

## How to correctly install and level a 3-piece slate.

### Basic steps to leveling a 3 piece slate.

First of all, we're going to have to break this down into sections, as leveling a 3 piece slate is more like a marriage between the slate and the frame of the table, with the floor interfering with the union of the two. You can't talk about leveling the slates unless you go back to the beginning of first installing the frame of the table. I've broken down this process into different sections as you will understand the principals better this way. I can not even begin to explain all the different learned variables to this challenge as some of them are just learned over time because of having to work on all the different kinds of slates. Some methods are just improvised as you go. What I'm going to give you here in this lesson...LOL...is the basic principles of the system that I use to accomplish this feat.

### Section 1: Installing the frame of the table.

Once you've packed in, assembled the frame, tightened all the necessary nuts and bolts, you're ready to now level the frame of the table.

Step 1: In this first step, all you are concerned with is leveling out any possible twist in the frame of the table that may, or may not be present. Take a 4ft carpenter level or longer, place it on the table at one end, reading from side to side. Place your starrett level on top of the carpenter level. Pay attention to the machinist level, not the carpenter level. The carpenter level's only purpose here is to give our machinist level a much wider base to sit on since all we're concerned with at this time is the level of the frame; we're NOT concerned with the end to end level at this point.

Checking both ends of the frame this way, take a mental note of the level of both ends of the frame. At this stage of the game, the table is already down on the floor as low as it can go as its setting on all 4 legs/feet, so from here you only have 2 legs/feet with which to level the side to side level of the frame. This can be tricky depending on what kind of table you're installing. Some tables require you place shims under the feet, some you can place the shims between the frame and leg pedestals, and some tables have adjustable leg levelers. Only "you" know what you are working with at this point. Bottom line, level the frame of the table from side to side first. Once correcting the level at one end of the table, go to the other end and check, correct, then go to the other end, check, correct. Once the side to side is leveled, and no longer changing as you level it out, and now both ends read the same level from side to side, you're now ready to level the table frame from end to end. Determine which end of the table is lowest, if either, then at that end of the table you only have to deal with the level of them two legs/feet, as the rest of the table is already level side to side. Raise the low end of the table at to match the high end to a level in which both ends are now the same level. You are now ready to install the slate.



As you can see in the top row of pictures I'm using a 6 foot carpenter's level to check the level of the frame from side to side, then end to end. As you can see in (pic 4) the bubble reads level, but then I place my machinist level on the carpenter level and it now shows the table is still un-level. This is why you only rely on the carpenter level to give your machinist level a much longer base to more accurately read the level of the frame of the table. Trying to level the frame of the table with only a machinist level will drive you nuts because it'll read differently in every place you put it. All we're trying to do here is find the center of the level from side to side and end to end. Once you place the slate on the frame, you'll have to level the frame again, but not nearly as much with so much weight on the frame.

Section 2: Installation of the 3 piece slate.



Step 1: Install the center slate first. Slates are ground head to foot, so when installing the center slate, look at the grind marks of the slate. They are the wide “C” looking marks on the slate from the finish grinding. The center of the grind marks should be going in the direction of the head of the table, with the lower outside grind marks curving away from the head of the table. Once determining in which direction to install the center slate, slide it on the frame of the table to the center. Not all slates are marked as to which direction they’re mounted to each other. If you can’t see the grind marks, then take your machinist level, turn it up on its side and drag it across the slate lightly. I do this to identify the high spots in the grind marks on the slates. All 3 slates should be ground in the same direction, if they’re not, then you have mismatched slates. Sorry, but I don’t trust the drawn curved line on the slates.



Step 2: Take a tape measure and center the slate from end to end on the frame of the table. At this stage, you are NOT concerned with the slate being centered from side to side, approximately centered will do. Not all frames are exactly straight from end to end. Even timber strand can be off a little over a 9ft distance. If the sides bow in or out, you’re never going to be able to find center anyway, not until you install the end slates.

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Step 3: If you’re setting up a Diamond with a ball return, then before you install the end slate make sure you first mount the ball box as you will have little room to line it up after the slates are installed. Use clamps to hold the ball box in place while you install the mounting bolts.

