

**Official Standards and Practices for the Preparation, Education, and
Certification of Twenty-First Century Watchmakers**



**Standards and Practices
for
Watchmakers**

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FOREWORD

My Fellow Horologists:

Times have certainly changed. The mechanical watch of today is the outgrowth of centuries of progress through trial and error, experimentation, research and discovery. In the latter part of the 20th century micro-miniaturization in conjunction with quartz technology has made its mark through the process of developing the now famous quartz crystal watch.

Interestingly, the same quartz technology has enabled the proliferation of "digital innovations" in the 21st Century, changes which have made possible the large-scale production of precision parts, and in turn, this has enabled the manufacture of incredible mechanical timepieces of high accuracy. As a result, industry is now capable of placing more precision mechanical timepieces in the hands of a world population than ever before; and the world has embraced fine mechanical watches as an art form.

Ironically, the need for trained experts in the maintenance of these timepieces has increased dramatically. And now, as we stand in the new millennium, we find that the skills and knowledge of our ancient honorable craft are being called for once again. But this time, these skills must be coupled with "cutting edge" integration of the newer technology. Today's watchmaker must not only work with his/her *feet* planted in history, but his/her *head* focused on the incredible changes wrought by the "digital age."

This document is unique in that it incorporates the combination of the old and the new, the merging of ancient skills with the technological "miracles" of a new era. It is our hope that the knowledge, skills and work ethics outlined in this "Standards and Practices" statement become the basis for the education and assessment of a whole new generation of horologists. It is believed that qualified watchmakers working with industry, professional associations, and research communities and, as always, one another, face a truly exciting, gainful future.

May this important document help to pave the way.

Sincerely,

William O. Smith, Jr. CMW, CMC, FAWI

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Acknowledgments

Setting standards is perhaps the most difficult challenge that a skilled craft can do for itself. It involves the efforts of many who have the tenacity to work through this type of chore and see it through to the end. In its mission statement, AWCI has dedicated itself “to preserving and promoting the highest standards of workmanship in the horological crafts. It is the role of AWCI to set the standard of excellence to be applied to the quality of instruction for both the repair and restoration practices that are taught worldwide to watch and clockmakers.” It is through perseverance, commitment, patience and cooperation that this document has arrived at its current form. As the craft and the organization evolve, so will this document. We entrust the safekeeping of these standards to the AWCI membership and its Board of Directors to maintain. I wish to acknowledge the following for their help in bringing the document to this level today. It is through their sacrifice that this document stands for the quality that is the hallmark of our organization.

Board of Examiners (BOE)

Jerry Faier, CMC21, Chairman; Wesley Grau, CMW21, Chief Examiner of BOE; Joe Schrader, CMW21; Jack Kurdzionak, CW21; Harold D’Sousa, CW21; Bernhard Stoeber, CW21 (Industry Advisor); and Gerhard Loitz, (Industry Advisor)

We also want to thank the members of the Industry Advisory Board (IAB) who have helped us with suggestions and considerable knowledge. In addition, thank you to the dozens of other professionals who took their time and energy to help us complete our mission.

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Introduction: AWCI's Standards of Excellence

The standards of performance expressed in this document represent the agreed upon knowledge, skills, performances, and dispositions required of the watchmaker of the **21st century**, if he/she is to attain certification status and be accorded this designation by the American Watchmakers-Clockmakers Institute (AWCI).

In brief, "KNOWLEDGE" refers to the content or body of information pertinent to the modern practice of horology. In other words, what should a modern watchmaker KNOW?

"Skill" refers to the DEMONSTRATION of the knowledge through various types of performance. Thus, whether we speak of replacing a watch battery or cutting a balance staff on a lathe, researching information for technical specifications for a watch movement, or tempering steel, we are referring to what a watchmaker must be able to DO with his or her knowledge.

Finally, "DISPOSITIONS" refers to the exhibition of a behavior of professionalism, and addresses such topics as ethics, attitudes toward quality of service, cleanliness of workplace, and attitudes consistent with a high degree of professionalism.

In this document, the reader will find the term "PROFICIENCY" used quite often. This is a general term often used to itemize or "detail" (break into smaller components) a specific standard, and frequently will involve the combining of knowledge, dispositions, and skill demonstrations in a single statement. One might think of the proficiency statements here as expressions of what a watch/clockmaker should "know and be able to do".

As an organization that professes to bear the highest standards for watchmaking education, assessment, certification, and ongoing practice, **it is imperative that AWCI, through the agreement of its expert members, in concert with business and industry, set forth these standards, and demand that its membership abide by them proudly.**

Code of Ethics

AWCI's Code of Ethics is a fundamental one, which asks that all members of the Institute conduct themselves as professional horologists in ways which will reflect well upon themselves, the organization, and profession.

This is a simple statement, certainly, but it can be seen more clearly what is meant by the code when one reads the "dispositions" expected of each level of AWCI certification. A careful examination of all dispositions should be made by any member who wishes to possess an official AWCI certification, for neither performance nor amount of knowledge can be meaningfully attached to those who would not also adhere to the dispositions expressed.

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21st Century Certification Categories

I. Knowledge and Skill Requirements for each:

- Watch Specialist (WS) - Under development
- Watch Technician (WT) - Under development
- Certified Watchmaker (CW21)
- Certified Master Watchmaker (CMW21)
- Certified Master of the Institute (CMI)

1. Watch Specialist (WS)

Definition:

A **Watch Specialist (WS)** is the most knowledgeable person in a *retail* environment. He/she has expertise in the history of watchmaking and the various brands of watches that make up that history, yesterday and today. They will also have direct knowledge of the market segmentation of the brands and the warranty requirements of each. They will be able to identify and explain the various product's features and benefits, as well as the materials used in today's watch manufacturing processes. This person will be able to **educate** the consumer on operation, maintenance and setting of a wide variety of products, including those with complications.

Proficiencies:

A. Assessing Customer Needs

- By interviewing the customer, this individual will be able to assist them in determining which products and features are being sought after in order to help with the selection from a variety of appropriate timepieces.
- This individual will be able to explain all the features and qualities of the different brands, to help with the determination of the best watch varieties to share with the customer.

B. Product Knowledge: Features and Benefits

The **WS** must be able to clearly verbalize to the customer the following product features and benefits:

- They are able to discuss the features and timekeeping abilities of mechanical and quartz watches, so that customers can make informed decisions about the various products and brands.

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- They are able to elaborate on the different styles, materials and surface treatments used in watch cases, so the customer understands the level of protection the case offers and which style is appropriate for their expressed needs.
- They are able to explain the different levels of water resistance (and differentiate this from water proofing), to help the customer with watch selection.
- They are able to demonstrate the different styles, materials and surface treatments of watch crystals so the customer understands their advantages and disadvantages.
- They are able to inform the customer of the various bracelet styles, designs, materials, closures, and adjusting methods so they can better choose their options.

