



WorkPlace Training - elearning

Course Descriptions

An easy to access, menu driven curriculum allows the learner to concentrate on the topics specific to their job requirements. For anyone taking measurements, new hires, students or a refresher for more experienced technicians. All titles have their own parameter specific glossary, pre and post tests and Certificate of Competency.

Precision Measurement Series-Level I

WPT1001 Introduction to Measurement and Calibration

Introduction

Definition of metrology; measurements in manufacturing; measurement in the global marketplace; importance of measurement

Development and Concerns of Metrology

Need for better measurements; determine and describe the differences between resolution, accuracy, precision; calibration; Type A Uncertainty, Type B Uncertainty; review questions

Standards and Standardization

Working standards, check standards, international standards, levels of standard accuracies; accuracy ratio between levels of calibration pyramid; requirements of traceability; metrology standardization documents; review questions

Managing the Metrology System

When a metrology system is needed; components of a metrology system; periodic calibration; determining period, fixed time intervals or other means, measurement assurance; record keeping, categories on a good record keeping form, computer record keeping programs, record stickers; documented procedures; components of a procedure, standardization documents, ISO and QS9000, ANSI Z-540, ISO 25, Malcolm Baldrige, training; components of a training program, records, review questions

Making Good Measurements: Elements of a Measurement System

Measuring instrument (calibration); calibration pyramid, relating the instrument to the national standard; unit under test; preparation of the UUT; fixture or jig setup; measuring procedure; operator; analysis of measured data; display of final analyzed result; measurement assurance, isolating errors, capability study, gage R & R; review questions

Units and Measurement Instruments

Length; rulers, height gages, optical comparators, micrometer/calipers, metrology laser, others: roundness, squareness, flatness, surface finish, area, volume, Mass: balances (single-pan, dual pan, electronic) Time: electronic counters, atomic clocks, Temperature; thermometers (liquid-in-glass, metallic stem, thermostats, electrical thermometric, thermistors) flow; flowmeters (rotation, pressure drop, positive displacement) electrical

quantities; DC voltages (meters), resistance (multimeters), DC current, AC measures, review questions

WPT1002 Precision Electrical Measurement

Basic DC and Low Frequency Measurement

Measurement Units; Coherent, uniform and unified; Defined, Realized and Represented; Disseminated and Extended. Measurement Instruments: Types; Principals of Operation; Measurement Methods: Direct; Differential; Transfer; Ratio; Indirect
Essential Math: Basic Algebra, Engineering and Scientific Notation, Logarithms, Calculating Power Gain/Loss; Ratios, Decibels, Conversions, Calculating Specifications; three types of ac meter responses; peak, full wave, and root mean squared (rms), Conversion of ac voltages using form factors , Calculation of pass/fail measurement limits from instrument specifications Measurement Uncertainty-a Beginning: Calculating error and Correction Factors, Types of Errors: Systematic Errors; Instrument, Environmental, Observational, Concepts of Measurement Uncertainty

Standards and Traceability

Why Measurements Must be Traceable; What Is Involved in a Traceable Calibration, Standards
The Ideal Standard; Standards for your Measurements, Traceability: Establishing and Maintaining Traceability

Practical Considerations for Precision Electrical Measurement

Grounding: Ideal vs. Real Ground; Power Line Ground Systems; Safety-Ground Ground
Loop Errors, Shielding: Electromagnetic Radiation; Shielding from Electric Fields;
Magnetic Field Coupling; Minimizing Magnetic Pickup; Magnetic Shielding,
Guarding: Instrument Guard; High-Impedance Measurements; Guarding Current Sources

Sources of Measurement Error

Thermal EMF's, Contact Resistance, Insulation Resistance, Surface Leakage, Dielectric Absorption, Noise and AC to DC Converters, Parasitic Capacitance, Bias Current, Pumpout Current

Electrical Safety

Introduction, Electrical Safety Fundamentals, Shocking Stories

Additional topics

Lab Practices; Introduction, Test Instruments. Electro-Static Discharge, Routine Maintenance
Scope Hints; Noise Problems, TDR, Probing, Troubleshooting, Aliasing, Harmonic Distortion, Stability, Pulse Capture

WPT1003 Precision Temperature Measurement

Introduction

Temperature affects nearly every physical measurement you make, requiring you to make corrections to your measurements due to temperature variations. Because of this, the accuracy of all your measurements depends on your ability to accurately measure temperature.

