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Data Collection Analysis and Management System

Technology and Communication
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ABSTRACT

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Wärtsilä Power Plant Technology Fuel Laboratory is the place where the PPT team tests their samples of different fuel types such as Heavy Fuel Oil, Light Fuel Oil, Crude Oil, Straight Bio Fuel Oil among others. These samples are measured to define their characteristics and properties using different devices.

Data Collection Analysis and Management System were developed to collect and analyse measured data from the laboratory devices. Every device has own database in MS Excel format and Visual basic for application (VBA) is the programming language used to develop this project. Main functions consist of searching and importing files. Import function can import data from same excel file format (.xls), text format (.txt), comma separated variable (.csv) or portable document format (.pdf).

Main Search File was done after the application for the entire device was ready. This last file is used for searching the seven database files. Results display the list of all properties of the sample from different devices into one worksheet. Laboratorian can compare how the samples properties change depending on the time interval or see how one samples properties within different device. This makes it easier for them to see if the sample has a very high or very low value in specific properties that may cause/had caused problem to specific power plants.

The main target of this project is the fuel laboratory team but this project is saved in IDM so that can be accessed by everyone inside the company using a LAN connection or VPN connection.

Keywords MS Excel, VBA, IDM, LAN, User Form, VPN

ABBREVIATION

VBA	Visual Basic for Application
VBE	Visual Basic Editor
VPN	Virtual Private Network
IDE	Integrated Development Environment
PPT	Power Plant Technology
LAN	Local Area Network
IDM	Integrated Document Management
CGI	Common Gateway Interface
PDF	Portable Document Format
HTTP	HyperText Transfer Protocol
LHV/NHC	Lower Heat Value/Net Heat of Combustion
HHV/GHC	Higher Heat Value/Gross Heat of Combustion
HTML	HyperText Markup Language
API	Application Programmable Interface
CRU	Combustion Research Unit
DSC	Differential Scanning Calorimetry

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1 INTRODUCTION

Wärtsilä was established in the year 1834 and the company is a global leader in complete lifecycle power solutions for the marine and energy markets. They have operations in 160 locations in 70 countries worldwide.

The company is the leading supplier of power plant for power generation which is also a provider of ship power solutions including engines, automation and power distribution systems as well as sealing solutions for the marine industry among others. The company offer solutions for base load power generation, grid stability & peaking, industrial self-generation also for the oil and gas industry. [7]

Wärtsilä Power Plant Technology Fuel Laboratory is the place where PPT team test their samples of different fuel types such as Heavy Fuel Oil, Light Fuel Oil, Crude Oil, Straight Bio Fuel Oil among others. These samples are measured to define their characteristics and properties using different device.

Data Collection Analysis and Management System is an application that aims to collect measured data from the devices. Every device has own database in MS Excel format and Visual basic for application (VBA) is the programming language used to develop this project. Main functions consist of searching and importing files. Import function can import data from same excel file format (.xls), text format (.txt), comma separated variable (.csv) or portable document format (.pdf)

Main Search File is done after the application for the entire device ready. This last file will search and list all the properties of the sample from different devices into one worksheet. Laboratorian can compare how the samples properties change depending on the time interval or see how one samples properties within different device. This makes it easier for them to see if sample has a very high or very low value in specific properties that may/had cause problem to specific power plants.

It is expected that the program will be used by different people inside the company based on the defined access of the user but the main target is the fuel laboratory team. The requirements of this project were successfully achieved and saved in IDM to be access using a LAN connection or VPN connection.

2 TECHNOLOGY OVERVIEW

The tool used for this application is MS Excel and program in Visual basic for application or simply called as VBA, Visual Basic Editor (VBE) is the editor used.

2.1 MS EXCEL

MS Excel is one of the world's most common spreadsheet programs in used. In this program we can create worksheets, database draw charts and make tasks and others related to numeric information easier. [3]

2.2 VBA and IDE

Visual Basic for Application (VBA) development software is included with each component of the MS Office suite programs such as Word and Excel. Starting the VBA development software places in the VBA programming environment Integrated Development Environment (IDE) which provides numbers of tools for use in the development of the project. [4]

2.3 VISUAL BASIC EDITOR

On top of the window like in most applications there is Menu bar. Standard Toolbar is also available which gives the user an easy access to common tools that are available within the application. Project Explorer Window lists all projects that are currently open including those projects opened by excel during start up. [4]

Window where the code is written is the object code window.

List of attributes or properties of the currently selected object of the project explorer window are displayed in properties window. These properties are used to manipulate the appearance and behaviour of the object.

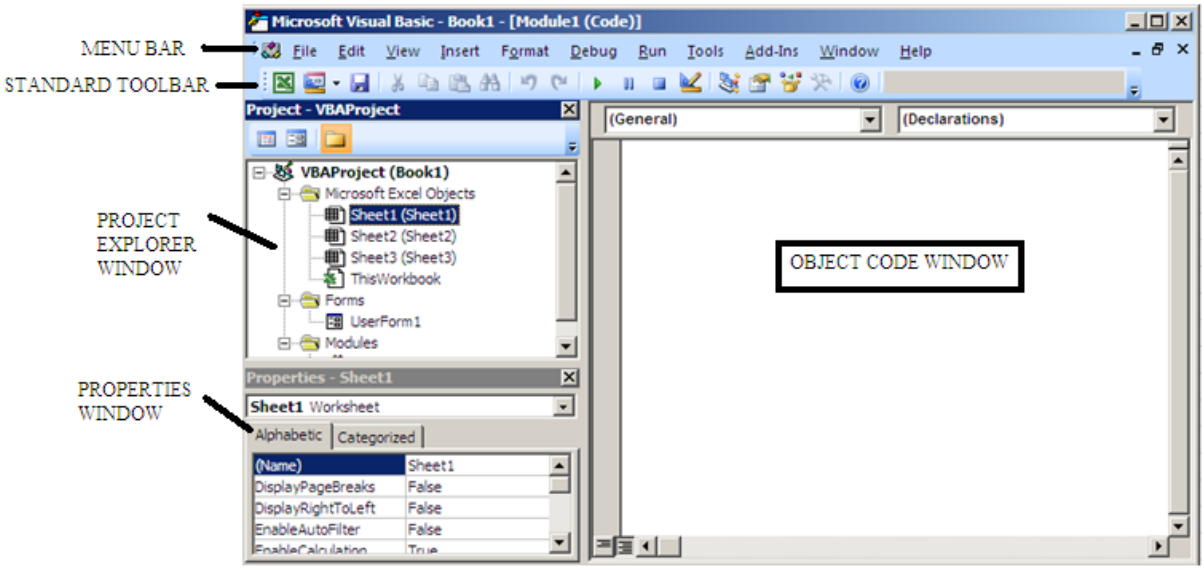


Figure 1. VBE

2.4 USER FORM

User forms are similar to other VBA objects which have methods, properties and events that are use to control the appearance and behaviour of interface window. Forms allow programmers to build custom interface with office applications in VBA. [4]

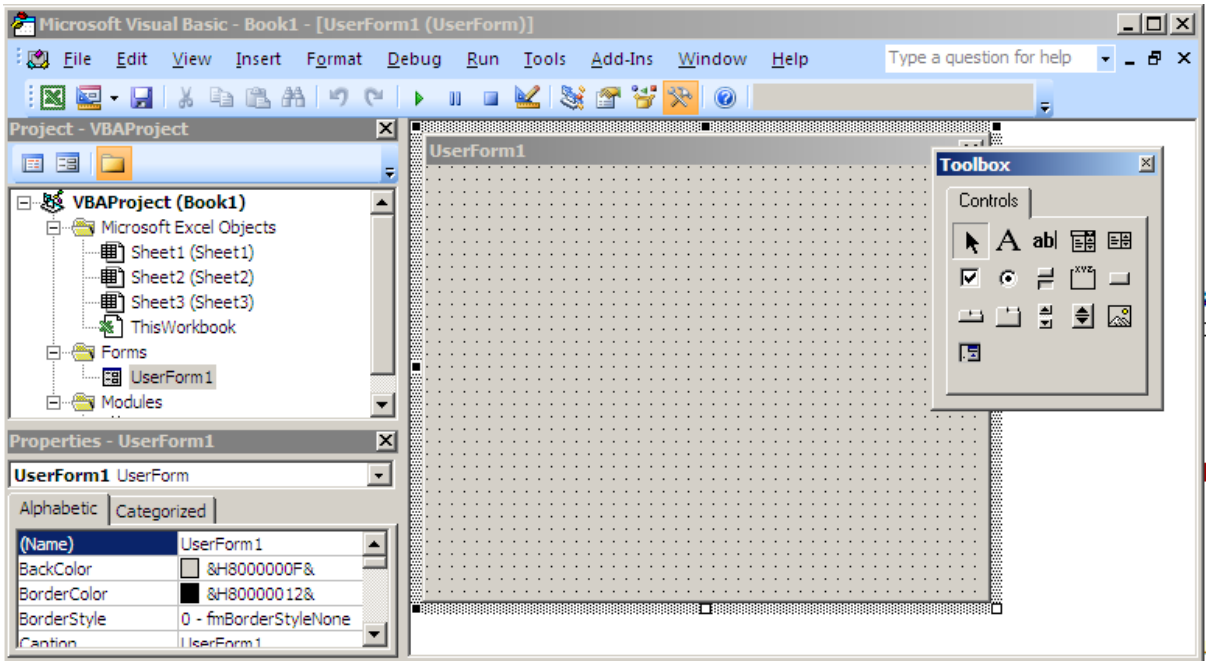


Figure 2. User Form

2.5 VPN CONNECTION

Virtual Private Network is a temporary physical route formed over structured topology. The Virtual Private networking represents the process of transmitting data over a VPN. The category of the VPN use in accessing this project is the remote access VPN which enables both fixed location and mobile workers to communicate with a central location. In this case, if a network includes a connection to the internet, it's possible that they can create a VPN connection from home to work. [5]

Intranet users with appropriate user rights can establish a remote access VPN connection with VPN server. The user can access the protected resources of the company's network and all communication is encrypted for data confidentiality purpose. [2]

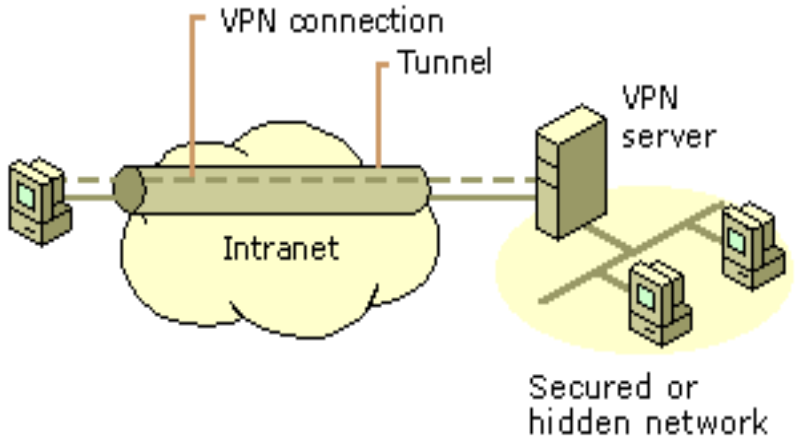


Figure 3. Remote Access VPN [2]

3 DEVICES USED

There are seven different devices in the laboratory and each of them has different method of measurements. Pictures of device was taken from the Fuel Laboratory site.

3.1 Bomb Calorimeter

Bomb Calorimeter Device is used to measure the samples Heat Values such as HHV or GHC and LHV or LHC. This device has an internal hard drive that is accessible through Intranet.

Higher Heat value can also be known as the Gross Heat of Combustion which is the quantity of energy released when a unit mass of fuel is burned in a constant volume enclosure, with the products being gaseous, other than water that is condensed to the liquid state. [6]

Net Heat of Combustion or the Lower Heat Value is the quantity of energy released when a unit mass of fuel is burned at constant pressure, all of the products including water that is being gaseous. [6]

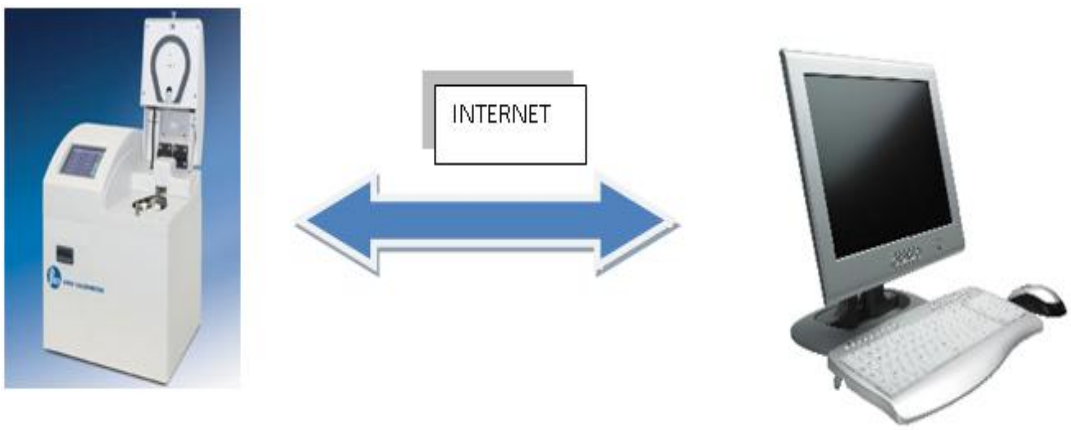


Figure 4. BC device

3.2 Malvern Mastersizer

Malvern Mastersizer enables the determination of size distribution of solid particles or liquid droplets in a sample. Laser diffraction is the technique used in this device. [6]

Figure 5. Malvern Mastersizer device[6]

3.3 Rheometer

Rheometer device can be used to characterize liquid flow behaviour as well as transforms in semi-solid materials both in rotational or oscillatory mode in the temperature range -40/-20..200°C (the range depends on measuring geometry). This device can mainly used to check the viscosity, cloud point and pour point of the sample. [6]

The complexity of the fuel heating and treatment system is determined by viscosity value. The temperature at which a cloud or a haze of wax crystals appears at the bottom of the samples is called Cloud Point while the temperature below which the fuel does not flow is the Pour Point. [6]

Figure 6. Rheometer device[6]

3.4 Titration

Titration device enables a wide range of potentiometric titration and is mainly used to reveal bio oils acid number, iodine value and peroxide value.

Acid number is the amount of KOH needed to neutralize free fatty acids while iodine value is the measure of hydrocarbon chain, a mass of iodine that is consumed by 100 grams of bio oils sample. [6]

Figure 7. Titration device

3.5 Differential Scanning Calorimetry (DSC)

Measuring the difference in the amount of heat required to increase the temperature of a sample and reference when measured as a function of temperature is done using DSC device.[6]

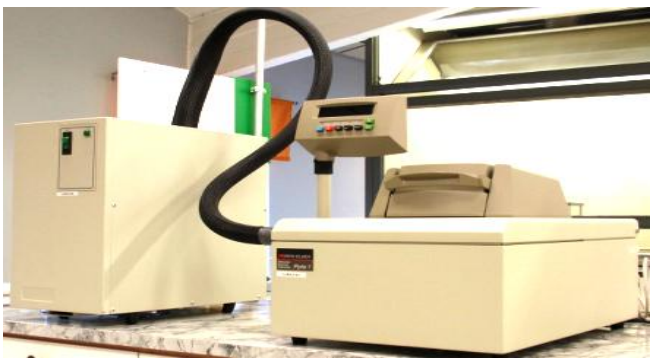


Figure 8. DSC device[6]

3.6 Rancimat

This device is used as the analyzer of only bio fuels. Rancimat tests the effectiveness of the antioxidants, additives and unwanted impurities in specific temperature. [6]

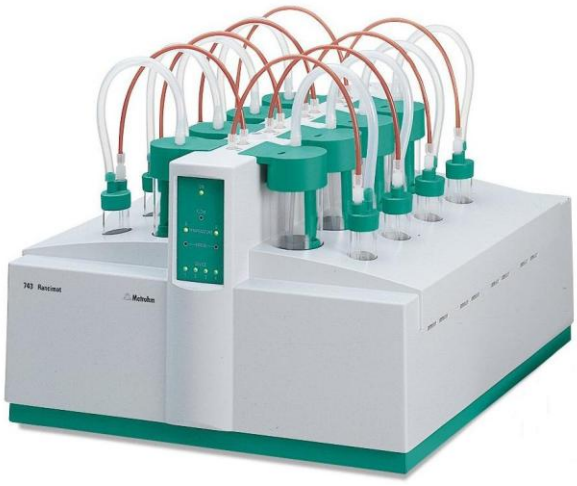


Figure 9. Rancimat device

3.7 Combustion Research Unit (CRU)

Examination of ignition sensitivity and combustion periods of liquid fuels is done using CRU device. The fuel that will be measured in this CRU needs to be sufficiently low. [6]

Figure 10. CRU device

4 THE APPLICATION DESCRIPTION

The main functionality of this application is to search measured data and import data for specific device, but to make this function works there are other functions that forms these main functionalities.

4.1 Requirement Analysis

Requirements analysis consist of the applications must have, should have and nice to have.

The application must have

- Own database file for all devices (MS Excel form)
- All files must have search function where all consist of criteria's ID numbers, Measurement Dates & additional criteria are
    - GHV and NHV for Bomb Calorimeter
    - Initial temp, End Temp and Atmosphere for DSC
    - Fuel Types and valid measurements for Rheometer
    - Arrival date, fuel type and valid for Titration
    - Temperature for Rancimat
    - Fuel Type and Ignition condition for CRU
    - MM only consist of ID numbers& Meas. date
- Import function for Titration, Bomb Calorimeter, DSC. These three consist of common properties that must be present such as ID number, Measurement Date & Time, Sample Weight. Additional Properties are
    - Spike Weight, Initial Temp, Temp. Rise, GHV, EEV, File Name, Link for Titration
    - Initial Temp, End Temp, Heat rate and Atmosphere for DSC
    - For Titration must include Arrival date, Operator, Fuel Type, Notes, Valid, 0-test consumption, KOH consumption. Then divided into three categories
        - Acid Number and Strong Acid Number
        - Iodine Value and Average Iodine Value
        - Peroxide Value and Average peroxide Value

- Main Search File
- Heat Values calculation for Bomb Calorimeter

The application should have

- User Interface for search/import
- Add to database function after import
- Check for duplicate when adding to database
- Additional search UI for Rheometer that can select from 4 meas. points to get the viscosity values and shear rate

Application is nice to have

- Access to user Manual
- Rheometer, adding measurements automatic data reformatting
- Calculation formula for Acid Number, Peroxide Value, Iodine Value
- Exit/Cancel function

5 DATA COLLECTION ANALYSIS & MANAGEMENT SYSTEM

The application needs to have the design to understand how the program should work. This section will go through the design of the program.

5.1 Access of computers

These seven devices have their own database in excel file where the measurements are stored. Malvern Mastersizer database, Rancimat and CRU have the same applications. All three devices aren't SONAD computers which mean that these computers are not able to connect to the Wärtsilä's intranet compass. The only way to add the data's to the database when the measurements are done is to copy/paste it to the SONAD computer that can access the IDM. The remaining databases have the function that includes import function which can access straight from the devices.

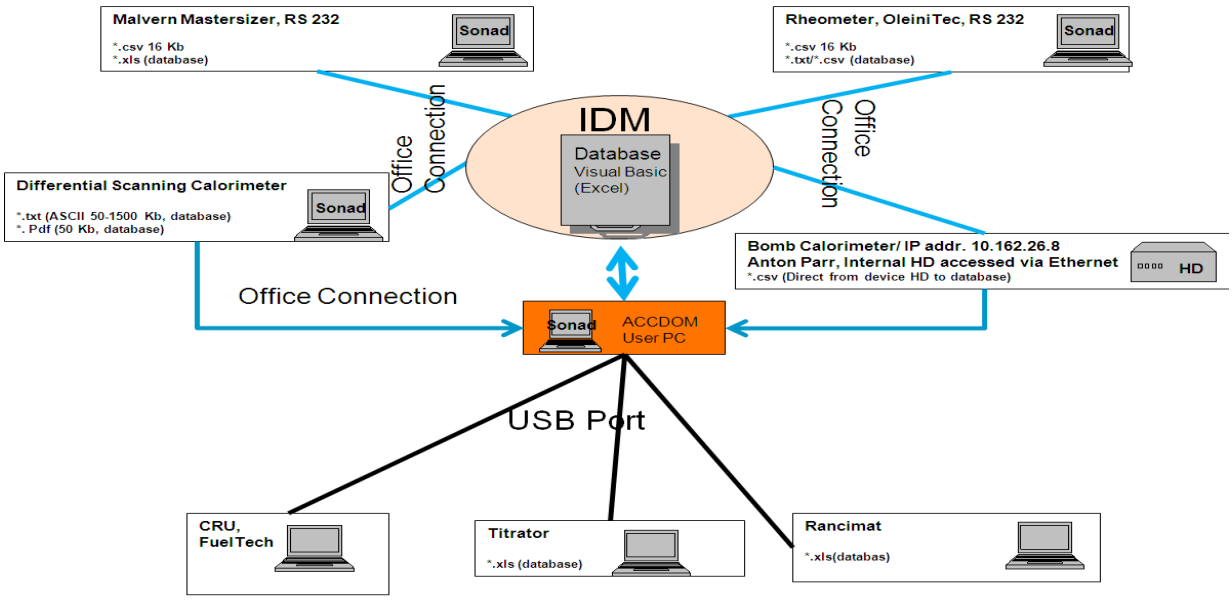


Figure 11. Access of computers

5.2 Flowchart

This flowchart will focus only to the Bomb Calorimeter and Main Search. Importing data for the Bomb Calorimeter consist of different functions.

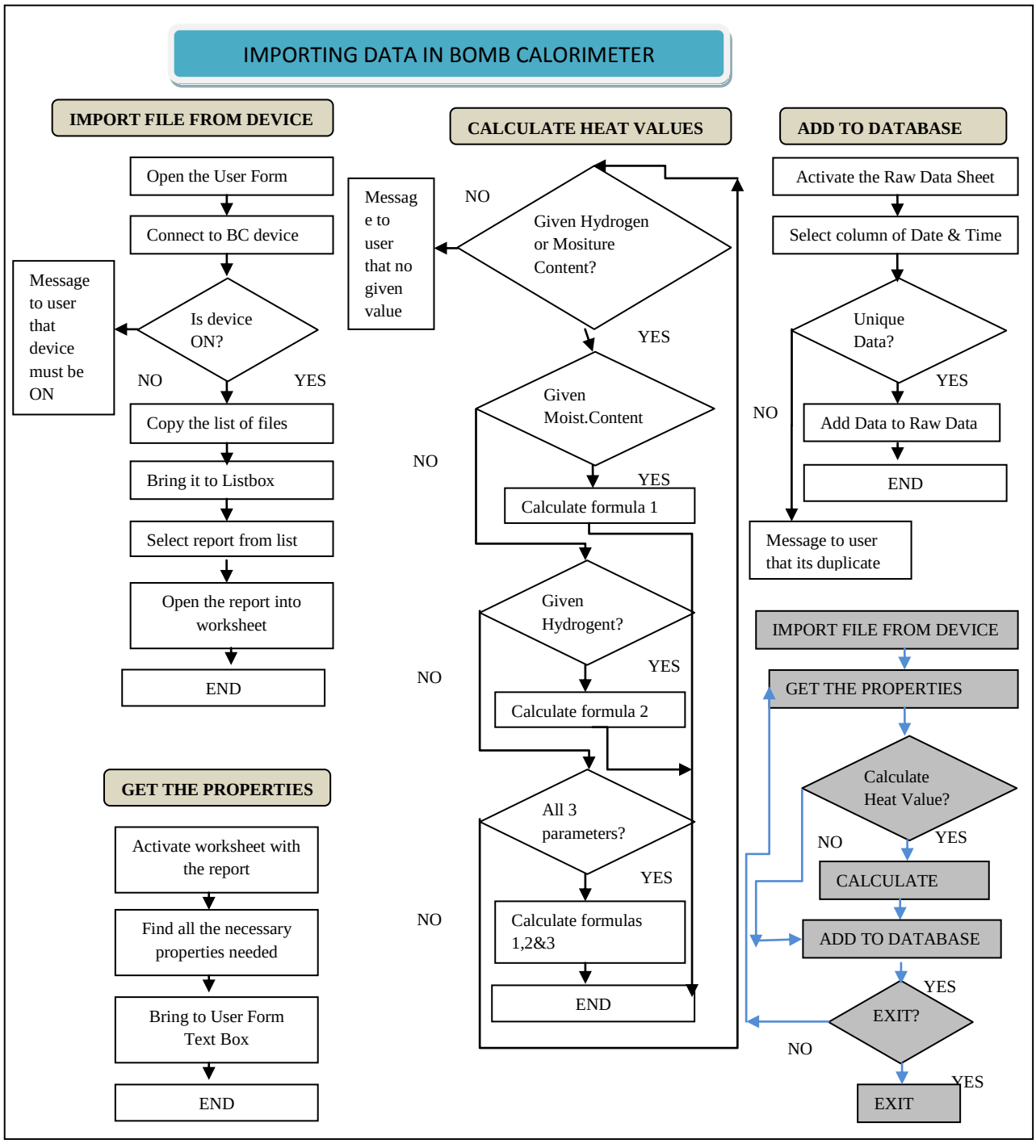


Figure 12. Flowchart for Importing in Bomb Calorimeter

This flowchart is for the Search function of Bomb Calorimeter, search can be from the Raw data or from Device.