C. Customer Education and Product Maintenance

- They will inform the customer of the benefits of proper storage of all watches in order to avoid damage or malfunctioning.
- They will demonstrate to the customer the setting and winding of the timepiece so they fully understand the proper operations of their watch.
- They will advise the customer of the factory-recommended warranty requirements, product care and intervals to maintain product quality.
- They will act as a liaison on all communications between the customer and the service provider (watchmaker) during the service process so the customer is kept current.
- They will make a record of the features, identification numbers, any visual damage (indicate the general condition of the product), and any customer comments regarding their watch and its operation when it is taken in for service.

D. Sales Team Support

- Explain any new or technically specific information to store associates to ensure they are aware of the features and benefits of new products.
- Organize instruction booklets and/or sales-related reference materials for use by the sales team, assemble copies of all technical information, etc. and establish a known central location for its storage for use by others.
- Educate their fellow staff on proper product handling procedures during presentations to customers to minimize stock damage.
- Examine stock watches periodically to ensure they are in new and working condition and rotate stock to insure product freshness.

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2. Watch Technician (WT)

Definition:

A **Watch Technician (WT)** services primarily the exterior of watches of modern and recent production where spare parts are available, according to manufacturer-specified procedures and requirements. He/she is capable of maintaining (including refinishing) and replacing pertinent exterior components of the case and bracelet (as made available by manufacturer), restoring water-resistance, as well as the capacity for replacing common quartz and mechanical movements. (Additional brand-specific and/or product-specific training may be required.) He/she must model AWCI's Code of Ethics in all of his/her customer dealings and maintain those professional standards in dealing with the product's integrity.

Proficiencies:

A. Tool and Equipment Requirements and Maintenance

- The WT will use AWCI-recommended furniture, tools and equipment to establish an efficient and safe work environment.
- The WT will maintain all tools, equipment and supplies in proper, ready for work, condition to ensure efficient and quality workmanship.

B. Service Policies and Procedures

- The WT will maintain all technical and product documentation, organized for ease of accessing the required information, for other store personnel.
- The WT will apply applicable industry standards and brand-specific policies to all procedures done to maintain the watch in an optimal condition and the quality set out by the specific manufacturer.

C. Analysis skills

- The WT will write a summary of the customer's problems with their watch by collecting information to be used to ascertain the repair requirements.
- Document the watches "in-take" condition to establish a baseline of its physical quality through visual and tactile examination.
- Confirm the customer's watch concerns by examining the watch with the customer, to reaffirm that the requested service would be most useful and what other recommended service procedures would be appropriate for the observed problems.
- Analyze, using appropriate test equipment, the current operating condition of the watch to help confirm the requested intervention.
- Clearly define to the customer the required procedures, including the cost and time requirements, to initiate repair process.

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D. Service skills

- They will replace batteries using appropriate case opening equipment and procedures to ensure product protection and proper functioning of the watch.
- They will be able to install and/or size a strap or bracelet, using the correct method, determined by the design and composition of the watch, to properly fit the watch to the customer's wrist.
- They will repair watch links, pins, springs, clasps and etc. by using the appropriate tools and parts to ensure the watch strap or bracelet is secure on the customer's wrist.
- They will clean the bracelet and case using appropriate cleaning methods to ensure that all foreign matter is removed from the exterior of the watch.
- They are able to refinish case and bracelet materials to manufacturer's requirements/standards.
- Perform water-resistance testing, using the appropriate method, in order to ensure the water-resistance of the watch has been returned to its original quality.
- They will be able to properly replace any needed gaskets, using appropriate methods to re-secure the interior of the watch and to restore the original level of water-resistance.
- They will install crystals as per the manufacturer's specifications to ensure the integrity of the water-resistance and/or aesthetics of the watch.
- They will perform needed adjustments to regulate the watch to the manufacturer's specifications to ensure proper timekeeping after proper diagnosis.
- They are able to correctly install the hands to any watch insuring that both proper alignment and indexing of accessory functions is maintained within manufacturing requirements.
- They are able to install a pre-tested quartz or mechanical movement in a watch to restore it to its original functioning.
- They will use original replacement parts to ensure the overall integrity of the watch remains as designed and manufactured by the trademark owner named on the dial.

E. Administration

- The WT will utilize computers and appropriate software to facilitate workflow and operation of a watch repair shop in order to meet customer needs as efficiently as possible.
- Maintain basic shop organization/supplies and layout to ensure efficient service results.
- Able to monitor, order and store spare parts that are acquired from material houses and/or manufacturers (including the ability to use company specific CDs or Extranet applications).
- Perform the brand-specific final quality control check to ensure proper operation and appearance of the watch after repair.

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3. Certified Watchmaker (CW21)

Definition:

A **Certified Watchmaker (CW21)** services primarily watches of modern and recent production, where spare parts are available, according to manufacturer specified service procedures and requirements. He/she is capable of making basic components and able to modify replacement parts in order to fit them properly into a movement or watch. He/she must model AWCI's code of ethics in all of his/her dealings.

The 21st Century Certified Watchmaker, in the performance of his/her horological skills and knowledge, must meet or exceed all industry requirements for repair and parts replacement, meet all technical specifications, and demonstrate the highest standards of workmanship stipulated by AWCI.

Proficiencies:

A. General

1. Work Planning the CW21 will perform:

- They are able to plan all work processes while keeping in mind any economical aspects and deadlines.
- They are proficient in the proper selection of tools, equipment and measuring devices.
- They ensure that all tools, equipment and measuring devices are in "ready for service" condition.
- They are able to acquire, interpret and document data (taken from measuring and testing) from appropriate equipment.
- They are able to acquire, interpret and apply information from catalogs, factory technical documents, charts, schematics, diagrams.

2. Quality Standards

- These individuals show a keen awareness and knowledge of quality and the Standards and Practices set forth by AWCI.
- They show as part of their professionalism that quality is a key factor for success in a competitive market.
- They use a systematic approach in determining, locating and addressing quality issues.
- They document all quality issues and corrective actions needed when reviewing a product.
- They use the appropriate testing procedures, testing devices, and documentation to demonstrate the work they perform.
- They carefully analyze and document warranty issues to ensure proper corrective actions and customer assurance of quality.

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3. General Safety and Handling of Hazardous Material and the Environment

- The CW21 handles materials and operates all machines and equipment according to applicable safety regulations, state/city codes and environmental standards.
- They properly process/dispose of all shop and bench materials, especially hazardous materials, safely and in accordance with all state and local requirements.
- They look out for potential hazards in storage of any materials and take action to ensure their safety, the safety of the store and the safety of customers' products.
- They are "stewards" of the environment and use extreme care in changing/handling/disposing of lubricants, solutions and other potentially hazardous materials in accordance with federal, state and local health protection and environmental standards.

4. Knowledge of Materials and their Properties

- The CW21 uses a "purpose-based" selection of materials according to composition, properties, shape and manufacturers' specifications and recommendations.
- They ensure the proper and safe storage of all materials.
- They ensure the checking and identifying of precious metals and alloys and make sure all of these materials are cared for properly.

5. Equipment and Tool Maintenance

- The CW21 takes pride and responsibility for the maintenance of all tools, machines, and equipment he/she uses.
- They are familiar with the troubleshooting and diagnostic procedures for machines and equipment they use when problems arise.

