



Bar Code & Label Layout Specification



This document outlines the FedEx Ground bar code specifications and provides descriptions of all key components effective January 2004.

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REVISION HISTORY

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		Initial document	Frank Patterson	
3/01/00		Adds support for plain paper labels	Amy Anderson	03/01/00
1/05/01R3jck		Home Delivery icon change. Add software version number to label. Remove I2of5 information	Joe Kuhn	01/05/01
FY02.A		Clarify laser and inkjet printing requirements COD label printing added to overall specification from previous separate document. Enhance PDF417 use for Home Delivery Extend description of system type on shipping label Code 128 subset clarification for Zip bar codes	Joe Kuhn Amy Anderson	12/01/01
FY 03	Page 11	Clarify the physical size of the FedEx Ground UCC/EAN 128 based on width and print type	Amy Black	12/1/02
	Page 17	Added Element & sub-element separator chart		
	Page 18	Updated the Ground and Home Delivery General 2D Data Format - 01 envelope to Common Label format		
	Page 19	Updated the Ground and Home Delivery General 2D Data Format - 03 envelope to Common Label format		

	Page 19	Added Store Number field to the 03 envelope		
	Page 19	Date Certain & Home Delivery labels must contain the recipients phone number in the 2D bar code and on the label		
	Page 19	Return manager: Change the L11 segment containing the full tracking number of the bar code to the original outbound package number to link it to the return package number.		
	Page 20	3 rd Party Billing 03 Envelope L11 required segment		
	Page 44	Added the Current Shipper Print Evaluation Process		
	Page 46	Added the FedEx Ground/Home Delivery CSP Evaluation Process		
	Page 48	Added the Impact of Bar Code Quality Issues		
	Page 49	Added FedEx Ground COD/ECOD Thermal & Plain Paper Label Requirements		
FY 04		Minor text changes to the document No label specification update	Amy Black	12/1/03

SPECIFICATIONS

FEDEx GROUND “96” CODE 128

The primary bar code used as part of the FedEx Ground bar code strategy is a Code 128 bar code designed to conform to the Latest ANSI and UCC¹ standards for transportation industry bar codes. It is referred to as the “96” bar code because it always begins with a “96”.



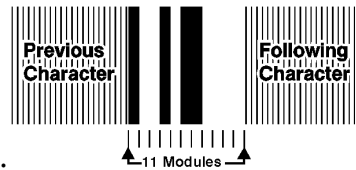
GENERAL

CODE 128 is a variable length, high-density alphanumeric symbology. Three different character subsets can be used within a Code 128 bar code to more efficiently encode the data. FedEx Ground requires subset C for the “96” sortation bar code. Zip bar codes may use subset B if alpha information is encoded.

Subset	Description
Subset A	The first sub-set encodes all uppercase and ASCII control characters
Subset B	The second sub-set encodes all upper and lower case characters.
Subset C	The third sub-set encodes numeric digit <i>pairs</i> 00 through 99.

Each subset has it's own advantages. For example if no alpha data is to be encoded the data density within the code can be effectively doubled by using sub-set C. Code 128 has 106 different bar and space patterns. Each pattern can have different meanings depending upon which subset is used

¹ ANSI = AMERICAN NATIONAL STANDARDS INSTITUTE; UCC = UNIFORM CODE COUNCIL. The primary organizations responsible for establishing industry standards.



The character in the above example can be interpreted as an “SOH” character (ASCII 64) in subset A, “a” in subset B, or the number 65 in subset C.

Code 128 also has the capability to encode four special function codes (FNC1 - FNC4). FedEx Ground uses only FNC1.

Their uses are as follows:

Function Code	Description
FNC1	Reserved for EAN ² applications
FNC2	Used to instruct the bar code reader to concatenate the message in the bar code with the message in the next code.
FNC3	Used to instruct the bar code reader to perform a <i>RESET</i> . When FNC3 is encoded anywhere within a symbol any data within the symbol is discarded
FNC4	Remains available for use in closed system applications

Special start characters tell the reader which of the character sets is initially being used and three special *shift* characters permit changing character sets within a bar code symbol.

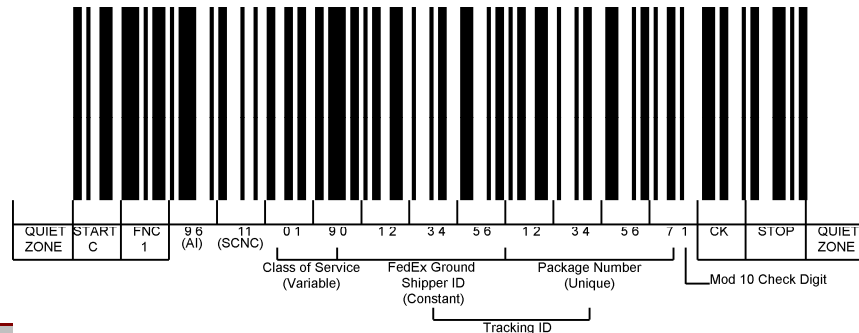
Code 128 also employs an internal check digit for data security. This internal check digit is calculated by the bar code printing application. Each bar code reader also reads and re-calculates this check digit as part of the decode process. The internal check digit is separate from any human readable check digit that may be employed for manual data entry accuracy, and does not become part of the data stream. For this reason code 128 is referred to as a *self-checking* code.

The **UCC/EAN Code 128** symbology is a variation of the original Code 128, and was designed primarily for use in product identification applications. The EAN/UCC 128 specification uses the same code set as Code 128, except that it does not support FNC2 - FNC4. FNC1 is used as part of the start code in the symbol. The FedEx Ground “96” bar code is a UCC/EAN Code 128 symbol.

² EAN = EUROPEAN ARTICLE NUMBERING Association.

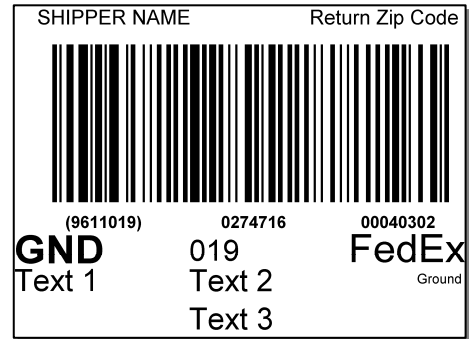
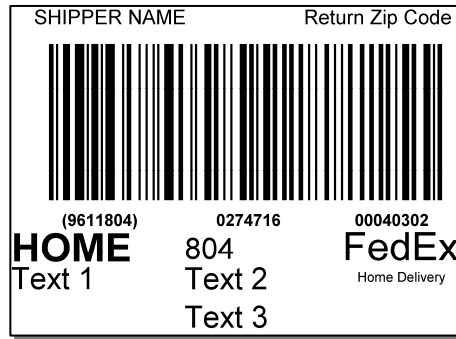
DATA CONTENT:

The data content of the FedEx Ground "96" UCC/EAN Code 128 bar code is as specified below:



Character(s)	Use	Description
1	Start Character	Indicates start of bar code and sets character sub set to "C".
2	FNC1	"Function 1" character identifies symbology as "UCC/EAN - 128"
3-4	Application Identifier	Two-digit number that identifies the bar code as a shipping label.
5-6	SCNC	Two digit " Serial Container Numeric Code " - "11,12,13" identifies the carrier as " FedEx Ground ".
7-9	Class of Service	Three-digit number used to identify the FedEx Ground class of service.
10-16	FedEx Ground Shipper ID	Seven-digit unique shipper identification number.
17-23	Package Number	Seven-digit package serial number.
24	Check Digit	One digit, mod-10 data field check digit.
25	Check Digit	Symbology Check Digit
26	Stop Character	Stop character - delineates the end of the bar code.
Totals: 26 Total Characters, 22 User defined Characters		Note: Start and Stop characters, FNC1 and Symbology Check Digit are not user definable. They should be automatically created by the bar code printing application.

The layout of the human readable text and graphics required with the FedEx Ground "96" bar code is as shown below.



Below is an example of how the FedEx Ground "96" bar code may be used in a custom, shipper-created label application. Specific label layouts will be reviewed and approved by the Bar Code Analysts at FedEx Ground.

As indicated below, the meter number, printer type, printer number (if more than one printer operates on a system), software name and version number must be shown along the bottom edge of the label. (The meter number is assigned by FedEx for company supplied shipping systems and may not be available for externally supplied systems.) Printer type shall be configurable for a given system type and the software name and version number must be sufficient to easily identify the product producing the label. Recommend the use of six-point text.

Refer to *Appendix F* for a complete list of class of service codes, icons, application Identifiers and descriptive text labels.



Use N of X for multi-piece shipments. N is which package of a total of X packages in a shipment. 1 of 1 indicates a single piece shipment. 24 point text

Software 4 digit code
Version number
Printer number & type
Meter number.
6 point text

PHYSICAL PROPERTIES:

The specified physical properties of the FedEx Ground “96” Code 128 bar code have been developed to ensure accurate readability with all bar code scanning systems in use now and in the foreseeable future.

The individual components of the specification were determined as follows:

Bar / Space Width - Determined by the scanner type, depth of field and presentation speed.

X-Dimension – The width of the minimum narrow element (bar or space) is a dimensional parameter, which can be used to calculate the symbol's actual width

Bar / Space Tolerance - This is the amount the bars and/or spaces can vary from symbol to symbol without changing the overall print quality grade or significantly altering the size of the symbol. The tolerance is roughly equivalent to 20% of the X-dimension.

Horizontal Label Registration Tolerance – How much the different colors of ink used to print the bar code label can be out of alignment with one another. This is primarily related to multi-color offset printing.

Width - The overall width of the bar code is a result of the X-dimension and wide to narrow ratio. The width usually cannot be set independently.

Height - The overall height of the bar code was established to ensure that bar codes were not so small that they could pass between two scanners without being read. Maximum height is not significant³, as increased height only improves scan capability.

Quiet Zone - The specified Quiet Zone is a requirement taken from the Code 128 symbology specification and is equivalent to 10 times the maximum X-dimension. A 0.1-inch quiet zone shall also be applied above and below the symbol.

Human Readable Text - The human readable text is required by FedEx Ground and is used to enable an operator to manually enter the data encoded in the bar code in case of a scanner failure or label damage. Extra human readable information is also included to enable the operator to determine the class of service, any secondary service⁴, and *origin* zip code⁵.

³ Up to the overall maximum allowable height.

⁴ COD, AutoPOD, etc.

⁵ Useful if the package needs to be returned to the shipper.

The important physical properties evaluated on the FedEx Ground "96" Code 128 bar code are:

Bar Size

X-Dimension (Narrow Bar Width)

Minimum: 0.017"

Maximum: 0.019"

Horizontal Label

Registration Tolerance: ± 0.10"

Overall Bar Code Size: **THERMAL**

Minimum height for three standard size x dimensions of thermally printed bar codes

17 mil X-dimension = 1.40" height

18 mil X-dimension = 1.40" height

19 mil X-dimension = 1.40" height

(Note: **Plain paper or laser bar codes** must follow the plain paper portion of this specification)

PLAIN PAPER or LASER

17 mil X-dimension = 1.50" height

18 mil X-dimension = 1.50" height

19 mil X-dimension = 1.50" height

Quiet Zones:

10.0 times the X-Dimension on each side (0.20")

0.1" On top and bottom

Label Stock:

Use only white label stock. (Near infrared for direct thermal printing)

The *Application Identifier*, *SCNC Code*, and *Class of Service Code* should be placed below the bar code as shown.

The use of graphical icons to indicate the primary mode of transport has been discontinued.

Please refer to Appendix F for a complete list of mandatory text icons and respective class of service codes.

PRINT QUALITY:

The print quality specifications were developed to ensure all scanners could read the bar codes. The major print quality criteria are:

Print Contrast Signal (PCS) - The Print Contrast Signal values were established to ensure the bar codes would be readable at the conveyor speeds used on the FedEx Ground automated package sorters. The scanners cannot consistently read bar codes with low PCS values on the sorters, although they may read well with a hand scanner. High quality white label stock along with high quality print is required to achieve the specified PCS. (Thermal labels should be of a Near Infra Red type to support scanners operating in the 630nm to 670nm range. Labels should also exhibit stable print characteristics through exposure to varying heat and temperature conditions.)

Decode Margin - Decode margin is a graded measure of decodability; or how close a given scan comes to a reference decode failure. Lower margins indicate an increased susceptibility to decoding failure due to scanning errors.

Average Bar Error - The average bar growth in the symbol relative to its X-dimension.

Reflectance - Given in two parts, reflectance is a measure of the reflected laser light from the bars (dark) and spaces (light).

Defects - This is a graded measure of the maximum element reflectance non-uniformity due to any noise within the element due to voids, spots, or fuzzy edges.

Print Contrast Signal

Minimum Print Contrast:	90%
Desirable Contrast Range:	95 - 100%

Symbol Contrast (min.): 65%

Decode Margin (min.): "A" grade

Average Bar Error (max.): $\pm 0.10X$

Defects (max.): 15%

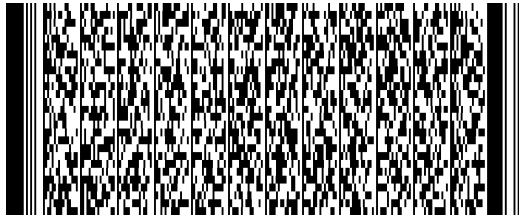
Reflectance

Light:	$\geq 80\%$
Dark:	$\leq 15\%$

The overall print quality must be ANSI grade "A".

PDF-417 Two-Dimensional Symbol

An innovation introduced by FedEx Ground is the PDF-417 Two Dimensional Symbol. Use of the PDF-417 enables FedEx Ground customers to encode large amounts of data into the symbol, which will travel with the package. It is referred to as the 2D bar code.

