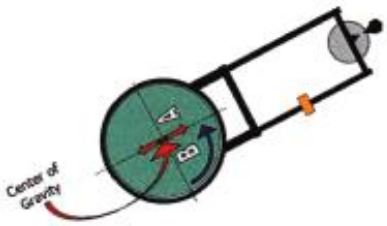
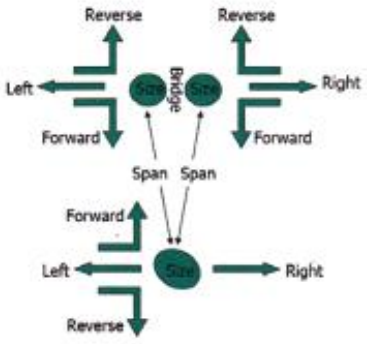
Bowling Pro Shop Certification Program

IBPSIA





Phase I - Technical Manual Second Edition

Second Edition Acknowledgements

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IBPSIA Curriculum
Phase 1 – Technical Manual
Second Edition

A. FITTING AND DRILLING TECHNIQUES

1. Physical analysis of the hand
2. Definition of fitting terms
3. Measuring devices
4. Tool operation

B. PRODUCT KNOWLEDGE

1. Balls
    a. *Coverstock*
    b. *Core design*
    c. *Weight systems layout*
    d. *Scaling*
2. Bags
3. Shoes
4. Accessories

C. WORK BENCH ACTIVITIES

1. Plugging techniques
2. Resurfacing
3. Repairs
4. Insert Placement

D. LANE WORK

1. Customer needs analysis
2. Product delivery
3. Lessons
4. Use of video equipment

E. CUSTOMER SERVICE

1. Standards of performance
2. Retail merchandising
3. Sales and service
4. Shop layout / setup

Learning Modules

Learning Module 1

Fitting

LM1-1 – LM1-29

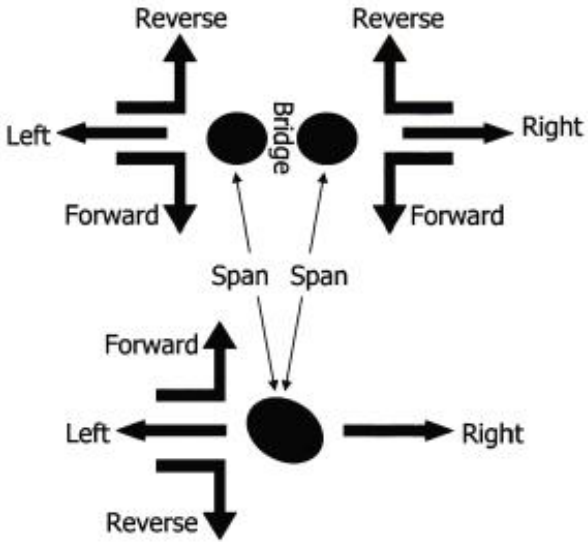
Learning Objectives

Understanding the complexities of the "pie;" determining span measurement, pitch, hole size and shape; creative thinking for unusual fitting problems; defining fitting terminology.

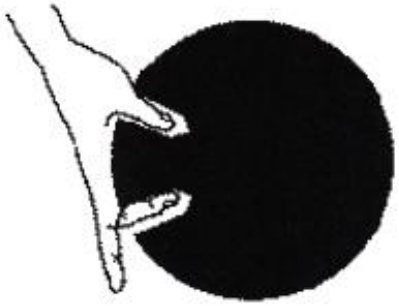
Key Points

- Grip Types
- Fitting Terminology
- Components of Fit
- Thumb Pitch
- Finger Pitches
- Span Measurements
- Span and Pitch Chart
- Hole Size and Shape
- Pie Chart Formula Theory
- Working with Unusual Hands
- Working with Calluses
- Tools and Techniques
- Review Questions

Fitting Terminology

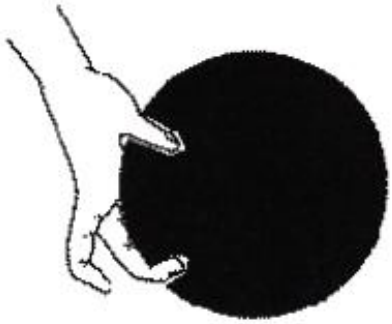


The Types of Grip



Conventional
In the conventional grip the fingers are completely inserted to the second joint and the thumb is completely inserted.

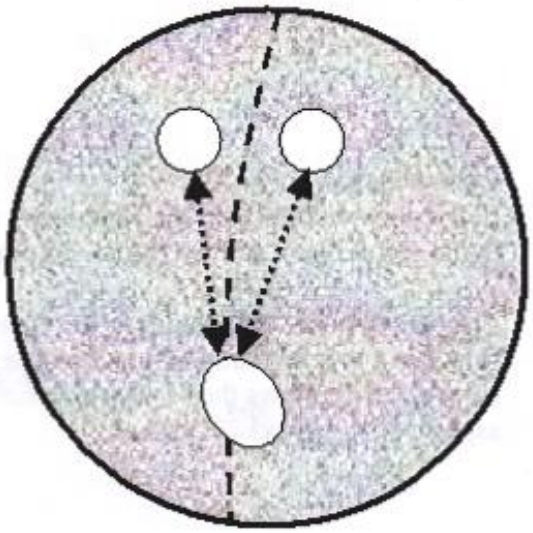
The conventional is a good grip for the beginner, as it provides a low revolution rate at release and slight ball motion. This allows the bowler to concentrate on other aspects of their physical game.



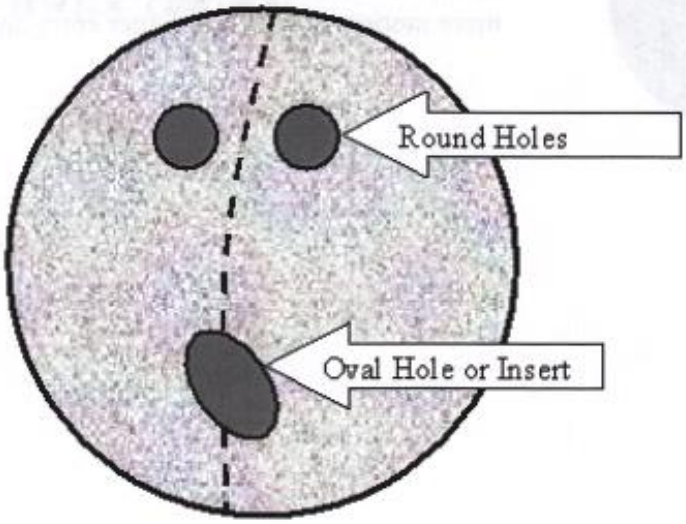
Fingertip
In the fingertip grip the fingers are inserted to the first joint and the thumb is completely inserted.

The fingertip is a more advanced grip for the bowler, as it provides the potential for a higher revolution rate at release and the most ball motion. This allows the bowler to create more motion and achieve larger entry angles to the pocket.

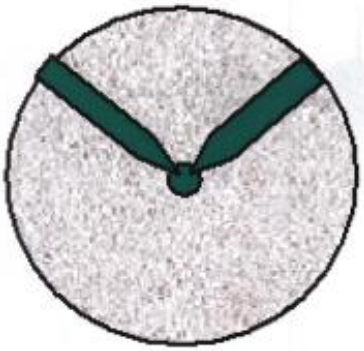
Span — the distance between the holes used for the purpose of grip



Hole Size and Shape — the internal measurements and shape of the drilled holes or inserts used in the bowling ball

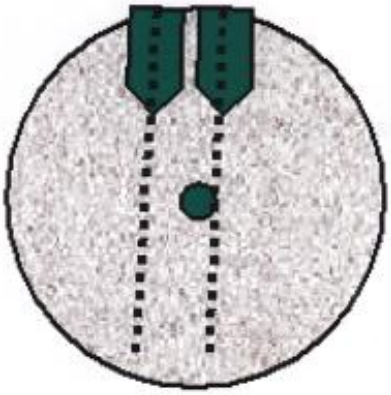


Pitch — the angle at which a hole is drilled into a bowling ball



Zero
Pitch in which the gripping hole is angled to the center of the bowling ball

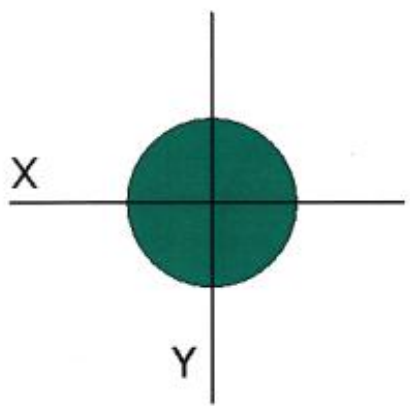
Forward
Pitch in which the gripping hole is angled toward the center of grip

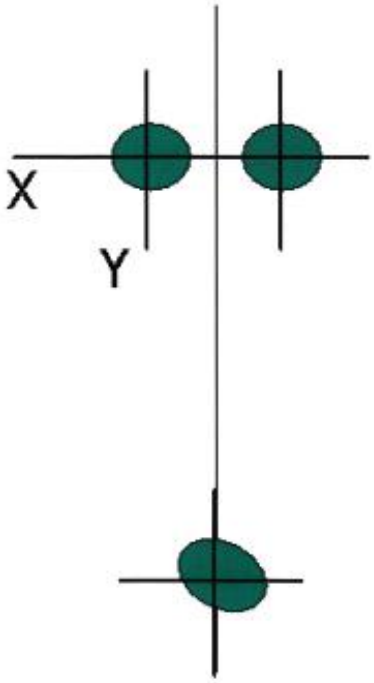


Reverse
Pitch in which the gripping hole is angled away from the center of grip

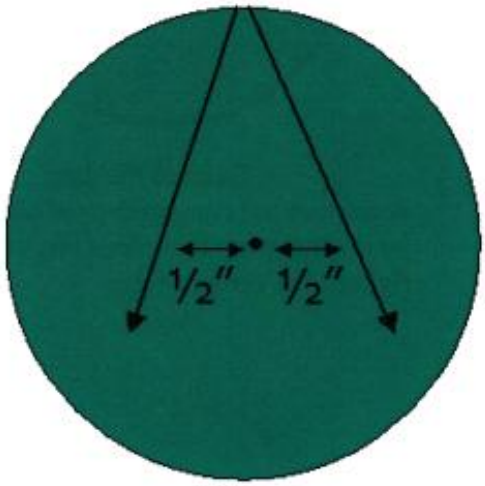
Lateral Pitches
Right and left components of pitch in which the gripping hole is angled left or right of the center of grip

The Pitches are based off the X and Y axis, Y being parallel to the centerline.



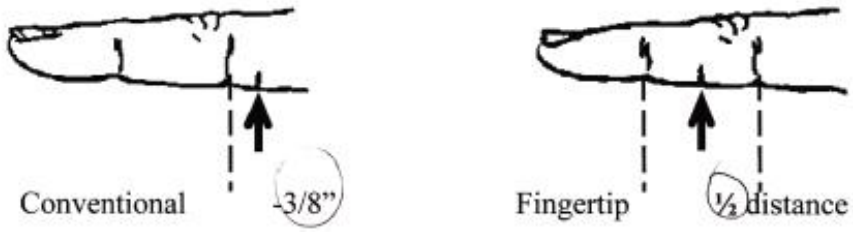


The measurement of pitch is the distance that the hole center deviates from the center of the ball



Determining Span Measurement

Because of the many types of ball fitters on the market, this process will differ, depending upon which ball fitter you use. Refer to the ball fitter's manual for instructions. Regardless of which ball fitter you use, many technicians believe that it is a good idea to draw lines on the customer's fingers for reference. See illustration.



Others disagree about drawing lines on the customer's fingers – and never do so.

Different Ball Fitters

As a starting point, when using a Brunswick, Jayhawk or AMF ball fitter, with the thumb fully inserted in the ball and with no play in the "web" area, the line on the customer's finger should line up with the leading (front) edge of the finger hole for both the middle and ring finger.

For a conventional grip with the fingers inserted into the ball to the second joint line (with the thumb seated in properly) a 90° angle of the fingers into the holes will be formed.

For a fingertip grip with the fingers inserted to the first joint line (with the thumb seated in properly) you should see the second knuckle slightly raised from the ball, allowing the first joint line to stay in contact with the leading edge of the finger hole, forming a 90° angle of the fingers into the holes.

When using a Bill Taylor ball fitter, the lines on the customer's fingers are used to read the span from the ball fitter with the thumb fully inserted in the fitter and the hand curved around the device.

Additional Bill Taylor Fitting Techniques

Another technique used by many technicians in determining span for the ring finger comes from Bill Taylor – The 5/16 Rule.

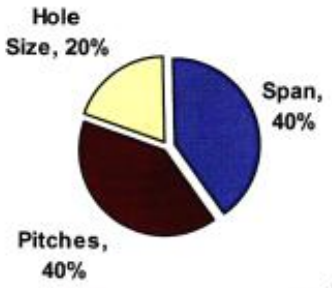
The following apply to that method of fitting:

1. Establish a straight line from the elbow through the wrist to the fingertips.
2. Mark the crease line (first for fingertip, second for conventional) on both the middle and ring fingers.
3. With the hand in a cupped position extend the crease line of the ring finger to the middle finger.
4. Measure the distance from the crease line on the middle finger to the line extended from the ring finger.
5. Add 5/16" to the measurement for the middle finger, then subtract the measurement from #4: this will yield the measurement for the ring finger.

Pie Chart Formula Theory

The ability to relax the hand while holding onto the ball, and to have a good arm swing and release, is created by the relationship between three components. Understanding these three components may help you solve existing fit problems, as well as improve your technique for initial fittings.

The theory behind the formula is as follows:



- Span = 40%
- Pitches = 40%
- Hole Size = 20%

Important

When you are creating a new fit, keep these percentages intact. Using this formula creates less stress on the hand and a more consistent release.

The Relationship of Span, Pitches and Hole Size

The following two examples illustrate the relationship of span, pitches and hole size.

Example No. 1

Problem: A customer continually drops the ball.

Solution: When you check the customer's fit, you determine that the span is correct (40%), and so is the hole size (20%). If using the "Pie Chart Formula," you now can deduce that an incorrect thumb pitch is causing the customer to drop the ball.

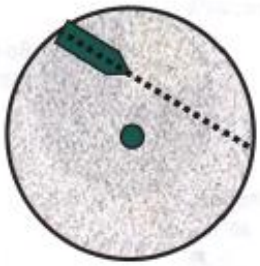
Example No. 2

These relationships often exist at different percentages in fits that you may check. If the span is too long, instead of being 40% of the fit, it will be 60%. To accommodate for this, the thumb pitch would have to be reduced to adding reverse, thereby dropping its percentage to 20%.

These trade-offs usually are acceptable, but they have the potential for causing trouble. In this example, these percentages create excessive pressure on the fingers, which can cause excessive callusing and pain in the finger joints.

Thumb Pitch

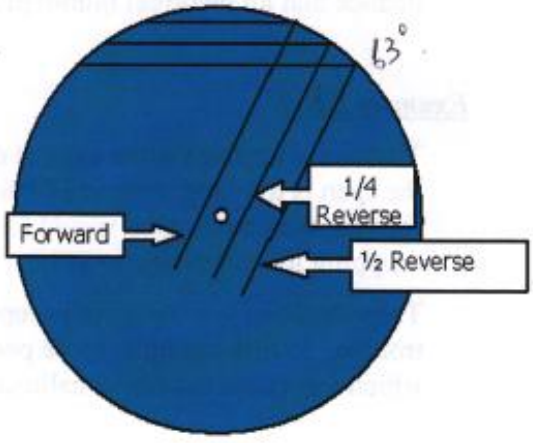
Pitch is 40° of the Pie Chart Formula. To maintain the 40° values, it is important to understand the relationship between the thumb pitch and the span.



A shorter span requires less reverse or more forward than a longer span

A longer span requires more reverse or less forward than a shorter span

To maintain the same angle in the thumb as span increases, more reverse pitch is required.

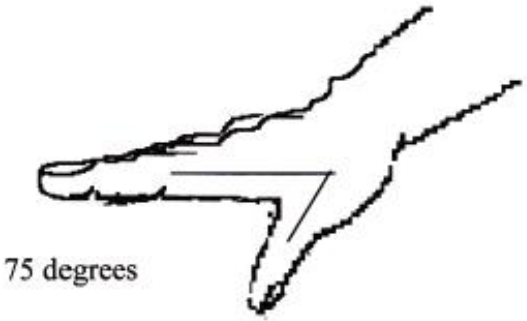


See "Thumb Pitch Chart" On page LM1-11

Checking Flexibility 柔韧性.

Flexibility is a key consideration where pitch is concerned. With the palm facing the floor and the hand extending straight out, point the thumb directly towards the floor.

Using slight pressure, pull the thumb towards the body keeping it straight towards the floor. Note the angle the hand can achieve and refer to the chart on LM1-11



(hand pictures demonstrating all the angles not available, however line drawings appear within the chart on the following page)

Thumb Angle Conversion Pitch Chart

135° Very flexible	120° Average flexibility	105° Some flexibility	90° Average tight	75° Very tight	
Pitch	**Span**	**Span**	**Span**	**Span**	**Span**	**Pitch**
15/16 Forward	2 1/2"	2 3/8"	2 1/4"	2 1/8"	2	15/16 Forward
7/8 Forward	2 5/8"	2 1/2"	2 3/8"	2 1/4"	2 1/8"	7/8 Forward
13/16 Forward	2 3/4"	2 5/8"	2 1/2"	2 3/8"	2 1/4"	13/16 Forward
3/4 Forward	2 7/8"	2 3/4"	2 5/8"	2 1/2"	2 3/8"	3/4 Forward
11/16 Forward	3"	2 7/8"	2 3/4"	2 5/8"	2 1/2"	11/16 Forward
5/8 Forward	3 1/8"	3"	2 7/8"	2 3/4"	2 5/8"	5/8 Forward
9/16 Forward	3 1/4"	3 1/8"	3"	2 7/8"	2 3/4"	9/16 Forward
1/2 Forward	3 3/8"	3 1/4"	3 1/8"	3"	2 7/8"	1/2 Forward
7/16 Forward	3 1/2"	3 3/8"	3 1/4"	3 1/8"	3"	7/16 Forward
3/8 Forward	3 5/8"	3 1/2"	3 3/8"	3 1/4"	3 1/8"	3/8 Forward
5/16 Forward	3 3/4"	3 5/8"	3 1/2"	3 3/8"	3 1/4"	5/16 Forward
1/4 Forward	3 7/8"	3 3/4"	3 5/8"	3 1/2"	3 3/8"	1/4 Forward
3/16 Forward	4"	3 7/8"	3 3/4"	3 5/8"	3 1/2"	3/16 Forward
1/8 Forward	4 1/8"	4"	3 7/8"	3 3/4"	3 5/8"	1/8 Forward
1/16 Forward	4 1/4"	4 1/8"	4"	3 7/8"	3 3/4"	1/16 Forward
0	4 3/8"	4 1/4"	4 1/8"	4"	3 7/8"	0
1/16 Reverse	4 1/2"	4 3/8"	4 1/4"	4 1/8"	4"	1/16 Reverse
1/8 Reverse	4 5/8"	4 1/2"	4 3/8"	4 1/4"	4 1/8"	1/8 Reverse
3/16 Reverse	4 3/4"	4 5/8"	4 1/2"	4 3/8"	4 1/4"	3/16 Reverse
1/4 Reverse	4 7/8"	4 3/4"	4 5/8"	4 1/2"	4 3/8"	1/4 Reverse
5/16 Reverse	5"	4 7/8"	4 3/4"	4 5/8"	4 1/2"	5/16 Reverse
3/8 Reverse	5 1/8"	5"	4 7/8"	4 3/4"	4 5/8"	3/8 Reverse
7/16 Reverse	5 1/4"	5 1/8"	5"	4 7/8"	4 3/4"	7/16 Reverse
1/2 Reverse	5 3/8"	5 1/4"	5 1/8"	5"	4 7/8"	1/2 Reverse
9/16 Reverse	5 1/2"	5 3/8"	5 1/4"	5 1/8"	5"	9/16 Reverse
5/8 Reverse	5 5/8"	5 1/2"	5 3/8"	5 1/4"	5 1/8"	5/8 Reverse
11/16 Reverse	5 3/4"	5 5/8"	5 1/2"	5 3/8"	5 1/4"	11/16 Reverse
3/4 Reverse	5 7/8"	5 3/4"	5 5/8"	5 1/2"	5 3/8"	3/4 Reverse
13/16 Reverse	6"	5 7/8"	5 3/4"	5 5/8"	5 1/2"	13/16 Reverse
7/8 Reverse	6 1/8"	6"	5 7/8"	5 3/4"	5 5/8"	7/8 Reverse

Thumb Pitches

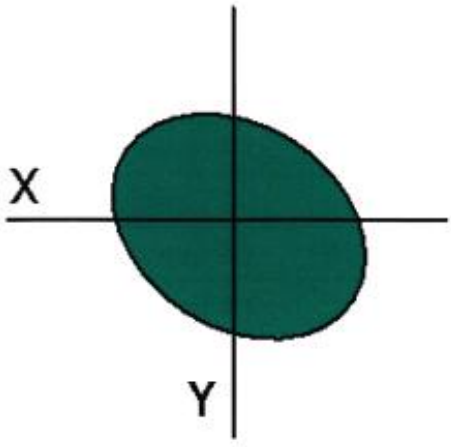
Thumb Pitches — Forward and Reverse

From the "Span and Thumb Pitch Chart" on the preceding page, record the suggested thumb pitch for span. With that thumb pitch, adjust for these characteristics.

If thumb is . . .	Do this . . .
Long — 2 5/8" or longer	***Add*** 1/8" reverse pitch
Short — 2" or shorter.	***Subtract*** 1/8" reverse pitch
Extremely moist skin	***Add*** 1/8" reverse pitch
Extremely dry skin	***Subtract*** 1/8" reverse pitch

Thumb Pitches — Right or Left Pitch

Experience has demonstrated that 0 right or left pitch will accommodate the majority of your customers.



Finger Pitches

Finger Pitches – Conventional Fit

As viewed from the traditional philosophy regarding finger pitches, in a conventional fit, the fingers are inserted into the ball up to the second joint. The conventional span is more relaxed than a fingertip span, so it provides only 30% of the "Pie Chart Formula." (Fingertip is 40%). This lessens the impact of the span measurement to hold onto the ball but increases the need for finger pitches to make up for that 10% loss. This keeps the "Pie Chart formula" total at 100%.

The "Conventional Finger Pitch Chart" that follows gives a starting place for normal fingers.

Conventional Finger Pitch Chart

Conventional Finger Pitch Chart	
3 inches	3/8 forward
3 1/8 inches	3/8 forward
3 1/4 inches	3/8 forward
3 3/8 inches	3/8 forward
3 1/2 inches	3/8 forward
3 5/8 inches	1/4 forward
3 3/4 inches	1/4 forward
3 7/8 inches	1/4 forward
4 inches	1/8 forward
4 1/8 inches	1/8 forward
4 1/4 inches	1/8 forward

Finger Pitches – Fingertip

All fingertip pitches should start at zero forward / reverse.