6. Customer Service and Workshop Organization

- The CW21 is the epitome of professionalism when handling customer consultations.
- They shall take care to secure the items of the customer in his/her possession.
- They are the key person in a professional workshop organization, assisting with the coordinating of repairs and the flow of repair work through the workshop.
- They keep up to date by acquiring data and information using current information technology, and see to it that all information is properly stored and protected.

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- They are able to monitor, order and store spare parts that are acquired from material houses and/or manufacturers (including the ability to use company specific CDs or Extranet applications).
- They will use original replacement parts to ensure the overall integrity of the watch as designed and manufactured by the trademark owner named on the dial.

B. Electronic/Quartz Watches

1. Theoretical Knowledge

- The CW21 will be able to elaborate on the specific properties and characteristics of materials used in quartz watches, ferrous, non-ferrous, and synthetics.
- They will be able to explain the physics, chemistry, and electronic functioning of quartz watches.
- They will be able to perform and describe the proper functions and testing methods of: batteries, quartz oscillators, integrated circuits, coils, electro- and permanent magnets, LED/LCD displays, etc.

2. Tools and Equipment

- The CW21 will be able to maintain all the tools, machines, equipment used to service quartz watches.
- They will be able to systematically troubleshoot problems with the machines and equipment if procedural problems develop, and keep them in proper working condition.
- They will properly select and use appropriate tools, devices and machines (purpose-based) in the service and testing of quartz watches.

3. Troubleshooting – Diagnosis

- The CW21 must be able to check the layout, function, and interaction of mechanical and electronic parts and components to evaluate the condition of a watch.
- They are able to determine the difference between normal wear and functional defects, selecting the appropriate repair procedures to follow, and are able to document their decisions.
- They are able to perform appropriate tests and verify pertinent parameters (i.e., rate, current consumption, coil resistance, etc.) for diagnostic purposes as well as using this information in estimating of repair costs.
- They are able to demonstrate the analysis of functional problems using systematic testing procedures, documenting all items found.

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- With the use of appropriate testing equipment (dry and wet method), they can perform water-resistant and/or waterproof tests (depending on the case design, FTC regulations and/or ISO norms and the dial and/or case markings), and demonstrate any problems, documenting all items found.

4. Service Procedures:

a. Movements

- The CW21 will demonstrate the necessary skills for the service of a quartz watch according to the manufacturer's specifications.
- Where applicable, they will be able to adjust, repair and/or replace mechanical and/or electronic components.
- They are able to properly select and utilize electronic measuring devices for the testing of quartz watches including the measurement of the rate of traditional movements as well as circuits equipped with inhibition systems.
- They are able to select and replace the battery for a given watch according to the manufacturer's specifications.
- They are able to demonstrate the measurement of power consumption, lower working voltage, coil resistance, and other pertinent electrical parameters in a DC circuit.
- They will adjust the electronic and mechanical parameters of a given watch based on manufacturer's specifications.
- They are able to disassemble all appropriate parts and components of a movement, preparing them for service and re-assembly and the testing of the watch's functional aspects according to given technical documents.
- They will clean the movement and its parts using the appropriate cleaning machines and solutions.
- They will demonstrate the proper lubrication of the movement according to manufacturer's specifications being sure that proper quantities and placement of the lubricants are used. (See C, 7, Lubrication below.)
- They are able to service quartz watches with additional functions such as, but not limited to, simple calendar, chronograph, various energy charging systems and storage systems (solar, ecodrive, kinetic, etc.)
- They are able to properly set the hands on quartz watches for both proper alignment (in both dimensions) and proper indexing of accessory functions.
- On completion of service, they will demonstrate the proper functional testing of assembled units to ensure they meet the manufacturer's specifications.

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b. The Cases

- The CW21 is able to de-case and re-case watches without leaving any marks, fingerprints or allowing any particulate material to enter any part of the watch.
- They will demonstrate the cleaning of case components both manually and with ultrasonic cleaners.
- They are able to refinish cases and bracelets to original manufacturer's requirements/standards.
- They will show the proper lubrication of case components as well as the use of locking agents (e.g., Loctite™).
- They will demonstrate the proper sealing and testing of water-resistant and waterproof cases (depending on the case design, FTC regulations and/or ISO norms and the dial and/or case markings) using both dry and wet testing methods.

C. Mechanical Watches

1. Theoretical Knowledge

- The CW21 will possess a working knowledge of physics, chemistry, mechanics, horology and the mathematics needed to explain and demonstrate the essential functions and properties of watches including calculating the frequency of oscillators, gear ratios, beat rates, etc.
- They will be able to determine the proper mainspring needed for replacement from calculations.
- They will be able to explain the needed adjustments to a movement from data provided from various records of test equipment.

2. Case servicing procedures

- The CW21 will be able to elaborate on the specific properties and characteristics of watch cases, both ferrous and non-ferrous, precious metals, as well as synthetics.
- They are able to identify various surface treatments (i.e., gold plating, PVD, etc.) to the case. They can also demonstrate the appropriate care, cleaning and handling of the cases, bracelets or their components that carry these treatments.
- They are able to repair and/or replace any case component.
- They are able to refinish cases and bracelets to original manufacturer's requirements/standards.
- They will be able to identify all components, prepare them for disassembly/assembly according to technical documents.

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- They will be able to correct functional problems of assembled parts.
- They will perform testing of water resistant and waterproof cases (depending on the case design, FTC regulations, and/or ISO norms and the dial and/or case markings) to pinpoint any problems using systematic testing procedures (both wet and dry methods).
- They will show the proper lubrication of case components as well as the use of locking agents (e.g., Loctite™).
- They will demonstrate the cleaning of watch case components both manually and with ultrasonic cleaners.

3. Tools and Equipment

- The CW21 will show the proper maintenance and servicing of all tools and keep them ready for service (application based).
- Given several choices, they will select and use the most appropriate tool(s) for a given task.
- They will show which tools, devices and machines are the best for a given task (purpose based).
- They will be able to troubleshoot problems with machines and equipment and make minor adjustments when needed.

4. Movement Servicing

- The CW21 has the knowledge of all service procedures necessary to maintain a watch's "product specific standards" according to the manufacturer's specifications.
- They are able to evaluate the condition of a watch by checking the layout, function and interaction of all mechanical components.
- They are skilled in determining wear and functional defects, and selecting the appropriate repair procedures to correct those problems. They then document those corrections for both customer and shop records.
- They are skilled in checking (and recording) the rate and amplitude of oscillators with appropriate equipment.
- Using technical sheets, they are able to identify all parts and components, prepare them for disassembly/assembly, and can determine the functional aspects that must be checked against those on the sheets to insure that factory specifications (such as endshake, escapement functions, etc.) are maintained.
- Using systematic testing procedures, they are able to determine (pinpoint) and correct functional problems as well as document them for the customer and the shop.
- They can identify worn/damaged parts and delineate their replacement options.
- They are able to fit spare parts (even if there is a need for machining or trimming the piece for a better fit) respecting the manufacturers' original design and quality intent.

