INTERNATIONAL STANDARD

ISO 1004

Third edition
1995-06-15

Information processing — Magnetic ink character recognition — Print specifications

Traitement de l'information — Reconnaissance des caractères à encre magnétique (MICR) — Spécifications d'impression

Reference number
ISO 1004:1995(E)

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International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1004 was prepared by Technical Committee ISO/TC 68, *Banking and related financial services*, Subcommittee SC 2, *Operations and procedures*.

This third edition cancels and replaces the second edition (ISO 1004:1977), of which it constitutes a technical revision.

Annexes A to D of this International Standard are for information only.

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Information processing — Magnetic ink character recognition — Print specifications

Section 1 — Font E 13 B

1 Scope

Section 1 of this International Standard specifies the shapes, dimensions and tolerances for the ten digits and four special symbols to be printed in magnetic ink[1] and used for the purposes of character recognition. It describes the various types of printing defects and other printing considerations, together with the tolerances permitted, and also contains specifications for signal level measurement and references to Optical Character Recognition (OCR), a technology now often used in conjunction with E 13 B MICR reading.

The characters specified in section 1 of this International Standard were developed initially for use in banks to permit automatic document handling for bank data processing, but they have application to other automatic processing systems as well.

2 Character configuration

2.1 Designation

The series of standard magnetic ink characters consists of ten digits and four special symbols. They are identified as follows:

Name	Designation
Zero	Stoke 0
One	Stoke 1
Two	Stoke 2
Three	Stoke 3
Four	Stoke 4
Five	Stoke 5
Six	Stoke 6
Seven	Stoke 7
Eight	Stoke 8
Nine	Stoke 9
Symbol 1	Stoke 10
Symbol 2	Stoke 11
Symbol 3	Stoke 12
Symbol 4	Stoke 13

2.2 Dimensions

Detailed dimensions and the reference centre lines of the printed characters for Strokes 0 to 13 are shown in figures 1 to 14 inclusive. Figure 15 illustrates the character design matrix. Dimensions of the printed characters are as follows:

1)	Character height	2,972 mm (0.117 in)
2)	character widths	1,321 mm (0.052 in) 1,651 mm (0.065 in) 1,981 mm (0.078 in) 2,311 mm (0.091 in)
3)	width of horizontal and vertical bars	0,330 mm (0.013 in)
4)	minimum width of horizontal bars (this specification does not apply to vertical bars, see 5.5)	0,279 mm (0.011 in)
5)	corner radii (except Stroke 0, see figure 1)	0,165 mm (0.0065 in)
6)	tolerance (average edge)	± 0,038 mm (± 0.0015 in)

3 Character spacing and alignment

3.1 Spacing of characters

3.1.1 Common fields (fixed format)

3.1.1.1 The distance between the right average edge of adjacent characters shall be 3,175 mm ± 0,254 mm (0.125 in ± 0.010 in) (see figure 16).

(Average edge is defined and discussed in clause 5.)

3.1.1.2 The accumulation of spacing tolerances in any common (fixed format) field is limited to the extent that the accumulation does not infringe upon the boundaries defining this field.

1) As used in this International Standard, the term "magnetic ink" means ink capable of being magnetized and sensed.

3.1.2 Minimum space — any field

The minimum space between the right average edge of adjacent characters, whether they are in the same field or adjoining fields, can never be less than 2,921 mm (0.115 in). This also applies to variable format fields. Maximum or other spacing requirements in variable fields shall be specified by the individual machine manufacturer involved.

3.2 Alignment of characters

3.2.1 Definition

alignment: The relative vertical location of a character with respect to adjacent characters within a given field. The horizontal centre line of each character is indicated on drawings of the printed character by the symbol ℄$_H$. These centre lines serve to establish vertical alignment of all characters, since all characters are designed about the same horizontal centre line.