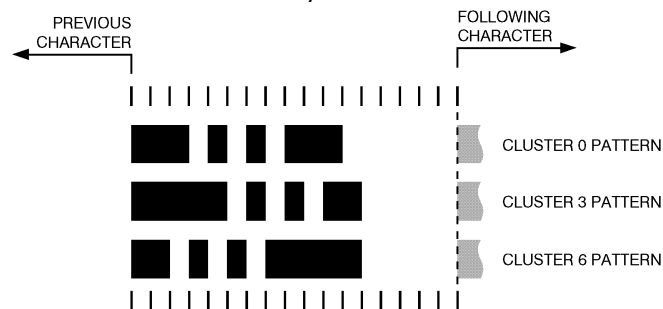


GENERAL

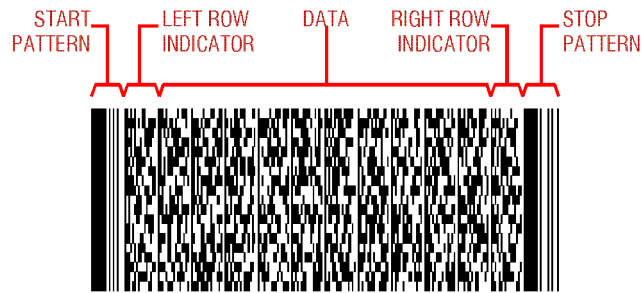
PDF-417 is a high-density two-dimensional alphanumeric bar code symbology that essentially consists of a series of stacked linear bar codes. The symbology is capable of encoding the entire 255-character ASCII data set. PDF stands for "**P**ortable **D**ata **F**ile" and the symbology can encode up to 2725 characters in a single symbol, however this is reduced by the error correction level and the application. FedEx Ground has set a limit of 350 characters. The complete PDF-417 specification provides many encoding options including data compression options, error detection and correction options, and variable size and aspect ratios.

The PDF-417 symbology was originally published by *Symbol Technologies, Inc.* to fill the need for higher density bar codes, and has since been released into public domain.

PDF-417 symbols consist of an array of code words.



Code words are small bar and space patterns similar to those on a standard linear bar code. The code words are grouped and stacked on one another in a specific order to produce a complete PDF symbol. An individual PDF-417 symbol consists of at least 3 rows of up to 30 code words and may contain up to 90 code words per symbol with a maximum of 928 code words per symbol. Each row contains a beginning and ending indicator to identify its location within the symbol.



The code words in a PDF-417 symbol are generated using one of the following three data compression modes. This allows more than one character to be encoded into a single code word.

1. **EXTENDED ALPHANUMERIC COMPACTION (EXC)** mode. This mode supports encoding all printable ASCII characters and can compress approximately 2 characters per code word.
2. **BINARY / ASCII PLUS** mode. Binary mode supports encoding the entire ASCII character set and can compress approximately 1.2 characters per code word.
3. **NUMERIC COMPACTION** mode can encode only the numeric characters 0 through 9. Numeric mode can compress approximately 3 characters per code word.

One or more modes can be used within a symbol by using special shift and latch characters to switch between modes within the symbol. Because different data compression modes can be used in different combinations, it is possible for symbols produced from the same data to appear very different. **PDF symbol printed for FedEx Ground must be 10 columns wide.**

If the symbol contains more than 300 characters, 11 columns should be used and the resultant symbol should have a rectangular, not square, shape.

PDF-417 also includes nine different levels of data security and error detection / correction. Each successively higher level offers increased data security, but adds additional overhead.

Each PDF symbol has two code words for error detection. These function similarly to check digits in standard linear bar codes. Error correction compensates for label defects and mis-decodes. There are essentially two types of errors that can occur in a bar code symbol:

1. **ERASURES** - Missing or deleted code words.
2. **MIS-DECODES** - Errors that cause the reader to interpret a particular code word incorrectly.

The nine available error correction or security levels are numbered 0 through 8. Each higher security level allows for a higher number of erasures and mis-decodes to be recovered from. Note that since it takes 2 code words to recover from a mis-decode (one code word to detect the error; one to correct it) a given security level can support

half the number of mis-decodes that it can un-decoded or missing code words.

Error detection and correction is encoded into additional code words. A PDF-417 symbol can contain a maximum of 928 total code words for data and error correction combined. The additional code words associated with the error correction are referred to as *overhead* since they take up space within the symbol, yet they are not user-defined data.

The relationship between security level, error correction capacity and the amount of overhead (expressed in number of code words) required for each security level is outlined below:

Security Level	Max. Number of Erasures	Max. Number of Misdecodes	Added Overhead (Code Words)
0	0	0	2
1	2	1	4
2	6	3	8
3	14	7	16
4	30	15	32
5	62	31	64
6	126	63	128
7	254	127	256
8	510	255	512

FedEx Ground requires the use of security level 5 in PDF417 bar codes.

DATA CONTENT:

The use of the PDF-417 in conjunction with the FedEx Ground label is intended to be consistent with the procedures and practices described in draft ANSI MH10.8.3; "Two Dimensional Symbols for Use with Unit Loads and Transport Packages". The following information is a summary of these procedures and is not meant to replace or supersede the ANSI standard. It is intended as a guide for use with the FedEx Ground PDF-417 symbol. *Note:* Since this is written in a FedEx Ground context, some descriptions and notations are different than those in the ANSI MH10.8.3 standards document.

The data content of the FedEx Ground PDF-417 symbol is grouped into three categories:

- Mandatory transportation data.
- Optional transportation data.
- Trading Partner data.

Because PDF-417 is a 2 dimensional stacked symbology, it is not possible to illustrate the data content as with the FedEx Ground "96" Code 128 symbol.

The ANSI MH10.8.3 standard provides a clear, yet flexible structure and method for representing data. This structure is similar to the structure used by EDI.

Each symbol consists of

- A MESSAGE HEADER
- A FORMAT HEADER
- Formatted data
- A FORMAT TRAILER
- A MESSAGE TRAILER

A format header and formatted data followed by a format trailer is called a *FORMAT ENVELOPE*. More than one format envelope may be used within a single symbol.

The mandatory and optional data fields require a minimum of 40 characters (including message overhead). Depending on the amount of data encoded in the mandatory and optional data fields, the PDF-417 symbol can contain between 151 and 310 additional characters of trading partner data and additional message overhead.

NOTE: The total number of characters in the symbol, including message overhead cannot exceed 350 characters.

If the symbol contains more than 300 characters, 11 columns should be used and the resultant symbol should have a rectangular, not square, shape.

ELEMENT AND SUB-ELEMENT SEPARATORS

The ANSI MH10.8.3 standard defines the characters used as format, field, element and sub-element separators. The final character of a message is also defined. These characters are non-printing ASCII characters and must be present in the data string and encoded in the symbol. Failure to enter all formatting and separator characters will result in unusable data.

Subset		Description
FS	Decimal 28, Hex 1C	The non-printing ASCII Field Separator character used to separate segments
GS	Decimal 29, Hex 1D.	The non-printing ASCII Group Separator character used to separate elements
RS	Decimal 30, Hex 1E	The non-printing ASCII record separator used to indicate the end of a format envelope and the end of the message header
US	Decimal 31, Hex 1F	The non-printing ASCII Unit Separator character used to separate sub-elements
EOT	Decimal 04, Hex 04	The message trailer consists of a single non-printable ASCII end of transmission EOT character. This character must not be used elsewhere in the symbol

GROUND AND HOME DELIVERY GENERAL 2D DATA FORMAT – 01 ENVELOPE

FedEx Ground PDF-417 Symbol Message Structure Using ANSI MH10.8.3.

Description ⁶	Required ⁷	Added Overhead (Code Words)	Data Format ⁸	Maximum Data Length
Message Header ^R _S		4	[] > ^R _S	
Format Envelope Header (Carrier Data 01)		5	01 ^G _S vv ⁹	
Recipient Postal Code ^G _S	M	1	(an, 5 or 6) ^G _S	6
Recipient Country Code ^G _S	M	1	(n, 3) ^G _S	3
Class of Service (assigned by carrier) ^G _S	M	1	(an, 1-3) ^G _S	3
Tracking Number (assigned by carrier) ^G _S	M	1	(an, 1-20) ^G _S	20 ¹⁰
Origin Carrier SCAC ^G _S	M	1	(an, 2-4) ^G _S	4
Pickup Location (carrier assigned shipper ID) ^G _S	C ¹¹	1	(an, 1-7) ^G _S	7
Julian Pickup Date ^G _S	O	1	(n, 3) ^G _S	3
Shipment ID Number (assigned by shipper) ^G _S	O	1	(an, 1-30) ^G _S	30
Container n of total of x ^G _S	O	1	(n, 1-4/n,1-4) ^G _S	9
Weight in pounds (decimal is a character) ^G _S	M	1	(r ¹² 1-8) ^G _S	8
Cross Match Postal Code to State (Y or N) ^G _S	M	1	(a, 1) ^G _S	1
Recipient Street Address Line 1 (Primary Street Address) ^G _S	M	1	(an, 1-30) ^G _S	30
Recipient City ^G _S	M	1	(an, 1-30) ^G _S	30
Recipient State/Province	M	1	(an, 2)	2
Format Separator, ^R _S		1	^R _S	
Message Trailer ^E _{OT}		1	^E _{OT}	

NOTE: Limit postal codes in the 01 section to five-digit numeric or six characters alpha. (The plus 4 must not be part of the zip code in the 2D bar code)

⁶ ^R_S = Record Separator, ^G_S = Group Separator, ^E_{OT} = END OF TRANSMISSION

⁷ Data element is either Mandatory (M), Optional (O), or Conditional (C)

⁸ a = alpha, n = numeric

⁹ vv represents the two-digit version assigned by ANSI MH10.8.3. vv=96

¹⁰ FedEx Ground Tracking ID uses 15 digits; SSCC-18 uses 20 digits

¹¹ Required if the SSCC-18 is used as the tracking number; not required if the FedEx Ground UCC/EAN 128 bar code is the tracking number

¹² r = radix floating decimal (for example, 145.05)

GROUND & HOME DELIVERY GENERAL 2D DATA FORMAT – 03 ENVELOPE

Description	Required	Added Overhead Code Words	Data Format	Maximum Data Length
Format Envelope Header		11	03 ^{F_S G_S U_S} VVVVVV ¹³	
Recipient Company Name ^{F_S}	M	6	N1 ^{G_S} ST ^{G_S} (an, 1-30) ^{F_S}	30
Recipient Additional Company Name ^{F_S}	O	4	N2 ^{G_S} (an, 1-30) ^{F_S}	30
Recipient Address Line 2 & 3 ^{F_S}	O	5	N3 ^{G_S} (an, 1-30) ^{G_S} (an, 1-30) ^{F_S}	60
Recipient City, State, Postal Code, and Country Code ^{F_S}	M	7	N4 ^{G_S} (an, 1-20) ^{G_S} (a,2) ^{G_S} (an, 5 or 6 or 9) ^{G_S} (n, 3) ^{F_S}	34
Store Number	O	7	N9 ^{G_S} ST ^{G_S} (an, 1-10) ^{F_S}	10
Recipient Contact Name and Phone Number ^{F_S}	M	12	G61 ^{G_S} DC ^{G_S} (an, 1-30) ^{G_S} AD ^{G_S} (n,10) ^{F_S}	40
Date for Date Certain Delivery	C ¹⁴	8	NTE ^{G_S} DEL ^{G_S} YYYYMMDD ¹⁵	8
Format Separator, ^{R_S}		1	^{R_S}	

NOTE: The recipient phone number is required to be present in the 2D bar code as well as in the human readable for Home Delivery and Date Certain Services

RETURN MANAGER - ADDITIONAL DATA FIELDS REQUIRED IN THE 2D - 03 ENVELOPE

Description	Required	Added Overhead (Code Words)	Data Format	Data Length
Format Envelope Header		11	03 ^{F_S G_S U_S} VVVVVV	
FedEx Ground full 22 digit original tracking number ^{16F_S}	O	8	L11 ^{G_S} (n, 22) ^{G_S} 08 ^{F_S}	22
Customer Reference Number (CR, IN, PO, & SI) ^{17F_S}	O	8	L11 ^{G_S} (an, 1-30) ^{G_S} CR ^{F_S}	30
FedEx Ground Shipper number to be billed ^{F_S}	M	8	L11 ^{G_S} (n, 7 or 9) ^{G_S} (11 or 12) ^{18 F_S}	97

¹³ ANSI X12 version number VVVVVV=004010

¹⁴ Required only when using Date Certain services

¹⁵ YYYY = Year, MM = Month, DD = Day

¹⁶ This is the full tracking number of the bar code to the original outbound package number to link it to the return package number.

¹⁷ CR-Customer Reference Number, IN-Invoice Number, PO- Purchase Order Number, SI-Shipment ID Number(shipper's identifying number for shipment)

¹⁸ If the 7 digit FedEx Ground shipper number is to be billed use the billing qualifier 11 or if the 9 digit FedEx account number is to be billed then use the billing qualifier 12

The example above shows the additional 03 data that is required for Return Manager. The L11 segments may contain the FedEx Ground original outbound bar code number (22 digits) with a 08 qualifier in the first segment and the customer reference number with a CR qualifier in the second segment. SSCC-18 and twelve-digit I 2 of 5 bar codes shall not be used. Alternately the CR may be replaced with an IN, PO, or SI for invoice number, purchase order number, or shipment identifier respectively. However, only one reference field can be provided at a time. If the shipper does not require reference information, the field is not required to be present. An additional L11 segment must be supplied. This segment can contain either a seven digit Ground shipper number or a nine-digit account number. A qualifier of 11 is used with a Ground shipper number and a qualifier of 12 is used with a nine-digit account number as shown in the following examples:

Please note that service codes 836 and 842 are restricted to home return destinations and must also contain the additional 03 information for Home Delivery.

3RD PARTY BILLING - ADDITIONAL DATA FIELDS REQUIRED IN THE 2D - 03 ENVELOPE

Description	Required	Added Overhead (Code Words)	Data Format	Data Length
Format Envelope Header ^{G_s}		11	03 ^{F_s G_s U_s} VVVVVV	
FedEx Ground Shipper number to be billed ^{F_s}	M	8	L11 ^{G_s} (n, 7 or 9) ^{G_s} (11 or 12) ^{19 F_s}	9

¹⁹ If the 7 digit FedEx Ground shipper number is to be billed use the billing qualifier 11 or if the 9 digit FedEx account number is to be billed then use the billing qualifier 12

MESSAGE HEADER

The message Header must be the first data characters in the symbol. For the FedEx Ground PDF-417 "2D" symbol the message header must be presented as []>RS.