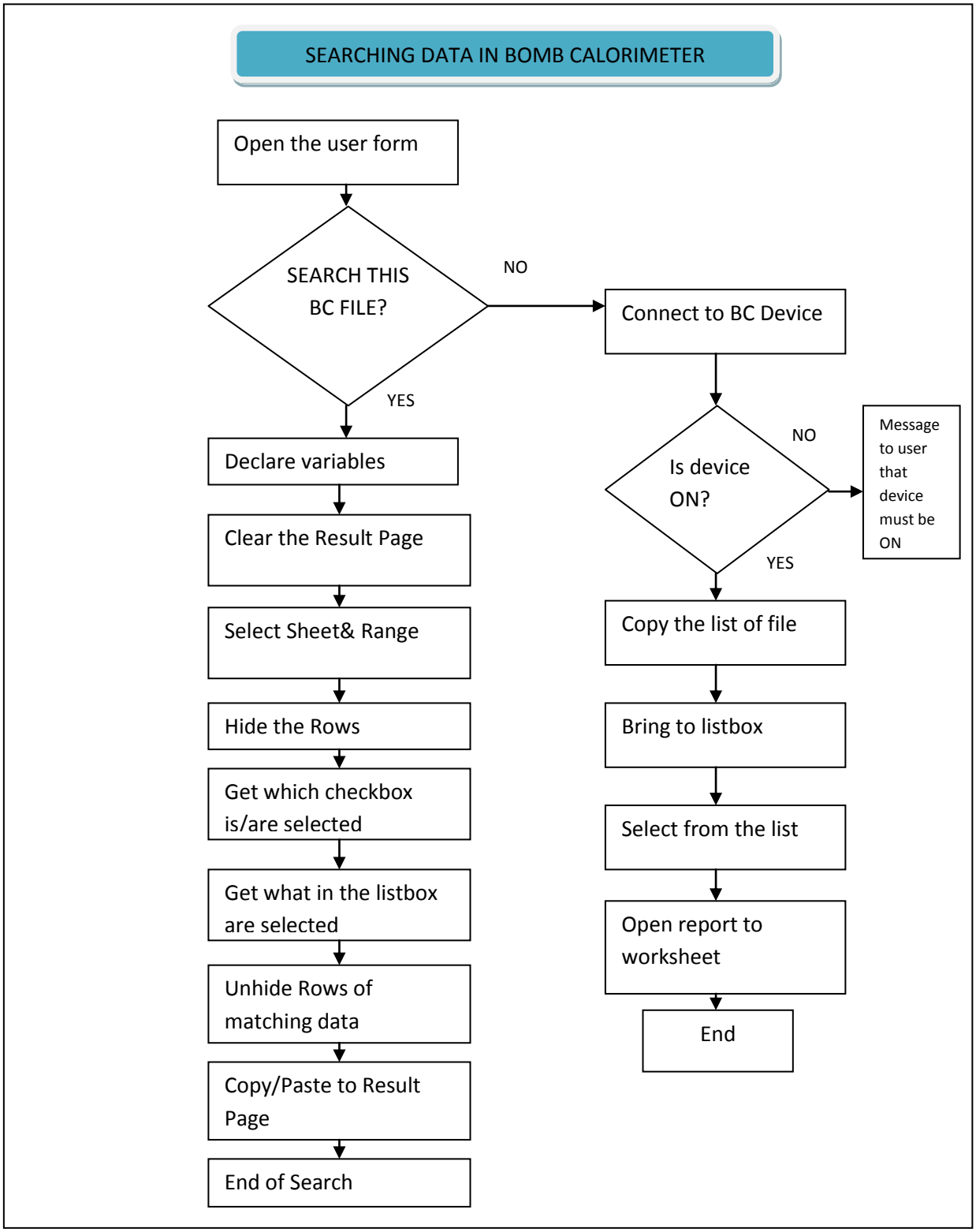


Figure 13. Flowchart for Searching Bomb Calorimeter

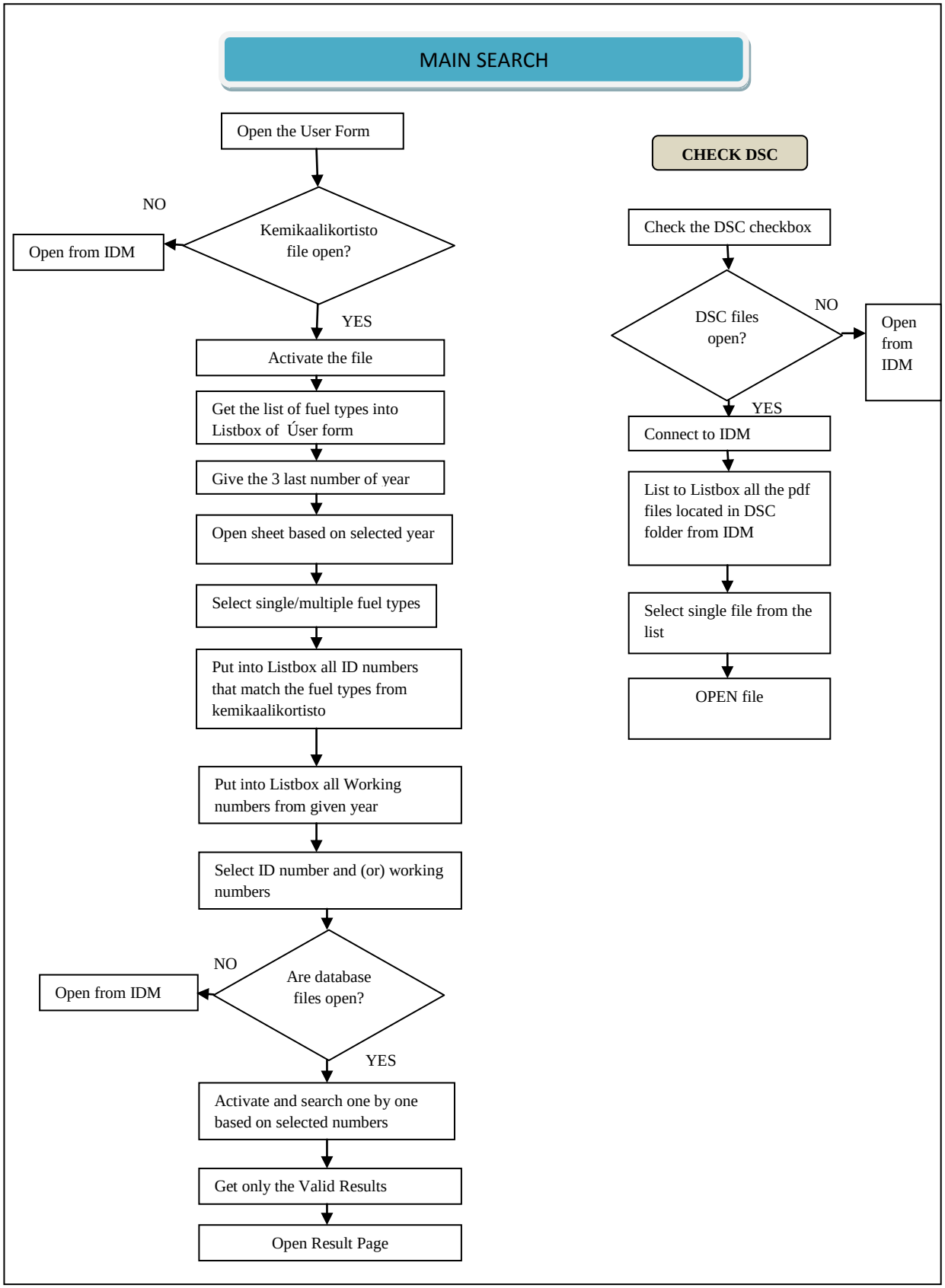


Figure 14. Flowchart for Main Search

Main Search connects to IDM and opens eight files including the kemikaalikortisto to get the fuel types.

5.3 Use Case Diagram

This use case diagram is done with the software Borland Together.

5.3.1 Use Case for Bomb Calorimeter

Two main function import and search for the user. There are other functions included to the main functionalities that cannot be discarded. Import needs the connection to the device, get necessary properties, select the measurements to be imported, calculate heat values and add to raw data.

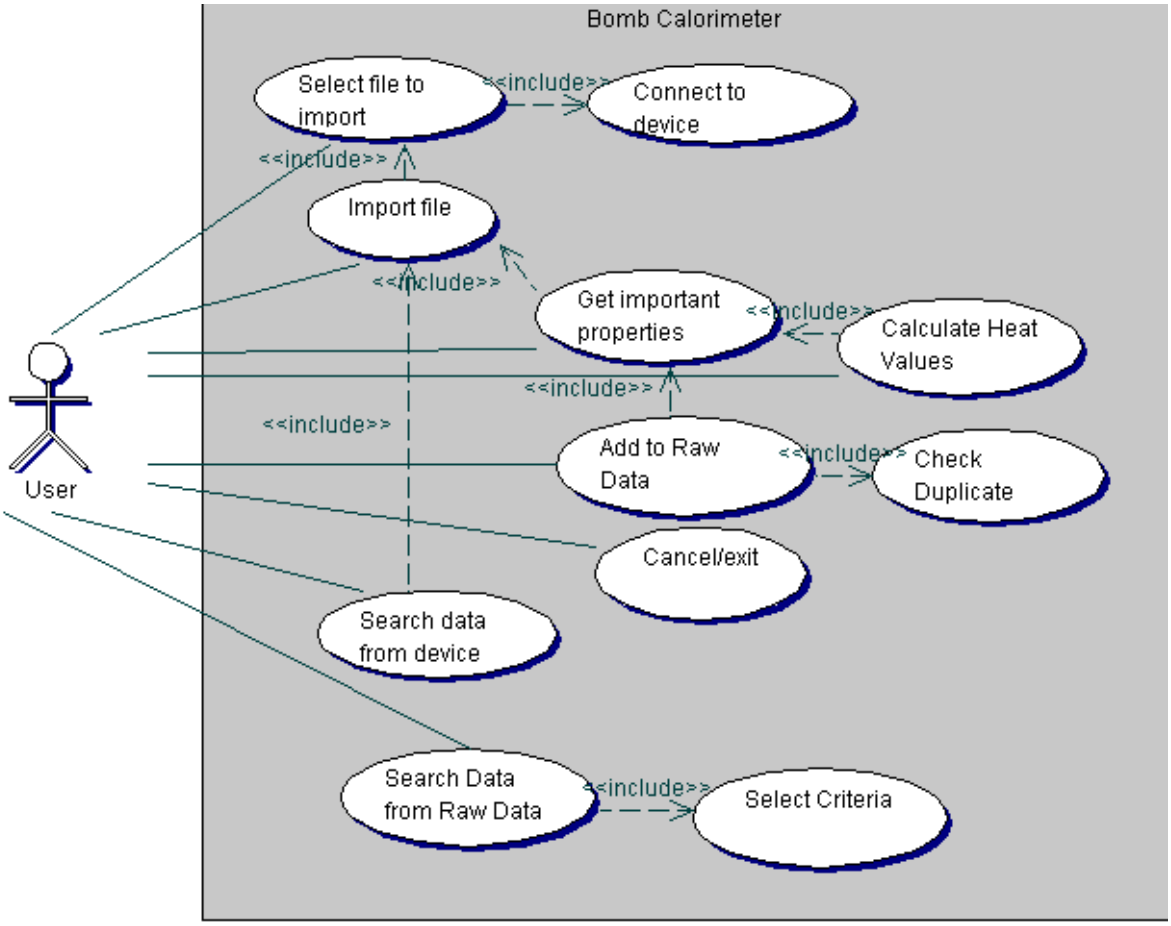


Figure 15. Bomb Calorimeter Use Case Diagram

5.3.2 Use Case for Rheometer

Rheometer's main function is to import viscosity and cloud points. Searching for viscosity has same four criteria's to select and the matching measurements can further get the viscosities by giving the four shear rates.

Adding data is done by adding into worksheet but there is code that reformats the inputted data into another worksheet. Further details will be in the Rheometer part of this report.

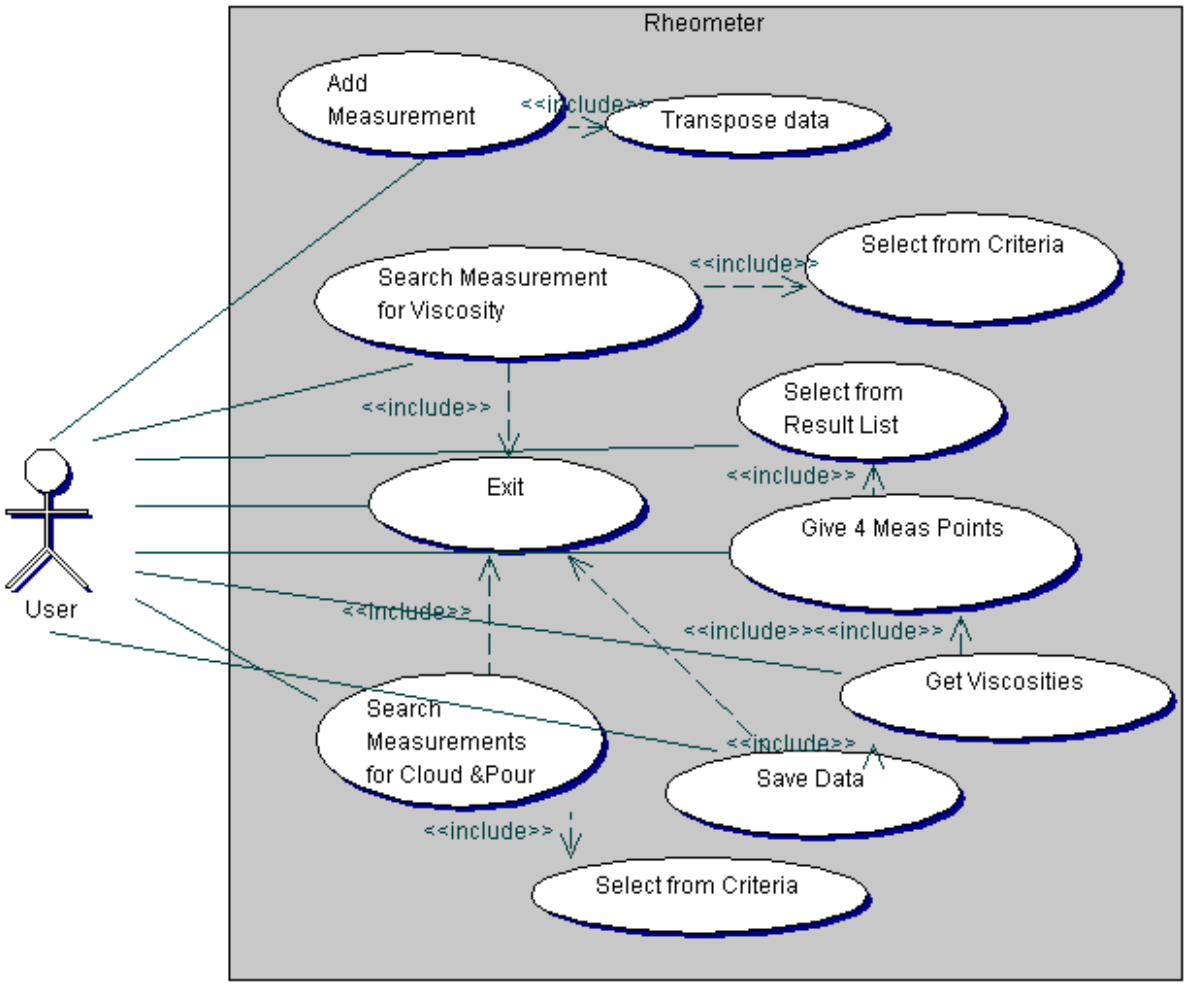


Figure 16. Rheometer Use Case Diagram

5.3.3 Use Case for DSC

Two main function import and search for the user. Import needs to open the file in the local drive, get necessary properties and add to raw data. Search can be from the database file or from the IDM where the list of .pdf files are stored.

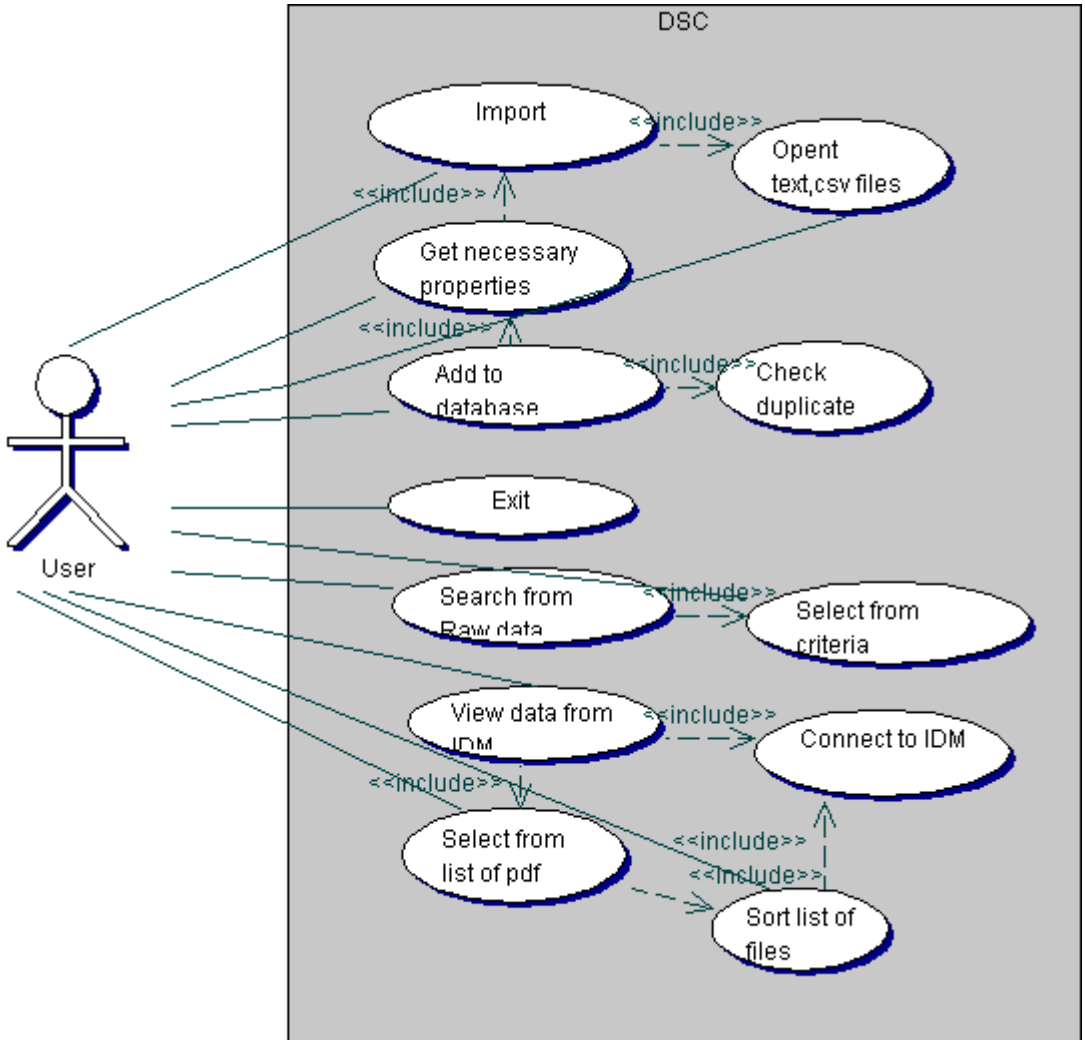


Figure 17. DSC Use Case Diagram

5.3.4 Use Case for Main Search

Main Search connects to IDM and opens eight files including the kemikaalikortisto to get the fuel types. User have to give the year, then based on selected fuel types, list of Id numbers and working numbers are listed where user have to select. User can also display desired database separately.

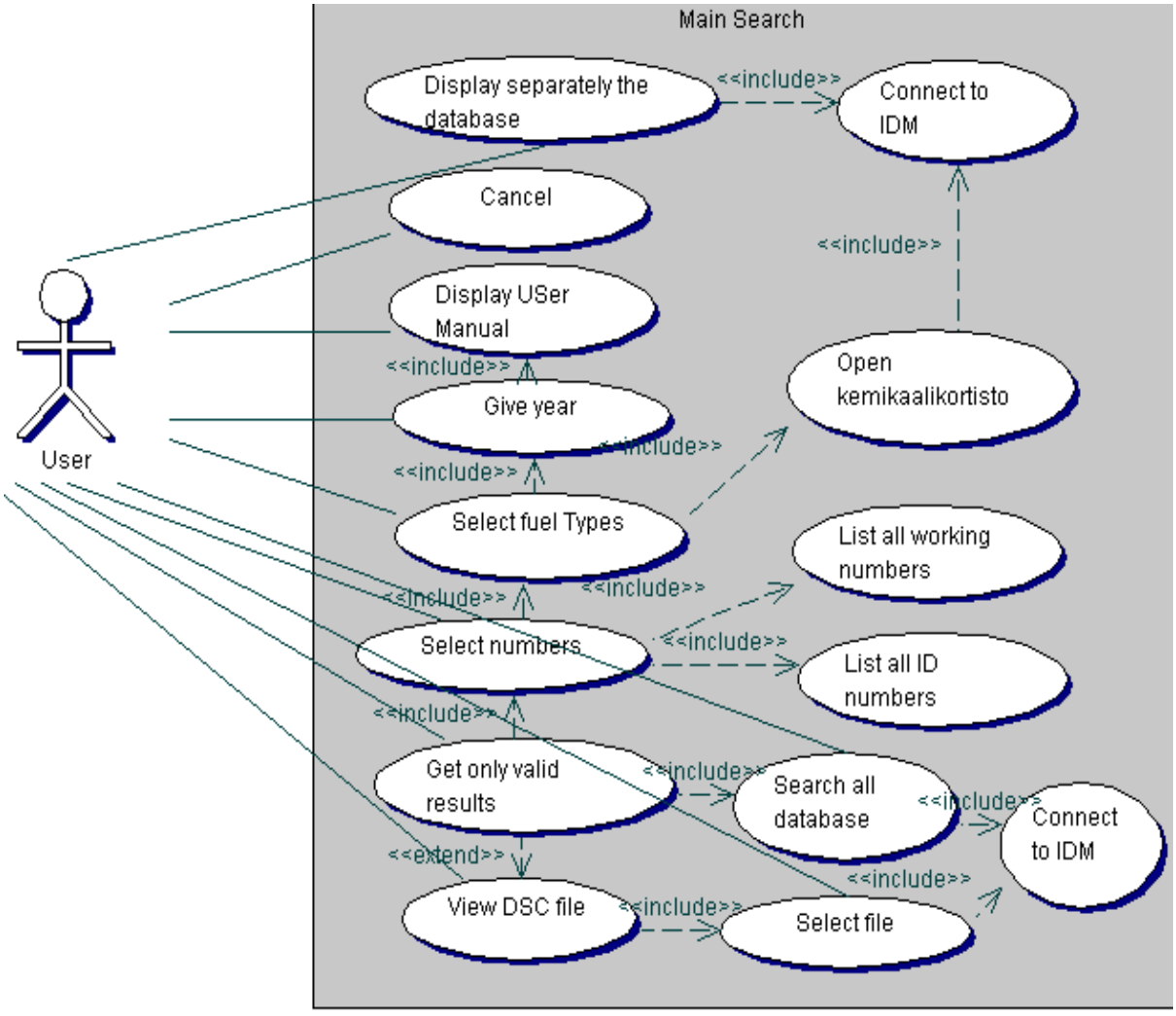


Figure 18. Main Search Use Case Diagram

6 THE IMPLEMENTATION & RESULT

In this particular part of report, the result during implementation of the code is discussed.

6.1 Bomb Calorimeter Application

Bomb Calorimeter Application has the main page Worksheet named ‘BCStart’. This Worksheet contains two Form Control Buttons.

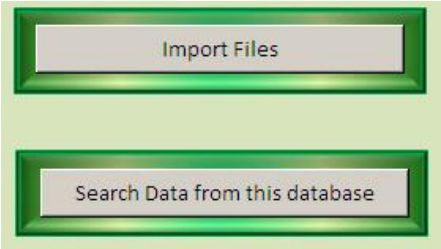


Figure 19. Bomb Calorimeter Form Control Buttons

These Form Control Buttons contains a macro shown in Snippet 1 which opens the specific user form (user interface) assigned to specific button.

```
Sub UserForm2Shw()
'Displays the user form 2 object
'which is for import
UserForm2.Show
End Sub

Sub UserFrm3Shw()
'Displays the user form 4 object
'which is the form for searching this BC database
UserForm4.Show
End Sub
```

Snippet 1. Control Buttons code

User form named UserForm2 is assigned to import while UserForm4 is for searching. Control buttons when pressed will display the forms.

6.1.1 Import Files

Clicking the button with name ‘Import Files’ will open the User Form shown in *Figure 15. BC Import File Connect.* In this UI the steps are marked in numbers for user to know what the process is.