3.2.2 Tolerances

Vertical alignment tolerance is that which is consistent with good printing practice and subject to the following interpretations:

a) alignment of a line of characters printed in any field should be such that the bottom edges of adjacent characters within each field do not vary vertically by more than 0,381 mm (0.015 in) (see figure 17);

b) on characters that do not come down to the "base" line (see figures 13, 14, and 16), the tolerance specified in a) applies to the horizontal centre line.

4 Character skew

The maximum allowable character skew is ± 1°30' measured with respect to the bottom edge of the document. (See figure 18.)

5 Character tolerances

5.1 Dimensions

See figures 1 to 14 for dimensions of printed characters.

5.2 Definition of "average edge"

average edge: An imaginary line that divides the irregularities along the edge of a printed character so that the summation of the white areas on one side of the line is equal to the summation of the black areas on the other side (see figure 19). (The typical edge of a printed character is not a straight line.)

5.3 Average edge tolerance

The average edge tolerance for all stroke edges shall be ± 0,038 mm (± 0.0015 in) applied to the dimensions (measured from ℄ and ℄$_H$) that locate the edges. A typical illustration of this tolerance is shown in figure 20.

The average edge of the radii shall be tangential to the average edge of the stroke and shall fall within the ± 0,038 mm (± 0.0015 in) tolerance specified for stroke edges (See 2.2)

5.4 Edge irregularity tolerance

5.4.1 Peaks and valleys about the average edge are permitted to extend to ± 0,089 mm (± 0.0035 in) from the dimension locating the edge. An example is shown in figure 21. However, when these occur the sum of the edge present in the 0,038 mm to 0,089 mm (0.0015 in to 0.0035 in) zone shall not exceed 25% of the total edge.

5.4.2 An occasional void can be present at the edge and cause a valley that exceeds the limits mentioned above. The maximum allowable size of such voids is specified in clause 6.

5.4.3 An occasional excursion (such as feathering or stringing out) can be present at the edge and extend beyond the 0,038 mm to 0,089 mm (0.0015 in to 0.0035 in) zone. Such occasional excursions are not considered to be edge irregularities, and are defined as extraneous ink that is "attached" to the character. The maximum allowable size and quantity of such excursions is given in clause 8.

In measuring the size of such excursions, only the portion that extends beyond the 0,089 (0.0035 in) limit mentioned in 5.4.1 should be considered since the portion of the excursion in the 0,038 mm to 0,089 mm (0.0015 in to 0.0035 in) zone is controlled by character edge irregularity limits given in 5.4.1.

5.5 Minimum width of horizontal bars

The distance between the average edges of any horizontal bar shall be at least 0,279 mm (0.011 in). (This specification is an adjunct to the dimension specification locating each edge. This specification does not apply to vertical bars since vertical bars are controlled entirely by the dimensions locating each edge.

6 Voids

6.1 Definition

voids: The absence of ink within the specified outline of the printed character.

6.2 Maximum allowable single void

6.2.1 The maximum allowable single void anywhere in the character, including at an edge, shall be of a size that can be contained entirely within the boundary of a 0,203 mm × 0,203 mm (0.008 in × 0.008 in) square, with the following exception:

> If the portion of the character involving a single void is two or more zones wide [each zone is 0,330 mm (0.013 in) wide], then the maximum allowable single void must be completely surrounded by ink and contained entirely within the boundary of a 0,254 mm × 0,254 mm (0.010 in × 0.008 in) square.
>
> In this case, voids at edges are not included and are, therefore, limited to a 0,203 mm × 0,203 mm (0.008 in × 0.008 in) square. (See figure 22.)

6.2.2 Single voids that are long and narrow are called "needle" type voids. They are allowable in any length anywhere on the character provided that they are no wider than 0,051 mm (0.002 in), average edge to average edge.

6.3 Maximum allowable combined voids

The combined areas of all voids, in any vertical column or horizontal row nominally 0,330 mm (0.013 in) wide, shall not exceed 20% of the area of the column or row. (See figure 23.)

7 Uniformity of ink film

The ink deposited shall be uniformly distributed within the outlines of each character. Conditions to be avoided include excessive squeeze-out, halo, and other uneven deposits.

