



TECHNICAL TRAINING - SWAPPING DOWNTIME FOR PRODUCTIVITY!

Mechanical Systems & Tools – Syllabus [Detailed]

1 Staying Safe in the Mechanical World!

Your automation.ie *Fact Sheets!*

Understand Mechanical Energy Types!

- Potential Energy
- Kinetic Energy

Know the Hazards in the Mechanical World

Be aware of Personal Protective Equipment (PPE)

Appreciate the Importance of Good Housekeeping

2 Engineering Pocket Books.

Familiarization of the *Zeus Pocket-Book*

Familiarization the *Engineers Reference Pocket-Book*

Familiarisation of the *Engineers Reference Handbook*

3 The ISO Metric System.

Understanding the ISO System

Understand the concept of *Base & Derived* Units

Use Software to Perform Quantity Conversions

Practice Metric & Imperial Conversion Exercises

4 Tools & Their Correct Use.

Understand Drive Systems for Screws & Bolts:

- Screwdrivers - Information, Types & Sizes:
 - Flat
 - Philips
 - Pozidriv
- Hex Type Drives:
 - Allen Keys
 - Standard TORX
 - Security TORX

The Importance of The Right Tool for the Right Job!

Use an Impact Screwdriver

Know your Spanners:

- Metric / Imperial types
- Understand A / F and A / C Terminology
- Spanner Types:
 - Open Spanners
 - Ring Spanners
 - Combination Spanners
 - Crows Foot Spanners
 - Adjustable Spanners
 - Ratcheting Ring Spanners
 - Hook Spanners
 - Pin Spanners

Circlip Types:

- Twin eye External
- e-clip External
- Twin eye Internal
- Wire type Internal

Circlip Pliers:

- Internal
- External

Dismantle and Rebuild Circlip assemblies.

Sockets:

- 4,6,8,& 12-point Sockets
- Metric / Imperial
- AF / AC Terminology
- Accessories:
 - Swivel Sockets
 - Universal jointed Sockets
 - Universal joint extensions
 - Fluted Sockets
 - Specialised Sockets
 - Drives and drive sizes
 - Ratchet Handles
 - Speeder Handles

Torque Wrenches:

- Types:
 - Beam
 - Click
 - Electronic
- Understanding Torque Calibration Units:

- Newton Meters
- Kilogram Meters
- Kilogram Centimetres
- Foot Pounds
- Understand Range & Span
- Torque the Nut or Torque the Bolt?
- Care & Calibration
- Practical Session using a Torque Wrench

Examine the contents of a Typical factory Toolbox!

5 Mechanical Measurement.

Use a Vernier Callipers - Metric & Imperial

Use a Micrometer - Metric & Imperial

Using Measuring Gauges:

- Thread Pitch Gauges
- Slip Gauges
- Feeler Gauges

6 Engineering Materials.

Know the Properties of Engineering Materials

Understanding Specific Engineering Materials

- Metals
- Polymers
- Ceramics
- Composites

Understanding Basic Metallurgy:

- Ferrous Metals:
 - Pig, Wrought & Cast Irons
 - Carbon Steel & Alloy Steel
 - Heat Treatment of Steel
- Non-Ferrous Metals:
 - Bronze
 - Aluminium
 - Copper
 - Lead
 - Nickel
 - Tin
 - Titanium
 - Zinc
- Alloys
 - Brass
 - Bronze

- Solder

Understand Hardness & Rockwell numbers

7 Methodical Dismantling & Re-assembly Practices.

Cleanliness & Organisation

Methodical Dismantling

Good Storage Practices

Methodical Reassembly Practices

Functionality Testing & Returning to Production

8 Lubrication, Friction & Wear (Tribology).

Understand the purpose of Lubrication

Know about Viscosity & Viscosity Index

Understand what Full-Film Lubrication is

Understand what Boundary Lubrication is

Lubrication example as applied to a Journal Bearing

What are & why use Automatic Lubricating Systems

9 Mechanical Seals.

Gaskets:

- Application of Gaskets
- Gasket Materials
- Gasket Inspection
- Making a new Gasket

O-Rings:

- Application of O-Rings
- Inspecting of O-Rings
- Replacing O-Rings

Lip Seals:

- Application of Lip Seals
- Inspecting of Lip Seals
- Replacing Lip Seals

Stuffing Boxes & Gland Packings:

- Applications of Stuffing Boxes
- Cutting & Packing Methods
- Adjusting a Packing Set
- Lubrication of Packings

10 Limits & Fits.

Understand the Principal of Limits & Fits

Understanding the ISO Referencing System

Consulting the *Engineers Reference Handbook*:

- Clearance Fits
- Transition Fits
- Interference Fits

11 Drills, Drill Bits & Reamers.

Safety First!

