.</p> <p>Apply standard techniques necessary for installation procedures as per manual.</p> <p>Inspect installed components for damage.</p> <p>Ensure that the installed instrument is intact and working properly</p> <p>Generate an output report as per standard.</p> <p>Ensure good housekeeping and safe working practices at all time</p>	<p>Define types of hazard.</p> <ul style="list-style-type: none"> <li>• Fire</li> <li>• Inflammable Material</li> <li>• Explosive gases</li> <li>• Toxic Chemicals</li> </ul> <p>Understand and implement Piping &amp; Instrumentation Diagram P&amp;ID.</p> <p>Understanding a Process Control Loop.</p> <p>Understanding of IFCD (Interface Control Diagram)</p> <p>Understand safety regulations.</p> <p>Understand Electrical/ Electronic/Instrumentation symbols</p> <p>Understand the functional parameters of Temperature instruments i.e. Thermometer, Temperature Gauge etc.</p> <p>Understand the SOP of instrument commissioning process.</p>	<p><b>Total</b> 37 Hrs</p> <p><b>Theory:</b> 06 Hrs</p> <p><b>Practical:</b> 31 Hrs</p>	<p>Digital</p> <p>First Aid box</p> <p>Hand glove</p> <p>Flat screwdriver set</p> <p>Philips screwdriver set</p> <p>Tweezers</p> <p>Tagging marks</p> <p>Hand drill machine</p> <p>Insulation tape</p> <p>Lugs punch (up to 10mm)</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p> <p>Field/ Industry</p>

				Sheets Pencils Erasers Pencil sharpeners Paper cutter Scissors Color pencils Different tags and Locks WD-40	
<b>LU 2:</b> Install & commission pressure instruments	<b>The trainee will be able to:</b> Perform site inspection as per drawing. Analyze process instrument to be installed. Apply standard techniques necessary for installation procedures as per manual. Inspect installed components for damage. Ensure that the installed instrument is intact and working properly Generate an output	Define types of hazard. <ul style="list-style-type: none"> <li>• Fire</li> <li>• Inflammable Material</li> <li>• Explosive gases</li> <li>• Toxic Chemicals</li> </ul> Understand and implement P & ID.... Understanding a Process Control Loop. Understanding of IFCD (Interface Control Diagram) Understand safety regulations. Understand Electrical/ Electronic/Instrumentation symbols Understand the functional parameters of Pressure instruments i.e. Manometer,	<b>Total</b> 37 Hrs <b>Theory:</b> 06 Hrs <b>Practical:</b> 31 Hrs	Bourdon tube pressure gauge (0~20 Bar) Bourdon tube pressure gauge (0~400 Bar) Bourdon tube pressure gauge (0~200 Bar) Combination plier electrical Nose plier Hacksaw Tape measures (0~3m) Safety shoes	Classroom or demonstration room Workshop/Lab Field/Industry

	<p>report as per standard.</p> <p>Ensure good housekeeping and safe working practices at all time</p>	<p>Pressure Gauge, D.P Cell etc.</p> <p>Understand the SOP of instrument commissioning process.</p>	<p>Safety goggles</p> <p>Hearing protection</p> <p>Respiratory mask</p> <p>First Aid box</p> <p>Hand glove</p> <p>Flat screwdriver set</p> <p>Philips screwdriver set</p> <p>Insulation tape</p> <p>Open end spanner set (5~32mm)</p> <p>Ring spanner set (5~22mm)</p> <p>Tagging marks</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/ sheets</p> <p>Pencils</p> <p>Erasers</p>	
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				Pencil sharpeners Paper cutter Scissors Color pencils Different tags and locks WD-40	
<b>LU 3:</b> Install & commission level instruments	<b>The trainee will be able to:</b> Perform site inspection as per drawing. Prepare process instrument to be installed. Apply standard techniques necessary for installation procedures as per manual. Inspect installed components for damage. Ensure that the installed instrument is intact and working properly Generate an output report as per standard. Ensure good housekeeping and safe working practices at all	Define types of hazard. <ul style="list-style-type: none"> <li>• Fire</li> <li>• Inflammable Material</li> <li>• Explosive gases</li> <li>• Toxic Chemicals</li> </ul> Understand and implement P & ID..... Understanding a Process Control Loop. Understanding of IFCD (Interface Control Diagram) Understand safety regulations. Understand Electrical/ Electronic/Instrumentation symbols Understand the functional parameters of Level instruments i.e. digital level gGauges, manual level gauges etc. Understand the SOP of instrument commissioning process.	<b>Total</b> 37 Hrs <b>Theory:</b> 06 Hrs <b>Practical:</b> 31 Hrs	Wire striper Digital multimeter Digital clamp meter (0~400A) Tape measures (0~3m) Safety shoes Safety goggles Hearing protection Respiratory mask First Aid box Insulation tape Cable tie Hand glove Flat screwdriver set Phillips screwdriver set	Classroom or demonstration room Workshop/Lab Field/ industry