A ridge of ink that outlines a character and that appears dense in relation to the ink deposited within the character is acceptable provided that it does not exceed 0,038 mm (0.0015 in) between its average edges. Such ridges are predominant in letterpress printing and some impact printing.

8 Extraneous ink

8.1 Definition

8.1.1 Extraneous ink, magnetic

Any magnetic ink which appears in the 15,9 mm (0.625 inch) MICR clear band other than the E 13 B MICR characters. (See 8.2.1.1 and 8.2.2, and figure 24). The MICR clear band is applicable to both the front and back of the document.

8.1.2 Extraneous ink, nonmagnetic

Any ink (nonmagnetic) appearing in the 8,0 mm (0.315 inch) optical clear band (area) that interferes with optical reading of E 13 B MICR characters. It is splatter, smear, tracking, feathering, stringing out, toning, back offset, and so forth. (See 8.2.1.2, and figure 24). This clear area is defined in ISO 1831[1] and includes the printing band for the MICR characters. The optical clear band applies only to the document front.

8.2 Limitations

8.2.1 Extraneous ink, front

8.2.1.1 Magnetic ink

Extraneous magnetic ink on the front of the document within the MICR clear band is acceptable if the spots can be contained in a 0,08 mm × 0,08 mm (0.003 in × 0.003 in) square.

Spots that cannot be contained in a 0,08 mm × 0,08 mm (0.003 in × 0.003 in) square are acceptable provided that they can be contained in a 0,1 mm × 0,1 mm (0.004 in × 0.004 in) square and are limited to one per character space and total not more than five per field.

Spots that are found to be located within the outermost limits established by the character edge irregularity tolerance are to be considered under the character edge irregularity specifications.

8.2.1.2 Non-magnetic ink

Spots within the 8,0 mm (0.315 in) optical clear band that can be contained inside a circle 0,2 mm (0.008 in) in diameter are acceptable as long as no two spots are closer than 1,0 mm (0.040 in) to each other or to an E 13 B character regardless of PCS values. See ISO 1831 for the definitions of Visual Spectrum and Print Contrast Signal (PCS).

1) ISO 1831: 1980, *Printing specifications for optical character recognition.*

8.2.2 Extraneous magnetic ink, back

Extraneous magnetic ink on the back of the document within the area of the MICR clear and is not acceptable if the spots cannot be contained in a 0,15 mm × 0,15 mm (0.006 in × 0.006 in) square.

9 Debossment (impression)

Penetration of the printed character into the surface of the paper is known as debossment. When it is excessive, it can be the cause of rejects or misreads. Signal levels may be reduced or distorted because the magnetic ink characters are displaced from the magnetic pick-up device by the debossment depth. Debossment on the face of the document may or may no cause fractures of the paper fibers which are detectable on the reverse side.

A category of equipment which can measure debossment to within a repeatability of 0,0025 mm (0.001 in) is the light section microscope. Typical vendors of this equipment are Zeiss and Stangert.

This standard established 0,025 mm (0.001 in) as the maximum allowable debossment. However, it is recognized that this specification depth is frequently exceeded by letterpress printing, press numbering, and ribbon encoding without immediately causing MICR reading problems. Additional tolerances beyond the stated 0,025 mm (0.001 in) limit may be acceptable depending upon several associated factors such as signal strength, uniformity of ink coverage, and evenness of debossment. Therefore, it is recommended before sample documents are rejected for exceeding these debossment specifications, that back-up evaluation and testing for the above factors be employed.

For example:

(1) Uneven debossment such as deeper penetration by a vertical narrow stroke of a character, as compared to a broader portion of the same character coupled with insufficient signal from the ink can cause rejects.

(2) Although uniform debossment of an entire character with adequate signal strength probably will not cause rejects, considering that these conditions can occur, a further explanation of tolerances acceptable under the certain circumstances is contained in annex A.

10 Signal level

10.1 Definitions

10.1.1 Signal level: The amplitude of the voltage waveform produced when a dc-magnetized printed character is scanned by a suitable magnetic reading head. A Typical character waveform of Stroke 12 (Symbol 3) as it appears on the face of an oscilloscope is given in figure 25.

