Developing a Forecast Modelling Tool for a Newly Restructured Fluid Conveyance Provider Company

by

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ABSTRACT

The KLM Group trades roughly 15 000 products in the fluid conveyance industry. Managing inventory levels and production schedules is currently supported by a manual forecasting process. The company wishes to incorporate an automated forecasting process which can be used to estimate future monthly sales. A lead time of three months on most of their products renders out the necessity of a daily forecast.

There are many different types of quantitative and qualitative forecasting methods that can be used. Presented in this document is a quantitative approach to forecasting depicting the different methods. These methods differ in terms of the type of historical data patterns they accommodate, i.e. trend, seasonal, constant, etc. The chosen methods presented in this document are most widely used in the industry as they cover the most essential data patterns.

A model has been developed that uses *each* of these methods to estimate a forecast for *every* item. The forecast generated by the method that yields the smallest *Mean Absolute Percentage Error* (MAPE) is then chosen as the forecast for that item. This is referred to as the *Best Fit Approach.*

Key words: *forecasting, best fit, MAPE, data patterns.*

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$$F(t) = \frac{X(t) + X(t-1) + \ldots + X(t-n+1)}{n} \qquad [1\text{-}1]$$

Weighted Moving Average Method

$$F(t) = R(t) \times X(t) + R(t-1) \times X(t-1) + \ldots + R(t-n+1) \times X(t-1) \qquad [1\text{-}2)$$

Exponential Smoothing Method

$$F(t) = F(t-1) + \alpha \times \big(X(t-1) - F(t-1)\big) \qquad [2\text{-}1]$$

Holt's Method

$$L(t) = \alpha \times X(t) + (1-\alpha) \times \big(L(t-1) + T(t-1)\big) \qquad [2\text{-}2]$$

$$T(t) = \beta \times \big(L(t) - L(t-1)\big) + \big(1-\beta\big) \times T(t-1) \qquad [2\text{-}3]$$

$$F(t) = L(t) + T(t) \qquad [2\text{-}4]$$

Holt Winter's Method

$$L(t) = \alpha \times \frac{X(t)}{s(t-c)} + (1-\alpha) \times \big(L(t-1) + T(t-1)\big) \qquad [2\text{-}5]$$

$$T(t) = \beta \big(L(t) - L(t-1)\big) + \big(1-\beta\big) T(t-1) \qquad [2\text{-}6]$$

$$s(t) = \gamma \times \frac{X(t)}{L(t)} + \big(1-\gamma\big) \times s(t-c) \qquad [2\text{-}7]$$

$$F(t) = \left(L(t) + T(t)\right) \times s(t-c)$$ [2-8]

Accuracy

$$PE(t) = \frac{X(t) - F(t)}{X(t)} \times 100$$ [3-1]

$$MPE = \frac{\sum_{i=1}^{n} PE_i}{n}$$ [3-2]

$$MAPE = \frac{\sum_{i=1}^{n} |PE_i|}{n}$$ [3-3]

Where:

$F(t) = Forecast\ at\ time\ period\ (t)$

$X(t) = Actual\ demand\ at\ time\ period\ (t)$

$t = Time\ period$

$n = Number\ of\ observations\ at\ time\ period\ (t)$

$R(t) = Weighting\ factor\ at\ time\ period\ (t)$

$\alpha, \beta, \gamma = Smoothing\ factors\ /\ desired\ response\ rates$

$L(t) = Estimate\ of\ the\ base\ level\ at\ time\ period\ (t)$

$T(t) = Estimate\ of\ the\ trend\ at\ time\ period\ (t)$

$s(t) = Estimate\ of\ seasonal\ multiplicative\ factor\ at\ time\ period\ (t)$

$c = Number\ of\ periods\ in\ the\ seasonal\ pattern$

$0 < \alpha, \beta, \gamma < 1$

$PE(t) = Percentage\ Error\ at\ time\ period\ (t)$

$MPE = Mean\ Percentage\ Error$

$MAPE = Mean\ Absolute\ Percentage\ Error$

1. INTRODUCTION

1.1 THE COMPANY

* Please note that due to privacy reasons the company's name may not be identified and will therefore be referred to from here on as the *KLM Group.*

The KLM Group is a fully integrated provider of complete fluid conveyance products and services to major role players in the energy, water and chemical industries. The company's heritage reaches back to 1924 and today they serve on a regional, national and international scale. [1]

They have traditionally been marked as a trading company, where they buy and sell mainly pipes, pumps, valves, fittings and couplings. Today they also design and develop their own range of products, which they either manufacture themselves, or package with products sourced from accredited suppliers. The group has in recent years managed to expand their service offering to include installation, supply chain and maintenance projects.

Through a process of innovation, expansion and acquisition the group is in the process of consolidating their three divisions namely Energy, Water and Chemical into a single business unit. During the course of the company's growth and in recognising the need of BEE transformation within the South African economy, The KLM Group was formed. The KLM Group is thus a culmination of leading companies active across the fluid conveyance cycle, optimising the synergies that exist between these individual entities:

- KLM Energy – KLM Energy is the largest supplier of valves, pipes and fittings to the fuels industry in South Africa. The market is serviced from ideally situated offices and depots to provide the exceptional service expected in the petrochemical sector.

- KLM Water – KLM Water's prime focus is on providing innovative products and services to the fluid conveyance industry, addressing the unique needs of a pipeline system over its entire lifetime.

- KLM Chemical – KLM Chemical designs, manufactures and installs plastic tanks and vessels for the chemical, food and water industries. Vessels and tanks are designed according to customer specifications and fabricated in thermoplastic; fibreglass laminated or reinforced polyester resin for aggressive chemical processing.

The restructured group allows KLM to manage the actual cost of fluid conveyance across the entire life cycle of the product, optimising margins throughout the entire supply chain for a more integrated, cost effective solution. The KLM approach eliminates the danger of a low cost upfront, followed by excessive maintenance and installation costs. They can provide a value added service and give customers the competitive advantage they need.

Headed by a dynamic and visionary management team, KLM is positioned for rapid but solid growth. The company operates at three strategic levels:

- Provision of Integrated Packages & Products
- Continued Development of niche Products
- Innovation, Services & providing Solutions

1.2 THE PROJECT

The three divisions, KLM Energy, KLM Water and KLM Chemical, currently incorporate a manual forecasting method, known as a *Judgemental Approach*. Judgmental approaches rely on human knowledge and expertise. A sales member investigates previous sales and possible future demand, and based on these values an estimate for future sales is predicted. As sales members deal directly with customers and demand, they might have an expert opinion on projected sales.

For a group that trades in roughly 15 000 products, this can be a very tedious task to perform manually. One of the problems that can arise is that some of the items might simply be overlooked when forecasting manually and in the long run this can have a negative impact on future predictions of sales. Another problem with the manual procedure is that all the data patterns in the history (such as trend or seasonality) might not be identified properly. This can lead to very inaccurate estimates and ordering new stock based on these values can be dangerous. Sales values that are estimated too high, will lead to high stock and high inventory costs. On the other hand, sales values estimated too low can lead to no stock and therefore no sales.

Another problem that might surface is the bias treatment of projected sales. Salespersons are usually measured by their number of sales and they might therefore overestimate demand to improve their own chances for a bonus.

Taking into account the problems with the manual procedure and the desire to fulfil the company's strategic objectives of the newly integrated business unit, the need for a computerised forecasting model developed.

The aim of this project is to provide the KLM Group with an automated forecasting model which can be used to forecast future monthly sales. This will be done by taking into account the forecasting theory, the company's requirements and the architecture of the business system.

2. LITERATURE REVIEW

2.1 GATHERING INFORMATION

Before embarking on a new project, a comprehensive literature study needs to be performed in order to fully facilitate the engineer. Gathering information on what has previously been accomplished in similar projects, will reveal what has and has not yet been investigated, will help in identifying possible risks and difficulties and enable the engineer to establish researchable hypotheses.

While conducting a literature study, it is important to stress that it is a constant process of gathering and assimilating information; evaluating and analysing data and structuring and writing of arguments.

In this dissertation data and information will be gathered by means of the library, internet, books, articles, manuals, interviews, discussions, meetings and observation. By evaluating previous work done on this topic, a methodology will be established to deliver the best possible solution.

2.2 DEFINITION AND IMPORTANCE OF FORECASTING

Frequently there is a lead time between awareness of an event and occurrence of that event. If the outcome of the event relies on identifiable factors, planning can play an important role in the success of that event. If the lead time is zero, planning for the event cannot occur. However if the lead time for decision making is long, planning can be beneficial and in such instances forecasting is needed to determine when the event will occur so that appropriate actions can be taken.

In management situations, the need for forecasting is great because the lead time for decision making ranges anything between a year, months, days and in the extreme cases even hours (for example scheduling production).

When utilised correctly, forecasting is a powerful tool that can help management attain the goals and objectives of the company. The need for forecasting is increasing as management attempts to decrease its dependence on chance and become more scientific in dealing with its environment. [2] In the functional areas of finance and accounting, forecasting can provide the basis for budgetary planning and cost control. Production and operations rely on forecasting to plan capacity, resources, production and inventory. Marketing makes use of forecasting to plan for new products and establish marketing strategies.

2.3 FORECASTING APPROACHES

Situations where forecasting may be applied vary widely and in order to deal with these diverse applications, several forecasting techniques have been developed. These fall into two major categories – qualitative (or technological) and quantitative methods. [2]

Qualitative techniques are based on the expertise and judgement of specialists, either individual persons or a panel of experienced people. These qualitative methods include salesperson surveys and the Delphi approach where a forecast is determined based on the specialist's knowledge of the sales and demands. There are drawbacks to these techniques due to human prejudice and specialists who may not be as knowledgeable as perceived. Using these models for large scale companies may not prove optimal.

Quantitative techniques can be applied when these three conditions exist: [2]

- Historical information regarding sales is available.
- This information can be quantified in the form of numerical data.
- It can be assumed that some aspects of the data patterns identified in the history will continue into the future.

The idea behind quantitative modelling is that a forecast can be determined by investigating the past.

Quantitative techniques consist of two major models – time-series analysis and causal (regression) models.

The objective of time-series forecasting is to discover the pattern in the historical data series and extrapolate that pattern into the future. This historical data is observed over successive increments of time. These observed patterns may be analysed to provide a better understanding of the factors that determine the demand. Time-series forecasting do not take into account what caused past data; they simply assume that past trends and patterns will continue into the future.

Causal forecasting assumes that some underlying factor or factors in the environment contribute to the demand. A forecast is determined by estimating the relationship between a dependent and one or more independent variables. Independent variables can include price, advertising, weather, competitors, etc.

Although causal methods such as regression analysis are beneficial, some potential issues may arise. The validity of the forecast may be questioned due to the uncertainty of whether all the predictors that affect the demand have been accounted for. Data collection can be costly and may not be very reliable.

2.4 TIME-SERIES ANALYSIS

Considering the current forecasting method of the company (judgemental approach where a salesperson uses his expertise to determine a forecast), the characteristics of the data and the number and frequency of forecasts required, the time-series method seems the most advantageous. The only purpose of the proposed forecasting model is to forecast future values. The factors that contribute to the reason why the historical data behave in the way they do, is of no concern in this study. In a survey conducted in 2003, it was estimated that 71% of companies make use of time-series analysis as their main method of forecasting. [3]

The historical data employed for the forecasting can be decomposed into *noise* and *pattern*. A critical task in forecasting is to separate the *noise* from the *pattern* component so that only the *pattern* can be used for forecasting. Noise is defined as a random error term with zero mean and cannot be forecasted. Data patterns can be categorised into five main types: constant (stationary), trend, seasonal, seasonal trend and irregular. [2]

Rough illustrations of these data patterns are illustrated below.

1) A constant pattern exists when the data values fluctuate around a stable mean.

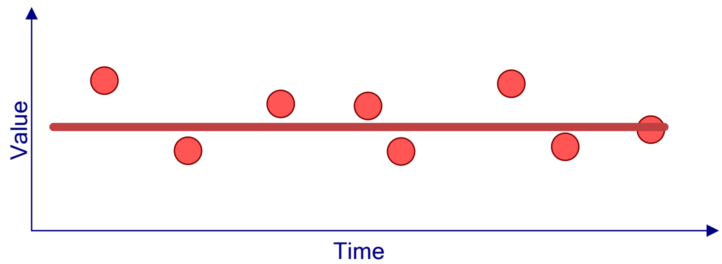


Figure 1-1: Constant Data Pattern

2) A trend pattern exists when the data values increase or decrease over a long period of time with only occasional deviations.

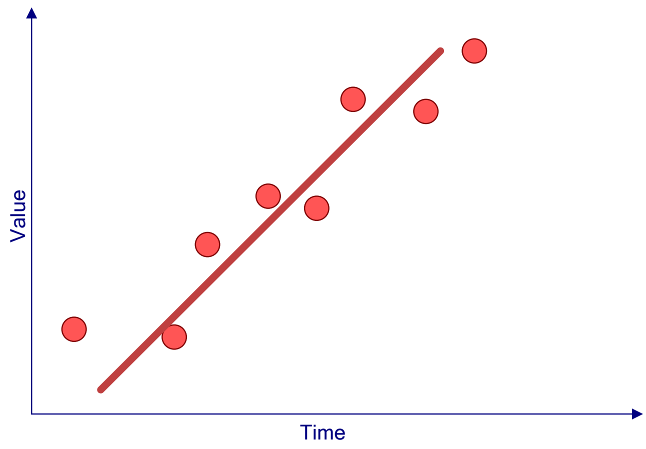


Figure 1-2: Trend Data Pattern

3) A seasonal pattern exists when the data values exhibit a periodically recurring peak around a mean.

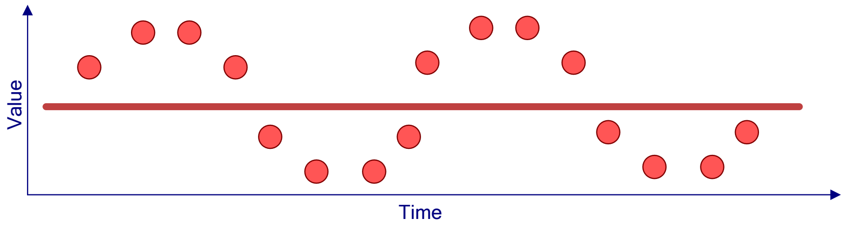


Figure 1-3: Seasonal Data Pattern

4) A seasonal trend pattern exists when the data values exhibit a periodically recurring peak with a continual increase or decrease in the mean value.

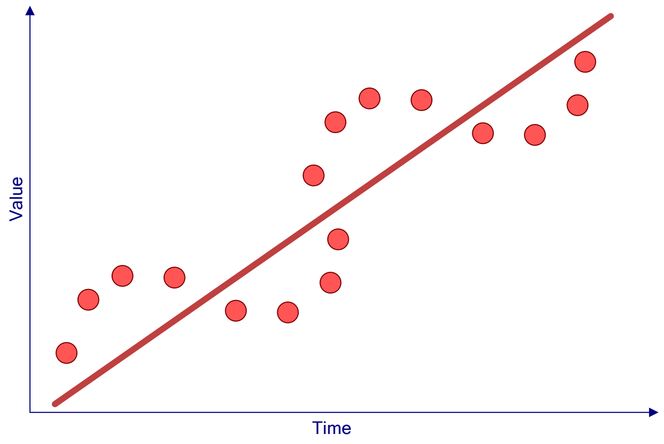


Figure 1-4: Seasonal Trend Data Pattern

5) An irregular data pattern exists when no pattern can be detected in the historical values.

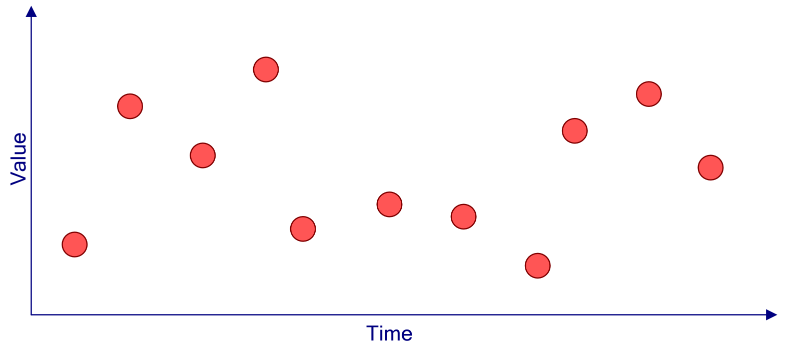


Figure 1-5: Irregular Data Pattern

Many data series include combinations of the above patterns. When selecting the appropriate time-series method, it is important to consider the various data patterns and select a method that best fit the data to present an accurate forecast.

2.5 TIME-SERIES SMOOTHING METHODS

The foundation of time-series smoothing methods are the simple "weighting or smoothing of past observations in a time series in order to obtain a forecast for the future." [2] By doing so random errors are averaged, resulting in a better forecast from the historical data.

The major advantages of these smoothing methods are their low cost and the effortlessness with which they can be applied. These characteristics make them particularly attractive when a large number of items need to be forecasted.

The time-series smoothing methods can be classified into two distinct groups: Averaging methods and Exponential Smoothing methods.

2.5.1 AVERAGING METHODS

Averaging methods is a straightforward approach that uses the average of the historical data to determine a forecast.

2.5.1.1 SIMPLE MOVING AVERAGE

This method uses the average of the *n* time periods of a given data set to calculate the forecast. It does not use all the historical data values, but only *n*-number of values. As a new value becomes available after each new period, a new average can be calculated by dropping the oldest value and including the newest one; hence the name 'moving average'.

Using a moving average of order one uses only the previous data point as the forecast for the next period. It therefore does not smooth any data patterns such as trend or seasonality. The larger the order of the moving average (the number of historical data values used for each average), the greater the smoothing effect but the less important recent values become.

This method is most effective if the data has no noticeable trend or seasonality and for a time series that fluctuates about a constant base level. [4]

$$F(t) = \frac{X(t) + X(t-1) + \ldots + X(t-n+1)}{n} \qquad (1\text{-}1)$$

Where:

$F(t) = \text{Forecast at time period } (t)$

$X(t) = \text{Actual demand at time period } (t)$

$t = \text{Time period}$

$n = \text{Number of observations at time period } (t)$

2.5.1.2 WEIGHTED MOVING AVERAGE

Where the *Simple Moving Average* gives equal weight to each component of the moving average database, a weighted moving average allows any weights to be placed on each element, providing of course that the sum of all weights equals 1. [4] Using this method places emphasis on the most recent data (provided a larger weight is assigned to these values) and can result in better values.

$$F(t) = R(t) \times X(t) + R(t-1) \times X(t-1) + \ldots + R(t-n+1) \times X(t-1) \quad (1\text{-}2)$$

Where:

$F(t) = Forecast\ at\ time\ period\ (t)$

$X(t) = Actual\ demand\ at\ time\ period\ (t)$

$t = Time\ period$

$n = Number\ of\ observations\ at\ time\ period\ (t)$

$R(t) = Weighting\ factor\ at\ time\ period\ (t)$

2.5.2 EXPONENTIAL SMOOTHING METHODS

These methods apply an unequal set of weights to past data, which decreases exponentially as the data values get older. A few smoothing parameters have to be defined for each method which determines the weights assigned to each observation.

How quickly a forecast reacts to a change in pattern depends on these smoothing parameters. As these values increase, more importance is placed on the most recent data. For example, an alpha value of 0.5 assigns a weight of 50% to the 1^{st} historical value, 25% to the 2^{nd} historical value, 13% to the 3^{rd} historical value, and so on. Whereas for an alpha value of 0.2, the distribution will be 20% to the 1^{st} historical value, 16% to the 2^{nd} historical value, 13% to the 3^{rd} historical value, and so on. [5]

2.5.2.1 SIMPLE EXPONENTIAL SMOOTHING

This is the simplest case of exponential smoothing. The forecast is determined by using the previous forecast plus an adjustment for the error that occurred in calculating the previous forecast. The previous forecast error is used to correct the next forecast in a direction opposite to that of the error.

$$F(t) = F(t-1) + \alpha \times \left(X(t-1) - F(t-1) \right) \tag{2-1}$$

Where:

$F(t) = Forecast\ at\ time\ period\ (t)$

$X(t) = Actual\ demand\ at\ time\ period\ (t)$

$t = Time\ period$

$\alpha = \text{Smoothing factor, or desired response rate}$

$0 \leq \alpha \leq 1$

A point of concern with this method however, is the initialisation phase and obtaining the initial forecast. Some proposed methods include using the first observed value as a substitute for the first forecast or using the average of the first few values as the initial forecast.

2.5.2.2 DOUBLE EXPONENTIAL SMOOTHING: HOLT'S METHOD

If it is believed that a time series exhibits a linear trend (and no seasonality), Holt's Method often yields good forecasts. [5]

The forecast for Holt's method is obtained by using two smoothing parameters and three equations. This method estimates a value of the base level (L_t) and the trend (T_t) of the time series and the summation of these two gives the forecast for the period.

$$L(t) = \alpha \times X(t) + (1-\alpha) \times \big(L(t-1) + T(t-1)\big) \tag{2-2}$$

$$T(t) = \beta \times \big(L(t) - L(t-1)\big) + \big(1-\beta\big) \times T(t-1) \tag{2-3}$$

$$F(t) = L(t) + T(t) \tag{2-4}$$

Where:

$F(t) = \text{Forecast at time period } (t)$

$X(t) = \text{Actual demand at time period } (t)$

$t = \text{Time period}$

$L(t) = \text{Estimate of the base level at time period } (t)$

$T(t) = \text{Estimate of the trend at time period } (t)$

$\alpha,\beta = \text{Smoothing factor, or desired response rate}$
$0 \leq \alpha,\beta \leq 1$

For example, suppose that L_{10} = 20 and T_{10} = 2. This means that after observing X_{10}, the base level of the time series is 20 and that it is increasing by 2 units per period.

The initialisation of Holt's method requires two estimate values, one for the initial base level and another for the initial trend. L_0 is simply chosen as X_0, the first observed value of the data series. [2] To obtain an estimate of the trend from one period to another, the slope of the observed data is used after plotting these values. [2] However it should be noted that these values should be free from randomness and *noise* (as discussed in Section 2.4 paragraph 2) as it could take the forecasting system a long time to recover the influence of these values if they do not represent the actual scenario.

2.5.2.3 TRIPPLE EXPONENTIAL SMOOTHING: HOLT WINTER'S METHOD

The methods examined thus far can deal with almost any type of data, as long as there is no indication of seasonality. The most appropriate method to use for which trend and seasonality are present, is Holt Winter's method. [5]

This method is similar to Holt's method, except for an additional equation and smoothing parameter to cater for seasonality. L_t is an estimate of the base level, T_t is an estimate of the trend and S_t is included for the seasonal smoothing.

$$L(t) = \alpha \times \frac{X(t)}{s(t-c)} + (1-\alpha) \times \left(L(t-1) + T(t-1)\right) \tag{2-5}$$

$$T(t) = \beta \left(L(t) - L(t-1)\right) + \left(1-\beta\right) T(t-1) \tag{2-6}$$

$$s(t) = \gamma \times \frac{X(t)}{L(t)} + \left(1-\gamma\right) \times s(t-c) \tag{2-7}$$

$$F(t) = \left(L(t) + T(t)\right) \times s(t-c) \tag{2-8}$$

Where:

$F(t) = Forecast\ at\ time\ period\ (t)$

$X(t) = Actual\ demand\ at\ time\ period\ (t)$

$t = Time\ period$

$L(t) = Estimate\ of\ the\ base\ level\ at\ time\ period\ (t)$

$T(t) = Estimate\ of\ the\ trend\ at\ time\ period\ (t)$

$s(t) = Estimate\ of\ seasonal\ multiplicative\ factor\ at\ time\ period\ (t)$

$c = Number\ of\ periods\ in\ the\ seasonal\ pattern$

$0 < \alpha, \beta, \gamma < 1$

$\alpha, \beta, \gamma = Smoothing\ factors\ /\ desired\ response\ rates$

To initialise Holt Winter's method, one complete season's data is needed to estimate the seasonal indices (S_{-11} – S_0), the initial base level (L_0) and the initial trend (T_0). The initial trend is calculated in the exact manner as for Holt's method. The seasonal factors are calculated as an average of averages per season / quarter / month.

To estimate L_0, the average monthly demand during the previous year is calculated to give an estimate of the base level at the middle of the year (month 6.5 of the year). This estimate has to be calculated for the end of month 12 of the previous year (beginning of this year). Therefore our estimate of the base level is: $L_0 = (12 – 6.5)*T_0$.

2.6 EVALUATION CRITERIA

To determine the accuracy of a specific forecasting method, the suitability of that method to the given data needs to be measured. This can be referred to as "goodness-of-fit", or how well the forecasting model is able to reproduce the known data. [2] By using time series analysis, a subset of the known data can be used to forecast the rest of the known data and in doing so enable the study of the accuracy of the forecast.

Demand for a product is generated by a number of factors too complex to simulate accurately in a model. Therefore unfortunately all forecasts certainly contain some error.

The error of a forecast is defined as the difference between the actual value and the forecast value for that period. Forecasting methods are often chosen as the best fit when the *mean squared error* (MSE) has been minimised. This can however create a few problems as the MSE does not facilitate comparison across different time series and for different time intervals, since it is an absolute measure. [2]

To overcome the limitations of the MSE, alternative measures have been introduced that deals with percentage errors:

$$PE(t) = \frac{X(t) - F(t)}{X(t)} \times 100 \qquad (3\text{-}1)$$

$$MPE = \frac{\sum_{i=1}^{n} PE_i}{n} \qquad (3\text{-}2)$$

$$MAPE = \frac{\sum_{i=1}^{n} |PE_i|}{n} \qquad (3\text{-}3)$$

Where:

$$F(t) = Forecast\ at\ time\ period\ (t)$$

$$X(t) = Actual\ demand\ at\ time\ period\ (t)$$

$$t = Time\ period$$

$$n = Number\ of\ observations\ at\ time\ period\ (t)$$

$$PE(t) = Percentage\ Error\ at\ time\ period\ (t)$$

$$MPE = Mean\ Percentage\ Error$$

$$MAPE = Mean\ Absolute\ Percentage\ Error$$

Equation (3-1) calculates the percentage error for period *t*. Equation (3-2) then calculates the average of these values to give the mean percentage error. The MPE is likely to be small since positive and negative PE's tend to offset one another. Therefore the mean absolute percentage error is computed as in equation (3-3) by using the absolute values of PE in equation (3-3).

Choosing a forecasting method that minimises the *MAPE* will give a much better indication of the accuracy of the method than if a method was chosen to minimise the *MSE.*

3. METHODOLOGY

To achieve the objective of the forecasting model, a time series approach will be followed which is a quantitative method that uses mathematical modelling to forecast demand. Modelling allows one to replicate business problems and use various mathematical and statistical methods to provide an optimal solution.

3.1 FORECASTING SPECIFICATIONS

The forecasting model presented to the company will incorporate the following set of criteria as specified by management / decided on by the author:

- The forecast model will be used on a monthly basis and should estimate 12 months' worth of future sales.
- 3 Years' sales history will be provided and should be investigated for data patterns to enable a good forecast.
- Forecasting should be visible on group and item level of all the products.
- The forecast model should be able to distinguish between different branches and divisions within the company.
- The model will be used by various stakeholders – from sales personnel to top management.
- The forecast will be represented on a graph displaying the quantities and sales values for the specific items.

3.2 FORECASTING PROCESS

The following process should be followed on a monthly basis by the various stakeholders in generating forecast models (this process should typically be completed within the first week of each new month):

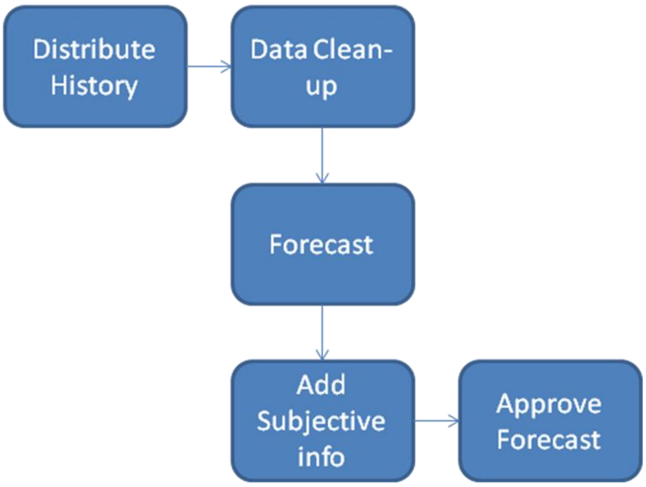


Fig 2: Forecast Process

- Distribute History: Sales history of the previous *n* period(s) is distributed to the sales team (sales manager / personnel). Only the history relevant to the current user is distributed i.e. data per division and per branch.

- Data Clean-Up: The user reviews the historical data so that only correct and relevant data are recorded and used for forecasting purposes. This implies removing the *noise* of the data as described in Section 2.4 paragraph 2. These outliers should be removed as they are a once off recording and do not give an honest representation of the history.

- Forecast: This modified data is then generated into the forecasting model to present a forecast for the next 12 months. A '*Best Fit Approach*' will be applied to select the most appropriate forecasting method that best resembles the data. This will be discussed in detail in Section 3.3

- Add Subjective Information: The sales team examine this forecast where they then apply subjective knowledge to these values (personal experience and expertise). This may include adding actual possible demand to the data due to the awareness of an unexceptional event (for example a once-off big order from a client).

  It should be noted that adding subjective information to a mathematically modelled forecast is a better approach than solely making use of personal experience to determine the forecast as in the event of Qualitative techniques (discussed in Section 2.3 paragraph 2).

- Approve Forecast: The final forecast is then sent to management for approval. The calculated forecast as well as the subjective information added will be visible. Management then applies their own subjective knowledge to select the appropriate values and approve the forecast as official for that period.

Performance measurements can be incorporated to measure the accuracy with which the sales personnel / a branch cleaned the data and added subjective information to obtain a good forecast with a high accuracy percentage. This will serve as a motivation to not take this task lightly as wrong data *(*containing a lot of *noise)* can give a wrong forecast which can have dangerous consequences.

3.3 DEVELOPING THE MODEL

Building the forecasting model consists of five essential steps: [6]

i. Understanding the objective

ii. Data collection

iii. Preliminary analysis

iv. Building the model

v. Testing the model

Each of these steps will now be discussed in more detail.

3.3.1 UNDERSTANDING THE OBJECTIVE

It is important to clearly define the problem and understand the objective. Determining specifications beforehand and adhering to them will lead to a successful forecasting model and a satisfied customer.

These specifications have already been defined in Section 3.1. The objective is therefore to provide a model to the company that will forecast demand for the future twelve months by looking at three years' sales history. The company has a three month lead time on almost all of their products which will render a daily forecast unnecessary.

3.3.2 DATA COLLECTION

Three years' sales history is gathered from all the various sales personnel at all the different branches. This data is then organised to give a single sales value per item per month, while still distinguishing between the various divisions, branches and departments.

The collected data should have all the outliers removed, as explained in Section 3.2 paragraph 3. The initial process of gathering and cleaning the data is very time consuming. However this cleaning process should be done thoroughly in order for the model to give an accurate representation of the future demand.

After this initialisation phase, only the latest values have to be cleaned from there on. Each month the most outdated values (month $t - 36$) are replaced by the most recent data as there is only a need for three years' historical data (36 months).

3.3.3 PRELIMINARY ANALYSIS

Preliminary analysis is conducted to experiment with several different techniques and to establish the most suitable parameter values for the different methods.

Table 1 indicates all the parameter values that have to be defined for all the various forecasting methods. The initial values that will be used for these parameters are indicated in the third column. (Please refer back to Section 2.5 for the relative equations for each method.)

Table 1: Parameter Values

FORECAST METHOD / PARAMETER VALUE	RESTRICTION	VALUE(S)
Moving Average & Weighted Moving Average		
Moving average period, *n*	$1 < n < t$	4
Weighting factor, *R*	Σ All R = 1	$R(t_0) = 0.4$
		$R(t_{-1}) = 0.3$
		$R(t_{-2}) = 0.2$
		$R(t_{-3}) = 0.1$
Exponential Smoothing		
Level Smoothing factor, α	$0 < \alpha < 1$	0.25
Holt's Method		
Level Smoothing factor, α	$0 < \alpha < 1$	0.2
Trend Smoothing factor, β	$0 < \beta < 1$	0.3
Holt Winter's Method		
Level Smoothing factor, α	$0 < \alpha < 1$	0.5
Trend Smoothing factor, β	$0 < \beta < 1$	0.4
Seasonal Smoothing factor, γ	$0 < \gamma < 1$	0.6
Number of periods in the length of seasonal pattern, *c*	$c > 0$	12

These parameter values were chosen only as initial values. The final combination of values used per forecast method per item has been carefully calculated by means of a Microsoft Excel tool, Excel solver. These parameter values were selected within the allowable ranges such as to minimise the Mean Absolute Percentage Error. Each parameter value has a different effect on a method and selecting optimal values is important for the overall success of the forecast generated.

Characteristics of the moving average period *n:*

The moving average period *n* refers to the number of historical periods used to determine the forecast. If *n* is 1, meaning a moving average of order 1, only the previous period's value is used as the forecast for the next period. [4]

If *n* is small, the forecast will quickly respond to most recent "real" changes but might also respond to noise. If *n* is large, the forecast will be slow to respond to "real" changes in the system but will not likely respond to noise.

Figure 3 shows the effect of the moving average period *n* on historical data. The blue line represents the actual data and the coloured lines represent different n values, resulting in different fittings to the data. The chosen value of *n* for this model is based on analysing past data and minimising the error.

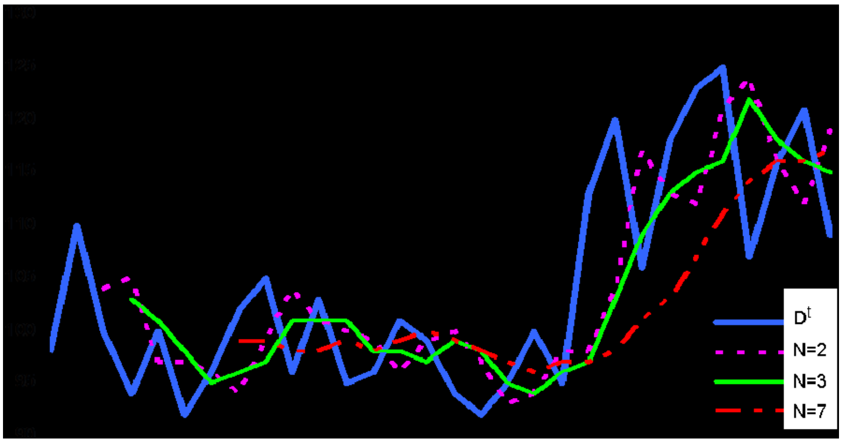


Figure 3: The effect of α on a moving average forecast

Characteristics of the smoothing factor α:

Alpha is a smoothing factor that assigns a set of weights to past data, which decreases exponentially as the data values get older.

As alpha increases, the weights applied to the newer data also increases. Therefore if α is large, the forecast will quickly respond to most recent "real" changes but might also respond to noise. If α is small, the forecast will be slow to respond to "real" changes in the system but will not likely respond to noise.