Heat and Temperature

Describe and understand basic Molecular structure, Kinetic Energy, Heat, Temperature, Thermometers, Ice Point, Steam Point and Triple Point, Absolute Zero.

Temperature Scales

Celsius, Kelvin, Fahrenheit, Rankine, Thermodynamic, ITS-1990, Conversion Formulas

Thermometers

Mercury-in-Glass, Alcohol-in-Glass, Resistance Thermometers, Operating Principles, Calibration Principles,

Thermometer Calibration, Uncertainty, Measurement Errors

Related Heat Sensing and Measuring Instruments

Principles, Construction and Methods of Operation of Thermistors, RTD's, Thermocouples, Infrared Sensing Devices, Selection Guide

Basic Principles of Uncertainties in Temperature Measurement

Introduction, Bath Calibration Uncertainties, Readout Devices, Isothermal Baths, Dry Well Calibration Uncertainties

WPT1004 Precision Dimensional Measurement

Linear Measurements Standards

Definition of the Meter, Length Standards, Units of Measure

Measuring Instruments

Micrometers, Calipers, Types and Accuracies, Selection, Sensitivity, and Accuracy of Measuring Instruments, Absolute and Comparison Measure, Causes of Error and Correction: Temperature, Gage Deformation, Elastic Deformation, Error Analysis

Gage Blocks

History, Requirements, Methods of Measuring, Traceability, Uncertainty, Surface Finish, Thermal Expansion, Selection, Precautions, Calibration, Wringing, Types and Characteristics

Making Angular Measurements

Clinometers, Sine Bars and tables; Trigonometric functions, Practical applications; Angle gage blocks

Optical Instruments

Using the eye as an optical instrument, Hints for making precise optical measurements, Use and principles of Optical flats, Grades, Light Interferometry, Light Interference, Reflection, Calculating surface flatness using interference patterns, Reading flatness error, Care of optical measurement devices, Microscopes, Comparator

WPT1005 Precision Pressure & Vacuum Measurement

Pressure Fundamentals

.Definition, Mathematical Formulas, Pascals, Boyles, Charles and Combined Gas Laws, Measurement Modes

Type of Pressure

Gauge Pressure, Vacuum, Absolute, Differential, Effects of changes in Atmospheric Pressure, Pressure Units and their Conversion

Pressure Measurement Devices

The Bourdon Tube Pressure Gage, Dead Weight Piston Gages, Calibration, Errors, Safety

Transducers

Measurand, Displacement or Stress, Force-Summing Devices, Accuracy; Stability, Drift, Aging, Frequency Response; Step Pressure Change, Natural Frequency and Resonance's, Static Overpressure, Dynamic or Transient Overpressure, Concepts of Accuracy; Static Error Band, Linearity, Hysteresis, Repeatability

Principles of Vacuum

Concepts, Production of Vacuum, Conductance, Long Path vs. Short Path, Vacuum Ranges, Gauges

WPT1006 Precision Flow Measurement

Density Principles and Measurement Corrections

Density Measurement Principles, Correcting Indicated Weight, True Mass vs Apparent Mass, Weight Density Principles, Weight Densities of Various Materials.

