Designation: F 1943 – 98 (Reapproved 2003)

Standard Test Method for Determining the Dynamic Thermal Response of Thermal Mass Transfer Ribbon Products—Atlantek Method[1]

This standard is issued under the fixed designation F 1943; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the measurement of thermal response of various thermal mass transfer ribbons used for facsimile, labels, medical recorders, plotters, and printers.

1.2 The Atlantek Thermal Response Tester Model 200 described in this test method may be used for specification acceptance, product development, and research applications. Although this test method identifies specific printheads, the tester does support additional printheads.

1.3 *This standard does not purport to address all of the safety concerns, if any associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements, see Section 8.

2. Referenced Documents

2.1 *ASTM Standards:*

D 685 Practice for Conditioning Paper and Paper Products for Testing[2]

F 1405 Test Method for Determining the Dynamic Thermal Response of Direct Thermal Imaging Products - Atlantek Method[2]

2.2 *ANSI Standards:*[3]

PH2.17 Density Measurements—Geometric Conditions for Reflection Density

PH2.18 Density Measurements—Spectral Conditions

3. Terminology

3.1 *Definitions:*

3.1.1 *back coating*, *n*—the coating placed on the noninked side of a thermal transfer ribbon which imparts abrasion resistance to enhance printhead life and prevents the printhead from sticking to the polyester carrier.

3.1.2 *receptor*, *n*—the surface upon which the transfer is placed which may be paper, film or fabric.

3.1.3 *thermal mass transfer product*, *n*—paper, film, or other substrate upon which multi-component coatings have been applied. The imaging components on the transfer side of the products are generally a pigmented wax or resin. Under heat from the thermal head and pressure roll the image is transferred to a receptor surface. The non-printing side of these ribbons contains a backcoating, which imparts abrasion resistance to enhance printhead life.

3.1.4 *thermal response*, *n*—the relationship between the thermal image optical density (*y*-axis) versus printhead energy (*x*-axis). Printhead energy is a function of both pulse width (strobe time or T_{on}) expressed in milliseconds (ms) and energy expressed in millijoules (mJ). When energy is expressed in millijoules, printhead resistance is taken into account. Thermal response plots are commonly prepared both ways. The latter is preferred.

3.2 *Symbols:*

3.2.1 T_{cycle}—the time between printed lines. The larger the T_{cycle} value, the more time between printed lines. The result is slower print speeds. Smaller T_{cycle} values correspond to faster print speeds. Time between printed lines equals dot "on" time plus dot "off" time ($T_{cycle}=T_{on}+T_{off}$).

3.2.2 T_{on}—the amount of time that the heating elements (dots) on the printhead are energized. Typically, this value is in milliseconds. T_{on} is also called strobe time.

4. Summary of Test Method

4.1 This test method involves imaging mass thermal transfer product using an Atlantek Model 200 Thermal Response Test System. The equipment is the same as that covered in Test Method F 1405. The equipment differs from that used in Test Method F 1405 in that it contains apparatus to allow for thermal ribbon supply and take-up rolls (see Fig. 1). The system is designed to provide thermal response measurements using printheads commonly used in facsimile units, label printers, medical recorders, plotters, and other thermal printers. This system is based on a special purpose controller board, which drives a standard thermal printer using a programmable stepping drive controller. This system includes provisions for mounting standard performance printheads. A personal computer controls the system with parameter programming accomplished from menu-driven software designed specifically for thermal response and performance characterizations.

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[1] This test method is under the jurisdiction of ASTM Committee F05 on Business Imaging Products and is the direct responsibility of Subcommittee F05.02 on Inked Transfer Imaging Products.

Current edition approved Dec. 10, 1998. Published March 1999.

[2] *Annual Book of ASTM Standards*, Vol. 15.09.

[3] Available from the American National Standards Institute, 11 West 42nd St., New York, NY 10036.

