1. WHAT IS FLARE?
   a. It is a migration of axis points to seek a stable position. (see illustration)

2. WHAT CAUSES FLARE (or a ball to seek its preferential or stable axis)?
   a. A differential in energy between the North and South vs. the East and West planes of the core.

3. WHAT DETERMINES THIS ENERGY AND HOW IT IS MEASURED?
   a. The energy along each plane is developed through shape and density - each contributing to the energy of the plane.

   b. The energy is measured by the amount of force and time it takes to make a revolution - in other words, how much effort is required to move the ball one revolution. This is called the Radius of Gyration (R of G).

4. HOW DOES THIS ENERGY (R of G) CORRELATE TO THE PERFORMANCE CHARACTERISTICS OF THE BALL, RELATIVE TO THE BREAKPOINT AND BACKEND REACTION?
   a. The East/West plane predominantly dictates the ease of which the ball will spin (spin rate) off the bowler's hand. The North/South plane dictates the amount of backend reaction. Therefore if the East/West plane or the X-axis has a low R of G, the ball will rev easy and not be sensitive to the oil in the heads. If the X-axis has a high R of G it will save energy and skid more readily on oil. Just the opposite applies to the North/South plane or the Y-axis. If the R of G is low along this axis, the backend will be less violent or nonexistent. But if it is high, the energy will release much later and produce a more pronounced reaction.

5. WHAT ROLE DOES FLARE PLAY & HOW DOES IT RELATE TO R of G?
   a. Flare adds traction. Each track is a new surface, thus it has more friction than the previous track because the previous track rolled over an earlier part of the lane (which in most cases contains more oil.) R of G along the X and Y axis will determine how much flare there will be and when it will begin to flare. The difference between the X and Y axis determines how much flare the ball will have. The X axis will dominate in determining where on the lane the flare will begin.

6. WHAT IS CERAMICS?
   a. Any material formed under pressure and fired to remove all binding material (epoxy, etc.). Several popular materials are: Iron Oxide, Zinc Oxide and Aluminum Oxide.

7. WHY USE CERAMICS?
   a. Placing ceramics in the core of a ball improves the ball's hitting power by raising the coefficient of restitution (C of R). This is the amount of energy transferred from the ball to the pin. It hits harder because no energy is reabsorbed by the ceramic part of the core. Non-ceramic core balls absorb energy from the pin at contact.
   b. Fired ceramics are not drillable thus they cannot be altered during drilling. What you start with is what you end with. Millable or alloy type ceramics consist of ceramic powder mixed with a binding agent and made at the ball manufacturing plant. This is than placed in the core and is much softer and less adhesive than fired ceramics. Millable or alloy ceramics absorb energy rather than repel it, thus they have a lower C of R than fired ceramics.
   c. By placing ceramic cores in outer cores, we can significantly alter the R of G along one of the axis without any substantial change to the other axis. We also can control the flare (differential) more easily and it becomes more predictable.

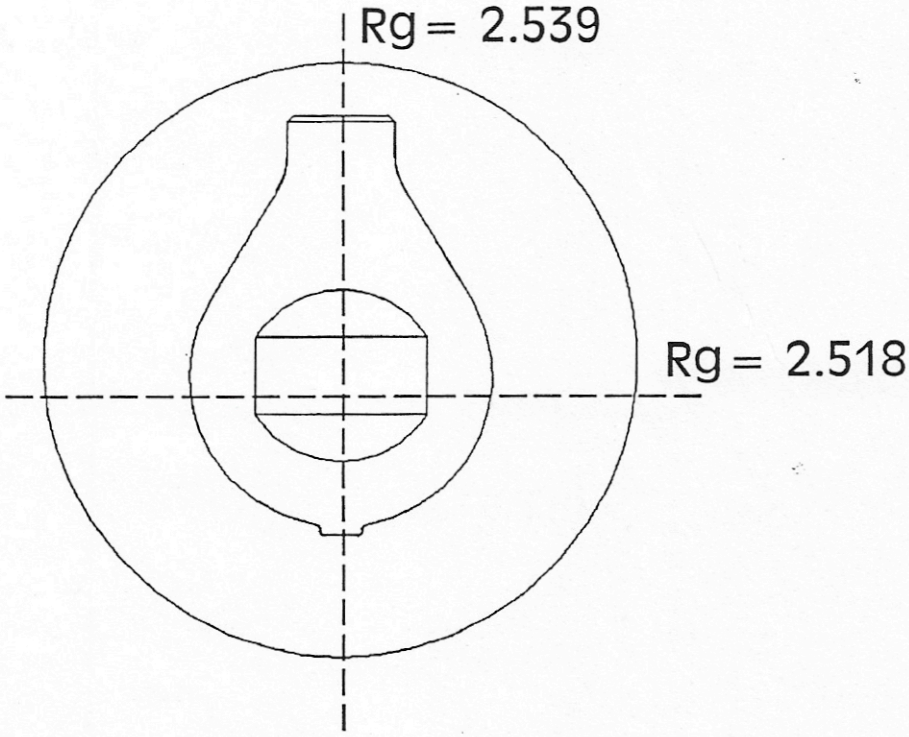
8. WHAT ROLE DOES CERAMICS PLAY IN BALL PERFORMANCE?
   a. The average non-fired ceramic ball or non-ceramic ball, has a C of R of between 70-72%, that is the amount of energy transferred from ball to pin. Ceramic (fired) core powered balls average between 3-5% higher which equals about 2 to 3 more strikes per league session or 12 to 18 more strikes per PBA event. This in one reason why ceramic balls have won 12 out of 16 tournaments during the Winter Tour.

