



ITTF QUALITY PROGRAMME

FOR RACKET CONTROL – MANUAL 9



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1. INTRODUCTION

This **Technical Leaflet Manual** describes the tests used in a racket control center. While the tests are generally designed to verify that every racket fulfills the requirements of the ITTF Laws of Table Tennis and the ITTF Regulations for International Competitions, they also include additional tests as approved by the **Board of Directors ITTF Council**.

The primary functions of the racket tester are to inspect and measure rackets, record results, and communicate with other officials. A racket tester cannot validate or disqualify a racket; he or she can only test the racket and report the findings to the necessary umpire or referee. Through the course of a competition, a racket tester will handle the rackets of many players. It is important to handle rackets with care, understanding that each racket is a vital tool of a professional player. Specifically, rubber surfaces should not be touched with bare fingers. If a racket must be adjusted, such as trimming of edges or removal of tape, it is recommended that this be done by the player.

A description of each test follows. Appendix **A** lists each test and its respective limit for quick reference.

For those players and officials who are interested in acquiring a deeper understanding, Appendix B describes the principles which form the basis of the racket tests and limits.

During the past decades, with increasing industrial capabilities, the table tennis racket has become a sophisticated piece of equipment. This may be beneficial for the players and spectators, however to use equipment which has almost unlimited variations and possibilities requires certain minimum standards. An example is the use of speed glue which, at a first glance, brought more power to the game; but bore the risk of health issues. In addition, even when driven to perfection, the behavior of equipment should not be unpredictable for the opponent.

This need for minimum standards necessitated the creation of Laws and Regulations regarding the racket and instituted the concept of racket control. The purpose of racket control is to contribute to the fairness for which table tennis is known. Racket testing will not detect every possible deficiency by total control; the concept is to keep deficiencies within a reasonable range that will ensure fair play.

A racket tester should not be guided by the ambition to detect fraud but assist players in optimizing their fair play. A breach of the Laws and Regulations for rackets definitely needs to be penalized, but may nevertheless be unintentional, and unless the contrary is obvious, this is what should be assumed in favor of the player who might simply try to optimize his equipment legally. This of course does not preclude keeping an eye on the characteristics of rackets and their owners throughout a tournament.

Especially in professional play, the table is the players' workplace. Racket testing should assist them and, to do so, requires additional duties of them, but should not be an unnecessary burden.

1.1. TERMS OF REFERENCE

The principal Laws and Regulations which guide racket testing are:

- 2.4 The Racket
- 3.2.1.3, which describes the use of racket coverings
- 3.2.4 Racket Control



1.2. CONTACT

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REGULARITY OF BLADE AND RACKET COVERINGS





2. REGULARITY OF BLADE AND RACKET COVERINGS

Visual inspection is the first thing that a racket tester should do when he receives a racket. A racket should always be checked to see that it satisfies the basic requirements of a table tennis racket. These include:

- **Colour** – There must be one coloured side and one black side.
- **Wooden Blade** – The blade must be composed mostly of natural wood, though layers of other fibrous reinforcement materials are permitted. The surface of the blade may have a thin layer of lacquer, but not coated with paint or very thick lacquer over 0.1 mm thick.
- **Surface Regularity** – The racket covering must be flat, continuous, and have a regular appearance such as in texture and colour. The racket covering should extend up to the limits of the blade, though the referee may provide guidance regarding the tolerance to be permitted.
- **Damage** – The referee should provide guidance to describe the amount of racket damage that will be tolerated. In general, slight damage around the edge of a racket may be permitted depending on the extent; but significant blade damage, or a crack, chip, or missing pimple in the hitting area usually will have to be reported and the referee decides if an exchange of the racket is required or not. Damages during the game can lead to an exchange of the racket as well.
- **Attachment of Topsheet, Sponge and Blade** – The racket covering must be completely attached to the blade. Problems in this regard may be directly visible, but during inspection the tester should be careful not to risk further detachment. The referee will make the final ruling.
- **Treated Rubber** – Racket coverings must not be treated, i.e. its physical or chemical properties must not have been changed, whether deliberately or not. This is difficult to declare with certainty, unless a reference rubber in the original state is available for comparison. However, it can always be checked that the surface of the racket covering should be clean and free of any additional substance or materials.
- **Other Irregularities** – There are many additional conditions which may cause a racket to be considered irregular and not permitted for competition. There are also many irregularities which would be considered acceptable. For example, a part of the blade near the handle might be uncovered, or covered with different materials; this would normally be accepted if this area is covered by the player's hand. Or the back side of a penhold racket might be covered with paint, or plastic, treated rubber, etc. Again, this is permitted, provided that it is matt and the colour is black or bright colour. The use of rubber material or unauthorised racket coverings, that is similar to an authorised racket covering is not allowed, even on a side not used for striking the ball. When in doubt, the racket tester should note the irregularity and inform the referee, who will make the final decision



AUTHORISATION OF RACKET COVERINGS





3. AUTHORISATION OF RACKET COVERINGS TESTING PROCEDURE

Racket coverings (rubber) must be on the current List of Authorised Racket Coverings (LARC) published by the ITTF. The rubber must have the **supplier's name**, brand name, **product name** and the ITTF logo. In addition, if the rubber exists only with an ITTF number on the LARC, then the ITTF number on the rubber is also mandatory. Be aware that some racket coverings have two versions, one with and one without a number, and in these cases the ITTF number on the rubber is not required.

The latest LARC is available on equipment.ITTF.com in the Racket Coverings section. It is updated daily, and all new rubbers are authorised with immediate effect while all rubbers that have been removed lose their authorisation with immediate effect. Note that National Associations may extend the period of validity for their national play.

As an exception, racket covering that were authorised on the first day of a tournament shall be valid for use until the last day of this tournament, even if any changes have occurred in the LARC in between.

When doing a lookup of the covering in the LARC, note that the list is not purely alphabetical. For each **supplier brand**, all rubbers which have an ITTF number are first, followed by all rubbers without numbers. Therefore, you will find a "Megabrand 001 Toprubber" far before a "Megabrand Superrubber".

The branding area on a racket covering can contain additional text or wordings than the above listed requirements (brand name, product name, ITTF Logo and ITTF number) in case the branding area fits with the published artwork on ITTF equipment website. If the markings do not match, the racket covering is not authorised.

If other branding/marketing difficulties arise, the referee retains the final decision.

The branding area of a rubber can contain text in addition to what is listed on the LARC. For example, rubber with the text "Butterfly Sriver S-D13" is authorised as "Butterfly Sriver S". However, care should be taken to ensure that any additional text does not refer to a completely different rubber which was authorised by itself in the past and removed from the list in the meantime. Such an example would be the "DHS 651" (still authorised) and the "DHS 651 PF4" (withdrawn in January 2004). A LARC archive is helpful to resolve this matter. Also, a comparison with the original branding area on the ITTF website can be used via the Internet connection in the Racket Control Center. In any case the final decision is with the referee.



