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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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24p. diagrams

OFFICE : No. 201 Mahestan Bld. Enghelab Sqr. TEHRAN IRAN
Tel. 00 98 21-6432854
Fax 00 98 21-6420759
Po.Bo. 18915-133

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REPORT

CONVERSION OF

MONARK Co.

HOT CHAMBER

FINAL REPORT

Contract No. 97/331P

UNIDO's PROJECT No. MP/IRA/96/041

Jan 1999

Factory : No. 4 Irqy Street Rajaii. Street TEHRAN IRAN
Telfax 0098-21-5052836 Po.Bo. 18915-133

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SYNOPSIS

Under supreme supervision of **UNIDO** the **CFC** phase project has been implemented in Iran to phase out 100 % ODS in some Iranian White Industries

The project No. **MP/IRA/96/041** has been nominated to Islamic Republic of Iran for the Multilateral Fund for the implementation of The Montreal Protocol Financing.

The project was approved by Montreal Protocol Multilateral Fund executive committee. The project was actually started in November 1994, but the implementation of the project has been already started from January 1994, by recommendation of Montreal Protocol and request of Government of Islamic Republic of Iran, the refrigerant R134a was finally approved and selected by **UNIDO** as an alternative for refrigerant R12.

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INTRODUCTION

According to **UNIDO** contract No. **97/331P** with Industrial Control Research Center Co. **(ICRC)** the existing ***Monark Co.*** hot chambers facilities shall be converted and modified to phase out CFC-12 and suitable for **R134a** refrigerant to perform functionality and performance test of converted refrigerators and complying with ISO standards 7173, 8187, and 5155.

1 This project has been prepared based on the requirements of Islamic Republic of Iran indicated in the country program no *UNEP/OZL.PRO/EX COM/10/24* dated 27 May 1993 prepared by **UNDP**.

2 The **CFC** phase out project in ***Monark Co.*** will enable ***Monark Co.*** to convert the existing production line facilities and existing hot chambers into Non CFC production line, using **R134a** refrigerant.

3 The converted Hot Chamber Installations will provide more than 20 data points in the refrigeration circuit this means more information and the ability of analyzing refrigeration system and new refrigerant effect.

6 The reconstructed Hot Chamber will be able to check and test one refrigerator and/or ref.-freezers units at the same time. The same equipment and data processing system, as will be used at plant test room will be installed in this chamber.

7 The immediate effect of this project at ***Monark Co.*** is to perform all required check and tests, suitable for Refrigerator & Freezers using Ozone Friendly Gases. The existing test facilities in ***Monark Co.*** are not adequate for check and testing, converted ref. and freezer units, in addition to that the hot rooms are not able to perform Energy Consumption and Optimization Program.

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ICRC Hot Chamber Characteristics

In order to convert ***Monark Co.*** hot rooms facilities , ICRC shall provide following services:

- Supply of new equipment.
- Redesign of old equipment
- Delivery of technical drawings and software.
- Installation and commissioning.
- Start-up of the equipment and the technology.
- On-the-job training of the plant personnel.

With respect to **ISO** standards test requirements, and for the purpose of functionality and performance tests of the new redesigned Refrigerator and Ref.-Freezers using R134a refrigerants. The existing hot room in ***Monark Co.*** is being converted and equipped in such a way to enable ***Monark Co.*** to check and test at least one different models of refrigerators and freezers at ambient temperature 32 to 43 degree centigrade at one hot room chambers . In addition to these services is providing. But the hot room is capable to test eight refrigerators and freezers in case of adding more transducers and sensors in the main panel in the hot room:

a) Procurement of new test measurement and data processing equipment.
b) Redesign and rebuilding of presently used equipment and installation.
c) Installation, commissioning, trial operation, start-up and on-the-job training

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MONARK HOT CHAMBER TECHNICAL SPECIFICATION

As previously mentioned , ***Monark Co.***'s plant is producing 200 refrigerator daily . And subsequently the hot chamber should have been able to cover plant daily test requirement as well as other activities. Therefore, the converted hot chamber should respond to all test requirement and be able to meet ISO standards numbers 7371, 5155, 8187 as set forth in the contract and IJISI, Iranian standards numbers 254, 2482, 2818. The plant hot chamber technical specification are as follows:

- Hot Chamber Dimension about 3.5 mt. by 4 mt.
- Refrigerator test ability simultaneously, 2 units
- Ability to perform following operational tests and report:

1 - Pull down test.
2 - Continuous run test.
3 - Cyclic run test.
4 - Ice Freeze test.
5 - Energy consumption test

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- 20 Measuring points, including. (for one applia.)