Figure 4 shows the effect of alpha on the weights assigned to historical data. The chosen values of α for this model are based on analysing past data and minimising the error.

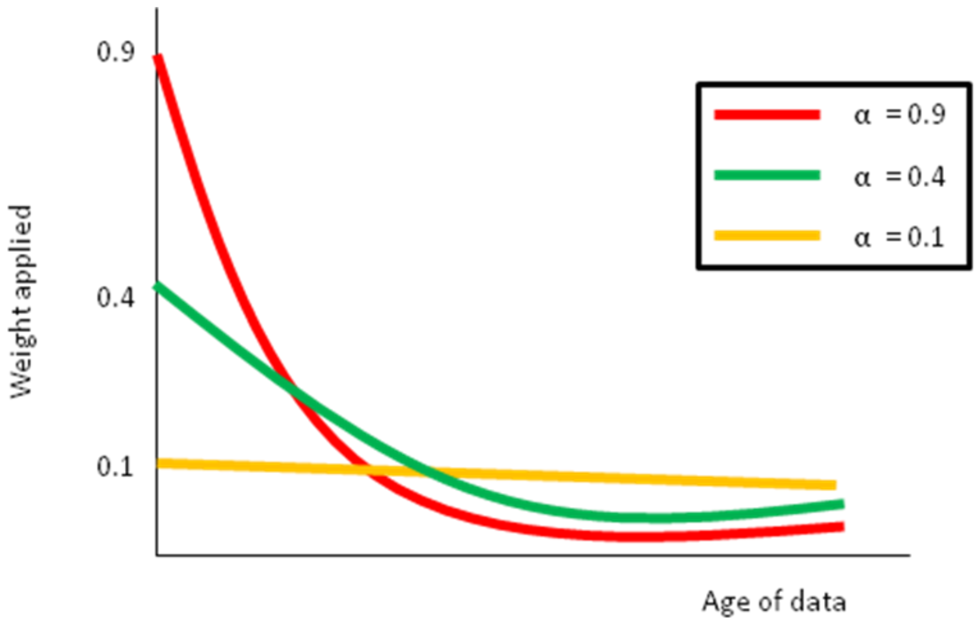


Figure 4: The effect of α on the weights assigned to historical data

Characteristics of the *c*-value used in Holt Winter's method:

This parameter describes the length of seasonality (e.g. number of months or quarters in a year). The chosen value of 12 suggests that each month's seasonality is unique compared to that of the other months. For example, when forecasting for July 2010 using Holt Winter's method, the seasonality of July has to be incorporated. Therefore the seasonality factor of July 2009 will be used, instead of the seasonality factor of the previous month, June 2010.

The parameter values described in Table 1 have been obtained through trial and error by investigating the mean absolute percentage error (MAPE). Parameter values that minimise the MAPE were chosen as the most satisfactory. These values are not fixed however and can be changed at any time by a specialist/manager if he deems it necessary.

Adaptive response rate exponential smoothing (ARRES) is a smoothing method that uses a mechanism to determine the most suitable smoothing parameters over time as a function of forecast errors. When the forecast is accurate a small alpha value is used and when the error is large a large alpha value is used. However in practice, this method is often not found to be any better than regular exponential smoothing methods and therefore the choice of predetermined parameter values can be justified. [6]

3.3.4 BUILDING THE MODEL

This phase entails the actual building of the forecasting model. Using the statistical and mathematical knowledge gained, a complete forecasting model is built to enable the user with a forecast for the following twelve months.

63% of respondents to a survey said they use Microsoft Excel to do their forecasting. [3] Building this model, Microsoft Excel will also be incorporated as the main modeling tool.

The developed model makes use of three Excel files to do all the calculations and present a final forecast:

File 1: Determining the *Best-Fit*

File 2: Aggregation & Disaggregation

File 3: User-friendly interface

3.3.4.1 FILE 1: DETERMINING THE *BEST FIT* FORECAST

A *best fit* approach is applied to determine the best possible method to use when forecasting each item / group. This file therefore calculates *five* forecasts for *each* product by using the five methods as discussed in Section 2.5: Simple Moving Average, Weighted Moving Average, Simple Exponential Smoothing, Holt's Method and Holt Winter's Method. The method that generates the lowest Mean Absolute Percentage Error (MAPE) is then chosen as the *Best Fit* and the forecast obtained from that method will be used as the final forecast for that product.

The MS Excel file consists of 20 sheets and the calculations within each sheet will be discussed in detail.

Sheet 1: Actual Sales History

This sheet contains all the original sales values of the items / groups of the past 36 months.

Sheet 2: Clean Sales History

This sheet contains all the “clean” sales values of the items/groups of the past 36 months. These values were obtained from the sales personnel after the outliers have been removed.

Sheet 3: Parameters

This sheet contains all the required parameters and the values assigned to them (as specified in Section 3.3.3, Table 1).

Sheet 4: Moving Average

A forecast is determined for each item / group by using the moving average method (equation [1-1]) and the data from the “*Clean Sales History*” sheet. The forecast is calculated starting at period 5 as the moving average period is 4. A forecast is determined for 44 months (48 minus the moving average period of 4), from which the first 32 months (36 minus the moving average period of 4) have actual values available.

Sheet 5: Moving Average Error

The difference between the actual value and the forecast value is known as the error. This sheet contains the errors calculated for the first 32 months (equation [3-1]) by using data from the "*Clean Sales History*" sheet and the "*Moving Average*" sheet. The MAPE (Mean Absolute Percentage Error) is then determined from these values (equation [3-3]).

Sheet 6: Weighted Moving Average

A forecast is determined for each item / group by following the same procedure as mentioned under sheet 2, the only difference being that unequal weights are assigned to the 4 months used for the moving average (equation [1-2]). These weights are obtained from the "*Parameters"* sheet.

Sheet 7: Weighted Moving Average Error

The difference between the actual value and the forecast value is known as the error. This sheet contains the errors calculated for the first 32 months (equation [3-1]) by using data from the "*Clean Sales History*" sheet and the "*Weighted Moving Average*" sheet. The MAPE (Mean Absolute Percentage Error) is then determined from these values (equation [3-3]).

Sheet 8: Exponential Smoothing

A forecast is determined for each item / group by using the exponential smoothing method (equation [2-1]), the parameters as defined in the "*Parameters"* sheet and the data from the "*Clean Sales History*" sheet. A forecast is determined for 48 months, from which the first 36 months have actual values available.

The initial value (at period 4) is obtained by taking the average of the first 3 periods from the data in the "*Clean Sales History*" sheet.

The forecast for the last 12 months (periods 37 – 48) is obtained by using the averages of the previous 12 months' (periods 25 – 36) historical data and forecast values, instead of just the single, previous period (period 36).

Sheet 9: Exponential Smoothing Error

The difference between the actual value and the forecast value is known as the error. This sheet contains the errors calculated for the first 36 months (equation [3-1]) by using data from the "*Clean Sales History*" sheet and the "*Exponential Smoothing*" sheet. The MAPE (Mean Absolute Percentage Error) is then determined from these values (equation [3-3]).

Sheet 10: Holt's Method - Level

This sheet calculates base level estimates (equation [2-2]) for each item / group by using the parameters as defined in the "*Parameters"* sheet, data from the "*Clean Sales History*" sheet and data from "*Holt's Method – Trend"* sheet. This is determined for a period of 36 months. The initial values for period 1 are simply the initial values of period 1 in the "*Clean Sales History*" sheet.

Sheet 11: Holt's Method - Trend

This sheet calculates trend estimates (equation [2-3]) for each item / group by using the parameters as defined in the "*Parameters"* sheet and the data from the "*Holt's Method - Level*" sheet. This is determined for a period of 36 months. The initial values for period 1 are simply the gradient of the first 12 periods' values in the "*Clean Sales History*" sheet.

Sheet 12: Holt's Method

A forecast is determined for each item / group by using Holt's method (equation [2-4]), data from "*Holt's Method - Level*" sheet and data from "*Holt's Method – Trend"* sheet. A forecast is determined for 48 months, from which the first 36 months have actual values available.

The forecast for the last 12 months (periods 37 – 48) is obtained by using the averages of the previous 12 months' (periods 25 – 36) data from the "*Holt's Method - Level*" sheet and data from "*Holt's Method – Trend"* sheet, instead of just the single, previous period's values (period 36).

Sheet 13: Holt's Method Error

The difference between the actual value and the forecast value is known as the error. This sheet contains the errors calculated for the first 36 months (equation [3-1]) by using data from the "*Clean Sales History*" sheet and the "*Holt's Method*" sheet. The MAPE (Mean Absolute Percentage Error) is then determined from these values (equation [3-3]).

Sheet 14: Holt Winter's Method - Level

This sheet calculates base level estimates (equation [2-5]) for each item / group by using the parameters as defined in the "*Parameters"* sheet, data from the "*Clean Sales History*" sheet, data from "*Holt Winter's Method – Trend"* sheet and data from "*Holt Winter's Method – Seasonal*" sheet. This is determined for a period of 36 months. The initial values for period 1 are calculated as described in Section 2.5.2.3.

Sheet 15: Holt Winter’s Method - Trend

This sheet calculates trend estimates (equation [2-6]) for each item / group by using the parameters as defined in the “*Parameters”* sheet and the data from the “*Holt Winter’s Method - Level*” sheet. This is determined for a period of 36 months. The initial values for period 1 are simply the gradient of the first 12 periods’ values in the “*Clean Sales History*” sheet.

Sheet 16: Holt Winter’s Method - Seasonal

This sheet calculates seasonal estimates (equation [2-7]) for each item / group by using the parameters as defined in the “*Parameters”* sheet, data from the “*Clean Sales History*” sheet and data from “*Holt Winter’s Method – Level*” sheet. This is determined for a period of 36 months. The initial values for periods 1 - 12 are calculated as described in Section 2.5.2.3. Periods 13 – 24 use the seasonal estimates calculated in periods 1 – 12 and periods 25 – 36 makes use of the seasonal estimates calculated in periods 13 – 24.

Sheet 17: Holt Winter’s Method

A forecast is determined for each item / group by using Holt Winter’s method (equation [2-8]), data from “*Holt Winter’s Method - Level*” sheet, data from “*Holt Winter’s Method – Trend”* sheet and data from “*Holt Winter’s Method – Seasonal*” sheet. A forecast is determined for 48 months, from which the first 36 months have actual values available.

The forecast for the first 12 months (periods 1 – 12) is obtained by using the seasonal estimates of periods 1 – 12. The forecast for periods 13 – 24 uses the seasonal estimates of periods 13 – 24, the forecast for periods 25 – 36 uses the seasonal estimates of periods 25 – 36 and the forecast for periods 37 – 48 uses the seasonal estimates of periods 37 – 48.

The forecast for the last 12 months (periods 37 – 48) is obtained by using the averages of the previous 12 months' (period 25 – 36) data from the "*Holt Winter's Method-Level*" sheet and data from "*Holt Winter's Method – Trend"* sheet, instead of just the single, previous period's values (period 36).

Sheet 18: Holt Winter's Method Error

The difference between the actual value and the forecast value is known as the error. This sheet contains the errors calculated for the first 36 months (equation [3-1]) by using data from the "*Clean Sales History*" sheet and the "*Holt Winter's Method*" sheet. The MAPE (Mean Absolute Percentage Error) is then determined from these values (equation [3-3]).

Sheet 19: Comparison

This sheet displays all the MAPE values per item / group as computed from all the various methods (data from the – *Error* sheets). The method with the lowest MAPE is chosen as the best fit for that particular item / group.

Sheet 20: Forecast

The function of this sheet is to display the forecast of the selected best-fit method next to the specific item / group. The information in this sheet will serve as an input for the graphical displays.

3.3.4.2 FILE 2: AGGREGATION & DISAGGREGATION

Performing the process described in the previous section can be very time consuming and may necessitate a lot of data storage when over 15 000 products have to be forecast.

Pareto Analysis is therefore utilised to reveal the items of greatest interest so that most of the time and effort can be concentrated on these items. Pareto Analysis is sometimes referred to as the *80-20 rule*. This technique suggests that only 20% of the products contribute to 80% of the total activity (and vice versa). [7]

Pareto Analysis was conducted on all the products to reveal the top 20% of items that contribute to 80% of the sales values and to 80% of the quantities sold. The items classified into both these categories were labelled the *A-items.*

All the items are classified into certain groups. The best-fit approach as mentioned in the previous section is used to forecast items on a group level and for all the A-items. All the remaining items are forecast by means of disaggregation settings. This method uses the forecast on the upper level to determine the forecast on the lower levels.

Microsoft Excel Macros were written in this file to determine the percentage contribution of every item to its higher level group. Using the forecast obtained for the group by the best-fit method and disaggregation, a forecast is obtained for all the remaining items, based on the percentage contributions.

3.3.4.3 FILE 3: USER-FRIENDLY INTERFACE

This file is the final presentation of the forecasting model. It incorporates the information from the other two files to enable the user with an easy to use, visual representation of the forecast model.

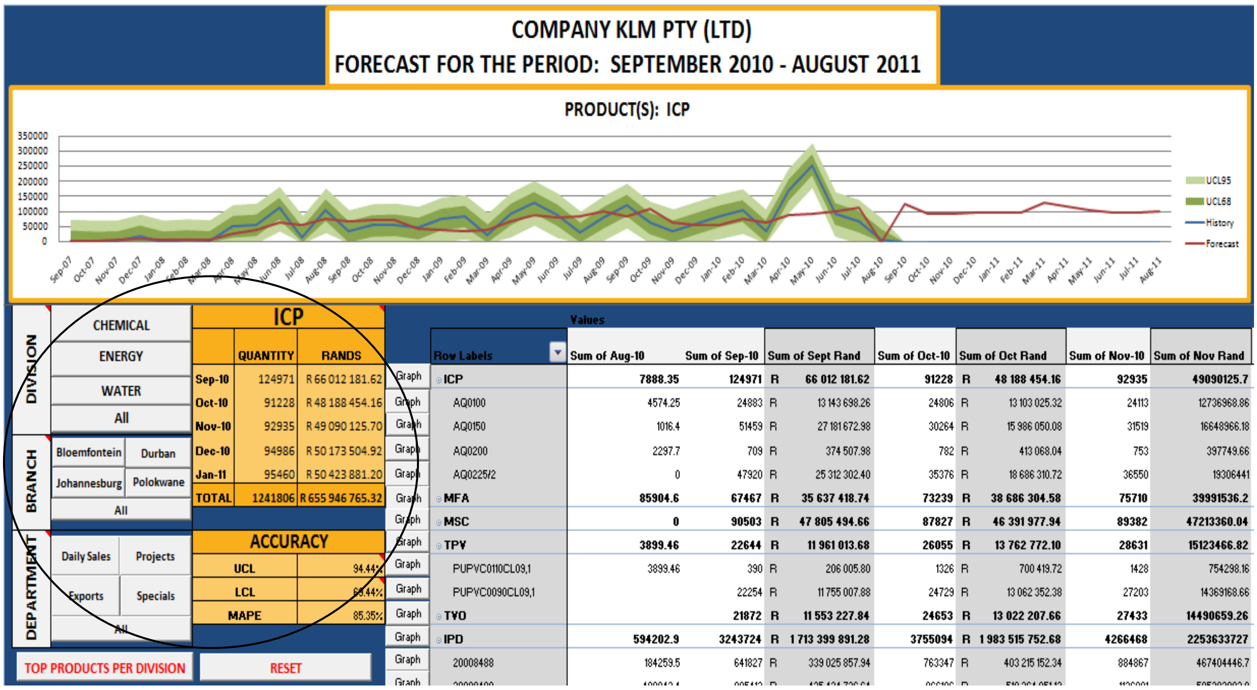
The user can select different branches, divisions and departments to present a graph of the proposed forecast, either on item or group level. The user can also select to see the top 100 items per division.

As a button is selected, the graph displays the historical data of the past 36 months, the “best fit” forecast calculated to fit the historical data over a period of 36 months and the forecast estimated for the next 12 months for the selected item / group.

The forecast quantities and sales values for the selected item or group for the next 5 months are presented in a table next to the graph.

Accuracies are also shown in a table to give the user an indication of the validity of the forecast displayed. (Comments are inserted to display acceptable ranges of these measurements) Control limits are included in the graph – 68% of the calculated “best fit” forecast of the item should be within the dark green control limits, and 95% of the calculated “best fit” forecast of the item should be within the light green control limits to render the applicable forecast a success.

Figure 5 gives an indication of what this presentation will look like.



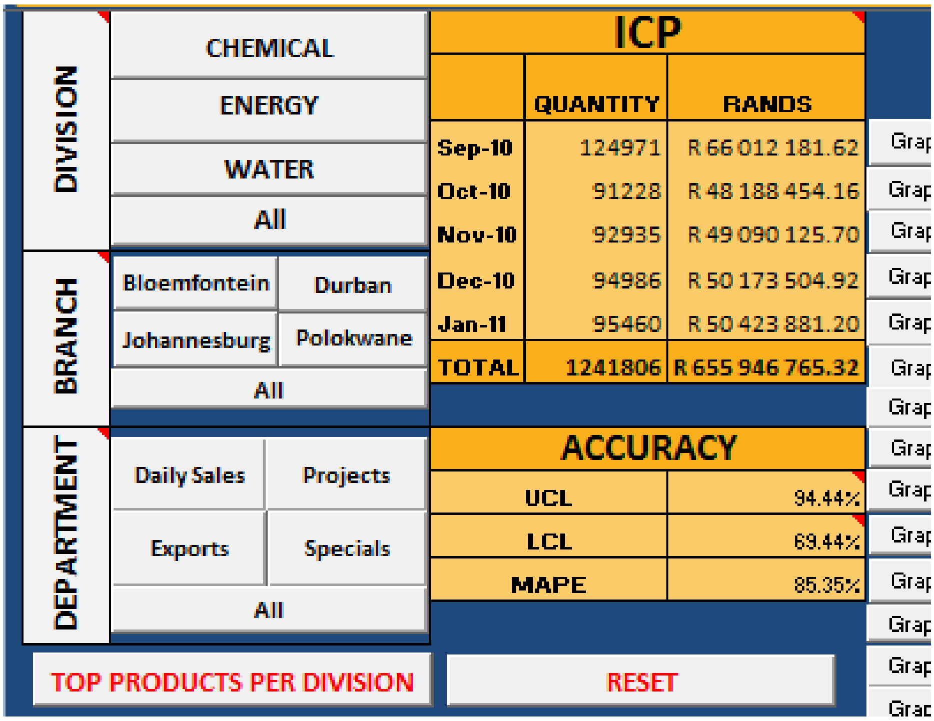


Figure 5: Snap shot of the presentation file

3.3.5 TESTING THE MODEL

To determine the accuracy and ultimately the success of the forecasting model, it has to be tested and validated against reliable data.

This process has to be conducted frequently to update the forecasting model as and when necessary, as it depends on the dynamism of the business environment. [6]

4. RESULTS

For the purpose of this document, 235 items were randomly selected and their key results obtained from the developed model are presented in Appendix A. Appendix B shows the corresponding graphs of the items. Both these sets of results show case the actual demand over a historical period of 36 months, the forecasting method chosen based on the minimum *MAPE* and an estimate of the future demand for a period of 12 months.

It is important to measure and track the performance of the forecast model. As a very general rule, a MAPE of 10% - 20% is considered good, but for some applications, 40% might be good; for others, it might be possible to obtain a MAPE of 3%. [6]

Observing the results in Appendix A renders a correlation between an item that had the *noise* separated from the *pattern* component of the historical data (row 57) and a low *MAPE* value (rows 39 – 43). The *noise* is defined as a random error term with zero mean and cannot be forecasted. This boasts true of the fact that garbage in equal garbage out. If the input data are not analysed and edited to remove once-off extreme values, the forecast generated may not give an accurate representation of the scenario as the actual data pattern is not identified. It is therefore important to try and determine what parts of the data will represent the actual *pattern* and what parts will contribute to being *noise* and then remove the *noise.*

Item 74341486, column no 10 in Appendix A is a good example of an item whose actual demand has not been analysed and edited to remove any unusual activities. Values fluctuate between 32749.92 and 0 within a matter of a few months, resulting in an inaccurate forecast with a very high *MAPE.*

Investigating into the matter why some of these items have such extreme fluctuations in their sales values, proved that zero or low stock levels was the main reason for zero or low sales and not necessarily zero demand. Using a manual forecasting method where an experienced sales person "guesses" the future demand could be a factor, amongst others, for inaccurate managing of inventory levels. This newly designed automated forecasting system, which makes use of mathematical and statistical methods to estimate a future demand, might help solve this problem.

Another important observation from the results is the type of forecasting method used when a certain data pattern exists. These data patterns can clearly be seen in Appendix B.

Holt Winter's method is chosen when a definite trend / seasonality exist. The forecast generated will also include some form of trend / seasonality. Some of the items in Appendix B that use Holt Winter's method are: (sequential numbers) 1, 2, 14, 16, 17, 27, 28, 30, 37, 50, 76 and 215. (When the Holt Winter method generates a large *MAPE*, it might be understood that the item is free from seasonality or a trend).

Holt's method is used when a definite trend exists. The forecast generated will also include some form of trend. Some of the items in Appendix B that use Holt's method are: (sequential numbers) 15, 56, 85 and 87. (When the Holt method generates a large *MAPE*, it might be understood that the item is free from a trend).

When Moving Average method is used, the forecast generated will not replicate a trend / season but will likely smooth out to a constant average of the last few actual values. Some of the items in Appendix B that use Moving Average method are: (sequential numbers) 23, 29, 32, 67.

When Weighted Moving Average method is used, the forecast generated will not replicate a trend / season but will likely smooth out to a constant average of the last few actual values. Some of the items in Appendix B that use Weighted Moving Average method are: (sequential numbers) 25, 35, 38, 104.

When Exponential Smoothing method is used the forecast generated will not replicate a trend / season but will likely smooth out to a constant average of the last few actual values. Some of the items in Appendix B that use Exponential Smoothing method are: (sequential numbers) 33, 34, 41, 42, 228, 231.

Management was involved during most of the processes, giving inputs, commentaries and feedback. Management agreed that this model will be greatly beneficial in assisting them with vital information about the items.

5. CONCLUSION

“Developing a forecasting system is not easy.” [4] However, it must be done because forecasting is fundamental to any business organisation. In the short term a forecast can assist in determining production schedules, inventory levels and materials planning amongst others. In the long term a forecast can be used on a strategic level to determine factors such as marketing strategies and developing new products or services.

A few forecasting models exist that caters for various applications. The most popular of these is Time Series Analysis. This model examines historical data over a long period of time and presumes that the future demand will follow similar data patterns.

The most prevalent data patterns observed, includes data points scattered in such a way as to signify a constant value, trend, season, seasonal trend or irregular data. A lot of forecasting methods exist that can determine the most accurate forecast per historical data pattern. The forecast methods used in this model includes Moving Average, Weighted Moving Average, Exponential Smoothing, Holt’s Method and Holt Winter’s Method.

A best-fit approach is applied to maximise the benefit gained from all these different methods and to provide the most accurate forecast. All the methods are therefore calculated for each item and the method resulting in the lowest mean absolute percentage error (MAPE) is chosen as the best method for that specific item.

Pareto Analysis is incorporated to determine the top 20% of the items that contribute to 80% of the activity. These items can be called the *fast movers* and special attention should be paid to the activities of these items. Aggregation and disaggregation settings are incorporated to forecast the remaining 80% (*slow movers*) of the items.

All this information is made visible on a graph which shows the historical data, how closely the forecast values fit the historical data and then also the forecast determined. The user can select different branches and different divisions to present a graph of the proposed forecast, either on group or item level, displaying either sales values or quantities.

It is important to note that forecasts are always wrong! "A perfect forecast is like a hole in one in golf: great to get but we should be satisfied just to get close to the hole – or, to push the analogy, just to land on the green."

The ideal philosophy is to use statistical and mathematical knowledge to create the best forecast possible and then hedge by maintaining flexibility in the system to account for the inevitable forecast error

6. APPENDICES

6.1 APPENDIX A

235 Items were randomly selected and their final results from equations (1-1) to (3-3) are displayed here to give a representation of the forecasting model.

Row 1:	*Sequential numbering of items.*
Row 2:	*Stock number of items.*
Rows 3 – 38:	*Actual demand of items over the past 36 months. (September 2007 to August 2010)*
Rows 39 – 43:	*Mean Absolute Percentage Error(s) obtained per item for each forecast method shown, where:* *MA is the Moving Average method,* *WMA is the Weighted Moving Average method,* *ExS is the Exponential Smoothing method,* *HOLT is Holt's method, and* *HW is the Holt Winter's method.*
Row 44:	*The method in rows 39 – 43 with the minimum MAPE is chosen as the method that fits the historical data the best and it is therefore assumed that*
Rows 45 – 56:	*The forecast generated by the method chosen in row 44 depicted over the next 12 months. (September 2010 to August 2011)*
Row 57:	*✓ indicates that the actual demand (rows 3 – 38) has been edited from "noise" in the data pattern.*

		1	2	3	4	5	6	7	8	9	10
ITEM		75101482	75201485	AQ0080	AQ0100	AQ0150	AQ0175	AQ0200	AQ0225	AQ0225/2	74341486
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	0	0	252	271	169	72	36	123	75	0
	Oct 2007	6576	6536	172	371	321	55	82	60	125	6695
	Nov 2007	12805.4	43844	192	322	134	35	59	59	35	1769
	Dec 2007	8109.88	2120.6	174	494	258	46	58	112	50	15596
	Jan 2008	1040	29780	270	322	358	43	96	55	50	3352.4
	Feb 2008	2974	3278	397	579	452	72	60	75	31	12055
	Mar 2008	22523	40583	250	256	433	51	125	57	44	9593
	Apr 2008	2990	1760	316	323	328	91	44	78	93	0
	May 2008	16859.5	4288.4	218	241	353	103	88	104	82	460
	Jun 2008	27126	17641	205	500	270	99	66	102	73	37329
	Jul 2008	1334	15700	247	462	335	78	43	46	43	11694
	Aug 2008	2108	19011.7	345	146	400	53	82	74	72	26228
	Sep 2008	6761.5	30927	127	201	161	40	43	70	22	32561.9
	Oct 2008	9005	16329	201	516	299	59	114	74	82	6324
	Nov 2008	41989.9	44920	180	203	242	109	64	96	57	32749.9
	Dec 2008	9384	21748	159	206	218	62	32	51	24	10793
	Jan 2009	2338	8434	226	178	188	34	58	78	55	25555.4
	Feb 2009	43463	54189	318	358	347	73	81	37	27	1972
	Mar 2009	28444	52315	245	321	261	99	82	55	62	4084
	Apr 2009	10489	6840.6	241	217	193	82	100	32	67	0
	May 2009	21333	11198.7	308	107	336	42	62	45	50	11020
	Jun 2009	27345	20706	238	526	168	90	57	80	55	45931.2
	Jul 2009	61217	67625	312	322	172	107	41	73	110	79124
	Aug 2009	95285.6	42221.9	225	295	396	115	71	106	95	84194.8
	Sep 2009	26629	18785	120	415	293	38	42	117	49	16462
	Oct 2009	26074	83985	121	277	226	44	54	118	148	56011
	Nov 2009	30092	19163	372	520	254	80	52	83	53	10833
	Dec 2009	31833	48392	305	333	248	31	133	40	16	28150
	Jan 2010	32375	9421.5	205	320	270	55	32	78	14	7801
	Feb 2010	20301	15380	350	690	179	32	125	54	71	18721
	Mar 2010	5871.7	9614	152	257	69	42	48	40	137	36002
	Apr 2010	12079	33126	190	130	133	57	63	66	34	15850
	May 2010	26724	3279.12	131	239	211	37	51	21	38	703
	Jun 2010	8801	2351	355	242	150	50	29	55	28	4109.79
	Jul 2010	19186	22580	214	152	56	60	59	40	32	13034
	Aug 2010	7736	13036.8	155	249	296	90	195	47	43	10844
MAPE (%)	**MA**	94.53%	136.78	39.69%	48.37%	43.46%	44.55%	48.39%	43.70%	90.22%	257.41
	WMA	92.48%	131.79	42.48%	48.97%	43.11%	45.48%	47.89%	48.64%	94.00%	253.35
	ExS	93.27%	150.33	38.16%	49.11%	47.98%	45.29%	45.94%	39.58%	83.82%	279.43
	HOLT	156.62	189.62	36.78%	53.77%	42.66%	45.35%	51.98%	45.64%	78.70%	297.16
	HW	171.46	118.64	26.21%	37.86%	33.65%	30.40%	35.34%	46.43%	47.05%	660.67
BEST FIT		WMA	HW	HW	HW	HW	HW	HW	EXS	HW	WMA
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	9027	13967	164	302	173	42	38	50	42	5206
	Oct 2010	13115	29769	165	399	216	43	79	50	104	8354
	Nov 2010	28385	33565	253	356	166	58	55	50	42	8376
	Dec 2010	17518	15150	216	344	181	34	69	50	25	7982
	Jan 2011	7140	13477	233	277	194	34	58	50	32	7897
	Feb 2011	12704	10221	354	552	216	40	83	50	36	8064
	Mar 2011	6870	14489	214	290	153	42	79	50	66	8028
	Apr 2011	1879	4317	246	227	137	50	65	50	50	8008
	May 2011	0	1057	217	199	190	38	62	50	43	8014
	Jun 2011	0	916	269	439	119	48	47	50	39	8020
	Jul 2011	0	0	256	318	100	47	44	50	46	8017
	Aug 2011	0	0	235	247	213	49	106	50	51	8016
***NOISE* REMOVED**				✓	✓	✓	✓	✓	✓	✓	

		11	12	13	14	15	16	17	18	19	20
ITEM		14201008	14201051	AQ0100-MIDI	AQ0150-MIDI	AQ0500	AQ0350	AQ0400	AQ0300/2	AQRH-0027-15	AQRH-0027-7.5
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	0	0	101	57	16	39	48	23	0	0
	Oct 2007	8540.52	0	38	55	31	95	55	48	0	0
	Nov 2007	11875.5	0	53	44	36	38	30	25	0	0
	Dec 2007	14341.8	0	52	29	20	4	39	9	0	0
	Jan 2008	5439.54	0	53	15	22	18	15	11	0	0
	Feb 2008	7742.4	0	31	62	18	42	24	15	0	0
	Mar 2008	20270.7	0	141	58	29	45	65	10	0	0
	Apr 2008	10948.8	0	158	126	25	28	44	20	0	0
	May 2008	11992.3	0	47	55	22	26	35	15	0	0
	Jun 2008	9643.38	0	113	75	30	24	47	10	0	0
	Jul 2008	24735.6	0	154	62	18	79	30	17	0	0
	Aug 2008	15219.4	0	120	163	8	61	29	43	0	0
	Sep 2008	3432.42	0	57	101	30	64	29	46	0	0
	Oct 2008	90546.9	0	88	103	14	38	60	43	0	0
	Nov 2008	21135	0	95	204	10	57	61	21	0	0
	Dec 2008	4201.38	0	33	54	18	48	54	10	0	0
	Jan 2009	12835.2	0	59	70	17	73	6	15	0	0
	Feb 2009	930	0	97	95	27	83	13	16	0	0
	Mar 2009	2502.3	0	95	62	13	72	43	14	0	0
	Apr 2009	12206	0	131	69	10	77	10	20	0	0
	May 2009	182544.	0	54	64	15	41	28	24	0	0
	Jun 2009	55831.7	0	95	113	18	72	33	31	0	0
	Jul 2009	9762	0	95	125	35	70	17	17	0	0
	Aug 2009	4119.6	0	141	102	33	26	30	31	21	0
	Sep 2009	19267	0	123	134	8	44	29	26	11	0
	Oct 2009	13139	0	115	63	10	35	16	20	4	0
	Nov 2009	23080	0	95	57	11	26	38	5	0	0
	Dec 2009	35930	0	95	60	18	11	9	5	0	0
	Jan 2010	70083	0	68	74	13	23	10	7	0	0
	Feb 2010	45266	0	95	188	35	28	21	8	0	1
	Mar 2010	23826	0	102	112	17	33	37	18	0	4
	Apr 2010	1243.2	0	65	61	13	4	7	9	0	0
	May 2010	15481.2	0	126	45	8	21	9	34	2	0
	Jun 2010	12331.5	340380	52	77	10	37	47	10	0	0
	Jul 2010	37818	100440	88	72	2	28	19	12	0	22
	Aug 2010	13459.2	0	55	104	8	7	16	8	0	10
MAPE (%)	**MA**	476.36	4.80%	36.87%	45.98%	75.48%	67.32%	100.64	81.16%	14.68%	13.93%
	WMA	554.21	6.92%	37.87%	53.09%	81.65%	64.99%	97.00%	92.17%	16.67%	15.34%
	ExS	364.43	4.80%	36.08%	38.60%	70.18%	82.05%	100.31	75.00%	16.67%	13.86%
	HOLT	345.13	3.39%	40.74%	49.14%	64.77%	81.08%	72.35%	71.01%	12.12%	9.45%
	HW	318.92	6.06%	56.10%	36.60%	70.17%	49.11%	43.48%	43.98%	12.12%	12.12%
BEST FIT		HW	HOLT	EXS	HW	HOLT	HW	HW	HW	HW	HOLT
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	28388	25381	75	109	13	30	25	21	1	12
	Oct 2010	24009	30046	75	77	12	23	29	9	1	12
	Nov 2010	24467	34711	75	116	12	12	20	4	1	12
	Dec 2010	34275	39376	75	54	11	13	7	5	1	12
	Jan 2011	17650	44041	75	66	11	9	12	5	1	12
	Feb 2011	0	48706	75	134	10	6	27	5	1	12
	Mar 2011	14197	53371	75	82	10	2	10	4	1	12
	Apr 2011	85743	58036	75	61	9	0	12	5	1	12
	May 2011	82816	62701	75	49	9	0	23	2	1	12
	Jun 2011	32543	67366	75	85	8	0	11	1	1	12
	Jul 2011	10036	72031	75	87	8	0	12	0	1	12
	Aug 2011	0	76696	75	94	7	0	0	0	1	12
***NOISE* REMOVED**			✓	✓	✓		✓	✓	✓	✓	✓

