ภาคผนวก

1. Code Program วิธี Key Gas

```
%Gas_intp.m
n=input('Enter years in service:');
CO=input('Enter CO (ppm):');
H2=input('Enter H2 (ppm):');
CH4=input('Enter CH4 (ppm):');
C2H2=input('Enter C2H2 (ppm):');
C2H4=input('Enter C2H4 (ppm):');
C2H6=input('Enter C2H6 (ppm):');
TCG=CO+H2+CH4+C2H2+C2H4+C2H6;
fprintf('TCG is:%d\n',TCG)
percentCO=(CO*100)/TCG;
fprintf('The percentage CO is:%5.2f\n',percentCO)
percentH2=(H2*100)/TCG;
fprintf('The percentage H2 is:%5.2f\n',percentH2)
percentCH4=(CH4*100)/TCG;
fprintf('The percentage CH4 is:%5.2f\n',percentCH4)
percentC2H2=(C2H2*100)/TCG;
fprintf('The percentage C2H2 is:%5.2f\n',percentC2H2)
percentC2H4=(C2H4*100)/TCG;
fprintf('The percentage C2H4 is:%5.2f\n',percentC2H4)
percentC2H6=(C2H6*100)/TCG;
fprintf('The percentage C2H6 is:%5.2f\n',percentC2H6)
if (H2>=100 & CH4 >=120 & C2H6>=65 & C2H4>=50 & C2H2>=35 & CO>=350 &
TCG>=720)
  disp('Limits of Dissolved Gases form IEEE.')
  if (percentCO>percentH2&percentCO>percentC2H2&percentCO>percentC2H4)
  disp('Key Gas is CO the pattern of overheated cellulose.')
  elseif (percentC2H4>percentCO&percentC2H4>percentH2&percentC2H4>percentC2H2)
  disp('Key Gas is C2H4 the pattern of overheated oil.')
```

```
    elseif
(percentH2>percentCO&percentH2>percentC2H4&percentH2>percentC2H2&percentC2H2<per
centCO)
    disp('Key Gas is H2 the pattern of corona in oil.')
    elseif
(percentH2>percentC2H2&percentC2H2>percentCO&percentC2H2>percentC2H4&percentC2H
2>20)
    disp('Key Gas is C2H2 the pattern of arcing in oil.')
    end
elseif(H2>=200 & CH4 >=50 & C2H6>=35 & C2H4>=80 & C2H2>=5 & CO>=500 )
    disp('Limits of Dissolved Gases form Dornenburg/Stritt.')
    if (percentCO>percentH2&percentCO>percentC2H2&percentCO>percentC2H4)
    disp('Key Gas is CO the pattern of overheated cellulose.')
    elseif (percentC2H4>percentCO&percentC2H4>percentH2&percentC2H4>percentC2H2)
    disp('Key Gas is C2H4 the pattern of overheated oil.')
    elseif
(pereentH2>percentCO&percentH2>percentC2H4&percentH2>percentC2H2&percentC2H2<per
centCO)
    disp('Key Gas is H2 the pattern of corona in oil.')
    elseif
(percentH2>percentC2H2&percentC2H2>percentCO&percentC2H2>percentC2H4&percentC2H
2>20)
    disp('Key Gas is C2H2 the pattern of arcing in oil.')
    end
elseif(H2>=500 & CH4 >=125 & C2H6>=75 & C2H4>=175 & C2H2>=7 & CO>=750)
    disp('Limits of Dissolved Gases form Bureau of Reclamation.')
    if (percentCO>percentH2&pereentCO>percentC2H2&percentCO>percentC2H4)
    disp('Key Gas is CO the pattern of overheated cellulose.')
    elseif (percentC2H4>percentCO&percentC2H4>percentH2&percentC2H4>percentC2H2)
    disp('Key Gas is C2H4 the pattern of overheated oil.')
