2004
Shaft Fitting Addendum

Featuring the DYNACRAFT SHAFT FITTING INDEX™

Technical Research Provided by
Jeff Summitt

Edited by
Jeff Summitt

Published by
Dynacraft Golf Products, Inc.
P.O. Box 4550
Newark, OH USA 43058
1-800-321-4833 / (740) 344-1191
www.dynacraftgolf.com
Email: dynacraft@dynacraftgolf.com

Acknowledgments

We would like to thank Graeme Horwood and the former Apollo Shaft Corp. technical staff for their assistance in compiling much of original data in this project. Our thanks also are offered to the technical staffs of many of the companies whose products are featured in this addendum for their assistance and recommendations.

I would personally like to thank the owners of Dynacraft Golf (Joe Sr. and Joe Jr.) for allowing myself the time and resources to conduct all of the testing. I would especially thank all the fellow tech staff members, past and present, for completing the day-to-day requirements, allowing myself to test the shafts for three months out of the year. A special thank you goes out to Forest Sands who has been instrumental in designing most of the shaft testing equipment that we use here at Dynacraft.

Most importantly, thanks to the thousands of clubmakers around the world who have taken this information and put it to practical use. Your kind comments and valuable input about this continuing project, and your shaft fitting success stories, are a great source of inspiration!

2004 Shaft Fitting Addendum

Dynacraft's Independent Research on Shafts Enters 15th Year

The "2004 Shaft Fitting Addendum" to "The Modern Guide to Shaft Fitting" contains thousands of shaft specifications that you will find of invaluable use in your custom clubfitting and shaft selection work. Detailed independent testing at the facility of Dynacraft Golf Products, Inc has generated the charts that follow.

Table of Contents

All specifications listed within this volume have been obtained from the unprecedented and ongoing Dynacraft Shaft Testing Project. Begun in 1989 with an initial group of 800 golf shafts, and now supplemented by subsequent testing of hundreds of additional shaft models, this project was started from the idea that golf shafts should be tested through uniform standards to obtain true "apples to apples" comparisons between various shaft designs. As detailed in the main text if "The Modern Guide to Shaft Fitting", shaft makers use widely varying methods to determine the parameters of their products, so making shaft-to-shaft comparisons through only specifications from different suppliers cannot be viewed as reliable. Only in this addendum you will find the specifications of hundreds of the most popular models in the game today, all tested under the same precise conditions.

It is very likely that some specifications listed in these pages will vary from those offered by shaft manufacturers and other golf club component distributors. Yet this should not be viewed, as indicating one measurement or another is incorrect. Rather, these variations are due to different testing methods used to obtain a particular specification. This book contains shaft specifications that were obtained under the test conditions detailed in Chapter 2 of "The Modern Guide to Shaft Fitting".

"The 2004 Shaft Fitting Addendum" has undergone many changes in the past year. First, there are only four chapters instead of six, yet all the important data still remains. The biggest addition is in the method of testing. Since it's inception, the Shaft Fitting Addendum has offered the Dynacraft Shaft Fitting Index (DSFI) as a means of comparing the stiffness of one shaft to another, and that index number could apply to the person's swing speed. The calculation to obtain this index number was derived from the cut shaft frequency and torque (see Chapter 7 of "The Modern Guide to Shaft Fitting"). While this formula has worked well in the past 15 years, we are always trying to improve upon understanding what makes a shaft stiff (or flexible) and how to relate that to why golfers successfully used what they do.

"The 2004 Shaft Fitting Addendum" has added four new data fields to better explain the characteristics of the shaft. For the past four years we have been using a digital deflection board to measure stiffness, to augment the frequency readings. The traditional method of deflection is to measure it with the butt clamped into the fixture (Butt deflection). However, we have also added another parameter and that is the tip deflection to determine relative stiffness to the other end of the shaft, which has become a hot topic. Next, we created a ratio between the butt and tip deflection to predict ahead of time what shafts may hit the ball higher or lower.

The biggest change may be the last field you will see in the Cut Data Charts labeled "DFSI Deflect. Method", which is a new way obtaining the stiffness rating of a shaft based upon the butt and tip deflections, rather than using frequency and torque. This will become the standard method of determining the DSFI rating of a shaft for irons, as it was the one area we felt was need for improvement in fitting. The graphite iron shafts always had lower DFSI ratings as compared to how they performed in field-testing. The results can be found in Chapter 4. We also

included both the Frequency/Torque method and the new Deflection method to the drivers listed in Chapter 4. Both methods do relate to one another, but there have always been shafts that have rated stiffer or more flexible than their rating would suggest. Now we have come up with a secondary method to determine relative stiffness. Please let us know which method you find more successful for future addendums.