Specific Gravity;

Principles, Determining Specific Gravity; Picnometer and Balance, Hydrometer, Specific Gravity Balance

Fluid Flow Measurements;

Basic Flow Concepts, Units of Measurement, Reynolds Numbers, Viscosity, Turn Down Ratios, Calibration Techniques; Weighing Methods; Dynamic, Static, Volumetric Method; Calibrated Tank, Piston/Cylinder

Flow Measurement Devices;

Differential Pressure Meters; Orifices, Venturi tubes, Flow tubes, Flow nozzles, Pitot tubes, Elbow meters, Target meters, Variable-area meters, Positive Displacement Meters, Reciprocating piston meters, Oval-gear meters, Nutating-disk meters, Rotary-vane meters, Velocity Meters; Turbine meters, Vortex meters, Electromagnetic meters, Ultrasonic flowmeters, Mass Flowmeters; Coriolis meters, Thermal-type mass flowmeters

WPT1007 Precision Mass Measurement

Mass Basics;

Defining formulas and supporting math, terminology, standards hierarchy,

Mass and Weight Principles;

Units, Classification and Applications, Physical Characteristics, Weight Calibration Reports, Density Standards, Calibration Weight Selection, Balance Verification, Weight Care and Maintenance

Weighing Instruments;

Mechanical; Principles of Operation, Electronic; Principles of Operation

Location;

Weighing Bench, Work Room, Temperature

Operation;

Leveling, Draft Shielding, Weighing Vessel, Weighing Pan, Calibration, Errors, Application

Weights;

Classes, Selection

Physical Influences;

Temperature, Moisture, Electrostatics, Magnetism, Static Buoyancy, Gravitation

Data Acquisition;

Standard Deviation, Sensitivity Drift, Linearity, Readability, Reproducibility, Uncertainty

WPT1008 Precision Force & Torque Measurement

Stress and Strain;

Relationships, Stress, Strain Elasticity, Tension or Compressibility

Characteristics and Operations of a Load Cell;
Strain Gages, Load Cell Configuration, Practical Apps

Torque Concepts and Applications;

What is Torque? Cosine Error, Torque Wrenches, Hooke's Law, Run Down Resistance, Set or Seizure, Breakaway, Reading the Scale
Torque Testers Calibration

Torque Auditing;

How Fasteners Fasten, Torque Measurement, Torque and Clamping Force, Torque Auditing; Static, Dynamic, Sources of Variation; Actual installation vs. specification, Fall-off (joint relaxation), Hard and soft joints, Tightening speed (frictional coefficients)

WPT1009 Measurement Uncertainty

Components

Sources of Uncertainty

Essentials of Expressing Measurement Uncertainty

Definitions, Evaluating, Distributions; Uniform, Triangular, Nominal, Combining, Expanded, Examples, Specification; Coverage Factors, Confidence Limits Correlation, Reporting Uncertainty; Manufacturer, User, Capabilities Statement, Traceability

Risk Analysis Introduction

Quantification, Consumer vs Producer, Approximation Methods, Measurement; Average Quality Level, Distribution, Bias, TUR,

Guardband

Limits, Interval Width, Delta Specification Limit, EOP% Intolerance

Related Statistical Tools;

PMAP, Process Capability, Gage R & R, ANOVA, Models for Measurement Uncertainty Analysis, Sample Plans, Structure of Random Samples, Reverse Standards

Standards;

ISO/IEC 17025:2005
ANSI/NCSL Z540.3:2007
JCGM 100:2008 (GUM)
JCJCGM 200:2008 (VIM)
ISO/IEC Guide 98-3:2008
ISO/IEC Guide 99:2007 (VIM)
ILAC arrangement and regional MRA's; and more.
GM 101:2008 (GUM supplement on Monte Carlo methods)

Software;

stand-alone measurement uncertainty calculators; calculators designed to work with Microsoft® Excel®; calibration management software; general-purpose statistical analysis software; and a mathematical analysis application

Features and Benefits;

Review of uncertainty tools, calibration management and automation software, statistics software, general purpose mathematical analysis software

