

Summer 2012 Design Report

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About Modular Designs

The creation of modular designs is a new concept that was recently brought into consideration. Modularizing the code will make it possible for individual parts of the plant to be request separately, instead of only having the option to request an entire plant. Once code is written for a specific part of the plant, an online form will then be created so that that part can be ordered. Creating an upper level code file is very different from creating a drawing file, in which all of the current plant components are drawn. I have created some basic guidelines for creating such a file in this google doc. These guidelines are far from complete, as the process of creating modular design files is still very new. All of the modular design files can be found in the ADT designs file, which can be found in Final Designs. In ADT designs there is a folder for each design component can be (or will be able to be) ordered online by an interested party. In each component's folder there should be a Mathcad file from which the online form will pull information from to create the requested design, *a method file which communicates between the user inputs, the drawing code and the labview code that outputs information to the user online*, and designs specifications in English and Spanish. *The method file is extremely important to make the online interface work correctly with the drawing code; I have created a method template so that in the future any design team member will know how to create a method file. The method template file is written in excel, and can be found in the ADT designs file, all actual method files should be saved as tab delimited text files, should all be titled Method.txt and saved within their modular design's folder in ADT designs.* The modular designs that we hope to create are the LFOM, the LCDC, the SRSF (there is already a demand for this design to replace pressure filters in Honduras) and the flocculator, sedimentation tank, and entrance tank. *We may also possibly want to design a turbidimeter and stock tank mixer.*

LFOM (Linear Flow Orifice Meter)

The LFOM was one of the higher priority modular designs, so it was the first one to be worked on. The first thing to be decided when creating a modular

design was exactly what we wanted the code to output. For the LFOM it was decided that all that needed to be drawn was simply the pipe with the orifice holes in it. Other parts of the rapid mix pipe and entrance tank do not need to be included because we do not know how the LFOM will be used by whoever requests it. User inputs also need to be chosen for each modular design. Every piece must have Q.Plant (the flow rate of the plant) as an input, but most parts will need to have other inputs as well. Most pieces will need other user inputs because now that the piece is not incorporated into the plant, additional aspects of the design that previously relied on other plant components will have to be supplied by the user. For the LFOM, there are simply 2 inputs, Q.Plant and HL.Lfom, which is the height of the LFOM. After the user inputs are stated in the code, then references to expert inputs are made. The entire expert inputs file is not referenced as not all the information in it is necessary for drawing an LFOM, or any part of the plant for that matter. After the expert inputs references, there is a section that includes references to other important files in Final Designs, which are MathFunctions, FluidsFunctions, MtoATranslators, MtoATranslatorsWrapped, PlumbingF, and the LFOM design file. Then finally there is the drawing code for the LFOM, which has been taken from the entrance tank code and had some changes made to it. At the end of the code needed to draw the LFOM, after already defining the AC variable, one of the most important things to include an undefined statement of the AC variable. This is necessary so that LabView can correctly fill in this variable with the information from the user inputs. Also the variables D.LfomOrifices, H.LfomOrifices, and N.LfomOrifices have been included in the bottom of the code set equal to nothing so that they can be filled in by LabView and then displayed in the design specs.

At this point the folder for the LFOM in ADT designs is complete. There is the drawing code, the drawing template code (created by Marlana Hinkley), the method file, and design specs in both English and Spanish that include the most important information about the LFOM that the user just created. LFOMs can now be ordered online using this form. An example of a LFOM with HL.Lfom set to 20 cm and Q.Plant set to 20L/s can be seen in 1 below.

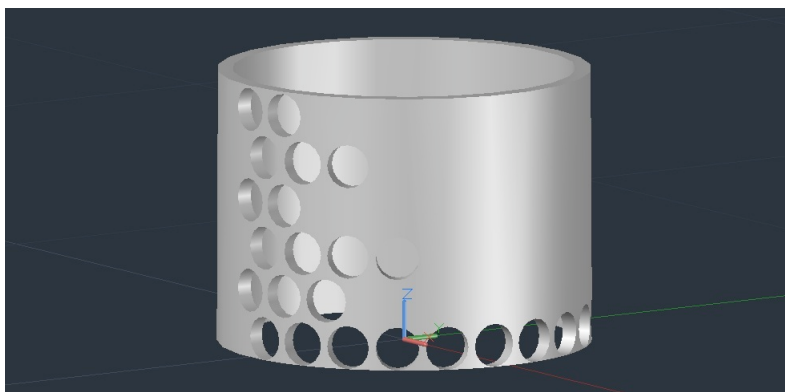


Figure 1: LFOM Example

LCDC (Linear Chemical Dose Controller)