10.1.2 Nominal signal level: The signal obtained from a properly printed reference printing sample, calibrated as 100 percent using the Wire Card Calibration procedure and suitable test equipment.

The Wire Card Calibration procedure involves the measurement of a standard magnetic flux generated by a sinusoidal electrical current (I), flowing through a straight wire positioned parallel to the gap and within the gap of a standard magnetic read head. Calibration is performed using procedures and test equipment as described in 10.4.

The chart shown in figure 26 and the waveforms in figure 27 illustrate the nominal signal level for designated peaks of each character when the Stroke 12 (Symbol 3) is at 100 percent.

10.1.3 Relative signal level: The ratio, stated as a percentage, that the signal level of a character being measured bears to the nominal signal level for that character with the reference Wire Card standard taken as 100 percent for the Stroke 12 (Symbol 3) (see figure 13).

The signal level of the character being measured is obtained using suitable procedures and test equipment. (See 10.2.)

10.1.4 Secondary reference document: A paper document specially printed in magnetic ink with a single Stroke 12 (Symbol 3) of the E 13 B font. This document is of known relative signal level as determined by the Wire Card Calibration procedure described in 10.4 for use in calibration of equipment used to measure relative signal level. Secondary reference documents are selected such that the relative signal of the printing theron is as close as practical to 100 percent of the nominal signal level. These documents are marked to indicate their actual relative signal levels (See figure 28). To perform as expected, MICR characters should be printed to the nominal dimensions shown in figures 1 through 14.

10.2 Test equipment and parameters

10.2.1 Test equipment

10.2.1.1 A means for moving a document bearing the dry magnetic ink printing from left to right (the characters are scanned from right to left), in a direction parallel to a single gap magnetic read head, and including means for holding the document in intimate contact with the face of a magnetic write head and read head.

10.2.1.2 A dc-magnetizing head (write head) capable of magnetizing the characters to saturation in a direction parallel to the bottom reference edge and in the plane of the printed characters. Note that saturation of the magnetic ink is important to achieve uniform signal levels within any waveform and also readings which are repeatable.

10.2.1.3 A single gap magnetic read head mounted with the long axis of the gap perpendicular to the bottom reference edge and parallel with the plane of the printed characters. Considering the magnetic read head gap as a plane of negligible thickness, the plane of the gap shall be perpendicular to the plane of the document and to the bottom reference edge of the document.

10.2.1.4 A linear amplifier to amplify the output of the magnetic read head for presentation on an oscilloscope.

10.2.1.5 An oscilloscope, or equivalent, for display of the voltage waveform(s) of the character(s) to be measured and the voltage waveform(s) of a calibrated Stroke 12 (Symbol 3) on a secondary reference document.

10.2.2 Equipment parameters

10.2.2.1 The relative speed of the document to the read head shall be 380 cm/s (150 in/s) within ± 2%. Combined character skew from all causes shall not exceed 1,5 degrees relative to the centre line of the read head gap.

10.2.2.2 The magnetizing read head shall be such as to produce dc magnetic saturation in printed characters in the direction specified in 10.2.1.2. The leading pole relative to the printed character is to be the north pole.

10.2.2.3 The magnetic read head shall have a 0,076 mm (0.003 in) gap and a minimum resonant frequency of 40 kHz. The height of the read head gap shall be 6,35 mm (0.250 in). The head shall be shielded on all sides, except the read face and the back, such that any induced noise shall not cause a signal-to-noise ratio less than 40:1 when reading 100 percent reference material (Brush Clevite Read Head, part number BK1251, or equivalent).

10.2.2.4 The amplifier shall have the following characteristics:

(1) **Gain.** The amplifier gain shall be such that an input sine wave of 10 mV ± 0,2 mV peak-to-peak at 1 kHz, produces a sine wave output of 2,4 V ± 0,4 V peak-to-peak.

(2) **Frequency response.**

(a) The amplifier gain shall not vary by more than ± 0,5 db from the 1 kHz gain over a frequency range of 200 Hz to 3 kHz.

