AWS SCC1.0 2026

Guideline for Welding Competition Organization and Weld Assessment

American Welding Society®

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Guideline for Welding Competition Organization and Weld Assessment

1st Edition

Prepared by
Prepared by The American Welding Society (AWS) WorldSkills Competition Committee.

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This Technical Guideline provides comprehensive guidance for organizing and evaluating the welds in welding competitions. It outlines the essential steps and considerations involved in planning, executing, and assessing welding competitions to ensure fairness, consistency, dependability, transparency and accuracy in evaluating competitors' welding skills. The guideline covers various aspects such as competition setup, weldment specifications, judging criteria, scoring methodologies, and participant eligibility. By following this guideline, competition organizers, judges, and competitors can uphold high standards, promote excellence, and foster a competitive environment that nurtures the growth and recognition of skilled welders everywhere fairly and consistently.

American Welding Society®

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Foreword

This foreword is not part of this standard but is included for informational purposes only.

In today's rapidly evolving world, the demand for skilled welders continues to grow, highlighting the critical need for welding competitions that showcase and recognize excellence in this craft. These competitions not only provide a platform for welders to demonstrate their skills but also serve as a catalyst for fostering innovation, collaboration, and professional development within the welding industry.

The Technical Guideline for Welding Competitions presented herein represents a significant milestone in setting a standardized framework for conducting and evaluating welding competitions. Developed through extensive collaboration among industry experts, educators, and competition organizers, this guideline aims to ensure fairness, consistency, and transparency in the evaluation process while upholding the highest standards of craftsmanship.

This forward-thinking guideline encompasses a wide range of essential aspects related to organizing welding competitions. It provides detailed guidance on competition setup, weldment specifications, judging criteria, scoring methodologies, and participant eligibility. By following these guidelines, competition organizers can establish a level playing field that encourages healthy competition and showcases the talents of participants in an objective and unbiased manner.

Moreover, this guideline serves as a valuable resource for judges, offering comprehensive information on evaluating welding techniques, joint quality, safety practices, and adherence to industry codes and standards. By adopting these standardized evaluation criteria, judges can provide meaningful feedback to participants, fostering continuous improvement and nurturing the next generation of skilled welders.

It is with great anticipation that we present this Technical Guideline for Welding Competitions. We believe that its implementation will contribute to raising the bar of excellence in welding craftsmanship, driving innovation in techniques and technologies, and ultimately strengthening the welding industry as a whole. We encourage competition organizers, judges, and participants to embrace these standards, continually refine their skills, and inspire others to pursue excellence in the noble art of welding.

We extend our deepest gratitude to all the contributors, industry partners, and welding professionals who have generously shared their knowledge and expertise to develop this guideline. It is through their collective efforts that we are able to establish a standardized framework for welding skill competitions, ensuring a vibrant and thriving future for the welding industry.

As new applications are developed and more experience is gathered, it is anticipated that changes in this standard will be required. Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS AWS WorldSkills USA Welding Competition Committee., American Welding Society, 8669 NW 36th Street, #130, Miami, FL 33166.

Dedication

Dear Welding Educators, S killsUSA State Directors, and Competition Hosts,

It is with great enthusiasm that I endorse this comprehensive guide for managing and scoring welding competitions, developed by the American Welding Society (AWS). The inclusion of the Recommended State Project Book and the National Project Book Samples for SkillsUSA welding competitions further strengthens its value. As the Executive Director of SkillsUSA, I have seen firsthand the transformative power of well-designed, fair, and measurable competitions in shaping our students' skills and preparing them for successful careers.

The welding competition has long set a standard of excellence within SkillsUSA, and this document continues to elevate that tradition. By providing a framework for both designing and scoring welding competitions, it ensures consistency and fairness across all competition levels, from regional qualifiers to state finals. What I find most impressive about this standard is its emphasis on objective, criterion-based scoring. This transparent approach not only enhances fairness but also motivates students to reach higher levels of proficiency. The fact that, at our national competitions, we now see every single welding project attempted and completed—none left unfinished—speaks volumes about the effectiveness of these shared standards in raising the bar for both competitors and competitions.

I am particularly excited about the flexibility this guide offers. While providing a solid foundation, it also allows for adaptation to meet specific needs and resources. This balance between consistency and customization is essential as we prepare students for the diverse demands of the modern welding industry. To all SkillsUSA state leaders and welding instructors, I strongly encourage the implementation of these standards in your competitions. By aligning with these national best practices, you are providing your students with an unparalleled opportunity to showcase their skills and prepare for success at the national level and beyond.

As we continue to evolve and improve our competitions, documents like this are crucial to our mission of empowering students to become skilled professionals, career-ready leaders, and responsible community members. Together, we can ensure that SkillsUSA welding competitions remain at the forefront of excellence in career and technical education.

Thank you to the AWS staff, the AWS Board of Directors, the AWS WorldSkills USA Competition Committee, and the SkillsUSA National Welding Technical Committee for your tireless efforts in developing these standards and for your ongoing commitment to the future of welding education.

Sincerely,
Chelle Travis
Executive Director, SkillsUSA

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Guideline for Welding Competition Organization and Weld Assessment

1. General Provisions

1.1 Scope

This document provides comprehensive guidance and best practices for conducting welding competitions. It covers various aspects, including safety measures, equipment requirements, participant eligibility, judging criteria, and event organization. The guideline ensures fair and standardized competition while promoting excellence in welding skills. Organizers are strongly encouraged to adopt these best practices to elevate the quality and integrity of welding competitions. Doing so can create a competitive and safe environment that benefits participants, spectators, and the welding industry.

1.1.1 Recommended Practices for Evaluating Welds in Welding Competitions. This document serves as a valuable resource for various types of welding competitions, including:

(1) Secondary and Post-Secondary Student Welding Competitions

(2) SkillsUSA Welding Competitions

(3) Professional Welder and Occupational Welding Competitions

(4) Apprentice and Journey worker Welding Competitions

(5) Individual or Team welding competitions

1.1.2 Application and Implementation. Welcome to the world of welding competitions! This document serves as an invitation and guideline for developing, hosting, and scoring welding competitions at various ability levels. This document is designed with both American Welding Society (AWS) and SkillsUSA standards in mind. Please use this guide in any way that is helpful.

For those new to developing welding competitions, please utilize this document and various AWS forums to their fullest potential. For those of you already familiar with developing welding competitions and would like to maximize the student and/or judge experience, please feel free to skip to the annexes, where you will find a number of completely different examples of competitions already held that you may modify to fit your needs. The intent of this document is to:

(1) Introduce students to AWS Welding Code Language.

(2) Provide measurable criteria to accumulate points to determine top performers.

(3) Provide quality metrics that exceed industry welding code acceptance criteria to ensure the ability to identify top performers

(4) Provide welding competition managers with a number of best practices to enhance the competition experience for their competitors, ensuring transparency and impartial scoring.

(5) To help you save time when volunteering to support your local welding competitions.

(6) And finally, to make an effort to have all Local, State, and National SkillsUSA Welding competitions to be in alignment.

These guidelines will help you design and execute a fast, fair, and defendable welding competition.

1.2 Limitations

This guide provides valuable recommendations for conducting welding competitions effectively. The guideline assumes a certain level of expertise and may not be suitable for beginners or inexperienced welders. The guideline focuses primarily on the technical aspects of welding and may not address other important factors, such as safety protocols or environmental considerations. Additionally, the guideline may not account for the specific requirements or variations in different welding competition formats, which could limit its applicability in certain contexts.

This guideline is not a standardized criteria and shall not be utilized as a means to evaluate welding performance qualifications. It is recommended that the latest edition of AWS B2.1, *Specification for Welding Procedure and Performance Qualification*, is referenced if welding qualification is desired in a welding competition environment. While the guideline offers valuable insights, it is important to consider these limitations and adapt them to specific competition settings to ensure comprehensive and fair assessments.

1.3 Units of Measurement

This guideline uses the U.S. Customary Units and the International System of Units (SI). The latter are shown within brackets ([ ]) or in appropriate columns in tables and figures. The measurements are not exact equivalents; therefore, each system must be used independently.

1.4 Safety

Safety and health issues and concerns are beyond the scope of this guideline and, therefore, are not addressed herein. Safety and health information is available from the following sources:

American Welding Society:

(1) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

(2) AWS Safety and Health Fact Sheets

(3) Other safety and health information on the AWS website

Material or Equipment Manufacturers:

(1) Safety Data Sheets supplied by materials manufacturers

(2) Operating Manuals supplied by equipment manufacturers

Applicable Regulatory Agencies

Work performed in accordance with this guideline may involve the use of materials that have been deemed hazardous and may involve operations or equipment that may cause injury or death. This guideline does not purport to address all safety and health risks that may be encountered. The user of this guideline should establish an appropriate safety program to address such risks as well as to meet applicable regulatory requirements. ANSI Z49.1 should be considered when developing the safety program.

2. Normative References

The documents listed below are referenced within this publication and are suggested to the extent specified herein. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

American Welding Society (AWS) standards:

AWS A2.4: *Standard Symbols for Welding, Brazing, and Nondestructive Examination*

AWS A3.0M/A3.0:2025: *Standard Welding Terms and Definitions*

AWS B1.10: *Guide for the Nondestructive Examination of Welds*

AWS B1.11: *Guide for the Visual Examination of Welds*

AWS B2.1: *Specification for Welding Procedure and Performance Qualification*

AWS B4.0: *Standard Methods for Mechanical Testing of Welds*

AWS B5.1: *Specification for the Qualification of Welding Inspectors*

AWS QC1: *Standard for AWS Certification of Welding Inspectors*

AWS QC7: *Standard for AWS Certified Welders*

American National Standards Institute (ANSI):

ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

SkillsUSA:

Recommended Projects & Scoring Criteria for State SkillsUSA Welding Championships

SkillsUSA Recommended Procedures for Conducting a SkillsUSA Welding Contest

3. Terms and Definitions

AWS A3.0M/A3.0:2026, *Standard Welding Terms and Definitions,* provides the basis for terms and definitions used herein. However, the following terms and definitions are included below to accommodate usage specific to this document.

The terms and definitions in this glossary are defined by the AWS WorldSkills Competition Committee and are preceded by asterisks defined as they relate to this guideline. For the purposes of this document, the following terms and definitions apply:

actual throat. The shortest distance between the weld root and the face of a fillet weld. See AWS A3.0M/A3.0:2026 Figure B25(A)−(D). See also **effective throat** and **theoretical throat**

***anonymity.** The practice of using participant numbers or codes instead of names during judging to maintain fairness and minimize bias or favoritism.

arc gouging (AG). Thermal gouging using an arc cutting process variation to form a bevel or groove.

as-welded. *adj*. Pertaining to the condition of weldments prior to subsequent thermal, mechanical, or chemical treatments.

***award categories.** The predefined categories in which participants can receive recognition and awards based on factors such as skill level, age group, or specific welding processes.

back weld. A weld made at the back of a single groove weld. See AWS A3.0M/A3.0:2026 Figure B24(C).

backgouging. The removal of weld metal and base metal from the weld root side of a welded joint to facilitate complete fusion and complete joint penetration upon subsequent welding from that side.

backing weld pass. A weld pass resulting in a backing weld.

backing ring. Backing in the form of a ring, generally used in the welding of pipe.

backing weld. Backing in the form of a weld. See AWS A3.0M/A3.0:2026 Figure B24(D).

backing. A material or device placed adjacent to the joint root, or on both faces of a joint in electroslag and electrogas welding, to support and shield molten weld metal. The metal or nonmetal backing may be partially fused or remain unfused during welding. See AWS A3.0M/A3.0:2026 Figures B8(D), B12(C), and B37.

base metal. The metal or alloy being welded, brazed, soldered, cut, or coated.

bevel angle. The angle between the bevel of a joint member and a plane perpendicular to the surface of the member. See AWS A3.0M/A3.0:2026 Figures B6(A)–(D), and B6(I).

boxing. The continuation of a fillet weld around a corner of a member as an extension of the principal weld. See AWS A3.0M/A3.0:2026 Figure B23(F).

butt joint. A joint type formed by butting ends of one or more workpieces aligned in approximately the same plane. See AWS A3.0M/A3.0:2026 Figures B1(A), B2(A), B3, B10(B), B10(D), B52(A), and B52(B). See also **skewed joint**.

butt weld. A nonstandard term for a weld in a butt joint.

***ceremony.** A formal event or gathering where the results of the welding competition are announced and participants' achievements are celebrated.

complete joint penetration (CJP)**.** A groove weld condition in which weld metal extends through the joint thickness. See AWS A3.0M/A3.0:2026 Figure B26. See also **complete joint penetration weld**, **incomplete joint penetration**, **joint penetration**, and **partial joint penetration weld**.

***competition design.** The process of creating a range of welding tasks that test various welding processes, techniques, and skills. These tasks should be challenging and representative of real- world welding applications.

***competition documentation.** The detailed descriptions, drawings, specifications, and any specific requirements or constraints associated with each welding task in the competition.

***competition report.** A comprehensive document that includes details such as task descriptions, participant list, scores, judges' feedback, and any noteworthy observations or incidents that occurred during the welding competition.

***competition rotation.** The systematic rotation system in place to ensure fairness, where each participant receives an equal opportunity to tackle different tasks and difficulty levels during the competition.

***competition scoring rubric.** A defined series of metrics used to assess welding competition projects and performance.

***competitor.** An individual who registers and competes in the welding competition.

complete fusion. Fusion over the entire fusion faces and between all adjoining weld beads.

continuous weld. A weld that extends continuously from one end of a joint to the other. Where the joint is essentially circular, it extends completely around the joint.

corner joint. A joint between two members located approximately at right angles to each other.

crater. A depression in the weld face at the termination of a weld bead.

defect. A discontinuity or discontinuities that by nature or accumulated effect render a part or product unable to meet minimum applicable acceptance standards or specifications. See also **discontinuity**.

***difficulty levels.** The assigned levels of difficulty for each welding task based on factors such as the complexity of the welding process, joint type, materials, and other relevant considerations.

discontinuity. An interruption of the typical structure of a material, such as a lack of homogeneity in its mechanical, metallurgical, or physical characteristics. A discontinuity is not necessarily a defect. See also **defect**.

***drawings.** As used in this guideline, refers to plans, design, detail drawings and competition project plans.

effective length of weld. The length throughout which the correctly proportioned cross-section of the weld exists. In a curved weld, it shall be measured along the weld axis.

effective throat. The minimum distance from the fillet weld face, minus any convexity, to the weld root. In the case of a fillet weld combined with a partial joint penetration groove weld, the weld root of the groove weld is used. See AWS A3.0M/A3.0:2026 Figures B25(A)–(D) and B25(I). See also **actual throat** and **theoretical throat**.

***eligibility.** The criteria that determine whether an individual is qualified to participate in the welding competition, including minimum age, experience level, and any necessary certifications or qualifications.

***equipment.** The tools, machinery, welding machines, consumables, and materials required for participants to perform the welding tasks during the competition.

filler metal. The metal or alloy to be added in making a welded, brazed, or soldered joint.

fillet weld leg. The distance from the joint root to the toe of the fillet weld.

fillet weld size, *equal leg*. The leg length of the largest isosceles right triangle inscribed within the fillet weld cross section. See AWS A3.0M/A3.0:2026 Figures B25(A) and (B).

fillet weld size, *unequal leg*. The leg lengths of the largest right triangle inscribed within the fillet weld cross section. See AWS A3.0M/A3.0:2026 Figure B25(E).

fillet weld. A weld of approximately triangular cross-section joining two edges in a corner joint, one surface and one edge in a lap joint, or two surfaces in a T-joint.

finish. *verb.* The use of mechanical methods (e.g., grinding, machining) to prepare a surface to meet a quality standard requirement.

flat welding position. The welding position in which welding is performed from the upper side of a joint or surface in which the weld axis, at the point of welding, is approximately horizontal, and the weld face lies in an approximately horizontal plane. See AWS A3.0M/A3.0:2026 Figures B16A–B16C, B17(A), B18(A), B19(A), and B20(A).

fusion depth. The distance that fusion extends into the base metal or previous bead from the surface melted during welding.

fusion zone. The area of base metal melted as determined on the cross-section of a weld.

fusion. The melting together of filler metal and base metal or of base metal only, to produce a weld. See also **fusion depth**.

fusion-type discontinuity. Signifies slag inclusion, incomplete fusion, incomplete joint penetration, and similar discontinuities associated with fusion.

gas pocket. A nonstandard term for **porosity**.

gas metal arc welding (GMAW). An arc welding process that uses an arc between a continuous filler metal electrode and the weld pool. The process is used with shielding from an externally supplied gas and without the application of pressure.

short circuiting gas metal arc welding (GMAW-SC). A process variation in which the consumable electrode is deposited during repeated short circuits.

thermal gouging (TG). A thermal cutting process variation removing metal by melting or burning the entire removed portion to form a bevel or groove.

groove angle. The total included angle of the groove between workpieces.

groove face. The surface of a joint member included in the groove.

groove weld. A weld in a weld groove on a workpiece surface, between workpiece edges, between workpiece surfaces, or between workpiece edges and surfaces.

heat-affected zone (HAZ). The portion of base metal whose mechanical properties or microstructure have been altered by the heat of welding, brazing, soldering, or thermal cutting.

***hybrid joint.** A non-standard welded joint utilized in competition environments to challenge a welder's skill and competency of welding.

intermittent weld. A weld in which the continuity is broken by recurring unwelded spaces.

joint penetration. In a groove weld, the distance weld metal extends from the weld face to the weld root, exclusive of weld reinforcement.

joint root. That portion of a joint to be welded where the members approach closest to each other. In cross-section, the joint root may be either a point, a line, or an area.

joint. The junction of members or the edges of members that are to be joined or have been joined.

***judge.** An experienced welding professional who evaluates and scores participants' performance during the competition. The judge role can be segmented into a lead role or project role based on competition requirements.

layer. A stratum of weld metal or surfacing material. The layer may consist of one or more weld beads laid side by side.

machine. *verb*. To shape, plane, mill, grind, cut, rout, abrade, or achieve a desired contour or finish using machine-operated tools.

magnetic particle testing (MT). A nondestructive examination method using applied or residual magnetic fields to detect surface and near-surface discontinuities.

***organizer.** The entity responsible for planning, coordinating, and executing the welding competition.

overlap, *fusion welding*. A weld profile discontinuity in which the reentrant angle at the weld toe, weld root, or weld bead toe is acute (less than 90°).

peening. The mechanical working of metals using impact blows.

piping porosity. A form of porosity having a length greater than its width extending through the weld approximately perpendicular to the weld face.

partial joint penetration weld. A groove weld in which incomplete joint penetration exists.

porosity. Cavity-type discontinuities formed by gas entrapment during solidification.

***positioned weld.** A weld made in a joint that has a specific welding position associated to facilitate making the weld.

postweld heat treatment (PWHT). Any heat treatment applied to a weldment subsequent to welding.

preheating. The application of heat to the base metal immediately before welding, brazing, soldering, thermal spraying, or cutting.

penetrant testing (PT). A nondestructive examination method using a penetrating medium to enhance visual detection of discontinuities open to the test surface.

***registration.** The process by which participants provide their information, including name, contact details, experience level, and any specific equipment requirements, to enter the welding competition officially.

***result calculation.** The process of compiling scores from individual tasks to determine the overall rankings of participants in the welding competition. Weighted scoring may be applied for tasks of different difficulty levels.

root face. That portion of the groove face within the joint root See AWS A3.0M/A3.0:2026 Figure B5.

root opening. The separation of workpieces at the joint root.

radiographic testing (RT). A nondestructive examination method using penetrating radiation to produce images for detection of discontinuities in a test object.

***safety measures.** The protocols, procedures, and guidelines in place to ensure the safety of participants and minimize the risk of accidents or injuries during the welding competition. This includes the use of personal protective equipment (PPE), fire prevention measures, and proper ventilation.

***scoring criteria.** The established guidelines and standards by which judges evaluate and score participants' performance. These criteria often include factors such as weld quality, accuracy, technique, speed, and adherence to specifications.

***Score Keeper.** Responsible for documenting project evaluations and written notes to ensure accurate and transparent scoring.

Shopmaster. A key competition support role responsible for helping contestants set up their welding stations, maintaining safety and material flow, and ensuring all booths operate efficiently throughout the event.

single-welded joint, *fusion welding*. A joint welded from one side only.

spatter. Metal particles expelled during fusion welding. Those particles adhering to the weld and adjacent base metal may require removal if they interfere with subsequent operations.

stringer bead. A type of weld bead made without appreciable weaving motion.

tack weld. A weld made to hold parts of a weldment in proper alignment until the final welds are made.

temporary weld. A weld made to attach a piece or pieces to a weldment for temporary use in handling, shipping, or working on the weldment.

theoretical throat. The distance from the beginning of the joint root perpendicular to the hypotenuse of the largest right triangle inscribed within the cross-section of a fillet weld. See AWS A3.0M/A3.0:2026 Figures B25(A)–(D). See also **actual throat** and **effective throat**.

ultrasonic testing (UT). A nondestructive examination method using high-frequency sound waves for the detection of volumetric discontinuities in a test object.

***venue.** The location where the welding competition takes place, providing adequate space, lighting, ventilation, and safety measures.

weave bead. A type of weld bead made using weaving.

weld axis. A line through the length of a weld, perpendicular to and at the geometric center of its cross-section.

weld bead. A weld resulting from a pass. See also **stringer bead** and **weave bead**.

weld face. The exposed surface of a weld on the side from which welding was done.

weld pass. A single progression of welding along a joint. The result of a pass is a weld bead or layer.

weld reinforcement. Weld metal in excess of the quantity required to fill a weld groove.

weld root. The points, shown in cross-section, at which the root surface intersects the base metal surfaces.

weld tab. Material added to either end of a weld joint to provide support for weld metal at the start or termination of weld passes. Weld tabs should be configured to match the joint geometry.

weld toe. The junction of the weld face and the base metal.

weld. A localized coalescence of metals or nonmetals produced either by heating the materials to the welding temperature with or without the application of pressure or by the application of pressure alone, and with or without the use of filler metal.

weldability. The relative ease with which a material may be welded to meet an applicable standard.

welder certification. Documentation attesting to the performance qualification of a welder.

welder performance qualification. Demonstration of a welder's ability to produce an acceptable test coupon in accordance with an applicable qualification standard.

welder. An individual performing manual or semiautomatic welding.

***welding competition.** A structured event where participants showcase their welding skills and compete against each other in various welding-related tasks or challenges.

welding power source. An apparatus for supplying electric current and voltage suitable for welding.

welding operator. An individual who observes and controls an automatic, mechanized, or robotic welding process.

welding procedure specification (WPS). A document detailing the required process variables for a specific application to ensure repeatability when executed by properly trained and qualified personnel.

welding procedure. A detailed description of the materials and methods used to weld materials, including activities before and after the application of the welding process.

***welding sequence.** The order of making the welds in a weldment or on a welding project.

welding. A joining process that produces coalescence of materials by heating them to the welding temperature, with or without applying pressure alone, and with or without the use of filler metal.

weldment. An assembly joined by welding.

4. Guidelines for Welding Competitions

4.1 Scope and Objectives

Welding competitions provide a platform for welders to demonstrate their skills, foster excellence in welding craftsmanship, and promote safety standards within the welding industry. Outlined within this clause are best practices aimed at ensuring the successful planning, execution, and design of welding competitions while upholding the highest standards of safety, fairness, and skill assessment within the welding community.

4.2 General Rules for Competition

Participants must adhere to all safety regulations and wear appropriate personal protective equipment (PPE) at all times during the competition, including welding helmets, gloves, aprons, and safety glasses. Compliance to ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes* shall be enforced.

4.2.1 Contestants are responsible for bringing their welding tools and any necessary competition-related items, unless specified.

4.2.2 Proper welding attire, including flame-resistant clothing and work boots, must be worn by all contestants while actively engaged in welding activities.

4.2.3 Contestants are strictly prohibited from entering the contest areas during the setup day. Tools and equipment should not be left unattended or dropped off at the site early, as their security is not guaranteed.

4.2.4 Cell phones are strictly prohibited within the contest area. Contestants must keep all cell phones turned off and stored in a safe place out of sight during the entire competition duration.

4.2.5 Personal music devices, headphones, or other electronic devices that may cause distraction are prohibited in the contest area.

4.2.6 All welding activities must comply with industry-standard safety regulations.

4.2.7 Contestants are expected to demonstrate proficiency in various welding processes, including but not limited to, shielded metal arc welding (SMAW), gas metal arc welding (GMAW), gas tungsten arc welding (GTAW), and flux-cored arc welding (FCAW).

4.2.8 Any deviations from the provided project specifications or contest rules may result in penalties or disqualification at the committee's discretion.

4.2.9 Respectful and professional conduct is expected from all participants, including interactions with fellow contestants, judges, organizers, instructors, and spectators.

4.2.10 Any concerns, disputes, or clarifications regarding contest rules or procedures should be addressed to the designated competition officials promptly and courteously.

4.2.11 Any instances of cheating, unsafe practices, or unethical behavior will result in immediate disqualification and may lead to further disciplinary actions.

4.2.12 Contestants are responsible for their actions and decisions during the competition, including the interpretation of project requirements and adherence to time constraints.

4.2.13 The decisions of the judging panel and competition officials are final and binding. Contestants must accept and abide by the decisions made without dispute or argument.

