Compétition
Universitaire Appliquée d'Exosquelette
ACE 2026
Applied Collegiate Exoskeleton
Competition

2026 Preliminary Rulebook

last updated : 20-10-2025

UdS
Faculté
de génie

Université de Sherbrooke

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1 Major Changes

1. Metabolic Test and Obstacle Course are merged into the new Athletic Test
2. Addition of a Judge Piloting Test and removal of Strength Tests
3. Mandatory safety inspection to participate in all tests
4. Adapted the Design Review Scoring sheet to avoid redundancy with new tests

2 Executive Overview

2.1 ACE Competition Statement:

The ACE Competition aims at testing the functional capabilities of lower body exoskeletons designed and built by undergraduate student teams. The purpose of this is to help push forward and increase interest in this relatively new and upcoming technology by creating a friendly competition where teams can share, discuss and test the real-world potential of their designs. To realize this goal, the competition puts forward a wide range of tests designed to measure suits' strength, endurance and versatility. Suits should also be ergonomic, cost efficient, weight efficient and adaptable to a wide range of pilots in order maximize their performance in the competition.

ACE2026 brings unique challenges that raise the bar in terms of versatility in control algorithms. A new test will have judges pilot every suit to assess their control performances. Safety is and always has been our top priority, and this new test brings a whole deal of safety and legal risks. To maintain appropriate safety with these new changes, a strict safety inspection has been put in place. Teams must meet every requirement of the inspection to be allowed to participate in the event.

All teams are expected to behave in a fair and constructive way and not take advantage of rule loopholes. The organizers of the ACE Competition reserve the right to alter the rules at any time if deemed necessary. Teams will be notified of any major changes but should always refer to the ACE website for the latest version of the rulebook, schedules, registrations and deadlines.

Official ACE website: https://www.acecompetition.ca/

Organizing committee e-mail: competitionace@usherbrooke.ca

Discord server: https://discord.gg/wFXFP8rTFC

2.2 Competition Design

The competition includes 4 main events:

1. Design review (175 points)
2. Judge piloting test (100 points)
3. Ergonomic tests (75 points)
4. Athletic test (125 points)

They are described in section 5 and their scoring details are shown in Appendixes B to E. Teams' final ranking in the competition will be in order of most points cumulated.

To be allowed to compete, teams must submit a safety report (detailed in Appendix A) and pass the safety inspection (document available on the ACE website).

Safety reports must be submitted 8 weeks in advance of the competition. The goal of the report is to make sure that no major design oversight or out-of-scope technology would cause a team to fail the safety inspection. Reports will be reviewed by the organizing committee only, which will provide teams with a list of design changes no less than 6 weeks prior to the competition. The reports will not be shared with any other teams.

The safety inspection will be held in the morning of the second day of the competition. Inspectors will prescribe mandatory changes to non-conforming exoskeletons. Teams that do not implement these changes properly or fail to have them approved by safety inspectors before the end of the safety inspection period will not be allowed to compete.

2.3 Brief Technical Summary

Here are some technical points to which each exoskeleton and team must conform:

1. Exoskeletons must be designed and assembled completely by the competing team.
2. Exoskeletons must be portable, stand-alone devices and they cannot be tethered to a power source that is located off the suit.
3. Exoskeletons must be designed to passively or actively assist the user in movement and/or transfer loads off the user to the ground.
4. Exoskeleton may only apply forces to the environment through contact forces with the ground (e.g. no jet engine propulsion).
5. Exoskeletons may not replace the pilot's human gait with different types of locomotion (e.g. wheels, continuous track).
6. Exoskeletons must be controlled by the pilot; no outside control may be utilized.
7. Exoskeleton parts cannot pose potential harm to the pilot or bystanders.
8. Exoskeletons must comply with the technical requirements outlined in section 3.

In this document, the terms exoskeleton, exo, suit and exosuit are used interchangeably.

3 Technical Requirements

In addition to the requirements outlined in the safety report, the safety inspection will verify that exoskeletons follow the specifications of this section.