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- They can demonstrate the procedure for the checking of power reserve as well as perform the test.
- They are able to de-case and re-case movements.
- They are able to properly set the hands on any mechanical watch for both proper alignment (in both dimensions) and proper indexing of accessory functions.
- They will demonstrate the cleaning of watch components both manually and with ultrasonic cleaners.
- The CW21 is skilled in the analysis and documentation of warranty issues, regardless of the reason(s) for its return.

5. Servicing of Automatic Watches

- The CW21 will demonstrate the necessary skills for the service of an automatic watch according to the manufacturer's specifically stated specifications when the information is available.
- They are able to evaluate the condition of a watch by checking the layout, function and interaction of all mechanical components.
- They are skilled in determining wear and functional defects, and selecting the appropriate repair procedure(s) to correct those problems. They then document those corrections for both customer and shop records.
- They are skilled in checking (and recording) the rate and amplitude of oscillators with appropriate equipment.
- Using technical sheets, they are able to identify all parts and components, prepare them for disassembly/assembly, and can determine the functional aspects that must be checked against those on the sheets to insure that factory specifications (such as endshake, escapement functions, etc.) are maintained.
- Using systematic testing procedures, they are able to determine (pinpointing) and correct functional problems as well as document them for the customer and the shop.
- They can identify worn/damaged parts and delineate their replacement options.
- They are able to fit spare parts (even if there is a need for machining or trimming the piece for a better fit) respecting the manufacturers' original design and quality intent.
- They can demonstrate the procedure for the checking of power reserve as well as perform the test.
- They are able to de-case and re-case automatic mechanical movements.
- They are able to properly set the hands on any mechanical watch for both proper alignment (in both dimensions) and proper indexing of accessory functions.

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- They will demonstrate the cleaning of watch components both manually and with ultrasonic cleaners.
- The CW21 is skilled in the analysis and documentation of warranty issues, regardless of the reason(s) for its return.

6. Servicing of Chronographs

- The CW21 will demonstrate the necessary skills for the service of chronograph watches according to the manufacturer's specifically stated specifications.
- They are able to evaluate the condition of a watch by checking the layout, function and interaction of all mechanical components.
- They are skilled in the determining of wear and functional defects, and selecting the appropriate repair procedure(s) to correct those problems. They then document those corrections for both customer and shop records.
- They are skilled in checking (and recording) the rate and amplitude of oscillators with appropriate equipment.
- Using technical sheets, they are able to identify all parts and components, prepare them for disassembly/assembly, and can determine the functional aspects that must be checked against those on the sheets to insure that factory specifications (such as endshakes, escapement functions, etc.) are maintained.
- Using systematic testing procedures, they are able to determine (pinpoint) and correct functional problems as well as document them for the customer and the shop.
- They can identify worn/damaged parts and delineate their replacement options.
- They are able to fit spare parts (even if there is a need for machining or trimming the piece for a better fit) respecting the manufacturers' original design and quality intent.
- They can demonstrate the procedure for checking of power reserve as well as perform the test.
- They can follow the assembling of parts and components according to technical documents.
- They are able to perform the necessary functionality checks of an assembled unit.
- They are able to de-case and re-case mechanical chronograph movements.
- They are able to properly set the hands on any mechanical chronograph for both proper alignment (in both dimensions) and proper indexing of accessory functions.
- They will demonstrate the cleaning of watch components both manually and with ultrasonic cleaners.
- The CW21 is skilled in the analysis and documentation of warranty issues, regardless of the reason(s) for its return.

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- The CW21 is skilled at checking and adjusting chronograph functions of common chronograph systems, including but not limited to column wheel, shuttle, and modular.

7. Lubrication

NOTE: It is the philosophy of AWCI that lubricant choice and lubrication are as much a professional skill as is any other watch manipulation. Whether in examination or in daily practice, proper application of lubricants is critical to the long term operation of the watch. As such, not only knowing where, how much, and what type to use is critical but also knowing brand-specific recommendations. Due to constructional material usage and variation, certain types of lubricants work better in some applications than others. This must be taken into consideration by the bench professional when performing this skill.

- The CW21 is a master at lubrication of watch movements, according to manufacturer's specifications and/or generally accepted practices.
- They possess the knowledge and skill to apply such materials as 'Epilame' to control the lubricants when either needed or specified by a given manufacturer.

8. Gear Train

- The CW21 can detect and correct end shake and side shake issues
- They are able to adjust and repair or replace any item in the gear train components as well as mainsprings or barrels, as specified by a given manufacturer, when faults are detected.
- They can repair/restore pivots and their finishes, as well as adjust and replace jewels and bearings as needed.
- They are skilled at burnishing all pivots and any work surfaces, where this type of finish results in longer wear, and increased durability.

9. The Escapement

- The CW21 is thoroughly knowledgeable of the mechanics and design of lever escapements and their varieties.
- They are able to adjust, repair and/or replace escapement components when faults are uncovered. (They can adjust all pertinent functions of the escapement.)

10. Oscillators

- The CW21 can adjust, restore/repair/replace any component of an oscillating system when faults keep the watch from performing to standards.
- They are able to demonstrate the ability to restore/repair or replace staffs and jewels/bearings as needed.
- They are skilled in the burnishing of all pivots, especially balance wheel pivots.
- They are able to poise the balance wheel statically and dynamically.

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D. Micro-Mechanic

1. Theoretical Knowledge

- The CW21 possesses the knowledge of the specific properties and characteristics of materials, both ferrous and non-ferrous as well as synthetics, used in the manufacture of watches and their cases.
- They are able to select the proper materials for a given repair according to their composition, properties, and usage.

2. Measuring, Tracing, Drawing, Truth

- The CW21 is able to prepare shop drawings, charts, designs, technical drawings, etc. manually and with computer assistance, complete with measurements to aid in making and fitting of replacement components (i.e., stems, staffs, wire springs and springs from flat stock).
- They are able to select and use with repeatable accuracy a variety of measuring devices to determine dimensions and angles under consideration for systematic and coincidental error determination.
- They are able to check rotational symmetry of components for trueness, roundness and poise, and correct any found errors.

3. Heat Treatment

- The CW21 is able to change the properties of ferrous metals by thermal treatment (i.e., hardening, tempering).
- They are able to maintain and verify desired specification(s) after thermal treatment.

4. Machines and Equipment

- The CW21 will show the proper maintenance and servicing of all tools to keep them ready for service (application based).
- Given several choices, they will select and use the most appropriate tool(s) for a given task.
- They will show which tools, devices and machines are the best for a given task (purpose based).
- They will be able to troubleshoot problems with machines and equipment and make minor adjustments when needed.

5. Shaping Metals by Hand

- The CW21 will be proficient in the sawing/cutting a variety of ferrous, non-ferrous and synthetic materials.
- They are able to demonstrate their ability to file shapes and surfaces to specific requirements (planes, angles, parallels, etc.).
- They are careful to ensure that any burrs, as a result of metal working, are removed and that no chips or burrs are allowed to contaminate the work piece or area.

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- They are careful in the selection of clamping devices according to characteristics of the work piece and needs of the project (leave no marks).
- The CW21 is proficient in cutting threads (inside and outside), in both metric and American systems.