4.3 Welding Competition Design

Welding competition designs or formats vary depending on the objectives, participant demographics, and specific requirements. Common welding competition designs or formats include:

(1) Station Based

(2) Simultaneous Start

(3) Flow Through

(4) Submission

Consider various factors, such as objectives, participant demographics, requirements, experience, stakeholder input, and potential pilot testing, when designing or proposing the most appropriate style of competition. Below are key elements of each competition design:

4.3.1 Station-Based. In a station-based competition design, participants move or rotate through a series of designated stations:

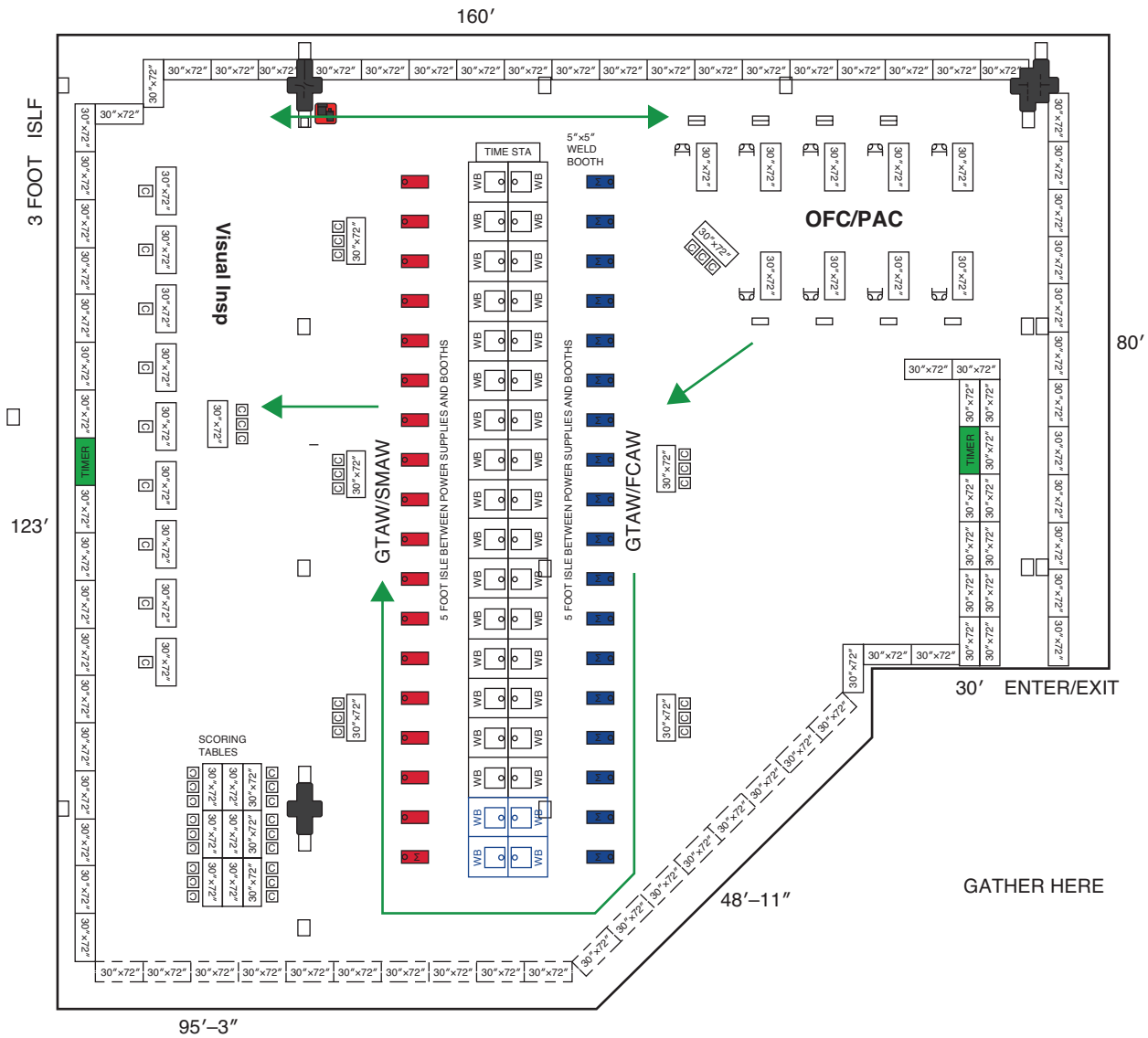


Figure 4.1—Station Based Welding Competition Layout

(1) Each station is designed to focus on different welding tasks or techniques.

(2) Contestants typically rotate among stations, completing specific welding assignments or challenges within a designated time frame.

(3) This format allows for a structured and systematic evaluation of participants' skills across various welding processes and scenarios. Competitions such as WorldSkills utilize this model; see **Figure 4.1** for an example layout and Annex E for a sample schedule.

4.3.2 Simultaneous Start. In a simultaneous start competition, all participants begin welding simultaneously:

(1) Often, identical or similar projects or tasks are utilized.

(2) Contestants work independently on their respective projects, with each participant judged based on individual performance and outcomes.

(3) This format emphasizes speed, efficiency, and individual proficiency, as participants compete head-to-head in real-time. Competitions such as National SkillsUSA utilize this model; see **Figure 4.2** for an example.

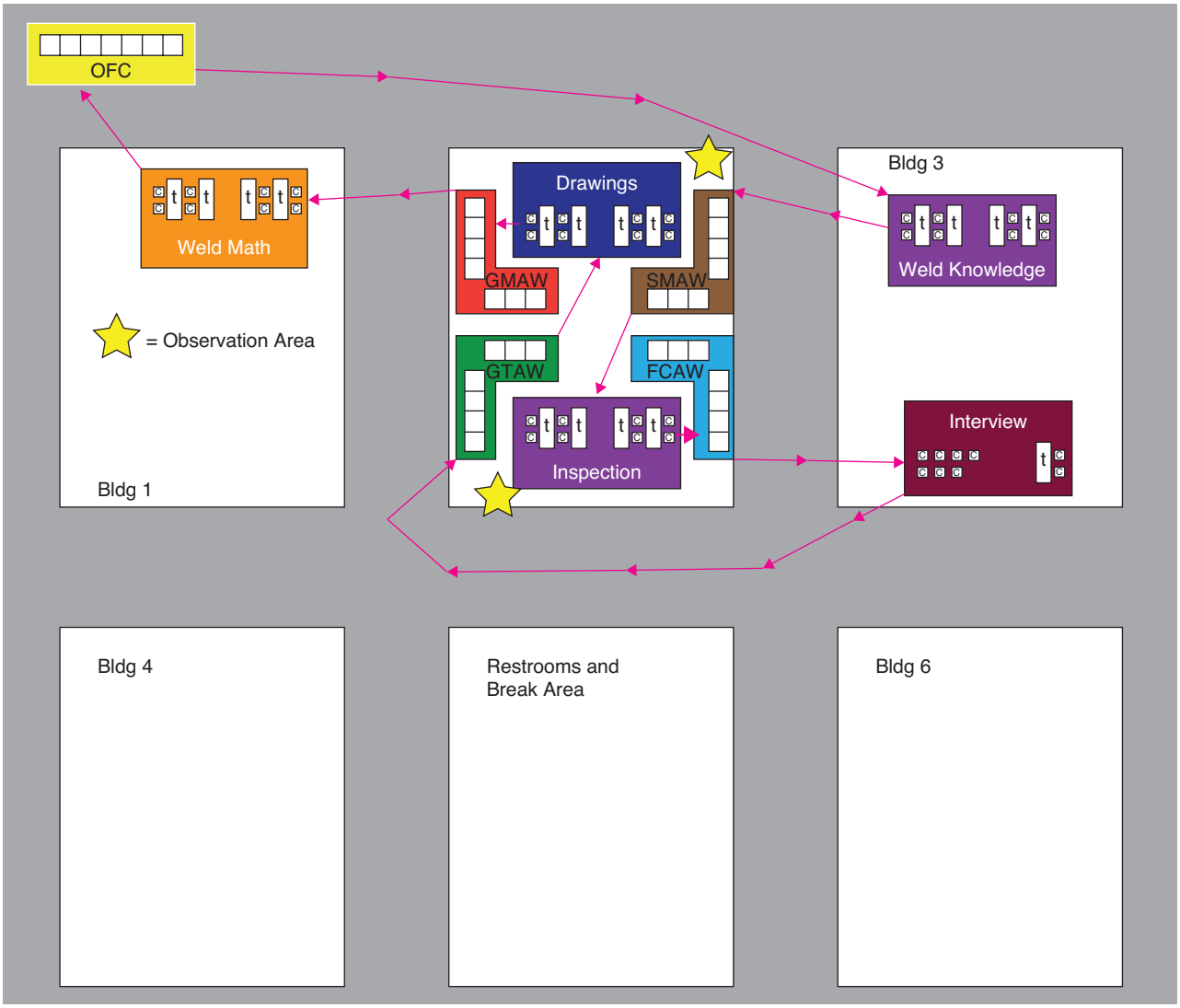


Figure 4.2—Simultaneous Start Competition

4.3.3 Flow Through. The flow-through competition design involves a continuous workflow, where participants progress through different stages or stations seamlessly.

(1) Ensures efficient use of time and resources by organizing project tasks in a logical sequence and minimizing delays or bottlenecks. Smooth transitions between project stages or stations allows participants to focus on their work and maintain productivity throughout the competition.

(2) Contestants start at the initial station and proceed through subsequent stages as they complete each task or requirement.

(3) This format promotes efficiency and workflow optimization, allowing for a smooth transition between welding processes and project phases. Many welding competitions embody this model, including AWS Section and District contests.

4.3.4 Submission Based. In a submission-based competition model, participants are tasked with creating a welding project or art piece within a specified timeframe prior to the competition.

(1) Contestants submit their completed projects for judge evaluation based on predetermined criteria, such as creativity, craftsmanship, and adherence to specifications.

(2) This format allows for greater flexibility in project design and execution, as participants can showcase their creativity and technical skills in a pre-prepared piece.

4.4 Facility and Venue

Several factors, including the number of participants, the complexity of the competition, and available space influence the selection of the contest site. Local and regional contests are typically hosted at local schools due to their convenience and accessibility. However, there is a growing trend to host state-level competitions in public arenas. While arenas offer increased exposure to the public, organizing contests in such venues demands additional effort from the organizing committee. Moreover, depending on the venue's facilities and infrastructure, it may result in significant electrical cost implications. Hence, careful consideration of venue suitability and logistical requirements is essential to ensure the successful staging of the competition.

4.4.1 Public School. If you are using a public school, it is extremely important to get the complete support of the individual in charge of the institution for its use. A visit to the individual in charge to secure their permission, confirmed by a written letter of agreement indicating their affirmative response, is essential. Ensuring that said individual is not exposed to certain competition details is very important to eliminate any perception of an unfair advantage as the host school.

4.5 Funding

Funding supports the Welding Competition Contest Committee in securing essential resources through sponsorships, industry partnerships, and fee-based participation. These funds ensure the procurement of materials, equipment, and personnel needed for a successful event while fostering collaboration between education and industry to strengthen the welding profession.

4.5.1 Sponsorship. A robust *Contest Committee* plays a pivotal role in securing the necessary funds and resources for the welding competition. As contests operate as non-profit events, procuring supplies and equipment can present challenges. To address this, the committee should actively engage industrial members to contribute base materials for the test projects. Additionally, local distributors may offer support by supplying filler metals and potentially loaning welding equipment.

4.5.2 Post Sponsorship Activities. It is imperative to express gratitude to donors through letters of appreciation and to ensure the careful preservation and prompt return of loaned equipment. See 8.7.

4.5.3 Volunteer Recruitment. When recruiting personnel such as judges, tool room attendants, and material handlers, the local American Welding Society (AWS) Section serves as a valuable resource. Consideration should also be given to involving vocational students not participating in the contest and local apprenticeship programs to support the smooth running of the event.

4.5.4 Business and Industry Partnerships. Establishing partnerships is pivotal for competition committees as they bridge the gap between education and industry needs. Consider collaborating with local AWS sections, local industry, and individuals engaged with industry trends, as this proves beneficial. Partnerships between education and industry remain a cornerstone of the welding competition's success and the development of the welding profession.

4.5.5 Fee-Based Competition. A fee-based welding competition model involves participants paying a registration fee to enter the competition. This fee covers the costs associated with organizing and hosting the event, including venue rental, equipment procurement, staffing, and administrative expenses. Organizers may seek sponsorship or partnership opportunities to supplement registration fees and enhance the competition experience.

4.6 Welding Competitor

Welding competitions welcome participants from various backgrounds, each bringing their unique skillsets and aspirations to the arena. Competitors are categorized into three main groups based on their educational or professional status:

4.6.1 High School (Secondary). High school students with a passion for welding and fabrication participate in these competitions to showcase their skills and craftsmanship. These young welders demonstrate their abilities through structured projects or tasks, competing against peers to earn recognition and potentially opening doors for future welding industry opportunities.

4.6.2 College (Post Secondary). College-level competitors include students enrolled in vocational, technical, or higher education institutions pursuing welding-related courses or programs. These individuals have honed their skills through academic training and practical experience, aiming to refine their abilities further and demonstrate their proficiency on a larger stage.

4.6.3 Professional. Professional welders, including those employed in various manufacturing, construction, and fabrication industries, participate in competitions to test their expertise against fellow professionals. These seasoned welders bring years of experience and specialized knowledge to the competition, seeking to showcase their mastery of welding techniques and compete for top honors in their field.

4.6.4 Competitor Coaching. Competitor coaching is vital in preparing participants for welding competitions, regardless of their educational or professional background. Coaches provide guidance, instruction, and support to help competitors refine their skills, develop effective strategies, and optimize their performance during the competition. Pre-competition coaching sessions focus on technique refinement, project preparation, and mental readiness, while post-competition coaching offers feedback, analysis, and areas for improvement to enhance future performance. Competitor coaching ensures that participants are well-equipped to face the challenges of the competition and strive for excellence in their welding endeavors.

4.7 Written Examination for Competition

During welding competitions, the assessment of welding theory and knowledge is great to implement. Competitors undergo comprehensive assessment across various essential aspects of welding practices and knowledge. Below are common areas of assessment:

4.7.1 Welding Theory and Knowledge. Participants are assessed on their understanding of basic principles of welding processes, including weld joint design, terminology, and heat input, as well as their knowledge of factors such as distortion control and weldability of materials.

4.7.2 Safety and PPE. Competitors demonstrate their knowledge of safety protocols in welding operations, the proper selection and use of personal protective equipment (PPE), hazard identification, risk assessment, and emergency procedures for handling hazardous materials.

4.7.3 Inspection Methods. Competitors are evaluated on their familiarity with nondestructive testing (NDT) techniques such as visual inspection, liquid penetrant testing, and ultrasonic testing, their ability to interpret inspection reports and identify weld discontinuities and defects, and their adherence to welding codes, standards, and regulations

4.7.4 Metallurgy. The examination tests comprehension of basic metallurgical principles and material properties, the effects of heat input and welding processes on materials, an understanding of metallography and microstructures, and familiarity with heat treatment processes and their impact on weld performance.

4.7.5 Welding Symbols and Drawings. Competitors demonstrate their ability to interpret welding symbols according to relevant standards, read and understand welding drawings, blueprints, and technical specifications, identify weld joint configurations and welding symbols on drawings, and apply geometric dimensioning and tolerancing (GD&T) principles in welding design.

4.8 Competition Design

A well-structured competition design is essential for maintaining fairness, consistency, and efficiency in a welding competition. By implementing a detailed pre-competition checklist, organizers can effectively plan and execute the event, ensuring a seamless experience for both participants and attendees.

4.8.1 Pre-competition Checklist. Developing a comprehensive pre-competition checklist allows organizers to ensure smooth planning, execution, and success of the welding competition while providing a positive experience for competitors and attendees. When designing the competition, consideration should be given to the following:

4.9 Welding Equipment and Materials

Access to the proper welding equipment and materials is critical to the success, safety, and fairness of any welding competition. By utilizing a detailed equipment and materials checklist, organizers can ensure that all required resources are in place, allowing competitors to perform at their best while maintaining industry standards.

4.9.1 Equipment and Materials Checklist. Utilizing this comprehensive checklist, welding competition organizers can ensure that all necessary equipment and materials are readily available to facilitate a successful and engaging competition experience for competitors while prioritizing safety and quality standards.

4.9.2 Equipment Calibration & Maintenance. To ensure consistency and reliability, all welding equipment should be inspected, calibrated, and tested before the competition begins. Maintenance personnel should be on-site to address any equipment malfunctions and conduct routine checks.

4.9.3 Material Specifications & Consistency. To maintain fairness, all competitors should work with uniform materials that match the required specifications. Variations in material thickness, composition, or quality can impact welding outcomes and should be minimized through careful sourcing and preparation.

4.9.4 Logistics & Setup. Organizers should plan for equipment transportation, storage, and setup to avoid delays on competition day. Ensuring clear guidelines on workspace layout, power distribution, and accessibility helps create a smooth and efficient competition experience.

4.10 Competition Schedule

A well-structured competition schedule ensures an organized, efficient, and fair welding competition. By developing a detailed schedule and best practices for timing, organizers can optimize workflow, accommodate logistical needs, and create a seamless experience for competitors, judges, and attendees.

4.10.1 Schedule Development. When the contest is developed, consideration must be given to the time allowed for welding the project and the competition environment. This sample schedule outlines a full-day simultaneous start welding competition, encompassing registration, orientation, welding rounds, judging, and awards ceremony. Adjustments can be made to accommodate specific competition requirements, time constraints, and logistical considerations. See **Figure 4.3** Sample Contest Schedule. Additional examples are in Appendix E for additional sample contest schedules.

4.10.2 Best Practices for Scheduling. Organizers should start the contest as early in the day as practical and include extra time in event of any trouble issues. Have the judges and helpers report for orientation and placement at least one hour before the contest starts. The list below is a consecutive list of schedule items to consider.

(1) Participant Registration and Check-in

(2) Orientation Session

(3) Tool and Equipment Inspection

(4) Final Preparations

(5) Competition Briefing

(6) Welding Competition (Round 1)

(7) Lunch Break

(8) Welding Competition (Round 2)

(9) Final Welding and Clean-up

(10) Project Inspection and Judging

(11) Award Ceremony and Closing Remarks

(12) End of Competition Day

(13) Post-event Debrief

Table 4.1
Pre-Competition Checklist

Step	Checklist Item	Details	Lead
1	**Establish Planning Committee**	*Form a committee with individuals experienced in events, welding competitions, and industry professionals.*	
2	**Define Competition Objectives**	*Clarify goals like skill assessment, welding excellence, student engagement, and industry collaboration.*	
3	**Determine Competition Format**	*Choose a format (station-based, simultaneous, flow-through, submission-based) based on demographics and logistics.*	
4	**Secure Venue and Facilities**	*Identify a venue with proper space, welding stations, power supply, ventilation, and safety compliance.*	
5	**Procure Supplies and Equipment**	*Acquire welding supplies, safety equipment, and tools; arrange for welding machines and workbenches.*	
6	**Establish Competition Rules and Guidelines**	*Develop rules, scoring criteria, project requirements, safety protocols, and time limits.*	
7	**Recruit and Train Volunteers**	*Recruit and train volunteers for judges, supervisors, and registration staff roles.*	
8	**Promote and Publicize the Competition**	*Create promotional materials and use various channels like social media and local media outlets.*	
9	**Establish Registration Process**	*Set up online/manual registration and collect participant information, waivers, and entry fees.*	
10	**Prepare Participant Packets**	*Include rules, schedules, safety guidelines, maps, and identification badges.*	
11	**Arrange for Accommodations and Logistics**	*Coordinate lodging, transportation, parking, and venue signage for out-of-town participants and attendees.*	
12	**Conduct Pre-Event Safety Inspections**	*Inspect welding equipment, electrical systems, ventilation, and emergency procedures.*	
13	**Test Run Equipment and Welding Stations**	*Ensure proper functioning of welding machines and gas supplies; conduct trial runs.*	
14	**Finalize Event Schedule and Logistics**	*Complete the schedule, coordinate with vendors, and confirm delivery of supplies and services.*	
15	**Communicate with Competitors and Stakeholders**	*Share updates, logistical information, and provide communication channels for support.*	
16	**Prepare for Contingencies**	*Develop plans for unforeseen issues like weather, equipment malfunctions, or participant withdrawals.*	
17	**Conduct Final Walkthrough and Briefings**	*Walk through the venue to confirm readiness; brief volunteers and judges on roles and protocols.*	

Table 4.2
Welding Equipment and Materials Checklist

	Item	Details	Notes
1	**Safety Equipment**	Provide safety equipment such as curtains, barriers, fume extraction, and ensure PPE for participants. Ventilation systems (e.g., exhaust fans, fume extractors) should maintain air quality.	*Conduct a pre-competition safety check to ensure compliance with safety standards.*
2	**Welding Machines**	Ensure adequate numbers of SMAW, GMAW, GTAW and FCAW machines. Verify proper functioning, calibration, and accessories (e.g., leads, torches, regulators).	*Check all machines at least 24 hours before the event for readiness.*
3	**Welding Stations**	Set up individual stations with welding booths or partitions. Equip each with welding tables, clamps, and fixtures for securing workpieces.	*Verify partitions are stable and safe for competitors.*
4	**Welding Consumables**	Stock up on consumables like electrodes, welding wire, shielding gases (e.g., argon, CO2), flux-cored wire, filler metals, gas nozzles, contact tips, and drive rolls. Ensure variety to accommodate different processes and materials.	*Double-check availability for each welding process being used in the competition.*
5	**Welding Tools and Accessories**	Supply tools like welding hammers, wire brushes, chipping tools, pliers, measuring instruments, and angle grinders. Ensure competitors have access to toolboxes or carts. See Annex B for a sample tool list.	*Label all tools and ensure spares are available for backup.*
6	**Project Materials**	Provide materials like carbon steel, stainless steel, and aluminum. Prepare pre-cut or pre-fabricated materials in various shapes and sizes to suit competition tasks.	*Ensure materials are defect-free and match the task requirements.*
7	**Welding Fixtures and Jigs**	Offer fixtures, jigs, and clamping devices for aligning and securing workpieces. Ensure versatility for different positions and joint configurations. Include templates for welding or cutting layouts.	*Check adjustability and stability of fixtures and jigs.*
8	**Welding Inspection Tools**	Provide tools like welding gauges, fillet weld gauges, and visual inspection tools. Set up an inspection area with adequate lighting and magnification for detailed weld evaluation.	*Ensure inspection tools are calibrated and meet competition requirements.*
9	**Welding Safety Signs and Labels**	Display clear safety signs, labels, and instructions throughout the competition area to highlight safety protocols, hazard warnings, and emergency procedures.	*Place signs at entry points, critical areas, and workstations for maximum visibility.*
10	**Emergency Equipment**	Prepare first aid kits, fire extinguishers, eye wash stations, and emergency contact details. Designate trained personnel to handle emergencies.	*Train personnel in first aid and emergency response before the event.*
11	**Equipment Maintenance and Support**	Arrange technical support for equipment repair and maintenance during the competition to address breakdowns promptly.	*Have technical support staff on standby throughout the event.*

START TIME	10 Groups of 7, 10 Stations	
7:30-8:00	Competitors and Instructors MUST BE just outside the Grand Ballroom for Roll Call and any additional instructions.	
8:00	Contestants Ushered into Contest Area	
8:00-8:30	Safety inspection and additional Instructions for the specific contest area, and Stand By for Contest Start	
8:30-9:00	Round 1 Start/Finish	ROUND #1
9:00-9:10	Transition to Round 2	
9:10-9:40	Round 2 Start/Finish	ROUND #2
9:40-9:50	Transition to Round 3	
9:50-10:20	Round 3 Start/Finish	ROUND #3
10:20-10:30	Transition to Round 4	
10:30-11:00	Round 4 Start/Finish	ROUND #4
11:00-11:10	Transition to Round 5	
11:10-11:40	Round 5 Start/Finish	ROUND #5
11:40-11:50	Transition to Round 6	
11:50-12:20	Round 6 Start/Finish	ROUND #6
12:20-12:50	Transition to Round 7	
12:50-1:00	Round 7 Start/Finish	ROUND #7
1:00-1:30	Transition to Round 8	
1:30-1:40	Round 8 Start/Finish	ROUND #8
1:40-1:50	Transition to Round 9	
1:50-2:20	Round 9 Start/Finish	ROUND #9
2:20-2:30	Transition to round 10	
2:30-3:00	Round 10 Start/Finish	ROUND #10
3:00-3:10	Contest Over! Contestants can leave when they are finished and have their project turned in for evaluation	

State SkillsUSA Sample Welding Contest Time Schedule (7 per group, 10 Stations, 30 min ea. 70 competitors per day)

START TIME	3 groups of 16, 6 stations	
7:30-8:00	Competitors be at the Contest Area OUTSIDE the Welding Contest Area Along the South Wall. Line up Numerically with the Lowest Number In the Southeast corner of the building.	
8:00	Contestants Ushered into Contest Area	
8:00-8:30	Safety inspection and additional Instructions for the specific contest area, and Stand By for Contest Start	
8:30-9:30	Round 1 Start/Finish	ROUND #1
9:30-9:45	Transition to Round 2	
9:45-10:45	Round 2 Start/Finish	ROUND #2
10:45-11:00	MOVE TO NEW AREA	
11:00-12:00	Round 3 Start/Finish	ROUND #3
12:00-12:30	LUNCH/Transition to Round 4	LUNCH
12:30-1:30	Round 4 Start/Finish	ROUND #4
1:30-1:45	MOVE TO NEW AREA	
1:45-2:45	Round 5 Start/Finish	ROUND #5
2:45 - 3:00	Transition to Round 6	
3:00-4:00	Round 6 Start/Finish	ROUND #6
4:00	Contest Over! Contestants can leave when they are finished and have their project turned in for evaluation.	

National SkillsUSA Sample Welding Contest Time Schedule (17 per group, 6 Stations, 1 hr. ea., 48 competitors per day).