WPT1017 Time and Frequency

Time

Measurement Time Scales

Universal Time, International Atomic Time, Synchronization, Coordinated Universal time

Digital Clock Accuracy and Synchronization

General Purpose Units, Precision Units

Time Base Standards in Clocks

Accuracy and Stability, Cesium Beam Standards, Hydrogen Masers, Rubidium Standards, Quartz Oscillators

Sources of Error

Frequency Offset and Oscillator Aging, NIST, Loran C, GOES, GPS

Time Code Formats

Frequency

Specifications

Universal Time, International Atomic Time, Synchronization, Coordinated Universal time

Offset

Phase Comparison, Phase Deviation, Measurement Period, 10:1 DUR, Sample Graphs

Stability

Short-term, Long-term, Frequency Domain, Time Domain, Standard Deviation, Allan Variance, Sample Graphs, Flicker Floor

Frequency Standards

Operating Principles of; Quartz, Atomic, Rubidium, Cesium, Hydrogen Masers

Transfer Standards

WWVB, Groundwave; Loran-C, GPS, Receiving Equipment-Pseudo-random noise, Course acquisition code, Precision code GPS

Performance

GPS Calibration Methods: Frequency counter, Time interval method

WPT1020 Uncertainty Management

Introduction

- Communicating about measurements and measurement equipment

What is a Specification?

- Why do we need specifications?
- The use of specifications in measurement and metrology
- The form(s) taken by specification
- Some examples of specifications of measuring equipment
- How to read and interpret specifications
- The importance of specifications in calibration
- What it means to be in or out of spec.
- Practice reading, interpreting, calculating

What is a Tolerance?

- How are tolerances stated?
- What is the difference between a tolerance and a specification?
- Some examples of tolerances of measuring equipment
- How to read and interpret tolerances
- The importance of tolerances in calibration
- What it means to be in or out of tolerance
- Practice reading, interpreting, calculating

Measurement Uncertainty (this is not a full treatment, just an intro in context)

- Definitions (in context) of measures of measurement reliability and quality
- Accuracy
- Precision
- Resolution
- Repeatability and Reproducibility
- Traceability
- How do these definitions fit with specifications and tolerances?
- Special cases: floor specs, % of full scale vs % of reading, ppm, values near zero
- Calculation of measurement uncertainty – budgets
- Converting specifications and tolerances to uncertainty
- Practice calculating

Accreditation: rules relating to specifications and tolerances

Ratios

- The 10:1 principle; 4:1, 3:1
- What did they mean in the past: Definitions in MIL-STD-45662
- What do they mean now? Definitions in ANSI/NCSL Z-540-1, ISO 10012-1 and ISO/IEC 17025
- Are they useful? If so, why?
- Accuracy ratios, tolerance ratios, uncertainty ratios
- Ratios and traceability
- Practice calculations

Specifications, Tolerances, and Uncertainty

- Inspection and test
- Errors of Type I
- Errors of Type II
- Decision rules
- Definitions
- Applying them
- Responsibility (whose)
- Measurement uncertainty and decision rules

Changes to and Adjustment of Decision Rules

- Guardbanding
- Determining conformance to identified metrological specifications and taking measurement uncertainty into account
- Practice calculations

WPT1021 AC/DC Calibration and Metrology

Basic concepts: including power produced by voltage

Thermal converters, single element vacuum thermocouple converters.

Making transfers and the determination of alternating voltage and current, frequency effects.

Understand AC-DC Devices including multijunction thermocouples, log/antilog converters, electrostatic and electrodynamic instruments

Using AC-DC transfer standards

Explain and understand types of AC-DC transfer standards.

Vacuum thermocouple-based standards.

AC-DC voltage transfers i.e. plane of reference and frequency response

Follow the correct procedures in making the transfer; preparation and using shunts for AC-DC current transfers.

Describe transfer errors and their avoidance; 4-terminal connections, proper connections and hookups, distortion and noise.