		21	22	23	24	25	26	27	28	29	30
ITEM		AQRH-0034-7.5	91016090-R	91016110-R	14201056	14201062	76388473	76406473	14201065	14201068	14202040
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	5	0	4	0	0	39	20	0	0	0
	Oct 2007	10	0	2	34551.9	9816.47	95	18	0	70192.6	12042
	Nov 2007	0	0	3	0	18099.2	30	19	24483.5	304205.	88621.2
	Dec 2007	0	0	12	7145.82	144923	114	0	412268.	198108.	1023
	Jan 2008	0	0	0	67972.7	92055.1	15	11	45756.2	125806.	14397
	Feb 2008	0	0	25	3455.75	9705.1	24	15	78860.8	349682.	63999
	Mar 2008	0	0	8	50904.5	237723.	71	10	77470	352226.	27098.4
	Apr 2008	0	0	0	32596	9705.1	44	20	34920	493167.	28640.6
	May 2008	0	0	18	52837.0	9705.1	29	15	55632	27206.2	117166.
	Jun 2008	0	0	4	70808.4	51240	47	10	22814	996823.	121905.
	Jul 2008	0	0	7	7139.8	9150	39	17	112670.	1655	1098
	Aug 2008	0	0	26	25604.6	0	20	43	305030.	153873.	111348
	Sep 2008	0	10	4	34475	23302	23	46	22204	161820.	193233
	Oct 2008	0	0	5	39351.1	0	66	43	145189	129025	195900
	Nov 2008	6	20	6	22631	11041	71	21	0	78988.9	34696.8
	Dec 2008	6	0	0	0	0	74	10	108624.	955687.	18608.4
	Jan 2009	3	0	3	187636	12566	6	15	178425	262330.	58392
	Feb 2009	1	0	6	39155.9	144387	13	16	33855	502694.	255750
	Mar 2009	5	0	0	96896	13420	43	14	264740	140788	240906
	Apr 2009	0	0	0	40565	0	10	12	8283	214568	0
	May 2009	15	0	10	17000.7	0	28	2	49418.4	126970.	99180
	Jun 2009	5	0	0	75243.9	41006.9	70	31	314760	140292	89400
	Jul 2009	0	0	1	7663.9	0	17	17	370902	814476	1866
	Aug 2009	0	0	15	141947	9760	30	51	252814	139506	0
	Sep 2009	25	0	3	308644	19612	29	26	86217	331838	0
	Oct 2009	16	0	12	96171	0	16	20	14640	750391	5196.6
	Nov 2009	10	0	0	446336	0	38	5	216135	152388	5077.8
	Dec 2009	0	5	0	25856	25802	9	5	152329	0	3285
	Jan 2010	2	0	0	35115	0	10	7	58824	11235	6847.8
	Feb 2010	7	0	1	52521	8235	21	8	234942	466467	16668
	Mar 2010	0	0	0	4000	22710	37	18	326923	59583	195084
	Apr 2010	18	0	6	43464	0	7	9	12810	8540	6948
	May 2010	10	0	1	617.7	0	9	44	233361.	29077.7	10218
	Jun 2010	0	4	2	8729.74	6224.48	47	0	469497	100230	5286
	Jul 2010	8	5	0	0	0	19	12	25376	508874	97788
	Aug 2010	10	0	17	0	47340.5	0	0	525722	804030	0
MAPE (%)	**MA**	57.32%	19.48%	59.76%	511.17	29.70%	117.61	109.17	306.53	272.33	407.56
	WMA	70.41%	20.08%	60.92%	585.38	25.78%	115.50	127.23	284.82	293.37	449.42
	ExS	45.11%	18.89%	67.40%	732.73	39.63%	117.83	104.06	284.88	367.97	446.59
	HOLT	42.84%	14.20%	66.09%	715.57	155.56	96.45%	101.66	288.23	1335.97	607.74
	HW	66.02%	15.15%	399.38	104.98	191.43	77.22%	72.94%	137.62	769.05	445.69
BEST FIT		HOLT	HOLT	MA	HW	WMA	HW	HW	HW	MA	MA
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	34	2	2	59824	6602	18	28	83034	586072	13508
	Oct 2010	18	2	5	87865	17466	28	12	102723	725320	17512
	Nov 2010	10	2	2	0	18435	20	4	416839	656074	4063
	Dec 2010	6	2	2	99872	18668	6	8	163525	692874	9610
	Jan 2011	4	2	1	18390	17151	8	10	180778	665085	36109
	Feb 2011	4	2	3	35781	17894	16	13	367950	684838	23365
	Mar 2011	6	2	1	27967	17880	4	11	39417	674718	246
	Apr 2011	8	2	1	8130	17818	5	15	185281	679379	0
	May 2011	22	2	2	10009	17785	11	7	447377	676005	0
	Jun 2011	6	2	1	47	17825	3	11	363626	678735	0
	Jul 2011	4	2	1	0	17817	1	12	718779	677209	0
	Aug 2011	5	2	4	0	17813	0	0	0	677832	0
***NOISE* REMOVED**			✓				✓	✓			

		31	32	33	34	35	36	37	38	39	40
ITEM		14202042	AQRH-0042-7.5	AQRH-0048-7.5	AQRH-0060-7.5	14203042	91016075-R	14203044	14203052	91116482-R	91116484-L
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	0	96	37	53	0	0	0	0	0	0
	Oct 2007	109635	0	10	10	74322.8	0	5319.48	0	0	0
	Nov 2007	125745.	280	165	152	80309.0	0	65589.9	59711.8	0	0
	Dec 2007	120458.	327	440	259	168376.	40	0	313277.	17	0
	Jan 2008	90468.0	25	30	40	44302.7	0	0	38279.3	0	0
	Feb 2008	111635.	15	40	18	63228.0	0	52303.6	52207.6	10	0
	Mar 2008	153490	2	0	12	213013.	0	76050.0	35083.5	2	0
	Apr 2008	119145	0	0	40	123306.	0	0	17524.5	1	2
	May 2008	204532.	5	9	11	14622.6	5	118849.	32541.1	2	1
	Jun 2008	168186.	20	10	12	31223.3	4	7993.09	3610.3	2	1
	Jul 2008	153788.	20	5	20	0	0	0	134627.	0	1
	Aug 2008	444970.	8	20	8	439552.	0	30853.2	57193.4	0	1
	Sep 2008	139367.	0	0	0	81443.8	0	132446.	26140.1	0	0
	Oct 2008	132994.	0	0	0	60208.6	0	43394.2	28746.5	0	0
	Nov 2008	169810.	0	10	10	149294	23	0	0	0	0
	Dec 2008	675659.	2	0	0	222485.	0	0	140720.	0	0
	Jan 2009	43687.5	10	10	10	95414.1	0	82575.3	18892.3	0	0
	Feb 2009	43494.8	0	0	20	38621.4	0	159250	88722.2	0	0
	Mar 2009	681512	0	0	0	262433	0	176188	0	0	1
	Apr 2009	182560	0	0	0	79781	0	0	168199	0	1
	May 2009	216408	0	0	0	187192.	0	155809.	256128	9	1
	Jun 2009	177357	0	0	5	0	0	0	176640	0	0
	Jul 2009	49116	0	0	0	178498	35	19596	0	0	2
	Aug 2009	92564.1	0	6	10	97246.4	0	65617.9	0	1	0
	Sep 2009	155551	0	0	0	166547	15	4712.3	152238	10	0
	Oct 2009	211904	5	5	5	45060	27	110118	27906	8	0
	Nov 2009	12080	0	0	0	287531	4	65837	27263	7	0
	Dec 2009	223820	0	0	0	135271	0	0	0	0	0
	Jan 2010	332278	0	0	0	79282	47	83503	0	0	0
	Feb 2010	358481	0	0	0	98490	0	65332	10261	0	0
	Mar 2010	260992	32	14	55	219623	0	170977	20653	0	2
	Apr 2010	240996	0	0	0	115529	14	31400	10261	0	0
	May 2010	21756	0	10	10	23847.5	0	76863.5	20652.8	0	1
	Jun 2010	2738.44	0	5	8	0	3	0	23037.9	4	1
	Jul 2010	221229	0	0	0	125000	10	59073	0	0	0
	Aug 2010	151590	0	0	0	49374	0	37490.4	0	0	0
MAPE (%)	**MA**	524.40	12.29%	19.48%	22.21%	67.78%	35.10%	93.75%	47.73%	20.74%	19.27%
	WMA	593.15	14.92%	18.83%	23.45%	53.82%	34.67%	109.02	44.79%	23.90%	21.04%
	ExS	473.75	31.68%	16.76%	14.94%	80.21%	36.07%	92.47%	72.27%	16.18%	19.37%
	HOLT	362.20	299.64	118.07	111.67	103.21	34.40%	108.49	131.57	36.36%	21.87%
	HW	247.94	940.98	70.19%	157.49	105.73	217.90	67.01%	90.56%	80.18%	23.29%
BEST FIT		HW	MA	EXS	EXS	WMA	HOLT	HW	WMA	EXS	MA
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	161193	0	3	7	39477	14	41180	15173	3	1
	Oct 2010	78304	0	3	7	55603	15	48500	8373	3	1
	Nov 2010	386450	0	3	7	56459	15	0	7901	3	1
	Dec 2010	182959	0	3	7	52097	16	68713	8707	3	1
	Jan 2011	187185	0	3	7	52845	16	285725	9045	3	1
	Feb 2011	427352	0	3	7	53619	17	228125	8648	3	1
	Mar 2011	263927	0	3	7	53367	17	9038	8704	3	1
	Apr 2011	156827	0	3	7	53211	17	178221	8756	3	1
	May 2011	108174	0	3	7	53303	18	4708	8748	3	1
	Jun 2011	265969	0	3	7	53320	18	25304	8731	3	1
	Jul 2011	312437	0	3	7	53298	19	53114	8739	3	1
	Aug 2011	0	0	3	7	53297	19	0	8740	3	1
***NOISE* REMOVED**										✓	✓

		41	42	43	44	45	46	47	48	49	50
ITEM		91116485 -R	91116486 -R	91116487 -R	92100480	92100485	92110485	AQF0200 X0200T1 600	AQF0225 X0250T1 600	AQF0250 X0250T1 600	AQF0300 /2X0300T 1600
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	4	0	0	0	0	0	0	12	0	59
	Oct 2007	0	0	0	0	0	0	0	0	4	63
	Nov 2007	2	0	0	0	0	0	0	0	3	35
	Dec 2007	1	0	0	2	0	0	0	12	0	123
	Jan 2008	2	6	0	0	0	0	0	0	0	14
	Feb 2008	1	6	1	0	0	0	0	2	0	58
	Mar 2008	3	3	1	0	0	0	0	0	0	40
	Apr 2008	0	0	0	0	1	0	0	0	1	110
	May 2008	0	1	0	0	0	0	0	2	0	150
	Jun 2008	4	0	0	0	0	6	0	0	0	150
	Jul 2008	7	1	2	0	1	0	0	0	0	162
	Aug 2008	0	1	0	0	0	0	0	0	2	100
	Sep 2008	0	0	0	0	0	0	0	2	0	150
	Oct 2008	0	2	10	0	4	0	0	6	2	100
	Nov 2008	0	0	2	0	0	0	0	0	0	100
	Dec 2008	0	0	0	0	1	0	0	4	0	150
	Jan 2009	0	8	0	0	0	0	0	14	1	78
	Feb 2009	0	0	0	4	0	0	0	0	6	102
	Mar 2009	0	0	0	0	0	0	0	0	3	22
	Apr 2009	1	0	0	6	0	0	0	0	2	160
	May 2009	0	0	1	0	0	0	0	0	2	155
	Jun 2009	0	4	0	0	0	0	0	0	0	63
	Jul 2009	0	1	1	0	1	0	0	2	0	43
	Aug 2009	0	0	0	0	0	0	0	0	0	70
	Sep 2009	10	10	10	6	5	1	0	0	2	64
	Oct 2009	0	0	0	0	2	2	14	0	0	120
	Nov 2009	1	0	1	0	0	2	0	0	2	55
	Dec 2009	1	2	0	0	0	2	0	2	0	110
	Jan 2010	1	1	0	0	0	0	0	0	0	47
	Feb 2010	0	0	0	0	0	0	0	4	1	62
	Mar 2010	0	0	0	0	13	22	7	10	2	25
	Apr 2010	0	0	0	0	0	0	13	0	6	163
	May 2010	0	0	0	0	0	0	0	1	0	157
	Jun 2010	0	2	0	0	0	0	0	2	3	64
	Jul 2010	0	0	0	0	0	0	0	0	0	150
	Aug 2010	0	3	0	0	0	0	0	0	1	40
MAPE (%)	**MA**	30.21%	31.86%	24.58%	11.81%	17.24%	15.96%	11.94%	41.88%	34.55%	73.95%
	WMA	35.00%	40.42%	21.58%	11.94%	19.52%	17.65%	12.28%	42.72%	37.22%	74.54%
	ExS	16.24%	25.98%	17.94%	11.49%	17.10%	16.42%	11.01%	30.45%	27.23%	71.87%
	HOLT	34.27%	37.23%	22.49%	10.67%	19.22%	15.74%	7.27%	35.23%	27.30%	73.79%
	HW	19.58%	41.72%	24.16%	12.12%	83.89%	18.18%	9.09%	37.11%	42.18%	46.75%
BEST FIT		EXS	EXS	EXS	HOLT	EXS	HOLT	HOLT	EXS	EXS	HW
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	2	2	1	1	3	3	4	2	2	76
	Oct 2010	2	2	1	1	3	4	4	2	2	84
	Nov 2010	2	2	1	1	3	4	5	2	2	55
	Dec 2010	2	2	1	1	3	4	5	2	2	108
	Jan 2011	2	2	1	0	3	5	5	2	2	40
	Feb 2011	2	2	1	0	3	5	6	2	2	133
	Mar 2011	2	2	1	0	3	5	6	2	2	24
	Apr 2011	2	2	1	0	3	6	6	2	2	118
	May 2011	2	2	1	0	3	6	6	2	2	122
	Jun 2011	2	2	1	0	3	6	7	2	2	70
	Jul 2011	2	2	1	0	3	7	7	2	2	91
	Aug 2011	2	2	1	0	3	7	7	2	2	52
***NOISE* REMOVED**		✓	✓	✓	✓		✓	✓			

		51	52	53	54	55	56	57	58	59	60
ITEM		AQF0300 X0300T1 000	AQF0300 X0300T1 600	AQF0300 X0300T2 500	AQF0300 X0300TD	AQF0350 X0350T1 600	AQF0400 X0400T1 000	AQF0400 X0400T1 600	AQF0400 X0400TD	AQF0450 X0450T1 600	AQF0450 X0450TD
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	37	0	0	0	4	0	14	0	3	0
	Oct 2007	33	0	8	0	0	0	20	0	5	5
	Nov 2007	17	0	10	0	8	0	47	0	2	1
	Dec 2007	1	0	1	0	15	0	58	0	14	15
	Jan 2008	18	0	129	0	60	0	0	20	0	9
	Feb 2008	20	0	60	0	27	0	6	0	14	0
	Mar 2008	150	0	30	0	17	0	4	10	4	0
	Apr 2008	150	0	80	0	50	0	14	10	18	2
	May 2008	150	0	80	0	30	0	10	10	0	0
	Jun 2008	130	0	80	0	30	0	38	10	10	4
	Jul 2008	100	0	90	0	31	0	34	10	10	5
	Aug 2008	44	0	50	0	51	0	20	10	10	5
	Sep 2008	117	0	60	0	16	0	12	10	11	5
	Oct 2008	151	0	60	0	54	0	34	20	20	18
	Nov 2008	6	0	40	0	30	0	0	20	17	10
	Dec 2008	55	0	60	0	40	0	47	20	10	10
	Jan 2009	68	0	46	0	80	0	55	20	26	4
	Feb 2009	80	0	63	0	80	30	24	10	20	5
	Mar 2009	16	0	80	0	50	0	22	10	20	4
	Apr 2009	88	0	80	0	50	0	40	20	30	2
	May 2009	90	0	80	0	50	0	50	10	30	4
	Jun 2009	90	0	70	0	29	0	45	10	20	10
	Jul 2009	32	0	58	0	59	40	30	10	20	5
	Aug 2009	18	0	62	0	40	0	40	10	20	5
	Sep 2009	68	0	83	0	41	0	40	20	24	0
	Oct 2009	49	0	55	0	40	0	40	10	25	0
	Nov 2009	20	0	30	0	34	0	50	10	5	0
	Dec 2009	130	0	30	0	37	0	50	10	5	10
	Jan 2010	100	96	28	50	50	0	50	10	5	10
	Feb 2010	80	50	40	0	50	30	40	10	5	10
	Mar 2010	80	0	50	0	50	0	40	10	10	10
	Apr 2010	45	0	50	0	70	0	50	10	10	8
	May 2010	26	0	40	0	60	0	50	10	10	10
	Jun 2010	58	0	30	0	60	0	40	10	25	6
	Jul 2010	43	0	30	0	70	50	30	0	10	10
	Aug 2010	28	0	137	0	225	0	23	0	8	0
MAPE (%)	**MA**	130.21	6.33%	35.56%	4.17%	30.74%	16.67%	29.16%	25.00%	65.13%	45.34%
	WMA	123.23	7.53%	39.55%	4.17%	31.35%	16.67%	27.23%	26.88%	72.18%	53.98%
	ExS	141.60	6.33%	31.62%	4.17%	29.60%	15.89%	29.32%	26.27%	62.39%	41.78%
	HOLT	207.76	4.55%	83.18%	3.03%	57.54%	11.44%	54.26%	34.62%	63.92%	51.48%
	HW	252.82	6.06%	65.52%	3.03%	75.76%	12.12%	62.36%	108.48	98.44%	122.63
BEST FIT		WMA	HOLT	EXS	HW	EXS	HOLT	WMA	MA	EXS	EXS
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	51	13	57	0	37	9	13	3	11	6
	Oct 2010	70	13	37	0	40	9	42	3	16	6
	Nov 2010	14	13	24	0	34	9	50	3	7	6
	Dec 2010	59	13	27	0	47	9	79	3	12	6
	Jan 2011	57	13	64	0	115	9	44	3	8	6
	Feb 2011	54	13	50	0	86	9	31	3	15	6
	Mar 2011	71	13	48	0	63	9	29	3	11	6
	Apr 2011	80	13	64	0	104	9	50	3	21	6
	May 2011	74	13	60	0	82	9	52	3	11	6
	Jun 2011	78	13	54	0	72	9	68	3	21	6
	Jul 2011	49	13	55	0	96	9	54	3	15	6
	Aug 2011	25	13	78	0	175	9	46	3	14	6
***NOISE* REMOVED**			✓	✓	✓	✓	✓	✓	✓	✓	✓

		61	62	63	64	65	66	67	68	69	70
ITEM		AQF0500X0500T10	AQF0500X0500TD	AQFR0250X0250T16-A	ELB45,CS-0100	ELB90,CS-0200	ECAPGALV-0025-BSP	PNIPPGALV-0040-BSP	RCONGALV-050040-BSP	723790108	6988/01
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	10	0	11	10	10	0	0	0	13	0
	Oct 2007	0	0	4	0	11	0	0	9	0	0
	Nov 2007	0	0	0	0	32	0	0	0	0	0
	Dec 2007	0	0	3	16	3	0	0	24	3	0
	Jan 2008	10	8	0	1	26	0	0	38	4	0
	Feb 2008	0	5	4	2	17	0	0	22	20	0
	Mar 2008	0	0	10	1	26	3	0	10	10	0
	Apr 2008	0	6	12	8	10	3	0	10	12	0
	May 2008	0	1	14	17	0	3	0	10	10	0
	Jun 2008	0	10	10	4	3	3	0	10	5	0
	Jul 2008	20	10	1	12	32	6	9	10	10	0
	Aug 2008	0	2	12	4	9	6	10	10	10	0
	Sep 2008	0	14	10	25	3	6	10	10	15	0
	Oct 2008	0	10	0	1	4	6	10	20	15	0
	Nov 2008	0	10	2	75	17	6	10	10	10	0
	Dec 2008	0	10	14	0	6	20	10	10	15	0
	Jan 2009	0	15	0	0	0	20	10	10	10	0
	Feb 2009	0	8	4	2	0	30	20	20	15	29
	Mar 2009	0	16	11	4	0	30	20	20	10	0
	Apr 2009	0	14	15	25	0	30	20	30	15	3
	May 2009	0	10	11	0	2	22	20	15	10	0
	Jun 2009	0	11	22	5	1	20	20	30	10	0
	Jul 2009	0	10	4	2	4	20	34	20	15	40
	Aug 2009	0	2	10	1	9	20	20	20	15	0
	Sep 2009	0	0	10	5	0	20	35	10	15	0
	Oct 2009	0	7	1	0	2	12	20	15	20	4
	Nov 2009	0	3	12	5	26	12	20	10	33	28
	Dec 2009	10	1	3	0	20	12	20	30	23	0
	Jan 2010	0	14	3	0	6	12	20	30	33	0
	Feb 2010	0	0	10	0	0	12	18	30	36	2
	Mar 2010	0	10	10	0	5	12	20	20	38	30
	Apr 2010	0	10	20	0	4	10	20	30	30	10
	May 2010	0	21	6	3	0	16	20	30	39	0
	Jun 2010	4	12	12	7	6	10	15	30	40	0
	Jul 2010	0	10	1	0	5	13	10	35	30	55
	Aug 2010	0	2	18	11	5	0	0	1	7	0
MAPE (%)	**MA**	8.33%	77.14%	147.02	165.24	63.32%	26.15%	22.71%	157.66	38.99%	42.81%
	WMA	8.33%	79.30%	154.02	188.40	64.52%	30.34%	25.67%	154.58	39.68%	47.22%
	ExS	7.68%	84.65%	135.86	141.38	61.16%	30.05%	27.50%	147.68	38.96%	34.71%
	HOLT	10.36%	91.67%	146.18	174.31	95.33%	47.91%	27.11%	148.07	46.45%	34.17%
	HW	12.12%	204.49	171.36	63.76%	109.29	52.44%	90.89%	185.29	79.65%	27.27%
BEST FIT		EXS	MA	EXS	HW	EXS	MA	MA	EXS	EXS	HW
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	2	3	11	2	8	0	8	4	16	15
	Oct 2010	2	6	3	0	8	0	7	20	19	15
	Nov 2010	2	4	5	0	8	0	7	8	21	15
	Dec 2010	2	4	9	0	8	0	7	31	25	15
	Jan 2011	2	13	2	0	8	0	7	40	27	15
	Feb 2011	2	7	8	0	8	0	7	35	56	15
	Mar 2011	2	9	14	0	8	0	7	24	39	15
	Apr 2011	2	14	20	0	8	0	7	33	44	15
	May 2011	2	13	15	0	8	0	7	26	41	15
	Jun 2011	2	18	20	0	8	0	7	34	35	15
	Jul 2011	2	17	3	6	8	0	7	32	44	15
	Aug 2011	2	4	22	0	8	0	7	18	35	15
***NOISE* REMOVED**		✓					✓				✓

		71	72	73	74	75	76	77	78	79	80
ITEM		7722/02	8069/04	8557/02	9104/32	9418/01	9995/01	BEND0400X45SCH160	FLA0065T1000/1600/3	FLA0700PUD25MM-SP	JIS0350X0400X0280
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	2	18	0	4	8	38	9	0	16	0
	Oct 2007	10	8	0	6	5	8	0	0	10	0
	Nov 2007	0	16	0	1	20	44	0	0	52	10
	Dec 2007	41	56	0	8	0	22	0	0	17	0
	Jan 2008	0	2	0	2	0	18	6	0	6	0
	Feb 2008	0	0	0	10	6	10	25	2	5	0
	Mar 2008	10	6	0	0	0	12	10	0	10	0
	Apr 2008	20	13	0	0	0	27	1	0	11	0
	May 2008	10	20	0	0	10	5	1	0	15	2
	Jun 2008	20	10	0	6	0	10	1	0	10	3
	Jul 2008	15	10	5	0	4	4	10	0	10	3
	Aug 2008	17	10	0	12	0	23	10	0	10	5
	Sep 2008	15	10	10	0	11	4	10	0	9	5
	Oct 2008	10	7	10	31	17	14	5	0	7	5
	Nov 2008	10	10	10	9	0	2	5	0	10	10
	Dec 2008	20	20	10	9	11	26	10	0	15	5
	Jan 2009	10	20	10	13	10	14	5	0	9	5
	Feb 2009	20	20	10	20	4	61	4	12	15	5
	Mar 2009	10	20	10	20	0	70	2	0	6	5
	Apr 2009	10	14	10	20	0	38	10	0	8	5
	May 2009	20	5	10	24	0	50	5	0	7	5
	Jun 2009	20	15	10	10	0	28	5	0	10	5
	Jul 2009	20	30	10	10	13	31	20	0	4	5
	Aug 2009	20	10	10	10	7	50	21	6	5	10
	Sep 2009	20	10	10	20	10	13	20	5	6	8
	Oct 2009	20	12	10	20	26	15	15	5	10	5
	Nov 2009	20	5	10	20	0	18	25	5	14	8
	Dec 2009	10	8	10	20	5	4	28	5	10	0
	Jan 2010	10	5	10	20	0	2	2	5	10	0
	Feb 2010	10	10	10	20	5	7	0	5	10	0
	Mar 2010	10	20	10	20	0	29	0	5	10	0
	Apr 2010	20	60	10	20	6	10	0	5	5	0
	May 2010	10	60	10	20	3	0	7	5	5	5
	Jun 2010	10	20	20	20	18	2	0	5	5	5
	Jul 2010	20	20	15	19	0	20	0	5	5	5
	Aug 2010	10	0	0	10	0	26	0	0	3	0
MAPE (%)	**MA**	35.87%	60.30%	11.63%	30.23%	38.10%	131.57	78.31%	14.17%	39.14%	23.31%
	WMA	37.73%	63.45%	13.82%	32.32%	44.61%	144.98	75.36%	16.50%	42.90%	25.35%
	ExS	35.99%	56.31%	17.86%	28.82%	33.37%	159.20	71.71%	17.29%	42.86%	18.70%
	HOLT	37.21%	88.69%	22.25%	32.46%	35.19%	136.86	99.66%	15.37%	53.73%	36.48%
	HW	115.05	153.52	110.95	174.97	146.28	94.27%	149.80	102.58	59.52%	151.21
BEST FIT		MA	EXS	MA	EXS	EXS	HW	EXS	MA	MA	EXS
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	8	6	9	22	6	3	0	5	6	0
	Oct 2010	14	11	9	22	6	0	7	5	7	0
	Nov 2010	10	14	9	22	6	0	11	5	16	0
	Dec 2010	27	39	9	22	6	0	14	5	10	0
	Jan 2011	7	12	9	22	6	0	6	5	6	0
	Feb 2011	10	13	9	22	6	0	14	5	7	0
	Mar 2011	11	20	9	22	6	0	6	5	6	0
	Apr 2011	19	35	9	22	6	0	4	5	5	0
	May 2011	15	35	9	22	6	0	5	5	5	0
	Jun 2011	19	20	9	22	6	0	3	5	5	0
	Jul 2011	20	27	9	22	6	0	12	5	3	0
	Aug 2011	18	10	9	22	6	0	13	5	3	0
***NOISE* REMOVED**										✓	

		81	82	83	84	85	86	87	88	89	90
ITEM		M010/05 A	M063/01	M272/08 A	POLYFO AMFLOA T	R2153/03	R5625-07	REDCC0 080X005 0SCH160	REDEC0 100X004 0SCH160	SKIROPE 07	STAND0 01
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	23	0	19	18	0	0	0	0	0	0
	Oct 2007	22	0	7	6	4	0	0	0	0	0
	Nov 2007	1	0	5	16	0	8	0	0	0	0
	Dec 2007	14	0	1	0	0	0	0	0	0	0
	Jan 2008	0	10	6	34	0	0	0	0	0	0
	Feb 2008	0	0	14	8	0	0	0	0	0	0
	Mar 2008	0	0	0	10	0	2	0	0	0	0
	Apr 2008	8	0	0	0	0	2	0	0	0	0
	May 2008	0	0	0	0	0	10	0	0	0	0
	Jun 2008	4	0	0	0	0	0	0	0	0	0
	Jul 2008	1	0	2	0	0	3	0	0	0	0
	Aug 2008	4	5	4	0	0	2	0	0	0	0
	Sep 2008	2	5	2	1	0	0	0	6	0	0
	Oct 2008	0	5	9	1	0	0	1	0	0	0
	Nov 2008	3	5	15	0	0	0	0	0	2	0
	Dec 2008	2	5	7	2	0	0	0	5	0	0
	Jan 2009	5	5	10	7	2	1	0	0	0	0
	Feb 2009	2	0	14	0	0	0	0	0	0	0
	Mar 2009	2	0	13	8	0	0	0	0	0	0
	Apr 2009	2	0	20	10	0	0	6	0	0	0
	May 2009	0	0	20	0	0	0	0	0	0	0
	Jun 2009	6	0	14	0	0	2	2	0	0	0
	Jul 2009	2	0	20	8	0	4	0	0	0	0
	Aug 2009	9	0	20	0	2	0	2	0	2	10
	Sep 2009	10	0	17	0	5	5	2	0	2	0
	Oct 2009	10	0	6	1	0	2	0	0	6	0
	Nov 2009	10	0	28	0	0	1	0	0	0	0
	Dec 2009	15	5	7	0	0	0	0	4	0	0
	Jan 2010	15	0	8	6	0	0	1	0	0	0
	Feb 2010	15	0	0	2	14	0	0	2	0	0
	Mar 2010	15	0	0	2	0	0	0	0	0	0
	Apr 2010	11	0	7	0	0	0	0	4	0	2
	May 2010	10	0	4	0	0	0	0	0	0	0
	Jun 2010	10	0	8	0	2	0	0	0	0	6
	Jul 2010	15	0	12	0	2	0	0	0	0	0
	Aug 2010	3	0	11	0	0	0	0	0	0	0
MAPE (%)	**MA**	42.68%	10.42%	43.59%	29.88%	22.50%	23.75%	13.54%	15.94%	14.93%	12.15%
	WMA	43.18%	12.50%	45.88%	34.49%	27.75%	23.83%	15.00%	15.58%	15.83%	12.22%
	ExS	48.28%	12.66%	44.81%	36.21%	17.09%	15.80%	15.21%	17.54%	14.82%	11.41%
	HOLT	58.01%	13.12%	87.84%	39.15%	13.12%	22.22%	7.10%	13.01%	10.64%	8.13%
	HW	314.59	69.61%	730.90	59.55%	16.04%	67.88%	18.18%	15.15%	12.12%	9.09%
BEST FIT		MA	MA	MA	MA	HOLT	EXS	HOLT	HOLT	HOLT	HOLT
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	10	1	9	0	3	0	1	1	1	2
	Oct 2010	10	1	10	0	3	0	1	1	1	2
	Nov 2010	10	1	11	0	3	0	1	1	1	2
	Dec 2010	8	1	11	0	3	0	1	1	1	2
	Jan 2011	9	1	10	0	4	0	0	1	1	2
	Feb 2011	9	1	11	0	4	0	0	1	1	2
	Mar 2011	9	1	11	0	4	0	0	1	1	2
	Apr 2011	9	1	10	0	4	0	0	1	1	2
	May 2011	9	1	10	0	4	0	0	1	1	2
	Jun 2011	9	1	11	0	4	0	0	1	1	2
	Jul 2011	9	1	11	0	5	0	0	2	1	2
	Aug 2011	9	1	10	0	5	0	0	2	1	2
***NOISE* REMOVED**		✓				✓	✓	✓	✓	✓	✓

		91	92	93	94	95	96	97	98	99	100
ITEM		X0020/03	X0135/01	X0197/05	Z104/13	Z508/03	REPAIRC OUPCIF0 75	PUMP00 3H	REPAIRC OUPCIF0 63	JJ0040C OUPLIN G	MALEEL BOWCO PP015X1 /2
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	0	0	0	106	286	69	188	3	7	39
	Oct 2007	0	0	0	237	108	36	129	2	3	8
	Nov 2007	0	0	0	107	87	37	139	0	17	19
	Dec 2007	0	0	0	153	211	4	52	0	2	2
	Jan 2008	0	0	0	14	125	142	226	0	20	25
	Feb 2008	0	0	0	96	73	14	141	0	2	36
	Mar 2008	0	0	0	256	252	54	217	2	0	42
	Apr 2008	0	0	0	29	58	2	173	0	10	31
	May 2008	0	0	0	81	113	15	118	2	23	28
	Jun 2008	0	0	0	63	50	5	117	2	42	23
	Jul 2008	0	0	0	43	113	46	102	0	2	33
	Aug 2008	0	0	0	32	115	16	46	0	1	10
	Sep 2008	0	0	0	175	40	21	214	0	14	26
	Oct 2008	0	0	0	85	78	35	46	8	9	6
	Nov 2008	0	0	0	70	125	51	75	8	15	37
	Dec 2008	0	0	0	45	96	14	62	0	3	31
	Jan 2009	0	0	0	38	70	-2	84	4	4	12
	Feb 2009	0	0	0	109	100	5	88	8	7	12
	Mar 2009	0	0	0	95	76	26	50	0	5	7
	Apr 2009	0	60	0	85	65	18	67	1	44	28
	May 2009	100	0	0	140	60	11	56	0	7	26
	Jun 2009	0	0	0	223	150	232	259	0	4	20
	Jul 2009	0	0	0	92	150	47	82	4	34	34
	Aug 2009	0	60	0	15	50	38	64	0	6	21
	Sep 2009	0	0	0	89	45	6	79	0	1	28
	Oct 2009	0	0	0	42	66	21	70	4	14	20
	Nov 2009	0	0	0	10	55	23	68	0	6	7
	Dec 2009	0	0	0	57	67	4	60	6	2	35
	Jan 2010	10	0	0	18	29	3	49	0	0	0
	Feb 2010	0	0	0	1	12	0	5	0	1	22
	Mar 2010	0	0	0	85	48	17	35	18	3	17
	Apr 2010	17	0	0	16	33	14	17	0	21	14
	May 2010	0	0	0	30	36	15	51	0	8	15
	Jun 2010	8	0	0	7	32	4	116	7	7	14
	Jul 2010	0	0	0	9	65	21	39	7	7	20
	Aug 2010	0	0	0	8	12	18	0	0	42	44
MAPE (%)	**MA**	13.84%	7.29%	0.00%	262.92	63.97%	87.15%	94.15%	33.18%	153.56	62.60%
	WMA	14.16%	6.67%	0.00%	279.94	64.61%	99.51%	99.10%	31.66%	158.21	66.92%
	ExS	12.10%	7.89%	0.00%	349.87	72.83%	98.53%	107.01	36.50%	166.08	57.55%
	HOLT	10.41%	5.45%	0.00%	261.20	62.41%	324.37	86.44%	39.63%	266.77	93.00%
	HW	12.12%	6.06%	0.00%	154.19	69.62%	448.64	71.66%	32.69%	271.80	101.67
BEST FIT		HOLT	HOLT	HW	HW	HOLT	MA	HW	WMA	MA	EXS
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	5	5	0	30	48	15	62	4	16	20
	Oct 2010	4	4	0	0	44	15	35	4	18	20
	Nov 2010	3	3	0	0	39	17	20	4	21	20
	Dec 2010	2	1	0	0	34	16	18	4	25	20
	Jan 2011	1	0	0	0	29	16	5	4	20	20
	Feb 2011	0	0	0	0	24	16	2	4	21	20
	Mar 2011	0	0	0	0	19	17	0	4	22	20
	Apr 2011	0	0	0	0	14	16	0	4	22	20
	May 2011	0	0	0	0	9	16	0	4	21	20
	Jun 2011	0	0	0	0	4	16	0	4	22	20
	Jul 2011	0	0	0	0	0	16	0	4	22	20
	Aug 2011	0	0	0	0	0	16	0	4	22	20
***NOISE* REMOVED**		✓	✓						✓		