	State	National
Competitors per day	70	48
# of Stations	10	6
Time per Station	30 min	1 hr
# of competitors per Station	7	16

State vs National Counts

Figure 4.3—Sample Contest Schedule

4.11 Post Competition

A thorough post-competition process ensures the event concludes smoothly while laying the foundation for future welding competitions. By following a structured checklist, organizers can efficiently finalize results, recognize participants and volunteers, evaluate successes and areas for improvement, and begin planning for the next competition.

4.11.1 Identify Immediate Activity. By following this comprehensive post-competition checklist, organizers can ensure a smooth transition from the competition to the post-event phase, effectively wrap up all activities, and lay the groundwork for future welding competitions.

4.11.2 Competition Analysis & Reporting. A formal post-debriefing with organizers, judges, and key stakeholders allows for a thorough evaluation of the event's performance. This includes identifying strengths and challenges, assessing scoring fairness, reviewing rule consistency, and analyzing competitor turnout and engagement trends.

Table 4.3
Post Competition Activities

Task	Description	Notes
Results Compilation	Collect scoring sheets, evaluation forms, and judges' notes from each competition category or event. Compile scores and rankings for all competitors.	*Ensure all forms are collected before judges leave.*
Verify Results	Double-check scoring calculations and verify accuracy to ensure fairness and transparency. Resolve any discrepancies or inconsistencies.	*Have a second person review for accuracy.*
Award Distribution	Prepare certificates, trophies, medals, or prizes for winners. Organize an award ceremony and coordinate with sponsors for timely delivery of awards.	*Confirm award shipment/ delivery dates in advance.*
Participant Feedback	Solicit feedback through surveys, interviews, or forms. Gather input on competition format, rules, judging criteria, venue, and overall experience. Analyze for future improvements.	*Use an online survey tool for easier data collection.*
Volunteer Recognition	Express gratitude to volunteers, judges, staff, and sponsors. Provide certificates of appreciation or small tokens of gratitude.	*Consider social media shoutouts or a recognition event.*
Financial Reconciliation	Review financial records, receipts, and expenses. Reconcile budgets, income, and expenditures to ensure accuracy and accountability. Prepare financial reports.	*Submit final financial summary to stakeholders.*
Future Planning	Reflect on the competition's success and identify opportunities for improvement. Start planning the next event, considering feedback and industry trends.	*Set a tentative date for the next competition.*

4.12 Recommended Grievance Process Development.

Eligibility to File a Grievance: Any participant may file a formal grievance if they believe a rule violation or procedural error has occurred during the competition. This process is critical for establishing fair and equitable competition. Development considerations:

4.12.1 Filing Timeline. Grievances must be submitted in writing within a designated timeframe. It is recommended that submissions be made no later than two hours after the conclusion of the relevant competition round. Grievances submitted after this deadline will not be considered.

4.12.2 Submission Process. Grievances must be submitted to the Lead Judge or the designated competition official. The competition committee should establish and provide a grievance form in such an event.

4.12.3 Review Process. The Lead Judge and at least two members of the Competition Oversight Committee will review the grievance. Decisions will be based on the documented competition rules, judging criteria, and evidence provided.

4.12.4 Communication and Documentation. The decision on grievances(s) will be communicated and documented to the complainant within a reasonable timeframe of submission, or before the awards ceremony if applicable. Decisions made by the grievance review panel are final and binding, with no further appeals.

4.12.5 Disqualification for Misuse. Submission of false or frivolous grievances may result in disqualification of the complainant from the competition.

4.12.6 Limitations. The grievance procedure development process outlined herein does not supersede any existing rules, policies, or procedures established by the hosting organization or governing body of the competition. In cases where such pre-existing guidelines exist (e.g., SkillsUSA Competitions), those rules take precedence and must be followed. This grievance process is intended to supplement, not replace, existing frameworks, and should only be applied within the scope and authority granted by the hosting organization.

5. Welded Projects and Assessments

5.1 Scope and Objectives

Welding competition projects and welding skill tests are the foundation of the competition. It is necessary to foster creativity and innovation in welding by recognizing projects that push the boundaries of traditional welding practices, introducing new techniques, materials, or applications. This clause specifically focuses on defining the criteria, guidelines, and procedures for welded projects for competition. The scope encompasses a wide range of welding applications, including but not limited to structural, artistic, industrial, and innovative projects.

5.2 Identifying Projects for Competition

Projects should reflect industry standards, challenge competitors' technical skills, and promote craftsmanship.

5.2.1 Welding Project Types. Outlined are guidelines that reflect industry best practices, encouraging competitors to adhere to recognized welding codes and standards, thereby contributing to the overall improvement of welding craftsmanship. See Table 5.1 for a comparison of competition projects. Common types of projects include:

(1) Single Process Projects

(2) Combination Process Projects

(3) Workmanship Test Plates and Pipe

(4) Fabrication Projects

(5) Time Based Projects

(6) Sculpture and Metal Artwork

5.2.2 Single Process Project. Recommended when the competition aims to assess competitors' proficiency in a specific welding process, such as SMAW, GMAW, GTAW, FCAW, OFW, or OFC. See **Figure 5.3**.

(1) Suitable for competitions focusing on skill development, technique refinement, and adherence to industry standards for a particular welding process.

(2) Ideal for competitors to demonstrate mastery in a specific welding technique or discipline.

(3) Facilitates efficient use of time and resources by streamlining the start of the competition and maximizing competitors' productivity.

(4) Competitions such as SkillsUSA implement single-process projects. To view sample projects, see the appendix.

5.2.3 Combination Process Project. Recommended when the competition seeks to evaluate competitors' versatility, adaptability, and proficiency in utilizing multiple welding processes.

(1) Provides competitors with opportunities to demonstrate their competency in integrating different welding techniques to achieve project objectives.

(2) Suitable for competitions emphasizing holistic welding skills, problem-solving abilities, and the ability to select and apply appropriate welding processes based on project requirements.

(3) Projects designed to align with the objectives to reflect local welding practices, materials, or applications prevalent in the state or region hosting the competition.

(4) Competitions such as SkillsUSA and AWS competitions implement combination process projects. To view a sample project, **See Figure 5.4**.

5.2.4 Workmanship Test Plates and Pipe. Utilized when the competition aims to assess competitors' welding skills based on industry-standard performance qualification tests. In the welding competition environment, weld tests play a pivotal role in assessing competitors' abilities and skills.

(1) Provides objective criteria and evaluation methods for assessing competitors' weld quality, technique, and adherence to established standards.

(2) Offers competitors the opportunity to demonstrate their ability to produce welds that meet specified requirements and acceptance criteria commonly used in industry settings.

(3) When implemented in competition, test coupons embody consistency, uniformity, and fairness in testing competitors' welding skills.

(4) Judging personnel are typically familiar with welder qualifications, especially CWIs. Utilizing test plates enhances fairness and equity in the competition. Competitions such as SkillsUSA implement workmanship test plates in competition. To view sample test plates and pipes, see the appendix.

(5) Evaluation of workmanship test plates and pipes can be favorable as equipment for destructive or nondestructive testing readily available.

5.2.5 Performance Qualification Test Plates and Pipe. In industry, the qualification of welders and welding operators requires that a test coupon shall be made according to a Standard Welding Procedure Specification (SWPS) or a qualified welding procedure specification (WPS). This requires the test coupon to be prepared and tested in accordance with the requirements of the identified code or specification. See 1.2 for limitations and use of this guideline. It is recommended that the latest edition of AWS B2.1, *Specification for Welding Procedure and Performance Qualification*, is referenced if welding qualification is desired in a welding competition environment.

5.2.6 Fabrication Projects. Fabrication projects are utilized in welding competitions to evaluate competitors' abilities in fabricating components and assemblies according to specified requirements and industry standards. In the competition setting, fabrication projects serve as a tangible demonstration of competitors' skills, knowledge, and craftsmanship.

(1) Provides competitors with an opportunity to showcase their fabrication skills, including layout, cutting, fitting, and assembly of components, to achieve project objectives.

(2) Emphasizes the importance of craftsmanship and workmanship in producing high-quality fabricated structures or assemblies, reflecting industry best practices and standards.

(3) Facilitates the assessment of competitors' problem-solving abilities, adaptability, and creativity in overcoming fabrication challenges or obstacles encountered during the competition.

(4) Typically, Fabrication projects are utilized when a team of competitors is desired. Competitions such as SkillsUSA State and Regional competitions implement Fabrication Projects. To view sample projects, see the appendix.

5.2.7 Time-Based Projects. Utilized in welding competitions to evaluate competitors' abilities to complete fabrication tasks within specific time constraints, simulating real-world production scenarios. In the competition environment, time-based projects provide a practical assessment of competitors' efficiency, productivity, and time management skills.

(1) Promote proficiency in welding techniques and fabrication methods as competitors work to complete project tasks efficiently while maintaining high standards of workmanship.

(2) Encourages competitors to strategize and prioritize tasks effectively to optimize workflow and maximize productivity within the given time frame.

(3) Offers competitors the opportunity to demonstrate their ability to work under pressure and maintain quality standards while adhering to strict time constraints.

(4) Competitions such as the AWS Professional Welder competition implement time-based projects. To view sample projects, see the appendix.

5.2.8 Welded Sculpture and Metal Artwork. Utilized in welding competitions to assess competitors' creativity, artistic expression, and welding skills in producing visually captivating and structurally sound pieces. In the competition environment, welded sculptures and metal artwork provide a platform for competitors to showcase their artistic talents and technical abilities.

(1) Provides competitors with a creative outlet to express their artistic vision through welding techniques, such as sculpting, shaping, and welding metal materials into unique and imaginative forms.

(2) Offers competitors the opportunity to demonstrate their mastery of welding processes and techniques while integrating them seamlessly into the creation of welded sculptures and metal artwork.

Table 5.1
Overview of Welding Project Types

Project Type	Description	Key Benefits	Example Competitions	Notes
Single Process Project	Focuses on a specific welding process (e.g., SMAW, GMAW, GTAW, FCAW, etc.)	Assesses mastery in a particular welding technique.	SkillsUSA, AWS Competitions, WorldSkills, FFA	*Best for technique refinement in one process.*
Combination Process Project	Involves multiple welding processes within a single project	Tests versatility, adaptability, and proficiency in various welding techniques.	SkillsUSA, AWS Competitions, WorldSkills, FFA	*Ideal for holistic skill assessments.*
Workmanship Test Plates and Pipe	Focus on weld quality based on industry-standard performance qualification tests	Objective criteria to assess weld quality, technique, and adherence to standards	SkillsUSA, WorldSkills	*Test plates ensure fairness in judging.*
Performance Qualification Test Plates	Based on industry performance qualification, using a specific welding procedure specification (WPS)	Tests adherence to industry welding codes.	AWS Competitions	*Requires use of current Welding Standards.*
Fabrication Projects	Projects to fabricate components and assemblies as per specifications and standards	Showcases layout, cutting, fitting, and assembly skills.	SkillsUSA State/ Regional Competitions	*Emphasizes craftsmanship and problem-solving.*
Time-Based Projects	Focuses on completing tasks within a specified time limit	Evaluates efficiency, productivity, and time management under pressure.	AWS Professional Welder Competition	*Underscores time management while fostering friendly competition.*

5.3 Welding Competition Project Design

When designing welding projects for competitions, careful attention to project design is crucial as it directly influences competitors' work's complexity, scope, and assessment criteria Included below are critical elements that significantly impact the design of the welding project.

5.3.1 Base Material. The cost of materials for the project must be carefully considered. Carbon steel is the most practical choice for most projects, though including other materials is encouraged where feasible. Most of the project should utilize carbon steel, with stainless steel and aluminum incorporated as appropriate. Once the material requirements are defined, the test project should be formally documented.

5.3.2 Preparation of Materials. Material preparation is critical to ensuring the quality and accuracy of the welding process, allowing competitors to focus on their skills without material-related issues while promoting fairness and consistency across the competition. When designing a project, consider all material preparation factors and constraints to ensure the smooth execution of the welding competition.

5.3.3 Welding Processes. Choosing the appropriate welding processes for competitions is essential to ensure fairness, relevance, and the effective assessment of competitors' skills and abilities. In the welding competition environment, selecting welding processes plays a crucial role in providing competitors with opportunities to showcase their proficiency and versatility in various welding techniques.

(1) Prioritize safety considerations when selecting welding processes.

(2) Ensure the welding process aligns with the project requirements and competition objectives.

(3) Select welding processes that complement each other and allow competitors to showcase their versatility and proficiency in multiple techniques.

(4) Welding process selection is crucial–it directly influences the outcome and assessment of competitors' skills and abilities in each project type.

5.3.4 Filler Materials. Selecting the appropriate welding filler material significantly impacts the welded joints' quality, integrity, and performance, thereby directly influencing the competitiveness and success of welding competition competitors. Considerations should be taken when identifying type, diameter, etc.

5.3.5 Project Type: The specific requirements and objectives of the welding project dictate the choice of filler material. Different projects may require filler materials with specific properties, such as strength, corrosion resistance, or compatibility with base materials.

5.3.6 Base Material Compatibility: Filler material selection is influenced by the type of base material being welded. Compatibility between the filler and base material is crucial for achieving strong, durable welds with minimal risk of defects or failures.

5.3.7 Welding Technique: The welding technique used in the competition also impacts filler material selection. Certain welding processes may require specific types or forms of filler material to ensure proper fusion, deposition, and mechanical properties of the weld joint.

5.3.8 Project Weld Joint Geometry. When developing a project design for a welding competition, careful attention must be paid to weld joint geometry as it significantly influences the welding process, quality of the weld, and overall success of competitors. Consideration into different types of welding competition projects is necessary as weld joint geometry within the competition project ensures that competitors are challenged to demonstrate their welding skills in a variety of contexts, enhancing the competitiveness and educational value of the competition.

5.3.9 Common Types of Weld Joints. Developing a project that utilizes common weld joints, such as butt joints, lap joints, and fillet joints, is crucial as they can be strategically utilized to create diverse and challenging project designs that test competitors' skills and abilities across different welding techniques and scenarios.

5.3.10 Configuration of Weld Joints. Incorporating various weld joint configurations into competition projects allows competitors to showcase their proficiency in weld preparation, fitup, and welding techniques specific to each joint type, thereby providing a comprehensive assessment of their capabilities. Welding competition projects can be structured to simulate real-world welding scenarios and challenges, providing competitors with valuable opportunities for skill development and professional growth.

5.3.11 Welding Sequence. When designing welding projects for competitions, thoughtful consideration of the welding sequence is vital as it directly impacts competitors' welds' efficiency, quality, and success. The type of welding competition can influence the optimal welding sequence chosen for the project.

(1) **Station-Based competitions**, where competitors move between different welding stations to complete various tasks, the welding sequence should be organized to facilitate smooth transitions between stations while ensuring efficient use of time and resources.

(2) **Simultaneous Start competitions**, where competitors begin welding simultaneously, may require a welding sequence that allows all competitors to start their projects concurrently. These potentially necessitating tasks can be completed in parallel or staggered start times for different sections of the project.

(3) **Flow Through** competitions, where competitors progress through a series of welding stations or checkpoints, may benefit from a welding sequence that aligns with the flow of the competition, ensuring that competitors can seamlessly advance through each stage of the project without encountering bottlenecks or delays.

5.4 Welding Symbols

Clear and accurate welding symbols ensure consistency and precision in competition projects.

5.4.1 Requirements for Welding Symbols. Once the test or project requirements are established, a detailed drawing should be created using standard drafting practices to ensure accuracy and uniformity.

5.4.2 Standard Welding Symbols. Welding symbols, terms, and definitions should be in accordance with the latest American Welding Society standards (AWS A3.0 *Standard Welding Terms and Definitions* and AWS A2.4 *Standard Symbols for Welding, Brazing, and Nondestructive Examination*).

5.5 Dimensions and Tolerances

Define precise dimensions, tolerances, and joint types for each component of the project. Ensure all measurements are accurately documented and adhered to throughout the fabrication process. Properly defined joint types, such as butt joints, lap joints, or fillet joints, facilitate efficient welding competitions. Apply the latest standards for drawings and blueprints, including those set by ANSI, ISO, AWS, and ASME, to ensure consistency and clarity in design, dimensioning, and welding symbols, facilitating accurate interpretation.

5.6 Welding Procedure Specification (WPS)

When organizing welding competitions, careful consideration must be given to the Welding Procedure Specification (WPS), as it serves as the foundation for ensuring the quality, consistency, and integrity of welded joints produced by competitors. WPSs are extensively used in industry to establish standardized procedures for welding various materials, thicknesses, and joint configurations, making them an invaluable tool to introduce in a competition setting.

5.6.1 Documentation Practices. Welding Procedure Specifications (WPSs) should be written explaining how the project is to welded. The WPSs should be included or attached to the project drawing. Copies of the test project should be kept secure. Advance copies of the contest project should be kept to a minimum. See **Figure 5.5**.

5.6.2 Standard Welding Procedure Specifications. Any welding competition may use AWS Standard Welding Procedure Specifications (SWPSs). It is encouraged that qualified or standard welding procedure specifications (WPSs) are used. Implementation of these specifications aligns the competition practices with industry standards.

5.7 Workmanship Test Plates and Pipe.

When designing welding competitions, it's essential to carefully select the test plates and pipe to be used, as they serve as crucial elements in assessing competitors' welding skills and abilities. See Figure 5.1 and Figure 5.2.

5.8 Position of Test Welds

Proper classification of welding positions ensures fairness, standardization, and alignment with industry practices in competition settings.

5.8.3 Welding Position. Competition requirements for as welded positions. All welds that will be encountered in actual competition shall be classified as (1) flat, (2) horizontal, (3) vertical, or (4) overhead in conformance with the definitions of welding positions described in AWS A3.0M/A3.0:2026, *Standard Welding Terms and Definitions* or the latest version if desired.

5.8.4 Groove Weld Test Positions- Plate. Groove welds designated for competition shall use the following AWS defined welding positions. See Figure 5.1.

(1) Position 1G (Flat). The test plates shall be placed on an approximately horizontal plane and the weld metal shall be deposited from the upper side.

(2) Position 2G (Horizontal). The test plates shall be placed on an approximately vertical plane with the groove approximately horizontal.

(3) Position 3G (Vertical). The test plates shall be placed on an approximately vertical plane with the groove approximately vertical.

(4) Position 4G (Overhead). The test plates shall be placed on an approximately horizontal plane and the weld metal deposited from the underside.

5.8.5 Fillet Weld Test Positions. Fillet welds, plate, or pipe welded in the competition shall use the following AWS defined welding positions. See Figure 5.2.

(1) Position 1F (Flat). The test plates shall be so placed that each fillet weld shall be deposited from the upper side with its axis approximately horizontal and its throat approximately vertical.

(2) Position 2F (Horizontal). The test plates shall be so placed that each fillet weld shall be deposited on the upper side of the horizontal surface and against the vertical surface.

(3) Position 3F (Vertical). The test plates shall be placed in approximately vertical planes, and each fillet weld shall be deposited on the vertical surfaces.

(4) Position 4F (Overhead). The test plates shall be so placed that each fillet weld shall be deposited on the underside of the horizontal surface and against the vertical surface.

(5) Position 5F (Pipe Horizontal-Fixed)—The test pipe shall be placed with its axis approximately horizontal and the fillet approximately vertical. The pipe(s) or plate shall not be rotated during welding.

5.8.6 Groove Weld Test Positions- Pipe. Pipe welded in competition shall use the following AWS defined welding positions. See Figure 5.1.

(1) Position 1G (Pipe Horizontal-Rotated)—The test pipe shall be placed with its axis approximately horizontal and the groove approximately vertical. The pipe shall be rotated during welding to deposit the weld metal from the upper side.

(2) Position 2G (Pipe Vertical-Fixed)—The test pipe shall be placed with its axis approximately vertical and the groove approximately horizontal. The pipe shall not be rotated during welding.

(3) Position 5G (Pipe Horizontal-Fixed)—The test pipe shall be placed with its axis approximately horizontal and the groove approximately vertical. The pipes shall not be rotated during welding.

(4) Position 6G (Pipe Inclined-Fixed)—The test pipe shall be inclined at approximately 45° with the horizontal. The pipe shall not be rotated during welding.

5.9. Project Assembly and Orientation

Clear project assembly and orientation requirements are essential to ensure consistency, fairness, and adherence to competition. Defining welding positions, reference points, tack weld allowances, and inspection hold points help competitors navigate the process effectively while maintaining accuracy in evaluation.

5.9.1 Project Assembly. Competitors must be able to denote and identify the project orientation for welding during the competition.

5.9.2 Base Plate. Any project used in the competition should have a reference point or baseplate to establish the correct orientation for welding or information otherwise indicating the direction or position in which welding is performed.

5.9.3 Limited Welding Positions. In competition situations, like fabrication, the project assembly may be completed in multiple components. Limiting or identifying the position and direction in which the project and components are to be welded should be clearly stated in competition documents.

5.9.4 Tack Welds. The tack welding of a project or test plates for competition is typically allowed in any position or direction. Any restrictions or requirements necessary for the tack welding of projects or test plates should be clearly stated.

5.9.5 Hold Point(s). Hold points are designated stages within the welding process where work must be paused for inspection or approval before proceeding. Consider establishing key moments in the welding process, such as after preparation, before welding starts, or after a specific weld pass. The competition guidelines should clearly define hold points to ensure competitors understand when they must halt and undergo inspection.

5.10 Project Design Considerations

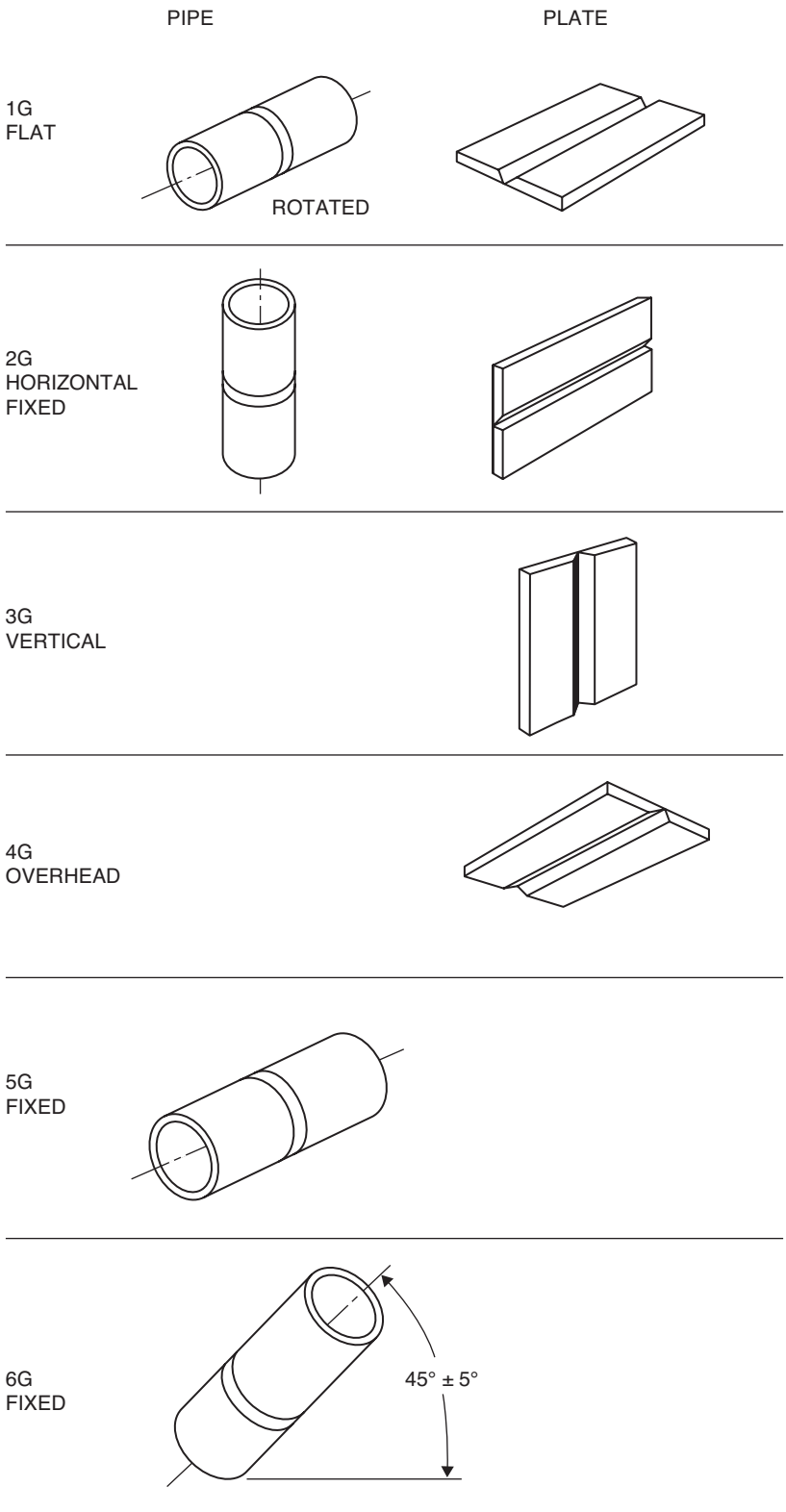
Effective project design ensures fair and challenging competition by aligning complexity with competitor skill levels while allowing for clear evaluation and scoring. Key considerations include weld placement, minimum weld count, visual accessibility, and testing feasibility to maintain accuracy and efficiency in judging.

5.10.1 Skill Level. Consider the skill level of the competitor with the design and weld placement to promote a challenging but competitive environment. See Appendices for sample projects of varying skill levels.

5.10.2 Minimum Number of Welds. To effectively implement a scoring system that identifies clear competition winners, the minimum number of welds on a project should be 8.