Why? The main responsibility of the fingers is creating ball rotation.

- The belief of many technicians is that if the span is correct, then zero pitch places the fingers in the ball where the finger pads have maximum ball contact.
- Others say that this relationship changes as the thumb exits the ball.

If you subscribe to the first theory, then the zero pitch distributes the pressure evenly on the finger pads, thereby relieving excess stress on the finger joints.

There are differences of opinion within the industry about finger pitches. The most significant difference of opinion relates to the belief that pitching the fingers forward creates more lift, thereby creating more revolutions, and that the result is more hook. Actually, producing more revolutions comes from the bowler's leverage and timing, not from the pitch of the fingers.

You may see fits that have excessive forward finger pitch. And, they seem to work for the bowler. Our concern is to give you guidelines that will work for the majority of your customers.

Exceptions

If the first finger joint . .	**Illustration**
is flexible, then ***zero*** pitch will work	
will not bend beyond this point, then use ***1/4" reverse*** finger pitch	
will not bend beyond this point, then use ***1/2" reverse*** finger pitch	

Pitch "what you see;" 3/4" reverse pitch or more is possible and sometimes required. By using these exceptions, you will not have to adjust the span for stiff or arthritic joints.

Finger Pitches — Left and Right

- Follow the formula below when you are drilling a ball for right-handed bowlers.
- Reverse the formula for left-handed bowlers.

Grip	Pitches
Conventional / Fingertip	***Middle finger – 1/4" left*** ***Ring Finger – 5/8" right*** This will accommodate most of your customers

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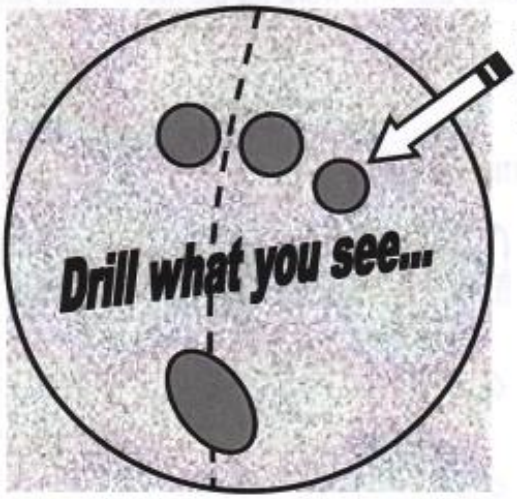
Finger Pitches — Index and Pinky



When fitting and drilling extra gripping holes – drill what you see. Often times it is best to drill the additional hole after the initial holes have been finished and you can put the customer's hand into the ball.

Determining Hole Size

These determinations are based on a ball fitter that measures hole sizes in increments of 64ths.

Fingers

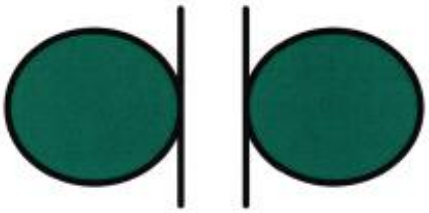
If the ball is drilled . . .	Select a hole size . . .
Conventional	That finger easily passes through up to but not including second joint
Fingertip	That first joint barely passes through

Not Sure?

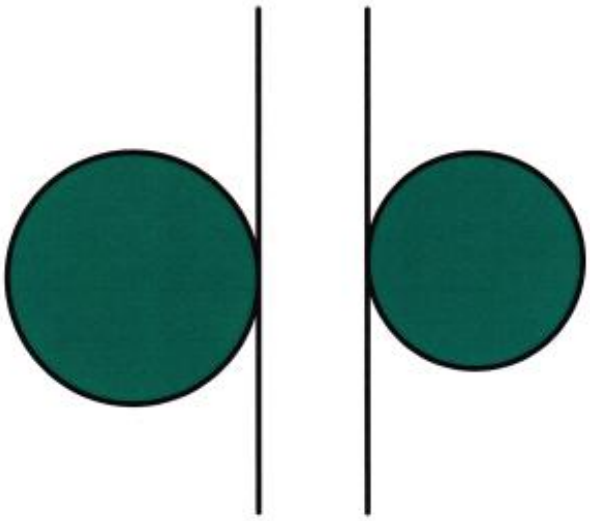
When in doubt, reduce hole by 1/64 inch. You can always enlarge the holes.

Bridge Width

As the finger hole sizes increase, the bridge distance needs to increase as well to insure the integrity of the area surrounding the fingers.



Average bridge for smaller holes is 1/4" to 5/16"



As hole sizes increase, larger bridges become necessary. 3/8" or more is sometimes required.

Ball Weight for a New or Novice Bowler

If ball weight is. . .	Then . . .
15 – 16 pounds	Go up one to two hole sizes from hole size that thumb will ***NOT*** fit through
12 – 14 pounds	Go up two to three hole sizes from hole size that thumb will ***NOT*** fit through
6 – 11 pounds	Go up three hole sizes from hole size that thumb will ***NOT*** fit through

Thumb

If the thumb is. . .	Then . . .
Flat and oval	Needs oval and a determination of oval angle. In most cases, a 45° angle will be sufficient
Round	Check for possible taper. If taper is required, open up backside of thumbhole.
Callused	Check for cause – see callus charts. Create groove inside hole to accommodate callus. Be careful of making the overall size of the hole too big. (use hole size for thumb excluding callus, then create groove).

Ovals

Purpose

To create a more contoured hole in the bowling ball, closely resembling the shape of the thumb. The oval holes, in combination with the correct span/pitch relationships, will result in less tension of the hand while in the ball. A hand that is more relaxed will allow for a fluid, consistent swing and timing.

Tools for Ovaling

- Mill/Drill
- Sharp drill bits (*end mills or spaded drills recommended, but optional*)
- Swoval, Jonell oval fitting tool or some device to determine degree of oval
- Protactor, Turbo 2-N-1 Pro Sect, Jayhawk Quarter Scale or device to measure degree of oval
- Jayhawk, Brunswick or BT fitting device to determine starting hole size
- Jayhawk oval sizers or custom made oval fitting ball (*optional*)

Measuring for Ovals

When measuring for an oval, there are three specific areas to note:

1. **Thinnest part of thumb** – the original or starting drill bit

   Find the hole size that would let only the thin side of the thumb through if the device were elongated. *Caution – the tendency of many, even with experience, is a starting hole size too tight.*

2. **Thickest part of thumb** – the final width or cut amounts

   Slide calipers or standard fitting device over widest or thickest part of thumb. Feel for a consistent, slight drag over thee thumb. Note this measurement next to the starting hole size on the specification sheet. Example: (.850) or (1.000)

3. **Oval angle** – the degree of oval above the horizontal line (drawn perpendicular to the center line through the middle of the thumb hole)

Using a properly fitted bowling ball belonging to the customer for whom an oval is being created, place fingers into the ball and guide the thumb into the thumbhole just deep enough to allow for the widest part of the thumb to touch the top of the thumbhole.

Mark the edge of the thumbhole with lines that correspond to the lines on the bowler's thumb. Draw a straight line connecting the two points through the center of the thumbhole, and extend the line at least 3" to either side of the thumbhole.

Line up the protractor or other device designed to measure degrees to measure ovals, with the centerline of the grip through the center of the thumbhole and zero perpendicular to the centerline. Measure the degree at which the lines marked from the edge of the thumbhole pass through the protractor. This is the degree of oval. Note this measurement on the specification sheet. Example: (45°)

Choosing Ball Weight

For first time bowlers and first time ball owners, choosing the correct ball weight is an important part of the fitting process. Improper ball weight (too light or too heavy) can make it difficult to accomplish a comfortable grip.

Some general rules to follow:

1. The bowler is using a house ball comfortably for one game, and then tires – a ball weighing the same as the house ball, when properly fitted, should be fine.
2. The bowler uses a house ball for three games with little or no problem – a ball two pounds heavier than the house ball, when properly fitted, should be fine.
3. Junior bowlers – 10% of their body weight PLUS two pounds as a maximum.
4. Test the customer's ability to handle and swing the weight by placing a ball in a sling (buff-a-ball) or a handled box and have them swing it as if they were bowling (without releasing it, of course).

Working with Unusual Hands

Our customers' hands are not always perfect. Use these guidelines to make necessary adjustments.

Problem	Possible Solution
Arthritic finger joints	● Oval holes may reduce pressure ● Use more than average bevel for comfort ● Severe pitch changes to reduce overall stress ***For example***: Reduce forward pitch in fingers by 1/4" to 1/8" – if this is done, increase forward pitch in thumb by 1/8"
Missing fingers	Possible use of other fingers
Tendonitis	● Lighter ball can help ● Shorten span and increase forward pitch in thumb
Sensitive nerve or tendon	Cut groove or notch at location of tendon to relieve pressure
Pain, soreness, swelling	Evaluate fit Observe bowler's method of release

The Importance of Checking the Bowler's Hand

Any bowler who bowls too little, or too much, is bound to have problems with his/her bowling hand. The infrequent bowler does not give the hand a chance to become accustomed to the friction caused by the ball leaving the hand.

No matter how good the fit, there must be some degree of pressure on the fingers and thumb. If the bowler does not bowl enough, blisters may form at the spots of contact. These usually are minor and develop when the occasional bowler bowls too many games in one session

Normal Callus

An average bowler will form a callus – a hard, thickened area on the skin – wherever the fingers and thumb have contact with the ball. It is formed because of the weight bearing of the ball on certain parts of the hand. This may be good for a bowler.

Pathological Callus

Excess pressure, an ill-fitting ball, and improper use of a properly-fitted ball may cause what is known as a pathological callus. This is one to worry about because it is painful and greatly hinders a bowler. The pathological callus is a hard mass of skin surrounded by an inflamed rim, and it may have a deep central core like a corn. These areas do not stretch when the thumb or fingers are flexed. The result is a burning sensation.

Examples

Broken blood vessels underneath nails.

Figure 1

* Span too long
* Hole too tight
* Insert too tight
* Excessive forward pitch

Figure 2

* Excessive left or right pitch
* Holes or inserts too tight

Calluses

Figure 3
- Span too long
- Hole too tight
- Insert too tight
- Excessive forward pitch

Figure 4
- Span too short
- Inserts worn out

Figure 5
- Excessive reverse
- Span too short or too long
- Hole too big

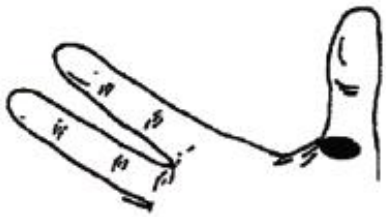


Figure 6
- Span too short or too long
- Hole needs more bevel
- Hole too big

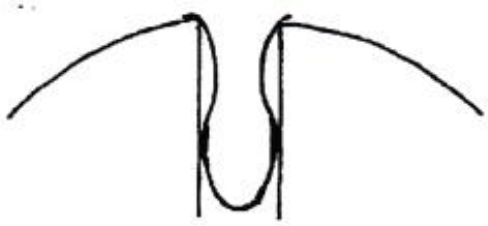


Figure 7
- Illustrates friction points

Calluses

Figure 8
- Finger used to support wrist
- OK unless painful

Figure 9
A — Span too short
A — Excessive reverse pitch
B — Excessive left pitch
B — Hole too small

Figure 10
- Lack of flesh between first and second thumb joints
- Hole too tight
- Round hole drilled, should be oval

Figure 11
- Excessive right pitch
- Hole too small

REVIEW QUESTIONS

1. To engineer the correct fit, a theory has been introduced to alleviate existing fit problems and may help improve adjusting an initial fitting. What is this theory and why is it necessary to a bowler?

2. Priorities are given to the three components in engineering a proper fit. What are these percentages? In what circumstances would these change?

3. If a bowler complains of constantly dropping the ball, what would need to be checked? What clues from the bowler's hand could provide insight into the problem?

4. For the following spans, what would be the thumb pitch for each in order to achieve a 63° angle with a thumb flex of 105°?

SPAN	PITCH
3 3/8"	_____
3 5/8"	_____
4"	_____
4 7/8"	_____
5 1/8"	_____
5 1/2"	_____

5. For a bowler with moist skin, how would the thumb pitch need to be adjusted? for dry skin? for a long thumb? Why are these characteristics important to engineering the proper fit?

6. For a conventional grip, what would be the forward or reverse finger pitch for the following spans?

SPAN	PITCH
3"	_____
3 3/8"	_____
3 3/4"	_____
4"	_____
4 1/2"	_____

7. What is the difference between a conventional and a finger tip span? How does this affect the percentages of the fitting theory?

8. Explain the direction of reverse pitch from the middle of the grip.

9. Explain the direction of forward pitch from the middle of the grip.

10. Explain lateral pitch.

11. What forward or reverse finger pitches should an unadjusted finger tip span start at?

12. To ensure the correct finger pitch for the bowler, what characteristics must be taken into consideration? What adjustments would need to be made for these characteristics?

13. How do you determine hole size for the fingers in a conventional grip? in a finger tip grip?

14. What could be the cause(s) of the following problems:

    a. Broken blood vessels underneath fingernails?

    b. Extreme calluses (burns) on pads of fingers?

    c. Large callus on the back of thumb?

    d. Excessive callusing on the right side of thumb?

    e. Excessive callusing on the left side of thumb?

15. Describe how you would fit a bowler for an oval thumb hole.

16. If a bowler experiences pain, soreness or swelling in the hand or joints using a ball you fit, what would you do?

SKILLS DEMONSTRATION

You must fit two (2) individuals, using your choice of devices, for instructor review. Your instructor must sign-off on the demonstration below, with comments, if necessary:

COMMENTS:

DATE:_____ SIGNATURE:_____

MODULE EVALUATION

1. Was material comprehensible as presented in the manual and the classroom?

2. What would you change?

3. Did instructor presentation and conduct allow you to gain a maximum understanding of the materials, and how could we improve?

Instructor's name: _____

Date: _____

PLEASE RETURN TO INSTRUCTORS

Learning Module 2

Drilling

LM2-1 – LM2-17

Learning Objectives

Lay out of a ball before drilling and the completion of the drilling process

Key Points

- Drilling Process
- The Final Finesses for the Fit

Recommended Tools

Drawing Tools:
Grease pencils, scratch awl, or other marking instrument

Layout Tools:
Quarter scale, Pro Sect©, Armadillo©, or other rulers

Drilling Machinery:
Milling machines, vacuum or otherwise

Notes on the Process

The mark of a professional pro shop operator is his/her ability to show technical expertise in the area of fitting and drilling. It is very important to be able to drill the same fit repeatedly within close tolerances.

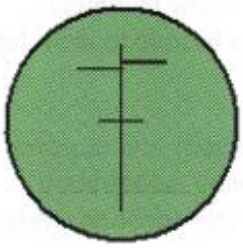
The modern bowling ball has multiple densities of materials internally and requires strong machines with sharpened carbide bits and/or endmills. Using substandard equipment will make it difficult, if not impossible to do quality work (drilling ovals for example).

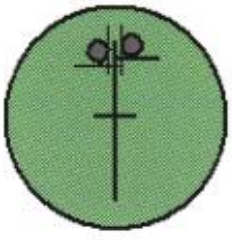
Routinely sharpen your drill bits and maintain your equipment and the investment will pay for itself many times over and save headaches.

When it comes to your equipment spare no expense – these are the tools of your trade.

Drilling Layout — Option 1

Drill Fingerholes First



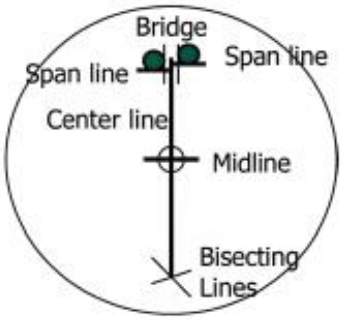


Follow these steps to start the drilling process.

1. Draw the centerline and the midline of grip
2. Dividing the span for the middle finger in half, draw the span line for the middle finger
3. Use the difference between the middle finger span and the ring finger span and draw the span line for the ring finger
4. Draw the bridge lines
5. Select the correct drill bit for the middle finger
6. Set the drill press for the correct pitches
7. Align drill bit so the cutting edges will contact the bridge line and the span line
8. Drill the middle finger hole
9. Repeat steps 5 through 8 for the ring finger
10. If specs call for finger inserts, bevel the holes and install them now

Thumb

Follow these steps to drill the thumbhole.

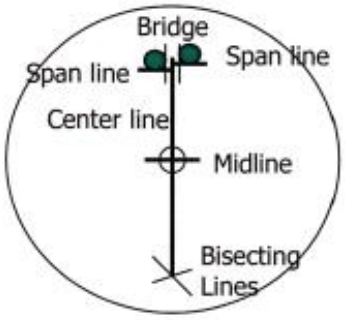
Step	Action
1	Using a span ruler that measures at least in 16ths, place ruler clip in the bottom edge of the middle finger hole
2	Refer to specification sheet for span measurement
3	Measure from bottom edge of middle fingerhole along center line and mark exact span coordinates 

Follow same procedure for ring finger.

The Marked Spot

This spot is the front edge of the thumbhole. At the marked spot, drill the thumb hole.

Note: It may be necessary to draw an arcing line with the exact span coordinates for each finger. Where these lines bisect is the front edge and center line of the thumbhole.

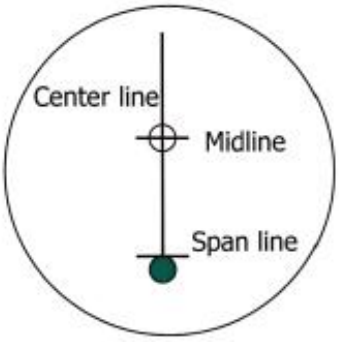
Step	Action
1	Select the correct thumbhole drill bit
2	Set all pitches for thumb coordinates
3	Align drill bit so the center of the drill is on the center line and the edge closest to the fingers cuts the hole on the bisected mark
4	Drill hole 

Note: When you have finished the drilling process, place the ball on your beam scale and, following the USBC guidelines for weighing and balancing, check to make sure the ball you have just drilled meets the USBC specifications.

Drilling Layout – Option 2

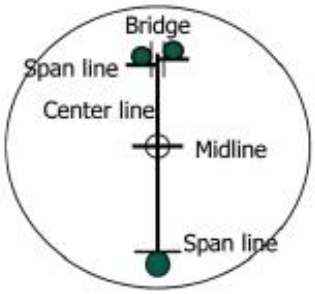
Drill Thumb First

Follow these steps to start the drilling process.

Step	Action
1	Draw center line and midline of grip
2	Select correct thumbhole drill bit
3	Set all pitches for thumb coordinates
4	Align drill bit so the center of the drill bit is on the center line and the edge closest to the midline of the grip touches the span line.
5	Drill hole 

Drilling Layout – Option 2 *continued*

Drill Fingerholes

Step	Action
1	Using a span ruler that measures at least in 16ths, place ruler clip in the front edge of the thumbhole
2	Refer to specification sheet for span measurement
3	Measure from front edge of thumbhole to a point 3/16" left of center and mark exact span coordinates
4	Measure from front edge of thumbhole to a point 3/16" from center line and mark exact span coordinates.*
5	Draw span lines
6	Draw bridge lines (3/8" for conventional grip, 1/4" for inserts/fingertip)
7	Align drill bit so cutting edges will contact the bridge line and the span line and set correct pitches
8	Drill hole for middle finger
9	Set correct pitches and follow same for ring finger 

* If installing finger inserts, measure the size of the front edge of the insert and deduct that amount from the total span.

Drilling Ovals

There are three commonly used methods of noting the measurement —

1. Initial measurement 1" cut to (1.031) at 45°
2. Amount to be cut 1" with (.031) cut at 45°
3. Initial measurement 1" cut to (1 1/32) at 45°

In these examples, the outcome is the same — 1" is 1.00 and .031 is being removed ending with 1.031. The process of cutting is the same.

Cutting the Oval

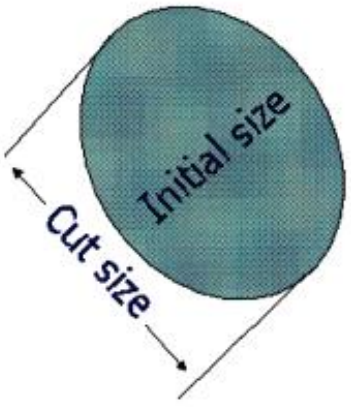
1. Set desired pitches of fitted ball
2. Select starting drill bit and drill hole
3. Move pitches at ratio determined by oval angle chart *(next page)*

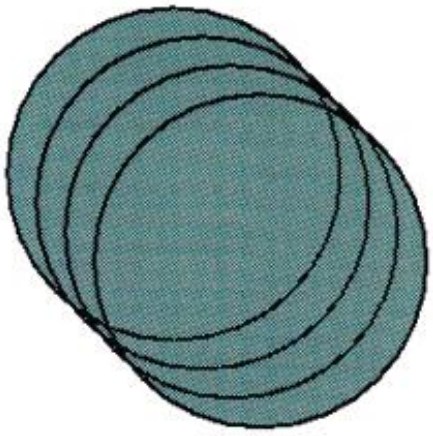
(Note: Do not move more than .050 combined. Calculate cuts to make several if necessary, but none more than a combined total of .050 at one time. Doing so will cause a large ridge in back of thumbhole.)

4. Using same bit or endmill, drill hole again
5. Repeat steps 3 and 4 until final width, or total cut has been achieved

Notes on Ovals

1. Remember that when drilling ovals using two axes, the amount the bit cuts is less than the total movement on both axes.





The Math of the Oval Angle

Angle Required	Ratio
0 Degrees	0V:1H
5 Degrees	1V:9H
10 Degrees	2V:9H
15 Degrees	1V:3H
20 Degrees	4V:9H
25 Degrees	5V:9H
30 Degrees	2V:3H
35 Degrees	7V:9H
40 Degrees	8V:9H
45 Degrees	1V:1H
50 Degrees	9V:8H
55 Degrees	9V:7H
60 Degrees	3V:2H
65 Degrees	9V:5H
70 Degrees	9V:4H
75 Degrees	3V:1H
80 Degrees	9V:2H
85 Degrees	9V:1H
90 Degrees	1V:0H

Oval Drilling Guide

For drilling an oval at angle alpha back a distance Z you must move the table a distance X over and Y up. Formulas used are shown below.

$Z^2 = X^2 + Y^2$
$X = Z * \cos(\text{alpha})$
$Y = Z * \sin(\text{alpha})$

Oval-to=Mill Movement Chart (.001")

Oval Width (Z) (thousandsths, 0.001")								
Oval Angle (alpha) (degrees)	30		60		90		120	
	X	Y	X	Y	X	Y	X	Y
20	28	10	56	21	58	31	113	41
25	27	13	54	25	38	82	109	51
30	26	15	52	30	78	45	104	60
35	25	17	49	34	74	52	95	69
40	23	19	46	39	69	58	92	77
45	21	21	42	42	64	64	85	85
50	19	23	39	46	58	69	77	92
55	17	25	34	49	52	74	69	98
60	15	26	30	52	45	78	64	104
65	13	27	25	54	38	82	51	109
70	10	28	21	56	31	85	41	113

Note: Left hand ovals and right hand ovals over 90 degrees simply move the x-axis in the opposite direction

The Final Finesses for the Fit

Bevels

Every ball gets a new sanding disk for uniformity. Sand thumbhole first, fingers second. The bevel area should be at least 3/16" for comfort.

