Electronics U
by Global Electronics Association

SYLLABUS

IPC/WHMA-A-620 for Operators

This course provides a practical introduction to the terms, concepts, and acceptably criteria of the IPC/WHAM-A-620 standard as they apply to the role of the operators, technicians, and other assembly line staff.

COURSE OBJECTIVE

After completing this course, you will be able to effectively navigate, locate, and apply the criteria specified in the IPC/WHAM-A-620 standard in your role as an electronics assembly line operator, technician, or supervisor.

LEARNING OBJECTIVES PER COURSE MODULE

MODULE 1: GENERAL STANDARD INFORMATION AND REQUIREMENTS

- Identify scope and purpose of IPC/WHMA-A-620 standard
- Navigate IPC/WHMA-A-620 using table of contents
- Recognize product classifications
- Recognize acceptable, process indicator, and defect conditions
- Demonstrate ability to read and apply criteria in IPC/WHMA-A-620
- Differentiate between System International (SI) and Imperial English Units of measurement
- Recognize order of precedence
- Identify requirements for handling, safety, and ESD protection
- Identify requirements for tools and equipment
- Differentiate between rework and repair

MODULE 2: PREPARATION, MEASURING, AND TESTING

- Define general requirements for wire preparation
- Identify conductor and insulation defects
- Define requirements for measuring cables and wires
- Describe in-process and final acceptance requirements for electrical and mechanical testing

MODULE 3: SOLDERED TERMINATIONS AND HIGH VOLTAGE

- Describe requirements for soldered terminations
- Identify materials, tools, and equipment used in hand-soldered terminations
- Distinguish types of solder alloy
- Describe criteria for soldered connections subject to high voltages

MODULE 4: CRIMP TERMINATIONS, INSULATION DISPLACEMENT CONNECTIONS, AND SPLICES

- Describe requirements for crimp terminations
- Identify materials, tools, and equipment used in crimp terminations
- Distinguish between open and closed barrel terminations
- Describe requirements for insulation displacement connections and discrete wire terminations
- Identify requirements for splices produced through hand soldering and crimping

MODULE 5: ULTRASONIC WELDING, CONNECTORIZATION, AND MOLDING

- Identify requirements for insulation clearance and weld nugget
- Describe requirements for hardware mounting, strain relief, sleeving, and boots
- Identify common defect conditions related to connectorization
- Distinguish methods of encapsulating components, such as molding and potting
- Identify requirements for molded and potted components

MODULE 6: MARKING/LABELING AND SECURING

- Identify requirements for marking and labeling cable and wire harness assemblies
- Identify requirements for securing cable and wire harness assemblies
- Distinguish methods for securing cable and wire harness assemblies

MODULE 7: ELECTRICAL SHIELDING AND PROTECTIVE COVERINGS

- Identify requirements for braided shielding and shield termination
- Describe materials used in electrical shielding
- Distinguish types of protective coverings, including braiding, heat shrink tubing, and taping
- Identify requirements for protective coverings

MODULE 8: CABLE ASSEMBLIES AND FINISHED ASSEMBLY INSTALLATION

- Identify requirements and acceptance criteria for coaxial, biaxial, and multiaxial cable assemblies
- Describe general requirements for finished assembly installation
- Identify requirements for hardware installation, torque, and stress relief

FINAL EXAM

Students must complete the Final Exam with a passing score of 75% in order to access and download your Qualified IPC/WHMA-A-620 Operator Certificate. Students may attempt the exam up to three (3) times. Please note that a third and final attempt is permitted after 24 hours of the second attempt.

COURSE RESOURSES

Everything you need to successfully complete the IPC/WHMA-A-620 Workforce Training course is included and available on the Electronics U Learning Management System.

COURSE COMPONENTS AND REQUIREMENTS

The asynchronous IPC/WHMA-A-620 Workforce Training program provides engaging videos, activities, and quizzes designed to help you learn, remember, and apply cable and wire harness assembly processes. The course is composed of the components described in Table 1.

You must begin with Module 1 and complete each Module pre-quiz and post-quiz in order to advance to the next Module. Glossary items can be accessed at any time via hyperlinked words or the link on the Module homepage.