```

```
   elseif
(percentH2>percentCO&percentH2>percentC2H4&percentH2>percentC2H2&percentC2H2<per
centCO)
   disp('Key Gas is H2 the pattern of corona in oil.')
   elseif
(percentH2>percentC2H2&percentC2H2>percentCO&percentC2H2>percentC2H4&percentC2H
2>20)
   disp('Key Gas is C2H2 the pattern of arcing in oil.')
   end
elseif(H2>=(20*n+50)&CH4>=(20*n+50)&C2H6>=(20*n+50)&C2H4>=(20*n+50)&C2H2>=(
5*n+10)&CO>=(25*n+500)&TCG>=(100*n+1500))
   disp('Limits of Dissolved Gases form Age Compensated.')
   if (percentCO>percentH2&percentCO>percentC2H2&percentCO>percentC2H4)
   disp('Key Gas is CO the pattern of overheated cellulose.')
   elseif (percentC2H4>percentCO&percentC2H4>percentH2&percentC2H4>percentC2H2)
   disp('Key Gas is C2H4 the pattern of overheated oil.')
   elseif
(percentH2>percentCO&percentH2>percentC2H4&percentH2>percentC2H2&percentC2H2<per
centCO)
   disp('Key Gas is H2 the pattern of corona in oil.')
   elseif
(percentH2>percentC2H2&percentC2H2>percentCO&percentC2H2>percentC2H4&percentC2H
2>20)
   disp('Key Gas is C2H2 the pattern of arcing in oil.')
   end
else
   disp('Normal')
end
x=[percentCO;percentH2;percentCH4;percentC2H2;percentC2H4;percentC2H6];
bar(x)
text(0.8,-4,'(CO)','FontSize',[10])
text(1.8,-4,'(H2)','FontSize',[10])
```

```
text(2.8,-4,'(CH4)','FontSize',[10])
text(3.8,-4,'(C2H2)','FontSize',[10])
text(4.8,-4,'(C2H4)','FontSize',[10])
text(5.8,-4,'(C2H6)','FontSize',[10])
grid on
ylabel('[%Combustibles]');
title('Key Gases Method : Maximum gas from graph')
```

2. Code Program วิธี The Amount of Key Gases

```
%amount_intp.m
H2=input('Enter H2 (ppm):');
CH4=input('Enter CH4 (ppm):');
C2H6=input('Enter C2H6 (ppm):');
C2H4=input('Enter C2H4 (ppm):');
CO=input('Enter CO (ppm):');
CO2=input('Enter CO2 (ppm):');
Gas=char('H2(ppm)=Normal<150                    Abnormal>1000','CH4(ppm)=Normal<25
Abnormal>80',...
  'C2H6(ppm)=Normal<10   Abnormal>35','C2H4(ppm)=Normal<20   Abnormal>100',...
  'CO(ppm)=Normal<500    Abnormal>1000','CO2(ppm)=Normal<10000  Abnormal>15000')
Value=[H2;CH4;C2H6;C2H4;CO;CO2];
disp('A mount of key gases method');
fprintf('\nInterpretation is\n')
if (H2<150)
  disp('Quanlity of H2 is normal.')
elseif (H2>1000)
  disp( 'Quanlity of H2 is abnormal(arcing,corona).')
end
if (CH4<25)
  disp('Quanlity of CH4 is normal.')
elseif (CH4>80)
  disp('Quanlity of CH4 is  abnormal(sparking).')
```

```
end
if (C2H6<10)
  disp('Quanlity of C2H6 is normal.')
elseif (C2H6>35)
   disp('Quanlity of C2H6 is abnormal(local overheating).')
end
if (C2H4<20)
   disp('Quanlity of C2H4 is normal.')
elseif (C2H4>100)
   disp('Quanlity of C2H4 is abnormal(severe overheating).')
end
if (CO<500)
   disp('Quanlity of CO is normal.')
elseif (CO>1000)
   disp('Quanlity of CO is abnormal(severe overloading).')
end
if (CO2<10000)
   disp('Quanlity of  CO2 is normal.')
elseif (CO2>15000)
   disp('Quanlity of CO2 are abnormal(severe overloading).')
end
```

3. Code Program วิธี Döernenburg Ratio

```
%Doernenburg Ratio_intp.m
H2=input('Enter H2 (ppm):');
CH4=input('Enter CH4 (ppm):');
CO=input('Enter CO (ppm):');
C2H2=input('Enter C2H2 (ppm):');
C2H4=input('Enter C2H4 (ppm):');
C2H6=input('Enter C2H6 (ppm):');
% R is Ratio
R1=CH4/H2;
R2=C2H2/C2H4;
R3=C2H2/CH4;
R4=C2H6/C2H2;
disp('Result of Analysis :')
    if(R1>1.0 & R2<0.75)
        if(R3<0.3)
          if(R4>0.4)
            disp('Thermal Fault.')
          else
            disp('Thermal Fault.')
          end
        else
          disp('Fault not identifiable resmple.')
        end
    elseif((R1>1.0 & R2<0.75 & R4>0.4)|(R1>1.0 & R3<0.3 & R4>0.4)|(R2<0.75 & R3<0.3 &
R4>0.4))
       disp('Thermal Fault.')
    elseif(R1<0.1)
      if(R2>=0.75)
        if(R3<0.3)
          if(R4>0.4)
            disp('Corona (Low Intensity PD).')