		101	102	103	104	105	106	107	108	109	110
ITEM		TEEEQUALCOPPER015MM	ELBOWCOPPER015X90	FEMADAPTCOPP015X1/2	CLAMPHOSE65MM	SOC0025GALV	DRIPLINESAD/COMB	MALEADAPTCOPP015X1/2	JIS0040X025CON	JIS0080X90BENDS/R	RED0160X0110SOLV
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	48	37	0	8	5	27	0	0	0	0
	Oct 2007	21	82	10	21	0	13	0	0	0	0
	Nov 2007	47	21	25	25	0	43	0	7	0	0
	Dec 2007	8	6	0	7	0	11	0	0	0	1
	Jan 2008	34	69	2	9	0	54	0	0	0	0
	Feb 2008	55	3	0	55	0	26	0	0	0	0
	Mar 2008	23	37	9	7	10	77	0	0	0	0
	Apr 2008	25	48	12	15	6	16	2	30	0	0
	May 2008	19	59	45	5	7	39	3	0	0	0
	Jun 2008	5	25	10	17	0	18	14	0	0	4
	Jul 2008	20	25	20	24	0	60	0	1	0	0
	Aug 2008	23	9	3	0	0	11	0	0	0	0
	Sep 2008	19	10	5	5	2	63	0	3	0	0
	Oct 2008	31	44	22	18	0	24	0	1	0	0
	Nov 2008	32	53	22	19	4	119	5	0	0	0
	Dec 2008	24	27	1	-5	21	22	0	0	0	0
	Jan 2009	8	13	0	13	0	5	0	0	0	0
	Feb 2009	35	38	18	18	3	28	3	0	0	0
	Mar 2009	8	11	10	6	0	10	1	0	0	0
	Apr 2009	42	2	0	16	6	28	2	0	0	0
	May 2009	39	0	16	14	0	22	4	0	0	0
	Jun 2009	19	24	24	14	11	13	2	0	0	0
	Jul 2009	26	12	3	39	0	36	14	10	20	20
	Aug 2009	4	20	13	5	0	32	0	0	0	0
	Sep 2009	36	15	2	26	3	13	2	0	0	6
	Oct 2009	26	33	17	19	8	25	0	0	0	2
	Nov 2009	17	30	5	3	6	28	3	0	0	0
	Dec 2009	19	31	8	15	5	17	1	0	2	0
	Jan 2010	42	16	0	22	0	10	0	1	0	0
	Feb 2010	2	21	2	1	0	10	0	0	0	0
	Mar 2010	35	20	12	19	0	27	4	1	0	50
	Apr 2010	13	27	10	4	0	18	0	0	0	50
	May 2010	25	33	6	6	0	8	0	0	4	0
	Jun 2010	5	4	0	27	6	0	0	0	0	0
	Jul 2010	9	9	3	14	6	3	0	0	0	0
	Aug 2010	24	21	18	0	2	19	1	0	0	3
MAPE (%)	**MA**	139.07	116.05	141.62	127.26	30.81%	119.53	35.96%	15.28%	12.50%	34.72%
	WMA	134.62	122.37	136.31	125.67	33.31%	129.17	38.99%	17.22%	12.50%	46.67%
	ExS	136.53	119.14	143.17	126.35	27.38%	109.42	31.65%	15.29%	8.65%	26.72%
	HOLT	130.88	164.00	151.10	148.31	27.65%	106.93	35.21%	40.02%	7.88%	34.90%
	HW	203.35	236.91	143.53	144.29	59.29%	99.24%	76.31%	19.11%	9.09%	20.00%
BEST FIT		HOLT	MA	WMA	WMA	EXS	HW	EXS	MA	HOLT	HW
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	22	17	5	14	4	14	0	0	2	3
	Oct 2010	22	13	8	11	4	22	0	0	2	0
	Nov 2010	21	15	9	10	4	7	0	0	2	0
	Dec 2010	20	17	9	10	4	4	0	0	2	0
	Jan 2011	20	16	9	11	4	4	0	0	2	0
	Feb 2011	19	15	9	11	4	2	0	0	2	27
	Mar 2011	19	16	9	11	4	0	0	0	1	19
	Apr 2011	18	16	9	11	4	0	0	0	1	0
	May 2011	17	16	9	11	4	0	0	0	1	53
	Jun 2011	17	16	9	11	4	0	0	0	1	67
	Jul 2011	16	16	9	11	4	0	0	0	1	3
	Aug 2011	16	16	9	11	4	0	0	0	1	0
***NOISE* REMOVED**										✓	✓

		111	112	113	114	115	116	117	118	119	120
ITEM		COUPLIN GELECT 0250	AQRC1-0062-15	AQRC1-0186-20	AQRH-0114-15	AQRS1-0193-20X50	SOC0025 SS	AQRC1-0233-30	161482629	198150090	VALVE0050BALLS/S
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	0	0	2	0	0	9	0	0	0	0
	Oct 2007	0	0	0	0	0	32	0	0	0	0
	Nov 2007	0	1	0	0	0	7	1	13	6	0
	Dec 2007	0	0	3	0	3	11	0	0	10	1
	Jan 2008	0	0	0	0	0	6	0	14	0	0
	Feb 2008	0	2	0	0	0	10	1	0	0	10
	Mar 2008	0	0	0	0	0	9	1	21	40	0
	Apr 2008	0	0	0	0	0	1	0	0	0	0
	May 2008	2	11	0	29	0	12	0	19	36	0
	Jun 2008	8	0	11	0	10	20	0	40	57	0
	Jul 2008	0	0	1	1	0	25	3	0	0	0
	Aug 2008	0	0	0	0	0	82	1	58	30	0
	Sep 2008	0	0	0	0	0	9	0	250	200	0
	Oct 2008	0	0	-1	0	1	30	0	0	0	0
	Nov 2008	0	0	0	0	0	17	0	0	0	0
	Dec 2008	0	0	0	0	0	18	0	3	0	0
	Jan 2009	0	0	0	0	0	2	0	10	0	0
	Feb 2009	0	0	0	2	0	0	0	17	0	0
	Mar 2009	0	0	0	0	0	19	0	30	5	0
	Apr 2009	0	0	1	0	3	12	0	12	3	0
	May 2009	0	1	15	0	9	14	2	36	13	0
	Jun 2009	0	2	0	0	0	12	3	18	14	0
	Jul 2009	20	0	9	6	6	27	2	0	8	0
	Aug 2009	0	7	0	0	0	8	0	42	0	0
	Sep 2009	0	2	10	0	0	11	0	20	0	0
	Oct 2009	0	6	1	2	0	4	3	8	5	0
	Nov 2009	14	4	1	1	0	26	0	0	0	1
	Dec 2009	0	4	2	0	10	0	0	0	30	0
	Jan 2010	0	7	5	0	0	0	0	0	5	3
	Feb 2010	0	4	3	0	0	0	0	0	0	0
	Mar 2010	3	9	63	2	0	0	0	0	0	0
	Apr 2010	10	10	13	0	2	4	0	0	10	0
	May 2010	0	16	11	0	1	0	0	0	7	0
	Jun 2010	8	1	2	0	1	0	0	0	0	0
	Jul 2010	0	0	0	0	0	0	2	0	0	0
	Aug 2010	9	11	19	6	0	0	0	0	10	20
MAPE (%)	**MA**	15.95%	62.88%	87.15%	21.35%	24.65%	85.48%	15.80%	149.30	29.03%	12.15%
	WMA	17.84%	55.89%	78.91%	22.92%	36.74%	81.63%	16.60%	192.63	30.97%	12.22%
	ExS	17.18%	59.90%	75.43%	16.71%	19.70%	83.09%	16.03%	95.91%	44.68%	12.16%
	HOLT	14.36%	54.18%	105.85	39.09%	22.16%	110.65	19.08%	124.92	57.59%	19.44%
	HW	38.27%	447.78	577.93	21.82%	30.95%	161.52	123.56	112.37	52.24%	15.15%
BEST FIT		HOLT	HOLT	EXS	EXS	EXS	WMA	MA	EXS	MA	MA
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	5	8	17	2	1	0	1	0	5	5
	Oct 2010	5	8	17	2	1	0	1	0	4	7
	Nov 2010	6	9	17	2	1	0	1	0	5	8
	Dec 2010	6	10	17	2	1	0	1	0	6	10
	Jan 2011	6	10	17	2	1	0	1	0	5	8
	Feb 2011	6	11	17	2	1	0	1	0	5	8
	Mar 2011	6	12	17	2	1	0	1	0	5	9
	Apr 2011	7	12	17	2	1	0	1	0	5	9
	May 2011	7	13	17	2	1	0	1	0	5	8
	Jun 2011	7	14	17	2	1	0	1	0	5	8
	Jul 2011	7	14	17	2	1	0	1	0	5	9
	Aug 2011	8	15	17	2	1	0	1	0	5	9
***NOISE* REMOVED**		✓			✓	✓		✓		✓	✓

		121	122	123	124	125	126	127	128	129	130
ITEM		STUB-PE100-0280-011	TEQCST L-0050	TEQSS3 16-0010-COMP	TREDPE 10-0450X03 15-F	UNIONG ALV-0015-BSP	UNIONS S316-010-COMP	LP-PTFEEQ T80	RECCCS TL-0200X01 00	RECGVU -040C032 P16	RECPE1 00-315-280
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	0	0	0	0	0	0	0	0	0	0
	Oct 2007	0	0	1	0	0	0	4	1	0	6
	Nov 2007	0	0	0	0	0	0	1	0	2	10
	Dec 2007	0	0	12	0	5	0	0	0	0	1
	Jan 2008	0	0	2	10	2	0	0	1	2	0
	Feb 2008	0	0	2	10	2	0	10	3	0	0
	Mar 2008	10	2	0	0	0	3	15	0	0	6
	Apr 2008	40	0	11	0	5	0	0	13	0	0
	May 2008	0	0	0	0	4	2	4	2	0	0
	Jun 2008	0	1	0	8	9	0	17	1	0	2
	Jul 2008	0	0	0	0	0	0	4	0	0	1
	Aug 2008	50	1	0	3	0	0	0	0	0	0
	Sep 2008	0	0	0	4	0	0	1	2	0	0
	Oct 2008	0	0	6	8	0	4	5	1	0	2
	Nov 2008	0	0	10	0	0	0	0	1	3	0
	Dec 2008	0	0	16	1	0	0	3	0	7	0
	Jan 2009	0	0	0	0	0	0	18	0	2	0
	Feb 2009	0	6	0	1	0	0	0	0	0	0
	Mar 2009	2	3	0	1	0	1	0	0	0	0
	Apr 2009	0	0	0	0	0	0	0	0	18	0
	May 2009	0	0	0	0	0	0	0	5	1	0
	Jun 2009	10	0	13	1	0	0	8	0	0	0
	Jul 2009	0	32	0	1	0	0	17	5	10	2
	Aug 2009	0	0	7	4	4	0	6	0	4	0
	Sep 2009	0	7	3	1	1	0	4	0	1	0
	Oct 2009	0	7	0	0	1	0	0	0	14	0
	Nov 2009	0	0	0	0	1	1	0	0	1	0
	Dec 2009	0	8	0	0	0	1	1	7	1	0
	Jan 2010	2	25	0	0	0	0	0	0	0	7
	Feb 2010	2	7	13	3	9	0	0	0	0	5
	Mar 2010	0	3	18	13	3	0	15	0	0	4
	Apr 2010	3	3	0	3	1	2	0	1	0	2
	May 2010	4	0	0	0	0	0	0	0	0	1
	Jun 2010	0	0	0	0	0	0	4	0	10	0
	Jul 2010	0	1	0	1	1	0	3	0	2	2
	Aug 2010	9	2	5	1	3	1	3	0	7	0
MAPE (%)	**MA**	23.89%	44.58%	31.76%	54.14%	23.73%	21.35%	54.72%	19.27%	99.62%	33.96%
	WMA	24.23%	45.63%	32.88%	68.20%	25.51%	20.42%	71.00%	24.79%	85.79%	37.85%
	ExS	19.50%	47.75%	26.25%	44.42%	20.23%	19.96%	46.20%	16.94%	100.83	24.23%
	HOLT	24.39%	51.65%	29.83%	57.77%	33.38%	19.11%	61.36%	42.69%	93.81%	41.65%
	HW	41.26%	57.95%	62.69%	52.75%	117.87	21.16%	45.10%	35.81%	2006.46	108.92
BEST FIT		EXS	MA	EXS	EXS	EXS	HOLT	HW	EXS	WMA	EXS
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	3	1	3	2	3	1	1	0	5	3
	Oct 2010	3	1	3	2	3	1	1	0	6	3
	Nov 2010	3	2	3	2	3	1	1	0	5	3
	Dec 2010	3	2	3	2	3	1	1	0	6	3
	Jan 2011	3	2	3	2	3	1	1	0	5	3
	Feb 2011	3	2	3	2	3	1	0	0	5	3
	Mar 2011	3	2	3	2	3	1	0	0	5	3
	Apr 2011	3	2	3	2	3	1	0	0	5	3
	May 2011	3	2	3	2	3	1	4	0	5	3
	Jun 2011	3	2	3	2	3	1	2	0	5	3
	Jul 2011	3	2	3	2	3	1	0	0	5	3
	Aug 2011	3	2	3	2	3	1	0	0	5	3
***NOISE* REMOVED**		✓	✓	✓	✓	✓	✓		✓		

		131	132	133	134	135	136	137	138	139	140
ITEM		REDCPP-0315-0200-F	SADD-505-0020-0500	SN-110000998	SOCKGALV-0015-BSP	SPACER, 0150PTFE0032	167369012	167369104	167546406	548-PSV-552	BERMAD 080PRVF
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	0	11	3	0	1	0	0	0	5	0
	Oct 2007	30	4	2	1	2	0	0	0	7	2
	Nov 2007	0	1	0	3	0	0	0	0	9	0
	Dec 2007	0	3	0	0	0	0	0	0	0	0
	Jan 2008	4	8	2	17	0	0	0	0	5	0
	Feb 2008	7	3	2	0	1	0	0	0	0	15
	Mar 2008	9	0	0	4	0	0	0	0	4	48
	Apr 2008	5	4	2	4	0	2	0	0	14	72
	May 2008	2	1	7	1	2	6	0	0	2	0
	Jun 2008	3	5	0	0	0	0	2	0	14	0
	Jul 2008	0	0	10	5	0	0	0	0	27	6
	Aug 2008	0	0	0	0	0	0	0	0	5	3
	Sep 2008	0	0	0	0	0	0	0	0	14	0
	Oct 2008	0	0	0	0	0	0	1	1	5	15
	Nov 2008	0	0	0	0	0	0	0	0	3	6
	Dec 2008	7	0	2	0	0	0	0	0	6	0
	Jan 2009	4	0	3	0	0	0	0	0	14	0
	Feb 2009	0	0	1	0	2	0	1	1	2	1
	Mar 2009	2	0	3	1	0	0	0	1	3	2
	Apr 2009	22	5	1	3	4	2	5	1	16	1
	May 2009	5	8	0	2	2	0	0	0	8	12
	Jun 2009	23	2	2	1	0	0	1	0	13	1
	Jul 2009	16	3	14	9	3	10	1	0	16	0
	Aug 2009	15	2	5	0	1	5	5	5	6	0
	Sep 2009	24	7	4	0	0	0	0	0	24	2
	Oct 2009	7	3	0	3	0	5	3	0	11	13
	Nov 2009	7	4	7	1	4	0	5	0	10	2
	Dec 2009	17	4	1	0	0	6	0	0	9	0
	Jan 2010	2	0	1	0	0	0	0	0	4	3
	Feb 2010	1	0	2	2	0	2	0	0	12	0
	Mar 2010	1	2	3	4	0	0	3	0	92	1
	Apr 2010	0	0	0	0	0	0	3	0	28	0
	May 2010	0	1	0	7	3	0	0	0	14	0
	Jun 2010	4	0	1	0	0	0	0	4	4	0
	Jul 2010	3	0	2	3	3	0	0	0	49	5
	Aug 2010	28	0	6	2	1	5	3	4	40	0
MAPE (%)	**MA**	121.00	21.51%	52.40%	34.67%	28.65%	18.99%	28.75%	23.75%	116.40	56.04%
	WMA	132.93	21.86%	54.97%	36.04%	29.13%	20.33%	25.53%	24.67%	121.33	65.40%
	ExS	124.55	18.66%	54.41%	29.13%	25.67%	19.12%	26.87%	24.11%	78.91%	76.44%
	HOLT	162.30	35.83%	57.06%	48.85%	23.10%	19.51%	20.97%	18.37%	114.21	79.39%
	HW	217.61	91.29%	129.52	90.50%	73.95%	23.86%	42.62%	21.21%	99.67%	49.72%
BEST FIT		MA	EXS	MA	EXS	HOLT	MA	HOLT	HOLT	EXS	HW
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	9	1	3	2	2	2	2	1	27	1
	Oct 2010	11	1	3	2	2	2	2	1	27	2
	Nov 2010	13	1	4	2	1	2	2	1	27	0
	Dec 2010	16	1	4	2	1	3	2	1	27	1
	Jan 2011	12	1	3	2	1	2	2	1	27	1
	Feb 2011	13	1	4	2	1	2	2	1	27	1
	Mar 2011	14	1	4	2	1	3	2	1	27	1
	Apr 2011	14	1	4	2	1	3	2	1	27	1
	May 2011	13	1	4	2	1	2	2	1	27	1
	Jun 2011	13	1	4	2	1	2	2	1	27	1
	Jul 2011	13	1	4	2	1	3	2	1	27	0
	Aug 2011	13	1	4	2	1	3	2	1	27	0
***NOISE* REMOVED**						✓	✓	✓	✓		

		141	142	143	144	145	146	147	148	149	150
ITEM		STRAINGALV-0050-BSP	VALF-VKDIM-0032-E	VALVESPINDLE01.2	WATERMETER0050	AQER0766ID	AQER0940ID	BENDST0600X45DEG	CLEAT-PLATE0100-M12	COUPLINGCOMP020STRT	ENDCAP0200SCH40
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	0	0	3	20	5	1	0	3	7	3
	Oct 2007	0	0	0	4	1	0	2	0	7	0
	Nov 2007	12	0	0	0	13	0	0	6	0	2
	Dec 2007	4	0	0	2	0	0	0	0	6	0
	Jan 2008	0	2	2	0	2	0	0	0	2	0
	Feb 2008	4	0	0	0	6	0	0	0	4	0
	Mar 2008	0	0	3	1	4	1	0	4	6	0
	Apr 2008	18	3	8	2	-1	0	0	0	34	0
	May 2008	0	0	5	1	1	0	0	2	11	0
	Jun 2008	23	0	15	0	0	0	0	0	33	0
	Jul 2008	0	16	9	0	1	0	0	1	7	0
	Aug 2008	0	3	4	0	3	0	0	10	5	2
	Sep 2008	2	0	10	1	4	2	0	5	34	0
	Oct 2008	2	1	8	0	12	0	0	1	13	0
	Nov 2008	10	0	1	1	1	0	0	7	10	35
	Dec 2008	0	0	4	0	6	1	0	5	16	0
	Jan 2009	0	0	3	0	1	0	0	0	20	0
	Feb 2009	0	0	1	0	0	0	0	12	5	29
	Mar 2009	0	0	5	2	0	1	0	3	9	0
	Apr 2009	0	0	1	12	3	0	0	1	3	0
	May 2009	0	0	0	7	2	0	0	0	1	3
	Jun 2009	0	0	0	1	0	0	2	0	2	0
	Jul 2009	6	0	0	0	4	0	0	0	42	12
	Aug 2009	0	0	0	7	1	0	0	3	6	0
	Sep 2009	0	0	38	2	3	0	1	4	1	0
	Oct 2009	1	0	9	6	4	0	0	0	5	2
	Nov 2009	0	0	2	0	1	0	0	0	0	0
	Dec 2009	0	0	0	6	2	0	0	0	20	4
	Jan 2010	0	0	0	3	6	0	0	2	6	0
	Feb 2010	0	0	0	6	0	0	0	0	0	0
	Mar 2010	10	0	5	0	1	0	0	1	24	2
	Apr 2010	2	0	1	0	3	0	0	1	4	0
	May 2010	0	0	5	0	3	0	0	0	2	0
	Jun 2010	0	0	1	0	0	0	0	2	1	0
	Jul 2010	0	5	7	4	0	0	0	2	8	0
	Aug 2010	0	7	4	5	0	0	0	6	2	0
MAPE (%)	**MA**	31.88%	23.21%	102.06	52.27%	77.43%	9.38%	6.25%	61.01%	193.29	24.64%
	WMA	43.29%	26.37%	101.05	45.02%	69.38%	8.75%	5.83%	55.43%	193.08	27.38%
	ExS	24.26%	16.08%	112.32	43.86%	67.93%	9.89%	7.15%	52.36%	214.40	20.47%
	HOLT	34.10%	24.12%	135.29	69.68%	72.35%	10.01%	4.61%	61.47%	165.40	25.90%
	HW	46.65%	20.83%	118.50	40.87%	175.30	12.12%	6.06%	112.27	231.80	22.87%
BEST FIT		EXS	EXS	WMA	HW	EXS	WMA	HOLT	EXS	HOLT	EXS
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	1	3	5	0	2	0	1	2	6	0
	Oct 2010	1	3	5	1	2	0	1	2	6	0
	Nov 2010	1	3	5	11	2	0	1	2	5	0
	Dec 2010	1	3	5	2	2	0	1	2	5	0
	Jan 2011	1	3	5	3	2	0	1	2	4	0
	Feb 2011	1	3	5	9	2	0	1	2	4	0
	Mar 2011	1	3	5	24	2	0	1	2	4	0
	Apr 2011	1	3	5	10	2	0	1	2	3	0
	May 2011	1	3	5	1	2	0	1	2	3	0
	Jun 2011	1	3	5	4	2	0	0	2	2	0
	Jul 2011	1	3	5	10	2	0	0	2	2	0
	Aug 2011	1	3	5	0	2	0	0	2	2	0
***NOISE* REMOVED**		✓	✓				✓	✓			✓

		151	152	153	154	155	156	157	158	159	160
ITEM		FLA0050 T1000/16 00/8	G0150T2 5/40	G0250T1 6JMP	GS0080T 1000/160 0/3	PVCFCR OSS075X 050CL16	ELBOW0 020MFG ALV	REDSOC 025X020	COUPLIN GCOMP0 32STRT	MC&F08 10X1000I DFG	R986/18
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	42	12	0	1	4	0	1	6	0	2
	Oct 2007	3	20	0	2	3	1	0	4	0	0
	Nov 2007	14	31	3	0	34	0	0	2	3	1
	Dec 2007	0	10	0	0	2	2	0	2	0	0
	Jan 2008	3	2	2	0	0	0	0	0	0	4
	Feb 2008	0	2	0	0	0	0	0	0	0	8
	Mar 2008	0	2	2	0	0	0	0	0	0	0
	Apr 2008	2	3	0	0	0	0	0	1	0	0
	May 2008	1	6	1	0	0	0	0	0	0	1
	Jun 2008	1	27	0	0	0	0	0	0	0	6
	Jul 2008	0	9	2	0	0	2	0	0	0	0
	Aug 2008	0	20	7	0	0	1	0	0	0	2
	Sep 2008	0	22	0	0	0	0	0	0	0	1
	Oct 2008	0	0	5	4	0	0	0	0	0	0
	Nov 2008	0	32	2	3	0	0	5	0	0	1
	Dec 2008	0	3	0	3	1	0	12	0	0	0
	Jan 2009	0	21	9	0	0	0	1	0	3	0
	Feb 2009	0	0	0	0	0	0	0	0	0	0
	Mar 2009	2	8	2	3	2	0	1	0	0	4
	Apr 2009	12	36	3	18	0	0	0	0	0	7
	May 2009	0	0	0	1	1	0	0	0	0	0
	Jun 2009	1	3	0	9	0	0	0	0	0	2
	Jul 2009	0	3	0	5	2	2	0	6	0	0
	Aug 2009	7	0	1	0	0	0	0	3	6	0
	Sep 2009	2	0	0	1	6	2	0	1	1	1
	Oct 2009	12	1	0	4	0	0	0	0	1	0
	Nov 2009	0	13	1	2	0	0	3	0	2	0
	Dec 2009	2	8	3	13	0	11	0	4	0	4
	Jan 2010	4	0	1	1	0	1	0	0	0	0
	Feb 2010	0	1	0	2	8	20	0	0	0	0
	Mar 2010	1	1	0	0	0	0	0	5	0	1
	Apr 2010	2	0	2	6	0	0	0	3	0	2
	May 2010	0	3	0	2	0	0	6	0	0	0
	Jun 2010	1	0	0	1	0	0	0	1	1	9
	Jul 2010	6	4	6	6	1	0	0	1	0	24
	Aug 2010	3	3	6	0	0	0	0	0	0	19
MAPE (%)	**MA**	39.04%	110.34	27.00%	86.25%	24.48%	24.19%	44.36%	28.33%	17.71%	32.56%
	WMA	40.36%	127.68	27.38%	68.87%	24.24%	18.88%	41.49%	29.52%	15.63%	33.32%
	ExS	40.87%	105.14	25.24%	98.81%	19.74%	23.74%	33.80%	22.78%	17.03%	29.66%
	HOLT	82.81%	139.96	33.19%	86.99%	29.52%	25.83%	30.77%	25.92%	13.64%	43.44%
	HW	100.06	87.03%	269.08	70.94%	33.69%	33.57%	14.58%	262.12	63.49%	82.45%
BEST FIT		MA	HW	EXS	WMA	EXS	WMA	HW	EXS	HOLT	EXS
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	3	2	3	3	2	0	1	1	1	12
	Oct 2010	4	52	3	3	2	0	3	1	1	12
	Nov 2010	4	4	3	3	2	0	1	1	1	12
	Dec 2010	4	1	3	2	2	0	1	1	1	12
	Jan 2011	4	1	3	3	2	0	0	1	1	12
	Feb 2011	4	1	3	3	2	0	1	1	1	12
	Mar 2011	4	2	3	3	2	0	0	1	1	12
	Apr 2011	4	2	3	3	2	0	1	1	1	12
	May 2011	4	1	3	3	2	0	0	1	1	12
	Jun 2011	4	2	3	3	2	0	0	1	1	12
	Jul 2011	4	2	3	3	2	0	0	1	1	12
	Aug 2011	4	0	3	3	2	0	0	1	1	12
***NOISE* REMOVED**				✓		✓	✓	✓		✓	✓

		161	162	163	164	165	166	167	168	169	170
ITEM		REDCC0080X0050SCH123	REPAIRCOUPCIF090	PUMP005H	REPAIRCOUPCIF022	PVDF-CUB-0160-160	PVDF-MAF-0032-200	PVDF-MRF-0025-0020-2	PVDF-RLB-0225-0160	PVDF-TIF-0050-200	PPFW-BOM-0025
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	5	24	31	6	3	0	0	0	2	2
	Oct 2007	0	16	10	0	2	0	0	0	5	17
	Nov 2007	2	19	17	12	4	0	0	0	8	10
	Dec 2007	31	26	20	14	0	0	0	0	0	41
	Jan 2008	4	3	10	11	15	0	0	0	0	0
	Feb 2008	12	12	7	2	8	0	0	0	5	2
	Mar 2008	16	0	10	16	6	0	0	0	10	25
	Apr 2008	7	1	42	2	0	0	0	0	0	6
	May 2008	9	12	123	22	4	0	0	0	2	19
	Jun 2008	28	17	3	11	2	0	0	0	3	1
	Jul 2008	2	27	1	87	16	0	0	0	2	10
	Aug 2008	7	17	44	31	4	0	0	0	8	40
	Sep 2008	11	12	10	6	10	0	0	0	14	25
	Oct 2008	2	13	10	5	11	0	0	0	2	4
	Nov 2008	36	11	14	13	9	0	0	0	0	23
	Dec 2008	25	0	10	11	4	0	0	0	2	15
	Jan 2009	34	4	0	14	2	0	0	0	0	18
	Feb 2009	2	0	22	1	3	0	0	0	7	5
	Mar 2009	16	17	26	1	2	0	0	0	4	15
	Apr 2009	8	22	19	3	10	0	0	0	2	1
	May 2009	2	4	49	1	4	0	0	0	0	21
	Jun 2009	10	10	13	1	9	0	0	0	0	12
	Jul 2009	4	2	52	2	0	0	0	0	18	5
	Aug 2009	9	11	15	9	2	0	0	0	4	15
	Sep 2009	10	30	4	5	3	0	0	0	1	4
	Oct 2009	20	13	16	15	10	0	0	0	0	14
	Nov 2009	8	11	10	0	0	0	0	0	0	7
	Dec 2009	0	13	2	15	6	14	23	4	0	10
	Jan 2010	4	31	2	2	18	2	9	41	5	6
	Feb 2010	1	4	0	10	0	3	25	31	0	7
	Mar 2010	0	4	0	3	33	4	0	29	0	1
	Apr 2010	0	20	0	5	3	0	0	7	0	15
	May 2010	0	6	0	0	24	0	0	0	0	4
	Jun 2010	6	2	0	2	2	0	0	0	6	14
	Jul 2010	16	36	0	25	8	0	0	0	0	6
	Aug 2010	48	50	0	0	5	1	21	12	8	2
MAPE (%)	**MA**	169.38	108.49	108.38	196.92	108.30	13.63%	12.67%	27.34%	64.40%	158.54
	WMA	190.77	106.96	120.88	214.71	112.14	10.52%	14.69%	26.89%	57.89%	157.57
	ExS	149.74	106.73	122.36	245.78	98.89%	8.62%	12.38%	21.87%	57.22%	168.86
	HOLT	168.86	148.69	255.20	222.98	103.41	9.73%	8.31%	17.44%	56.78%	198.55
	HW	147.00	183.18	230.31	122.86	189.70	15.15%	12.12%	18.18%	105.21	326.73
BEST FIT		HW	EXS	MA	HW	EXS	EXS	HOLT	HOLT	HOLT	WMA
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	15	29	0	7	13	3	7	13	2	8
	Oct 2010	12	29	0	7	13	3	8	14	2	7
	Nov 2010	12	29	0	17	13	3	9	16	2	6
	Dec 2010	11	29	0	11	13	3	10	17	1	6
	Jan 2011	5	29	0	6	13	3	10	18	1	6
	Feb 2011	6	29	0	6	13	3	11	19	1	6
	Mar 2011	3	29	0	6	13	3	12	21	1	6
	Apr 2011	2	29	0	3	13	3	12	22	1	6
	May 2011	0	29	0	6	13	3	13	23	1	6
	Jun 2011	13	29	0	35	13	3	14	25	0	6
	Jul 2011	29	29	0	8	13	3	14	26	0	6
	Aug 2011	0	29	0	0	13	3	15	27	0	6
***NOISE* REMOVED**							✓	✓			

		171	172	173	174	175	176	177	178	179	180
ITEM		2N100FN 4312PV	2N100M N4312PV	2N100P4 3PV	2N300P4 3PV	65416002	72110010 8	72130011 0	73579010 9	75301873 9	75391161 1
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	0	1	0	0	8	7	0	30	0	20
	Oct 2007	1	10	0	1	6	3	1	0	0	30
	Nov 2007	0	0	1	0	0	9	2	1	0	20
	Dec 2007	1	3	2	1	0	10	2	0	0	7
	Jan 2008	0	2	0	0	0	0	0	0	0	57
	Feb 2008	0	0	0	0	0	0	2	3	0	12
	Mar 2008	5	8	0	14	0	3	0	0	0	6
	Apr 2008	4	0	0	3	0	6	0	0	0	8
	May 2008	3	7	0	0	0	18	0	2	0	5
	Jun 2008	6	10	0	2	2	0	2	1	0	11
	Jul 2008	0	0	0	2	0	2	5	0	0	4
	Aug 2008	5	12	0	2	2	1	0	18	0	0
	Sep 2008	3	8	0	0	10	4	5	10	0	7
	Oct 2008	83	2	0	8	3	9	3	0	0	6
	Nov 2008	2	32	0	13	0	13	5	0	0	19
	Dec 2008	0	3	0	3	0	0	0	15	0	11
	Jan 2009	0	11	0	6	5	2	4	23	0	12
	Feb 2009	4	0	0	0	3	5	6	50	0	9
	Mar 2009	0	0	0	0	3	1	2	12	0	1
	Apr 2009	0	1	0	0	2	1	0	1	0	17
	May 2009	0	0	0	0	0	0	0	0	2	0
	Jun 2009	0	14	0	4	0	4	0	15	0	2
	Jul 2009	0	0	0	0	4	1	0	0	0	0
	Aug 2009	0	0	0	0	0	19	0	2	0	0
	Sep 2009	0	12	4	5	0	7	0	14	0	3
	Oct 2009	7	5	2	0	5	0	0	0	0	0
	Nov 2009	0	0	0	9	1	10	7	0	0	17
	Dec 2009	2	25	0	0	16	6	10	2	0	4
	Jan 2010	0	8	2	2	2	6	3	0	0	4
	Feb 2010	3	0	0	0	1	9	3	1	1	12
	Mar 2010	0	0	0	0	0	85	2	0	3	11
	Apr 2010	2	3	2	0	0	1	0	0	3	5
	May 2010	1	0	4	2	6	4	0	0	0	0
	Jun 2010	2	6	0	8	0	7	0	0	0	0
	Jul 2010	0	25	4	16	0	3	0	0	2	2
	Aug 2010	3	17	0	4	0	1	0	0	0	13
MAPE (%)	**MA**	77.69%	70.26%	16.15%	37.77%	57.20%	236.39	30.61%	127.61	15.97%	92.03%
	WMA	63.29%	76.24%	16.67%	33.56%	49.64%	209.73	30.17%	125.05	16.04%	101.01
	ExS	67.27%	67.19%	17.93%	32.26%	48.15%	244.12	26.29%	119.04	17.16%	80.79%
	HOLT	76.71%	73.44%	13.78%	41.28%	45.35%	244.13	25.22%	132.73	11.78%	98.53%
	HW	34.43%	134.10	21.21%	240.44	92.70%	2567.01	61.96%	56.84%	15.15%	92.42%
BEST FIT		HW	EXS	HOLT	EXS	HOLT	WMA	HOLT	HW	HOLT	EXS
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	1	14	2	7	3	5	2	0	1	8
	Oct 2010	1	14	2	7	3	4	2	0	1	8
	Nov 2010	2	14	2	7	3	4	2	0	1	8
	Dec 2010	0	14	2	7	3	4	2	0	2	8
	Jan 2011	0	14	3	7	3	4	2	0	2	8
	Feb 2011	1	14	3	7	3	4	2	0	2	8
	Mar 2011	2	14	3	7	3	4	2	0	2	8
	Apr 2011	1	14	3	7	3	4	2	0	2	8
	May 2011	2	14	3	7	3	4	2	0	2	8
	Jun 2011	0	14	3	7	3	4	2	0	2	8
	Jul 2011	14	14	3	7	3	4	2	0	2	8
	Aug 2011	0	14	4	7	3	4	2	0	2	8
***NOISE* REMOVED**				✓						✓	

