

Currently, FINA recognizes 87 different dives, which are broken down into six categories:

DIVE TYPES:

- **Forward Group**
The diver faces forward off the end of the diving board. Dives in this group vary from the simple forward dive to the very difficult three and one half somersaults. A running approach of not less than four steps is normally used for dives in this group. The last step is termed the "hurdle" and it is from this that the diver generates height on take off.
- **Backward Group**
All dives in the backward group begin with the diver at the end of the board, back to the water. The direction of movement is away from the board. As there is no run up, height is harder to generate, and good technique is required to complete the dive.
- **Reverse Group**
These dives begin like the Forward Group, the diver moving forward to the end of the board. However, the rotation is back towards the board in a reverse or "backward" movement, hence the name "reverse".
- **Inward Group**
These dives start like the Backward Group with the diver at the end of the board with his/her back to the water. However, from take off, motion is in towards the board, not away from it.
- **Twist Group**
Any dive in which the body is deliberately twisted (rotated on the axis of its length) is included in this group. Just to complicate matters, twist dives may incorporate any of the four groups mentioned above (forward, backward, reverse, inward). Because of the large number of combinations, this group consists of more dives than the others.
- **Arm stand Group**
This group is only used off the platform, not the springboards. Here the diver assumes an armstand position on the end of the platform before executing the dive. Steadiness in the armstand is important.

DIVE COMPONENTS:

There are five basic evaluation components of a dive:

- **Approach**
Should be smooth and forceful, showing good form.
- **Take Off**
The diver must show control and balance, plus the proper angle of landing the hurdle and leaving the board for the particular dive being attempted.
- **Elevation**
The amount of spring or lift the diver receives from the take-off greatly affects the appearance of the dive. Since more height means more time, the higher elevation generally affords greater accuracy and smoothness of movement.
- **Execution**
This is most important, for this is the dive. A judge watches for proper mechanical performance, technique, form and grace.
- **Entry**
The two criteria to be evaluated here are the angle of entry, which should be vertical, and the amount of splash which should be as little as possible.

The Biomechanics of Diving :

A classic scientific article to print and take with you to the pool if you can't bear to watch your diver's first attempt at an inward 1½ on five meter platform. Enjoy. There's a test afterward.

by Derek Travis (1996)

Let's review the basic definitions involved:

MASS: The quantity of matter in a body.

WEIGHT: A measure of the effect of the force of gravity on the mass of an object.

GRAVITY: The force exerted by the pull of the earth on all matter.

CENTER OF GRAVITY: The point through which the force of gravity seems to act (the balance point).

FIRST LAW - "THE PRINCIPLE OF INERTIA"

A body at rest resists being set in motion, and when set in motion by outside forces, equally resists attempts to alter or stop its motion. The resistance or reluctance to change in the existing state of a body moving in a straight line is termed INERTIA. When the body is ROTATING about an axis this resistance to change is termed the MOMENT OF INERTIA.

SECOND LAW - "THE PRINCIPLE OF ACCELERATION"

A force acting on a body produces either an acceleration (constant increase of velocity) or a deceleration (constant decrease of velocity). The force of gravity produces an acceleration (or deceleration) of 32 feet (9.80m) per second for every second it acts on a body. The change in velocity of the body is proportional to the magnitude of the force acting on it.

THIRD LAW - "THE PRINCIPLE OF EQUAL AND OPPOSITE REACTIONS"

Every action produces an opposite reaction of equal momentum. An outstretched arm can only be moved across the body by virtue of the fact that the muscle responsible for moving the arm is attached to the trunk, which will react by moving towards the arm with equal MOMENTUM. When the feet are fixed to the earth (or diving board) the trunk and the earth rotate in theory towards the arm. The mass of the earth is so great however that its velocity is so small as to be for all practical purposes non-existent.

THE CENTER OF GRAVITY OF A DIVER

A diver's mass is the matter of which it is composed. A unique point is associated with every diver, around which the diver's mass is equally distributed in all directions. This is known as the center of mass of the diver. Since the diver is subject to gravitational force, the center of mass may also be referred to as the center of gravity (CG), the point about which a diver's weight is equally balanced in all directions. It can also be viewed as the point at which the entire weight of the diver's body may be considered as concentrated. Knowledge of the location of the diver's CG for various body positions is useful to the teacher/coach for the following reasons:

- The flight path of the diver can be predicted at the instant of take-off.
- The amount of rotation possessed by the diver can be assessed at the instant of take-off.
- It is the main reference point used to describe a diver's linear and angular motion.