  1 - Humidity, one point for one hot room.
  2 - Compressor Power, one point
  3 - Motor current, one point.
  4 - Supply Voltage, one point.
  5 - Hot chamber air temperature reading, one point.

  160 points for eight models in case of improving the system by spending very low costs.

- Computerized graphical diagram of the refrigerator performance data sheet.

- Test measurement tolerance for temperature reading 0.3 degree centigrade.

- Computerized data processing system.

- Full color test sheet system reporting.

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- On screen and data reporting system ability with following characteristics;

1 - Test number.
2 - Product name.
3 - Product model
4 - Product internal volume
5 - Compressor name
6 - Compressor model
7 - Compressor cooling capacity
8 - Compressor current
9 - Thermostat setting
10 - Thermostat type.
11 - Total test running time.
12 - Ambient temperature.
13 - Voltage rating
14 - Working percentage
15 - Evaporator mean air temperature
16 - Cabin mean temperature
17 - Evaporator bulb temperature
18 - Crisper temperature.
19 - Actual compressor running time
20 - Energy consumption
21 - Compressor motor winding temperature
22 - Compressor shell temperature.
23 - Compressor discharge temperature.
24 - Condenser inlet temperature.
25 - Condenser out let temperature.
26 - Condenser mid temperature
27 - Evaporator inlet temperature
28 - Evaporator outlet temperature.
29 - Freezing temperature.
30 - Refrigeration system condition display.

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ACTIVITIES

The following activities were accomplished so far toward the first interim report

1 - Planning for

a) Hot chambers system management.
b) Hot chambers graphic display management.
c) Hot chambers calibration setting parameters.
d) Hot chambers test standards management

2 - Preparing all material .

3 - Installing Component and material and Data Logger Panel .

4 - Technical data collecting.

5 - Engineering testing of electronic and electrical system

6 - Hot chamber design review.

7 - Data processing software installing.

8 - Data processing hardware installing.

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9 - Thermal amplification electronic cart installing

10 - installing of timer 1 flow chart..

11 - Last test of data loggers electronic cart.

12 - Last connection of data loggers to the computers.

13 - Interface electronic cart design for PC and operating system.

14 - RTX3 electronic diagram design.

15 - RTX electronic diagram design.

16 - UNIDO, CRC - 386 design.

17 - UNIDO, TC- 100 design.

18 - UNIDO, in-out CRC design.

19 - Preparation of operating system display flow chart.

20 - Visits and coordination;

- Visiting plant four days, two engineers, one time.
- Visiting and coordinating with UNDP office .
- Technical negotiation with ***Monark Co.*** engineers in order to coordinate activities.
- Visiting hot chamber several times in order to coordinate activities.

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21 - Activities On Hot Chamber

a) Hot Chamber Heat Control Design
b) Hot Chamber Heat Capacity
c) Hot Chamber Heat Leak
d) System Control Planning
e) Cooling System Ordering

22 - Following steps were taken to manufacture hot chamber hoods

a) Designing
b) Fabricating
c) Preparing
d) Hood Installing
e) Sensors preparation
f) Sensor check and test
g) Sensor installing
h) Wiring
i) Wiring Control
j) Selecting Blower and Fan
k) Blower check and test
l) Blower installation

23- Following Component and Parts were Designed and manufactured

a) Complete Data Logger System
b) Thermal Amplifier
c) Electrical Control Panel
d) Electronic Control Panel
e) Complete Heat control system
f) Hot Air Circulation System

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SUPPLY PARTS AND MATERIALS

In order to fabricate components and electronic kits following material and parts have been purchased so far and fabricated .

1 - Semiconductor sensors for measuring temperature from - 30 to + 110 degree centigrade. 16 each

2 - Electronic humidity measurement sensor 1 each

3 - Electronic data logger cart for temperature measurement 2 each

4 - Electronic data logger cart for humidity Calibration 1 each

5 - ADC912 Converter IC for system conversion management.