3.1 Energy Source

1. The suit cannot be powered by a combustion engine or use flammable liquids or gas for fuel.
2. The suit cannot contain any voltage higher than 59 V DC.
3. The suit cannot be powered by hydraulic systems.
4. The maximum power at each joint is 1kW (1.34 HP).
5. Elastic bodies expected to store 50 J or more of energy (springs, bungee ropes, etc) must be properly restrained :
    a. Elastic bodies under tension or flexion (bungee rope, flexion bar, tension spring) : evenly spaced braces must restrict the outward extension of the elastic body (in case of sudden rupture). The body must have 1 brace per 50 J increment, e.g. a body expected to contain up to 205 J must have 5 equally distant braces along its length (not including its anchor points). Teams are expected to justify the strength of their braces with appropriate calculations or simulations.

    b. Helicoidal springs (tension or compression) or torsion springs : must be covered over its total length or range of operation to prevent pinch points.
    c. Helicoidal compression spring : open length must be smaller than 3x its diameter to prevent buckling. Both spring seats must remain parallel at all times and be capable of resisting impacts and forces much higher than the force of the spring alone. Teams are expected to justify the strength of their anchor points with appropriate calculations or simulations.
6. Exoskeletons containing electric energy must have an emergency shutoff switch (electric e-stop) that isolates the battery from the rest of the suit. The switch must be accessible to the pilot and bystanders no matter the orientation of the exoskeletons.
7. When the electric e-stop is disengaged, the electric circuit must remain unenergized until the pilot performs a separate action (e.g. presses a separate button, etc).
8. Exoskeletons containing pneumatic energy must have an emergency shutoff switch (pneumatic e-stop) that isolates the compressor and/or accumulator (tank) from the rest of the suit. The switch must be accessible to the pilot and bystanders no matter the orientation of the exoskeletons.
9. When the pneumatic e-stop is disengaged, the pneumatic circuit must remain unenergized until the pilot performs a separate action (e.g. presses a separate button, etc).
10. Each independent pneumatic section (hoses, actuators and accumulators) must have a valve that allows manual release of pressure from that section.
11. Maximum tank pressure is 59.3 bar at 21°C (860 psi at 70°F), which corresponds to the vapor pressure of carbon dioxide (CO_2) (see exception below).
12. Suits with pressures higher than 860 PSI must meet the following criteria:
    a. Have a pressure appropriate SCBA tank and regulator, a manual shutoff valve and two burst disks (one low pressure and one high pressure).
    b. The tank, regulator, valve, burst disks and fittings must be unmodified, off the shelf parts that comply with CSA, NIOSH, or NFPA standards. They must be used and accounted for in the design in accordance with the manufacturer guidelines.
    c. The tank filling pressure must not exceed 4,500 psi.
    d. The low pressure burst disk must be positioned between the regulator and the low-pressure circuit. Its burst pressure must be no more than 20% above the operating pressure of the low-pressure circuit.
    e. The high pressure burst disk must be positioned between the regulator and the tank. Its burst pressure must be no more than 70% above the operating pressure of the low-pressure circuit or 7,500 psi, whichever is lower.
    f. Both burst disks must have their exhaust oriented away from the pilot's head
    g. The regulator, its fittings and the tank fittings must be physically protected from impacts (e.g. with a cover or cage) that may occur in normal operation, including as a result of a pilot fall.
    h. A qualified professional must have conducted a hydrostatic test on the tank no more than five years before the competition date. Teams will be asked to provide a signed declaration from the professional with test results attesting that the tank passed the test.
13. Any safety device that handles energy (wire, hose, fuse, e-stop, valve, spring, motor, etc) must be compliant with applicable ANSI/ATSM, CE, CSA or equivalent safety norm.
14. Pneumatic devices cannot reach higher than the pilot’s shoulder or pose a risk to their eardrums.

3.2 Mechanical

1. Exoskeletons must have mechanical stops preventing any joint movements beyond the physical limits of the user on each actuated joint (passive or active). Non-actuated joints are not required to have mechanical stops. Mechanical stops must be capable of handling twice the force (Security factor >2) they are expected to handle under normal conditions, which includes pilot weight, suit weight, actuation forces and impacts (i.e. pilot falls). Teams are expected to justify the strength of their hard stops with appropriate calculations or simulations.
2. To participate in the judge piloting test, exoskeletons must be able to accommodate any body size included in the ranges presented in Appendix G.

3.3 Electronics

1. Electronics cannot be grounded to the suit (no electrical connection between electronics and body of the suit).
2. No loose wires can be present on the suit. They must be secured to the exoskeleton's structure.

3.4 Added Weights

The Athletic Test will require exoskeletons to carry a payload (added weight) during testing (25 lbs for soft exoskeletons and 50 pounds for hard exoskeletons). A hard (rigid) exoskeleton is defined as one that redirects some weight to the ground, as opposed to a soft exoskeleton which doesn't.