(b) The amplifier gain between the frequencies 200 Hz and 75 Hz shall not drop more than 3 db below the 1 kHz gain.

(c) The amplifier gain below 75 Hz shall not exceed the 1 kHz gain.

(d) The amplifier gain above 3 kHz shall drop on a smooth curve such that: at 5,1 kHz ± 600 Hz, the gain is 3 db below the 1 kHz gain; and at 11,2 kHz ± 1,2 kHz, the gain is 12 db below the 1 kHz gain.

NOTE – A gain 3 db below a reference value is 0,707 of the reference value; a gain 12 db below a reference value is 0,25 of the reference value.

(3) **Roll-Off.** The high frequency roll-off characteristics of the amplifier shall be equivalent to that of a four section resistance-capacitance filter with buffering between stages, that is, non-peaking, and have an attenuation of 6 db per octave per stage or 24 db per octave for the four stages.

(4) **Linearity.** At any frequency within the range from 75 Hz to 11,2 kHz ± 1,2 kHz, the amplifier gain shall be linear within ± 0,5 db for an input voltage range of 3 mV to 25 mV peak-to-peak.

(5) **Noise.**

(a) With the input connection to ground, the noise output shall not exceed the voltage which is equivalent to one percent of the nominal output signal level.

(b) A circuit diagram of a suitable amplifier is given in annex A.

10.2.2.5 The oscilloscope may be of any commercially available type intended for laboratory measurements and equipped with a graticule bearing horizontal and vertical rulings.

10.3 Testing procedure

10.3.1 The horizontal trace which appears on the face of the oscilloscope when the output of the amplifier is connected to the ac input of the oscilloscope, but with no document being scanned, is adjusted to coincide with the lowest ruling on the oscilloscope graticule.

10.3.2 A secondary reference document with a Stroke 12 (Symbol 3) character is placed in the transport and scanned. Set the vertical gain to 2X magnification and adjust the vertical centring so that the deflection from the uppermost division to the baseline is 200 percent of the positive peak amplitude of the symbol being measured. This may be done as follows:

(1) Determine the number of major divisions on the graticule in the vertical direction.

(2) Divide this number by two.

(3) Multiply this by the relative signal level percentage of the secondary reference document. Stroke 12 (Symbol 3) character being used and divide by the nominal value (see figure 29) for the character to be measured. Adjust the vertical gain so that the vertical deflection of the character being observed is equal to this calculated deflection.

For example:

(a) Eight major divisions are on the face of the oscilloscope.

(b) A secondary reference document relative signal level is at 104 percent.

(c) If the character being measured is a Stroke 12 (Symbol 3) character, the nominal value for this character is 100 so the number of divisions equals (8/2)*(104/100), which equals 4,16. If the character being measured is a 9, the nominal value for this character is 165 so the number of divisions equals (8/2)*(104/165), which equals 2,52.

(d) If the character to be measured is a Stroke 12 (Symbol 3) character, adjust the vertical gain so that the average amplitude of the third and fifth peaks on the secondary reference document is 4,16 divisions on the graticule. If the character to be measured is a 9, adjust the vertical gain so that the average amplitude of the third and fifth peaks on the secondary reference document is 2,52 divisions on the graticule.

(e) Four divisions then correspond to 100 percent for the character being measured. The vertical gain must be adjusted again if a different character is to be measured.

10.3.3 An alternate procedure that is slightly more accurate but may take more time when measuring a large number of documents may be used to determine relative signal strength as follows:

(1) A secondary reference document with a calibrated Stroke 12 (Symbol 3) character is placed in the transport and scanned. The average amplitude of the third and fifth peaks of this character is then measured, using the highest resolution possible on the oscilloscope.

(2) This value is then scaled by dividing by the relative signal level of the secondary reference Stroke 12 (Symbol 3) character and multiplying by the nominal relative value for the character to be measured (see figure 29). The resulting value is the nominal signal level for the character to be measured.