You will notice the Cut Shaft Data in the 2004 Addendum is divided into two sections. After 15 years of testing, more than half of the shafts have either been deleted from manufacturers' current product line or in some unfortunate cases, the shaft company is no longer in business. Because of the influx of new shafts, we felt it best to keep all the information in one text as a way to compare the old and new shafts alike. This way, clubmakers can utilize the 2004 Shaft Fitting Addendum to make educated choices for replacement or substituted shafts.

Lastly, we have a procedural outline to follow when selecting shafts based on the swing speed of the golfer. We have updated the conversion factors for length and even grip weighting. There are also examples in which to follow that might make it easier to understand the Principles of DSFI. This addendum also provides an outline to allow you to pre-determine head weight, swingweight and even frequency prior to assembling the club when you are making a change from our standard testing procedures. Field observations as well as the questions clubfitters have had using the DSFI in the past brought about all these additions we made since the Shaft Fitting Addendum was introduced. All in all, these additions should be even more user friendly in you shaft fitting selections.

Finally, allow us to provide an explanation of why we believe the Dynacraft Shaft Fitting Index remains the No.1 method for modern shaft selection. Since the innovative index was first published in 1992, some shaft manufacturers, major OEM's and various component distributors have followed suit in recommending shaft models by swing speed ratings. These can serve as a valuable source of information to the clubmakers, yet these are not likely to represent the comprehensive picture that "The Modern Guide to Shaft Fitting" and DSFI provide. DSFI not only offers recommended swing speeds for the majority of shafts used by clubmakers today, it does so based on *actual cut shaft measurements* based on the manufacturers recommended trimming instructions. In other words, DSFI recommendations are based upon shaft performance characteristics, as clubmakers and their customers will experience them. Other listings are based purely upon raw shaft specifications, or upon specifications provided by the manufacturer, and thus cannot be regarded as truly independent. Every shaft listed in this publication has been individually tested and quantified by the Dynacraft Technical Staff.

For a more complete tutorial on implementing the Dynacraft Shaft Fitting Index in your clubmaking, please refer to Chapter 7 of "The Modern Guide to Shaft Fitting". An updated, quick reference guide also is contained in Chapter 4 of this book. For those who do not currently have the "Modern Guide to Shaft Fitting", you can download off of www.dynacraftgolf.com for free.

Additionally, at the beginning of each section you will find a brief introduction about the set of specifications and a table of contents for that section. Use these guides to find the shaft model or reference the specification that is required.

CUT SHAFT DATA

In hand with the DSFI Swing Speed Ratings, this section contains the most important, and most usable, information in this publication. All cut shaft specifications have been obtained according to the assembled club parameters detailed in Chapter 2 of "The Modern Guide to Shaft Fitting".

Cut Shaft Data

In the "Shaft Fitting Addendum", non-ultralight graphite shafts (>70 g) are now tested at lengths that many clubmakers are assembling the clubs to due to the lack of weight ports in woods or heavier heads in general. The new standard Driver test lengths are 44" for men's flexes and 43" for L-flex shafts. For the #5-irons, the Men's flexes are tested at 38.5" and the L-flex at 37.5". This complements the changes made in 1996, were the ultralight graphite shafts were tested at 45" (44" for Ladies). Steel shafted Drivers remains tested at 43" (42" Ladies) and steel shafted #5-irons at 37.5" (36.5" Ladies). We felt it was important for clubmakers to have useful information based upon the design applications of the shafts in question.

Some Cut Shaft entries do have gaps in their listings, particularly in regard to raw shaft weight, raw shaft balance point, tip and butt diameters. Shaft models that do not have these listings were tested in the spring of 1992, shortly before the publication of the original "Shaft Fitting Addendum". Rather than hold these shafts out of the '92 addendum, the Dynacraft Technical Staff opted to go ahead and trim them according to the manufacturer specifications and include that data in the '92 Cut Shaft Data. Once the shaft was trimmed, however, the initial tip diameter, butt diameter, raw shaft weight and balance points were lost, as the shaft was no longer in its original form. But as golfers play with shafts in their cut form, this should not be a cause of concern to the clubmakers.

In many cases, raw shaft torque is not included. Shafts tested after the 1993 Addendum was published will have this as a standard specification. In the first two addenda there was an entire section devoted to raw shaft data, which was eliminated in the 1994 Addendum because most of the information was repetitive. Again, golfers play with cut shafts and the raw torque is merely for comparative purpose verses the cut shaft torque specification.

Flex	**Raw Weight (g)**	**Tip Diam. (in.)**	**Butt Diam. (in.)**	BP1 (in.)	BP2 (in.)	BP3 (in.)	Static Weight (g)	Head Weight (g)	Grip Weight (g)	Shaft Weight (g)	Freq. (cpm)	Butt Deflect. (oz.)	Tip Deflect. (.oz.)	T/B Ratio	Torque Cut (deg)	Torque Raw (deg)	Length -Bore Type	DSFI F / T method	DSFI Deflect. method

FLEX is simply the starting point provided by the manufacturers to describe the stiffness of their shafts. When possible, the L, A, R, S and X-flexes of each shaft for woods and irons were tested. **Raw Weight** is simply the static weight of the shaft before it was trimmed for testing. **Tip Diameter and Butt Diameter were** measured with calipers to within 0.01".