Understand transfer standard calibration; AC-DC difference, half-scale range intercomparison

Inductance and Capacitance

Explain the SI definition of inductance; standard of inductance, traceable standards, time constants and inductive reactance in AC circuits.

Explain the SI definition of capacitance.

Describe the Realization of the Farad, traceable capacitance standards, time constants, capacitive reactance in AC circuits, comparing the currents in inductors and capacitors.

Impedance and AC Ratio

Describe and understand impedance, admittance and immittance, AC reactance.

Understand and use audio frequency dividers; resistive and reactive dividers.

Explain RF ratio; and connector and hookup considerations.

WPT1022 Precision Humidity Measurement

Introduction to Humidity Measurement

Key Terminology

Vapor Pressure, Saturation Water Vapor Pressure, Relative Humidity, Dalton's Law, Dew Point, Frost Point, Supercooled Water, Absolute Humidity, Mixing Ratio, PPM by Volume, PPM by Weight, Enthalpy, Pressure Effects

Specification

Vapor Pressure, Saturation Water Vapor Pressure, Relative Humidity, Dalton's Law, Dew Point, Frost Point, Supercooled Water, Absolute Humidity, Mixing Ratio, PPM by Volume, PPM by Weight, Enthalpy, Pressure Effects

Humidity Measuring Instruments

Wet and Dry Bulb Psychrometers, Theory, Operating Principles

Chilled Mirror Hygrometer Theory

Principles in Chilled Mirror-Peltier Cooling, Dew Point Depression, Slew Rate, Platinum RTD

CM Operation and Maintenance

Dew Point Measurement, Contamination, Dew or Frost, Sampling, Pressure Effects

Sensors

Displacement, Bulk Polymer Resistive, Capacitive, Saturated Salt Lithium Chloride, Aluminum Oxide Dew Point, Piezo-Resonance

Accuracy of the Measurement

Error Sources; Conformity, Hysteresis, Dead Band, Repeatability Kelvin Effect, Raoult Effect

Calibration

Two Pressure Humidity Calibration, Two Pressure Principle, RH Generator, Computer Controlled System

Measurement Uncertainty

Precision Measurement Series-Level II

WPT1024 Certified Calibration Technician (CCT) Test Prep

GENERAL METROLOGY (30 Questions)

Base SI Units, Derived SI Units, SI Multipliers and Conversions, Fundamental Constants, Common Measurements, Principles and Practices of Traceability, Types of Measurement Standards, Substitution of Calibration Standards

MEASUREMENT SYSTEMS (25 Questions)

Measurement Methods, Measurement Data, Characteristics of Measurements, IM&TE Specifications, Primary Error Sources, Measurement Systems and Capabilities, Measurement Assurance Programs (MAPs)

CALIBRATION SYSTEMS (25 Questions)

Calibration Methods, Industry Practices and Regulations

Control of the Calibration Environment, Calibration Processes for IM&TE, Process flow; Logistical information, Roles and responsibilities, Scheduling, Manual and Automated Calibration, Systems Records and Records Management, Reporting Results

APPLIED MATHEMATICS AND STATISTICS (20 Questions)

Technical and Applied Mathematics (Application), Scientific and engineering notation, English/Metric conversions, Ratios, Linear interpolation and extrapolation, Rounding, truncation, and significant figures, Number bases, Volume and area, Angular conversions, Graphs and plots Applied Statistics, Basic statistical tools, Common distributions, Descriptive statistics, Sampling issues

QUALITY SYSTEMS AND STANDARDS (15 Questions)

Quality Management Systems; System components, Procedures

The Seven Quality Control Tools, Quality Audits, Preventive and Corrective Action; Process improvement techniques, Nonconforming material identification, Impact assessment of nonconformances Supplier Qualification and Monitoring, Professional Conduct and Ethics, Occupational Safety Requirements; Hazards and safety equipment, Hazardous communications (HAZ-COM), Housekeeping, Quality Standards and Guides