<u>Coefficient of Restitution:</u>

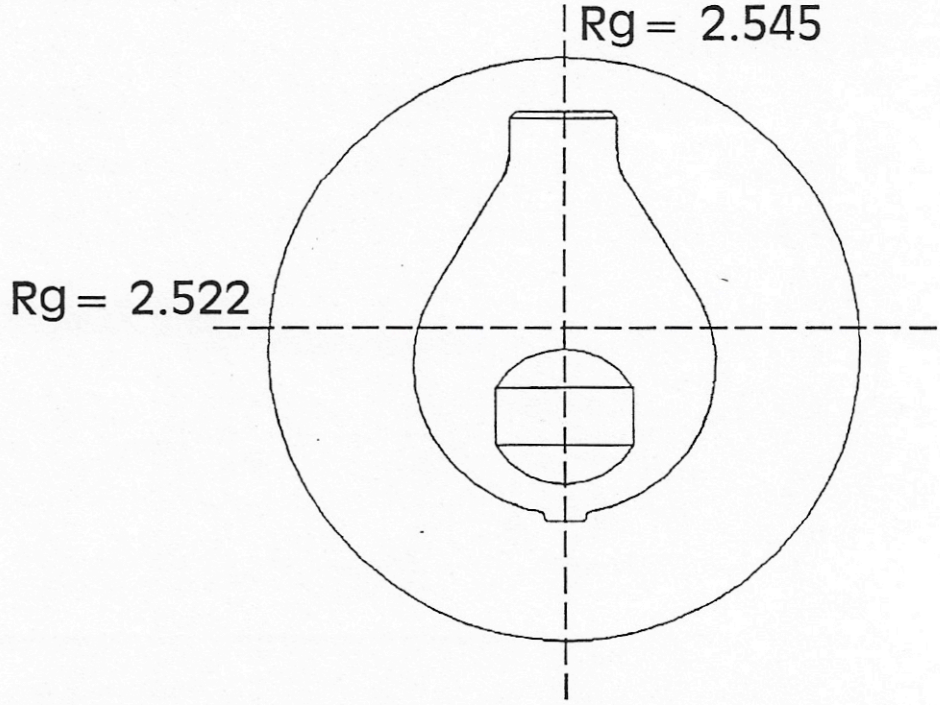
Critical Mass	= 74%
Code Red	= 73%
NRg	= 76%
Sensor II	= 75%