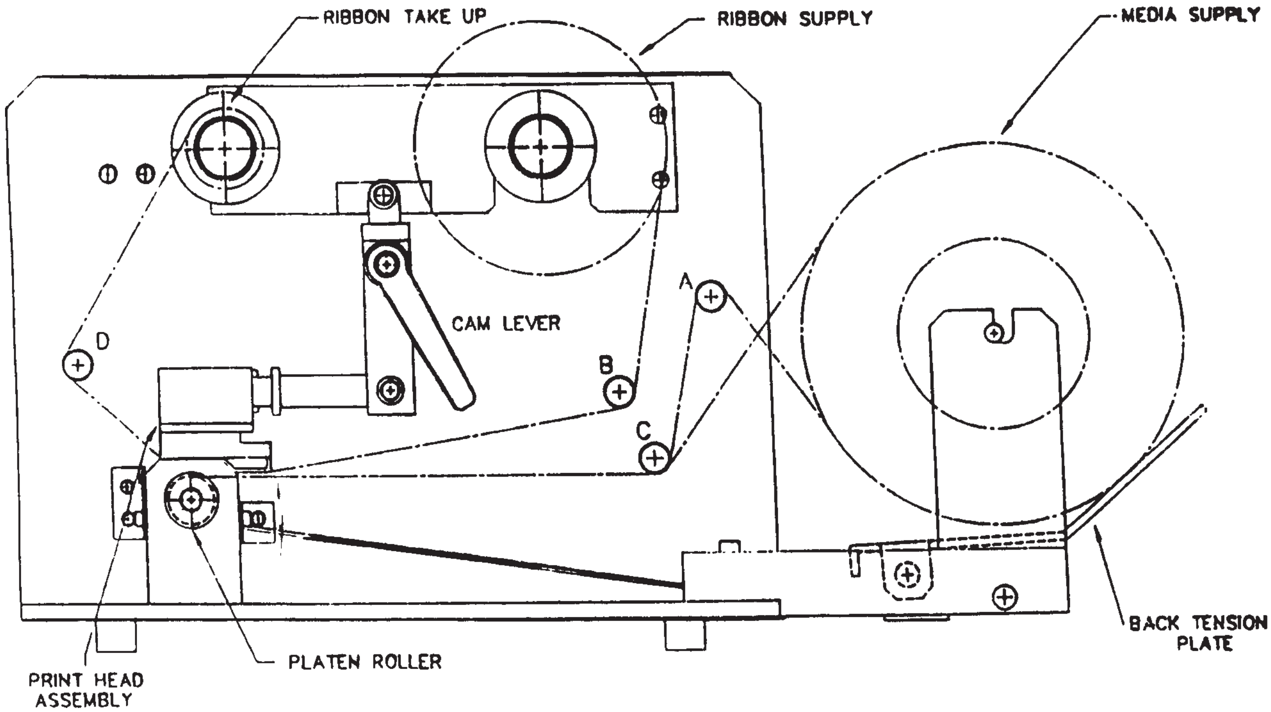

FIG. 1 Atlantek Model 200 (Side View) Test Specimen (Media) Loading—Roll Form

4.2 To determine thermal response, thermal product in roll or sheet form is fed into the printer. From the main menu, the test system is configured to the test mode. Again from the main menu, "execute a test" is chosen. A standard existing test file can then be loaded and the new test can be given a file name or default standard test conditions can be used. The test thermal product (media) is identified, printhead voltage set, and the test executed. Densitometer measurements can then be entered into the test file (manually or automatically). Data in the test file created can then be used to graphically display the thermal response of the test thermal product.

5. Significance and Use

5.1 The Atlantek test system allows simulation of the printing conditions of thermal transfer printers in the marketplace. Thus, this system is useful in matching thermal transfer product performance to various thermal printheads.

5.2 This test system is useful for new product development. Thermal transfer printer manufacturers can design print control algorithms to match particular printhead designs to thermal imaging products.

5.2.1 Thermal imaging product manufacturers can formulate and design products (media) to provide a match with certain printhead designs.

5.3 Manufacturing process control can make thermal response comparisons relative to process changes.

5.4 Customers for thermal products can use this test method to compare supplies from various manufacturers.

5.5 The test system can be used to evaluate thermal response of facsimile, label, medical recorder, plotter, and other thermal transfer products (media).

5.6 Performance differences between printheads and media combinations can be measured and presented graphically. The interrelationship between printing control variables can also be studied.

6. Interferences

6.1 Testing under controlled environmental conditions is recommended. Wide variations in temperature and relative humidity can effect transfer efficiency and the resulting image density measurements.

6.2 Printhead loading and alignment is important to achieve reliable and reproducible results.

6.3 When testing new and experimental coatings, the printhead must be visually inspected for any residue or buildup and cleaned if required. Residue may prevent intimate printhead contact with the thermal imaging transfer product surface, resulting in lower image density on the receptor and may cause printhead damage.

6.4 Thermal transfer products are sensitive to prolonged exposure to heat and should be protected from exposure prior to testing.

6.5 The receptors surface smoothness has a direct impact of the transfer efficiency.

7. Apparatus

7.1 *Atlantek Thermal Response Test System*, Model 200.3.

7.2 *IBM*, *PC/AT*, or true compatible with the following minimum configuration: 512K RAM, 12 MHz clock, 20 megabyte hard disk, 1.2M floppy disk, standard keyboard, monochrome or color system, parallel port (two required for plotting option) and serial port (two required for automatic densitometer readings).

7.3 *Densitometer*, Macbeth Model RD-914 (spectral response: black and white, visual) or equivalent. A serial interface is required for entering density measurements automatically to the test data file.

7.4 *Software*, Tech *Graph*Pad[4] or equivalent (optional for plotting graphs).