```

```
            else
               disp('Corona (Low Intensity PD).')
            end
          else
            disp('Fault not identifiable resmple.')
          end
        else
          disp('Fault not identifiable resmple.')
        end
      elseif((R1<0.1 & R2>=0.75 & R4>0.4)|(R1<0.1 & R3<0.3 & R4>0.4)|(R2>=0.75 & R3<0.3
& R4>0.4))
        disp('Corona (Low Intensity PD).')
      elseif(R1>=0.1 & R1<=1.0)
        if (R2>0.75)
          if(R3>0.3)
            if(R4<0.4)
              disp('Arcing(High Intensity PD).')
            else
              disp('Arcing(High Intensity PD).')
            end
          else
            disp('Fault not identifiable resmple.')
          end
        else
          disp('Fault not identifiable resmple.')
        end
      elseif((R1>=0.1 & R1<=1.0 & R2>0.75 & R4<0.4)|(R1>=0.1 & R1<=1.0 & R3>0.3 &
R4<0.4)|(R2>0.75 & R3>0.3 & R4<0.4))
        disp('Arcing(High Intensity PD).')
      else
        disp('Fault not identifiable resmple.')
      end
```

4. Code Program วิธี Roger Ratio

```
%Rogers Ratio_intp.m
H2=input('Enter H2 (ppm):');
CH4=input('Enter CH4 (ppm):');
C2H6=input('Enter C2H6 (ppm):');
C2H4=input('Enter C2H4 (ppm):');
C2H2=input('Enter C2H2 (ppm):');
R1=CH4/H2; % R is Ratio
R2=C2H2/C2H4;
R3=C2H4/C2H6;
disp('Result of Analysis :')
if (R1<0.1)
   if(R2>=0.1 & R2<=1.0)
      if(R3<1.0)
         disp('Case 0: No Fault or Unit Normal.')
         else(R3>=1.0 & R3<=3.0)
         disp('Case 3: Low temperature thermal overloading.')
      end
   elseif(R2>1.0 & R3>=1.0 & R3<=3.0)
      disp('Case 4: Thermal < 700 celsius.')
   elseif(R2>1.0 & R3>3.0)
      disp('Case 5: Thermal > 700 celsius.')
   elseif((R2>1.0 & R3>=1.0 & R3<=3.0)|(R3>=1.0 & R3<=3.0))
      disp('Case 4: Thermal < 700 celsius.')
   elseif((R2>1.0 & R3>3.0)|(R3>3.0))
      disp('Case 5: Thermal > 700 celsius.')
   elseif(R2>1.0)
      disp('Case 4: Thermal < 700 celsius or Case 5: Thermal > 700 celsius.')
   elseif(R3>=1.0 & R3<=3.0)
      disp('Case 3: Low temperature thermal overloading.')
   end
```

```
elseif((R1<0.1 & R2<0.1 & R3<1.0)|(R1<0.1 & R2<0.1)|(R2<0.1 & R3<1.0)|(R1<0.1 & R3<1.0))
   disp('Case 1: PD ratio Influence voltage (RIV).')
elseif((R1>=1.0 & R1<=3.0 & R2>=0.1 & R2<=1.0 & R3>3.0)|(R1>=1.0 & R1<=3.0 & R2>=0.1 & R2<=1.0)|(R2>=0.1 & R2<=1.0 & R3>3.0)|(R1>=1.0 & R1<=3.0 & R3>3.0))
   disp('Case 2: High energy arcing.')
elseif(R2>1.0 & R3>=1.0 & R3<=3.0)
   disp('Case 4: Thermal < 700 celsius.')
elseif(R2>1.0 & R3>3.0)
   disp('Case 5: Thermal > 700 celsius.')
elseif(R2>=0.1 & R2<=1.0 & R3>=1.0 & R3<=3.0)
   disp('Case 3: Low temperature thermal overloading.')
elseif(R1<0.1 & R2>=0.1 & R2<=1.0)
   disp('Case 3: Low temperature thermal overloading.')
   else
   disp('Fault not identifiable resmple.')