*** Note- the maximum legal (ABC) limit is 78%

CORE ANALYSIS

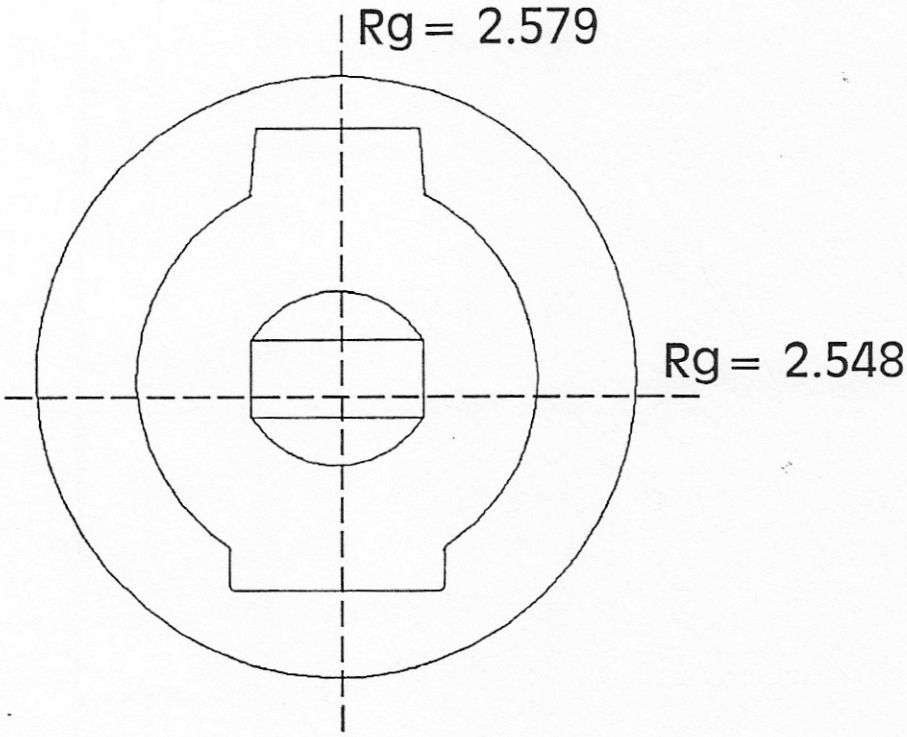


CRITICAL MASS
differential = .021

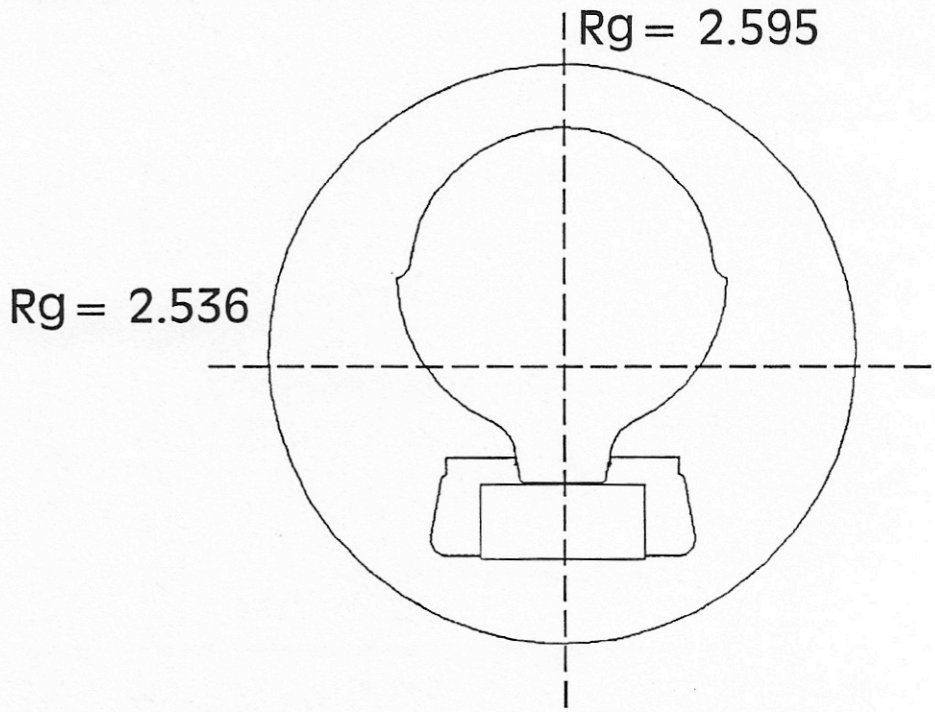


SENSOR II
differential = .023

CORE ANALYSIS

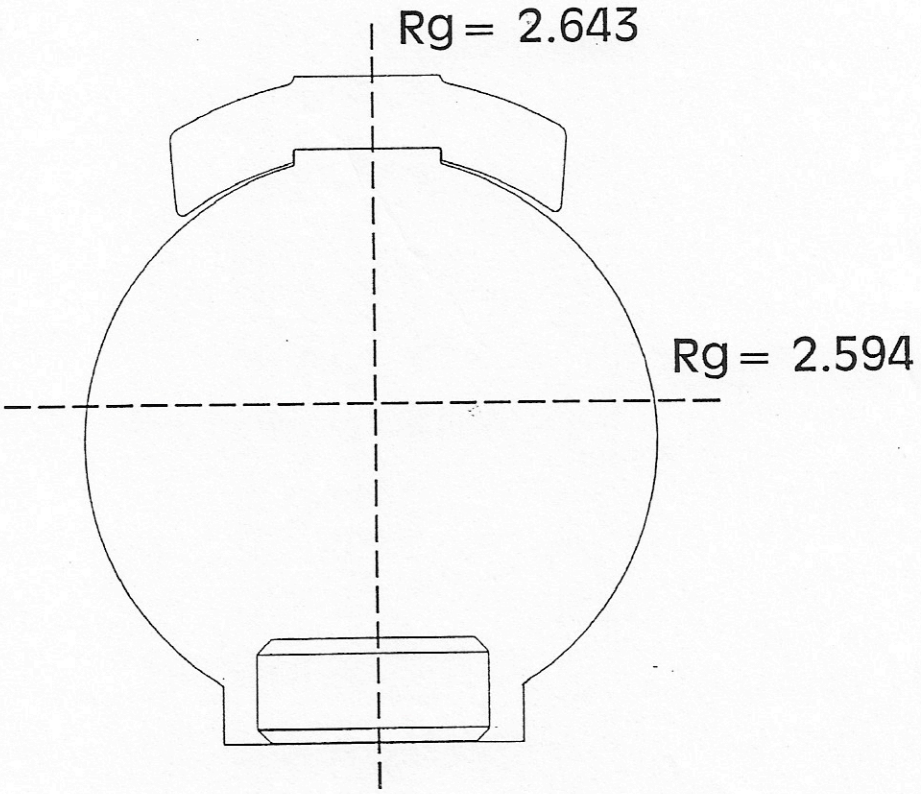


CODE RED
differential = .031



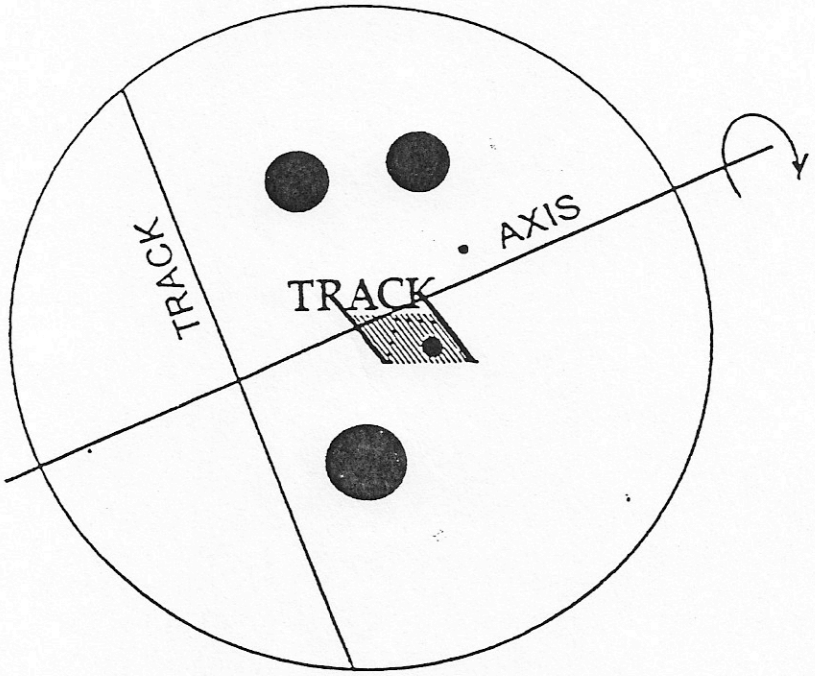
NRg