Table 1. Module Components and Description

Module Component	Description
Module Pre-Quiz	Short (3 to 5-questions) quiz designed to help you identify what you knowand what you still need to learn.
Module Sections	"Bite-sized" segments of text, videos, graphics, and activities that explain the key points of the Module content and provide opportunities for you to think about how you would apply processes at work.
Module Post-Quiz	Five to 10-question quiz designed to help you confirm what you know, identify areas that still need work.

STUDY TIPS

1. **Use the Learning Objectives.** Refer to the Module learning objectives often.

   Why? Keeping the learning objectives fresh in your mind helps keep your efforts focused on those aspects of the training that will help you achieve the learning goals for the Module.

2. **Quiz yourself.** After you complete a Module, ask yourself questions such as: What are the key ideas? What terms or ideas are new to me? How do these ideas relate to what I already know? Then, check the Module content to see how well you did.

   Why? Quizzing yourself allows you to identify what you *really* know and what you still need to work on.

3. **Quiz yourself periodically.** After you engage with the Module content, quiz yourself, and review your answers. Wait a couple of days and quiz yourself again without first reviewing the material.

   Why? Regular self-quizzes help you connect the content to what you already know and what you've learned and thought about since you first learned that content. Tying the content to

these other bits of knowledge in your brain makes it easier to recall when you need to apply it on the job later on. Research also shows that the effort required to recall what you've learned entrenches it more firmly into your long-term memory than if you were to re-read or highlight the same material.

4. **Mix it up.** When you quiz yourself, mix in topics or questions from different Modules. Online or homemade flashcards can make this fun. Just remember to keep the cards you get right in the rotation even if they appear less often.

   Why? It may be more difficult than practicing one subject at a time, but mixed practice has two distinct advantages. First, because it is more complex and requires more effort, mixed practice more effectively stores the content in your long-term memory (practicing a lot of the same thing often makes you feel like you've mastered the content, but it's quickly forgotten because you are mostly relying on your short-term memory). Second, in real-life you often have to deal with different types of problems in no particular order. In other words, to be successful it's better to practice like you play—or work!

5. **Express it in your own words.** Explain the new content to somebody else in your own words or write a summary of each Module, adding images and examples that help you better understand and remember the content.

   Why? Learning, that is *acquiring knowledge and skills that are easily retrieved from memory, so you can address problems and opportunities*, is very much about connecting new stuff to the older stuff already stored in your memory. Therefore, learning the same topic will be a little different for everybody because each one of us is connecting the new stuff to different old stuff. In other words, the most durable kind of learning happens when you connect new content with objects, people, and experiences that are meaningful to *you*. One of the most effective ways to do that is to express newly learned material in your own words.

6. **Dive in.** Read the Module learning objectives, then try to explain the key ideas. How do these ideas relate to what you already know?

   Why? It may seem silly to try to answer a question or solve a problem before being taught how, but you are much more likely to learn and remember the solution if you try to work your way through it first. In fact, a wide range of experts, from farmers and mechanics to physicists and mathematicians, have sought their answers through a mixture of dogged research and trial and error. Trying to figure something out before you know too much about it puts all your past knowledge to work in search of answers, heightening your awareness of what you do and do not know about the topic at hand. When you hit on those answers, the new knowledge easily and firmly connects to the related concepts and experiences in your memory because you have been actively remembering them. Even if you are not right on every count, the effort will have primed your brain to find, learn, remember, and recall the Module content that is new to you.

7. **Take time to think about it.** While doing some routine task like walking the dog, jogging, or washing the dishes, take a few minutes to think about a recent learning experience. What are the main ideas and how do they relate to my work? Can I apply what I've learned to improve my job performance? If you've already tried to apply what you've learned at work, ask what went well and went poorly? What do I need to learn or do to get better results the next time?

   Why? Thinking about how your past experiences and current knowledge relate to what you've recently learned helps to connect and store this new knowledge in your long-term memory so that it is easy to recall when needed. Considering how well you learn something or how well you apply that learning at work will help you identify effective learning and workplace strategies. Think about an especially successful learning or work experience. What was different about those experiences? How can you take what worked and apply it to this situation?

8. **Limit your study time.** Work through relatively small amounts of information in 20- or 30-minute sittings rather than long, continuous study sessions.

   Why? Our brains can only process so much information at a time. Learning is more effective when you give your brain a little time to sort and transfer information from working memory to long-term memory. If you take on too much at a time, or proceed too quickly, you may overload your working memory and forget important parts of the content before they are committed to your long-term memory.