6. Shaping Metals by Machine

- The CW21 is skilled in the operation and use of the lathe.
- They are familiar with the machine cutting of various metals used in watchmaking and the proper use of the following: selecting cutting fluids, proper tool bits, proper feeds and machine speeds.
- They are also adept at drilling and boring.
- They are able to turn with both cross slides (with tool bits) and hand gravers with T-rests.
- They are skilled at using cutting and smoothing broaches to match and finish a required hole size for pivots, taps, etc.

7. Other Techniques Used for Connection of Parts, Both Reversible/Irreversible

- The CW21 is familiar with all types of threading systems and capable of making screws to match either existing or those missing.
- They are proficient in making pins of all types both taper and straight to the specific requirements of the project.
- They are proficient in the use of heat for soldering (soft, hard), etc. but always aware and take great care with temper issues of the metals being soldered.
- They are cautious and appropriate in the use of glues/adhesives of all types when joining metals (ferrous, non-ferrous) and synthetics.
- Because staking is such a widely used technique for holding pieces permanently together, the CW21 is skilled at riveting/staking pieces together as required.

8. Surface Finishing

- The CW21 is adept at grinding and polishing. They use great care in the selection and application of the devices and compounds to ensure the match of the intended finish or that the desired finish matches the intended surface quality of the original.
- They can recognize and duplicate the following finishes (depending on their available equipment) such as, grinding, brushing, polishing, graining, sand blasting of surfaces, etc. by hand and/or with machines.
- They are skilled at producing burnished finishes both on pivot surfaces as well as flat stock.

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4. Certified Master Watchmaker (CMW21)

Definition:

In addition to possessing all the knowledge, skills and dispositions of the **CW21**, a Certified Master Watchmaker (**CMW21**) has also mastered all the skills and professional knowledge to service a wide range of timepieces including highly complicated, vintage, and antique watches. He/she is able to design spare parts, manufacture and fit them so that they function as if original. They are familiar with the design and functioning of a variety of escapements both current and archaic. They also have kept abreast of engineering design changes that are being used in a variety of modern watches.

He/she possesses advanced communication and leadership skills for the purpose of training other watchmakers. This includes the ability to interact and consult with consumers during the entire service process and to manage a workshop (and/or retail business) on a professional level, setting an example for other workers and watchmakers that may be on his/her staff. He/she must model AWCI's Code of Ethics in all of his/her dealings.

CMW21 Prerequisites:

The candidate must present a portfolio to the BOE for approval which documents all of the following:

1. The candidate must have held CW21 status for at least three years. They will have acquired a certain number of CEUs (continuing education units—see **IV Continuing Education Program** below) which the content and design of which will be determined at a later date.
2. Candidates must demonstrate a working knowledge of the use of computers and related technology as applied to horology (including fundamental CAD drawing programs), usage of electronic measuring devices and research skills. They are to design and carry out a simple project of their choosing to demonstrate these skills. (With approval of the BOE, the candidate may use manual drafting techniques in place of CAD work. The candidate must apply for a variance first.)
3. Candidates must successfully complete written and practical examinations, as approved by the BOE and administered through AWCI. The practical examination will include the servicing of a vintage chronograph or similar complication watch that the **candidate provides**, into which the BOE will install a set of defects and parts to be replaced and/or fitted. This “masterpiece” watch will require at least the following items to be completed by the candidate **before** they sit for the final supervised exam portion and then bring the watch to the final session (i.e., the staffing portion) **a movement bridge; the setting lever and/or spring; the stem; and a balance staff (see below*)**. The hairspring will have been properly mounted and pinned, both to the

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collet and to the stud (the Breguet overcoil for the outer terminal curve is preferred).

*The candidate will make, under supervision of an exam administrator, a replacement staff and fit it to his/her “masterpiece” watch during the practical portion of the exam. Using raw stock, they will turn the staff, heat treat it and install it. The balance wheel must be poised and the watch regulated when the task is complete.

4. Candidates must submit at least one article, before the completion of their **CMW21**, to the *Horological Times* for publication on some subject, approved by the BOE, which the candidate develops. This is limited to any horological subject including new research, product testing, development of new or helpful products, improvements to current testing or shop practice skills, lubrication products/practices, etc.
5. Candidates must demonstrate the ability to educate other watchmakers. As such, they are required to submit an outline for a bench course to the BOE for approval. The subject matter is open to any horological subject. Once approved, they must develop the materials to use in the class, then offer and teach the course to a group of at least 8 or more AWCI watchmaker members. The course can be one that has been previously offered but must be updated to current information levels. If a curriculum is developed that would include more than one instructor, a team teaching program can be submitted with the approval of the BOE and the Education Committee for this section. It is expected that each instructor would have a unique part to teach so that this requirement is clearly met. If the candidate has taught other courses within the previous 3 years before application for the CMW21, then the candidate may submit a document testifying to this accomplishment to the BOE. If accepted, this may be used to satisfy this requirement.

Essential Dispositions:

The Certified Master Watchmaker 21, adheres to AWCI’s Professional Standards and Practices, and demonstrates the following:

1. They have a strong commitment to systematic shop practices.
2. They maintain a clean and professional work environment.
3. They are highly vigilant with safety and environmental concerns within their work environment. They ensure that hazardous materials are properly handled, stored and disposed of.
4. As professionals, they adhere to AWCI’s Code of Ethics at all times.
5. They willingly document and warrant all professional services.
6. They are personally committed to the advancement of professional knowledge.
7. They are active role models in their commitment to professional standards, quality horological education, and continual growth of horological knowledge.
8. They know the value of brand-specific training as offered by industry manufacturers and AWCI and are committed to updating their knowledge and skills regularly.

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5. Certified Master of the Institute (CMI)

Definition:

The Certified Master of the Institute possesses the professional knowledge to service a wide range of timepieces (e.g., complicated watches, vintage pieces, whether watches or clocks). He/she needs to be able to design spare parts and manufacture them. He/she has advanced communication and interaction skills for the purpose of training watchmakers and clockmakers in preparing for both the CC21 and CW 21 exam. He/she must model AWCI's Code of Ethics in all of his/her dealings.

Candidates must hold both CMW21 and CMC21 statuses for three years and have demonstrated skills in the restoration of vintage and complicated watches **and** clocks.

Candidates must understand the use of lathe and milling machinery and demonstrate their use in the restoration or conservation of timepieces, both modern and historic.

The Certified Master of the Institute is:

1. Dedicated to the preservation of horological knowledge.
2. Dedicated to horological education and willing to share his/her knowledge with others.
3. Dedicated to the Standards and Practices of the AWCI, and to the continual growth and improvement of the Institute and its practices.

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II. Pathways to 21st Century Certification

There are a number of ways to obtain any of the above certifications. The following summaries are suggestions **only**, and other avenues may be developed to help the watchmaker improve his standing.