1. Teams may provide their own weights. If not, they will be provided with standard gym plates. These weights must be dead weights, meaning they do not provide any utility or feature to the suit.
2. Weights must be anchored to the suit, not the pilot.

4 Safety and Legal Considerations

In participating to the event, every participant (judge, sponsors, pilots, volunteers, members of participating teams, members of the organizing committee, etc) recognizes and agrees to the terms and conditions of this document.

4.1 Pilot Participation

1. Pilots must fill in the pilot consent form. Any person that has not completed the form will not be allowed to pilot their team's suit during the competition.
2. Pilots must wear a bike helmet (or equivalent head protection) as well as safety glasses and steel cap footwear (both certified ANSI/ATSM, CSA or equivalent) while piloting a suit.

4.2 Teams Responsibilities

1. Teams are responsible for the physical integrity of their exoskeletons and will not hold the organizers responsible for any damage to their exoskeletons that could reasonably be caused by participating in the event, such as pilot falls.
2. Teams are also responsible in ensuring their exoskeleton does not cause harm to their pilot or anyone else. Participating teams affirm that their exoskeleton conforms to the safety

specifications outlined in this document and that all the information they provided about their suit is accurate to the best of their knowledge.

3. Teams agree to follow safety instructions during testing. The organizing committee will exclude participating pilots that seem intoxicated, act recklessly or otherwise endanger themselves or others.
4. Teams must ensure that their exoskeleton continues to meet the safety standards validated during the safety inspection. They must promptly report to the organizing committee any damage or modifications that could compromise safety. The organizing committee may require corrective changes and may disqualify teams that fail to implement these changes or fail to report such damage or modifications.
5. Teams hereby waive any and all claims for losses and damages, regardless of cause, against the University of Sherbrooke, the General Engineering Student Association at the University of Sherbrooke (AGEG), the event venue owner, suppliers, and their affiliated companies, as well as their officers, directors, employees, and agents, whether incurred before, during, or after the event.

4.3 Safety Inspection

1. Inspectors will not perform tests to validate that each component is rated as or composed of the materials stated by their team. Teams will bear responsibility for any injury or damage incurred to themselves or others as a result of incorrect or omitted information regarding their exoskeleton and its components.
2. An exoskeleton that doesn't allow all inspection actions to be properly taken (e.g. battery is not visible, joints can't be moved through their entire range of motion when powered off) will fail the safety inspection.
3. Inspectors will be instructed to fail the inspection of a suit that contains technology falling outside the scope of what is expected and accounted for in the inspection protocol. Teams must advise the organizing committee of the presence of any exotic technology in their suit (compliant mechanisms, supercapacitors, gas springs, etc) in their safety report so that the inspection protocol can be adapted accordingly to allow that technology.

4.4 Media and Image Rights

By participating in the competition, each participant expressly grants the organizing committee, its representatives, and invited media personnel the irrevocable right to capture, record, and reproduce their likeness, image, and voice as well as their exoskeleton and other designs presented at the competition through photography, video, or any other recording medium during the course of the event. Participants further consent to the unrestricted use, publication, distribution, and dissemination of such materials for purposes of public communication, including but not limited to promotional, educational, and informational materials, whether in print, digital, or broadcast form. No financial or other compensation shall be payable to participants for the use of such images or recordings. All rights in such materials shall remain the exclusive property of the organizing committee.

5 Event Details

5.1 Design Review

The design review focuses on evaluating all design choices on the exoskeleton and especially those that aren't addressed by the other tests, such as body attachments, software, costs, materials and assembling. Teams will present their suit in front of a panel of judges for a maximum of 20 minutes followed by a 10 min question period. Visual support (eg. powerpoint presentation) are allowed and recommended. Teams may have their suit with them during the presentation to illustrate mechanical components, but active suits must not be powered on during the presentation. The scoring table can be found in Appendix B.

5.2 Judge Piloting

In this test, judges will pilot each team's exoskeleton and perform 4 exercises from the list shown in Appendix F. The 4 exercises will be the same for each team and will not be disclosed before the competition. The goal of this is to incentivize teams to make versatile control algorithms that can properly perform a wide variety of exercises while conserving testing duration and complexity to a minimum.

Judges will review and score the exoskeleton's assistance based on the criteria outlined in Appendix C. These criteria are designed with the intention of rewarding actuation that is smooth, responsive and optimized to the specific motion. This test will not evaluate the maximum strength of the actuation.

In order to perform this test, suits must be able to fit the body sizes of the judges. Appendix G shows ranges of body dimensions among which judges will lie. Teams must be able to accommodate any body dimensions in these ranges to perform this test.