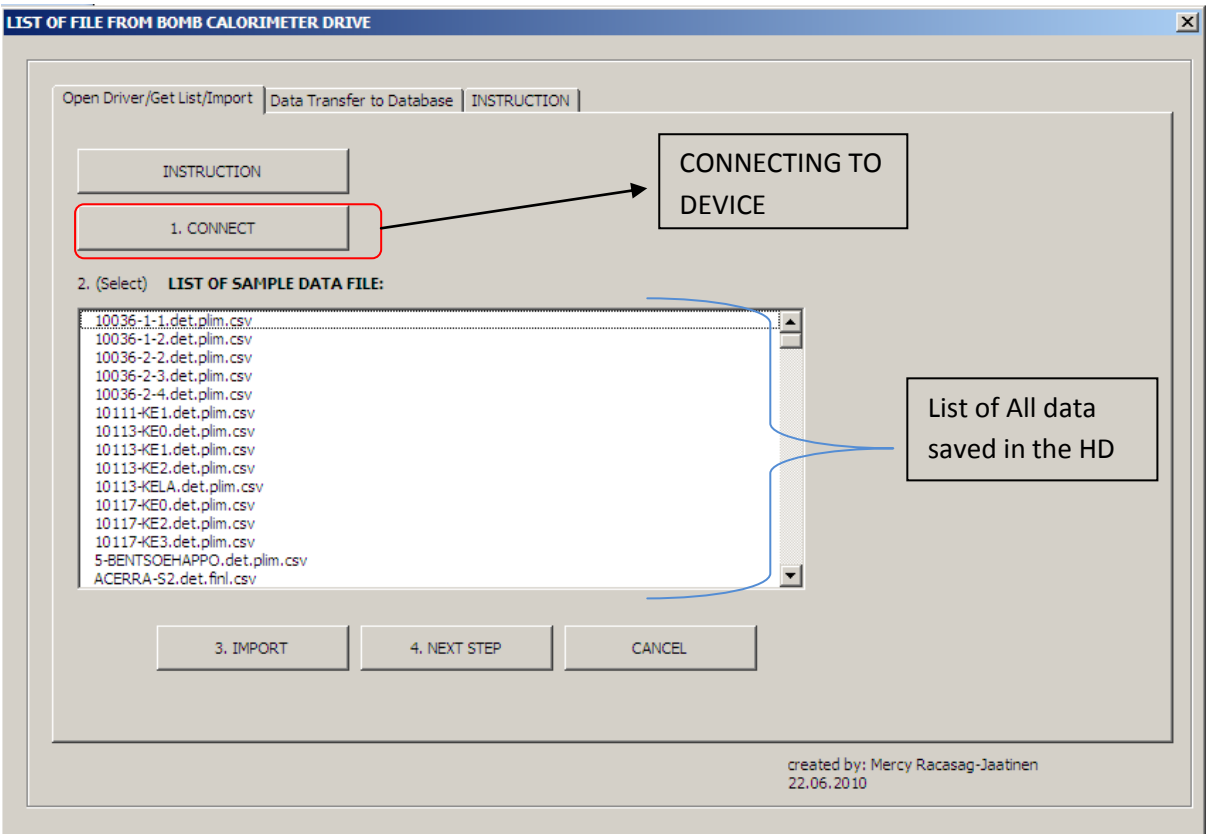


Figure 20. BC Import File Connect

```
Private Sub CommandButton3_Click()
ConnectDvce ' To connect to the device
End Sub
```

Snippet 2. Command Button Connect

Shown in the Snippet 2 is the code for the Connect command button that will run the function ConnectDvice. This function is describe in the next page of this report.

```
Sub ConnectDvce()
On Error GoTo ConnectMsg        'declare what to do if error occur
Application.ScreenUpdating = False 'disable screen updates
'Open the linkas workbook
Application.Workbooks.Open ("http://10.162.26.8/cgi-bin/runlist.cgi")
Application.DisplayAlerts = False 'disable alerts
Workbooks("runlist.cgi").Sheets(1).Select 'activate the first sheet of the workbook opened,
Cells.Select
Range("A1").Activate
Selection.Copy 'copy the list located in column A
Windows("BombCalorimeter.xlsm").Activate
 Sheets("BCOpenDrive").Select 'worksheet to be pasted
Range("A1").Paste
Selection.PasteSpecial Paste:=xlAll, Operation:=xlNone, SkipBlanks:= _
        False, Transpose:=False 'Paste all data, no calculation done, (copy as it is)
Sheets("Runlist_BombCalorimeter").Activate

Range("A1").Select
Application.CutCopyMode = False 'disable the cut copy mode
Workbooks("runlist.cgi").Close savechanges:=False 'close without saving changes
ListFile

ConnectMsg:        'if error occur inform the user and exit

MsgBox "Please check if the device is ON"

Exit Sub

Application.DisplayAlerts = True

Application.ScreenUpdating = False

End Sub
```

Snippet 3. ConnectDevice code

This function opens the link as a workbook which is runlist.cgi that contains all the files listed in Column A of first sheet. The range will be copied and pasted into BombCalorimeter workbook for the user form's listbox. To close the workbook without saving then settings for save changes needs to be False. Prompt message to the user will show if the device is close.

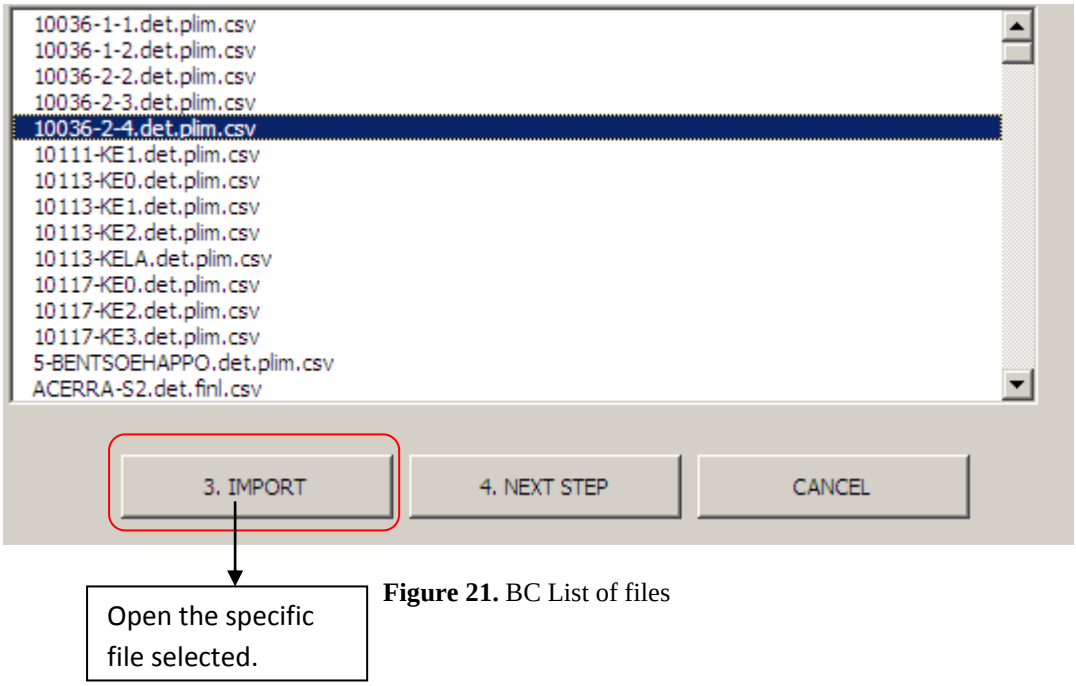


Figure 21. BC List of files

In ***Figure 21.*** *BC List of files* we can see that files are in .csv extensions but this will be in CGI extension stands for Common Gateway Interface which is a based standard for synchronizing external application with information server that are found throughout the internet or Hypertext Transfer Control(HTTP). [1] Documents with CGI File format provides an API, which receives the users input and produce the document in HTML form back to user. Query to the server through an IP address is done to retrieve the measurement data from the database stored in the device. In this case, the feedback document uses the web browser to display data as HTML document as shown in Figure 22 but we have to get and save the necessary properties and value into the Excel Database File.

The code for Command Button named ‘Import’ is shown in ***Snippet 4.*** Settings for application for both cut copy mode and the display alert as FALSE. In this reason, any prompts or alert messages while the macro is running will not show up.

```
Private Sub CommandButton1_Click()
Application.CutCopyMode = False
Application.DisplayAlerts = False 'disable for prompt messages
SelectV 'look for selected file and copy the link
ImportFile  'follow link,open file and import to worksheet
Application.CutCopyMode = False
Application.DisplayAlerts = True
Sheets("BCRawData").Activate 'Activate the RawData
End Sub
```

Snippet 4. Code for Import Command Button

This code consists of two separate codes such as SelectV and ImportFile. SelectV is the function to know what the selected file is and look for the link.

```
Sub SelectV()
Dim CellV As String
CellV = Range("Runlist_BombCalorimeter!S1").Value 'control source for list box
Sheets("Runlist_BombCalorimeter").Select
Range("A1:A65536").Select
Selection.Find(What:=CellV, After:=ActiveCell, LookIn:=xlValues, _
LookAt:=xlPart, SearchOrder:=xlByRows, SearchDirection:=xlNext, _
 MatchCase:=False).Activate 'find matching file from selected in list
ActiveCell.Offset(0, 1).Copy  'copy the link in next column
Range("Runlist_BombCalorimeter!S2").Select
        Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _
        False, Transpose:=False 'paste the link to another cell
Application.ScreenUpdating = False
End Sub
```

Snippet 5. Selected File Code

The Range.Find Method has the syntax ***Expression.Find(What, After, LookIn, LookAt, SearchOrder, SearchDirection, MatchCase, MatchByte, SearchFormat).*** Expression is the variable that represents the Range object which used as the selection Range ("A1:A65536") in Sheets("Runlist_BombCalorimeter"). Properties are described in ***Table 1.*** *Range.Find Properties* which was taken from the excel help developer reference. [9]

Table 1. Range.Find Properties

NAME	REQUIRED/ OPTIONAL	DATA TYPE	DESCRIPTION
What	Required	Variant	Data to search for.
After	Optional	Variant	The cell after which you want the search to begin. This corresponds to the position of the active cell when the search is done from the user interface.
LookIn	Optional	Variant	The type of Information
LookAt	Optional	Variant	Can be one of the following xlLookAt constants: xlWhole or xlPart
SearchOrder	Optional	Variant	Can be one of the following xlSearchOrder constants: xlByRow or xlByColumns
SearchDirection	Optional	xlSearchDrirection	Can be one of the following xlSearchDrirection constants: xlNext or xlPrevious
MatchCase	Optional	Variant	True to make the case sensitive, default is False
SearchFormat	Optional	Variant	The search format

```
Sub ImportFile()
Dim LinkOfFile As String
LinkOfFile = Range("Runlist_BombCalorimeter!S2").Value
Application.Workbooks.Open (LinkOfFile) 'open the link as workbook
GEtTHeReport 'transfer
Application.CutCopyMode = False
Application.ScreenUpdating = False
End Sub
```

Snippet 6. ImportFile Code

This function opens the link of the selected file from the list box which has the control source located in Range("Runlist_BombCalorimeter!S2").Value which is string data type.

```
Sub GEtTHeReport()
Application.ScreenUpdating = False
  Application.DisplayAlerts = False
  Workbooks("report.cgi").Sheets(1).Select 'select Sheet 1 of the report that was opened
  Cells.Select                    'from link
    Range("A1").Copy copy  'used cells from A1
    Workbooks("BombCalorimeter.xlsm").Activate
    Sheets("BCCopyingSheet").Select
    Range("a1").Paste  'paste to sheet of the bomb calorimeter file
Selection.PasteSpecial Paste:=xlAll, Operation:=xlNone, SkipBlanks:= _
          False, Transpose:=False  'paste as it is
    Sheets("BCCopyingSheet").Activate
    Application.CutCopyMode = False
 Workbooks("report.cgi").Close savechanges:=False  'close report without changes
 Application.ScreenUpdating = True
End Sub
```

Snippet 7. GEtTHeReport

Snippet 7 opens the report and copies it into the WorkSheet named BCCopyingSheet from the first row of column A. The paste method is set in a way that copied data will be pasted as it is.

Figure 22 *Original Report of Selected File* shows that the report is opened as a web document, and after running various macros, the document is now opened in worksheet given in next page.

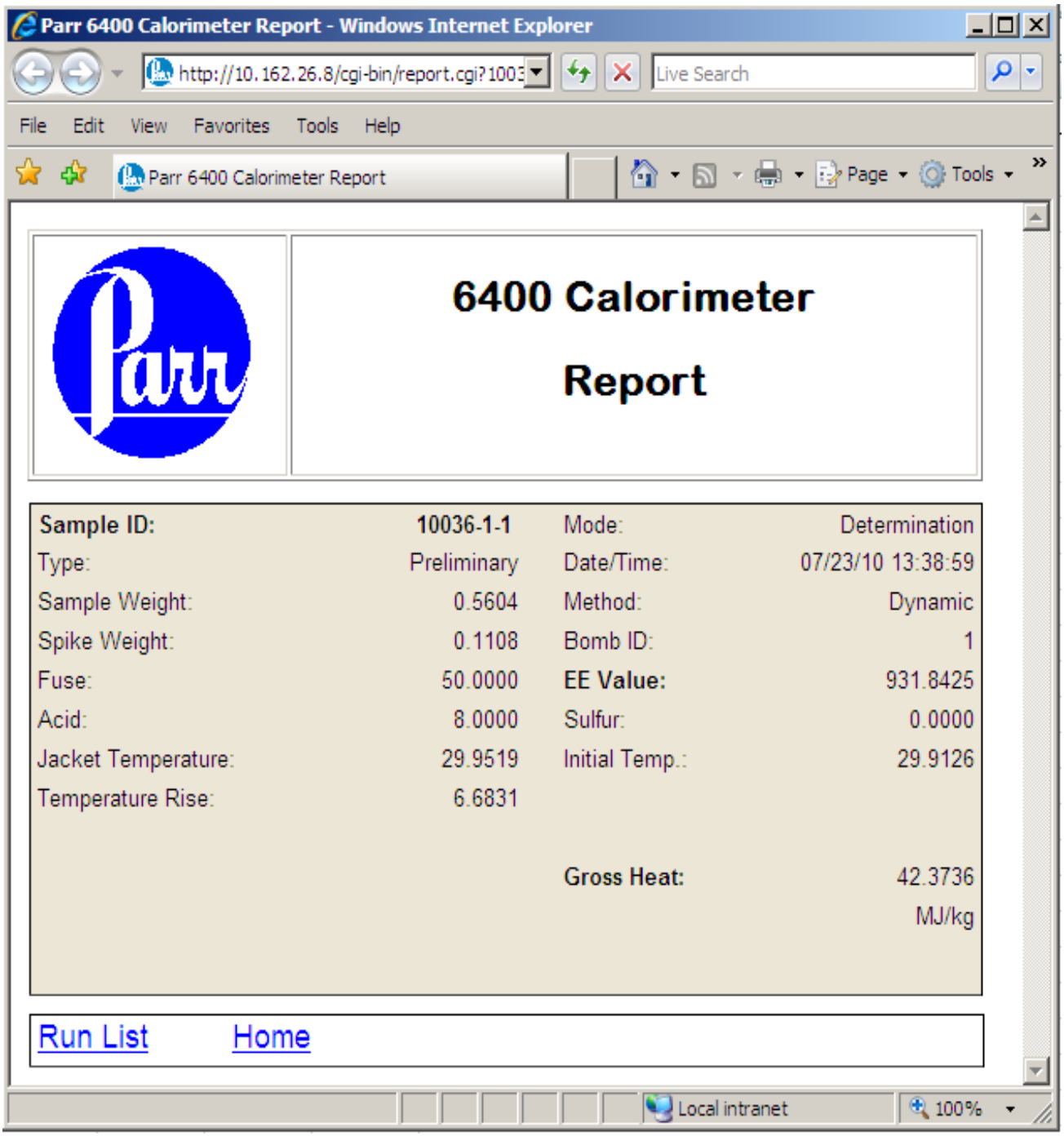
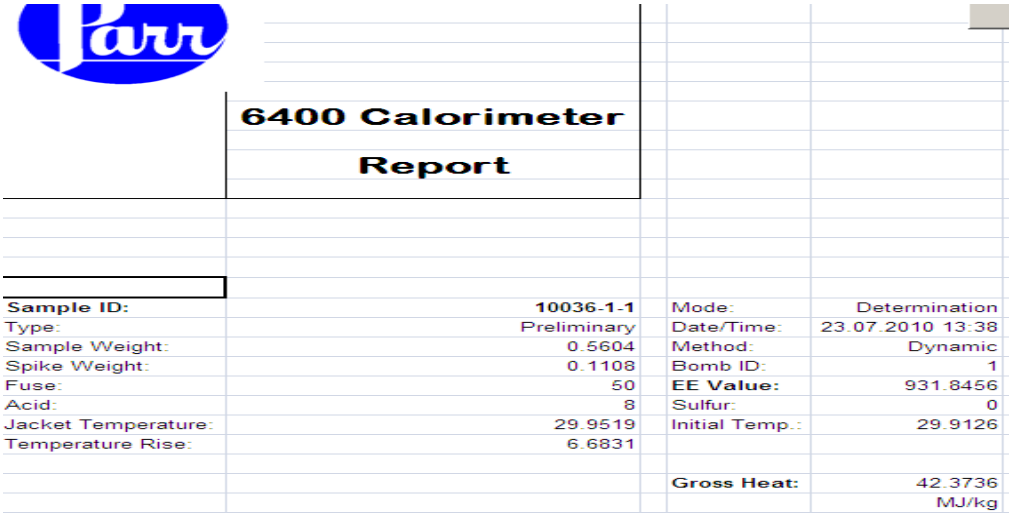


Figure 22. Original Report of Selected File



6400 Calorimeter Report

Sample ID:	**10036-1-1**	Mode:	Determination
Type:	Preliminary	Date/Time:	23.07.2010 13:38
Sample Weight:	0.5604	Method:	Dynamic
Spike Weight:	0.1108	Bomb ID:	1
Fuse:	50	**EE Value:**	931.8456
Acid:	8	Sulfur:	0
Jacket Temperature:	29.9519	Initial Temp.:	29.9126
Temperature Rise:	6.6831		
		Gross Heat:	42.3736 MJ/kg

Figure 23. Copying Worksheet

Worksheet in where the measurement selected from the previous task is now opened. This sheet will be used to get the necessary properties to be saved in this Bomb Calorimeter database.

6.1.2 Getting the Necessary Properties

Measurement from Figure 23 has too many properties and only specific properties discussed during the requirements analysis is needed to be saved into the Excel based database of this Bomb Calorimeter. Command Button 'Next Step' runs a macro that automatically activates the next page of this User Form and gets all the values of the properties that are needed.

```
Private Sub CommandButton4_Click()
Application.ScreenUpdating = False 'disable user to see what the macro is doing
MultiPage1.Value = 1 'Go to the user forms page 2
SelecttheDataFrmImport 'function to take necessary properties into range
GetDataBC 'function bring properites into the user form textbox
End Sub
```

Snippet 8. Command Button Next Step

```
Sub SelecttheDataFrmImport()
BCSName 'function that search the Sample Name and copy corresponding value into range
BCSWeight 'function that search the S.Weight and copy corresponding value into range
BCDate          'for Measurement Date
BCSpikeWeight 'for Spike weight
BCGHeat                 'for Gross Heat (HHV)
BCTempRise      'for Temperature Rise
BCInTemp        'for Initial Temperature
EEValue         'for EE Value
Application.ScreenUpdating = False
End Sub
Sub EEValue() 'Look for the EEValue and get the corresponding value on next column
 Sheets("BCCopyingSheet").Select
Range("A1:E50").Select 'Range where to find
Selection.Find(What:="EE Value:", After:=ActiveCell, LookIn:=xlFormulas, _
      LookAt:=xlPart, SearchOrder:=xlByRows, SearchDirection:=xlNext, _
      MatchCase:=False).Activate 'activate when found
ActiveCell.Offset(0, 1).Copy 'copy value from next column
Sheets("Runlist_BombCalorimeter").Activate
Range("AF15").Select 'Paste in this Sheet
Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _
          False, Transpose:=False 'Paste only values
 End Sub
Sub BCSName()'Look for the Sample ID
Sheets("BCCopyingSheet").Select
Range("A1:E50").Select
Selection.Find(What:="Sample ID:", After:=ActiveCell, LookIn:=xlValues, _
      LookAt:=xlPart, SearchOrder:=xlByRows, SearchDirection:=xlNext, _
      MatchCase:=False).Activate
ActiveCell.Offset(0, 1).Copy
Sheets("Runlist_BombCalorimeter").Activate
Range("AF3").Select
Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _
          False, Transpose:=False
 End Sub
 Sub BCSWeight()'Look for the Sample Weight
Sheets("BCCopyingSheet").Select
Range("A1:E50").Select
Selection.Find(What:="Sample Weight:", After:=ActiveCell, LookIn:=xlValues, _
      LookAt:=xlPart, SearchOrder:=xlByRows, SearchDirection:=xlNext, _
      MatchCase:=False).Activate
ActiveCell.Offset(0, 1).Copy
Sheets("Runlist_BombCalorimeter").Activate
Range("AF5").Select
Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _
          False, Transpose:=False
 End Sub
 Sub BCDate()'Look for the Measurements Date
Sheets("BCCopyingSheet").Select
Range("A1:E50").Select
Selection.Find(What:="Date/Time:", After:=ActiveCell, LookIn:=xlValues, _
      LookAt:=xlPart, SearchOrder:=xlByRows, SearchDirection:=xlNext, _
      MatchCase:=False).Activate
ActiveCell.Offset(0, 1).Copy
Sheets("Runlist_BombCalorimeter").Activate
```

```
Range("AF12").Select
        Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _
        False, Transpose:=False 'paste only values and don't transpose
End Sub
```

Snippet 9. SelectttheDataFrmImport

Snippet 9 is selects the properties of the measurement and put them in specific column to be used for bringing them into corresponding textbox of the user interface.

```
Sub GetDataBC()
'Bring the values of properties into user forms texbox
Application.ScreenUpdating = False 'unable user to see what macro does
TextBox1.Value = Range("Runlist_BombCalorimeter!AF3").Value 'Sample Name
TextBox2.Value = Range("Runlist_BombCalorimeter!AF5").Value  'SW
TextBox3.Value = Range("Runlist_BombCalorimeter!AG12").Value  'Date
TextBox4.Value = Range("Runlist_BombCalorimeter!AG13").Value  'Time
TextBox5.Value = Range("Runlist_BombCalorimeter!AF6").Value  'SpikeWeight
TextBox6.Value = Range("Runlist_BombCalorimeter!AF17").Value  'InTemp
TextBox7.Value = Range("Runlist_BombCalorimeter!AF10").Value  'TempRise
TextBox8.Value = Range("Runlist_BombCalorimeter!AF18").Value  'Gross Heat
TextBox9.Value = Range("Runlist_BombCalorimeter!S2").Value 'Link
TextBox10.Value = Range("Runlist_BombCalorimeter!S1").Value 'File Name
TextBox11.Value = Range("Runlist_BombCalorimeter!AF15").Value
TextBox19.Value = Range("Runlist_BombCalorimeter!AF12").Value
End Sub
```

Snippet 10. GetDataBC

GetDataBC function takes the properties into text boxes of the user form. TextBox1 is set to have the value for the Sample Name, TextBox2 for the Sample Weight and so on.