7.5 *Plotter*, HP Colorpro with Centronics parallel printer or equivalent, to prepare graphs.

8. Hazards

8.1 *Printhead Voltage*—Keep applied voltage at or below that specified for each printhead to avoid printhead damage. Before powering up the system and applying power, the voltage adjustment shown on the front panel should be turned fully counter-clockwise. This ensures that applied voltage will be below the maximum value recommended for the printhead.

8.2 As a guideline, the T_{cycle} value should be at least four times the T_{on} value when in full-width printing mode or two times the T_{on} value in reduced-width mode. The operating system software checks for this value. The actual relationship will depend upon the installed printhead.

8.3 Maximum T_{on} varies with printhead resistance. See table from the Atlantek Operator's Manual[5] for supplied printhead to ensure that the maximum value is not exceeded.

8.4 Prior to running a nonstandard test, consult the documentation for each printhead with regard to maximum recommended T_{on} energy, and printhead voltages.

8.5 *Changing Printheads*—Never attempt printhead replacement with the power on in the M200 system. The printhead should first be electrically disconnected from the printer by removing the printhead interface and printhead power connectors on the left side panel of the mechanism.

8.6 *Computer Connections*—Do not make or break any connections while the computer is powered up and the Model 200 is on.

8.7 *Printhead Damage*—Avoid having the printhead come in direct contact with uncoated papers since it could cause premature printhead abrasive failure. The ribbon should cover as much of the printhead as possible during normal operation to minimize the possibility of printhead damage.

9. Test Specimen

9.1 The test specimen (media) shall be sheets or a roll of thermal transfer product which has not been altered since it was manufactured.

9.2 Test specimens in sheet form for the standard Model 200 should be cut into individual strips 8-½ in. wide with a recommended length of 13 in. (minimum length is 11 in.). The Model 200 system also supports printheads of different widths and resolutions which will impact the width and length of the test sheet.

9.2.1 If test specimens are less than 8-½ in. in width with a minimum width of 4 in., they can be tested by enabling "reduced width" and "narrow header." To initiate this change from the test menu strike F8, "configure output image."

10. Calibration and Standardization

10.1 *Densitometer*—Calibrate the densitometer in accordance with the manufacturer's recommendations (see ANSI PH2.17 and PH2.18).

10.2 *Printhead Dot Line Alignment*—Adjust the printhead dot line alignment over the platen roller and set in accordance with the manufacturer's recommendations.

10.3 *Printhead Pressure*—Measure the printhead pressure with a force gage and set in the range from 7 to 8.5 lb (see Note 1). The pressure measurement is not precise. If the pressure is in this range, do not adjust.

NOTE 1—Since the nominal printhead width is 8.5 in., the pressure should be 0.8 to 1.20 lb/linear in.

10.4 *Ribbon Tensioning*—The tension on the supply and take-up spools are adjustable in the Model 200 by turning the screw that is located in each of the ribbon arbors. The tension setting can be measured by using a force dial. Factory setting for the ribbon tension is 6 oz for the supply spool and 10 oz for the take-up spool.

10.5 *Ribbon Peel Angle*—The Model 200 operates at a fixed peel angle for ribbon take-up. The equipment manufacturer does not believe that peel angle has a significant impact on image quality as long as it is between 20 - 70°.

10.6 *Thermalhead Resistance*—The system should be calibrated periodically by measuring the resistance of the thermal printhead. The equipment may be calibrated by the manufacturer or the end user. Excessive printhead energy, unchecked residue buildup and high ion content supplies are primarily responsible for printheads changing their average resistance value over time.

11. Conditioning

11.1 Although no special conditioning of thermal product samples is required, it would be prudent to compare only tests run under the same environmental and aging conditions (see Practice D 685).

12. Establishment of Test Parameters

12.1 *ROHN KF2008-B1 and Kyocera KST-216-8MPD1 Thermal Printheads*—See the table from the Atlantek Operator Manual for recommended nominal printhead voltages for various resistances of the supplied printhead. Set T_{cycle} and T_{on} as specified for each printhead and set printhead temperature at 35°C (Head Heating—On).

NOTE 2—There is no provision for printhead cooling.

13. Procedure

13.1 With the computer powered up and the printer switched on, the entry screen will appear on the monitor. Select Thermal Response Test and strike the Enter key.

13.2 The next screen message is to switch on the thermal response test system before striking the Enter key. Striking any other key will return the program to DOS.

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[4] Available from Binary Engineering Software, Inc., 400 Fifth Ave., Waltham, MA 02154.

[5] *Atlantek Operators Manual for Model 200 Thermal Response Test System*, available from Atlantek Corp., 10 High St., Wakefield, RI 02879.

13.3 Upon striking the Enter key, the computer will check for the presence of a formatted diskette in Drive A and present the main system menu. The monitor screen will appear as shown in Fig. 2.