Never use a sanding disk until it is in shreds.

Escape Ramps — also called Relief

"Escape ramps" is a term used to describe material from the top finger side of the thumbhole. This may be necessary to help a lesser skilled bowler to release the ball cleanly.

It also can accommodate thumbs with unusual shapes or callusing.

Finger Grips

Be sure to glue them in and remove any portion of the grip that protrudes onto the surface of the ball.

Thumb Solids

More and more, thumb solids have become a part of the drilling process. They provide a consistent texture from ball to ball. They are available in different sizes and textures.

Thumb Inserts

Thumb inserts are available in a number of different pre-drilled shapes and sizes.

REVIEW QUESTIONS

1. Describe how to lay out a bowling ball with no insert or slugs by drilling the finger holes first.

2. Describe how to lay out a bowling ball with finger inserts by drilling the finger holes first.

3. How would you produce uniformity of bevel on a bowling ball?

4. What is the benefit of using a thumb insert or slug in the thumb hole?

5. What steps are taken to prepare a bowling ball for plugging?

6. What table movements are necessary to create a:

45° oval angle? —

60° oval angle? —

7. Define centerline —

8. Define midline —

SKILLS DEMONSTRATION

You must drill a bowling ball for yourself or someone else, using specs you have taken and hit those marks on the ball, for instructor review. Your instructor must sign-off on the demonstration below, with comments, if necessary:

COMMENTS:

DATE:_____ SIGNATURE:_____

MODULE EVALUATION

1. Was material comprehensible as presented in the manual and the classroom?

2. What would you change?

3. Did instructor presentation and conduct allow you to gain a maximum understanding of the materials, and how could we improve?

Instructor's name: _____

Date: _____

PLEASE RETURN TO INSTRUCTORS

Learning Module 3

Bowlers

LM3-1 – LM3-9

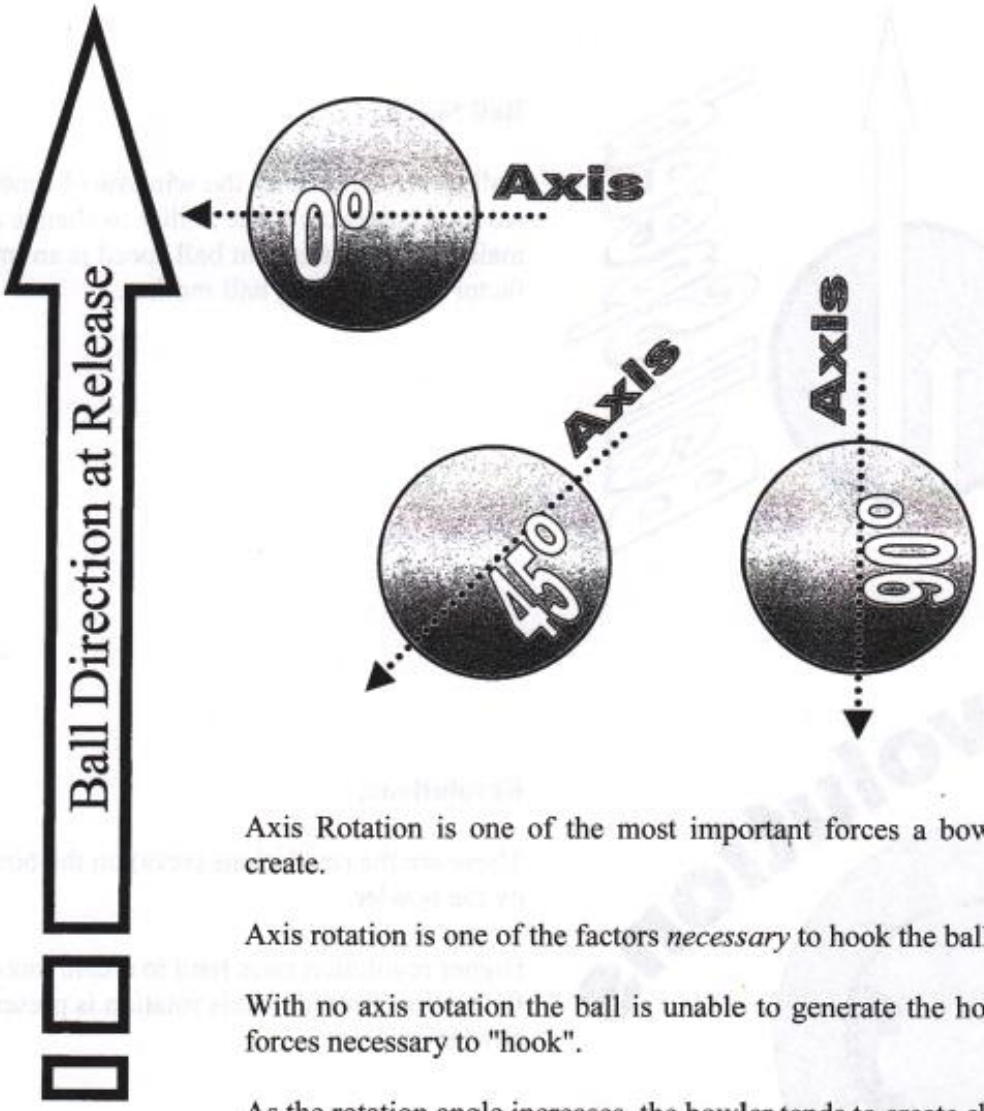
Learning Objectives

Understand the forces that the bowler creates; introduction to concepts

Key Points

- Ball Speed
- Axis Rotation
- Revolutions
- Axis Tilt

Axis Rotation -- The degree that the bowler's axis is rotated in the horizontal plane towards the bowler at release.



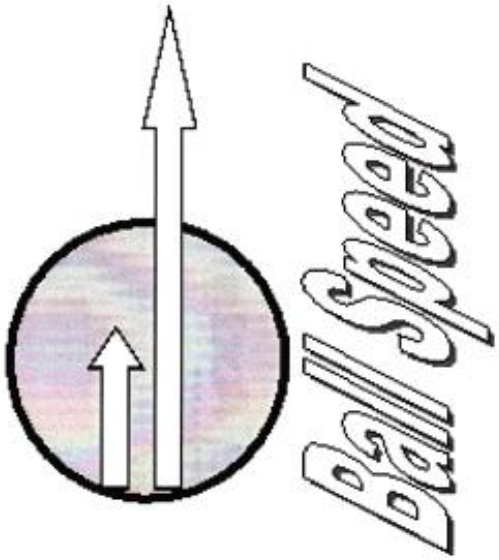
Axis Rotation is one of the most important forces a bowler can create.

Axis rotation is one of the factors *necessary* to hook the ball.

With no axis rotation the ball is unable to generate the horizontal forces necessary to "hook".

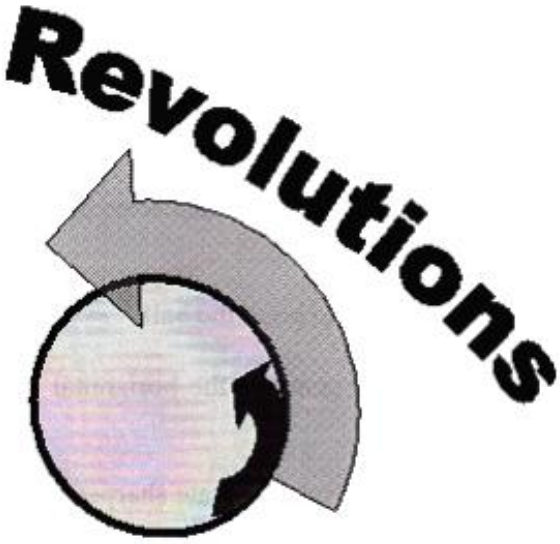
As the rotation angle increases, the bowler tends to create sharper breakpoints.

Ball Speed and Revolutions Explained



Ball Speed:

Ball speed determines the window of time in which reaction can occur. The ability to change and maintain consistency in ball speed is an important factor in controlling ball motion.



Revolutions:

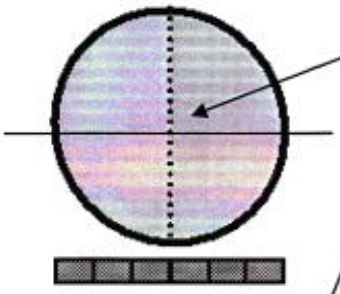
These are the revolutions (revs) on the bowling ball by the bowler.

Higher revolution rates tend to create more potential for motion, provided axis rotation is present in the bowler's release.

Ball Speed Chart

TIME	MPH
3.41	12
3.15	13
2.92	14
2.73	15
2.56	16
2.41	17
2.27	18
2.15	19
2.05	20
1.95	21
1.85	22

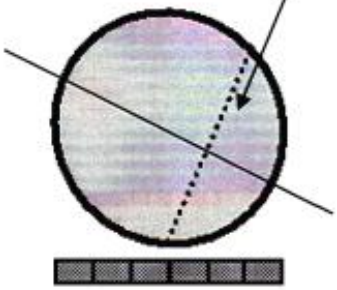
Axis Tilt: The degree that the bowler's axis is rotated in the vertical plane.



No tilt (Full Roller)

Ball Track:

The area on the ball that comes in contact with the lane when the ball is rolled is called the ball track.

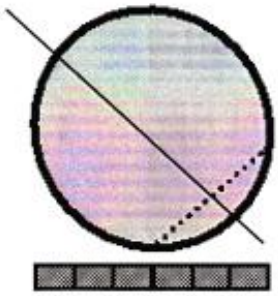


Slight Tilt (3/4 Roller)

How are Vertical Tilt and Track Size Related?

How much vertical axis tilt the bowler's release has dictates the circumference of his/her ball track.

The more vertical tilt a release has, the smaller the circumference of the ball track.



Large Tilt (Spinner)

REVIEW QUESTIONS

1. What is axis tilt?

2. What is axis rotation?

3. Why does ball speed affect ball motion potential?

4. What are four measurable forces bowlers produce?

5. How is track circumference determined?

SKILLS DEMONSTRATION

None necessary

MODULE EVALUATION

1. Was material comprehensible as presented in the manual and the classroom?

2. What would you change?

3. Did instructor presentation and conduct allow you to gain a maximum understanding of the materials, and how could we improve?

Instructor's name: _____

Date: _____

PLEASE RETURN TO INSTRUCTORS

Learning Module 4

Ball Motion

LM4-1 – LM4-9

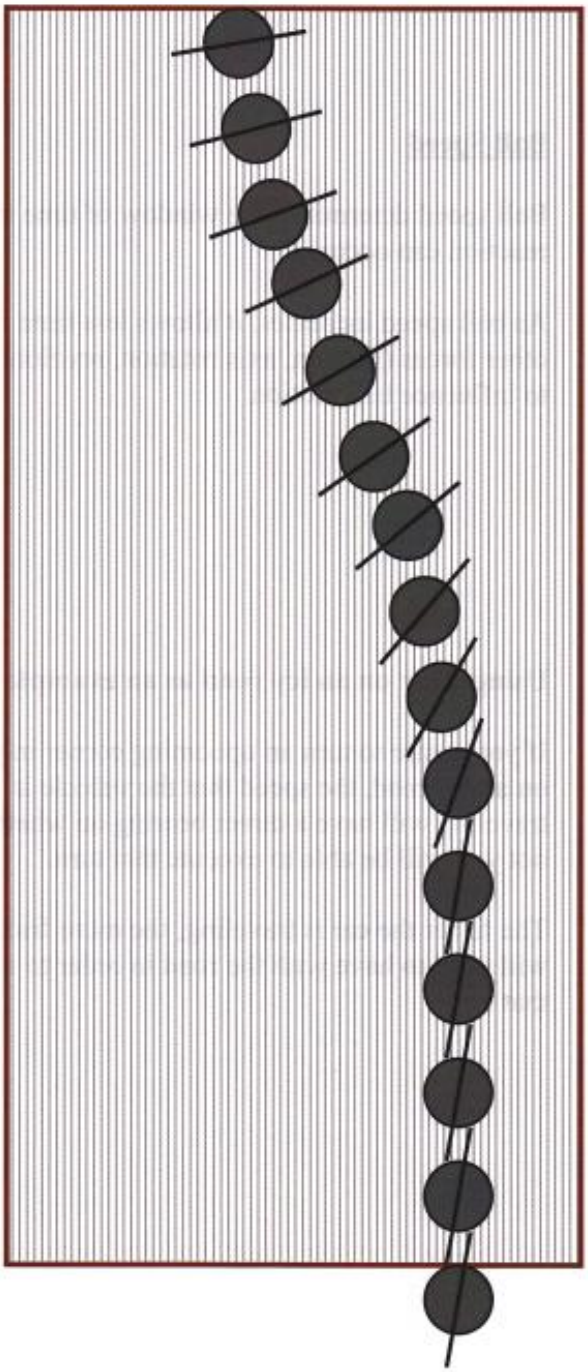
Learning Objectives

To understand ball motion and how the four bowler variables factor into motion

Key Points

- Fundamentals of Ball Motion
- Friction
- Bowler Influences

Fundamental Principles of Motion



Friction

Without some sort of friction between the ball and the lane, there would be no tendency for the ball to hook. Friction does not cause hook, but it is a component that needs to be present for the ball to hook.

As the ball travels down the lane, it starts to cause a small amount of friction on the lane base. As friction increases, the ball will begin to hook in the direction of axis rotation.

The Bowler Influences

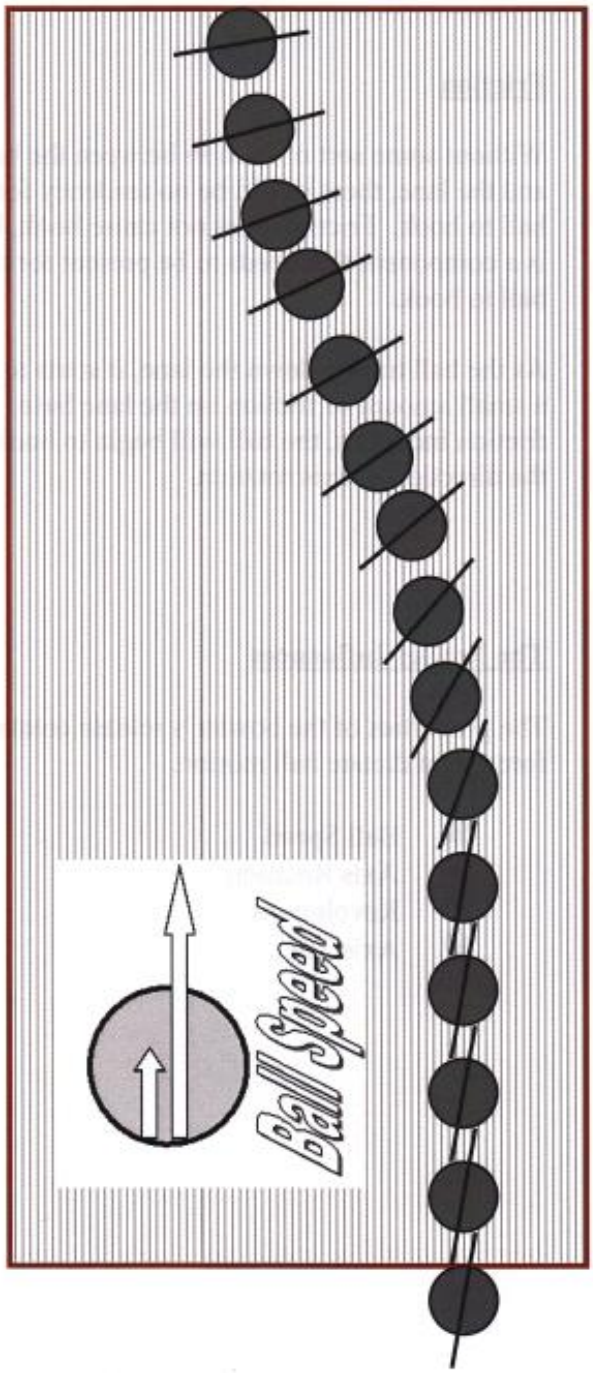
The properties of the bowler's release create the forces that dictate ball motion.

- Ball Speed
- Axis Rotation
- Revolutions
- Axis Tilt

Ball Speed

Ball speed determines the window of time in which reaction can occur.

As ball speed increases, it allows less time for the other forces (friction, axis rotation, revolutions, tilt) to influence ball motion.



Using a car on an icy road as an example

If you desire to turn an upcoming corner in your car on an icy road, the speed that the vehicle is traveling will have a direct bearing on whether or not you will be able to execute that turn.

The faster the car is traveling, the more friction we will need to have with the road in order to make that turn.

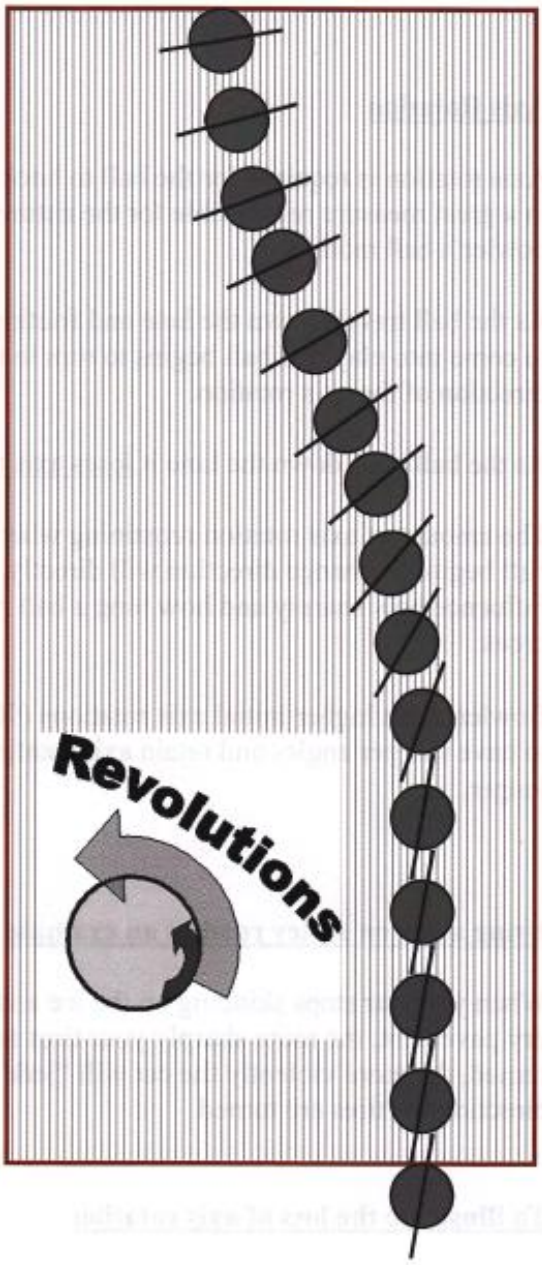
Revolutions (Rev Rate)

Revolutions are one of the component forces creating friction with the lane. More revolutions create the potential for stronger ball motion.

Using a car as an example

Revolutions can be compared to the throttle on your car. The more you step on the throttle, the more power you have.

If the car has front wheel drive, you have a better chance to make the corner with more revolutions.



Axis Rotation

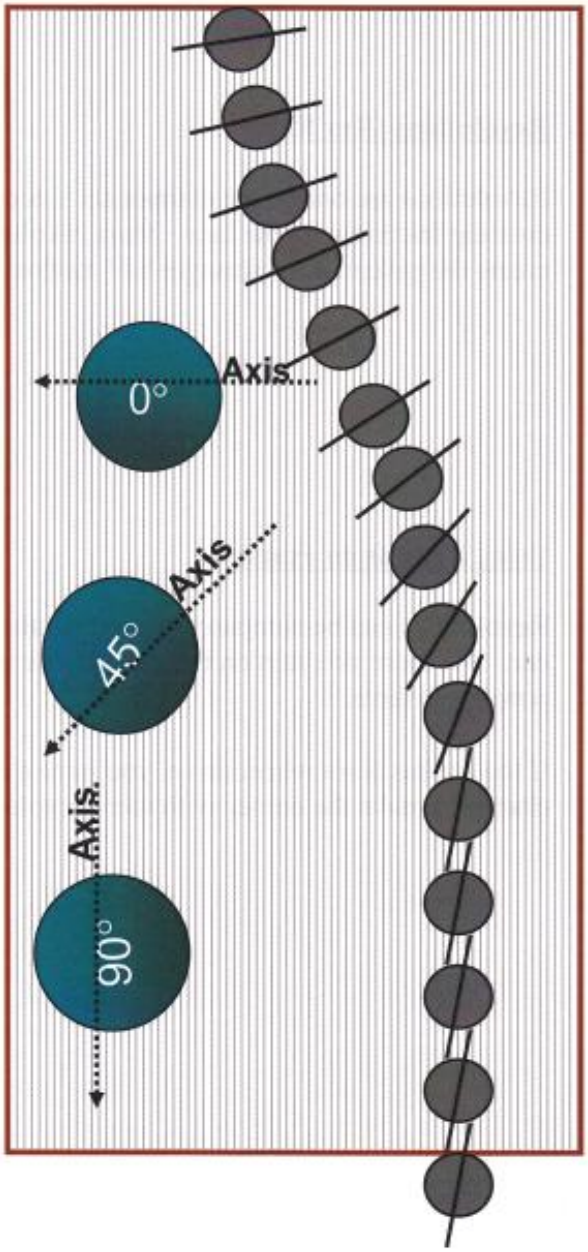
Axis rotation is required for the ball to hook and is in a great measure responsible for the nature of the bowler's ball motion.

As the ball travels down the lane and friction starts to come into play, the ball begins to turn in the direction of the axis rotation.

As the ball goes down the lane it loses axis rotation.

The amount of axis rotation remaining when the ball begins to change direction will directly influence how sharply and how long a ball might break.

Bowlers with higher initial axis rotations (90°) tend to have sharper angles and retain axis rotation longer.