end
```

5. Code Program วิธี Key Gas จากหม้อแปลง 20 ตัว

```
%    DGA by Key Gases Method
%    Tranformer  O2     N2     CO2    CO     H2     CH4    C2H2   C2H4   C2H6
%    tf          ppm    ppm    ppm    ppm    ppm    ppm    ppm    ppm    ppm
%define data
data= [1         2799   66637  9596   1737   2004   9739   5      5113   2750
       2         1201   16043  1290   640    35882  8470   7      90     2139
       3         2615   13407  241    145    57     13     12     11     0
       4         13647  60177  189    0      760    88     0      0      0
       5         3105   56338  554    621    1308   335    6      86     112
       6         6215   71620  973    400    1127   137    524    154    71
       7         20887  60779  1896   375    354    4161   73     6614   2476
       8         2950   15100  163    48     10     5      2      2      2
       9         22297  52323  1136   370    120    1029   36     3139   872
       10        3540   15300  290    133    50     10     12     10     2
       11        5901   22134  96     8      0      0      0      0      0
       12        27599  64492  714    362    111    1607   38     2019   771
       13        6930   24279  64     360    102    123    40     95     69
       14        9250   81154  170    371    135    125    42     53     70
       15        5162   22301  35     1      0      1      0      0      0
       16        12059  68122  186    4      0      2      0      8      2
       17        18000  58000  1500   540    210    1100   11     4500   1400
       18        11069  59497  1985   461    770    1420   40     1452   401
       19        7217   55884  1386   354    168    1353   63     3281   581
       20        2488   76772  6649   837    9817   36962  213    7836   11608 ];

tf=data(:,1);   O2=data(:,2);   N2=data(:,3);   CO2=data(:,4);
CO=data(:,5);   H2=data(:,6);   CH4=data(:,7);   C2H2=data(:,8);
C2H4=data(:,9);  C2H6=data(:,10);

% Total Combustible Gases
TCG=CO+H2+CH4+C2H2+C2H4+C2H6;
```

```
percentCO=(CO*100)./TCG;
percentH2=(H2*100)./TCG;
percentCH4=(CH4*100)./TCG;
percentC2H2=(C2H2*100)./TCG;
percentC2H4=(C2H4*100)./TCG;
percentC2H6=(C2H6*100)./TCG;

Percent=[percentCO percentH2 percentCH4 percentC2H2 percentC2H4 percentC2H6];
% results data percent of Gases
A=0; B=0; C=0; D=0; E=0;
fprintf('Key gases method\n');
for i=1:1:20
    fprintf('\n Transformer %d\n\n ',i)
    if (data(i,6)>=100 & data(i,7)>=120 & data(i,10)>=65 & data(i,9)>=50 & data(i,8)>=35
& data(i,5)>=350)
    disp('Limits of Dissolved Gases form IEEE.')
    if(Percent(i,1)>Percent(i,2)&Percent(i,1)>Percent(i,4)&Percent(i,1)>Percent(i,5))
    A=A+1;
    disp('Key Gas is CO the pattern of overheated cellulose.')
elseif(Percent(i,5)>Percent(i,1)&Percent(i,5)>Percent(i,2)&Percent(i,5)>Percent(i,4))
    B=B+1;
    disp('Key Gas is C2H4 the pattern of overheated oil.')
elseif(Percent(i,2)>Percent(i,1)&Percent(i,2)>Percent(i,5)&Percent(i,2)>Percent(i,4)&Percent(i,4
)<Percent(i,1))
    C=C+1;
    disp('Key Gas is H2 the pattern of corona in oil.')
elseif(Percent(i,2)>Percent(i,4)&Percent(i,4)>Percent(i,1)&Percent(i,4)>Percent(i,5)&Percent(i,4
)>20)
    D=D+1;
    disp('Key Gas is C2H2 the pattern of arcing in oil.')
    end
```

```
elseif(data(i,6)>=200 & data(i,7)>=50 & data(i,10)>=35 & data(i,9)>=80 &
data(i,8)>=5 & data(i,5)>=500)
disp('Limits of Dissolved Gases form Dornenburg/Stritt.')
if(Percent(i,1)>Percent(i,2)&Percent(i,1)>Percent(i,4)&Percent(i,1)>Percent(i,5))
A=A+1;
disp('Key Gas is CO the pattern of overheated cellulose.')
elseif(Percent(i,5)>Percent(i,1)&Percent(i,5)>Percent(i,2)&Percent(i,5)>Percent(i,4))
B=B+1;
disp('Key Gas is C2H4 the pattern of overheated oil.')