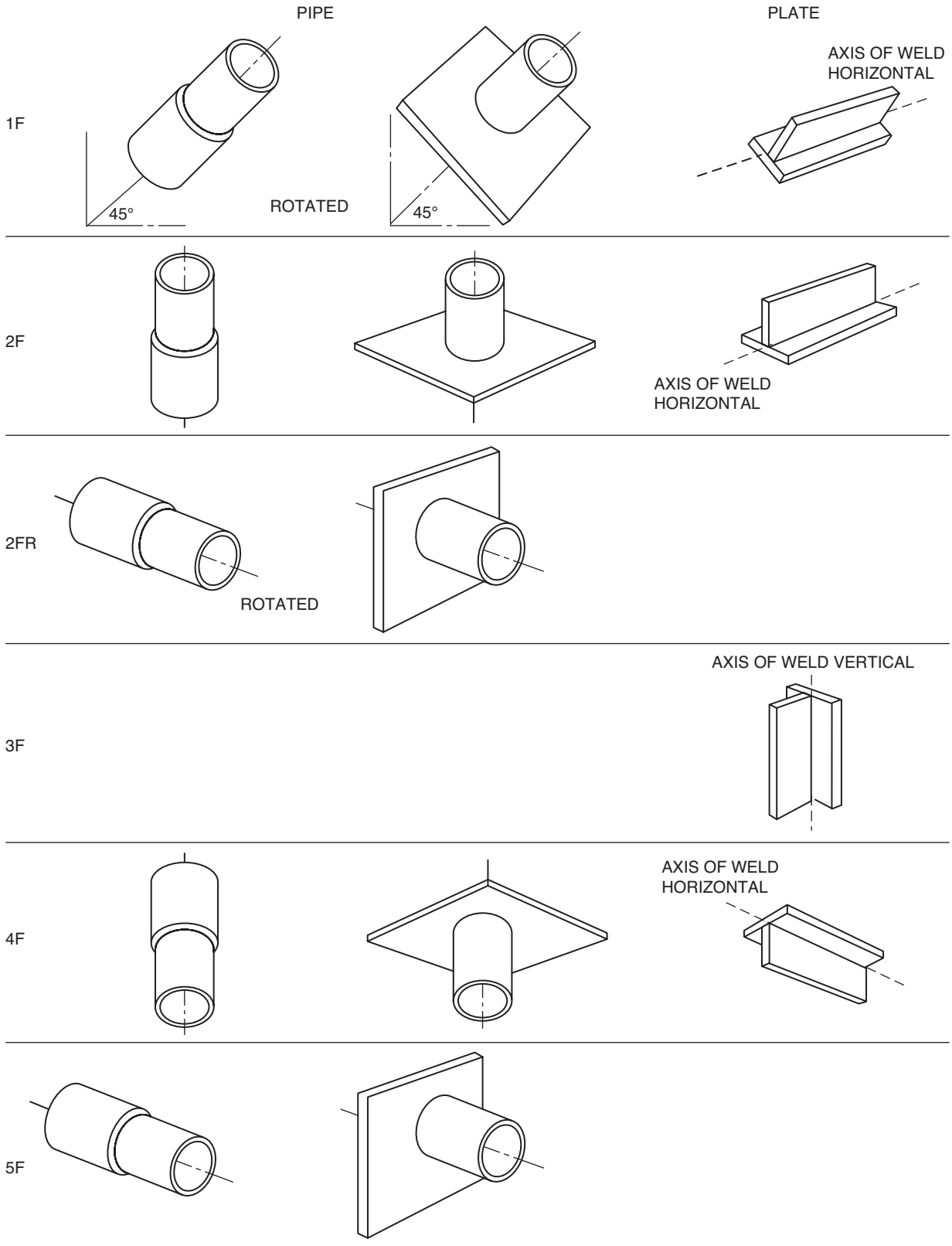
5.10.3 Visual Examination. Any project design should consider the visual examination of the welds and the instruments used in the evaluation. Designs that prohibit or limit the visual examination of welds often create challenges and bottlenecks in the scoring process.

5.10.4 Testing Requirements. If mechanical or nondestructive testing of a project is desired, the design must ensure that the examination can be conducted and adequately achieved.



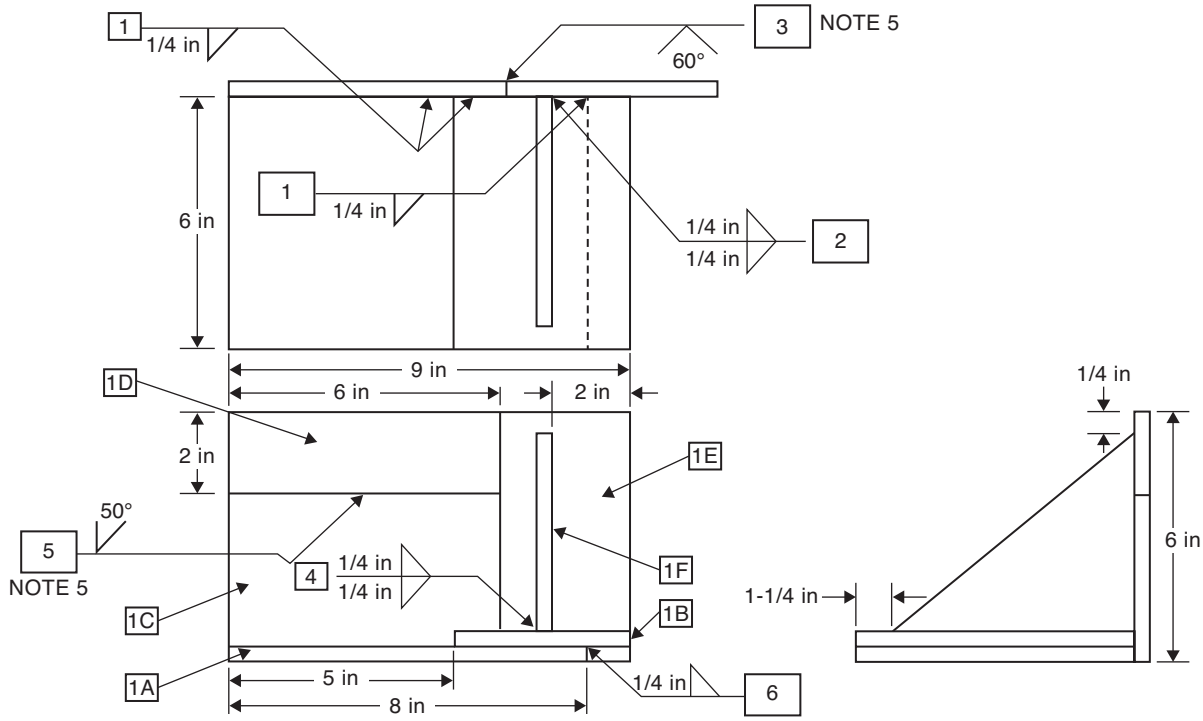
(Source: AWS B2.1)

Figure 5.1—AWS Defined Welding Positions for Plate and Pipe-Groove



(Source: AWS B2.1)

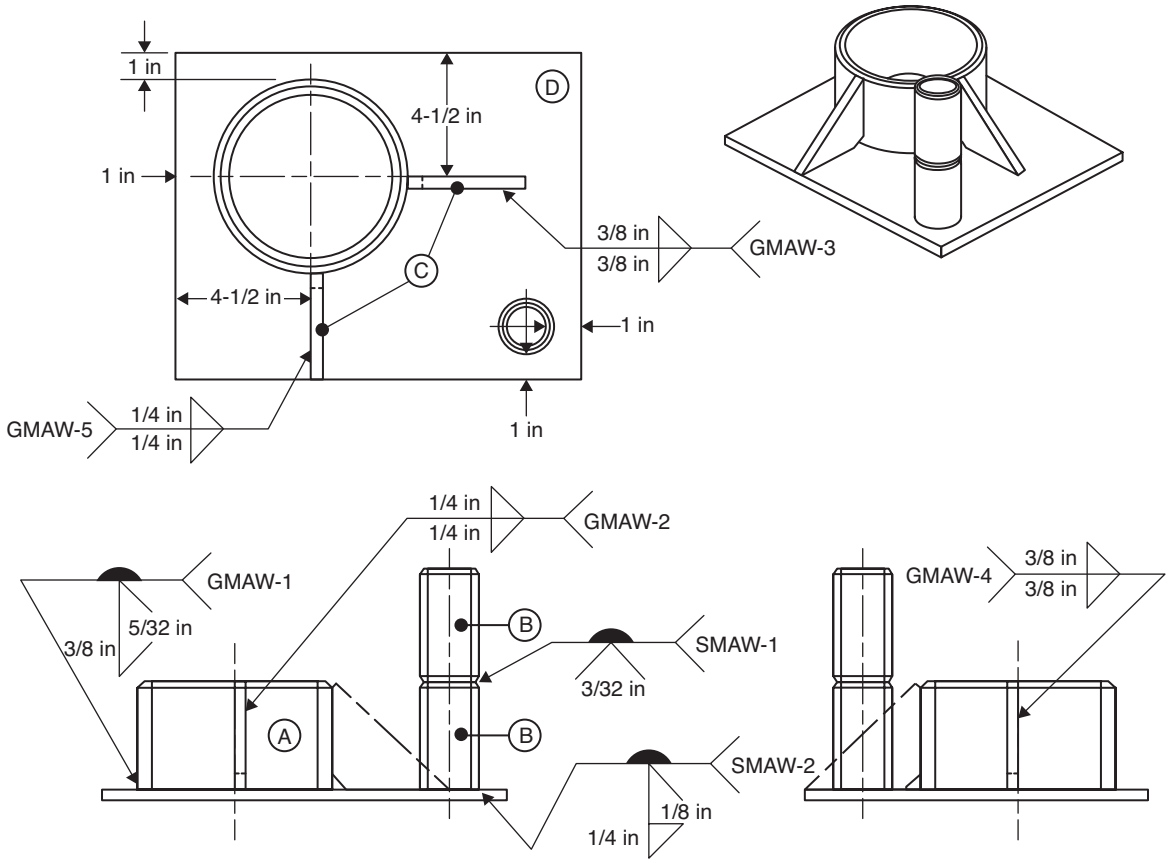
Figure 5.2—AWS Defined Welding Positions for Plate and Pipe-Fillet



NOTES:
1. All dimensions U.S. Customary Units. DRAWING IS NOT TO SCALE.
2. Fit and tack the assembly on bench before attaching to the assembly arm.
3. ALL WELDING DONE IN POSITION TO DRAWING ORIENTATION.
4. Employ boxing where applicate.
5. Melt thru not required.
6. Visual examination in accordance with the requirements of AWS QC-10, Table 1.

Part	Number Required	Welding Procedure
1A	1	0.045 in. E71T-1 electrode
1B	1	180–200 Amperes DCEP
1C	1	24–25 Volts
1D	1	200–275 imp wire feed speed
1E	1	75% Ar 25% CO_2 @ 35–40 CFH
1F	1	All vertical welds to be done uphill

(Source: AWS Recommended Procedures for Conducting a SkillsUSA Welding Contest)
Figure 5.3—Sample Single Process Project



NOTES:
Item A: 6 in. Schedule 80 4 in. long bevel ends.
Item B: 2 in. Schedule 80 4 in. long bevel ends.
Item C: 3/8 in. × 4 in. × 4 in. angle plate.
Item D: 3/8 in. × 12 in. × 14 in. carbon steel.

SMAW-1 & SMAW-2:
Root pass: 3/32 in. E-6010 Electrode, DCEP, 40–70 Amperes
Fill pass: 3/32 in. E-7018 Electrode, DCEP, 70–100 Amperes

GMAW-1 through GMAW-5:
0.035 in. E70S-6 wire
130–160 Amperes
200–270 ipm wire feed
18–20 Volts
75% Ar, 25% CO_2 @ 35–45 CFH

(Source: AWS Recommended Procedures for Conducting a SkillsUSA Welding Contest)
Figure 5.4—Sample Combination Process Project

5

SkillsUSA

SkillsUSA

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Welding Procedure Specification

WPS 108

WPS No. WPS 108 Revision 2 Date 1/03/2023 By CRV

Authorized By EN Date 4/19/2016 Prequalified ■

Welding Process(es) FCAW-G Type: Manual ☐ Machine ☐ Semi-Auto ■ Auto ☐

Supporting PQR(s) Prequalified

JOINT

Type T-Joint, Butt, Flanged

Backing Yes ☐ No ■ Single Weld ■ Double Weld ■

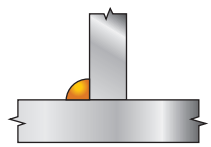
Backing Material N/A

Root Opening 0 Root Face Dimension N/A

Groove Angle N/A Radius (J-U) N/A

Back Gouge Yes ☐ No ■

Method N/A



BASE METALS

Material Spec. A-36 to A-36

Type or Grade to

Thickness: Groove ( ) Unlimited - NA

Fillet (in) Unlimited -

Diameter (Pipe,) N/A - N/A

FILLER METALS

AWS Specification A5.20

AWS Classification E71T-1

SHIELDING

Flux N/A

Electrode-Flux (Class) N/A

Gas

Composition 75%Argon/25%CO_2

Flow Rate 35-45 CFH

Gas Cup Size 1/2″ - 3/4″

PREHEAT

Preheat Temp., Min. 60 Deg.F

Thickness Up to 3/4″ Temperature N/A

Over 3/4″ to 1-1/2″ N/A

Over 1-1/2″ to 2-1/2″ N/A

Over 2-1/2″ N/A

Interpass Temp., Min. N/A Max. N/A

POSITION

Position of Groove All Fillet All

Vertical Progression: ■ Up ☐ Down

ELECTRICAL CHARACTERISTICS

Transfer Mode (GMAW):

Short-Circuiting ☐ Globular ☐ Spray ☐

Current: AC ☐ DCEP ■ DCEN ☐ Pulsed ☐

Other N/A

Tungsten Electrode (GTAW):

Size N/A Type N/A

TECHNIQUE

Stringer or Weave Bead Both

Multi-pass or Single Pass (per side) Multiple/Single

Number of Electrodes 1

Electrode Spacing: Longitudinal N/A

Lateral N/A

Angle N/A

Contact Tube to Work Distance 1/2″ to 3/4″

Peening N/A

Interpass Cleaning Chip slag and wire brush

POSTWELD HEAT TREATMENT PWHT Required ☐

Temp. N/A Time N/A

WELDING PROCEDURE

Layer/Pass	Process	Filler Metal Class	Diameter	Cur. Type	Amps	Volts	Travel Speed	Other Notes
All	FCAW-G	E71T-1	0.045	DCEP	200-260	20-26	5-12	WFS:200-500ipm

(Source: Recommended projects & scoring criteria.)

Figure 5.5—Sample Project Welding Specification Procedure

6. Judging Requirements and Structure

6.1. Scope and Objectives

The role of a welding competition judge encompasses evaluating weld quality, verifying adherence to specifications and safety standards, applying technical expertise, and ensuring a fair and impartial assessment of participants. Judges are tasked with recognizing talent, providing constructive feedback, upholding professional and ethical standards, and serving as an educational resource for competitors to foster growth and learning.

While most welding and fabrication codes define acceptable discontinuities and tolerance ranges, welding competitions elevate these benchmarks to create a more challenging environment. Competitions emphasize precision, craftsmanship, and technical excellence by requiring adherence to stricter criteria beyond industry welding code. This approach not only ensures a high level of performance but also allows for clear and measurable differentiation among competitors, facilitating objective ranking.

Judging in this context relies on a structured rubric with quantifiable scoring methods to ensure consistency, transparency, and fairness. These elevated guidelines facilitate the identification of top-performing participants, resulting in a clear and objective ranking of winners. For a competition to be effectively scored, a robust framework of ethics and qualified judging personnel must first be established.

6.2. Judging Personnel

Judging personnel are responsible for the technical welding expertise to interpret and comply with the welding competition. Individuals assigned the task of performing formal visual examinations should be qualified. The three elements of qualification may include education, training, and experience. Since visual examination requires the ability to see small discontinuities or imperfections, good visual acuity is also desirable.

It should be specified by the competition host or the oversight body (i.e., the competition committee) to identify and communicate the qualifications required to judge the competition. The individual(s) in this role may be volunteer or contracted and should possess one of the following qualifications:

6.2.1 AWS Certified Welding Inspector (CWI). Current certification as an AWS Certified Welding Inspector (CWI) or Senior Certified Welding Inspector (SCWI) in compliance with AWS QC1 *Standard for AWS Certification of Welding Inspectors*.

6.2.2 Appointed Personnel. An individual who, by training or experience, or both, in metals fabrication, inspection, and testing, is competent to perform inspection of the work. The individual examining the welds should be familiar with the principles and methods of visual examination outlined in the latest edition of AWS B1.11 *Guide for the Visual Examination of Welds.*

6.2.3 Competition Alumni. Former Welding Competitors, by experience at a level deemed appropriate for judging activities. The individual examining the welds should be familiar with the principles and methods of visual examination outlined in the latest edition of *AWS B1.11 Guide for the Visual Examination of Weld* and the concepts within this guideline.

6.3. Hierarchy of Competition Oversight

Establishing a clear hierarchy for welding competition oversight is essential to ensure effective management, promote fairness, maintain safety standards, and deliver a seamless and professional event experience for all participants. Identified in 6.3 are suggested roles and responsibilities for competition oversight and management. See Figure 6.1 for the flowchart.

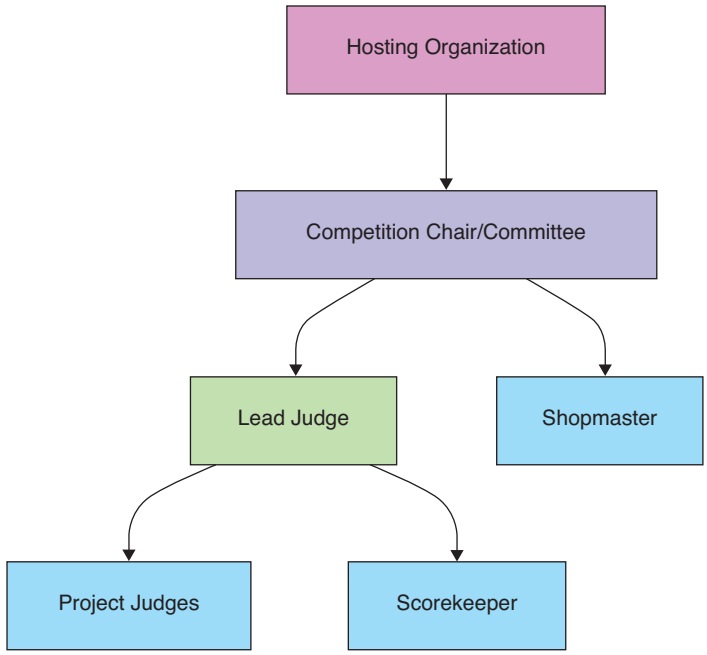


Figure 6.1—Competition Hierarchy by Role

6.3.2 Hosting Organization. The designated organization is responsible for organizing, hosting, and coordinating all aspects of the competition, including oversight of the event and associated liabilities.

6.3.2.1 Event and Liability Management: The hosting organization assumes full responsibility for the event, including legal and financial liabilities.

6.3.2.2 Safety Oversight. The hosting organization is tasked with ensuring all safety measures are in place. This includes monitoring competitors' adherence to ANSI Z49.1 *Safety in Welding, Cutting, and Allied Processes* and verifying the proper use of personal protective equipment (PPE).

6.3.3 Competition Chair or Committee. The individual or group responsible for the direct management of the competition, ensuring the competition runs smoothly and aligns with established rules.

6.3.3.1 Competition Management. The chair or committee is responsible for overseeing the competition's operations, including judging, maintaining order, and ensuring that all participants are competing fairly.

6.3.3.2 Awards Ceremony. The chair or committee is responsible for organizing and presenting awards and certificates to winning competitors at the closing ceremony. See 8.1.

6.3.3.3 Safety Oversight and Management. In collaboration with the hosting organization, the chair or committee ensures all safety protocols are followed, including monitoring competitor adherence to *ANSI Z49.1 Safety in Welding, Cutting, and Allied Processes* and proper use of PPE.

6.3.4 Lead Judge: The Lead Judge oversees competition scoring operations, ensures adherence to rules and guidelines, manages judge training, and resolves disputes, ensuring fair and efficient competition. Additionally, the Lead Judge serves as the main contact with the Competition Chair, facilitating communication and coordination between the judging team and competition organizers. Lead judge responsibilities may include:

6.3.4.1 Competition Coordination. Ensure the smooth operation of the competition, coordinating with other judges, competitors, and event staff.

6.3.4.2 Rules and Guidelines. Familiarization with the competition rules and guidelines, and ensuring all judges are aware of and adhere to them.

6.3.4.3 Judging Criteria. Oversee the judging criteria and scoring system to ensure consistency and fairness.

6.3.4.4 Judge Training. Provide training and guidance to other judges, ensuring they understand the competition guidelines and scoring metrics.

6.3.4.5 Safety. Promote and enforce safety measures and best practices throughout the competition. Monitor the safety practices of competitors, ensuring they follow *ANSI Z49.1 Safety in Welding, Cutting, and Allied Processes* and use personal protective equipment correctly.

6.3.4.6 Dispute Resolution. Responsible for handling any disputes or appeals arising within the competition or scoring team and making final decisions regarding scoring outcomes.

6.3.4.7 Time Management. Monitor the competition schedule and ensure it runs on time.

6.3.4.8 Primary Point of Contact. Serve as the primary point of contact for competitors and answer any questions or concerns they may have.

6.3.4.9 Scoring Review. Review and validate the scores and results provided by the project judges.

6.3.5 Scorekeeper. The Scorekeeper maintains detailed records of each project's evaluation, including photographs, measurements, and written assessments.

6.3.5.1 Point Totals. Accurately record and total points for each project, ensuring precision in calculating overall scores.

6.3.5.2 Ranking. Determine participant rankings based on total points, avoiding errors and ensuring transparent communication of final rankings.

6.3.5.3 Report Preparation. Thoroughly prepare reports for each project, including relevant details and presenting results with clarity.

6.3.5.4 Judging Criteria. Adhere to established judging criteria, apply metrics to maintain competition fairness, and collaborate with judges to address any criteria interpretation issues.

6.3.5.5 Scoring Collateral. Efficiently manage the distribution and collection of scoring tools or designated platforms, ensuring familiarity and addressing any issues during the competition.

6.3.5.6 Safety Oversight. Monitor the safety practices of competitors, ensuring they follow *ANSI Z49.1 Safety in Welding, Cutting, and Allied Processes* and use personal protective equipment correctly.

6.3.6 Project Judge. Project Judges assess competitors' welding projects, provide constructive feedback to the lead judge, assign scores, and maintain fairness and quality control throughout the competition. Project judge responsibilities:

6.3.6.1 Evaluation. Assess the competitors' welding projects based on established processes and metrics, including weld quality, workmanship, and compliance with competition criteria.

6.3.6.2 Documentation. Keep detailed records of each project's evaluation, including photographs, measurements, and written assessments.

6.3.6.3 Feedback. Provide constructive feedback to lead judge after evaluating competition projects, offering suggestions for improvement.

6.3.6.4 Scoring. Assign scores to each project, following the established criteria.

6.3.6.5 Fairness. Ensure fairness and impartiality in the judging process, treating all competitors equally.

6.3.6.6 Quality Control. Identify any discrepancies or non-compliance issues with the welding projects and report them to the lead judge.

6.3.6.7 Communication. Collaborate with the lead judge, scorekeeper, and shopmaster to maintain clear and efficient communication during the competition.

6.3.6.8 Safety Oversight. Monitor the safety practices of competitors, ensuring they follow ANSI Z49.1 *Safety in Welding, Cutting, and Allied Processes* and use personal protective equipment correctly.

6.3.7 Shopmaster. The Shopmaster assists competitors with equipment setup, monitors safety practices, manages materials, and ensures the welding booths' smooth functioning during the competition. Shopmaster responsibilities:

6.3.7.1 Welding Station Setup. Prepare welding booths with the necessary equipment, materials, and safety measures before the competition begins.

6.3.7.2 Competitor Assistance. Provide assistance to competitors as needed and address technical issues.

6.3.7.3 Safety Oversight. Monitor the safety practices of competitors, ensuring they follow ANSI Z49.1 *Safety in Welding, Cutting, and Allied Processes* and use personal protective equipment correctly.

6.3.7.4 Equipment Maintenance. Ensure the proper functioning and maintenance of welding equipment throughout the competition.

6.3.7.5 Material Handling. Manage the distribution and control of welding materials and consumables, ensuring they are readily available to competitors.

6.3.7.6 Communication. Relay information between the competitors and the judging team, including updates on competition progress and issues that may arise.

6.3.7.7 Timekeeping. Assist in keeping track of time during the competition, such as monitoring welding durations and notifying competitors of time limits.

6.4. Competition Personnel Duties

Judging personnel shall be responsible for all competition inspections and judging criteria. The Lead Judge and Project Judges should identify scheduling and examination processes for the competition. These examinations fall into three categories based on the time they are performed, as follows: (1) prior to competition, (2) during competition, and (3) after competition. See Table 6.1 for a checklist of duties by role.

6.4.1 Prior to Competition. Prior to competition, some typical action items requiring attention by the Lead Judge should include the following:

6.4.1.1 Audit Drawings and Specifications. Ensure all weld symbols and dimensions are adequate for competition and adhere to AWS A2.4: *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, AWS A3.0M/A3.0:2026: *Standard Welding Terms and Definitions*, etc. Examine fitment and alignment of joints in accordance with drawings. See **Figure 6.2**.