differential = .059

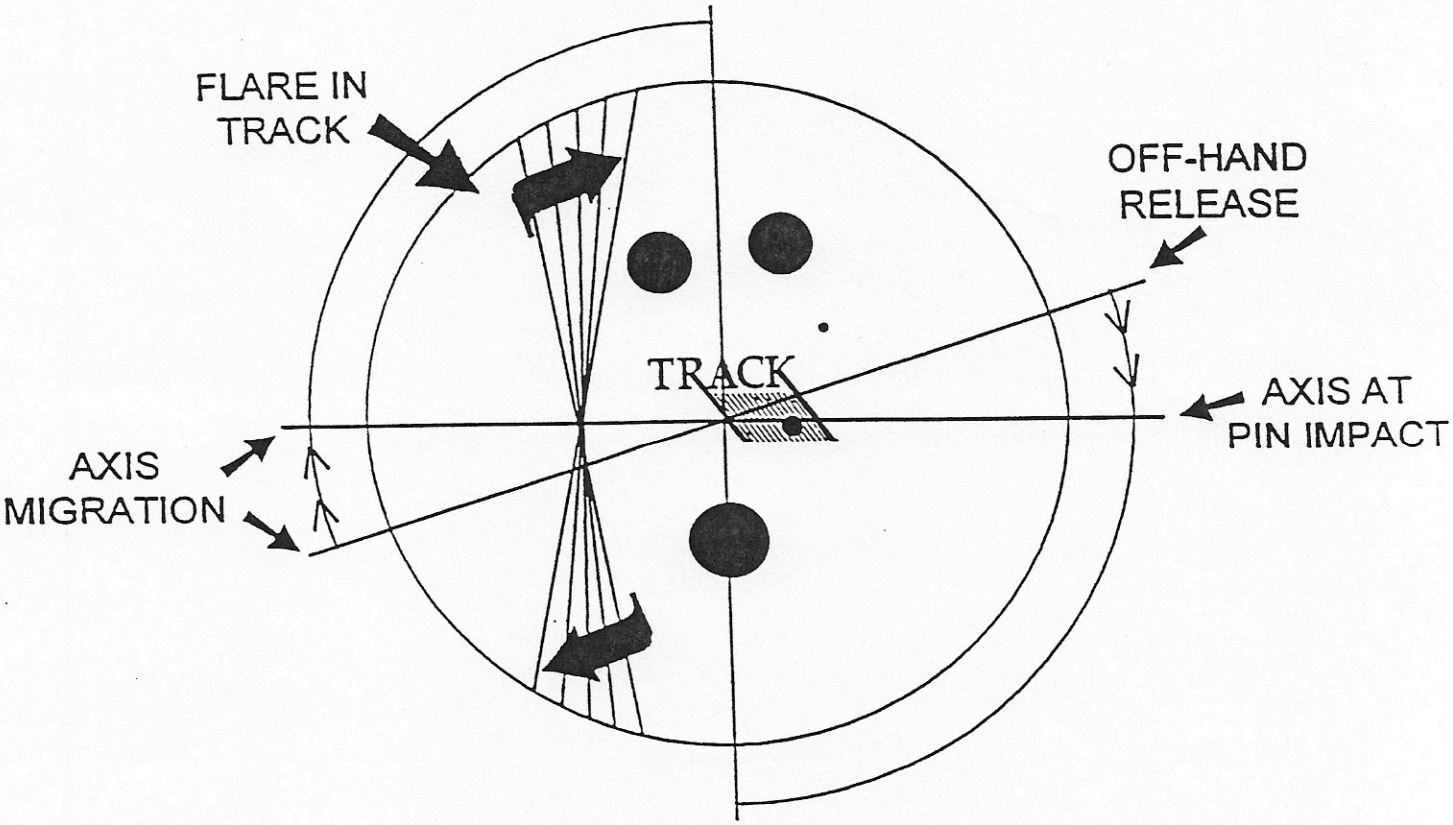
CORE ANALYSIS



FLARE
differential = .048

TRACK FLARE ILLUSTRATED





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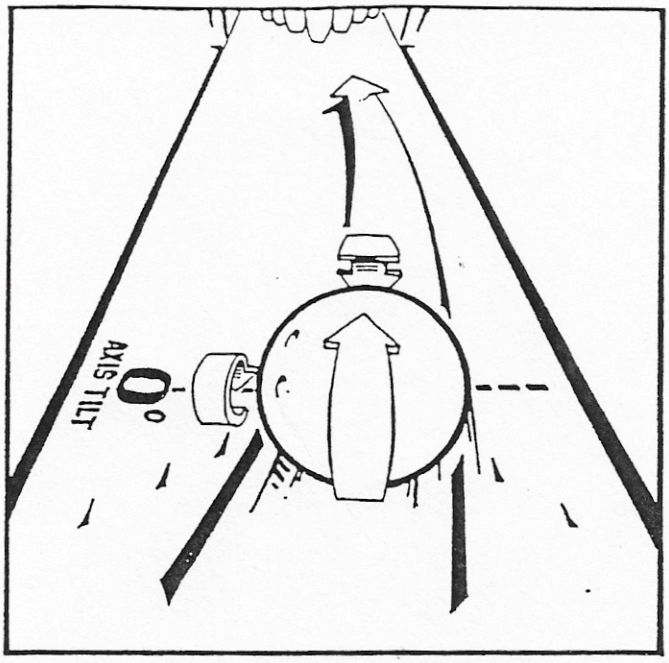
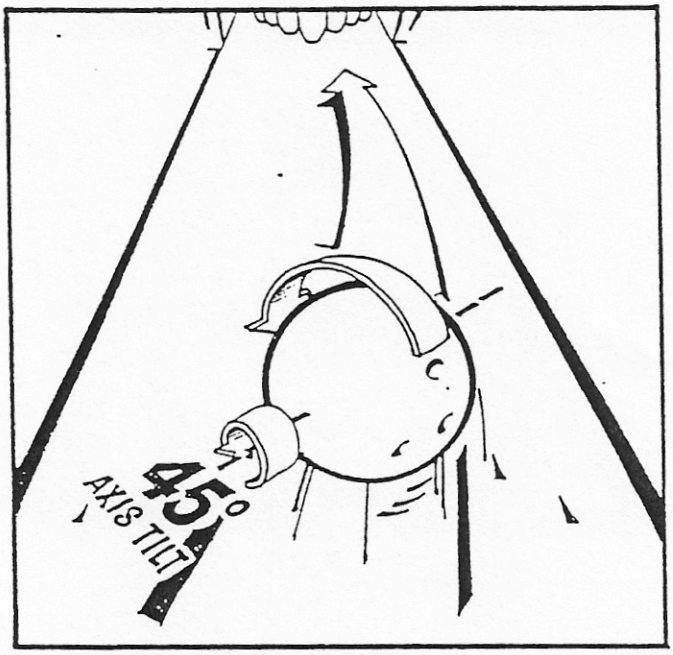
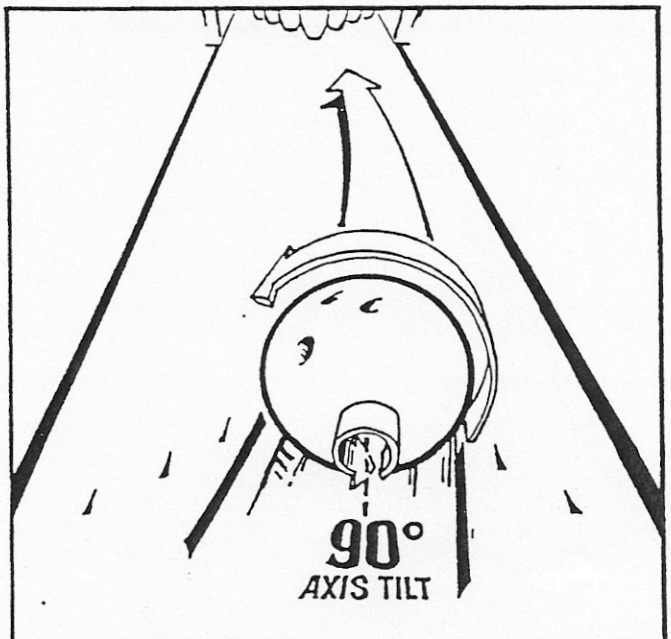
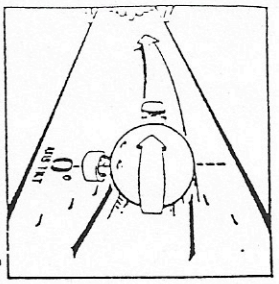

