Club Assembly

I. CUSTOM ASSEMBLY

A. Choosing Clubheads

The first priority in the custom club building process is to choose a head. Clubheads are available in many different styles, shapes and finishes. Most of the heads sold by component companies emphasize perimeter weighting. The weight is distributed around the center of gravity. This allows a ball that is hit off center to not cause the clubhead to vibrate or turn as much. The effect is a shot that flies almost as far and straight as one hit dead center. Both the irons, metal woods and the graphite heads use this benefit of perimeter weighting to their advantage.

Choosing a head is a personal decision. What looks good to you may not pique the customer's interest. Make sure a half dozen different styles and finishes are available for the customer to choose from. Having a demonstrator model of the club to hit may be all it takes to complete the sale. Both you and the customer will feel better knowing he/she has hit the club and likes it. Building one club (3w or 5-iron) before you complete the set is a good way to finalize the right specifications and win trust.

B. Shaft Trimming

Once the head and shaft are selected, the shaft must be "prepped". Preparing the shaft to be epoxied into the head is a two-step process. First the shaft must be trimmed from the tip end (when the trimming instructions call for it), then the tip must be abraded to allow the epoxy to bond to it.

1. Steel Shafts

When a shaft is purchased, a set of trimming instructions will accompany the shaft. These are detailed instructions provided by the manufacturer explaining how the shaft is to be trimmed before installation into the head. One of the basic principles of shaft trimming is, the more of the tip that is removed, the stiffer the shaft will become. Examine a set of steel-shafted irons. Look at the distance from the top of the hosel to the first step in the shaft. The first step moves 1/2" closer to the hosel, as the clubs get shorter. Within a set of irons virtually all shafts will progressively become stiffer from the 1-iron to the 9-iron.

Along with the tip section becoming shorter, the head weight of each successive clubhead becomes heavier. This increase in weight does not totally offset the decreasing length of the tip section and make the shaft more flexible.

The reason for the progression of stiffness is distance and accuracy. The long irons are usually harder to get airborne. By making the 3-iron shaft more flexible than the 8-iron shaft, the ball will tend to fly higher

and farther. The 8-iron shaft is stiffer, because the golfer wants accuracy over distance. This follows the second principle of shaft trimming. The more flexible the shaft, the greater the distance. A stiff shaft delivers more accuracy, but less distance and clubhead feel.

2. Tapered Tip Shafts

Tapered tip shafts are rarely used in the assembly of components because 99 percent of component clubheads are produced with parallel hosel bore diameters. However, some re-shaft jobs do require using the taper tip version of the shaft. Remember, tapered shafts are manufactured at different lengths for specific iron heads. The 39" tapered iron shaft is for the 1-iron, the 38 1/2" for the 2-iron, the 38" for the 3-iron etc. The 35" shaft is for the 9-iron and all the wedges in the set.

3. Pre-flexed vs. Combination Flex

A set of parallel tip iron shafts come from the manufacturer all one length.* Depending on the type of shaft it is, the uncut length will vary. The shaft will be either pre-flexed or combination flex. Pre-flexed shafts are manufactured to one certain flex, most commonly extra stiff, stiff, regular, mens A, or ladies flex. On the other hand, combination flex shafts can be trimmed differently to achieve two different flexes. The most popular combination flex shafts are the R&S flex combination and the mens A flex and ladies L flex combination.

Most parallel tip steel shafts are cut from the tip end in increments of 1/2" per iron head. Pre-flexed shafts all follow the same tip trimming guide. The 1-iron will not be tip trimmed at all. The 2-iron will be tip trimmed 1/2", the 3-iron one inch, the 4-iron 1 1/2" etc. This pattern continues through the 9-iron at 4" tip trim. Normally the wedges are tip trimmed the same as the 9-iron. With combination shafts, an adjustment is made to the tip end before the 1/2" incremental tipping begins. Either the shaft will be cut like the pre-flexed shaft above, or it will be tipped a certain amount before the 1/2" incremental tipping begins, to achieve the stronger flex of the two.

*Flex Flow shafts from True Temper, Rifle and FM Precision from Brunswick are parallel tip shafts that are sold in the manner of taper tip shafts, they are ordered in increments of 1/2".