TEST FOR VOLATILE ORGANIC COMPOUNDS





4. TEST FOR VOLATILE ORGANIC COMPOUNDS

Volatile organic compounds (VOCs) have been banned by the ITTF. The current limit is 3.0 ppm, but it may change if decided by the ITTF Executive Board. VOCs are measured using the MiniRAE-Lite device. Setup and calibration of the device is described in [Appendix B 4.2](#).

TEST PROCEDURE

1. Prior to measuring each side of a racket, read the background VOC level by turning the cap to the open air. Record the background reading on the Racket Control Report Form [3](#).
2. Apply the cap to the middle of the rubber surface for 20 seconds, with gentle hand pressure to enclose the cap but not compress the rubber. Write the reading on the same form. The difference between the reading after 20 seconds and the background reading is the "real reading".

Racket Coverings	coloured side	black side
VOC Background level reading (A)		
VOC Reading after 20 seconds (B)		
VOC Reading result (B-A)		

3. Repeat the same procedure with the other side of the racket. Before doing so, remove the cap from the racket and allow the system to aerate until it reaches the previous background level.
4. In those competitions where a second RAE equipment is available, and when a racket is found with a reading over the allowed limit, the second device shall be used to confirm the result of the first measurement. If the second device also gives readings above the acceptable level then it is clear that the racket has failed the test. However, if the second device gives readings below the defined limit then the racket is deemed to be within acceptable limits.
5. To turn off the instrument, press and hold the MODE key for 3 seconds, and a 5 second countdown to shut off begins. Once the countdown stops and the display shows "Unit off..." release the MODE key, and the instrument is now switched off.

When using the MiniRAE-Lite, it should be taken into account that the tolerance of the reading is $\pm 10\%$. So, a player should not receive any disciplinary action if his or her racket does not release more than the limit stated by the ITTF Executive Board plus a 10% allowance of this limit. E.g.: if the limit is 3.0 ppm, the tolerance would be ± 0.3 and the maximum reading that a racket covering may release would be 3.3 ppm.

4.1 PRINCIPLE AND RATIONALE

The release of Volatile Organic Compounds (VOC) must be tested because it is a requirement of Regulation 3.2. The reason for this is that table tennis, like all other sports, should consider the health of players, spectators and all others involved. To do so, first speed gluing and then boosting and any other treatment of rubbers was declared illegal. The purpose of the VOC test is to ensure that at the time of the match, when the equipment is present in the venue, there is no VOC exposure which may be harmful or may give an unfair advantage to a player.

It is ITTF's strong conviction that the ban of VOCs is in favor of all players not only because of the health issue; in addition, for example, using VOCs deliberately (such as in speed gluing) requires application

shortly before the match and therefore has only disturbed the reasonable match preparations of players and their coaches.

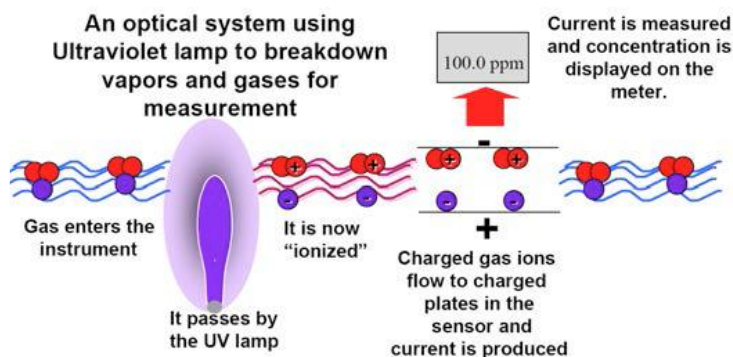
When executing a VOC test, the background level B is subtracted from the "gross reading" A (final display after 20 secs) in favor of the player, because the result is the lower bound of possible VOC levels coming from the racket itself. If a racket has in fact zero VOC emissions, this is trivial because the reading A will equal the reading B. If a racket has in fact VOC emissions of $3 \times B$, three times the background B, the reading A will be at most $4 \times B$, so the result counting is at most $4 \times B - 1 \times B = 3 \times B$.

It is in the nature of VOC emissions that the first seconds of the test will already show the direction of the journey: If after 10 seconds the reading did not change at all, it is very likely that the same holds after 20 seconds. In busy situations, consideration may be given to this fact.

On the other hand, precision is crucial in close cases. For example, a reading reaching the limit after exactly 20 seconds is an acceptable result, no matter how fast it is increasing from the 21st second on. Another example, if the racket tester is not sure whether he or she had a precise look at the timer, there is no harm in just repeating the measurement while keeping a closer eye on the stopwatch.

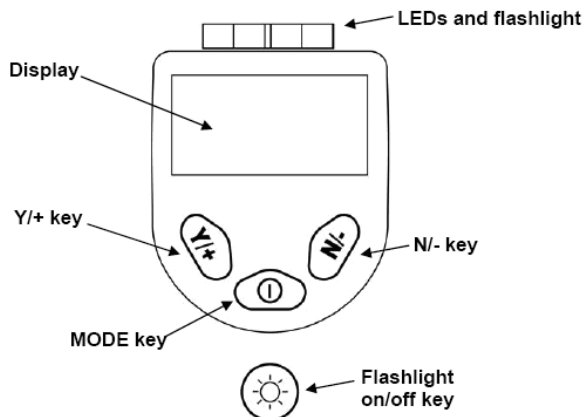
4.2. MINIRAE-LITE SETUP

The MiniRAE-Lite is currently used by the ITTF and is a photoionization detector (PID) which uses ultra-violet (UV) light to break down chemicals to positive and negative ions that can be easily measured.

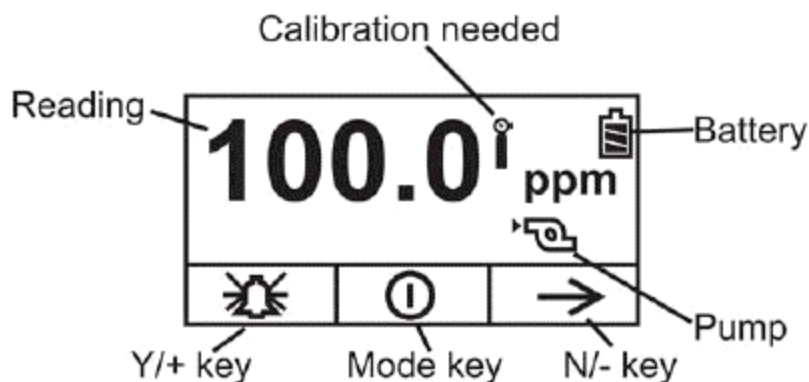


The instrument's user interface consists of the display, LED's, an alarm transducer, and four keys. The keys are:

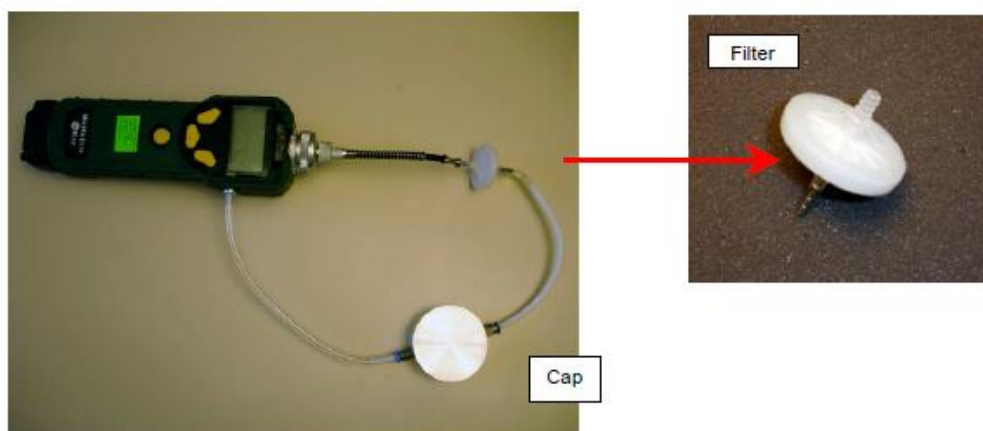
- Y/+
- MODE
- N/-
- Flashlight On/Off



The display shows the following information:

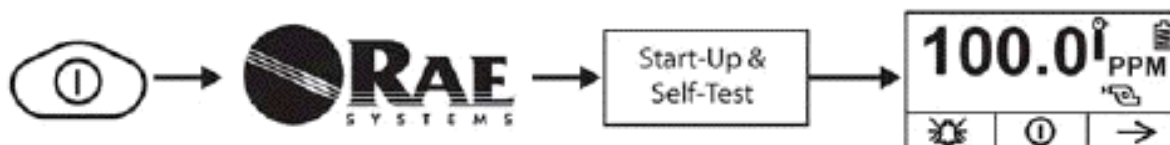


For proper measurement on the surface of the coverings of the racket, the device is used together with a special cap connected by two tubes to the MiniRAE Lite. These tubes shall be of PTFE Teflon. A filter supplied by RAE shall be used to reduce the effects of the humidity and dust. If there is a mark "INLET" on the filters, that side of the filter should face away from the device. The filter shall be changed every two events, in the case of competitions with duration of a maximum of 5 days. For World Championships the filter shall be changed once in the middle of the competition. For Olympic and Paralympic Games the filter shall be changed twice during the competition.



DEVICE SETUP

1. Connect the air outlet tube, which is with the device, to the threaded hole in the right side of the instrument.
2. Connect the flexible tube to the top part of the device and then the filter to this tube.
3. Connect the flexible tubes to the Teflon tubes attached to the cap.
4. To turn on the instrument press and hold the MODE key.
5. When the display turns on, release the MODE key.





6. When the display shows "Ready ... Start sampling?" press the Y/+ key to start the measurement.
7. Zeroing calibration: Every day, before starting any measurement, a Zeroing calibration is recommended.
 - a. Go to a fresh air environment.
 - b. Press and hold the MODE and N/- keys at the same time.
 - c. A password will be required (normally "0000"). Use the Y/+ and N/- keys to change numbers. Press Enter (MODE key).
 - d. Select "Calibration" and "Zero calib".
 - e. When the display shows "Please apply zero gas..." press Y/+ key to start calibration and wait for 30 seconds, and the calibration is finished.
8. Span calibration: before each competition the MiniRAE Lite shall be calibrated with a span gas. For Olympic and Paralympic Games this calibration shall be done daily, after the Zeroing calibration. This operation shall only be done by an experienced person. A bottle of 10 ppm of Isobutylene shall be used as a reference gas for the span calibration.



FLATNESS TEST





5. FLATNESS TEST

5.1. ELECTRONIC FLATNESS DEVICE

This device consists of a gauge set in the center of a supporting body which spans the racket. The body is placed across the racket and the gauge's contact point will touch the rubber. The gauge displays the difference in height between the center and the edges.

For convex racket coverings (center thicker than edge), the gauge shows readings > 0.00 mm; for concave racket coverings (center thinner than edge) the gauge shows readings < 0.00 mm.



TEST PROCEDURE:

1. Turn on the gauge. Make sure it is set to display millimeters, not inches.
2. Rest the device on the flat calibration block and reset the gauge to 0.00 if necessary.
3. Place the device across the rubber, being sure that the device is not resting on the raised moulded branding area of the rubber. Read the gauge display.
4. Perform at least 2 diagonal measurements on each side of the racket; one as shown in the picture above, and another in the perpendicular orientation.
5. Record both flatness values for each side the highest magnitude (worst) reading. Do not take an average. The Both measured flatness values must be ≥ -0.50 mm and $\leq +0.20$ mm.

5.2. ELECTRONIC FLATNESS DEVICE WITH ADJUSTABLE FEET

This is an optional step which can be taken if the flatness device has adjustable feet.

TEST PROCEDURE:

1. Place a straightedge (such as a net gauge) along the racket surface to see if there are visible hills or valleys – localized areas which are distinctly not flat.
2. If there is such an area, adjust the feet of the device such that the contact point will touch the highest magnitude point, while the feet span the point.
3. Reset the gauge to 0.00 on the calibration block.
4. Place the device on the rubber to measure the area which was identified.
5. Record the reading if it exceeds the specified limits. Note that this localized flatness reading should not be added to a thickness reading.

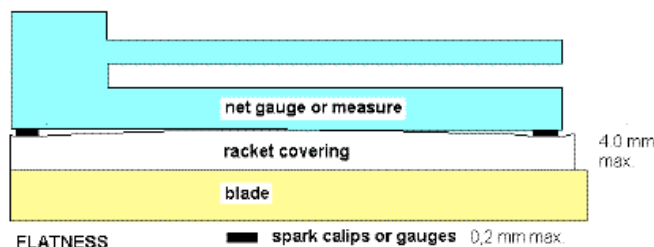
In the example below, a cut-out area has been identified (left picture). The flatness device is adjusted to measure the hill by placing the left foot into the cutout. Alternately, the valley could be measured by shifting the device to the left, placing the gauge contact point in the valley.



5.3. MANUAL FLATNESS DEVICE – NET GAUGE

A striking surface must be flat. A net gauge laid down with its straight edge on the rubber and observed against the light should not show a gap between it and the rubber. In the call area, if an umpire is satisfied with the flatness there is no need to perform a measurement. When measured, the magnitude of curvature may not be more than 0.2 mm when the shape is convex, and 0.5 mm when the shape is concave.

The magnitude of curvature can be tested by using standardized steel blades. In the picture above, the net gauge rests on 0.2 mm blades. If the center of the net gauge touches the rubber surface, this indi-



cates that this side of the racket is convex.

Optionally, tape that is 0.2 mm thick may be affixed to a net gauge for convenience, as shown below. The thickness of the tape can be verified using calipers or the electronic flatness measurement device. This permits a quick test for flatness using the method previously described.