6.4.1.2 Verify Material and Consumables. Confirm that the materials and consumables match those specified. Examine base material and ensure correct materials and grain direction are correct.

6.4.1.3 Verify Welding Procedure. Ensure welding procedures match drawings and competition facilities can accommodate welding requirements. All welding procedures should be accessible and clearly defined. See 5.6.

6.4.1.4 Establish and Verify Hold Points. Assign appropriate scoring criteria to evaluate competition project and any necessary hold points for in-process inspection.

6.4.1.5 Documentation Plan. Provide scoresheets, drawings, booklets, etc., for all competition oversight personnel and competition participants.

6.4.1.6 Scorekeeping Protocol. The scorekeeper should have a method in place to accumulate scores from judges and accurately rank and report competition outcomes. See 7.12.

6.4.2 During Welding. During welding, some typical action items requiring attention by those responsible for weld quality should include the following:

6.4.2.1 Verify Conformance. Ensure competitors are adhering to Welding Procedure Specifications (WPS), processes, position, and progression of weld to the conformance to drawing or scoring criteria. Enforce safety protocol and measures.

6.4.2.2 In-Process Examination. Examine any finished weld(s) to scoresheet criteria or any finishing or grinding requirements and conformance to any hold points.

6.4.3 After Welding. Following welding, some typical action items requiring attention by the visual examiner and judging team should include the following:

6.4.3.1 Weld Quality and Dimensional Verification. Evaluate weld surface quality based on established criteria and verify weld and project dimensions for accuracy. This includes any necessary mechanical or nondestructive testing.

6.4.3.2 Documentation and Reporting. Review and document any remarks or findings and report results through the appropriate scoresheet. See 7.12.

Table 6.1
Competition Personnel Duties, see 6.4

Criteria/Duties	Competition Chair	Scorekeeper	Lead Judge	Shopmaster	Project Judges
Review drawings and specification: Ensure all weld symbols and dimensions are adequate for competition and adhere to AWS 2.4, 3.0 etc.	X		X		
Verify material and consumables: Confirm that the materials and consumables match those specified.	X		X		
Verify welding procedure: Ensure welding procedures match drawings and competition facilities can accommodate welding requirements.	X		X	X	
Establish examination points: Assign appropriate scoring criteria to evaluate competition project and any necessary hold points for in-process inspection.	X	X	X		
Establish documentation plan: Provide scoresheets, drawings, booklets, etc.	X	X	X		
Scorekeeping: The scorekeeper should have a method in place to accumulate scores from judges and accurately rank and report competition outcome.	X	X			
Examine base material: Ensure correct materials and grain direction is correct.	X		X	X	X
Examine fitup and alignment of joints.	X				X
Review welding consumables and welding equipment.	X		X	X	X

6.5. Ethics

Ethics are the cornerstone of competition; all individuals involved in judging and scoring must have an unbiased approach to their role. For the successful execution of a welding competition, qualified judging personnel should express:

6.5.4 Conflict of Interest. Judges must disclose and avoid any potential conflicts of interest, such as relationships with competitors, to maintain impartiality and uphold the competition's integrity.

6.5.5 Confidentiality. Information related to scoring, competitor performance, or judging criteria should be kept confidential to protect the fairness of the competition and the privacy of participants.

6.5.6 Consistency in Scoring. Judges must apply scoring criteria uniformly across all competitors, ensuring fairness and transparency. Regular calibration sessions or training can help achieve this consistency.

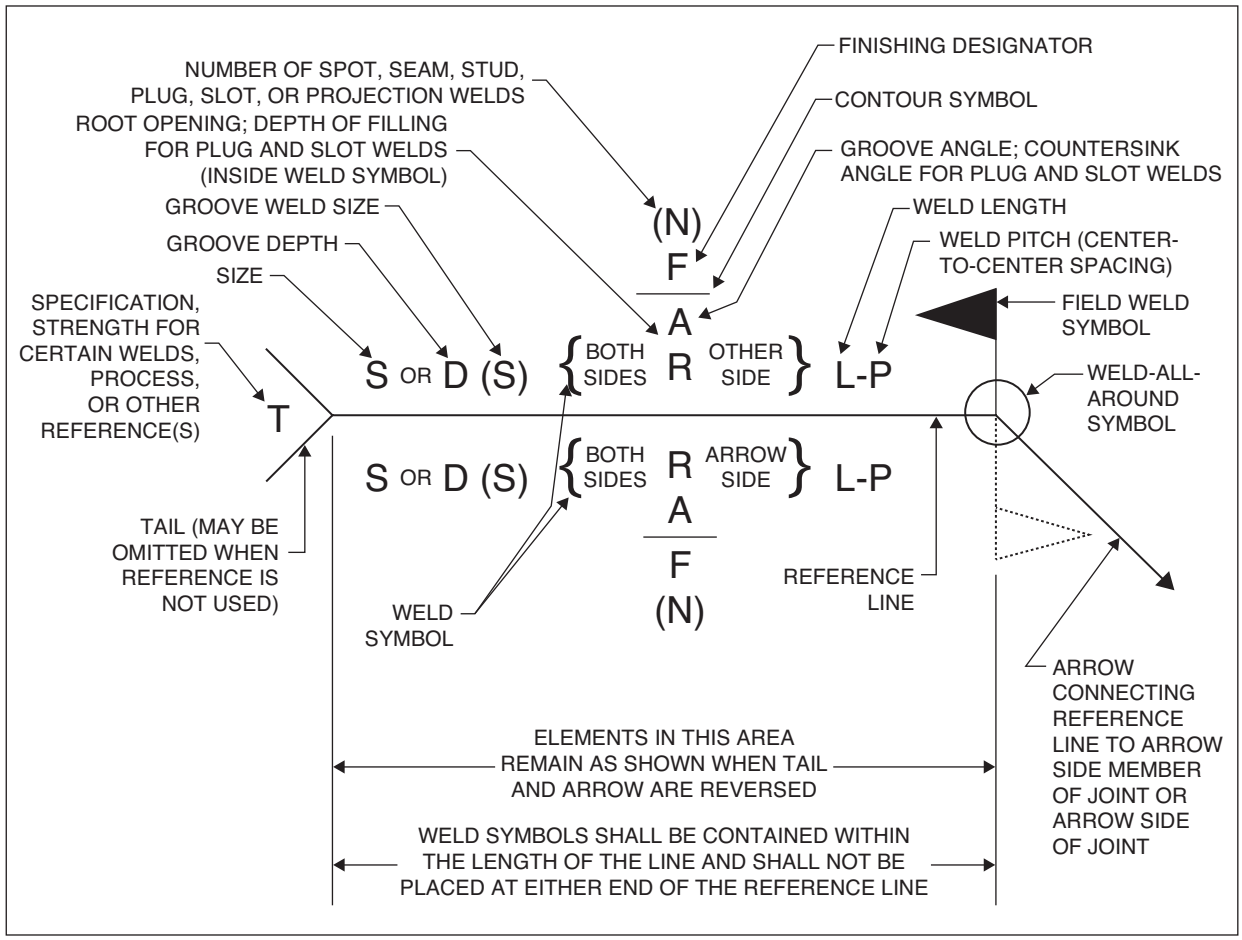
6.5.7 Professional Conduct. Judges should demonstrate professionalism in interacting with competitors, fellow judges, and organizers, fostering a respectful and supportive competition environment.

6.5.8 Documentation of Decisions. All scoring and decisions should be thoroughly documented, providing an audit trail that can be reviewed in case of disputes or appeals.

6.5.9 Accountability. Judges should take responsibility for their scoring decisions and be prepared to justify them based on the established criteria. This accountability reinforces the credibility of the competition.

6.5.10 Ethical Leadership. Judges should serve as role models for ethical behavior, setting a high standard of integrity and impartiality for all participants and stakeholders.

6.5.11 Fair Appeal or Grievance Process. A clear and fair process for addressing disputes or appeals should be established, ensuring that any concerns regarding scoring or decisions are resolved transparently and equitably. See 4.12 for Grievance Procedures.



(Source: AWS Welding Inspection Technology 6th Edition)
Figure 6.2—AWS Standard Welding Symbol Elements

7. Scoring and Evaluation

7.1 Scope and Objectives

In aiming for equitable standards across all welding competitions, this clause offers direction and suggestions to facilitate the implementation of an ethical and efficient scoring model. The objective is to emphasize best practices that align harmoniously to establish shared scoring criteria. Recognizing the distinct circumstances of each competition, this guide provides a toolbox and structured approach to managing welding competitions across all levels. By integrating fast, fair, defendable, consistent, statistical quality analysis, this approach quantifies welding skills effectively, ensuring that the evaluation process is objective and reliable.

This clause specifies best practices and methods for scoring and evaluating welds in competition. Effective scoring and judging criteria that can be used to establish the critical framework for the evaluation process are outlined.

7.2 Visual Inspection and Scoring of Weld Surface Quality

Judging personnel are responsible for visually examining the weld surface to verify the weld profile meets the acceptance criteria specified by the scoring documents. Table 7.1 offers a range of suggested metrics for the evaluation of welds in competition. Workmanship best practices may address such items as surface roughness, weld spatter, and arc strikes.

7.2.1 Minimum Number of Welds for Scoring. All projects designed for competition should offer a minimum of 1 weld for evaluation and scoring. As the number of scored welds increases, the competition evaluation becomes more refined. This will result in a clearer, defined tier of competition winners.

7.2.2 Minimum Number of Scoring Metrics. All projects should have a minimum of 8 Visual Acceptance metrics aggregated from Table 7.1. It is up to the competition committee to select and identify those metrics used during evaluation.

7.2.3 Intended Use and Selection of Metrics. Tables 7.1, 7.2, and 7.3 serve as glossaries of common visual inspection metrics, thus allowing the competition oversight to select those that best align with the specific requirements and objectives of the contest. This flexibility enables the implementation of relevant metrics, such as surface roughness, weld spatter, arc strikes, etc., for a tailored and efficient assessment process. It is not intended for all the metrics listed in these tables to be used in a single competition.

7.3 Discontinuities

Many discontinuities can be found by visual examination of the completed weld. Reference should be given to AWS A3.0M/A3.0:2026, *Standard Welding Terms and Definitions;* AWS B1.10, *Guide for the Nondestructive Examination of Welds*; and AWS B1.11, *Guide for the Visual Examination of Welds* for additional context and identification of defects and discontinuities in welds. The following are typical discontinuities found at the surface of weld:

(1) Porosity

(2) Incomplete fusion

(3) Incomplete joint penetration

(4) Undercut

(5) Underfill

(6) Overlap

(7) Cracks

(8) Metallic and nonmetallic inclusions

(9) Workmanship and cleanliness

7.4 Minimum Weld Deposit Requirements Before Examination

If any of the following is exhibited, then all evaluation criteria assigned to the weld shall be zero or disqualified from further scoring:

7.4.1 Slag. If slag is present and prevents weld examination.

7.4.2 Weld Location. If the deposited weld is not located as specified by the weld symbol; i.e., if a weld is deposited on the arrow side vs. the other side.

7.4.3 Weld Progression. If the deposited weld is performed in the incorrect progression as specified. i.e., Uphill vs Downhill.

7.4.4 Welding Process. If the deposited weld is completed using the incorrect process.

7.4.5 Incomplete Weld. Any weld not meeting specified length requirements except intermittent welds, i.e., an unfinished weld that resulted from time constraints.

7.4.6 Discretional Omission. Any weld deposited that violates competition rules or is identified by the judging body to be excluded from scoring to ensure an ethical competition, i.e., a weld performed unsafely, drawing or blueprint errors, weld deposited after time called, etc.

7.5 Weld Cleaning

If required for a competition environment, any of the following criteria should be used during the evaluation of welded projects for scoring. Any weld not meeting the criteria should be marked zero points:

7.5.1 Root and Fill Pass Cleaning. Cleaning between weld passes shall be limited to hand chipping and hand wire brushing or power wire brushing.

7.5.2 Cleaning Position. Weld cleaning shall be done in the same position as the welding position specified in the competition.

7.5.3 Grinding and Finishing. Unless specified, using power tools to perform chipping, grinding, or cutting on root or intermediate weld passes shall be prohibited. Power chippers or angle grinders shall not be used during the competition. Except as otherwise:

(1) Upon weld test completion and after visual inspection, the weld may be flushed by power tools as necessary in order to facilitate testing.

(2) The preparation and layout of materials prior to welding.

7.6 Visual Acceptance Criteria

Clear and consistent visual acceptance criteria ensure objective evaluation of weld quality in competition settings. Utilizing standardized inspection methods and scoring metrics promotes fairness and aligns with industry best practices.

7.6.1 Visual Examination. All welds subjected to visual examination for project judging shall be inspected for defects and discontinuities. When acceptable, the project drawing and scoresheet should include assigned identification or Weld Numbers in coordination with the metrics for evaluation. All welds need not be scored if desired or specified; a minimum of 8 scoring metrics is recommended.

7.6.2 Substitutions. Table 7.1 Visual Acceptance Criteria scoring metrics can be substituted if desired. The visual acceptance criteria utilized should be sourced from a suitable welding standard.

7.7 Destructive Testing

7.7.1 Visual Examination. All groove welds subjected to guided bend tests shall meet the requirements of Table 7.3.

7.7.2 Guided Bend Tests. Guided bend test specimens shall be prepared by cutting the test plate as shown in **Figure 7.1**, whichever is applicable, to form specimens approximately rectangular in cross-section. The specimens shall be prepared for testing in conformance with Figures 7.11 or 7.12, as applicable.

7.7.3 Root, Face, and Side Bend Specimens. Each specimen shall be bent in a bend test jig that meets the requirements shown in Figure 7.1, and the maximum bend radius is not exceeded. Any convenient means may be used to move the plunger member in relation to the die member.

7.7.4 Specimen Placement. The specimen shall be placed on the die member of the jig with the weld at midspan. Face bend specimens shall be placed with the face of the weld directed toward the gap. Root bend and fillet weld soundness specimens shall be placed with the root of the weld directed toward the gap. Side bend specimens shall be placed with that side showing the greater discontinuity, if any, directed toward the gap.

7.7.5 Weld and HAZ Placement. The plunger shall force the specimen into the die until the specimen becomes U-shaped. After testing, the weld and HAZ shall be centered and completely within the bent portion of the specimen.

7.7.6 Wraparound Jig. When using the wrap-around jig, the specimen shall be firmly clamped on one end so that there is no sliding of the specimen during the bending operation. After testing, the weld and HAZ shall be completely in the bent portion of the specimen. Test specimens shall be removed from the jig when the outer roll has been moved 180° from the starting point.

7.7.7 Root, Face, and Side Bend Tests. The convex surface of the bend test specimen shall be visually examined for discontinuities. For evaluation, see Table 7.4.

7.7.8 Fillet Weld Macroetch Test. Macroetch test specimens, when inspected visually, shall be evaluated using criteria established in Table 7.4.

7.7.9 Fillet Weld Break Test. Fillet Weld Break test specimens, when inspected, shall conform to the following requirements:

(1) **Visual Examination.** To pass the visual examination, the fillet weld shall present a reasonably uniform appearance and shall be free of overlap, cracks, and excessive undercut. There shall be no porosity visible on the surface of the weld.

(2) **Fracture Surface.** The specimen shall receive full points if the test bends flat upon itself. If the fillet weld fractures, the fractured surface shall show complete fusion into the root of the joint. Evaluation of the fractured surface shall conform to the criteria of Table 7.4.

7.8 Nondestructive Examination (NDE) Acceptance Criteria

7.8.1 Acceptance Criteria. Specifying the maximum allowable indications for various welding discontinuities detected through radiographic and ultrasonic inspection methods is welcomed in welding competitions. Acceptance thresholds are detailed for cracks, porosity, incomplete fusion, foreign inclusions, and measurable discontinuities based on their type, size, and frequency. See Table 7.4.

7.8.2 Combination of Metrics. For evaluation, the metrics outlined in Table 7.4 may be combined into a single scoring mark if desired. This approach allows for a consolidated assessment of welding discontinuities, including cracks, porosity, incomplete fusion, foreign inclusions, and measurable discontinuities, based on their type, size, and frequency as detected through radiographic and ultrasonic inspection methods.

7.9 Welder Certification

The issue of welder certifications during a welding competition is a viable inclusion and an impactful opportunity for competitors. If welder certifications or qualifications are issued, the competition must meet the performance testing and evaluation requirements established within an appropriate welding standard. See Limitations 1.2.

7.10 Scoring Documentation and Reporting

7.10.1 Scoresheets. Scoresheets are written documents that report individual competitor results in a competition. They are essential for ensuring transparency, fairness, and clarity in the evaluation process. The content of the scoresheet should contain sufficient details to provide the reader with a clear, concise, yet complete understanding of the competitor's performance and competition results. It should also allow the extent of the examination and the findings to be reconstructed if necessary. The Scoresheet serves a critical purpose in competition:

(1) **Documentation of Results**. Provides a formal record of each competitor's performance. Ensures that results are clearly documented and easily accessible for post-competition review. Competition judging personnel are responsible for completing the scoresheet and executing the scoring process from the result data collected.

(2) **Transparency and Fairness.** Promotes confidence in the competition process by outlining how scores were determined. Demonstrates impartiality through consistent application of scoring criteria.

(3) **Feedback for Competitors.** Offers detailed insights into performance, highlighting strengths and areas for improvement. It serves as a learning tool for participants to refine their skills.

(4) **Validation of Judging Process.** It serves as evidence that judges adhered to formalized evaluation criteria. Allows competition organizers to verify consistency and accuracy in scoring.

(5) **Reconstruction of Findings.** Ensures that the details of the evaluation process can be retraced for quality assurance or dispute resolution. Provides a reference for analyzing trends or patterns in competitor performance.

(6) **Support for Recognition and Awards.** Provides the basis for determining rankings and awarding distinctions. Ensures that merit-based decisions are justified and well-documented.

An example of a scoresheet format is in Annex A.

7.11 Scoresheet Development

Developing a comprehensive scoresheet is critical to establishing a fair and effective scoring rubric. The scoresheet should align with the competition's goals and evaluation criteria and provide clear, concise, and actionable feedback for competitors. The following process outlines the steps to create an effective scoresheet that aligns with industry standards and competition guidelines:

7.11.1 Define the Purpose of the Scoresheet. Clearly articulate the primary goals of the competition and how the scoresheet will support these objectives:

(1) Determine the key outcomes to be documented, such as individual performance, adherence to standards, and areas for improvement.

(2) Ensure the scoresheet serves as a transparent and detailed record of evaluations, enabling reconstruction of findings.

7.11.2 Identify Scoring Categories. Develop scoring categories that reflect the core competencies being assessed, such as:

(1) Visual inspection (e.g., weld appearance and profile).

(2) Dimensional accuracy (e.g., adherence to tolerances).

(3) Safety compliance (e.g., proper use of PPE).

(4) Adherence to Welding Procedure Specification (WPS).

(5) Time management and efficiency.

(6) Knowledge and Theory examination

(7) Base evaluation categories on established guidelines, such as Table 7.1 Visual Acceptance Criteria or AWS standards.

7.11.3 Determine Weightings and Point Allocation. Assign appropriate weights or maximum points to each scoring category based on its importance in the competition:

(1) Ensure the total possible score reflects the competition's emphasis on craftsmanship, precision, and compliance.

(2) Effectively weigh and allocate points and scores through applicable conversion or calculation. See Annex D for example.

7.11.4 Create a User-Friendly Layout. Format the scoresheet with clear sections for each category, including:

(1) Category Name.

(2) Maximum Points.

(3) Judge's Score.

(4) Comments/Feedback.

(5) Use a structured table format to enhance readability and consistency.

(6) Incorporate a summary section for total scores, rankings, and judge signatures.

7.11.5 Include a Detailed Rubric. Provide specific criteria for each category to guide judges in assigning scores.

(1) Ensure criteria are measurable, objective, and aligned with competition guidelines.

(2) Clearly defined scoring marks.

(3) Include any references or instructions for conducting the examination.

7.11.6 Test and Validate the Scoresheet. Conduct a mock evaluation using the scoresheet to identify potential gaps or ambiguities:

(1) Gather feedback from judges to ensure the scoresheet is intuitive and practical.

(2) Adjust weights, criteria, or formatting based on trial outcomes.

(3) Train judges on how to use the scoresheet, emphasizing consistent application of scoring criteria.

(4) Conduct calibration sessions to align scoring practices and reduce subjective variability.

7.11.7 Incorporate Digital Tools (If Applicable). Utilize tools such as ZipGrade or similar platforms to streamline scoring and automate calculations. Ensure digital scoresheets are compatible with manual backups for redundancy. See Annex H.

7.11.8 Document and Distribute. Finalize the scoresheet and provide copies to judges and competition officials. Sharing a summary of scoring criteria with participants is encouraged to promote transparency.

Table 7.1
Visual Acceptance Criteria for Welding Competition, See 7.7

(A) **Scoring Metric Development**. When developing scoring metrics for welding competitions, competition oversight should refer to Table 7.1 for visual inspection and evaluation criteria to ensure consistency, fairness, and objectivity in scoring.

(B) **Guidelines for Selecting Visual Inspection Criteria**. Competition oversight should carefully evaluate the specific weld types and procedures involved in the competition (e.g., fillet welds, groove welds, or multi-process projects) and select the appropriate visual acceptance criteria based on the complexity and skill level required. Table 7.1 includes a variety of criteria critical to assessing weld quality, but the importance of each criterion may vary depending on the project's and competition's focus. A combination of metrics can be used individually or grouped together.

(C) **Technical Competence.** The competition oversight should align the selected scoring metrics with the skills being tested in the competition. For example, in competitions testing welding progression or joint geometry, it is important to choose criteria that will accurately reflect the weld's execution, adherence to procedures, and overall craftsmanship. This ensures that competitors are evaluated based on the core competencies of the welding task at hand.

(D) **Adaptation and Relevance**. Adapt the criteria from Table 7.1 to the unique needs of the specific competition. While the table provides a comprehensive framework, flexibility is essential. Criteria should be selected based on the materials, processes, and difficulty level of the welding tasks. A clear and transparent approach to selecting criteria will maintain the integrity of the competition and provide all participants with an equal opportunity to succeed.

(E) **Sample criteria**. See Annex A and C for examples of competition scoring systems that utilize the metrics in Table 7.1 for additional information or ideas on how the framework can be applied.

	Suggested Measured Discontinuity	Definition	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Welded Projects or Coupons	**Surface Porosity**	Any indication of porosity regardless of measurement with or without optics.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	End Crater Cross-Section	All craters should be filled to provide the specified weld size, except for the end of intermittent fillet welds outside of their effective length.	None			
	Root Penetration Suck-Back Or Concavity	Any measurable cavity.	None	≤ 1 indication. Or any single continuous indication ≤ 25mm length.	≤ 3 indications. Or any single continuous indication ≤ 35mm length.	≤ 5 indications. Or any single continuous indication ≤ 45mm length.