	time			Open end spanner set (5~32mm)  Ring spanner set (5~22mm)  Allen key set (1~10mm)  Tagging marks  Hand drill machine  Lugs punch (up to 10mm)  Computer  Speakers  Multimedia projector  Logbook  Handbooks  Design books/ Sheets  Pencils  Erasers  Pencil sharpeners  Paper cutter  Scissors  Color pencils  Different tags and	
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				locks WD-40	
<b>LU 4: Install &amp; commission flow instruments</b>	<p><b>The trainee will be able to:</b></p> <p>Perform site inspection as per drawing.</p> <p>Prepare process instrument to be installed.</p> <p>Apply standard techniques necessary for installation procedures as per manual.</p> <p>Inspect installed components for damage.</p> <p>Ensure that the installed instrument is intact and working properly</p> <p>Generate an output report as per standard.</p> <p>Ensure good housekeeping and safe working practices at all time</p>	<p>Define types of hazard.</p> <ul style="list-style-type: none"> <li>• Fire</li> <li>• Inflammable Material</li> <li>• Explosive gases</li> <li>• Toxic Chemicals</li> </ul> <p>Understand and implement P &amp; ID....</p> <p>Understanding a Process Control Loop.</p> <p>Understanding of IFCD (Interface Control Diagram)</p> <p>Understand safety regulations.</p> <p>Understand Electrical/ Electronic/instrumentation symbols</p> <p>Understand the functional parameters of Flow instruments i.e. Volumetric flow meters, mass flow meters, orifice type flow meters</p> <p>Understand the SOP of instrument commissioning process.</p>	<p><b>Total</b> 37 Hrs</p> <p><b>Theory:</b> 06 Hrs</p> <p><b>Practical:</b> 31 Hrs</p>	<p>Pipe vice</p> <p>Combination plier electrical</p> <p>Nose plier</p> <p>Wire stripper</p> <p>Side cutter</p> <p>Pipe cutting tool</p> <p>Tube flaring tool</p> <p>Hacksaw</p> <p>Center punch</p> <p>Digital multimeter</p> <p>Digital clamp meter (0~400A)</p> <p>Tape measures (0~3m)</p> <p>Cable tie</p> <p>Safety shoes</p> <p>Safety goggles</p> <p>Hearing protection</p> <p>Respiratory mask</p> <p>First Aid box</p> <p>Insulation tape</p>	