13.4 *Configure Test System*—Choose Configure Test System by striking the F8 key. The screen will appear as shown in Fig. 3. From this menu, selection option F1, Enable Test System. Strike the F1 key and the screen will return to the main system menu.

NOTE 3—Before striking the Enter key again the operator has the option to insert a formatted, high-density diskette into Drive A. In some of the older versions of the Model 200 this diskette is required for tests and data storage.

13.5 *Test Specimen Loading*—The software test program refers to the thermal product test specimen as media.

13.5.1 *Roll Form Media*—See Fig. 1 for a side view of the test apparatus. Mount the two appropriately sized core plugs into the ends of the core, slide the mounting shaft through the center and insert the shaft into the slots in the supply mounts at the rear of the mechanism. Core plugs are provided for 1–, 1.5– and 2–in. cores. Be sure that the brush side of the back tension plate is in contact with the roll of media.

13.5.1.1 The thermal ribbon imaging surface (inked side) must be facing down as it passes between the printhead and platen roller. Printhead pressure should be released by rotating the cam lever on the right side of the head mounting mechanism up (counter clockwise). Feed the ribbon around bar "B," between the printhead and receptor stock, around bar "D" and over to the empty take-up core. Tape the start of the ribbon to the take-up core. Center the ribbon by adjusting the ribbon stop plate. Wind enough ribbon onto the take-up core to both align the ribbon and remove wrinkles introduced in the threading process. When roll media threading is complete, align the media under the printhead. Next, rotate the cam lever down (clockwise) to place the printhead in contact with the media imaging surface.

13.5.1.2 The receiver material may be fed to the platen in either of two paths depending on the amount of back tension necessary to prevent the target media from wrinkling. For lighter tension, support the media roll on the spindle and thread the media under the metal bar (C), and between the printhead assembly and platen roller. If the media tends to wrinkle during printing, additional back tension may be necessary. This may be achieved by threading the media over bar "A" prior to going under bar "C."

```
                                        Head Measurements:
                                           22.5 Volts
                                           27.5 Deg C
Atlantek Thermal Response Test System

    MAIN SYSTEM MENU

  Choose from:

    F1  - Execute a Test
    F2  - Print Single Test Pattern
    F3  - Test File Editor
    F4  - Directory of Test Files
    F5  - View a Test File
    F6  - View default parameters
    F7  - Invoke PLOT Utility
    F8  - Configure Test System
    F9  - Exit from Tester

Using Function keys
```

FIG. 2 Main System Menu

```
                                        Head Measurements:
                                           22.5 Volts
                                           27.5 Deg C
 CONFIGURE TEST SYSTEM

 Choose from:

 F1  - Enable TEST System
 F2  - Enable SAMPLE Mode
F10  - Return to MAIN MENU

 Using Function keys
```

FIG. 3 Configure Test System

13.5.2 *Sheet Form Media*—Loading the media is similar to the procedure described in 13.5.1.1. Again the thermal imaging surface must be facing down and a little more care is needed to properly align the media between the printhead assembly and platen roller. The receiver material must be aligned under the media in the transfer nip. When media and receiver sheets are aligned, rotate the cam lever down to place the printhead in contact with the backside of the media.

13.6 *Execute a Test*—Choose Execute a Test by striking the F1 key. The following prompt will appear:

You may now load an existing file or define a new file by typing in a file name of up to 8 alphanumeric characters:

13.6.1 Name a new test file and enter test parameters established in Section 12 or recall an existing test file with established test parameters.

13.6.2 If the file name is not found on the diskette, the screen will go directly to the test menu, which will display the standard default settings for the installed printhead.

13.6.3 If the file name is found on the diskette, the following screen prompt will appear:

The parameters have been loaded on the existing file; please type the name of the file into which you wish to save this test (up to 8 alphanumeric characters):

Type New File Name: _____

Upon entering the new file name, the test menu will appear on the screen.

13.7 *Test Menu*—Screen appears as shown in Fig. 4.

13.7.1 *Test Parameters*—A wide variety of test parameters are available with this test unit. For example, test parameters might be selected as given in Table 1.

13.7.2 *Changing and Defining Test Parameters*—If the test parameters as defined in the Test Menu are correct, proceed to 13.7.3.