		181	182	183	184	185	186	187	188	189	190
ITEM		ADFPP-0020-1/4IN	ADMPVCU-0032-1.0	ADMSS316-010-1/2NPT	BND90PE100-0400,17-F	BNIPP,CS-0015	COMP-510-0063	FRDCSTL0400X0300-ASA	LP-PTFE90ELB25	LP-PTFEEQT25	LP-PTFEFLNG50-64MM
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	4	0	0	0	0	0	0	0	0	87
	Oct 2007	10	0	1	2	0	0	0	0	0	128
	Nov 2007	22	5	0	0	0	0	0	0	0	151
	Dec 2007	1	0	11	0	0	0	0	0	0	4
	Jan 2008	42	2	4	0	0	0	0	0	0	11
	Feb 2008	8	3	3	0	0	0	8	0	0	21
	Mar 2008	4	0	0	0	0	0	0	0	0	217
	Apr 2008	0	0	0	0	0	0	0	0	0	45
	May 2008	4	0	2	0	0	0	0	21	2970	60
	Jun 2008	0	0	2	0	0	0	0	17.5	0	29
	Jul 2008	0	4	1	0	0	0	4	28	276	433
	Aug 2008	0	2	0	0	0	0	0	49	0	40
	Sep 2008	5	0	2	0	0	0	0	44	0	5
	Oct 2008	0	2	0	0	0	0	0	56	0	23
	Nov 2008	0	0	1	2	0	0	22	49	0	211
	Dec 2008	2	2	0	0	0	0	10	24.5	0	12
	Jan 2009	0	0	0	0	0	0	7	0	0	25
	Feb 2009	2	2	2	0	0	0	3	10.5	0	6
	Mar 2009	13	6	0	2	0	4	10	31	0	152
	Apr 2009	6	6	4	0	0	0	6	64	0	79
	May 2009	0	0	0	0	0	0	44	77	0	92
	Jun 2009	10	6	10	0	0	0	5	45.5	0	43
	Jul 2009	6	0	4	0	2	1	27	77	0	74
	Aug 2009	8	2	0	1	2	0	15	73.5	0	69
	Sep 2009	6	0	0	3	0	0	3	70	0	119
	Oct 2009	2	0	0	0	0	0	12	42	0	289
	Nov 2009	4	0	0	0	5	0	3	0	0	104
	Dec 2009	4	0	1	0	0	0	1	0	0	274
	Jan 2010	0	0	0	0	2	0	0	0	0	227
	Feb 2010	2	0	0	0	0	0	0	0	0	144
	Mar 2010	13	2	1	4	4	0	0	0	0	497
	Apr 2010	4	0	0	2	0	0	0	0	1272	55
	May 2010	2	0	0	0	4	0	2	0	96	30
	Jun 2010	6	6	0	0	10	4	3	0	0	55
	Jul 2010	3	0	0	1	2	0	11	0	0	106
	Aug 2010	2	0	3	0	3	0	0	0	0	19
MAPE (%)	**MA**	50.89%	22.92%	25.42%	23.61%	27.07%	8.33%	117.54	27.74%	13.80%	292.73
	WMA	54.37%	23.47%	25.58%	27.36%	24.14%	10.83%	129.86	33.27%	5.52%	280.10
	ExS	45.10%	22.44%	18.46%	21.23%	26.73%	10.71%	105.13	25.54%	13.85%	298.75
	HOLT	101.98	22.87%	34.43%	13.84%	19.41%	6.66%	121.13	36.39%	19.07%	365.27
	HW	146.28	34.27%	36.92%	20.71%	27.27%	9.09%	714.70	63.74%	12.12%	218.18
BEST FIT		EXS	EXS	EXS	HOLT	HOLT	HOLT	EXS	EXS	WMA	HW
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	3	0	0	1	3	1	0	0	39	87
	Oct 2010	3	0	0	1	3	1	0	0	16	285
	Nov 2010	3	0	0	1	4	1	0	0	18	83
	Dec 2010	3	0	0	2	4	1	0	0	20	117
	Jan 2011	3	0	0	2	4	1	0	0	20	98
	Feb 2011	3	0	0	2	4	1	0	0	19	841
	Mar 2011	3	0	0	2	5	1	0	0	20	172
	Apr 2011	3	0	0	2	5	1	0	0	20	356
	May 2011	3	0	0	2	5	1	0	0	20	363
	Jun 2011	3	0	0	2	6	0	0	0	20	1144
	Jul 2011	3	0	0	2	6	0	0	0	20	427
	Aug 2011	3	0	0	2	6	0	0	0	20	0
***NOISE* REMOVED**			✓	✓	✓	✓	✓		✓	✓	

		191	192	193	194	195	196	197	198	199	200
ITEM		LP-PU10ELB125	LP-PU5ELB125	LP-PUEQT125	LP-PUPIPE125-4.00M	LP-PUPIPE125-6.00M	PEBW-CUB-0280-100	PEBW-FFPB30-0315-17	PEBW-FFR-0355-031511	PEBW-FFS-0110-017-10	PEBW-GOL-0090-100
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	6	0	125	0	0	125	30	30	30	40
	Oct 2007	0	8	119	0	0	119	32	32	32	47
	Nov 2007	6	15	112	0	0	112	30	30	30	50
	Dec 2007	0	60	96	0	0	96	39	39	39	49
	Jan 2008	0	27	224	0	0	224	33	33	33	56
	Feb 2008	0	17	172	0	0	172	34	34	34	53
	Mar 2008	10	50	252	0	0	252	34	34	34	55
	Apr 2008	1	30	141	0	0	141	38	38	38	63
	May 2008	0	30	18	0	0	18	36	36	36	68
	Jun 2008	1	31	43	0	0	43	39	39	39	65
	Jul 2008	40	51	203	0	0	203	30	30	30	72
	Aug 2008	4	16	231	0	0	231	36	36	36	69
	Sep 2008	1	54	142	0	0	142	30	30	30	79
	Oct 2008	2	30	58	0	0	58	32	32	32	82
	Nov 2008	5	40	210	0	0	210	30	30	30	80
	Dec 2008	22	80	180	0	0	180	39	39	39	85
	Jan 2009	6	80	157	0	0	157	33	33	33	94
	Feb 2009	0	50	110	0	0	110	34	34	34	89
	Mar 2009	10	50	101	0	0	101	34	34	34	96
	Apr 2009	32	50	176	0	0	176	38	38	38	100
	May 2009	9	29	69	0	0	69	36	36	36	100
	Jun 2009	0	59	286	0	0	286	39	39	39	105
	Jul 2009	8	40	171	0	0	171	30	30	30	108
	Aug 2009	0	41	65	0	0	65	36	36	36	110
	Sep 2009	6	40	117	0	0	117	38	38	38	112
	Oct 2009	3	34	232	0	0	232	30	30	30	115
	Nov 2009	19	37	181	0	0	181	35	35	35	113
	Dec 2009	1	50	96	0	55	172	30	30	50	118
	Jan 2010	0	50	81	0	4	161	34	34	34	124
	Feb 2010	0	50	70	0	0	180	40	40	40	123
	Mar 2010	0	70	151	0	0	159	36	36	36	128
	Apr 2010	3	60	119	0	0	121	40	40	40	130
	May 2010	2	60	78	0	0	83	36	36	68	131
	Jun 2010	1	70	100	2	0	102	40	40	40	134
	Jul 2010	0	225	291	5	0	300	34	34	34	136
	Aug 2010	15	32	134	0	0	139	36	36	36	140
MAPE (%)	**MA**	121.65	35.00%	48.75%	7.92%	14.32%	42.48%	8.44%	8.44%	12.74%	6.75%
	WMA	107.29	33.16%	47.97%	8.17%	5.73%	43.32%	8.99%	8.99%	12.75%	8.06%
	ExS	115.60	33.58%	48.15%	7.92%	14.32%	41.67%	8.31%	8.31%	12.37%	10.70%
	HOLT	116.72	46.53%	78.89%	5.75%	10.83%	75.83%	9.11%	9.11%	12.53%	2.72%
	HW	154.62	61.49%	78.98%	6.06%	6.06%	73.53%	6.68%	6.68%	10.29%	17.85%
BEST FIT		WMA	WMA	WMA	HOLT	WMA	EXS	HW	HW	HW	HOLT
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	3	94	133	1	0	177	35	35	38	129
	Oct 2010	6	99	162	1	0	177	34	34	37	132
	Nov 2010	7	97	161	1	0	177	37	37	50	134
	Dec 2010	7	91	153	1	0	177	37	37	39	137
	Jan 2011	6	95	155	1	0	177	39	39	44	139
	Feb 2011	6	94	156	1	0	177	37	37	43	142
	Mar 2011	6	94	156	1	0	177	42	42	49	144
	Apr 2011	6	94	156	1	0	177	39	39	59	147
	May 2011	6	94	156	1	0	177	43	43	47	149
	Jun 2011	6	94	156	1	0	177	35	35	40	151
	Jul 2011	6	94	156	1	0	177	39	39	47	154
	Aug 2011	6	94	156	2	0	177	41	43	42	156
***NOISE* REMOVED**			✓	✓	✓	✓		✓	✓	✓	✓

		201	202	203	204	205	206	207	208	209	210
ITEM		PEBW-QRB1-0090-100	PEBW-QRL-0025-16	PEBW-RCE-0160-0140-6	PEBW-REE1-0180-0160	PEBW-RLC-0075-0032-1	PEBW-RLE1-0355-0250-	PEBW-RSC-0090-007511	PEBW-TIB-0063-100	PEBW-TRB-0250-0160	PEFW-CAM-0050
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	638	0	8	5	4	0	0	2	2	0
	Oct 2007	280	0	9	0	0	0	0	2	0	0
	Nov 2007	379	0	6	0	0	0	3	3	2	0
	Dec 2007	285	2	2	2	0	0	0	0	0	0
	Jan 2008	395	0	0	4	9	0	0	4	0	0
	Feb 2008	570	0	0	0	0	0	0	0	0	0
	Mar 2008	413	0	16	9	0	0	0	10	0	0
	Apr 2008	374	0	0	0	0	0	0	1	0	0
	May 2008	331	0	2	0	0	0	0	7	0	0
	Jun 2008	255	2	6	1	0	0	0	0	0	0
	Jul 2008	360	0	6	5	0	0	0	18	0	0
	Aug 2008	460	0	0	0	0	0	1	3	0	0
	Sep 2008	167	4	3	16	2	0	0	1	7	0
	Oct 2008	279	2	3	7	0	0	0	0	0	0
	Nov 2008	305	15	28	3	0	1	6	1	1	0
	Dec 2008	255	9	10	0	0	0	0	0	5	0
	Jan 2009	296	7	10	0	2	0	4	3	0	0
	Feb 2009	418	20	12	0	0	0	0	0	6	0
	Mar 2009	321	2	2	0	0	0	6	0	0	2
	Apr 2009	306	12	1	6	0	0	0	6	1	0
	May 2009	368	26	9	4	2	0	5	10	4	0
	Jun 2009	388	14	2	19	12	0	0	0	0	0
	Jul 2009	462	7	1	2	0	0	12	3	0	0
	Aug 2009	275	0	0	0	0	5	6	2	0	14
	Sep 2009	165	0	0	1	0	0	0	30	0	0
	Oct 2009	187	5	0	1	14	10	2	6	0	0
	Nov 2009	427	0	4	8	0	0	3	0	6	2
	Dec 2009	372	1	0	22	2	0	4	0	0	0
	Jan 2010	234	0	10	15	0	10	8	0	0	0
	Feb 2010	411	2	2	9	3	0	2	2	0	0
	Mar 2010	200	16	0	0	10	0	2	2	0	0
	Apr 2010	172	2	0	0	0	0	9	13	8	0
	May 2010	167	2	1	6	0	0	6	6	21	2
	Jun 2010	387	2	0	2	0	0	11	2	4	0
	Jul 2010	279	2	0	2	0	3	14	1	2	0
	Aug 2010	109	6	11	0	0	0	3	0	0	0
MAPE (%)	**MA**	41.16%	78.48%	108.30	86.26%	25.84%	19.27%	54.20%	103.60	51.06%	15.63%
	WMA	41.55%	76.57%	123.51	103.28	25.63%	19.17%	54.77%	115.75	45.86%	17.08%
	ExS	41.03%	84.82%	102.60	73.25%	25.13%	18.39%	48.88%	79.70%	41.95%	11.52%
	HOLT	36.94%	68.61%	116.19	72.52%	24.58%	12.58%	42.63%	87.66%	34.71%	10.47%
	HW	35.80%	239.37	186.04	120.81	21.75%	15.15%	217.12	585.12	26.29%	12.12%
BEST FIT		HW	HOLT	EXS	HOLT	HW	HOLT	HOLT	EXS	HW	HOLT
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	177	3	4	0	0	1	6	6	0	0
	Oct 2010	281	4	2	4	5	1	6	6	0	0
	Nov 2010	206	4	5	5	0	2	6	6	11	0
	Dec 2010	176	4	2	10	1	1	6	6	4	0
	Jan 2011	278	4	4	10	9	1	6	6	0	0
	Feb 2011	168	4	2	4	2	1	6	6	5	0
	Mar 2011	151	4	3	9	4	1	6	6	0	0
	Apr 2011	149	4	1	3	0	1	6	6	5	0
	May 2011	177	4	2	5	2	1	6	6	13	0
	Jun 2011	145	4	1	12	8	1	6	6	2	0
	Jul 2011	83	4	1	8	0	1	6	6	1	0
	Aug 2011	101	4	2	5	3	2	6	6	1	0
***NOISE* REMOVED**		✓				✓	✓			✓	✓

		211	212	213	214	215	216	217	218	219	220
ITEM		PEFW-GYM-0025	PPBW-CUB-0040-100	PPBW-TIB-0063-060	PPBW-TIL-0063-100	PPBW-TRB-0090-0032	PPBW-TRB-0110-0050-1	PPFW-BOM-002589	PPFW-CAM-0020	PPFW-MAM-0075	PPFW-TIM-0063
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	0	0	10	0	0	0	13	0	0	0
	Oct 2007	0	0	0	0	0	0	43	1	0	0
	Nov 2007	0	0	0	0	0	0	27	0	2	0
	Dec 2007	0	1	2	0	0	0	54	0	0	0
	Jan 2008	0	0	0	0	0	0	42	2	0	0
	Feb 2008	0	0	0	0	0	0	77	0	0	0
	Mar 2008	0	2	0	0	0	0	21	0	0	0
	Apr 2008	0	10	0	0	0	0	39	11	0	2
	May 2008	0	0	0	0	0	0	18	0	11	0
	Jun 2008	0	0	0	0	0	0	60	0	1	7
	Jul 2008	0	2	0	0	1	0	11	0	0	0
	Aug 2008	0	1	0	0	0	0	63	0	0	0
	Sep 2008	0	2	1	0	0	0	24	0	1	5
	Oct 2008	0	2	0	2	2	3	119	0	0	0
	Nov 2008	0	0	1	6	6	2	22	0	0	0
	Dec 2008	0	2	0	0	0	0	5	0	0	0
	Jan 2009	0	0	0	0	0	0	28	0	0	2
	Feb 2009	0	8	0	0	0	0	10	0	0	0
	Mar 2009	0	0	0	0	0	0	28	0	1	0
	Apr 2009	0	14	0	0	0	0	22	1	15	0
	May 2009	0	0	0	0	0	0	13	2	0	0
	Jun 2009	0	0	0	0	0	0	25	0	9	6
	Jul 2009	0	0	0	0	0	0	30	7	0	0
	Aug 2009	0	0	0	0	1	0	13	0	10	0
	Sep 2009	10	3	0	5	5	2	25	6	1	1
	Oct 2009	0	2	0	0	0	0	28	4	1	1
	Nov 2009	0	2	5	0	0	0	17	4	0	0
	Dec 2009	0	8	0	2	0	1	13	7	0	0
	Jan 2010	0	4	0	0	4	2	10	4	3	0
	Feb 2010	0	0	0	0	0	0	27	9	22	2
	Mar 2010	4	0	0	0	0	0	18	5	6	0
	Apr 2010	3	4	0	0	0	0	8	16	11	0
	May 2010	1	6	5	2	0	4	0	1	2	0
	Jun 2010	0	2	0	0	0	2	3	1	0	1
	Jul 2010	0	0	0	6	0	6	3	0	0	0
	Aug 2010	0	0	0	0	0	0	19	11	0	6
MAPE (%)	**MA**	14.24%	29.51%	15.63%	21.70%	18.28%	24.48%	121.73	85.74%	79.43%	23.37%
	WMA	12.36%	32.53%	15.83%	21.46%	17.63%	25.97%	135.73	81.68%	86.37%	24.36%
	ExS	13.35%	23.18%	13.82%	21.85%	18.29%	25.24%	115.17	77.55%	63.43%	19.37%
	HOLT	9.91%	31.41%	15.74%	16.27%	16.42%	18.62%	109.87	77.58%	69.71%	19.80%
	HW	12.12%	48.71%	15.15%	18.18%	15.20%	24.24%	89.24%	492.48	128.07	30.23%
BEST FIT		HOLT	EXS	EXS	HOLT	HW	HOLT	HW	EXS	EXS	EXS
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	1	1	1	2	0	2	0	9	3	2
	Oct 2010	1	2	1	2	1	2	77	9	3	2
	Nov 2010	1	1	1	3	3	2	43	9	3	2
	Dec 2010	1	5	1	2	0	2	31	9	3	2
	Jan 2011	1	2	1	3	2	2	44	9	3	2
	Feb 2011	1	4	1	3	0	2	46	9	3	2
	Mar 2011	1	2	1	3	0	2	33	9	3	2
	Apr 2011	1	16	1	2	0	2	21	9	3	2
	May 2011	1	3	1	3	0	2	4	9	3	2
	Jun 2011	1	1	1	3	0	3	22	9	3	2
	Jul 2011	1	2	1	3	5	3	20	9	3	2
	Aug 2011	1	1	1	2	1	3	28	9	3	2
***NOISE* REMOVED**		✓	✓	✓	✓	✓	✓				✓

		221	222	223	224	225	226	227	228	229	230
ITEM		PVCF-AF3-0025-0500	PVCF-CA1-0032	PVCF-FL1-0200	PVCF-GY1-0040	PVCF-MA2-0375	PVCF-PO1-0050	PVCF-QR1-0160	PVCF-RC1-0040-0025	PVCF-TI1-0032	PVCF-TI3-0050-1500
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	32	5	0	4	1	7	0	16	0	2
	Oct 2007	7	7	0	0	13	0	0	19	12	4
	Nov 2007	11	3	0	2	0	6	0	26	14	0
	Dec 2007	6	0	2	0	2	2	0	3	11	15
	Jan 2008	10	5	0	0	4	4	0	12	2	8
	Feb 2008	9	0	2	1	4	6	0	0	0	6
	Mar 2008	1	0	8	2	0	34	0	1	0	0
	Apr 2008	12	4	5	1	0	11	0	12	22	0
	May 2008	20	2	15	0	0	31	0	15	5	2
	Jun 2008	25	12	7	0	1	7	0	27	25	16
	Jul 2008	35	9	4	0	3	5	0	17	7	4
	Aug 2008	9	5	10	1	4	33	0	12	6	6
	Sep 2008	30	12	7	0	11	13	2	13	5	11
	Oct 2008	17	5	1	1	1	10	3	11	13	9
	Nov 2008	18	3	4	0	6	16	3	0	11	4
	Dec 2008	12	4	3	0	0	20	0	4	14	2
	Jan 2009	8	14	0	0	0	5	0	0	0	3
	Feb 2009	19	0	2	2	0	9	3	15	1	2
	Mar 2009	12	3	0	12	3	3	18	22	3	10
	Apr 2009	14	16	0	7	2	1	1	1	1	4
	May 2009	5	8	0	1	0	2	9	10	1	9
	Jun 2009	22	13	0	0	3	13	5	2	2	0
	Jul 2009	8	15	0	7	1	6	0	11	9	2
	Aug 2009	11	6	2	2	2	1	1	30	5	3
	Sep 2009	4	22	9	6	4	5	4	10	15	8
	Oct 2009	26	10	2	0	0	0	2	11	0	0
	Nov 2009	0	6	0	6	0	20	11	12	15	6
	Dec 2009	0	3	0	3	4	1	1	2	2	11
	Jan 2010	0	4	0	6	0	0	2	3	10	0
	Feb 2010	0	12	5	0	1	24	0	4	3	29
	Mar 2010	4	24	1	0	1	4	6	18	5	3
	Apr 2010	0	6	5	0	3	2	2	6	0	24
	May 2010	0	14	1	0	0	1	0	2	2	2
	Jun 2010	0	9	2	0	0	4	4	0	1	8
	Jul 2010	0	15	7	4	0	8	6	14	9	8
	Aug 2010	0	20	4	5	0	2	0	8	0	5
MAPE (%)	**MA**	40.72%	71.59%	61.06%	49.14%	40.56%	175.62	80.07%	141.42	112.09	99.00%
	WMA	40.05%	74.22%	63.09%	42.52%	34.61%	172.51	64.63%	138.44	132.16	102.19
	ExS	39.24%	63.02%	61.77%	44.79%	39.01%	199.33	88.92%	137.53	127.19	89.05%
	HOLT	67.49%	66.22%	84.58%	50.75%	33.76%	148.66	82.91%	149.42	122.60	91.09%
	HW	124.04	313.72	112.60	57.15%	83.41%	4738.87	54.55%	254.15	141.53	233.26
BEST FIT		EXS	HOLT	MA	WMA	HOLT	HOLT	HW	EXS	MA	EXS
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	0	16	4	3	1	4	4	19	8	12
	Oct 2010	0	16	5	3	1	5	8	19	9	12
	Nov 2010	0	16	5	3	1	5	1	19	9	12
	Dec 2010	0	16	5	3	1	4	1	19	8	12
	Jan 2011	0	16	5	3	1	4	1	19	8	12
	Feb 2011	0	16	5	3	1	5	8	19	8	12
	Mar 2011	0	16	5	3	1	4	2	19	8	12
	Apr 2011	0	16	5	3	1	4	3	19	8	12
	May 2011	0	16	5	3	1	4	8	19	8	12
	Jun 2011	0	16	5	3	1	4	3	19	8	12
	Jul 2011	0	16	5	3	1	4	1	19	8	12
	Aug 2011	0	16	5	3	1	4	0	19	8	12
***NOISE* REMOVED**					✓			✓			

		231	232	233	234	235
ITEM		PVDF-BIF-0050	PVDF-CUB-0160-16023	PVDF-GOF-0050-20045	PVDF-MAF-0032-20045	PVDF-MRF-0025-0020-245
HISTORICAL SALES: SEPTEMBER 2007 – AUGUST 2010	Sep 2007	1	30	10	0	0
	Oct 2007	0	20	22	5	0
	Nov 2007	1	7	7	0	0
	Dec 2007	0	57	34	2	0
	Jan 2008	0	12	16	3	0
	Feb 2008	4	6	4	0	0
	Mar 2008	0	8	0	0	0
	Apr 2008	0	5	4	0	21
	May 2008	0	11	0	0	17.5
	Jun 2008	2	4	0	4	28
	Jul 2008	2	0	0	2	49
	Aug 2008	0	4	5	0	44
	Sep 2008	0	6	0	2	56
	Oct 2008	0	19	0	0	49
	Nov 2008	3	11	2	2	24.5
	Dec 2008	6	12	0	0	0
	Jan 2009	0	9	2	2	10.5
	Feb 2009	0	1	13	6	31
	Mar 2009	0	17	6	6	64
	Apr 2009	0	0	0	0	77
	May 2009	4	2	10	6	45.5
	Jun 2009	0	0	6	0	77
	Jul 2009	0	0	8	2	73.5
	Aug 2009	5	3	6	0	70
	Sep 2009	0	0	2	0	42
	Oct 2009	9	15	4	0	0
	Nov 2009	0	4	4	0	0
	Dec 2009	2	4	0	0	0
	Jan 2010	0	12	1	0	0
	Feb 2010	0	11	13	2	0
	Mar 2010	0	5	4	0	0
	Apr 2010	2	0	2	0	0
	May 2010	8	0	6	6	0
	Jun 2010	11	2	2	0	0
	Jul 2010	12	2	3	0	0
	Aug 2010	4	13	2	0	0
MAPE (%)	**MA**	38.35%	92.13%	56.23%	22.92%	26.31%
	WMA	37.80%	102.36	62.40%	23.47%	31.40%
	ExS	32.17%	82.69%	54.13%	22.18%	23.47%
	HOLT	29.24%	89.81%	86.86%	22.87%	35.61%
	HW	97.59%	115.28	131.25	34.24%	55.70%
BEST FIT		HOLT	EXS	EXS	EXS	EXS
FORECAST: SEPTEMBER 2010- AUGUST 2011	Sep 2010	4	8	3	0	0
	Oct 2010	5	8	3	0	0
	Nov 2010	5	8	3	0	0
	Dec 2010	6	8	3	0	0
	Jan 2011	6	8	3	0	0
	Feb 2011	6	8	3	0	0
	Mar 2011	7	8	3	0	0
	Apr 2011	7	8	3	0	0
	May 2011	7	8	3	0	0
	Jun 2011	8	8	3	0	0
	Jul 2011	8	8	3	0	0
	Aug 2011	9	8	3	0	0
***NOISE* REMOVED**					✓	✓

6.2 APPENDIX B

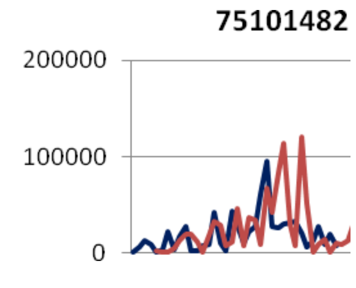
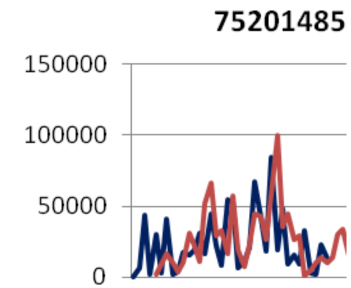
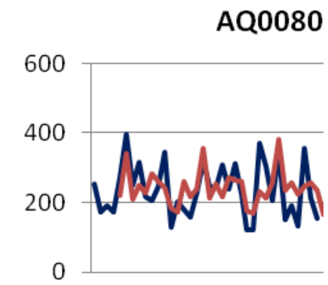
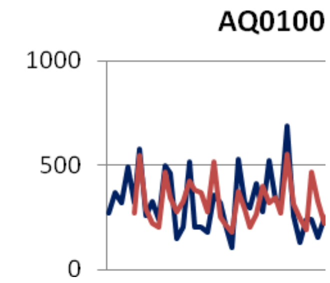
Displaying the results of equations (1-1) to (3-3) in graphical format.

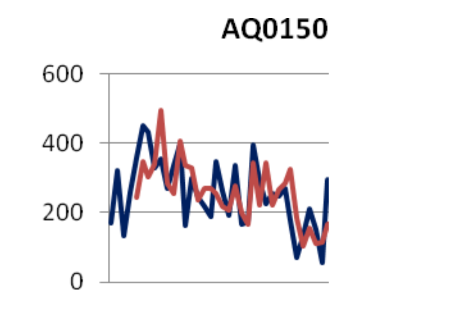
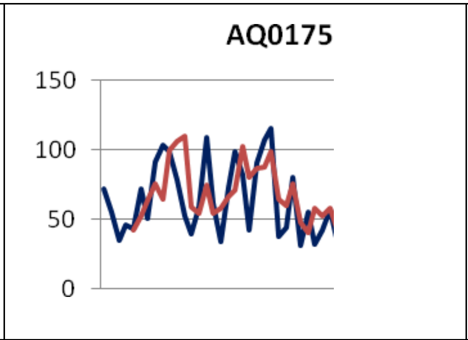
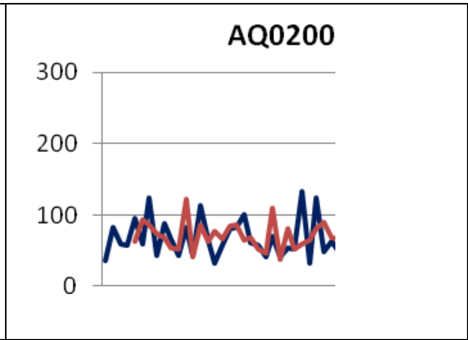
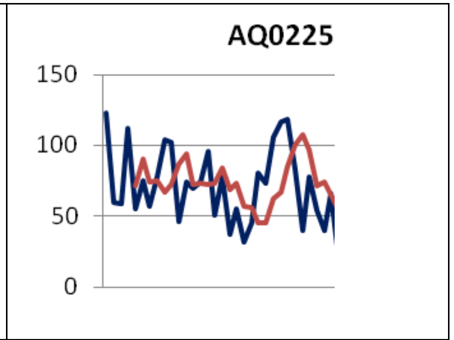
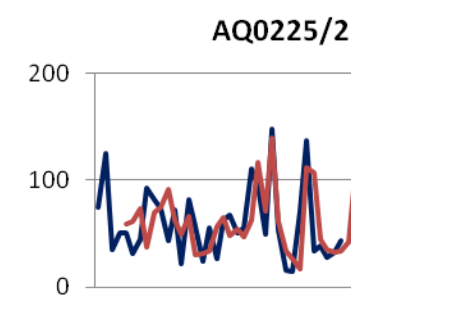
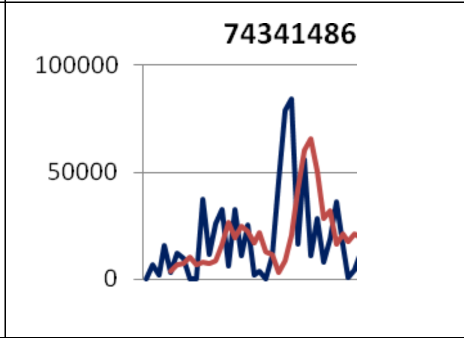
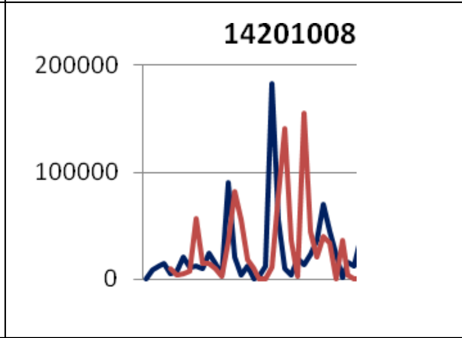
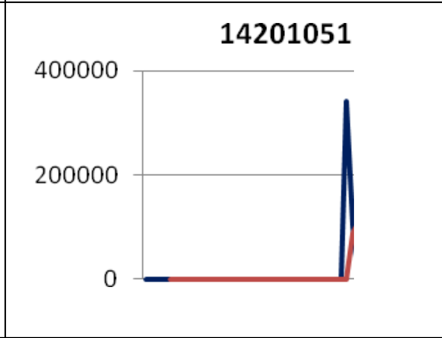
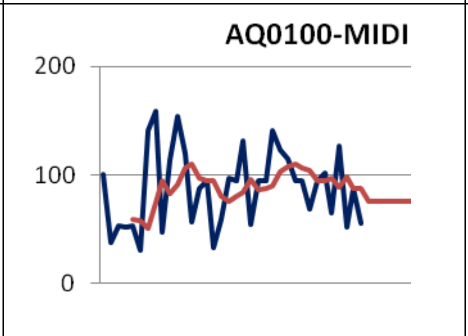
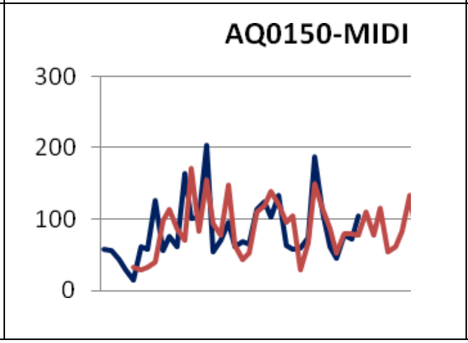
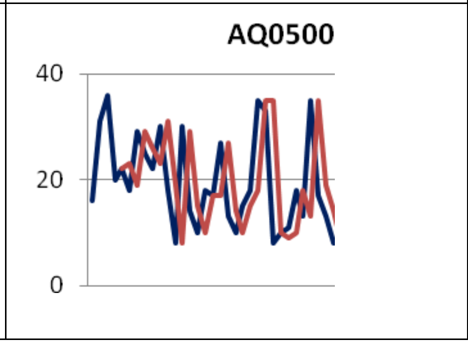
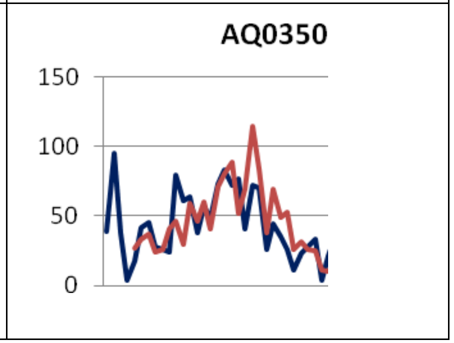
Please note that for displaying purposes (a bigger graphical window) the values on the x-axis's have been removed.

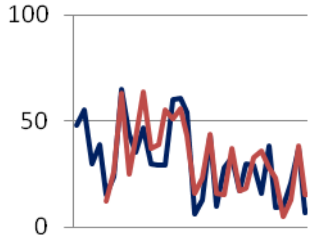
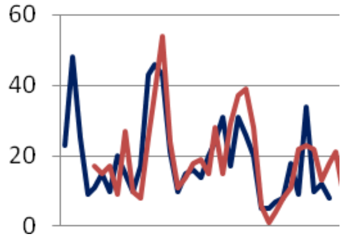
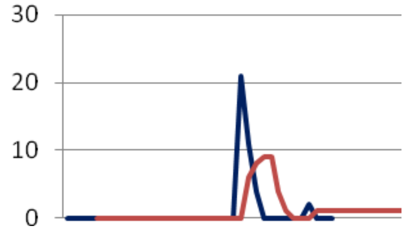
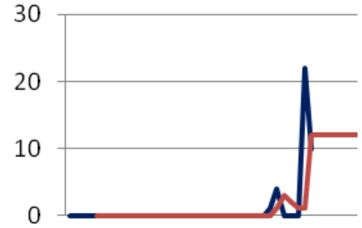
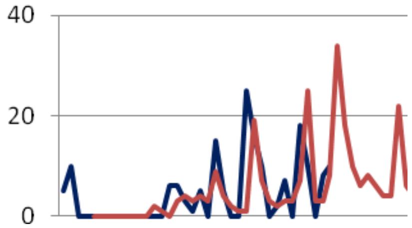
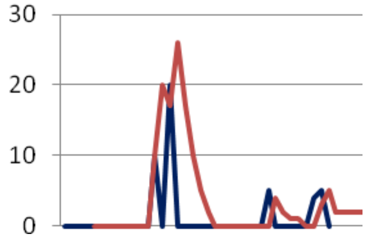
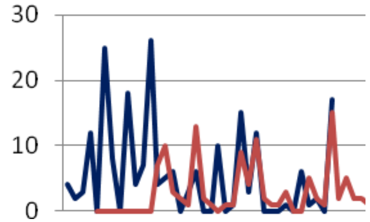
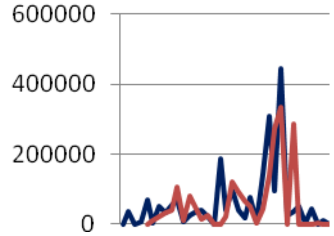
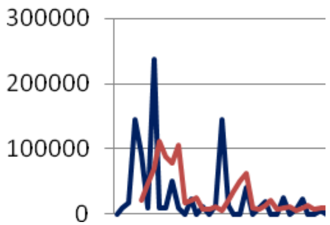
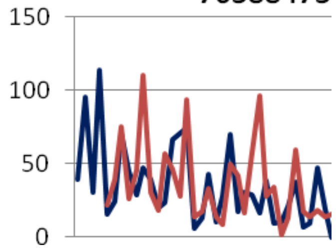
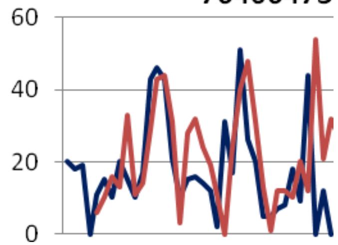
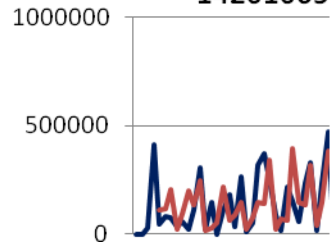
The value of the x-axis for all the graphs is the time period from August 2007 – August 2011.

