# Bilge Oily Water Separator Flow Control

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## ABSTRACT

This paper offers a means of separating water from its immiscible mixture with oil present at the bilge, while preserving oil, the lower compartment of a ship, and guiding it to a waste-oil tank for purification and then reuse. In this project, by using a microcontroller that is interfaced with an oil sensor and relays, we suggest separating oil and water by electronic means and to be specific with some relays and electrical components. The bilge water collected would be free of oil and other contaminants after isolation and can be drained back into the sea without causing any disruption to the aquatic environments. The benefits provided by the proposed approach over conventional ones are also enlisted, along with a description of the frameworks commonly used for this mission. This project would comply with international regulations such as MARPOL (Sea Pollution) and MEPC (Marine Environment Protection Committee), which ban ships from directly injecting (oil-containing) water from the ship's bottom because of its unhealthy impact on the ocean's marine life.

***Keywords***-*Bilge, Electronic method, Marine ecosystems, Oil-sensors, Oil-water separators*

## NOMENCLATURE

| | |
|---|---|
| *PPM* | *Part Per Million* |
| *MARPOL* | *International Convention for the Prevention of Pollution.* |
| *OWS* | *Oily Water Separator* |
| *MCU* | *Microcontroller Unit* |
| *LED* | *Light Emitting Diode* |

## 1.0 INTRODUCTION

An oily water separator (OWS) is a shipboard equipment piece that helps the crew of a vessel to extract oil from bilge water before discharging the bilge water overboard. In ship operations, bilge water is a virtually inevitable commodity. Oil is also found in bilge water created near shipboard machinery (such as in the engine room) and its direct discharge will lead to an unacceptable transfer of waste oil to the marine environment. Within MARPOL by international consensus. Onboard any vessel, oily water can be found. It is pumped into the bilge tank which needs to be treated before it can be flushed to the sea in an oily water separator.

### 1.1 Similar System

This project also has a resemblance to the distinct and typical style of separating oil and water from the bilge well up to this date on board each tank.[2] We also consider the several considerations that may also impact the water quality depending on the situation of the engine room, such as the state of the pipe, the cleanliness of the bilge well and, of course, the condition of the segregated bilge oil tank itself. It was also referred to[1] on the basis of some simple control and process to distinguish oil or some sludge from water. Our venture or predominant task in this project is primarily center around how we control the progression of the fluid from our bilge to the furthest limit of the cycle and we control the choice and stream control just to be over the edge or to be return back to the bilge oil isolated tank dependent on the liquid PPM perusing after the cycle in the oil water separator unit.

### 1.2 Current System

Current system control of the liquid flow coverings many types of vessel around the world which comply to the rules and regulation on the MARPOL convention.[3] Starting from a basic control system from bilge well, it transfers to Oil Water Separator Unit or passing by Bilge separator oil tank first, either way, and to the end to the process. Normally we transfer the fluid by pump or motor and however this triggered us to create a new system where by the old conventional type is where the Motor is not running automatically when the float sensor device in the bilge well is rising up. Add on to that the basic and conventional control is not control the water flow after the process automatically, either we do it manually of we monitor it manually. The overboard valve of basic and conventional control system similarly to every other ship will not operated automatically.

### 1.3 Proposed System

An advanced arrangement and drew nearer is to be thought of and to be introduced locally available each ship. Our thought is to help the motor or suction/transfer pump runs naturally or automatically when the bilge well is half full or practically full rely upon the situation of the water level sensor and furthermore give a programmed motor or pump too between Bilge Isolated Oil Tank (when the tank is full or relies upon level to be preset) to the Oil Water Separator Unit. At the absolute last advance of the cycle is we need to present the 3-way control valve. After the water come out from the OWS unit, the PPM value will appear on the LCD display and this will choose to open the 3-way valve, either to be overboard or return back to the Bilge Isolated Oil Tank once more. For this control, if the water tainting is under 15 PPM, the overboard valve will the open and is safe to be dump to the sea, however in the event that the water defilement ppm is in excess of 15 PPM, the overboard valve will be closed consequently and the return valve will be open and stream back to Bilge Isolated Oil Tank and the cycle will on a circle until we stop it physically.