9. **Sleep.** Make sure to get the right amount of sleep. You may be able to function with less, but most healthy adults should get between 7 and 9 hours of sleep each night. Teens and children require more.

   Why? Your brain uses down time to sort through the days input, dumping the unnecessary bits and integrating newly learned material with what we already know. While you sleep, the rest of your body goes about repairing tissue, generating new cells, and eliminating toxins. Research shows that healthy sleeping habits lead to improved mood, weight loss, increased ability to learn and retain information, and better performance.

10. **Cut out distractions.** Set aside your smartphone, and resist answering emails, surfing the Net for your next purchase, or checking in on your Facebook page.

11. **Focus on one thing at a time.** Effective multitasking is a widespread myth. Research shows that multitaskers had a very difficult time sorting through irrelevant material and were outperformed by more singularly focused people across many different measures.

    Why? Aside from compromising the quality of your work, distractions and multitasking take a big bite out of the limited amount of time you have to get things done. Every time you switch tasks, you waste time getting yourself started on the new task and restarting the one you stopped. Research shows that task switching can eat up as much as 25% of your time,

depending on the complexity of the tasks. Twenty-five percent represents 10 hours of a forty-hour work week!

12. **Believe in yourself.** It's important to realize that you can literally increase your brain power and become an expert at whatever you (again literally) put your mind to. You are not stuck with some finite amount of intellectual ability at birth. In other words, if you think you can or think you can't, you're right.

    Why? Research has proven that the human brain is malleable. It grows new and faster connections through the effort of learning. If you feel that you are "bad' at something like math or gardening, you can become much better at with deliberate and persistent study and practice. If you haven't had much success until now, you may have been using poor study strategies. For example, extensive research has shown that multiple re-readings in close succession, highlighting, and continually pouring over notes are time-consuming strategies that yield poor results at the cost of the more effective strategies described here. However, it's important that you adjust your mindset to truly take these facts into account. A learning setback is not a result of limited intelligence. It simply means that you may have to change strategies, increase focus, get creative, or work harder. It's also important to remember that learning things in a permanent and easily retrievable way requires effort.

    The authors of *Make It Stick: The Science of Successful Learning* describe how the effort you put into the study strategies described above lead to meaningful learning:

    > Effortful recall of learning…requires that you "reload" or reconstruct the components of the skill or material anew from long-term memory rather than mindlessly repeating them from memory. During this focused, effortful recall, the learning is made pliable again: the most salient aspects of it become clearer, and the consequent reconsolidation helps to reinforce meaning, strengthen connections to prior knowledge, bolster the cues and retrieval routes for recalling it later, and weaken competing routes.

RESOURCES:

Andreatta, B. (2016). *Wired to grow: Harness the power of brain science to master any skill.* Santa Barbara, CA: Seventh Mind Publishing.

Brown, P. C., Roediger, H. L., & McDaniel, M. A. (2014). *Make it stick: The science of successful learning.* Cambridge, MA: The Belknap Press of Harvard University Press.

Carey, B. (2015). *How we learn: The surprising truth about when, where, and why it happens.* New York, NY: Random House.

Dweck, C. S. (2008). *Mindset: The new psychology of success.* New York, NY: Ballantine Books.

Keller, G. W., & Papasan, J. (2013). *The one thing: The surprisingly simple truth behind extraordinary results.* Hudson Bend, TX: Bard Press.

PARTICIPANT RESPONSIBILITIES

You will have unlimited 24/7 access to the IPC/WHMA-A-620 Workforce Training course materials for three months. However, you must complete all Modules and the final exam within one month of registration. It is up to you to immediately report any technical difficulties that may hamper your ability to access or use course materials. Please refer to the Learning Management System section in this syllabus to familiarize yourself with its use. If you cannot resolve the issue, please send an email with a detailed description of the problem to support@electronicsu.org.

ELECTRONICS U LEARNING MANAGEMENT SYSTEM

Upon accessing the course for the first time, make sure to take a moment to update your personal profile. Electronics U supports the most recent versions of Google Chrome, Firefox, Safari,Internet Explorer, and Microsoft Edge. Courses can be accessed on desktops, laptops, tablets, and mobile phones. Please refer to Browser Settings under the Start Here! Tab on your dashboard to make sure your browser is set to function seamlessly with the Electronics U Learning Management System. If you need further technical assistance, please send an email to support@electronicsu.org or call Global Electronics Association Member Support at +1 847-597-2862.