13.7.2.1 *Pattern Type*—Choose the pattern type option by striking the F2 key and the following prompt will appear:

Do you wish to change Test Pattern type? (Y/N):

If Yes, the menu appears as shown in Fig. 5. Choose the checkerboard pattern by striking the F1 key and the new menu will appear as shown in Fig. 6. Choose 10 % pattern by striking the F1 key and the screen will return to the test menu.

```
                                        Head Measurements:
                                           22.5 Volts
                                           27.5 Deg C
                    TEST MENU

Head Type: Rohm                  File Name:
Image width: FULL                Printhead Resistance:  621 Ohms

Choose from:                          current values

   F1  - Reset to Default values
   F2  - Pattern type                   10%
   F3  - Dot Pulse Duration (Ton)     Seq up to 0.50 ms
   F4  - Tcycle                         5.000 ms
   F5  - Media Type                   NONE
   F6  - Head Heating (ON/OFF)        ON
   F7  - Wait for Printhead Temperature  YES
   F8  - Configure Output Image
   F9  - Do the Above Defined Test
   F10 - Exit to Main Menu - caution
         choices will not be saved

Using Function keys
```

FIG. 4 Test Menu

TABLE 1 Example Test Parameters

Parameters	ROHM KF2008-B1	KYOCERA KST-216-8MPD1
Pattern Type:		10 %
Dot pulse duration (T_{on})	Sequence up to 0.50 ms or 1.00 ms	
T cycle		5.000 ms
Head heating (on/off)		On
Waiting for printhead temperature		Yes
Printhead voltage		See 12.1

```
                              Head Measurements:
                                 22.5 Volts
                                 27.5 Deg C

   SUPPORTED TEST PATTERNS

 Choose from:

   F1  - Checkerboard Pattern
   F2  - Pixel On/Off Pattern
   F3  - Walking One
   F4  - Bar Codes

   F10 - Return to TEST MENU

 Using Function keys
```

FIG. 5 Pattern Type

13.7.2.2 *Dot Pulse Duration (T_{on})*—Choose the dot pulse duration (T_{on}) option by striking the F3 key. The following prompt will appear:

Do you wish to sequence this parameter? (Y/N):

Select Yes and the following prompt appears:

You have chosen to sequence the Dot Pulse Duration
Please type the maximum value of this parameter
in milliseconds (0.01 to 2.0):_____

Enter the desired value and the following message appears:

This parameter will be sequenced from 10 % value to 100 % (100 % representing the value just typed in) in steps of 10 %. This will appear as a single 8 by 11 sheet with 10 fields of output appearing as horizontal stripes for each value in the sequence and with increasing values appearing along the paper direction.

Strike any key to continue...........

Striking any key returns the screen to the test menu.

```
                                  Head Measurements:
                                     22.5 Volts
                                     27.5 Deg C

   TO SET THE TEST PATTERN

 Choose from:

   F1  - 10% Pattern
   F2  - 20% Pattern
   F3  - 30% Pattern
   F4  - 40% Pattern
   F5  - 50% Pattern
   F6  - 60% Pattern
   F7  - 70% Pattern
   F8  - 80% Pattern
   F9  - 90% Pattern
  F10  - 100% Pattern

 Using Function keys
```

FIG. 6 Setting the Test Pattern

13.7.2.3 T_{cycle}—Choose the T_{cycle} option by striking the F4 key and the following prompt appears:

Do you wish to sequence this parameter? (Y/N): _____

Select No and the screen appears as shown in Fig. 7. Choose

```
                                  Head Measurements:
                                     22.5 Volts
                                     27.5 Deg C

   TO SET TCYCLE

 Choose from:

   F1  -   3.0 ms
   F2  -   4.0 ms
   F3  -   5.0 ms
   F4  -   6.0 ms
   F5  -   7.0 ms
   F6  -   8.0 ms
   F7  -   9.0 ms
   F8  -  10.0 ms

   F9  - To Display LOWER Tcycle Values
  F10  - To Display HIGHER Tcycle Values

 Using Function keys
```

FIG. 7 T_{cycle} Option

the desired option and the screen returns to the test menu.

13.7.2.4 *Printhead Temperature*—A printhead set temperature above that of room temperature should be established to control this variable. The Head Heating and Waiting for Printhead Temperature options should be toggled on (F6 and F7) keys, respectively.

13.7.3 *Printhead Voltage*—Check head measurement value and adjust printhead voltage to desired value.

NOTE 4—If the adjusted value is greater than 10 % above the nominal voltage, the operating system issues a warning.

13.7.4 *Do the Above Defined Test*—If the test parameters as defined in the test menu are correct, strike the F5 key to enter media type (identification of thermal test product) and then choose the Do the Above Defined Test option by striking the F9 key.

13.7.4.1 *Choose Pattern Size*—Upon striking the F9 key, the screen will appear as shown in Fig. 8. Select F4 to generate 80 by 80 dot blocks for densitometer measurements. Upon striking F4, the printer will start or the screen message will indicate the following:

Waiting for temperature ....

NOTE 5—The printhead described in this test method has 8 dots/mm.

13.7.4.2 *Enter File Comments*—As soon as the printer starts operating, the screen will change, allowing the operator to enter comments into the test file (see Fig. 9).

13.7.4.3 A test printout example is shown in Fig. 10.

13.7.5 *Input Densitometer Readings*—After entering comments, the operator will be queried regarding densitometer readings with the screen shown in Fig. 11.