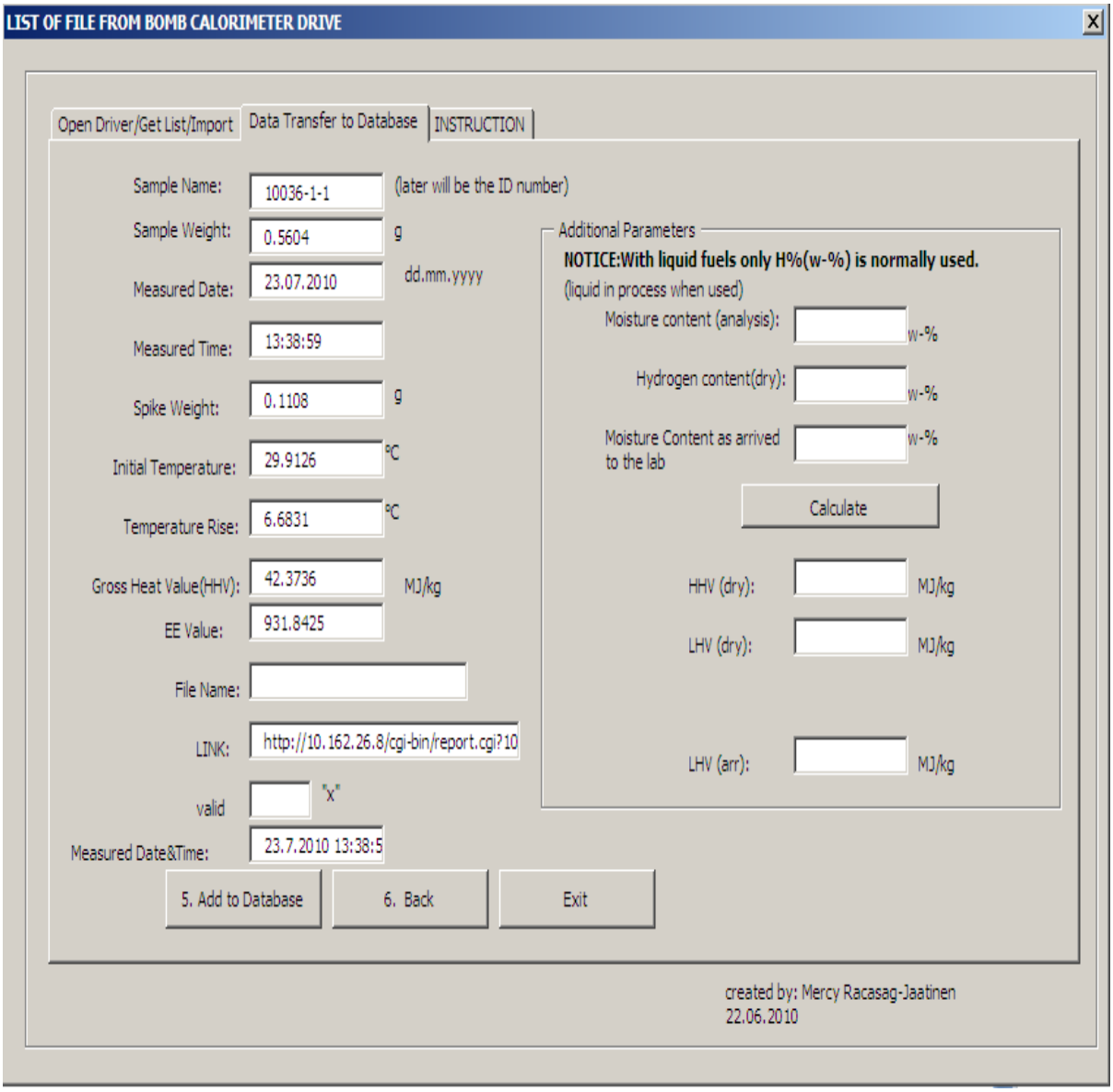


Figure 24. Data Transfer to Database

The user form looks like in Figure 24 above where values are shown with their corresponding properties. Heat Value Calculation is an option for user to do.

6.1.3 Heat Values Calculation

There is the Additional Parameter section in this page wherein the user can calculate the Higher Heat Value (HHV) or the Lower Heat Values (LHV) before saving the measurements to the database.

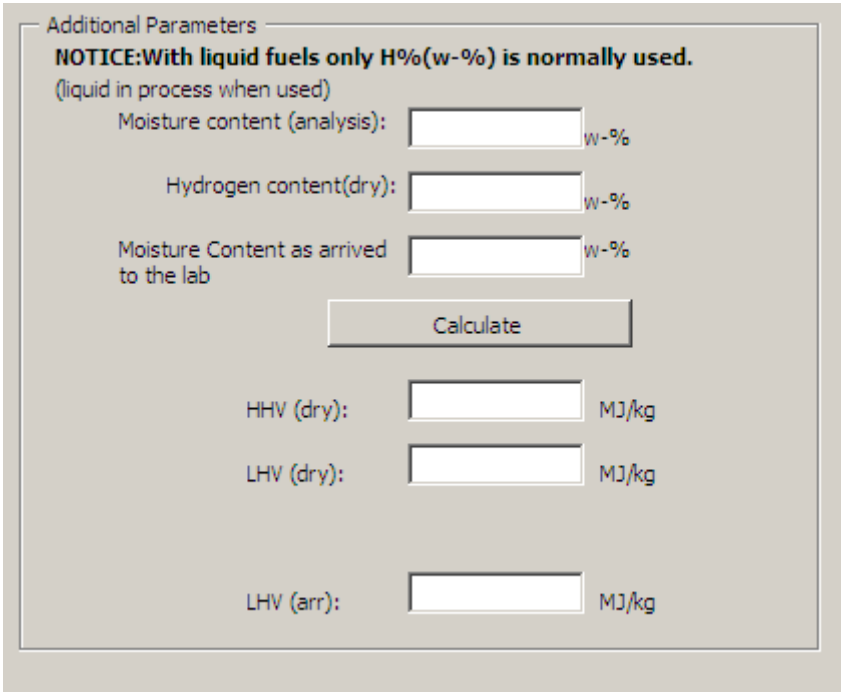


Figure 25. Heat Values

Calculation for the HHV or LHV needs the Moisture Content as analysis (M_a), Hydrogen Content (H %) or Moisture Content that arrived (M_{ar}).

$$HHV\ (dry) = Measured\ Value\ *(100/100- M_a) \quad (1)$$

$$LHV\ (dry) = HHV\ -0.2122\ *\ H\% \quad (2)$$

$$LHV\ (arrived) = LHV\ (dry)*((100- M_{ar})/100- 0.02441\ *\ M_{ar}) \quad (3)$$

```
Private Sub CommandButton11_Click()
'Message to user that there isn't any values if all three properties are missing
If TextBox12.Value = "" And TextBox13.Value = "" And TextBox15.Value = "" Then
MsgBox "There is't any value either for Hydrogen or Moisture Content"
'If only moisture content is given then formula 1 is used
ElseIf (Not TextBox15.Value = "") And TextBox12.Value = "" Then
TextBox16.Value = TextBox8.Value * (100 / (100 - TextBox15.Value)) 'only HHV dry
TextBox14.Value = "" 'Cancel values of LHV(dry) LHV(arr)
TextBox17.Value = ""
Label52.Caption = ""
'If Hydrogen content given then formula 2
ElseIf (Not TextBox12.Value = "") And TextBox15.Value = "" Then
TextBox14.Value = TextBox8.Value - (0.2122 * TextBox12.Value)
Label52.Caption = "water is neglictable" 'additional label shows when this is used
'if both moistures are present then use all 3 formulas one after another
ElseIf (Not TextBox12.Value = "") And (Not (TextBox15.Value = "") And_
 (Not (TextBox13.Value = ""))) Then
TextBox16.Value = TextBox8.Value * (100 / (100 - TextBox15.Value))
TextBox14.Value = TextBox16.Value - (0.2122 * TextBox12.Value)
TextBox17.Value = TextBox14.Value * ((100 - TextBox13.Value) / 100) - 0.02441 *
TextBox13.Value
Label52.Caption = ""
End If
End Sub
```

Snippet 11. Command Button Calculate

The formula follows the process, if given only the Moisture Content as analysis (M_a) then use formula (1), if only given Hydrogen Content (H%), use formula (2), if both are given then use the formula (1) and whatever result got using (1) will be used to calculate the formula (2). While in the case that all three are given including the Moisture Content that arrived (M_{ar}), formula will use the step from (1) to (2) and the outcome will be then used for calculating the formula (3).

6.1.4 Check Duplicate before Adding

There are samples that are measured several times in period of time which makes multiple appearance of the sample name or ID number except for measurement date & time.

```
Private Sub CommandButton5_Click()
Sheets("BCRawData").Activate
CheckDateAndTime 'function to check duplicate measurement date and time
End Sub


Sub CheckDateAndTime()
On Error GoTo Ex
Dim DTime As String 'declare the value of DTime to string
Worksheets("BCRawData").Activate
DTime = UserForm2.TextBox19.Value 'Set DTime as the textbox value
With Range("S6:S65536").Select 'find in column S if there is match to DTime
Selection.Find(What:=DTime, After:=ActiveCell, LookIn:=xlValues, _
        LookAt:=xlPart, SearchOrder:=xlByRows, SearchDirection:=xlNext, _
       MatchCase:=False).Activate 'Activate the cell
End With
If ActiveCell.Value = UserForm2.TextBox19.Value Then
MsgBox "Duplicate" 'Give prompt message to user that its duplicate
Else
Ex: BCToADDData 'else if no duplicate then Add data to raw data
Exit Sub
End If
End Sub
```

Snippet 12. Check Duplicate Entry

Snippet 12 finds a matching value of the measurement date & time from the user form within the specific range. If found match, then prompt a message to the user that it is a duplicate else add the data.

6.1.5 Add to Database

The Data will be added to the Worksheet name “BCRawData” from the text box of the form.

```
Sub BCToADDData()
‘Bring the textbox values into corresponding range of cells
Sheets("BCRawData").Activate
Range("A7").EntireRow.Insert ‘Insert new row in row 7
 Range("BCRawData!A7").Value = TextBox1.Value ‘Sample name to a7
Range("BCRawData!D7").Value = TextBox2.Value’‘Sample weight to d7
 Range("BCRawData!B7").Value = TextBox3.Value‘‘Meas.Date to b7
 Range("BCRawData!C7").Value = TextBox4.Value
Range("BCRawData!G7").Value = TextBox5.Value
 Range("BCRawData!E7").Value = TextBox6.Value
Range("BCRawData!F7").Value = TextBox7.Value'Added parameters
Range("BCRawData!H7").Value = TextBox12.Value
Range("BCRawData!I7").Value = TextBox13.Value
Range("BCRawData!J7").Value = TextBox14.Value
Range("BCRawData!K7").Value = TextBox8.Value
Range("BCRawData!L7").Value = TextBox9.Value
Range("BCRawData!M7").Value = TextBox10.Value
Range("BCRawData!N7").Value = TextBox11.Value
Range("BCRawData!O7").Value = TextBox18.Value
Range("BCRawData!P7").Value = TextBox15.Value'Added values'
Range("BCRawData!Q7").Value = TextBox17.Value
Range("BCRawData!R7").Value = TextBox16.Value
Range("BCRawData!S7").Value = TextBox19.Value
MsgBox "Suceessfully added"
End Sub
```

Snippet 13. Add Data to Database

6.1.6 Searching the Bomb Calorimeter

This Bomb Calorimeter database has two option for searching the measured samples, one is to search the database excel file based on the given criteria's e.g. Sample Name, Measurement Date, Gross Heat Value and Net Heat Values. The user can define any combination, based on what checkbox are selected. Second option is to connect to the Bomb Calorimeter Device and open the measurements with the reference to the filename saved and open it one at a time.

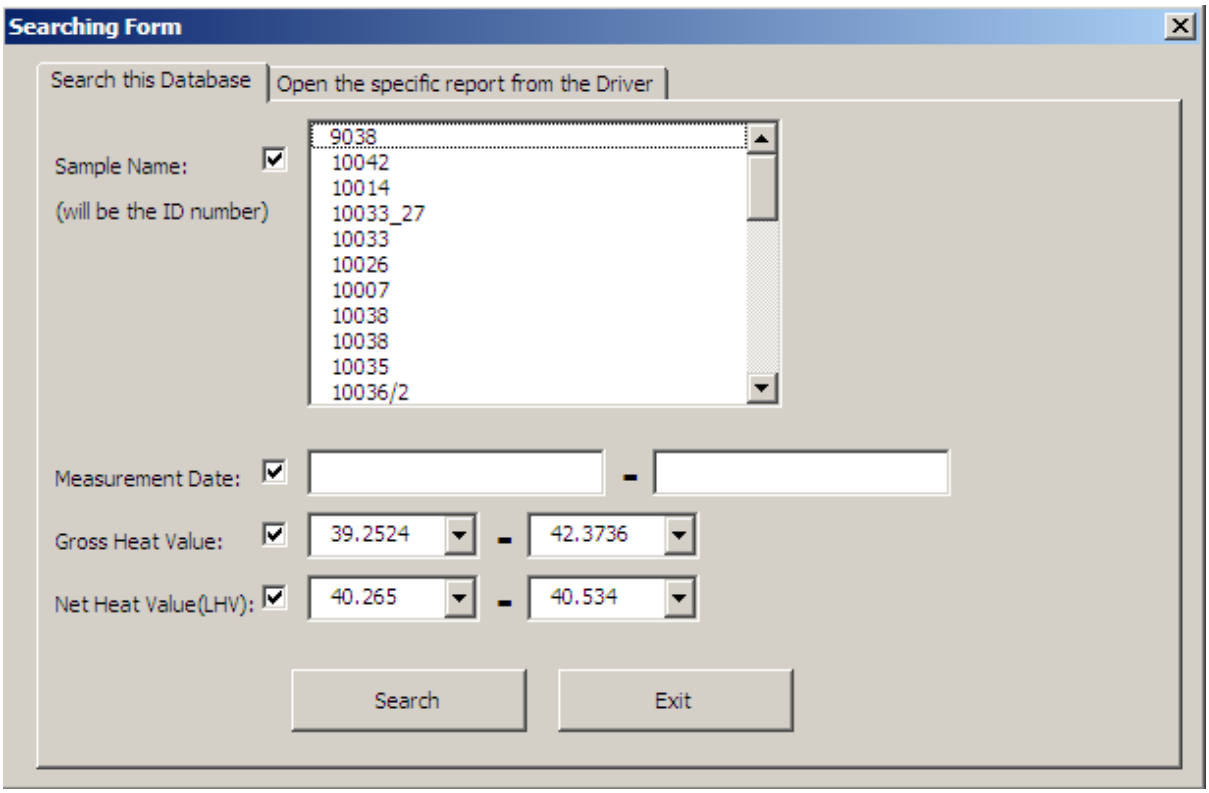


Figure 26. Searching the BC Database User Form

Figure 26 shows the Form for the first option. Each criteria's have their own checkbox. When the checkbox is selected for example with the Sample Name (ID number) criteria, the list of sample Name or ID number will be listed for the user to select one or more.

This function is combination of *Do While...Loop Statement*, *for...Next Statement* and *If...Else statement*. Few possibilities were tested, first used to filter the matching criteria but then using different combinations and multi-select list box decided to use the Hide/Unhide Row. The idea was referred from a previous project. [8] This program hides all the rows and when a match is found the row unhide until the last row is reached. When the search is successful, the entire visible row except the header will be copied to the result page of this database, otherwise prompt message to user will show if no match found.

```
Sub OtherOptionForSearchng()
'This function hide used range, unhide matching rows based on the combinations of selected
'criteriassuch as Sample weight, Measurement Date, Gross Heat Value and Net Heat Value
'Listbox for Sample Name can have mutiselection
 Application.ScreenUpdating = False
Sheets("BCResult").Range("C3:FY28").ClearContents 'Clear the sheet from previous search
   Dim BCRow As Integer 'declare the variables
   Dim DateM, DateM2 As Date
   Dim i As Long
   Sheets("BCRawData").Select 'Activate Raw data
   On Error GoTo Err_Execute
   BCRow = 6
Range("BCRawData!A6:R1000").EntireRow.Hidden = True 'Hide entirerow of used range
Do While Len(Range("A" & CStr(BCRow)).Value) <> 0
'(Sample Name,Gross Heat and Net Heat Value) 'get the selected list from muti selection listbox
If (UserForm4.CheckBox1.Value = True And UserForm4.Che ckBox2.Value = False _
 And UserForm4.CheckBox3.Value = True And UserForm4.CheckBox4.Value = True) Then
For i = 0 To UserForm4.ListBox1.ListCount – 1
If UserForm4.ListBox1.Selected(i) And _
(Range("A" & CStr(BCRow)).Value = CStr(UserForm4.ListBox1.List(i)) And _
 (Range("K" & CStr(BCRow)).Value > Range("BCStart!AH3").Value And _
Range("K" & CStr(BCRow)).Value < Range("BCStart!AH4").Value) _
And (Range("J" & CStr(BCRow)).Value > Range("BCStart!AJ3").Value And _
Range("J" & CStr(BCRow)).Value < Range("BCStart!AJ4").Value)) Then
Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
                End If
                Next i
'Checkboxes for Meas.Date,GHV,LHV are set to true
ElseIf (UserForm4.CheckBox1.Value = False And UserForm4.CheckBox2.Value = True _
 And UserForm4.CheckBox3.Value = True And UserForm4.CheckBox4.Value = False) Then
          DateM = UserForm4.TextBox1.Value  'Set the min date
          DateM2 = UserForm4.TextBox2.Value   'max date
          'Row K is for Gross Heat, B for Measurement Date, J for LHV
 If (Range("K" & CStr(BCRow)).Value > Range("BCStart!AH3").Value And _
Range("K" & CStr(BCRow)).Value < Range("BCStart!AH4").Value) _
And Range("B" & CStr(BCRow)).Value >= CDate(DateM) And _
Range("B" & CStr(BCRow)).Value <= CDate(DateM2) And _
(Range("J" & CStr(BCRow)).Value > Range("BCStart!AJ3").Value And _
```

```
Range("J" & CStr(BCRow)).Value < Range("BCStart!AJ4").Value) Then
        Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
End If
'Sample Name and LHV are selected
 ElseIf (UserForm4.CheckBox1.Value = True And UserForm4.CheckBox2.Value = False _
 And UserForm4.CheckBox3.Value = False And UserForm4.CheckBox4.Value = True) Then
For i = 0 To UserForm4.ListBox1.ListCount - 1
If UserForm4.ListBox1.Selected(i) And _
 (Range("A" & CStr(BCRow)).Value = CStr(UserForm4.ListBox1.List(i)) _
And (Range("J" & CStr(BCRow)).Value > Range("BCStart!AJ3").Value And _
Range("J" & CStr(BCRow)).Value < Range("BCStart!AJ4").Value)) Then
            Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
            End If
            Next i
ElseIf (UserForm4.CheckBox1.Value = True And UserForm4.CheckBox2.Value = False _
 And UserForm4.CheckBox3.Value = True And UserForm4.CheckBox4.Value = False) Then
  For i = 0 To UserForm4.ListBox1.ListCount - 1
  If UserForm4.ListBox1.Selected(i) And _
   (Range("A" & CStr(BCRow)).Value = CStr(UserForm4.ListBox1.List(i)) _
  And (Range("K" & CStr(BCRow)).Value > Range("BCStart!AH3").Value And _
Range("K" & CStr(BCRow)).Value < Range("BCStart!AH4").Value)) Then
'Unhide row if match value from Row A&K which are rows for Sample Name and GHV respectively
    Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
            End If
            Next i
'Unhide row if match value from Row J and Row K which are rows LHV and GHV respectively
ElseIf (UserForm4.CheckBox1.Value = False And UserForm4.CheckBox2.Value = False _
 And UserForm4.CheckBox3.Value = True And UserForm4.CheckBox4.Value = True _
  And (Range("K" & CStr(BCRow)).Value > Range("BCStart!AH3").Value And Range("K" &
CStr(BCRow)).Value < Range("BCStart!AH4").Value) And _
(Range("J" & CStr(BCRow)).Value > Range("BCStart!AJ3").Value And Range("J" &
CStr(BCRow)).Value < Range("BCStart!AJ4").Value)) Then
        Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
''ID number_MDate_and_GHV
ElseIf (UserForm4.CheckBox1.Value = True And UserForm4.CheckBox2.Value = True _
 And UserForm4.CheckBox3.Value = True And UserForm4.CheckBox4.Value = False) Then
            DateM = UserForm4.TextBox1.Value
            DateM2 = UserForm4.TextBox2.Value
For i = 0 To UserForm4.ListBox1.ListCount - 1
If UserForm4.ListBox1.Selected(i) And _
 (Range("A" & CStr(BCRow)).Value = CStr(UserForm4.ListBox1.List(i)) And _
 (Range("K" & CStr(BCRow)).Value > Range("BCStart!AH3").Value And _
Range("K" & CStr(BCRow)).Value < Range("BCStart!AH4").Value) _
And Range("B" & CStr(BCRow)).Value >= CDate(DateM) And _
Range("B" & CStr(BCRow)).Value <= CDate(DateM2)) Then
            Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
            End If
            Next i
```

```
'Unhide row if measurement date from column B are between the min and max date given
ElseIf (UserForm4.CheckBox1.Value = False And UserForm4.CheckBox2.Value = True _
And UserForm4.CheckBox3.Value = False And UserForm4.CheckBox4.Value = False) Then
        DateM = UserForm4.TextBox1.Value
        DateM2 = UserForm4.TextBox2.Value
If (Range("B" & CStr(BCRow)).Value >= CDate(DateM) _
And Range("B" & CStr(BCRow)).Value <= CDate(DateM2)) Then
Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
End If
'Criteria selected are ID number (Sample Name) and Measurement Date
ElseIf (UserForm4.CheckBox1.Value = True And UserForm4.CheckBox2.Value = True _
 And UserForm4.CheckBox3.Value = False And UserForm4.CheckBox4.Value = False) Then
          DateM = UserForm4.TextBox1.Value
          DateM2 = UserForm4.TextBox2.Value
For i = 0 To UserForm4.ListBox1.ListCount - 1
If UserForm4.ListBox1.Selected(i) And _
 (Range("A" & CStr(BCRow)).Value = CStr(UserForm4.ListBox1.List(i)) _
And Range("B" & CStr(BCRow)).Value >= CDate(DateM) And _
Range("B" & CStr(BCRow)).Value <= CDate(DateM2)) Then
            Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
            End If
            Next i
'If only ID number (S.N) is selected, unhide row from column A match, this is multi select list box
 ElseIf (UserForm4.CheckBox1.Value = True And UserForm4.CheckBox2.Value = False _
And UserForm4.CheckBox3.Value = False And UserForm4.CheckBox4.Value = False) Then
For i = 0 To UserForm4.ListBox1.ListCount - 1
If UserForm4.ListBox1.Selected(i) And _
 (Range("A" & CStr(BCRow)).Value = CStr(UserForm4.ListBox1.List(i))) Then
          Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
            End If
            Next i
'If only Gross Heat is selected criteria, unhide row from column K match, this is multi select list box
ElseIf (UserForm4.CheckBox1.Value = False And UserForm4.CheckBox2.Value = False _
 And UserForm4.CheckBox3.Value = True And UserForm4.CheckBox4.Value = False _
 And (Range("K" & CStr(BCRow)).Value > Range("BCStart!AH3").Value And Range("K" &
CStr(BCRow)).Value < Range("BCStart!AH4").Value)) Then
        Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
'If only Net Heat is selected criteria, unhide row from column Jmatch, this is multi select list box
 ElseIf (UserForm4.CheckBox1.Value = False And UserForm4.CheckBox2.Value = False _
 And UserForm4.CheckBox3.Value = False And UserForm4.CheckBox4.Value = True _
And (Range("J" & CStr(BCRow)).Value >= Range("BCStart!AJ3").Value And Range("J" &
CStr(BCRow)).Value <= Range("BCStart!AJ4").Value)) Then
        Rows(CStr(BCRow) & ":" & CStr(BCRow)). EntireRow.Hidden = False
'Measurement Date and Gross Heat are selected
ElseIf (UserForm4.CheckBox1.Value = False And UserForm4.CheckBox2.Value = True _
 And UserForm4.CheckBox3.Value = True And UserForm4.CheckBox4.Value = False) Then
        DateM = UserForm4.TextBox1.Value
         DateM2 = UserForm4.TextBox2.Value
```

```
 If (Range("K" & CStr(BCRow)).Value > Range("BCStart!AH3").Value And Range("K" &
CStr(BCRow)).Value < Range("BCStart!AH4").Value) _
And Range("B" & CStr(BCRow)).Value >= CDate(DateM) And Range("B" & CStr(BCRow)).Value
<= CDate(DateM2) Then
          Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
            End If
'Measurement Date and Net Heat are selected
ElseIf (UserForm4.CheckBox1.Value = False And UserForm4.CheckBox2.Value = True _
 And UserForm4.CheckBox3.Value = False And UserForm4.CheckBox4.Value = True) Then
          DateM = UserForm4.TextBox1.Value
          DateM2 = UserForm4.TextBox2.Value
If (Range("J" & CStr(BCRow)).Value > Range("BCStart!AJ3").Value And Range("J" &
CStr(BCRow)).Value < Range("BCStart!AJ4").Value) And _
Range("B" & CStr(BCRow)).Value >= CDate(DateM) And Range("B" & CStr(BCRow)).Value <=
CDate(DateM2) Then
Rows(CStr(BCRow) & ":" & CStr(BCRow)). EntireRow.Hidden = False
        End If
'Only GHV is unselected (124)
 ElseIf (UserForm4.CheckBox1.Value = True And UserForm4.CheckBox2.Value = True _
 And UserForm4.CheckBox3.Value = False And UserForm4.CheckBox4.Value = True) Then
           DateM = UserForm4.TextBox1.Value
          DateM2 = UserForm4.TextBox2.Value
For i = 0 To UserForm4.ListBox1.ListCount - 1
If UserForm4.ListBox1.Selected(i) And _
 (Range("A" & CStr(BCRow)).Value = CStr(UserForm4.ListBox1.List(i)) _
And (Range("J" & CStr(BCRow)).Value > Range("BCStart!AJ3").Value And _
Range("J" & CStr(BCRow)).Value < Range("BCStart!AJ4").Value) And Range("B" & _
CStr(BCRow)).Value >= CDate(DateM) And Range("B" & CStr(BCRow)).Value <= _
CDate(DateM2)) Then
            Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
              End If
              Next i
 'ALL four citerias are selected (1234)
 ElseIf (UserForm4.CheckBox1.Value = True And UserForm4.CheckBox2.Value = True _
 And UserForm4.CheckBox3.Value = True And UserForm4.CheckBox4.Value = True) Then
 DateM = UserForm4.TextBox1.Value  'Min Date
 DateM2 = UserForm4.TextBox2.Value  'Max Date
 For i = 0 To UserForm4.ListBox1.ListCount – 1 'Multiselect Sample Name List
If UserForm4.ListBox1.Selected(i) And  (Range("A" & CStr(BCRow)).Value = _
CStr(UserForm4.ListBox1.List(i)) And (Range("K" & CStr(BCRow)).Value > _
Range("BCStart!AH3").Value And Range("K" & CStr(BCRow)).Value < _
Range("BCStart!AH4").Value) And (Range("J" & CStr(BCRow)).Value > _
Range("BCStart!AJ3").Value And Range("J" & CStr(BCRow)).Value <  _
Range("BCStart!AJ4").Value) And Range("B" & CStr(BCRow)).Value >= CDate(DateM) _ And
Range("B" & CStr(BCRow)).Value <= CDate(DateM2)) Then
            Rows(CStr(BCRow) & ":" & CStr(BCRow)).EntireRow.Hidden = False
              End If
              Next i
```

```
 End If
  BCRow = BCRow + 1
   Loop
Sheets("BCRawData").Select
Rows("6:1000").SpecialCells(xlCellTypeVisible).Copy 'Copy only visible rows
Sheets("BCResult").Activate
Range("C3").Select
Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _
False, Transpose:=True 'Paste to result page worksheet
Worksheets("BCRawData").Activate
Rows("6:1000").EntireRow.Hidden = False 'show the entire row in Raw data
Sheets("BCResult").Select
MsgBox "Complete." 'Message to user when successful
UserForm4.Hide 'Hide the form
Sheets("BCResult").Select    'Activate the Reult page for user to view the result of search
Exit Sub
Err_Execute:MsgBox "No Match Found,try again"   'Message if no match found
    Worksheets("BCRawData").Activate
    Rows("6:1000").EntireRow.Hidden = False
    Worksheets("BCStart").Activate 'activate Start page
End Sub
```

Snippet 14. Search Function from Raw Data [8]

This multiple pages Snippet 14 is the code for the search which give the combination of the four criteria. The user can select any combination or select just one. The result will be in the worksheet named BCResult, where all the matching measurements are copied after search.

