



# Estimating The Amount Of Rubber Needed To Make A Mold

Estimating the amount of rubber needed to make a mold can be a difficult task. However, having enough rubber or having too much rubber left over is not only frustrating, but costly. Successfully mastering this task is not that complicated and, like most things related to mold making, the more often you try it the better you become. There are a number of variables to consider including complexity of the model (varying dimensions, configuration, undercuts, draft, etc.), type of mold being made (2 piece poured block vs. 3-D brush-on), type of mold rubber being used, etc.. The following will serve as a rudimentary way to mathematically estimate your material requirements for making molds using rubber that is poured (such as our PMC-121 Series) and rubber that is brushed on (Brush-On 50 or EZ MIX 50).

## Making A Mold Using Rubber That Is Poured over A Model

To illustrate, we will assume that our model is a cube measuring 3” wide by 3” long and 3” high (7.62 cm X 7.62 cm X 7.62 cm). To hold both our model and the rubber, we will need a containment field or box that measures 4” wide, 4” long and 4 “ high (10.16cm X 10.16cm X 10.16cm).

**Easy Method:** The easiest way to estimate your rubber requirements (by volume) is to place the model in the containment field and pour water up and over the model. The amount of water used represents the amount of rubber you will need. Be careful to remove all water and thoroughly dry model and containment field before pouring rubber.

**Calculating Requirements By Weight:** To estimate the amount of rubber needed, we will calculate the volume (cubic inches) of rubber needed to make the mold. This value, using the specific volume for the type of rubber used, will then be converted to mass or weight of rubber required.

**A.) Calculate volume of box holding the mold:**  $4'' \times 4'' \times 4'' = 64$  cubic inches (1,048.76 cubic centimeters).

**B.) Calculate volume of the cube:**  $3'' \times 3'' \times 3'' = 27$  cubic inches (442.45 cubic centimeters)

**C.) Subtract the volume of the cube from volume of the box to get total volume of rubber that you will need to make the mold:**  $(B - A) =$  cubic inches to make mold. **64 cu. In. - 27 cu. In. = 37 cubic inches (1,048.76 - 442.45 = 606.31 cubic centimeters).** 37 cubic inches (606.31 cm<sup>3</sup>) represents the **volume** of rubber needed to make the mold.

**D.) The next step is to convert the volume value (37 cu. in. or 606.31 cm<sup>3</sup>) to a weight value - pounds or kilos.** To do this, you need to know what your mold rubber will yield on a cubic inches per pound (cm<sup>3</sup>/kilo) basis. The “value” you need to do this is called the “**Specific Volume**” and is included on every Smooth-On product technical bulletin under the “Technical Headings” section. For PMC- 121/30, the specific volume is 27.7 cubic inches per pound (963 cm<sup>3</sup>/kg.). This means that a pound (kilo) of PMC-121/30 will occupy 27.7 cu. in. (963 cm<sup>3</sup>) of space.

**E.) To figure the weight, the next step is to divide the volume of the rubber needed to make the mold by the specific volume yield of the mold rubber:**  $37 \text{ cu. in.} \div 27.7 \text{ cu. in.} = 1.34 \text{ lbs.}$   $(606.31 \text{ cm}^3 \div 963$

cm<sup>3</sup> = .630 kg.) 1.34 lbs. or .630 kg. is the total weight of rubber that you will need to make the mold (Part A + Part B).

## **Brush-On Mold\*\***

Our goal is to make a brush on mold of the cube (used in our example above) by brushing a ¼" (.65 cm.) layer of rubber over the entire surface area of the cube with the exception of the bottom of the cube that is resting on the table. The mold will be an open face mold with 5 sides of the cube covered with rubber.

### **1.) Calculate surface area of cube that will be covered by rubber:**

Area of each side: 3" x 3" = 9 square inches (58.1 cm<sup>2</sup>)

Total area: 5 sides x 9 sq. in. = 45 square inches (290.30 cm<sup>2</sup>).

### **2.) Calculate volume of rubber needed: Surface area of cube X thickness of brush on mold.**

45 sq. in. x .25" = 11.25 cu. In. (184.4 cm<sup>3</sup>)

**3.) Using the same calculation as our previous example Part D), the next step is to convert the volume value to a weight value - pounds or kilos:** 11.25 cu. In./19 cu. in per lb. = 0.59 lbs. 184.4 ÷ 685 cm<sup>3</sup>/kg. This is the total weight of rubber that you will need to make the mold (part A + part B).

\*\*For complex brush on molds divide your model into sections and then calculate the surface area of each section separately, then add them up to get the total.

## **Pour On Blanket or Shell Molds**

Blanket molds are usually made by pouring rubber directly over the model after having set up side walls to provide desired mold thickness (See Smooth-On Tech. Bulletin #14). The model is covered with clay to a desired thickness. Then it is encased with a hard shell or mother mold. The clay is then removed and the rubber poured into the cavity to fill the void left by the clay.

\*\*The volume of clay used to cover the model directly corresponds to the volume of rubber needed to make the mold.

### **To Estimate the amount of rubber**

1.) Form clay into a cube and calculate the volume of the clay.

Volume = Length x Width x Height

2.) Using the methods described in the above examples, convert the volume of rubber to weight of rubber needed.

### **Alternate Method**

1.) Weigh the clay. (Example: 3 lbs. \ 1.36 kg.)

2.) Because modeling clays are generally more dense than mold rubbers, we must correlate the specific gravity of clay to the specific gravity of mold rubber. Most oil-based clays (plasticine or *Chavant* clays) have a specific gravity of around 1.5 g/cm<sup>3</sup>. The specific gravity of PMC-121/30 mold rubber (found in technical bulletin is 1.04): Correlation Number: 1.04 / 1.5 = 0.70

3.) To equate the amount of rubber needed with the weight of the clay, multiply the weight of the clay by the Correlation Number: 3 lb. X 0.70 = 2.1 lb. (1.36 kg. X 0.70 = 0.95 kg.)

This is the amount of rubber you will need.

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