UNCERTAINTY (10 Questions)

Uncertainty Budget Components, Uncertainty Management, Uncertainty Determination and Reporting Practice test questions based on the Six Levels of Cognition based on Bloom's Taxonomy

ISO 17025 Compliance Series

WPT1026 Introduction to ISO/IEC 17025 for Technicians

Computer Based Training Modules: content, terminology, concepts, graphics, formulas, real world examples, and practice questions from subject matter experts throughout the calibration industry designed to better prepare for accreditation and audit. Primary SME is Philip Stein

Scope of the Lesson

The lesson will cover the requirements of the standard, how it is applied to calibration and test laboratories, and what a technician who works for an accredited lab needs to know. On completion, you will understand these topics and will understand what behavior and activities are required of you in order for your work to be conformant to the standard.

Intro to documentary standards

Quality systems and standards

Prescriptive and non-prescriptive standards

Accreditation, registration, and certification

ISO/IEC 17025 and ISO/IEC Guide 58

Accreditation bodies and ISO/IEC 17025

Mutual agreement and mutual recognition Conformance and conformity assessment

Requirements of the standard(s), shoulds, and notes

- Normative references
- Additional requirements from accreditation bodies
- The assessment process
- Deficiencies, nonconformances, corrective action, responses
- Preassessment, reassessment, surveillance

WPT1027 Assessment to Requirements of ISO/IEC 17025

The course **Introduction to ISO/IEC 17025 for Technicians** is a prerequisite to this course.

The lesson will cover the requirements of the standard, how it is applied to calibration and test laboratories, and what a technician who works for an accredited lab needs to know. On completion, you will understand these topics and will understand what behavior and activities are required of you in order for your work to be conformant to the standard.

Internal Assessments

- The internal audit team
- Process and schedule
- Contents of the assessment
- Intro to documentary standards
- Quality systems and standards
- Prescriptive and non-prescriptive standards
- Accreditation, registration, and certification
- ISO/IEC 17025 and ISO/IEC Guide 58
- Accreditation bodies and ISO/IEC 17025
- Mutual agreement and mutual recognition Conformance and conformity assessment
- Requirements of the standard(s)
- Shalls, shoulds, and notes
- Normative references
- Additional requirements from accreditation bodies
- The assessment process
- Deficiencies, nonconformances, corrective action, responses
- Preassessment, reassessment, surveillance

Audits and Auditors

- ISO 10011
- Assessor qualifications
- Assessor training requirements

- Requirements for confidentiality
- Assessor roles – Lead, technical, associate

The Assessment Process

- Assignment
- Planning
 - Desk audit, first round of deficiencies and corrective action
- Scheduling the assessment
- Agenda and assessor roles
- The opening meeting
- The tour
- Lead assessor roles and responsibilities
- Technical assessor roles and responsibilities
- Technical interviews and observations of tests/calibrations
- Daily meetings
- The closing meeting

After the Assessment

- The final report
- Typical documentation produced
- Deficiencies and Corrective action
- Proficiency testing and interlaboratory comparisons
- Review of laboratory submissions
- Review of entire final package
- Assessor revisits and continuing assignments

WPT1028 Interval Analysis

- BONUS!! INTERVAL ANALYSIS CALCULATOR TOOL INCLUDED!! -

- The requirement for Interval Analysis
- Definitions associated with Interval Analysis
- Statistics associated with Interval Analysis
- Basic Statistics
- Statistical techniques
- Reliability Models
- Implementing Interval Analysis
- Reliability Targets & Measurement Risk
- Data Conditioning
- Equipment Groups
- Analyzing Data and reviewing Reliability Model
- Interval Analysis Methods
- Adjustment Methods
- Economics of Interval Analysis
- Implementation Methods
- Interval Extensions