0°
AXIS TILT


45°
AXIS TILT


90°
AXIS TILT

TRACK INC

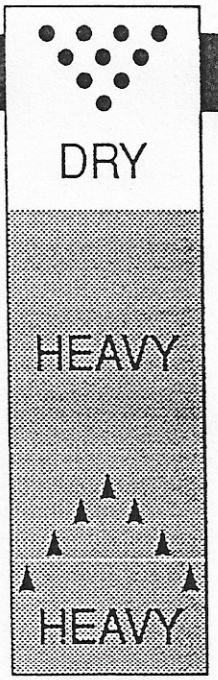


Forward Roll with Minimal Axis Tilt

Drilling Types conducive to roll: 1) Positive Weights
2) Label or Leverage Type

Ideal Condition: Wet / Dry

DRILLING RECOMMENDATION #1

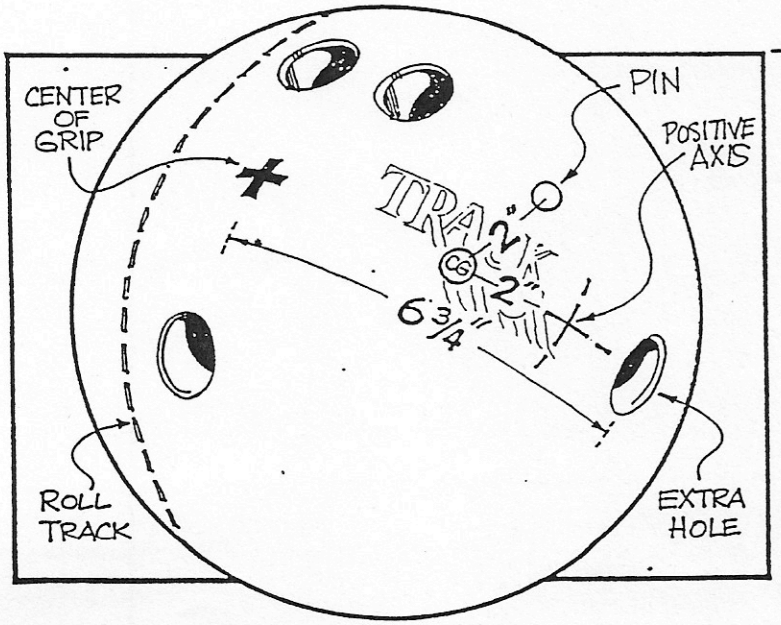


FIRST CONDITION:

Heavy oil in Heads and Pines,
Dry Back Ends

IDEAL ROLL PATTERN:

Unstable Drilling

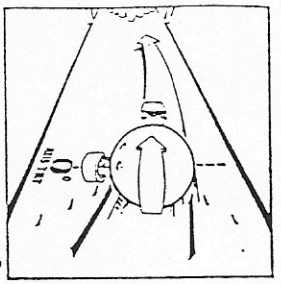


Ball Choice: NRg™ or similar
Pin 1" - 2" out

Top Weight: 3.0 - 3.5 oz.

Position pin at 12:00 from CG, position CG 2 inches from positive axis. Drill extra hole 6-3/4 inches from grip and bring back to 1/2 positive.

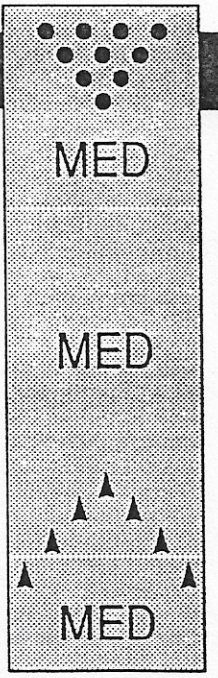
TRACK INC



Forward Roll with Minimal Axis Tilt

Drilling Types conducive to roll:	1) Positive Weights 2) Label or Leverage Type
Ideal Condition:	Wet / Dry

DRILLING RECOMMENDATION #2

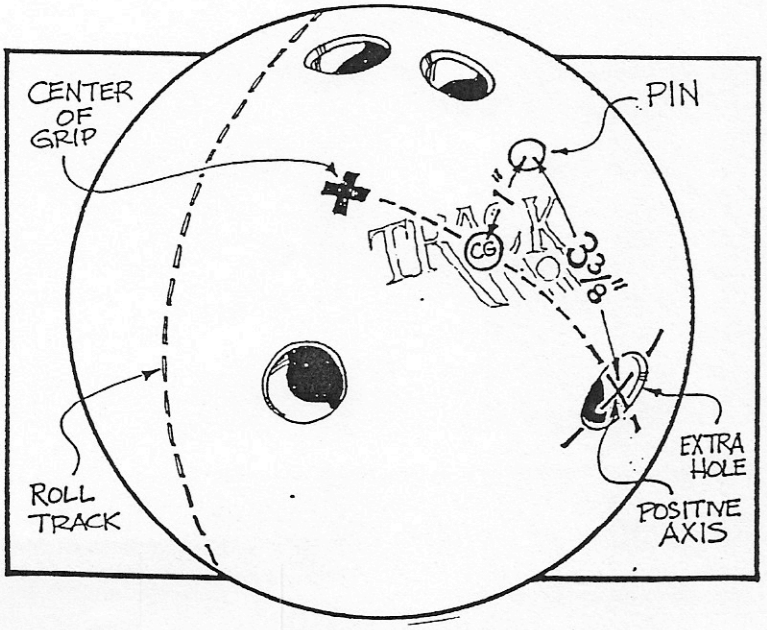


SECOND CONDITION:

Medium oil in Heads and Pines, with moderate carrydown.

IDEAL ROLL PATTERN:

Unstable Drilling

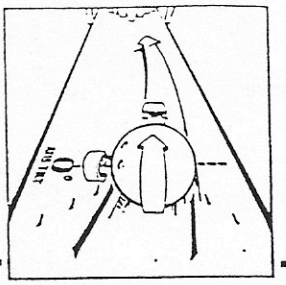


Ball Choice: NRg™ or similar
Pin 0" - 1" out

Top Weight: 3.5 - 4.0 oz.

Position pin at 12:00 from CG, position CG 3-3/8 inches from positive axis. Drill extra hole on axis point and bring back to 1/2 positive.

TRACK INC

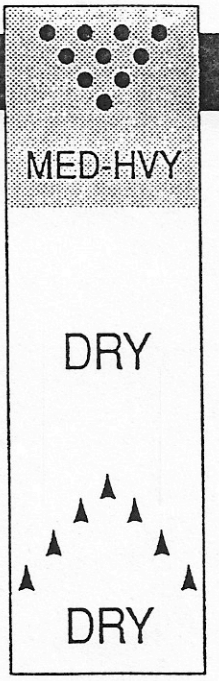


Forward Roll with Minimal Axis Tilt

Drilling Types conducive to roll: 1) Positive Weights
2) Label or Leverage Type

Ideal Condition: Wet / Dry

DRILLING RECOMMENDATION #3

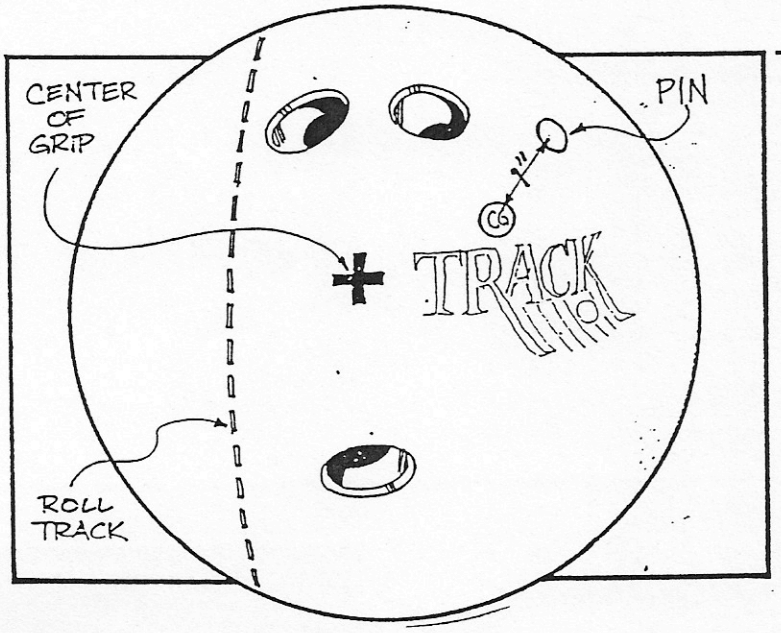


THIRD CONDITION:

Dry Heads and Pines with moderate to heavy carrydown.