Piloting judges will attend the safety inspection to learn the usage of every critical safety feature as they're being tested in the inspection. Teams will be able to help judges put on and adjust their suit, but judges will not be given any training on the suit's functioning and piloting. Teams must be present and ready to intervene in case of a suit malfunction during the judge piloting test.

5.3 Ergonomic Tests

This event will include a Don & Doff test as well as an emergency Doff test. The scoring table can be found in Appendix D.

The Don & Doff test is designed to test how reliably pilots can put on and remove the suit. For this test, 3 pilots must put on and off the suit completely. When the first person has taken off the suit, the next person may begin to put on the suit and so on. Each person must put the suit on by themselves, with no help from their teammates. Time starts when the first pilot begins putting on the suit, and time is stopped when the third pilot has completely taken off the suit. The use of a suit stand is allowed, but the suit must be completely removed from the stand before the next pilot can start putting on the suit. A suit stand is a frame that provides no assistance besides holding the suit. Each team will have the opportunity to complete the Don & Doff test twice. Only the team's best attempt is considered.

The emergency Doff test is designed to measure how quickly a pilot can remove the suit in an emergency. For this test, a person starts with the suit completely on and both their arms above their head. Time starts when they move their hands, and time is stopped when they have completely taken off the suit. They must take off the suit by themselves, with no help from a suit stand or their

teammates. Each team will have the opportunity to complete the emergency Doff test twice. Only the team's best attempt is considered. The two tests must be performed by two different pilots.

5.4 Athletic Test

This test assesses the strength and adaptability of the exoskeleton's assistance by measuring its impact on the pilot's metabolic expenditure while looping around an obstacle circuit.

The circuit is composed of 4 distinct sections:

1. Squats: pilots squat under a series of bars 2/3 their height.
2. High knees: pilots hop over a series of hurdles at their upper knee height.
3. Quick steps: pilots step over a long series of mini hurdles at about mid-shin height.
4. Backwards walking

Pilots will loop around the circuit at a pace of 1 turn per minute for a total of 10 turns (10 minutes). An ACE volunteer will walk alongside them at this exact pace. If the volunteer laps the pilot (pilot is a full lap behind), the attempt is considered invalid (and will not be retaken).

Pilots will take the test twice, once with and once without wearing their exoskeleton. Both attempts will include their appropriate added weights (a weighted vest will be provided for the no-exoskeleton test).

ACE volunteers will instruct the pilots to retake a section if it is improperly traversed (without compensation for lost time).

Results will be derived from the variation in metabolic metrics from both tests. Proper calculations are used to limit bias caused by pilots' physical capabilities. Pilots must be physically capable of finishing the test, an incomplete attempt is considered invalid (and will not be retaken).

The calculations and scoring details are detailed in Appendix E. Pilots will have a mandatory 15 minutes resting period before each attempt to ensure their metabolic metrics are at their resting values.

Appendix A Safety Report Details

The following details must be present in your safety report. All reports will only be viewed by the organizing committee. Pictures may be computer design (CAD) screenshots as long as they are representative of the suit that will be used during the competition.

- Title Page (University, team name, group leader(s) name(s) and contact info, date)
- Table of contents
- Team presentations
    - Background on team and project goals
    - Team composition (number of active members, their field and year of study)

** Start the next section on a new page. Do not mention your university or team name beyond this point. The previous sections will not be given to the reviewers for anonymity purposes.*

- Project overview
    - Picture of the overall suit
    - Exoskeleton type (soft or hard)
    - Power source(s) (batteries, pneumatics, springs, …)
    - Actuation method (electric motors, compressors, springs, …)
- Mechanical Overview
    - Brief explanation of each joint's structure and motion
    - Brief explanation of how the suit is attached to the pilot and how the pilot may be removed from the suit quickly if they would be unable to remove it by themselves (eg. pilot falls unconscious)
    - Brief explanation of the added weights anchoring to the suit.
    - Brief explanation of the body size adjustments to the full range described in appendix G.
    - Detailed explanation of each mechanical risk and how they are properly mitigated. Mechanical risks include :
        - Pinch points and sharp edges
        - Hyperextension of motorized joints (with calculations or simulations)
        - Any moving/actuated part (motors, clutches, gears, …)
        - Any other potential mechanical risk
- Electrical Overview (if applicable)
    - Power system overview
    - Battery ejection system overview
    - Block diagram of electrical system with the following details :
        - Voltage and wire gage specified for each line
        - E-stop positioning and rating
        - Fuse(s) positioning and specs (max amp, type (slow blow, fast action, …)) or circuit breaker positioning and specs
        - Battery positioning and spec
    - Calculation of maximum current, tension and power consumed by actuators
    - Maximum battery power
    - Picture of emergency shutoff switch (e-stop) location on the suit
    - Detailed explanation of each electrical risk and how they are properly mitigated. Electrical risks include :
        - Electrical shorts

