MARINE FENDERS INTERNATIONAL, INC.

ANCHOR SELECTION

Because the anchor is the key to effective mooring or anchoring it is essential to know what to expect from various types. Any anchor's performance is dependent first upon it ability to bite into the bottom through the plowing effect of its flukes and secondly upon its ability to maintain a continuous resistance to drag once it is implanted in the bottom.

Therefore, the optimum design of an anchor is influenced primarily by the specific composition of the ocean floor, which is generally categorized into three groups: mud, sand, and rock or marl. Mud varies the most in consistency and offers little resistance to dragging forces. Sand is almost ideally consistent and anchors specifically designed for sand bottoms reach excellent holding efficiency. On the other hand rock or marl is a very poor holding ground where an anchor's dead weight is its only asset.

An anchors efficiency is expressed in holding-power ratio, that is the holding force per anchor weight. The proof test involves applying a static load to the assembled anchor to test its structural design and material properties as related to the holding force.

The holding power of an anchor is affected greatly by the angle of its flukes. In order for the flukes to enter the bottom at an angle that will allow the crown or head to penetrate to a depth producing maximum efficiency, the angle of the fluke to the shaft should approximate 50 degrees in mud bottoms and 30 degrees in sand.

Anchor holding-power is also dependent upon other bottom conditions, the duration of drag and the ratio between the length of the mooring line and the water depth.

Optimum design of an anchor is influenced by the specific composition of the ocean floor. Basically, we categorize the ocean bottoms into three groups:

1. Mud, or silt, which varies the most in consistency and offers little resistance to forces.
2. Sand, ideally the most consistent, and where anchors specifically designed, reach excellent holding efficiency.
3. Rock, or Marl, poor holding ground where an anchor's dead weight is its only asset.

The efficiency of an anchor in a given test is expressed in terms of "Holding Power" per pound of its own weight, not in "Proof test" which indicates physical properties of the material.

The fluke angle of an anchor has a definite effect upon the "Holding Power". The flukes should enter the bottom at an angle that will allow the crown, or head, to penetrate to a depth which can produce maximum efficiency. Additionally, we have determined the following:

1. The angle of fluke penetration in mud bottom should be approximate 50°.
2. In sand the penetration angle should be in the area of 30°.
3. For anchoring in various bottoms a compromise approximating 43° is desirable.

Other considerations in selecting an anchor should include:

1. Convenience for handling and stowing.
2. Aptitude for taking hold.
3. Physical strength.
4. Freedom from fouling, which all anchors do, but some in lesser degrees.
5. Influence developed by the chain's catenary, which absorbs shock loads, and lowers the angle of pull at the anchor by its weight.

The anchor is the key to effective anchoring or mooring. It is essential to know what to expect from various anchors. The resistance of an anchor to being dragged through a soil has been considered as occurring in two stages: first, biting into the bottom due to the plowing effect of the flukes, and secondly, maintaining a continuous resistance to drag after it is planted into the bottom.

Holding Power for the two most widely used anchors are as follows:

1. Stockless type anchors in sand develop a holding power to weight ratio of seven to one. In mud it develops three to one. The angle of penetration in both cases is 45°.
2. Workboat type anchors in sand develop a holding power to weight ratio of twenty to one, with the angle of penetration being 30°. In mud it develops nine to one with the angle of penetration being 50°.

The depth of penetration in all preceding cases is compiled from three to seven feet in sand, and from seventeen to twenty feet in mud. All calculations incorporate a 0° scope angle.