				<p>Hand glove</p> <p>Flat screwdriver set</p> <p>Philips screwdriver set</p> <p>Open end spanner set (5~32mm)</p> <p>Ring spanner set (5~22mm)</p> <p>Allen key set (1~10mm)</p> <p>Tagging marks</p> <p>Hand drill machine</p> <p>Lugs punch (up to 10mm)</p> <p>Pitot tube</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/ Sheets</p> <p>Pencils</p> <p>Erasers</p>	
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				Pencil sharpeners Paper cutter Scissors Color pencils Different tags and locks WD-40	
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<p><b>LU 5:</b> Recommission process loop</p>	<p><b>The trainee will be able to:</b></p> <p>Make visual inspection for faults in the system</p> <p>Verify installation as per SOPs.</p> <p>Ensure that the connections/ terminations are secure</p> <p>Perform test run and sensory inspection</p> <p>Verify accurate signal transmission</p> <p>Identify modifications required in the system</p> <p>Validate as per manual/ SOP</p> <p>Finalize documentation and report to relevant personnel</p>	<p>Understand Electrical/ Electronic/Instrumentation symbols</p> <p>Understand the functional parameters of Instruments &amp; Sensors related to:</p> <ul style="list-style-type: none"> <li>• Temperature instruments</li> <li>• Flow instruments</li> <li>• Pressure instruments</li> <li>• Level instruments</li> </ul> <p>Understand assembling &amp; dismantling techniques.</p> <p>Understand testing techniques of connections.</p> <p>Understand electronic fault diagnosis.</p> <p>Understand the documented data and data sheet for Instruments &amp; sensors.</p> <p>Understand the component parameter, ratings and application of sensors.</p> <p>Understand and interpret technical drawings.</p> <p>Understand different techniques necessary for installation procedures.</p> <p>Prepare report for final results</p>	<p><b>Total</b></p> <p><b>Total</b></p> <p>32 Hrs</p> <p><b>Theory:</b></p> <p>06 Hrs</p> <p><b>Practical:</b></p> <p>26 Hrs</p>	<p>Digital thermometer (-10~400 Co)</p> <p>Infrared thermometer (0~2000 Co)</p> <p>Bourdon tube pressure gauge (0~20 Bar)</p> <p>Bourdon tube pressure gauge (0~400 Bar)</p> <p>Insulation tape</p> <p>Bourdon tube pressure gauge (0~200 Bar)</p> <p>Surface level gauge (2 feet)</p> <p>Surface level gauge (8 feet)</p> <p>Capacitance type level instrument</p> <p>Cable tie</p> <p>Work Bench (4x8 feet, height 3 feet)</p> <p>Bench vice</p> <p>Pipe vice</p> <p>Combination plier electrical</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p> <p>Field/ industry</p>
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				<p>Nose plier</p> <p>Wire striper</p> <p>Side cutter</p> <p>Pipe cutting tool</p> <p>Tube flaring tool</p> <p>Hacksaw</p> <p>Chisel (8")</p> <p>Pin punch set</p> <p>Hole punch set (5~ 20mm)</p> <p>Center punch</p> <p>Soldering / de soldering station</p> <p>Digital multimeter</p> <p>Digital RPM meter (0~10000 RPM)</p> <p>Digital clamp meter (0~400A)</p> <p>Frequency meter (0~20MHZ)</p> <p>Digital micrometer set (0~200mm)</p> <p>Phase tester</p> <p>Tape measures (0~3m)</p> <p>Tape measures (0~50m)</p>	
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				Protection suite Safety shoes Safety goggles Hearing protection Respiratory mask First Aid Box Hand glove Flat screwdriver set Philips screwdriver set Watchmaker screwdriver set Tweezers Open end spanner set (5~32mm) Ring spanner set (5~22mm) Allen key set (1~10mm) Tagging marks Hand drill machine Lugs punch (up to 10mm) Computer	
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				Speakers Multimedia projector Logbook Handbooks Design books/ sheets Pencils Erasers Pencil sharpeners Paper cutter Scissors Color pencils Different tags and locks WD-40	
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# PRECISION INSTRUMENTATION



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Module-5  
CBT Curriculum  
National Vocational Certificate Level 3

Version 1 - November, 2019

## Module 5: 0714001036 Calibrate instruments

**Objective of the module:** The aim of this module is to develop advanced knowledge, skills and understanding to calibrate instruments.

**Duration:** 180 Hrs      **Theory:** 30Hrs      **Practical:** 150 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU1:</b> Calibrate temperature instruments	<p><b>The trainee will be able to:</b></p> <p>Plan and set standard/master calibrator necessary for calibration.</p> <p>Check and verify instrument reliability or any damage.</p> <p>Ensure proper working of temperature calibration apparatus.</p> <p>Install and set-up standard/master calibrator</p> <p>Perform calibration tasks as per standards.</p> <p>Verify performance of instrument as per standards and calibrate if necessary.</p> <p>Document test results as per SOP</p>	<p>Define types of hazard.</p> <ul style="list-style-type: none"> <li>• Fire</li> <li>• Inflammable Material</li> <li>• Explosive gases</li> <li>• Toxic Chemicals</li> </ul> <p>Understand and implement P &amp; ID .....drawing.</p> <p>Understanding a Process Control Loop.</p> <p>Understanding of IFCD (Interface Control Diagram)</p> <p>Understand safety regulations.</p> <p>Understand Electrical/ Electronic/Instrumentation symbols</p> <p>Understand the functional parameters of temperature instruments.</p> <p>Understand the SOP of instrument commissioning process.</p>	<p><b>Total</b> 45 Hrs</p> <p><b>Theory:</b> 09 Hrs</p> <p><b>Practical:</b> 36 Hrs</p>	<p>Temperature calibrator (0~600Co)</p> <p>Temperature calibrator (400~2000Co)</p> <p>Digital multimeter</p> <p>Millivolt source (-10~10v)</p> <p>Milliampere source (0~20mA)</p> <p>Safety shoes</p> <p>Safety goggles</p> <p>First Aid Kit</p> <p>Test probes</p> <p>Hand gloves</p> <p>Digital thermometer (0~400Co)</p> <p>Screwdriver set</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p> <p>Field/ Industry</p>



