

MULTIPLI **MACHINE STUDY** **and** **Analysis PROGRAM**

Before we go into the working features of this software, let us review the rules of use and application for a moment. Unfortunately, due to such a wide variation in overall mill operations and, in some instances, "voodoo" paper making, the following disclaimer is necessary.

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WHY THIS PROGRAM WAS DEVELOPED

All paper machine's production is governed by the rate of DRAINAGE hereafter referred to as "RATE OF FORMATION". The data and knowledge base for this software is drawn from over 40 years of cylinder machine design and fabrication experience. Along with this, of course, goes almost the same amount of time and intense scrutiny of both ***MULTIPLI***'s and other manufactures' types of like equipment. The intent is to assist in furthering this art form to the **pinnacle of potential** as related to the **RATE OF**

FORMATION. As we learned more and more about cylinder board manufacturing, we also learned more about the people attempting to manufacture under this process. Due to the varied backgrounds, learning experiences, and types of equipment used, no common nomenclature nor general understanding exist unilaterally. We feel that if some **common comparison system** were in place, a much better overall appreciation of this manufacturing process could be achieved. Example: the best of these numbers are produced with a 42" dia. dry vat running at a 0.6% consistency with a 320 C.S.F. (Canadian Standard Freeness). This program contains the most basic of formulas used in such an analysis system. We have attempted to present this information in a simple and easy to use format, with as predictable results as possible. We are always eager for any input that would either simplify, expand on, or improve this software and its application.

INSTALLATION AND ABOUT THE PROGRAM

This version of this application was written using Qt 5.11.1 (<https://www.qt.io/>). As such, it's very portable and capable of running on most any operating system, such as Windows, Linux, and Mac. However, due to the burdens required to provide binary installers ready to run on all of those operating systems, this application is only being provided in binary form for Microsoft Windows, which will run on any Intel-based Windows 7 and higher system, either 32-bit or 64-bit.

To run this application on other operating systems, or to extend or modify the Windows version, it will be necessary for you to compile it yourself from the source code provided on GitHub at <https://github.com/dewhisna/MultipliMachineStudy>. To compile it from source, you will, of course, need to download the correct Qt package for your computer from <https://www.qt.io/>. And you will need to install, and possibly purchase, the proper C++ compiler and development tools for your system.

To install the application on Windows, simply download the latest installer from <https://github.com/dewhisna/MultipliMachineStudy/releases> or obtain it from Multipli Machinery. Copy the installer package to a convenient location on your computer, such as your desktop. Right-click the installer package and select "Run as Admin" and follow the directions.

ABOUT THE PROGRAM

The cylinder board industry basically stands on two feet, FORMATION QUANTITY and FORMATION QUALITY. The quantity and quality of product directs every major decision making process, driving this industry in one form or another. The paper making process is like a large circle with QUALITY at one end of the diagonal and QUANTITY at the other. Literally hundreds of variables and constants lie on both halves of this circle. A single change of any point on the circle affects the total paper making either directly or indirectly in varying degrees. Therefore, when using this program, one should fill in as much information as possible in all of the related windows before drawing conclusions.

Every variable within the program is changeable. This is to say, all numbers entered will produce a numerical result **regardless of reality**. Example: The logic base used is centered around the formula:

SHORT TONS PER DAY / FACE WIDTH in inches / NUMBER OF CYLINDERS

Unlike the comparison of TONS PER INCH OF TRIM, this approach yields a technique by which present or potential maximum production of any grade on any machine may be analyzed, since all calculations are based on **tons / inch of forming area**.

To help keep the numbers within **reality**, we have installed a set of "benchmarks". These numbers supplied by **MULTIPLI** are in two(2) grades, FOLDING BOX and TUBE BOARD. At present, three(3) cylinder sizes may be solicited, 36" DIA. , 42" DIA. , AND 48" DIA. The data is from only quality board machines, at present standards, from Japan, U.S.A., Canada, and South America. Therefore, the **MULTIPLI** CONSTANT is about Quality and not maximum predicible tons for any given machine.

APPLICATION

To further protect the reality aspects and maintain real-time mathematical continuity, the user will notice that some "edit boxes" are white (editable) and some are dark (read-only). Only a white box may be changed at any one time. Edit box selection may be navigated by pressing "TAB" or "SHIFT (+) TAB", or done via a mouse or track ball.

All calculations can also be done in the metric system. To change from U.S. to metric or vice versa, you can select SETUP on the Main Menu after closing all open calculation windows and select "METRIC". Or use the "METRIC" check-box at the top of the main SHEET FORMATION calculation window. A check mark will appear if you are in Metric, and no check mark if you are in U.S. (or Imperial) units.