SAMPLE NAME		10007	10038	10038
MEASUREMENT DATE		23.06.2010	08.06.2010	08.06.2010
MEASUREMENT TIME		12:26:10	12:53:13	13:35:46
SAMPLE WEIGHT	g	0.5111	0.5512	0.5586
INITIAL TEMP	°C	29.8456	30.0025	29.6117
TEMP. RISE	°C	5.8443	5.4088	5.4845
SPIKE WEIGHT	g	0.0000	0.0000	0.0000
Hydrogen (H)				
Moisture Content(as arrived)	w-%			
LHV (dry)	MJ/kg			
GROSS HEAT	MJ/kg	44.1395	37.8436	37.8775
LINK		http://10.162.26.8/cgi-bin/report.cgi?I	http://10.162.26.8/cgi-bin/report.cgi?I	http://10.162.26.8/cgi-bin/report.c
FILE NAME		KONDENSA2.det.plim.csv	ID10038.det.plim.csv	ID10038-2.det.plim.csv
EE Value		931.9013	931.9288	931.9288
Valid	(x)		x	x
Moisture Content(analysis)	w-%			
LHV(arr)				
HHV(dry)				

<< Back

Figure 27. Bomb Calorimeters Result Page

The second option for user is to search the device itself which is similar to our previous function IMPORT. Here is the User Form for this particular search.

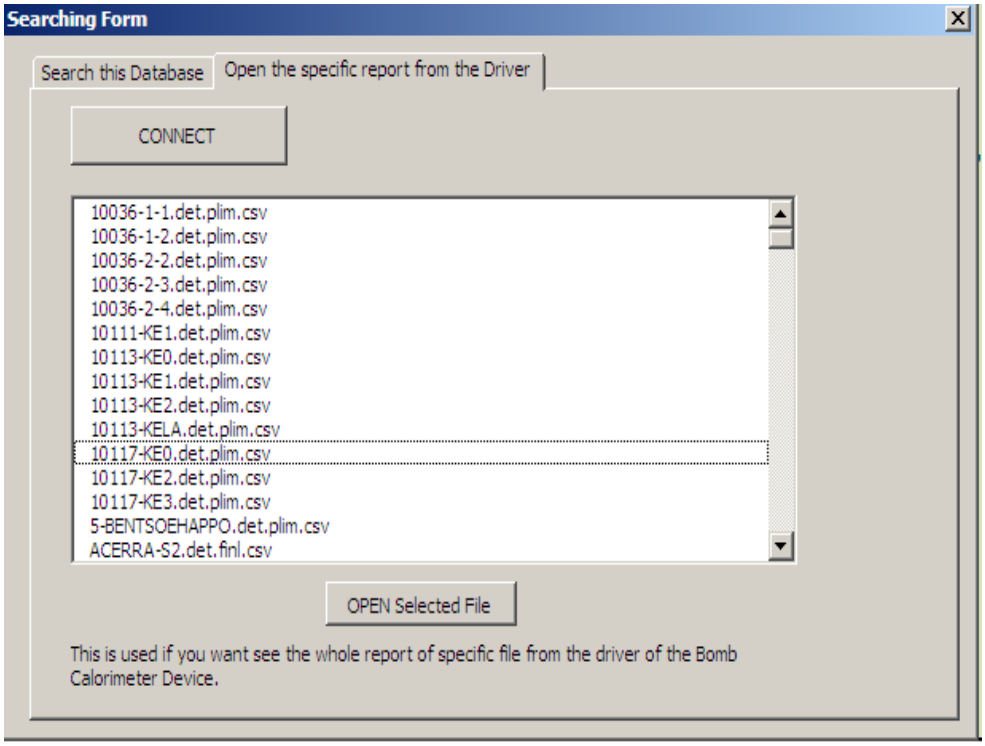


Figure 28. Searching the BC Device User Form

Snippet 3, 5, 6 and 7 are used in this function as of Import. This consist of exactly same process which connect to Bomb Calorimeter device, open the link as workbook and copy all the list of files that will be placed in the list box too. The user can select one file, then open the selected file in worksheet.

6.2 DSC Application

DSC has two main functionalities like the Bomb Calorimeter but the import for external file is taken from the user's local drive while the search is connecting to IDM to get the list of PDF files stored in there after measuring from DSC device.

6.2.1 DSC Search Function

This DSC search form has two options too, similar to the Bomb Calorimeter except this search directly from IDM wherein all the measured data were directly saved. All the measured data in IDM are in PDF format. In Figure 29 below shows the user form for searching the DSC database where measurements that weren't in PDF files are saved.

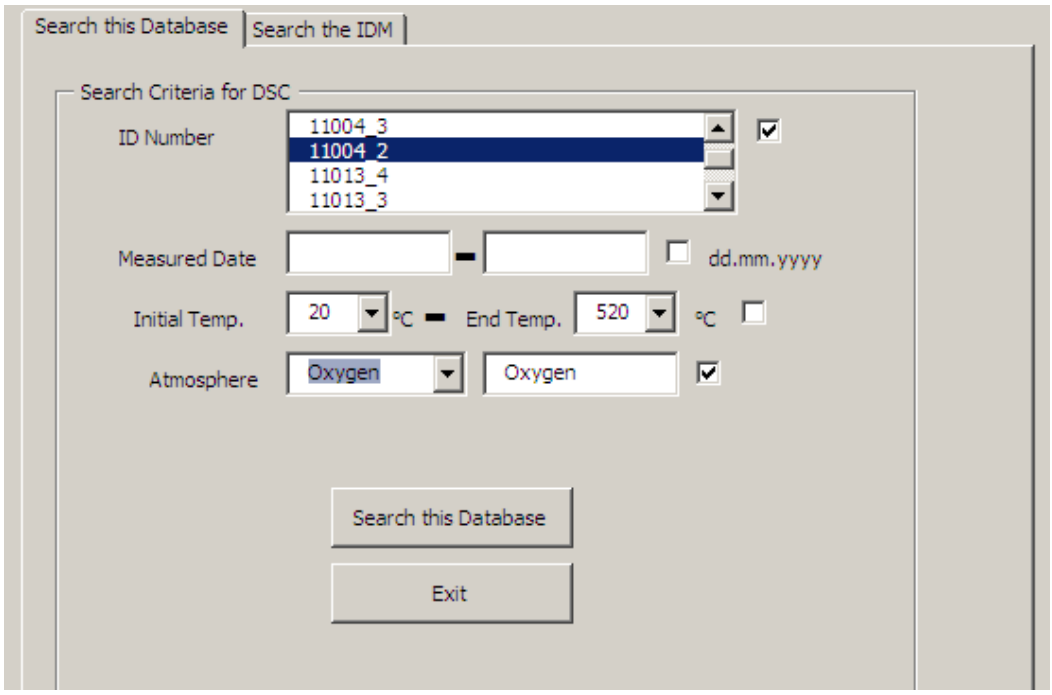


Figure 29. *User Form for Searching DSC database*

```
Sub Clr()
If Range("DSCResult!B1").Value = 0 Then 'if no values before search
Exit Sub'exit this function
Else 'else if there are measurements then clear
Sheets("DSCResult").Activate
Range("C3:FY28").ClearContents'Clear the DSC Result Page
End If
End Sub
```

Snippet 15. Clear Function

This function for searching the DSC is similar to Snippet 14 for the Bomb Calorimeter except that there is additional function shown in Snippet 15. This function clears the Result Page for the previous search done by the user. The reason is for the user to look at the real measurements and not overwriting from previous search.

```
Private Sub CommandButton8_Click() 'Exit button in search form
UserForm1.Hide 'Hide the search user form
End
```

Snippet 16. Exit Function

Exit Command Button has a function shown in Snippet 16 which closes the user form. Closing the user form is set to Hide and to open a form is set to Show.

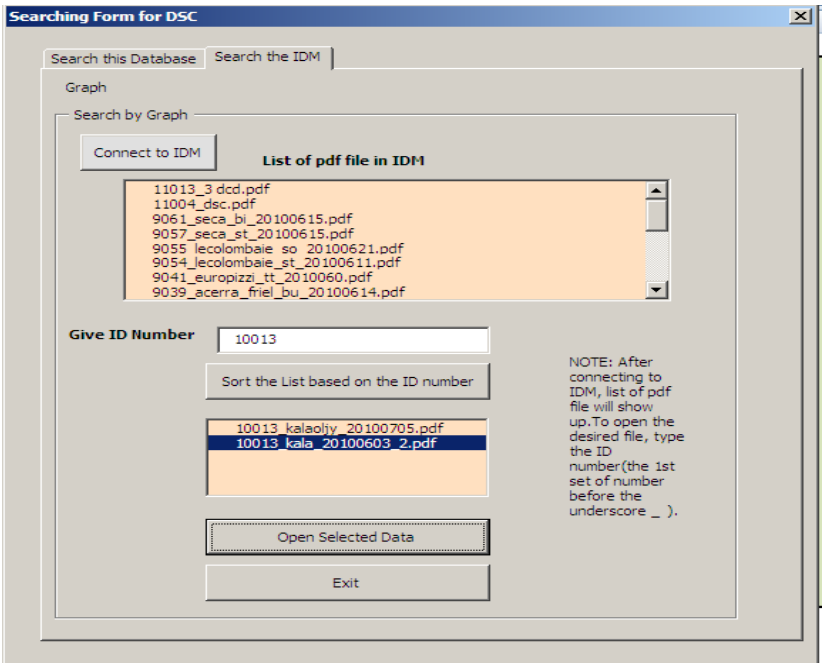


Figure 30. Searching the IDM for DSC

Figure 30 shows the user form to search the data from IDM, these needs to connect to the IDM first, list all the files and select file to view. This list box accepts only single selection.

```
Sub CopyALLPDF()
'This function filters all the pdf files and copy/paste to another sheet destination
Sheets("Sheet2").Select
 Range("B2:B600").ClearContents
Sheets("Destination_frm_IDM").Select
        With Sheets("Destination_frm_IDM")
                .AutoFilterMode = False 'filter the range where list of pdf files are located
                .Range("C14:C300").AutoFilter Field:=1, Criteria1:="*.pdf"
        End With
Range("C15:C" & Range("C65536").End(xlUp).Row).SpecialCells(xlCellTypeVisible).Copy
Sheets("Sheet2").Activate'copy from the last used all visible cells
Range("B2").PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _
        False, Transpose:=False 'paste values
End Sub
```

Snippet 17. Copy list of pdf files

The function for connect to IDM is similar to Snippet 3 of Bomb Calorimeter except that the file format that is listed are pdf files shown in Snippet 17. There are empty rows, with the use of Autofilter mode makes it easier to filter only the list that is in pdf format located in Column C.

```
Sub FilterPDFbasedOnID()
'This function filters the pdf files based on the given ID number in the userform textbox
On Error GoTo DSC_Error
Application.ScreenUpdating = False 'disable updating screen when macro runs
Dim DSCStartRow As Integer
Dim IDNumber As String
        DSCStartRow = 2
        IDNumber = UserForm1.TextBox10.Value 'Textbox in userform where user put the
'ID number. Pdf files consist of 'ID numbers_*.pdf

   Sheets("Sheet2").Activate'This is the sheet where list of files are temporarily located,
Column A is list of ID numbers from the file name, Column B is real name listed from IDM,
column C are list of trimmed filename where spaces before the name are removed
   Range("Sheet2!A2:C300").EntireRow.Hidden = True
'Row B must not be emypty because its the measurement date
Do While Len(Range("B" & CStr(DSCStartRow)).Value) <> 0
        If Range("A" & CStr(DSCStartRow)).Value = IDNumber Then
'Unhide the entire row of match ID from column A
         Rows(CStr(DSCStartRow) & ":" & CStr(DSCStartRow)).EntireRow.Hidden = False
        End If
                DSCStartRow = DSCStartRow + 1
   Loop

     Sheets("Sheet2").Select 'Copy visible rows and paste into another location
   Range("B2:B" & Range("C65536").End(xlUp).Row).SpecialCells(xlCellTypeVisible).Copy
     Sheets("DSCStart").Activate
     Range("CA2").Select
      Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _
False, Transpose:=False 'There are formula in cells but this paste only values
          Worksheets("Sheet2").Activate
          Rows("2:300").EntireRow.Hidden = False
          Sheets("DSCStart").Select
Exit Sub
'if no found based on ID number then prompt message to user, unhide the rows which are _
hidden for searching purpose, then go to the Start page of this DSC
DSC_Error: MsgBox "No DSC measurements found."
   Worksheets("Sheet2").Activate
   Rows("2:300").EntireRow.Hidden = False
   Worksheets("DSCStart").Activate
Application.ScreenUpdating = True
End Sub
```

Snippet 18. Sort List of pdf file

Snippet 18 function sort the list of files based on the given ID number in the textbox. Then the user needs to select from the list box what to open.

```
Private Sub CommandButton6_Click()
Application.DisplayAlerts = False 'dont prompt user for any alert messages
On Error GoTo OpenningError
LookFrmKronodoc 'search the given range for the value similar to what is
'selected from the list box then activate the matching cell.
FollowHyperlink ''follow the link and open the file
OpenningError: Exit Sub
Application.DisplayAlerts = True
End Sub
```

Snippet 19. Command Button to Open selection

Snippet 19 is the code for the command button named Open selected file from the user form interface.

```
Sub LookFrmKronodoc()
Dim LinkToselected As String
LinkToselected = Range("DSCStart!CE2").Value
   Workbooks("kronodoc").Activate  'file  from IDM
   Range("A1:H300").Select 'find match from what is selected in listbox in this range
   Selection.Find(What:=LinkToselected, After:=ActiveCell, LookIn:=xlFormulas, _
     LookAt:=xlPart, SearchOrder:=xlByRows, SearchDirection:=xlNext, _
     MatchCase:=False).Activate 'activate matching file name
End Sub
```

Snippet 20. Look from Kronodoc file

Snippet 20 shows the code that search the kronodoc file which is the temporary workbook opened after opening the IDM. This function search the given range for the value similar to what is selected from the list box then activate the matching cell.

```
Sub FollowHyperlink()
Application.ScreenUpdating = False 'disable user for seing how the macros run
Application.DisplayAlerts = False 'disbale prompt messages such as alerts
    ActiveCell.Hyperlinks(1).Follow 'follow the link, this open it as web page
    Workbooks("DSC.xlsm").Activate 'activate the workbook file DSC
    Application.ScreenUpdating = True
Application.DisplayAlerts = False
End Sub
```

Snippet 21. Follow Hyperlink function

Snippet 21 is the code that activates the hyperlink of the active cell that was just selected using the function in Snippet 20.

Figure 33 gives us the view of the measured data we just selected. In this case we opened the measurement named 10013_kala_20100603_2.pdf as web document.

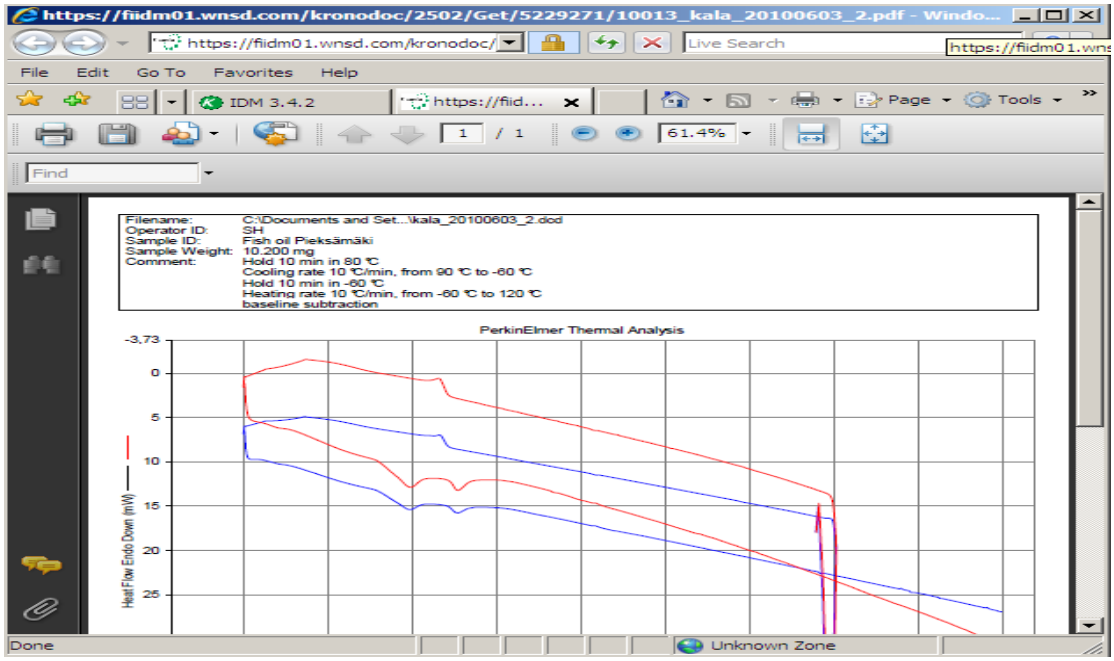


Figure 33. DSC Opened Measurement in IDM

6.2.2 DSC IMPORT

DSC Import function can import a text files or comma separated values file (csv).

```
Sub Import_Text_DSC() 'function that will import files from local drive
On Error GoTo Ex_DSC
Dim ImportFileName As String
Set CSheet = ActiveCell
ImportFileName = Application.GetOpenFilename(filefilter:= _
"Text Files (*.txt),*.txt," & "CSV Files (*.csv),*.csv") 'filter text or csv file formats
'open the file as new workbook, file delimites by delimeter character which is Tab
Application.Workbooks.OpenText Filename:= _
ImportFileName, DataType:=xlDelimited, Tab:=True
ActiveSheet.UsedRange.Copy Destination:=CSheet
ActiveWorkbook.Close
Ex_DSC: 'Err_DSCCommand
End Sub
```

```
Sub DSCImportBtn()
Sheets("TextCopy").Activate
Range("A1").Select
Import_Text_DSC 'import text or csv file
Application.ScreenUpdating = False
DSCGetData.Show 'show the user form for importing necessary properties
End Sub
```

Snippet 22. DSC code for Import files

Snippet 22 shows the code for import function which displays the Open window that user can select file of text or csv format and copy the content of the file into worksheet named TextCopy.

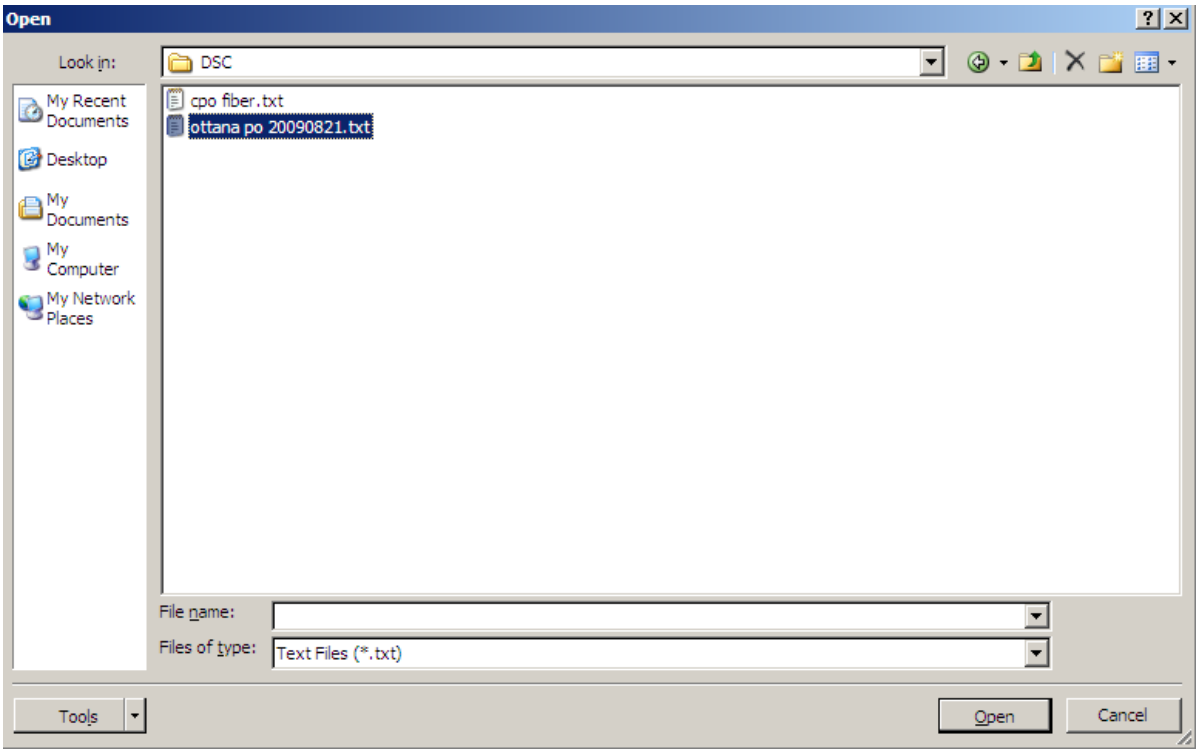
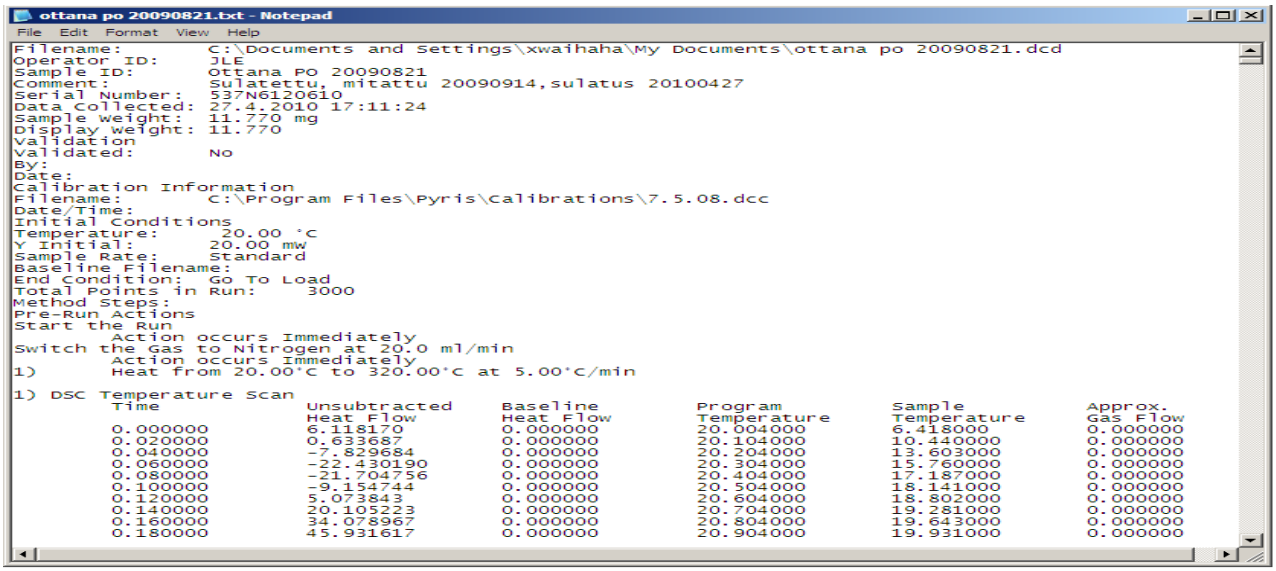


Figure 34. Open window

The open file window shows in **Figure 34** where user can select files from local drive. After selecting the desired file, the program will copy to a certain worksheet.