Flex	Raw Weight (g)	Tip Diam. (in.)	Butt Diam. (in.)	**BP1 (in.)**	**BP2 (in.)**	**BP3 (in.)**	Static Weight (g)	Head Weight (g)	Grip Weight (g)	Shaft Weight (g)	Freq. (cpm)	Butt Deflect. (oz.)	Tip Deflect. (.oz.)	T/B Ratio	Torque Cut (deg)	Torque Raw (deg)	Length -Bore Type	DSFI F / T method	DSFI Deflect. method

For cut shaft testing, three different variations of **balance point** were recorded. Balance Point #1 (BP1) was based on the raw shaft before trimming. Balance Point #2 (BP2) was the measurement of balance point after trimming for installation into a clubhead. Balance Point #3 (BP3) was the balance point measurement for the club when assembled with the test clubhead and grips at standard length and swingweight C-6 (ladies length) or D-1 (at men's length). In all cases the balance points are measured up from the tip of the shaft (or groundline on BP3).

Flex	Raw Weight (g)	Tip Diam. (in.)	Butt Diam. (in.)	BP1 (in.)	BP2 (in.)	BP3 (in.)	**Static Weight (g)**	**Head Weight (g)**	**Grip Weight (g)**	**Shaft Weight (g)**	Freq. (cpm)	Butt Deflect. (oz.)	Tip Deflect. (.oz.)	T/B Ratio	Torque Cut (deg)	Torque Raw (deg)	Length -Bore Type	DSFI F / T method	DSFI Deflect. method

Static weight is the overall measurement of the club's total weight when assembled with a matching core size grip and the appropriate metal wood Driver or #5-iron. Similarly, **head weight, grip weight and cut shaft weight** were recorded to allow comparisons of the total weight of the test Drivers and #5-iron that were assembled to the C-6 and/or D-1 swingweights. While critical to the overall placement of the shaft in the DSFI rankings, these parameters are not addressed individually in the text of the book.

Flex	Raw Weight (g)	Tip Diam. (in.)	Butt Diam. (in.)	BP1 (in.)	BP2 (in.)	BP3 (in.)	Static Weight (g)	Head Weight (g)	Grip Weight (g)	Shaft Weight (g)	**Freq. (cpm)**	Butt Deflect. (oz.)	Tip Deflect. (.oz.)	T/B Ratio	Torque Cut (deg)	Torque Raw (deg)	Length -Bore Type	DSFI F / T method	DSFI Deflect. method

Shaft frequency refers to the number of cycles per minute (cpm) that the shaft registered after assembly to the appropriate finished Driver or #5iron specifications. The standard swingweights for the L-flex clubs is C-6 and Men's flexes are tested at D-1. The frequency measurements are recorded for the standard length men's and ladies metal wood Drivers (43", 42") and #5-irons (37.5", 36.5"), unless otherwise noted. Frequency derived from butt clamping 5.25" with the gripped club.

Flex	Raw Weight (g)	Tip Diam. (in.)	Butt Diam. (in.)	BP1 (in.)	BP2 (in.)	BP3 (in.)	Static Weight (g)	Head Weight (g)	Grip Weight (g)	Shaft Weight (g)	Freq. (cpm)	**Butt Deflect. (oz.)**	**Tip Deflect. (.oz.)**	T/B Ratio	Torque Cut (deg)	Torque Raw (deg)	Length -Bore Type	DSFI F / T method	DSFI Deflect. method

Butt and tip deflection readings are two new measurements to compare relative flex using a deflection board with a load cell to record the force when the shaft is deflected 4". The measurement is provided in ounces of force and the cantilevered length is 5.25", which is the same as the frequency to show how these two measurements compare. Deflection is a long time measurement for flex, because it is analogous to the shape of the shaft when it is bent during the swing. Normally deflection has been recorded by clamping the butt end. We have also added tip deflection to provide insight into one of the hot topics of late – tip stiffness.

Flex	Raw Weight (g)	Tip Diam. (in.)	Butt Diam. (in.)	BP1 (in.)	BP2 (in.)	BP3 (in.)	Static Weight (g)	Head Weight (g)	Grip Weight (g)	Shaft Weight (g)	Freq. (cpm)	Butt Deflect. (oz.)	Tip Deflect. (.oz.)	**T/B Ratio**	Torque Cut (deg)	Torque Raw (deg)	Length -Bore Type	DSFI F / T method	DSFI Deflect. method

T/B Ratio stands for tip to butt ratio. This is simply the relationship between the tip and butt deflection measurements to illustrate the stiffness distribution of the shaft. Shafts that have higher T/B ratios can be described as lower bend points (tip weak, butt stiff) or shafts that might produce a higher trajectory. Shafts with a lower T/B ratio can be described as higher bend point (firm tip, weak butt) or lower launch angle shafts. The T/B ratio does not reflect the actual bend point location, rather provides a meaningful parameter to predict which shafts may launch the ball either higher or lower relative to one another.