		<p>Prepare a technical report</p> <p>Understand the functions of the temperature master calibrator</p>	<p>Tweezers</p> <p>Wire cutter</p> <p>Combination plier</p> <p>Nose pliers</p> <p>Watch makers screwdriver set</p> <p>Allen key set</p> <p>Spanner set metric / imperial</p> <p>Adjustable spanner set</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design Books/ Sheets</p> <p>Pencils</p> <p>Erasers</p> <p>Pencil sharpeners</p> <p>Paper cutter</p> <p>Scissors</p> <p>Color pencils</p> <p>Different tags and</p>	
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				locks WD-40	
<b>LU 2:</b> Calibrate pressure instruments	<p><b>The trainee will be able to:</b></p> <p>Plan and set standard/master calibrator necessary for calibration.</p> <p>Check and verify instrument reliability or any damage.</p> <p>Ensure proper working of pressure calibration apparatus.</p> <p>Install and set-up standard/master calibrator</p> <p>Perform calibration tasks as per standards.</p> <p>Verify performance of instrument as per standards and calibrate if necessary.</p> <p>Document test results as per SOP</p>	<p>Define types of hazard.</p> <ul style="list-style-type: none"> <li>• Fire</li> <li>• Inflammable Material</li> <li>• Explosive gases</li> <li>• Toxic Chemicals</li> </ul> <p>Understand and implement P &amp; ID.... drawing.</p> <p>Understanding a Process Control Loop.</p> <p>Understanding of IFCD (Interface Control Diagram)</p> <p>Understand safety regulations.</p> <p>Understand Electrical/ Electronic/Instrumentation symbols</p> <p>Understand the functional parameters of pressure instruments.</p> <p>Understand the SOP of instrument commissioning process.</p> <p>Understand the functions of Pressure master calibrator</p> <p>Prepare a technical report</p>	<p><b>Total</b> 45 Hrs</p> <p><b>Theory:</b> 09 Hrs</p> <p><b>Practical:</b> 36 Hrs</p>	<p>Pressure Calibrator (0~20bar)</p> <p>Pressure Calibrator (100~600bar)</p> <p>Pressure Calibrator (-1~0bar)</p> <p>Digital multimeter</p> <p>Digital Leak tester</p> <p>Millivolt source (-10~10v)</p> <p>Milliampere source (0~20mA)</p> <p>Safety shoes</p> <p>Safety goggles</p> <p>First Aid Kit</p> <p>Test probes</p> <p>Hand glove</p> <p>Screwdriver set</p> <p>Tweezers</p> <p>Wire Cutter</p> <p>Combination Plier</p>	<p>Classroom or demonstration room</p> <p>Workshop/Lab</p> <p>Field/ Industry</p>

				Nose pliers Allen key set Spanner set metric / imperial Adjustable spanner set Computer Speakers Multimedia projector Logbook Handbooks Design books/ sheets Pencils Erasers Pencil sharpeners Paper Cutter Scissors Color pencils Different tags and locks WD-40	
<b>LU 3:</b> Calibrate Level instruments	<b>The trainee will be able to:</b> Plan and set	Define types of hazard.	<b>Total</b> 45 Hrs	Level calibrator (0~20feet)	Classroom or demonstration room

