

# ASC X9 TR 6–2006

## Guide to Quality MICR Printing and Evaluation



A Technical Report prepared by:  
Accredited Standards Committee X9, Incorporated  
Financial Industry Standards

Registered with American National Standards Institute

**Date Registered: 1-31-07**

# Contents

Page

Foreword .....	viii
Guide to Quality MICR Printing and Evaluation.....	Error! Bookmark not defined.
1 Introduction.....	1
1.1 Scope and Purpose .....	1
1.2 What you need to know in this technical report .....	2
2 Normative References.....	3
3 Terms and definitions .....	4
4 General .....	7
4.1 An Overview of tools and Processes .....	7
4.2 Document Sampling and Sample Size .....	7
4.3 Other Considerations with MICR Quality Control .....	8
5 MICR Evaluation Tools and Techniques .....	9
5.1 Human Eye and Hand.....	9
5.2 MICR Position and Dimension Gauge .....	9
5.3 Small Optical Comparator (8X-12X Magnification) .....	12
5.4 Large Optical Comparator (20X-50X Magnification) .....	13
5.5 Microscope.....	14
5.6 Magnetic Tester .....	15
5.7 Debossment and Embossment Testers .....	15
5.8 Paper Testing.....	15
5.9 MICR Document Specification Form .....	16
6 Optical Evaluation .....	17
6.1 Basics of Optical Document Evaluation .....	17
6.2 The MICR Clear Band and Optical Clear Band .....	17
6.3 Paper.....	17
6.4 Optical Background .....	17
6.5 Optical Format .....	17
6.6 MICR Positioning.....	18
6.7 Adjacent Character Spacing and Alignment .....	19
6.8 Character and Line Skew.....	20
6.9 Basic Character Dimensions.....	22
6.10 Average Edge.....	22
6.11 Basic Tolerances.....	23
6.12 Edge Irregularity Allowances .....	23
6.13 Vertical and Horizontal Bars .....	23
6.14 Voids.....	23
6.15 Uniformity of Ink .....	27
6.16 Extraneous Ink.....	28
6.17 Debossment and Embossment.....	28
7 Calibration Documents .....	28
7.1 What is a Calibration Document? .....	28
7.2 Calibration Standards .....	29
7.3 Basic Usage .....	29
8 Magnetic Evaluation.....	29

**ASC X9 TR 6-2006**

8.1	Basics of Magnetic Document Evaluation .....	29
8.2	Signal Strength .....	30
8.3	Testing of all Character Peaks .....	30
8.4	First Peak Importance .....	31
8.5	Signal Level Limits .....	31
8.6	Horizontal Peak Locations.....	31
8.7	Non-Uniformity of the Waveform .....	31
8.8	Extraneous Peaks.....	34
8.9	Skew and Edge Irregularities.....	36
9	Debossment and Embossment .....	37
9.1	General.....	37
9.2	Debossment .....	37
9.3	Embossment .....	37
9.4	Manual Detection of Debossment and Embossment.....	38
9.5	Measurement of Debossment and Embossment .....	38
10	Paper .....	40
10.1	Introduction.....	40
10.2	Basis Weight of Paper .....	40
10.3	Grain Direction .....	40
10.4	Fillers, Coating and Background Inks .....	41
10.5	Moisture Level.....	41
10.6	Electrical Properties .....	42
10.7	Other Considerations .....	43
11	MICR Readers and Reader/Sorters .....	43
11.1	General Concepts .....	43
11.2	Reader/Sorter Types.....	44
11.3	Document Handling.....	44
12	Permanence.....	45
12.1	Introduction.....	45
12.2	Permanence of Ink Regarding Fold Resistance .....	46
13	Vendor Responsibility .....	46
13.1	Introduction .....	46
13.2	Parameters .....	46
13.3	User Education.....	46
13.4	Verification and Testing of MICR Printing Systems.....	47
13.5	Non-Impact Printing Guidelines .....	47
13.5.1	Hardware.....	47
13.5.1.1	Paper Registration .....	47
13.5.1.2	Development.....	47
13.5.1.3	Other Hardware Issues .....	48
13.5.1.4	Service/Maintenance Program.....	48
13.5.2	Software.....	48
13.5.2.1	E-13B Font .....	48
13.5.2.2	Printer Alignment .....	48
13.5.2.3	Quality Assurance.....	48
13.5.2.4	MICR Line Spacing.....	48
13.5.3	MICR Supplies.....	48
13.5.3.1	MICR Dry Ink (Toner) .....	48
13.5.3.2	MICR Dry Ink Cartridges.....	49
13.5.3.3	MICR Bond Paper .....	49
13.5.4	Quality Assurance .....	49
13.5.4.1	Quality Check List.....	49
13.5.5	Security.....	49