Watch Specialist (WS) - Under development (as of Jan. 2009)

May be achieved by participating in the following courses and passing a written examination:

1. Correspondence courses
2. AWCI courses
3. Traveling Bench Courses conducted by approved AWCI instructors
4. On-site/job training at approved AWCI locations
5. Internet training

Watch Technician (WT) - Under development (as of Jan. 2009)

May be achieved by participating in the following courses and passing a written and practical examination as administered by the BOE:

1. AWCI Academy Courses
2. Approved REC school courses
3. Courses designed for this certification and conducted by approved AWCI instructors
4. Tutoring/apprenticeship under the supervision of an AWCI approved instructor who possesses either a CW 21 or CMW 21 certification.

Certified Watchmaker 21 (CW21)

May be achieved by any one of the following:

1. Taking and successful completion of the CW21 examination.
2. Formal training at an approved AWCI (REC) school or in a course of study approved by the AWCI Board of Directors as recommended by the Education Committee and Board of Examiners **and** successful completion of the CW21 examination.
3. Successful completion (certification) of a 3,000 hour WOSTEP training program within the past 5 years **and** by passing the chronograph section and the written portion of the current CW21 examination.

NOTE: Pathways 4 and 5, described below, will be discontinued as of December 31, 2008. Holders of the AWI CW or CMW Certifications (as well as the CEWT and/or CMEW) must register before this date to reserve their right to upgrade their Certification.

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4. Holding an AWI Certified Watchmaker Certification, or by holding a WOSTEP 3,000 hour certificate prior to 2003 **AND** by passing the chronograph section **and** the written portion of the current CW21 examination. Those who hold the CMW/AWI title will be upgraded to the CMW21 Certification upon passing these same requirements.
5. Those holding the AWI CEWT and/or CMEW title may receive upgrading to the CW21 Certification by passing the current written exam, the Micromechanical portion, the Automatic Watch section, and the Chronograph sections of the CW21 examination (in summary, by taking all **but** the Electronic Watch section of the CW21 examination).

All upgrades must be successfully completed by December 31, 2010.

Certified Master Watchmaker 21 (CMW21)

There are 2 pathways to achieving the CMW21

A. The traditional procedure:

1. To attain the Certified Master Watchmaker 21 (**CMW21**) a candidate must first apply for this certification to the BOE after having held the CW21 for a minimum of 3 years.
2. They must also provide evidence of formal bench experience during that period.
3. They then must develop and submit a portfolio to the BOE of supportive materials that shows what the candidate has done within the past 5 years towards the requirements. It must also show how the candidate plans to demonstrate the remaining required knowledge, skills and disposition requirements as stated above in section I, #4.

Having completed all the requirements set forth by the BOE they will be granted the **CMW21** certificate.

B. Alternate pathway:

The candidate may also choose to submit to the BOE, a written proposal program of how they will meet all the requirements stated in I, #4 above plus additionally what they feel truly shows the skills and qualities of a master craftsman. Although this option will allow more flexibility, it must be remembered that this program, however designed, *must meet all requirements stated above*. The candidate may choose to exceed these requirements, but they must contain at least the minimum requirements that AWCI expects from a CMW21 as stated above. If approved, the candidate must produce the proposal in documented form (the portfolio) with all the requirements from the BOE also being met and included in that program, to the levels requested. Video-graphics and/or notarized documents may be required.

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Honorary CW21 and CMW21

Upon the recommendation by the Board of Examiners and approval by the Board of Directors, the AWCI may bestow an honorary **HCW21** or **HCMW21** title onto a deserving candidate. A potential candidate, however, may submit a request for this title to the BOE for approval. The BOE will recommend the necessary work or information to be submitted to receive their endorsement. CEUs will not be required to retain this title.

Certified Master of the Institute (CMI)

This title may only be achieved by:

1. The presentation of a portfolio to the BOE that documents the successful acquisition of both **CMC21** and the **CMW21**.
2. They then submit a request to the BOE for approval and recommendation to the AWCI Board of Directors. If they are approved by the BOE, the documentation will be forwarded to the BOD for their approval.
3. With the approval of the Board of Directors, the title will be conferred.

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III. 21st Century Certification Examinations

1. Introduction

All certification levels for AWCI must be achieved through a demonstration of knowledge, skills and disposition standards as deemed appropriate by the BOE for each level of certification.

NOTE: To become certified as a 21st Century Certified Watchmaker (**CW21**), the candidate must score at least a 5.0 rubric (71.4%) on **each** of the five (5) performance tasks in the examination. Should only 3 or 4 of the 5 performance tasks score at this level, the candidate may request to re-take the 1 or 2 performance tasks that did not meet the minimum standard, **BUT** must do so **within** one (1) year of the original completion of the examination. **There are charges for each performance task.** Please contact AWCI for current charges of each performance task. Should the candidate **NOT** meet the minimum standards in all 5 performance tasks after this re-take, they must wait one (1) year before applying to retake the **entire examination**. All performance tasks must be re-taken at that time, at the current full cost of the examination .

2. Written examinations will address the knowledge, skills and dispositions that are better assessed in written form. They are listed for each certification category.

WS: Written exam – Time allowance and number of questions to be determined.

WT: Written exam – Time allowance and number of questions to be determined.

CW21: 26 to 30 questions – to be answered in a 3.5 hour time frame at approved examination sites.

CMW21: 30 to 35 questions – details and number of questions are designed and determined by the BOE based on the program submitted by the candidate.

3. Practical Performance Examinations

The candidate must demonstrate the above-mentioned knowledge, skills and disposition standards by completing sample tasks in time frames as outlined below. Good performance examinations require actual conditions, actual materials, and as much “real-life” quality as can be built into them. Certified Watchmakers (CW21) must work on real timepieces, preferably with their own tools, in a solid and secure environment, with informed guidance as to the expectations AWCI has for each

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performance. To this end, 21st century timepieces will be used wherever pertinent to the standards.

Note: Watch movements for examination purposes may vary as influenced by technological change, availability, and economic requirements (cost to AWCI). The Board of Examiners will select appropriately equivalent movements for each examination, and notify candidates in advance which movements they will be working with, to allow candidates the opportunity to familiarize themselves with the calibers upon which they will be assessed.

4. Sample Tasks for the Certified Watchmaker (CW21)

Time: 32.0 hours

1. Do the complete service of a quartz watch (currently e.g. ETA 955.XXX family with E.O.L.- end of life indicator and A.S.S.-controlled motor drive), perform all measurements and verifications of functions as stated in factory technical sheets as well as any item that is listed in these AWCI Standards and Practices that is appropriate to that product.
2. Do the complete service of an automatic watch (current e.g. ETA 28XX family) including correcting built-in defects (e.g., adjusting end shake, straightening wheels, adjusting escapement, adjusting hairspring error in either flat or round or both—any item that is listed in these AWCI Standards and Practices that is appropriate to that product).
3. Do the complete service of a Chronograph (current e.g. ETA 7750 family) including adjustment of all chronograph functions which have been misadjusted as well as any item that is listed in these AWCI Standards and Practices that is appropriate to that product.
4. Perform micromechanical procedures as specified. This may involve simple turning, cutting, and/or polishing of metals. Or, it may require a common repair procedure with a balance and its staff or set stem using a standard watchmaker's lathe. This **will** require making and recording micro-measurements as part of the performance task.
5. Take a written examination as described above. (See page 35 for sample questions.)