Note: Instead of pre-drilling the lag-bolt holes, use a bar of hand soap to coat the 3/8<sup>ths</sup> bolt threads first, then run them into the timber strand, they’ll go in like screwing them into a block of Styrofoam. After you’ve mounted it, then take it back off as it’ll be in the way later when mounting the rail bolts, but the bolt holes will be already lined up and made as to be able to mount it when it’s time to

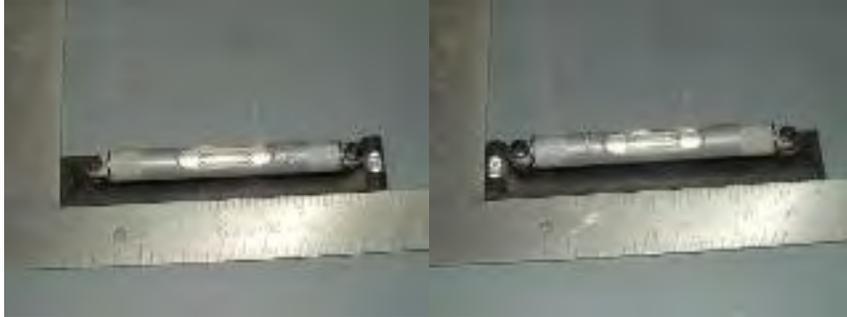


Step 4: Place the head slate on the frame of the table with the grind marks facing in the same direction as the center slate, slide it up to the center slate, and flush it with the center slate. Repeat this step for the end slate.



Step 2: Once the frame has been leveled from side to side until no more changes from one end to the other are detected, then check the frame of the table for level from end to end and adjust as necessary from the same end you leveled the frame from without the slate being placed on the table. You are now ready to start the leveling of the slates.

#### Section 5: Leveling the slates.



Note: Before using your machinist level you should always check it for accuracy. Take a right angle square and place it on the slate, then place the level in the inside corner as pictured. Step: (1) Turn the square and level together in a circle until the level reads level. Step: (2) Then take the level without moving the square and turn it around 180 degrees and place it back into the corner of the square. If your level reads correctly, then the bubble will be centered again, if not then you need to

correct your level. You do this by adjusting up or down the level using the adjusting nuts located at the end of the level. For example, if your level reads .0010 of an inch low then raise it by half way to .0005 low. You only correct your level by half increments because if you bring it back to level from here, all you've done is reverse the level in the opposite direction. Once you've made your first correction then repeat steps 1 & 2. Do this as many times as it takes to calibrate your level, as you cannot level a slate without an accurate level.

Notes: In order to properly level the slates, one must first determine the relationship between the frame of the table and the slates. In the following diagram I'll show you how to determine if the frame of the table is swayback, crowned, or inconsistent, as well as how to determine if the slates are crowned, swayback or inconsistent in their level. The following diagram is of a Diamond 9 foot 3-piece slate. The following steps and procedures apply to any and all 3-piece slates regardless of the manufacturer.

Step 1: Now that you've got the slate all mounted and centered and flush to each other, loosen up all the slate screws a little bit, enough so that they're not applying any pressure against the slates. The reason for this is because we have no idea as to how flush or square this frame is, so we're not going to assume anything is perfect as of yet. By the way, when you set up the frame of the table you should have taken notice as to make sure that all cross members were flush to the main frame support to begin with. And sometimes a bowed center support can give you the impression of a crowned slate.

Step 2: Now that the slates are just sitting there, without moving the slates, try to rock the slates to see that they are in fact, sitting flat against the frame of the table.

Step 3: In this step, we're going to fine tune the level of the frame with the use of the slates. In fig 1, take 2 utility knife blades and place them at positions R3 and L3 going from side to side across the head end of the slate. Place your carpenter level on top of the razor blades, then place your machinist level on top of the carpenter level, then level the frame of the table accordingly. Before leveling, slide a dollar bill under the carpenter level between razor blades as to insure there is no contact between the level and the slate. If there is because the slate is crowned, double up the razor blades, we don't want the level touching the slate anywhere.

Note: The reason for this setup is to give us the "precise average" level reading of the slate thereby eliminating the highs and lows that will be detected with the use of the machinist level used alone.