6 - Electronic parts consist of resistor. IC, capacitor, and diode.

7 - Data Logger Panel

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```
Dim Black, Blue, Green
Dim Cyan, red, Magenta, YELLOW
Dim gray, L_Blue, L_Green
Dim L_cyan, L_red, L_Magenta, L_yellow

Dim prn_color As Integer 'False=Black & White ; True=Color

Dim printcolor As Integer
Dim Y, Repstr$, Rot_Txt_no%
Dim printerdrawwidth As Integer
Dim offset, PageNo
Dim Lb_Tmp As Label
Dim FirstKey

Dim Rec_Max%
      Dim SegEn
      Dim ActiveFrame     As Integer
      Dim ActiveLabel     As Integer
      Dim Seg_n           As Integer

      Dim PrnPageNo       As Integer
      Dim ActivePage      As Integer


      Dim sl%, st%, sw%, sh%, dw%
      Dim a30 As String * 30

      Dim rr() 'Extracted Results


      '
    Sub cmd_click (Index As Integer)

        Select Case Index
            Case 0                          'print
                screen.MousePointer = 11
                Cmd(0).Enabled = False
                Cmd(1).Enabled = False
                DoEvents
                Call Print_All
                Call Save_Spec
                screen.MousePointer = 0
                Cmd(0).Enabled = True
                Cmd(1).Enabled = True
                'Unload Me
```

```
        Case 1                          'Save
            nn = Variable("Prnt", "Write")
            nn = Variable("Prnt", "Read")
        Case 2                          'cancel
            Unload Me
        Case 3
            Me.Hide
            Paper.Show
    End Select
    Exit Sub
End Sub

'-------------------------------------------------------------------------------
'
Sub Color_chk_Click (Value As Integer)

    If color_chk.Value = False Then
        prn_color = False
        color = 0
        Black = color
        Blue = color
        Green = color
        Cyan = color
        red = color
        Magenta = color
        YELLOW = color
        gray = color
        L_Blue = color
        L_Green = color
        L_cyan = color
        L_red = color
        L_Magenta = color
        L_yellow = color

    Else
        prn_color = True
        Black = QBColor(0)
        Blue = QBColor(1)
        Green = QBColor(2)
        Cyan = QBColor(3)
        red = QBColor(4)
        Magenta = QBColor(5)
        YELLOW = QBColor(6)
        gray = QBColor(8)
        L_Blue = QBColor(9)
        L_Green = QBColor(10)
        L_cyan = QBColor(11)
```

```
        L_red = QBColor(12)
        L_Magenta = QBColor(13)
        L_yellow = QBColor(14)
    End If

End Sub

'-------------------------------------------------------------------------
'
Sub crv (mode$, Rec1, Rec2)

  Select Case mode$
    Case "prn"
        printer.ForeColor = Black
        printer.FontName = "Arial"
        printer.FontSize = 10
        obj = activeobj

        'print x_axis
        printer.DrawWidth = 3 * printerdrawwidth
        printer.Line (Rec1, 0)-(Rec2, 0)'axis
        printer.DrawWidth = 1
        printer.DrawStyle = 2'=DOt 3=Dash-Dot 4=Dash_Dot_Dot
        For i = -300 To 1000 Step 100
            printer.Line (Rec1, i)-(Rec2, i)
        Next i
        Rec = zoom(Seg_n).X1
        printer.DrawWidth = 3 * printerdrawwidth
        printer.ForeColor = IIf(prn_color = False, Black, zoom(Seg_n).Bord
        printer.Line (Rec, -300)-(Rec, 1000)
        printer.DrawStyle = 0 'Solid
        printer.DrawWidth = 1 * printerdrawwidth

        printer.CurrentX = Rec - RecLb(Seg_n).Width / 2
        printer.CurrentY = 1030
        printer.Print RecLb(Seg_n).Caption

        n = -1
        R1 = (Rec1 \ 10 + 1) * 10
        R2 = (Rec2 \ 10) * 10

        printer.FontSize = 5
        printer.ForeColor = Black
        For Rec = R1 To R2 Step 10
            printer.Line (Rec, 10)-(Rec, -10), Black
            n = n + 1
            If n Mod 3 = 0 Then
                B$ = Right$("0" & Rec \ 60, 2) & ":" & Right$("0" & Rec Mo
```

