ASME Y14.24-2012
[Revision of ASME Y14.24-1999 (R2009)]

Types and Applications of Engineering Drawings

Engineering Drawing and Related Documentation Practices

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

ADOPTION NOTICE

ASME Y14.24, "DRAWINGS TYPES AND APPLICATIONS OF ENGINEERING DRAWINGS", was adopted on 14 February 2000 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: Commander, U.S. Army ARDEC, ATTN: RDAR-QES-E, Picatinny Arsenal, NJ 07806-5000. Copies of this document may be purchased from the American Society of Mechanical Engineers (ASME), Three Park Avenue New York, New York, United States, 10016-5990. http://www.asme.org/

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The American Society of Mechanical Engineers
Two Park Avenue • New York, NY • 10016 USA

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This Standard will be revised when the Society approves the issuance of a new edition. There will be no written interpretations of the requirements of this Standard issued to this edition.

Periodically certain actions of the ASME Y14 Committee may be published as Cases. Cases are published on the ASME Web site under the Committee Pages at http://cstools.asme.org/ as they are issued.

Errata to codes and standards may be posted on the ASME Web site under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

The Committee Pages can be found at http://cstools.asme.org/. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting "Errata" in the "Publication Information" section.

The American Society of Mechanical Engineers
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FOREWORD

Subcommittee 24, Types and Applications of Engineering Drawings, was formed in June 1973 as a subcommittee of the American Society of Mechanical Engineers (ASME) Committee Y14, Standards for Engineering Drawings and Related Documentation Practices. The Subcommittee was formed to prepare a standard that defined the accepted drawing types used to establish engineering requirements in the production and procurement of hardware.

The basis for this Standard was Chapter 200 of the military standard MIL-STD-100, Engineering Drawing Practices. Work on this Standard considered the types of engineering drawings most frequently used by business, industry, and government communities in the United States. This Standard attempts to serve the individual and combined needs of these communities and ensure consistency of application and interpretation.

On this basis, a series of meetings were held to identify, select, and prepare proposed text and illustrations. At each stage of development, the Subcommittee considered the selection of requirements best suited for a national standard. Members of the Y14.24 Subcommittee represented a cross-section of American industry and the Department of Defense (DoD). Liaison with technical societies such as the National Defense Industrial Association (NDIA), Aerospace Industries Association (AIA), Electronic Industries of America (EIA), and the Society of Automotive Engineers (SAE International) provided technical support.

Drawing definitions are intended to permit preparation by any suitable method (manual, computer-aided, photographic, etc.); therefore, preparation techniques or methods of reproduction are not described.

The original edition of ASME Y14.24M was approved as an American National Standard on November 3, 1989. It was adopted and approved for use by the DoD on March 30, 1990. It was reaffirmed in 1996 without change.

Upon release of the original edition, it was referenced by the DoD as a replacement of the majority of Chapter 200 of MIL-STD-100E, which was released September 30, 1991. Input received from the DoD user community indicated that additional detail and clarification were needed to ensure understanding and application of the requirements when this Standard is invoked on government contracts.

Subcommittee 24 was reformed and began work on revising the Standard at a meeting in Garland, Texas from October 8 through October 10, 1991. ASME Y14.24 was approved as an American National Standard on June 24, 1999. It was reaffirmed in 2004 without change. Work on this revision began in September 2002.

The following is a summary of the significant changes incorporated in this revision:

(a) Definitions were relocated to section 3, para. 1.2 was added, and section 1 was redesignated accordingly.

(b) Paragraph 1.3 (former para. 1.4) was revised to separate preparation methods from formats and to clarify the relationship between ASME Y14.24 and ASME Y14.41.

(c) Paragraph 1.10 was added to address drawing hierarchy.

(d) Definitions of *drawing tree*, *type designation*, and *Design Activity Identification (DAI)* were added.

(e) The definition and use of the term "FAA-PMA" were deleted.

(f) The term "unique identifier" and all variables of it used with the term "identifier" were deleted.

(g) The term "descriptive identifier" was deleted to agree with changes to ASME Y14.100-2012, clarifying that a descriptive identifier may be used as a PIN.

(h) Former para. 13.11 and former Figs. 43 and 44 were deleted.

(i) Section 16 and Figs. 16-1, 16-2, and 16-3 were added.

