Supplimentary Study Guide

Introduction

The ERSA / USRSA initiated the original stringer Certification program in 1986 to recognize individuals with a basic level of stringing competence. Today's Master Racquet Technician (MRT) program recognizes and rewards racquet sports service professionals who demonstrate superior technical competence and product knowledge.

The ERSA and the industry will support MRTs' competence and expertise by actively encouraging players to seek out MRTs for racquet sales and service.

Racquet technicians who pass all portions of the certification exam will receive a "Master Racquet Technician" certificate. It is the intention of the ERSA that this certificate be considered by:

- Consumers, when selecting a racquet technician
- Employers, when hiring a new racquet technician

Certification by the ERSA whether as a Master Racquet Technician, or as a Certified Stringer, involves a comprehensive written test and a detailed practical test. Each measures your understanding and skills with respect to all facets of racquet service — installing grommets and string, re-gripping, and handle sizing. Additionally, to attain MRT status, you'll be required to demonstrate understanding and customization of weight and balance as well as current frame and string technologies and how those technologies translate to player satisfaction.

ERSA Certification Programs will:

- Set a standard of excellence in racquet service and product knowledge
- Encourage and promote professionalism in the racquet sports industry
- Instill consumer confidence in racquet stringers and technicians
- Expand the availability of expert racquet stringers and technicians
- Endorse the competence of qualified racquet stringers and technicians

The primary source of material for certification is the ERSA's *Stringer's Digest*, which is sent to each member. The information in this Supplemental Study Guide is best understood in conjunction with the information presented in the *Stringer's Digest.*

Requirements

MRT status will be good for one full year from testing date. Maintaining MRT status will require passing an annual written mini-test designed to demonstrate understanding of the

year's significant new technologies. This mini-test will be open book, and will be administered through the mail.

Certified Stringer status will carry no expiration date.

Applicants will take a three-part test: a written (multiple choice and short answer) section, a racquet evaluation section, and a hands-on racquet service section. Applicant is allowed to use a *Stringer's Digest* or manufacturer's instructions during the stringing section only.

Applicant will supply a strung racquet. Racquet must be less than three years old and in good condition. The applicant will also supply a new replacement bumper and grommet system for this racquet.

All applicants will cut strings and remove bumper/grommets from a racquet. Applicants will then install new bumper/grommets and string the frame under the observation of the appointed ERSA tester.

Professional machines will be supplied at each test site. Applicants may bring a machine of their choice with ERSA approval. If you have any questions or problems regarding machine use, contact the ERSA. Basic tools and accessories will be available at the test site; however, applicants are encouraged to bring their own tools.

Applicants will string a racquet installing a synthetic string in the mains and natural gut in the crosses. Applicants will be given approximately 19'6" of synthetic string and approximately 20' of gut and should be sure to bring a frame which accommodates these string lengths. The frame must also accommodate two lengths of string (with 4 tie-off holes). Applicants upgrading from Certified Stringer to MRT will not be required to take the hands-on portion.

All applicants will increase the handle size of their racquet by 1/8 inch using a provided heat-shrink sleeve. A heat gut will also be provided for shrinking the sleeve. Applicants must also apply a synthetic replacement grip to a racquet. Grips provided will include a self-adhesive backing, eliminating the need for two-sided tape. Staple guns are provided for securing the grip to the butt cap. This is a required procedure for the test.

Grading

Applicants must: A) score 84% or higher on the written portion; B) correctly answer 84% of the questions posed on the racquet evaluation section; C) achieve an evaluative score of 14 (out of 17 possible points) on the string/grommet removal and grommet replacement section; D) achieve an evaluative score of 84% on the stringing section and; E) execute building up and gripping a handle without any errors. In addition, the stringing score sheet contains 8 criteria which must be met to achieve a passing score, regardless of the point total. These include: alternating tensioning of mains (no more than 3 strings ahead on one side), pulling one string at a time, avoiding notching of mains during weaving, installing pattern specified by manufacturer, avoiding crossovers at the head, avoiding any mis-weaves in string face, turning in a frame without cracks or broken/cracked/unseated grommets, completing the bumper/grommet removal and replacement within 20 minutes, completing the string job within 60 minutes, and completing the handle sizing/grip replacement within 20 minutes.