elseif(Percent(i,2)>Percent(i,1)&Percent(i,2)>Percent(i,5)&Percent(i,2)>Percent(i,4)&Percent(i,4
)<Percent(i,1))
C=C+1;
disp('Key Gas is H2 the pattern of corona in oil.')
elseif(Percent(i,2)>Percent(i,4)&Percent(i,4)>Percent(i,1)&Percent(i,4)>Percent(i,5)&Percent(i,4
)>20)
D=D+1;
disp('Key Gas is C2H2 the pattern of arcing in oil.')
end
elseif(data(i,6)>=500 & data(i,7)>=125 & data(i,10)>=75 & data(i,9)>=175 &
data(i,8)>=7 & data(i,5)>=750)
disp('Limits of Dissolved Gases form Bureau of Reclamation.')
if(Percent(i,1)>Percent(i,2)&Percent(i,1)>Percent(i,4)&Percent(i,1)>Percent(i,5))
A=A+1;
disp('Key Gas is CO the pattern of overheated cellulose.')

elseif(Percent(i,5)>Percent(i,1)&Percent(i,5)>Percent(i,2)&Percent(i,5)>Percent(i,4))
B=B+1;
disp('Key Gas is C2H4 the pattern of overheated oil.')
elseif(Percent(i,2)>Percent(i,1)&Percent(i,2)>Percent(i,5)&Percent(i,2)>Percent(i,4)&Percent(i,4
)<Percent(i,1))
C=C+1;
disp('Key Gas is H2 the pattern of corona in oil.')
```

```
elseif(Percent(i,2)>Percent(i,4)&Percent(i,4)>Percent(i,1)&Percent(i,4)>Percent(i,5)&Percent(i,4
)>20)
                    D=D+1;
                disp('Key Gas is C2H2 the pattern of arcing in oil.')
            end
          else
              disp('Normal')
                E=E+1;
        end
fprintf('\n==========================================================================')
       end
      sum(A);
      fprintf('\n\n\n Key Gas is CO the pattern of overheated cellulose. : %d \n',sum(A))
      sum(B);
      fprintf('\n Key Gas is C2H4 the pattern of overheated oil. : %d \n',sum(B))
      sum(C);
      fprintf('\n Key Gas is H2 the pattern of corona in oil. : %d  \n',sum(C))
      sum(D);
      fprintf('\n Key Gas is C2H2 the pattern of arcing in oil. : %d  \n',sum(D))
      sum(E);
      fprintf('\n Normal. : %d \n',sum(E))
fprintf('\n==========================================================================')
      Total=sum(A)+sum(B)+sum(C)+sum(D)+sum(E);
      percentA=(sum(A)*100)/Total;
      fprintf('\n\n\n Percent of Key Gas is CO the pattern of overheated cellulose. : %d
\n',percentA)
      percentB=(sum(B)*100)/Total;
      fprintf('\n Percent of Key Gas is C2H4 the pattern of overheated oil. : %d \n',percentB)
      percentC=(sum(C)*100)/Total;
      fprintf('\n Percent of Key Gas is H2 the pattern of corona in oil. : %d  \n',percentC)
      percentD=(sum(D)*100)/Total;
      fprintf('\n Percent of Key Gas is C2H2 the pattern of arcing in oil. : %d  \n',percentD)
```

```
percentE=(sum(E)*100)/Total;
fprintf('\n Percent of Normal. : %d  \n',percentE)

% figure display
set(gcf,'NumberTitle','off','Name','DGA by key gases method',...