```
                printer.CurrentX = Rec - 2'offset / 13
                printer.CurrentY = -12
                printer.Print B$
            End If
        Next Rec

        'graph
        For n = 0 To 1
            For d = 1 To 6
                If curve_Item(n, d) < 50 Then
                    z = curve_Item(n, d)
                    If curve_color(n, d) = 15 Then col = 0 Else col = curv
                    printer.ForeColor = IIf(prn_color = False, Black, QBCo
                    For Rec = Rec1 To Rec2 - 1
                        bool1 = grf(26, Rec) = 789
                        bool2 = grf(26, Rec + 1) = 789
                        If bool1 And bool2 Then
                            Y1 = grf(z, Rec)
                            Y2 = grf(z, Rec + 1)
                            printer.Line (Rec, Y1)-(Rec + 1, Y2)
                        End If
                    Next Rec
                End If
             Next d
        Next n
    Case "grfall"
        On Error Resume Next 'Note:Karim
        obj = activeobj
        grafall.Cls
        grafall.DrawMode = 7                          '(7=xor 13=copy)
        RecAll_End = UBound(grf, 2) - 1
        If Err = 9 Then
            Rec_Max = 0
            Exit Sub
        End If
        Rec_Max = RecAll_End
        screen.MousePointer = 11
        sw = IIf(RecAll_End < 100, 100, RecAll_End)
        grafall.ScaleWidth = sw'+ recall_end \ 10
        grafall.ScaleLeft = 0
        recall_start = 1
        grafall.Line (recall_start, 0)-(RecAll_End, 0), QBColor(3)


        For n = 0 To 1
        For d = 1 To 6
          If curve_Item(n, d) < 50 Then
            z = curve_Item(n, d)
```

```
            If hr.lbt(z).Visible = True Then
              grafall.ForeColor = QBColor(curve_color(n, d))
              For Rec = recall_start To RecAll_End - 1
                If grf(26, Rec) = 789 And grf(26, Rec + 1) = 789 Then
                  grafall.Line (Rec, grf(z, Rec))-(Rec + 1, grf(z, Rec + 1
                End If
              Next Rec
            Else
                curve_Item(n, d) = 50
                hr.lbt(z).ForeColor = QBColor(0)
                hr.lbt(z).BackColor = &H202020
            End If

            End If
          Next d
        Next n
        screen.MousePointer = 0
    Case "grfzoom"
        On Error Resume Next
        obj = activeobj

        zoomarea = 30
        zoomarea2 = zoomarea \ 2
        grafzoom.ScaleWidth = zoomarea
        'X = Int(zoom.X1 + .5)
        'If X > Rec_Max Then Stop
        grafzoom.ScaleLeft = X - zoomarea2

        Rec_Start = IIf(X - zoomarea2 > 0, X - zoomarea2, 0)
        Rec_end = IIf(X + zoomarea2 < Rec_Max, X + zoomarea2, Rec_Max)

        'Rec_Start = Seg(ActiveSeg).Left
        'Rec_End = Rec_Start + Seg(ActiveSeg).Width
        'grafzoom.ScaleWidth = Seg(ActiveSeg).Width
        'grafzoom.ScaleLeft = Rec_Start