Where: []> is the compliance indicator used to identify the symbol as conforming to the ANSI MH10.8.3 standard.

TRANSPORTATION (CARRIER) DATA FORMAT

The data format header for the transportation data field must immediately follow the message header and be presented as **01GSyy**.

Where: **01** indicates the data follows the transportation (carrier) format.

GS is the non-printing ASCII group separator character (decimal 29, hex 1D).

yy indicates the last two digits of the year of publication of the ANSI MH10.8.3 standard being used. The current standard was published in 1996. The value for this field is therefore "96".

There are *mandatory* and *optional* transportation data fields. Separators must delimit all fields even blank ones. No separator is used following the last field. The *group separator* (GS) is not used following the last field in which data is entered. Instead, a record separator immediately follows the last field (RS) character to indicate the end of the carrier data format message envelop.

MESSAGE TRAILER

The message trailer consists of a single non-printable ASCII end of transmission EOT character (decimal 04, hex 04). This character must not be used elsewhere in the symbol.

TRADING PARTNER DATA (03 AND 05 SECTIONS)

Trading Partner data can be any information that is agreed upon by trading partners (for example, purchase order number, recipient name, ANSI X12 204 data). The ANSI MH10.8.1M-2000 standard provides a wide range of options for representing data. FedEx Ground will recognize either data with UCC/EAN application identifiers (AIs) or data with ANSI x12 segment structure.

The mandatory data and optional transportation (carrier) data must be the first data format in the FedEx Ground PDF-417 symbol.

Trading partner data may follow the carrier data. If used, X12 segment 03 data should precede 05 data using UCC/EAN application identifiers.

TRADING PARTNER DATA FORMAT

By definition, the trading partner data may be in any format mutually agreed upon between trading partners. The ANSI MH10.8.3 standard provides a wide variety of formatting options that follow rules similar to those used in the carrier data format outlined above.

Only UCC/EAN application identifier and ANSI X12 segment formats should be used within the FedEx Ground PDF-417 2D symbol.

Format Using ANSI X12 Segment Structure (03 Section):

Data may also be presented using ANSI X12 data segment²⁰ syntax.

Format Envelope Header: **03FSGSUSvvrr**.

Where: **03** indicates data is formatted following X12 segment syntax.

FS is the non-printing ASCII Field Separator character (decimal 28, hex 1C). The field separator is used to separate segments.

GS is the non-printing ASCII Group Separator character (decimal 29, hex 1D). The field separator is.

US is the non-printing ASCII Unit Separator character (decimal 31, hex 1F). The field separator is used to separate sub-elements.

vvrr is the version and release number of the X12 document being used.

Format Using UCC/EAN Application Identifiers (05 Section):

²⁰ For additional information on X12 data segment syntax, refer to the ANSI MH10.8.1M-200 standard

Format Envelope Header: **05GS**.

Where: **05** indicates that data is formatted with UCC/EAN application identifiers.

GS is the non-printing ASCII field separator character (decimal 29, hex 1D). This character is used between data fields.

DATA LINKING

Because the FedEx Ground PDF-417 symbol is not intended to be a stand alone symbol, specific fields in the symbol are used to link it with the FedEx Ground "96" bar code or the UCC/EAN SSCC-18 bar code. Either of these symbols can be used for high-speed automated sortation.

When used in conjunction with the UCC/EAN SSCC-18 bar code, the SSCC-18 Vendor ID and Container ID must be encoded in the appropriate fields within the PDF-417 symbol.

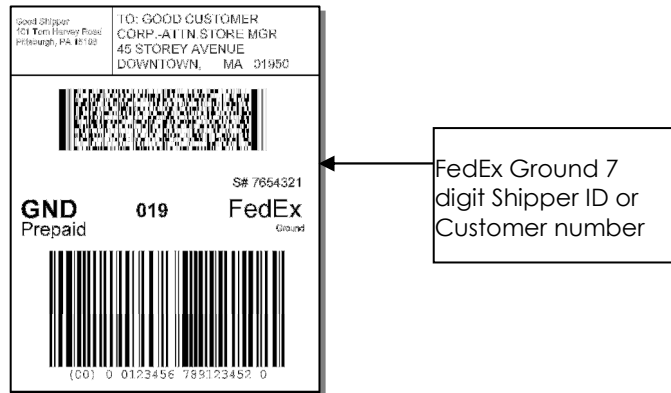
In order for Fed Ex Ground systems to accept the proper bar code combinations, it is important to provide some indication of which symbols are present on the package. *DIFFERENT STANDARD CARRIER NUMERIC CODES (SCNC)* and *STANDARD CARRIER ALPHANUMERIC CODES (SCAC)* have been assigned to indicate if more than one symbol is required; and if so, which ones. The standard carrier codes to be used for each possible bar code combination are listed below.

Primary Symbol	SCNC	Secondary Symbol	SCAC
FedEx GROUND "96" Code 128	11	None	N/A
FedEx GROUND "96" Code 128	13	UCC/EAN- 128 SSCC-18	N/A
FedEx Ground "96" Code 128	12	FedEx GROUND PDF-417 "2D"	RPSB
UCC/EAN- 128 SSCC-18	N/A	FedEx GROUND PDF-417 "2D"	RPSC

Note the SCNC is used in the FedEx Ground "96" bar code. The SCAC is used in the PDF-417 "2D" symbol. Neither the SCAC nor SCNC is used in the UCC/EAN SSCC-18 bar code.

ADDITIONAL TEXT & ICONS

When the PDF-417 “2D” symbol is used with the UCC/EAN SSSC-18, the appropriate FedEx shipper ID must be placed as illustrated in the example below. Please note that the truck and plane icons were previously discontinued along with the air service codes.



The graphical icons are no longer supported. Refer to *Appendix F* for a complete revised list of the text, text icons and class of service codes. Appendix F is maintained as a separate document.

PHYSICAL PROPERTIES:

The specified physical properties of the FedEx Ground PDF-417 “2D” symbol have been developed to ensure accurate readability by the handheld scan guns in use now and with other bar code scanning systems that may be introduced in the future.

The individual components of the specification were determined as follows:

Module Height / Width – Determined by the scanner type, the specified module size was selected to ensure adequate scanner performance with raster laser type scanners.

X-Dimension – The width of the minimum narrow element (bar or space) is a dimensional parameter, which can be used to calculate the symbol's actual width

Number of Columns – Selected to provide a symbol with a rectangular shape overall. Rectangular symbols read better than square symbols with a raster laser scanner.

Aspect Ratio – A specific overall aspect ratio *is not specified*. The aspect ratio can vary widely from symbol to symbol depending on content. The aspect ratio selected should be as low as possible to result in a rectangular symbol.

Width – The overall width of the symbol is a result of the X and Y-dimensions, number of columns and aspect ratio. The width usually cannot be set independently.

Height – The overall height of the symbol is also a result of the X and Y-dimensions, number of columns and aspect ratio. The height usually cannot be set independently. If all other factors are held constant, the height of the symbol will vary with the data content.

Quiet Zone – The specified Quiet Zone is a requirement taken from the PDF-417 symbology specification and is equivalent to 20 times the X-dimension. A 0.1-inch quiet zone shall also be applied above and below the symbol.

Error Correction – The error correction level was chosen as a good compromise between data security and symbol size (and overhead).

The important physical properties evaluated on the FedEx Ground PDF-417 “2D” symbol are:

Module Size

X-Dimension (Module Width)

Minimum:	N/A
Nominal:	0.010"
Maximum:	N/A

Y-Dimension (Module Height)

Minimum:	N/A
Nominal:	0.050"
Maximum:	N/A

Error Correction: Level 5

Overall Bar Code Size:

Nominal Width: 2.40"

Quiet Zones: 0.04" (1mm) min.
0.1" On top and bottom

Label Stock: Use only white label stock.
(Near Infrared for direct thermal printing)

PRINT QUALITY:

The print quality specifications were developed to ensure all scanners could read the bar codes. The major print quality criteria are:

Print Contrast Signal (PCS) – The Print Contrast Signal values were established to ensure the bar codes would be readable at the conveyor speeds used on the FedEx Ground automated package sorters. The scanners cannot consistently read bar codes with low PCS values on the sorters, although they may read well with a hand scanner. High quality white label stock along with high quality print is required to achieve the specified PCS. (Thermal labels should be of a Near Infra Red type to support scanners operating in the 630nm to 670nm range. Labels should also exhibit stable print characteristics through exposure to varying heat and temperature conditions.)

ANSI X3.182 Grade – This is a graded measure of conformance to ANSI standard for PDF-417 print quality.

AIM Uniform Symbology Specification Grade – This is a graded measure of conformance to AIM²¹ standard for bar code print quality.

Minimum Unused Error Correction – Given as a percentage, this is a measure of

Print Contrast Signal

Minimum Print Contrast:	90%
Desirable Contrast Range:	95 – 100%

Symbol Contrast (min.):	65%
ANSI X3.182 Grade:	“A” grade
AIM Uniform Symbology Specification Grade:	“A” grade
Minimum Unused Error Correction:	62%

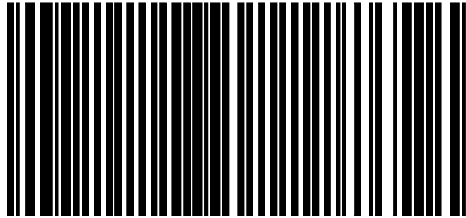
The overall print quality must be ANSI grade “A”.

Refer to *Appendix F* for a complete list of the text, icons and class of service codes

²¹ AIM = Automatic Identification Manufacturers Association

UCC/EAN CODE 128 “SSCC-18”

In an effort to provide shippers with a more convenient way of tracking their packages, FedEx Ground incorporated support for the SSCC-18 bar code into their bar code strategy.



GENERAL

The SSCC-18 is an industry standard linear bar code for container marking in the commercial, industrial, and retail sectors as determined by the Uniform Code Council (UCC). The SSCC-18 is used to identify a shipping container for both the shipper and recipient. FedEx Ground supports the use of the SSCC-18 as package identification for all systems. When properly used in conjunction with the FedEx Ground PDF-417 “2D” symbol or the “96” Code 128 bar code, the number encoded SSCC-18 becomes the package tracking identification number.

The FedEx Ground PDF-417 “2D” symbol or the “96” Code 128 bar code are required to be used with the SSCC-18 to provide the transportation information not included in the SSCC-18²². Since FedEx Ground has integrated full support for the SSCC-18 into all systems, shippers will only have to maintain one reference number for their packages. That means a shipper that currently has a shipping system designed around the SSCC-18 need not modify that system for a FedEx Ground bar code.

NOTE: The SSCC-18 must always be used with a FedEx Ground bar code.

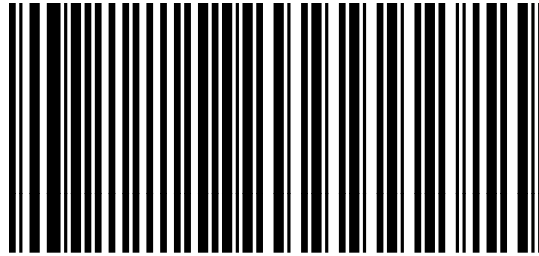
The SSCC-18 is a twenty-digit UCC/EAN Code 128 bar code. Because the application identifiers allow these codes to be identified automatically, FedEx Ground restrictions on the presence of other bar codes can be relaxed. Shippers can now have complete flexibility as to how many symbols appear on the package²³.

²² e.g. “Class of Service” code and FedEx GROUND Shipper Identification Number.

²³ As long as all of the symbols conform to UCC/EAN or coordinate standards.

DATA CONTENT

The data content of the SSCC-18 bar code is illustrated below.



UCC/EAN-128 symbol
SSCC-18 data structure

(00) 0 0012345 55555555 8

Position	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Character	PT	M1	M2	M3	M4	M5	M6	M7	S1	S2	S3	S4	S5	S6	S7	S8	S9	C

Any 18 digit number where:

PT is a Packaging Type assigned by a particular M2-M7 using the following logic:

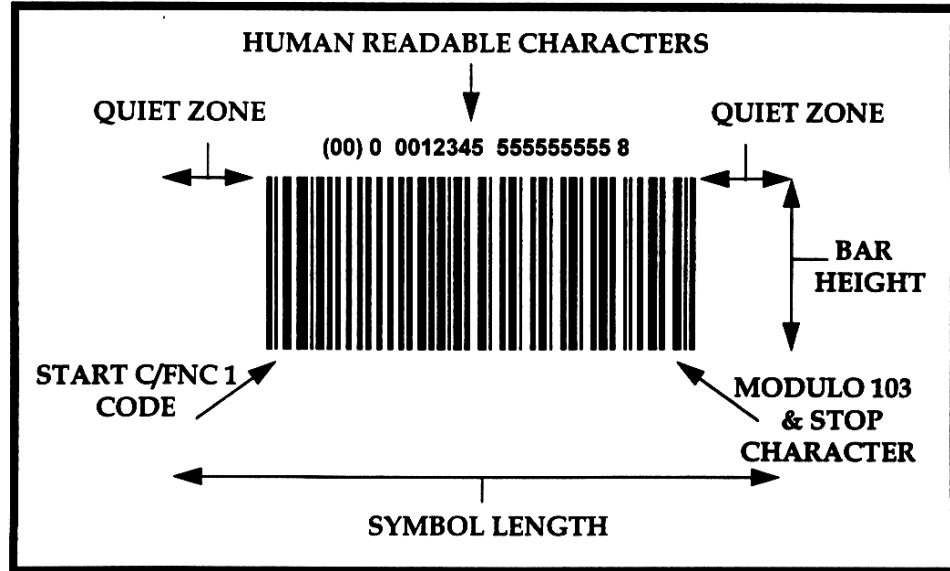
- 0 Indicates the shipping container is a case or a carton.
- 1 Indicates the shipping container is a pallet (larger than a case).
- 2 Indicates the shipping container is a container larger than a pallet.
- 3 Indicates the shipping container is undefined.
- 4 Indicates the shipping container is for internally defined intra-company use.
- 5-9 Reserved for future use.