6.2.3 DSC Get/Add/Cancel Data

Figure 35 shows the original view of the measured data in a text file format.



ottana po 20090821.txt - Notepad

File Edit Format View Help

```
Filename:          C:\Documents and Settings\xwaihaha\My Documents\ottana po 20090821.dcd
Operator ID:       JLE
Sample ID:         Ottana PO 20090821
Comment:           Sulatettu, mitattu 20090914,sulatus 20100427
Serial Number:     537N6120610
Data Collected:    27.4.2010 17:11:24
Sample Weight:     11.770 mg
Display Weight:    11.770
Validation
Validated:         No
By:
Date:
Calibration Information
Filename:          C:\Program Files\Pyris\Calibrations\7.5.08.dcc
Date/Time:
Initial Conditions
Temperature:        20.00 °C
Y Initial:         20.00 mW
Sample Rate:       Standard
Baseline Filename:
End Condition:     Go To Load
Total Points in Run:     3000
Method Steps:
Pre-Run Actions
Start the Run
        Action occurs Immediately
Switch the Gas to Nitrogen at 20.0 ml/min
        Action occurs Immediately
1)      Heat from 20.00°C to 320.00°C at 5.00°C/min

1) DSC Temperature Scan
        Time            Unsubtracted    Baseline        Program         Sample          Approx.
                        Heat Flow       Heat Flow       Temperature     Temperature     Gas Flow
        0.000000        6.118170        0.000000        20.004000       6.418000        0.000000
        0.020000        0.633687        0.000000        20.104000       10.440000       0.000000
        0.040000        -7.829684       0.000000        20.204000       13.603000       0.000000
        0.060000        -22.430190      0.000000        20.304000       15.760000       0.000000
        0.080000        -21.704756      0.000000        20.404000       17.187000       0.000000
        0.100000        -9.154744       0.000000        20.504000       18.141000       0.000000
        0.120000        5.073843        0.000000        20.604000       18.802000       0.000000
        0.140000        20.105223       0.000000        20.704000       19.281000       0.000000
        0.160000        34.078967       0.000000        20.804000       19.643000       0.000000
        0.180000        45.931617       0.000000        20.904000       19.931000       0.000000
```

Figure 35. DSC measured data in text file format

User form for getting only the necessary parameters displays as in Figure 36. The user can now select either to get the data, save it to database or cancel the whole process.

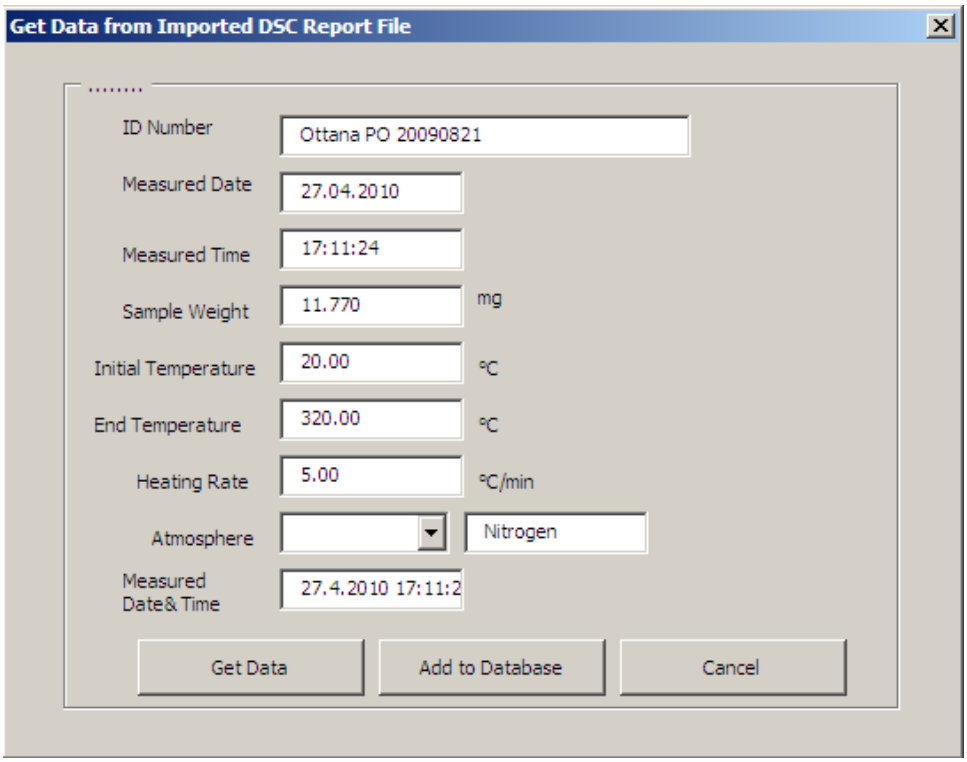


Figure 36. Get Data Form

Command button Get Data has the code shown below.

```
Private Sub CommandButton2_Click()
Sheets("DSCRawData").Activate
CopyData 'function that search properties and place the values in given range
GetDataDSC 'function that place the property values into user form text boxes
End Sub
```

Snippet 23. Get Data Command Button

There are two functions included in this command button which are the CopyData and the GetDataDSC.

```
Sub GetDataDSC() 'place the properties into their corresponding textboxes
Application.ScreenUpdating = False
TextBox1.Value = Range("TextCopy!AB1").Value 'S. Name from range to textbox
TextBox2.Value = Range("TextCopy!AB2").Value 'Meas.Date from range to textbox
TextBox3.Value = Range("TextCopy!AB8").Value
TextBox4.Value = Range("TextCopy!AB4").Value 'initial temp
TextBox5.Value = Range("TextCopy!AB5").Value  'end temp
TextBox6.Value = Range("TextCopy!AB6").Value 'Heating rate
TextBox7.Value = Range("TextCopy!AB7").Value
TextBox8.Value = Range("TextCopy!AB3").Value
TextBox9.Value = Range("TextCopy!AA2").Value 'Meas.Date/Time to textbox
End Sub
```

Snippet 24. GetDataDSC

Get Data is the function to get the properties from the file that was just imported into the textbox of the user form.

```
Sub CopyData() 'function that that get the necessary properties
Application.ScreenUpdating = False
copySmID 'Find Sample Name/ID number string, go to next column to get the value
copyMDte 'Find Meas. Date  string, go to next column to get the value
copySWeight 'Find Sample Weight string, go to next column to get the value
copyAtmosphereitrogen 'Find  atmosphere
copyAtmosphereO
copyHeatfrm 'find heat
End Sub
```

Snippet 25. Copy Data

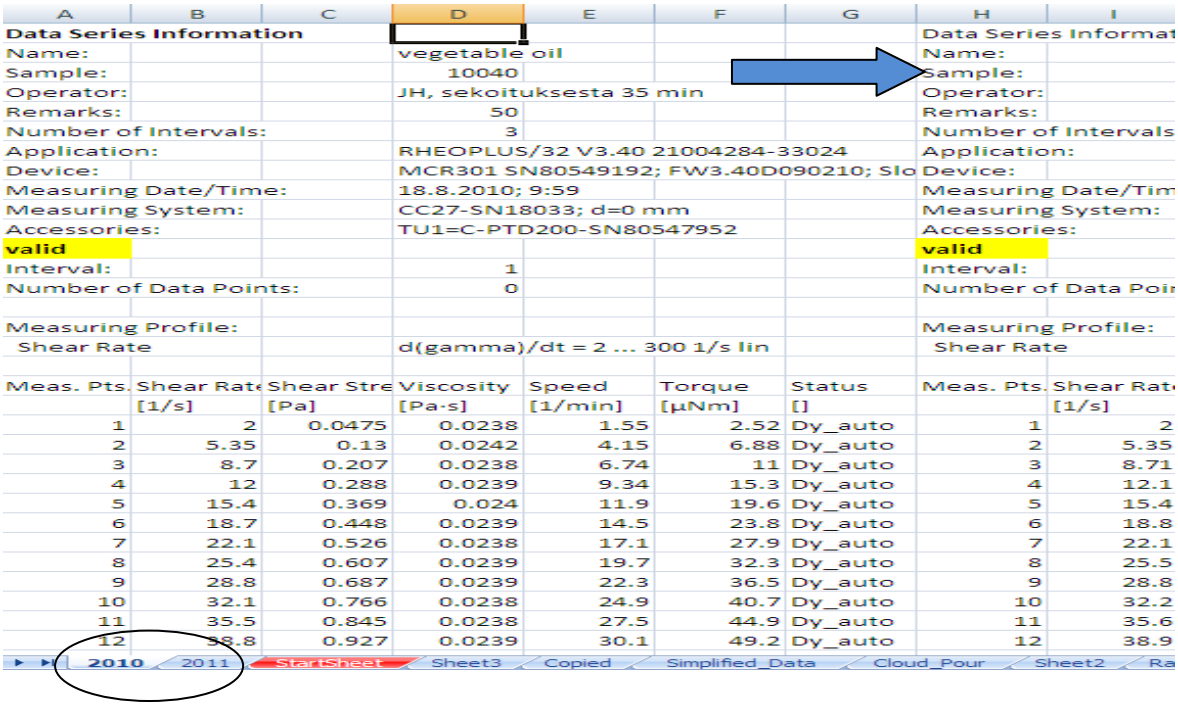
Snippet 25 is the functions that get the necessary properties. Add to database function is similar in Bomb Calorimeter. Duplicate checking is also necessary before adding data to database which is done by checking the measurement date and time.

6.3 RHEOMETER APPLICATION

Rheometer needs to have an automatic reformatting of added measurements. Search functions consist of two, search viscosity or search for cloud point/pour point.

6.3.1 Adding Measurement Data

Measurements added to this database are copied exactly same format from the Rheometer PC, 7 columns/data which include a large amount of numbers or data points in each measurement **Figure 37.** The Sheets names are the year of measurements.



Data Series Information							Data Series Informat	
Name:			vegetable oil				Name:	
Sample:			10040				Sample:	
Operator:			JH, sekoituksesta 35 min				Operator:	
Remarks:			50				Remarks:	
Number of Intervals:			3				Number of Intervals	
Application:			RHEOPLUS/32 V3.40 21004284-33024				Application:	
Device:			MCR301 SN80549192; FW3.40D090210; Slo				Device:	
Measuring Date/Time:			18.8.2010; 9:59				Measuring Date/Tim	
Measuring System:			CC27-SN18033; d=0 mm				Measuring System:	
Accessories:			TU1=C-PTD200-SN80547952				Accessories:	
valid							valid	
Interval:			1				Interval:	
Number of Data Points:			0				Number of Data Poi	
Measuring Profile:							Measuring Profile:	
Shear Rate			d(gamma)/dt = 2 ... 300 1/s lin				Shear Rate	
Meas. Pts.	Shear Rate	Shear Stre	Viscosity	Speed	Torque	Status	Meas. Pts.	Shear Rat
	[1/s]	[Pa]	[Pa·s]	[1/min]	[µNm]	[]		[1/s]
1	2	0.0475	0.0238	1.55	2.52	Dy_auto	1	2
2	5.35	0.13	0.0242	4.15	6.88	Dy_auto	2	5.35
3	8.7	0.207	0.0238	6.74	11	Dy_auto	3	8.71
4	12	0.288	0.0239	9.34	15.3	Dy_auto	4	12.1
5	15.4	0.369	0.024	11.9	19.6	Dy_auto	5	15.4
6	18.7	0.448	0.0239	14.5	23.8	Dy_auto	6	18.8
7	22.1	0.526	0.0238	17.1	27.9	Dy_auto	7	22.1
8	25.4	0.607	0.0239	19.7	32.3	Dy_auto	8	25.5
9	28.8	0.687	0.0239	22.3	36.5	Dy_auto	9	28.8
10	32.1	0.766	0.0238	24.9	40.7	Dy_auto	10	32.2
11	35.5	0.845	0.0238	27.5	44.9	Dy_auto	11	35.6
12	38.8	0.927	0.0239	30.1	49.2	Dy_auto	12	38.9

2010 2011 StartSheet Sheet3 Copied Simplified_Data Cloud_Pour Sheet2 Ra

Figure 37. Raw Data for Rheometer

Macro was created so that whenever added measurements to a Sheet e.g. 2011, it also automatically adds to a simplified format, each measured data will be added to the row (one measurement per row) **Figure 38** shows that each property is now in columns and measurements are in row. The code for this function is shown in **Snippet 26.**

	A	B	C	D	E	F
1	Measurement Date/Time	Name(Fuel Type)	Sample(ID)	Operator:	Temperature	Meas. Po
2	18.8.2010; 9:59	vegetable oil	10040	JH, sekoituksesta 35 min	50	90
3	4.10.2010; 13:50	other 2	10038	JLE, directly from thermos	50	60
4	18.10.2010; 12:07	vegetable oil 1	10057	HI; area 0,01-200 1/s , 90point	25	90
5	18.10.2010; 12:48	vegetable oil 2	10057	HI; area 0,01-50 1/s , 90points	25	90

Figure 38. Simplifued Raw Data for Rheometer

```
Sub PutToSimplifiedData()
Dim i, rw, LastRow, NextRow As Long
NextRow = Range("A65536").End(xlUp).Row + 1 'last used row in column A
Cells(NextRow, 1) = ActiveCell.Offset(7, 0).Value
LastRow = Range("A65536").End(xlUp).Row
        i = Range("XFD2").End(xlToLeft).Select 'finds the last used column in row 2
        For rw = LastRow To 1 Step -1 'xfd is the last column in excel 2007
If ActiveCell.Offset(7, 0).Value = _
Sheets("Simplified_Data").Range("A65536").End(xlUp).Value Then 'check if meas date&time
MsgBox "Same Measurement Date/Time Please check." ' has match then prompt message
Else 'else accept the data be paste row by row
ActiveCell.Offset(10, -3).Value = "valid"
```

```
Sheets("Simplified_Data").Range("B65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Value 'Find the first empty row and place Fuel Type value
Sheets("Simplified_Data").Range("C65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(1,0).Value 'ID number
Sheets("Simplified_Data").Range("D65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(2, 0).Value 'operator name
Sheets("Simplified_Data").Range("E65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(3, 0).Value 'temperature
Sheets("Simplified_Data").Range("J65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(4, 0).Value
Sheets("Simplified_Data").Range("K65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(5, 0).Value
Sheets("Simplified_Data").Range("L65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(6, 0).Value
Sheets("Simplified_Data").Range("A65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(7, 0).Value'Find the first empty row for meas.date and place value
Sheets("Simplified_Data").Range("H65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(8, 0).Value'Find the first empty row for meas.system and place value
Sheets("Simplified_Data").Range("O65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(9, 0).Value
Sheets("Simplified_Data").Range("I65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(10, 0).Value
Sheets("Simplified_Data").Range("G65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(36, 0).Value
Sheets("Simplified_Data").Range("F65536").End(xlUp).Offset(1, 0).Value = _
ActiveCell.Offset(31, 0).Value 'Find the first empty row for meas. points and place value
End If
Exit Sub
Next rw 'do next
End Sub
```

Snippet 26. Simplifying added measurements

This code simplifies or reformats the arrangement of the measurement added to the sheets. Measurement date and time is checked for duplicate. When the seventh Row of the new added data (measurement date and time) is similar to the last used row of column A of the sheet name Simplified_Data then prompt a message to user of the duplicate. If unique data then this function copy all the important properties to the Simplified_Data using offset function. It is set that the active cell be from the second row of the last column which is in MS Excel 2007 set to be column XFD.

6.3.2 Searching the Rheometer

This searching function for Rheometer has also two options, either to search the viscosity or the Cloud Point. In **Figure 39** we can see that there are almost similar parameters as the previous device search functions too, but there are additional functions in this application.

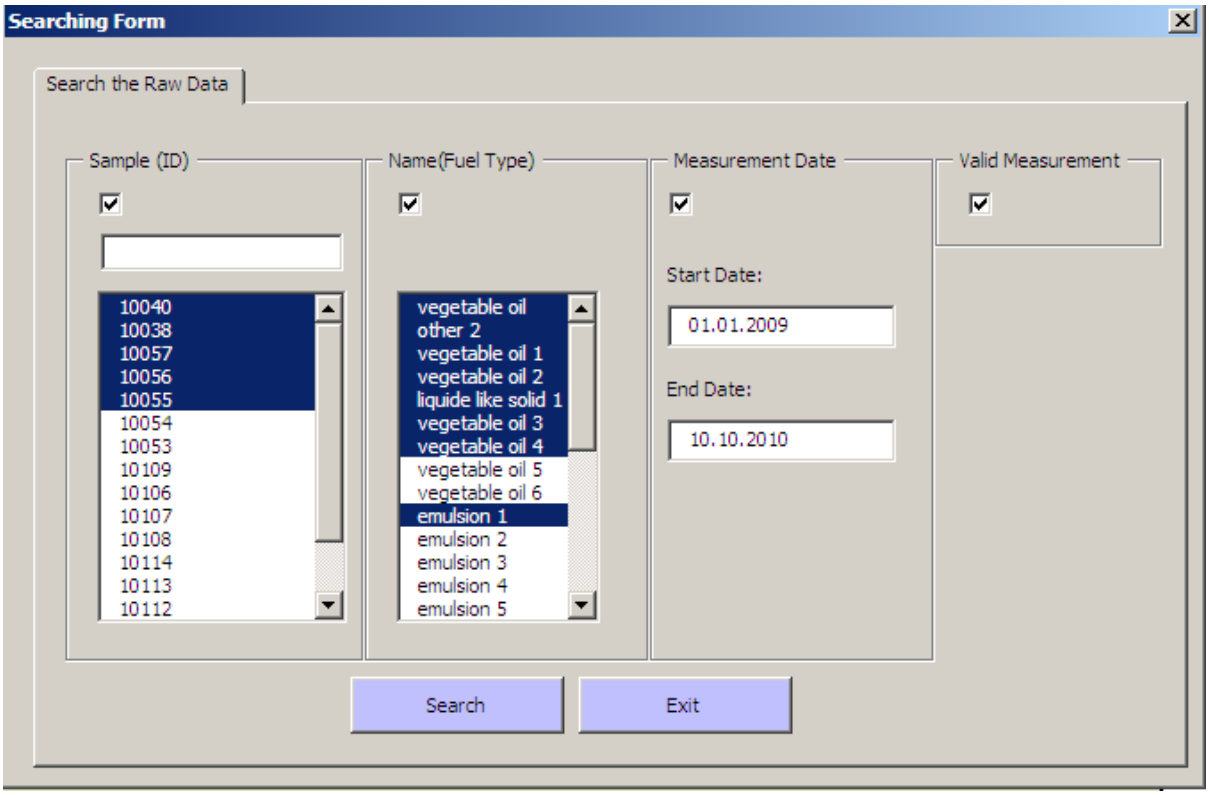


Figure 39. Search Form for Viscosity

6.3.3 Additional Measuring Points Get Data

After searching based on the combination of criteria such as ID numbers, Fuel Types, Measurement Date and/or valid values, another user form will display. The user has to select single measurement from the results of the previous search function and give the measuring points values. This additional function is done because there are plenty of measuring points in every measured data.

Example in **Figure 40** shows that in the column 6 indicates that the measuring points for that particular sample is 90 and the program needs only to get the corresponding viscosity of only four measuring points.

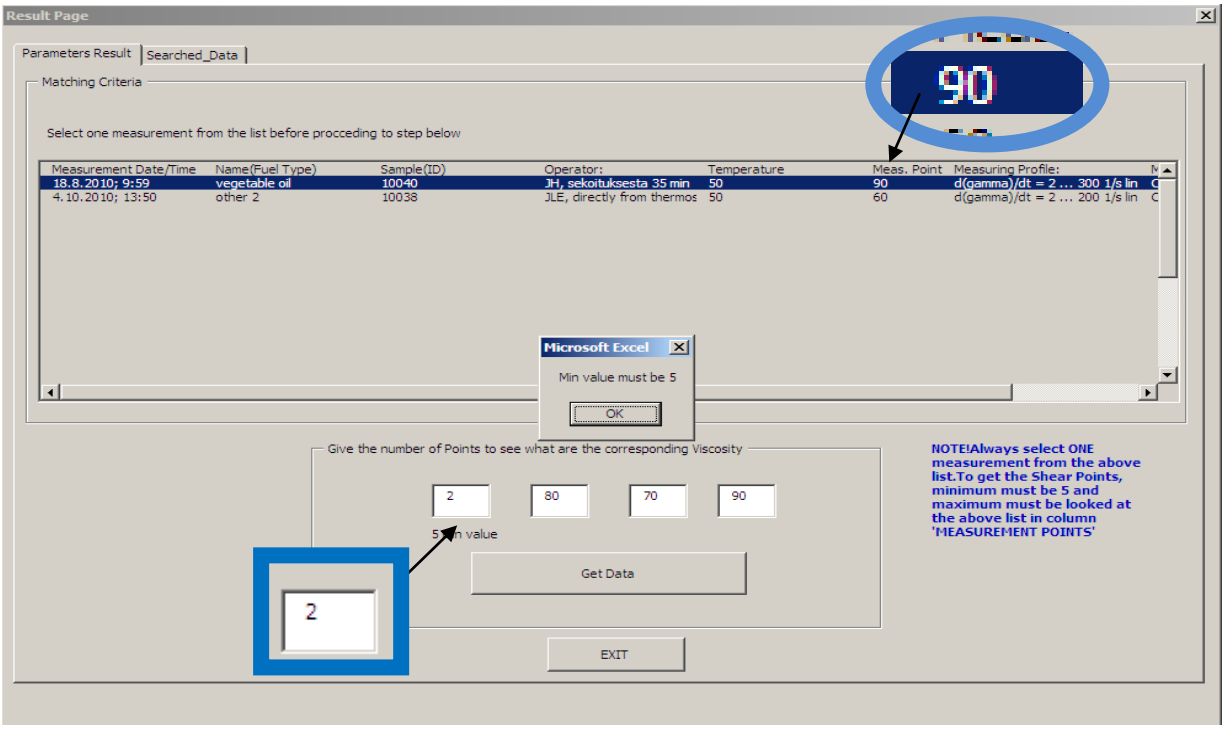


Figure 40. Shear Points Get Data

Message Box appears in the Figure 40, this is for the reason that minimum point given is 2 which is the limit of 5.

```
Private Sub CommandButton1_Click()
If TextBox1.Value < 5 Then 'Check for min meas points given
MsgBox "Min value must be 5"
TextBox1.Value = ""
Else 'If min is >=5
Range("Sheet1!C2").Value = UserForm2.TextBox1.Value 'control source for 1st point
Range("Sheet1!C3").Value = UserForm2.TextBox2.Value 'control source for2nd point
```

```
Range("Sheet1!C4").Value = UserForm2.TextBox3.Value 'control source for 3rd
Range("Sheet1!C5").Value = UserForm2.TextBox4.Value 'control source 4th point
UserForm2.TextBox25.Value = Range("Sheet1!D1").Value
UserForm2.TextBox26.Value = Range("Sheet1!E1").Value
Find_DataRheom 'Look for matching measurements from selected result
MultiPage1.Value = 1 'activate the second page of the user form
GetTheResultsToPage2 'Put to textboxes all the main information
GetTheMatchingReport 'Get the corres.g viscosities based on meas points given
End If
End Sub
```

Snippet 27. Command Button Get Data

Snippet 27 is the code for the command button named Get Data. Checking for the minimum value of the measurement point is set to 5. If more than 5 then next snippets are used.

