

# DIN EN ISO/IEC 15438:2009-12 (E)

Information technology –Automatic identification and data capture techniques –PDF417 bar code symbology specification (ISO/IEC 15438:2006);English version EN ISO/IEC 15438:2010

---

## Contents

|   | Page |
|---|------|
| Foreword.....   | 5    |
| Introduction .....  | 6    |
| 1 Scope .....   | 7    |
| 2 Normative references .....  | 7    |
| 3 Terms and definitions .....   | 7    |
| 4 Symbols, operations and abbreviated terms .....                     | 9    |
| 4.1 Symbols .....   | 9    |
| 4.2 Mathematical operations.....                                      | 10   |
| 4.3 Abbreviated terms .....   | 10   |
| 5 Requirements .....  | 10   |
| 5.1 Symbology characteristics .....                                   | 10   |
| 5.1.1 Basic characteristics .....                                     | 10   |
| 5.1.2 Summary of additional features .....                            | 11   |
| 5.2 Symbol structure .....  | 12   |
| 5.2.1 PDF417 symbol parameters.....                                   | 12   |
| 5.2.2 Row parameters .....  | 13   |
| 5.2.3 Codeword sequence.....  | 13   |
| 5.3 Basic encodation .....  | 14   |
| 5.3.1 Symbol character structure .....                                | 14   |
| 5.3.2 Start and stop characters .....                                 | 15   |
| 5.4 High level (data) encodation.....                                 | 16   |
| 5.4.1 Function codewords.....   | 16   |
| 5.4.2 Text Compaction mode .....                                      | 19   |
| 5.4.3 Byte Compaction mode.....                                       | 23   |
| 5.4.4 Numeric Compaction mode .....                                   | 25   |
| 5.4.5 Advice to select the appropriate compaction mode .....          | 27   |
| 5.4.6 Treatment of PDF417 reserved codewords.....                     | 27   |
| 5.5 Extended Channel Interpretation .....                             | 28   |
| 5.5.1 Encoding the ECI assignment number.....                         | 28   |
| 5.5.2 Pre-assigned and default Extended Channel Interpretations ..... | 29   |
| 5.5.3 Encoding ECI sequences within compaction modes .....            | 30   |
| 5.5.4 Post-decode protocol .....                                      | 32   |
| 5.6 Determining the codeword sequence.....                            | 32   |
| 5.7 Error detection and correction .....                              | 32   |
| 5.7.1 Error correction level .....                                    | 32   |
| 5.7.2 Error correction capacity .....                                 | 33   |
| 5.7.3 Defining the error correction codewords .....                   | 34   |
| 5.8 Dimensions.....   | 34   |
| 5.8.1 Minimum width of a module (X).....                              | 34   |
| 5.8.2 Row height (Y).....   | 34   |
| 5.8.3 Quiet zones.....  | 35   |
| 5.9 Defining the symbol format .....                                  | 35   |
| 5.9.1 Defining the aspect ratio of the module .....                   | 35   |
| 5.9.2 Defining the symbol matrix of rows and columns .....            | 35   |
| 5.10 Generating the error correction codewords .....                  | 36   |
| 5.11 Low level encodation .....                                       | 38   |
| 5.11.1 Clusters.....  | 39   |
| 5.11.2 Determining the symbol matrix.....                             | 39   |