13.7.5.1 *F1*—Choosing F1 will enter the readings at a later date, and will return the program to the main system menu.

13.7.5.2 *F2*—Choosing F2 will add the following message to the screen:

You may enter up to 10 densitometer readings
Terminate by entering no reading:
Press any key when ready

13.7.5.3 *F3*—Choosing F3 will add the following message to the screen:

You may enter up to 10 densitometer readings
Press any key when ready

```
                              Head Measurements:
                                  22.5 Volts
                                  27.5 Deg C

Choose pattern size:

   F1  -    8 by  8  dot blocks
   F2  -   16 by 16  dot blocks
   F3  -   40 by 40  dot blocks
   F4  -   80 by 80  dot blocks
   F10 -  Return to TEST MENU

Using Function keys
```

FIG. 8 Pattern Size

```
                              Head Measurements:
                                22.5 Volts
                                27.5 Deg C

          No comments in file

Type up to 4 lines of COMMENTS to be stored with this test:
(entry may be terminated early by entering a blank line)

     Type 1st line (up to 80 characters)
```

FIG. 9 File Comments

13.7.6 *Densitometer Entries*—If F2 or F3 were selected in 13.7.2.4, the screen given in Fig. 12 will next appear after any key is pressed. Refer to ANSI PH2.17 and PH2.18 for proper densitometer use.

13.7.7 *Plot Variable Entry*—After selecting the number of densitometer entries, the operator will be asked to select the plot variable entry (*x*-axis) by the screen shown in Fig. 13.

13.7.7.1 If F1 is chosen, the screen message will change to:

Transmit Densitometer reading 1a.
Press any key to Exit

13.7.7.2 *Plot Type for T_{on} Sequences*—If F2 is chosen, the screen will appear as shown in Fig. 14. If F1 is chosen, go to 13.7.7. If F2 is chosen, the program will prompt the operator to confirm the printhead resistance (ohms) value to make the energy calculations. The prompt will appear as shown in Fig. 15.

13.7.8 *Density Measurements*—The last screen prompt before asking for densitometer measurements is shown in Fig. 16. Striking any key will then initiate the prompt for densitometer readings shown in Fig. 17. After all the densitometer readings have been entered and the test is complete, passing any key will save the data files to the "A:" disk drive, exit the program, and return to the main system menu.

14. Interpretation of Results

14.1 *Data Plot*—The data plot will be in the form of the "S" curve shown in Fig. 18.

14.1.1 The bottom portion of the plot (A in Fig. 18) shows background measurement in the densitometer readings were taken to the extreme lowest energy levels where no visible image was formed. Generally, whiter surfaces have lower background readings.

14.1.2 The top portion of the plot (C in Fig. 18) indicates the maximum density capability of the thermal product.

14.1.3 The steep sloped portion of the plot (B in Fig. 18) indicates how the thermal image transfers at a given energy level.

14.2 When comparing more than one thermal product, the more the thermally responsive product will be the "S" plot furthest to the left. Fig. 19 shows three sample test plots. Sample 1 is more thermally responsive than Samples 2 and 3. Sample 3 is the least thermally responsive.

14.3 If Sample 1 (Fig. 19) yields an image density of 1.0 in a certain facsimile printer, Samples 2 and 3 will yield lower and lowest respective densities.

