



Designation: F1943 – 98(Reapproved 2008)

Standard Test Method for Determining the Dynamic Thermal Response of Thermal Mass Transfer Ribbon Products—Atlantek Method¹

This standard is issued under the fixed designation F1943; 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 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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:²

D685 Practice for Conditioning Paper and Paper Products for Testing

F1405 Test Method for Determining the Dynamic Thermal Response of Direct Thermal Imaging Products—Atlantek Method

2.2 ANSI Standards:³

PH2.17 Density Measurements—Geometric Conditions for Reflection Density

PH2.18 Density Measurements—Spectral Conditions

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.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

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 F1405. The equipment differs from that used in Test Method F1405 in that it contains apparatus to allow for thermal ribbon supply and take-up rolls (see Fig. 1). The system is

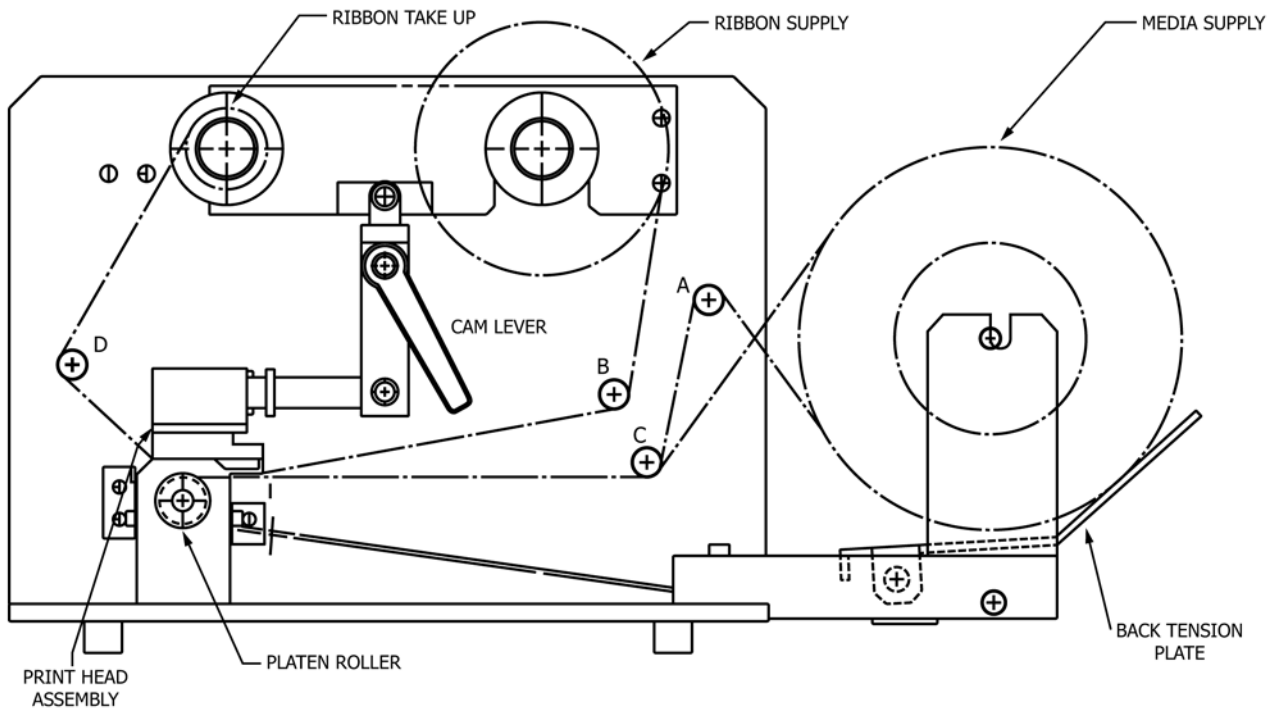


FIG. 1 Atlantek Model 200 (Side View) Test Specimen (Media) Loading—Roll Form

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.

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 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*⁴ 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 8-1/2 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 8-1/2 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 **D685**).

⁴ *Atlantek Operators Manual for Model 200 Thermal Response Test System*, available from Atlantek Corp., 10 High St., Wakefield, RI 02879.