Using a car on an icy road as an example

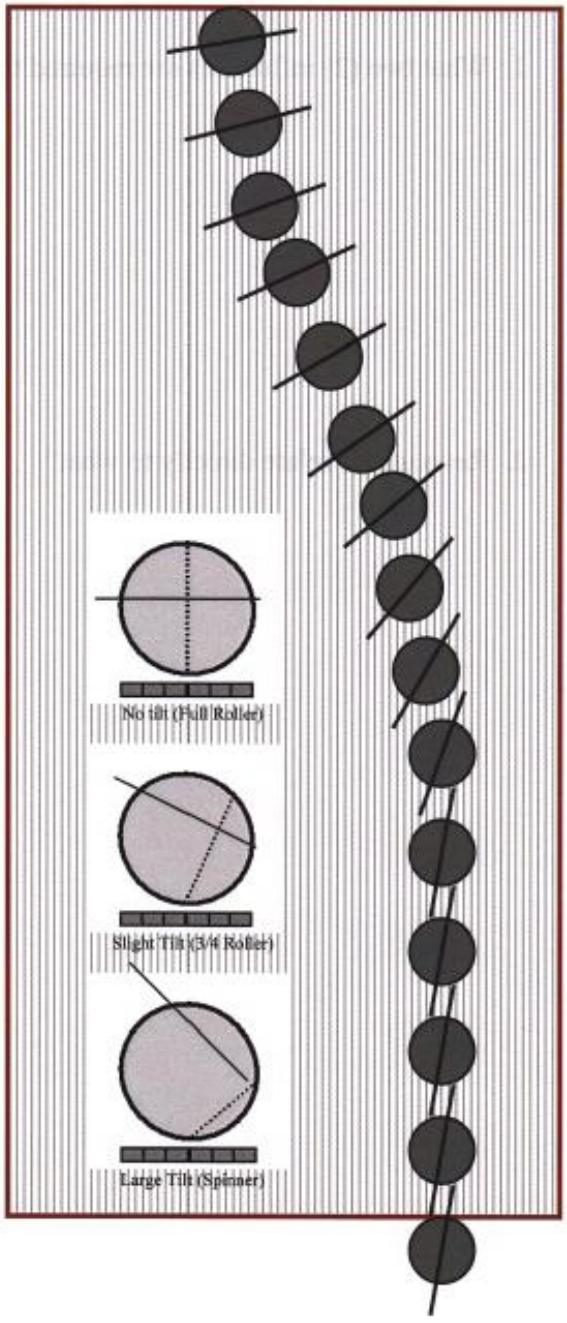
When your car stops skidding on the ice and you hit dry pavement, the more sharply your tires are turned, the more violently the car will "jerk" in the direction the tires are turned.

To illustrate the loss of axis rotation

When your car stops skidding on the ice and you hit dry pavement, the friction with the dry pavement will tend to turn your tires "straight," and the steering wheel may be jerked out of your hands.

Vertical Axis Tilt

How much vertical axis tilt the bowler's release has dictates the circumference of his/her ball track. The more vertical tilt a release has, the smaller the circumference of the ball track. A smaller track circumference with the same number of revolutions as a larger track will generate less friction per revolution.



Using bike tires as an example

The tires on a child's bike need to roll over more times to cover the same distance as a bike with larger tires – those having a larger circumference.

REVIEW QUESTIONS

1. What two (2) influences are required for a bowling ball to hook?

2. Revolutions relate directly to what?

SKILLS DEMONSTRATION

None necessary

MODULE EVALUATION

1. Was material comprehensible as presented in the manual and the classroom?

2. What would you change?

3. Did instructor presentation and conduct allow you to gain a maximum understanding of the materials, and how could we improve?

Instructor's name: _____

Date: _____

PLEASE RETURN TO INSTRUCTORS

Learning Module 5

Ball Properties

LM5-1 – LM5-11

Learning Objectives

Understand ball properties and how they play a part in ball motion

Key Points

- Coverstock / Veneer
- Surface Preparation
- Radius of Gyration
- Differential
- Intermediate Differential (for Asymmetrical Cored Balls only)
- Track Flare
- Points on the Ball's Surface
  - Pin Location
  - Center of Gravity (CG)
  - Preferred Spin Axis

Coverstock Composition

The composition of the coverstock dictates, to a high degree, what kind of friction values can be attained between the ball and the lane.

- Plastic (Polyester)
- Urethane
- Reactive Urethane
- Particle Reactive

Ball Surface Preparation

The treatment of the ball's surface influences traction.

- Rough finishes provide a tread effect that reduces hydroplaning by increasing traction.

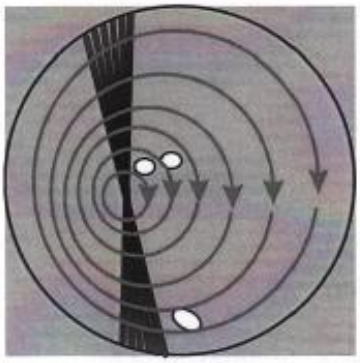
Using snow tires as an example...

When normal tread is not sufficient to provide the necessary traction, the use of studded tires provides the ability to maintain control of the vehicles direction.

Sanding Techniques

Texturing the ball's coverstock by using abrasives will give you the opportunity to affect the ball reaction.

It is important to note that there are great ranges available when we sand the ball's surface. There are paper ranges from 220-2000 grit and liquid polishing compounds, giving the modern pro shop professional a rainbow of different options to affect ball reaction.

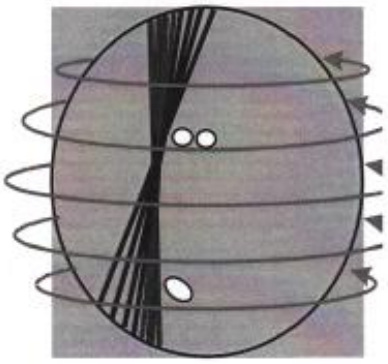


- **With center of the pivot point (bow tie)**

  — Most overall traction

- **Parallel to release ball track**

  — Gradually increasing traction as the ball flares

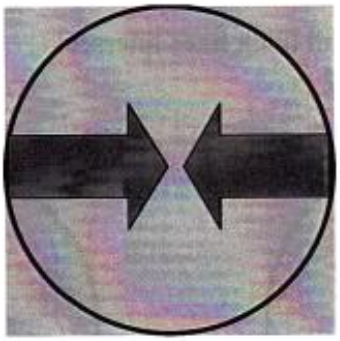


- **Perpendicular to release ball track**

  — Traction gradually decreasing as the ball flares

Radius of Gyration

Measurement of the core's resistance to change in motion, RG is an indication of the displacement of mass inside a ball.



Lower RG *– less resistant to change in motion*

Higher RG *- more resistant to change in motion*

This means:

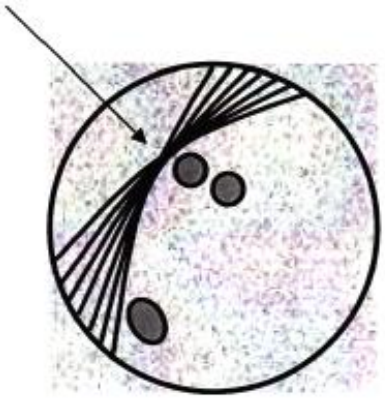
- High RB balls are those in which mass is displaced farther from the center of the ball. These balls have the tendency to retain axis rotation longer, skid down the lane farther and have a sharper break point.
- Low RG balls are those in which mass is displaced closer to the center of the ball. These balls have the tendency to lose axis rotation more easily, roll earlier and have an earlier break point.

Track Flare

Track flare is caused by the core's desire to reach a stable axis and directly relates to friction.

Pivot Point (bow tie)

Point on the ball's surface where all track lines intersect

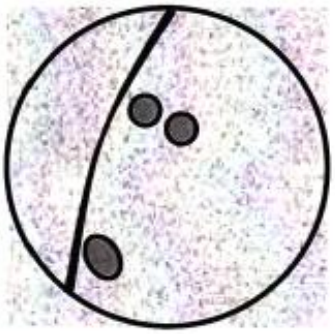


Balls that are flaring

With each revolution, fresh ball surface is exposed to the lane.

Any oil picked up on the coverstock will not influence the ball's reaction as it exits the oil pattern, thus creating a quicker and stronger ball reaction compared to non-flaring balls of the same veneer.

More flare = More friction per revolution



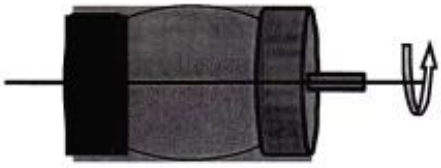
Balls that are not flaring

With each revolution, the ball tends to roll in the oil it has picked up on the previous revolution.

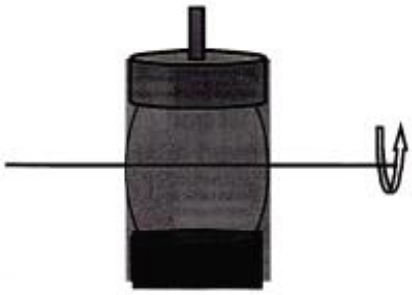
The oil in the rolling track of the ball reduces the ability of the ball to suddenly change direction as it exits the oil pattern. Non-flaring balls tend to have smoother breakpoints.

Understanding Differential RG Values

Simply put, the difference between core RG values when rotated on different axes.



The core's RG value when Rotated on its low RG axis (through the pin)



The core's RG value when rotated on its high RG axis (90° from the pin)

- Higher differential cores have the most flare potential. The core will have a stronger tendency to seek its own preferred spin axis
- Lower differential cores will have less flare potential, as they are more stable.

RG Differentials

Cores that have differential have a preferred spin axis (PSA). By placing the pin in an unstable position with respect to the bowlers' positive axis we create the potential for more flare.

With no differential, there will be no track flare.

Points on the Ball's Surface

Pin

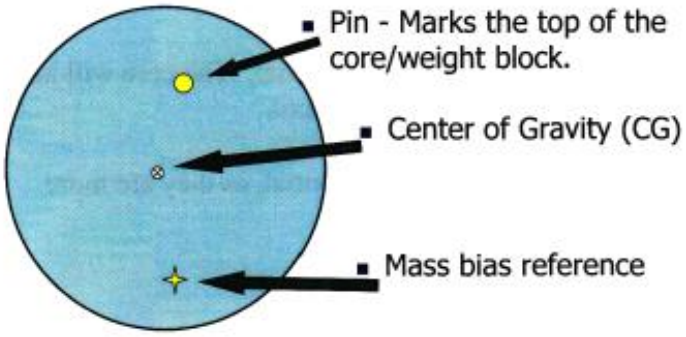
A small round discoloration on a bowling ball that marks the top of the core/weightblock.

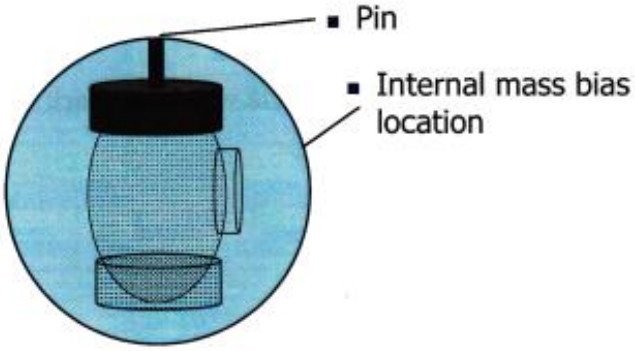
Center of Gravity (CG)

That point in a body or system around which the whole mass is concentrated and may be assumed to act. The point on the surface of the bowling ball where static balance is zero in all directions on a do-do scale — usually marked by a logo.

Mass Bias Position

Weight in a particular area of the ball, the location of which is often indicated by a marking on the surface of the ball.





REVIEW QUESTIONS

1. What are the properties of a bowling ball that affect ball reaction?

2. Define "radius of gyration."

3. What are the characteristics of a ball with a high RG?

4. What are the characteristics of a ball with a low RG?

5. Define RG differential.

6. What are the characteristics of a high-flare potential bowling ball?

7. Why is ball surface texture important to ball reaction?

8. Define center of gravity.

9. What causes track flare?

10. What is mass bias?

11. What does the composition of the coverstock dictate?

12. How would you sand a ball to create the most overall traction?

13. What affect does sanding a ball perpendicular to the initial release ball track have?

SKILLS DEMONSTRATION

None necessary

MODULE EVALUATION

1. Was material comprehensible as presented in the manual and the classroom?

2. What would you change?

3. Did instructor presentation and conduct allow you to gain a maximum understanding of the materials, and how could we improve?

Instructor's name: _____

Date: _____

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Learning Module 6

Layouts

LM6-1 – LM6-29

Learning Objectives

To understand how ball layout can affect motion and how to accomplish the layout of modern bowling balls with reference to the bowler's axis of rotation

Key Points

- Positive Axis Point (PAP)
- Core / Axis Angles
- Pin Safe Zone
- Layout Terminology
- Layout Techniques
- Balance Holes
- Layout Factors
- Preferred Spin Axis (PSA) Balls with intermediate differential of more than .008

Understanding Ball Layouts

Axis of Rotation (initial release axis)

To develop any understanding of layouts, one must first know the individual's axis of rotation. There are many different ways of releasing the bowling ball and this must be taken into consideration when drilling any of the contemporary core shapes.

Using Ball Layout to Manage Track Flare

One of the primary considerations in the layout of any ball is track flare. How much of the core's potential to flare do we want? Sometimes flare is good, other times bad. How much do you really need?

Using Ball Layout to Manage Core RG values

Depending upon the bowler's method of release (rev. speed, rotation, tilt) and lane conditions, we might need lower RG or higher RG layouts to best compliment his/her game.

Something to Remember

Keep layouts in perspective, you must match any ball's coverstock and preparation to the lane condition to maximize the affect of dynamics (layout).

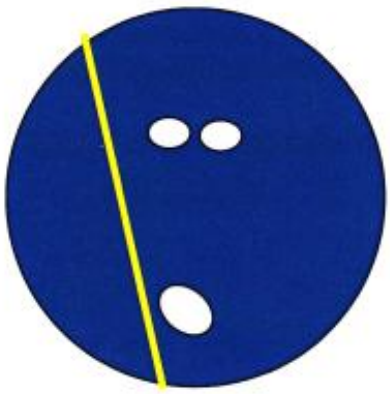
The right ball choice and layout can enhance the chances to score, but will not throw strikes by itself.

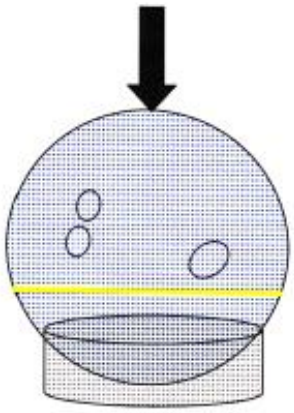
There is no substitute for good technique.

Finding the Axis Point

The axis point is easily attainable from the customer's current ball. There are several methods you can use to locate the PAP. To find the axis point using a ball spinner:

Step	Action
1	Trace the track with your marking pencil
2	Place the ball, track side down, in your ball spinner
3	Adjust the ball so the track is parallel to the ball dish
4	Turn on the spinner *(The pencil line should be constant. If it is wobbling, turn the spinner off and readjust)*
5	When a stable line is seen, place the pencil at the top of the ball *(The center of this pencil mark is your axis. This point should be equal distance to the marked track in all directions)*





Horizontal Coordinate

To get the horizontal coordinate of the axis point:

Step	Action
1	Draw a line down the center of the finger holes through the center of the thumbhole. (Center line)
2	Measure half the distance from the thumb to the fingers and mark – this is the center of the grip
3	Take a quarter scale and draw a horizontal line perpendicular to the grip line, at its center. (Midline)
4	Draw a vertical line from this line through the axis point.
5	Measure the distance from the center of the grip to the intersection of the vertical line

Vertical Coordinate

Measure the length of the vertical line to the axis point. This is the vertical coordinate.

Axis Tilt

Measure distance across track on surface of the ball. See chart (LM6-5) to convert inches to degrees. Remember: A large horizontal PAP is not always low tilt, nor is a small horizontal PAP always high tilt.

Write Them Down

Record these coordinates on the customer's spec sheet.
For example: 5 inches right, 1 inch up.
(All procedures and illustrations are for right-handed bowlers. Reverse this procedure for left-handed bowlers.)

Importance of Tilt

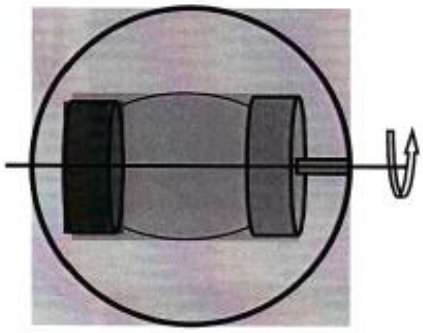
Distance across the track on the surface of the ball in inches	=	Axis Tilt in Degrees	
13.5 13		0 3	Adjust for Axis tilt as if the player has lower ball speed
12.5 12		7 10	Use layouts that retain axis tilt longer
11.5 11 10.5		13 17 20	Ball speed and rev rate relationship will determine layout
10 9.5 9		24 27 30	Adjust for axis tilt as if the player has higher ball speed
8.5 8 7.5		33 37 40	Use layouts that lose axis tilt faster, higher friction balls with balance holes

Core Placements and Ball Reaction

The information and diagrams apply only to symmetric cored balls. Asymmetric cored balls remain unstable near 90°

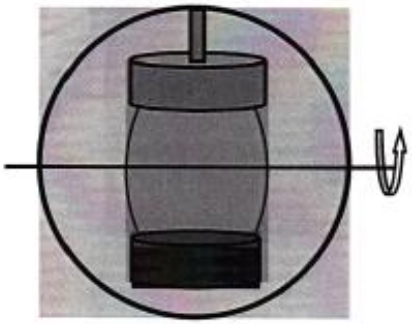
Stable core positions near 0°

When the pin is positioned at or near the bowler's axis of rotation, the core is in a more stable alignment.
1. There will be little or no flare.
2. The core is in its lowest RG position.



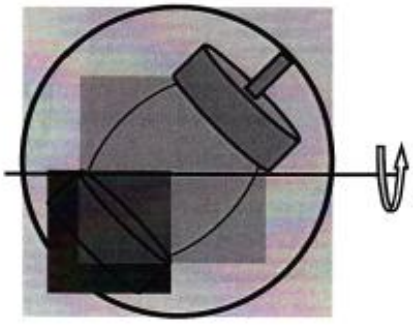
Stable core positions near 90°

When the pin is positioned at or near 90° to the bowler's axis of rotation, the core is also near a stable alignment.
1. There will be little or no flare.
2. The core is placed in its' highest RG position.



Unstable core positions near 45°

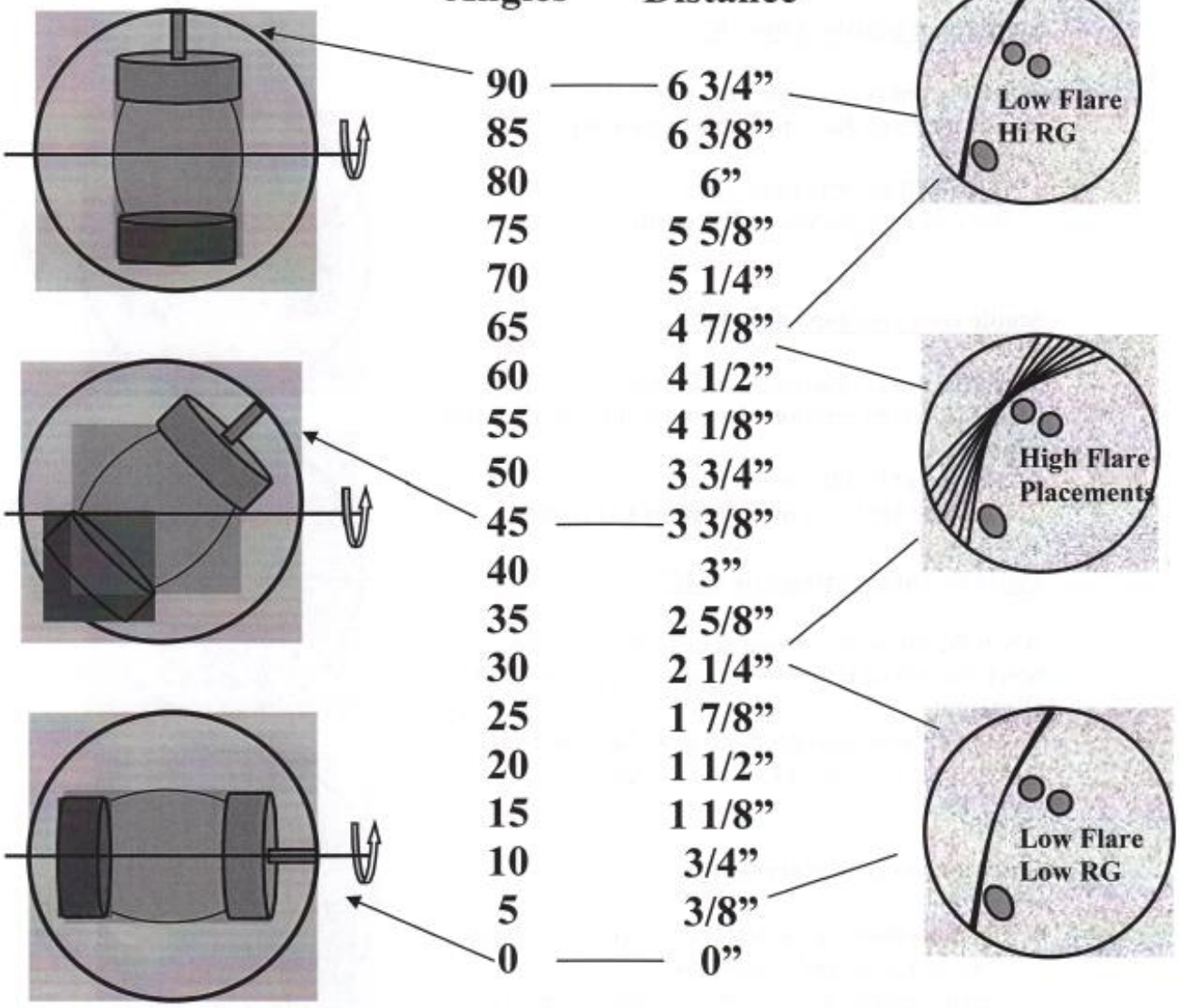
When the pin is positioned at or near 45° to the bowler's axis of rotation, the core is in an unstable alignment.
1. These placements promote more flare potential.
2. The core is placed in a stronger position.



Overview on core placements:

1. Pin placements at or near 45 ° promote the most flare potential and overall hook.
2. Track flare decreases as the pin position gets near the bowler's axis or 90° to the axis.
3. Near axis pin positions enhance earlier reactions.
4. 90° pin positions enhance later reactions.

Core Angle to Distance From Axis
Reference Chart



Safe Zone

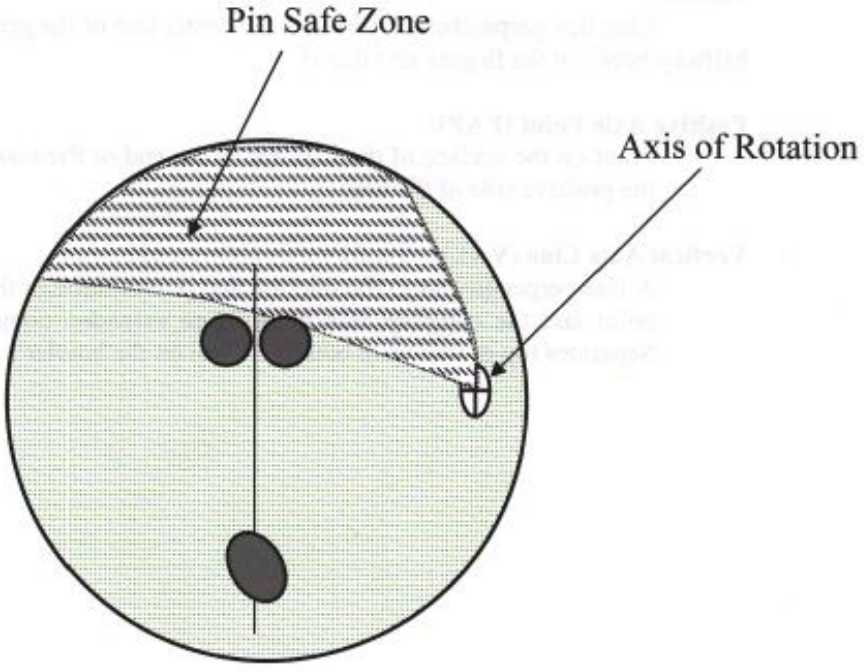
When positioning the core in a high flaring layout it is important to make certain that the track does not flare over the gripping holes.