|   |   |           |
|---|---|-----------|
| 5.11.3  | Determining the values of the left and right row indicators .....     | 39        |
| 5.11.4  | Row encoding .....  | 40        |
| 5.12  | Compact PDF417 .....  | 40        |
| 5.13  | Macro PDF417 .....  | 40        |
| 5.13.1  | Compaction modes and Macro PDF417 .....                               | 41        |
| 5.13.2  | ECIs and Macro PDF417 .....   | 41        |
| 5.14  | User guidelines .....   | 41        |
| 5.14.1  | Human readable interpretation .....                                   | 41        |
| 5.14.2  | Autodiscrimination capability .....                                   | 41        |
| 5.14.3  | User-defined application parameters .....                             | 41        |
| 5.14.4  | PDF417 symbol quality .....   | 42        |
| 5.15  | Reference decode algorithm .....                                      | 42        |
| 5.16  | Error detection and error correction procedure .....                  | 42        |
| 5.17  | Transmitted data .....  | 43        |
| 5.17.1  | Transmitted data in the basic (default) interpretation .....          | 43        |
| 5.17.2  | Transmission protocol for Extended Channel Interpretation (ECI) ..... | 43        |
| 5.17.3  | Transmitted data for Macro PDF417 .....                               | 44        |
| 5.17.4  | Transmission of reserved codewords using the ECI protocol .....       | 44        |
| 5.17.5  | Symbology identifier .....  | 44        |
| 5.17.6  | Transmission using older protocols .....                              | 44        |
| <b>Annex A (normative) Encoding/decoding table of PDF417 symbol character bar-space sequences .....</b>   |   | <b>45</b> |
| <b>Annex B (normative) The default character set for Byte Compaction mode .....</b>                       |   | <b>57</b> |
| <b>Annex C (normative) Byte Compaction mode encoding algorithm .....</b>                                  |   | <b>58</b> |
| <b>Annex D (normative) Numeric Compaction mode encoding algorithm .....</b>                               |   | <b>59</b> |
| <b>Annex E (normative) User selection of error correction level .....</b>                                 |   | <b>60</b> |
| E.1   | Recommended minimum error correction level .....                      | 60        |
| E.2   | Other user consideration of the error correction level .....          | 60        |
| <b>Annex F (normative) Tables of coefficients for calculating PDF417 error correction codewords .....</b> |   | <b>61</b> |
| <b>Annex G (normative) Compact PDF417 .....</b>   |   | <b>66</b> |
| G.1   | Description .....   | 66        |
| G.2   | Print quality .....   | 66        |
| <b>Annex H (normative) Macro PDF417 .....</b>   |   | <b>67</b> |
| H.1   | Macro PDF417 overview .....   | 67        |
| H.2   | Macro PDF417 syntax .....   | 67        |
| H.2.1   | The segment index .....   | 68        |
| H.2.2   | File ID field .....   | 68        |
| H.2.3   | Optional fields .....   | 69        |
| H.2.4   | Macro PDF417 terminator .....   | 70        |
| H.3   | High level encoding considerations .....                              | 70        |
| H.4   | Encodation example .....  | 70        |
| H.5   | Macro PDF417 and the Extended Channel Interpretation protocol .....   | 71        |
| H.5.1   | Macro PDF417 with ECI 000000 and 000001 (GLI 0 and 1) .....           | 72        |
| H.5.2   | Macro PDF417 and other ECIs .....                                     | 72        |
| H.6   | Macro PDF417 data transmission .....                                  | 72        |
| H.6.1   | Operating in buffered mode .....                                      | 73        |
| H.6.2   | Operating in unbuffered mode .....                                    | 74        |
| H.6.3   | Reset-to-Zero transmissions .....                                     | 74        |
| <b>Annex I (normative) Testing PDF417 symbol quality .....</b>  |   | <b>75</b> |
| <b>Annex J (normative) Reference decode algorithm for PDF417 .....</b>                                    |   | <b>76</b> |
| J.1   | Initialisation .....  | 76        |
| J.2   | Reference decode algorithm for line decoding .....                    | 76        |
| J.3   | Filling the matrix .....  | 78        |
| J.4   | Interpretation .....  | 79        |

|  |            |
|--|------------|
| <b>Annex K (normative) Error correction procedures</b> .....   | <b>80</b>  |
| <b>Annex L (normative) Symbology identifier</b> .....  | <b>82</b>  |
| <b>Annex M (normative) Transmission protocol for decoders conforming with original PDF417 standards</b> .....                  | <b>83</b>  |
| <b>M.1 Basic Channel mode</b> .....  | <b>83</b>  |
| <b>M.2 GLI encoded symbols</b> .....   | <b>83</b>  |
| <b>M.3 Macro PDF417 symbols</b> .....  | <b>84</b>  |
| <b>M.3.1 Transmission in buffered mode</b> .....   | <b>84</b>  |
| <b>M.3.2 Transmission in unbuffered mode</b> .....   | <b>85</b>  |
| <b>M.4 Transmission of reserved codewords using the original PDF417 protocol</b> .....   | <b>86</b>  |
| <b>M.5 Achieving compatibility between old and new PDF417 equipment</b> .....  | <b>86</b>  |
| <b>M.5.1 Encoders</b> .....  | <b>86</b>  |
| <b>M.5.2 Decoders</b> .....  | <b>86</b>  |
| <b>Annex N (informative) Algorithm to minimise the number of codewords</b> .....   | <b>89</b>  |
| <b>Annex O (informative) Guidelines to determine the symbol matrix</b> .....   | <b>90</b>  |
| <b>O.1 Parameters affecting the determination of the matrix</b> .....  | <b>90</b>  |
| <b>O.2 Guidelines should any parameters not be achieved</b> .....  | <b>93</b>  |
| <b>Annex P (informative) Calculating the coefficients for generating the error correction codewords — Worked example</b> ..... | <b>94</b>  |
| <b>Annex Q (informative) Generating the error correction codewords — Worked example</b> .....                                  | <b>95</b>  |
| <b>Annex R (informative) Division circuit procedure for generating error correction codewords</b> .....                        | <b>98</b>  |
| <b>Annex S (informative) Additional guidelines for the use of PDF417</b> .....   | <b>99</b>  |
| <b>S.1 Autodiscrimination compatibility</b> .....  | <b>99</b>  |
| <b>S.2 Pixel-based printing</b> .....  | <b>99</b>  |
| <b>S.2.1 General principles</b> .....  | <b>99</b>  |
| <b>S.2.2 Programmer's Example</b> .....  | <b>99</b>  |
| <b>Bibliography</b> .....  | <b>101</b> |