Table 7.1 (Continued)
Visual Acceptance Criteria for Welding Competition, See 7.7

	Suggested Measured Discontinuity	Definition	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Welded Projects or Coupons	**Incomplete Root Fusion/ Penetration**	Any visible indication where the root weld exhibits incomplete penetration or only fusion on one side of the joint.	None	≤ 1 indication. Or any single continuous indication ≤ 25mm length.	≤ 3 indications or any single continuous indication ≤ 35mm length.	≤ 5 indications or any single continuous indication ≤ 45mm length.
	General Undercut	Any measurable depth of undercut > 1/32”. Any two adjacent indications separated by a distance smaller than the depth of the larger indication shall be considered as a single indication.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Continuous Undercut:	Any undercut measured over 3/8” in length or any 2 measurable indications of intermittent undercut within 1 linear inch.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Intermittent Undercut	Any undercut measured ≥ 3/8” in length. If measured indication falls within ≤1” of separate undercut indication in any direction.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Advanced Undercut Metric	Any measurable undercut depth ≥ 1/32”. When applicable, multiple indications shall have undercut length measured and totaled. The combined length of these indications shall be converted to a percentage and applied against the weld length.	None	≤ 1 indication. Or ≥ 5% of weld length	≤ 3 indications or ≥ 10% of weld length	≤ 5 indications or ≥25% of weld length
	Groove Weld Underfill	Weld joint has been completely filled with smooth transition a toes of weld face. No visible bevel face or root opening.	None	≤ 1 indication or ≥ 5% of weld length	≤ 3 indications or ≥ 10% of weld length	≤ 5 indications or ≥25% of weld length
	Uniform Weld Surface Layer Width	Unless specified, the smallest width measured of the weld bead or cap passes shall be used as baseline weld width measurement. Any measured width variation > 1/8” is denoted as an indication.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications

Table 7.1 (Continued)
Visual Acceptance Criteria for Welding Competition, See 7.7

	Suggested Measured Discontinuity	Definition	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Welded Projects or Coupons	**Groove Weld Underfill**	Weld joint has been completely filled with smooth transition a toes of weld face. No visible bevel face or root opening.	None	≤ 1 indication or ≥ 5% of weld length	≤ 3 indications or ≥ 10% of weld length	≤ 5 indications or ≥25% of weld length
	Uniform Weld Surface Layer Width	Unless specified, the smallest width measured of the weld bead or cap passes shall be used as baseline weld width measurement. Any measured width variation > 1/8” is denoted as an indication.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Weld Bead Irregularities and Uniformity	Any weld bead appearance irregularity exhibited. Irregularities include inconsistencies of the following: layering/ sequencing of weld passes, weld ripple variations, weave technique, temper color changes, and tie-ins.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Start/stops or Tie-ins Continuous Weld Irregularities	All tie-ins of a continuous weld should be uniform and consistent.	≤ 1 indication	≤ 3 indications	≤ 5 indications	≤ 7 indications
	Incomplete Fusion/ Penetration	Any measurable indication of incomplete fusion or joint penetration on CJP welds or as specified.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Weld Reinforcement: Face/ Cap Pass	Measured weld reinforcement on cap/ final pass(es) at a minimum is to be flush and reinforcement not to exceed 1/8”.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications

Table 7.1 (Continued)
Visual Acceptance Criteria for Welding Competition, See 7.7

	Suggested Measured Discontinuity	Definition	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Welded Projects or Coupons	**Weld Reinforcement: Root**	Measured weld reinforcement on root pass as follows: minimum is to be flush and reinforcement not to exceed 1/8”.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Fillet Weld Concavity/ Convexity	Measured profile of convexity or concavity on fillet welds ± 1/16” of specified size.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Cracks	All types of cracks, including microcracks and crater cracks.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Overlap	Any measurable indication of overlap or cold lap.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Foreign Inclusions	Any visible inclusions, not limited to; slag, tungsten, welding consumable or filler, etc.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Temper/Contamination Discoloration Irregularities	Any visible indication of poor shielding gas coverage, excessive heat input, or oxidation/corrosion (i.e. stainless steel).	None	≤ 1 indication	≤ 3 indications. or≥25% of weld length	≤ 5 indications or ≥50% of weld length
	Weld Metal Spatter	Weld spatter exhibited on welded project or coupon.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Fillet Weld Leg Size	Fillet weld leg size variations from specified size ± 1/16”.	None	≤ 1 indication	≤ 3 indications or ≥25% of weld length	≤ 5 indications or ≥50% of weld length
	Weld Length	Specified weld lengths have ≤ 1/8” in variation.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Deposited Weld Made in Correct Position	Weld deposited in the correct position as specified.	Yes			
	Correct Weld Progression	Weld deposited with correct progression, either uphill, downhill, combination, etc.	Yes			
	Intermittent Weld Centers tolerance	Weld centers exhibit ≤ 1/8” of variation from specified tolerance.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Intermittent Weld Length Tolerance	Weld lengths exhibit ≤ 1/8” of variation from specified tolerance.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications

Table 7.1 (Continued)
Visual Acceptance Criteria for Welding Competition, See 7.7

		Suggested Measured Discontinuity	Definition	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Welded Projects or Coupons	**Final Dimensions**	Final dimensions of project exhibit ≤ 1/16” of variation from specified tolerance.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications	
	Weld Joint Fitup Conditions	Weld joint fitup and geometry meets the specifications of the drawing and exhibits ≤ 1/16” of variation from specified tolerance.	Complete	≤ 1 indication	≤ 3 indications	≤ 5 indications	
	Free of Base Metal Distortion	Base metal is free of distortion, camber, or misalignment exhibiting ≤ 1/8 variation of specified tolerance.	Yes				
	Base Metal Free of Burn Through	Fillet welds and all specified Partial Penetration Joints are free of burn-through or visible weld penetration.	Yes				
	Correct Joint Geometry Conformity	Weld joint geometry meets the specifications of the drawing.	Yes				
	Completed Coupon Free From Grinding or Other Metal Removal On The Cap Pass(es) and Penetration	Weld surface and weld toes of cap or final passes are free of grinding or filing.	Yes				
	Weld Surface Free of Slag, Arc strikes, Touchdowns, Grind/ Finish Markings, or Debris	99% of the project is clean and presentable for visual inspection and scoring.	Yes				
	Fillet Weld Underfill	Weld joint has been completely filled with smooth transition a toes of weld face in relation to specified leg sizes. The throat of the fillet welding is flush or slightly convex. Any measured underfill ≤ 1/16” is not permitted.	None	≤ 1 indication	≤ 3 indications or ≥25% of weld length	≤ 5 indications or ≥50% of weld length	
	Weld Termination and Tie-In Height	All weld tie-ins are not to exceed a height variation of more that 1/16”.	≤ 1/16”	≤ 1/8”	≤ 3/16”	≤ 1/4”	
	Weld Surface Elongation Cavity	The final surface layer or cap pass(es) of the weld is free of any elongated cavity or any worm tracks.	≤ 1/16”	≤ 1/8”	≤ 3/16”	≤ 1/4”	

Table 7.1 (Continued)
Visual Acceptance Criteria for Welding Competition, See 7.7

	Suggested Measured Discontinuity	Definition	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Welded Projects or Coupons	**100% Root Penetration**	The entire length of the root pass exhibits complete penetration and fusion	Yes			
	100% Weld Reinforcement	The entire length of the weld joint or groove exhibits flush or convex reinforcement.	Yes			
	Root Concavity	The root reinforcement is to be flush, any measured depression ≤ 1/32” is not permitted.	None	≤ 1 indication	≤ 3 indications or ≥25% of weld length	≤ 5 indications or ≥50% of weld length
	Fillet Weld Throat	Fillet weld throat not to exceed ≤ 1/16” of variation from specified tolerance.	None	≤ 1 indication	≤ 3 indications. Or ≥25% of weld length	≤ 5 indications. Or ≥50% of weld length
	Test Coupon Misalignment	Welded coupons are free of any misalignment, whether linear, circumferential, or angular.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Incorrect Root Gap for Fillet Welds	All fillet weld root gaps are zero or as specified.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Test Coupon Distortion and Camber	Welde coupons are free of distortion and camber.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Correct Weld Bead Sequence	Weld bead sequencing completed to minimize number of weld craters; where vertical, horizontal, flat, etc. welds are placed progressively i.e., completing vertical welds before horizontal.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Corner welds exhibit a full radius contour?	The outside corner weld joint exhibits a full radius convex profiled- underfilled or with flat profile is not permitted.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Project is free from stray arc strikes?	Any visible arc strike or arc mark identified	None	≤ 1 indication	≤ 3 indications	≤ 5 indications

Table 7.1 (Continued)
Visual Acceptance Criteria for Welding Competition, See 7.7

	Suggested Measured Discontinuity	Definition	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Welded Projects or Coupons	**Tie-ins at corners are smooth and continuous?**	Welds that transition around 90° contours or similar geometry should exhibit smooth and uniform appearance.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Is the project assembled in accordance with the drawing?	Verify drawing specifications and project assembly	Yes			
	Order of operations completed correctly	Project assembly was completed in proper order as specified.	Yes			
	Does the overall workmanship display consistency among all welds?	All welds must be consistent with no significant discontinuities.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Overall bead width not to exceed 1/16 in. Does the weld meet this requirement?	Variation in width (from max to min) for any weld face.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Undersized Welds	Weld Size not to be larger by anything greater than 1/16 in. anywhere along the weld length and no smaller than specified on the drawing.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Fillet Weld Profiles	Fillet welds can be slightly concave, flat, or slightly convex with the crown not to exceed 3/32 in.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Excessive Weld	The weld size exhibits excessive width, throat, thickness, passes/layers, etc. as specified.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Groove Weld Profiles	Welds can be flush or exhibit reinforcement not to exceed 3/32 in.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Weld/Base Metal Fusion	Complete fusion shall exist between base and weld metal with no cold lap present.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Post Weld Cleaning of GTAW Project	GTAW-deposited welds should not exhibit any evidence of mechanical cleaning on the welded surface after welding.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications

Table 7.1 (Continued)
Visual Acceptance Criteria for Welding Competition, See 7.7

	Suggested Measured Discontinuity	Definition	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Welded Projects or Coupons	**Correct weld location placed in drawing accordance**	Are all deposited welds of correct length, position, and location as specified.	Yes			No
	Completed project	All of the specified welds have been completed and all project components have been assembled.	Yes			No
	Hold Point Completed	**Conformance of hold points observed**	Yes			No

Notes:
a. Class 1: Creates a Yes/No system for efficient scoring.
b. Class 1 & 4: Creates a tiered approach for more spread of metrics in scoring and can add more evaluation effort.
* Calculating Weld Length Percentage = (Total Length of Weld with Variation Beyond Metric/Total Weld Length)x100.

Table 7.2
Visual Acceptance Criteria for Welding Fabrication Competition

	Suggested Measured Discontinuity	Definition	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Welding Fabrication	Dimensional Accuracy	Conformance of final part dimensions to the drawing specifications.	Yes	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Fitup Tolerance	Alignment and fitup of parts before welding.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Joint Preparation	Any incorrect surface preparation, cleanliness, and edge quality before welding.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Hold Points	Conformance to all hold points	Yes	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Tack Weld Quality	Strength, size, and placement of tack welds during fitup.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Weld Alignment	Straightness and uniformity of weld along the joint line.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Weld Appearance	Overall aesthetic quality, including uniformity and smoothness.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Assembly Squareness	Overall squareness of the fabricated assembly. Square within specified +/-.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Distortion Control	Degree of warping or distortion in the fabricated assembly.	No visible distortion.	Minor distortion within tolerances.	Noticeable distortion but correctable.	Severe distortion beyond repair.
	Fastener Quality	Proper installation and alignment of bolts, rivets, or other fasteners.	All fasteners installed correctly.	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Overall Cleanliness	Cleanliness of the work area and removal of debris or contaminants.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Tool and Resource Usage	Proper use of tools and materials without waste or damage.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Fabrication Time	Time taken to complete the fabrication project.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Final Assembly Integrity	Overall structural strength and integrity of the finished project.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications

Notes:
a. Class 1: Creates a Yes/No system for efficient scoring.
b. Class 1 & 4: Creates a tiered approach for more spread of metrics in scoring and can add more evaluation effort.
* Calculating Weld Length Percentage = (Total Length of Weld with Variation Beyond Metric/Total Weld Length)x100.

Table 7.3
Visual Acceptance Criteria for Cutting Competition

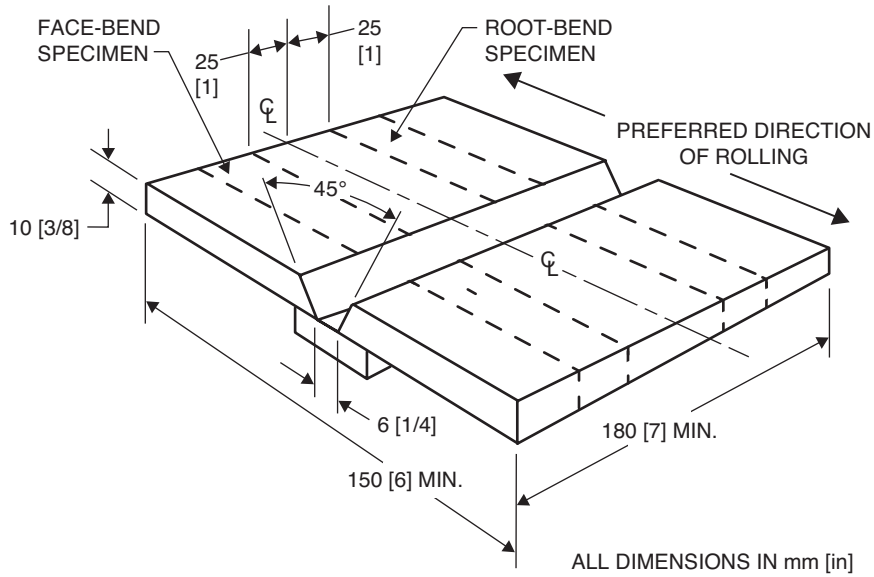
	Suggested Measured Discontinuity	Definition	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Cutting & Gouging Projects	Kerf	The cut is completely through the material.	≤ 1/16”	≤ 3/32”	≤ 1/8”	≤ 1/4”
	Dross	Any unremoved dross from the cut edge or surface.	None	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Workmanship and Consistency	All cuts are consistent with no significant discontinuities.	Yes	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Drawing Conformance	Are the final cuts of correct length, position, and location as specified.	Yes	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Radial or Circular Cut quality and consistency	All cuts are consistent with no significant discontinuities.	Yes	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Straight Cut Quality and Consistency	Verify quality and straightness with gauges or appropriate visual inspection tools.				
	Post Weld Cleaning of OFC Project	OFC project should not exhibit any evidence of mechanical grinding or cleaning on project surface after cutting.	Yes	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Correct Cut Location Placed in Drawing Accordance	Are the performed cuts of correct length, position, and location as specified by the drawing.	Yes	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Completed Project	All of the specified cuts have been completed.	Yes	≤ 1 indication	≤ 3 indications	≤ 5 indications
	Correct Progression	Cutting/Gouging operation performed in the correct progression.	Yes			
	Bevel Angle Variation	Does the bevel angle exhibit measurable variation along its entire length.	None	≤ ± 5°	≤ ± 7°	≥ ± 7°
	Roughness Quality	Using AWS Gauge C4.77 for roughness quality, pair the correct sample to the cut surface as follows:	D	C	B	A
	Tie-ins are smooth and continuous?	All reentrant cuts are consistent and uniform.	None	≤ 1 indication.	≤ 3 indications.	≤ 5 indications.
	Go-No Go Gauge	Any indication where the Go-No Go gauge exhibits +3/32” tolerance variation from template within any measured 1” along cut surface.	None	≤ 1 indication.	≤ 3 indications.	≤ 5 indications or Go-No Go Gauge does not fit
	Cut Surface(s) Free of dross, Grind/Finish Markings, or Debris	Verify any visible indications of dross or grind markings.	Yes			

Notes:
a. Class 1: Creates a Yes/No system for efficient scoring.
b. Class 1 & 4: Creates a tiered approach for more spread of metrics in scoring and can add more evaluation effort.
* Calculating Weld Length Percentage = (Total Length of Weld with Variation Beyond Metric/Total Weld Length)x100.

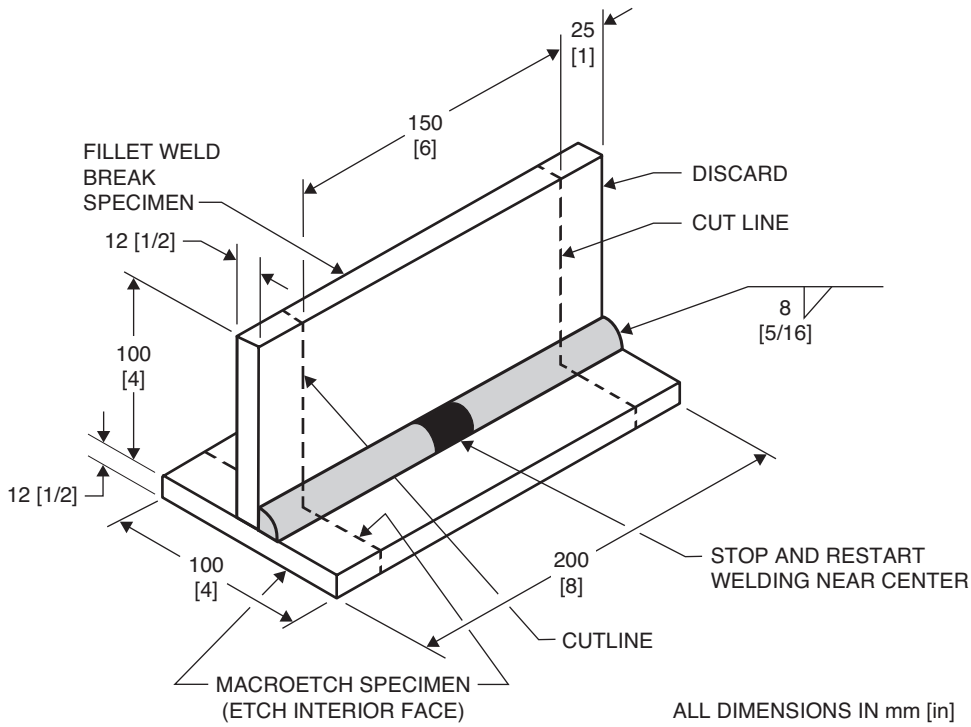
Table 7.4
Destructive and Nondestructive Testing Acceptance Criteria, See 7.9

Specimen	Measured Item	Reference	Class 1 (Full Points)[a]	Class 2 (0.7 Points)	Class 3 (0.4 Points)	Class 4 (0 Points)[b]
Root, Face, or Transverse Bend Test	Porosity	The specimen is free from surface-breaking indications/flaws, measured on the convex surface of the specimen, after bending. Any Cracks occurring on the corners of the specimen during bending shall not be considered unless there is evidence that they result from discontinuities.	None	1 indication	2 indications	≥ 3 indications or any measured indication ≥ 3mm
	Crack (any)					
	Incomplete Fusion					
	Metallic or non-metallic foreign inclusions					
Fillet Weld and Nic Break Test	Crack (any)	The specimen is free from surface breaking indications/flaws, measured on the convex surface of the specimen, after breaking.	None	1 indication	2 indications	≥ 3 indications or any measured indication ≥ 3mm
	Porosity					
	Incomplete Fusion					
	Metallic or non-metallic foreign inclusions					
	The fillet weld is completely fused between each deposited weld pass					
	Specimen did not fracture		Yes			
Macroetch Test	Lack of interpass fusion		None	1 indication	2 indications	≥ 3 indications or any measured indication ≥ 3mm
	Crack (any)					
	Incorrect root gap for fillet welds					
	Any measurable discontinuity in any direction					
	Nondestructive Examination Acceptance Criteria					
Radiographic Inspection	Crack (any)	The weld is free from any indications/ flaws, measured in the weld. See 7.8.	None	1 indication	2 indications	≥ 3 indications or any measured indication ≥ 3mm
	Porosity					
	Incomplete Fusion					
	Metallic or non-metallic foreign inclusions					
Ultrasonic Inspection	Any Discontinuity	Any discontinuity with measurable length.	None	1 indication	2 indications	≥ 3 indications or any measured indication ≥ 3mm

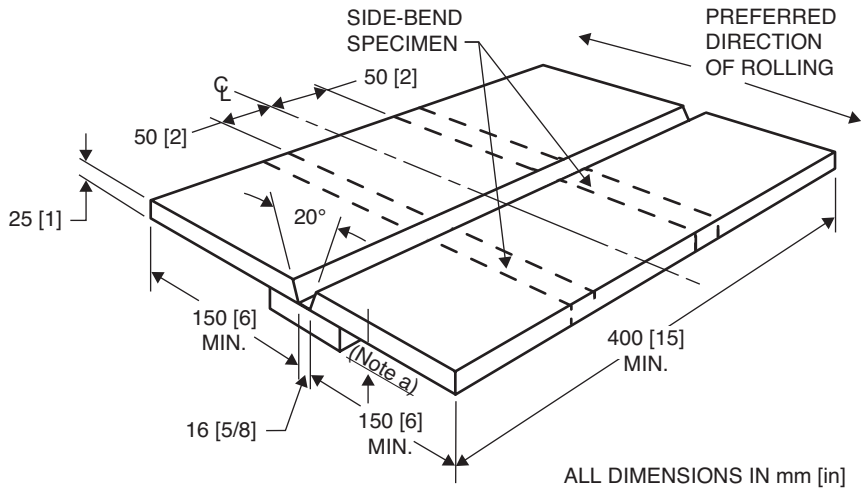
Notes:
a. Class 1: Creates a Yes/No system for efficient scoring.
b. Class 1-4: Creates a tiered approach for more spread of metrics in scoring and can add more evaluation effort.
* Calculating Weld Length Percentage = (Total Length of Weld with Variation Beyond Metric/Total Weld Length)x100.



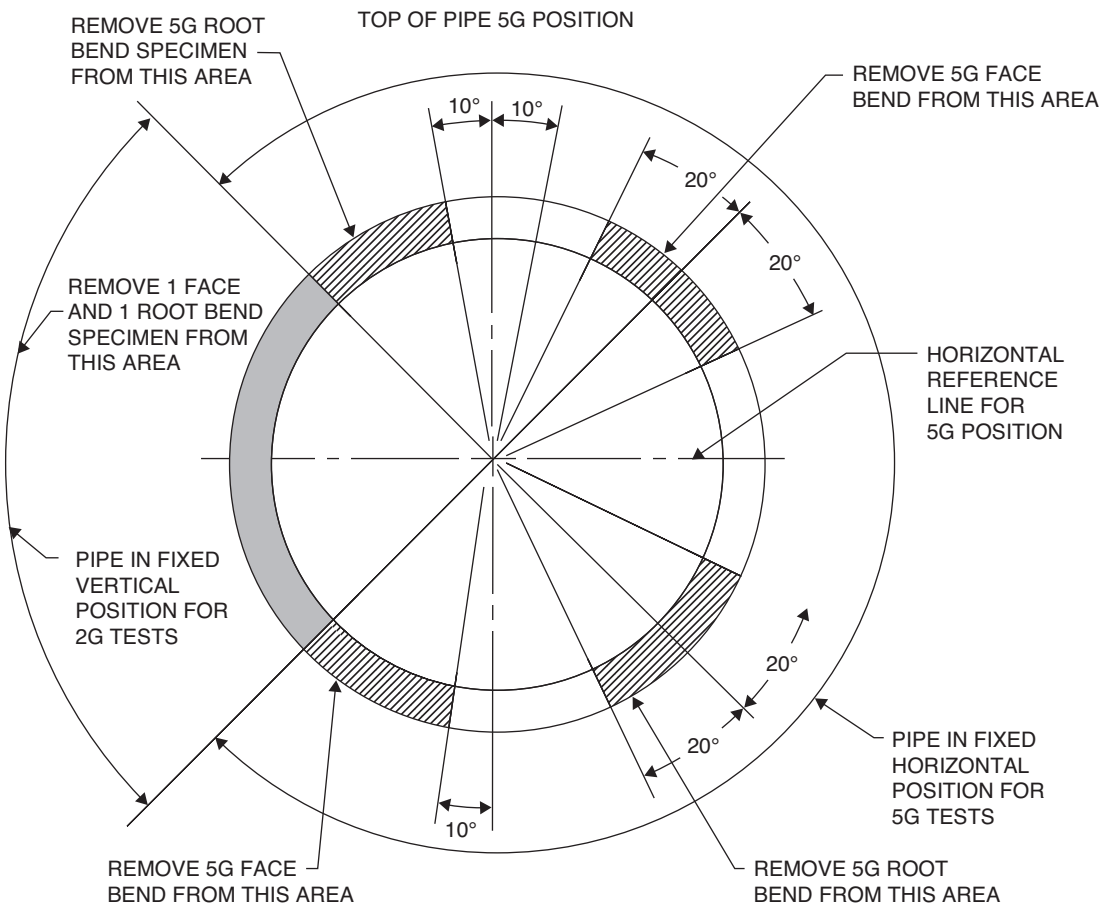
(Source: AWS D1.5)
Figure 7.1—Test Plate Root and Face Specimen Location



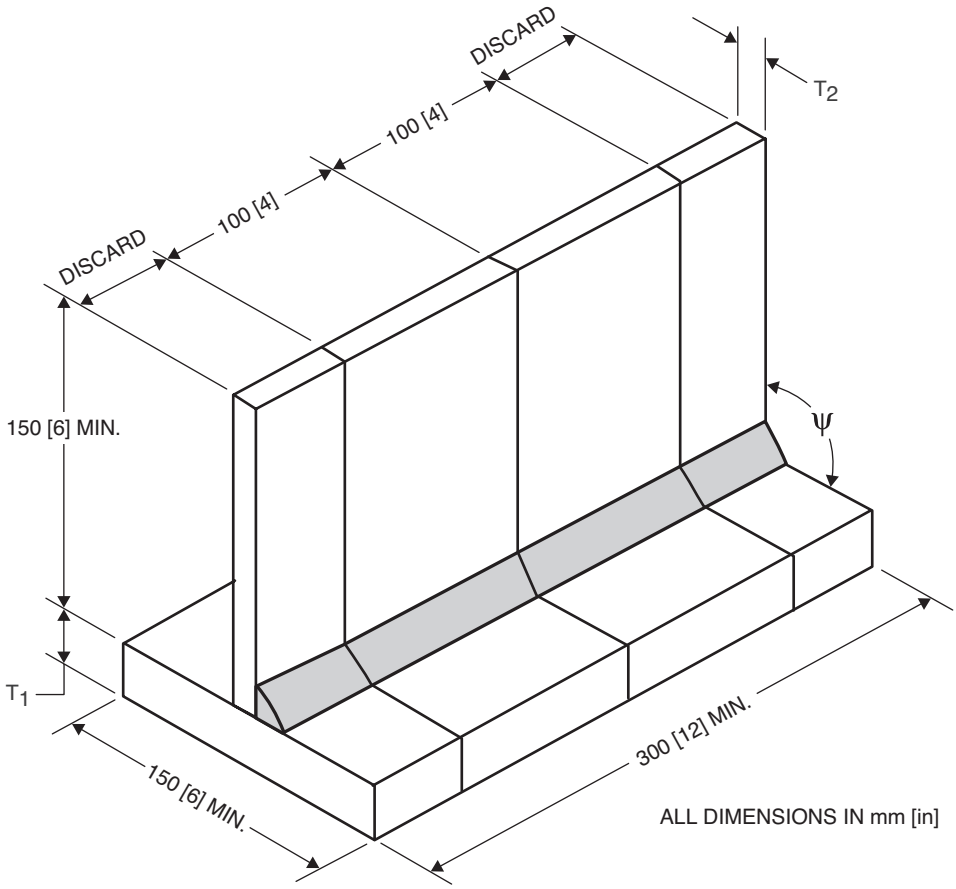
(Source: AWS D1.5)
Figure 7.2—Fillet Weld Break Specimen Location



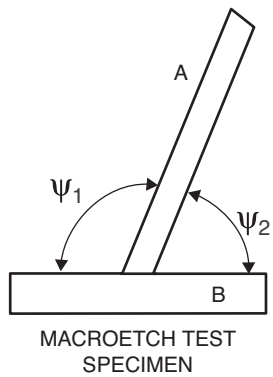
(Source: AWS D1.5)
Figure 7.3—Test Plate Side Bend Specimen Location