(j) Paragraph 15.5 (former para. 13.5) was revised to add reference to ASME Y14.31, to delete requirements located in ASME Y14.31, and to delete former Fig. 34.

(k) Figure A-1 Notes were revised to replace the terms "contractor" and "subcontractor" with the terms "design activity" and "subdesign activity," respectively.

Commendation is extended to the companies and the DoD departments and agencies for sponsoring participants in this activity and to those whose earlier efforts provided the basis for this Standard. The success of this effort can be attributed to their demonstrated interest, cooperation, and support.

Coordination of this Standard with the International Organization for Standardization (ISO/TC10/SC1) is intended to help enhance world understanding of the various types of drawings in use within the United States.

Suggestions for the improvement of this Standard are welcome. They should be sent to The American Society of Mechanical Engineers, Attn.: Secretary, Y14 Standards Committee, Two Park Avenue, New York, NY 10016-5990.

This revision was approved as an American National Standard on November 14, 2012.

ASME Y14 COMMITTEE
Engineering Drawing and Related Documentation Practices

(The following is the roster of the Committee at the time of approval of this Standard.)

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CORRESPONDENCE WITH THE Y14 COMMITTEE

General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by proposing revisions and attending Committee meetings. Correspondence should be addressed to:

Secretary, Y14 Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
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http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the standard, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the standard to which the proposed Case applies.

Attending Committee Meetings. The Y14 Standards Committee regularly holds meetings or telephone conferences, which are open to the public. Persons wishing to attend any meeting or telephone conference should contact the Secretary of the Y14 Standards Committee or check our Web site at http://cstools.asme.org/csconnect/.

TYPES AND APPLICATIONS OF ENGINEERING DRAWINGS

1 GENERAL

1.1 Scope

This Standard defines the types of engineering drawings most frequently used to establish engineering requirements. It describes typical applications and minimum content requirements. Drawings for specialized engineering disciplines (e.g., marine, civil, construction, optics, etc.) are not included in this Standard. It is essential that this Standard be used in close conjunction with ASME Y14.34, ASME Y14.35M, ASME Y14.41, and ASME Y14.100.

1.2 Conventions

The following conventions are guidance used in this and other ASME Y14 standards.

1.2.1 Mandatory, Nonmandatory, Guidance, and Optional Words

(a) The words "shall" and "will" establish a mandatory requirement.

(b) The words "should" and "may" establish a recommended practice.

(c) The words "typical," "example," "for reference," or the Latin abbreviation "e.g." indicate suggestions given for guidance only.

(d) The word "or" used in conjunction with a mandatory requirement or a recommended practice indicates that there are two or more options for complying with the stated requirement or practice.

1.2.2 Cross-Reference of Standards. Cross-reference of standards in the text with or without a date following the standard identity is interpreted as follows:

(a) Reference to other ASME Y14 standards in the text without a date following the standard identity indicates the issue of the standard as identified in the References section shall be used to meet the requirement.

(b) Reference to other ASME Y14 standards in the text with a date following the standard identity indicates that only that issue of the standard shall be used to meet the requirement.

1.2.3 Invocation of Referenced Standards. The following examples define the invocation of a standard when specified in the References section (section 2) and referenced in the text of this Standard:

(a) When a referenced standard is cited in the text with no limitations to a specific subject or paragraph(s) of the standard, the entire standard is invoked. For example, "dimensioning and tolerancing shall be in accordance with ASME Y14.5" is invoking the complete standard because the subject of the standard is dimensioning and tolerancing and no specific subject or paragraph(s) within the standard are invoked.

(b) When a referenced standard is cited in the text with limitations to a specific subject or paragraph(s) of the standard, only the paragraph(s) on that subject is invoked. For example, "assign part or identifying numbers in accordance with ASME Y14.100" is only invoking the paragraph(s) on part or identifying numbers because the subject of the standard is engineering drawing practices and part or identifying numbers is a specific subject within the standard.

(c) When a referenced standard is cited in the text without an invoking statement such as "in accordance with," the standard is for guidance only. For example, "for gaging principles, see ASME Y14.43" is only for guidance and no portion of the standard is invoked.

1.2.4 Parentheses Following a Definition. When a definition is followed by a standard referenced in parentheses, the referenced standard is the controlling standard for the definition.