M1-M7 is a unique number assigned by the company holding a particular M2-M7 to identify any one entity (for example, product, container, pallet) from another entity for 12 months or the life of the entity, whichever is longer.

C is a modulo 10 check character.

(THIS INFORMATION IS AN EXCERPT FROM THE UCC SPECIFICATION. PLEASE REFER TO THE CURRENT UCC SPECIFICATION FOR THE MOST RECENT INFORMATION ON THE PROPER USE OF THE SSCC-18 BAR CODE. CONTACT INFORMATION IS PROVIDED IN THE REFERENCE SECTION OF THIS DOCUMENT.)

PHYSICAL PROPERTIES:



Bar Size

X-Dimension (Narrow Bar Width)

Minimum:	0.017"
Maximum:	0.020"

Bar / Space Tolerance:

0.20X

Horizontal Label

$\pm 0.10''$

Registration Tolerance:

Overall Bar Code Size:

Minimum height for three standard size x dimensions of thermally printed bar codes

THERMAL

17 mil X-dimension = 1.40" height

18 mil X-dimension = 1.40" height

19 mil X-dimension = 1.40" height

(Note: **Plain paper or laser bar codes** must follow the plain paper portion of this specification)

PLAIN PAPER or LASER

17 mil X-dimension = 1.50" height

18 mil X-dimension = 1.50" height

19 mil X-dimension = 1.50" height

Quiet Zones:

10.0X On each side (0.25")

0.1" On top and bottom

Label Stock:

Use only white label stock. (Near Infrared for direct thermal printing)

PRINT QUALITY:

The print quality specifications were developed to ensure all scanners could read the bar codes. The major print quality criteria are:

Print Contrast Signal (PCS) – The Print Contrast Signal values were established to ensure the bar codes would be readable at the conveyor speeds used on the FedEx Ground automated package sorters. The scanners cannot consistently read bar codes with low PCS values on the sorters, although they may read well with a hand scanner. High quality white label stock along with high quality print is required to achieve the specified PCS. (Thermal labels should be of a Near Infra Red type to support scanners operating in the 630nm to 670nm range. Labels should also exhibit stable print characteristics through exposure to varying heat and temperature conditions.)

Decode Margin – Decode margin is a graded measure of decodability; or how close a given scan comes to a reference decode failure. Lower margins indicate an increased susceptibility to decoding failure due to scanning errors.

Average Bar Error – The average bar growth in the symbol relative to its X-dimension.

Reflectance – Given in two parts, reflectance is a measure of the reflected laser light from the bars (dark) and spaces (light).

Defects – This is a graded measure of the maximum element reflectance non-uniformity due to any noise within the element due to voids, spots, or fuzzy edges.

Print Contrast Signal

Minimum Print Contrast:	90%
Desirable Contrast Range:	95 – 100%

Symbol Contrast (min.): 65%

Decode Margin (min.): "A" grade

Average Bar Error (max.): $\pm 0.10X$

Defects (max.): 15%

Reflectance

Light:	$\geq 80\%$
Dark:	$\leq 15\%$

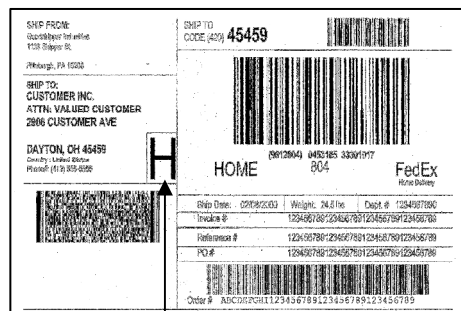
The overall print quality must be ANSI grade "A".

FEDEx HOME DELIVERY BAR CODE LABELING REQUIREMENTS

THE FEDEx HOME DELIVERY BAR CODES follow the same format as the FedEx Ground128 (96) bar code specifications except for the “H” that is located near the ship to address and the logo will change to FedEx Home Delivery.

Refer to *Appendix F* for a complete list of the text, icons and class of service codes

A large bold printed “H” must be printed using block font with a minimum font point size of 44 surrounded by a box. Ideally, the “H” should be located immediately to the left of the Ship To address. The “H” should have a minimum height of $\frac{3}{4}$ “ and a minimum width of $\frac{1}{4}$ “. If it is not possible to print the “H” **immediately to the left of the Ship To address, it may be placed** elsewhere, but must be within 1” of the Ship To address. See the examples below.



SHIP FROM:
Borden Supply for active
1120 Tilgham St
Pittsburg, PA 15222

SHIP TO:
CUSTOMER INC.
ATTN: VALUED CUSTOMER
2806 CUSTOMER AVE
DAYTON, OH 45459
Country: United States
Phone# (616) 855-8286

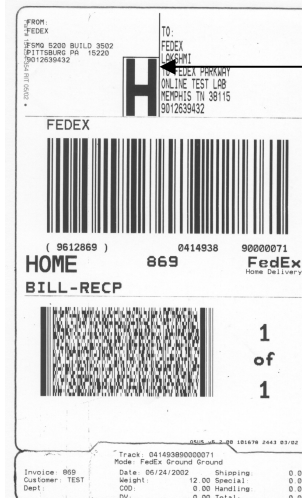
SHIP TO CODE (429) **45459**

SHIP TO BARCODE

HOME 004 FedEx Home Delivery

Ship Date: 05/24/2002 Weight: 24.8 lbs. Dept #: 1234567890
Invoice #: 1234567890123456789012345678901234567890
Reference #: 1234567890123456789012345678901234567890
PO #: 1234567890123456789012345678901234567890
Order #: A5C7890123456789012345678901234567890

A large bold printed "H" is shown to the left of the ship to address, with an arrow pointing to it.



FROM:
FedEx
Bldg 5200 BULD 3502
9117 TOLSON RD
9012638432

TO:
FEDEX
PRICHT
THE FEDEX PRIMARY
MAILING TEST LAB
MEMPHIS TN 38115
9012638432

FEDEX

HOME 869 FedEx Home Delivery

BILL - RECP

1 of 1

Track: 04189880000071
Mode: FedEx Ground Ground
Invoice #09 Date: 05/24/2002 Shipping: 0.00
Customer: TEST Weight: 12.00 Special: 0.00
Dest: 000: 0.00 Handling: 0.00
SV: 0.00 Total: 0.00

A large bold printed "H" is shown to the left of the ship to address, with an arrow pointing to it.

Note: The icon for the Home Delivery service codes is now “HOME” and the FedEx Ground logo is replaced with “FedEx Home Delivery” as shown above.

PLAIN PAPER LABEL BAR CODE

THE PLAIN PAPER LABEL BAR CODE follows a similar format as the FedEx Ground 128 bar code specifications except for the physical properties of the bar code. Plain paper bar codes are larger to increase readability through tape and plastic.

The layout of the human readable text and graphics required with the FedEx Ground Plain Paper “96” bar code is as shown below. See Appendices G and H.

1. Appendix G1- Basic Plain Paper Format – Portrait
2. Appendix G2- Basic Plain Paper Format – Landscape
3. Appendix G3- Basic Plain Paper Format EPDI – Portrait
4. Appendix G4- Basic Plain Paper Format EPDI – Landscape
5. Appendix H1- FedEx Home Delivery Plain Paper Format EPDI – Portrait
6. Appendix H2- FedEx Home Delivery Plain Paper Format EPDI – Landscape

This is the layout for bar codes produced by FedEx Ground for the Plain Paper product. Below are two examples of how the FedEx Ground Plain Paper “96” bar code may be created from our label application.



Refer to *Appendix F* for a complete list of class of service codes, icons, application Identifiers and descriptive text labels.

PHYSICAL PROPERTIES:

The specified physical properties of the FedEx Ground Plain Paper “96” Code 128 bar code have been developed to ensure accurate readability with all bar code scanning systems in use now and in the foreseeable future.

The individual components of the specification were determined as follows:

Bar / Space Width – Determined by the scanner type, depth of field and presentation speed.

X-Dimension – The width of the minimum narrow element (bar or space) is a dimensional parameter, which can be used to calculate the symbol's actual width

Bar / Space Tolerance – This is the amount the bars and/or spaces can vary from symbol to symbol without changing the overall print quality grade or significantly altering the size of the symbol. The tolerance is roughly equivalent to 20% of the X-dimension.

Width – The overall width of the bar code is a result of the X-dimension and wide to narrow ratio. The width usually cannot be set independently.

Height – The overall height of the bar code was established to ensure that bar codes were not so small that they could pass between two scanners without being read. Maximum height is not significant²⁴, as increased height only improves scan capability.

Quiet Zone – The specified Quiet Zone is a requirement taken from the Code 128 symbology specification and is equivalent to 10 times the maximum X-dimension.

Human Readable Text – The human readable text is required by FedEx Ground and is used to enable an operator to manually enter the data encoded in the bar code in case of a scanner failure or label damage. Extra human readable information is also included to enable the operator to determine the class of service, any secondary service²⁵, and *origin* zip code²⁶.

The important physical properties evaluated on the FedEx Ground “96” Code 128 bar code are:

²⁴ Up to the overall maximum allowable height.

²⁵ COD, AutoPOD, etc.

²⁶ Useful if the package needs to be returned to the shipper.

Bar Size

X-Dimension (Narrow Bar Width) 0.017"

Minimum: 0.020"

Maximum:

Horizontal Label Registration Tolerance: ± 0.10"

Overall Bar Code Size:

Minimum (WxH) 3.25" X 1.50"

Maximum (WxH) 3.34" X 1.50"(Additional height permitted)

Paper Size (WxH):

Minimum 8.50" X 11.00"

Maximum 8.50" x 11.00"

Quiet Zones: 10.0X On each side (0.25")

0.1" On top and bottom

Label Stock: Use only white label stock. (Near Infrared for direct thermal printing)



The Application Identifier, SCNC Code, and Class of Service Code should be placed below the bar code as shown.

Refer to Appendix F for a complete list of the text, abbreviations and class of service codes

PRINT QUALITY:

The print quality specifications were developed to ensure all scanners could read the bar codes. The major print quality criteria are:

Print Contrast Signal (PCS) – The Print Contrast Signal values were established to ensure the bar codes would be readable at the conveyor speeds used on the FedEx Ground automated package sorters. The scanners cannot consistently read bar codes with low PCS values on the sorters, although they may read well with a hand scanner. High quality white label stock along with high quality print is required to achieve the specified PCS. Only pure white paper is permissible.

Decode Margin – Decode margin is a graded measure of decodability; or how close a given scan comes to a reference decode failure. Lower margins indicate an increased susceptibility to decoding failure due to scanning errors.

Average Bar Error – The average bar growth in the symbol relative to its X-dimension.

Reflectance – Given in two parts, reflectance is a measure of the reflected laser light from the bars (dark) and spaces (light).

Defects – This is a graded measure of the maximum element reflectance non-uniformity due to any noise within the element due to voids, spots, or fuzzy edges.

Print Contrast Signal

Minimum Print Contrast: 90%

Desirable Contrast Range:

95 – 100%

Symbol Contrast(min.): 65%

Decode Margin (min.): "A" grade

Average Bar Error (max.): $\pm 0.10X$

Defects (max.): 15%

Reflectance

Light: $\geq 80\%$

Dark: $\leq 15\%$

In addition, the overall print quality grade must be "A".

CHECK DIGIT CALCULATION ALGORITHMS

FEDEX GROUND CODE 128 BAR CODE("96"BAR CODE)

Check digits are included in the human readable interpretation of the FedEx Ground code 128 bar code to prevent manual data entry errors. These check digits should not be confused with the internal code 128 symbology check digit. The symbology check digit is a required part of the code 128 symbol structure and is not counted as part of the user defined data encoded in the symbol. This check character is necessary for the bar code reader to ensure correct decode performance. And is usually calculated by the bar code printing application.

The FedEx Ground Code 128 bar code employs a weighted *modulo 10* check digit for the user defined data. The algorithm used for calculating the FedEx Ground "96" Code 128 symbol's data field check digit is the same basic algorithm used for the UCC/EAN Code 128 "00" bar code. For the sake of clarity, separate examples of the calculation are illustrated below for both the FedEx Ground "96" bar code and the SSCC-18 bar code.

For complete details on the UCC/EAN code 128 SSCC-18 check digit, contact the *Uniform Code Council*.

The basic check digit calculation is as follows:

- ❑ Digit positions are labeled from *right to left*.
- ❑ Digit 1 is the check character.
- ❑ For the FedEx Ground "96" bar code, digits 2 through 8 are the package ID number; digits 9 through 15 are the shipper ID. Digits 16 through 22 are not used in the FedEx Ground "96" check digit calculation.
- ❑ For the SSCC-18 bar code, digits 11 through 17 are the shipper ID number, digits 2 through 10 are the container serial number, and digit 18 is the container type. Digits 19 & 20 are not used in the check digit calculation.

Step 1. Starting from *position 2*, add up the values of the *even numbered positions*.

Step 2. Multiply the results of step Step 1. By three.

Step 3. Starting from *position 3*, add up the values of the *odd numbered positions*. Remember – *position 1* is the check digit you are trying to calculate.

Step 4. Add the result of step Step 2. To the result of step Step 3.

Step 5. Determine the smallest number which when added to the number from Step 4. Results in a multiple of 10. This is the check digit.

The calculation process is illustrated in the example below.

Example:

Determine the data to be included in the check digit calculation.