14.4 Visual observation of the test image plots reveal causes of low thermal transfer.

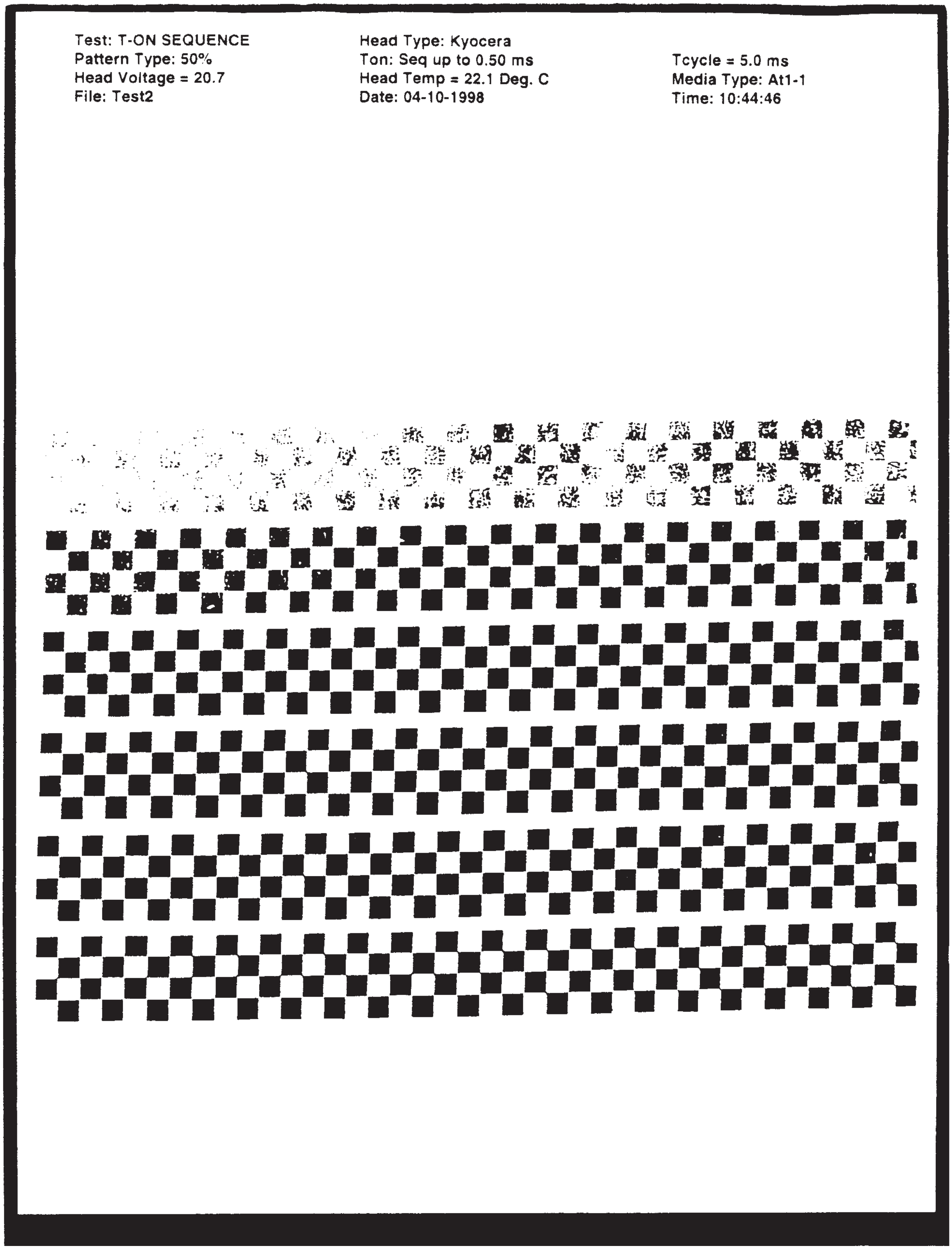

FIG. 10 Test Printout Example

14.4.1 If the image areas show voids and nonuniform image fill, the thermal imaging surface has not fully contacted the printhead elements. This is generally due to the thermal imaging surface not being sufficiently smooth and level to

```
                                        Head Measurements:
                                          22.5 Volts
                                          27.5 Deg C

      TO INPUT DENSITOMETER READINGS

   Choose from:

      F1  -  Enter them at a later date
      F2  -  Enter them manually now
      F3  -  Enter them by automatically reading
              the densitometer now

   Using Function keys
```

FIG. 11 Input Densitometer Readings

```
                                        Head Measurements:
                                          22.5 Volts
                                          27.5 Deg C

 Number of Entries to Average per Densitometer Reading

          F1  -  1 Entry
          F2  -  2 Entries
          F3  -  3 Entries
          F4  -  4 Entries
          F5  -  5 Entries

      Using Function keys
```

FIG. 12 Densitometer Entries

```
                                        Head Measurements:
                                          22.5 Volts
                                          27.5 Deg C

  SELECT PLOT VARIABLE ENTRY

  Choose from:

     F1  -  MANUAL mode
     F2  -  AUTOMATIC mode

  Using Function keys
```

FIG. 13 Plot Variable Entry

match the particular printhead characteristics. In actual thermal printing, the image print quality will be negatively effected by this condition.

14.5 *Visual Ranking*—The image test samples can be ranked lowest to highest thermal response.

14.5.1 Highest thermal response products will show greater image density at the lowest printhead energy levels.

14.5.2 In addition to thermal response, maximum image density comparisons can be made by comparing images printed at the highest printhead energy level.

```
                                        Head Measurements:
                                          22.5 Volts
                                          27.5 Deg C

 SELECT DESIRED PLOT TYPE FOR TON SEQUENCES

    Choose from:

    F1  -  OD vs. TON (msec)
    F2  -  OD vs. ENERGY (mj)
    F3  -  OD vs. ENERGY DENSITY (mj/mm2)

    Using Function keys
```

FIG. 14 Plot Type for T_{on} *Sequences*

```
        CURRENT RESISTANCE is ->  621 Ohms

 Enter Printhead Resistance or c/r for CURRENT value:____
```

FIG. 15 Current Resistance

```
                                        Head Measurements:
                                          22.5 Volts
                                          27.5 Deg C

   * * * * * * * * IMPORTANT * * * * * * * *

  Take optical density readings from BOTTOM of test sheet
  to TOP of test sheet

  Strike any key to continue .....
```

FIG. 16 Density Measurements

```
   Transmit Densitometer reading 1a
      Press any key to EXIT
```

FIG. 17 Exit the Program

15. Report

15.1 *Data Plot*—To analyze results and make comparisons, prepare an *x-y* plot. Optical density is the *y*-axis and printhead energy in terms of millijoules (mJ) of pulse width (T_{on}) is the *x*-axis.