	<p>standard/master calibrator necessary for calibration.</p> <p>Prepare standard/master calibrator necessary for calibration</p> <p>Check and verify instrument reliability or any damage.</p> <p>Ensure proper working of level calibration apparatus.</p> <p>Install and set-up standard/master calibrator</p> <p>Perform calibration tasks as per standards.</p> <p>Verify performance of instrument as per standards and calibrate if necessary.</p> <p>Document test results as per SOP</p>	<ul style="list-style-type: none"> <li>• Fire</li> <li>• Inflammable material</li> <li>• Explosive gases</li> <li>• Toxic chemicals</li> </ul> <p>Understand and implement P &amp; ID ....drawing.</p> <p>Understanding a Process Control Loop.</p> <p>Understanding of IFCD (Interface Control Diagram)</p> <p>Understand safety regulations.</p> <p>Understand electrical/ electronic/instrumentation symbols</p> <p>Understand the functional parameters of Level instruments.</p> <p>Understand the SOP of instrument commissioning process.</p> <p>Understand the functions of Level master calibrator</p> <p>Prepare a technical report</p>	<p><b>Theory:</b> 09 Hrs</p> <p><b>Practical:</b> 36 Hrs</p>	<p>Digital multimeter</p> <p>Millivolt source (-10~10v)</p> <p>Milliampere source (0~20mA)</p> <p>Safety shoes</p> <p>Safety goggles</p> <p>First Aid kit</p> <p>Test probes</p> <p>Hand glove</p> <p>Screwdriver set</p> <p>Tweezers</p> <p>Wire cutter</p> <p>Combination plier</p> <p>Nose pliers</p> <p>Watch makers screwdriver set</p> <p>Allen key set</p> <p>Spanner set metric / imperial</p> <p>Adjustable spanner set</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia</p>	<p>Workshop/Lab</p> <p>Field /industry</p>
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				projector Logbook Handbooks Design books/ Sheets Pencils Erasers Pencil sharpeners Paper cutter Scissors Color pencils Different tags and locks WD-40	
<b>LU 4:</b> Calibrate flow instruments	<b>The trainee will be able to:</b> Plan and set standard/master calibrator necessary for calibration. Prepare standard/master calibrator necessary for calibration Check and verify instrument reliability or any damage. Ensure proper working of flow calibration apparatus. Install and set-up	Define types of hazard. <ul style="list-style-type: none"> <li>• Fire</li> <li>• Inflammable Material</li> <li>• Explosive gases</li> <li>• Toxic Chemicals</li> </ul> Understand and implement P & ID drawing. Understanding a Process Control Loop. Understanding of IFCD (Interface Control Diagram)	<b>Total</b> 45 Hrs <b>Theory:</b> 09 Hrs <b>Practical:</b> 36 Hrs	Gas Flow Calibrator (0~10m <sup>3</sup> ) Liquid Flow Calibrator (0~10m <sup>3</sup> ) Digital multimeter Digital Leak tester Millivolt source (- 10~10v) Milliampere source (0~20mA)	Classroom or demonstration room Workshop/Lab Field/ Industry

	<p>standard/master calibrator</p> <p>Perform calibration tasks as per standards.</p> <p>Verify performance of instrument as per standards and calibrate if necessary.</p> <p>Document test results as per SOP</p>	<p>Understand safety regulations.</p> <p>Understand Electrical/ Electronic/Instrumentation symbols</p> <p>Understand the functional parameters of Flow instruments.</p> <p>Understand the SOP of instrument commissioning process.</p> <p>Prepare a technical report</p> <p>Understand the functions of Flow master calibrator</p>	<p>Safety shoes</p> <p>Safety goggles</p> <p>First Aid kit</p> <p>Test probes</p> <p>Hand glove</p> <p>Screwdriver set</p> <p>Tweezers</p> <p>Wire cutter</p> <p>Combination plier</p> <p>Nose pliers</p> <p>Watch makers screwdriver set</p> <p>Allen key set</p> <p>Spanner set metric / imperial</p> <p>Adjustable spanner set</p> <p>Computer</p> <p>Speakers</p> <p>Multimedia projector</p> <p>Logbook</p> <p>Handbooks</p> <p>Design books/ sheets</p> <p>Pencils</p>	
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				Erasers Pencil sharpeners Paper cutter Scissors Color pencils Different tags and locks WD-40	
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# PRECISION INSTRUMENTATION



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Module-6  
CBT Curriculum  
National Vocational Certificate Level 3

Version 1 - November, 2019



## Module 6: Communicate at workplace

**Objective of the module:** The aim of this module is to develop advanced knowledge, skills and understanding to communicate at workplace.