Bar Code Data 9 6 1 1 0 2 0 9 8 7 6 5 4 3 1 2 3 4 5 6 7 C

96	=	UCC/EAN Application Identifier	(not included)
11	=	SCNC	(not included)
020	=	Class of Service	(not included)
9876543	=	RPS SHIPPER ID	INCLUDED
1234567	=	PACKAGE NUMBER	INCLUDED
C	=	Check Digit	To be calculated

Tracking Number	FedEx Ground Shipper ID							PACKAGE NO.							
	SHIPPER ID							PACKAGE NO.							
DATA	9	8	7	6	5	4	3	1	2	3	4	5	6	7	C
Position (Odd/Even)	O	E	O	E	O	E	O	E	O	E	O	E	O	E	O
Digit Position	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

- Starting with position 2, add the data digits in the even numbered positions.

$$7 + 5 + 3 + 1 + 4 + 6 + 8 = 34$$

- Multiply the results by three.

$$34 \times 3 = 102$$

- Starting with position 3, sum the odd numbered digits...

$$6 + 4 + 2 + 3 + 5 + 7 + 9 = 36$$

- Add the two sums together...

$$36 + 102 = 138$$

- Now subtract this sum from the next highest multiple of ten...

$$140 - 138 = 2$$

The difference is the check digit.

The check digit in this case = **2**.

The complete data string then is :

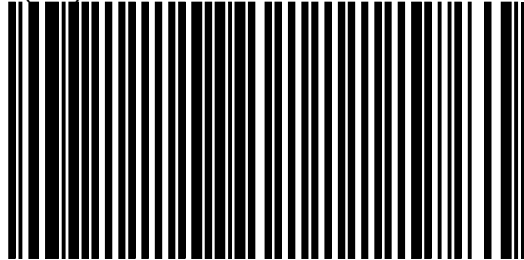
9611020 9876543 12345672

UCC/EAN SSCC-18 BAR CODE

The calculation process for the "00" bar code is illustrated in the example below.

Given the following bar code...

(00) 0 0012345 000000002 ?



follow these steps to calculate the check digit.

1. With the SSCC-18 bar code, the last two (left most) digits are not included in the calculation.

The number used for the calculation is:

00012345000000002

2. As with the FedEx Ground "96" bar code, start with position 2 and add the data digits in the *even numbered positions*.

$$0+0+2+4+0+0+0+0+2=8$$

3. Multiply the results by three.

$$8 \times 3 = 24$$

4. Starting with position 3, *sum the odd numbered digits*...

$$0+1+3+5+0+0+0+0=9$$

5. Add the two sums together...

$$24+9=33$$

6. Now subtract this sum from the next highest multiple of ten...

$$40-33=7$$

The difference is the check digit.

The check digit in this case = **7**.

The complete data string then is :

0 00123450000000027

BAR CODED ZIP CODES

GENERAL

In order to speed the SWAK (Scan, Weigh And Key) process and reduce data entry errors, FedEx Ground developed the ability to accept the destination ZIP code encoded in a separate linear bar code. Accepts destination ZIP codes in three formats.

Currently, this capability is only applicable at SWAK.

FedEx Ground accepts destination zip codes in three formats:

1. **FIVE DIGIT** – Plain Five digit number, no data identifiers or control characters.
2. **VICS** – Five-digit destination ZIP code with three-character alphanumeric data identifier.
3. **FACT** – Five-digit destination ZIP code with three-digit numeric data identifier.

The specifications for FedEx Ground bar coded destination ZIP codes is as listed below. At this time all destination ZIP codes must be five digits in length numeric or six characters alpha. FedEx Ground cannot accept three, nine or eleven digit ZIP codes.

Also, Canadian postal codes can only be accepted in bar coded format at Canadian origin facilities.²⁷

DATA CONTENT

FIVE DIGIT



Symbology: Code 39
Total number of digits encoded: 5

Human Readable Text 24 Point

VICS



Symbology: Code 39
Number of characters encoded: 8

Human Readable Text 24 Point

²⁷ The ability to scan Canadian Postal codes was incorporated into all *Canadian* SWAK systems in early 1998.

FACT

(420) 12345



Symbology:

UCC/EAN
128

Total number of digits
encoded:

8

Human Readable Text

24 Point

(To encode Canadian alpha postal codes, use subset B for Code 128.)

Note: All Code 128 bar codes used for sortation ("96" & "00") shall use subset C.

PHYSICAL PROPERTIES

The specified physical properties of the zip code bar codes have been developed to be consistent with the physical properties of the other FedEx Ground bar codes that may be present on the same label.

The individual components of the specification were determined as follows:

Bar / Space Width – Determined by the scanner type, depth of field and presentation speed.

X-Dimension – The width of the minimum narrow element (bar or space) is a dimensional parameter, which can be used to calculate the symbol's actual width

Bar / Space Tolerance – This is the amount the bars and/or spaces can vary from symbol to symbol without changing the overall print quality grade or significantly altering the size of the symbol. The tolerance is roughly equivalent to 20% of the X-dimension.

Wide to Narrow Ratio – Dictated by the depth of field of the overhead scanners. Since the bar coded zip codes are currently read only with hand held scanners at SWAK, the specified wide to narrow ratio is merely set to be the same as that of the other FedEx Ground bar code(s) present on the label.

Width – The overall width of the bar code is a result of the X-dimension and wide to narrow ratio. The width usually cannot be set independently.

Height – The overall height of the bar code was established to ensure that bar codes would fit conveniently on the label.

Quiet Zone – The specified Quiet Zone is a requirement taken from the Code 128 and Code 39 symbology specifications and is equivalent to 10 times the maximum X-dimension.

Human Readable Text – The human readable text is required by FedEx Ground and is used to enable an operator to manually enter the data encoded in the bar code in case of a scanner failure or label damage.

The important physical properties evaluated on the FedEx Ground destination zip codes are:

Bar SizeX-Dimension (Narrow
Bar Width)

Minimum: 0.010"

Maximum: 0.020"

Bar Code Height:

Minimum 0.50"

Quiet Zone: 10.0X

PRINT QUALITY:

The print quality specification was developed to ensure the bar coded destination zip codes were physically consistent with all other FedEx Ground bar codes.

The major print quality criteria are:

Print Contrast Signal (PCS) – The Print Contrast Signal values were established to ensure the bar codes would be readable at the conveyor speeds used on the FedEx Ground automated package sorters. Since the bar coded zip codes are read only at SWAK with hand held scan devices, the PCS values specified only Bar codes with low PCS values cannot be consistently read by the scanners on the sorters, although they may read well with a SWAK or **STAR** scanner. High quality white label stock along with high quality print is required too achieve the specified PCS.

Decode Margin – Decode margin is a graded measure of decodability; or how close a given scan comes to a reference decode failure. Lower margins indicate an increased susceptibility to decoding failure due to scanning errors.

Average Bar Error – The average bar growth in the symbol relative to its X-dimension.

Reflectance – Given in two parts, reflectance is a measure of the reflected laser light from the bars (dark) and spaces (light).

Defects – This is a graded measure of the maximum element reflectance non-uniformity due to any noise within the element due to voids, spots, or fuzzy edges.

Print Contrast Signal

Minimum Print Contrast: 90%

Desirable Contrast Range: 95 – 100%

Symbol Contrast (min.): 65%

Decode Margin (min.): "A" grade

Average Bar Error (max.): $\pm 0.10X$

Defects (max.): 15%

Reflectance

Light: $\geq 80\%$

Dark: $\leq 15\%$

In addition, the overall print quality grade must be ANSI grade "A".

BAR CODE EVALUATION PROCESS

OVERVIEW

Each shipper or vendor printing a FedEx Ground bar code must have the bar code approved *before they can be used on any package*.

This approval process is necessary to ensure the shipper gets proper service and each package can be handled correctly.

CURRENT SHIPPER PRINTED EVALUATION PROCESS

The current process through which FedEx Ground bar codes are approved is as follows:

1. Shipper notifies their Account Executive that they want to print their own FedEx Ground bar code labels.
2. Account Executive supplies Shipper with bar code specifications
<http://www.fedex.com/us/solutions/ppe/mcode.html>
3. Shipper designs preliminary bar code layout and sends, faxes or emails a copy to groundlabel@fedex.com. Bar code analysis fax number is 412-859-2490. Required is one single piece and multi-piece shipment for each service code.
4. Bar code Analysis will make modifications to the shippers layout an faxes or email recommended changes within 24-48 hours. A mocked up bar code example may accompany the email or fax to help the shipper see what changes need to be made.
5. Adjustments are usually software related at this point, moving text fields and defining the layout of the labels. This process may take several rounds before being completed. Depending on the shipper's ability to make the changes, this process may take several days.
6. When Bar Code Analysis can find no other items that need to be adjusted based on a fax or email, it is requested of the shipper to send actual sample labels to:

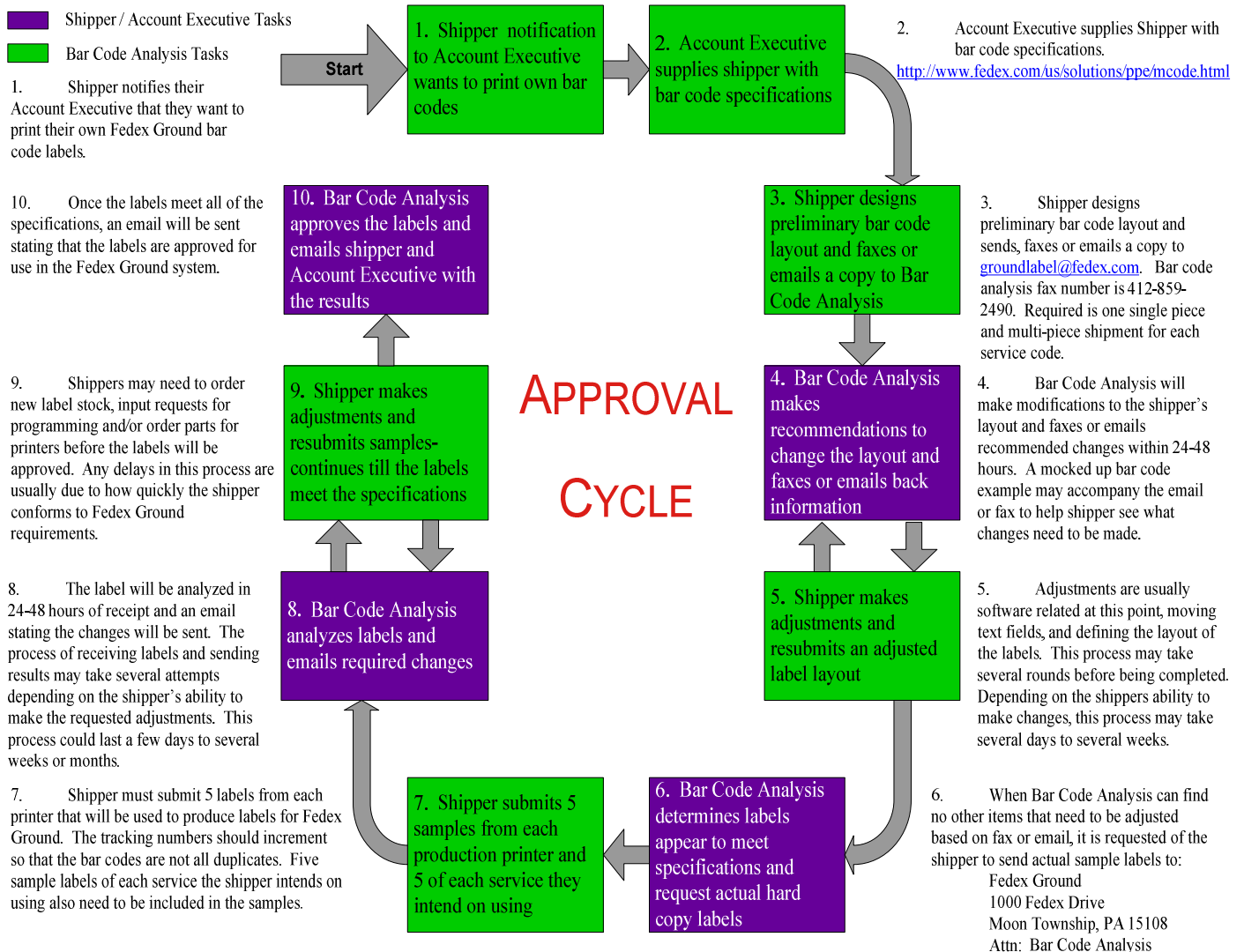
**FedEx Ground
1000 FedEx Drive
Moon Township, PA 15108
Attn: Bar Code Analysis**

7. Shipper must submit 5 labels from each printer that will be used to produce labels for FedEx Ground. The tracking numbers should increment so that the bar codes are not all duplicates. Five samples of each service the shipper intends on using also need to be included in the samples
8. The label will be analyzed in 24–48 hours of receipt and an email stating the changes will be sent. The process of receiving labels and sending results may take several attempts depending on the shippers ability to make the requested adjustments. This process could last a few days to several weeks or months
9. Shippers may need to order new label stock, input requests for programming and/or order parts for printers before the labels will be

approved. Any delays in this process are usually due to how quickly the shipper conforms to FedEx Ground requirements

- Once the labels meet all of the specifications, an email will be sent stating that the labels are approved for use in the FedEx Ground system. Accompanying this email will be a recommended package number to start the labels printing so there will not be a duplication problem.

FedEx Ground Bar Code Evaluation Process – Approval Cycle



IMPACT OF BAR CODE QUALITY ON SORTATION

Overview

FedEx Ground relies on the latest technology in bar codes to sort and track packages, unlike any other small package transportation company. Packages are sorted at automated hubs at speeds in excess of 550 feet per minute. At these speeds, it is important that the bar code meet the FedEx Ground specifications so the overhead scanners can read the bar code. If the bar code cannot be read, the package is routed to the relabel area. A duplicate of the original bar code is applied to the package to ensure the package will sort properly. The package is then re-circulated through the hub sortation system.