(3) To determine the relative signal level of any particular character under test, measure the vertical deflection of the appropriate positive peaks (figure 29) and divide by the nominal signal level for that character as determined above.

For example:

(a) If the relative signal level for the calibrated Stroke 12 (Symbol 3) character equals 104 percent and measures 800 mV on the oscilloscope, then the nominal voltage for a Stroke 12 (Symbol 3) character is (800 mV)*(100/104) = 769 mV. The nominal voltage for Stroke 13 (Symbol 4) character would be (800 mV)*(67/104) = 515 mV.

(b) If another Stroke 12 (Symbol 3) character measures 750 mV, the relative signal level is (750/769) = 97,5%. If a Stroke 13 (Symbol 4) character measures 560 mV, the relative signal level is (560/515) = 108,7%.

10.4 Wire card calibration of secondary reference documents.

10.4.1 The wire card calibration procedure is based on the signal level obtained from the magnetic flux generated by a sinusoidal current, I, of fixed magnitude and given frequency carried by a straight cylindrical conductor centred and in intimate contact with the read head gap. See figure 29.

10.4.2 The magnetic flux to be used for calibration shall be the flux developed by a cylindrical conductor extending over the full gap and with the following nominal diameter and drive current:

(1) Conductor diameter shall be equivalent to the standard dimensions of AWG B&S GAUGE # 28

Annealed copper, single Formvar, 0,32 mm (0.01264 in) in diameter.

(2) The drive current, I, shall be a sinewave of 8,6 mA, zero to peak (± 2 percent), at 5,77 kHz (± 2 percent). The drive current shall not contain more than 5 percent total harmonic distortion.

The straight wire shall be taped to a stiff paper card. The tape shall not be thicker than 0,05 mm (0.002 in). A 100 Ω (1 percent, 0,1 watt) resistor may be connected in series with one end of the wire to facilitate current measurement. A suitable device for generating the magnetic flux for the calibration is shown in figure 30.

10.4.3 Test equipment required

The following test equipment should be used:

(1) **A Moore Magnetic Character Tester (MCT), or equivalent.** Caution: The read head gap height in the Moore tester is 6,35 mm (0.250 in) requiring careful alignment of the test documents. The head springs shall be in good condition and the machine shall be warmed up for at least 15 minutes before making measurements.

(2) **A properly calibrated oscilloscope.** The oscilloscope shall have an input impedance of at least 1 MΩ for display of the wire card current level, the output voltage level from the tester induced by the wire card current, and the voltage waveform of the character to be calibrated.

(3) **A screwdriver, wrench, and small hammer.** These tools shall be used to adjust the height and rotation of the heads. A small screwdriver shall be used to adjust the potentiometer that controls the voltage to the write head.

10.4.4 Wire card calibration procedure

10.4.4.1 Disconnect all loads from the output of the amplifier except the oscilloscope. Carefully adjust the current in the wire to 8,6 mA (zero to peak) at 5,77 kHz and place the wire card on a flat, nonconductive surface near the back of the tester.

10.4.4.2 Disconnect the two wires to the ac motor and remove the screws that hold the read head in the machine. The output of the MCT should be ac coupled to the input of the oscilloscope, and the oscilloscope trace baseline should be set to the bottom graticule line. After the tester has warmed up, manually move the wire card over the read head with the head touching the wire centrally until the maximum signal amplitude is measured on the oscilloscope. The maximum (zero to peak) amplitude of the output sine wave which corresponds to the 100 percent signal level should be recorded.

10.4.4.3 Reconnect the ac motor wires and remount the read head in the machine. Using a document similar to the secondary reference document with a single Stroke 12 (Symbol 3) character, carefully adjust the height and rotation of the read and write heads to give a maximum output for the third peak of the Stroke 12 (Symbol 3) character using the screwdriver, wrench, and hammer. The adjustment of the write head is more difficult than the adjustment of the read head and requires several iterations since the document must be erased and re-measured after each adjustment.