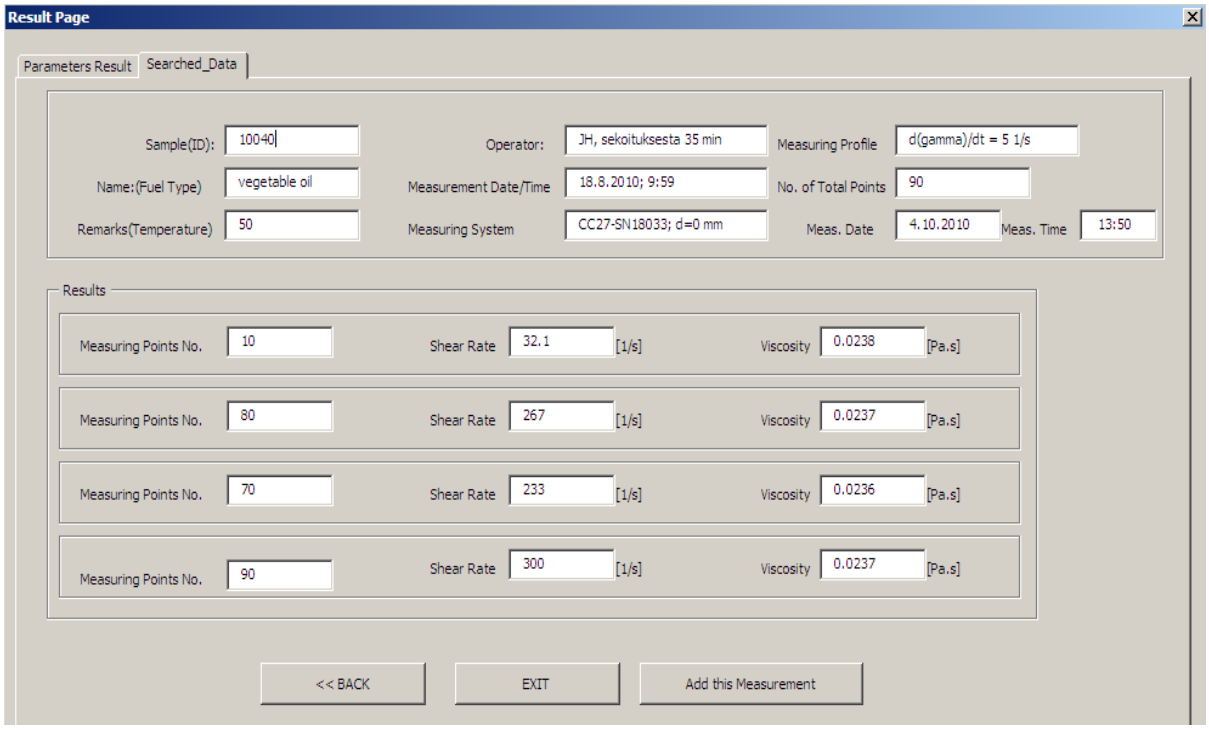


Figure 41. Viscosity, Shear Rate based on Meas. Points

Figure 41 shows the corresponding Shear Rate and Viscosity value of certain measuring points given while Snippet 28 shows the code that takes the values into the form.

```
Sub GetTheResultsToPage2()
'Bring main properties to textbox in page 2 such as Sample ID, fuel type
UserForm2.TextBox9.Value = ActiveCell.Value 'measurement date
Range("Sheet1!D2").Value = ActiveCell.Value 'selected from list control source
UserForm2.TextBox6.Value = ActiveCell.Offset(-7, 0).Value
UserForm2.TextBox5.Value = ActiveCell.Offset(-6, 0).Value
UserForm2.TextBox8.Value = ActiveCell.Offset(-5, 0).Value
UserForm2.TextBox7.Value = ActiveCell.Offset(-4, 0).Value
UserForm2.TextBox10.Value = ActiveCell.Offset(1, 0).Value
UserForm2.TextBox11.Value = ActiveCell.Offset(10, 0).Value
UserForm2.TextBox12.Value = ActiveCell.Offset(24, 0).Value
UserForm2.TextBox13.Value = UserForm2.TextBox1.Value
UserForm2.TextBox14.Value = UserForm2.TextBox2.Value
UserForm2.TextBox15.Value = UserForm2.TextBox3.Value
UserForm2.TextBox16.Value = UserForm2.TextBox4.Value
End Sub
```

Snippet 28. *GetTheResultToPage2 function*

Snippet 29 in the next page finds for matching measurement from different worksheets except those that are mentioned in the code.

```
Sub Find_DataRheom()
'this function finds the meas.date from selected list of resultin user for. This search all the worksheets except the given worksheet names

Dim MeasDate 'declare variables
Dim sheetNumber, countSheet, currentSheet As Integer

On Error Resume Next currentSheet = ActiveSheet.Index
MeasDate = UserForm2.ListBox2.Value 'selected from the listbox
sheetNumber = ActiveWorkbook.Sheets.Count
'search inside sheet in row 9 from first column to last column which is XFD
With ThisWorkbook.Worksheets(countSheet).Range("A9:XFD9").Select
For countSheet = 1 To sheetNumber ' first sheet to last sheet found
'if sheets name are one of this then skip the sheet
 If Sheets(countSheet).Name = "Cloud_Pour" _
Or Sheets(countSheet).Name = "StartSheet" _
 Or Sheets(countSheet).Name = "RawData" _
Or Sheets(countSheet).Name = "Sheet2" _
Or Sheets(countSheet).Name = "Simplified_Data" _
Or Sheets(countSheet).Name = _ "Cloud_PourPoint" _
Or Sheets(countSheet).Name = "Sheet1" _
Or Sheets(countSheet).Name = "Sheet3" _
Or Sheets(countSheet).Name = "Copied" Then
    Exit Sub
    Else
'else activate the sheet and search for the measurement date and activate when when found
       Sheets(countSheet).Activate
       Cells.Find(What:=MeasDate, After:=ActiveCell, _
LookIn:=xlFormulas, LookAt :=xlWhole, SearchOrder:=xlByRows, _
SearchDirection:=xlNext, MatchCase:= False).Activate

If ActiveCell.Value = MeasDate Then Exit Sub
   End If
Next countSheet

End With
End Sub
```

Snippet 29. Find_ DataRheom Function

When match of measurement date and time is found from the sheet then Snippet 30 will follow.

```
Sub GetTheMatchingReport()
Application.ScreenUpdating = False 'disable screen upate
Application.DisplayAlerts = False 'disable alerts
Sheets("Sheet2").Range("A1:G65536").ClearContents
Range(ActiveCell.Offset(0, -3).EntireColumn, ActiveCell.Offset(0,
3).EntireColumn).Copy 'copy entire 7 columns of the matching measurments
Sheets("Sheet2").Activate
Range("A1").Select
Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, SkipBlanks:= _
False, Transpose:=False 'paste in sheet name Sheet2
Application.ScreenUpdating = True
Application.DisplayAlerts = True
Sheets("Sheet2").Activate 'This sheet will be used for searching the measuring points
Range("A1").Select
First_Meas_Points 'function to find first meas points
Secnd_Meas_Points 'function to find second meas points
Third_Meas_Points 'function to find third meas points
Fourth_Meas_Points 'function to find fourth meas points
End Sub
Sub First_Meas_Points() 'Get the first meas. Points, function for the rest of three are same
Dim MPoint1 'declaration
On Error Resume Next
MPoint1 = UserForm2.TextBox1.Value
If MPoint1 = "" Then Exit Sub
With ThisWorkbook.Worksheets("Sheet2")
    Cells.Find(What:=MPoint1, After:=ActiveCell, LookIn:=xlValues, LookAt _
 :=xlWhole, SearchOrder:=xlByRows, SearchDirection:=xlNext, MatchCase:=False).Select
    UserForm2.TextBox17.Value = ActiveCell.Offset(0, 1).Value 'bring to textbox
       Range("Sheet1!A2").Value = UserForm2.TextBox17.Value
    UserForm2.TextBox18.Value = ActiveCell.Offset(0, 3).Value
     Range("Sheet1!B2").Value = UserForm2.TextBox18.Value
    If ActiveCell.Value = MPoint1 Then Exit Sub
End With
End Sub
```

Snippet 30. GetTheMatchingReport Function

Snippet 30 function copy the entire 7 columns of the matching measurements and gets all the corresponding four viscosity based on the given points and put them to text box of the form.

```
Sub AddToDatabase()
Sheets("RawData").Select 'activate the raw data of this file
'bring the values from textbox into range of cells
'main properties which  includes Meas.Date, ID number, Fuel Type, Temperature
Range("B65536").End(xlUp).Offset(1, 0).Value = UserForm2.TextBox9.Value 'MDT
Range("A65536").End(xlUp).Offset(1, 0).Value = UserForm2.TextBox5.Value 'ID
Range("C65536").End(xlUp).Offset(1, 0).Value = UserForm2.TextBox6.Value 'FT
Range("D65536").End(xlUp).Offset(1, 0).Value = UserForm2.TextBox7.Value 'T
Range("F65536").End(xlUp).Offset(1, 0).Value = UserForm2.TextBox10.Value
'MSystem
Range("E65536").End(xlUp).Offset(1, 0).Value = UserForm2.TextBox11.Value
Range("S65536").End(xlUp).Offset(1, 0).Value = UserForm2.TextBox25.Value
Range("T65536").End(xlUp).Offset(1, 0).Value = UserForm2.TextBox26.Value
'1st set of measuring points with corresponding shear rate and viscosity values
'format decimal values
Range("G65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!C2").Value
Range("G65536").End(xlUp).Offset(1, 0).Value =
Format(Range("G65536").End(xlUp).Offset(1, 0), "#")
Range("H65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!A2").Value
Range("H65536").End(xlUp).Offset(1, 0).Value =
Format(Range("H65536").End(xlUp).Offset(1, 0), "#.#")
Range("I65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!B2").Value
Range("I65536").End(xlUp).Offset(1, 0).Value =
Format(Range("I65536").End(xlUp).Offset(1, 0), "#.###")
'2nd set of measuring points with corresponding shear rate and viscosity values
'format decimal values
Range("J65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!C3").Value
Range("J65536").End(xlUp).Offset(1, 0).Value =
Format(Range("J65536").End(xlUp).Offset(1, 0), "#")
Range("K65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!A3").Value
Range("K65536").End(xlUp).Offset(1, 0).Value =
Format(Range("K65536").End(xlUp).Offset(1, 0), "#.#")
Range("L65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!B3").Value
```

```
Range("L65536").End(xlUp).Offset(1, 0).Value =
Format(Range("L65536").End(xlUp).Offset(1, 0), "#.###")
'3rd set of measuring points with corresponding shear rate and viscosity values
'format decimal values
Range("M65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!C4").Value
Range("M65536").End(xlUp).Offset(1, 0).Value =
Format(Range("M65536").End(xlUp).Offset(1, 0), "#")
Range("N65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!A4").Value
Range("N65536").End(xlUp).Offset(1, 0).Value =
Format(Range("N65536").End(xlUp).Offset(1, 0), "#.#")
Range("O65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!B4").Value
Range("O65536").End(xlUp).Offset(1, 0).Value =
Format(Range("O65536").End(xlUp).Offset(1, 0), "#.###")
'4th set of measuring points with corresponding shear rate and viscosity values
'format decimal values
Range("P65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!C5").Value
Range("P65536").End(xlUp).Offset(1, 0).Value =
Format(Range("P65536").End(xlUp).Offset(1, 0), "#")
Range("Q65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!A5").Value
Range("Q65536").End(xlUp).Offset(1, 0).Value =
Format(Range("Q65536").End(xlUp).Offset(1, 0), "#.#")
Range("R65536").End(xlUp).Offset(1, 0).Value = Range("Sheet1!B5").Value
Range("R65536").End(xlUp).Offset(1, 0).Value =
Format(Range("R65536").End(xlUp).Offset(1, 0), "#.###")
End Sub
```

Snippet 31. Add to database function

User has option to add this data with the four measuring points, viscosity and shear rate values.

This function will look for the last used row and using the offset(1,0) will select the row after which is the first empty row where the values will be added.

Formatting for the decimal point depends to the property assigned.

6.4 MAIN SEARCH APPLICATION

Main search file is the last file of this project that created. This file has the most interaction with the IDM which access all the seven databases. There is also one additional file that this application has access into which is the chemical archive file in MS Excel format.

This chemical archive file saved as *kemikaalikortisto.xls* contains all the Sample Names, the corresponding ID numbers and what fuel types they are. When the user form initialize, the program automatically opens the archive file. In the textbox shown in figure below, the user have to enter three digits of the year where the user wants to search from.

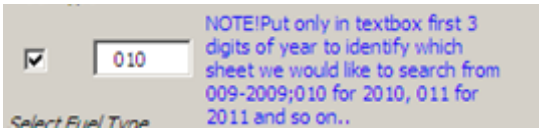


Figure 42. Textbox Year

In the ***Figure 42***, there is '010' which will activate the worksheet of year 2010 such as the näytteet2010 and työnumerot2010 located in ***Figure 43***.

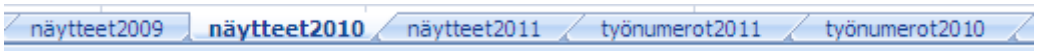


Figure 43. Kemikaalikortisto Worksheet

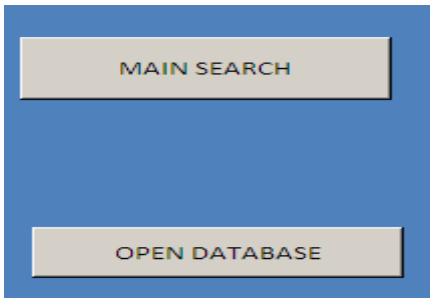


Figure 44. Main Search files command button

There are two main command button in this file. Main Search opens the form shown in Figure 46 while Open database opens the Figure 45.

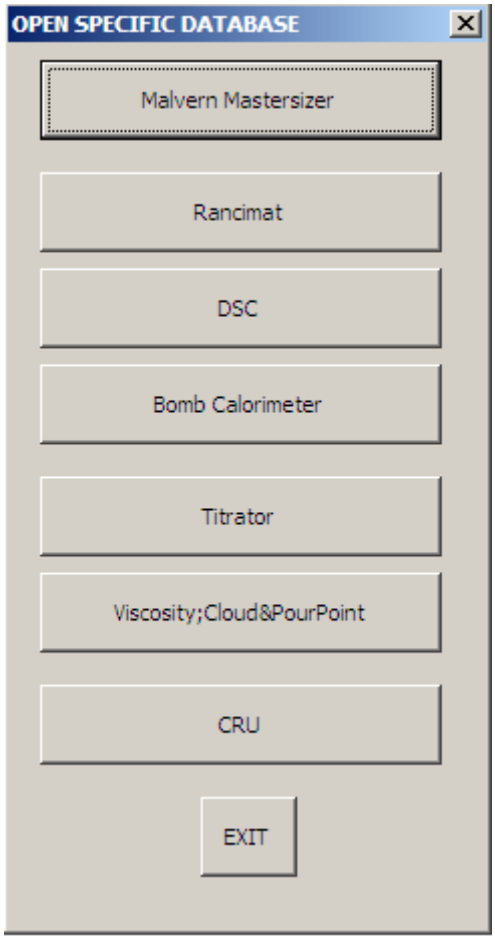


Figure 45. Open database form

The figure above will open/display the specific database that the user selects. This will open the file directly from the IDM where all the database files are saved. Viscosity;Cloud&Pour Point button is for Rheometer database.

Main Search command button opens the form in Figure 46, when this form shows there is an automatic function initializes which opens the Kemikaalikortisto file for the ID numbers.

```
Private Sub UserForm_Initialize()
'run macro that checks if kemikalikortisto is open when user form is initialized/loaded
CheckBox2.Value = True
CheckIfOpenKemikaalikortisto
End Sub
```

Snippet 32. Main Search Form Initialize function

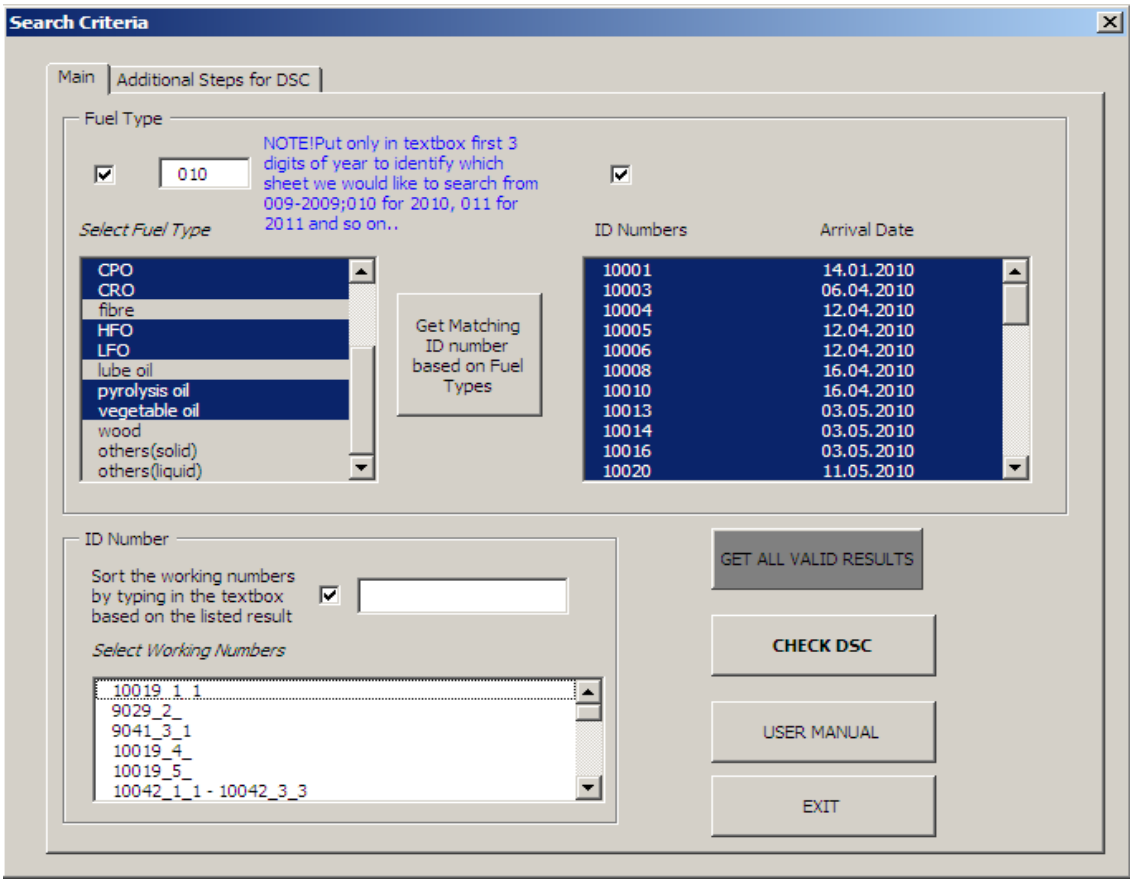


Figure 46. *Main Search User Form*

The list of fuel Types are listed in the list box where the user can have the option to select one or more then based on the fuel types, the program will search all the matching ID numbers and working numbers that will be in list box

```
Private Sub CommandButton6_Click()
Application.ScreenUpdating = False 'diable screen update
'Function that opens the seven files else activate if it's already opened
'search every files based on the ID numbers or Working numbers
ForMalvern
DeleteUnValidValue 'delete all results that are not marked as valid
Workbooks("MainSearch_01_12.xlsm").Activate 'go to result page of this file
Worksheets("RESULT").Activate
UserForm3.Hide 'hide the search form
Application.ScreenUpdating = True
End Sub
```

Snippet 33. *Get All valid result command button*

```
Sub ForMalvern()
If UserForm3.CheckBox5.Value = True And _
UserForm3.CheckBox4.Value = True Then
'check if files are open then activate it else if closed then open them from IDM
CheckIfOpenTit 'open titration database file and search based on given numbers
CheckIfOpenBC 'open & search from Bomb calorimeter
CheckIfOpenMalvern 'open & search from Malvern mastersizer database file
CheckIfOpenRancimat 'open & search from Rancimat
CheckIfOpenCRU 'open & search from CRU
CheckIfOpenRheometer 'open & search from Rheometer
CheckIfOpenDSC1 'open & search from DSC
End If
End Sub
```

Snippet 34. Open the files

Snippet 34 is a combination of some functions which has been used already in the previous snippets in this report. This function opens all databases in the IDM and search them one by one based on the selected ID number(s) and/or working number(s).

All the matching measurements are copied to their corresponding worksheet in this file. There are huge numbers of measurements that contains same ID numbers but the final result will only show those that are marked as valid after the measurements is done. This is marked as valid 'x' in specific row of each database.

```
Sub DeleteUnValidValue()
'there are sheet names corresponds to the device name where results from searching
'based on id numbers and(or) working numbers are pasted
'clear the entire row if column for valid values is emty which must be marked as 'x' if
'the measurement is valied
On Error GoTo Errx
Sheets("TitIodine").Activate 'Valid values is located in column M for Iodine value
Range("M:M").SpecialCells(xlCellTypeBlanks).EntireRow.ClearContents
Sheets("TitAcid").Activate'Valid values is located in column N for Acid number
Range("N:N").SpecialCells(xlCellTypeBlanks).EntireRow.ClearContents
Sheets("TitPeroxide").Activate 'Valid values is located in column M for Peroxide
Range("M:M").SpecialCells(xlCellTypeBlanks).EntireRow.ClearContents
Sheets("RancimatResult").Activate'Valid values is located in column H for Rancimat
Range("H:H").SpecialCells(xlCellTypeBlanks).EntireRow.ClearContents
Sheets("MalvernResult").Activate'Valid values is located in column Z for Malvern
Range("Z:Z").SpecialCells(xlCellTypeBlanks).EntireRow.ClearContents
Sheets("BombCResult").Activate'Valid values is located in column O for Bomb C.
Range("O:O").SpecialCells(xlCellTypeBlanks).EntireRow.ClearContents
Errx: Exit Sub
End Sub
```

Snippet 35. Delete unvalid measurements

This function will delete all unwanted measurements which are not valid.

The worksheet named Result contains all seven devices and the corresponding necessary parameters chosen based on the meeting. In **Figure 47**, result was found for all the devices except the Rheometers Cloud Point, which is reasonable because during the search, there isn't any added data for Cloud Point, only Viscosity has all the measured data.

This results are only based on the measrurements marked as valid

	Sample Name	öljy Pieksämäki huhtikuu	Puola; "Talia", LBF fuel	d Oil), manufacture	olden Star), Kivih
BACK	Fuel Type	animal fat	animal fat	pyrolysis oil	vegetable oil
	ID NUMBER	10013	10112	10042	10040
TITRATION	Measurement Date		17.12.2010		
	Iodine Value		52.35534423		
	Measurement Date		15.12.2010	7.9.2010	
	Acid Number		4.095437017	15.15	
	Measurement Date	04.05.2010			
	Peroxide Value	9.849540704			
Bomb Calorimeter	Measurement Date	06.02.2010		09.08.2010	06.01.2010
	Gross Heat Value	39.4178		42.8074	44.1858
	HHV(dry)	0		0	0
	LHV(arr)	0		0	0
	LHV(dry)	0		40.376	0
Rancimat	Measurement Date		29.12.2010		
	Temperature		100		
	Induction Time Automatic		21.11		
	Evaluation Sensitivity		1		
Malvern Mastersize	Measurement Date			09.09.2010	
	Surface Weighted Mean D[3,2]			10.9	
	Volume Weighted Mean D[4,3]			63.957	
	d(0.1)			5.451	
	d(0.5)			11.757	
	d(0.9)			143.105	
Viscosity	Measurement Date				18.8.2010; 9:59
	Meas Points				10
	Shear Points [1/s]				32.1
	Viscosity [Pa.s]				0.0238
	Meas Points				40
	Shear Points [1/s]				133
	Viscosity [Pa.s]				0.0238
	Meas Points				80
	Shear Points [1/s]				267
	Viscosity [Pa.s]				0.0237
	Meas Points				90
	Shear Points [1/s]				300
	Viscosity [Pa.s]				0.0237
Cloud&Pour Point	Pour-pt, low [t, °C]				
	Viscosity [PaS]				
	Pour-pt, high t, °C				
	Viscosity[PaS]				
	Cloud-pt t, °C				
	Viscosity[PaS]				
CRU	Measurement Date		21.01.2011	02.09.2010	
	Work Number		10112_m_55_550	10042	
	Ignition				
	Wall T		550	560	
	p chamber		55	40	
	p Pilot		300	1000	
	p Main		1000	1000	
	Pilot Inj period		0	850	
	Delay		0	0	
	Main Inj period		850	850	
	Inj. Temp		65	65	
	Air temp		494	500.6	
	ID		1.2	3.14	
	MRD		1.35	4.39	
	EMC		2.52	14.46	
	EC		3.19	22.91	
	PCP		0.15	1.25	
	MCP		1.17	10.07	
	ABP		0.67	8.45	
	MaxROHR		9.31	1.07	
	PMR		1.57	5.78	
	AR		7.69	6.74	
	MaxPI		8.18	7.19	

Figure 47. Main Search Result Page

6.5 OTHER APPLICATIONS

The rest of the devices have similar applications but different properties in each user form.

6.5.1 Import

Titration's import interface has an option from which sheet it needs to take the data. The description for Titration device mentioned that the device measures the samples acid number, iodine value and peroxide value. Each of them has individual sheet and may contain similar sample name. Program compares the database last added data and imports the next to it. Figure 49 shows the properties of Acid Number that needed to be imported.