To accomplish this, the pin should be placed in the area between a line drawn from the bowler's positive axis point that is 1 1/2" above the vertical axis line (VAL), and a line drawn from the bowler's PAP that continues over the top of the fingerholes, thus creating the "Pin Safe" zone

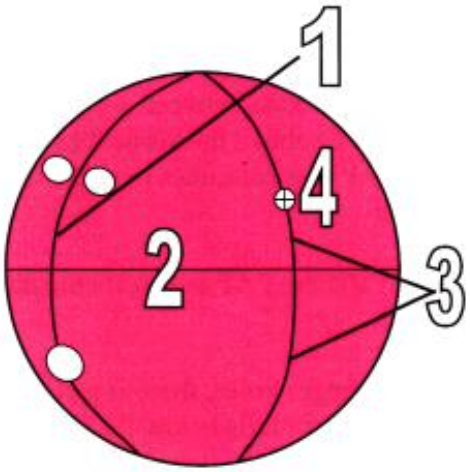
The point where a line drawn through the pin and the PAP intersects the track will be very close to the bow tie of the ball track.

If the pin falls **below** the line drawn above the finger holes, there is a chance the track would flare through the finger holes. If the pin falls below the line drawn 1 1/2" above the VAL, there is a chance that the ball would flare in the opposite direction, rolling over the thumb hole.

This would apply to any ball in which the pin is in a high flare position. Putting the pin too high on strong asymmetric cored ball may cause the ball to roll over the thumb hole as well as the finger holes.



Layout Terminology



1) Centerline

2) Midline

3) Vertical axis line (VAL)

4) Positive axis point (PAP)

Center Line:
Vertical line between the fingers and through the middle of the thumb.

Midline:
Line that perpendicularly bisects the center line of the grip. A horizontal line halfway between the fingers and thumb.

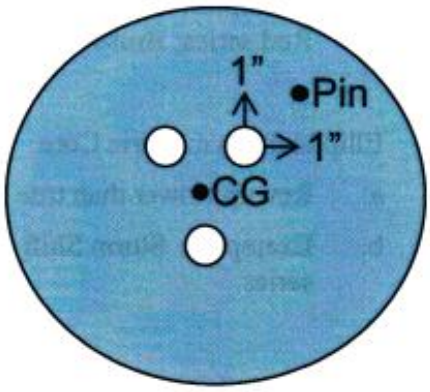
Positive Axis Point (PAP):
Point on the surface of the ball that is the end of the bowlers axis of rotation, on the positive side of the ball

Vertical Axis Line (VAL):
A line perpendicular to the midline that passes through the bowler's positive axis point and the negative axis point when extended completely around the ball. Separates top of ball from bottom of ball on the bowler's axis of rotation.

EZ Drill #1 (No balance hole)

Use this drilling procedure for bowlers using their first fingertip ball without defined PAP or for bowlers with no PAP available.

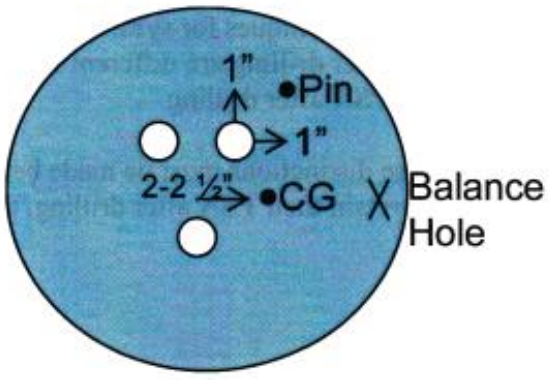
Put pin 1 inch above and 1inch to the right of ring finger (mirror image for left handed bowler).



EZ Drill #2 (With balance hole)

Use this drilling procedure for bowlers using their first fingertip ball without defined PAP or for bowlers with no PAP available.

Put pin 1 inch above and 1inch to the right of ring finger. Swing CG 2 ½ inches to the right of midline. (Mirror image for left handed bowler).



3 Types of Cores in Bowling Balls

1. Symmetric Core
   a. No intermediate differential
   b. No preferred spin axis (PSA)
   c. Examples: Ebonite Vortex/Gamebreaker Series; Storm Agent and Hot Rod series; Brunswick Rocket core

2. Elliptical Asymmetric Core
   a. Rev up slower than true asymmetric cores
   b. Examples: Storm Shift series; Ebonite NV series; Brunswick Zone series

3. True Asymmetric Core
   a. Ref up faster and read sooner than elliptical asymmetric cores
   b. Examples: MoRich EZ Rev series; RotoGrip Epic series

Layouts for the Modern Bowling Environment

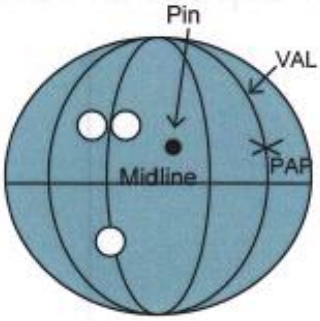
Layout techniques are different for two different types of bowling balls. Types of bowling balls are determined by whether or not they retain their **PSA** after drilling.

Layout techniques for **symmetrical cored balls** and balls that do not retain their **PSA** after drilling are different from **asymmetrical cored balls** that do retain their **PSA** after drilling.

These distinctions must be made because of the greater gyroscopic inertia of balls that retain their **PSA** after drilling, thereby, affecting the resulting ball motion.

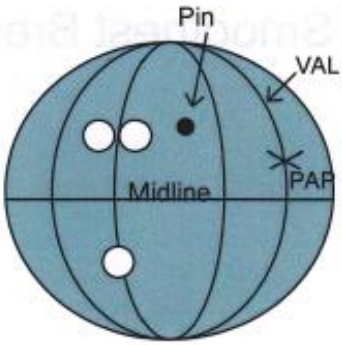
Pin Distance Above the Midline

The pin distance above the midline controls the shape of the breakpoint and the sharpness of the transition for both types of balls.



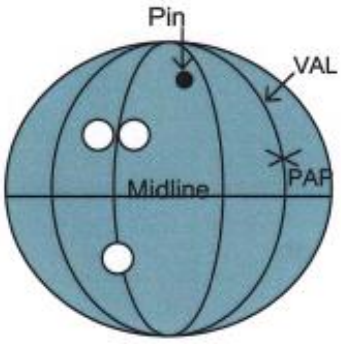
Smoother breakpoint

Low pin positions cause the ball to start up sooner with a smoother more continuous transition.



Medium breakpoint

Medium pin positions cause the ball to start up later with a slightly shorter transition.



Sharper breakpoint

High pin positions cause the ball to start up much later with the shortest transition.

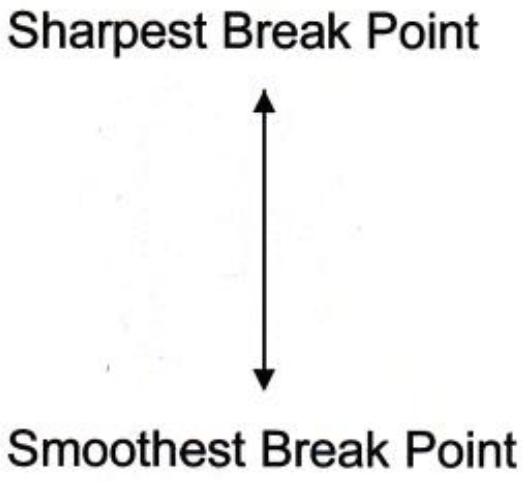
Symmetrical Layouts

Pin Up with Balance Hole

Pin Up – No Balance Hole

Low Pin with Balance Hole

Low Pin – No Balance Hole



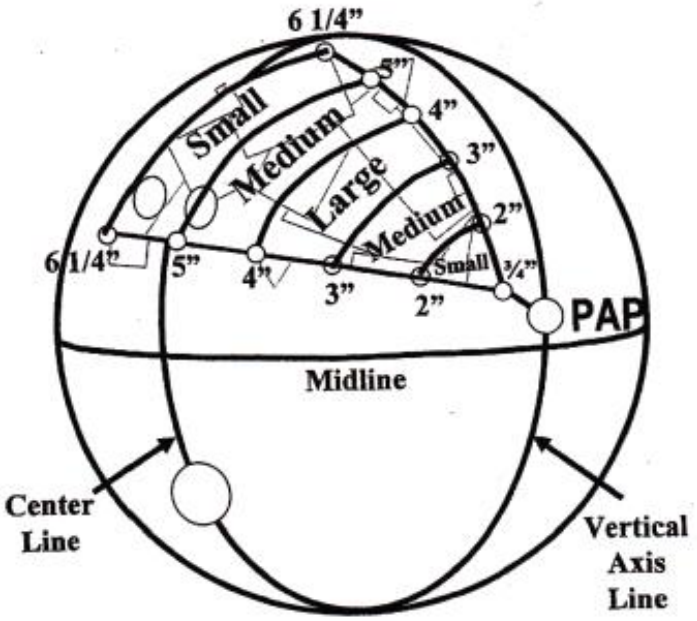
Track Flare – for Balls with Symmetrical Cores

Track flare is determined by PIN to PAP distance:

Large track flare – 3" to 4" from PAP

Medium track flare – 2" to 3" from PAP for earlier breakpoint;
4" to 5" from PAP for later breakpoint

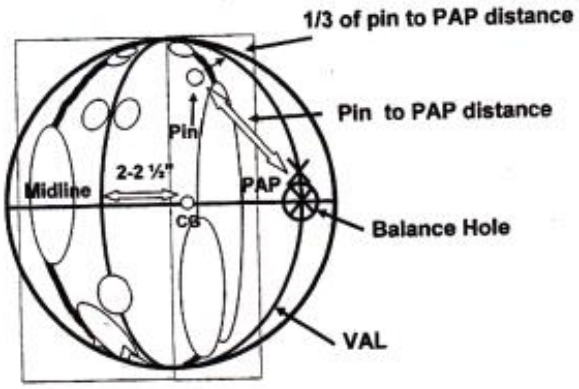
Small track flare – ¾" to 2" from PAP for earlier breakpoint
5" to 6 ¼" from PAP for later breakpoint



Symmetrical Layouts

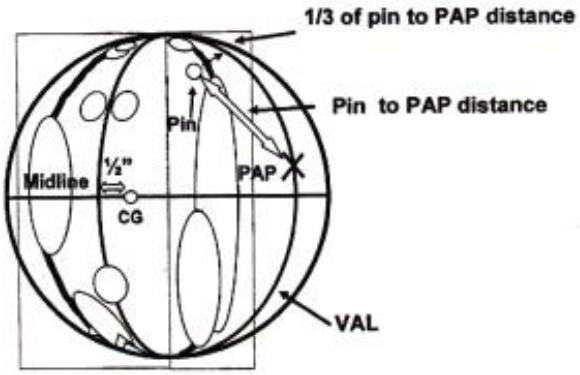
Pin Up with Balance Hole – Sharpest Breakpoint

High pin positions cause the ball to start up much later with the shortest transition.



Pin Up – No Balance Hole – Medium Sharp Breakpoint

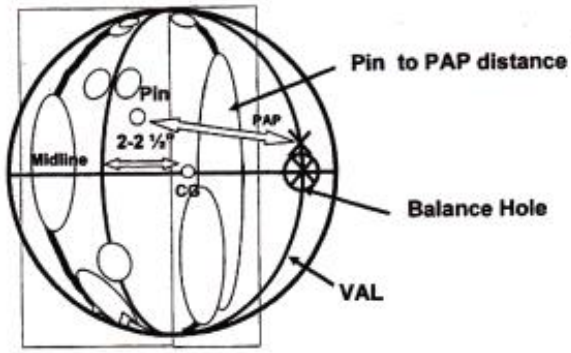
High pin positions cause the ball to start up much later with the shortest transition



Symmetrical Layouts

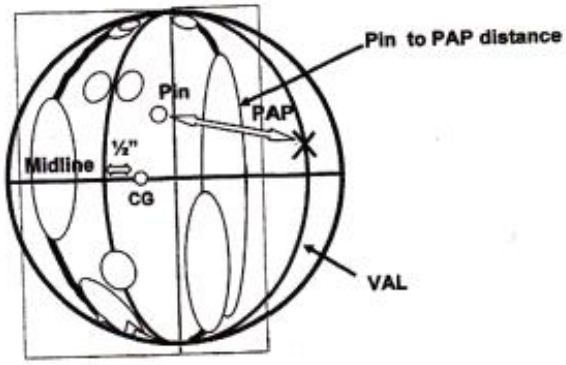
Low Pin with Balance Hole – Medium Breakpoint

Low Pin positions cause the ball to start up much earlier with the longest transition



Low Pin – No Balance Hole – Smoothest Breakpoint

Low pin positions cause the ball to start up much earlier with the longest transition.



Layout Procedures

For Asymmetric Cored Ball (can also be used for symmetric cored balls by marking a PSA 6 ¾" from pin through CB)

1. Choose the PIN to PAP distance for the flare desired
2. Choose the PSA to PAP distance for ball reaction desired
3. Choose the vertical distance from the PIN to the MIDLINE for length of breakpoint and transition desired
4. Reverse PAP coordinates and draw MIDLINE and locate center of grip
5. DRILL THE BALL
6. Position the BALANCE HOLE if desired / needed
7. Adjust the depth of the BALANCE HOLE / GRIPPING HOLES for legality and smoothness of breakpoint desired
8. Adjust the SURFACE of the ball to match the land conditions

Track Flare – for Balls with Asymmetrical Cores

Track flare is determined by PIN to PAP distance.

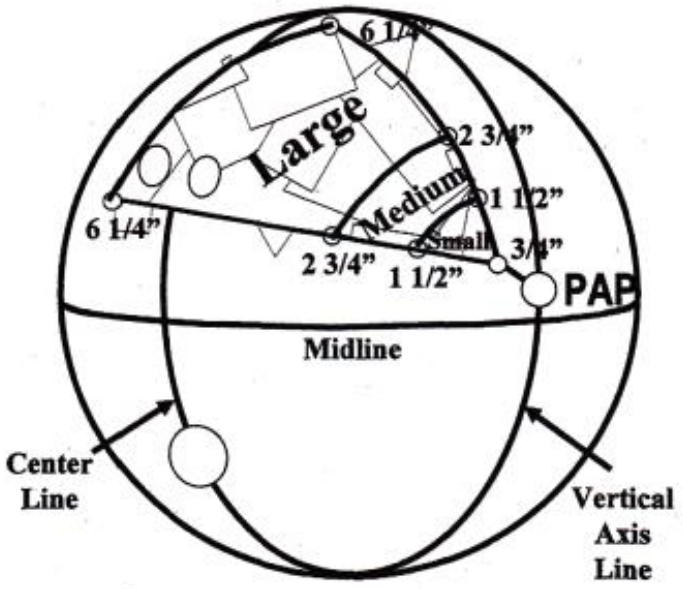
Large Track Flare – 2 ¾" to 6 ¼" from PAP

Pin distances closer to 6 ¼" produce more FORWARD ROLL (less axis rotation)

Pin distances closer to 2 ¾" produce more SIDE ROLL (more axis rotation)

Medium Track Flare – 1 ½" to 2 ¾" from PAP

Small Track Flare – ¾" to 1 ½" from PAP



Asymmetrical Layouts

Asymmetrical cores that hold their PSA after drilling (usually greater than .008 intermediate differential)

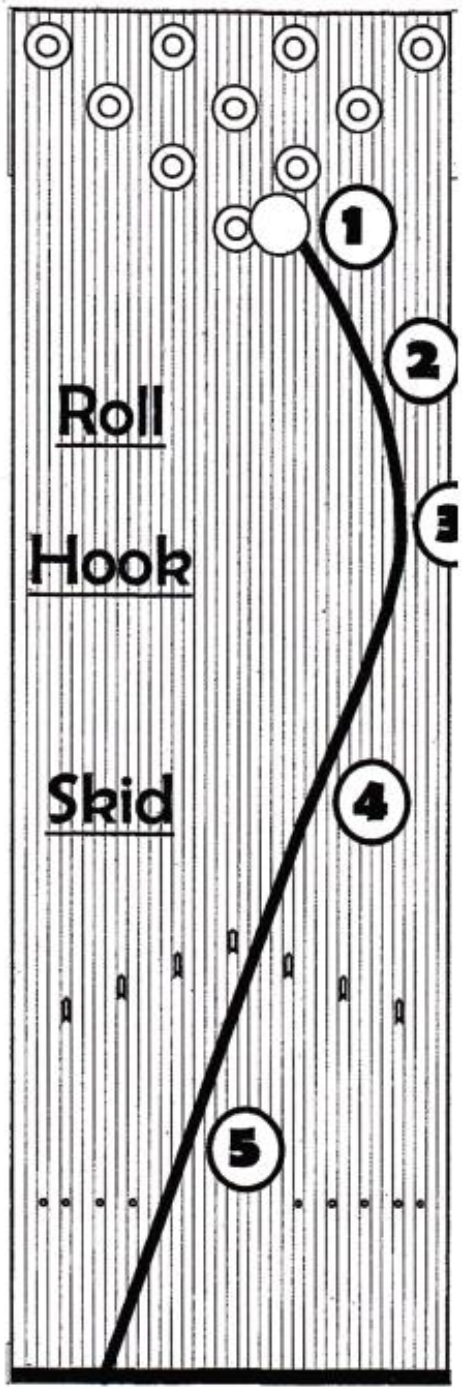
Because of the strong **Preferred Spin Axis (PSA)**, all balls with strong asymmetrical cores retain their PSA after drilling.

The **60 degree spin time** measures the strength of a ball's PSA. This reflects the ability of a ball to respond to lane friction as the ball travels down the lane. The shorter the **60 degree spin time,** the quicker the ball responds to lane friction.

Balls that retain their **PSA** after drilling are more versatile than any other types of balls because moving the PSA on the ball allows the driller to shape the breakpoint more effectively.

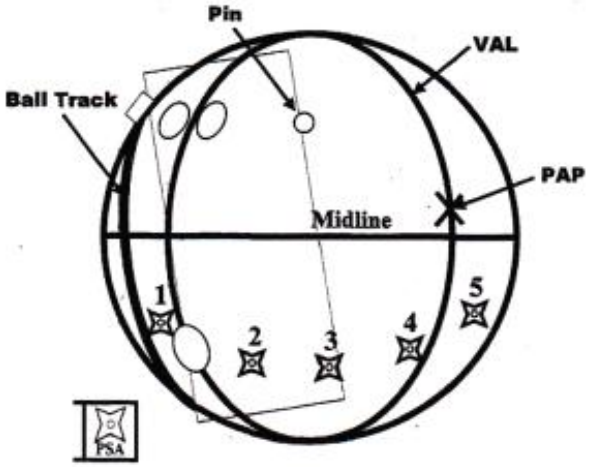
Ball reaction is determined by the PSA to PAP distance

(#) Indicates when the ball revs up and starts to lose axis rotation and tilt



The five basic ball reactions:

1. Latest Revs
2. Sharp Break Point
3. Hook and Set
4. Forward Roll
5. Earliest Rev

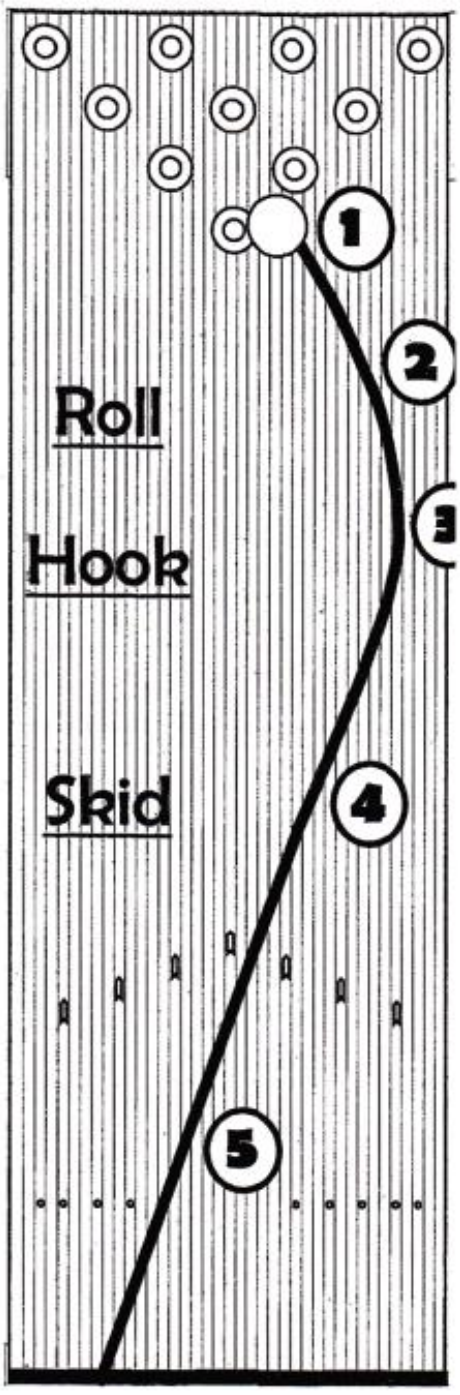


Ball Reaction Chart for Pin to PSA distance of 6 ¾"

Mass Bias Position	Ball Reaction	Pin to Positive Axis Point distance										
		1"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	4 1/2"	5"	5 1/2"	
1	Late Revs	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	Mass Bias to Positive Axis Point distance
2	Sharp Break point	6 1/2"	6 1/4"	6 1/8"	6"	5 7/8"	5 3/4"	5 1/2"	5 3/8"	5 1/4"	5 1/8"	
3	Hook & Set	6 1/8"	5 7/8"	5 1/2"	5 1/4"	5"	4 3/4"	4 3/8"	4"	3 3/4"	3 1/2"	
4	Forward Roll	6"	5 1/2"	5 1/8"	4 3/4"	4 3/8"	4"	3 1/2"	3 1/8"	2 3/4"	2 3/8"	
5	Maximum Early Revs	5 3/4"	5 1/4"	4 3/4"	4 1/4"	3 3/4"	3 1/4"	2 3/4"	2 1/4"	1 3/4"	1 1/4"	

Ball reaction is determined by the PSA to PAP distance

(#) Indicates when the ball revs up and starts to lose axis rotation and tilt



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1. Latest Revs
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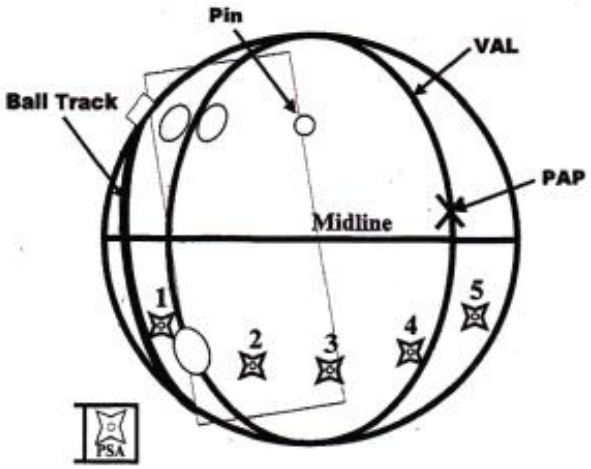

Ball Reaction Chart for Pin to PSA distance of 6 ¾"

Mass Bias Position	Ball Reaction	Pin to Positive Axis Point distance										
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1	Late Revs	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	6 3/4"	Mass Bias to Positive Axis Point distance
2	Sharp Break point	6 1/2"	6 1/4"	6 1/8"	6"	5 7/8"	5 3/4"	5 1/2"	5 3/8"	5 1/4"	5 1/8"	
3	Hook & Set	6 1/8"	5 7/8"	5 1/2"	5 1/4"	5"	4 3/4"	4 3/8"	4"	3 3/4"	3 1/2"	
4	Forward Roll	6"	5 1/2"	5 1/8"	4 3/4"	4 3/8"	4"	3 1/2"	3 1/8"	2 3/4"	2 3/8"	
5	Maximum Early Revs	5 3/4"	5 1/4"	4 3/4"	4 1/4"	3 3/4"	3 1/4"	2 3/4"	2 1/4"	1 3/4"	1 1/4"	

A Guide For Matching Ball to Condition

Information Gathering

1. Player type (revs, speed, rotation, tilt)
2. Lane conditions and desired line

Ball Surface?