4. Graphite Shafts

Understanding the trimming instructions for graphite shafts can at times be difficult. The trimming is very often more different from company to company, than it is with steel. Try not to over complicate the situation. Just read and follow the instructions carefully.

Parallel tip graphite shafts are also designed in pre-flexed and combination flex forms. Most of these shafts use trimming instructions similar to the steel shafts. The only major difference may be the amount of incremental

tip trimming. While many of these shafts use the 1/2" per iron head tip trimming, some use 1/4" incremental tip trimming. Still others require no tip trimming before installation. Be sure to carefully read all trimming instructions before proceeding. With graphite, always measure twice and cut only once!

C. Preparing the Tip

1. Steel Shafts

In order for epoxy to bond to the shaft, the chrome plating on the steel shaft must be abraded. The rougher the tip, the better. A one-inch belt sander equipped with 60 grit sandpaper is the ultimate tool for steel shaft tip preparation. Do not grind the shaft on hard disk sanders. This can gouge the shaft and be a possible cause of shaft breakage.

The amount of the tip that is sanded depends on the depth of shaft penetration. If there is no ferrule, try to sand the tip within 3/16" of the top of the hosel. Naturally, if there is a ferrule, the shaft can be sanded above the hosel, not to extend above the height of the ferrule on the shaft.

2. Graphite Shafts

The recommended procedure for preparing graphite shaft tips for installation is to lightly scrape the tip with a sharp razor knife. Try to remove only the polyurethane and any paint covering the shaft. The razor is the best method because it is virtually impossible to damage the shaft with a knife.

Some experienced clubmakers sand the tips of graphite shafts on a 1"X30" or 1"X42" belt sander. This must be done with extreme caution and is not recommended for the inexperienced clubmaker. There are belts available for belt sanders made especially for sanding the tip of graphite shafts. These belts are much more gentle to the shaft, do not cut into the graphite fibers and are the absolute best method to use.

D. Crimping (Optional - Steel Only)

Once the steel shaft has been trimmed and sanded it should slide into the hosel of an iron or metal wood with relative ease. As long as the epoxy secures the shaft to the head there is no problem. But should the epoxy break down there is nothing to keep the head from flying off the shaft. The optional procedure of crimping iron and metal wood steel shafts will solve this problem.

Crimping the shaft knocks the shaft out of round. This is to prevent the shaft from sliding easily into the hosel as before. The head will have to be driven onto the shaft similar to the procedure required to drive on a tapered shaft. Remember crimping is an option, but is also a safe guard. Never crimp a graphite shaft.

E. Hosel Preparation

1. Cleaning

It is a good idea to examine the inside of the hosel to make sure there is no dirt or foreign substances that might keep the epoxy from adhering properly. Acetone or epoxy solvent will clean any unknown substance from inside the hosel. Wire brushes or flex hone tools are also recommended to rough up the inside of the hosel and allow for superior bonding between the epoxy, the hosel and the shaft.

F. Coning

Any metal hosel that is receiving a graphite shaft has to be countersunk to relieve any sharp edges that could fracture the shaft. A 20 degree countersink will remove the sharp edge on the top inside of the hosel. Even though most metal heads are pre-coned, it is a good idea to take a few seconds and countersink the hosel again. Irons and metal woods that do not require ferrules (barrel hosel) may develop a sharp edge after countersinking. A deburring ball will remove the sharp edge.

G. Swingweight

Swingweighting golf clubs is a topic that will surely create an argument between clubmakers. Some will say it is totally outdated, while others will revere swingweight like one of the ten commandments. One thing about swingweight is very clear, it is the easiest method for your competitors to show your work is substandard.

The swingweight of a golf club is determined by the clubhead weight, the shaft weight and balance point, the grip weight and the length at which the club is assembled. Most component head weights are not randomly chosen. They are formulated to achieve a certain swingweight at a certain length with a particular shaft weight in mind. For example, let's assemble a 3-iron from the Golfsmith catalogue. Most of the 3-iron head weights are 239 or 240 grams. If the head is assembled to a standard weight steel shaft (128 grams, before trimming) and cut to the Golfsmith standard for a men's 3-iron (39") gripped with the average weight grip (50 grams) with one piece of two-sided tape, the golf club will swingweight to about D0. The rest of the set will fall into the D0 swingweight range because the head weights are increasing at 7 grams per head while the clubs are shortened by 1/2". This formula has been used by the major manufacturers for years. For them, club making is a breeze, since most offer one head, one shaft, one grip at one length.