BENEFITS OF QUALITY BAR CODES

- Ensures the best possible guaranteed service
- Provides real time information regarding the status of shipments
- Ensures data capture is accurate and complete
- Minimizes handling of packages which in turn reduces claims
- Improved shipment integrity
- Ensures accurate billing

WHY RELABELS OCCUR

If a package is not labeled properly, it will potentially need to be relabeled. There are three major contributing factors that cause packages to be re-labeled: bar code placement, damaged bar code and poor quality bar code.

Bar code Placement

Bar codes should never be placed in the following places:

- Under straps
- Over an edge/corner/seam
- Placed on the small end

Damaged Bar Code

If a label is damaged because it is ripped, torn, wrinkled, wet or soiled, the package will have to be re-labeled.

Poor Quality Bar Code

The quality of a FedEx Ground bar code plays a significant role. If the quality of the bar code is poor, it cannot be read by the sortation scanners and will need to be relabeled. The following are typical bar code quality problems:

- Print head problems or Split Bars
- Faded or Voids in the Print
- Incorrect data content
- Quiet zone too small
- Smudged bar code
- Toner fusion problem
- Wrinkle in the print
- Duplicate package numbers
- Print contrast too low (It must be 90% or higher.)

Plastic Covering Bar Code

- Under tape
- Under plastic

KEYS TO SUCCESS

- Ensure that the front line parcel processing operator understands the importance of maintaining bar code quality
- Be proactive in solving bar code quality issues
- Work with FedEx Ground for help in resolving of bar code quality issues
- Establish preventative maintenance programs on labeling system

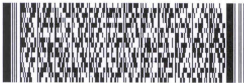
APPENDIX C - C.O.D./E.C.O.D. THERMAL & PLAIN PAPER LABEL REQUIREMENTS

The FedEx Ground thermal and plain paper labels for C.O.D. and Electronic C.O.D. follow the same format as the FedEx Ground 128 bar code specifications. In addition to printing the shipping label and meeting the requirements as stated in the "FedEx Ground Bar Code & Label Layout Specification," customers who plan to produce the FedEx Ground C.O.D./E.C.O.D. labels must also incorporate the following:

Two duplicate C.O.D./E.C.O.D. labels will print following the FedEx Ground shipping label. **The C.O.D./E.C.O.D. labels will not be affixed to the package, but placed inside a pouch provided by FedEx Ground (OP-013POUCH). The pouch will then be adhered to the outer packaging.**

The FedEx Ground PDF-417 symbol will stand alone on labels two and three. Information to be included in the stand-alone PDF-417 (2D) bar code on the two subsequent C.O.D./E.C.O.D. labels should duplicate the information included in the PDF-417 imprinted on the tracking label. The C.O.D. amount to be collected will also be printed on labels two and three. The doc tab on the bottom of the label will serve as a return address label for regular C.O.D. shipments and will serve as a reminder to not mail, but deposit funds for Electronic C.O.D. shipments.

See the examples listed below:

Mail Check To: Good Customer 1000 FedEx Drive Suite 1 Pittsburgh, PA 15108 Recipient: Customer Inc. Attn: Valued Customer Address Line 1 Address Line 2 Memphis, TN 38115	Regular C.O.D. COD
Original Tracking ID: 1234567891234567891234 Reference # 123456789123456789123456789123456789 C.O.D. Amount: \$500.00	
	
FedEx <small>Ground</small>	
TR v2.0 2443 12/00	
Good Customer 1000 FedEx Drive, Suite 1 Pittsburgh, PA 15108	

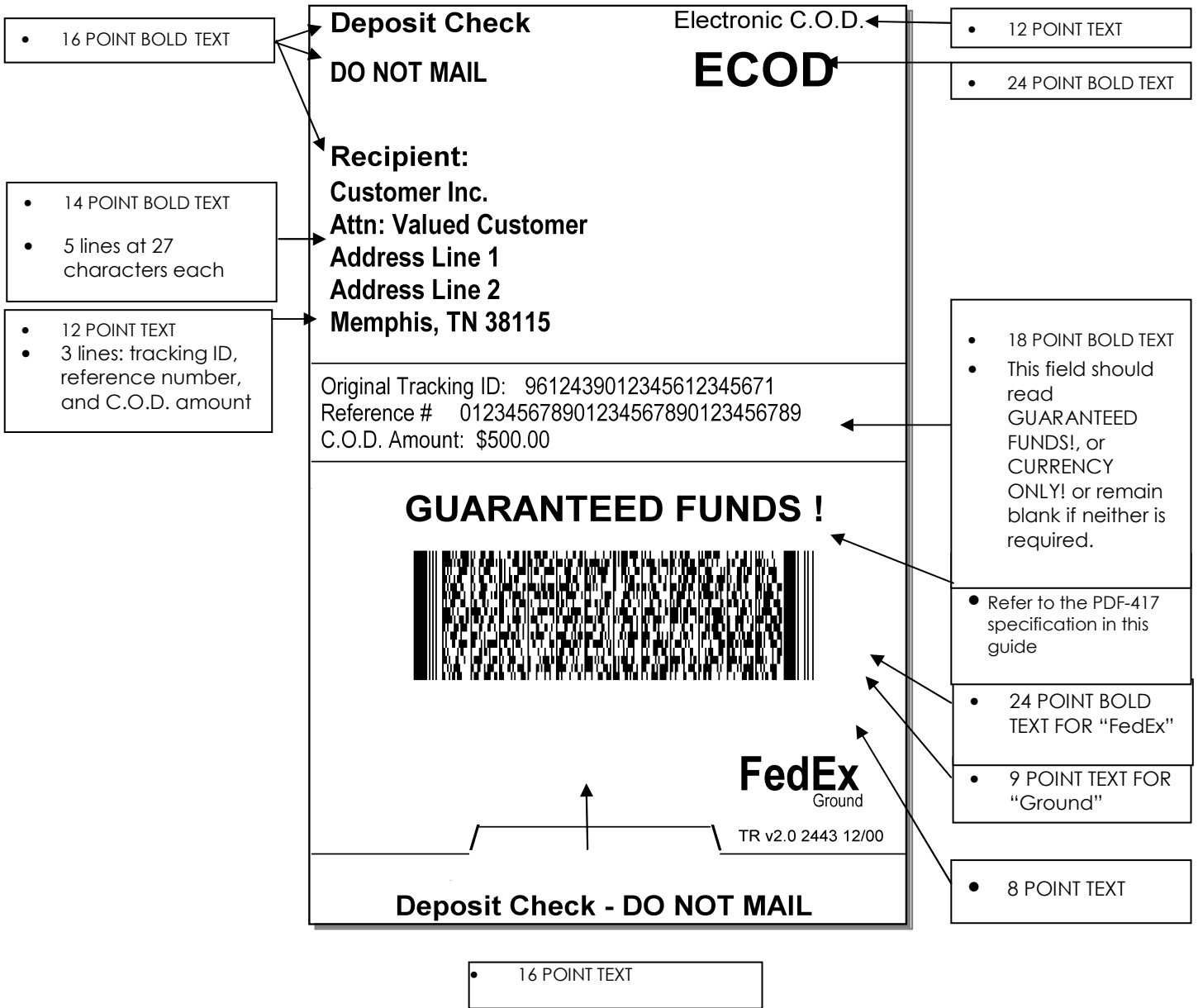
Sample: C.O.D. regular

Deposit Check DO NOT MAIL	Electronic C.O.D. ECOD
Recipient: Customer Inc. Attn: Valued Customer Address Line 1 Address Line 2 Memphis, TN 38115	
Original Tracking ID: 1234567891234567891234 Reference # 123456789123456789123456789123456789 C.O.D. Amount: \$500.00	
GUARANTEED FUNDS !	
	
FedEx <small>Ground</small>	
TR v2.0 2443 12/00	
Deposit Check - DO NOT MAIL	

Sample: Electronic C.O.D. – Guaranteed Funds

*Labels are not shown in actual size.

ELECTRONIC C.O.D. THERMAL LABEL FORMAT

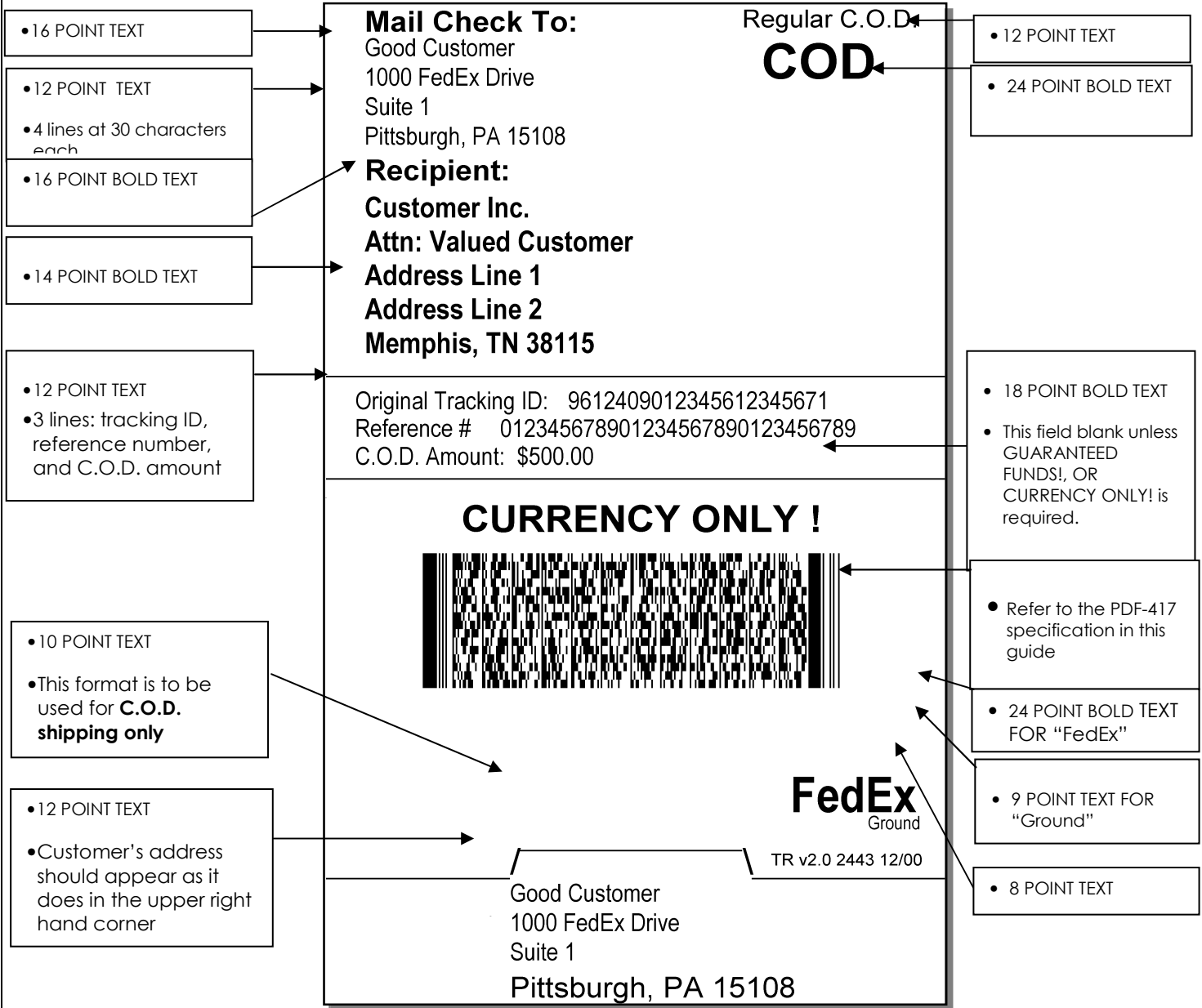


Note: Label not shown to actual size. Layout is to fit on a 4" x 6" label stock with additional dock tab.

Track ID is the original FedEx Ground bar code number. ("96" or "00")

Reference # is limited to thirty (30) characters

C.O.D. THERMAL LABEL FORMAT



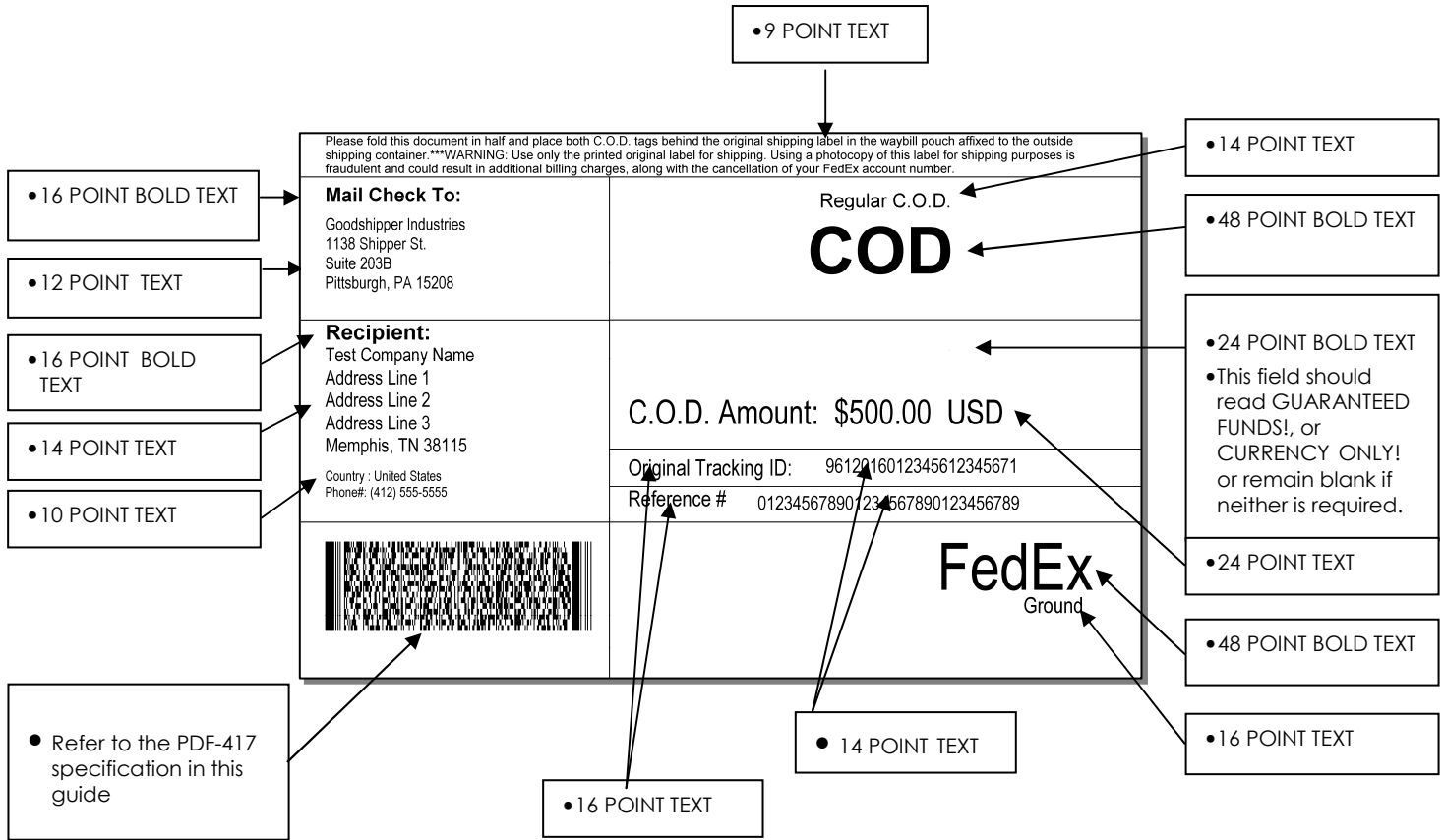
Note: Label not shown to size. Layout is to fit on a 4" x "6" label stock with additional dock tab.