**Duration:** 40Hrs      **Theory:** 10Hrs      **Practical:** 30Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<b>LU 1:</b> Communicate within the organization	<b>The trainee will be able to:</b> Communicate within a department Communication with other departments Use various media to communicate effectively Communicate verbally and non-verbally using professionalism	Knowledge and understanding about types of communication skills (i.e. Verbal communication, nonverbal cues speak volumes, visual communication)	<b>Total</b> 20 Hrs <b>Theory:</b> 05 Hrs <b>Practical:</b> 15 Hrs	Videos for related knowledge on multimedia Pen/Pencils Papers Printers Notebook/ note pads Computer Multimedia Projectors	Classroom or demonstration room Workshop/Lab
<b>LU 2:</b> Communicate outside the organization	<b>The trainee will be able to:</b> Communicate with vendors Communicate with clients/ customers Interact with other organizations Use various media to communicate effectively	Knowledge and understanding about types of an organizational communication (i.e. formal and informal communication) Directional communication Internal and external communication Oral and written communication	<b>Total</b> 20 Hrs <b>Theory:</b> 05 Hrs <b>Practical:</b> 15 Hrs		Classroom or demonstration room Workshop/Lab Field/ industry

## General assessment guidance for *Precision Instrumentation Lev-3*

Good practice in Pakistan uses sessional and final assessments, as described below. Good practice by vocational training providers in Pakistan, means to use a combination of these sessional and final assessments, combined to produce the final qualification result.

**Sessional assessment** is going on all the time. Its purpose is to provide feedback on what students are learning:

- to the student: to identify achievement and areas for further work
- To the teacher: to evaluate the effectiveness of teaching to date, and to focus future plans.

Assessors need to devise sessional assessments for both theoretical and practical work. Guidance is provided in the assessment strategy

**Final assessment** is the assessment, usually on completion of a course or module, which says whether or not the student has "passed". It is – or should be – undertaken with reference to all the objectives or outcomes of the course and is usually fairly formal. Considerations of validity e.g. ensuring that the student who gets the credit is the person who did the work – assume considerable importance in final assessment.

### Methods of assessment

For lessons with a high quantity of theory, written or oral tests related to learning outcomes and/ or learning content can be conducted. For workplace lessons, assessment can focus on the quality of planning the related process, the quality of executing the process, the quality of the product and/or evaluation of the process.

Methods include direct assessment, which is the most desirable form of assessment. For this method, evidence is obtained by direct observation of the student's performance.

Examples for direct assessment of Precision Instrumentation Lev-3 include:

- Work performances, for example installing instruments with required safety precautions
- Demonstrations, for example demonstrating how to calibrate instruments
- Direct questioning, where the assessor would ask the student why he is considering the certain type hacksaw blade for cutting
- Paper-based tests, such as multiple choice or short answer questions on health & safety, fabrication and installation of pipes etc.

Indirect assessment is the method used where the performance could not be watched, and evidence is gained indirectly.

Examples for indirect assessment of a Precision Instrumentation Lev-3 include:

- Work products, such as a completed pipe arrangement
- Workplace documents, such as notebook or practical activity journal

Indirect assessment should only be a second choice. (In some cases, it may not even be guaranteed that the work products were produced by the person being assessed.)

### **Principles of assessment**

All assessments should be valid, reliable, fair and flexible:

Fairness means that there should be no advantages or disadvantages for any assessed person. For example, it should not happen that one student gets prior information about the type of work performance that will be assessed, while another candidate does not get any prior information.

Validity means that a valid assessment assesses what it claims to assess.

Reliability means that the assessment is consistent and reproducible.

Flexibility means that the assessor has to be flexible concerning the assessment approach. For example, if there is a mishap during the assessment, the assessor should modify the arrangements to accommodate the students' needs.

## **Assessment strategy for Precision Instrumentation Lev-3 Curriculum**

This curriculum consists of 6 modules:

Module 1: Ensure Health, hygiene and safety of other individuals at work

Module 2: Perform benchwork

Module 3: Fabricate Piping & Tubing System

Module 4: Install & Commission Instruments

Module 5: Calibrate Instruments

Module 6: Communicate at workplace

### **Sessional assessment**

The sessional assessment shall be conducted after completion of each module in two parts: theoretical assessment and practical assessment.

Theoretical assessment for all learning modules must consist of a written paper lasting at least 30 minutes per module. This can be a combination of multiple choice and short answer questions.