- The hands-on portion will be evaluated by the tester and racquets will then be returned to the applicants.

- The ERSAwill score the written and racquet evaluation portions and evaluate the tester's scores on the hands-on score sheet.
- Applicants will receive test results within four weeks of the test date.
- Applicants must pass all three portions to become a Master Racquet Technician (MRT) or Certified Stringer.
- Applicant must complete written and racquet evaluation portions within 90 minutes (1.5 hours).
- Applicant must complete bumper/grommet removal and replacement within 20 minutes.
- Applicant must complete stringing portion within 60 minutes.
- Applicant must complete handle sizing/grip replacement within 20 minutes.

Hands-on procedure

Applicant understands the proper use of a balance board and placement of lead tape.

- Locates the balance point of a strung tennis racquet.
- Translates racquet balance to points head heavy or head light.
- Identifies where to place lead tape to meet certain objectives (MRT).
- Correctly identifies all racquet service errors in a strung racquet.

Applicant displays proper string cutting & bumper/grommet replacement techniques.

- Removes string and grommets using proper technique without scratching or marring frame.
- Inspects and prepares frame for new bumper/grommet installation.
- Installs bumper/grommet properly without scratching frame or damaging grommets.
- Must complete bumper/grommet removal and replacement within 20 minutes.

Applicant displays proper stringing techniques.

- Inspects unstrung frame.
- Mounts frame in machine to prevent any marring, distortion or frame damage.
- Inspects string and pre-stretches natural gut properly.
- Installs string according to frame manufacturer's specifications in accordance with ERSA guidelines.
- Ensures string clamps are adjusted to avoid slippage and/or crushing string.
- Maintains integrity of string and frame throughout stringing process.
- Produces top quality string job within 20-45 minutes for maximum point value.

- Must complete string job within 60 minutes.

Applicant displays proper handle sizing and gripping techniques.

- Cleans and prepares handle surface.
- Properly applies build-up material from very butt end (with butt cap left in place) to top of handle.
- Aligns build-up material within 1/8 inch of very butt end (butt cap is built up).
- Trims any excess build-up material and ensures bevels are maintained.
- Properly staples grip to butt to prevent slippage (required).
- Aligns grip end with butt edge (no more than 1/16-inch space).
- Completely covers build-up material with replacement grip.
- Wraps grip for right-hander with appropriate overlap (no more than 1/16 inch).
- Properly trims and secures grip end neatly with finishing tape.
- Must complete handle sizing/grip replacement within 20 minutes.

Customer Service

Racquet Selection

(MRT applicants only)

No one racquet is for everybody. In determining the needs and wants of a player, you'll need to gather as much information as possible. Whether fitting a tennis, racquetball, squash or badminton racquet, there are key questions you'll want to ask your customer to ensure he is satisfied and enthusiastic about the racquet you've sold him. Remember, the best advertising is word-of-mouth. It's also the least expensive! Among the questions you'll want to ask are, why are you changing racquets? What racquet do you currently use? What do you like and dislike about it? Do you prefer a midsize or oversize racquet? How much would you like to spend? You'll also want to know how many times per week he plays, his playing level and playing type, whether he has any arm or shoulder injury problems, if he's looking for more power or control, if he has loyalty to one particular brand and what court surface (tennis) he plays on. After you've narrowed the choices to 2-3 racquets, encourage the customer to take out a demo for a few days. Perhaps even offer two different racquets so he can compare their performance and feel. Be sure those demos have good quality strings and grips too! If a customer brings you several racquets and asks you to make them all feel the same, you can adjust racquet weight and racquet balance, but you cannot adjust racquet stiffness.