'Position',[100,100,600,450],'Color',[0.94,0.94,0.99])
Y=[percentA percentB percentC percentD percentE];
H=pie(Y);
textObjs=findobj(H,'Type','text');
OldStr=get(textObjs,{'String'});
Val=get(textObjs,{'Extent'});
Names={'overheated cellulose :'  ;'overheated oil :  ';'corona in oil :  ';'arcing in oil :
';'Normal :'};
NewStr=strcat(Names,OldStr);
set(textObjs,{'String'},NewStr,'FontSize',[11])
title('DGA by key gases method','FontSize',[13])
```

6. Code Program ของทั้ง 4 วิธี จากหม้อแปลง 20 ตัว

```
% DGA  Method
%   Tranformer  O2     N2     CO2   CO    H2     CH4    C2H2  C2H4  C2H6
%   tf          ppm    ppm    ppm   ppm   ppm    ppm    ppm   ppm   ppm
%define data
data= [1        2799   66637  9596  1737  2004   9739   5     5113  2750
       2        1201   16043  1290  640   35882  8470   7     90    2139
       3        2615   13407  241   145   57     13     12    11    0
       4        13647  60177  189   0     760    88     0     0     0
       5        3105   56338  554   621   1308   335    6     86    112
       6        6215   71620  973   400   1127   137    524   154   71
       7        20887  60779  1896  375   354    4161   73    6614  2476
       8        2950   15100  163   48    10     5      2     2     2
       9        22297  52323  1136  370   120    1029   36    3139  872
       10       3540   15300  290   133   50     10     12    10    2
       11       5901   22134  96    8     0      0      0     0     0
       12       27599  64492  714   362   111    1607   38    2019  771
       13       6930   24279  64    360   102    123    40    95    69
       14       9250   81154  170   371   135    125    42    53    70
       15       5162   22301  35    1     0      1      0     0     0
       16       12059  68122  186   4     0      2      0     8     2
       17       18000  58000  1500  540   210    1100   11    4500  1400
       18       11069  59497  1985  461   770    1420   40    1452  401
       19       7217   55884  1386  354   168    1353   63    3281  581
       20       2488   76772  6649  837   9817   36962  213   7836  11608 ];

tf=data(:,1);  O2=data(:,2);  N2=data(:,3);  CO2=data(:,4);
CO=data(:,5);  H2=data(:,6);  CH4=data(:,7);  C2H2=data(:,8);
C2H4=data(:,9);  C2H6=data(:,10);

    TCG=CO+H2+CH4+C2H2+C2H4+C2H6; % Total Combustible Gases
    percentCO=(CO*100)./TCG;
```

```
percentH2=(H2*100)./TCG;
percentCH4=(CH4*100)./TCG;
percentC2H2=(C2H2*100)./TCG;
percentC2H4=(C2H4*100)./TCG;
percentC2H6=(C2H6*100)./TCG;
Percent=[percentCO percentH2 percentCH4 percentC2H2 percentC2H4 percentC2H6];
% results data percent of Gases
A=0; B=0; C=0; D=0;
for i=1:1:20
    fprintf('\n Transformer %d\n ',i)
    fprintf('\n1.Key gases method\n');
    if (data(i,6)>=100 & data(i,7)>=120 & data(i,10)>=65 & data(i,9)>=50 & data(i,8)>=35
& data(i,5)>=350)
    disp('Limits of Dissolved Gases form IEEE.')
      if(Percent(i,1)>Percent(i,2)&Percent(i,1)>Percent(i,4)&Percent(i,1)>Percent(i,5))
        A=A+1;
      disp('Key Gas is CO the pattern of overheated cellulose.')
elseif(Percent(i,5)>Percent(i,1)&Percent(i,5)>Percent(i,2)&Percent(i,5)>Percent(i,4))
        B=B+1;
      disp('Key Gas is C2H4 the pattern of overheated oil.')
elseif(Percent(i,2)>Percent(i,1)&Percent(i,2)>Percent(i,5)&Percent(i,2)>Percent(i,4)&Percent(i,4
)<Percent(i,1))
        C=C+1;
      disp('Key Gas is H2 the pattern of corona in oil.')
elseif(Percent(i,2)>Percent(i,4)&Percent(i,4)>Percent(i,1)&Percent(i,4)>Percent(i,5)&Percent(i,4
)>20)
        D=D+1;
      disp('Key Gas is C2H2 the pattern of arcing in oil.')
    end
  elseif(data(i,6)>=200 & data(i,7)>=50 & data(i,10)>=35 & data(i,9)>=80 &
data(i,8)>=5 & data(i,5)>=500 )
    disp('Limits of Dissolved Gases form Dornenburg/Stritt.')
```

```
if(Percent(i,1)>Percent(i,2)&Percent(i,1)>Percent(i,4)&Percent(i,1)>Percent(i,5))
   A=A+1;
disp('Key Gas is CO the pattern of overheated cellulose.')
elseif(Percent(i,5)>Percent(i,1)&Percent(i,5)>Percent(i,2)&Percent(i,5)>Percent(i,4))
   B=B+1;
disp('Key Gas is C2H4 the pattern of overheated oil.')
elseif(Percent(i,2)>Percent(i,1)&Percent(i,2)>Pereent(i,5)&Percent(i,2)>Percent(i,4)&Percent(i,4
)<Percent(i,1))
   C=C+1;
disp('Key Gas is H2 the pattern of corona in oil.')