(Source: AWS B2.1)
Figure 7.4—Bend Specimen Location- Pipe

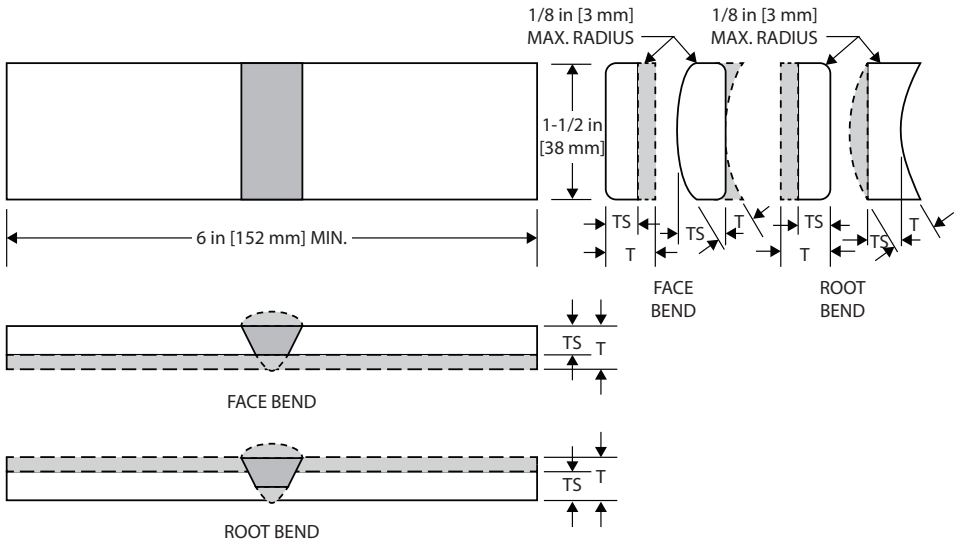


WELD SIZE	T_1 MIN.	T_2 MIN.
5 [3/16]	12 [1/2]	12 [1/2]
6 [1/4]	20 [3/4]	12 [1/2]
8 [5/16]	25 [1]	12 [1/2]
10 [3/8]	25 [1]	12 [1/2]
12 [1/2[	25 [1]	12 [1/2]
16 [5/8]	25 [1]	16 [5/8]
20 [3/4]	25 [1]	20 [3/4]
>20 [>3/4]	25 [1]	25 [1]



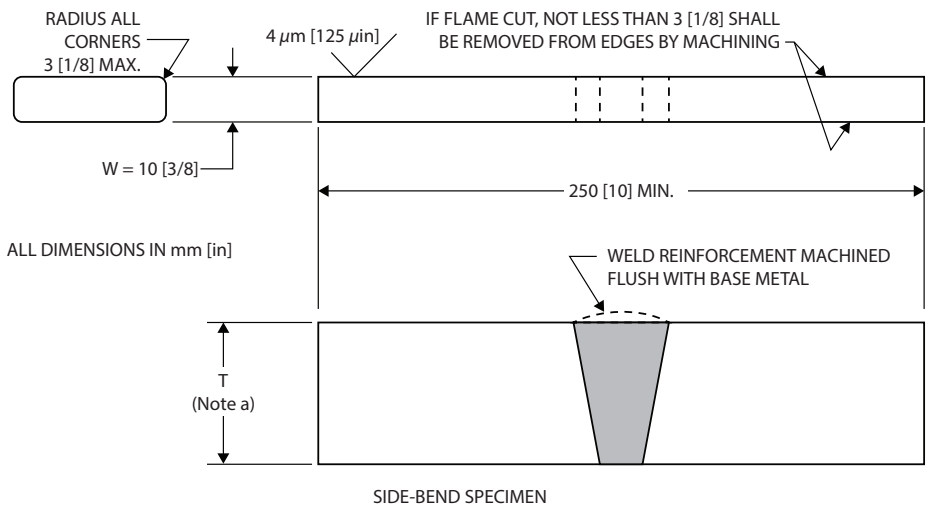
(Source: AWS D1.5)

Figure 7.5—Macroetch Specimens



INCHES			MILLIMETERS		
	Specimen Thickness (TS)			Specimen Thickness (TS)	
Thickness of Base Materials (T)	All Base Metal Welded with F-23 Filler Metals	All Other Materials	Thickness of Base Materials (T)	All Base Metal Welded with F-23 Filler Metals	All Other Materials
1/16 to 1/8	T	T	1.5 to 3	T	T
1/8 to 3/8	1/8	T	3 to 10	3	T
Over 3/8	1/8	3/8	Over 10	3	10

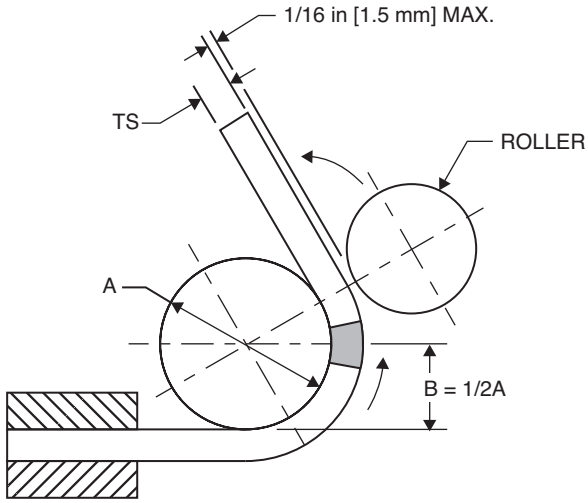
Notes:
1. Weld reinforcement and backing strip or backing ring, if any, shall be removed flush with the surface of the specimen.
2. If thermal cut, the edges shall be dressed by grinding, except in M-1 materials.
3. For pipe diameters of 2 in through 4 in [51 mm through 102 mm] NPS, the width of the bend specimen may be 3/4 in [19 mm] for pipe diameters of 3/8 in to 2 in [10 mm through 51 mm]. NPS, the bend specimen width may be 3/8 in [10 mm], with an alternative (permitted for pipe 1 NPS in and less) of cutting the pipe into quarter sections, in which case the weld reinforcement may be removed and no other preparation of the specimens is required.



[a] T depends on the thickness of test plate shown in Figures 7.1, 7.2, and 7.3; see 7.6. If T > 40 mm [1-1/2 in], see AWS B4.0 for guidance on cutting the specimen into strips between 20 mm and 40 mm [3/4 in to 1-1/2 in] wide.

(Source: AWS QC10 & Sidebends D1.5)

Figure 7.6—Bend Specimens



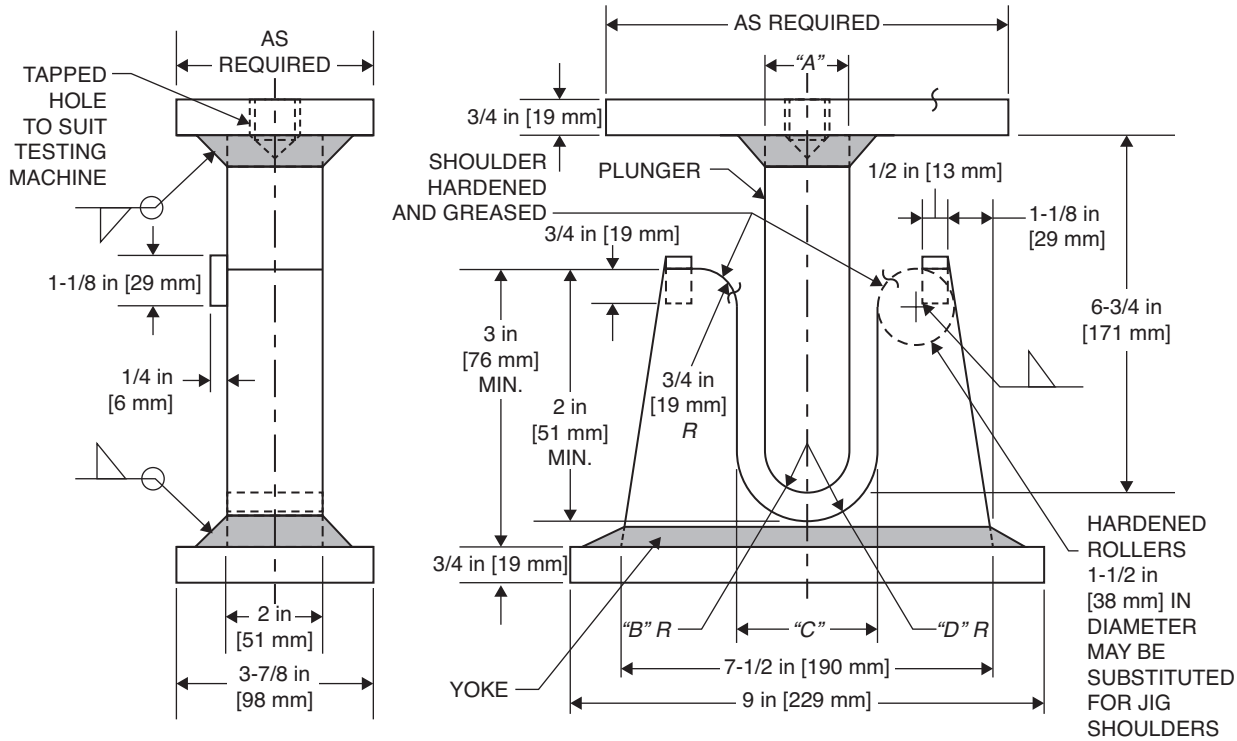
INCHES			MILLIMETERS		
Base Metal[b]	TS[a]	A	Base Metal[b]	TS[a]	A
M-23 (as welded) M-35 except B148 and B271 All base metals welded with F-23 consumables	<1/8 1/8	(16-1/2)TS 2-1/16	M-23 (as welded) M-35 except B148 and B271 All base metals welded with F-23 consumables	<3 3	(16-1/2)TS 50
M-11 M-23 (annealed) M-25 M-35, B148, and B271	<3/8 3/8	(6-2/3)TS 2-1/2	M-11 M-23 (annealed) M-25 M-35, B148, and B271	<10 10	(6-2/3)TS 67
M-24 (annealed) M-27, M-61, and M-62	≤3/8	8TS	M-24 (annealed) M-27, M-61, and M-62	≤10	8TS
M-52 and M-53	≤3/8	10TS	M-52 and M-53	≤10	10TS
M-54	≤3/8	14TS	M-54	≤10	14TS
All other M-Number metals	<3/8 3/8	4TS 1-1/2	All other M-Number metals	<10 10	4TS 40

[a] TS = Specimen thickness.
[b] For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bendtesting (see also Figures A.5A and A.5B

Notes:
1. To calculate the maximum bend diameter for any thickness specimen, use the following formula: A = (100 TS/E) – TS Where A = bend diameter, E = minimum tensile elongation, and TS = test specimen thickness.
2. The shoulders of the test figure shall either be hardened rollers free to rotate or hardened and greased fixed shoulder.

(Source: AWS QC10)

Figure 7.7—Guided Bend Test Equipment-Wrap Around



INCHES				MILLIMETERS			
Base Metal[b]	TS[a]	A	C	Base Metal[b]	TS[a]	A	C
M-23 (as welded) M-35 except B148 and B271 All base metals welded with F-23 consumables	<1/8 1/8	(16-1/2)TS 2-1/16	(18-1/2)TS + 1/16 2-3/8	M-23 (as welded) M-35 except B148 and B271 All base metals welded with F-23 consumables	<3 3	(16-1/2)TS 50	((18-1/2)TS + 1-1/2 57
M-11 M-23 (annealed) M-25 M-35, B-148, and B271	<3/8 3/8	(6-2/3)TS 2-1/2	(8-2/3)TS + 1/8 3-3/8	M-11 M-23 (annealed) M-25 M-35, B148, and B271	<10 10	(6-2/3)TS 67	(8-2/3) TS + 3 90
M-24 (annealed) M-27, M-61, and M-62	≤3/8	8TS	10TS + 1/8	M-24 (annealed) M-27, M-61, and M-62	≤10	8TS	10TS + 3
M-52 and M-53	≤3/8	10TS	12TS + 1/8	M-52 and M-53	≤10	10TS	12TS + 3
M-54	<3/8	14TS	16TS + 1/8	M-54	≤10	14TS	16TS + 3
All other M-Number metals	<3/8 3/8	4TS 1-1/2	6TS + 1/8 2-3/8	All other M-Number metals	<10 10	4TS 40	6TS + 3 63

[a] TS = Specimen thickness.
[b] For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing (see also Figures A.5A and A.5C).

Notes:
1. To calculate the maximum bend diameter for any thickness specimen, use the following formula: A = (100 TS/E) – TS where A = diameter, E = minimum tensile elongation, and TS = test specimen thickness.
2. The shoulders of the test figure shall either be hardened rollers free to rotate or hardened and greased fixed shoulder.

(Source: AWS QC10)
Figure 7.8—Guided Bend Test Equipment-Plunger

8. Awards and Recognition

8.1 Scope and Objective

Awards and Recognition within this guideline aim to establish principles for acknowledging and rewarding competitors' outstanding performance in welding competitions. It encompasses the entire process related to awards and recognition, including the categories of recognition, prize structures, and associated commemorative items. This clause serves as a comprehensive framework to ensure fairness, transparency, and consistency in recognizing the achievements of competitors, donors, and volunteers.

8.2 Individual & Team Placement

8.2.1 Competition Categories. Welding competitions may have multiple categories, such as individual and team competitions, each with its own rules and criteria.

8.2.2 Scoring System. The scoring system for individual and team placements should be clearly defined and communicated to all competitors. It should consider various performance factors, such as weld quality, speed, and adherence to safety practices. See Clause 7, Scoring and Evaluation.

8.2.3 Tie-Breaker Procedures. In the event of a tie in the competition, organizers should establish transparent tie-breaker procedures to determine final placements. These procedures should be communicated in advance to all competitors. See Clause 7, Scoring and Evaluation.

8.3 Monetary Rewards

8.3.1 Prize Structure. Competition oversight should outline the monetary rewards or prizes available to winners. The prize structure may include cash awards, scholarships, or other forms of recognition.

8.3.2 Distribution. Organizers should specify the process for awarding and distributing monetary rewards, including the timing and methods of payment.

8.3.3 Transparency. It is essential to maintain transparency in awarding monetary rewards, ensuring that the process is fair and unbiased. All decisions regarding prize distribution should be documented and available for review.

8.4 Commemorative Items

8.4.1 Design and Selection. Commemorative items, such as trophies or plaques, should be thoughtfully designed and selected to reflect the significance of the competition. Organizers should specify the criteria for these items.

8.4.2 Presentation Ceremony. Outline the procedures and protocols for presenting commemorative items to the winners, including the timing and location of the ceremony.

8.4.3 Customization. Organizers may consider customizing commemorative items to include the competition name, date, and other relevant details to make them more meaningful to the recipients.

8.5 Welding Certification

8.5.1 Certification Opportunities: The document should highlight any welding qualification or certification opportunities associated with the competition, including which certifications can be earned by competitors. See 1.2 for the limitations of this document.

8.6 Media Opportunities

8.6.1 Publicity and Promotion. Competition organizers should consider promoting the competition through media channels, including press releases, social media, and other promotional activities.

8.6.2 Participant Consent. As a best practice, organizers should address the issue of participant consent for media coverage, photography, and interviews. The consent process should respect the privacy and preferences of all competitors.

8.6.3 Post-Event Coverage. Consider opportunities and any details for post-event media coverage, such as sharing competition results, success stories, and highlights through various media outlets.

8.7 Volunteer Recognition

8.7.1 Volunteer Recognition Best Practices. Volunteers are the backbone of any successful competition, and recognizing their contributions is vital to show appreciation, inspire continued involvement, and foster a supportive community. Below are ideas and opportunities to ensure volunteers feel valued and acknowledged:

(1) Pre-Event Acknowledgment: mention volunteers in planning meetings or team briefings.

(2) Acknowledge volunteers during opening or closing ceremonies.

(3) Provide access to a designated rest area and refreshments.

(4) Send thank-you letters or emails.

(5) Distribute certificates of appreciation.

(6) Feature their contributions in newsletters or social media posts.

(7) Offer small gifts like custom merchandise, gift cards, or plaques.

(8) Host a volunteer appreciation event (e.g., luncheon or dinner).

(9) Highlight volunteer stories in press releases or sponsor reports.

(10) Share their achievements on websites or community platforms.

8.7.2 Sample Thank You Letter. A sample thank-you letter is provided to guide organizers in expressing gratitude to volunteers for their contributions and support during the competition, modify as needed to reflect the contributions of your competition volunteers. See Figure 8.1.

[Your Organization's Letterhead or Logo]

[Date]
[Sponsor's Name or Organization]
[Address]
[City, State, ZIP Code]

Subject: Thank You for Your Generous Support

Dear [Sponsor's Name/Title],

On behalf of the [Your Organization or Event Name], I extend our deepest gratitude for your invaluable support in sponsoring the [specific competition or activity, e.g., "AWS Welding Competition"]. Your contribution has played a pivotal role in making this event a success and fostering the development of skilled welders in our industry.

Your generous donation of [specific items, e.g., "welding equipment, materials, or financial support"] has allowed us to provide participants with the resources necessary to excel in their craft while upholding the highest standards of safety, professionalism, and excellence. The impact of your support resonates not only with the competitors but also with the broader welding community, inspiring innovation and growth.

We also want to assure you that all loaned equipment has been carefully maintained throughout the event. It will be returned promptly and in excellent condition. Please let us know your preferred process for coordinating the return or if you have any special instructions.

Once again, thank you for your commitment to advancing the welding profession and empowering future leaders in the field. Your generosity and partnership are truly appreciated, and we look forward to collaborating with you in future endeavors.

Warm regards,

[Your Full Name]
[Your Title]
[Your Organization]
[Contact Information]

Figure 8.1—Sample Volunteer Recognition Letter

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Annex A (Informative)
Simplified Scoring Document Following Table 7.1

This annex is not part of this guideline but is included for informational purposes only.

Competition Scoring Template

Participant Information

Name/ID: _____
Division: □ High School □ College □ Professional
Competition Category: _____

1. Welding Project Quality (Total: ___ Points)

All competition projects are subjected to inspection from the judging team following Visual Acceptance Criteria (Table 7.1):

1. Surface Porosity: All Welds
   - None (Full Points): _____
   - ≤ 1 Indication (0.7 Points): _____
   - ≤ 3 Indications (0.4 Points): _____
   - > 3 Indications (0 Points): _____
2. Weld Length Tolerance (±1/8”): Weld #3 & #7. Reference drawing for weld location.
   - None (Full Points): _____
   - ≤ 1 Indication (0.7 Points): _____
   - ≤ 3 Indications (0.4 Points): _____
   - > 3 Indications (0 Points): _____
3. Fillet Weld Concavity/Convexity (±1/16”): Weld #8. Reference drawing for weld location.
   - None (Full Points): _____
   - ≤ 1 Indication (0.7 Points): _____
   - ≤ 3 Indications (0.4 Points): _____
   - > 3 Indications (0 Points): _____
4. Correct Weld Progression: All Welds.
   - Yes (Full Points): _____
   - Incorrect (0 Points): _____
5. Joint Geometry Conformity: All Welds. Reference drawing for dimensions/tolerance.
   - Complete (Full Points): _____
   - ≤ 90% Conformity (0.7 Points): _____
   - ≤ 80% Conformity (0.4 Points): _____
   - ≤ 70% Conformity (0 Points): _____

6. Burn-Through or Visible Weld Penetration in Fillet Welds: Weld #1 through #5. Reference drawing for weld location.
   - None (Full Points): _____
   - ≤ 1 Indication (0.7 Points): _____
   - ≤ 3 Indications (0.4 Points): _____
   - > 3 Indications (0 Points): _____

3. Safety and Professionalism (Total: ___ Points)

1. Workstation Cleanliness (99% Clean):
   - Yes (Full Points): _____
   - No (0 Points): _____
2. PPE Usage:
   - Full Compliance (Full Points): _____
   - Partial or Non-Compliance (0 Points): _____

Scoring Summary

Total Welding Project Quality Points: _____/___
Total Technical Competence Points: _____/___
Total Safety and Professionalism Points: _____/___
Final Score: _____/___

Judges' Comments

Strengths:

_____

Areas for Improvement:

_____

Judge Name/Signature: _____

Annex B (Informative)
Sample Tool List for Welding Competitors

This annex is not part of this guideline but is included for informational purposes only.

B.1 Below is a curated selection of standard tools and safety equipment, organized for efficiency within a compact toolbox. This selection aligns with the requirements of most welding competitions, following the guidelines established by SkillsUSA. Competition organizers are encouraged to modify this list to ensure it meets the specific needs of their event.

Storage Options

- Toolbox size limit: 14" × 9" × 22" maximum

Alternative storage options:

- Open-top bag (no interior/exterior pockets)
- 5-gallon bucket without lid

Personal Protective Equipment (PPE)

- Welding hood (can be carried separately)
- Safety glasses
- Cutting goggles
- Extra clear lenses for welding hood
- Hearing protection
- Two types of gloves:
    - TIG welding/finesse work gloves
    - Welding gauntlet gloves for stick/flux core
- Welding cap/beanie

Measuring & Layout Tools

- Combination square set or speed square
- Tape measure (minimum 10ft)
- Combination tools with protractor and compass
- Scribe (without magnet)
- Fillet weld gauge set

Marking Tools

- Soapstone
- Ink pen (alternative options: lead pencil or other markers)

Cutting & Cleaning Tools

- Striker
- Torch tip cleaner
- Wire brushes:
  - Stainless steel brush
  - Carbon steel brush (separate to prevent contamination)
- Slag hammer
- Cold chisel
- Center punch

Pliers & Grips

- 6” needle-nose pliers
- 6” side-cut pliers (alternatively can use combined welder/welder’s helper pliers)
- 11R vise grip clamp (or regular vice grip)

Other Tools

- 16 oz ball-peen hammer
- Flashlight (for inspection)
- Pocket calculator

Annex C (Informative)
Sample Score Weighting Distribution and Conversion

This annex is not part of this guideline but is included for informational purposes only.

C.1 Overview

This annex provides a recommended framework for distributing and converting scores in welding competitions. The goal is to ensure fairness, consistency, and transparency in evaluating participants' performance based on measurable criteria. The scoring system should align with established welding standards and competition objectives.

C.2 Score Weighting Distribution

Scoring is divided into key evaluation categories to reflect technical skills and adherence to safety and professional standards. Below is a sample **score weighting distribution**:

Category	**Weight (%)**
Welding Project Quality	70%
Technical Competence	20%
Safety & Professionalism	10%

Each category consists of multiple assessment criteria that contribute to the overall score.

C.3 Score Breakdown and Conversion

Competitors are evaluated based on objective criteria, with specific deductions for defects, inaccuracies, or procedural errors. The **raw scores** from each criterion are converted into a final competition score using the following approach:

C.3.1 Welding Project Quality (70%)

This category assesses weld integrity, dimensional accuracy, and adherence to specifications. Points are awarded based on compliance with Visual Acceptance Criteria (e.g., Table 7.1), and deductions occur for discontinuities or deviations.

Sample **weighting per sub-criterion**:

Sub-Criterion	**Weight (%)**
Surface Porosity (All Welds)	15%
Weld Length Tolerance (Weld #3 & #7)	15%
Fillet Weld Concavity/Convexity (Weld #8)	15%
Correct Weld Progression (All Welds)	15%
Joint Geometry Conformity (All Welds)	20%
Burn-Through/Weld Penetration (Welds #1-5)	20%

C.3.2 Technical Competence (20%)

This section evaluates welding efficiency, adherence to the provided work plan, and overall execution of the assigned welds.

Sub-Criterion	Weight (%)
Completion within time limit	50%
Correct tool usage	50%

C.3.3 Safety & Professionalism (10%)

Competitors must follow industry-standard safety practices, including proper PPE usage and workstation cleanliness.

Sub-Criterion	Weight (%)
Workstation Cleanliness (99% Clean)	50%
Proper PPE Usage	50%

C.4 Score Conversion

Scores from all categories are summed and converted to a **100-point scale** using the formula:

$$Final\ Score = \left(\frac{Total\ Points\ Earned}{Maximum\ Possible\ Points} \right) \times 100$$

If rankings are needed, organizers may define scoring **tiers** such as:

Final Score (%)	Rank
90–100	Gold
80–89	Silver
70–79	Bronze
Below 70	No Placement

C.5 Tie-Breaking Procedure

If the guideline herein, two or more participants achieve the same **final score**, tie-breaking will be determined in the following order of priority:

1. **Higher Welding Project Quality Score**
2. **Higher Joint Geometry Conformity Score**
3. **Faster Completion Time**

If a tie remains, judges may review **overall execution consistency** and **adherence to WPS** as the final determinant.

Annex D (Informative)
Sample Welding Competition Schedules

This annex is not part of this guideline but is included for informational purposes only.