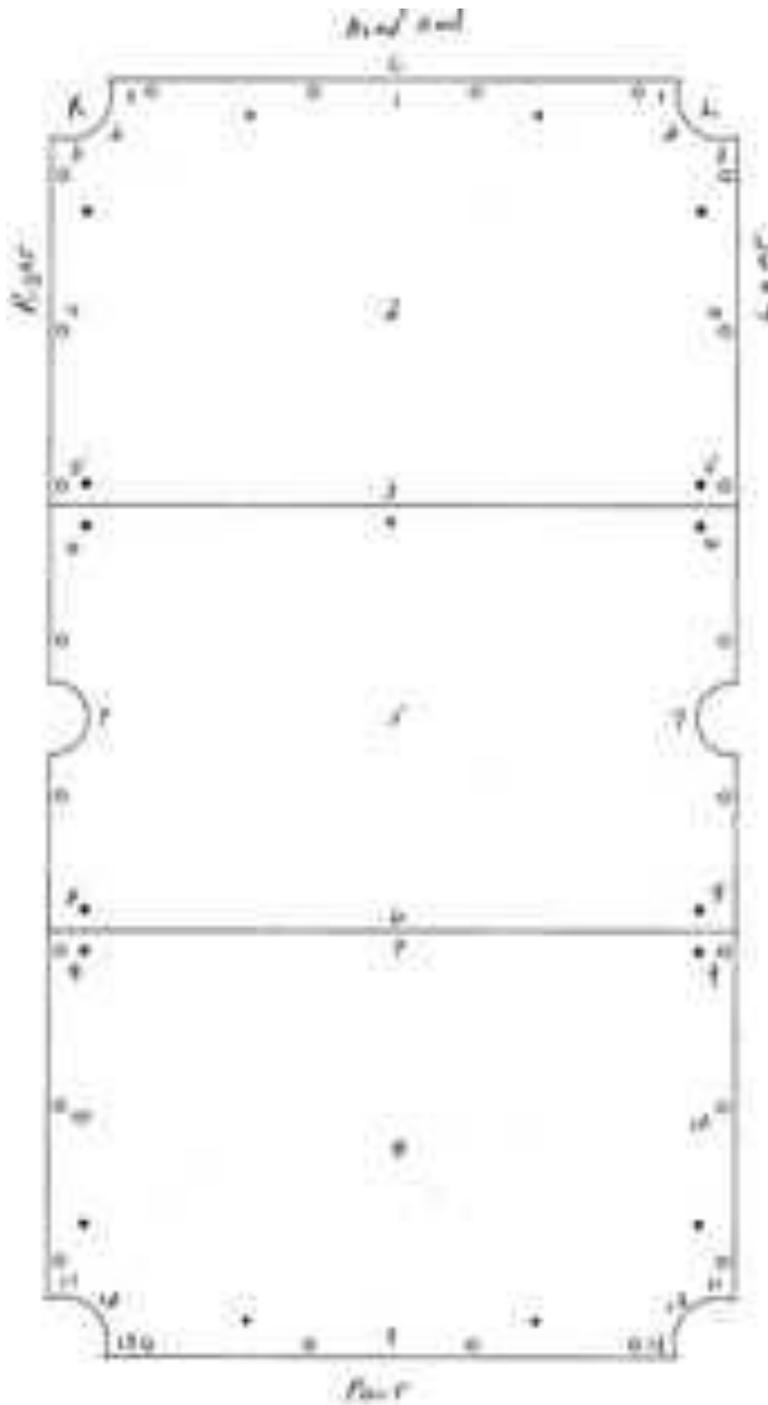
Step 4: Repeat step 3 for locations R11 and L11, adjust as necessary. Once you've corrected the level at one end of the slate, always go back to the other end and look for changes. Repeat steps 3 and 4 until there is no more changing in the level.

#### Section 6: Swayback table frame.

Step 1: Checking for end to end level. Using the same setup, check from R1 to R7 for level. This time take a piece of chalk and draw an arrow on the slate in the direction of the high end of the slate. In other words, if the level bubble is heading towards the end of the slate, away from the center slate, then the center slate is low. Your arrow should be pointing towards the outside edge of the head end slate. Along with the arrow, write down the reading of the level as well.

Step 2: Repeat this for R13 to R7, L1 to L7, and L13 to L7.