13.5.6	Services.....	50
13.5.6.1	Document Design .....	50
13.5.6.2	Digitizing Service .....	50
13.5.6.3	MICR Document Testing .....	50
13.5.6.4	Hardware and Software Maintenance .....	50
13.5.6.5	MICR Quality Assurance .....	50
Annex A	E-13B – MICR Character Outlines .....	51
A.1	Introduction.....	51
A.2	MICR Character Outlines .....	52
Annex B	Signal Levels and Waveforms .....	56
B.1	Introduction.....	56
B.2	Signal Levels and Wave Forms.....	56
Annex C	Magnetic Inks .....	64
C.1	Introduction.....	64
C.2	MICR Ribbons .....	64
C.3	MICR Dry Ink (Toner).....	65
C.4	MICR Wet Ink.....	65
C.5	Basic Physical Properties of MICR Ink.....	66
C.6	Technical Definitions .....	66
C.7	Magnetic Ink Guidelines .....	67
Annex D	MICR Testing Equipment and Services.....	69
D.1	Introduction.....	69
Annex E	MICR Quality Control Checklist.....	71
E.1	Checklist.....	71
E.2	General Inspection .....	71
E.2.1	Compare the MICR line format with the correct format for your bank .....	71
E.2.2	Quickly flip through the deck.....	71
E.2.3	Check a few samples for debossment or embossment using your finger tips .....	71
E.3	Check Registration, Layout and Document Dimensions .....	71
E.3.1	Make sure that all fields fall in the correct areas .....	72
E.3.2	Check for clear band intrusion, i.e., image in the clear band .....	72
E.3.3	Check for proper MICR line registration .....	72
E.3.4	Scan for possible character-to-character spacing and skew problems.....	72
E.3.5	Check character-to-character vertical alignment.....	72
E.3.6	Check document dimensions against specification.....	72
E.4	Check for Voids, Extraneous Ink and Other Print Defects.....	72
E.4.1	Examine the front of the clear band for extraneous ink.....	72
E.4.2	Examine the back of the clear band for extraneous ink.....	73
E.4.3	Examine all characters for voids .....	73
E.5	Check MICR Image Quality Specification Conformance .....	73
E.5.1	Compare character average edge outline with specification .....	73
E.5.2	Compare horizontal stroke width with specification .....	73
E.5.3	Compare edge irregularity with specification .....	73
E.6	Check MICR Signal Strength.....	73
E.6.1	Compare designated peak signal strength with specification for all characters .....	73
E.6.2	Examine character waveforms for non-uniformity or irregularities.....	73
E.6.3	Examine extraneous ink, if present, to verify that ink is magnetic .....	73
E.6.4	Examine clear band intrusions, if present, to verify that ink is magnetic .....	73
E.6.5	Evaluate debossed characters for waveform uniformity .....	73
E.7	Check Debossment/Embossment .....	73
E.7.1	Compare debossment / embossment levels with specification.....	74
E.8	The “Live” Test .....	74
E.8.1	Inform document producer of format or layout problems .....	74

**ASC X9 TR 6-2006**

**E.8.2 Assess severity of specification shortfalls, if any ..... 74**  
**E.8.3 Grade and Inform ..... 74**  
**Annex F Conversion Table ..... 75**

**Figures**

Figures .....vi  
Figure 1: MICR Position and Dimension Gauge ..... 12  
Figure 2: MICR Character Positioning..... 12  
Figure 3: Typical MICR Grid Eye Loupe Reticle..... 13  
Figure 4: Typical MICR Outline Eye Loupe Reticle (10X Normal Size) ..... 14  
Figure 5: Sample MICR Document Specification Form ..... 16  
Figure 6: Required Structures – Routing and Amount Fields..... 18  
Figure 7: Horizontal Character Spacing Errors ..... 19  
Figure 8: Character Alignment ..... 20  
Figure 9: On-Us and Dash Symbol Alignment ..... 20  
Figure 10: Line and Character Skew Errors ..... 21  
Figure 11: Maximum Permitted Character Skew ..... 22  
Figure 12: Edge Irregularity ..... 24  
Figure 13: Character Size Limits ..... 25  
Figure 14: Average Edge Considerations..... 26  
Figure 15: Void Structures..... 27  
Figure 16: Typical Calibration Document..... 29  
Figure 17: Examples of Waveform Non-Uniformity..... 33  
Figure 18: On-Us Symbol Waveform with an Extraneous Peak Caused by an Internal Void..... 35  
Figure 19: On-Us Symbol Waveform with an Extraneous Peak Caused by Extraneous Ink..... 35  
Figure 20: Skew and Waveform Distortion..... 36  
Figure 21: Debossment ..... 39  
Figure 22: Embossment ..... 39