10.4.4.4 Monitor the voltage across the write head and adjust the appropriate potentiometer with the small screwdriver until 0,35 V is measured. Then while running the test document through the machine, monitor the tester output and gradually increase the write head voltage until a maximum amplitude on the third peak is reached. Erase the document and re-measure to guarantee that the output is still at the maximum. The machine should now be ready to measure the secondary reference document.

Caution: For secondary reference documents to perform as expected, MICR characters should be printed to the nominal dimension shown in figures 1 to 14.

10.4.4.5 Place the secondary reference document in the transport and observe the output waveform with the oscilloscope ac coupled. Determine the average amplitude of the third and fifth peaks using the maximum resolution possible on the oscilloscope. The average of several runs should be used since there is usually some variation between runs and some noise generated by the tester.

10.4.4.6 The relative signal amplitude for the secondary reference Stroke 12 (Symbol 3) character can now be determined by dividing the average amplitude of the two peaks by the maximum amplitude measured with the wire card. For example, if the maximum output measured with the wire card was 740 mV and the average amplitude of the two peaks on the secondary reference document was 800 mV, then the relative signal strength for the secondary reference would be (800/740) = 108%.

10.4.4.7 The heads should be readadjusted whenever a new type of secondary reference document is calibrated. Minor changes in the paper or print quality may also change the optimal position for the write head.

10.5 Relative signal level tolerance

The relative signal level from any printed character may vary from 50% to 200% of its nominal signal level.

10.6 Residual signal level

The residual signal level is the signal delivered by character which has been voided.

Whenever mis-encoded information is voided, the residual signal level shall not exceed 5% of the nominal signal level for the Stroke 12 (Symbol 3) character.

The method employed to void should permit re-encoding of the document and re-reading in MICR equipment.

11 Paper

Paper should be made from virgin pulp (not recycled) with a basis grammage weight minimum of 90 g/m^2 which is considered ideal for paper documents.

It is recognized that certain particles embedded in paper can be a cause for machine rejects.

Paper should be used from which magnetic particles, such as iron and other ferromagnetic materials, have been eliminated or reduced to a minimum.

12 Format

12.1 Reference edges

12.1.1 Horizontal dimensions

All horizontal format dimensions are measured from the right-hand edge of the document. The right-hand edge of the first or right-hand character shall be located 7,925 mm ± 1,575 mm (0.312 in ± 0.062 in) from the right-hand reference edge. (See figure 31.)

12.1.2 Vertical dimensions

All vertical dimensions are measured from the bottom edge of the document.

12.2 MICR clear band

MICR clear band: A horizontal band 15.9 mm (0.625 in) high on both the front and back of a document and extending the full length of the document that must be kept free of any magnetic ink, other than the E 13 B font. See figure 24.

12.3 MICR print band

MICR print band: A rectangle of 6,35 mm (0.250 in) in height that has one side parallel to the horizontal aligning document edge and is intended to contain only magnetic ink characters or symbols of the E 13 B font in one single line. The vertical location of this band is determined by the application involved but the MICR print band must be wholly contained within the MICR clear band. Fonts E 13 B and CMC 7 shall not be permitted in the same MICR clear bands on any document. The MICR print band is defined only for the front of a document. See figure 24.

12.4 Optical clear band

Optical clear band: A rectangle with height of 8,0 mm (0.315 in) which has included within it the centrally located MICR print band. The width of the optical clear band shall be larger than the MICR printing by at least 2,5 mm (0.1 in) on the right and left sides. See figure 24 and ISO 1831.

12.5 Optical clear band background

12.5.1 General

Recognition of E 13 B characters, either by an optical reader or visually (original or microfilm), requires an adequate reflectance difference between the MICR printed characters and its surrounding background in the clear band of the document.

12.5.2 Background reflectance

Background: The colour in the optical clear band of the document.

The background reflectance shall be at least 60% minimum using the CIE/Y filter peaking at 555 nm, as per ISO 1831: 1980, subclause 4.2.3.