The problems with swingweight arise for the custom clubmaker when different components are used. What if the customer wants a lighter shaft? The head weight will have to be increased to make up for the loss of weight in the shaft. How about if the customer wants the clubs shorter than the Golfsmith standard? Again, more head weight is necessary. These are just a few of the problems that clubmakers will encounter when making custom clubs.

After a few sets of custom built golf clubs, the clubmaker will be able to

guess fairly accurately what the finished swingweight will be as the components and lengths are discussed.

H. Swingweighting Procedures

To determine the exact swingweight before assembly, tip trim the shaft for the appropriate flex if necessary, then slide the head onto the shaft, making sure the shaft reaches the bottom of the hosel. Trim the club to it's final length by cutting the butt of the shaft. Cut a used grip down the side so it can be slipped onto the butt end of the shaft, duplicating the final position of the real grip. The "dummy" grip should be similar in weight to the desired grip. Wrap the appropriate number of wraps of tape on the outside of the dummy grip to simulate the exact weight the grip will be when installed. The club can now be put on the swingweight scale to determine its initial swingweight.

If additional head weight is necessary, there are three options for the steel-shafted golf club. Lead powder can be poured down the shaft after the head has been epoxied. The lead powder should be secured with a cork specially designed for either the iron or wood shaft. The best method of swingweighting steel shafts is to use pre-made lead tip weights. Tip weights fit into the tip of the shaft and are epoxied into place as the shaft is epoxied in the head. The final method of swingweighting is rarely used for cosmetic reasons. Lead tape can be applied to the back of the head directly on the center of gravity. Lead tape is unsightly on a new set of irons and should only be used after consulting with the golfer.

Graphite-shafted clubs are swingweighted by using lead tip weights, lead tape, lightweight grips or by adding length to the golf club. Lead powder should not be used in graphite shafts because the smaller core of the graphite makes it too difficult to add enough and secure it in place. Tip weights are the first option because they are secured inside the tip of the-shaft. The problem with tip weights is they rarely recover enough weight to adjust the swingweight to normal specifications. Therefore, whenever possible try to use a lightweight grip (36-39g) to raise the swingweight more. As a last resort, adding length will allow you to increase head feel a little more. A mere 1/2" will add roughly 3 swingweight points without adding to the total weight of the golf club. Any time the graphite-shafted golf club is built to less than standard Golfsmith lengths it is wise to discuss the difficulties of achieving normal range swingweights with the customer.

I. Epoxy

The single most important ingredient in clubmaking mechanics is the epoxy used to bind the head to the shaft. An inferior bond will result in catastrophe. Reputation, credibility and future success will be lost by choosing the wrong bonding agent. You may be the most knowledgeable clubmaker in the universe, but without the best epoxy, you will likely fail as a clubmaker.

There are two types of epoxies used to bond the shaft and head together. One is a slow cure type that takes up to 24 hours to fully cure, while the

other is a quick set epoxy that can set up in as little as five to ten minutes. The inexperienced clubmaker is often drawn to the quick set epoxy. The temptation to try the club immediately is overwhelming. Don't be seduced by the lure of five-minute epoxies.

While there are a few fast set epoxies that can do the job, most will not stand up to the normal wear and tear of a golf club. Therefore, do not use five-minute epoxies for building golf clubs. One of the great advantages of the slow cure epoxy is the time it allows you to make sure every aspect of the job is done properly. If you are unsure about a particular aspect, the club can be pulled apart, checked and reset.

J. Shaft Installation

Mix the epoxy per manufacturer's recommendations. Be sure to stir sufficiently to mix the base and the activator.

If the clubhead requires a ferrule it must be installed prior to installing the shaft in the clubhead. If the head does not require a ferrule (rounded top hosel), skip this information. Put a few drops of epoxy on the tip of the shaft and push the ferrule onto the tip. It may be necessary to tap the ferrule on the shaft with a hammer or rubber mallet. When the bottom part of the ferrule and the tip of the shaft are flush, grab a piece of an old shaft and drive the ferrule 3/4" farther on to the shaft. The ferrule will be seated to its final position by the force of tamping the shaft into the clubhead.