5.4. PRINCIPLE AND RATIONALE

The flatness of a racket must be checked because of two reasons:

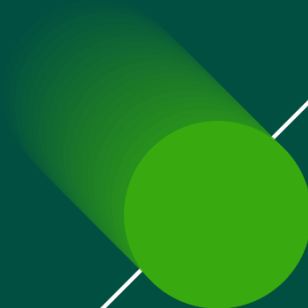
- a. Flatness by itself is a requirement of Law 2.4.1
- b. The thickness of the covering is measured at four points which are not in the center of the racket. There are several ways to use non-flatness in order to achieve an illegal thickness at other points of the covering. For example: Gluing a "bubble" in the center of a racket; having a "hill" in the direction of the handle etc.

For these reasons, a difference between the level of the edge points and the level of the center of the racket shall be detected and the result shall be used in two different ways:

- a. The result as it stands (worst of two values) will determine pass or fail for flatness.
- b. A concave covering has its maximum thickness at the edges. Therefore, this maximum is already covered by the thickness test itself. Nothing needs to be added or subtracted. A convex covering has its maximum thickness in the center. Therefore, the flatness result (= center minus edge) has to be added to the thickness result (= edge). A covering just appears convex because the bent is blade shall only be regarded convex to the extent not caused by the blade. This extent equals the difference of flatness on the convex side minus flatness on the concave side, and only this figure, if still positive, shall be added to the thickness result.



THICKNESS TEST





6. THICKNESS TEST

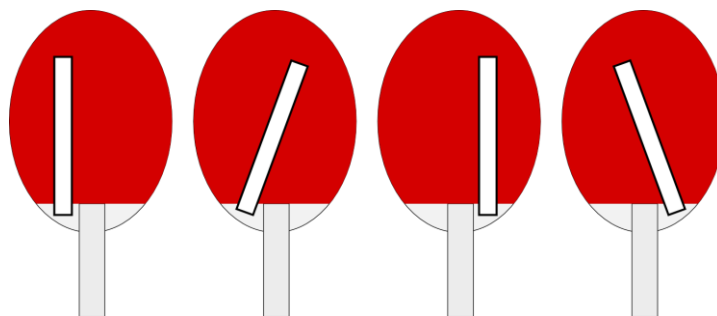
6.1. ELECTRONIC THICKNESS DEVICE

This device consists of a gauge set at the end of a supporting body. The body is placed on the rubber surface and the gauge's contact point touches the bare zone of the blade between the handle and the end of the rubbers as shown in the figure below.



TEST PROCEDURE

1. Turn on the gauge. Make sure it is set to display millimeters, not inches.
2. Rest the device on the flat calibration block and reset the gauge to 0.00 if necessary.
3. Place the device across the rubber such that the gauge's contact point rests on the blade, being sure that the device is not resting on the raised moulded branding area of the rubber.
4. For each side of the racket, perform and record 4 measurements in the orientations below.



5. Calculate and record the average of the four readings.
6. When thickness will be measured the sign (+ or -) before the result shown on the device will change (i.e.: -3,95 → 3,95 or 0,05 → -0,05).
7. If this side (A) of the racket is convex (one or two positive measurements in the flatness test), the measured flatness may need to be added to the thickness. Perform one of the following:

- a. If this side (A) is convex and the reverse side (B) is flat (zero value) or convex (positive value), add the flatness measurement of this side (A) to the thickness measurement (Example 1).
- b. If this side (A) is convex and the reverse side (B) is flat (zero value) or concave (one negative measurement in the flatness test),
 - i. and the sum of the two flatness measurements is positive, add this sum to the thickness measurement (Example 2).
 - ii. If this and the sum of the two flatness measurements is zero/negative, add nothing (Example 3).

8. If this side (A) of the racket is flat (zero value) or concave (negative measurements in the flatness test), the other sides flatness is not important and nothing will be added to the measured thickness (Example 4).

Example 1:

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Thickness measurement of red coloured side (A)	3.90	3.90	3.90	3.90
1. Flatness of red coloured side (A)	+0.10	+0.10	+0.10	+0.10
2. Flatness of coloured side (A)	+0.05	-0.05	0.00	-0.05
1. Flatness of black side (B)	+0.05	+0.05	+0.05	0.00
2. Flatness of black side (B)	0.00	0.00	+0.10	0.00
Final thickness result of red coloured side (A)	4.00	4.00	4.00	4.00

In bold are the values that will be used for calculation.

Example 2:

	Scenario 5	Scenario 6	Scenario 7	Scenario 8
Thickness measurement of coloured side (A)	3.90	3.90	3.90	3.90
1. Flatness of coloured side (A)	+0.10	+0.10	+0.10	+0.10
2. Flatness of coloured side (A)	+0.05	-0.05	-0.05	-0.05
1. Flatness of black side (B)	+0.05	+0.05	0.00	-0.08
2. Flatness of black side (B)	-0.05	-0.05	-0.05	-0.05
Final thickness result of coloured side (A)	3.95	3.95	3.95	3.92

In bold are the values that will be used for calculation.

Example 3:

	Scenario 9	Scenario 10	Scenario 11	Scenario 12
Thickness measurement of coloured side (A)	3.90	3.90	3.90	3.90
1. Flatness of coloured side (A)	+0.10	+0.10	+0.10	+0.10
2. Flatness of coloured side (A)	+0.05	-0.05	+0.05	-0.05
1. Flatness of black side (B)	+0.05	-0.05	-0.05	+0.10
2. Flatness of black side (B)	-0.10	-0.10	-0.20	-0.20
Final thickness result of coloured side (A)	3.90	3.90	3.90	3.90

In bold are the values that will be used for calculation.



Example 4:

	Scenario 13	Scenario 14	Scenario 15	Scenario 16
Thickness measurement of coloured side (A)	3.90	3.90	3.90	3.90
1. Flatness of coloured side (A)	-0.10	-0.10	0.00	0.00
2. Flatness of coloured side (A)	0.00	-0.05	0.00	0.00
1. Flatness of black side (B)	-0.05	-0.05	+0.05	+0.05
2. Flatness of black side (B)	+0.05	-0.10	-0.10	+0.10
Final thickness result of coloured side (A)	3.90	3.90	3.90	3.90

CONCLUSION

The thickness limit is defined under the Laws of Table Tennis of the ITTF Statutes + a measurement tolerance of 0.05 mm, and the result of the electronic device is rounded to the number of digits specified in the Law.

For example, if the Law requires thickness to be less than 4.05 mm with sponge and less than 2.05 mm without sponge, then:

- For racket coverings with sponge, the limit would be <4.10 mm.
- For racket coverings without sponge, the limit would be <2.10 mm.

Recall that the limit is applied to the average of four readings which is rounded to two digits. As two examples, with the limits as above:

4.10 / 4.09 / 4.09 / 4.09, which is in average 4.0925 mm = 4.09 mm, passes the racket control.

Opposite, 4.10 / 4.10 / 4.09 / 4.09, which is in average 4.0950 mm = 4.10 mm, fails the racket control.

