



NMFS' Density Standard for Sinking Line and Procedure for Determining the Specific Gravity of Line

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In response to requests from the fishing industry and line manufacturers for a clearer definition of sinking line, NMFS has established a definition for sinking line having a specific gravity of 1.03 or greater, which would be effective on April 5, 2008. NMFS used the following criteria for establishing a density standard for sinking line. In addition, NMFS has established a procedure for assessing the specific gravity of line, which would be used by NMFS in the future to determine whether or not a manufactured line is meeting the accepted density standard.

NMFS' DENSITY STANDARD FOR SINKING LINE

Data selected from 384 stations located along surveys conducted from 1997 through 2001 are summarized in the table below. Coverage is for continental shelf waters from the Gulf of Maine to Key West Florida. Depths ranged from approximately 5 fathoms to 300 fathoms with bottom temperatures ranging from 36.05°F (2.25°C) to 86.63°F (30.35°C).

Statistics for <i>Sigma - t</i> from 384 stations	
Minimum	19.639
Median	24.940
Maximum	27.560
Average	24.950

Based on these data, establishing the criteria for rope based on a *Sigma - t* value of 30.00 would ensure that rope would not float under the conditions described above. Rope manufactured with a density of 1.030 or greater at 60°F (15.56°C) would sink under these conditions.

Data were obtained from the Fisheries and Ecosystems Monitoring and Analysis Division, Northeast Fisheries Science Center, NMFS, Woods Hole, MA., at: <ftp://ftp.wh.who.edu/pub/hydro/> as well as from the National Oceanographic Data Center, Ocean Archive Data Base at: <http://www.nodc.noaa.gov/General/getdata.html>.

NMFS' PROCEDURE FOR DETERMINING THE SPECIFIC GRAVITY OF LINE

The following procedure was developed for determining the specific gravity of rope samples. It is based on Archimedes' Principle, or the Law of Hydrostatics, which says that any body partially or completely submerged in fluid is acted on by an upward force that is equal to the weight of the fluid displaced by the object in the liquid. The specific gravity of a solid is the ratio of the mass of the body to the mass of an equal volume of water at a standard temperature, in this case 60°F (15.56°C).

Specific gravity can be calculated using the equation:
$$Sg = \frac{A}{A - B}$$

where: Sg = specific gravity
 A = dry sample weight
 B = submerged sample weight

To determine the specific gravity of a line: obtain a sample with a length of approximately 18 inches by cutting cold with a knife. A minimum sample weight of 30 grams (dry weight) is recommended. Steel wire of known weight and density is used to bind the ends of the sample to keep them from fraying as necessary. It is also used to hold the sample in a coil shape and provide weight to assure the sample will be fully submerged when placed in water. The dry weight and submerged weight of the wire must be known in order to allow their affect to be removed from the calculation of specific gravity of the rope sample.

Submerge the sample in water of known specific gravity (Sg of water is measured to the 4th decimal place with a hydrometer). Water is maintained at 65°F (18.33°C) ± 5°F and the final specific gravity calculation is corrected to 60°F (15.56°C). The submerged sample is agitated and weighed on a daily basis for 7 days.

The submerged sample weight from the seventh day is used for the final calculation. The dry sample weight is then obtained after the sample is removed from the water and held at 135°F (57.22°C) for a 36-hour period.

Note that weights A & B must be corrected to exclude any material attached to the sample as described above for the purposes of binding, sinking, etc. Care must be exercised to insure that no outside influences adversely affect these weight measurements. Lastly, corrections for temperature and Sg of the water used in the above procedure need to be performed.

Weights are measured using an Adventurer balance, model AV-150 manufactured by Ohaus Corp., Pine Brook, NJ, with the following specifications: capacity - 150g, readability - 0.001g, repeatability - 0.001g, linearity - ± 0.002g, sensitivity drift - 10ppm/°C. The balance must be allowed to warm up for at least 60 minutes prior to weighing any samples. Standard calibration masses are weighed and recorded on a daily basis during testing to account for any variability in the measurements.