String Selection

When recommending strings, take the same approach as if you were selling a racquet. Too often, 30 minutes or more are spent on the racquet sale and the strings are selected on the basis of color or price. Remember, the racquet sale earns you a one-time profit, whereas

stringing profits are (or should be) repetitive. Take the time needed to fit your customer with the right string and the right tension. Whether you're stringing a newly sold racquet or someone's favorite old-timer, the right string and tension can determine how that racquet plays. Having a checklist will ensure consistency in how players are being serviced.

Many of the same questions asked to select a racquet will help fit the player with the right string and tension. Be careful not to slip into the "same string, same tension" mentality for regular customers either. Let them know about new strings in your inventory. Keeping accurate records will assist in determining whether a player is restringing often enough. It can also provide information on tensions, grommet replacement, grip replacement and any special needs.

You can service a player with a sore arm by: lowering tension, using a "softer" or multifilament string or natural gut, using a thinner string, checking and possibly altering grip size, adding a softer grip, possibly adding weight to the frame (to dissipate shock) and finally, encourage them to restring often enough. Many players pride themselves on not restringing for a year or more, believing the only time to restring is when a string breaks! Inform your customers about strings losing their resilience, requiring they do more work with their arm. Most are only aware of strings losing tension over time (which can lead to a loss of control), but explaining the loss of performance will provide further incentive for a player to restring.

String Technology

The term "synthetic gut" no longer carries much meaning. It does not mean that a string has a specific construction or playability characteristics like natural gut. It simply means the string is made of synthetic fibers. Most synthetic strings are constructed of nylon in a variety of ways to modify playability and durability. Some claim to duplicate natural gut's resilience (providing maximum power and feel) at a fraction of the cost. Synthetic strings tend to be easier to install than natural gut. When stringing with natural gut, it's important to avoid kinking the string as this could cause premature breakage. Elasticity refers to a strings ability to return to its original shape and condition after ball contact. Typically, elasticity will govern a string's ability to return energy to the ball. Elongation is the measure of a string's elasticity and is closely related to the power potential of a string. It also is a measure of a string's ability to absorb incoming ball shock during impact. All things being equal, the greater a string's elongation, the greater its ability to absorb incoming ball shock. Generally, multifilament strings with no center core have the greatest elongation of nylon strings. As a result of this characteristic, some multifilament strings lose tension faster than center core constructed strings. Pre-stretching can reduce short term tension loss or "creep" and some manufacturers recommend pre-stretching for this reason. It also helps reduce the string's tendency to re-coil during the stringing process, making handling easier.

Dynamic resilience of a stringbed will determine how well it can deform (absorb energy), return upon ball impact and provide the greatest energy return. The more dynamically resilient the string (or string plane), the greater the deformation and therefore the greater the energy return. Over a period of time and play, string tends to lose the ability to conform to its original shape, gradually imparting a different feel to the racquet and ultimately playing "dead."

Tensile strength is the force required to break the string during a straight pull. Generally, strings with higher tensile strength will have a higher breaking point. One of the biggest challenges for a racquet technician is dealing with string wear and string breakage. Chronic

string breakers have increased in numbers since the advent of wide body racquets. Wide body racquets tend to be stiffer than standard width frames. As a result when balls hit the strings very close to the frame, they can cause shearing or overload breakage. Although this type of string breakage near the frame can also be caused by worn or cracked grommets. Open string patterns also allow more string movement and cause frictional notching — the main reason for string breakage among tennis players who hit with spin.

Keep this information in mind when recommending a racquet for excessive top-spinners. While they'll love the extra bite on the ball that an open pattern allows, they'll blame you for breaking strings every week! There are a few ways to cure the chronic string breaker blues. First, a thicker version of their favorite string (if available) will offer similar playing characteristics but with slightly less feel. String savers are another way of reducing the "sawing" action of the mains against the crosses and can be used with their string of choice. Next, try using durability oriented synthetic strings. Finally, various hybrids (two different types or gauges of string in the same racquet) can be used to extend string life while still keeping costs reasonable. Probably the most effective hybrid available for reducing frictional notching combines Kevlar mains with nylon crosses. Be prepared to lower tension about 10% on these strings, though, to reduce the stiff, harsh feel of Kevlar which has about 3% elongation at 60 pounds.