        - Electrical discharge to the pilot or to bystanders
        - Battery pack combustion/explosion
        - Any other potential electrical risk
- Pneumatic overview (if applicable)
    - Power system overview
    - Maximum power at each joint
    - Gas type, gas filling apparatus, and number of bottles to be stored
    - Block diagram of pneumatic system with the following details :
        - Pressure and hose diameter specified for each line
        - Pneumatic e-stop positioning and rating
        - Position of manual pressure release valve for each independent pneumatic section
        - Maximum pressure rating for each pneumatic component (hose, accumulator, compressor, actuator, valve, …)
    - Picture of pressure evacuation switch (pneumatic e-stop) location on the suit
- Elastic energy overview (if applicable)
    - Calculation of maximum expected elastic energy contained in each elastic body.
    - For elastic bodies in tension or flexion (bungee rope, flexion bar, tension spring) :
        - Brace quantity and positioning
        - Brace strength (with calculations or simulations)
    - For compression springs :
        - Spring specs (length, width, spring rate)
        - Anchor points design and strength (with calculations or simulations)
- Any exotic or out of scope technology (compliant mechanisms, supercapacitors, gas springs, etc) and their proper risk mitigation (with calculations or simulations)
- Any additional safety risk

Appendix B Design Review Scoring Sheet

Judges will attribute points based on how true each statement are for your suit. Only elements that have been specifically presented or discussed by your team during the presentation will be considered. The final score will be an average of the total score given by each judge. Teams will be allowed to present in English only.

DESIGN REVIEW SCORING SHEET		
Category	**Description**	**Score**
Structural Design Support frame, mechanical components, materials and assembly	The suit allows natural motion of the middle and upper body	**/5**
	No component can fall easily or collide with environment	**/5**
	Material selection (weight, strength, cost) is appropriate	**/15**
	Fabrication and assembly methods are appropriate	**/15**
	Components are resistant to wear and mechanical fatigue	**/10**
	Suit has mechanical stops preventing hyperextension on non-actuated joints	**/10**
Actuation Methods with which the suit assists the pilot. *Includes passive and active elements that ease movements or transfers load off the pilot.*	Actuation strength can be adapted to pilot and payload weight	**/5**
	Actuation does not restrain pilot movement when suit is powered off	**/5**
	Actuation has defined and predictable behavior (software or other) for any environment and pilot movement	**/15**
Attachment Methods of attaching the exoskeleton to the pilot's body.	The number and size of attachments is optimized	**/10**
	Attachments are strong and don't allow the pilot to move relative to the suit	**/10**
	The suit can easily and rapidly be adjusted to match the pilot's physical dimensions (height and others)	**/5**
	Attachments can easily be undone by bystanders no matter the position of the pilot (e.g. : lying on the floor)	**/5**
Sensors and electronics reliability Failure points in boards, wires and sensors usage and fastening *All points given when not applicable to the suit*	Sensing methods are robust to environmental conditions (indoor and outdoor, inclined or uneven terrain, etc)	**/10**
	Electronics are properly shielded from electromagnetic noise	**/5**
	Wires are properly routed; they don't sag or extend away from the suit and can't be damaged easily by the suit	**/10**
	Electronic boards are protected against impacts and the risks of overheating are properly mitigated	**/5**
Presentation Presentation and delivery quality	Visual supports are relevant and well made.	**/10**
	Speakers are clear and dynamic	**/10**
	The presentation is structured coherently.	**/10**
	Total	**/175**

FINAL SCORE : /175

Comments :

Appendix C Judge Piloting Scoring Sheet

Each exercise is worth a maximum of 25 points if all criteria are met.