Flex	Raw Weight (g)	Tip Diam. (in.)	Butt Diam. (in.)	BP1 (in.)	BP2 (in.)	BP3 (in.)	Static Weight (g)	Head Weight (g)	Grip Weight (g)	Shaft Weight (g)	Freq. (cpm)	Butt Deflect. (oz.)	Tip Deflect. (.oz.)	T/B Ratio	**Torque Cut (deg)**	**Torque Raw (deg)**	Length -Bore Type	DSFI F / T method	DSFI Deflect. method

Cut shaft torque from 1989-92 was recorded on Apollo's test machinery as a tip-attached load cell moved in a clockwise, then counter-clockwise direction to measure that shaft's resistance to twisting. Torque testing was recorded at 1 ft.-lb. force (as in the raw shaft testing) and was performed in both directions, with the torque listed as the average of the two readings. From 1992 to the present, torque testing was conducted under the same conditions in Dynacraft's research facilities. **Raw shaft torque** has been tested at Dynacraft for new shafts to reveal the torque difference that result from trimming. In each case, torque measured by clamping 2" of the butt and affixing the torque arm 1" from the tip of the cut or uncut shaft.

Flex	Raw Weight (g)	Tip Diam. (in.)	Butt Diam. (in.)	BP1 (in.)	BP2 (in.)	BP3 (in.)	Static Weight (g)	Head Weight (g)	Grip Weight (g)	Shaft Weight (g)	Freq. (cpm)	Butt Deflect. (oz.)	Tip Deflect. (.oz.)	T/B Ratio	Torque Cut (deg)	Torque Raw (deg)	**Length -Bore Type**	DSFI F / T method	DSFI Deflect. method

Length is simply the actual cut club length that was tested at to provide the data. **Bore Type** (woods only). Due to the many hosel lengths and tip insertion depths and subsequent bottom of bore to groundline measurement (BBGM) that exist in metal wood heads today, it was necessary to create this parameter. For the purposes of identifying the bores, the original metal wood used for testing was a small size metal wood with a 3" hosel and 1.5" insertion depth and a 1.5" BBGM. This head is classified as a M1 bore type. The Mid Size metal wood used for testing has a 2.5" hosel, 1.5" insertion depth and 1" BBGM and classified as a M2 bore type. Lastly, an oversized metal wood used for this testing has a 1.75" hosel; 1.25" insertion depth and 0.5" BBGM that will be classified as a BB bore type. Iron shafts will not have a bore type classification. For the record, the #5-iron used for testing has 2.33" hosel length, 1.33" insertion depth and 1" BBGM.

Flex	Raw Weight (g)	Tip Diam. (in.)	Butt Diam. (in.)	BP1 (in.)	BP2 (in.)	BP3 (in.)	Static Weight (g)	Head Weight (g)	Grip Weight (g)	Shaft Weight (g)	Freq. (cpm)	Butt Deflect. (oz.)	Tip Deflect. (.oz.)	T/B Ratio	Torque Cut (deg)	Torque Raw (deg)	Length -Bore Type	**DSFI F / T method**	**DSFI Deflect. method**

The final listings, the **DSFI swing speed ratings**, are the most relevant information contained in this section. While all the parameters listing in these charts are important to your reference, it is the DSFI calculation that immediately reveals if a particular shaft should be considered for a certain player. We recommend starting any shaft fitting session by recording the golfer's average swing speed and then referring to the DSFI listings in Chapter 6 of this addendum. After narrowing down the list of shaft choices to those in the player's recommended swing speed ranges, refer to these charts for additional information on specific models.

DSFI F/T (frequency/torque) is the original DSFI rating of the shaft based on an algorithm that uses frequency and torque as the key parameters. **DSFI Deflect** (short for deflection) is a new method of rating the shafts based on a model, using butt and tip deflections as the key parameters. This has been added to this year's Shaft Fitting Addendum to help identify those shafts that perform stiffer or more flexible than the original DSFI method (see page 2-3 for explanation).

Again, as golfers play golf with shafts that have been cut to proper playing length, these Cut Shaft Data charts can serve as a valuable source of information in your clubmaking work. Unlike fitting guides that are based on uncut shaft specifications, measurements derived from shafts in their proper playing form are eminently more appropriate for fitting comparisons. These are the specifications upon which the DSFI listings that follow this section are based.