Some players may ask you to tell them how much longer their strings will last with Kevlar. Keeping accurate records is a great way to address this situation. However, simply inspecting the strings for notching and a "wear pattern" may provide you with the knowledge you need to approximate whether the strings will last through the next match or the next month.

With the advent of wide body racquets, a new phenomenon has developed, shock breakage or shearing of string near the frame. As frame cross-sections (beam height) increased, so did frame stiffness, requiring the strings to accept more load during ball impact. Consequently, racquetball, squash and tennis players are sometimes paying the price of off-center hits by having to restring. Using a thicker gauge or a multifilament string can help. (Keep in mind that increasing string thickness by one gauge can add 5-10 grams to overall racquet weight. A typical coil of 16 gauge nylon string weighs 15-20 grams.) If a customer is chronically breaking strings in the upper hoop near the frame, be sure to check the grommets for telltale wear or cracks. However, if the grommet barrels and bumper are in good condition, you might want to tube the center 6-8 mains at the head and/or consider a different string for your customer.

Frame Technology

(MRT applicants only)

A variety of methods are used to manipulate stiffness, weight and balance. Pre-wide-body frames relied solely on material placement in determining the stiffness of a frame. Some frames were stiffer in the shoulders, some stiffer at the tip as a result of placing higher modulus graphite or boron in these areas. Today, manufacturers enjoy the added variable of adjusting beam height or cross-section to make a frame stiffer or more flexible. Materials aside, increasing the cross section of a frame during production is the most effective way to increase stiffness. Increasing stiffness will increase frame shock and frame vibration. Frame shock is the force felt at the moment of impact. Frame vibration is the lasting movement or noise after the ball has left the strings. The most effective way to reduce shock is to add weight to a frame.

Weight and balance have moved to the forefront in frame design as manufacturers seek ways to improve maneuverability. Wilson's Hammer Technology (for tennis and racquetball) popularized lightweight, head-heavy frames. Most conventionally weighted tennis frames feature added weight at the butt end, ranging from 1-3 ounces. This helps counter the predominance of weight in the hoop area resulting in a head-light balance. Conversely, most lightweight, head-heavy frames remove weight from the butt end to reduce overall weight, while retaining a similar swing weight of a conventionally weighted and balanced frame. To increase a racquet's torsional stability (resistance to twisting), a manufacturer or a technician can increase grip size, add weight to 3 and 9 o'clock positions, make the hitting surface of the racquet head wider, or apply a high-friction grip.

Today's longer racquets can offer players a variety of benefits, including more reach, more power, more spin and reduced torque. Each additional inch increases power by 10%, all other things being equal. Longer racquets also generate more racquet head velocity, thus creating the potential for more spin. A racquet that is one inch longer can increase a player's court coverage by about 5%, while a two-inch longer racquet can increase court coverage by about 13%. Contrary to intuition, longer racquets can actually reduce the amount of torque, or twisting, experienced by off-center hits.

Not all players will benefit from longer racquets, so extensive play testing is recommended. Be sure each player who play tests a long racquet uses it in a match situation, hitting a variety of different shots.

Back to Basics

Seven Factors that Determine Stringbed Stiffness

When you talk tension with customers, you're actually talking stringbed stiffness. But tension is just one piece of the puzzle that determines how a stringbed feels to a player. A player normally feels one of three distinct stringbed sensations: loose (springy or lively); tight (hard, jarring, stiff); or dead (elongated, mushy, or 'bagged out'). Seven separate factors cumulatively determine overall stringbed stiffness and therefore the player's perception of power, feel, and control.