PRECAUTIONS

- If the wood near the handle is uneven, the gauge's contact point should carefully be placed in a spot which reflects the level of the blade.
Example 1: If a small piece of wood is missing, then the contact point must not be placed on this spot, or the reading will be too thick.
Example 2: If there is excess glue or lacquer on all spots but one, then the contact point must be placed on this spot, or the reading will be too low. If no such spots are available, ask the player to scratch off some lacquer. If the player refuses, refer the matter to the referee.
- If all the wood near the handle contains a layer of lacquer which does not cover the entire blade, and for any reason cannot be removed anywhere, then the estimated thickness of the lacquer must be added to the electronic thickness result. As a guide, such layers should not normally be thicker than 0.1 mm. A loupe can be used to measure the lacquer's thickness.

6.2. OPTICAL THICKNESS DEVICE – LOUPE

A magnifying glass (loupe) can be used when there is no possibility to check the thickness of a specific racket with an electronic device, regardless of whether such a device is actually available. It can also be used if there are doubts that the electronic device is measuring the real thickness of a rubber.

Some cases in which a loupe would be used are:



- An electronic device is not available.
- The wood near the handle has a layer of lacquer and the player refuses to remove it.
- The wood near the handle carries an additional layer of cork.
- The wood near the handle has a specific form which does not allow the contact point of the electronic device to rest on it at the same level as the blade.
- The rubber's moulded branding area (rubber name, ITTF number etc.) has an extension which does not allow the contact point to rest on the wood while the device rests on the flat rubber.
- In case of doubt that the electronic device can measure the actual thickness of the racket covering, due to any irregularity or unusual racket construction. In these cases, measurement by loupe should take precedence over the electronic device.

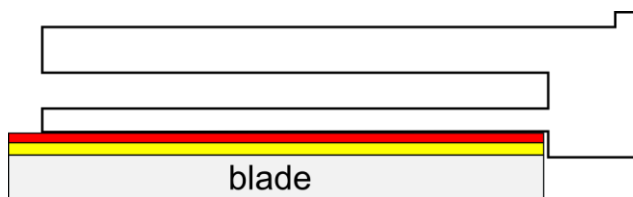
LOUPE TOLERANCES

When a loupe is used, the relative accuracy of the loupe may be evaluated by measuring a racket covering with the electronic thickness measurement device and comparing the result with the measurement taken with the loupe.

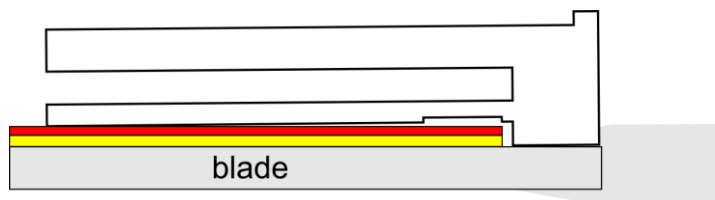
The referee may specify a tolerance to be applied when using a loupe. The tolerance of a loupe is dependent on its magnifying power and the scale of the reticle divisions; for a typical loupe, a tolerance of one-half scale unit or one scale unit can be expected, i.e. a loupe with a 0.1 mm scale may have a tolerance of 0.05 mm or 0.10 mm applied.

6.3. MANUAL THICKNESS DEVICE – NET GAUGE

An initial thickness measurement can be made with a net gauge. A typical net gauge can be rested on the surface of the rubber, with the 4 mm protrusion aligned with the edge. Visual inspection will show whether the rubber is thicker than the 4 mm guide. Use the 2 mm protrusion on the other side for rubber without sponge. Care should be taken not to press the net gauge into the rubber.



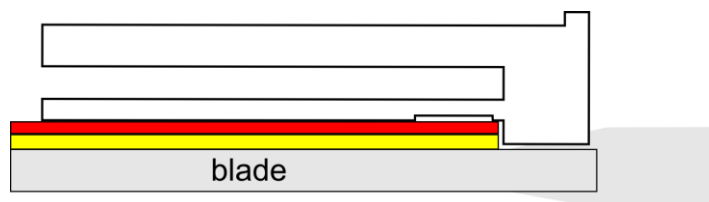
Alternately, the net gauge can be used in a manner similar to the electronic thickness device, with the net gauge in line with the handle. This method requires that the net gauge have a cutout with extra clearance to allow for the raised branding area on the rubber.





Rest the flat surface of the net gauge (left side in the pictures) on the rubber. If the 4 mm protrusion (right side) touches the blade as in the picture above, then the racket covering is less than 4 mm.

If the 4 mm protrusion does not touch the blade surface, as below, then the racket covering is thicker than 4 mm.



The 4 mm and 2 mm protrusions can be checked using the electronic thickness device. See the Laws of Table Tennis for the specified thickness limit.



6.4. PRINCIPLE AND RATIONALE

The thickness of the racket covering must be checked because it is a requirement of Law 2.4.3. An unlimited thickness will give advantages to those who can afford the most extreme industrial developments, so that the skill of a player may no longer be the main driver of a match result.

The thickness can normally be determined by evaluating the difference between the level of the covering and the level of the wood. However, there are cases where this measurement cannot be reliably performed. Then an optical measurement of the covering's thickness at the edge of the blade is in order.

It should be decided case by case which is the most accurate way to determine the thickness of a covering. However, in different tests of the same racket in the same tournament, consistency of the applied procedure should be ensured. A slight change of results in every test is normal, but a player who encounters erratic results, such as 3.92 in a first test and 4.09 in a second one, will lose confidence in the racket testing.

However, consistency should not be used as an argument for ignoring an unexpected result. It is quite possible that a racket with a thickness close to the limit will, for example, pass a test in the morning and will fail in the afternoon. Conditions of a racket may change slightly during the day, and this is the player's responsibility if he or she has chosen to use a racket at the limit. Preferably, this should be explained to a player already when the result is a "passed, but close". But definitely it shall be explained in cases of failure.



DISMANTLING RACKETS





7. DISMANTLING RACKETS

In certain circumstances, based on the respective rules, a post-match racket control test may include the dismantling of a racket, i.e., the rubber to be removed from the blade. The primary objective is to check whether there is an irregularity on the racket covering or blade, for example in a way which could have affected the measurements of thickness as described in section 6.

7.1. PROCEDURE

Dismantling of rackets is not part of the umpires' after-match duties and should be performed by trained racket testing staff and in the racket control room, only. The referee will be called to the racket control room and decides based on the measurement results by the racket tester whether dismantling is required or not.

Reasons for deciding that the racket be dismantled after the match include (but are not limited to):

- The racket is submitted to the racket control room before the match or after the match (due to delay of the player before the match):
 - and the result of the thickness measurement is an acceptable figure but does not look reasonable to the racket tester – for example because a check with a net gauge or a loupe suggests a bigger thickness.
 - and the result is more than 4.05 mm, so that the racket tester has to double check this value with the dismantling procedure.
 - and any preparation on the visible blade parts, e.g.: certain amount of lacquer on the handle area has been inspected which could lead to an after treatment on the blade.
- With the rubber surface of the racket, it looks like the pimples come to the surface and the rubber edge bends outwards.
- The appearance of the blade is leaving doubts about its carving to the umpire who checks the racket in the Call Area but cannot be proven legal/illegal unless examined separately.