D.1 Station Base Welding Competition Sample Schedule

Table D.1
Station Base Welding Competition Sample Schedule

Time	Activity	Details	Notes
7:30 AM	**Welcome and Networking**	Light refreshments and introductions for participants, sponsors, and volunteers. Opportunity for informal discussions before the event begins.	*Informal start ensures smooth check-in; helps participants acclimate to the venue.*
8:00 AM	**Participant Registration and Check-in**	Contestants check in, receive badges, and confirm tool/equipment compliance.	*Double-check participant readiness and address last-minute concerns during check-in.*
8:30 AM	**Orientation Session**	Overview of rules, safety protocols, scoring criteria, and station rotation process. Participants receive station maps and schedules.	*Provide clear instructions to avoid confusion during rotations.*
8:50 AM	**Tool and Equipment Inspection**	Judges inspect tools and equipment for compliance with competition guidelines.	*Allocate time to resolve any tool or equipment issues before starting.*
9:10 AM	**Final Preparations**	Contestants set up their workstations and prepare for the competition.	*Allow participants to organize stations and ensure readiness for tasks.*
9:30 AM	**Station Rotation (Round 1)**	Participants begin their rotations: Station 1: GMAW & FCAW Project Station 2: SMAW & OFC Project Station 3: GTAW Project Station 4: Inspection & Theory Test	
11:15 AM	**Station Rotation (Round 2)**	Participants rotate to their next assigned stations and continue their welding tasks or testing activities.	*Ensure clear rotation signals to prevent delays.*
1:00 PM	**Lunch Break**	Break for participants, judges, and helpers. Lunch is provided or participants supply their own.	*Lunch is timed to balance energy levels and maintain focus for remaining tasks.*
1:45 PM	**Station Rotation (Round 3)**	Participants rotate to their next assigned stations.	*Judges can finalize scores from earlier rounds during this rotation.*
3:30 PM	**Station Rotation (Round 4)**	Participants complete their final station activities.	*Assign extra monitors to ensure smooth progress in final stations.*

Table D.1 (Continued)
Station Base Welding Competition Sample Schedule

Time	Activity	Details	Notes
5:15 PM	**Final Welding and Clean-up**	Contestants finalize their tasks, clean their workstations, and prepare their projects for submission.	*Allocate cleanup time to maintain safety and fairness for judging.*
5:30 PM	**Project Inspection and Judging**	Judges inspect and evaluate completed projects at each station based on scoring metrics.	*Judging can be staggered as stations finish to save time and ensure thorough evaluation.*
6:15 PM	**Award Ceremony and Closing Remarks**	Winners are announced, prizes are distributed, and acknowledgments are made to participants, sponsors, and volunteers.	*Highlight participant achievements and sponsor contributions during the ceremony.*
6:30 PM	**Post-event Debrief**	Organizers, judges, and key volunteers review the event to identify successes and areas for improvement.	*Use participant feedback from surveys or informal chats to inform the debrief session.*

Schedule Considerations:

Lunch Placement: *Scheduled at midpoint to allow participants to recharge without disrupting focus or rotation continuity.*

Judging Flow: *Judges are encouraged to begin scoring as stations finish to prevent bottlenecks during final inspections.*

Feedback Opportunities: *Participant feedback is collected informally during clean-up or via post-event surveys to inform future improvements.*

D.2 Simultaneous Start Welding Competition Sample Schedule

Table D.2
Simultaneous Start Welding Competition Sample Schedule

Time	Activity	Details	Notes
7:30 AM	**Welcome and Networking**	Light refreshments and introductions for participants, sponsors, and volunteers. Opportunity for informal discussions before the event begins.	*Helps participants acclimate to the venue and build rapport among attendees.*
8:00 AM	**Participant Registration and Check-in**	Contestants check-in, receive badges, and confirm tool/equipment compliance.	*Ensure all participants are present and their tools meet competition requirements.*
8:30 AM	**Orientation Session**	Overview of rules, safety protocols, scoring criteria, and project guidelines. Participants receive competition materials.	*Provide clear instructions and emphasize time management for participants.*
9:00 AM	**Tool and Equipment Inspection**	Judges inspect tools and equipment for compliance with guidelines.	*Allocate time to resolve any tool or equipment issues before starting.*
9:30 AM	**Final Preparations**	Contestants set up their workstations and prepare for the simultaneous start.	*Allow participants to organize stations and ensure readiness for tasks.*
10:00 AM	**Simultaneous Start – Welding Begins**	All participants begin welding simultaneously on identical or similar projects. Judges monitor for safety, efficiency, and adherence to guidelines.	*Projects emphasize individual proficiency, speed, and accuracy in real-time.*
12:30 PM	**Lunch Break**	Break for participants, judges, and helpers. Lunch is provided, or participants can supply their own.	*Judges use this time to evaluate interim progress if required.*
1:15 PM	**Welding Resumes**	Participants continue working on their respective projects.	*Judges monitor for adherence to project specifications and welding quality.*
3:00 PM	**Final Welding and Clean-up**	Contestants finalize their tasks, clean their workstations, and prepare their projects for submission.	*Allocate cleanup time to ensure safety and readiness for judging.*
3:30 PM	**Project Inspection and Judging**	Judges inspect and evaluate completed projects based on scoring metrics. Feedback may be provided for educational purposes.	*Judges focus on accuracy, quality, and overall craftsmanship.*
5:00 PM	**Award Ceremony and Closing Remarks**	Winners are announced, prizes are distributed, and acknowledgments are made to participants, sponsors, and volunteers.	*Highlight participant achievements and sponsor contributions during the ceremony.*
5:30 PM	**Post-Event Debrief**	Organizers, judges, and key volunteers review the event to identify successes and areas for improvement. Documentation completed for future reference.	*Use participant feedback from surveys or informal chats to inform the debrief session.*

Schedule Considerations:

Identical Projects: Ensure all participants receive the same project or tasks; this model of competition requires direct comparison.

Real-Time Judging: Judges monitor/evaluate throughout the competition to streamline scoring management.

Efficiency Focus: This format emphasizes not only the quality of welds but also the speed and efficiency with which participants complete their projects.

Break Timing: The lunch break is scheduled at a midpoint to ensure participants and judges stay refreshed without impacting the competition flow.

D.3 Flow Through Welding Competition Sample Schedule

Table D.3
Flow Through Welding Competition Sample Schedule

Time	Activity	Details	Notes
7:30 AM	**Welcome and Networking**	Light refreshments and introductions for participants, sponsors, and volunteers. Opportunity for informal discussions before the event begins.	*Helps participants acclimate to the venue and build rapport among attendees.*
8:00 AM	**Participant Registration and Check-in**	Contestants check-in, receive badges, and confirm tool/equipment compliance.	*Ensure participants are prepared and equipment is compliant to avoid delays later.*
8:30 AM	**Orientation Session**	Overview of competition structure, rules, safety protocols, and project workflows. Participants receive schedules and instructions.	*Clearly explain the flow-through model and how participants will transition between stages.*
9:00 AM	**Tool and Equipment Inspection**	Judges inspect tools and equipment for compliance with competition guidelines.	*Allow extra time to address non-compliance issues and prevent bottlenecks during workflow.*
9:30 AM	**Competition Start – Station 1**	Participants begin at Station 1, completing the first stage of the project workflow.	*Ensure smooth transitions to minimize downtime as participants complete their tasks.*
10:30 AM	**Progression to Station 2**	Participants move to Station 2 to begin the next stage of the project.	*Judges monitor station readiness and participant transitions for efficiency.*
11:30 AM	**Progression to Station 3**	Participants proceed to Station 3, continuing their project.	*Provide guidance to ensure participants stay on schedule.*
12:30 PM	**Lunch Break**	Break for participants, judges, and helpers. Lunch is provided or participants can supply their own.	*Use this time to reset stations and ensure readiness for the next tasks.*
1:15 PM	**Resumption – Station 4**	Participants move to Station 4, completing advanced tasks or final project phases.	*Judges assess adherence to project workflows and welding standards.*
2:15 PM	**Final Welding and Clean-up**	Participants finalize their projects, clean their workstations, and prepare for submission.	*Allocate cleanup time to maintain safety and organization for judging.*
2:45 PM	**Project Inspection and Judging**	Judges evaluate completed projects at each station based on scoring metrics. Feedback may be provided for educational purposes.	*Stagger inspections to prevent delays and ensure thorough evaluation.*
4:15 PM	**Award Ceremony and Closing Remarks**	Winners are announced, prizes are distributed, and acknowledgments are made to participants, sponsors, and volunteers.	*Highlight the benefits of the flow-through model and participant achievements.*
4:45 PM	**Post-event Debrief**	Organizers, judges, and key volunteers review the event to identify successes and areas for improvement. Documentation completed for future reference.	*Gather insights from participants and judges to optimize future competitions.*

Annex E (Informative)
ZipGrade Integration

This annex is not part of this guideline but is included for informational purposes only.

E.1 Introduction

ZipGrade is a mobile and web-based grading tool designed to streamline scoring processes for multiple-choice assessments. This section outlines the **initial setup**, **quiz management**, and **lessons learned** from using ZipGrade in a competitive welding contest environment.

E.2 ZipGrade Account Registration & Access

To use ZipGrade, follow these steps:

1. **Register an Account**
    - Go to **www.zipgrade.com** and **create an account**.
    - The same login credentials can be used for **mobile** and **web applications**.
2. **Team Access**
    - All members of the **scoring team** can **share the same login** to capture scores in a **single cloud account**.
3. **Understanding Mobile vs. Web Functions**
    - Certain features are performed on **mobile devices**, while others are **only available via the web application**.

E.3 ZipGrade Functional Overview

Function	Performed On Mobile	Performed On Website
Create Quiz	✔	✕
Load Key (via scan or manual entry)	✔	✕
Set Points per Question *(up to two decimal places)*	✔	✕
Link Class to Quiz	✔	✕
Enter Scores	✔	✕
Select Quiz & Scan Papers	✔	✕
Review Scores & Papers	✔	✕
Edit Answers (for bad scans)	✔	✕
Sync to Cloud *(manual or automatic)*	✔	✕
Manage Students	✕	✔
Upload Student Data (via CSV)	✕	✔
Edit/Add/Delete Students	✕	✔
Print Bubble Sheets (per class, pre-numbered, or blank)	✕	✔
Grade Reports (view all scores)	✕	✔

E.4 Quiz Results & Data Analysis

H.4.1 Quiz Results Features

- **Item Analysis:** Displays the total number of correct answers per question. *(Not easily visible on the mobile app.)*
- **Quiz Details & Statistics:** Provides:
  - Item Analysis
  - Score Distribution Graph
  - Graded Papers with Scores
  - Better visibility of contest results compared to the mobile app.

E.4.2 Archiving Procedures

To maintain organized records:

- All high school students are designated with IDs 100-170.
- College students are designated with IDs 500-525.
- Each year, quizzes are copied, and the previous year's quizzes are archived to prevent accidental selection.

Archive Categories:

- Class Archive: Includes all class records, students, and graded papers.
- Quiz Archive: Stores all quizzes and graded papers.

E.5 ZipGrade Initial Setup (Mobile Application)

1. **Download & Install ZipGrade**
   - Find the ZipGrade App in the App Store (iOS) or Google Play Store (Android).
   - Download and open the application.

2. **Login**
    - Enter your registered username and password.
    - Press OK when prompted.
3. **Adjust Permissions & Settings**
    - Allow camera access and cellular data usage *(Internet is recommended on contest day)*.
    - Modify the following settings as needed:
        - Sharpness & Strictness *(Adjust if scanning issues occur)*
        - Enable “Warn Before Overwriting”
        - Enable “One Quiz Per Student”

E.6 Lessons Learned from ZipGrade Usage

H.6.1 Software & Data Entry Considerations

- Use Google Chrome, not Internet Explorer (IE), as copy/pasting from Grade Book to Excel does not work in IE.
- In Edit Key, points per question were previously capped at 20.9 but now support up to two decimal places (e.g., 99.99 max per question).
- To allow multiple correct answers, select both answers in the Edit Key. Use “Alternate Option” if either answer is acceptable.
- Student ID cannot exceed 9 digits (e.g., 999999999).

E.6.2 Quiz & Scanning Best Practices

- Quizzes are listed by Quiz Date in the Grade Book. Adjust the date to control display order.
- Use 100-question bubble sheets to pre-print contestant numbers.
- If a quiz is scanned multiple times, ZipGrade may prompt a warning message.
    - The system retains only the highest score for duplicate scans.

E.6.3 Reviewing & Managing Scores

- The Back button sometimes loses its place when reviewing scores. Instead, select “ZipGrade Section” from the menu to navigate correctly.
- **Check for:**
    - Multiple scans of the same paper
    - Scans without a linked Student ID *(e.g., unclear ID, fuzzy scan, etc.)*
    - **Note:** Graded papers can only be deleted in the mobile app.

E.6.4 Scanning Efficiency Tips

- Manual scanning can become physically exhausting after several hours. To speed up the process:
    - Use cell phone holders to keep devices steady.
    - Stack bubble sheets below the scanner and remove one at a time for quick scanning.
- Avoid mix-ups between different contest areas.
    - Assign specific scanning responsibilities to prevent saving scores in the wrong quiz.
    - Use scorebooks to track scanned papers effectively.

E.6.5 Contest Day Best Practices

- In 2018, judges were allowed to scan their scores, but this caused:
  - Overwritten scores from different contests.
  - Misidentified contest areas due to blank bubble sheets.

✔ **Solution:** Always **pre-print student numbers** and **contest areas** on bubble sheets to ensure proper tracking.

E.7 Conclusion

ZipGrade is an effective and efficient tool for managing multiple-choice assessments during competitions. However, proper setup and workflow management are crucial to preventing scanning errors, data loss, and contest mix-ups. By implementing best practices, such as pre-printed bubble sheets, organized scorebooks, and designated scanning roles, ZipGrade can significantly enhance accuracy and efficiency in competitive grading environments.

Annex F (Informative)
Sample Theory Exam for Welding Competitions

This annex is not part of this guideline but is included for informational purposes only.

Welding Theory Exam

[American Welding Society Competition]

Name: _____

Competitor #/I.D. _____

Contact Number: _____

Email Address: _____

Instructions

- This exam consists of 30 multiple-choice questions.
- Select the most appropriate answer for each question.
- Each question is worth approximately _____ points. The total score is _____.

1. Which welding process uses a continuously fed wire electrode and shielding gas?
   A) SMAW
   B) GTAW
   C) GMAW
   D) FCAW

2. What is the primary difference between FCAW and GMAW?
   A) FCAW uses a flux-cored wire, while GMAW uses a solid wire
   B) GMAW does not require shielding gas
   C) FCAW uses a foot pedal for current control
   D) GMAW cannot weld in all positions

3. In which welding process is a non-consumable tungsten electrode used?
   A) SMAW
   B) GTAW
   C) GMAW
   D) SAW

4. What type of current is typically used in TIG welding of aluminum?
   A) DCEN
   B) DCEP
   C) AC
   D) Pulsed DC

5. Submerged Arc Welding (SAW) is typically used for:
   A) Thin sheet metals
   B) High-speed production of thick plates
   C) Repair welding
   D) Welding overhead positions

6. Which process is commonly used for automated welding in manufacturing?
   A) GMAW
   B) SMAW
   C) SAW
   D) GTAW

7. What type of welding discontinuity appears as gas-filled cavities in a weld?
   A) Undercut
   B) Porosity
   C) Cracking
   D) Overlap

8. Which tool is commonly used to measure weld profiles and joint preparation angles?
   A) Micrometer
   B) Dial caliper
   C) Weld gauge
   D) Depth micrometer

9. During visual inspection, what does excessive concavity indicate?
   A) Insufficient filler material
   B) Excessive penetration
   C) Poor shielding gas coverage
   D) Incomplete fusion

10. What is the recommended magnification for visual inspection of welds according to AWS?
    A) 1x–2x
    B) 3x–5x
    C) 10x–15x
    D) 20x–30x

11. What is the primary alloying element in stainless steel?
    A) Carbon
    B) Chromium
    C) Manganese
    D) Nickel

12. Heat-affected zones (HAZ) in welding are most susceptible to:
    A) Cracking
    B) Excessive penetration
    C) Undercutting
    D) Surface porosity

13. Preheating is commonly used to:
    A) Reduce weld cooling rates
    B) Avoid excessive penetration
    C) Remove impurities from the base metal
    D) Increase arc stability

14. Which microstructure forms in carbon steel when it is rapidly cooled?
    A) Austenite
    B) Martensite
    C) Pearlite
    D) Ferrite

15. What type of information is typically located in the tail of a welding symbol?
    A) Welding process or specification
    B) Weld on the arrow side
    C) Weld on the other side
    D) Back weld

16. What does a triangular weld symbol indicate?
    A) Fillet weld
    B) Bevel weld
    C) Plug weld
    D) Seam weld

17. In a welding symbol, the tail is typically used to:
    A) Indicate the welding position
    B) Specify weld size
    C) Include process or other reference notes
    D) Show the length of the weld

18. The 3G welding position refers to:
    A) Overhead welding
    B) Vertical welding
    C) Horizontal welding
    D) Flat welding

19. What does the “6G” welding position indicate?
    A) A fixed pipe at a 45-degree angle
    B) A horizontal weld
    C) A groove weld on a flat plate
    D) A fillet weld

20. Which position is considered the most challenging for manual welding?
    A) 1F
    B) 2G
    C) 4G
    D) 6G

21. According to ANSI Z49.1, what minimum shade lens is required for SMAW at 100 amps?
    A) Shade 8
    B) Shade 10
    C) Shade 12
    D) Shade 14

22. What type of fire extinguisher is recommended for welding areas?
    A) Class A
    B) Class B
    C) Class C
    D) Class ABC

23. When should welding helmets and goggles be inspected for cracks or damage?
    A) Weekly
    B) Before each use
    C) After every weld
    D) Monthly

24. What is the main risk of welding in confined spaces?
    A) Overhead hazards
    B) Electrical shock
    C) Toxic fume accumulation
    D) Fire risk

25. What is the primary purpose of a welding curtain?
    A) Shield the welder from sparks
    B) Prevent arc flash exposure to bystanders
    C) Block ultraviolet light for the welder
    D) Protect against heat

26. Which AWS standard governs the structural welding of steel?
    A) AWS A2.4
    B) AWS D1.1
    C) AWS A3.0
    D) AWS D9.1

27. The AWS Certified Welding Inspector (CWI) credential requires knowledge of:
    A) Structural design principles
    B) Metallurgical testing procedures
    C) Welding inspection and standards compliance
    D) Automated welding technologies

28. What does “prequalified joint” mean in AWS D1.1?
    A) A joint that does not require procedure qualification testing
    B) A joint approved after testing
    C) A joint used in automated welding processes
    D) A joint requiring additional filler material

29. AWS A5.1 focuses on:
    A) Welding symbols
    B) Filler metal specifications
    C) Visual inspection criteria
    D) Arc welding safety

30. According to AWS standards, what is a critical element of welder qualification?
    A) Number of years of welding experience
    B) Welding process used
    C) Demonstrated ability to produce sound welds
    D) Type of welding power source

Answer Key

1. C
2. A
3. B
4. C
5. B
6. A
7. B
8. C
9. A
10. B
11. B
12. A
13. A
14. B
15. A
16. A
17. C
18. B
19. A
20. D
21. B
22. D
23. B
24. C
25. B
26. B
27. C
28. A
29. B
30. C

Annex G (Informative)
Central Maintenance and Welding's Sparks & Smoke Welding Competition

This annex is not part of this guideline but is included for informational purposes only.

G.1 Overview.

This annex provides insights into private-sector welding competitions, using the Central Maintenance and Welding (CMW) Sparks & Smoke Welding Competition as an example. This competition serves as both a fundraising event and a career exposure opportunity for welding students, designed to support the creation of an AWS Named Section Scholarship while fostering industry engagement.

G.2 AWS Named Section Scholarship Initiative.

The Central Maintenance and Welding Competition was established to raise funds for an AWS Named Section Scholarship managed through the AWS Foundation. These scholarships, funded by local members, companies, and donors, support welding students within the section. At CMW, the management team reviews student applications and selects a $1,000 scholarship recipient.

Additionally, because this event is recognized as an AWS Section event, it qualifies for a $1M insurance rider through AWS, further supporting the competition's sustainability and risk management.

G.3 Competition Structure

J.3.1 Team Welding Competition

The competition primarily invites teams of four students from welding schools, with instructors acting as coaches. The event is structured to be family-friendly, encouraging parents and guests to watch and support the competitors.

Safety Procedures

- All participants receive breakfast and a safety briefing before competing.
- A Job Hazard Analysis (JHA) is conducted, mirroring real-world industrial site safety practices.
- A Hot Work Permit is issued, and the competition area is marked with red danger tape.
- Wristbands are distributed to students and instructors after completing the safety briefing.
- Spectators must remain outside the Hot Work area but may set up viewing tents and chairs.

Competition Process

- Teams are given six hours to complete a fabrication project (e.g., fire ring, grill).
- Provided equipment includes:
    - Welders, leads, filler metals, and project components.
    - Personal tools such as safety glasses, gloves, wire brushes, measuring tape, and more, all donated by CMW's industry partners.

J.3.2 Individual Welding Competition

In addition to the team event, an individual welding competition allows students to showcase their artistic and technical abilities.

Project Requirements

- Competitors receive a "themed project" one month before the competition.
- The project must be student-fabricated, with documentation in a build book containing:
  - Inspiration and concept sketches
  - Photos of the fabrication process
  - Instructor verification letter confirming student work
  - CNC programming documentation (if applicable)
- Size and weight limits: The project must fit within 1' × 1' × 1' and weigh no more than 50 lbs.

Judging Process

- Projects are displayed for public viewing before judging.
- Local welding inspectors and professional welding artists evaluate the entries.

G.4 Industry Sponsorship & Engagement

CMW does not charge students or families to compete. Instead, funding comes from sponsors who contribute at various levels. These sponsors are encouraged to:

- Set up booths (10' × 10') to distribute promotional materials and giveaways.
- Provide hands-on demonstrations related to welding careers.

Common Sponsors Include:

- Welding industry manufacturers (e.g., Lincoln Electric, Miller)
- Local welding supply and gas vendors
- Equipment rental companies
- NDT and heat treatment companies
- Trade unions (e.g., Boilermakers, Pipe Fitters, Iron Workers, Millwrights)

The event fosters a "welding carnival" atmosphere, allowing students and attendees to explore different career paths through interactive displays.

G.5 Judging & Awards

At the conclusion of the team event, certified welding inspectors grade the projects using criteria similar to those outlined in this guideline. While inspections are underway, students participate in a guided tour of CMW's 50-acre property and 100,000 sq. ft. fabrication facility, gaining exposure to:

- Pressure vessel fabrication
- Boiler and piping projects
- Structural welding operations

Awards & Prizes

- Winners and runners-up are announced at the end of the day.
- Over $15,000 in prizes and scholarships were awarded in 2024.
- Raffle drawings for welding-related gear are held for attendees.

G.6 Sparks & Smoke BBQ Competition

The competition's name, Sparks & Smoke, originally referenced welding but has since expanded to include a BBQ competition for CMW employees.

BBQ Team Structure

- Each team must include at least one CMW employee.
- Teams start preparations at early morning (0-dark-thirty) on competition day.
- They are provided meat and side dish ingredients to prepare their best BBQ.

Judging Process

- The BBQ competition is open to all Welding Competition attendees for voting.
- Winners receive bragging rights and event recognition.

G.7 Conclusion

The Central Maintenance and Welding Sparks & Smoke Welding Competition serves multiple purposes:

- Showcases emerging welding talent
- Provides a real-world welding experience for students
- Engages industry professionals and sponsors
- Creates scholarship opportunities
- Functions as a recruitment tool for CMW

This competition fosters interest in welding careers while strengthening community ties by exposing students to an active welding operation and industry professionals.

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Annex H (Informative)
WorldSkills Competition

This annex is not part of this guideline but is included for informational purposes only.

J.1: To represent the United States in welding at the WorldSkills Competition, college and high school students typically follow a structured pathway facilitated by SkillsUSA, the organization responsible for selecting and preparing the WorldSkills USA team. The process involves several key steps:

1. **Participation in SkillsUSA Championships**: Students begin by competing in local and state-level SkillsUSA welding competitions. Excelling at these levels can lead to participation in the national SkillsUSA Championships.

2. **National Performance Evaluation**: Outstanding performers at the national level are identified through a detailed analysis of their competition results. This evaluation includes interest surveys and individual interviews to assess candidates' commitment and suitability for international competition.

3. **Weld Trials Selection Process**: Selected candidates are invited to participate in the American Welding Society (AWS) Weld Trials. This rigorous, eight-month-long process involves skill demonstrations and hands-on events designed to assess technical proficiency and adaptability. aws.org.

4. **Training and Preparation**: Candidates who excel in the Weld Trials undergo intensive training, often involving the individualized training plans. This preparation is crucial for developing the advanced skills necessary for international competition.

5. **International Competition**: The selected competitor represents the U.S. at the WorldSkills Competition, showcasing their welding expertise on a global stage.

This pathway demands dedication, exceptional skill development, and a commitment to continuous improvement, reflecting the high standards expected of WorldSkills competitors. This guideline was shaped by contributions from several past WorldSkills U.S. competitors, who aim to inspire and support future participants in continuing the legacy of success on the world stage. A special thanks to 1993 WorldSkills competitor Nicholas Peterson for his contributions and vision for the future of welding competition.

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Annex I (Informative)
Informative References

This annex is not part of this guideline but is included for informational purposes only.

American Welding Society (AWS) Standards:

AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*

AWS A3.0M/A3.0:2026, *Standard Welding Terms and Definitions*

AWS B1.10, *Guide for the Nondestructive Examination of Welds*

AWS B1.11, *Guide for the Visual Examination of Welds*

AWS B2.1, *Specification for Welding Procedure and Performance Qualification*

AWS B4.0, *Standard Methods for Mechanical Testing of Welds*

AWS B5.1, *Specification for the Qualification of Welding Inspectors*

AWS QC1, *Standard for AWS Certification of Welding Inspectors*

AWS QC7, *Standard for AWS Certified Welders*

SkillsUSA Technical Documents:

Recommended Projects & Scoring Criteria for State SkillsUSA Welding Championships

SkillsUSA Recommended Procedures for Conducting a SkillsUSA Welding Contest

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