1. Urethane, resin, plastic, particle reactive …
2. Surface preparation

What type of core do we need?

1. Overall RG value of the core
2. Differential

How should we "layout" our perfect ball?

1. How much flare is desired?
2. What core aspect would favor us?

Ball Layout Factors

Ball Speed —

Slower: The ball has more time to react, player potentially needs to delay the ball's roll.

Faster: The ball is getting down the lane quickly, player might need to get an earlier roll.

Axis Rotation —

Minimum rotation: Player might have a problem with early roll. Sometimes has a problem with rollout.

Maximum rotation: Player tends to have a strong ball reaction at the breakpoint — prone to skid-snap reactions.

Axis Tilt —

More Spin: Player has a smaller track circumference, might need to get an earlier roll.

No Spin: This player can sometimes get early roll and has the largest track circumference.

Revolutions —

Power Player: High initial rev rate, much potential for ball reaction.

Strokers: Lower initial rev rate, not as much potential for ball reaction.

Amount of Oil —

Heavy Oil: Flaring layouts, lower RG cores, higher differentials, aggressive coverstocks — sand as necessary.

Dryer Conditions: High RG core placements, high RG cores, lower differentials, pearls and harder coverstocks.

Backend Surface —

Carrydown: Flaring layouts, higher differential cores.

Stripped or Fresh: Stable layouts, lower differentials.

Tying It All Together

Many factors influence ball reaction:

The Bowler's Release

By far the most important factor is the bowler. A good ball will not correct a bad delivery.

Lane Conditions

The amount of oil and its location on the lane will dictate the best type of ball to be used and can make any ball a doorstop.

Ball Coverstock or Veneer

The coverstock and how it is prepared is the most important element when choosing any ball. Wrong cover = bad day.

Core Dynamics

Selecting the proper core dynamics can enhance your ball reaction. Improper core selection = less forgiving ball.

Ball Layouts and Drilling

A drilling layout should tie it all together and is the "tweak." Get the right cover, core and lay it out for maximum score.

Static Balance and the Easter Bunny

The static balance (side wt., etc.) has no real influence in the ball reaction and is only a consideration for legal specifications.

REVIEW QUESTIONS

1. How do you find a bowler's positive axis point (PAP)?

2. To ensure a bowler's track does not flare over any of the gripping holes, where should the pin be placed?

3. The following core axis angles result in what type of flare potential and what type of reaction potential?

Core Axis Angle	Flare	Reaction
90°	_____	_____
45°	_____	_____
0°	_____	_____

4. How far is the pin placed from a bowler's PAP to achieve the following core axis angles?

Core Axis Angle	Pin/Axis Distance
90°	_____
60°	_____
45°	_____
20°	_____
0°	_____

5. How is track flare potential affected by a balance hole on the high RG axis of the ball?

6. What is the vertical axis line (VAL)?

SKILLS DEMONSTRATION

You must layout three (3) bowling balls. Given information: bowler type; conditions; reaction bowler is looking for. Your instructor must sign-off on the demonstration below, with comments, if necessary:

COMMENTS:

DATE:_____ SIGNATURE:_____

MODULE EVALUATION

1. Was material comprehensible as presented in the manual and the classroom?

2. What would you change?

3. Did instructor presentation and conduct allow you to gain a maximum understanding of the materials, and how could we improve?

Instructor's name: _____

Date: _____

PLEASE RETURN TO INSTRUCTORS

Learning Module 7

Balancing

LM7-1 – LM7-12

Learning Objectives

Understanding why proper balancing of the bowling ball is essential before drilling; the USBC regulations

Key Points

- Statics
- Center of Gravity
- Balance Scale Equation
- USBC General Instructions for Weighing and Balancing Bowling Balls on a Beam Scale

Statics

Statics deals with the measurement of forces at work in systems that are at rest.

Center of Gravity

The center of gravity of an object is that point at which all forces, in all directions, balance.

A three-dimensional, solid object's weight presses downward as though all of its weight was concentrated at the center of gravity.

Center of Gravity and Static Balance

When the center of gravity of a system is on the pivot line, the system will balance.

The farther that the center of gravity of the system is from the pivot line, the more out of balance the system will be.

Balance Scale Equation

For the balance scale, the force on each side of the pivot can be calculated as:

Static Imbalance = (weight) x (distance)

- The down side of the balance scale with the largest force will go down.
- If the forces on both sides are equal, the balance scale will balance.

Note

Balance scales depend on both weight and distance, not on weight alone.

Position of Center of Gravity vs. Reading on a Do-Do Scale

As the balance point (center of gravity) of the bowling ball moves away from the actual center of the ball, the do-do scale will register a change in the balance as:

1 ounce on scale = .013 inch from center
OR
1 ounce on scale <1/64 inch from center for a 16-pound ball

USBC Bowling Ball Specifications

Bowling Ball Material

A bowling ball shall be constructed without voids in its interior, be of a nonmetallic composition material and conform to the specifications for weight, size and balance.

The use of minute, reflective particles or flakes for decorative purposes shall be permitted in a bowling ball provided such particles or flakes are made a part of the ball at time of manufacture; are evenly distributed in a uniform pattern under a transparent shell at least 1/4 inch beneath the surface of the ball so as to have no effect on the balance, and the total amount of such material does not exceed 1/2 ounce per ball.

Bowling Ball - Weight, Size, Markings And Holes

The circumference of a ball shall not be more than 27 inches, nor shall it weigh more than 16 pounds. The diameter of the ball must be constant.

The surface of a ball must be free of all depressions or grooves of specific pattern, except for holes or indentations used for gripping the ball, identification letters and numbers, and incidental chipping or marring caused by wear.

The following limitations govern drilling holes in a ball:

1. Holes or indentations, not to exceed five, for gripping purposes.
2. One hole for balance purposes, not to exceed 1-1/4 inch in diameter.
3. One (1) vent hole to each finger and/or thumb hole, not to exceed 1/4 inch in diameter.
4. One mill hole for inspection purposes, not to exceed 5/8 inch in diameter and 1/8 inch in depth.

Bowling Ball - Balance

After drilling, the following tolerances are allowed in the balance of the ball:

1. For a ball weighing 10 pounds or more:
   a. Not more than three ounces difference between the top of the ball (finger hole side) and the bottom (solid side opposite finger holes).
   b. Not more than one ounce difference between the sides to the right and left of the finger holes or between the sides in front and back of the finger holes.
2. For a ball weighing more than 8 pounds but less than 10 pounds:
   a. Not more than two ounces difference between the top of the ball and the bottom.
   b. Not more than 3/4 ounce difference between the sides to the right and left or between the front and back of the finger holes.
3. For a ball weighing less than 8 pounds:
   a. Not more than 3/4 ounce difference between the top of the ball and the bottom.
   b. Not more than 3/4 ounce difference between the sides to the right and left or between the front and back of the finger holes.

Bowling Ball - Surface Hardness

The surface hardness of a ball shall not be less than 72 Durometer "D". The use of chemicals, solvents or other methods to change the surface hardness of the ball is prohibited. (See Rule 18, Bowling Ball - Altering Surface).

Important

- The do-do scale only measures existing balance in the ball.
- It is impossible for the scale to detect how the weight is distributed in the ball in order to create that balance.

USBC General Instructions for Weighing and Balancing Bowling Balls on a Beam Scale

The three pages immediately following this page are reproduced from the USBC publication, "General Instructions for Weighing and Balancing Bowling Balls on a Beam Scale." Within those four pages of information are details on the following topics:

- How to Use a Do-Do Scale
- How to Find the Center of Gravity
- How to Lay Out Bowling Balls
- How to Lay Out the Desired Weight Pattern
- Weight Terminology

Definitions: Weigher — Position of individual facing ball and scale during weighing procedure.

NOTE: The designated ball areas (front — finger wt. etc.) illustrated in this folder are based on the position of the ball when placed in the scale.

Front — The one-half segment of the ball which includes the finger holes (See sketch #1.)

Back — The one-half segment of the ball which includes the thumb hole (See sketch #1.)

Finger or Thumb Weight — The difference in balance between the front and back portions of the ball. Example: If the thumb hole segment is one-half ounce heavier than the finger hole segment, the ball has one-half ounce of thumb weight.

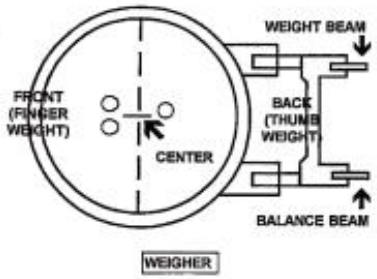
Right Side — The one-half segment of the ball determined by a plane equally dividing the finger and thumb holes through the center of the ball. The right side is determined by placing the thumb hole toward the weigher. (See sketch #2.)

Left Side — The one-half segment of the ball opposite the right side. (See sketch #2.)

Top — The one-half segment of the ball which includes both the thumb and finger holes. (See sketch #3.)

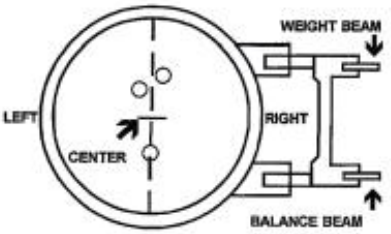
Bottom — The one-half segment of the ball which is opposite the side in which the holes for gripping the ball are drilled. (See sketch #3.)

SKETCH #1



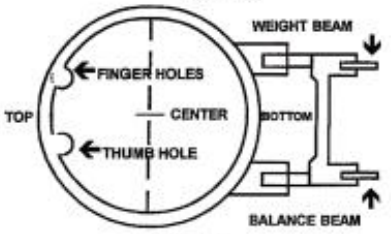
WEIGHER

SKETCH #2



WEIGHER

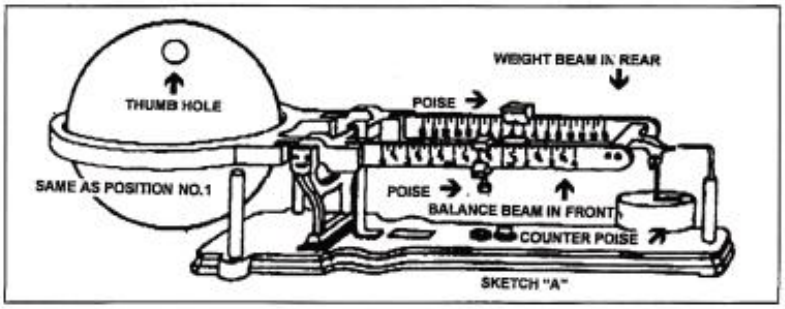
SKETCH #3



WEIGHER

Procedures for Weighing and Balancing a Bowling Ball

(All sketches are shown looking down at the ball and scale <u>except</u> Sketch A which shows the front side view.)



The scale shown in Sketch A represents the most sensitive and accurate of this type. The front beam is for balance while the back beam is used for gross weight. Varying types of balance scales may have different amounts of graduation on both the front and rear beams from 1/16 ounce to 1/2 ounce respectively. The diagrams demonstrate the theoretical method of centering bowling balls in the scale ring as the atarting point for weighing and balancing.

In Diagram #1 the line A-B represents the distance between the centers of each finger hole. Point E is 1/2 the distance of A-B. A line C-E is then drawn from the center of the thumb hole to the midpoint of the finger hole line. Point D is 1/2 the distance of line C-E and is the center of the ball and the starting position for weighing. Do not at any time be influenced by the drilling angle or pitch of the holes, or by the location of the name of the manufacturer.

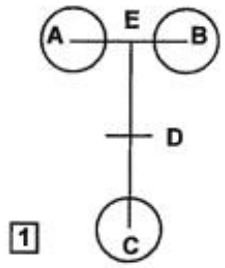
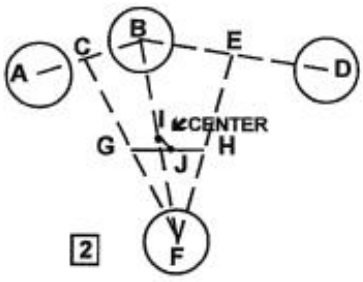
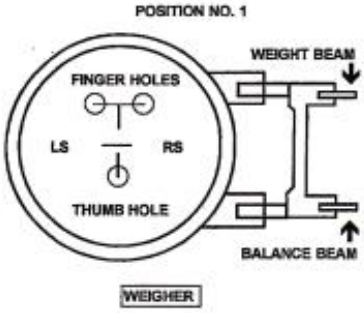


Diagram #2 indicates the method used in determining the center of the ball with more than two finger holes. The dotted line A-B-D connects the center of the three finger holes. Points C and E are the midpoints of line A-B and B-D respectively. Point I is the midpoint of line B-F. Points G and H are the midpoint of line C-F and E-F respectively. Points G and H are connected forming line G-H. Point J is the midpoint of line G-H. Point I is connected to Point J and the midpoint of this line is the center of the ball. This is a theoretical aid to help in finding the center of the ball and does not allow for the curvature of the ball.



Position No. 1 — Determine Gross Weight by placing the ball in the scale as in Sketch "A" and Position No. 1, with the thumb hole towards the weigher, the holes to be centered on a line from front to back. Place the poise (sliding weight on front beam) at zero, the poise (sliding weight on rear beam) is adjusted to obtain the gross weight. The poise on the front beam must be at zero to obtain gross weight. If the right and left sides of the ball are in perfect balance the gross weight from this test is the accurate gross weight.



Position No. 2 — Proving Weight and weighing right side of ball.

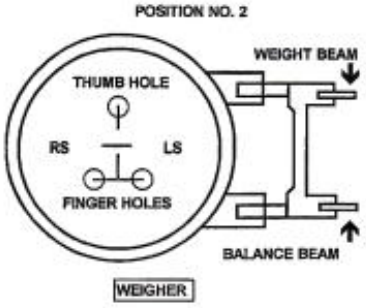
1. Rotate the ball 180 degrees as illustrated in Position 2, with the finger holes toward the weigher and centered on a line from back to front.

2. If the scale is not in balance, the poise on the front beam should be moved accordingly, until the scale balances.

3. If the front beam poise is moved one-half ounce to the right, for example, this signals that the right side of the ball is one-half ounce heavier than the left side. It also signals that the ball weighs slightly more than the result obtained in test 1.

4. Since there was a difference of one-half ounce between test 1 and 2, the gross weight equals the total of the weight determined in position 1 plus one-half the difference between the tests — In this example, one-fourth of an ounce more than the weight determined in position 1.

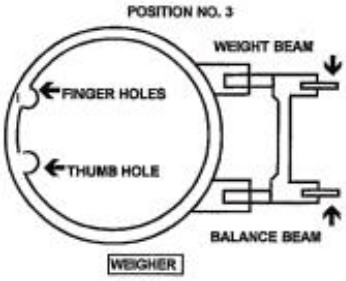
To double check the weight an accurate gross weight scale should be used.



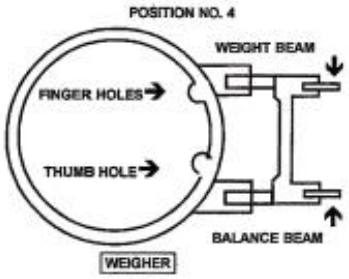
If a gross weight scale is not available and if either test 1 or test 2 shows the ball to be slightly over 16 pounds, the ball may be passed, provided one-half the difference does not bring the weight over 16 pounds and it balances in conformity with ABC/WIBC specifications. Let us assume in test 1 the ball weighed 15 pounds, 15 3/4 ounces, while in test 2 it weighed 16 pounds, 1/4 ounce. Taking one-half of 1/2 ounce, or 1/4 ounce, and adding it to 15 pounds, 15 3/4 ounces, would total 16 pounds and the ball would be acceptable providing it is otherwise within balance limits. The allowable difference between the left and right side of the ball shall not exceed one ounce.

Position No. 3 — Determine the difference between the top (drilled area) and bottom of ball.

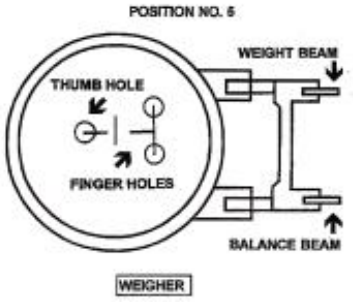
Place the ball as shown in Position No. 3. With the poise on the front beam set at zero, move the poise on the back beam so the scale is in balance.



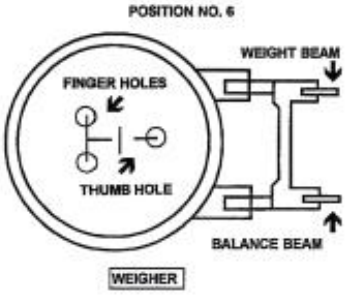
Position No. 4 — Rotate the ball 180 degrees so the finger and thumb holes are to the right as shown in Position No. 4. If scale remains in balance, top weight and bottom weight are equal. If the scale is not in balance, the poise on the front beam should be moved until the scale balances. A move of the poise on the front beam to the left to balance the scale indicates ball top weight in the amount shown on the front beam scale. If the poise on the front beam was moved to the right, this indicates bottom weight as shown on the scale. The difference should not exceed 3 ounces.



Position No. 5 — Determine Thumb or Finger Weight.
Set the ball in the scale as shown in Position No. 5, place the poise on the front beam at zero. Move the poise on the back beam until the scale is balanced.



Position No. 6 — Rotate the ball 180 degrees to Position No. 6. The thunb hole is now to the right of the weigher. If the poise on the front beam needs moving to the right in order to balance the scale this indicates finger weight in teh amount shown on the front beam. A move of the poise on the front beam to the left indicates thunb weight and again the amount would be read on the front beam. This difference must be one ounce or less to comply with ABC/WIBC specifications.



UNITED STATES BOWLING CONGRESS

REVIEW QUESTIONS

1. What are the ABC/WIBC regulatory allowances concerning static imbalance in a :

    a. Ball weighing 10-16 pounds?

    b. Ball weighing 8-10 pounds?

    c. Ball weighing less than 8 pounds?

2. What is the maximum circumference of a bowling ball?

3. Describe how to weigh a drilled ball, using a balance scale, to find the following:

    a. Side weight —

    b. Finger/thumb weight —

    c. Top/bottom weight —

4. What do statics deal with?

5. If a ball's static balance weights do not fall within the limits specified by ABC/WIBC, what can be done to meet those specifications?

6. What is the maximum weight of a bowling ball?

7. What is the minimum weight of a bowling ball?

8. What would cause a system to be out of balance?

SKILLS DEMONSTRATION

You must scale one ball, for instructor review. Your instructor must sign-off on the demonstration below, with comments, if necessary:

COMMENTS:

DATE:_____ SIGNATURE:_____

MODULE EVALUATION

1. Was material comprehensible as presented in the manual and the classroom?

2. What would you change?

3. Did instructor presentation and conduct allow you to gain a maximum understanding of the materials, and how could we improve?

Instructor's name: _____

Date: _____

PLEASE RETURN TO INSTRUCTORS

Learning Module 8

Plugging and Maintenance

LM8-1 – LM8-14

Learning Objectives

Maintenance, plugging and resurfacing all types of bowling balls

Key Points

- Maintenance
- Plugging
- Resurfacing

Maintenance

First Impressions

The hallmark of all successful pro shop operations is the quality of the work. Often, plug work is the first contact you will have with a potential customer, and that first contact will set the tone for your future with that consumer. If your skills are poor, nowhere will it be more evident than in this routine plugging and maintenance.

Dedicate the time and resources to excel at these skills. Buy the best equipment and a resurfacing machine if your budget allows. Fully train your employees and make them and yourself experts in these skills. Plug work is half artistry and half chemistry.

There is an old adage in the customer service industry:

"Under Promise, Over Deliver."

When you say you are going to deliver a plug job by a certain time, DO IT. Give uncommonly good service and you will be on your way to having a successful pro shop.

Plugging

Preparing holes

Follow these steps to prepare ball holes for plugging:

Step	Action
1	Remove existing round hole edges with sharp edge or new bevel at a 45° angle
2	Roughen the inside of holes or counterbore holes
3	Apply plug dams or mold clay ¼" away around edge of holes
4	Plug may shrink during hardening, so pour plug to top of the dam (approximately ¼")

After the plug hardens

Follow these steps to prepare the ball after the plug has hardened:

Step	Action
1	Cut the ball plug using a router or plug cutter
2	File or use knife to remove excess plug close to the contour of the ball
3	Sand excess plug and smooth to the ball contour using 400 grit wet sandpaper, 600 grit wet sandpaper
4	Use compound and polish to finish the plugged area
5	Re-weigh ball to find its center of gravity

Plugging Tips

- Maintain a room, ball and chemical (ball plug and color kit) temperature of 72° - 78°. Since ball plug is temperature sensitive, it is very important to maintain this temperature!
- Mix plug slowly for two minutes in a figure eight pattern. Occasionally, scrape the sides and bottom of the cup to ensure that the plug is mixed thoroughly.
- Use a stop watch or clock to time the amount of stirring. It is important that the plug be mixed for two full minutes to complete the reaction of the compound and hardener.
- When coloring the plug, add the color to the compound only. Add the hardener after the color has been matched to the ball. This will prevent over-mixing or having the plug cure before a color match is made.
- Plug large holes in two stages. Plug one half of the hole and let it cure completely. After this plug is hard and cool to the touch, plug the second half of the hole. This procedure helps prevent too much heat from being generated by the plug and causing it to crack.
- When plugging small holes, mix the plug and leave it in the cup until it becomes very warm, then pour immediately into the hole.
- Allow the plug to cure completely before routering and sanding. This helps prevent the plug from shrinking after the plug has been cut down.
- Pour excess uncured plug mixture into miniature ice cube trays for later use. When the plug cures, use the cubes to fill large holes. The plug cubes will not affect the curing of the liquid plug.
- When preparing a ball to be plugged, drill out any bevel or large cracks around the perimeter of the hole. This will increase plug adhesion and reduce the possibility of edge chipping or separation. Lightly sanding near the top of the hole will also help create better adhesion.
- Read and follow all manufacturer's instructions on the label of the bottle. This applies to ball plug and color kits.

