**Building Science Education Solution Center – Smart Refrigeration Tools**

Proficiency Level 2: Understand

**Learning Objective 2.1:**

* Know the definition of smart diagnostic tools and their components.

**Lecture Notes 2.1:**

Conventional HVAC tools may include several analog manifold gauges to measure refrigerant pressures and saturation temperatures, a multimeter to take electrical measurements, a pressure-temperature chart for different types of refrigerants, superheat charging table, thermocouples and psychrometers, and manufacturer data. The manifold gauges, multimeter and sensors are attached or inserted at various places in the HVAC system and the measurements are used in calculations and lookup tables to find the key operating characteristics of the equipment used to conduct maintenance, commission, or troubleshoot the system.

Smart tools replace older conventional equipment with two main sets of tools. The first set includes digital manifolds, sensors, and probes. Like the conventional measurement devices, these are attached to the system or within the ductwork to measure refrigerant pressures and saturation temperatures, actual refrigerant line temperatures, air wet bulb and dry bulb temperatures, airflow volume, and to take electrical measurements. These measurements are wirelessly streamed to the second set of tools, which are diagnostic applications loaded on a smartphone, tablet, or other device.

The diagnostic application checks that it has all the needed system data, will perform different calculations needed and help troubleshoot and diagnose different problems within the system. The application can perform all necessary calculations for commissioning and troubleshooting a system, such as subcooling, superheat, airflow estimation, operating capacity, and system efficiency.

**Problem Set 2.1:**

Conventional diagnostic tools include:

1. Wireless temperature sensor
2. Digital manifold
3. Pressure-temperature charts
4. Smartphone