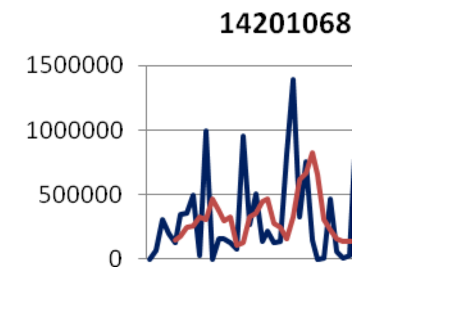
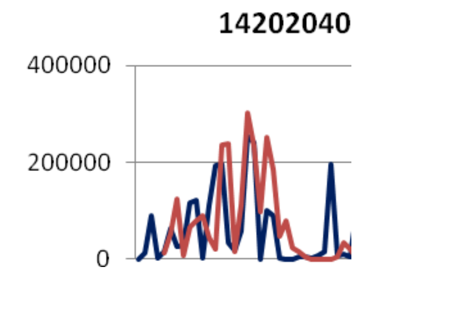
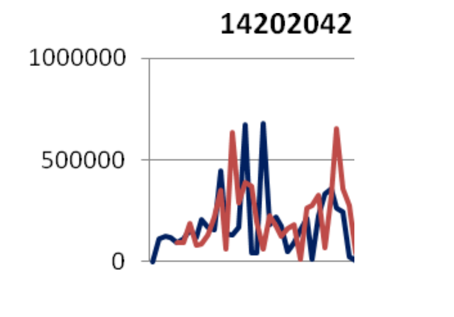
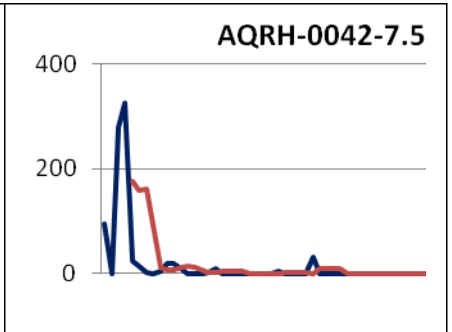
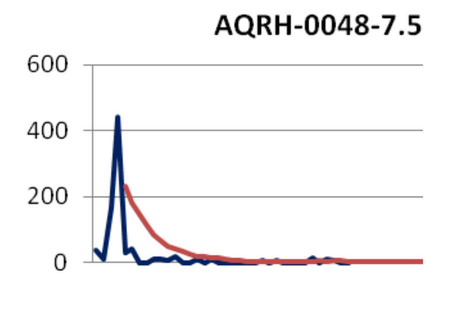
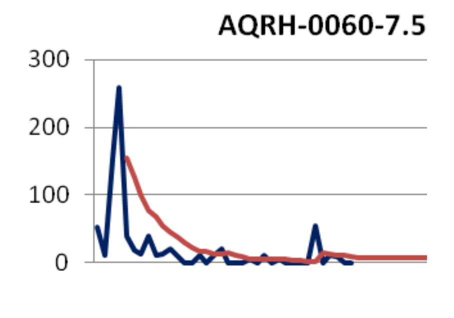
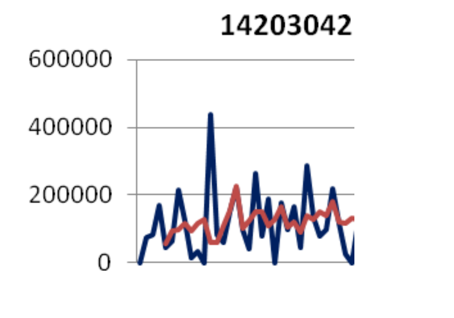
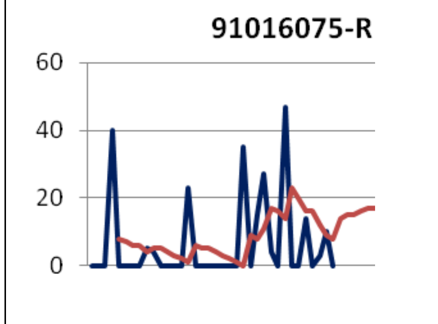
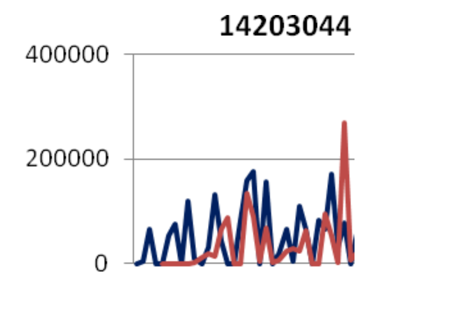
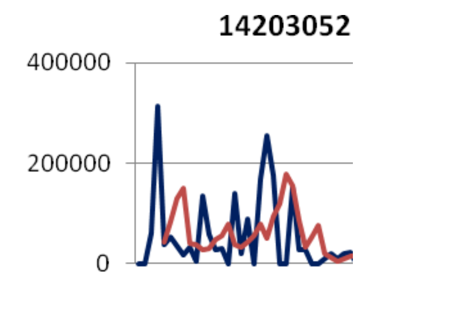
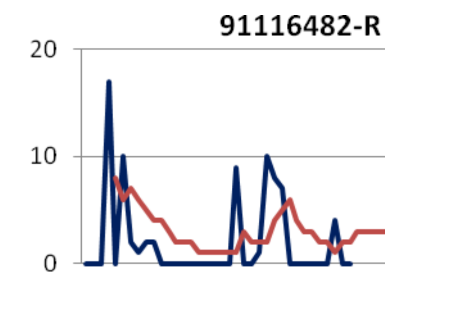
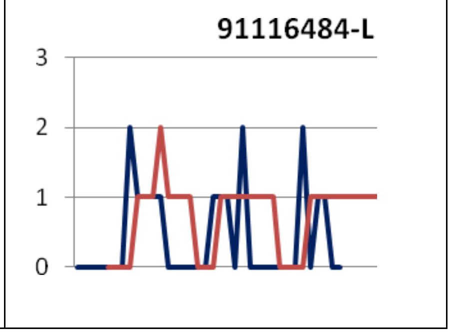
The blue line (actual historical demand) runs from August 2007 – August 2010.

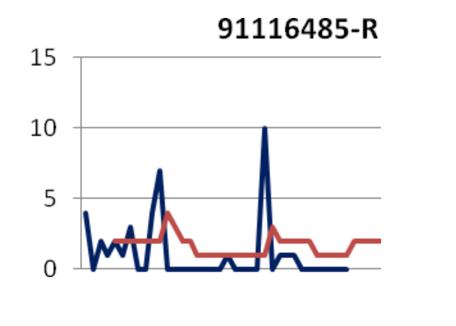
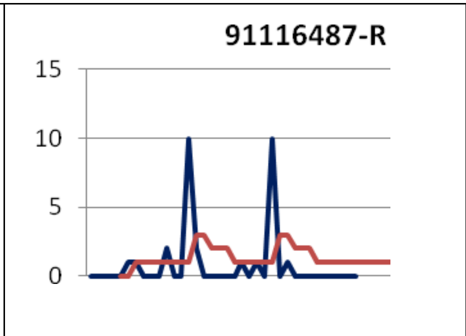
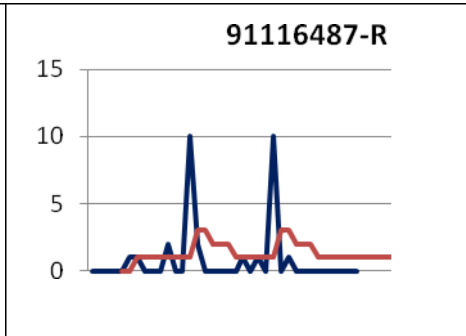
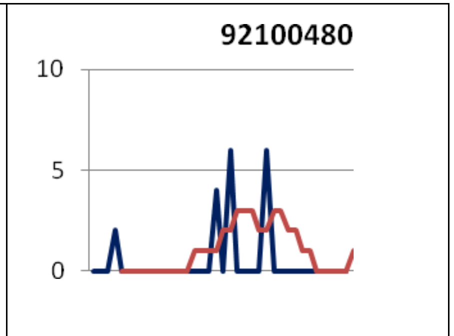
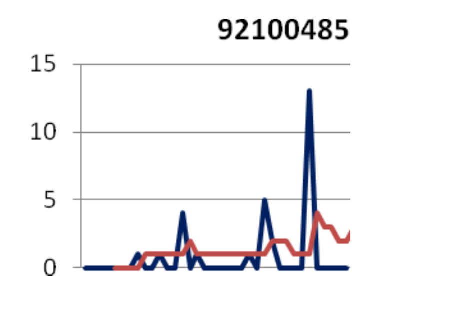
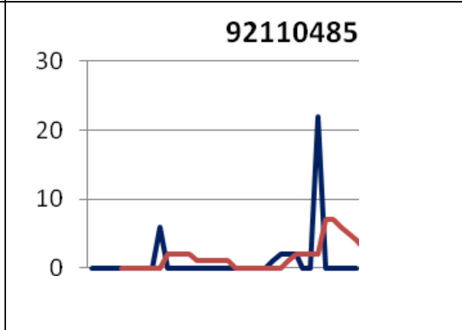
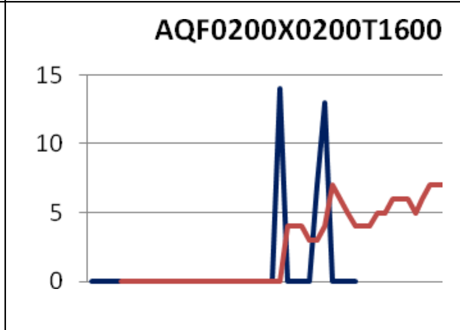
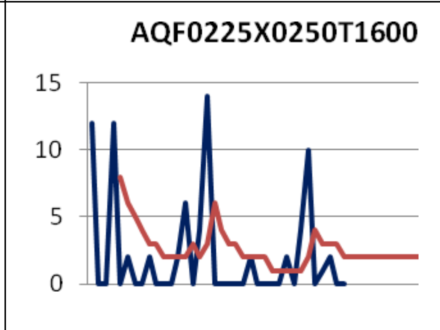
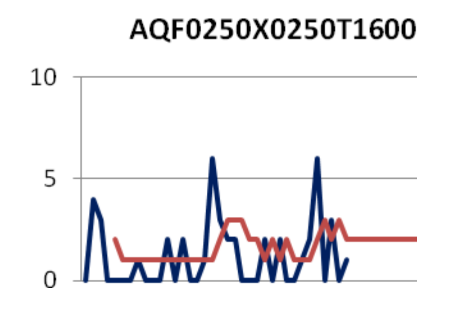
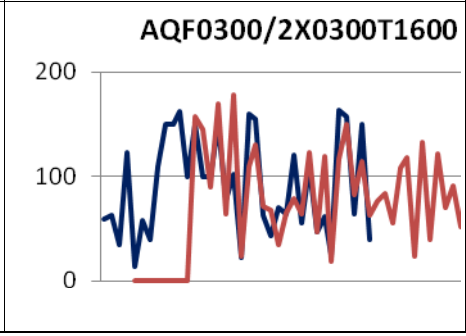
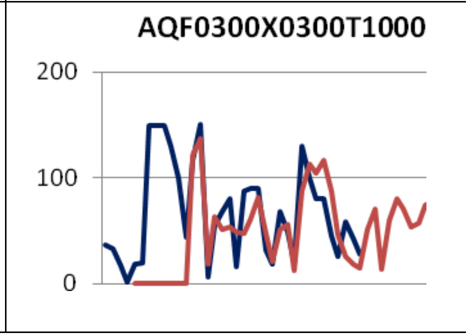
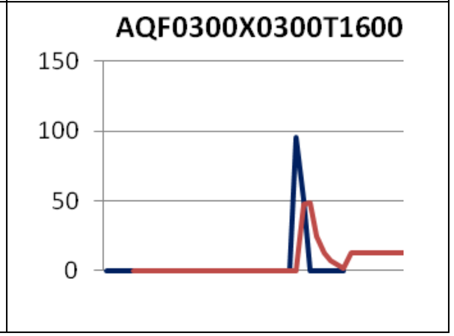
The red line (forecast) runs from August 2007 – August 2011.

1		2		3		4	

5		6		7		8	
9		10		11		12	
13		14		15		16	

17	**AQ0400** 	18	**AQ0300/2** 	19	**AQRH-0027-15** 	20	**AQRH-0027-7.5** 
21	**AQRH-0034-7.5** 	22	**91016090-R** 	23	**91016110-R** 	24	**14201056** 
25	**14201062** 	26	**76388473** 	27	**76406473** 	28	**14201065** 

29		30		31		32	
33		34		35		36	
37		38		39		40	

41		42		43		44	
45		46		47		48	
49		50		51		52	

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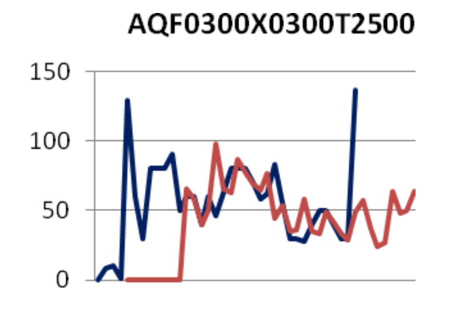
<td>
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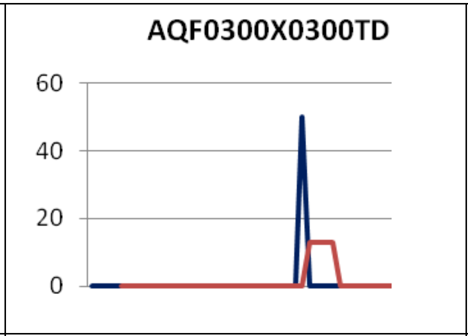
<td>
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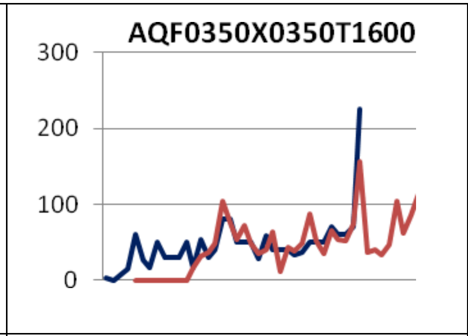
<td>
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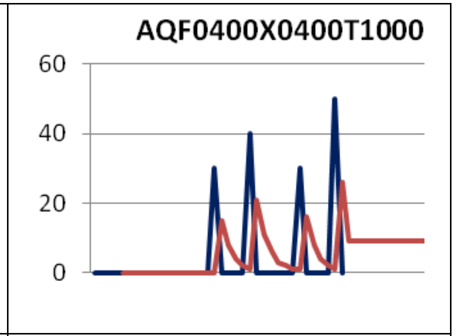
<td>
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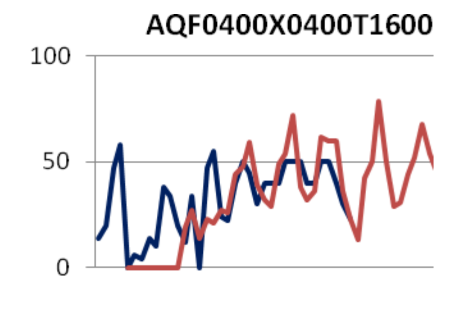
<td>
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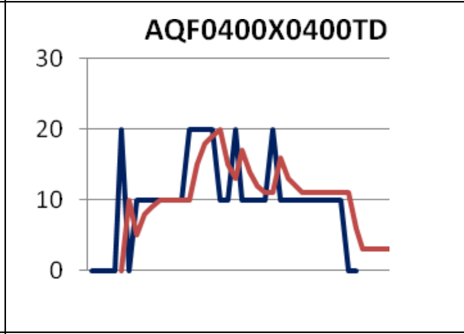
<td>
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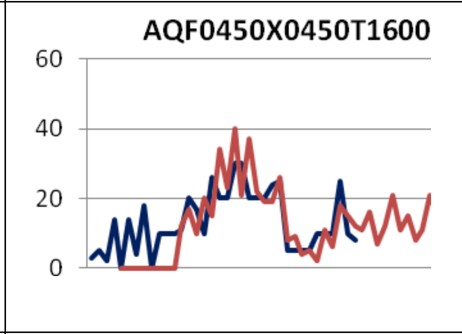
<td>
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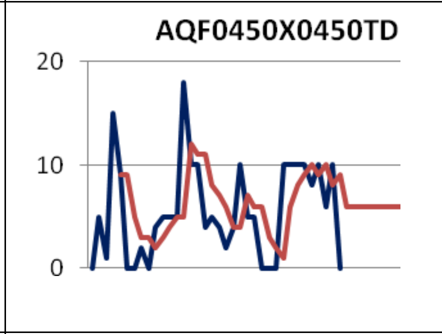
<td>
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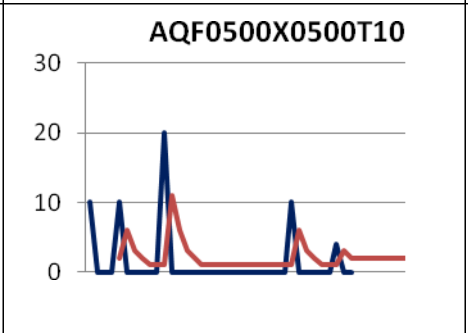
<td>
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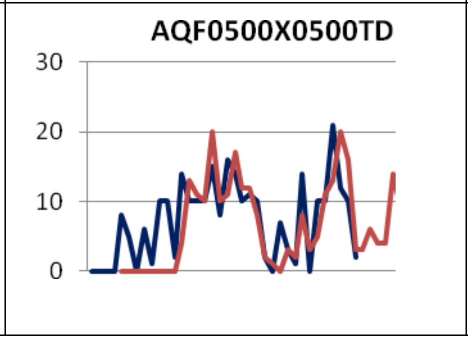
<td>
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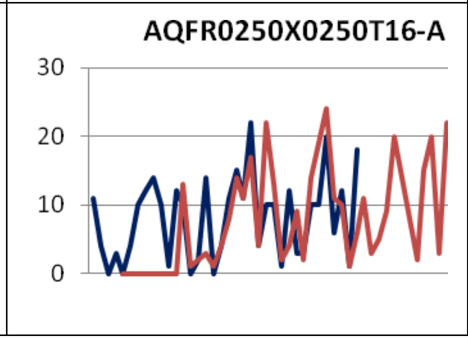
<td>
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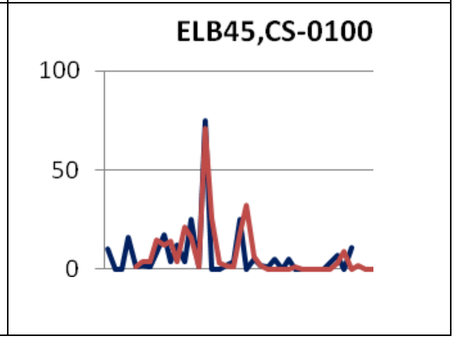
<td>
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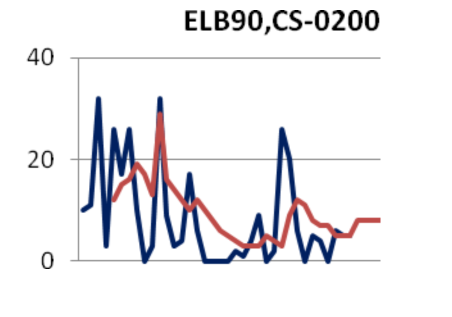

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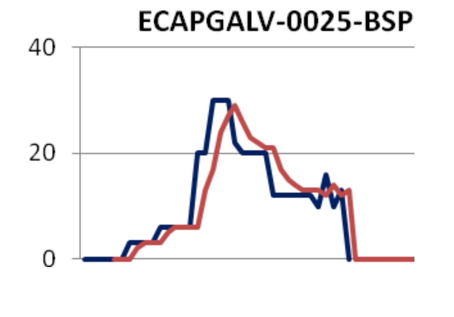

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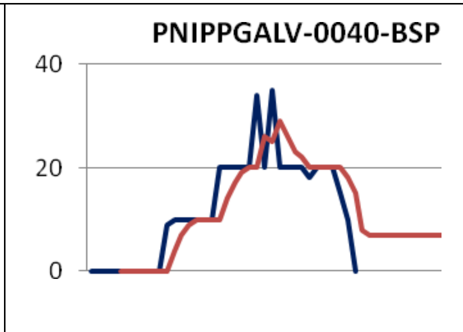

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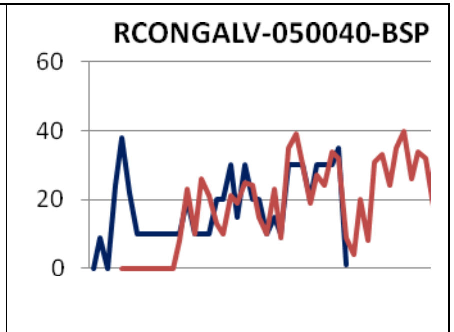

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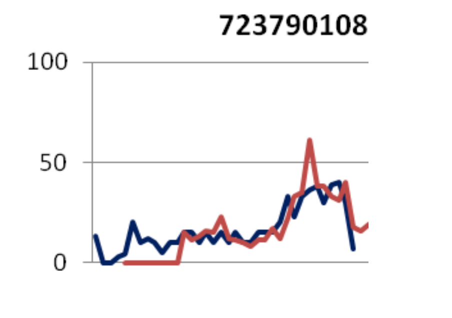

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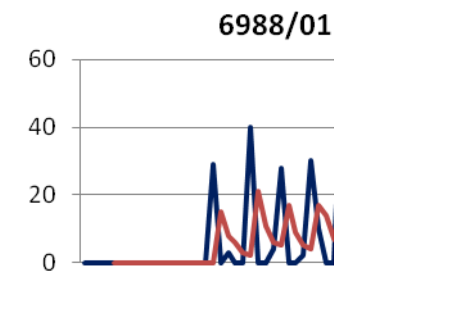

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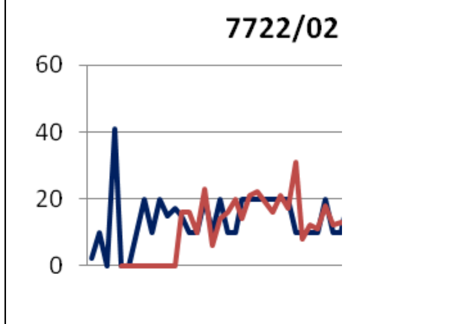

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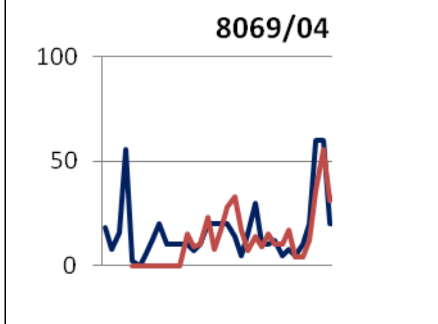

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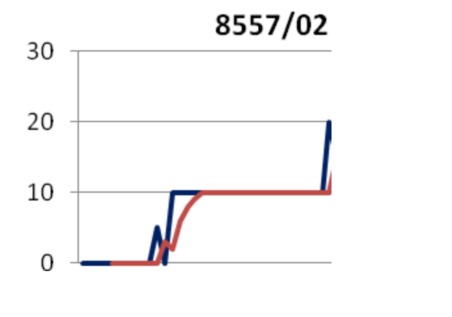

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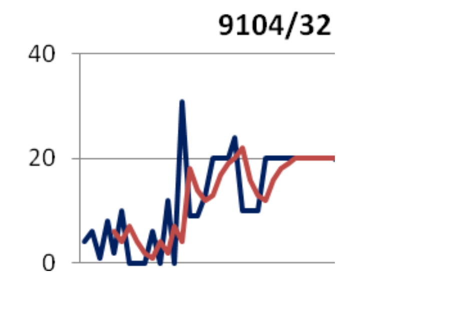

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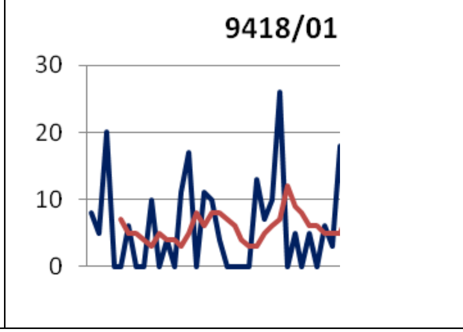

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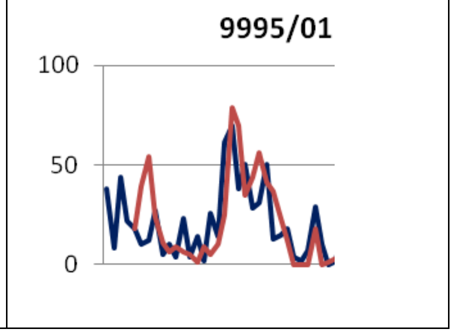
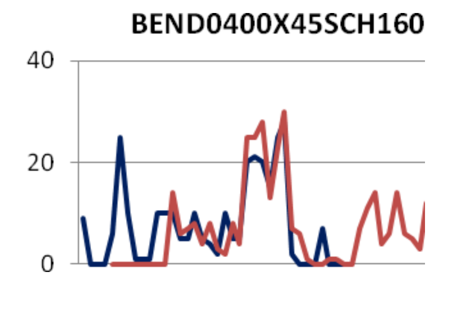
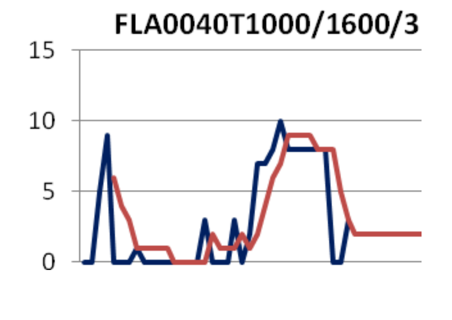
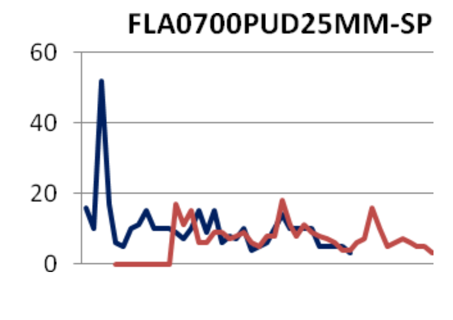
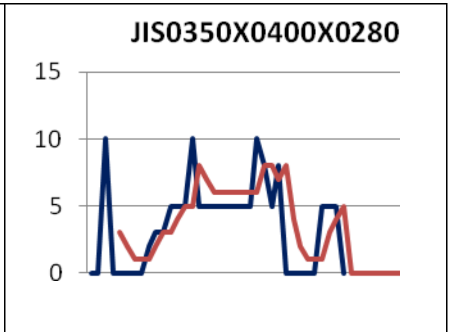
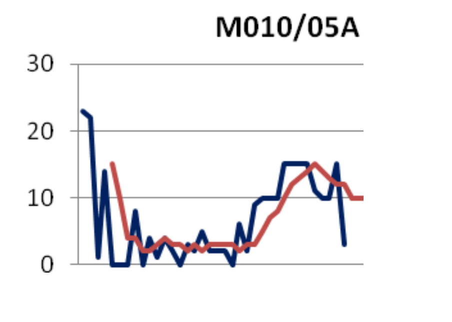
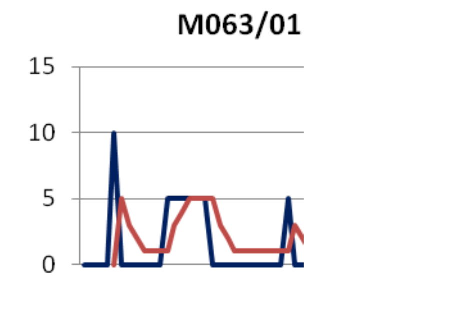
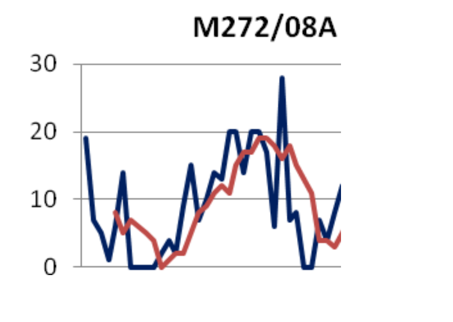
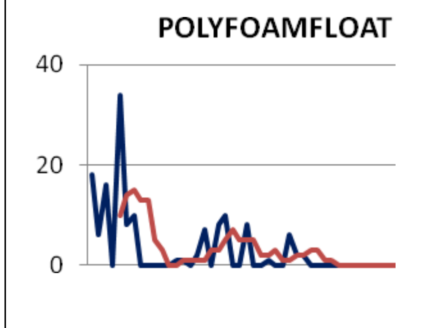
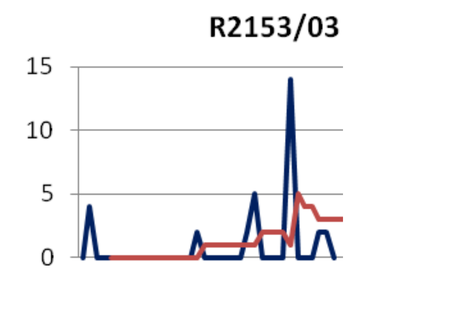
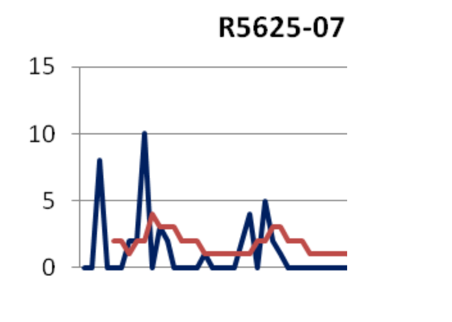
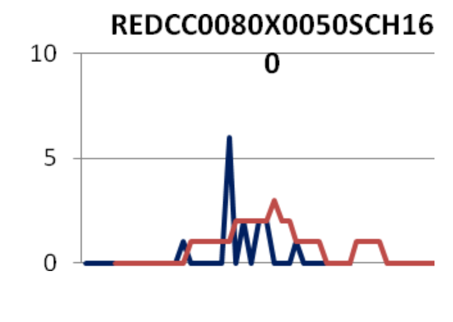
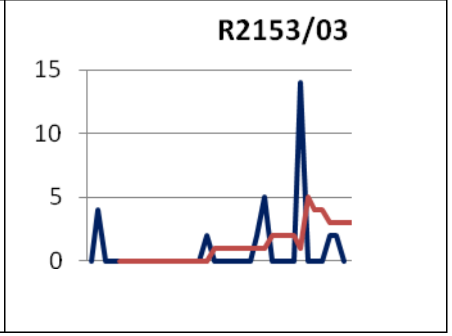
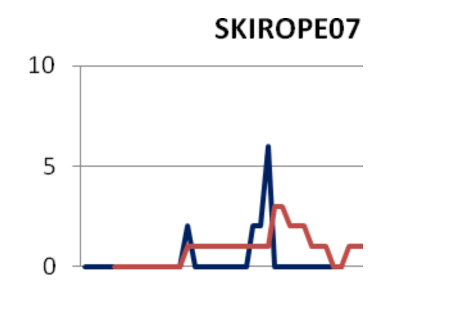
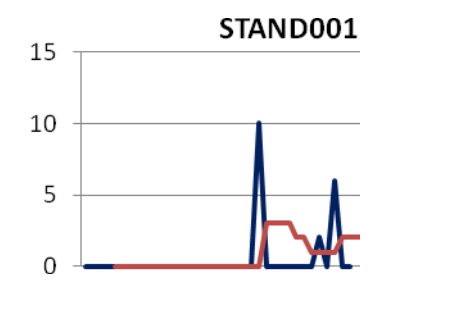
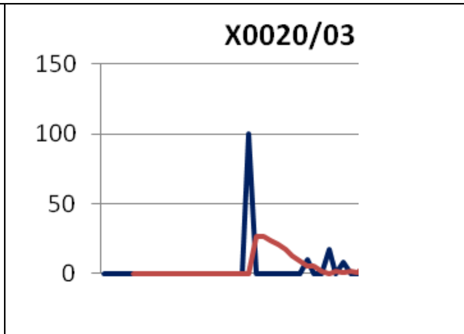
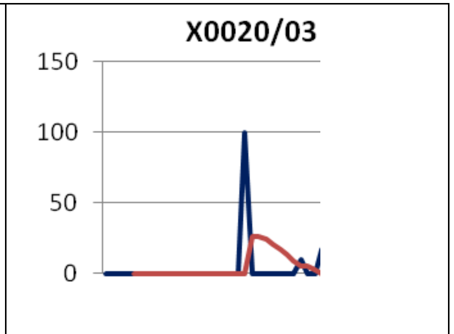
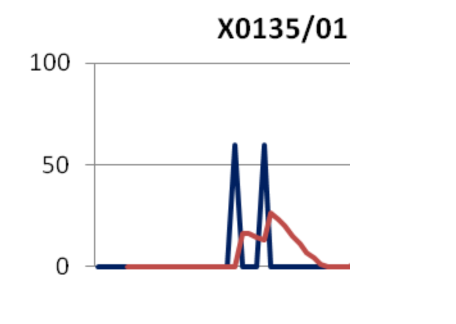
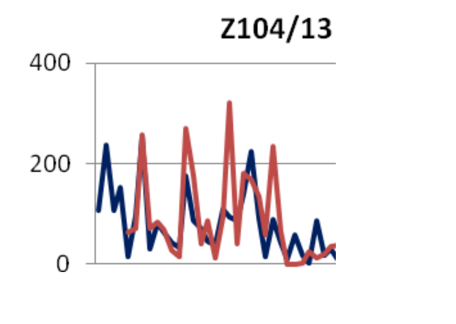
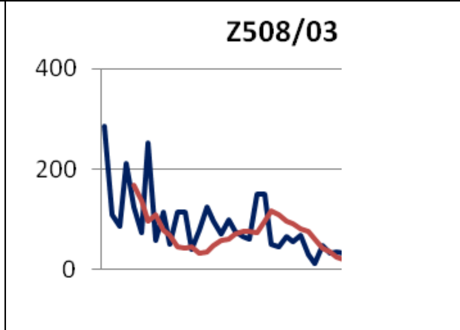
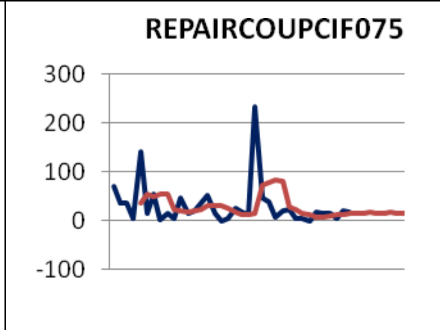
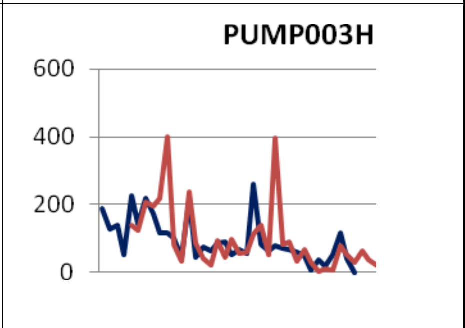
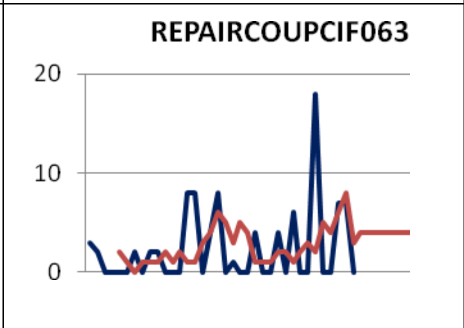
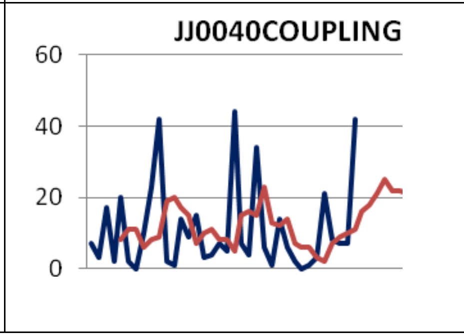
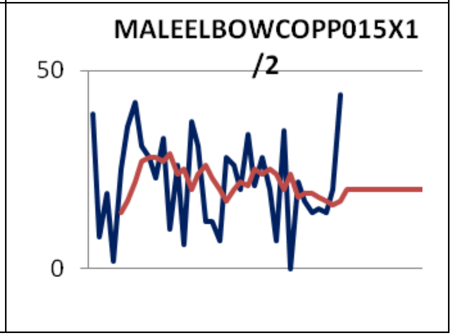
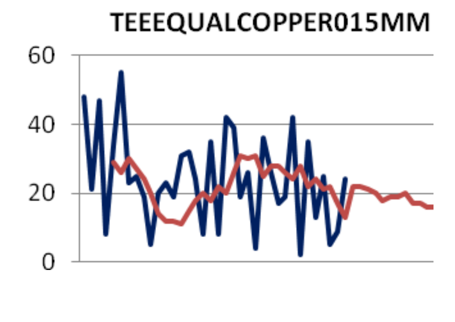
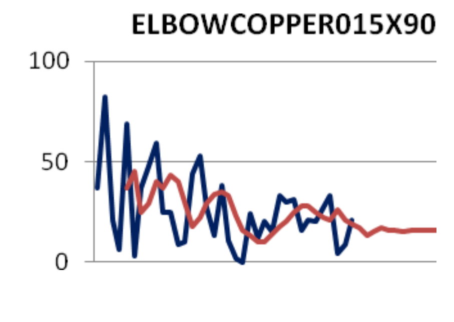
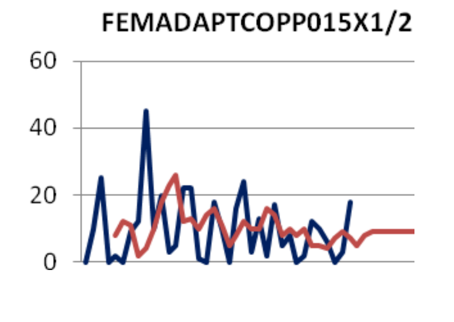
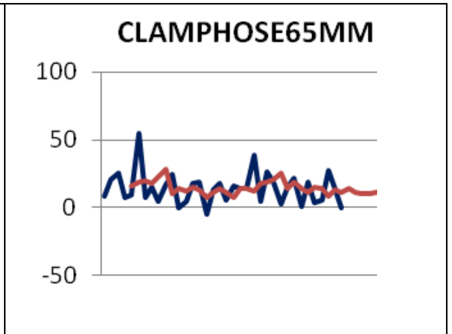
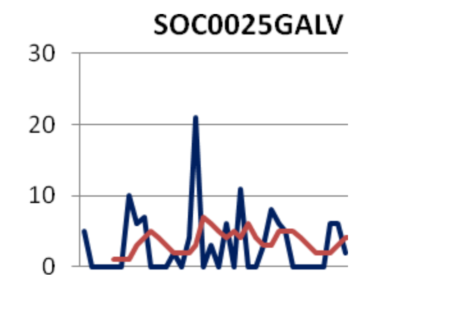
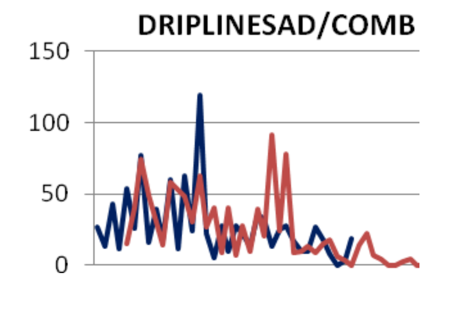
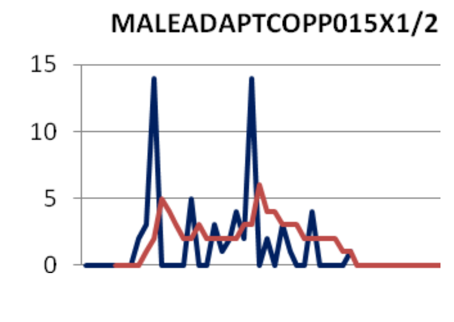
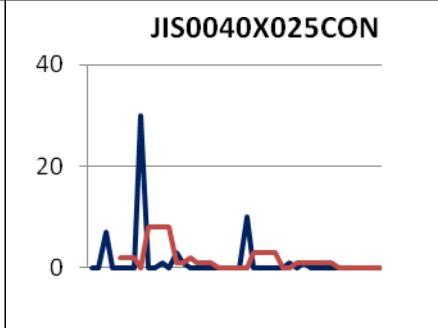
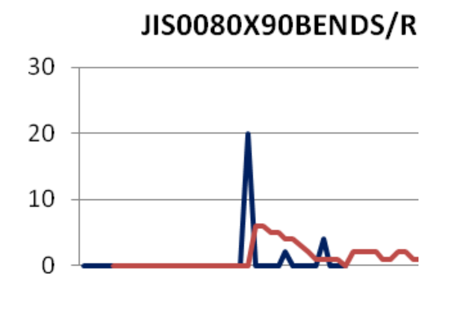
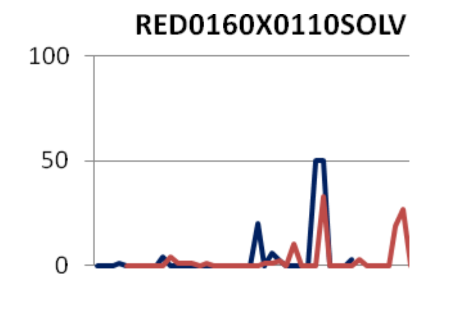
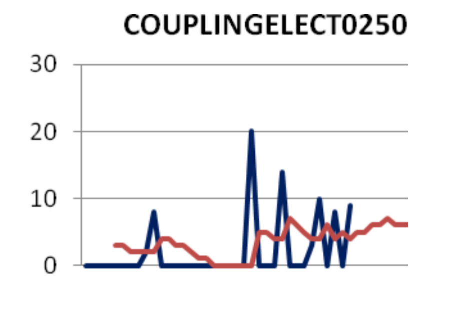
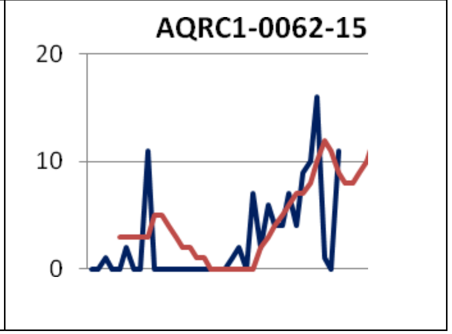