The second modular design that was worked on a design for the chemical dose controller. This proved to be significantly harder to break away from other parts of the the original plant code than the LFOM. Difficulties were created by the fact that many of the doser's, constant head tank's, and calibration column's elevations were defined by other parts of the plant. Other problems came up when trying to design a single doser that could work for any of the three chemicals we use in our plants. It seems most logical for a modular design of the doser to be a single doser, however then the question of what chemical to dose is a significant issue. Much of the design of each doser depends on the viscosity of each chemical. So to make the code as general as possible many different options for chemicals would have to be coded in. It has not yet been decided which and how many chemicals the code should be able to work for. For this reason work on the LCDC modular code has been put on hold for the time being, as it is believed that other modular designs will be easier to work out.

CDC Plant Drawing Code

Work on the CDC drawing code for the plant also needs to be done. Recently sliders have been added to the plant drawing code for the cdc system, they can be seen in figure 2 below. Other recent fixes also include correct placement of the fittings for the connector tube to attach and correct subtractions of many of the pieces attached to the lever arm. Finally, the option of one, two or three dosers has also been added. Three doser can be seen in figure 3, two dosers (which would be chlorine and plant coagulant) can be seen in figure 4, and one doser (currently the chlorine doser) is seen in figure 5.

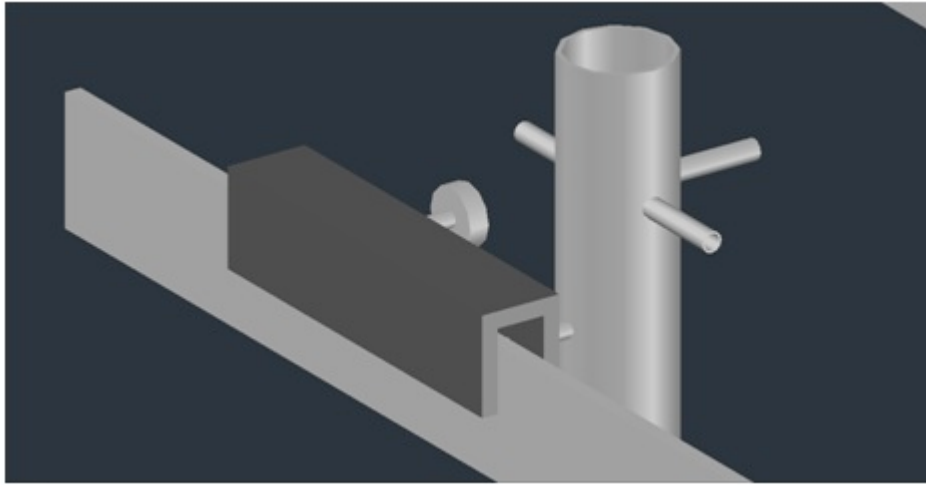


Figure 2: Slider and Fittings

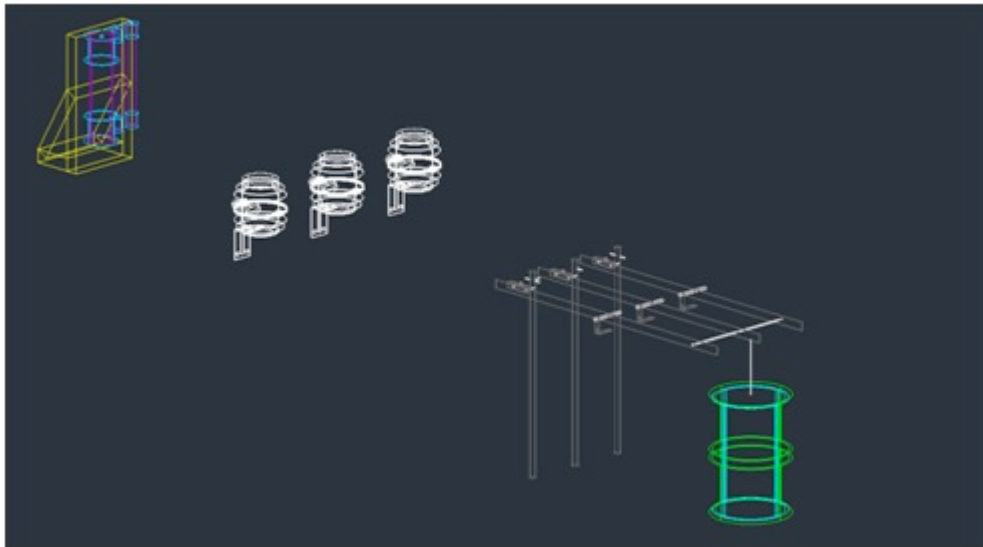


Figure 3: Three Dosers

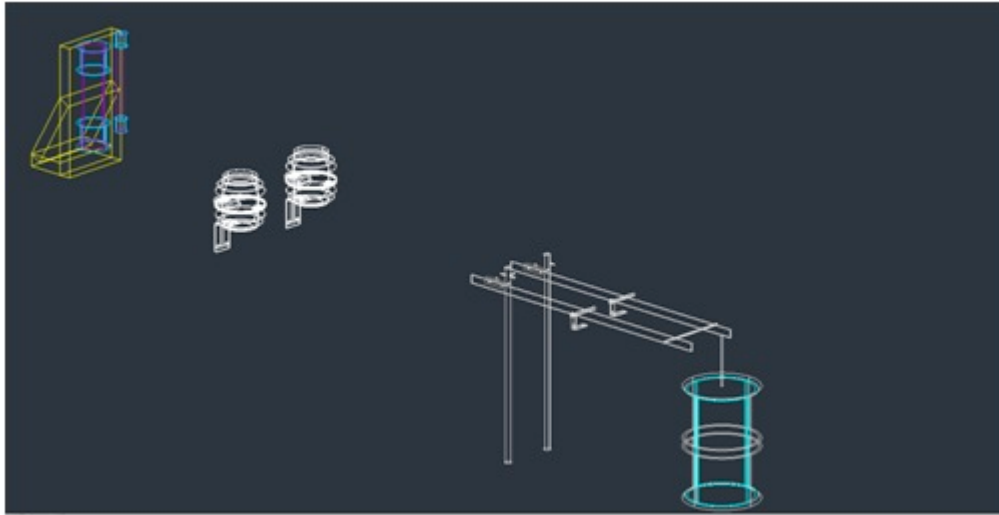


Figure 4: Two Dosers

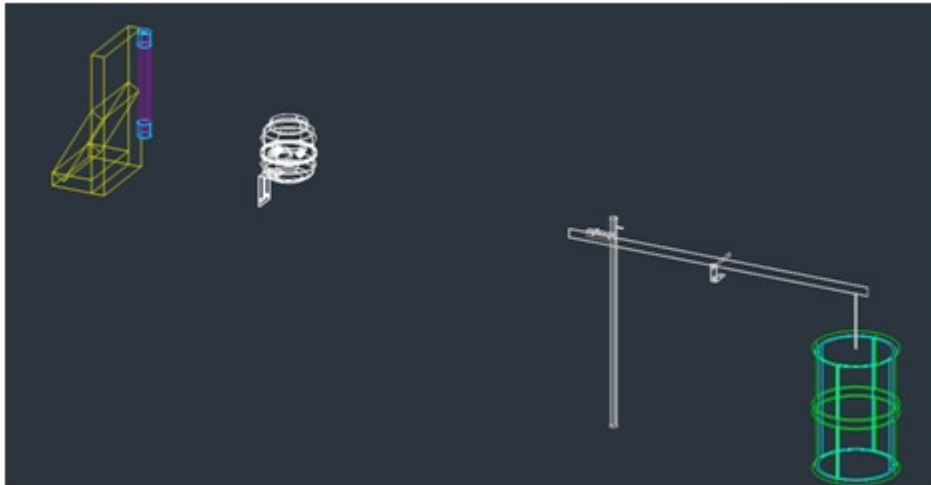


Figure 5: One Doser

SRSF (Stacked Rapid Sand Filter)