Note: You can only get 3 different readings doing this, high, low, or level. No matter what the readings are, they should be the same from one end to the other if the table is level from end to end. If for example, R1 to R7 reads .0010 high towards the end slate, but R13 to R7 reads .0020 high towards the foot end slate, the frame of the table has some sage to it, but it's not level from end to end as of yet, because if it were, both ends would be reading .0015 high equally. End to end; both sides are not always going to read the same. One side of the frame may sag more than the other side. One side may be perfectly level, while the opposite side may be high.



[Fig 1]



No matter what, you have to get both ends of the table reading uniformly the same, be it high, low, or level it don't matter. They may read differently from one side to the other, the bottom line is that they still have to read the same from end to end if the table is low in the middle yet centered from end to end. If the end to end is not equally the same, repeat step 3, section 5 until the end to end readings are the same uniformly.

Note: If the table is high centered from end to end see Section 7: Leveling Slates on a high centered frame, if the table is dead level from end to end, see Section 8: Leveling slates on level frame.

Step 3: Now that you have a level table from side to side, and end to end, I want you to check to see which side pocket has the least dip in the frame. Check the level and write down the readings from R1 to L7, L1 to R7, R13 to L7, and L13 to R7.

Which side pocket reads closest to level? Let's say it's the right side pocket in this case.

Step 4: Place your level setup including the razor blades at R3 to R5, and notice the level reading. Take a flat tip screw driver and a hammer, wedge the screw driver between the frame of the table and the slate backer inline with the slate screw and raise the slate up enough to insert a leveling shim between the slate and frame next to your screw driver next to the slate screw. Pound in the wedge until the slate is raised up until level. Tighten the slate screw until its snug.

Step 5: Repeat the same steps for L3 to L5, tighten slate screw snug.



Note: Shims at the seams of the slates should always be placed on the inside area of the slate screws, close to the slate screws. If the shims are a little too thick for my liking, I use my belt sander to thin the ends of the shims by placing them flat against a board and sanding them flatter. Other wise, these are the best shims I've ever bought and used in this business. When I'm done leveling the slates, I just go around and break off the remainder of the shim sticking out. Doing this also means that if anyone follows me in moving this table, they're going to have to get their own shims as mine are not going to be usable again...LOL. Home Depot and Lowe's carry the shims I buy.

Step 6: Now insert shims at R6 and L6. Pound them in far enough to raise the slate to almost flush with R5 and L5. Now insert shims at R8 and L8 just far enough in to hold the shims in place. Place the level setup to read from R5 to R8. Raise R8 to level, now do the same thing from L5 to L8. Take your machinist level, place it across the seam R5/R6, turn it up on edge, look under the level at the point of contact and see if the slates are flush to each other, raise R6 until flush with R5, snug slate screw. Repeat checking the level from R5 to R8, bring up to level, snug slate screw. Now repeat the same steps for L6 to L8.

Step 7: Now raise R9 close to flush with R8, then raise L9 to L8 until flush, snug slate screw. Go back to R9; raise it to flush with R8, snug slate screw.

Step 8: Place your level read from R3 to L3, it should still be level. Now snug your end slate screws and watch for any changes in the side to side level. Repeat the steps for R11 to L11.

Step 9: Time to check the overall level. If you leveled your table correctly from end to end at the start, then from R11 to R9, and L11 to L9 should be level. Now check the level between R3 to R5, R6 to R8, L3 to L5, L6 to L8, for end to end level, Now check R1 to L1, R5 to L5, R6 to L6, R8 to L8, R9 to L9 and R13 to L13 for side to side level.

Note: As a reminder all these level adjustments and checks should still be being done with your carpenter level straight edge and machinist level on top, still checking from razor blade to razor blade as to NOT be getting any faults slate readings. All the leveling you've done up to this point has been the easy leveling system, now it's going to get a little more complicated from here until it gets finished.

Step 10: In this step what we're going to do now is straight level the slates from end to end down both sides of the table using only the machinist level. Place your machinist level at R3 reading in the direction of the foot of the table. Note the level reading, and write it down with an arrow on the slate in the direction of the high bubble, if it's not already showing level. Then move the level to R5 and check the level there and do the same thing. What we're checking for is if there is any sag in the slate between points R3 to R5. Repeat the same level check between R6 to R8, R9 to R11, L3 to L5, L6 to L8, and from L9 to L11. Take a look at all the level readings you wrote down on the slate and determine which points have sag, if any. If for example: you determined that level at point R3 was reading .0010 high towards the head end of the slate, and point R5 was reading .0010 high towards the center slate, then you have a sag in the slate. To correct this, loosen one slate screw holding down this side of the side slate, place a shim in the center of the slate located at R4, pound it in a little, then retighten the slate screw back to flush with the seam. Check your readings again at points R3 and R5 for level. Repeat this step until the slate lays flat between these two points. When you're done, you should be able to place your machinist level any where along the outside edges of the slates on either side, reading from head to foot, the level should read level, or at least real close to level. Once you've straight lined both sides of the slates, you're ready to fine tune the level of the slates from side to side.