Figure 23:	Character Grid Dimensions .....	51
Figure 24:	Outline of Digits 0, 1, 2, and 3 .....	52
Figure 25:	Outline of Digits 4, 5, 6, and 7 .....	53
Figure 26:	Outline of Digits 8, 9, and the Transit and Amount Symbols .....	54
Figure 27:	Outline of the On-Ups and Dash Symbols .....	55
Figure 28:	Signal level table and theoretical waveform – Character One .....	56
Figure 29:	Signal level table and theoretical waveform - Character Two .....	57
Figure 30:	Signal level table and theoretical waveform - Character Three .....	57
Figure 31:	Signal level table and theoretical waveform - Character Four .....	58
Figure 32:	Signal level table and theoretical waveform - Character Five .....	58
Figure 33:	Signal level table and theoretical waveform - Character Six .....	59
Figure 34:	Signal level table and theoretical waveform - Character Seven .....	59
Figure 35:	Signal level table and theoretical waveform - Character Eight .....	60
Figure 36:	Signal level table and theoretical waveform - Character Nine .....	60
Figure 37:	Signal level table and theoretical waveform - Character Zero .....	61
Figure 38:	Signal level table and theoretical waveform - Transit symbol .....	61
Figure 39:	Signal level table and theoretical waveform - Amount symbol .....	62
Figure 40:	Signal level table and theoretical waveform - On-Ups symbol .....	62
Figure 41:	Signal level table and theoretical waveform - Dash symbol .....	63
Figure 42:	Magnetic Ink Hysteresis Curve .....	68

**Tables**

Tables .....	vii
Table 1: Summary of MICR QC Tools and Who Needs to Use Them .....	3
Table 2: Tests to Perform as per X9B Standards .....	11

## ASC X9 TR 6-2006

### Foreword

Since the introduction of the MICR (Magnetic Ink Character Recognition) document in 1957, which provided for the initial automation of the check processing system, there have been significant advances in technologies involved with the printing, processing, and testing of checks. Developments in these technologies have led to the expansion of the number of people with direct involvement in the production of MICR documents.

It is important to note that MICR quality requirements apply uniformly to all checks. While quality requirements may vary with application, there is generally no way to target documents for a specific application.

In 1988, when a major revision of American National Standard (ANS) X9.27, *Print Specifications for Magnetic Ink Character Recognition (MICR)*, was approved and printed, ASC X9B determined that additional work was required regarding MICR print quality. As a result, ASC X9B maintained an Ad Hoc MICR Print Quality Working Group that met at least three times each year until 1995. This group was concerned with addressing the challenges faced with the introduction of new MICR printing technologies.

This technical report is an effort to document much of what the original Ad Hoc MICR Print Quality Working Group felt was essential to be put into a single reference for industry use and as an educational tool for new comers. The initial report, issued as an ASC X9B Technical Guideline, TG-6, was published in 1995, and updated in 2000. The report content has been reviewed and updated to reflect the current MICR environment. In addition to the main body of the report, there are seven annexes in this technical report, which are provided for information purposes only.

This document is the product of many people's efforts over several years; however, our entire group would like to honor the memory of Glenn Mulligan, Xerox Corporation, who was the initial editor. Glenn was instrumental in arranging the original text and composing many of the illustrations prior to his death in 1993.

Publication of this Technical Report that has been registered with ANSI has been approved by the Accredited Standards Committee X9, Incorporated, 1212 West Street, Suite 200, Annapolis, MD 21401. This document is registered as a Technical Report according to the "Procedures for the Registration of Technical Reports with ANSI." This document is not an American National Standard and the material contained herein is not normative in nature. Published by

**Accredited Standards Committee X9, Incorporated**  
**Financial Industry Standards**  
**1212 West Street, Suite 200**  
**Annapolis, MD 21401 USA**  
**X9 Online <http://www.x9.org>**

Copyright © 2006 ASC X9, Inc.  
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without prior written permission of the publisher. Published in the United States of America. **NOTE The user's attention is called to the possibility that compliance with this technical report may require use of an invention covered by patent rights.**

By publication of this technical report, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the standards developer.