In case a post-match dismantling is decided, the umpires of the match are informed as early as possible, preferably before they appear at the playing area and start the match preparation. The umpires referee shall inform the player before the match that the racket will be collected for dismantling after the match. Should, for any reason, the racket be replaced before or during the match, both the original racket and its replacement will be collected and dismantled after the match.

After the match, the umpires shall collect the racket(s) and submit it/them immediately to the racket control room, so that the racket can be checked and dismantled if there is a doubt. There is no need to also collect the opponent's or doubles partner's racket, unless it was individually decided that this racket be also dismantled. The following individuals are admitted to the racket control room for the dismantling procedure: The player, one representative of the player's association, the referee, and ITTF racket testing staff (not limited but kept at a minimum). Apart from these people, the racket tester shall keep any result strictly confidential.

If the player is present, he/she shall be invited by the racket tester to dismantle the racket. If the player refuses or is not present, the player will bear the consequences that are pronounced by the referee. The racket covering(s) should be then examined according to section 7.2. while the blade is then examined according to section 7.3.

The racket tester should decide whether the racket has to come back after the match or not. When the racket is back the racket tester should call the referee when dismantling is required, let the player



~~dismantle, measure and show the result.~~ If ok, the racket will be given back to the player. If that is not ok, the referee can decide about further consequences.

The racket tester shall only make decisions of fact about the racket covering(s) and blade. Judicial comments, such as whether a player has committed a deliberate infraction or not, are the competency of the referee and should be strictly avoided by a racket tester.

The dismantling procedure may or may not include further measurements at the discretion of ITTF, the referee or the racket tester. Whereas the detection of an illegal blade may have consequences, regardless of whether this was the source for the different thickness readings.

This procedure may be adjusted by the referee to what is practical in the event, for example by appointing additional officials for any of the tasks described above.

7.2. RACKET COVERING CHECKS

The main objective of the racket covering check is to detect irregularities which may give the player an unfair advantage. The most common of such advantages is the ability to use a rubber which exceeds the thickness limit of Law 2.4.3.

To understand how this can happen, the racket tester should use a thickness device as for example KÄFER J200/JD200 device to measure 4 different points on positions with normal adhesive layers. The average value should not overpass the limit of Law 2.4.3.

Test procedure:

1. Check that the gauge value is 0.00 mm.
2. Check that there are no particles between the measuring plate and measuring pin.
3. Use the 4,00 mm calibration block; the result should be ~4,00 mm.
4. Insert the racket covering between measuring plate and pin, take care not to measure on adhesive knots.
5. Measure 4 points and calculate the average with 2 digits.



The thickness limit is defined by Law 2.4.3 + a measurement tolerance of 0.05 mm, and the result of the electronic device is rounded to the number of digits specified in the Law.

For example, if the Law requires thickness to be less than 4.05 mm with sponge and less than 2,05 mm without sponge, then:

- For racket coverings with sponge, the limit would be <4.10 mm.
- For racket coverings without sponge, the limit would be <2.10 mm.

Recall that the limit is applied to the average of four readings which is rounded to two digits. As two examples, with the limits as above:



4.10 / 4.09 / 4.09 / 4.09, which is in average $4.0925 \text{ mm} = 4,09 \text{ mm}$, passes the racket control.
Opposite, 4.10 / 4.10 / 4.09 / 4.09, which is in average $4.0950 \text{ mm} = 4,10 \text{ mm}$, fails the racket control.

With the dismantling also the glue layer should stick to the racket covering.

- In case there is no glue layer at the measuring points on the dismantled racket covering, another racket covering part with glue layer should be measured.
- If there is no glue layer on the racket covering at all and all glue is stuck to the blade, the following procedure will take place: the blade without racket coverings but with the glue layer on it will be measured with the thickness device (in average of all 4 spots, i.e.: $0,20 \text{ mm}$). Afterwards the glue will be removed from the blade, and the testing will be done as the blade flatness testing with the thickness device (in average of all 4 spots, i.e.: $-0,05 \text{ mm}$). The calculation of the two results will be the glue layer thickness (i.e.: $0,20 + -0,05 = 0,15 \text{ mm}$), that should be added to the dismantled racket covering results measured with the off-blade thickness device (Spot 1: $3,80 + 0,15 = 3,95 \text{ mm}$; Spot 2: $3,77 + 0,15 = 3,92 \text{ mm}$, etc.).

7.2.1. RESHAPING

The thickness data checked in the off-blade measurement may lead to different data from normal racket control on-blade. Such differences should be considered as normal reshaping of the racket covering due to its physical properties after being dismantled from the blade. But such reshaping should still stay in the limit of Law 2.4.3

Racket Control Value	Dismantling Value	Remarks	Result
3.98	4.04	with sponge	PASS
3.98	4.12	with sponge	FAILURE
1.98	2.04	without sponge	PASS
1.98	2.12	without sponge	FAILURE

The tolerance of 0.05 mm on top of the limit specified in Law 2.4.3 is intended to also cover any reshaping, for the benefit of the players. In return, players are strongly advised not to exploit the full tolerance when gluing the rubber to the blade. It is the player's responsibility that the rubber complies with the above limits both on and off the blade.

7.2.2. COMPENSATION

If a racket has been dismantled, the player can ask for compensation of the dismantled racket coverings.



7.3. BLADE CHECKS

The main objective of the blade check is to detect irregularities which may give the player an unfair advantage. The most common of such advantages is the ability to use a rubber which exceeds the thickness limit of Law 2.4.3. To understand how this can happen, the racket tester should recall that the thickness device does not measure the mere *thickness* of the rubber but the *height difference* between the rubber and the blade near the handle: The device has a metal “pin” (here between the tester’s fingers) and two plastic “feet” (resting on the rubber). The thickness result equals the extent to which the pin goes below the level of the plain created by the feet.

Here are the basic examples of what may make either the rubber thickness or a blade itself illegal. The Term of Reference which is backing this is Law 2.4.5: *“The blade, any layer within the blade and any layer of covering material or adhesive on a side used for striking the ball shall be continuous and of even thickness.”*



7.3.1. LACQUER NEAR THE HANDLE

In this picture the lacquer sheet near the handle appears to be thicker. Especially when the “end” of the rubber near the handle coincides with the “beginning” of the lacquer, this will create a problem: The pin of the thickness device will rest on the lacquered part of the blade, so that the height difference between the pin and the feet resting on the rubber is reduced.

Example: Say the lacquer has a thickness of 0.3 mm and the rubber is in fact 4.3 mm thick, which is illegal. Then the thickness device will record a thickness of only $4.3 - 0.3 = 4.0$ mm, which would be



legal.

(Although it is generally legal to cover the area near the handle with arbitrary material, in this case an illegal thickness is created which can be detected only after dismantling. Therefore, this outcome is considered a failure in the combination of blade and rubber which may overrule a pre-match thickness test.)