TERMS

- 1) **TONS / DAY.**(@ 2,000 lbs./ton in U.S., or kilograms/day in metric) Please note that with this program, one can view and use this number either from the wet end or as finished goods. This is particularly helpful in sizing of pulpers, piping, and the like.
- 2) **SHEET TRIM.** (in inches or millimeters) Like tons/day, sheet trim can be the formed tons at the wet end for beater room and wet end design, or be the trimmed tons at the dry end.
- 3) **CONSISTENCY.** This is the delivered consistency to the vat and not the actual forming consistency within the vat. If there is a top and/or back liner, these should be calculated separately. (also see HEAD BOX DILUTION)
- 4) **BASIS WEIGHT.** (in lbs/1000 square feet or grams/meter squared)
- 5) **MACHINE SPEED.** (in feet/minute or meters/minute)
- 6) **NUMBER OF VATS.** This is calculated from the **MULTIPLI** constants or may be entered for an existing or desired machine. If the **MULTIPLI** constants are used, a single stock system is assumed.
- 7) **GALLONS PER MINUTE.** (or liters/minute) Two(2) numbers are presented here, the total machine consumption and the average per vat. If the top or back liners are different, this should be allowed for.
- 8) **MACHINE EFFICIENCY.** If left at 100%, 24 hour days at 365 days per year is assumed. This adjustment is used to change tons per day (or kilograms per day) to match a year's production.

OTHER HELPS

Several other helps have been included that can play a major role in the overall design of the paper machine and are invokable from the main SHEET FORMATION calculator window.

1) FLOW

A) **PIPE SIZE.** This calculator will allow you to enter either of the two(2) variables and calculate the third. Example: if you know the gallons per minute and velocity in feet per second you want, enter them and then click the pipe size "CALC" button to get the correct pipe ID in inches.

B) **AREA SIZE.** This works just like the above, except we are playing to a known or unknown cross sectional area. This is very helpful in the design of reducers, headboxes, etc.

2) HEADBOX DILUTION. Here we are starting with a known consistency. We can then find how much water is required to dilute to another consistency.

3) PRODUCTION. (Tons Per Day or Kilograms Per Day) This is one of the most important parts of this program and allows you to calculate the production yield for a given machine speed, grade, face width, and machine efficiency (or up-time percentage). When launched within the SHEET FORMATION calculator, you can click "APPLY" and transfer your results back to the main SHEET FORMATION window and optionally recalculate the FORMATION CONSTANT.

CONTROL TERMS

1) CALC. Most calculator windows in this application will automatically calculate the results immediately as you update values. However, some calculator windows, such as the PIPE SIZE and AREA SIZE calculators, since two values are used to calculate the third, it's ambiguous when you change one value which of the other two you wish to be calculated. Therefore, after you have entered the required information, click the "CALC" button to update the results.

2) APPLY. Any time this option appears, when you click "APPLY" this information will be transferred back to the previous calculator window. If "CLOSE" is tagged first, all calculations are scrapped.

3) CLOSE. Tagging this control button will clear and exit the current calculator window, losing any information in that window.

4) HELP. This will bring up an online version of this text.

5) SAVE. SEE THE SECTION "**PRINT AND EDIT**".

PRINT AND EDIT

The Main Window in the Machine Study program is actually a full-screen text editor window. When saving data from a given calculator window, the "printout" information is first placed on this editor window (either clearing or appending present editor data). Then this editor window can be further annotated and/or sent directly to the printer.

The user can also select the "SAVE" option from the "FILE" menu selection, allowing the user to save and store information about a particular paper machine or setup configuration.

Note that at any later time, the user can use the "OPEN" option from the "FILE" menu selection to retrieve the saved file (or any other text file for that matter). This allows new information to be appended to an existing file or for the saved information to be printed (by using the "PRINT" option from the "FILE" menu selection).

Since this data is saved as a standard ASCII TEXT FILE, it can be copied or exported to almost any other document or program.

The printer setup, selection, and configuration can be done from the "PRINT" option on the "FILE" menu. Or, for a more interactive print setup experience, select "PRINT PREVIEW" on the "FILE" menu to see the configuration results before sending to the printer.

The specific printers and/or print-file-output types listed will depend on the printers configured in your Operating System. Refer to your Operating System documentation for printer installation and configuration.

IN CASE OF TROUBLE

If you have trouble installing or using the software, or would like to obtain additional copies or software updates, address all questions to:

Multipli Machinery Corp.

Email: makepaper@multiplimachine.com

<http://www.multiplimachine.com>