Head Size/String Length

While most stringers are aware that head size variations affect stringbed stiffness, most players aren't as savvy. If a customer changes from a midsize to an oversize frame and asks for the same tension, how should you respond? Most manufacturers do take head size differences into account when determining tension ranges. String length is a major factor. Longer strings must be strung at a higher tension to achieve the same stringbed stiffness as with shorter strings. According to Dr. Howard Brody, to change from one frame size to another (while retaining similar playing characteristics from the strings), the tension-divided-by-string-length ratio must be similar. (Sixty pounds of pull [machine] tension on an oversize frame's main string will produce a lower actual tension than the same 60 pound pull tension on a midsize frame's main string.) So when that customer who's just changed from a midsize to oversize frame says, "String it at 60 pounds, like before," you can explain why he might want to increase tension by a few pounds. Why then are shorter cross strings looser than longer main strings? Other factors come into play here, mainly the friction of the crosses

being pulled through the mains. It's not uncommon for a racquet to have main strings with 55 pounds of tension and crosses with 40 pounds. Matching main and cross string tensions would require increasing tension on the crosses to the point of deforming and probably damaging the frame. Also, the resulting stringbed stiffness would certainly be too high for most players. So, when that same customer shows up with a Stringmeter demanding to know why the crosses are so much looser than the mains, you can confidently explain why.

Pattern Density and Staggered Strings

Many frame makers have been redesigning string patterns on new racquets to meet specific objectives. Some increase string density in wide bodies to help maximize string life. Many also assert that a denser string pattern increases control for certain types of players. Or designers may increase string spacing to offer players more spin potential. Generally speaking, a more open string pattern yields lower stringbed stiffness than a dense pattern. Whether either one provides more control depends on style of play (for tennis players). Spin players may claim increased control on an open pattern because the strings can embed deeper into the ball, whereas a flat hitter finds more control with a dense pattern due to the increased stringbed stiffness. Players using open string patterns should be prepared to restring more often though. The increased string movement can cause notching and premature breakage. Denser patterns have become more popular in wide bodies to help increase string durability. In badminton, dense patterns allow stringing at very low tensions, while maintaining a reasonable stringbed stiffness. When stringing badminton frames, it's best to use the smaller badminton clamps to accommodate these denser patterns and not damage the string.

A few racquet manufacturers (Dunlop, Gamma, Prince) have introduced models that feature splayed, or staggered string patterns. Offered under a variety of names, each of these string systems is slightly different from the next, but all are similar in concept. Each string enters the frame on a different level, or plane, than the previous string. Due to the increased angle of each string entering the stringbed, string vibration is reduced. Also, overall stringbed stiffness is increased when tensioned the same as a conventional string pattern. Consequently, recommended tensions for staggered string racquets are typically lower compared to conventionally strung racquets. Another effect of these string systems is that cross strings alternate between "easy" and "hard" weaves that result in decreased tension on every other cross string. When stringing staggered string racquets, it's important to lock in the top (1X) cross with a "hard" weave. Otherwise, the outer mains and crosses will be floating, causing excessive vibration and not achieving their desired effect.

String Gauge

This factor causes more confusion than any other. If you string two identical racquets with different gauge (but otherwise identical) strings and perform the palm test with the strung racquets; the thinner gauge will have a higher harmonic pitch or "ping." Most people would logically assume the thinner string is tighter. Even though we found little difference when measured statically (i.e., RA Test), the racquet with thinner gauge may feel less stiff in play, due to the greater elasticity of the thinner string. Dr. Brody reports that, generally, a 17 gauge string will be about twice as elastic (100%) as a 15 gauge string, all other factors being equal. This increased elasticity results in lower dynamic stiffness (meaning the strings will feel more elastic) during ball contact. A player changing to a thicker string (for greater durability, for example) may complain that the "ping" isn't the same as with his thinner gauge string. However, increasing tension to reproduce that harmonic pitch would probably result in a stringbed stiffness too hard for his liking. So string for feel, not for the "ping."