IDEAL ROLL PATTERN:

Stable Drilling

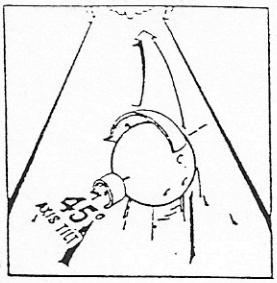


Ball Choice: Sensor™ or Sensor II™
Pin 0" - 1" out

Top Weight: 3.5 - 4.0 oz.

Position pin at 1:30 from CG, position CG to yield 1/2 positive side weight and 1/2 finger weight. No extra hole required.

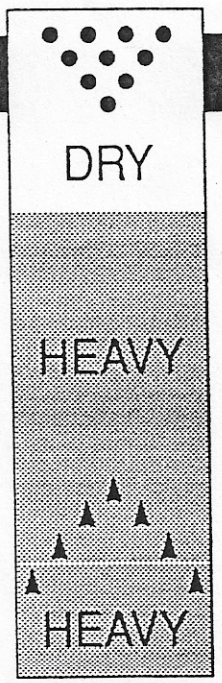
TRACK INC



Medium Roll with 45° Axis Tilt

Drilling Types conducive to roll:	1) Positive or Negative Weights 2) Label/ Leverage/Axis Leverage
Ideal Condition:	Blended Condition

DRILLING RECOMMENDATION #1

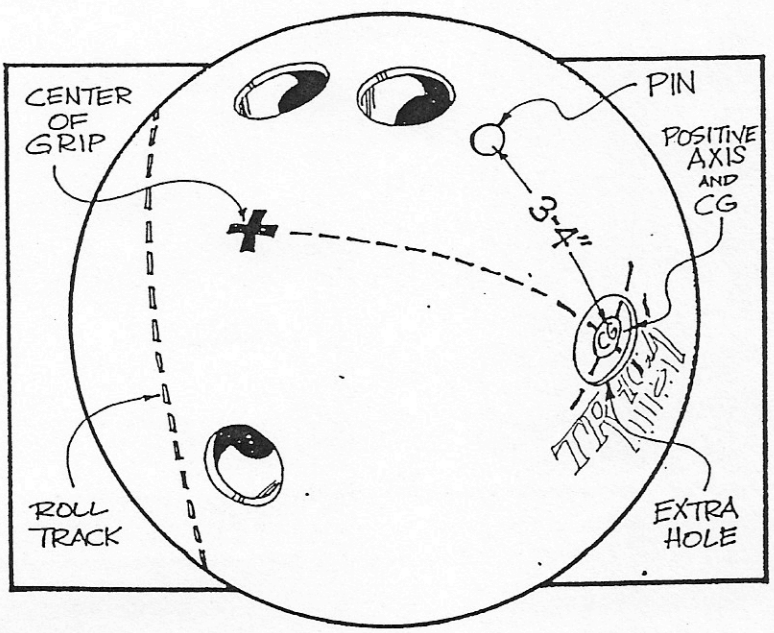


FIRST CONDITION:

Heavy oil in Heads and Pines,
Dry Backends.

IDEAL ROLL PATTERN:

Unstable Drilling

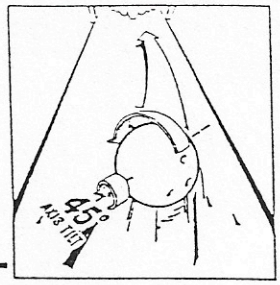


Ball Choice: NRg™ or similar
Pin 3" - 4" out

Top Weight: 2.0 - 3.0 oz.

Position CG on positive axis point with pin positioned at 1:30 from grip center. Drill extra hole on positive axis point (through CG), bring back to 1/2 positive.

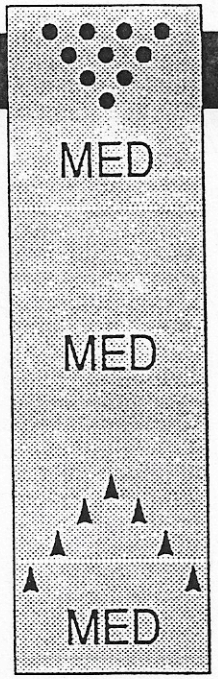
TRACK INC



Medium Roll with 45° Axis Tilt

Drilling Types conducive to roll:	1) Positive or Negative Weights 2) Label/ Leverage/Axis Leverage
Ideal Condition:	Blended Condition

DRILLING RECOMMENDATION #2

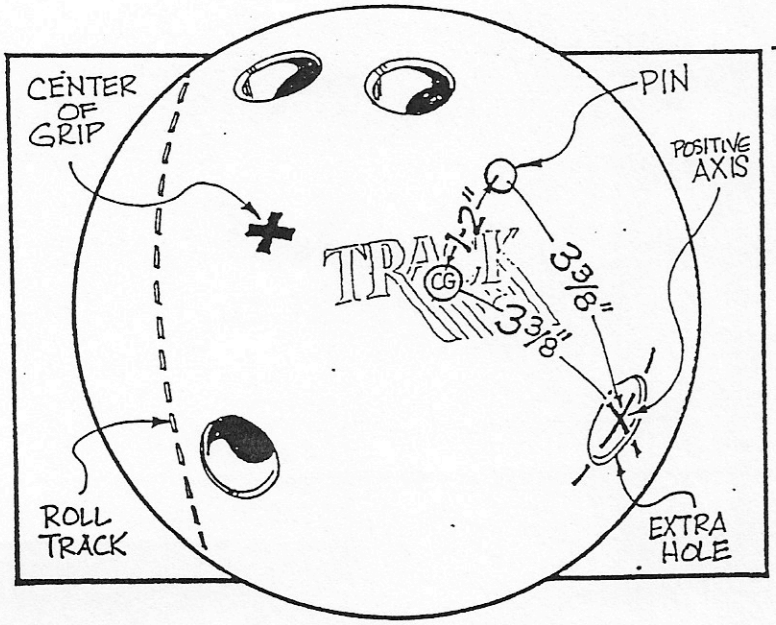


SECOND CONDITION:

Medium oil in Heads and Pines with moderate carrydown.