12.5.3 Print contrast signal (PCS)—magnetic ink printed character

Print contrast signal (PCS): The PCS of the MICR characters with respect to its optical clear band background shall be greater than 0,6. Use the method given in ISO 1831: 1980, subclause 5.4.5.

13 MICR ink permanence

Due to the multiple passes through high speed MICR reader sorters required in payment transfer systems, MICR printing is required to withstand at least twenty (20) passes without degrading the MICR reader performance.

Dimensions in millimetres

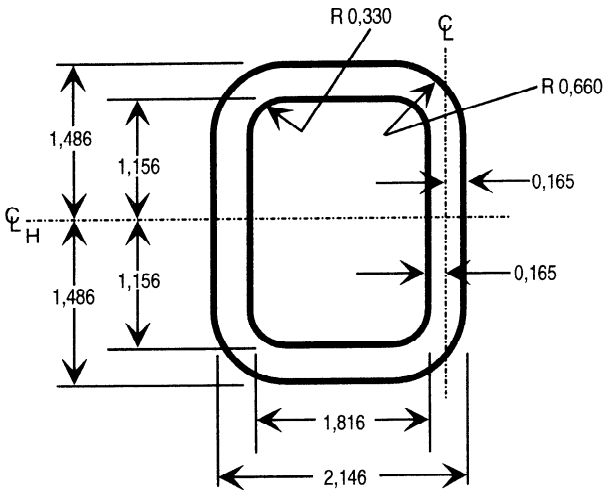

Figure 1 — Stroke 0 (Zero)

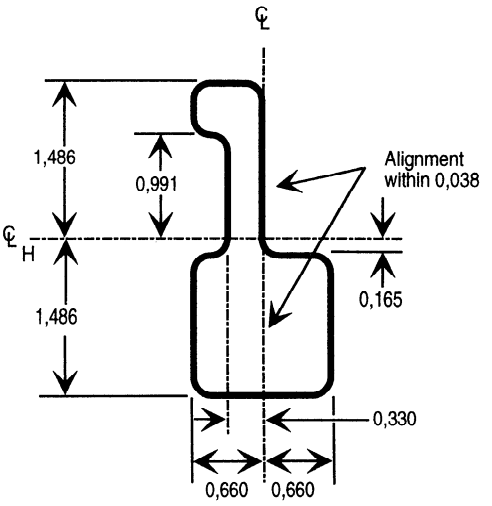

Figure 2 — Stroke 1 (One)

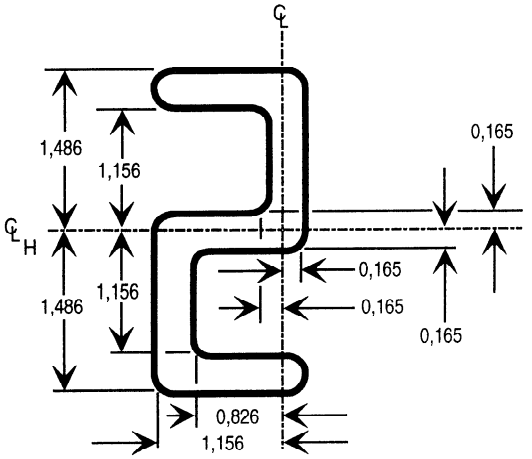

Figure 3 - Stroke 2 (Two)

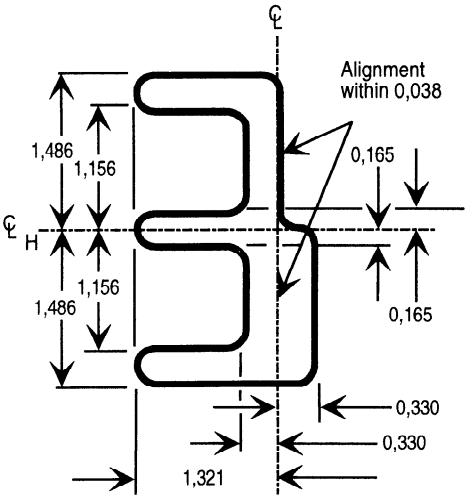

Figure 4 - Stroke 3 (Three)