CREATING ROTATION

During the flight of a diver there is only ONE force acting on the body, the force of gravity, so the diver is always balanced in the air and cannot overbalance or set himself rotating. In order to rotate, a diver must employ some other force. The only force available to him/her is the "reaction" of the earth's surface; it is opposing the force of gravity acting downwards on his/her body. The diver's muscular system keeps him/her upright. When standing too long, the diver's muscles tire and the diver falls over, i.e. he/she overbalances.

The earth's surface reacts upwards in effect through his/her feet, and as the diver topples over, the center of gravity passes outside the base (his/her feet). The diver rotates through 90 degrees from vertical to horizontal, i.e., "falls flat on their face."

When this is performed from a diving board, the extra height will enable the diver to enter headfirst. The body movements needed to provide the turning force necessary to produce the angular momentum required during the flight must be started while the feet are in contact with the board, that is during the take-off, and must be completed just before the feet lose contact with the board.

There are basically four methods of producing angular momentum:

- Overbalancing (Lean).
- Momentum Transfer (Jerk).
- Eccentric Leg Thrust (Hips bent).
- Eccentric Board Thrust (Springboard only).

OVERBALANCING (LEAN)

The simplest method of creating rotation, particularly for the beginner, is the lean. All forward and back dives require the body to overbalance just prior to the feet leaving the board. This is to ensure that the center of gravity is set in motion away from the board for reasons of safety. This slight lean at take-off will inevitably provide some angular momentum, however if lean were necessary to create rotation, reverse and inward somersaults would not be possible. The greater the lean at take-off the greater the angular momentum created, but only at the expense of height and therefore time. It should be reduced to a minimum consistent with the requirements of safety and aesthetics. Any lean during the take-off for a reverse and inward dive will induce angular momentum in the wrong direction, which will need to be overcome by extra angular momentum in the correct direction if the dive is to be performed successfully.

MOMENTUM TRANSFER (JERK)

When free in the air, an arm swing will result in the trunk moving "towards" the arm; when the arm stops moving, the trunk stops. If the trunk is prevented from reacting, the momentum stored in the arm as a result of the arm swing will be transferred to the rest of the body, pulling it round in the same direction. Momentum from the PART has been transferred to the WHOLE. For the given mass, the momentum stored in the PART of the body set in motion during the take-off will depend on the speed with which it is moving in the required direction at the moment the feet leave the board. The faster the PART is moving at the moment of take-off, the greater the amount of angular momentum stored in it. Double the speed produces twice the momentum. The angular momentum stored in the PART during this important phase of the take-off will be transferred to the WHOLE during the flight, rotating it in the same direction. $MOMENTUM = MASS \times VELOCITY$. Therefore a MASS moved a SHORT distance at HIGH speed would produce MORE MOMENTUM than when moved a greater distance at a slower speed. As the initiation of rotation must be coordinate with the final leg drive at take-off, this becomes of vital importance, especially in multiple somersaulting dives. In practice, momentum transfer from the arms can be combined with that of the upper trunk to provide a strong turning force when performing multiple somersaulting dives. Especially effective with back and reverse movements, as the normal upward arm swing is in the same direction as the body rotation. With forward and inward dives this same advantage can be achieved, providing the arm swing is made directional, i.e., changes direction when above the head.

ECCENTRIC LEG THRUST (HIPS BENT)

When the legs straighten at take-off, the thrust is along a line projected upwards from the toes passing through the hip joint. If the body is straight at take-off, so that this line passes through the body's center of gravity as well as the hip joint, the body will rise, but there will be no rotation from this action. If, during the take-off for a forward or inward dive, the body is bent forward at the hips or the back is rounded so that the body's center of gravity lies in front of the hip joint at the completion of the leg thrust, an off-center or eccentric turning force will be applied, causing rotation of the body about its center of gravity, in addition to the upward motion. The GREATER the distance between the hip joint and the center of gravity, the GREATER will be the angular momentum created, but the LESS force there will be available to project the body upwards and vice versa.

ECCENTRIC BOARD THRUST (SPRINGBOARD ONLY)

The line of thrust from the end of a rising springboard is at right angles to its surface. If at the moment of take-off, this line passes outside the body's center of gravity, then a turning force will be imparted. In forward and backward take-offs, this will assist the general rotation of the body, but in reverse and inward dives, it provides rotation in the wrong direction.

METHODS USED FOR SPECIFIC DIVES:

- OVERBALANCING FWD/BK/ARMST SS
- MOMENTUM TRANSFER ALL GROUPS

- ECCENTRIC LEG THRUST FWD/INWD
- ECCENTRIC SPRINGBOARD THRUST FWD/BK