Drill Bits:

- Metric / Imperial
- Drill Bit Design Characteristics
- Checking for Wear / Sharpening Options

Feeds & Speeds

Drilling Techniques

Reamers:

- Establishing Fits: Consult Limit & Fits Chart
- Feeds & Speeds

12 Screw Thread Technology.

Nomenclature for Threads

Examination of differing Thread Types:

- Metric
 - Metric Coarse
 - Metric Fine
- Unified Thread Standard (UTS)
 - UNC
 - UNF
 - UNEF

Referring to Engineering Pocket Books - Threads

Thread Lead, Thread Pitch, Thread Starts

Thread Handedness

Using Thread Gauges - Metric & UTS

Tapping an Internal screw thread

Cutting an External screw thread

13 Screws, Bolts, Nuts & Washers.

Screws:

- Types & Function:
 - Wood Screw
 - Machine Screw
 - Thread Cutting Machine Screw
 - Sheet Metal Screw
 - Self-Drilling Sheet Metal Screw
 - Socket Screw
 - Grub-Screw
 - Coach Screw
 - Threaded Bar

Bolts:

- Types & Function:
 - Hex Bolt
 - Cup Square Bolt
 - Eye Bolt
 - Eye Lag Bolt
 - J- Bolt
 - U- Bolt
 - Shoulder Bolt
 - Elevator Bolt
 - Hanger Bolt
 - Sex Bolt
 - Mating Bolt
 - Wing Bolt
 - Socket Bolt
- Bolt Head Markings

Common Head Types for Bolts & Screws

Nuts:

- Types & Function:
 - Hex Nut
 - Heavy Hex Nut
 - Nylon Insert Lock Nut
 - Half / Jam Nut
 - Nylon Insert Half Nut / Jam Nut
 - Wing Nut
 - Dome Nut
 - Acorn Nut
 - Flange Nut
 - Tee Nut
 - Square Nut
 - Prevailing Torque Lock Nut
 - K-Lock Nut / Keps Nut
 - Coupling Nut
 - Slotted Nut

- Castle Nut

Washers:

- Types & Function:
 - Flat Washer
 - Mudguard Washer
 - Finishing Washer
 - Split lock Washer
 - Serrated Lock Washer - External Tooth
 - Serrated Lock Washer - Internal Tooth
 - Square Washer
 - Dock Washer
 - Ogee Washer
 - Sealing Washer
 - Schnorr Washer
 - Nordlock Washer

14 Dealing with Broken / Sheared Studs & Damaged Threads.

Broken Stud Removal using Easi-Out's

Thread Repair using Helicoils

15 Bearings & their Applications.

Introduction to Bearings:

- Purpose of Bearings
- Defining Radial & Axial Loading

Bearing Types & Applications:

- Plain Bearings
- Ball Bearings
- Roller Bearings:
 - Standard Roller
 - Spherical Roller Bearings
 - Tapered Roller Bearings
 - Thrust Roller Bearings
- Needle Bearings:
 - Radial Needle Bearings
 - Thrust Needle Bearings
- Linear Ball Bearings

Maximising Bearing Service Life

Bearing Mounting & Dismounting

16 Power Transmission Systems.

Mechanical Drive Couplings

Electro-Magnetic Clutches & Brakes

Belts & Pulleys, Types & Tensioning:

- Flat Belts
- Vee Belts
- Poly-Vee Belts
- Timing Belts

Chains & Sprockets:

- Terminology
- Types
- Anatomy of Roller Chains
- Tensioning
- Breaking & Making Chain Links:
 - Quick Release Link
 - Split Link
 - Cotter Link
 - Rivet Link

17 Reading Mechanical Prints.

Engineering Drawing Equipment

Understand 1st & 3rd Angle Projection

Basic Engineering Drawing Principals

Introduction to Geometric Dimensioning & Tolerancing (GD&T)

18 Machining Processes.

Grinding:

- Cylindrical Grinding
- Surface Grinding

Centre Lathe

Milling Machine

CNC Machining

Spark Erosion

19 Welding Processes.

Gas

Electric Arc

MIG

TIG

This Item is Not Yet Available!

20 Open Floor Discussion!

Open Floor Discussion