Step 5: If you centered the center slate from end to end, then both end slates should have the same amount of over hang past the frame of the table at both ends, check just to make sure. Take a tape measure, and under the head slate, nearest the corner pocket, measure the amount of over hang on both sides of the end slate in relationship to the frame of the table. Slide the slate left or right in order to center the slate on the frame. Taking that final measurement of the overhang on the head slate, on the same side of the frame of the table, adjust your foot end slate to read the same overhang. Now, line up your center slate with the two outside slates as to create a straight edge down one side of the slate, the other side will match.

Note: Trying to center the center slate from side to side can be a waste of time and effort as not all table frames run true and straight down the middle. Some are wider or shorter than the ends of the frame, so as to avoid taking faults reading for centering the slates, I rely on the end measurements of the frame of the table as they are more accurate when measuring slate overhang. On this Diamond Pro 9ft, the slate over hang is 2 5/8" Pick one side of the table to make both end slates have the same over hang from the side of the frame nearest the corner pockets. You're more than likely going to have to line up the slates more as you adjust the slates in a straight line, just don't loose your over hang being the same amount at both ends of the slates. After you've lined up the slates, check the end to end over hangs once again as to ensure that they are the same. If you're within a 1/16" of an inch on both ends, your doing great. Note: The two main problems you'll have if the slate is not centered on the frame is (1) when you're all done and ready to install the rail bolts, you may find out that you can't get the rail bolts with washers on them to line up with the corner rail bolt holes because the washer is to close to the frame of the table, and (2) when you go to mount the slate screws, you might just find out that you ran the slate screws right through the very edge of the body instead of the meat of the frame wood.

### Section 3: Installing the slate screws.



Step 1: Starting with the end slate screw, install them first at an angle facing away from the center slate as much as possible, as this will help ensure that both ends of the slates are being pulled so to speak towards the center slate to help avoid any possible gapping between the end slates and the center slate.

Step 2: Once the end slate screws are installed, then install the 8 center seam slate screws. You are now ready to level the slates on the frame of the table.

Note: Use a bar of hand soap to coat the slate screw with as this will allow the screws too thread into the frame of the table like sticking a nail into a cube of warm butter. It's not smart to pre-drill the slate screw holes as this will sometimes remove the wood pressure needed to keep the slate screw from stripping out. If dealing with slate screw holes already stripped out, fill them with round tooth picks first, then re-install the slate screws. If dealing with slate screws with the heads stripped, drill out the head of the screw, lift the slate off the shank of the remaining screw, remove the screw with vice-grips, re-set the slate, and replace the slate screw.

### Section 4: Leveling the slate and frame together.



Step 1: Check the level of the end slates from side to side, and adjust the frame of the table accordingly, using the same carpenter level and machinist level set up again, once again we're NOT concerned about the level from end to end at this time.

Note: On the seams, I always try to make them flush across the slate screw holes in the slates, because sometimes they'll be off a little from there to the outside edge of the slate, and from a little past the screw holes to the center of the slate. Until the centers of the slates have been leveled from side to side, you can't correct this problem lining up the outside edges of the slates, so at this point, just pick a spot to make flush near the outside edge of the slates.

Step 11: Side to side slate leveling. This area of leveling can get a little tricky as I'm not the one doing it, you are. All I can do is give you the idea as to how to level the slates from here on out. Now that both sides of your slates are suppose to be level from end to end down the outside edges of the slate, let's check one more time the level from side to side using the carpenter level set up again, with the razor blade set up. If you have the slates level up to this point, then check the level from L1 to R1, L3 to R3, and so on until you've checked the side to side level at all check points. If your end to end level is correct, your side to side levels should all be level, if not, go back and recheck your end to end levels again. If L1 to R1, or L3 to R3 is off level slightly then correct this with the frame of the table, not the slates, as a minor correction in the frame at this point won't have much effect on the end to end level.