IDEAL ROLL PATTERN:

Unstable Drilling

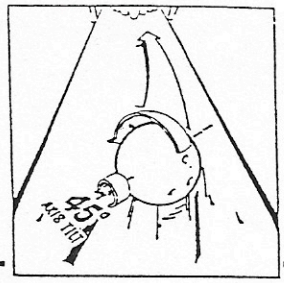


Ball Choice: NRg™ or similar
Pin 1" - 2" out

Top Weight: 3.0 - 3.5 oz.

Position pin at 12:00 from CG. Position CG 3-3/8" from positive axis. Drill extra hole on positive axis point, bring back to 1/2 positive. (Bring to 1/4 - 1/2 negative for earlier roll if desired)

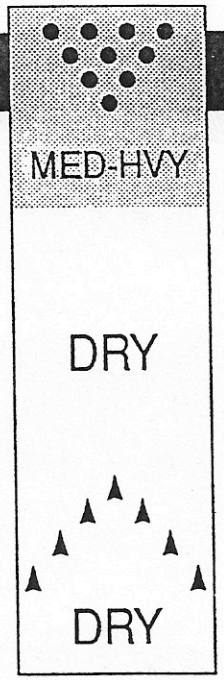
TRACK INC



Medium Roll with 45° Axis Tilt

Drilling Types conducive to roll:	1) Positive or Negative Weights 2) Label/ Leverage/Axis Leverage
Ideal Condition:	Blended Condition

DRILLING RECOMMENDATION #3

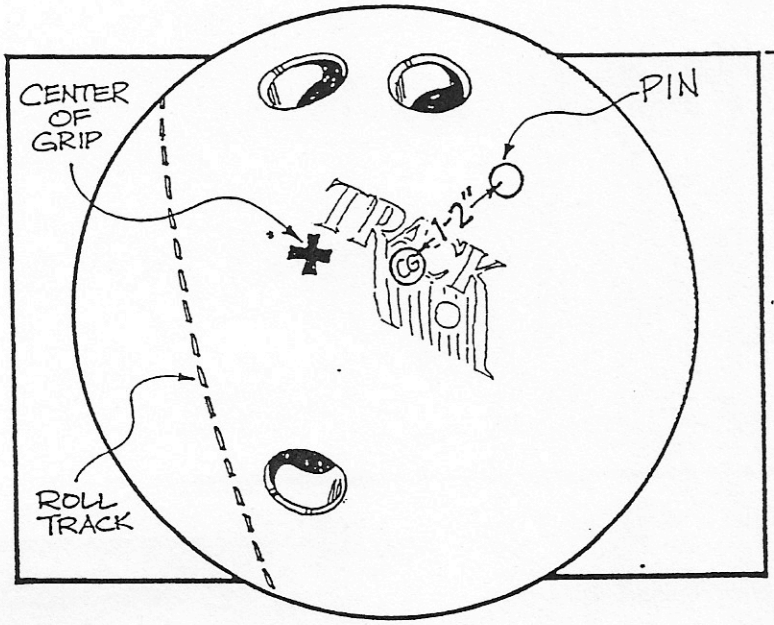


THIRD CONDITION:

Dry Heads and Pines with moderate to heavy carrydown.

IDEAL ROLL PATTERN:

Stable Drilling



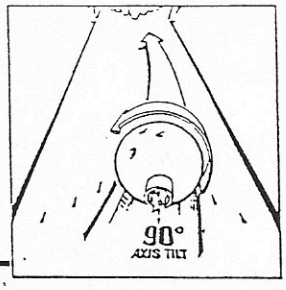
Ball Choice: Sensor II™ or similar

Pin 1" - 2" out

Top Weight: 3.5 - 4.0 oz.

Position pin at 1:30 from CG. Position CG 1/2 positive side. No extra hole required. (Select a "pin-in" ball for more length due to less track flare.)

TRACK INC

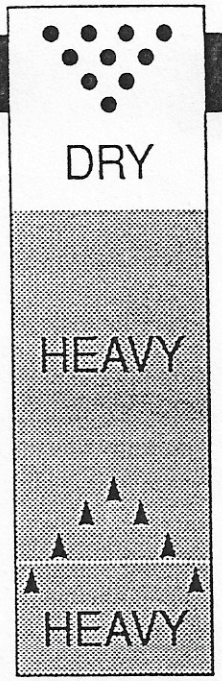


Maximum Side Roll with 90° Axis Tilt

Drilling Types conducive to roll: 1) Negative Weights
2) Leverage/ Axis Leverage/Axis

Ideal Condition: Hooking Heads with Heavy Carrydown

DRILLING RECOMMENDATION #1

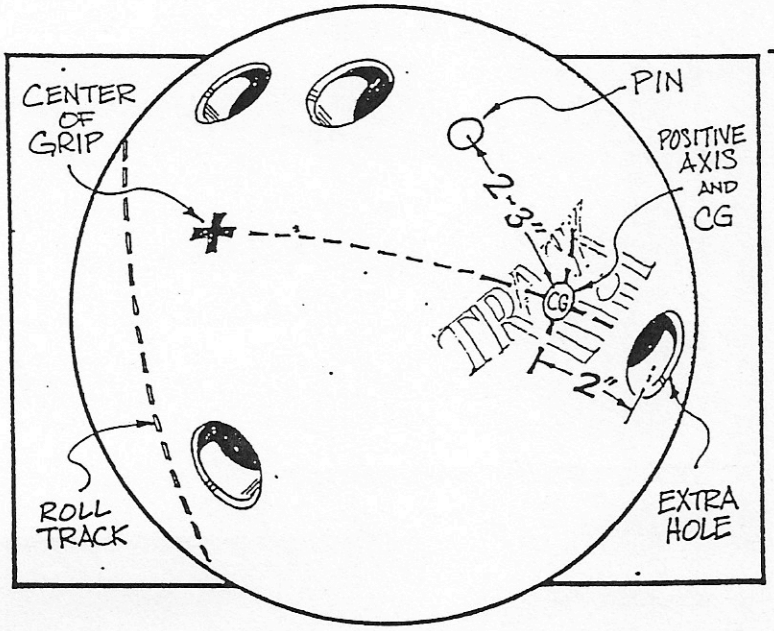


FIRST CONDITION:

Heavy Oil in Heads and Pines with Dry Backends.