        grafzoom.Cls
        grafzoom.DrawMode = 7                          '(7=xor 13=copy)
        grafzoom.Line (Rec_Start, 0)-(Rec_end, 0), QBColor(3)
        For n = 0 To 1
        For d = 1 To 6
          If curve_Item(n, d) < 50 Then
            z = curve_Item(n, d)
            If hr.lbt(z).Visible = True Then
              grafzoom.ForeColor = QBColor(curve_color(n, d))
              For Rec = Rec_Start To Rec_end - 1
                If grf(26, Rec) = 789 And grf(26, Rec + 1) = 789 Then
                  grafzoom.Line (Rec, grf(z, Rec))-(Rec + 1, grf(z, Rec +
```

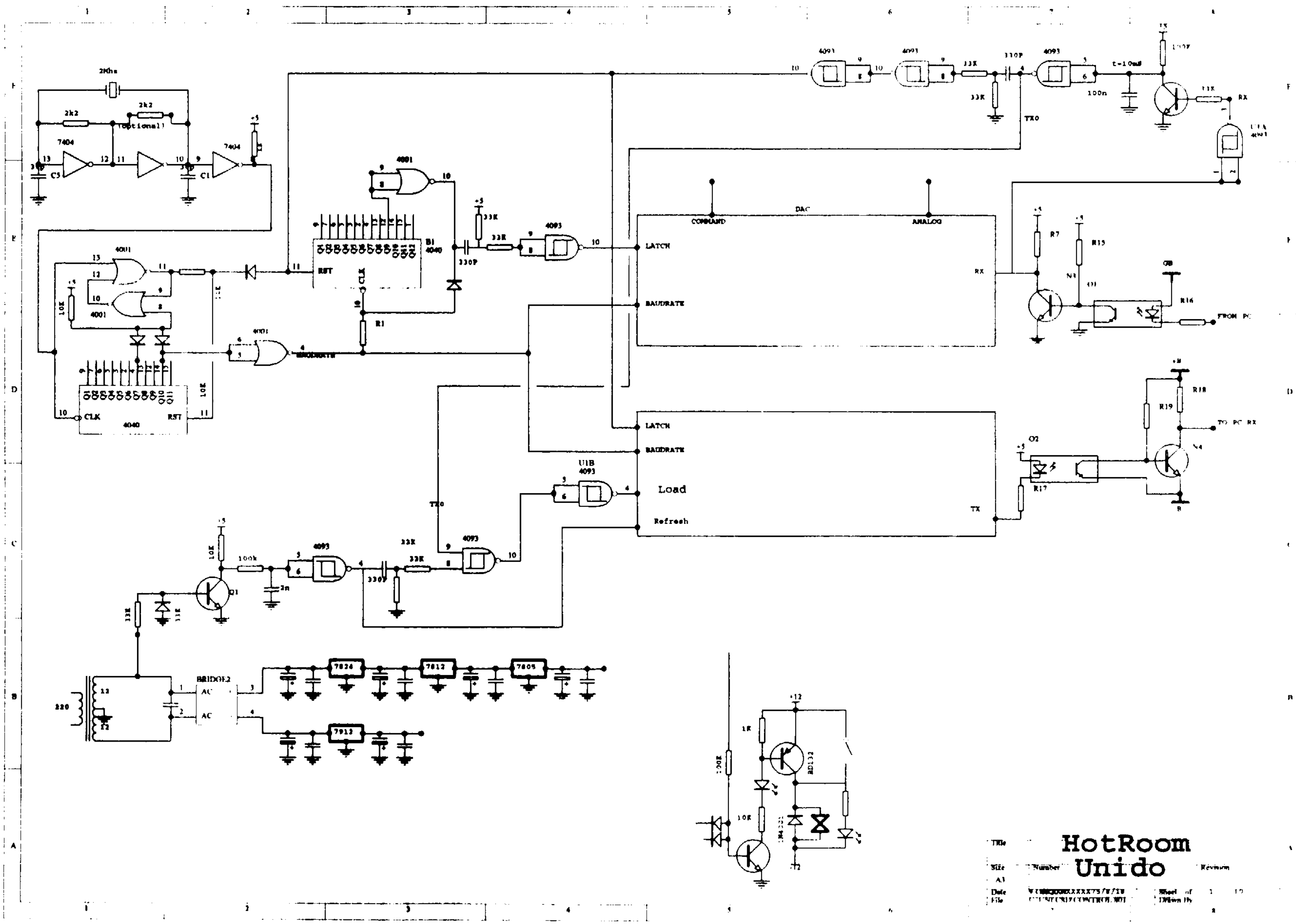
```
                End If
              Next Rec
            Else
                curve_Item(n, d) = 50
                hr.lbt(z).ForeColor = QBColor(0)
                hr.lbt(z).BackColor = &H202020
            End If

            End If
          Next d
        Next n
        screen.MousePointer = 0
        Call ResultsGrf_click
    End Select