Step 12: Starting with L3 to R3, check the side to side level with your machinist level, write down your readings. Repeat steps for L5 to R5, L6 to R6, L8 to R8, L9 to R9, and L11 to R11.

Step 13: After writing down all the level readings, determine if you have any side to side readings that indicate a crowned slate, meaning a high center of slate from side to side. In most cases, the side to side readings will show a low center of slate. Sometimes you get lucky and get one that shows dead level from side to side, if you do, count yourself as one of the lucky few.

Note: If in fact you have crowned slates, refer to Section 9: Leveling crowned slates.

Step 14: Now that you have determined the level from side to side, assuming that the slates have a little sag in them, from under the table, between the frame and the slate backer board, insert a shim at point C3, pound it in far enough as to hold itself in and recheck your side to side level from L5 to R5. If it still reads low, pound in the shim a little more. Keep in mind, while doing this you need to watch the level of the slate between points L1 to R1, as well as between points L3 to R3, and L4 to R4. The object here is to try and get this one piece of slate as flat as possible from side to side between all cross side leveling points. Depending on the degree of sag, the hardness of the slate, you may need to shim at points C2 and C1 as well. Sometimes because of effort and wood compression, you may need to use several shims at various points to accomplish this task as multiple shims will increase the lifting effort greater than just one or two shims. Repeat this step until the slate reads level from L5 to R5, as well as the other check points.

Step 15: Repeat step 14 at points L6 to R6, only this time when pounding in the shim, check for the slates to become flush with each other at points C3 and C4. When they're flush to each other you should be able to slide your level across the joint flat, back and forth and not hear any clicking sounds of the level as it passes from one side of the slate to the other. Repeat this for L8 to R8 as well as L7 to R7.

Step 16: Repeat steps 14 at points L9 to R9, then again at L13 to R13 as well as keeping an eye on the levels from L11 to R11, and L10 to R10.

Step 17: Now that the slates are level from side to side, and the seams are flush at points C3/C4 and C6/C7, you'll want to go back and check the end to end level of the slates again down both sides. Sometimes at this point in leveling, you may see that the corners of the slates are a little high point L3, R3, L11 and R11. You may need to at this time install the slate screws in these 4 slate screw holes as a way of pulling down the corners of the slates a little. I don't like using these 4 slate screws as I deem them unnecessary unless this problem occurs.

Step 18: Going back now to the 4 outside seam joints, check them for being flush to each other. If on any of the joints you determine that one side of the slate is just a little higher than the other side, try tightening the slate screw a little more on the high slate in order to pull it down flush with the opposite slate first. If this will not work, then loosen the slate screw on the low slate, tap in the shim, and then retighten. Repeat this until the slate seams are flush in all four points.

Step 19: Securing the slates from any future movement and finishing the slate seams. From this point on, it's a personal choice as to who's doing the work to finish the slates from here. My choice is to use super glue and bondo. I first super glue the outside edges of the slates from about 6 to 8 inches in, and about 6 to 8 inches of the center of the seams. This will insure that the slates won't shift in the future by themselves, thus creating seam problems down the road in time. Once the super glue has dried fully, I then take my scraper and scrape off the excess build up. Removing the super glue this way saves a lot of time.



When I'm finished with that, I then mix and apply my bondo in the seams and wait for that to dry. Unlike most who use bondo, I do very little sanding as I once again use my scraper to remove most all the bondo that I would otherwise have to sand off to remove. It's easy to remove the bondo just before it hardens, then lightly sand to finish. I use bondo because it's easy to use, and because it's a great filler for any chipped out portions of the slate which may be missing, as it's not so soft to dent in with the downward beating of the balls at a later date. It also acts as a bonding agent to help hold the seams together. Taking a slate apart after the use of bondo is easy, all you have to do is cut across the seam with a razor knife and cut into the bondo. This will prevent the slate from ever chipping when taking it apart.



There are more steps to installing and leveling 3 piece slates as you read above, but this is as far as I'm going with this information as this covers about 90% of what anyone is going to do. The rest of the information will be available with the DVDs as they become available.

Glen

Mike Pastori's finished Diamond 9ft Professional, with 30mm 3-piece slate, and ball return system.