77		78		79		80	
81		82		83		84	
85		86		87		88	

89		90		91		92	
93		94		95		96	
97		98		99		100	

101		102		103		104	
105		106		107		108	
109		110		111		112	

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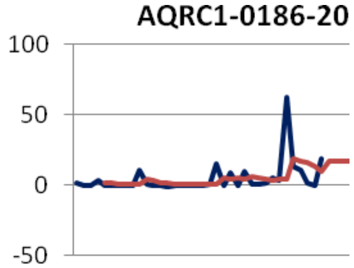

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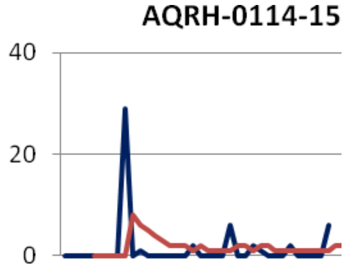

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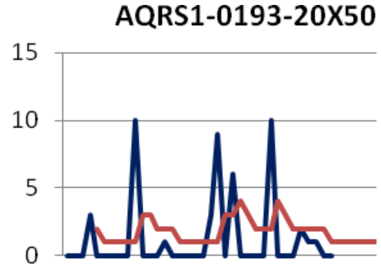

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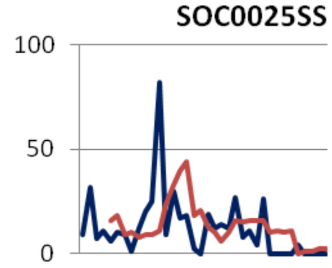

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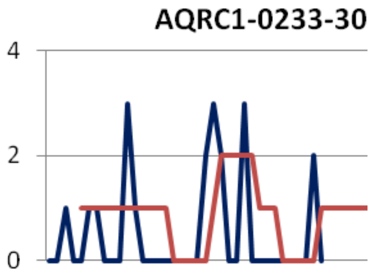

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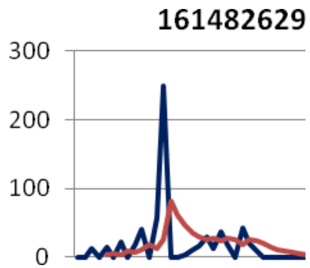

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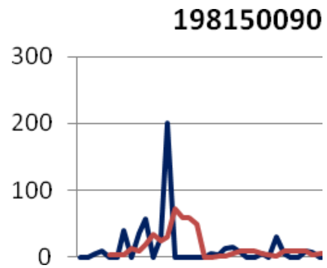

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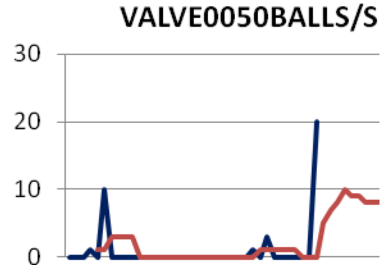

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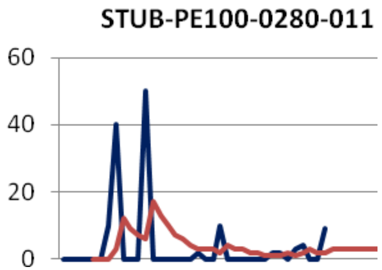

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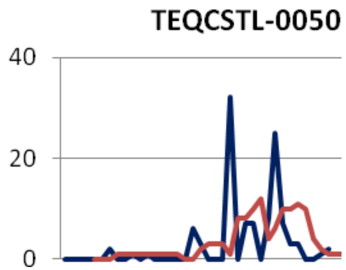

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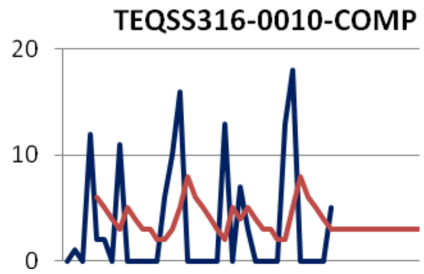

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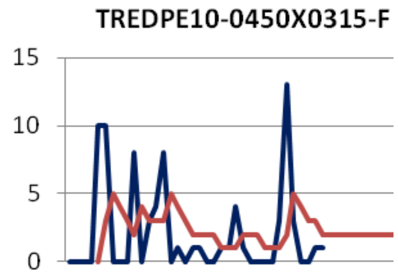

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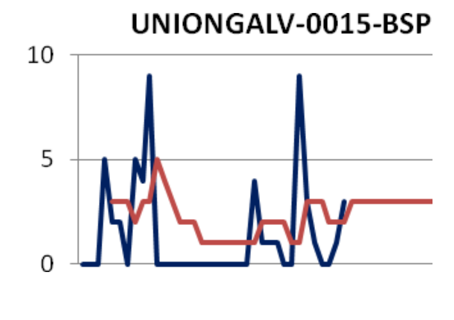

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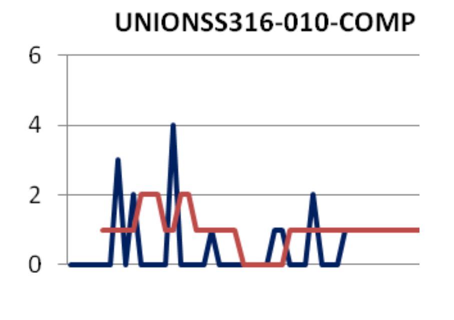

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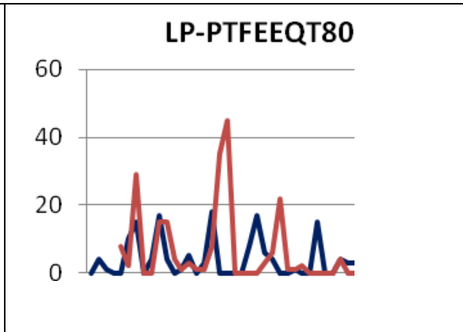

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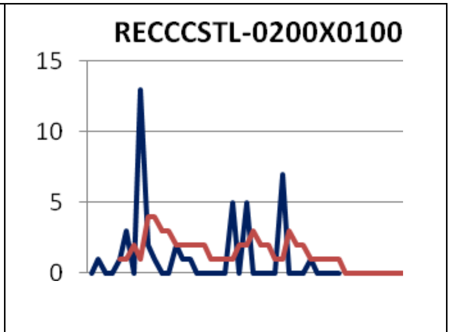

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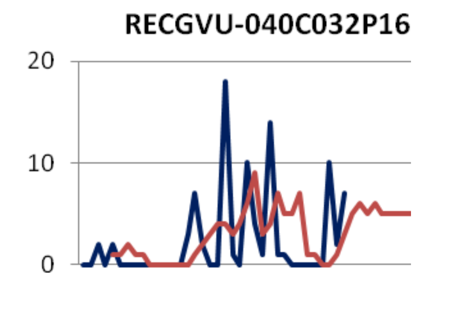

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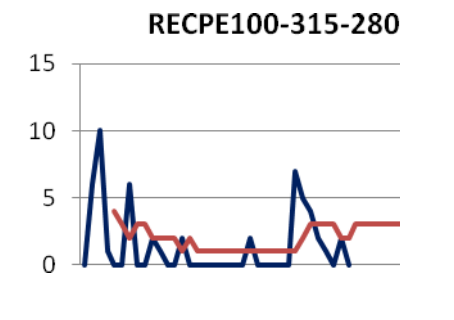

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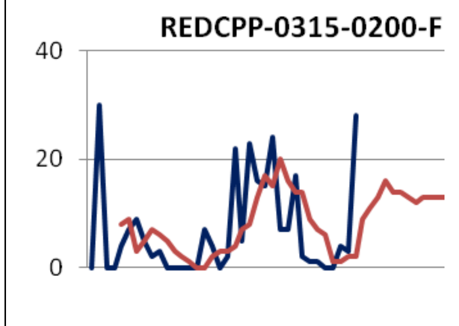

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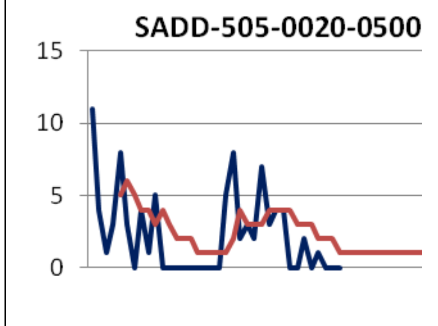

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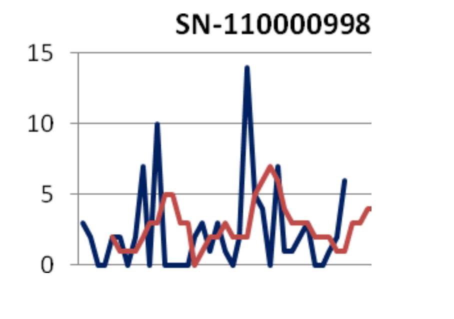

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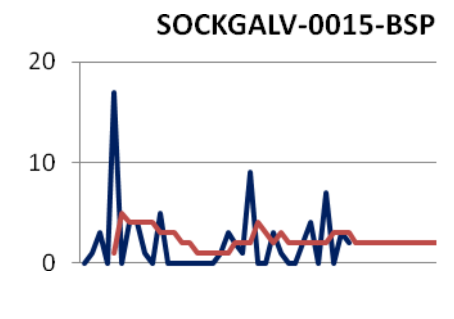

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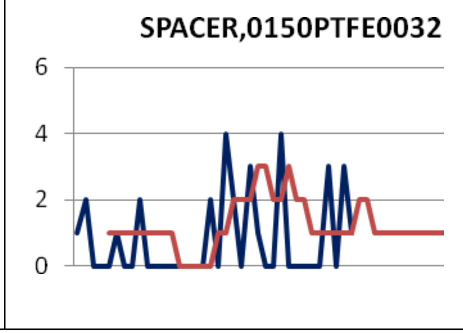

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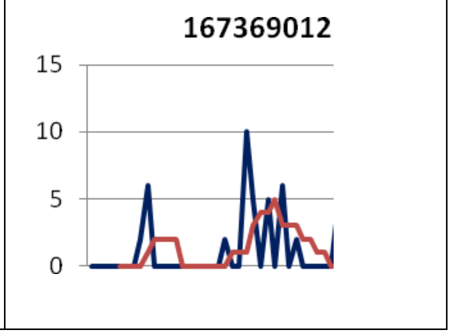
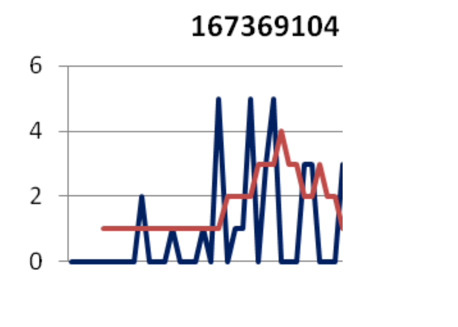
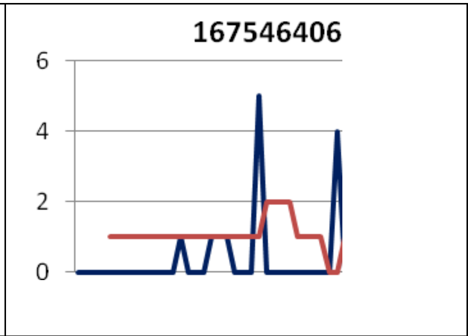
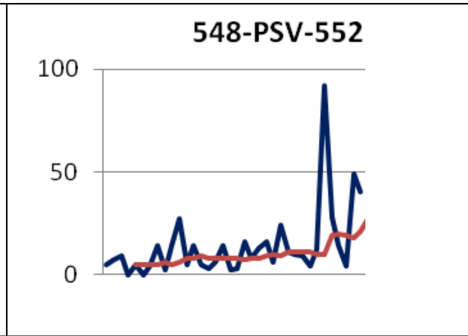
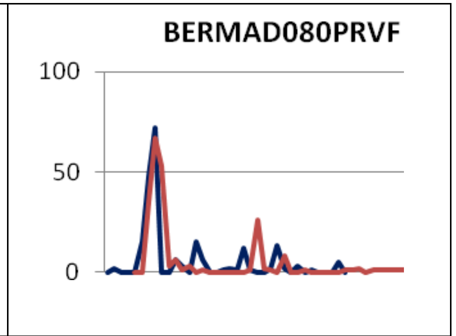
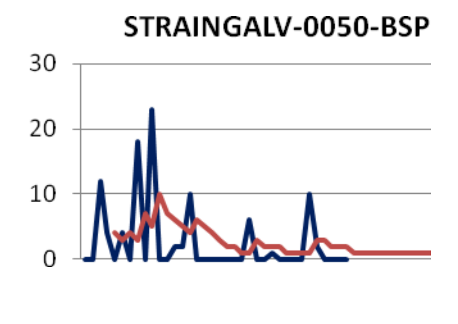
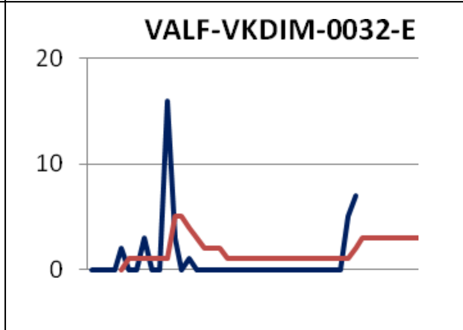
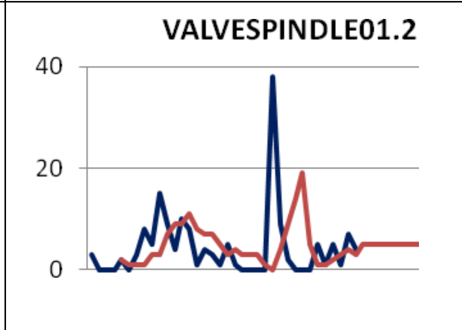
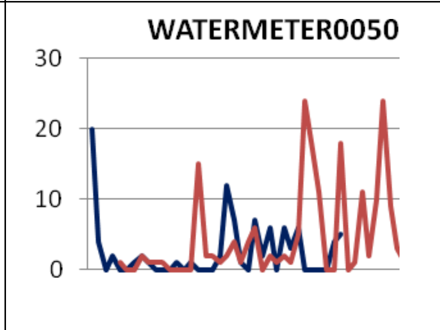
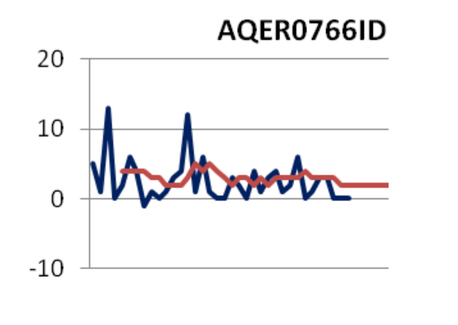
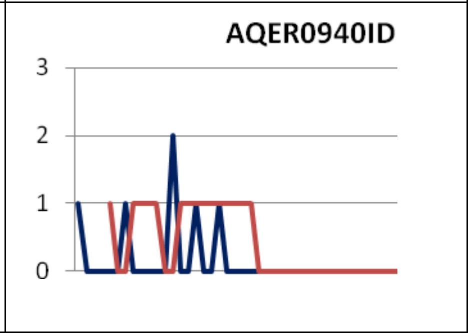
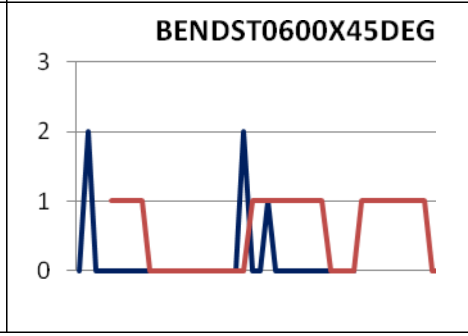
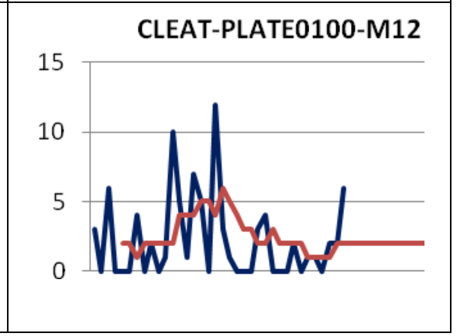


137		138		139		140	
141		142		143		144	
145		146		147		148	

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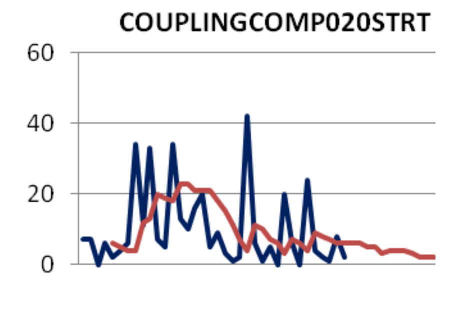

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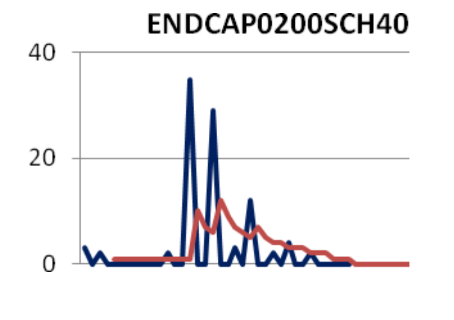

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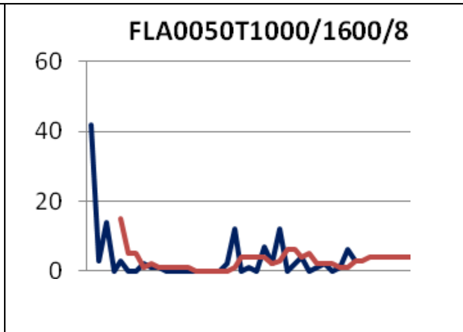

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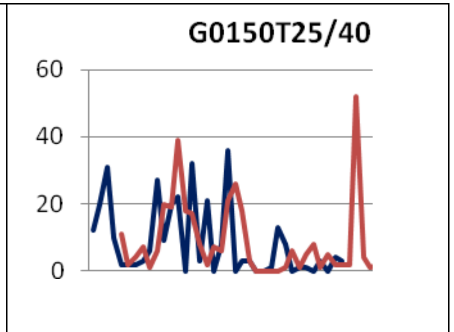

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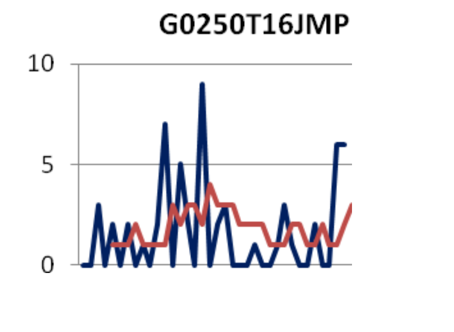

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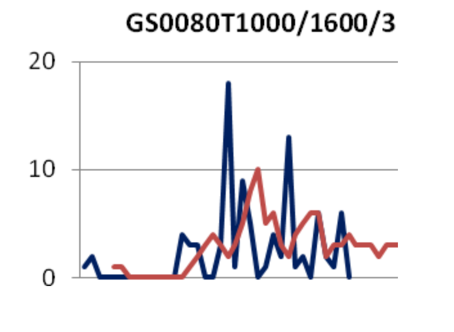

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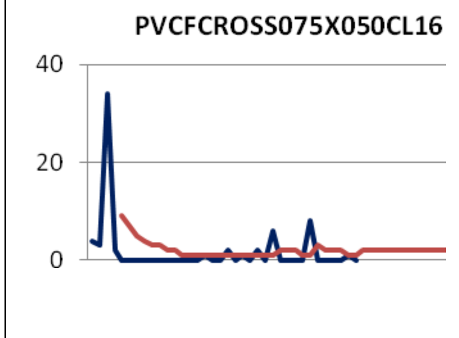

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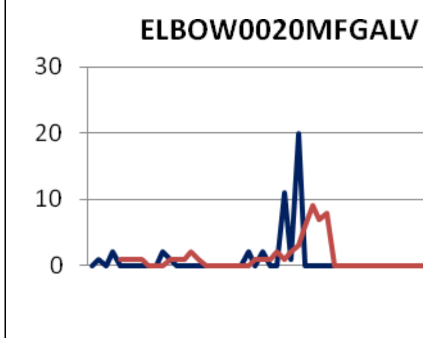

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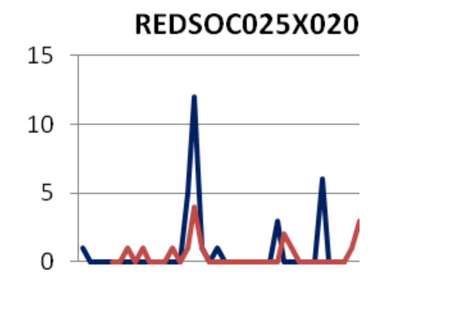

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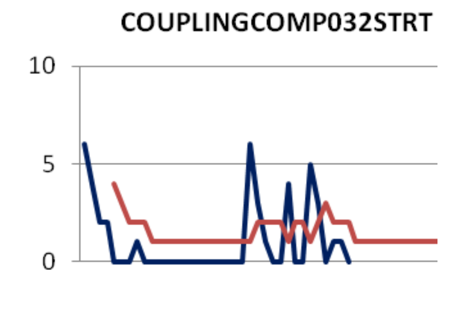

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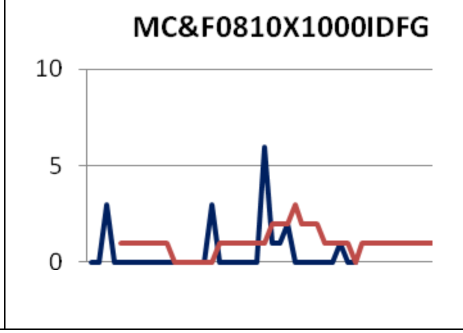

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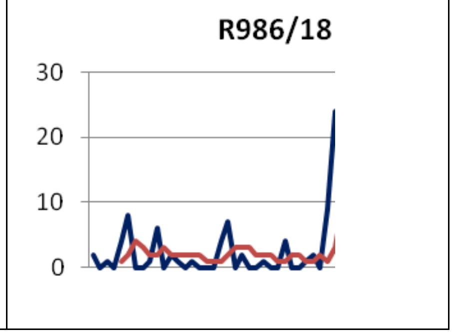

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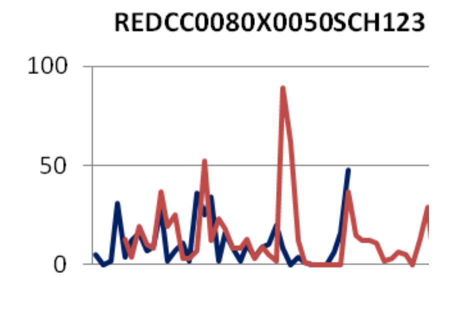

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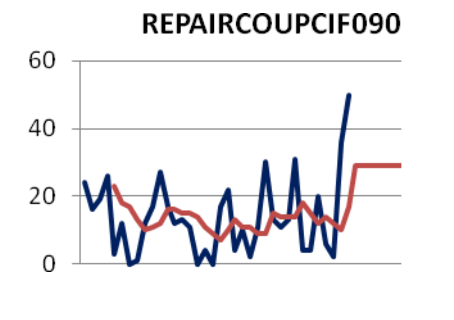

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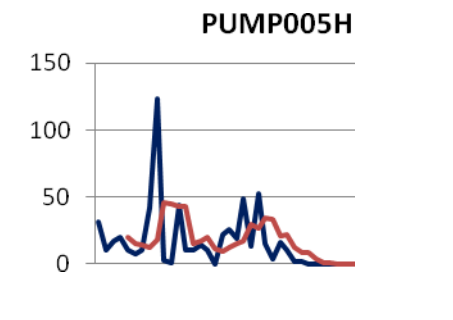

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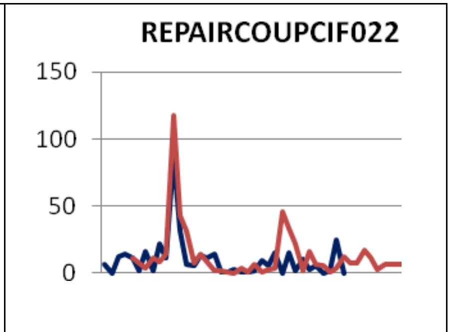

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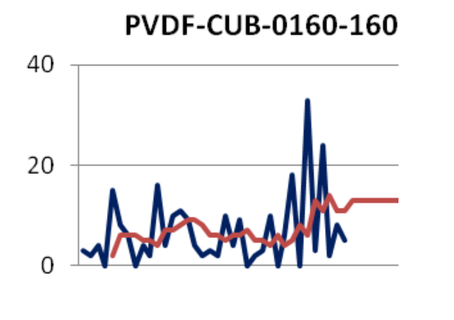

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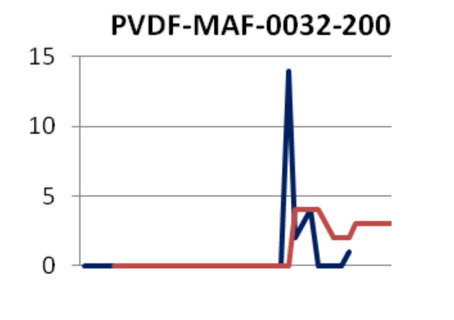

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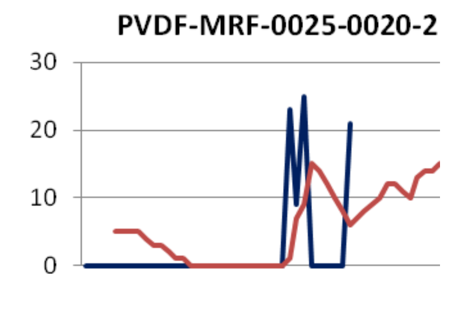

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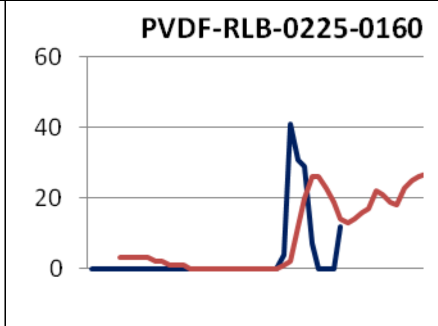