5. Examination Sites

WS and WT: Examination may be conducted at local businesses or approved REC schools or other sites as approved by AWCI.

CW21: Examination may be conducted at approved REC schools or AWCI Headquarters.

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CMW21: Examination at AWCI Headquarters only.

6. Assessments

WS and WT: Will be conducted by panel of two (see Certified Assessors)

CW21: Will be conducted by a panel of three (see Certified Assessors) plus a representative from AWCI.

CMW21: Will be conducted by a panel of five assessors of which three hold the CMW21 title.

7. Scoring Procedures and Logistics

Assessors employ “Scoring Rubrics” (the rules applied to performances which reflect AWCI standards) as determined by the Board of Examiners when assessing test materials.

A. Practical Performance Examination

Trained assessors will rate all work performed by candidates. This will be done on a 7 point scale (rubric). Scales have been developed by the BOE for the type of task, whether practical, performance, or written. For example, on a performance task, a candidate’s work will fall into one of these categories. (A sample of the scoring sheet employed for the CW21 assessment is included at the end of this document.)

1. Totally unsatisfactory or incomplete
2. Work partially completed, but unsatisfactory
3. Work partially completed, but satisfactory
4. Work completed but unsatisfactory
5. Work completed and satisfactory
6. Work completed with high degree of competence evident
7. Exemplary work of the highest order

B. Written Examination Rubric

On a written examination which involves the calculation of numeric values, such as “number of teeth in a missing wheel,” a value (or value range) is assigned and converted to the scale (i.e., the rubric), similar to the one above.

Essay and short answer questions will be scored in the following way:

1. Nothing is answered correctly for a given item, or no answer is given
2. Almost all of the response is incorrect
3. Portions of the response are correct, but most are incorrect
4. Some of the concepts are addressed correctly, but some are incomplete or incorrect
5. Most of the concepts within proficiency area are correct
6. The response contains minor errors, but is primarily correct
7. All concepts addressed by the proficiency prompt are correctly addressed, no discrepancies

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8. REC Schools

Contact AWCI Headquarters for current listings of REC Schools and those offering AWCI approved instruction which may lead to these certifications.

9. Rules for AWCI Certification Appeals Process

These Certification Appeal Rules (the “Rules”) shall govern the process for any individual wishing to appeal a failing grade on any part of an AWCI Certification Exam. All individuals taking AWCI Certification Exams have previously agreed, as a condition of taking the exam, that this appeals process is the exclusive means by which to seek review of a failing grade. Moreover, all individuals have agreed that this appeals process shall be final and binding upon the individual and AWCI.

A. Notice of Appeal. Any individual wishing to appeal a failing grade on any part of the AWCI Certification Exam must file a written Notice of Appeal with the AWCI Executive Director within thirty (30) days of receipt of his or her Certification Exam result. The form of the Notice of Appeal is available at AWCI’s office by calling: 866-367-2924 or (513) 367-9800. The Notice of Appeal must be filled out, signed and received at AWCI within the thirty (30) day deadline in order to be effective.

B. Board of Examiners Review. Upon receipt of the Notice of Appeal, the Executive Director shall submit an appeals packet to the Board of Examiners (the “BOE”) for review. The package shall contain the Certification Exam, but shall not disclose the identity of the individual seeking appeal. Within ninety (90) days of the receipt of the Notice of Appeal by AWCI, the BOE shall review the Certification Exam and vote on whether to uphold or overturn the failing grade. All votes shall be by the majority vote of the Board of Examiners. If a member participated in the same candidate’s final initial assessment, that member of the BOE shall not participate in the voting. Candidates will be promptly notified of the results of the Board’s vote.

C. Executive Committee Review. If any member of the Board of Examiners dissents with the Board of Examiners decision to uphold a failing grade, then the individual appealing the failing grade shall be granted a further right to appeal the BOE’s decision to the AWCI Executive Board. The notice from AWCI informing the individual of the Board of Examiner’s vote in upholding the failing grade shall also notify the individual if he or she has the right to appeal that decision to the AWCI Executive Committee. If the individual is given that right, he or she must exercise it by sending a written notice to the AWCI Executive Director requesting the appeal to the Executive Committee. The Executive Committee shall consider the appeal within ninety (90) days of the receipt of the notice by the Executive Director. The Executive Committee shall uphold the failing grade or overturn it by majority vote. The individual

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appealing the failing grade shall be promptly notified of the Executive Committee's action once it is taken.

D. Binding Decision. Except as noted in Section 3 above, all decisions of the BOE in upholding or overturning a failing grade shall be final and binding upon AWCI and the individual appealing the failing grade. In the event that the individual appealing the failing grade is given a right to appeal to the Executive Committee, then the action of the Executive Committee in upholding or overturning the final grade shall be final and binding upon AWCI and the individual appealing the failing score.

10. Board of Examiners

Function:

- The purpose of the BOE is the oversight of **all** certification and assessment processes, including construction, administration, and scoring of candidate assessments.

Membership:

- The Board of Examiners (BOE) consists of individuals appointed by the AWCI Board of Directors. It is the responsibility of the AWCI Education Committee to recommend candidate(s) for the BOE.
- The BOE will consist of 5 members with one individual designated as Chief Examiner (who may be retained for his/her services by AWCI). The remaining 4 examiners will consist of two assessment/content specialists in clockmaking, and two assessment/content specialists in watchmaking.
- Members of the BOE must be current members of AWCI, carry current certification titles (CC21, CW21, CMC21, and/or CMW21) and have a minimum of 8 years of bench experience as horologists/educators.

Duties:

- The Board will meet twice a year to construct and/or review all examinations.
- The BOE will be responsible for training Certified Assessors who will, in turn, conduct regional examinations according to regions, schools, or examination sites assigned by AWCI.

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- Examinations will reflect appropriate 21st Century content, skills and proficiencies.
- Examinations will be tested and reviewed for reliability and validity by the Chief Examiner, or a qualified agent of the Chief Examiner, yearly.
- The BOE will approve examinations for use for each testing year, which will coincide with AWCI's fiscal year.
- The BOE will supervise the preparation of examinations, and provide oversight to the exams as they are conducted.
- The BOE will select and train Certified Examiners (Assessors), individuals with appropriate background and skills to conduct assessments in a systematic manner as outlined in the BOE policy and training manual. Assessors must possess at least the minimum certification for the examination which they are scoring. Any variance from this must be approved in advance by the BOE.

Length of Term:

- Membership on the Board of Examiners will be for five years, with terms to overlap, to guarantee continuity and knowledge transmission.
- The Chief Examiner will serve an indefinite term, as determined by the AWCI Board of Directors, who will conduct a performance or personnel evaluation every two years.
- The person to fill the Chief Examiner position will be recommended to the AWCI Board of Directors for their approval by the Chair of the Education Committee with a 3/4th majority approval by the Education Committee membership.

Certified Examiners (Assessors):

- These individuals will act as agents of the Board of Examiners and represent AWCI in the formal assessment process. They will be trained and empowered to administer various assessments developed by AWCI as these are developed and revised. They may or may not participate in the actual development of these assessments, and also the scoring of candidate performance.

