Refrigeration & Air Conditioning Technology
SIXTH EDITION

SECTION 2

SAFETY, TOOLS AND EQUIPMENT, SHOP PRACTICES

UNIT 11

CALIBRATING INSTRUMENTS

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UNIT OBJECTIVES

After studying this unit, the reader should be able to

- describe instruments used in heating, air conditioning, and refrigeration.
- test and calibrate a basic thermometer at the low- and high-temperature ranges.
- check an ohmmeter for accuracy.
- describe the comparison test for an ammeter and a voltmeter.
- describe procedures for checking pressure instruments above and below atmospheric pressure.
- check flue-gas analysis instruments.

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THE NEED FOR CALIBRATION

- Instruments must be reliable
- Technicians rely on instrument readings to troubleshoot and evaluate systems
- Improper conclusions can be drawn if readings are inaccurate
- Taking care of tools requires calibration
- Voltage-measuring instruments must function properly for safety's sake

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CALIBRATION

- Definition: To change the instrument's output to correspond to a standard reading
- New electronic instruments with digital readout features stay calibrated longer
- Analog meters use a needle on the meter face to indicate value readings
- Follow manufacturer's instructions for the calibration of individual meters

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TEMPERATURE-MEASURING INSTRUMENTS

- Glass stem thermometers
  - Easy to use when measuring the temperature of a fluid
- Electronic thermometers
  - Simple to use, economical, and accurate
- Reference points for calibrating temperature measuring instruments
  - 32° F (ice water)
  - 212° F (boiling water)
  - 98.6° F (body temperature)
- The thermometer must be in good contact with the medium being measured

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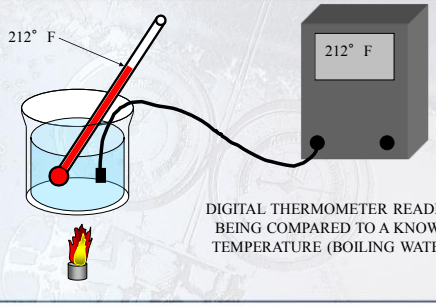

DIGITAL THERMOMETER READING BEING COMPARED TO A KNOWN TEMPERATURE (BOILING WATER)

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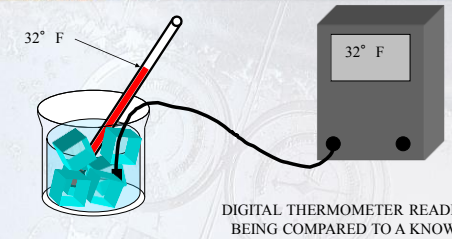

DIGITAL THERMOMETER READING BEING COMPARED TO A KNOWN TEMPERATURE (ICE WATER)

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PRESSURE TEST INSTRUMENTS

- To check the calibration of a gage manifold
  - Use a fresh cylinder of refrigerant standing at room temperature for a period of time
  - Determine cylinder pressure from known cylinder temperature (P/T chart)
  - Use a gage manifold to check the cylinder's pressure
- Gage dials have calibration screws

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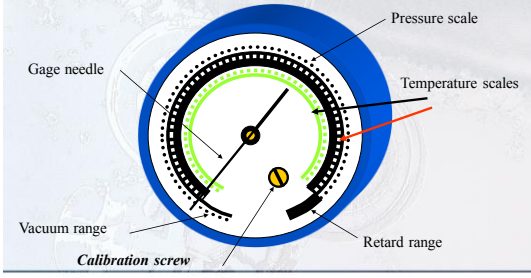
LOW PRESSURE GAGE



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ELECTRICAL TEST INSTRUMENTS

- Compare the instrument readings against known values
- Using high-quality resistors of know values can check ohmmeters
- The voltage scale of a voltmeter can be checked by comparing voltage readings against other voltmeters
- Clamp-on ammeters can be checked by comparing ammeter readings against another ammeter
- Calibration screw on meter (zero adjust)

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REFRIGERANT LEAK-DETECTION DEVICES

- Halide torch
  - Cannot be calibrated
  - The tube should be kept clean and clear
- Electronic leak detector
  - More sensitive than the Halide torch
  - Some have adjustments to alter sensitivity

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FLUE-GAS ANALYSIS INSTRUMENTS

- The chemicals in the flue gas analysis kit must be handled properly
- The valves should be checked periodically for leaks
- These devices cannot be calibrated

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GENERAL MAINTENANCE

- Buy the best batteries available
  - Inexpensive batteries can cause problems
  - Good quality batteries will not leak acid
- Test equipment must be properly maintained and kept clean
- Technicians must have faith in their test instruments

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UNIT SUMMARY

- Proper calibration helps ensure accurate readings
- Technician's safety can be compromised if test instruments are not calibrated properly
- Temperature-sensing instruments should be calibrated to known temperatures
- Pressure gages can be calibrated by comparing a known refrigerant tank pressure to the gage reading
- The accuracy of electrical test instruments can be checked by comparing readings to known values