Coat (do not fill) the inside of the hosel with epoxy. Epoxy should also be spread over the tip of the shaft to ensure proper bonding. If tip weights are needed, coat the inside of the shaft tip as well. Coat the tip weight shank with epoxy and insert it up the tip of the shaft.

Slide the shaft into the hosel and rotate the shaft into the hosel. If the steel shaft is crimped, hold the clubhead and drive the head and shaft against the floor (a driving plug in the butt of the shaft and a metal floor plate are recommended) firmly until the shaft seats against the bottom of the hosel bore.

Wipe all excess epoxy with a paper towel dampened with solvent. Make sure all traces of epoxy are wiped away, because it is very difficult to remove epoxy when it has set. Set the golf club in the playing position (upright or horizontal) to allow the epoxy to dry.

When the epoxy has set up, measure and cut the butt of the shaft to length. Golf clubs that have been swingweighted prior to epoxying the head will be ready for grip installation.

Swingweight steel shafts by using lead powder down the shaft. A cork the appropriate size of the shaft must be rammed down the shaft on top of the

lead with a ram rod to keep the powder in place.

The golf club may now be gripped.

K. Ferrule Finishing

One of the most difficult tasks to master is the finishing of the ferrule, commonly referred to as "turning down" a ferrule. Most often the unfinished ferrule leads to the perception of inferior clubmaking craftsmanship. In order to construct quality golf clubs it is imperative that the ferrule be finished properly, so it is flush to the hosel. Learning to turn down ferrules is intimidating at first, but with practice, it can be done. Proper technique and fundamentals are essential in obtaining an expert finish.

The belt sander is the fastest, most efficient method of turning down ferrules. The specifications of the belt sander are of the utmost importance. The motor speed should be in the 1150 to 1725 R.P.M. range. Faster motors will burn or melt the plastic ferrule. Instead of sandpaper, the belt sander needs to be equipped with a linen belt to turn ferrules. The linen belt abrades the plastic ferrule to the desired shape and will not scratch the hosel. The linen belts are available in two lengths, 30" and 42" to fit the two most common sizes of 1" belt sanders.

It is much easier to turn down ferrules when the golf club is supported by a ferrule support arm (stock #8209). This allows the clubmaker to concentrate on the ferrule and not worry about steadying the golf club.

If the shaft is graphite, wrap masking tape above the ferrule to prevent the linen belt from friction burning the paint on the shaft. The linen belt will not harm steel shafts. If the clubhead has a polyurethane finish below the ferrule, it should be protected also. Use clear plastic or cello tape since it is thinner and will allow the ferrule to be finished flush with the hosel.

1. Using the Golfsmith ferrule support arm (stock #8209)

Place the butt of the golf club through either hole in the wood block. One hole is for the gripped golf club, the smaller bore is for the ungripped golf club. The shaft rests in the felt-covered notch.

The toe of the club must rest in the palm of the right hand (if the ferrule support arm is mounted to the left of the sander). The left hand will lightly hold the shaft and control the pressure of the shaft against the linen belt. Slowly push the bottom of the ferrule into the belt and rotate with the right hand. The head must turn clockwise if you look down the shaft from the butt to the head. The clubhead must turn the proper direction to allow the ferrule to rotate against the belt. If this is not done the ferrule will burn.

The amount of pressure against the belt controls the amount of ferrule removed. The head must rotate in a constant motion to prevent the linen

belt from burning flat spots into the ferrule. Try to use the pressure of the belt to control the speed of the rotation.

When the ferrule and hosel are flush, position the whole ferrule into the belt, turn and remove ferrule until its sides are straight. With small (5/8" long or less) ferrules this step is often unnecessary.

The professionally turned ferrule has some shine to it. However for a professional look, wet a soft cloth or soft paper towel with acetone or epoxy solvent. Spin the shaft quickly against the wetted towel and the ferrule will shine. If the ferrule is not spun quickly, the cloth or towel will stick to the ferrule.

2. Practice

The way to learn ferrule turning is not on the job. You will soon be removing shafts to replace the ferrules that have just been mangled. Try taking a parallel tip iron shaft and sanding the tip. Next crimp the shaft sufficiently so that an iron head has to be forced onto the tip. This will allow a tight enough fit to hold the head securely onto the shaft. Place a ferrule onto the tip and pound the head tight. Practice ferrule after ferrule until the expert finish is obtained.