WPT1029 Proficiency Testing

- BONUS!! PROFICIENCY TESTING CALCULATOR TOOL INCLUDED!! -

- Introduction to Proficiency Testing
- Justification for Proficiency Testing participation
- Standards associated with Proficiency Testing
- Basic Statistics in Proficiency Testing

- Measurement Uncertainty Considerations in Proficiency Testing
- Proficiency Testing schemes (with examples for testing and calibration laboratories)
- Proficiency Testing Data Interpretation and Analysis (with examples)
- Simple implementation of Measurement Assurance Programs (MAP) within the laboratory

WPT1030 CMM's (Coordinate-measuring machine)

- Review of Basic Concepts and Vocabulary
- Basic CMM Measurements
- Sampling Issues
- Probing Systems
- Basic CMM Accuracy and Specifications
- Thermal Effects
- CMM Calibration
- Measurement Uncertainty

WPT1031 Water Quality, Measurement, pH, Conductivity

- pH Measurement Intro
- Equipment Used to Measure pH Calibration
- Uncertainty of pH Measurement
- Power Measurements
- Conductivity Intro
- Conductivity Measurements
- Influences on Conductivity Measurements
- Applications

WPT1032 Metrology for Engineers and Scientists

This course is designed to familiarize Engineers and Scientists with Metrology, the science of measurement. A quantitative analysis of design based on sound metrology principles will help engineers and scientists to design better products and services.

In order to evaluate multiple solutions to the design, physical measurements are made and the data analyzed. Predictions need to be made on how well the design will perform to its specifications before full scale production begins. Tests are performed using prototype models, computer simulation, designed experiments, destructive and non-destructive tests, scale models and stress tests among the many other methods of evaluation. An engineer works with many other people when designing their products:

- Marketing to understand customer requirements.
- Testing department to specify test requirements and understand test results.
- Manufacturing and production to ensure that products are made to specifications.
- Quality departments to ensure quality requirements.
- Measurement Parameters**
- Calibration technicians in the pre and post design phase.
- Principles and Instrumentation to Measure the following: Electrical, Dimensional, Pressure, Temperature, Humidity, Mass, Light Radiation, Acoustics, Chemical
- Statistics**
- Basic and Reliability Models, Measurement Decision Risk
- Measurement Uncertainty**
- Types of Uncertainty
- Determining Measurement Uncertainty
- Uncertainty calculations

- Combined uncertainty calculations
- Combining uncertainty methods
- Determining expanded uncertainty
- Analyzing and reporting uncertainty
- Analyzing and understanding calibration reports
- Applying uncertainty data
- Applications**
- Applying metrology concepts in product and instrument design
- Selecting Instruments
- Quality Aspects
- Validation/verification issues
- Safety Characteristics
- Determining Test Specifications
- Assigning appropriate Tolerances
- Calibration Aspects
- Special topics in Measurement Uncertainty
- Assessment Checklist

WPT1033 Safety in the Calibration Lab

Introduction

General Roles and Responsibilities for Supervisors and Technicians

Electrical Safety for Cal Lab Operations;

Floors, Grounding, Benches, Mobile Equipment, Safety Devices; Fuses, breakers, interlocks, grounding sticks, Connecting and disconnecting equipment, RF Permissible exposure, Arc Flash, Electrical equipment cleaning, Solvents, 2-man teams

Fires;

Electrical, Dry Chemical

Chemical;

MSDS, Toxic and physical, mercury, hydrazine, disposal, Good housekeeping, Liquid Nitrogen and Oxygen; physical, physiological, and chemical

Pressure;

Maximum Allowable Working Pressure (MAWP) and Maximum Operating Pressure (MOP), Test Pressure, Pressure Relief Devices, Component Requirements

Lasers;

Principles, Industrial hygiene, Explosion hazards, Nonbeam optical radiation hazards, Collateral radiation, Electrical and flammable hazards, Biological Effects; Eye, thermal

Temperature;

High heat, cold, cryogenics, Bath fluid flashpoints

Radiation;

Material, handling, storage, incident response