PICKLE PRO LABS

May 25, 2023

INTRODUCTION

Pickle Pro Labs (PPL) was founded by a team of leading sporting goods industry professionals with extensive backgrounds in sports-related equipment standards development, performance testing and product compliance. The team's collective experience includes decades of working closely with the governing bodies and major equipment manufacturers in Golf, Baseball, Softball, Football and Tennis. In many instances, the founders' efforts have been foundational to some of the longest standing, most effective equipment compliance programs in sports.

Having experienced first-hand the challenge of implementing new standards in established sports markets and how this negatively impacted participation and the market in general, the founders seek to work closely with the governing bodies of Pickleball to help these governing bodies evaluate their current performance and compliance standards and to help them improve their implementation and, in some cases, improve the processes altogether. Given the budding nature and rapid growth of Pickleball, there is a real urgency to move forward with a single, unified performance and compliance program to help protect the integrity of the game and to eliminate the potential for product-related issues from having a negative impact on the growing market.

SUMMARY OF CURRENT EQUIPMENT CERTIFICATION REQUIREMENTS

Currently, nearly all established pickleball leagues and tournaments require that equipment used during play be compliant with USA Pickleball's requirements. The current USA Pickleball equipment standards were last updated in 2021 and contain both paddle and ball parameters/requirements for certification (the full set of standards can be found on the USA Pickleball website). Given their ambiguity and reliance on indirect performance characteristics, it appears the USA Pickleball rules and equipment standards will require significant overhaul if they are to remain practical and relevant to the world's fastest growing sport.

Paddle Certification Requirements

There are no direct performance metrics identified in the paddle requirements. Instead, a variety of physical characteristics and indirect performance metrics including paddle length and width, surface roughness, surface friction and face deflection are utilized.

The official paddle requirements also include ambiguous language regarding certain types of materials and design characteristics that can be utilized.

Ball Certification Requirements

There are no direct performance metrics identified in the ball requirements. Instead, a variety of physical characteristics and indirect performance metrics including diameter, weight, compression and bounce are utilized.

The official ball requirements also include ambiguous language regarding certain types of materials and design characteristics that can be utilized.

Ongoing Compliance

Manufacturers are subject to compliance testing to ensure that products as-produced and as-sold are compliant with all requirements. The language regarding compliance testing is ambiguous, but it implies the same test methods utilized for certification will also be used for compliance.

STATE OF CURRENT EQUIPMENT CERTIFICATION AND COMPLIANCE PROCESS

PPL believes indirect performance measurements and physical characteristics (such as are currently utilized for pickleball equipment) are not adequate certification criteria because actual performance does not necessarily correlate with these measurements or characteristics. As such, it is possible for equipment to be designed in such a way that its actual performance exceeds expectations. Said more plainly, if a governing body relies solely on indirect performance measurements for certification, it means that governing body does not know the actual performance of the equipment it is certifying.

Historically, the lack of direct performance measurements for pickleball equipment has been mostly inconsequential. However, as the popularity of pickleball has exploded and a multitude of new products have entered the market, the inadequacy of the existing standards have been exposed and there is concern the standards will soon be further intentionally exploited by aggressive manufacturers or participants.

In addition to the inadequacy of the initial equipment certification, there is also a growing concern regarding equipment performance through the lifetime of the equipment. More specifically, some paddles appear to increase in performance through normal use and/or abuse.

Paddle performance increasing with use and/or abuse is especially problematic for compliance because the test methods outlined in the certification process are inadequate to identify and rank actual performance levels. For reference, the test method of primary concern, the face deflection test, consists of loading a face of the paddle with a 3 kg load (approximately 6.5 lb) and measuring the resulting face deflection. Most paddles in the market (both new and used) are indistinguishable from one another when compared using this test method – which is a significant red flag for the usefulness of the test since even simple observation by onlookers and players can quickly identify differences in paddle performance.

While the method is not outlined within their rules, USA Pickleball has begun utilizing a test other than its face deflection test for ‘in field’ compliance testing. The new test that has been implemented to identify non-compliant paddles is Ultrasonic NDT (Non-Destructive Testing). Ultrasonic NDT is used regularly in a variety of industries including aerospace and coatings. This test consists of emitting an ultrasonic signal into the surface of a sample and measuring the signal’s response. If properly calibrated, a change in signal indicates a material inconsistency in the sample.

Unfortunately, Ultrasonic NDT has also proven to be inadequate at identifying performance changes. Even ignoring the many challenges around validly calibrating each paddle, in its best-case scenario, Ultrasonic NDT only identifies inconsistencies – and these inconsistencies are not correlated with actual performance.

An additional real-world performance concern is how much spin a paddle can impart to a hit ball. While there is no test method outlined to measure actual spin rates of impacted balls, USA Pickleball utilizes face friction and surface roughness measurements as proxies for actual paddle spin performance. While this is not an unreasonable practice, friction and surface roughness have not been correlated with true spin rates and as such, should not be used as performance parameters.

WHAT IS NEEDED

PPL believes the optimal path forward for pickleball equipment certification is to establish a test method to directly measure paddle and ball performance. Such methods will be a significant improvement from current methods because the results will be independent of paddle and ball construction and because the results will correspond to real world performance measurements and observations.

In sports in which striking implements and balls are utilized and the rebound of the ball from the striking implement is a primary performance concern, best practices for equipment certification include establishing dynamic tests which directly measure the rebound of the ball from the striking implements.