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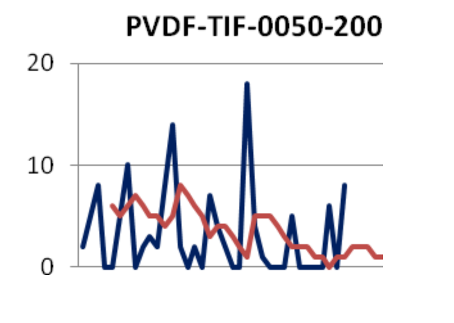

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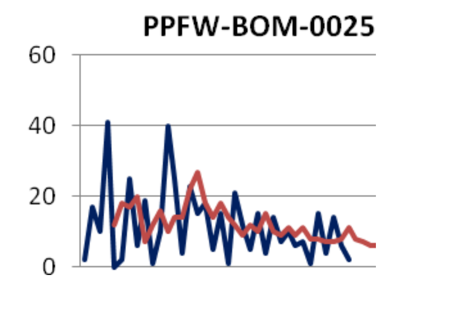

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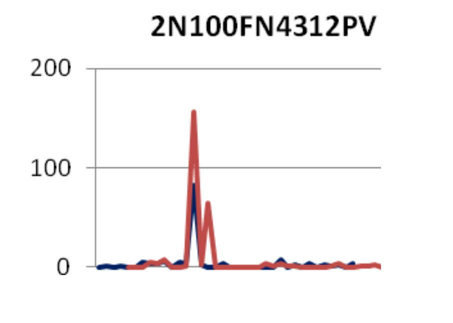

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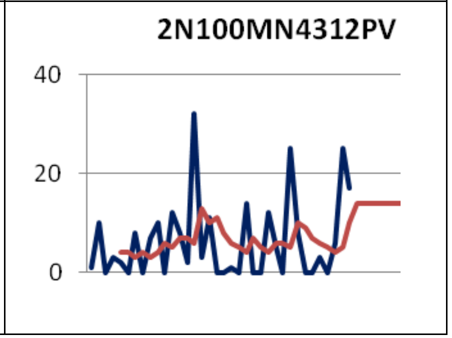
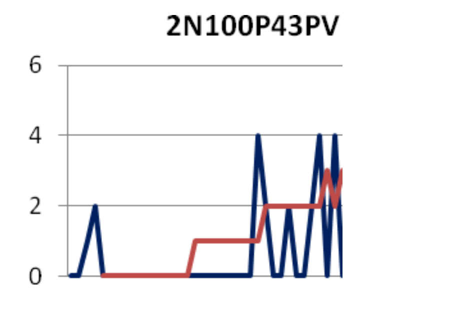
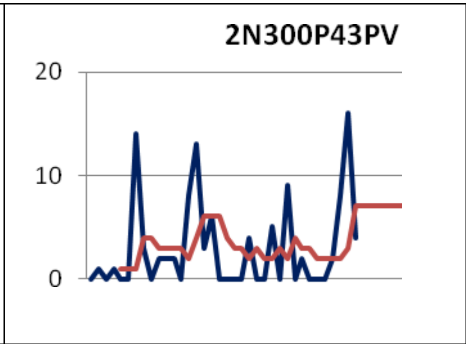
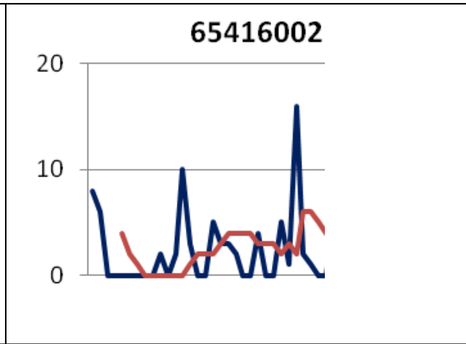
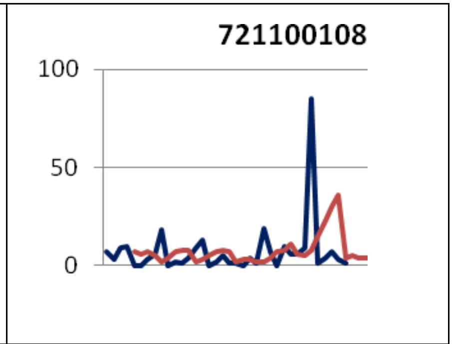
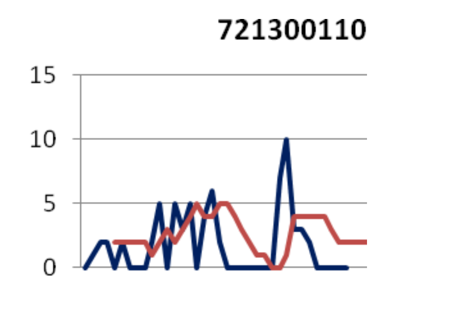
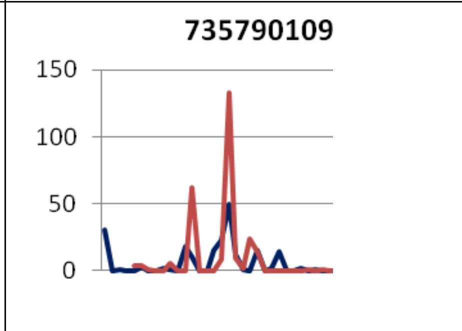
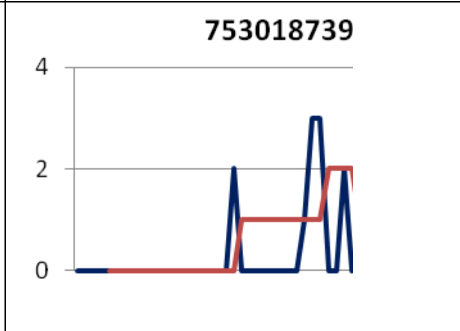
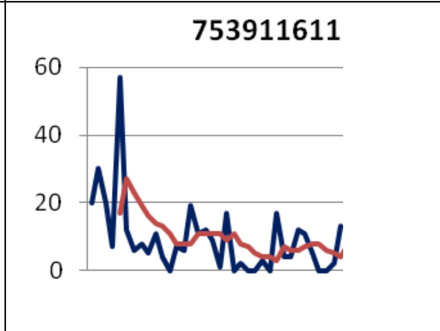
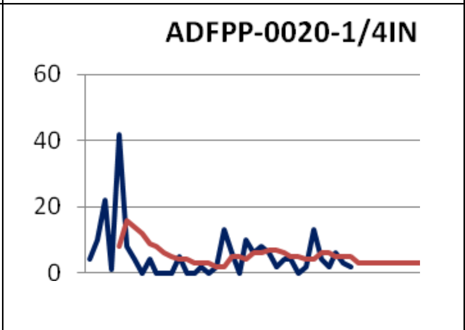
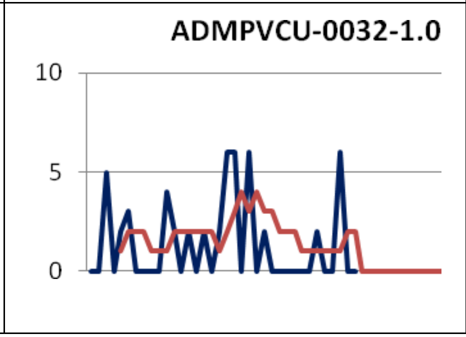
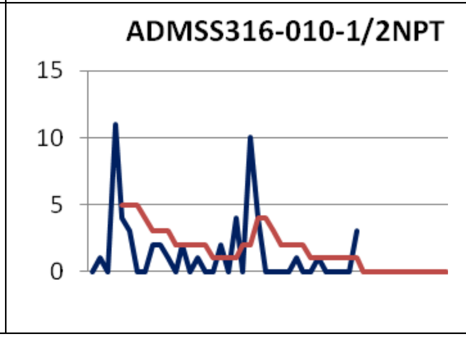
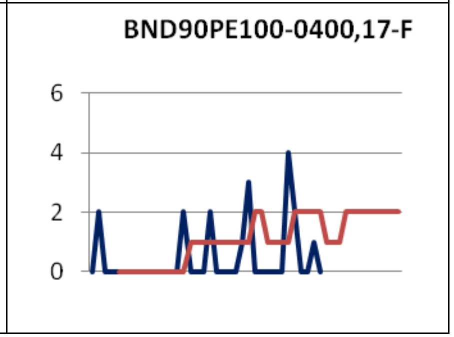


173		174		175		176	
177		178		179		180	
181		182		183		184	

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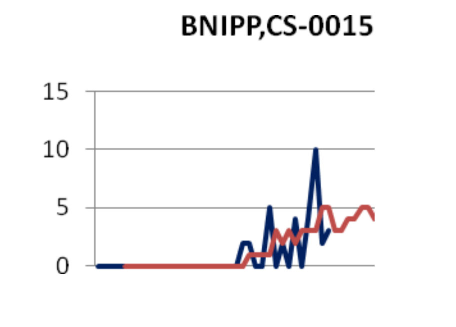

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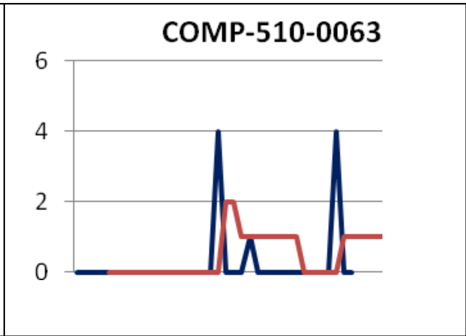

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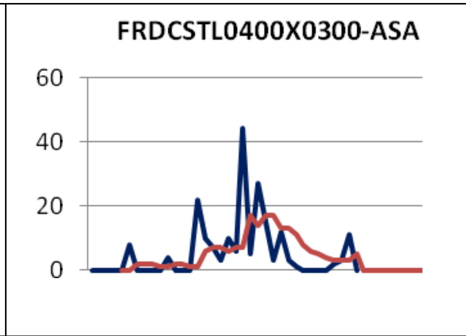

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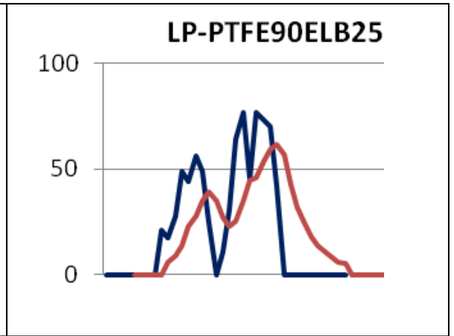

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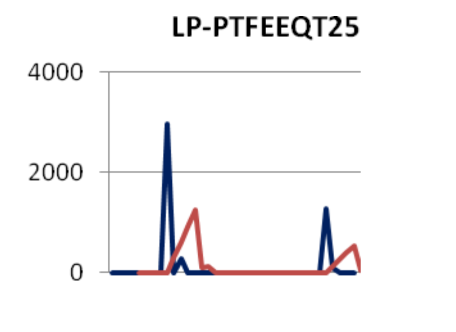

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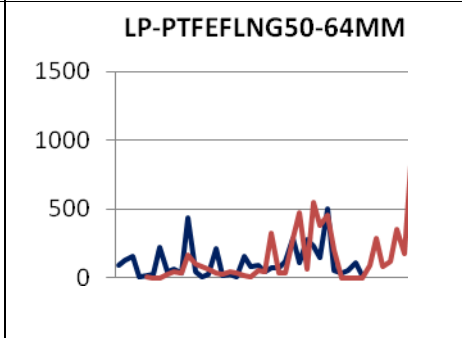

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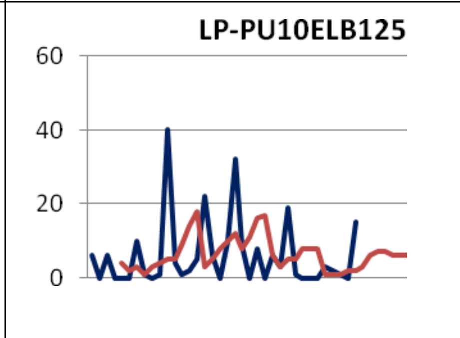

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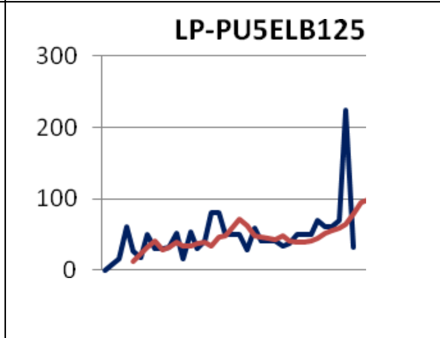

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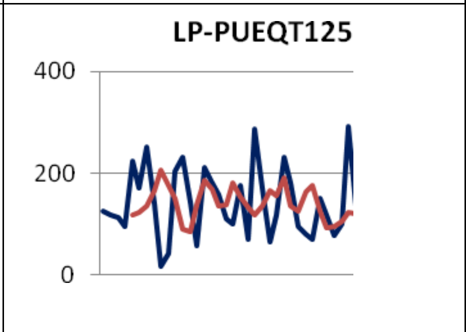

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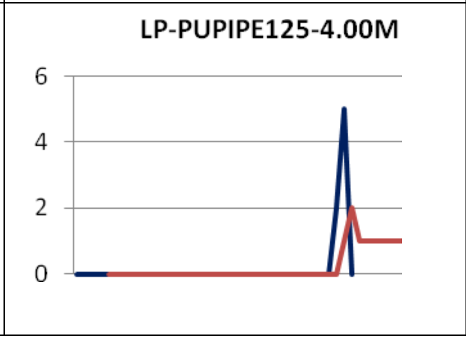

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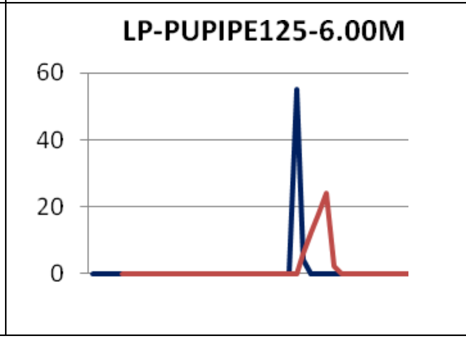

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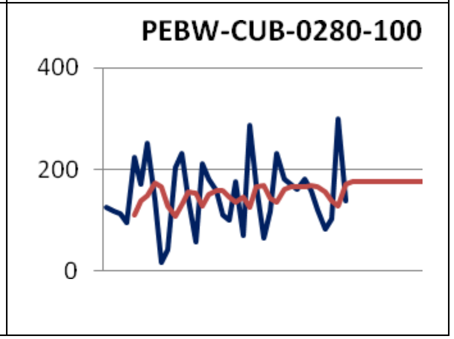

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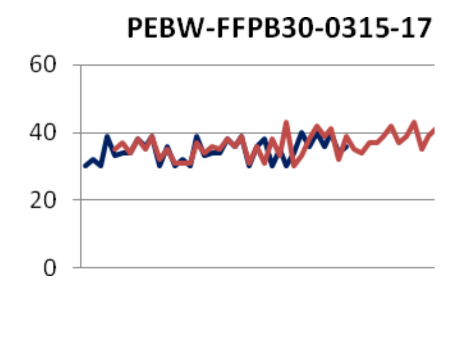

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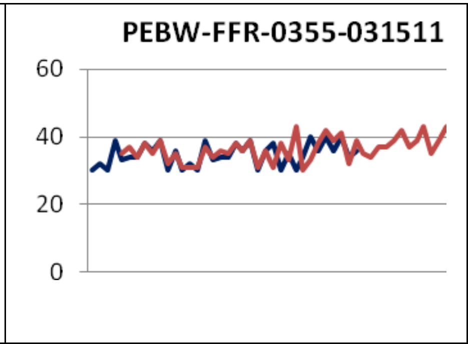

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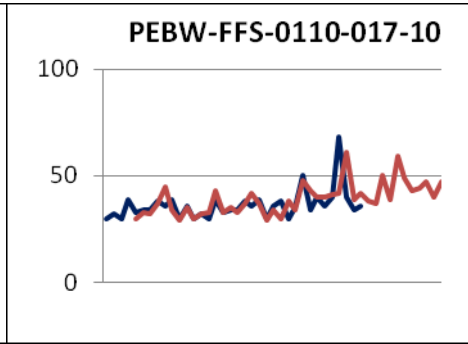

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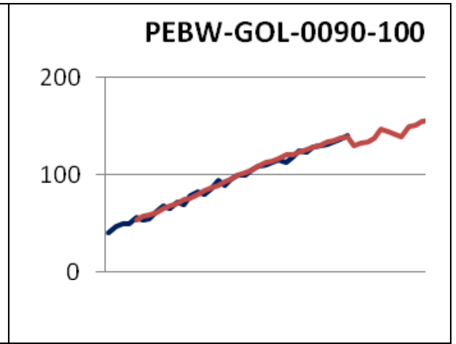

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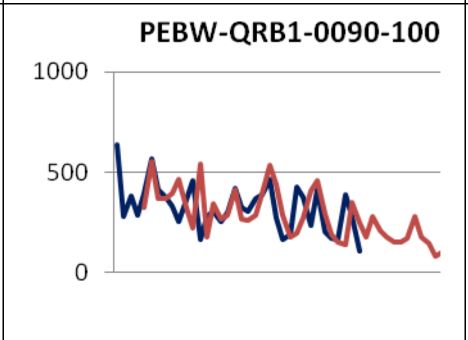

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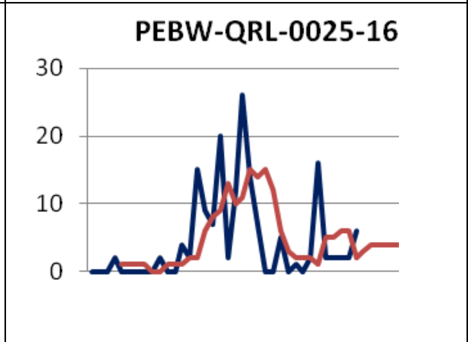

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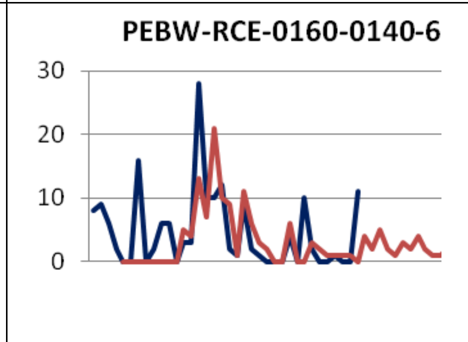

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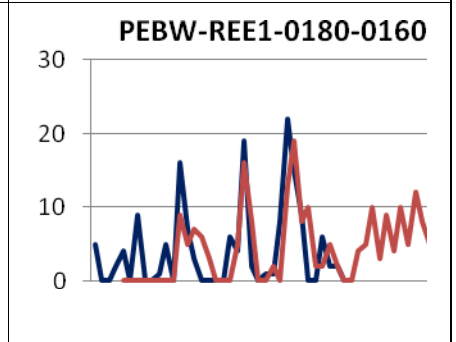

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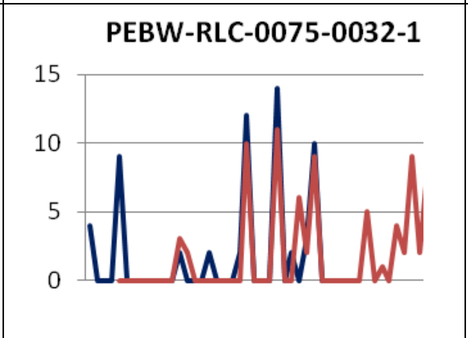

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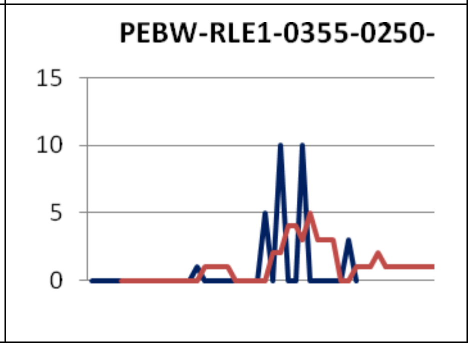

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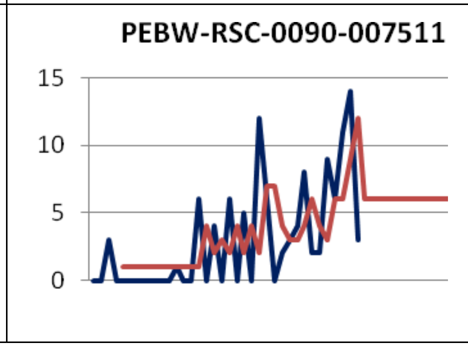

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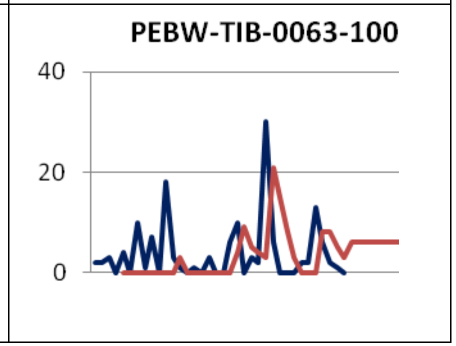

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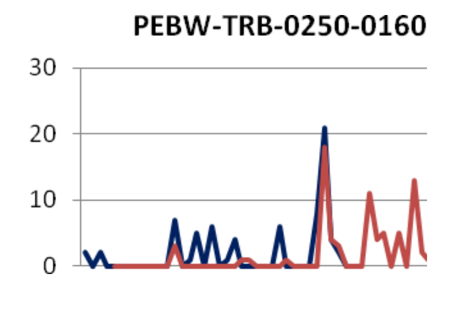

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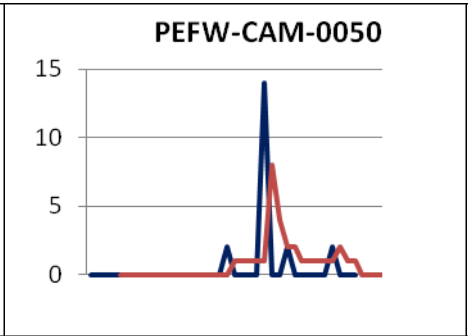

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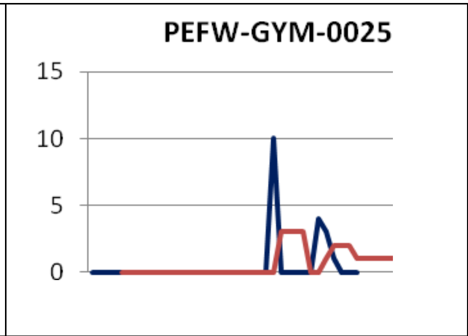

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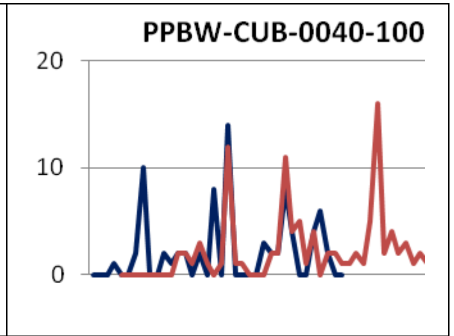

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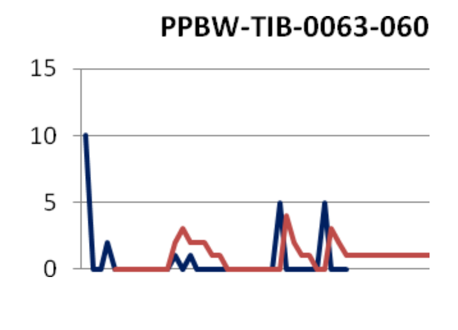

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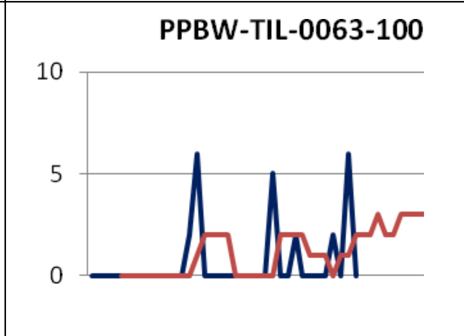

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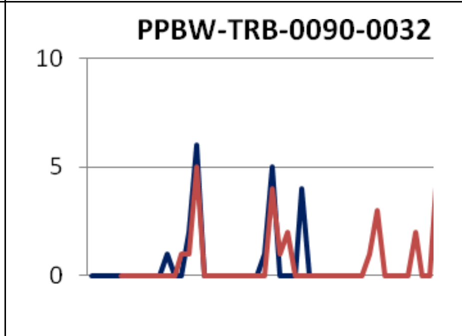

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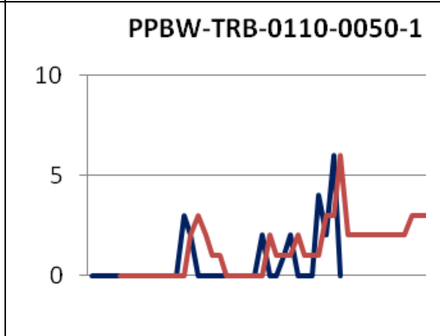

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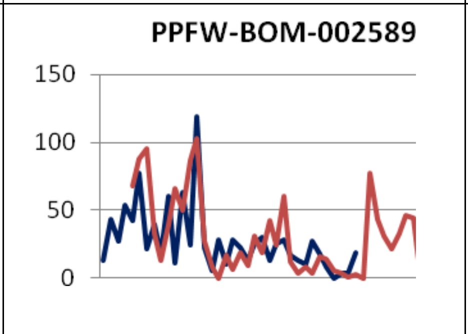

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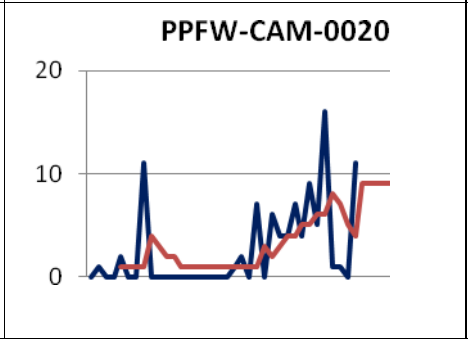

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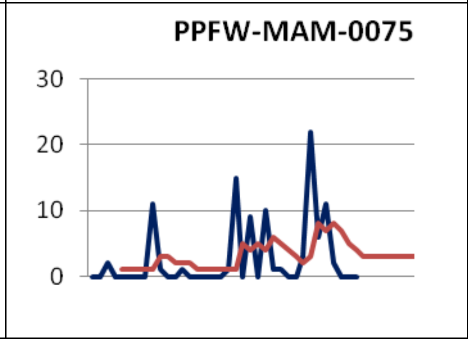

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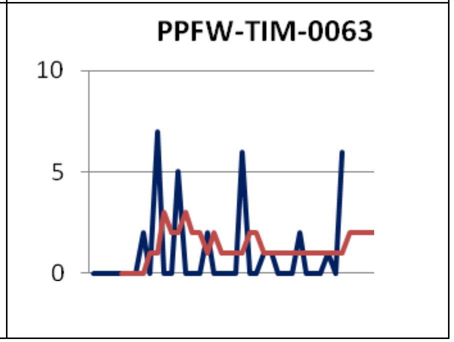
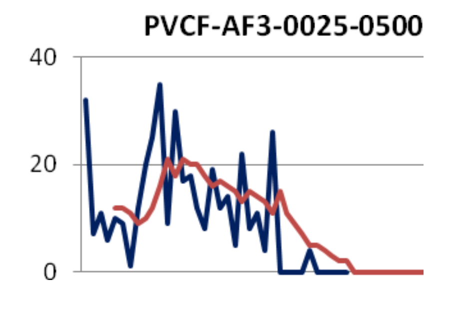
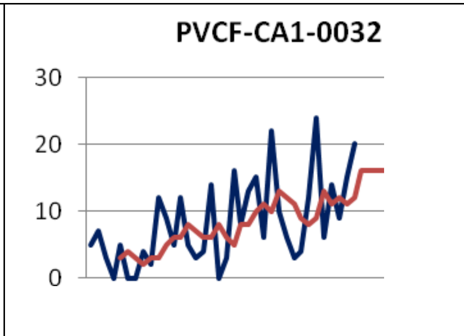
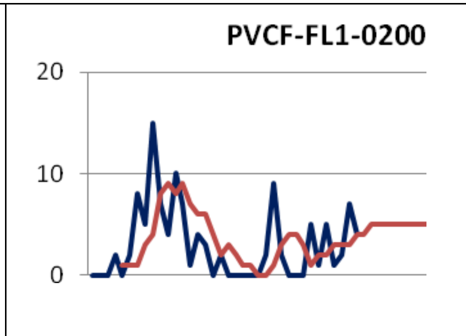
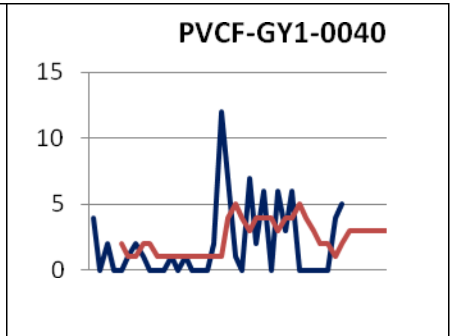
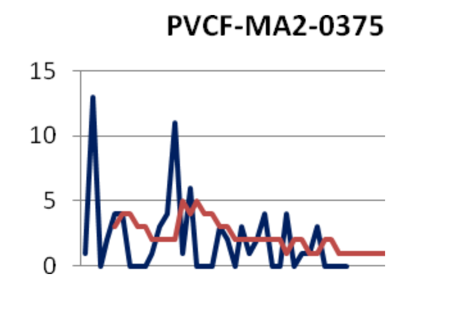
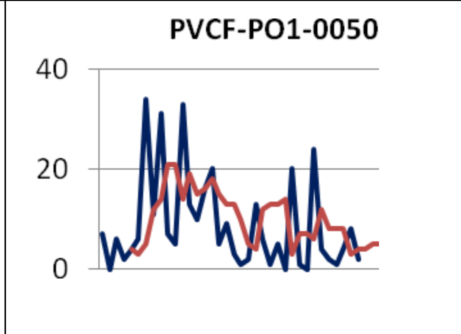
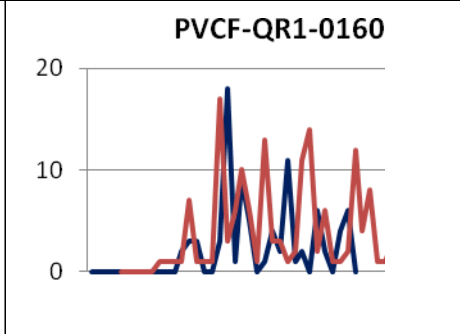
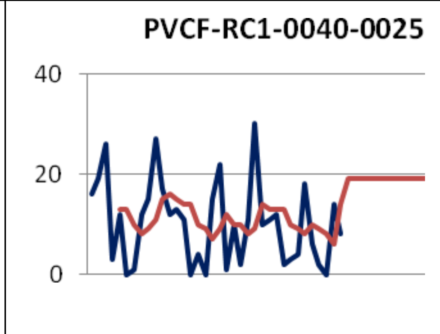
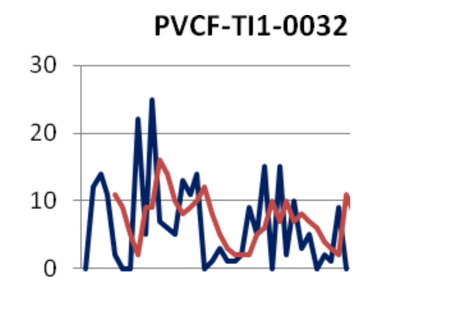
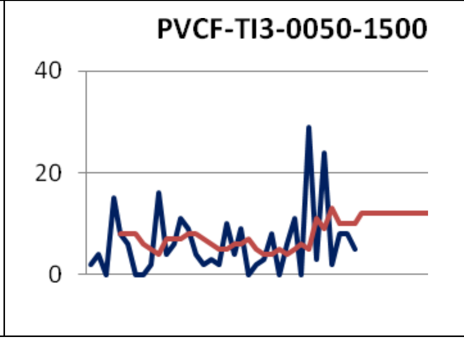
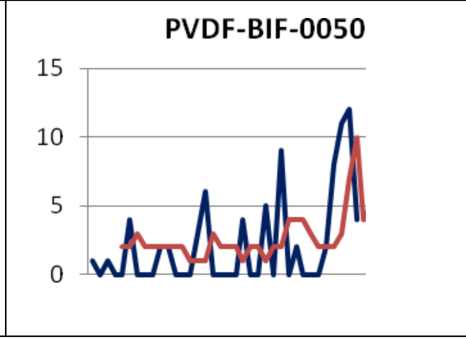
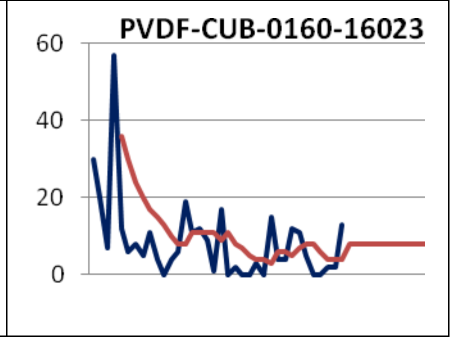
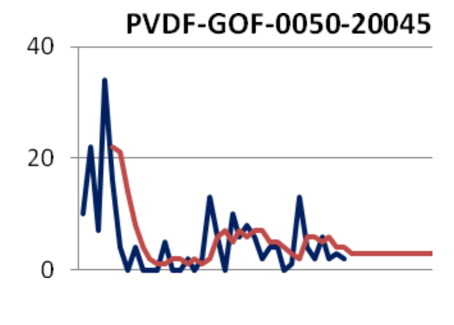
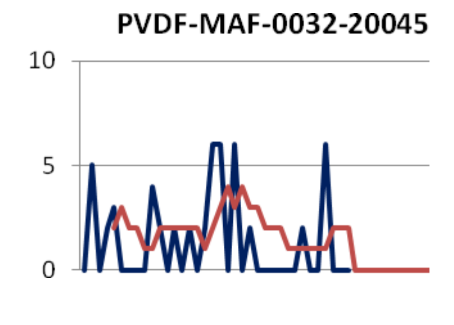
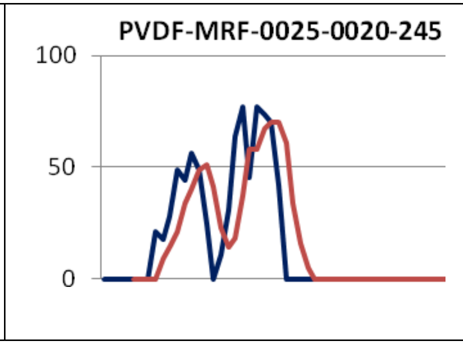


221		222		223		224	
225		226		227		228	
229		230		231		232	

233	PVDF-GOF-0050-20045 40 20 0	234	PVDF-MAF-0032-20045 10 5 0	235	PVDF-MRF-0025-0020-245 100 50 0

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