7.3.2. SANDED BLADE (STRIKING PART OF HANDLE)

Instead of *increasing* blade thickness near the handle, the opposite would have the same effect: *Decreasing* the blade thickness everywhere else but near the handle. This happens when the blade is sanded.



In this picture, the sanding may be concluded from two observations:

- 1) The branding inscription is almost gone
- 2) There are significant variations in the colour of the wood (note for example the area between the two green lines)



Moving the fingers over the blade, switching between the area near the handle and the rest of the blade, may indicate a height difference and / or a difference in roughness. A substantial concavity fails the racket - whether or not the rubber is too thick. Concavity can be visualized or measured by using one of the methods used for checking the flatness of a rubber - for example by using a net gauge resting over the area and showing a gap in the middle, or by using the electronic flatness or thickness device to measure a height difference.

7.3.3. SANDED BLADE (AREA NEAR HANDLE ONLY)

Even when only a small part of the blade is sanded, this will affect the measurement with the thickness device. In this picture, only the area between the two green lines is sanded. In this area, with the rubber on it, the proximal foot of the thickness device comes to rest, i.e. the foot which is closer to the pin. This foot is then resting lower than the distal foot, i.e. the one far from the pin. This creates a falling level towards the device's pin - and this causes the pin to measure less height.



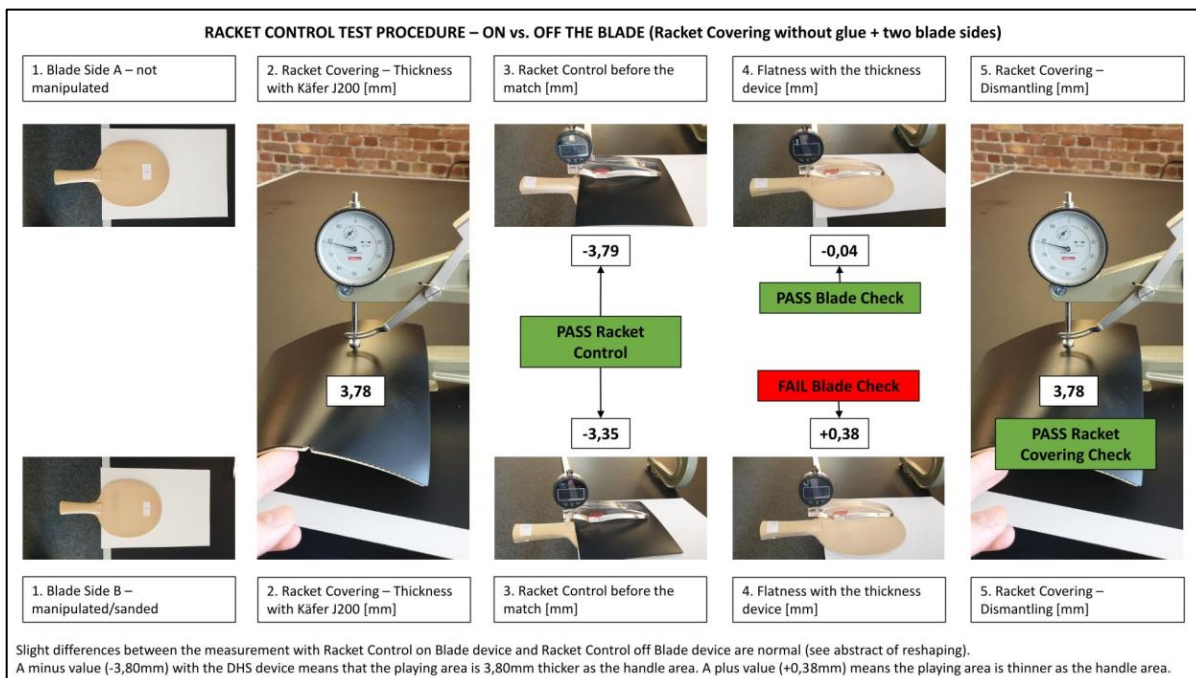
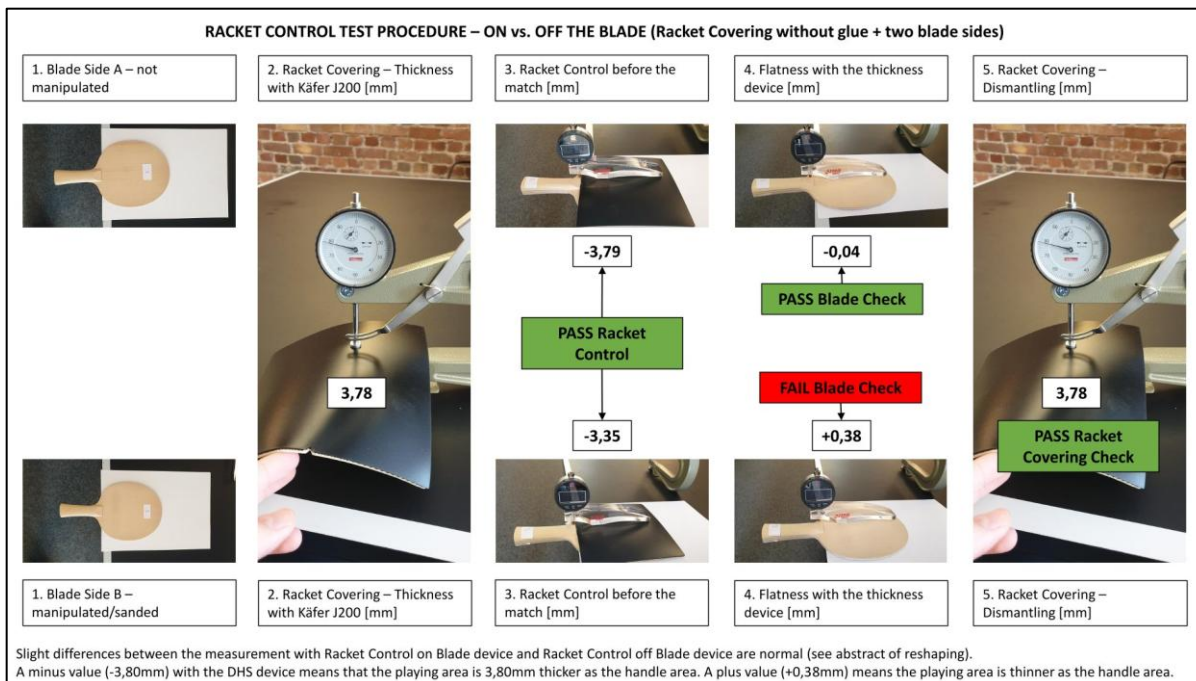
Therefore, a substantial concavity, to be detected like in the previous example, fails the racket, whether or not the rubber is too thick.

7.3.4. BLADE MEASUREMENTS

Consequently, the racket tester should first perform a standard thickness measurement with the rubber on the racket (see section 4.1) and then, after dismantling, measure the thickness of for all doubtful cases (lacquer on the handle, sanded blade at striking part and sanded blade at handle near) with the electronic thickness device (similar spots as in 4.1 only on the pure blade). The allowed limit of height difference between handle and striking/playing area should be between -0.50 mm and +0.20 mm at any checking spot. Afterwards the dismantled racket covering will be measured as described in 7.2.