Suggestions for the improvement or revision of this Technical Report are welcome. They should be sent to the X9 Committee Secretariat, Accredited Standards Committee X9, Inc., Financial Industry Standards, 1212 West Street, Suite 200, Annapolis, MD 21401 USA.

This Technical Report was processed and registered for submittal to ANSI by the Accredited Standards Committee on Financial Services, X9. Committee approval of the Technical Report does not necessarily imply that all the committee members voted for its approval.

The X9 committee had the following members:

Jim Shaffer, X9 Chairman  
Vincent DeSantis, X9 Vice-Chairman  
Cynthia Fuller, Executive Director  
Susan Yashinski, Managing Director

**Organization Represented**

**Representative**

ACI Worldwide  
American Bankers Association  
American Express Company  
American Financial Services Association  
Bank of America  
Capital One  
Certicom Corporation  
Citigroup, Inc.  
Clarke American Checks, Inc.  
Deluxe Corporation  
Diebold, Inc.  
Discover Financial Services  
Federal Reserve Bank  
First Data Corporation  
Fiserv  
FSTC, Financial Services Technology Consortium  
Hewlett Packard  
Hypercom  
iStream Imaging/Bank of Kenney  
IBM Corporation  
Ingenico  
Intuit, Inc.  
J.P. Morgan Chase & Co  
KPMG LLP  
MagTek, Inc.  
MasterCard International  
National Association of Convenience Stores  
National Security Agency  
NCR Corporation  
SWIFT/Pan Americas  
The Clearing House  
U.S. Bank  
University Bank  
VeriFone, Inc.  
VECTORsgj  
VISA  
Wachovia Bank  
Wells Fargo Bank

Jim Shaffer  
C. Diane Poole  
John Allen  
Mark Zalewski  
Daniel Welch  
Scott Sykes  
Daniel Brown  
Mike Halpern  
John W. McCleary  
John Fitzpatrick  
R. David Nein  
Katie Howser  
Dexter Holt  
Connie Spurgeon  
Skip Smith  
Daniel Schutzer  
Larry Hines  
Scott Spiker  
Ken Biel  
Todd Arnold  
John Spence  
Jana Hocker  
Jacqueline Pagan  
Mark Lundin  
Carlos Morales  
William Poletti  
Gray Taylor  
Sheila Brand  
Steve Stevens  
Malene McMahon  
Vincent DeSantis  
Marc Morrison  
Stephen Ranzini  
Brad McGuinness  
Ron Schultz  
Richard Sweeney  
Ray Gatland  
Ruven Schwartz



**ASC X9 TR 6-2006**

The X9B subcommittee on Check Related Transactions had the following members:

Dexter Holt, X9B Chairman  
Curt Siroky, X9B Vice Chairman  
Daniel Welch, X9B Vice Chairman

**Organization Represented**

All My Papers  
American Bankers Association  
American Financial Services Association  
BancTec, Inc.  
Bank of America  
Boise Paper Solutions  
Carreker  
Certicom Corporation  
Check Site, Inc.  
Citigroup, Inc.  
Clarke American Checks, Inc.  
ClearWave Electronics  
Compass Bank  
Davis & Henderson  
Deluxe Corporation  
Diebold, Inc.  
Discover Financial Services  
ECCHO  
Federal Reserve Bank  
First Data Corporation  
Fiserv  
FSTC, Financial Services Technology Consortium  
Huntington Bank  
Hypercom  
iStream Imaging/Bank of Kenney  
IBM Corporation  
IFSA  
ImageScan  
Ingenico  
Intuit, Inc.  
J.P. Morgan Chase & Co  
John H. Harland Company  
Liberty Enterprises, Inc.  
MagTek, Inc.  
National Security Agency  
NACHA The Electronic Payments Association  
NCR Corporation  
NetDeposit, Inc.  
Oce North America, Inc  
Orbograph  
Paychex Inc  
Piracle A  
RDM Corporation  
Relyco Sales Inc  
Reynolds and Reynolds Co.