For practical assessment, all procedures and methods for the modules must be assessed on a sessional basis. Guidance is provided below under Planning for assessment.

### **Final assessment**

Final assessment shall also be in two parts: theoretical assessment and practical assessment.

For the final practical assessment, each student shall be assessed over a period of 4-5 hours session. During this period, each student must be assessed on his ability to perform a complete job for each of the last 5 modules.

### **The assessment team**

The number of assessors must be adequate for the task.. For example, where two assessors are conducting the assessment, there must be a maximum of five students per assessor. In this example, a group of 20 students shall therefore require assessments to be carried out over a four-day period. For a group of only 10 students, assessments would be carried out over a two-day period only.

## Planning for assessment

Sessional assessment: assessors need to plan in advance how they will conduct sessional assessments for each module. The tables on the following pages are for assessors to use to insert how many hours of theoretical and practical assessment will be conducted and what the scheduled dates are.

Final assessment: Training providers need to decide ways to combine modules into a cohesive two-day final assessment program for each group of five students. Training providers must agree with the practical assessments in advance.

## Complete list of tools and equipment

S. No	Description	Quantity
1	Leather gloves	20 pairs
2	Cotton gloves	20 pairs
3	Goggles	20 nos.
4	Safety mask	100 pcs
5	Helmet	25 nos.
6	Safety belt	10 nos.
7	Safety Shoes	25 pairs
8	Ear plug / Ear Muff	25 pcs
9	Coverall	20 nos.
10	Measuring Tape	20 nos.
11	Combination Pliers	10 nos.
12	Vernier Caliper	10 nos.
13	Inside/Outside Caliper	10 nos.
14	Pointing chisel	10 nos.
15	Cold Chisel	10 nos.
16	Ball Peen Hammer	10 nos.
17	Straight Peen Hammer 2 lbs.	10 nos.
18	Club Hammer	10 nos.
19	Pipe Wrench 12" to 24"	10 nos.
20	Pipe Vise 6" with tripod	4 nos.
21	Ratchet die set 1/2" to 2"	3 nos.

22	Hand Hack Saw	20 nos.
23	Power Disc grinder 14"	5 nos.
24	Portable Welding Machine 3 Phase 300 Amp.	3 nos.
25	Face Shield and Holder with cable	20 nos.
26	File Set	5 sets
27	Pipe Reamer Set	10 nos.
28	Adjustable Wrench 8" to 12"	10 nos.
29	Phillips Screw Driver Set	5 set
30	Flat Screw Driver Set	5 set
31	Allen Key Set	5 set
32	Tin Snip Cutter	5 nos.
33	Pipe Cutter ½" to 2"	5 nos.
34	Open End Spanner Set (Metric)	5 set
35	Open End Spanner Set (Imperial)	5 set
36	Offset Ring Spanner Set (Metric)	5 set
37	Offset Ring Spanner Set (Imperial)	5 set
38	Combination Spanner Set (Metric)	5 set
39	Combination Spanner Set (Imperial)	5 set
40	Hammer Drill Machine (Hilti)	3 nos.
41	Hand Drill Machine	10 nos.
42	Twist Drill Set	5 set
43	Masonry Drill Set	5 set
44	Hydraulic Pipe Bender	2 nos.
45	Heat Gun	10 nos.
46	Fusion Machine (PPRC set 20mm ~63 mm)	4 nos.
47	Gas Cutter Set with Torch, Pipe	3 set
48	Acetylene Cylinder	3 nos.
49	Oxygen Cylinder	3 nos.
50	Magnate Sprit Level	20 nos.
51	Water Level	4 nos.
52	Soldering Machine	10 nos.

53	Flaring Tool Set	5 set
54	Swaging Tool Set	5 set
55	Tube Cutter	10 nos.
56	Bench Vise 6"	10 nos.
57	Tri Square 12" - 24"	20 nos.
58	Plumb bob with Mason Line	10 nos.
59	Different Tags and Locks	100 nos.
60	Disc 14" Power Cutter	10 nos.
61	Pin Grinder	4 nos.
62	Stone for Pin Grinder	2 nos.
63	Wire Brush for Pin Grinder	5 nos.
64	Shovel	5 nos.
65	Pick axe for digging	5 nos.
66	Wheel barrow	4 nos.
67	Chiseler (Jack Hammer Machine)	4 nos.
68	Chalk Liner	10 nos.
69	Trowel Adhesive	10 nos.
70	Mortar Pan	10 nos.
71	Breathing apparatus	5 nos.
72	Fire extinguishers	5 nos.
73	Fire blankets	5 nos.
74	First aid kits	2 nos.
75	Stretchers	2 nos.