7.4. CONCLUSION

Further explanations are described in the following graphics:





ADDITIONAL NOTES

When flatness is measured (with on-blade flatness device or on-blade thickness device), the result shown on the device will stay (i.e.: $0,20 \rightarrow 0,20$ or $-0,15 \rightarrow -0,15$).

When thickness is measured (with on-blade thickness device), the sign (+ or -) before the result shown on the device will change (i.e.: $-3,95 \rightarrow 3,95$ or $0,05 \rightarrow -0,05$).

Slight differences between the measurement with racket control on blade device and racket control off blade device are normal (due to device tolerances and reshaping).

A minus value ($-3,80$ mm) with the on-blade thickness device means that the playing area is $3,80$ mm thicker than the handle area. A plus value ($+0,38$ mm) means the playing area is thinner than the handle area.

An irregular blade may appear in different facets and extents, most of which can be detected by looking at the colour of the wood, feeling its roughness or measuring a height gap. Any of these irregularities, if significant, may influence the rubber thickness test and therefore should be taken seriously. The dismantling racket tester should bring any doubtful case before the referee, however avoiding any prejudice about responsibilities and consequences.



OPTIONAL TEST



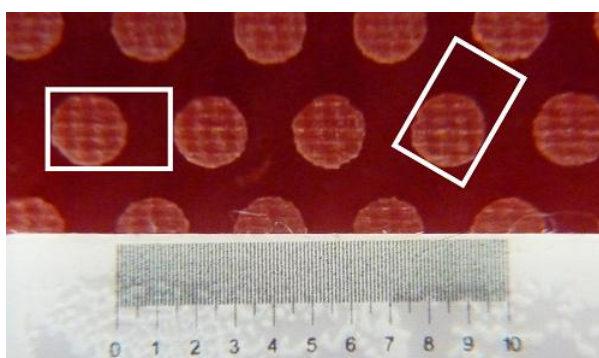


8. OPTIONAL TEST

The following tests are strictly optional and, in general, should only be used in cases of doubt which was found by inspection. They should not be a part of the normal racket testing procedure.

8.1. PIMPLE DENSITY

The pimple density of racket coverings is measured during the ITTF authorisation process, and therefore measurement of pimple density normally is not needed during racket control. However, in some cases the density is modified by the user, by stretching or other means. If there is doubt that the pimple density is within the specified limits, it can be quickly verified using a loupe.



Measure the pimple spacing, defined as the diameter of an individual pimple plus the space to a neighboring pimple, shown with the white boxes above. (In this example the pimple spacing is approximately 3.0 mm.)

The measured pimple spacing must be **< 3.5 mm**. A spacing of 3.5 mm or more indicates a pimple density below the minimum limit.

8.2. COLOUR

The colour of racket coverings is measured during the ITTF authorisation process; however, due to variations in production, it is possible that particular batches of rubber will not meet the precise requirements of Manual M4.

At this time, ITTF recommends use of the following guidelines:

- If the colour of the rubber is uneven, for example part of the hitting surface is faded – the racket shall be submitted to the referee.
- If a coloured pimples-out rubber is used with no sponge, and dark wood shows through it causing the overall appearance to be dark, or lettering printed on the blade shows through it causing it to be uneven – the racket shall be submitted to the referee.
- In all other cases, if the coloured rubber does not appear “bright colour” but meets all other requirements – it is recommended that use of the racket be permitted, as long as the opponent can clearly and easily distinguish the coloured side from the black side.

If a racket covering does not appear in bright colour, and it is believed to be caused by a production fault from the rubber manufacturer, please send a message and photo to the ITTF Equipment Department for further investigation.



8.3. GLOSS

Gloss of racket coverings is measured during the ITTF authorisation process; however, the gloss of a particular sheet of rubber may exceed the specified limit due to variations in production, or due to use.

At this time, the ITTF recommends that judgment of gloss be based on whether the gloss would adversely affect an opponent. Gloss measurement in racket control is not recommended.

If a racket covering seems excessively glossy, and it is believed to be caused by a production fault from the rubber manufacturer, please send a message and photo to the ITTF Equipment Department for further investigation.



SANCTIONS





9. SANCTIONS

9.1. VOLUNTARY TEST

Please refer to the article 3.2.4.2.4 of the ITTF statutes.

9.2. Voluntary test PRE-MATCH RACKET CONTROL TEST

Please refer to the article 3.2.4.2.3 of the ITTF statutes.

9.3. Voluntary test POST-MATCH RACKET CONTROL TEST

If a player fails in any racket control test after the match has been completed:

- on the blade (in case no on the blade measurement in the before match control has been done), or
- in the off blade/dismantling control,

the player's name will be written down on the infraction list and the referee will decide, taking into consideration any recommendation by the racket tester, if any additional sanction will be handed against that player. Without limiting the penalties stated under the ITTF Statutes, one or more of the following sanctions may be handed to the player in addition to recording their name down in the infraction list:

- a censure, reprimand, or warning,
- a fine of up to CHF10.000,
- a disqualification of results and outcomes of results in the relevant ITTF Sanctioned Events, including a forfeiture of any related awards, titles, ranking points or prizes; and
- a suspension from competing in any ITTF Sanctioned Events for up to 12 months.

If a player fails the racket control test with the first racket in the pre-match control test and subsequently, fails the post-match racket control test with their 2nd racket in the off blade or on the blade measurement, the player will get two notices on the infraction list at the same event.



APPENDIX - SUMMARY OF RACKET TESTS





10. APPENDIX – SUMMARY OF RACKET TESTS

#	Test	Specification	Remark / Example	Perform this test at:		
				Match Table	Call Area	Racket Control
2	Regularity of Blade and Racket Coverings	Tolerance from referee	Extension of rubber, scratches, missing pimples, broken wood, etc.	Yes	Yes	Yes
3	Authorisation of Racket Coverings	Must be on LARC	Supplier name, brand name, product name, ITTF logo and code/number	No	Yes	Yes
4	Volatile Organic Compounds	VOC level ≤ 3.3 ppm	Differential reading after 20 seconds.	No	No	Yes
5	Flatness	Concave ≥ -0.50 mm Convex $\leq +0.20$ mm	Worst of 2 perpendicular measurements. Do not average.	No	Yes	Yes
6	Racket Covering Thickness	With sponge: < 4.05 mm Without sponge: < 2.05 mm (plus a measurement tolerance of 0.05 mm)	Average of 4 measurements; 2 parallel, 2 across.	No	Yes	Yes
7	Dismantling	Blade of even thickness; ≥ -0.50 mm to $\leq +0.20$ mm	No overthick lacquer, no sanding	No	No	Yes
		see 6 - Racket covering thickness	Average of 4 measurements; No overthick	No	No	Yes
8	Pimple Spacing	Width of pimple + space < 3.5 mm		No	No	Optional

End of M9