Track ID is the original FedEx Ground bar code number. ("96" or "00")

Reference # is limited to thirty (30) characters

NOTE: If the doc tab is not present then the return address at the bottom of the labels needs to shift up so that the full address appears on the label. The address will be able to be cut off and used as an address label for the envelope to mail the C.O.D check back to the shipper

C.O.D. PLAIN PAPER LABEL FORMAT

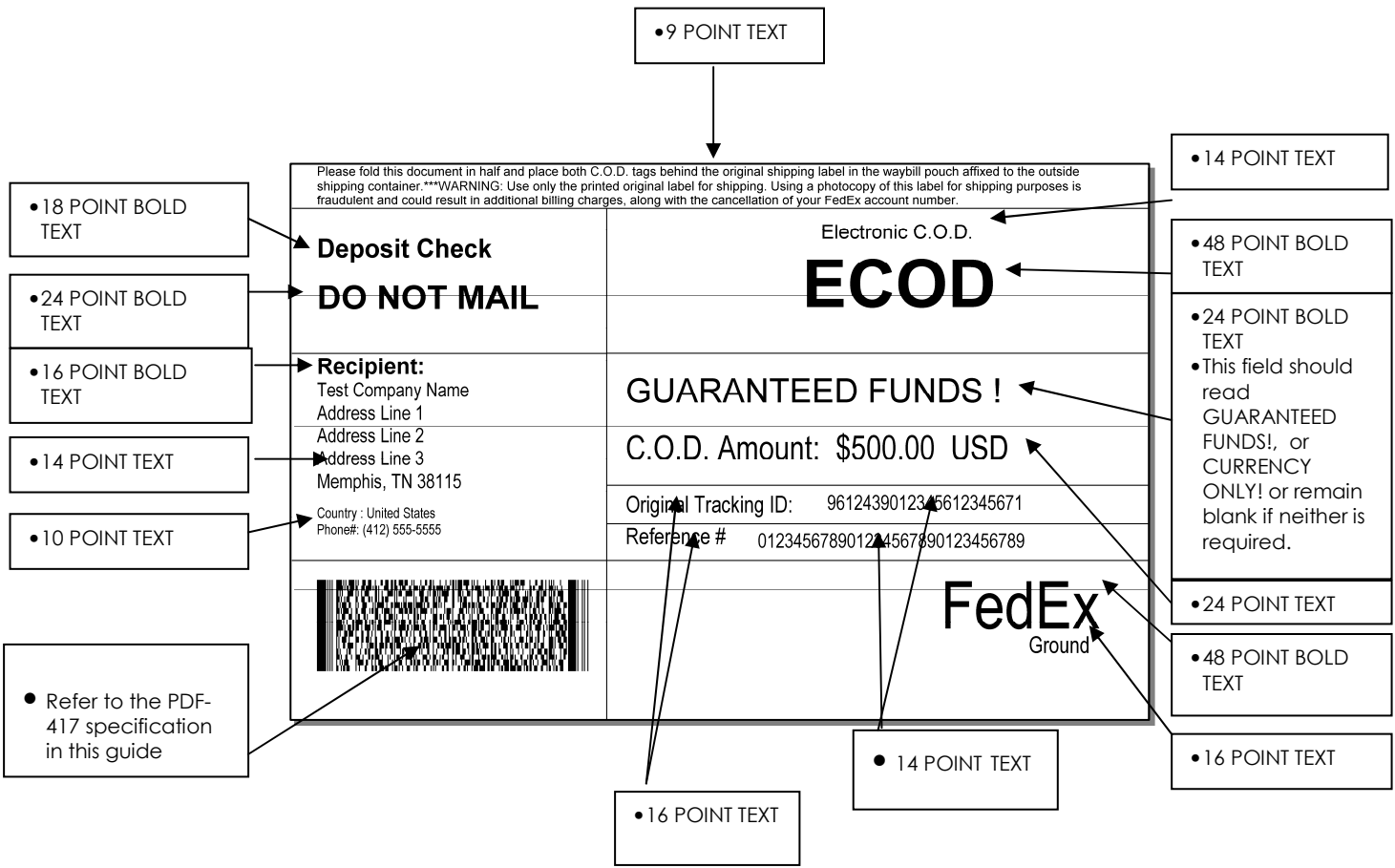


Note: Label not shown to size. Layout is to fit on a half sheet of white paper. (5 1/2" x 8 1/2")

Track ID is the original FedEx Ground bar code number. ("96" or "00")

Reference # is limited to thirty (30) characters

ELECTRONIC C.O.D. PLAIN PAPER LABEL FORMAT



Note: Label not shown to size. Layout is to fit on a half sheet of white paper. (5 1/2" x 8 1/2")

Track ID is the original FedEx Ground bar code number. ("96" or "00")

Reference # is limited to thirty (30) characters

APPENDIX F – ACTIVE SERVICE CODE LIST

Please refer to the latest external Appendix F document for the most recent information on service codes and associated text fields.

<http://grd.fedex.com/online/mcode/mcode.htm>

Select View Appendix F – this document will need downloaded to your computer prior to viewing.

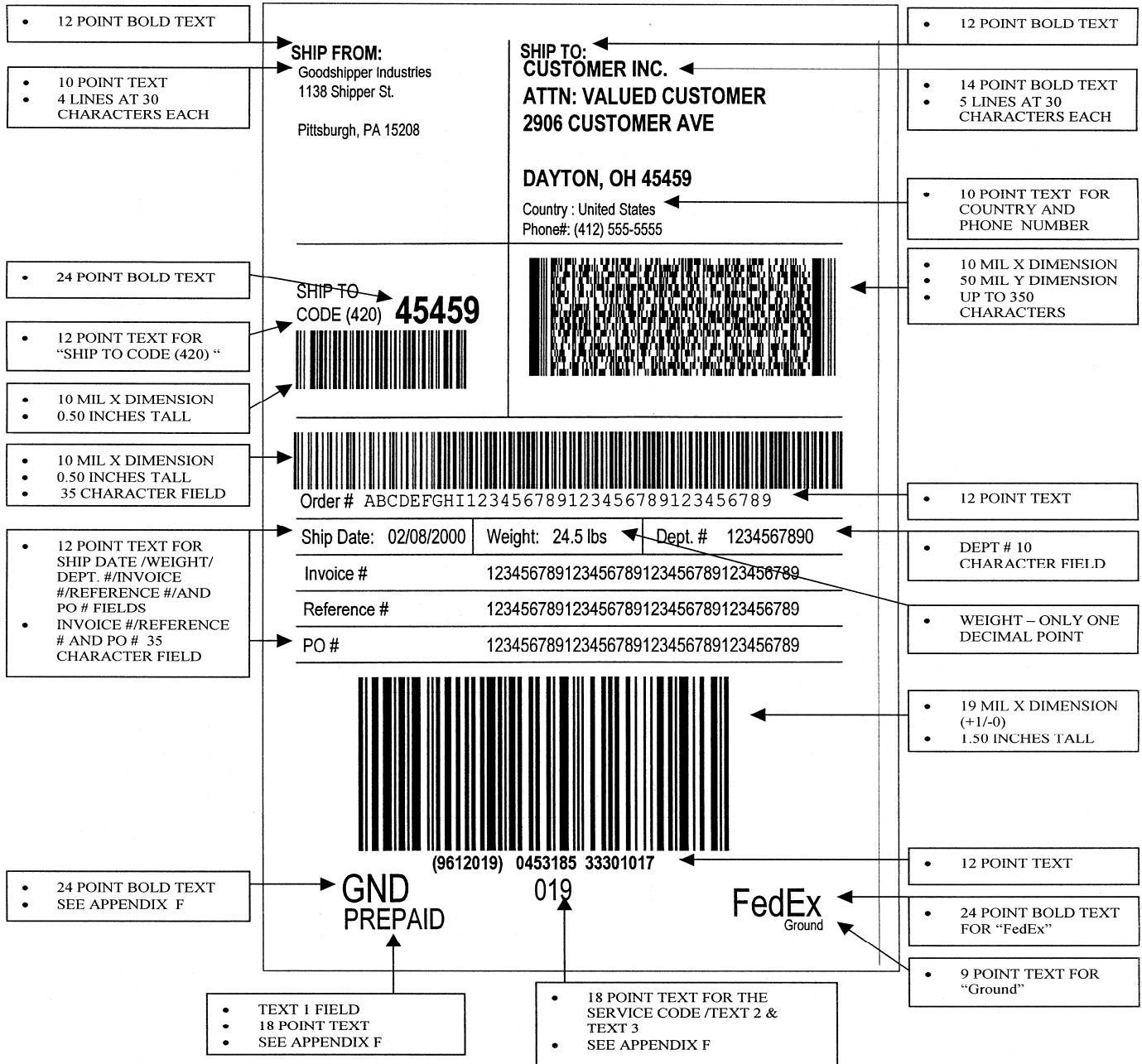
APPENDIX G – FEDEX GROUND PLAIN PAPER FORMATS

APPENDIX G1- BASIC PLAIN PAPER FORMAT – PORTRAIT

Note: Label not shown to actual size

BASIC PLAIN PAPER FORMAT

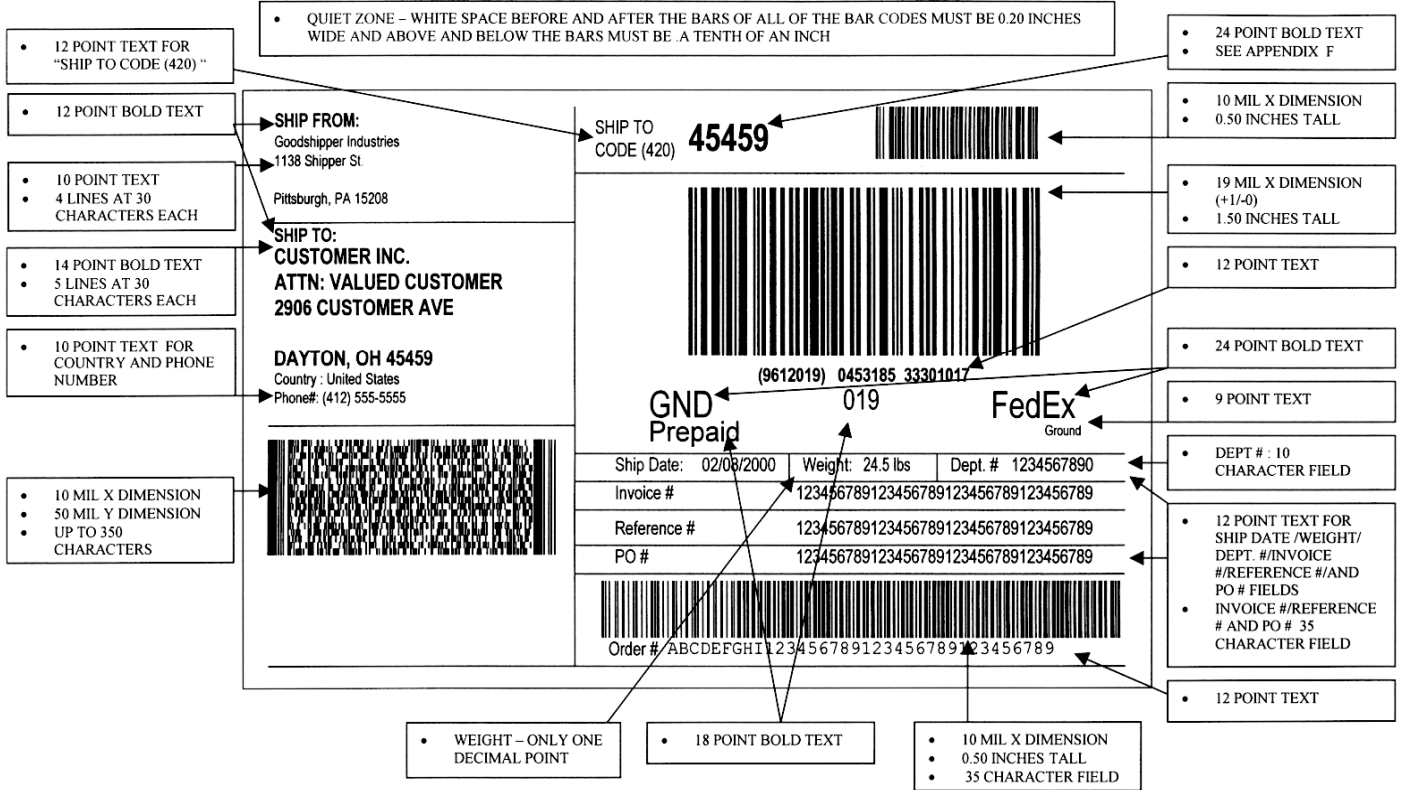
• QUIET ZONE – WHITE SPACE BEFORE AND AFTER THE BARS OF ALL OF THE BAR CODES MUST BE 0.20 INCHES WIDE