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- Individuals who may qualify for an Examiner (Assessor) position:
- AWCI Certified members
Industry representatives
REC School instructors
- Certified Examiners (Assessors) will be appointed by the Board of Examiners, pending completion of training and recommendation by the Executive Director and/or the AWCI Board of Directors.

IV. Continuing Education (CEUs)

It is the goal of AWCI to provide Continuing Education Units (CEUs) of study and practice to help those who are up and coming, as well as those who carry current certifications, develop their skills to maintain their edge. Being developed as the *Certification Development and Maintenance Program*, this element of the certification process will help ensure that all AWCI members are able to keep their skills sharp, up-to-date and have access to current technical information and techniques. To maintain their certifications, all certified members (excluding those with honorary titles) will have to acquire a number of these units, over a number of years, which will be determined as this project goes forward. This section, however, is currently under construction and all members are urged to watch the *Horological Times* for further details as the BOE and Education Committee develop and refine this program.

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V. Recommended Reading List

Author	Title	Edition / Year Publisher Location
1. Bulova School	*Training Manual	New York 1980
2. Daniels, G.	Watchmaking	London 1985
3. Fried, H.	*The Watch Repairer's Manual, Fourth Edition	Cincinnati 1986
4. Hamilton, J.L.	Timing Manipulations	Denver 1974
5. Humbert, B.	The Chronograph – Its Mechanism and Repair (Reprint 2 nd Edition)	Lausanne 1990
6. Jendritzki, H.	The Watchmaker and his Lathe	Lausanne 1982
7. Jendritzki, H.	*The Swiss Watch Repairer's Manual (Available for loan through the AWCI Library)	Lausanne 1977
8. Jendritzki, H.	Watch Adjustment	Lausanne 1963
9. LeCoultre, F.	A Guide to Complicated Watches (reprint)	Neuchatel 1985
10. Lang/Meis	Chronograph – Wristwatches to Stop Time	Atglen, PA 1993
11. Levin, L. & S.	Practical Benchwork for Horologists	Arlington, VA 1988
12. McMahan, S.	*The Practical Guide to Modern Watch Oiling (Available from Jules Borel Co.)	Self published 1995
13. Nicolet, J. C.	Turning and Milling Horology	Le Locle (no year)
14. Perkins, A.	*The Modern Watchmakers Lathe and How to Use it	Harrison 2003
15. Reymondin, et al	*The Theory of Horology	Neuchatel 1999
16. Witschi	*Training Course (www.witschi.com/e/produkte/?sub=6&cat=11)	Bueren 2003

The items marked with * are considered required reading for the CW21 and CMW21 examination

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VI. Sample Practice Questions for the CW21 Written Examination

1. Explain what is meant by a “fast beat” watch.
2. Lubrication is critical to the proper functioning of a watch. Discuss 4 ways the watchmaker can control the needless spreading of lubricants throughout a watch.
3. To make a watch “water resistant,” several things must be done to the case to ensure that water does not enter. Explain what must be done to a watch to return its original water resistant quality after complete movement servicing is performed.
4. What is meant by “dynamic poisoning” of a balance? How is this accomplished?
5. A customer brings you a quartz watch that seems to lose 5 minutes per day. Explain the following:
 - a. How could this happen?
 - b. How would you go about diagnosing the problem(s)?
 - c. What service would you recommend to the client?
6. A battery offers voltage and amperage to an electrical circuit. Define what each is and how they affect a quartz watch circuit.
7. What makes a watch a “chronograph?” Name the interior components that are used to accomplish these differences.
8. What changes must be made to manual wind watch to make it an automatic watch design?
9. Discuss the effect of amplitude of a balance, on the timekeeping quality of a watch.
10. How can the watchmaker change the amplitude of a balance given that the watch is fully wound? What is considered the “optimal” amplitude and why?

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VII. Additional Forms

21st Century Certification Program Variance Request

Candidate's name: _____

Examination date: _____

Please select one of the following:

- Watch Assessment
- Clock Assessment

The BOE may, under certain circumstances, grant an accommodation or a variance from the normal testing procedures to those candidates with special needs. It is AWCI's goal to ensure that the 21st Century Certification programs reflect the knowledge and skill levels of the candidates fairly. AWCI and the BOE are committed to compliance with the Americans with Disabilities Act. To that end you are asked to fill out the following and submit it to the BOE for review 45 days before your testing date. There is no guarantee that an accommodation or variance will be granted and NO variance or accommodation can or will be granted after that period.

1. Please describe the special need(s) that you have and how it impacts your ability to participate in this examination:

- Language
- Other: (Please explain) _____

2. Please describe the accommodation or variance you are requesting:

3. Please provide any other relevant information:

For Official Use Only

BOE ACTION:

- Approved
- Disapproved


Action taken and reason for action(s): _____

Signed: _____
Chief Examiner

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Sample Scoring Sheet from the Micro-Mechanical Section

The following example sheet is similar to an actual scoring sheet used for the evaluation of this section. It is given as an example **ONLY** to help you understand the detail that is scored. Some sections carry more weight as they effect the final operation of the product. If the staff does not meet the requirements of Section 1 below to start with, then the scoring is stopped.

American Watchmakers-Clockmakers Institute			
	Certified Watchmaker Examination Balance Staff Replacement (ETA 6497) Master Score Sheet		
Assessor #1:	Date Examination Scored:		
Assessor #2:	Test Piece ID #:		
Test Site:	Date Examination Administered:		
Verify that the assigned numbers for documents and workpiece are matching			
1			
Is Balance Wheel Fully Operational?		Comments	
Does the balance wheel turn freely?		yes	no
Appears the balance wheel to be flat and concentric?		yes	no
Appears the hairspring to be flat and centered?		yes	no
Was the old staff submitted?		yes	no
If all answers above are "YES", balance wheel is considered operational for scoring. If any answer above is "NO", the balance wheel is considered non-operational and therefore not scorable.			
2			
Staff Replacement (Staff Measuring Assessment Sheet)			Result
Record result from the Staff Measuring Assessment Worksheet			_____
3			
Cleanliness / Condition of Exam Piece		Comments	
Cleanliness / Damage		_____	
Endshake of Balance Wheel		_____	
4			
Hairspring / Centering between Regulator Pins		Comments	
Hairspring in Movement		_____	
Centered		_____	
Flat		_____	
Regulator Pins		_____	
Damage / Parallel		_____	
Hairspring Centering		_____	
(Remove Balance Wheel from Bridge)			
5			
Hairspring		Comments	
Flatness		_____	
Concentricity		_____	
6			
Roller Table		Comments	
Damage / Condition		_____	
Seating		_____	
Tightness		yes	no
(If Roller Table is not tight consider the Balance Wheel non operational and stop grading)			
7			
Underside of Balance Wheel		Comments	
Damage / Cutting Marks		_____	
Poising Marks		_____	
(Remove Hairspring)			
8			
Balance Wheel		Comments	
Trueness		_____	
Poising		_____	
Riveting		_____	
Condition / Marks		_____	
Tightness		_____	
(If Balance Wheel is not tight consider it non operational)			