IDEAL ROLL PATTERN:

Unstable Drilling

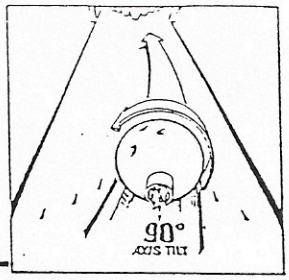


Ball Choice: NRg™ or similar
Pin 2" - 3" out

Top Weight: 2.0 - 2.5 oz.

Position CG on positive axis with pin positioned at 1:30 from grip center. Drill extra hole 2" past axis point and bring back to 0 sideweight.

TRACK INC

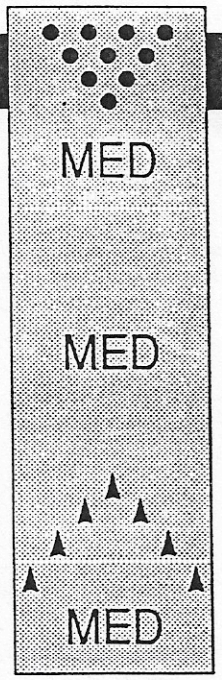


Maximum Side Roll with 90° Axis Tilt

Drilling Types conducive to roll: 1) Negative Weights
2) Leverage/ Axis Leverage/Axis

Ideal Condition: Hooking Heads with Heavy Carrydown

DRILLING RECOMMENDATION #2

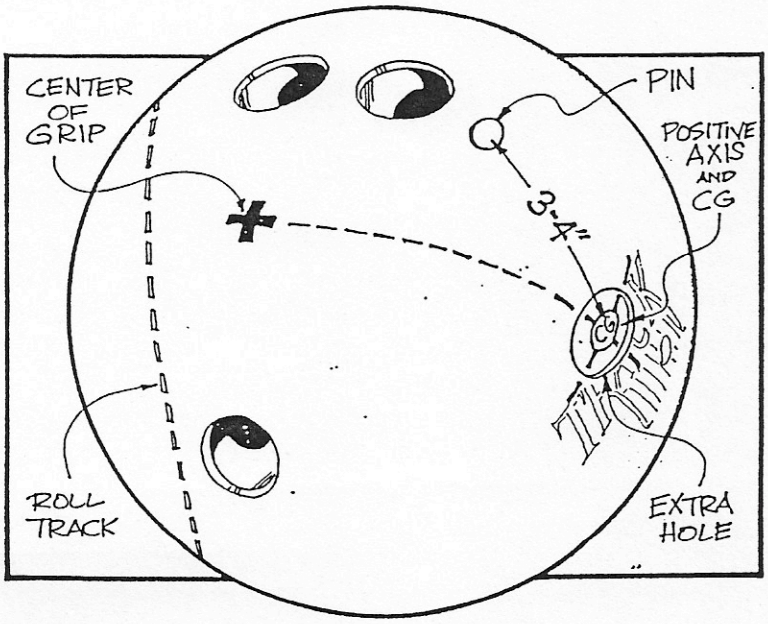


SECOND CONDITION:

Medium Oil in Heads and Pines with Moderate Carrydown.

IDEAL ROLL PATTERN:

Unstable Drilling

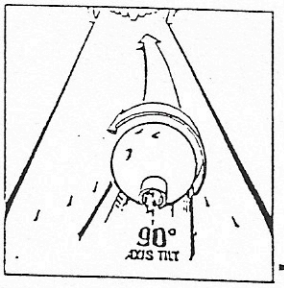


Ball Choice: NRg™ or similar
Pin 3" - 4" out

Top Weight: 2.0 - 3.0 oz.

Position CG on positive axis with pin positioned at 1:30 from grip center. Drill extra hole on positive axis (through CG). Bring back to 0 sideweight.

TRACK INC

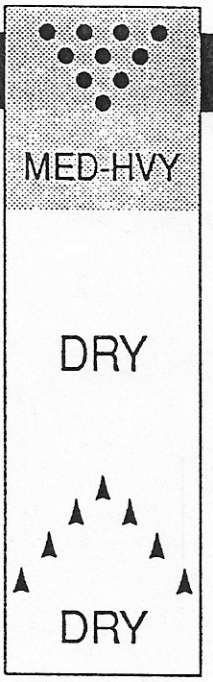


Maximum Side Roll with 90° Axis Tilt

Drilling Types conducive to roll: 1) Negative Weights
2) Leverage/ Axis Leverage/Axis

Ideal Condition: Hooking Heads with Heavy Carrydown

DRILLING RECOMMENDATION #3

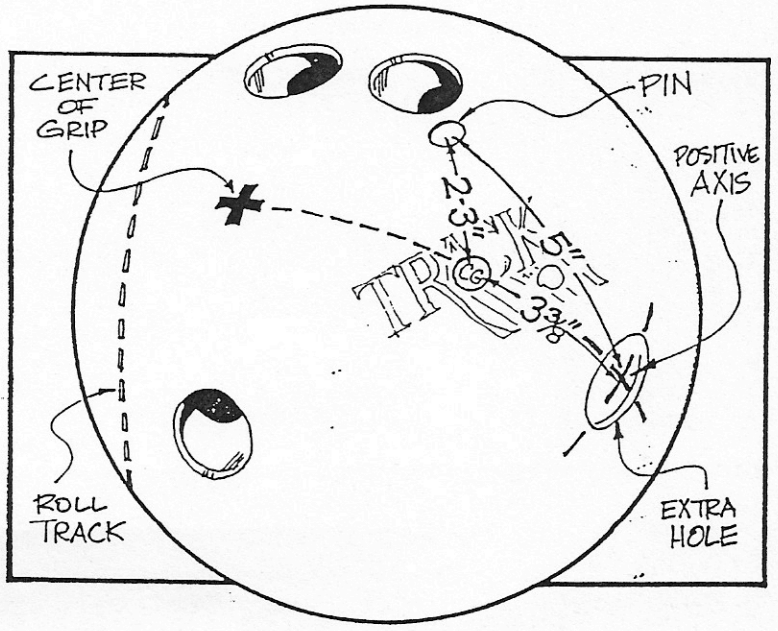


THIRD CONDITION:

Dry Heads and Pines with
Moderate to Heavy Carrydown.

IDEAL ROLL PATTERN:

Stable Drilling



Ball Choice: NRg™ or Sensor II™
Pin 2" - 3" out

Top Weight: 3.0 - 3.5 oz.

Position CG 3-3/8" from positive axis. Place pin 5" from positive axis positioned near the ring finger. Drill extra hole on axis and bring back to 1/2 positive. (Bring to negative for earlier roll if desired.)