elseif(Percent(i,2)>Percent(i,4)&Percent(i,4)>Percent(i,1)&Pereent(i,4)>Percent(i,5)&Percent(i,4
)>20)
   D=D+1;
disp('Key Gas is C2H2 the pattern of arcing in oil.')
end
elseif(data(i,6)>=500 & data(i,7)>=125 & data(i,10)>=75 & data(i,9)>=175 &
data(i,8)>=7 & data(i,5)>=750)
disp('Limits of Dissolved Gases form Bureau of Reclamation.')
if(Percent(i,1)>Percent(i,2)&Percent(i,1)>Percent(i,4)&Percent(i,1)>Percent(i,5))
   A=A+1;
disp('Key Gas is CO the pattern of overheated cellulose.')
elseif(Percent(i,5)>Percent(i,1)&Percent(i,5)>Percent(i,2)&Percent(i,5)>Percent(i,4))
   B=B+1;
disp('Key Gas is C2H4 the pattern of overheated oil.')
elseif(Percent(i,2)>Percent(i,1)&Percent(i,2)>Percent(i,5)&Percent(i,2)>Percent(i,4)&Percent(i,4
)<Percent(i,1))
   C=C+1;
disp('Key Gas is H2 the pattern of corona in oil.')
elseif(Percent(i,2)>Percent(i,4)&Percent(i,4)>Percent(i,1)&Percent(i,4)>Percent(i,5)&Percent(i,4
)>20)
   D=D+1;
disp('Key Gas is C2H2 the pattern of arcing in oil.')
```

```
            end
          else
             disp('Normal')
              E=E+1;
        end
    fprintf('\n2.A mount of key gases method \n');
    Gas=char('H2(ppm)=Normal<150                    Abnormal>1000','CH4(ppm)=Normal<25
Abnormal>80',...
    'C2H6(ppm)=Normal<10   Abnormal>35','C2H4(ppm)=Normal<20   Abnormal>100',...
    'CO(ppm)=Normal<500                             Abnormal>1000','CO2(ppm)=Normal<10000
Abnormal>15000');
    Value=[data(i,6);data(i,7);data(i,10);data(i,9);data(i,5);data(i,4)];
    fprintf('Interpretation is\n')
    if (data(i,6)<150)
       disp('Quanlity of H2 is normal.')
    elseif (data(i,6)>1000)
       disp( 'Quanlity of H2 is abnormal(arcing,corona).')
    elseif(data(i,6)>=150&data(i,6)<=1000)
       disp('Quanity of H2 would monitoring')
    end
    if (data(i,7)<25)
       disp('Quanlity of CH4 is normal.')
    elseif (data(i,7)>80)
       disp('Quanlity of CH4 is  abnormal(sparking).')
    elseif(data(i,7)>=25&data(i,7)<=80)
       disp('Quanity of CH4 would monitoring')
    end
    if (data(i,10)<10)
       disp('Quanlity of C2H6 is normal.')
    elseif (data(i,10)>35)
       disp('Quanlity of C2H6 is abnormal(local overheating).')
    elseif(data(i,10)>=10&data(i,10)<=35)
```

```
   disp('Quanity of C2H6 would monitoring')
end
if (data(i,9)<20)
   disp('Quanlity of C2H4 is normal.')
elseif (data(i,9)>100)
   disp('Quanlity of C2H4 is abnormal(severe overheating).')
elseif(data(i,9)>=20&data(i,9)<=100)
   disp('Quanity of C2H4 would monitoring')
end
if (data(i,5)<500)
   disp('Quanlity of CO is normal.')
elseif (data(i,5)>1000)
   disp('Quanlity of CO is abnormal(severe overloading).')
elseif(data(i,5)>=500&data(i,5)<=1000)
   disp('Quanity of CO would monitoring')
end
if (data(i,4)<10000)
   disp('Quanlity of  CO2 is normal.')
elseif (data(i,4)>15000)
   disp('Quanlity of CO2 are abnormal(severe overloading).')
elseif(data(i,4)>=10000&data(i,4)<=15000)
   disp('Quanity of CO2 would monitoring')
end
fprintf('\n3.Doernenburg Ratio method \n');
% R is Ratio
R1=data(i,7)/data(i,6);
R2=data(i,8)/data(i,9);
R3=data(i,8)/data(i,7);
R4=data(i,10)/data(i,8);
disp('Result of Analysis :')
 if(R1>1.0 & R2<0.75)
    if(R3<0.3)
```

```
            if(R4>0.4)
               disp('Thermal Fault.')