15.1.1 *Plot Utility*—If the program package includes Tech*Graph*Pad or similar software, invoke the program and prepare the data plot. An example is shown in Fig. 18.

15.1.2 *Manual Plot*—To prepare the plot manually, press F5 to view a test file plot and retrieve the test file data. Prepare the data plot and connect the data points to define the relationship.

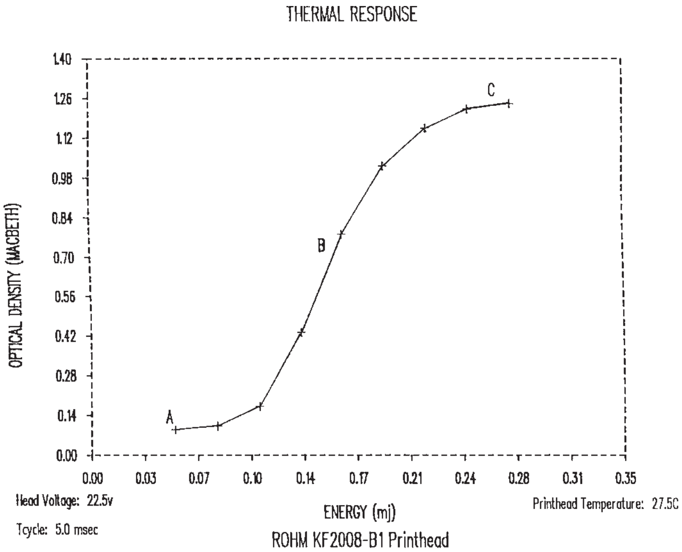

FIG. 18 Thermal Response

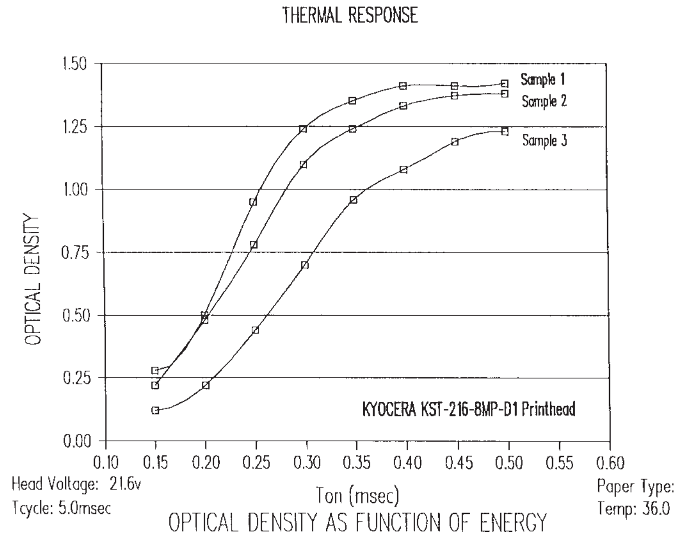

FIG. 19 Thermal Response Comparison

15.2 *Visual Ranking*—If a densitometer is not available, it is possible to make visual comparisons and rank the test samples in order of lowest to highest thermal response.

16. Precision and Bias

16.1 The precision and bias of this test method is being determined.

17. Keywords

17.1 dynamic thermal response; thermal imaging; thermal transfer

APPENDIX

(Nonmandatory Information)

X1. PRINTHEAD ALIGNMENT ADJUSTMENT

X1.1 To verify the alignment of the printhead dot line along the platen roll, press the test button on the front panel of the test unit. A consistent, uniform density should be observed across the width of the transferred image. To correct for nonuniformity, mechanical adjustment of the printhead is required.

X1.2 *Adjustment Procedure*:

X1.2.1 To correct printhead dot alignment across the platen roll, the thumbwheel located at the rear of the printhead mounting is used. This adjustment moves the entire printhead forward or backward with respect to the platen roll.

X1.2.2 To correct for nonuniform image density across the platen where the center may have greater density than the edges, the platen roll may require alignment with the printhead. Loosen the platen yoke locking nuts and move that end of the platen forward or backward until uniform image density is achieved.

X1.2.3 The entire trial and error adjustment process is complete when visual observations indicate image uniformity has been optimized. Once adjustments are completed, the thumbwheel or nuts, or both, should be secured.