End Sub

'
'
Sub CrvZoom ()

        On Error Resume Next
    obj = activeobj
    zoomarea = 30
    zoomarea2 = zoomarea \ 2
    grafzoom.ScaleWidth = Val(PrnLb(27)) * 60
    grafzoom.ScaleLeft = Seg(ActivePage).Left
    Rec_Start = grafzoom.ScaleLeft + 1
    Rec_end = Rec_Start + grafzoom.ScaleWidth - 1
    If Rec_end > UBound(grf, 2) Then Rec_end = UBound(grf, 2)
    grafzoom.Cls
    grafzoom.DrawMode = 7                          '(7=xor 13=copy)
    grafzoom.Line (Rec_Start, 0)-(Rec_end, 0), QBColor(3)
    For n = 0 To 1
        For d = 1 To 6
            If curve_Item(n, d) < 50 Then
                z = curve_Item(n, d)
                If hr.lbt(z).Visible = True Then
                    grafzoom.ForeColor = QBColor(curve_color(n, d))
                    If Rec_Start < 1 Then Rec_Start = 1
                    For Rec = Rec_Start To Rec_end - 1
                        bol1 = (grf(26, Rec) = 789)
                        bol2 = (grf(26, Rec + 1) = 789)
                        If bol1 And bol2 Then
                            Y2 = grf(z, Rec + 1)
                            Y1 = grf(z, Rec)
                            grafzoom.Line (Rec, Y1)-(Rec + 1, Y2)
                        End If
```

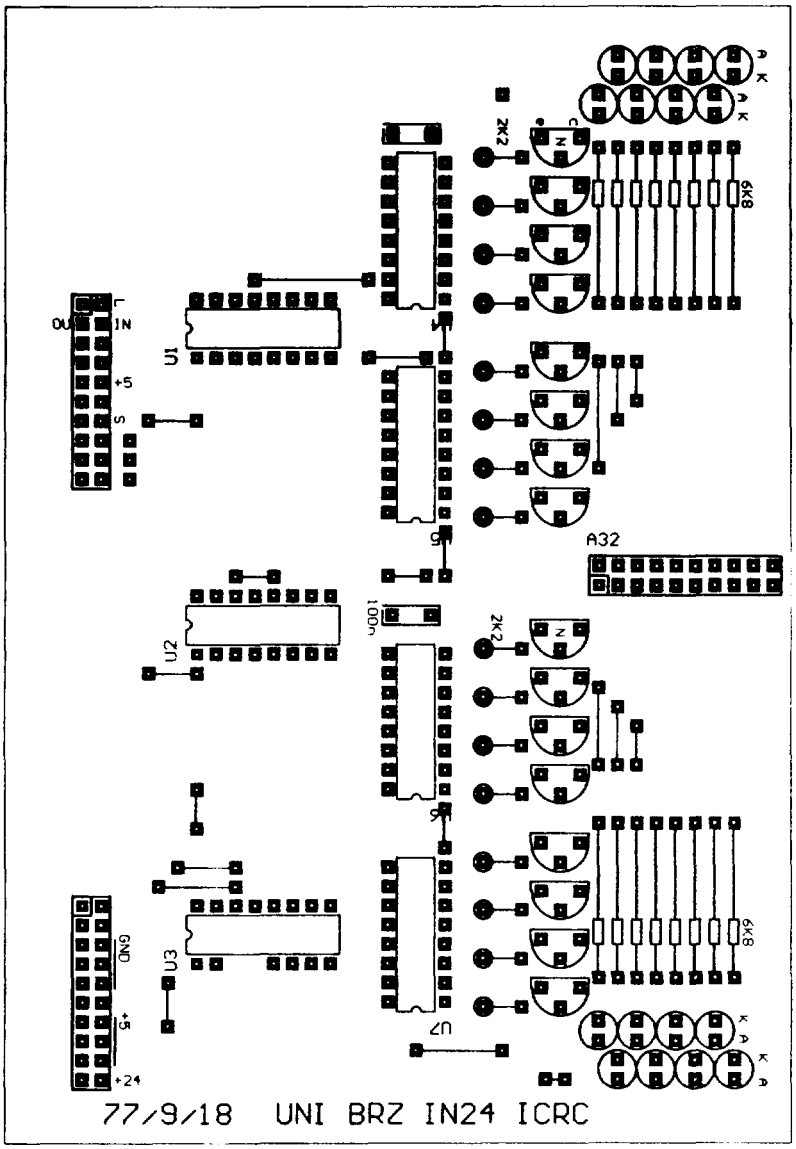
```
                    Next Rec
                Else
                    'curve_Item(n, d) = 50
                    'hr.lbt(z).ForeColor = QBColor(0)
                    'hr.lbt(z).BackColor = &H202020
                End If
            End If
        Next d
    Next n
    z = Int(zoom(ActivePage).X1)
    zoomzoom.X1 = z
    zoomzoom.X2 = z
    zoomzoom.BorderColor = zoom(ActivePage).BorderColor
    Grfzoom_pnl.BackColor = zoomzoom.BorderColor
    a$ = Right$(("0" & z \ 60), 2) & ":" & Right$(("0" & z Mod 60), 2)
    RecLb(ActivePage).Caption = a$
    Call ResultsGrf_click