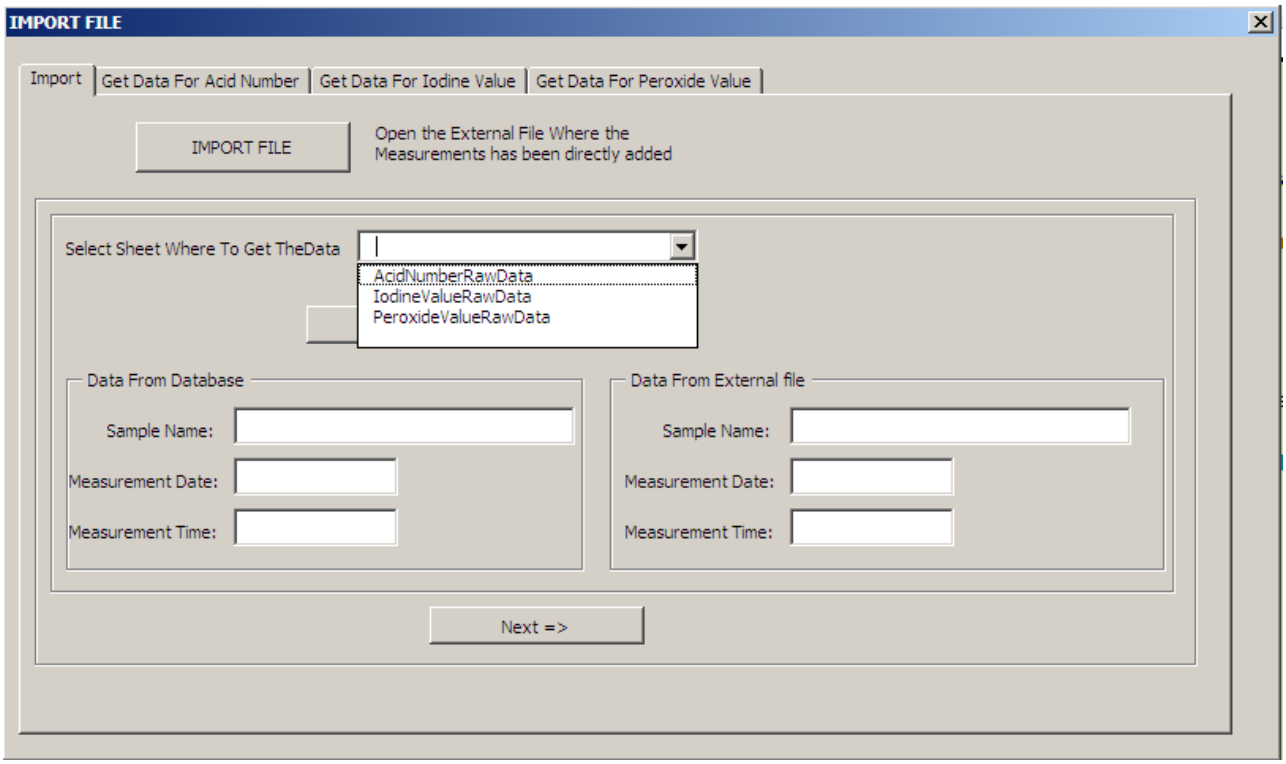


Figure 48. Titration Import

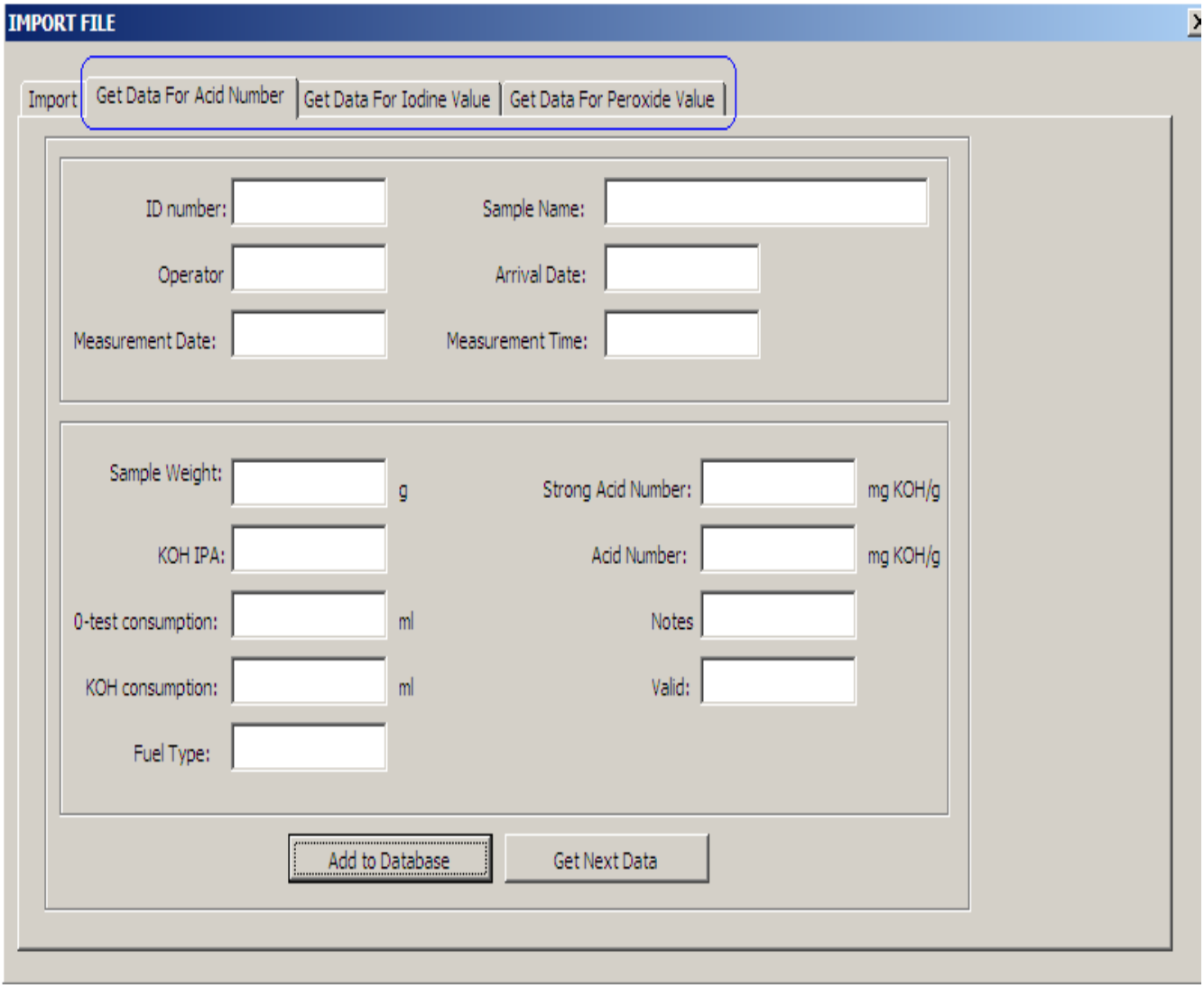


Figure 49. Acid Numbers Properties

Figure 49 shows what properties for the Acid number must import. There are pages for Iodine Value and Peroxide Value too where they have their own properties.

6.5.2 Search

Titration's search function is slightly different from others. In this search, there are three main criteria which are the ID number, measurements date and arrival date. User may choose only one from this three unlike other search function that user select multiple combinations. Additional option can be use to add in the search criteria by selecting the checkbox of Fuel types or valid measurements.

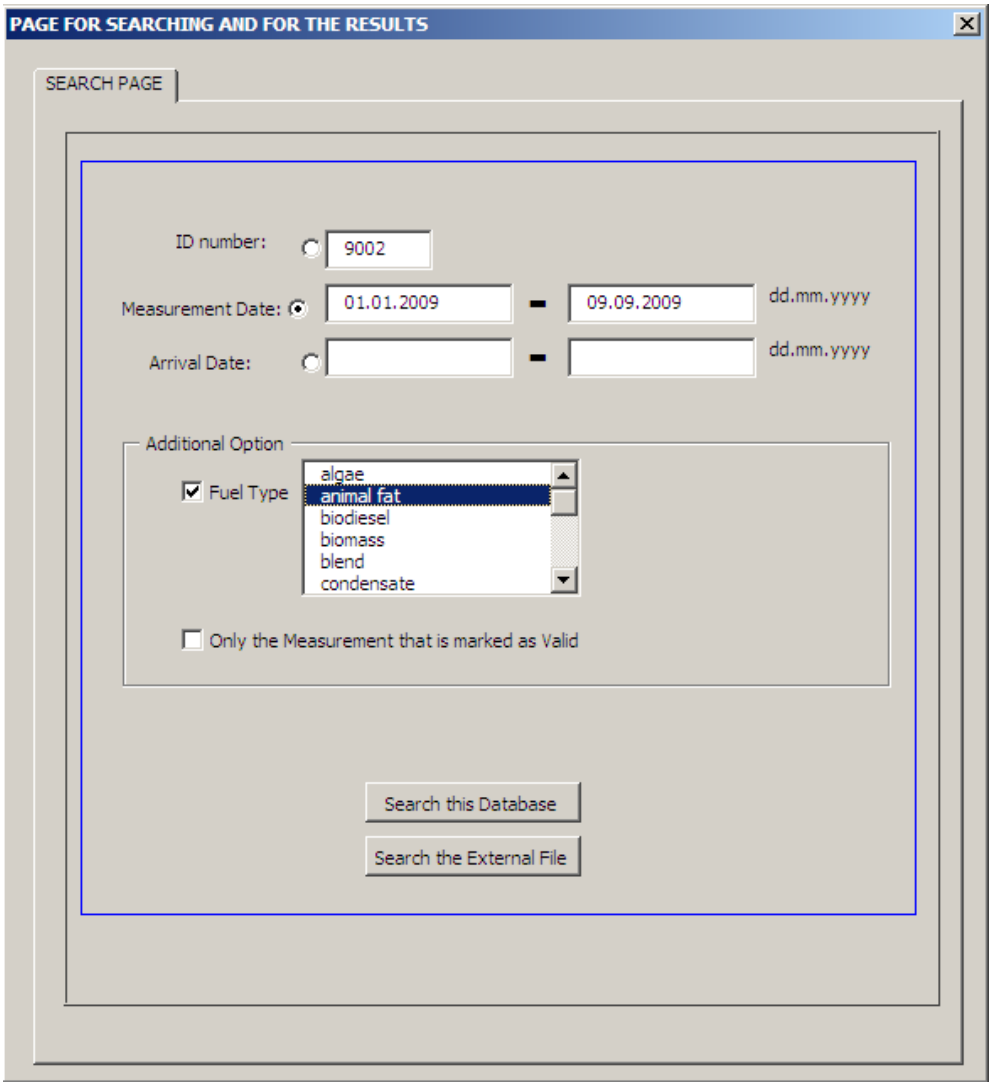


Figure 50. Titration Search

Marked as valid are those measurements that marked as 'x' as symbol for valid in column named valid. One sample is measured few times in one hour and all the measurements are saved but the laboratorian decides which among all the measurements is valid for the sample.

Rancimats and Malvern Mastersizers search form are similar except that in Rancimat there is the ‘valid’ option.

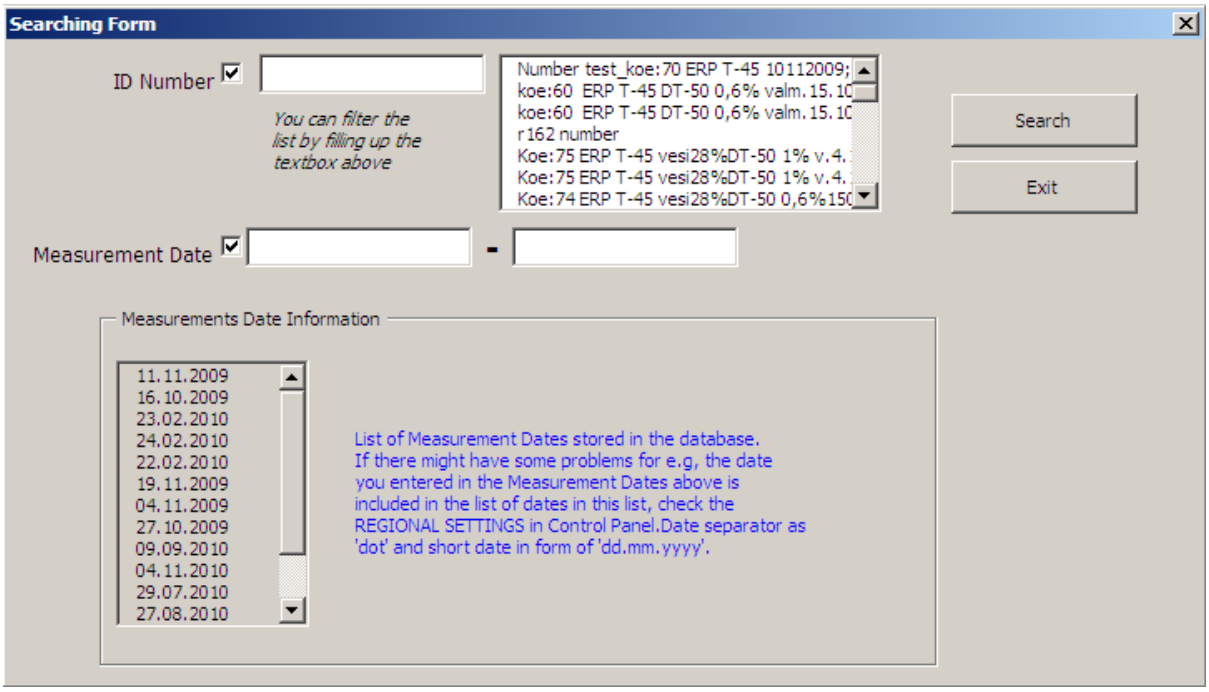


Figure 51. Malvern Mastersizer Search Form

Malvern only search based on ID number and/or measurements date. There are also in the list all the measurements date saved in the raw data so user can check what min date and max date to give that surely has a measurement.

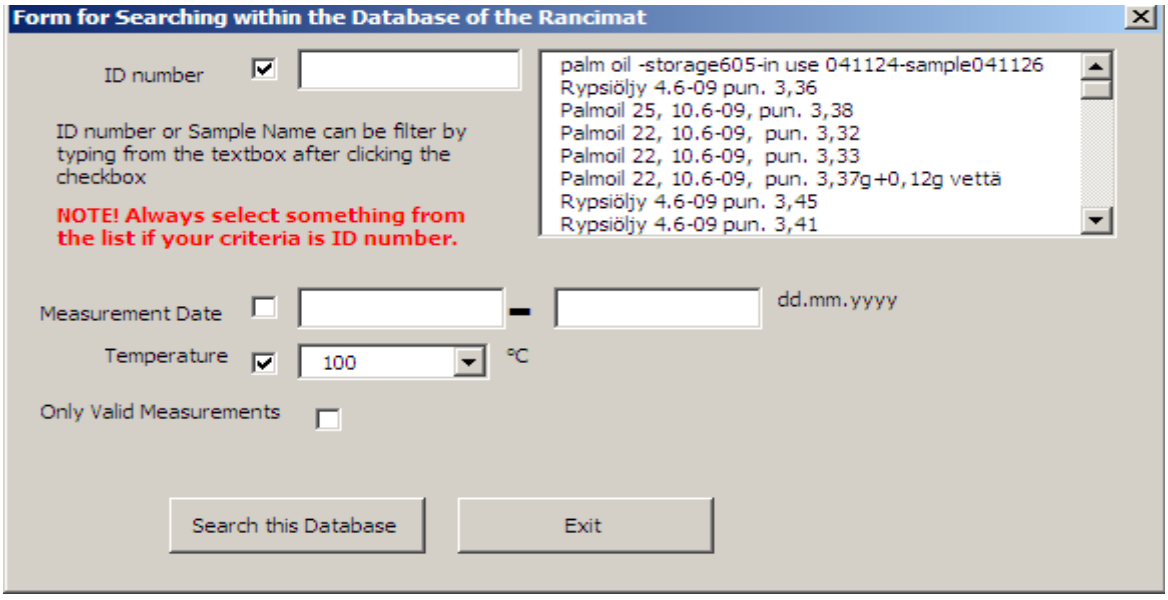


Figure 52. Rancimat Search Form

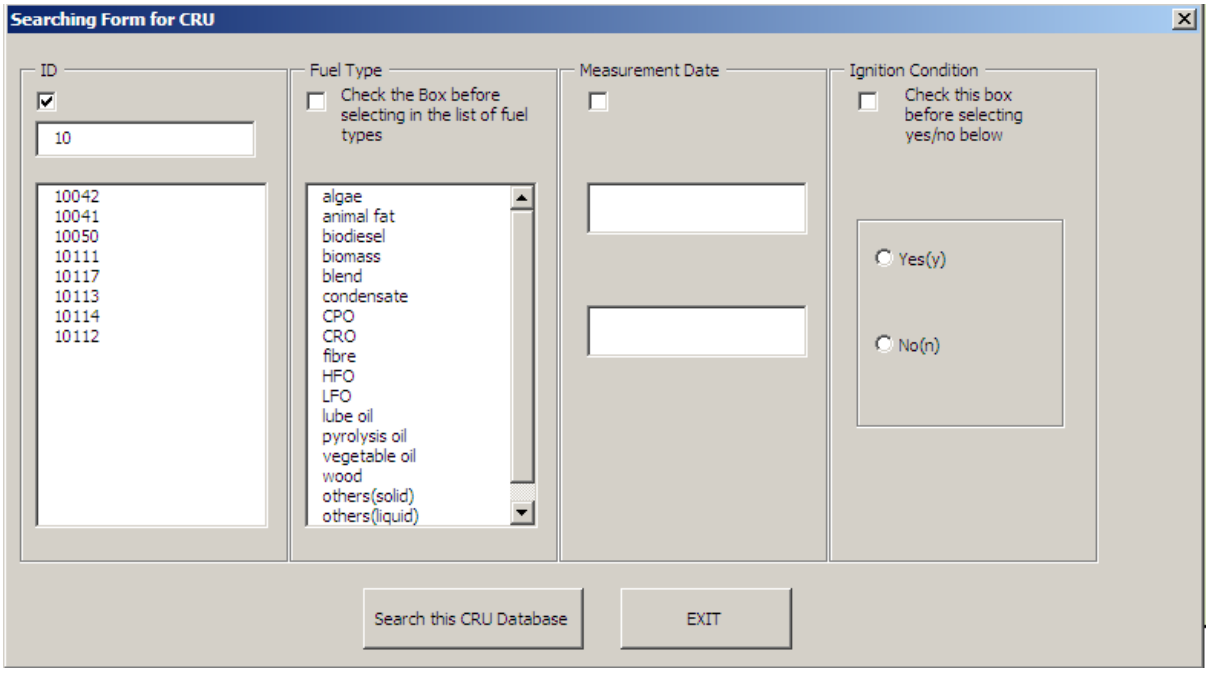


Figure 53. CRU Search Form

CRU is similar to Rheometers first search form interface which consist of criterias ID number, Fuel Types, Measurement Date. Ignition type either stated as “y” for yes or “n” for no is additional property for the CRU.

7 CONCLUSION

Data Collection Analysis and Management System is an application that aims to collect and analyze measured data from the devices. MS Excel is a common tool for everyone but this project gives a deeper knowledge on what kind of application this tool can make with the use of VBA.

Fuel laboratory is very new to Power Plant Technology (PPT) team and this project is challenging during the requirements analysis. There were plenty of idea on what and how to do the application. Important details such as what parameters are needed for adding to the database and in that case what needs to be excluded. Since all parameters are very important for every measurements, taking away one isn't an easy decision.

This project is important especially for fuel laboratory team to check and compare what kind of fuel samples they had measured the past few months/years. They now can see the trend of fuel types or some special power plants and easily can check if there is special problem that may occur/ occurred based on the samples measured.

The last part of this project is the testing and educating the laboratory team wherein we run and test the program together. The requirements of this project were successfully achieved and the application is being used. More measurements are added to the database all the time.

There are plenty of new terms, new devices that is worth knowing during the process of this project to understand the whole laboratory environment.

The application is being used and more measurements are added every now and then. The main target of this project is the fuel laboratory team but this application is saved in IDM where all internal workers can have an access depending to their user rights.

8 REFFERENCE

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APPENDIX 1

Access to VPN

Start->SONAD->Cisco System VPN Client->VPN Client

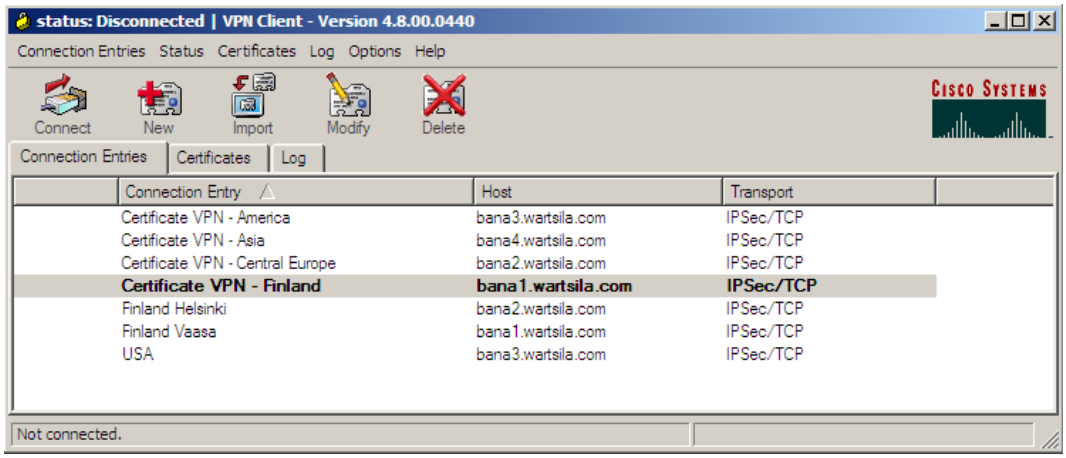

***Figure VPN1**. Log In VPN*

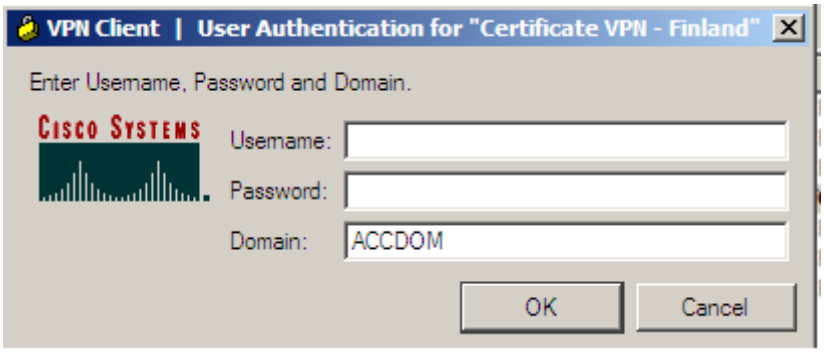

***Figure VPN2**. User Authentication*

After giving the username and password, the user can now have an access to the IDM where the projects are saved.

APPENDIX 2

IDM

IDM is the Integrated Document Management of Wärtsilä which is the documentation system used inside the company.

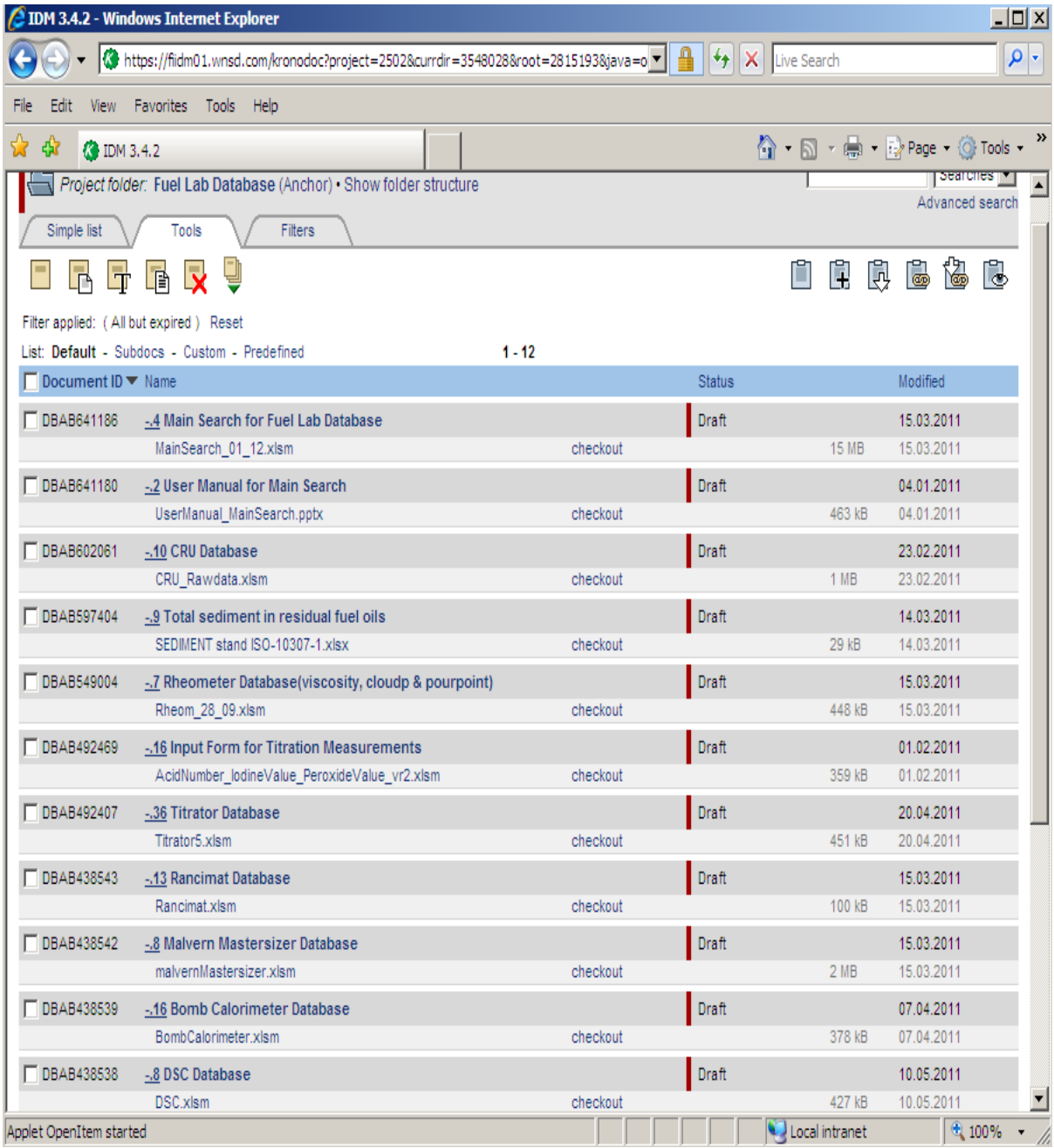

Figure IDM 1. *IDM list of Files*