## 2.0 METHODOLOGY

In this task the microcontroller encourages us to control the water level at the bilges, the tank and furthermore the 3 way Valve regulator. The sensor in the bilges is going about as a change to identify the level of the water, and will offer trigger to engine for the following activity. The level in the bilges can be demonstrates with LED light. This will likewise show that the motor is additionally running. Microcontroller exist in this framework to give programmed run and control with caution buzzer or sounder and furthermore LEDs. This likewise to decide the activity when the Bilge Separated Oil Tanks is full or practically full. Toward the finish of the cycle which is in the wake of entering the Oily Water Separator the following activity will be chosen by the estimation of the water PPM, by all methods this will trigger the last activity of the microcontroller and provide an order to the 3-way control valve.

### 2.1 Component

The segments of the framework require are comprise of (1) PIC16F84A This Microcontroller accompany 18 pins. This capacity as the mind processor of the framework, (2) 100 ohm Resistor as a latent two-terminal electrical segment that actualize the electrical opposition in circuit component, (3) Light Emitting Diodes (LEDs) to be a sign and trigger reaction and indicator,(4) Buzzer or a sounder to be introduced too to give more reaction helps and backing for affirmation of the control framework, (5) Sensor likewise introduced in the bilge well and inside the tank, (6) Motor also will be executed to move the water starting with one point then onto the next and possibly running naturally when actuated and just when required, (7) Relay is use in this circuit to control Motor and Buzzer/Sounder. Figure 1 below illustrates the schematic diagram of the system design.

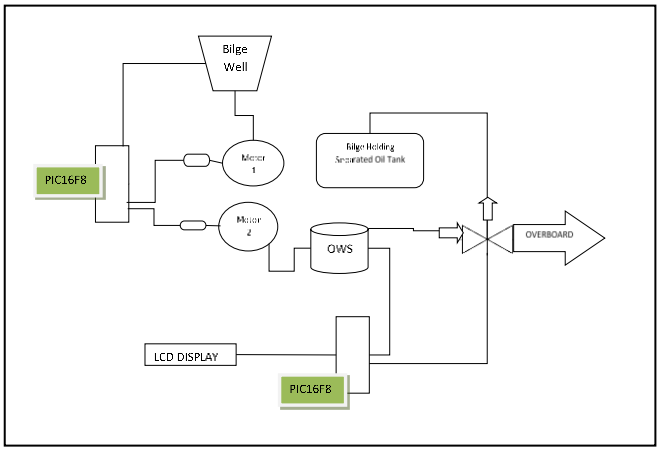


Figure 1 : Simplified Schematic Diagram

### 2.2 Operations

The operation is simplified into below description:

- When the bilge well reached high level, the High-Level Bilge Well LED will be on.
- When the bilge well is in normal position or low level. No LED will be on.
- Motor 1 will run when Bilge Well High-Level LED is on.
- Motor 1 will stop once the level is low.
- When Bilge Holding Separated Tank reached full or High-Level LED will on.
- Motor 2 will be running to transfer fluid to OWS(Oily Water Separator).
- The PPM value of the fluid will be decided by the OWS.
- Less than 15 PPM will be released overboard.
- More than 15 PPM will be return to Bilge Holding Separated Tank.

Table 1, shows the logic/truth of the operations.

| INPUT | | | OUTPUT | | |
|---|---|---|---|---|---|
| **Bilge Well** (BW) | **Bilge Holding Separated Tank** | **HOLDING TANK** HL | **BILGE HL** | **Motor 1** | **Motor 2** |
| A0 | A1 | B1 | B0 | B4 | B5 |
| 0 | 0 | OFF | OFF | OFF | OFF |
| 1 | 0 | OFF | ON | ON | OFF |
| 1 | 1 | ON | ON | ON | ON |
| 0 | 1 | ON | OFF | OFF | ON |

### 2.3 Microcontrollers

PIC16F84A [6] (Figure 2) id used in this system. This microcontroller is used as the center brain of the system, it has the simplest and most commonly use in any design without sophisticated modules to be attached. PIC is the integrated circuit which was frequently used to develop in controlling some exterior devices and lightening the load from the CPU in the system.

In this system it act like center nervous system with data and command control and it is recommended 8-bit PIC16F84A microcontroller. It is very stable and sufficient and capable enough to be the control of the system.