End Sub

'
'
Sub Extract_Results ()

    ReDim rr(0 To 4, 0 To 4)
          'rr(main,p1,p2,p3,p4;;TTT,work_on,work_off,Jule)
    Const main = 0, TTT = 0 'TTT=Total Test Time
    Const workon = 1, workoff = 2, Jule = 3
    Const CMT = 4    'CMT=Cabin Mid. Temprature
    x0 = 1
    n_cmt_main = 0
    For Page = 1 To PrnPageNo
        n_cmt_Seg = 0
        Rec1 = Int(Seg(Page).Left + .5)
        Rec2 = Rec1 + Int(Seg(Page).Width + .5)
        For Rec = x0 To Rec1
            If grf(26, Rec) = 789 Then
                If grf(18, Rec) < 30 Then
                    rr(main, workoff) = rr(main, workoff) + 1
                Else
                    rr(main, workon) = rr(main, workon) + 1
                End If
                rr(main, Jule) = rr(main, Jule) + grf(20, Rec)
                rr(main, CMT) = rr(main, CMT) + grf(4, Rec) + grf(5, Rec)
                n_cmt_main = n_cmt_main + 3'4
            End If
        Next Rec
        x0 = Rec1 + 1
```

```
            For Rec = Rec1 + 1 To Rec2
                If grf(26, Rec) = 789 Then
                    If grf(18, Rec) < 30 Then
                        rr(i, workoff) = rr(i, workoff) + 1
                        rr(main, workoff) = rr(main, workoff) + 1
                    Else
                        rr(i, workon) = rr(i, workon) + 1
                        rr(main, workon) = rr(main, workon) + 1
                    End If
                    rr(i, Jule) = rr(i, Jule) + grf(20, Rec)
                    rr(main, Jule) = rr(main, Jule) + grf(20, Rec)

                    rr(i, CMT) = rr(i, CMT) + grf(4, Rec) + grf(5, Rec) + grf(
                    n_cmt_Seg = n_cmt_Seg + 3
                    rr(main, CMT) = rr(main, CMT) + grf(4, Rec) + grf(5, Rec)
                    n_cmt_main = n_cmt_main + 3

                End If
            Next Rec
            rr(i, TTT) = Rec2 - Rec1
            rr(i, CMT) = Int(rr(i, CMT) / n_cmt_Seg + .5)
            x0 = Rec2 + 1
        Next Page
        Rec1 = RecEnd0
        For Rec = x0 To Rec1
            If grf(26, Rec) = 789 Then
                If grf(18, Rec) < 30 Then
                    rr(main, workoff) = rr(main, workoff) + 1
                Else
                    rr(main, workon) = rr(main, workon) + 1
                End If
                rr(main, Jule) = rr(main, Jule) + grf(20, Rec)
                rr(main, CMT) = rr(main, CMT) + grf(4, Rec) + grf(5, Rec) + gr
                n_cmt_main = n_cmt_main + 3
            End If
        Next Rec
        rr(main, TTT) = RecEnd0
        rr(main, CMT) = Int(rr(main, CMT) / n_cmt_main + .5)