## List of consumable supplies

1. Drill bit set
2. Process SOPs

3. Equipment maintenance manuals
4. Logbook
5. Stone for pin grinder
6. Wire brush for pin grinder
7. Wire brush (steel wire)
8. Chalk liner
9. Kerosene oil
10. Cutting oil
11. WD-40
12. Grease
13. Cotton rags
14. Hack saw blade
15. Emery paper
16. Grinding disc 4"
17. Cutting disc 4"
18. Grinding disc 7"
19. Cutting disc 7"
20. Wall cutting disc 7"
21. **GI pipes (1/2" ~ 1")**
22. GI elbow (90, 45)



23. GI tee
24. GI bend
25. GI union
26. GI cross tee
27. GI socket
28. GI reducer
29. Barrel nipple
30. M/F elbow
31. M/F socket
32. End plug
33. Bridge bend
34. **Copper Pipes (3/8" ~ 3/4")**
35. Elbow (90, 45)
36. Tee
37. Bend
38. Union
39. Cross tee
40. Socket
41. Reducer
42. **MS Pipes (1" ~ 4")**

43. Flanges (welded/threaded)
44. Tee
45. Elbow (90/45)
46. Bends
47. Reducer
48. Flanges (welded/treaded)
49. UPVC pipes (1/2" ~ 4")
50. UPVC socket
51. UPVC tee
52. UPVC elbow (90/45)
53. UPVC bends
54. UPVC reducer
55. UPVC Y-branch
56. UPVC P trap
57. UPVC multi flow trap
58. Test plug
59. UPVC union
60. UPVC male adopter
61. Brass thread tee
62. Brass thread elbow

- 63. Brass thread union
- 64. Brass thread socket
- 65. **CPVC pipe (1/2" ~ 1")**
- 66. CPVC elbow
- 67. CPVC tee
- 68. CPVC union
- 69. CPVC brass male adopter
- 70. **PPRC pipes (20 mm ~ 32 mm)**
- 71. Socket
- 72. Reducer
- 73. Treaded elbow
- 74. Male adopter
- 75. Female adopter
- 76. CP nipple
- 77. PE pipes (20 mm ~ 32 mm)
- 78. Socket
- 79. Elbow (90, 45)
- 80. Tee
- 81. Bend
- 82. Cross tee

83. Reducer
84. Flanges (welded/threaded)
85. Pressure reducing valve (1" ~ 3")
86. Injector valve (1" ~ 1 1/2")
87. Teflon tape
88. Lock tight/ hold tight
89. Thread
90. Silicon
91. Epoxy
92. Non-return valve (1/2" ~ 1")
93. Gate valve (1" ~ 3")
94. Ball valve (1/2" ~ 1")
95. Primer
96. Red oxide
97. Glass wool
98. Thermo pore
99. Dowels, screws
100. Pipe clamps, different size and models
101. Cement
102. Sand

## List of Stationary

1. Different tags and locks
2. ASTM – BS standards
3. Process SOPs
4. Equipment maintenance manuals
5. Log book
6. Handbooks
7. Design books/ sheets
8. Pencils
9. Erasers
10. Pencil sharpeners
11. Paper cutter
12. Scissors
13. Color Pencils
14. White chart paper
15. Brown sheets
16. White board markers (red, blue, green, black)
17. Permanent markers (black)
18. File covers

## Credit values

The credit value of the National Certificate Level 3 in Precision Instrumentation is defined by estimating the amount of time/ instruction hours required to complete each competency unit and competency standard. The NVQF uses a standard credit value of 1 credit = 10 hours of learning (Following Higher Education Commission (HEC) guidelines).

The credit values are as follows:

Competency Standard	Estimate of hours	Credit
1. Ensure Health, hygiene and safety of other individuals at work	40	04
2. Perform Benchwork	90	09
3. Fabricate Piping & Tubing System	150	15
4. Install & Commission Instruments	180	18
5. Calibrate Instruments	180	18
6. Communicate at workplace	40	04