**Representative**

Larry Krummel  
C. Diane Poole  
Mark Zalewski  
David Hunt  
Daniel Welch  
Jim Moore  
Don Harman  
Daniel Brown  
Trevor Kensey  
Mike Halpern  
John W. McCleary  
Mark Ross  
Kirk Maze  
Dragan Calusic  
John Fitzpatrick  
Bruce Chapa  
Julie Shaw  
Phyllis Meyerson  
Mark Kielman  
Connie Spurgeon  
Skip Smith  
Daniel Schutzer  
Michelle Dunkle  
Scott Spiker  
Ken Biel  
Rod Moon  
Katja Lehr  
Hanna Jabbour  
John Spence  
Jana Hocker  
Jacqueline Pagan  
Curt Siroky  
Rick Zecher  
Carlos Morales  
Sheila Brand  
Nancy Grant  
David Norris  
William Wong  
Tony Ribeiro  
Dave Kliewer  
Carl Tinch  
Alan Quarnberg  
Karin McNabb  
Rick Gagnon  
Mark Hoenie

Rosetta Technologies  
 Silver Bullet Technology, Inc.  
 Solutran  
 Source Technologies  
 Standard Register Company  
 SWIFT/Pan Americas  
 The Clearing House  
 The National Clearing House  
 Troy Group, Inc.  
 U.S. Bank  
 Unisys Corporation  
 VECTORsgj  
 Vicor, Inc.  
 VISA  
 Wachovia Bank  
 Wells Fargo Bank  
 WorkflowOne  
 Xerox Corporation

Jim Maher  
 Bryan Clark  
 Carmen R. Nordstrand  
 Wally Burlingham  
 Russell Hill  
 Malene McMahon  
 Steve Jackson  
 Karroll Searcy  
 Michael Riley  
 Christopher Stickney  
 David J. Concannon  
 Jerry Bowman  
 Rick Smith  
 Richard Sweeney  
 Keith Ross  
 Al Hecht  
 Mel Stephenson  
 Frank Bov

Under ASC X9, Inc. procedures, a working group may be established to address specific segments of work under the ASC X9 Committee or one of its subcommittees. A working group exists only to develop standard(s) or technical report(s) in a specific area and is then disbanded. The individual experts are listed with their affiliated organizations. However, this does not imply that the organization has approved the content of the standard or technical report. (Note: Per X9 policy, company names of non-member participants are listed only if, at the time of publication, the X9 Secretariat received an original signed release permitting such company names to appear in print.)

The X9B7 Quality Control of MICR Documents working group which developed this technical report had the following members:

Wally Burlingham, Source Technologies, Chairman and Project Editor  
 Don Harman, Carreker, Secretary

<b><u>Organization Represented</u></b> .....	<b><u>Representative</u></b>
Clarke American Checks, Inc.....	John W. McCleary
John H Harland Company.....	Curt Siroky
RDM Corp.....	Thomas Hayosh
Xerox.....	Frank Bov
Paychex, Inc.....	Carl Tinch
J.P. Morgan Chase & Co.....	Jackie Pagan
Deluxe Corporation.....	John Fitzpatrick
Troy Group.....	Michael Riley
Standard Register Company.....	Melissa Barnes
Unisys Corporation.....	David J. Concannon

This is a preview of "ASC X9 TR 6:2006". [Click here to purchase the full version from the ANSI store.](#)

# Guide to Quality MICR Printing and Evaluation

## 1 Introduction

### 1.1 Scope and Purpose

This technical report covers all MICR printing and is intended to improve MICR quality via understanding and uniform interpretation of existing standards and specifications of MICR. The basic elements of MICR are defined in existing American National Standards, which are referenced where appropriate. This document serves as a single reference for the foremost set of elements that will produce quality MICR documents.

The purpose of the document is to aid existing MICR printers as well as a new and ever expanding producer group in the production and evaluation of MICR documents, and, to attain broader MICR print specification conformance. Widespread distribution of this report is encouraged in order to include the following industry groups:

MICR printing equipment manufacturers and vendors – Software and Hardware

- Vendors of impact and non-impact MICR printing components and systems

- Developers of MICR application software

- Check printing equipment manufacturers

Financial Institutions

- Incoming QC inspection of MICR documents by banks

- Evaluation of reader/sorter rejects

- QC of proof encoding equipment

- Evaluating sources of checks for bank customers

- Production groups for the Image Replacement Documents ( IRDs )

Check issuers

- Users of high and moderate speed MICR printing equipment

- Users of table top MICR laser printers

Check printing companies

- Check design groups

- Check production groups

MICR reading and sorting equipment vendors – Software and Hardware

- Reader/sorter equipment manufacturers

- MICR quality testing tools and service companies