Below are the Tennis Industry Association's gauge standardization specifications.

U.S.	INT'L	DIAMETER (mm)
13	12	1.65-1.80
14	11	1.50-1.65
15	9.5	1.41-1.49
15L	9	1.33-1.41
16	8.5	1.26-1.34
16L	8	1.22-1.30
17	7.5	1.16-1.24
18	7	1.06-1.16
19	4	.90-1.06
20	3.5	.80-.90
21	3	.70-.80
22	2.5	.60-.70

String Type

Stringbed stiffness differences between nylon and aramid fiber (Kevlar®, Technora®) strings are well known. Aramid is stiff. To compensate for the lesser elongation of aramid, most companies recommend decreasing overall tension settings by 10%. This may concern players trying a aramid hybrid for the first time, but assure them the reduction is necessary to maintain the most acceptable playing similarities. Less significant variations may also be noticed with Zyex® blends and various nylon string constructions (i.e., coreless microfilaments, center-cored multifilaments, and outer-wraps variations).

Machine or Pull Tension

This one's pretty obvious; your machine's tension setting can have the greatest overall influence on stringbed stiffness. When you tell your customer 60 pounds, make sure your machine is giving you 60 pounds. Our rule of thumb: recalibrate every 20 to 25 string jobs, when making large tension adjustments, or whenever you move your machine.

Stringing Machine Type

Expect a stringbed stiffness difference between racquets strung on spring tension and continuous tension machines. Continuous pull machines, whether drop-weight or electronic (Babolat, Prince, Alpha, Gamma, etc.), will normally produce a firmer stringbed than will identically calibrated spring tension machines. A continuous tension machine (as the name implies) maintains a constant tension on a string to compensate for elongation and clamping, which generally results in a 10% firmer stringbed.

Stringer Technique

Finally, all stringers have different techniques. Tensioning string from varying distances, double pulling and pre-stretching all contribute to affect overall stringbed stiffness. Such varying techniques may be one explanation for small deviations in stringbed stiffness that occur even between two different stringers working in the same shop on the same machine. For example, we recorded single pulling and double pulling techniques (on a 1.25 mm nylon), using a spring tension machine — with varying results.

Conclusion

Our test results indicate that pull tension, head size, and string density have the greatest impact on overall stringbed stiffness. String gauge apparently makes the least difference in static testing, though most good players can feel the difference during play. What we refer to as “tension” is really the complex result of the seven interacting factors discussed here. Changes in any of these variables may affect the feel of a racquet and the way it plays. By knowing these factors and how they can affect stringbed stiffness, you can bring out the best in any frame and be a more knowledgeable advisor to all of your clients.

Rules of Tennis

Official Code of International Tennis Federations (ITF)

Rule 4 (excerpt): The Racket

Rackets failing to comply with the following specifications are not approved for play under the Rules of Tennis:

(a) The hitting surface of the racket shall be flat and consist of a pattern of crossed strings connected to a frame and alternately interlaced or bonded where they cross; and the stringing pattern shall be generally uniform, and in particular not less dense in the centre than in any other area. The strings shall be free of attached objects and protrusions other than those utilized solely and specifically to limit or prevent wear and tear or vibration and which are reasonable in size and placement for such purposes.

(b) The frame of the racket shall not exceed 29 inches (73.66 cm) in overall length, including the handle and 12½ inches (31.75 cm) in overall width. The strung surface shall not exceed 15½ inches (39.37 cm) in overall length, and 11½ inches (29.21 cm) in overall width.

(c) The frame, including the handle, shall be free of attached objects and devices other than those utilized solely and specifically to limit or prevent wear and tear or vibration, or to distribute weight. Any objects and devices must be reasonable in size and placement for such purposes.

(d) The frame, including the handle and the strings, shall be free of any device which makes it possible to change materially the shape of the racket, or to change the weight distribution, during the playing of a point.