I believe that the modular code for the SRSF is currently done. I have not checked the code with Monroe specifically, but the drawing that it outputs

seems to be the same as what the plant drawing code for the filter outputs at all flow rates. Please see figure 6 below. Again, similar to the LFOM I did have to change some of the original drawing code so that the code would be self-sufficient. Much of what I changed had to do with origin points and elevations. Many origin points that had been defined based on other files in the plant code were redefined so that they only relied on other parts of the filter. Also, for this code I had to include a significant portion of the sedimentation tank drawing code. The reason for this is again that many calculations in the filter code rely heavily on the sedimentation tank code. As for user inputs for this file I have decided (based on Monroe’s advice) to allow the user to only input a value for Q_{Plant} (the desired flow rate through the filter). In the future we may create another version of this modular code where the user is allowed to input more variables, such as sand size, but it is likely that such a file would be used only for research purposes. In the SRSF file in ADT designs there is the drawing code, the method file and finally the design specs in both english and spanish.

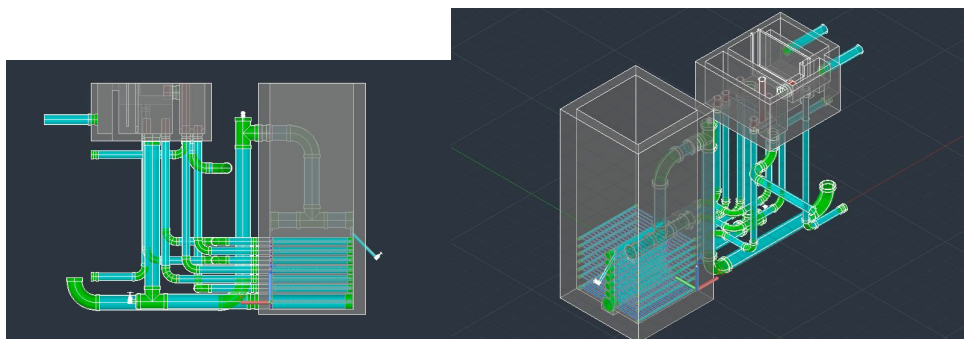


Figure 6: Two Views of the current modular filter

Low Flow Plant Layout

Very recently I began working on a new plant layout for low flow plants. I am collaborating with Julia Morris on this project. Currently I have moved the sedimentation tanks, flocculator and entrance tank into new locations. Please see the current low flow plant layouts below in figure 7. These layouts are clearly not done. The entrance tank has to be raised in the z direction, but that should be a quick fix (I realize where I messed up). The entrance tank must also be moved slightly in the negative x direction and the pipe connecting the entrance tank to the flocculator must be extended; this is because we want the walkway between the entrance tank and the flocculator to be the same as in “normal” flow plants but the flocculator is now so much smaller. Continuing with this task I will also have to move the chemical stock tanks, the chemical dose controller, main plant drain channel, rewrite the operator access slightly

and also eventually incorporate the new low flow filter. Except for the low flow filter these tasks should take a relatively short amount of time to complete and hopefully I will be able to accomplish them by the time the next report is due.

To make all these layout changes I came up with a relatively simple procedure. First I changed the sedimentation tank to be oriented how I wanted it to be, it is necessary to do this so that you know where your Plant.Origin is. I did this by including a small section at the end of the drawing file where I thawed all the layers in the file, then rotated and moved them as necessary and finally refroze all layers. I then created a stack of the file's AC output variable exclusively for low flow. I then used this procedure for both the entrance tank the flocculator codes. I think that this method is reasonable and simple enough so that in the future it will be relatively easy for design team members to change if they need to.

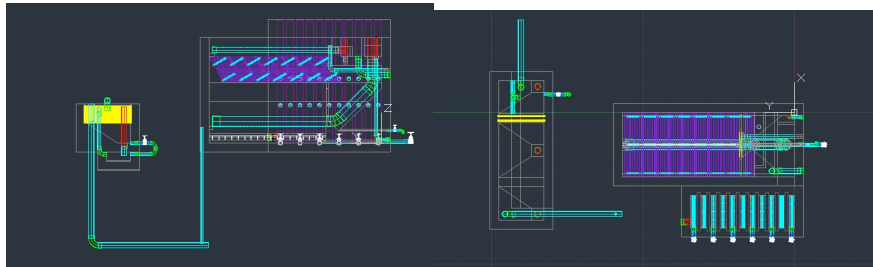


Figure 7: Two views of current low flow plant layout