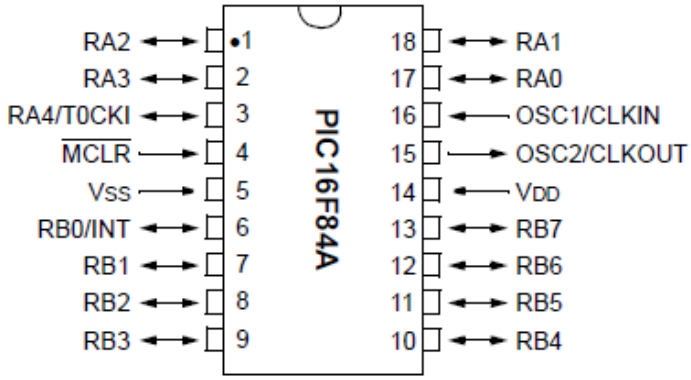


Figure 2 : PIC16F84A Microcontroller

### 2.4 Software

We use the C Compiler to make good use of the application and command composition, edit, compile, and program the microcontroller codes. This compiler strengthens the microcontroller that will be used in the programming languages of the highest standard. The programming algorithm can determine the state of the parts by actuating the input-output ports of the MCU, taking into account the relevant tasks. The simple capacity of the entire device to allow some interim recognition of the sensor input and output, LED and to activate outputs by the motor.

### 2.5 Programming Description

The program used to monitor the whole operation is embedded in the C language of the PIC16F84A microcontroller. All the codes were compiled using PIC Compilers and checked.

### 2.6 System Flow

According to the workflow, this system works in sensing the level of fluid in the bilge well that attached inside the bilge which is act like a switch float type sensor and send signal to the microcontroller unit. The MCU will decide the next action to run the motor 1 automatically. While in the bilge separating holding tank there is a sensor as well for the high level and send its signal to microcontroller to make up the next decision and action. Motor 2 will trigger and run to transfer fluid. On the other PIC controller unit, the fluid PPM value will make the next decision till the end of the process. Below at Figure 3 is shown a flowchart.

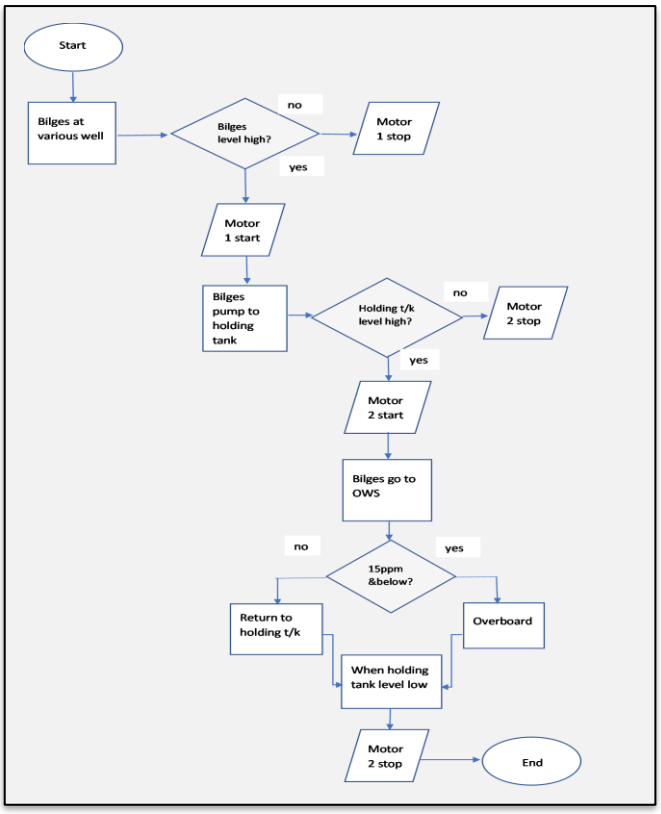


Figure 3: Flowchart of the system

### 2.7 Circuit

This circuit consists of the power supply, two segments of the microcontroller that contain the input components of the device, and the output components. The MCU device is combined with all these components.

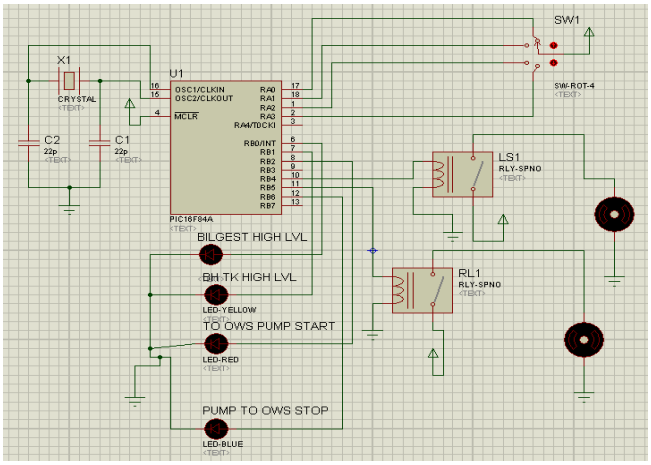


Figure 4 : Input and Outputs

As shown in Figure 4, all inputs are connected to port A and all the output are connected to the port B with LED.