APPENDIX G2- BASIC PLAIN PAPER FORMAT – LANDSCAPE

Note: Label not shown to actual size

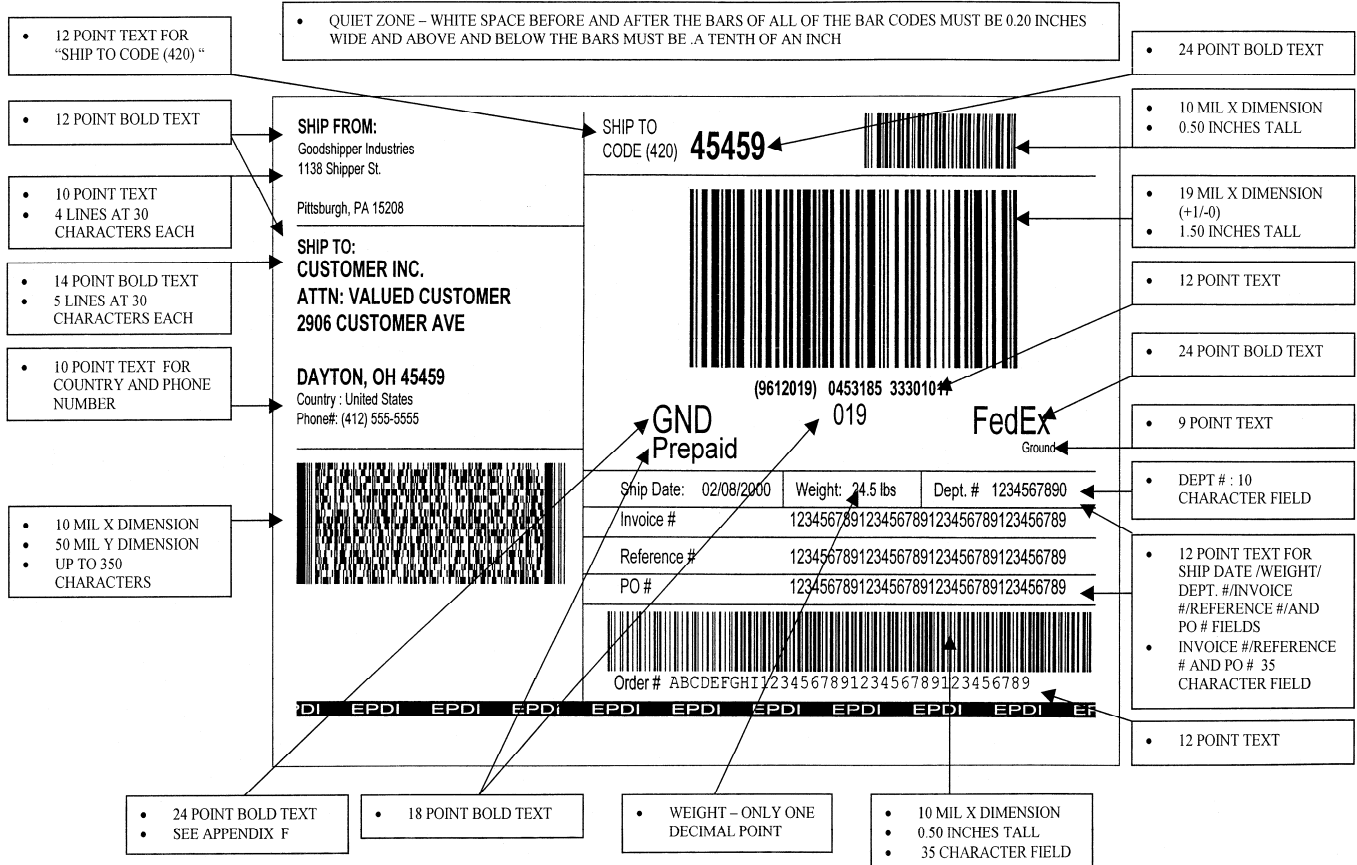
BASIC PLAIN PAPER FORMAT



APPENDIX G4- BASIC PLAIN PAPER FORMAT EPDI – LANDSCAPE

Note: Label not shown to actual size

BASIC PLAIN PAPER FORMAT EPDI



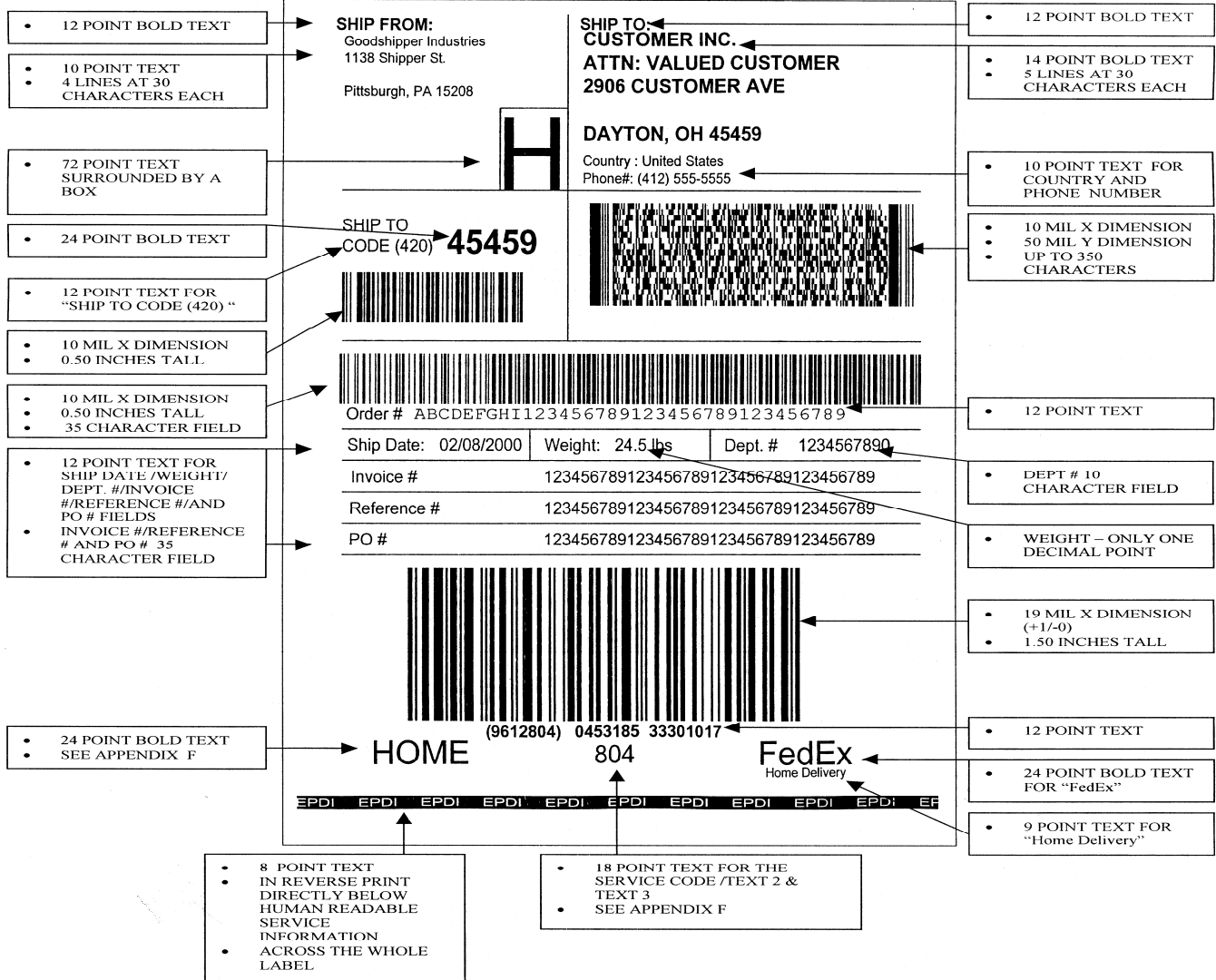
APPENDIX H – FEDEX HOME DELIVERY PLAIN PAPER FORMATS

APPENDIX H1 – FEDEX HOME DELIVERY PLAIN PAPER FORMAT EPDI – PORTRAIT

Note: Label not shown to actual size

HOME DELIVERY PLAIN PAPER FORMAT EPDI

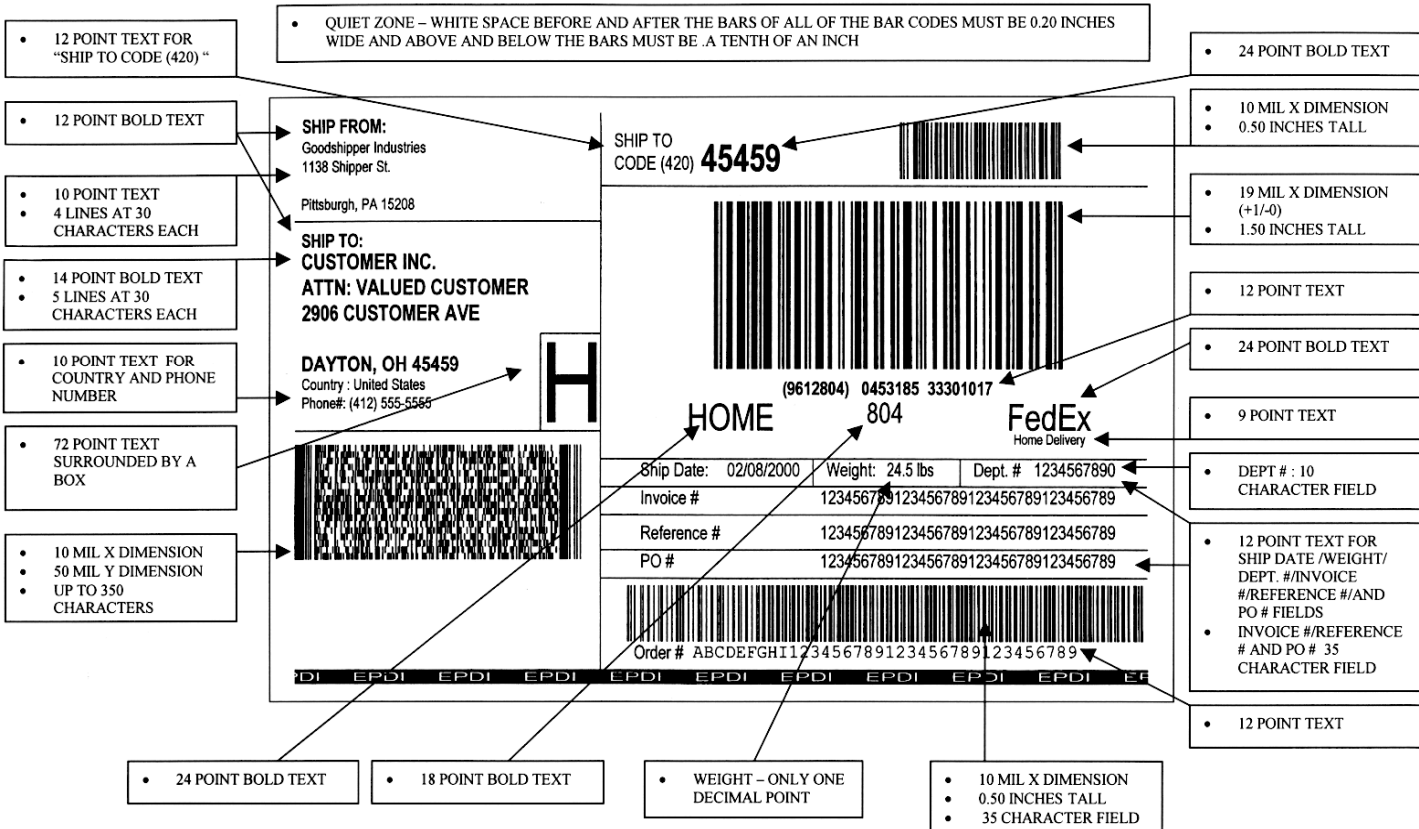
• QUIET ZONE – WHITE SPACE BEFORE AND AFTER THE BARS OF ALL OF THE BAR CODES MUST BE 0.20 INCHES WIDE



APPENDIX H1 – FedEx HOME DELIVERY PLAIN PAPER FORMAT EPDI – LANDSCAPE

Note: Label not shown to actual size

HOME DELIVERY PLAIN PAPER FORMAT EPDI



APPENDIX P – REFERENCES & ACKNOWLEDGEMENTS

REFERENCES & ACKNOWLEDGMENTS

REFERENCES:

Additional Information can be obtained from:

The American National Standards Institute (ANSI)

11 west 42nd Street

13th Floor

New York, NY 10036

1 (212) 642-4900

Fax: 1 (212) 398-0023

AIM USA

634 Alpha Drive

Pittsburgh, PA 15238

1 (412) 963-8588

Fax: 1 (412) 963-8753

BB: 1 (412) 963-9047

Internet: ADC @ aim.com

Uniform Code Council (UCC)

8163 Old Yankee Road

Suite J

Dayton, OH 45459

1 (513) 435-3870

Fax: 1 (513) 435-4749

ACKNOWLEDGMENTS:

Information from the following sources was used in the creation of this specification.

"The Bar Code Book"

Palmer, R.

Second Edition 1991

Helmets Publishing.

"B-Coder User's Guide"

author unknown

T.A.L Enterprises 1993

"SWAK-IV Technical Manual"

Hatcher, D; Donadlson, G.; Sponable, R ; et al.

QNX003.321

Mettler Toledo, Inc. 1997