Troubleshooting Ball Plugs

- What causes plugs to chip/crack and how can I prevent it from happening?
  - Two of the main reasons plugs will chip and crack are:
    - room temperature above 80° A temperature of 72°-78° (this applies to room, ball and chemicals) must be obtained for the plug to cure properly.
    - and/or the plug mass is too large, generating too much heat during cure. Large holes should be plugged in two stages, allowing the first half of the plug to cure completely before pouring the second half; OR when plugging large volume holes use plug cubes to lower the volume of poured plug; OR use less catalyst (hardener) for high volume holes. This is especially true for large holes in urethane balls, since the thicker shells of urethane balls tend to trap heat. This procedure helps prevent too much heat from being generated by the plug and causing it to crack.
  - **Remember that this is a chemical reaction and controlling heat is critical.**
- What are the causes of plug curing too slowly and what can be done to insure a solid cure?
  - A slow-curing plug could be caused by one of the following:
    - Defective pumps providing the incorrect ratio: test and replace pumps if necessary;
    - Plug that hasn't been mixed long enough: mix the plug for a full two minutes. Use a stop watch if necessary.
    - Room temperature below 70°: make sure the room temperature is between 72° - 78°
    - Small masses of plug that don't generate enough heat to provide a thorough cure: when plugging small holes, mix the plug and leave it in the cup until the plug becomes very warm. Pour immediately into the hole.

Troubleshooting Ball Plug, continued

- How can I make sure that my pumps are dispensing the correct amount of material?
  - Use the following test procedure:
    1. Use two identical cups.
    2. Dispense one plunge of compound into one cup.
    3. Dispense three plunges of hardener into the second cup.
    4. Place cups side by side on a level surface.
    5. Fluid levels in the cups should be identical.
    6. If the fluid is not at the same level, the pumps are not dispensing the proper amount of material. Replace pumps to avoid plug curing problems.
- Is there anything I can do to reduce air bubbles in the plug?
  - Air bubbles usually indicate that the plug has been mixed too vigorously. Mix the plug slowly in a figure 8 pattern, occasionally scraping sides and bottom of the cup. Do not pour plug into the center of the hole. This procedure tends to trap air bubbles at the bottom. Pour the plug slowly, using the stir stick as a guide so the plug runs down the wall of the hole. If air has already been entrapped while mixing, allow plug to stand in the mixing cup for approximately 10 minutes. The larger surface area in the cup will allow the air bubbles to escape more easily.

Troubleshooting Ball Plug, continued

- How can I prevent a plug from shrinking after it's been cut down and finished?
  - Plug will shrink after being cut down or finished because it has not completed the curing process. The frictional heat created when finishing the partially cured plug will cause a secondary reaction and swelling in uncured epoxy. The plug then shrinks as it cools. This usually occurs in cold weather or when plugging smaller holes. To prevent this from happening, place a 60-75 watt light 3-4" away from plug material for one to two hours immediately after the plug is poured. This will prevent shrinkage in cold weather. When plugging smaller holes, leave plug in the cup until it becomes warm, then pour in the hole.
- What causes separation between the seam of the plug and the ball and what steps can I take to prevent it?
  - Plug separation is caused by the interior of the hole not being completely clean or by improper or inadequate plug mixing. Clean the hole's interior with a fast drying solvent before plugging. This helps ensure good adhesion. For proper mixing, remember to follow manufacturer's instructions. Light sanding near the top of the hole will also help create a better adhesion.
- Is it safe to use heat lamps to help cure the plug in cold weather?
  - Yes, if care is taken not to overheat the plug. If heat lamps or other heating devices are used, be certain not to leave them unattended.

Resurfacing by Hand

Tools and Equipment

- Dry – 50-80 grit sandpaper or screen
- Wet – 150-180 grit, 220-280 grit, 400 grit, 600 grit sandpaper
- Rubbing compound, polish, spray lubricant
- Ball spinner
- Wet/dry sandpaper -- 80 grit, 120-150 grit, 220-320 grit, 400 grit, 600 grit, 1000 grit, 1500 grit
- Towels, clean cloths, water in spray bottle

Basic Tips

- Consider the ball to have six sides – top, bottom, left, right, front and back
- Determine the track wear – mild or heavy
- Use 80-120 grit to sand out the track and use other grits to remove scratches
- Some urethane coverstocks do not resurface easily and are hard to shine
- Depending on the wear of a ball, most can be resurfaced twice and still retain performance. Balls may be resurfaced more but cannot be less than 8.500 in diameter when completed.

Sanding

Each step of the sanding process may take 20-30 seconds. Deeper scratches may take longer. Reactive resin balls may take less time. During the sanding process, when changing grit, the next grit you use should be less than double the grit just used (i.e., from 120 to 220 grit, not 120 to 320 grit).

Note: Use water liberally and continually during each sanding phase for complete and adequate lubrication.

For a Dull Finish

Follow these steps.

Step	Action
1	Put the ball in the spinner with the ball label facing up.
2	Turn on the ball spinner.
3	Using 80 grit sandpaper, sand until the ball track – major and minor scratches – is gone.
4	Turn off the ball spinner.
5	Turn ball over 180° and repeat process, still using 80 grit sandpaper.
6	Turn off the ball spinner.
7	Without changing the position of the ball, use 120 grit sandpaper for the next sanding phase; turn ball 180° so the label is facing up.
8	Turn on the ball spinner and repeat the process.
9	Without changing the position of the ball, use 220 grit sandpaper for the next sanding phase; turn ball 180° so the label is facing down.
10	Turn on ball spinner and repeat process.
11	With ball label still facing down, begin sanding with 320 grit sandpaper. A smooth, grooved surface should appear.
12	Turn off ball spinner.
13	Repeat ball turning and turn on ball spinner.
14	Finish sanding ball, still using 320 grit sandpaper.

Use towels to dry surface. Spray ball with a spray lubricant and wipe off. Ball should look grooved but without dusty, dull appearance.

For a Moderate Shine

For any non-reactive resin ball, follow Steps 1 through 14, then follow the next steps.

Note: Remember to use water liberally while sanding to smooth and shine to prevent paper from loading.

Step	Action
15	Use 400 grit sandpaper and repeat the sanding and ball turning process.
16	Dry the ball surface.
17	Using a clean cloth, apply rubbing compound and buff to a shine.

Caution

Reactive resin coverstock is more responsive to sandpaper abrasives, so start the sanding process at Step 9, using 220 grit sandpaper. Be cautious using 80 or 120 grit sandpaper because it can take off ball labels and create deep grooves in the ball.

For High Shine

First, follow the steps for dull and moderate shines, then apply these next steps.

Step	Action
18	Use 600 grit sandpaper and repeat the sanding and turning process. Ball will now look semi-shiny.
19	Dry the ball surface.
20	Using a clean cloth, apply rubbing compound and buff to a shine.

For a Specialty Shine or "Super-High" Gloss

Follow the steps for dull, moderate, and high shines, then follow these steps.

Step	Action
21	Use 1000 or 1500 grit sandpaper. 1500 gives the brightest shine.
22	Repeat the sanding and ball turning process.

Ball will look shiny before application of polish.

REVIEW QUESTIONS

1. What steps are taken to prepare a bowling ball for plugging?

2. What steps are taken to prepare a bowling ball for drilling after the plug has hardened?

3. Describe how to resurface a bowling ball by hand.

SKILLS DEMONSTRATION

You must plug one ball, for instructor review. Keep in mind the time required for the plug to cure and harden. It is your responsibility to complete the demonstration during this four-day period. A permanent plugging station has been created for this purpose and is available to you before and after class. Baxter bits are available for cutting excess plug material. If you have never used one, we recommend you try it. Help is available from any instructor. Your instructor must sign-off on the demonstration below, with comments, if necessary.

COMMENTS:

DATE: _____ SIGNATURE: _____

MODULE EVALUATION

1. Was material comprehensible as presented in the manual and the classroom?

2. What would you change?

3. Did instructor presentation and conduct allow you to gain a maximum understanding of the materials, and how could we improve?

Instructor's name: _____

Date: _____

PLEASE RETURN TO INSTRUCTORS

Learning Module 9

Pro Shop Business

LM9-1 – LM9-23

Learning Objectives

Background information necessary to opening and operating a successful bowling pro shop

Key Points

- The Business of Bowling . . . The Sport of Bowling
- Technological Developments
- Role of the Pro Shop
- Important Ingredients in a Successful Pro Shop
- Professional Organizations

The Business of Bowling ... The Sport of Bowling

These two elements of bowling are dependent upon each other. On the business side are bowling centers, pro shops, ball manufacturers, i.e., the sellers of bowling. On the recreation and sport side are bowlers and industry supporters who want the integrity of the sport to be maintained and recognized. Wouldn't being recognized as an Olympic sport be great for bowling?

Some of those on the sports side believe that there are those on the business side who have let them down; that the integrity of the sport has been sacrificed to profit.

With aggressive and cooperative action, it is possible to ensure both bowling's integrity and its profitability.

Technological Developments

Although there have been numerous, valuable technological developments since wooden pins and wooden balls were the staples of the game, advances in equipment during the past 30 years have been relentless.

Most believe that these advancements have a profound effect on scoring today, sometimes inflating scores well beyond skill levels, and placing immense pressure on the American Bowling Congress and the Women's International Bowling Congress to adjust regulations to the technological reality.

Such efforts directly affect the business side of the sport. Since the business side of bowling is consumer-driven, products perceived by bowlers to be related to high scores are what sell.

For example:

- A consumer may come into your pro shop wanting "that ball that hooks the most."
- So ... you may stress to manufacturers that more "balls that hook" should be made because that's what your customer wants.
- Manufacturers listen to *their* customer — the pro shop professional — and make more "balls that hook."
- The center proprietor dresses the lanes to accommodate these new "balls that hook."
- Scores rise and the USBC authorities adjust regulations to the new balls and lane conditions.

Specific Technological Developments

Lighter Pins

In the mid-1960s, bowling pins were made lighter and coated with hard plastic. This development led to higher scores. USBC responded with rulings that forced pin manufacturers to bring the weight of the pin to its current 3.6 pounds.

Ball Surface

In the early 1970s, Professional Bowlers Association players started altering the surfaces of balls to create more friction, so their scores skyrocketed. The USBC responded by creating a 72 minimum hardness rule.

Lane Surface

Around 1970, urethane lane surfaces replaced lacquer, providing greater friction and a smoother surface for the ball. Machines that could be used to consistently put oil on the lane made their debut. Between these two developments and the blocked oiling patterns that resulted, yet higher scores were seen. The USBC responded by passing the Amendment 4 rule, which met with tremendous resistance from the proprietors.

More Friction

In 1981, urethane balls were introduced, further increasing friction between the lane and the ball surface when they were used. Two-piece urethane balls that changed the rotational dynamics of the ball once again raised the potential friction level of the ball. New ball cores were developed:

- Those that could revolve faster off the hand, because of the *low* Radius of Gyration (RG), and
- Those balls with cores that created a *high* RG so the balls could skid farther down the lane and break sharply.

Next came the reactive resin ball, with an additive that, once again, increased the hook potential of the ball.

The advent of particle coverstocks has added yet another consideration.

Add to these developments, better-trained coaches and highly-trained pro shop professionals, and it is easy to see why scores have continued to climb.

The Role of the Pro Shop

Despite pronounced cultural and technological changes over the past three decades, the basic role of the pro shop remains the same:

- To be a profit-making business, *and*
- To provide products and services to bowlers.

Ingredients of a Successful Pro Shop

- Prime Location
- Customer Service Orientation
- Accurate Record-Keeping
- Timely Inventory Control
- Dependable Supplier Network
- Retail Sales Plan and Skills
- Technical Knowledge and Skills
- Instructional Knowledge and Skills
- Participation in Professional Organizations

Prime Location

The old saw is "Location, location, location." The reason that it is an old saw is because it is true. Make sure that your shop is in the most highly visible and convenient-to-reach location possible.

This and many other business topics will be covered fully in "Business of Pro Shops" curriculum for the IBPSIA Certification Program.

Customer Service Orientation

In assuming the role of a bowling pro shop professional, one must understand that in order to provide sellable products and services — and to maintain a profitable operation — plans and actions must focus on the needs of the shop's customers.

Orientation toward the customers' needs must provide the basis for almost all the business decisions that the pro shop professional makes, from the layout of the shop to product inventory to equipment to selection of staff ... ad infinitem. When this method is followed, the benefits accrue in satisfied customers who recommend your shop to others and in the related profit that results from such customer satisfaction.

Accurate Record-Keeping

Accurate record-keeping allows you always to know what money is actually yours after all the bills, rent, wages, taxes, and other expenses are paid.

If you don't track when and what you sell, you have no basis for reordering stock. And you won't know how much money you are making — or not making. Keeping accurate books is essential to running any kind of business. Computers and appropriate software have made this responsibility easier, more accurate and less time-consuming.

Contracting with a firm that specializes in small business accounting is one way to keep on track. Such an arrangement also makes your year-end tasks easier.

There are several software programs on the market geared specifically to bowling pro shops. They allow you to customize your customer "spec sheets," manage your inventory and establish customer mailing lists.

Advertisements for the programs may be found in industry publications and some of the companies that offer such software are Associate Members of IBPSIA. One of the best ways to locate a system that works for you is to obtain the recommendation of another pro shop professional.

Timely Inventory Control

If you have products that hibernate in your inventory for 60 days, it may well be time to put them on sale.

With manufacturers producing so many types of bowling balls, you can't afford to overstock. Trends are not as easily defined as in the past — when one or two balls stayed on top for a long time. Networking with other pro shop professionals will help you become aware of trends. You can guarantee that whatever wins on the PBA television show on Saturday will be in demand — at least for that week!

Dependable Supplier Network

Your local distributor should be your best source of product assistance. That business is an extension of your inventory. Distributors can stock infinitely more inventory than you can — even that pair of EEE shoes that your best customer wants "yesterday." Customer service is as important to distributors and manufacturers as it is to you.

Retail Sales Plan and Skills

You are in this business to make money. Knowing how to sell your products will help you do that. It is extremely important to be able to expertly drill bowling balls and keep your shop well stocked, but having sales expertise — and the ability to listen to what your customer is really saying — also is vital to success.

Technical Knowledge and Skills

Drilling bowling balls has evolved into a science. It has become more technical as drill presses have become more precise and fitting devices have been improved. A pro shop professional must develop these technical skills, and learn new ones, in order to stay competitive.

Participation in Professional Organizations

Full participation in organizations — like the International Bowling Pro Shop & Instructors Association, the Billiard & Bowling Institute of America and the Bowling Proprietors' Association of America — that support your quest for continued business success pays dividends in continuing education, information and networking. Contact the organizations that specifically focus on your business interests, and then fully participate in the programs and services provided. It's good business.

Learning Objectives

The importance of pro shop location and layout in maximizing efficiency and promoting sales

Key Points

- Location and Signage
- Capitalizing Space
- The Fixed Layout
- Atmosphere
- The Work Area
- Work Tools and Equipment
- Hours of Operation

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Capitalizing Space

One of several methods used to set up a shop is to evaluate what each area of the physical facility generates in sales profits and labor costs. It's then a simple matter to allocate appropriate percentages of space in the shop for each of those areas. For example, if ball sales comprise 50 percent of your net profit, then 50 percent of your display space would be allotted to that product.

There are, of course, several methods of determining layout. These will be covered fully in Phase 2 of the curriculum for the Certification Program.

The Fixed Layout

Although shops may be segmented solely on the basis of merchandise type, another means of laying out your facility focuses on certain, virtually permanent, areas. These would be:

- The Cash Register Counter
- Work Benches — The Drill Press Area
- The Computer Area
- The TV/VCR Location
- Slotted Wall Displays
- Shelving Displays
- Storage Area
- Lighting

Atmosphere

Your shop should be inviting to customers. They should, immediately upon entering it, perceive that it is a friendly place to find expertise and products that they want. A neat, dust-free shop with a simple but eye-catching decor reflects your pride in your business and your respect for its customers.

Keep in mind, too, that your customer list includes men and women, young and not-so-young, novices and pro-level bowlers. Don't allow your shop to be used as a "hang out" for a clique of bowlers. No one who walks into your shop should perceive that he or she is an "outsider."

To create a friendly, inviting atmosphere you may:

- Make the doorway appear larger than it really is by keeping the area around the door clear of clutter. This is the spot to decorate sparingly and with attention-getting items.
- Minimize clutter so that customers feel comfortable and can move easily around your shop.
- Use background color, posters and mirrors to create an open atmosphere.
- Enclose storage areas if possible. If not, some items, such as inventoried products, can be stored neatly behind displays.
- Display your professional credentials.
- Arrange a seating area for customers. Display bowling industry publications for them to read while waiting.
- Use your TV/VCR to play — with permission from the pertinent entities, of course — PBA, teaching, marketing and sales videos.

Help Your Customers by Posting Price List

Charges for at least the following services should be posted in an easy-to-read format and in a visible location. Another way of being straightforward and up-front with those who come into your shop, this is a simple means of adding to your customer-oriented atmosphere.

Drilling Charges for Balls Purchased Elsewhere:

Conventional Grip	$??
Fingertip Grip	$??
Exotic Drilling	$??
Sanding	$??
Cleaning/Polishing	$??
Complete Resurfacing	$??
Plug Thumb	$??
Plug Fingers	$??
Plug Thumb and Fingers	$??
Extra Hole	$??
Remove Name	$??
Engrave Name	$??
Slugs	$??
Inserts	$??

Work Area

Give exceptional service by consistently acting on your customer-service-first philosophy. Your customers are the shop's "bread and butter." Make sure that all areas of your shop are customer-friendly, which means that they also must be employee-friendly. Following are a few ways to accomplish this:

- Make the area functional, efficient and safe by careful placement and maintenance of equipment, and by keeping surfaces of benches and tables — and the floor — clear of clutter.
- Keep your tools organized in the specific area in which they will be used, and keep them there.
- Beware of health risks associated with airborne particles generated by the work that you do. Research the possibilities and install the most effective air cleaning/circulating system that you can afford.

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- Beware of health risks associated with airborne particles generated by the work that you do. Research the possibilities and install the most effective air cleaning/circulating system that you can afford.

Hours of Operation

A savvy pro shop professional clearly displays the times and days that the shop will be open ... and is in the shop, or makes sure that an employee is on hand, during those days and times.

Keeping the customers' interests in mind, the shop owner or manager also should ensure that:

- The shop is opened and closed on time, and that someone is ready to assist customers during the time periods specified. If you or an employee must arrive late or leave early, make sure that a replacement is available.
- If you must be away from the shop during your normal operation schedule, post a sign — not a scrawled note — indicating precisely when the shop will be closed and when it will be reopened.
- An answering machine is installed, or that you have contracted with a phone answering service, so that you don't miss out on customers who call when the shop is closed. If you opt for an answering machine, make sure that your message reflects your professionalism and that the messages left are promptly returned.

Learning Objectives

Marketing in the pro shop; developing your customers; clues for successful communication

Key Points

- The Customer's Sphere of Influence
- Selling Yourself, Your Expertise and Your Service; Not Your Price
- Communication Skills
- Marketing Ideas

The Customer's Sphere of Influence — It May Be Wider Than You Think

Always assume that each of your customers knows, and is highly regarded by, every single person in your state or province. It's a good idea to clearly detail — in a friendly, conversational manner — your after-sale service policies during a customer's first visit to your shop. This procedure considerably reduces the potential for future problems, while giving you an opportunity to "sell yourself" and your professionalism.

Unfortunately, there always are a few problems along the road to success. With the goal of avoiding negative publicity via the bowlers' conversational network, remember that the way you deal with a dissatisfied customer in the first 30 seconds will determine their opinion of you, your ability to solve their problem and your shop.

Your first statement to a dissatisfied customer must be one in which you thank that customer for returning to the shop so that you can solve the problem. Immediately diffuse any negative thoughts that they may have about dealing with you. When you accomplish this, you considerably improve your standing and your chances of receiving valuable business referrals from the customer.

Any argument with a customer is wrong.
Even if you win the argument,
you may lose the customer.

Sell Yourself, Your Expertise and Your Service – Not Your Price

It always is important to maintain your professional image while dealing with customers. You want your shop to reflect an atmosphere that optimizes the comfort level of customers and gives them the confidence that you can deal with any and all of their bowling needs.

Potentially, some of the easiest customers to provide service for are those who have been referred to your shop by a satisfied customer. Price is not an issue with these people. They will enter the shop with positive attitudes and will be eager to benefit from your professional skills. Word-of-mouth recommendations are the backbone of virtually every successful pro shop.

Product Knowledge

Obviously, you cannot stock every product available, but you must keep up-to-date on all products on the market. Keep track of what's available, where you can order it, how soon you can receive it, and how much it will cost you and your customer.

Sell Your Inventory

Remain constantly aware of your inventory. When possible, guide each customer toward purchase of your inventoried products. This makes purchasing more convenient for them and adds to your efficiency, which translates into increased profit for your shop.

The keys, of course, are to inventory appropriately for your clientele and to make sure that products in your inventory fill the real needs of your customers.

Dealing with Browsers

People who are "just looking" are not always concentrating on price. They may very well be checking out the expertise of those who work in your shop. This is the time to use your skills in selling yourself and your services. Use this opportunity to plant the seeds of future sales — not all sales are closed on the customer's first visit.

Back up sales and service

Guarantee your work and make sure that the customer knows about your guarantees. Visit the leagues in your area and ask customers how their equipment is working for them. This type of personal research provides another opportunity for you to let your customers know that you are there for them.

Communication Skills

When you successfully communicate with your customers, they leave your shop smiling, excited and confident that they have made a wise choice in selecting your pro shop to handle their bowling needs. This is the reaction that you should seek from every customer, every day because it means business for you. There are several keys that will help you communicate successfully:

Listen to Your Customer

Listening skills are essential tools in providing superior customer service. The skills of listening, however, often are the most difficult to develop. Many times, what is *not* said by your customer is more important than what is spoken. If you aren't precisely sure what the customer is saying, ask open-ended "What" questions and listen carefully to the answers until you believe that you are in complete understanding of his/her position.

When seeking clarification, don't ask questions that can be answered with a "yes" or "no," and don't ask questions that begin with "Why." Asking "Why" can sound confrontational and it can open an overly-wide response range. Setting up a "yes" or "no" response can close the exchange before your receive the information that you need.