            else
               disp('Thermal Fault.')
            end
          else
            disp('Fault not identifiable resmple.')
          end
      elseif((R1>1.0 & R2<0.75 & R4>0.4)|(R1>1.0 & R3<0.3 & R4>0.4)|(R2<0.75 & R3<0.3 &
R4>0.4))
         disp('Thermal Fault.')
      elseif(R1<0.1)
        if(R2>=0.75)
          if(R3<0.3)
            if(R4>0.4)
              disp('Corona (Low Intensity PD).')
            else
              disp('Corona (Low Intensity PD).')
            end
          else
            disp('Fault not identifiable resmple.')
          end
        else
          disp('Fault not identifiable resmple.')
        end
      elseif((R1<0.1 & R2>=0.75 & R4>0.4)|(R1<0.1 & R3<0.3 & R4>0.4)|(R2>=0.75 & R3<0.3
& R4>0.4))
         disp('Corona (Low Intensity PD).')
      elseif(R1>=0.1 & R1<=1.0)
        if (R2>0.75)
          if(R3>0.3)
            if(R4<0.4)
```

```
            disp('Arcing(High Intensity PD).')
          else
            disp('Arcing(High Intensity PD).')
          end
        else
          disp('Fault not identifiable resmple.')
        end
      else
        disp('Fault not identifiable resmple.')
      end
    elseif((R1>=0.1 & R1<=1.0 & R2>0.75 & R4<0.4)|(R1>=0.1 & R1<=1.0 & R3>0.3 &
R4<0.4)|(R2>0.75 & R3>0.3 & R4<0.4))
      disp('Arcing(High Intensity PD).')
    else
      disp('Fault not identifiable resmple.')
    end
fprintf('\n4.Roger Ratio method \n');
    % R is Ratio
    R1=data(i,8)/data(i,9);
    R2=data(i,7)/data(i,6);
    R3=data(i,9)/data(i,10);
disp('Result of Analysis :')
if (R1<0.1)
  if(R2>=0.1 & R2<=1.0)
    if(R3<1.0)
      disp('Case 0: No Fault or Unit Normal.')
      else(R3>=1.0 & R3<=3.0)
      disp('Case 3: Low temperature thermal overloading.')
    end
  elseif(R2>1.0 & R3>=1.0 & R3<=3.0)
    disp('Case 4: Thermal < 700 celsius.')
  elseif(R2>1.0 & R3>3.0)
```

```
    disp('Case 5: Thermal > 700 celsius.')
  elseif((R2>1.0 & R3>=1.0 & R3<=3.0)|(R3>=1.0 & R3<=3.0))
    disp('Case 4: Thermal < 700 celsius.')
  elseif((R2>1.0 & R3>3.0)|(R3>3.0))
    disp('Case 5: Thermal > 700 celsius.')
  elseif(R2>1.0)
    disp('Case 4: Thermal < 700 celsius or Case 5: Thermal > 700 celsius.')
  elseif(R3>=1.0 & R3<=3.0)
    disp('Case 3: Low temperature thermal overloading.')
  end
elseif((R1<0.1 & R2<0.1 & R3<1.0)|(R1<0.1 & R2<0.1)|(R2<0.1 & R3<1.0)|(R1<0.1 &
R3<1.0))
  disp('Case 1: PD ratio Influence voltage (RIV).')
elseif((R1>=1.0 & R1<=3.0 & R2>=0.1 & R2<=1.0 & R3>3.0)|(R1>=1.0 & R1<=3.0 & R2>=0.1
& R2<=1.0)|(R2>=0.1 & R2<=1.0 & R3>3.0)|(R1>=1.0 & R1<=3.0 & R3>3.0))
  disp('Case 2: High energy arcing.')
elseif(R2>1.0 & R3>=1.0 & R3<=3.0)
  disp('Case 4: Thermal < 700 celsius.')
elseif(R2>1.0 & R3>3.0)
  disp('Case 5: Thermal > 700 celsius.')
elseif(R2>=0.1 & R2<=1.0 & R3>=1.0 & R3<=3.0)
  disp('Case 3: Low temperature thermal overloading.')
elseif(R1<0.1 & R2>=0.1 & R2<=1.0)
  disp('Case 3: Low temperature thermal overloading.')
  else
  disp('Fault not identifiable resmple.')
end
   fprintf('\n==========\n')
 end
```