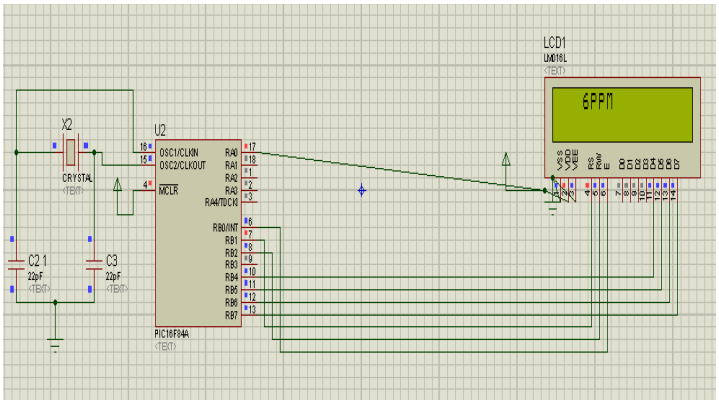


Figure 5 : LCD Displays circuit.

Figure 5 shown the value of fluid PPM after in the process inside the OWS. This will determine either the fluid can be overboard or it will return back to bilge holding separated tank and go through the cleaning process again in the OWS. Below 15 PPM the fluid will we be discharge and if more than 15 PPM, the fluid will be return back to the tank.

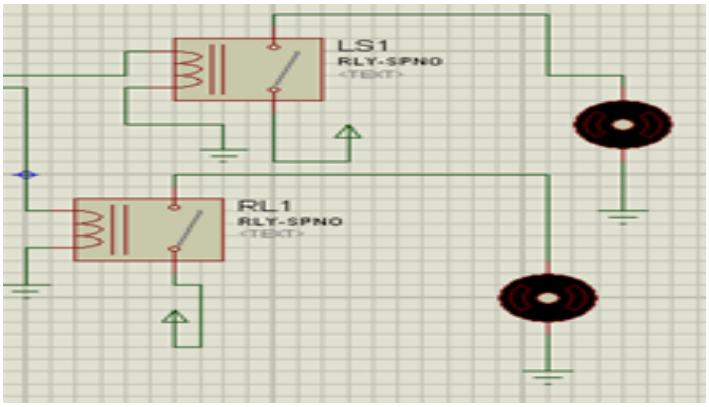


Figure 6 : Relays and Motor

Figure 6 shown that the relay and motor will operate accordingly when the LED of Bilge Well High-Level is on and Bilge Holding Separated Tank is on as well due the sensing method.

## 3.0 CIRCUIT DESIGN SIMULATION

The circuit of this system is made in the software Proteus Version 7. All of the component like what have you seen from Figure 4,5 and 6 were selected from the very own library inside the Proteues. All of those are connected with lines. After all the component have been laid out and arranged, the program was later compiled using a PIC C Compiler software to wite all the codes. There are two hex files for this system because it has two PIC Microcontroller in it. Both Microcontroller are the same characteristic and the same build. One hex file is compiled for the sensor part and another Hex file is loaded for the LCD Display microcontroller. Most input are using RA (Port A) pins and outputs system were connected through RB( Port B) pins.

## 4.0 RECOMMENDATIONS

In this journal, the author presented the operation of the flow transfer of the fluid and level sensing only in the system. The system is very basic to be used onboard any ship. Most important thing is the system allowed the motor to run automatically as programmmed. LED also presented to be a signal representative of this water level and Motor-running program. Most of the program which have similar basis like this paper might use different type of microcontroller but using different such sound wave control,ultra sonic level control, and many more. Similar basis but the aim is one. It is to transfer the fluid from the bilge to bilge holding tank efficiently using automatic control,transfer fluid to OWS as well and to decide either we can throw overboard or return it back to the bilge holding tank by using 3-way control valve.

## 5.0 CONCLUSIONS

This system will be the most basic requirement later days and soon in maritime business world and onboard every ship due sufficient use and only consist of few most basic component, of course this system can override manually but automatic program is always few times better than coventional method to save energy and time and easy to control and monitor. This system also could be improved in the futuree with more complex design to give more outcome, faster reaction and better work of flow.


## ACKNOWLEDGEMENT

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