PPL also believes a more effective compliance test is necessary. This compliance test must correlate with the direct paddle performance measurements, this way the market can be confident that paddles which pass the compliance test are also compliant with the global performance standard.

Recommended Direct Performance Methods

PPL believes Dynamic Performance Testing is the best method to directly evaluate equipment performance. As it is used herein, Dynamic Performance Testing means testing equipment under conditions which approximate real world impact conditions or parameters.

As it pertains to pickleballs, Dynamic Performance Testing will consist of projecting a ball against an opposing surface and determining the efficiency of the collision by evaluating the inbound and outbound speed and trajectory of the ball. This measurement, known as the ball's coefficient of restitution ("COR") is a reliable way to describe the "bounciness" of a ball. In addition to COR, PPL also recommends using Dynamic Performance Testing to measure the dynamic stiffness of the ball; this is done by measuring the peak force imparted by the ball as it impacts an opposing surface. Dynamic stiffness is critical because it describes the "hardness" of a ball. Both COR and dynamic stiffness are useful performance metrics; when impacting solid and incompressible surfaces, the COR measurement is the most relevant performance metric and dynamic stiffness is a more effective performance metric when the ball will be impacting surfaces that have the potential to deflect or deform.

As it pertains to paddles, PPL recommends Dynamic Testing that consists of projecting a ball against the paddle face and determining the efficiency of the collision by evaluating the inbound and outbound speed and trajectory of the ball. This measurement, commonly referred to as the Paddle Ball Coefficient of Restitution (PBCOR), is a wholistic measure of the efficiency of the paddle ball collision. More simply, PBCOR is the most effective way to quantify paddle performance.

Recommended Compliance Method

Based on the evidence seen to date, PPL believes the primary reason for increased paddle performance after use and/or abuse is the development of a "trampoline effect," which is the term commonly used to describe when the elastic deformation of the paddle face results in an improved collision efficiency and therefore higher ball rebound speeds. While it is clear USA Pickleball's paddle rule is intended to disallow paddles with trampoline effects, a trampoline effect can develop as the paddle incurs non-catastrophic paddle damage (either through standard use and/or abuse).

Given that the increased performance is caused by excessive face deflection, PPL recommends implementing a compliance method that measures the force required to generate a significant deflection in the paddle face. Unlike USA Pickleball's face deflection test, PPL recommends a more robust test with more appropriate parameters that is capable of distinguishing between paddles of varying performance levels.

PPL's recommended methodology is built on the same principles used for compliance testing in NCAA Baseball and Softball and PGA Golf. These organizations selected their particular compliance methods based on large data sets and strong correlation between direct performance methods and their particular compliance test. Based on the physical principles in play and preliminary paddle testing, PPL is confident there will also be a strong correlation between its direct performance method and its face deflection test.

Recommended Method for Spin Rate Assessment

The PPL recommends utilizing an optical system that will allow for the direct measurement of spin rates imparted to balls after oblique impacts with surfaces of varying friction and surface roughness thresholds. Direct spin rate measurements will allow governing bodies to establish rules based on direct performance attributes. Similarly, these direct measurements may also be able to justify the use of simpler, indirect measurements for compliance such as friction and surface roughness.

PPL'S PROGRESS

PPL has developed a face deflection test capable of identifying differences in paddles currently on the market. PPL has generated a significant baseline dataset for face deflection from off-the-rack paddles as well as a significant dataset for face deflection from paddles with varying levels of use. The datasets are complimentary and strongly suggest that paddle performance will follow the same general trends seen in the baseball and softball bat industry.

PPL has worked closely with Major League Pickleball (MLP) to begin implementing compliance testing based on PPL's face deflection testing at MLP events. While PPL's dynamic testing system is still in its testing phase and not enough data exists yet to build a direct correlation between face deflection and PBCOR, MLP has elected to take a practical approach to compliance. This practical approach is based on the MLP's opinion that the pace, quality and fairness of play at its events is largely acceptable; therefore MLP identified the average face deflection for the paddles in use by their professionals and has elected to establish a minimum face deflection value that is a significant and meaningful deviation from the

average face deflection value. Only paddles whose face deflection values are lower than the minimum face deflection value will be removed from play.

PPL has also commissioned work on dynamic testing systems for balls and paddles. Preliminary testing has shown promising results in line with expectations.

NEXT STEPS AND RECOMMENDATIONS

As soon as the PPL's dynamic testing equipment has been completed and fully tested, the next step is for the governing bodies to determine a preferred performance ceiling for paddles, at which point the allowable face deflection thresholds used for compliance can be adjusted as necessary.

Another salient aspect of paddle performance that must be considered is that paddle performance is not constant. It is clear that paddles can be artificially and potentially even naturally "broken-in" – meaning the paddle's performance can improve through targeted abuse or even excessive or unintended use cases. PPL will leverage knowledge gained from other industries to implement test methods that can account for this type of behavior during the equipment certification process.

CONCLUSION

Decades of experience in the sporting goods industry has taught the PPL that equipment testing and compliance is an ever-changing and evolving process. As manufacturing technologies change and as innovations are brought to market, it is necessary to constantly evaluate the effectiveness of the state of equipment testing. The PPL is well positioned to manage this process now and into the future.

PPL is working hard to ensure that the testing and certification processes for pickleball equipment are scientifically sound and can be implemented in any professionally run lab. We have connected with and are working to collaborate with all of the major pickleball organizations including USA Pickleball, MLP and PPA and we look forward to helping build a unified set of equipment standards that will benefit the greater pickleball market.