JUDGE PILOTING TEST SCORING SHEET				
Criteria	**Score 1**	**Score 2**	**Score 3**	**Score 4**
Actuation is smooth, no shaking or unnecessary interruption of actuation throughout the exercise	**/4**	**/4**	**/4**	**/4**
Each moving direction of each lower body joint is assisted	**/4**	**/4**	**/4**	**/4**
Body attachments don't cause any pain or discomfort. The suit is firmly secured and doesn't move relative to the body	**/5**	**/5**	**/5**	**/5**
Actuation adapts to pilot's pace when exercise is executed faster, slower or stops midway.	**/6**	**/6**	**/6**	**/6**
Actuation force varies throughout the movement following the load on each joint (eg. actuation is stronger on the bottom than the top of a squat)	**/6**	**/6**	**/6**	**/6**

FINAL SCORE : /100

Appendix D Ergonomic Test Scoring Sheet

For each category, the team with the fastest time will receive 75 points. Only the team's best attempt is considered. Each subsequent team's score will be determined with the following formula (results rounded down):

$$Final\ Score = \frac{1st\ place\ time}{Team's\ time} \times 75$$

ERGONOMIC TEST SCORING SHEET	
Category	**Score**
Don & Doff	**1st try :**
	2nd try :
Emergency Doff	**1st try :**
	2nd try :

FINAL SCORE : /75

Appendix E Athletic Test Scoring Sheet

Both (with and without suit) tests will yield a result for both pilots using the following formula, where a bigger heart rate increase yields a lower score:

$$Test\ Result = \left[1 - \frac{BPM\ post\ exercice - BPM\ pre\ exercice}{BPM\ post\ exercice}\right]$$

Test duration ends after 5 minutes or when participants fail to follow the imposed step rate for 15 consecutive steps or 45 total steps. The performance gain of each pilot, e.g. the impact of the suit on heart rate increase, will be calculated using the following formula :

$$Performance\ Gain = With\ Suit\ Result - Without\ Suit\ Result$$

Note that negative results are possible and would indicate that the suit reduces overall metabolic performances.

The final result will be an average of the performance gain of both pilots. The two pilots taking the second test (without suit) must be the same as the ones that took the first test (with suit). A team that does not use an appropriate added weight onto their suit will have its performance gain reduced by 50%.

The team with the highest performance gain result will receive 125 points. Each subsequent team's score will be determined with the following formula (results rounded down), to a minimum of zero :

$$Final\ Score = 125 \times \left[1 - \frac{abs(1st\ place\ performance\ gain - Team's\ performance\ gain)}{\sqrt{1st\ place\ performance\ gain^2 + Team's\ performance\ gain^2}}\right]$$

ATHLETIC TEST SCORING SHEET		
Category	**Description**	**Score**
Without suit	Test result (pilot 1)	
	Test result (pilot 2)	
Without suit	Test result (pilot 1)	
	Test result (pilot 2)	
Final result	Performance gain (average from both pilots)	

FINAL SCORE : /125

Appendix F Possible Exercises for Judge Piloting Test

Note : all exercises start from a standing upright position and return to it unless stated otherwise.

Possible exercises:

- Crab walk
- Sideways leg raise
- Side step
- Side step up
- Side step with pointed feet
- Narrow beam walk (forward)
- Narrow beam walk (backward)
- Forward lunges
- Backward lunges
- Squat
- Stair climbing (upwards, facing the front)
- Stair climbing (upwards, facing the back)
- Stair climbing (downwards, facing the front)
- Stair climbing (downwards, facing the back)
- Tip toe walking (forward)
- Tip toe walking (backward)

* visual representation of each exercise with maximum amplitude for each joint will be included in the final version of the rulebook

Appendix G Anatomical Dimensions Range for Piloting Judges

Piloting judges will have body dimensions that fall within the following ranges. Consider that they will also be wearing clothes, which is unaccounted for in the ranges. Ranges correspond to the 5th to 95th male percentile described in Gordon, Claire C. et. al (2014). 2012 Anthropometric Survey of U.S. Army Personnel: Methods and Summary Statistics (https://apps.dtic.mil/sti/tr/pdf/ADA611869.pdf), which also details how each body dimension is to be measured.

All dimensions are in inches.

Body Dimension	Specific Measurement	# in Survey	Min Value	Max Value
Hip Width	Hip Breadth	50	12.13	15.24
Hip Depth	Buttock Depth	17	8.03	11.46
Shoulder Width	Biacromial Breadth	8	15.12	17.60
Chest Depth	Chest Depth	25	8.31	11.73
Shoulder Height	Acromial Height	2	52.72	60.87
Hip Height	Trochanterion Height	83	32.44	38.78
Knee Height	Knee Height, Midpatella	56	17.44	21.10
Foot Length	Foot Length	36	9.84	11.54
Foot Width	Foot Breadth, Horizontal	35	3.70	4.37
Belly Depth	Waist Depth	88	7.40	11.81