For example, you might say: "*What would you like to accomplish with your new ball?*" or "*What would you like us to do to rectify this situation?*"

There may be times, too, when customers want you to make decisions for them. Once you are absolutely certain that this is what the customer is saying, a positive exchange may proceed as follows:

Customer: *"I don't know which ball to buy. I'm afraid that if I buy that one, it'll hook too much. And if I buy this one, it may not hook enough ... "*

Pro Shop Professional: *"I understand your dilemma. Considering all the options, I believe this ball will give you the results you're looking for."*

Most constructive listeners follow similar patterns of behavior. Some of the keys to their listening skills are that they:

- Identify the Customer's Expectations
- Create an Atmosphere of Caring and Concern
- Keep Each Promise Made
- Approach Each Customer From the Same Perspective — they are not judgmental and they do not generalize.
- Take the "I" Out of Conversations

Evaluate the Customer's Motivation for Buying

To most successfully provide service to your customers, you need to know what prompted them to visit your shop at this particular time. Following are some of the most common motivations:

- Peer Pressure. "*My friends said I should come in and buy this ball.*"
- To Improve Their Game. "*My team captain thought I should schedule a lesson.*" "*My friends have talked me into bowling in a scratch league and I want to be competitive.*"
- To Upgrade Equipment. "*I've been hauling this bag around for five years and it's really worn.*"

Tailor Your Service to the Customer's Motivation

Once you determine their primary motivation, you can talk to your customers on their level without "talking down" or patronizing them. This is extremely important in setting and holding to a program of successful communication. Make your customers aware that you understand their needs, and that those needs — however minor — will not be trivialized in your shop.

You'll have more fun and enjoy more financial success
*when you stop trying to get what **you** want*
*and start helping other people get what **they** want.*

Marketing Ideas

Offer Special Packages

At any time of the year — from peak sales seasons like the beginning of league play or the Christmas/Hanukkah holidays, to the summer doldrums — you can offer special "packages" to pique the interest of regular and intermittent customers.

For example, you can combine a specific ball, and a type of bag and shoes as a package, with or without a reduction of the price of any of the three elements of that package. Buyers always are looking for specials, and this is a simple means of enticing the customer who may not otherwise buy or who may only have bought one of the three items offered. You've made the buying experience easy for the customer by making some of the decisions yourself.

Keep Your Pro Shop Well Stocked

Successfully stocking your shop does not mean that you have to have one of everything. It does mean that you must maintain a representative variety of products, from the "old standbys" to those that exemplify the latest trends.

Display Prices Prominently

Customers should not have to ask the cost of any product or service in your shop. In fact, many customers simply will walk out of your shop if they can't find a price tag, sign or list for the items in which they are interested. Make sure that you prominently display the list of charges for services and that all your products are priced in some way.

Establish a Mailing List

You can easily notify customers about specials and new products, and send them your newsletter, if you have an accurate mailing list. A good computer software package will allow you to sort the mailing list so that specific customers can be informed about services and products in which they have expressed interest.

Conduct Clinics for Bowlers

Clinics that you lead should be coordinated with your "house" center or, in the case of a free-standing shop, with the center or centers in your area. When you "sell" yourself and your expertise to bowlers who appreciate your help with their games, you most likely also will "sell" your shop, its products and services to them.

Visit Leagues, Area Centers Regularly

When you visit league bowlers in a center, be sure to introduce yourself and your services. Don't assume that individuals within your best pool of potential customers — league bowlers — already know all the good things about you and your shop.

Be sure to pay attention to any special needs of senior and youth bowlers. These individuals deserve the same attention given to those in other age groups. Often, in fact, the disposable income available to these bowlers may be among the highest in your area. Handled in the proper manner, this fact can translate into good business for you and good service and products for them.

Remember, too, to pay attention to the "cheering sections" when you visit centers. That's where you'll be able to meet the parents of those youth bowlers and "sell" yourself and your shop to those who pay the youngsters' bills. When you cultivate a business relationship with a youth bowler and his/her family, you are building business for the present and future.

Make yourself and your business known to bowlers throughout your market area. Get to know the bowlers as individuals and assure them that you are available to help them excel at the sport you both love. Just be sure to maintain a friendly, not pushy, attitude toward those with whom you come in contact.

It also is important to maintain communication with those bowlers who already patronize your shop. Make an effort to remember their latest purchases and inquire about their satisfaction with those products and/or services. Pay attention to the bowlers' current needs and be ready to respond to inquiries regarding those upcoming purchases. Share any factual information that you may have regarding new products or trends. Your customers will appreciate being among the first to be "let in" on industry news.

In-House Promotions

Make a conscious effort to become involved in the programs offered by your "house" center or the centers in your area. As long as a center's promotions are of a type that is beneficial to the industry in general, ask to be involved. In other words, take your pro shop to the lanes.

Learning Objectives

Small Business Administration Information

Key Points

- Focus Your Idea
- Set a Goal
- Get Information and Feedback on Your Idea
- Examine Your Competition
- Talk to Customers
- Advantages and Disadvantages of Owning a Business
- Profile of a Successful Business Owner
- Common Problems Faced by Small Businesses

An excellent, and often overlooked source of sound business advice is the Small Business Administration. Following is an overview of information available through your local Chamber of Commerce, on business start-up:

The Idea

If you have decided to start your business "from scratch," you need to know how to find a good idea and turn it into a good business opportunity.

Business opportunities usually develop from simple ideas that come from pretty ordinary sources. They don' have to be sudden flashes of inspiration. Many very good ideas have developed from frustrating experiences as a customer, from suggestions from friends or business colleagues, or from personal interests.

To find a good idea and turn it into a good business opportunity, it is critical that you focus your idea, set a goal, and then get information and feedback on your idea.

Focus your idea

A business idea should be well focused. You should be able to explain it clearly and simply to potential customers, future employees, and investors. It should be straightforward and easy to understand.

If you can't describe your business idea in fifty words or less, then you may want to take another look at your idea. Perhaps it isn't clear.

Set a goal

Once you have focused your idea, set a goal that fits your idea. Think about where you want your business to be five to ten years from now. Make sure the goal is ambitious yet achievable. But, most of all, ***keep it simple***. Like your idea, your goal should be easy to explain to potential employees, financial sources, etc. The easier your idea is to explain, the easier it will be to achieve.

Get information and feedback on your idea

Once you have set a goal, you must learn as much as you possibly can about the industry or the market. You can do this by examining your competition, by talking to potential customers, and by taking advantage of the many other sources of information available in the area.

Examine your competition

Finding out what your competition does to stay in business can be one of the most important forms of market research that you will ever conduct. Read your competition's literature.

Your competitor is in business for a reason. You must find out what that reason is and what's going to make the competition's customers come to your business and buy your product or service instead of theirs.

You don't have to reinvent the wheel. If a competitor is doing a good job, why not take the best of his ideas and throw in a few of your own?

Ask your family, friends and co-workers: "What do you think of this?" They will be glad to help most of the time.

Seek out the competition and find out what you are up against in the marketplace. Is there room for another competitor in your community? Is there a profit potential or will another competitor be too much competition to make a profit?

Talk to customers

Successful businesses all seem to have at least one thing in common. Business owners continuously conduct the most basic of all forms of market research — they talk to customers.

Talk to potential customers about your idea. If you speak enough with potential customers, you will develop a vision of what is needed in the community. You can tailor your product or service to meet that need.

You really need to tune in to your customers — where they are, who they are, and what makes them buy. You need to know why they are buying, what they are buying now, if they'll actually buy your product or service, and how that fits into your scheme of things. If you don't attract and hold customers, you're not going to be in business very long.

You can't just do what you want to do and what you feel. You have to listen to your customers. Listening to your customers is the way to make a fortune. When you talk to your customer about your idea, don't approach it as a simple "yes or no" proposition. Be prepared to adjust your thinking about your product or your service as you go along. Use the information you've gathered to figure out ways to be better. You've got to be different, and you've got to be better if you want to succeed.

Now that you have thought long and hard about whether your idea can be turned into a successful business, you need to ask yourself ***why*** you want to go into business.

Do you have the characteristics to become a successful business owner? Have you realistically looked at the advantages and disadvantages of owning a business? Are you aware of some of the common problems faced by small businesses? These are questions you must ask yourself before, not after, the business has started.

Are You Ready to Start Your Own Business?

One of the first steps that you should take before deciding to go into business is to determine why you, the prospective owner, want to go into business. Have you realistically calculated the advantages and disadvantages of owning a business? Do you have many of the essential characteristics of a successful business owner? Are you ready to handle the common types of problems faced by small businesses? Are you ready to make the commitment and take the risks? Are you sure that this is what you really want? These are important questions that you need to ask yourself.

Advantages & disadvantages of owning a business

Advantages:

1. Being the boss
2. Direct involvement in all business decisions
3. Close contact with people (customers, employees, etc.)
4. Potential for higher income
5. Independence and personal satisfaction
6. Creative opportunity

Disadvantages:

1. Vulnerability to economic changes
2. Long business hours, possibly few vacations
3. Necessity to be competent in most areas of business
4. Greater financial risk
5. Responsibility for employees, creditors, customers, etc.
6. Having to meet obligations when inconvenient
7. Frustrations from customers, suppliers, government, etc.

Profile of a successful business owner

Successful business owners are known to have certain general attributes and characteristics that distinguish them from other people. These characteristics do not guarantee success in business, but acquiring them can increase the probability of success. You may not have all the experience necessary for starting a business, but you have to be willing to learn. Concentrating on and developing the characteristics and actions of successful business people can improve the odds of success in your new business.

Below are several major questions concerning a business owner's characteristics and attributes. Take time to answer these questions honestly. If the majority of answers are "yes," then you probably have what it takes to start and run your own business. If your answers are "sometimes" or "no," it is suggested that you choose partners in your business who are strong on your weak points. Having a business team with strengths and characteristics that compliment and match yours can be a deciding factor in the success of your business.

1. Drive and perseverance: Do you have the drive, persistence, and ambition to achieve and grow? Are you completely committed and determined to attain your goals? Do you strive to achieve excellence? Do you seek and take initiative? Are you a leader? Do you have a high level of self-confidence? Are you a hard worker? Do you have a low need for status and power? Do you have good health and an enormous amount of energy?
2. Responsibility and risk: Are you willing to accept complete responsibility for yourself and your business? Do you take charge of things and see them through? Are you willing to assume risk (financial, career, family)?
3. Human relations and management skills: Do you get along well with others? Do you level with people and say what you mean? Are you trustworthy and reliable? Do you have patience? Do you have the ability to organize well? Can you make quick and confident decisions? Do you have a tolerance for ambiguity, stress, and uncertainty? Are you aware of your strengths and weaknesses, as well as your partners'? Do you have good communication skills? Do you carefully read and understand important papers and documents before signing them? Do you seek and use feedback from your past actions?
4. Mental ability and technical knowledge: Do you have a "nose" for business? Are you creative and innovative? Do you have analytical skills? Do you have a "head" for numbers? Do you know or are willing to learn the technical aspects of your business?

Successful business owners are not gamblers. They view challenges as opportunities rather than risks. They can recognize an opportunity and know how to take advantage of it.

Successful business owners are fanatics about fundamentals. They pay dogged attention to their firms' finances, operations and the external forces that affect them. They have the ability to think like their customers and cannot put up with bureaucracy. One of the predominant traits of successful business owners is perseverance to the point of obsession. They demonstrate extraordinary motivation, tenacity, and will to succeed.

Business owners that win have vision, boundless energy, intellectual creativity and patience. They have confidence in themselves, their business, their employees and the community.

Common problems faced by small businesses

1. Owner's inexperience in business management
2. Too much debt — business too highly leveraged
3. Weak competitive strength
4. Lack of proper inventory controls
5. Lack of proper credit or collection controls
6. Low sales volume
7. Poor business location
8. Owner's lack of bookkeeping knowledge
9. Employee and labor problems

Utilize all available local resources when making your determination about the viability of your business idea. There are trade associations, government agencies, colleges and universities. Your community has a vested interest in your success.

While it is important to understand that 50 percent of all start-up companies fail in the first year, it's equally important to understand that with proper planning, yours does not have to be one of them.

Glossary of Terms and Phrases

G-1 – G-7

Actual span — Distance from edge of thumb hole nearest to center, to edge of finger holes nearest to center, including all inserts and/or grips. *(See also:* **True span, full span)**

Angle of entry — Angle, measured parallel to the boards, at which the bowling ball hits the pocket after completing its path down the lane.

Arc — Ball path from foul line to headpin that does not have a sharp, defined break point

Axis of rotation — Imaginary line, perpendicular to the track, along which a bowling ball rotates during its path down the lane

Axis point — One of two points located on opposite poles marking the endpoints of the axis of rotation.

Axis tilt — Angle between axis of rotation and the horizontal plane — caused by the bowler at the release, represents an angle of the axis rotation above a horizontal line through the middle of the ball.

Axis rotation — The degree that the bowler's axis is rotated in the horizontal plane towards the bowler at release.

Axis weight — Method of drilling in which the weight block is positioned so that its mass is evenly distributed around the axis of rotation. *(aka: pin on the axis)*

Back of hole — Portion of hole facing away from the center of the grip.

Backend — Fifteen feet of lane directly preceding the headpin.

Backup ball — Style of bowling in which the movement of the ball is from left to right for right-handers and from right to left for left-handers.

Balance hole — A hole placed in the ball (usually on the bowler's vertical axis line) to bring a ball back into ABC legal specifications.

Ball reaction — Change in direction of the ball's path.

Bevel — Rounded edge of any hole drilled in a bowling ball.

Blister — Raised sac under the skin's epidermis containing watery fluid, caused by irritation to the area.

Boards — Any one of 39 individual strips of wood pieced together to comprise the surface of the lane.

Bottom weight — Imbalance in which the half of the ball opposite the center of the grip weighs more than the half containing the center of the grip.

Break point — Point in the trajectory of a bowling ball at which the ball makes its greatest change in direction.

Bridge — Distance between the finger holes.

Caliper — A graduated rule with one sliding jaw and one that is stationary.

Callus — Thickened, hardened area of skin caused by build-up due to friction against the skin.

Carry down — Oil moved down the lane by the passing of bowling balls.

Center of gravity — That point in a body or system around which the whole mass is concentrated and may be assumed to act. The point on the surface of the bowling ball where static balance is zero in all directions on a do-do scale — usually marked by a logo.

Center line — Vertical line between the fingers and through the middle of the thumb.

Center line transposition (CLT) — Lateral shift of the center line, after drilling thumb first.

Conventional grip — Grip in which the bowler places his/her fingers in the ball to the second joint at a 90° angle, while placing his/her entire thumb in the ball.

Cosmetic bevel — Bevel at the extreme top of the hole which provides a neat appearance to the finished hole.

Coverstock — Outer shell of the bowling ball (composition varies).

Cranker — Bowler who generates revolutions by a cupped wrist, bent elbow or muscled arm-swing.

Cut-span/ cut-to-cut span — Distance from edge of thumb hole nearest to center, to edge of finger holes nearest to center, excluding all inserts and/or grips. *(See also:* **Edge span/edge to edge span**)

Deflection — Amount of displacement incurred in a bowling ball's trajectory after making contact with a headpin.

Degree of oval — Degree of oval of a hole will be to the center line measured on a horizontal line from the center of the thumb hole.

Differential of radius of gyration — Differences in low RG and high RG values of any bowling ball.

Dropped ring finger — A fit in which the ring finger span is intentionally shortened to be less than the middle finger span.

Dull finish *(less than 600 grit)* — Surface of a bowling ball appearing without reflection (unpolished). In general, a dull bowling ball is one in which the pours are open and clean.

Durometer — Device used to measure the hardness of a bowling ball.

Dynamic imbalance — Measure of weight in an object in motion.

Dynamics — Characteristics of the mass inside a bowling ball.

Edge span/edge to edge span — Distance from edge of thumb hole nearest to center to edge of finger holes nearest to center, excluding all inserts and/or grips. *(See also:* **Cut span/cut to cut span***)*

Equator — Line around the ball, perpendicular to the vertical axis and the midline covering the entire circumference of the ball.

Finger tip — Style of grip in which the bowler inserts fingers to the first joint, with the combined total of angle of the two joints equaling 90°, while placing the entire thumb in the ball.

Finger weight — Imbalance which effectively makes the side of the ball, divided by the midline, containing the finger holes, heavier than the side containing the thumb.

Flare — Refers to the bowling ball changing its axis of rotation while seeking its preferred spin axis during its path down the lane. The result is several distinct oil rings being visible around the ball. *(See also:* **Track flare***)*

Forward pitch — The drilled hole, either finger or thumb, is angled toward the midline (center) of the grip.

Friction — The resistance to motion of two moving objects or surfaces that touch.

Front of hole — Portion of the hole facing toward the center of grip.

Full roller — A bowler whose track passes between the thumb and fingers and whose track measures the circumference of the ball.

Full span — Distance from edge of thumb hole nearest to center to edge of finger holes nearest to center, including all inserts and/or grips. (*See also:* **True span, actual span***)*

Functional bevel — Any bevel on the ball produced to create a smooth edge or release of pressure on any part, or all, of a hole.

Gravity — Force that tends to draw all bodies in the earth's sphere toward the center of the earth.

Gripper/squeezer — Someone who holds on to the ball with excessive force.

Heads — Portion of the lane from the foul line to the range finders which are generally located 15 to 18 feet down the lane.

High performance balls — Balls designed to create specific reactions for different bowlers.

High track — A track outside of the thumb hole and finger holes that is no more than an inch from either.

Hinge angle — Angle at which the thumb is connected to the hand.

Hit the ball — Acceleration of the hand around the ball, from bottom to side, at the release point.

Hook — Amount, measured in boards and angle, that a bowling ball deviates from its original trajectory in its path down the lane.

Hook angle — Angle at which the bowling ball changes direction at its break point.

Hook potential — Degree to which the properties designed into a bowling ball aid in its potential to traverse boards during its path down the lane.

Horizontal axis measurement — Distance, measured perpendicular to the centerline of the grip, along the midline, at which the positive axis point is located.

Imbalance — Displacement of the center of gravity from the geometric center of a bowling ball.

Inside — The portion of the lane bounded by ten boards on each sides.

Label shift — Displacement of the label from the center of the grip.

Lateral pitches — Right and left components of hole angle in any drilled bowling ball.

Leverage position — In bowling, it is the position at which the bowler is able to use his body to create rotation, speed and momentum on the bowling ball.

Leverage weight — A drilling in which the center of the weight block is placed at a 45° angle to the axis of rotation.

Line — Intended path of the ball down the lane.

Loft — Distance the ball travels before actually making contact with the lane surface.

Low track — A track outside the finger holes and thumb hole, but more than two inches from either.

Mark — Point on the lane at which the bowler is aiming.

Mass bias — Weight in a particular area of the ball.

Midline — Line that perpendicularly bisects the center line of the grip. A horizontal line halfway between the fingers and thumb.

Moment of inertia (I_M) — Amount of force required to spin an object.

Negative weight — Imbalance which causes thumb, negative side or bottom weight.

Negative side weight — Imbalance in a ball that effectively makes the left side of the ball heavier for right- handed release players, and the right side of the ball heavier for left-handed release players.

Normal callus — Hard, thickened area on the skin caused by unusual pressure.

Oval angle —The degree of oval above the horizontal axis.

Ovaled — The shape of a hole being out of round.

Pathological callus — Hard mass of skin surrounded by an inflamed rim.

Pie Chart Formula — Theory that breaks fitting a ball to the bowlers hand in to three parts — span, pitches and hole sizes. The standard starting percentages being 40% span, 40% pitch, and 20% hole sizes.

Pin — A small round discoloration on a bowling ball that marks the top of the core/weight block.

Pin action —The manner in which the pins react to the impact of the bowling ball.

Pin shift — The process of creating reaction in a bowling ball by displacing the pin from the axis of rotation or the PAP.

Pitch — The angle at which a hole is drilled into a bowling ball in relationship to the center of the ball.

Pivot point — Point on the ball's surface where all track lines intersect.

Positive axis point (PAP) — Point on the surface of the ball that is the end of the bowlers axis of rotation, on the positive side of the ball

Positive weight — Imbalance which causes finger, positive side or top weight.

Positive side weight — Imbalance that effectively makes the right side of the bowling ball form the center of grip heavier than the left for right handed release player, and left side of the ball heavier than the right for left handed release player.

Preferred spin axis — The axis about which the bowling ball wants to rotate.

Radius of gyration (Rg) — An account of the distribution of the mass in an object.

Release point — Point in the delivery at which the ball leaves the hand.

Reverse pitch — The drilled hole, either finger or thumb, is angled away from the midline (center) of the grip.

Reverse block — A lane condition in which the inside portion of the lane is covered with less conditioner than the outside.

Revolutions — The number of times the bowling ball makes a complete rotation about its axis during its path down the lane.

Rotational energy — Spin or revolutions of the ball caused by the bowler. (*See also:* **Angular velocity**)

Safe zone — The area on the ball from one inch inside the vertical axis line to a line from the bowlers PAP to the ring finger and from the PAP to the equator, in which the pin of a ball can be placed safely without the track and holes interfering with one another.

Semi tip — A grip in which the bowler places his/her fingers in the ball between the first and second joint while placing the entire thumb in the ball. (Not a recommended grip pattern)

Shell — The outer portion of a bowling ball surrounding the core.

Shiny — A ball that looks glossy. In general, shiny balls have fewer open/exposed pours.

Skid — The portion of the bowling ball's path in which the velocity of the contact point on the ball is greater than zero and the ball is therefore actually not rolling but is instead sliding down the lane.

Snap — A ball path which has a sharp, defined breakpoint. However, when referring to the actual break point, the term snap is often used as a quantifying term.

Span — Distance from edge of thumb hole nearest to the center, to the edge of finger holes nearest to the center.

Squirt — The action of a bowling ball as it hydroplanes past its breakpoint.

Stacked leverage — A layout where the pin and CG are the same distance from the bowler's positive axis point.

Static weights — Measurements of forces at work in systems that are at rest — side, finger and top.

Stroker — Someone who has smooth swing and delivery without sudden acceleration.

Surface — The texture, both finish and hardness, of a bowling ball.

System of Bowling (SOB) — USBC regulations concerning balls, pins, lanes and dressing distribution.

Tapered — Any hole in which the upper diameter of the hole is larger than the bottom.

Thumb weight — An imbalance in a bowling ball which effectively makes the half of the ball containing the thumb heavier than the half containing the fingers, separated by the midline.

Track — Area of bowling ball that makes contact with the surface during its path down the lane. Because of revolving motion, this area is usually in the form of a ring or rings around the ball.

Track flare — The result of the migration of a bowling ball from the bowler's axis of rotation to the ball's preferred spin axis.

Track flare management — The regulation of the position of the flare intersections and thus the amount of flare.

Traction — The power, as of tires on pavement, to grip or hold to a surface while moving, without slipping.

Translational energy — Created by the ball traveling down the lane towards the pins.

True positive axis point (True PAP) — The axis point for a bowler taken from a ball with minimum track flare potential.

True span — Distance from edge of thumb hole nearest to center, to edge of finger holes nearest to center, including all inserts and/or grips. *(See also:* **Full span, actual span***)*

Vertical axis line/Midplane — A line perpendicular to the midline that passes through the bowler's positive axis point and the negative axis point when extended completely around the ball. Separates top of ball from bottom of ball on the bowler's axis of rotation.

Vertical axis measurement — The perpendicular measurement from the midline to the bowlers PAP.

Weight block — Traditionally, the dense part(s) of material found in the interior of a bowling ball.

Weight hole — *See Balance hole*