    End Sub

    Sub Form_Activate ()
    'Call Prnlb_Mousedown(0, 0, 0, 0, 0)
    End Sub

    '-------------------------------------------------------------------
    '
    Sub Form_Load ()
```

```
    If Dir("c:\hr1.exe") <> "" Then Exit Sub
    nn = Variable("Prnt", "Read")
    'PrnLb(2).Caption = Operator0
    'PrnLb(3).Caption = Chief0

    PrnPageNo = 0
    Cmd(0).Enabled = True
    Cmd(1).Enabled = True
    Call Color_chk_Click(True)
    'Set Lb_Tmp = TestName0

    grafzoom.ScaleHeight = -1450
    grafzoom.ScaleTop = 1100
    grafall.ScaleHeight = -1450
    grafall.ScaleTop = 1100

    Call crv("grfall", 0, 0)
    ActivePage = 1
    SegEn = -1

End Sub

'-------------------------------------------------------------------------
'
Sub Form_QueryUnload (Cancel As Integer, UnloadMode As Integer)

    hr.Visible = True

End Sub

'-------------------------------------------------------------------------
'
Sub Grafall_KeyDown (keycode As Integer, Shift As Integer)

    X = Int(X)
    ShiftDown = (Shift And 1) <> 0
    ww = PageWidth * 60
    Select Case keycode
        Case 49, 50, 51, 52, 53, 54
             Page = keycode - 48
             If Page > PrnPageNo Then Exit Sub
             ActivePage = Page
             Call PrnPageGrf_click
             DoEvents
             Exit Sub
        Case Key_Up
            Call PrnPageSpin_SpinUp
```

```
            Exit Sub
        Case Key_Down
            Call PrnPageSpin_SpinDown
            Exit Sub
        Case KEY_LEFT
            n = -5
        Case KEY_RIGHT
            n = 5
        Case KEY_NUMPAD4
            n = -30
        Case KEY_NUMPAD6
            n = 30
    End Select
    If ActivePage = 1 And n < 0 Then
        If Seg(1).Left + n < 0 Then n = -Seg(1).Left
    ElseIf ActivePage = PrnPageNo And n > 0 Then
        X1 = Seg(ActivePage).Left + Seg(ActivePage).Width + n
        If X1 > RecEnd0 Then
            n = RecEnd0 - (Seg(ActivePage).Left + Seg(ActivePage).Width)
        End If
    ElseIf n > 0 Then
        If Seg(ActivePage).Left + ww + n >= Seg(ActivePage + 1).Left Then
            n1 = Seg(ActivePage + 1).Left
            n2 = (Seg(ActivePage).Left + ww)
            n = n1 - n2 - 3
        End If
    ElseIf n < 0 Then
        If Seg(ActivePage - 1).Left + ww > Seg(ActivePage).Left + n Then
            n = Seg(ActivePage - 1).Left + ww - Seg(ActivePage).Left + 1
        End If
    End If
    'DoEvents
    Seg(ActivePage).Left = Seg(ActivePage).Left + n
    zoom(ActivePage).X1 = zoom(ActivePage).X1 + n
    zoom(ActivePage).X2 = zoom(ActivePage).X2 + n
    'DoEvents
    RecLb(ActivePage).Left = RecLb(ActivePage).Left + n
    RecLb(ActivePage).Caption = Val(RecLb(ActivePage).Caption) + n
    Call CrvZoom

    DoEvents
End Sub
```


HotRoom
Unido
Title
Size
A3
Number
Revision
Date
File
Sheet of
Drawn By
2Mhz
2k2
(optional)
7404
C3
C1
4001
4040
4093
B1
RST
CLK
BAUDRATE
R1
330P
33K
10K
100k
2n
Q1
BRIDGE2
AC
220
7824
7812
7805
7912
DAC
COMMAND
ANALOG
LATCH
RX
TX
Load
Refresh
U1B
TXO
t=10mS
100n
U1A
R7
R15
N3
O1
R16
FROM PC
R18
R19
TO PC RX
N4
O2
R17
+12
1K
BD132
1N4001
100K


2K2
6K8
A32
100n
U1
U2
U3
U7
+5
GND
+24
77/9/18 UNI BRZ IN24 ICRC