1.2.5 Notes. Notes depicted in this Standard in ALL UPPERCASE letters are intended to reflect actual drawing entries. Notes depicted in Initial Uppercase or lowercase letters are to be considered supporting data to the contents of this Standard and are not intended for literal entry on drawings. A statement requiring the addition of a note with the qualifier "such as" is a requirement to add a note, and the content of the text is allowed to vary to suit the application.

1.2.6 Acronyms or Abbreviations. Acronyms and abbreviations are spelled out the first time they are used in this Standard, followed by the acronym or abbreviation in parentheses. The acronym is used thereafter throughout the text.

1.2.7 Units. The International System of Units (SI) is featured in this Standard. It should be understood that U.S. Customary units could equally have been used without prejudice to the principles established.

1.2.8 Figures. The figures in this Standard are intended only as illustrations to aid the user in understanding the practices described in the text. In some

cases, figures show a level of detail as needed for emphasis. In other cases, figures are incomplete by intent so as to illustrate a concept or fact thereof. The absence of figure(s) has no bearing on the applicability of the stated requirements or practice. When the letter "h" is used for letter height in figures, or for symbol proportions, select the applicable letter height in accordance with ASME Y14.2.

1.2.9 Precedence of Standards. The following are ASME Y14 standards that are basic engineering drawing standards:

ASME Y14.1	Decimal Inch Drawing Sheet Size and Format
ASME Y14.1M	Metric Drawing Sheet Size and Format
ASME Y14.2	Line Conventions and Lettering
ASME Y14.3	Multiview and Sectional View Drawings
ASME Y14.5	Dimensioning and Tolerancing
ASME Y14.24	Types and Applications of Engineering Drawings
ASME Y14.34	Associated Lists
ASME Y14.35M	Revision of Engineering Drawings and Associated Documents
ASME Y14.36M	Surface Texture Symbols
ASME Y14.38	Abbreviations and Acronyms for Use on Drawings and Related Documents
ASME Y14.41	Digital Product Definition Data Practices
ASME Y14.100	Engineering Drawing Practices

All other ASME Y14 standards are considered specialty types of standards and contain additional requirements or take exceptions to the basic standards as required to support a process or type of drawing.

1.2.10 Unless Otherwise Specified (UOS). The phrase "unless otherwise specified" or the acronym "UOS" is used to indicate a default requirement. The phrase is used when default is a generally applied requirement and the exception can be clarified by providing a reference to another document or requirement.

1.3 Preparation Methods and Formats

1.3.1 Preparation Methods. Preparation methods (e.g., manual, digital, photographic, and cut and paste) and methods of depiction (e.g., pictorial, textual, or combinations thereof) are concerns of this Standard only to the extent that the drawing satisfies its intended purpose.

Use of ASME Y14.41 practices to prepare data sets does not preclude the use of this Standard. Data sets prepared with drawing graphic sheets shall meet the specific requirements for each drawing type defined in this Standard. Data sets prepared with no drawing graphic sheets shall meet the intent of the specific requirements for each drawing type defined in this Standard by using the practices defined in ASME Y14.41.

1.3.2 Formats. Formats (e.g., manual and digital, single or multisheet, drawing in book form, and computer printout) are concerns of this Standard only to the extent that the drawing satisfies its intended purpose. Formats shall be in accordance with ASME Y14.1.

1.4 Structure of Drawing Text

Textual information on drawings may be in numbered note form or in a format that uses section headings, numbered paragraphs, and subparagraphs grouped according to subject matter. See figures for examples.

1.5 Application Guidelines

Application guidelines are intended to aid in understanding the conditions under which specific types of drawings may be prepared. It is not intended that any application guideline imply that preparation of specific drawing types is always required.

1.6 Drawing Content

Requirements may be satisfied by direct delineation on the drawing or by reference to other documents that are a part of the drawing package. Such documents are invoked in individual drawings either by reference in the general notes, in the using assembly parts list, or both. Parts lists shall be in accordance with ASME Y14.34.

1.7 Tabulation

Any drawing type may be tabulated, as applicable, to delineate similar items that as a group have some common characteristics and some variable features.

1.7.1 Application Guidelines. Tabulated drawings are prepared to avoid preparation of individual drawings for each similar item tabulated. Each item included in the tabulation shall have a Part or Identifying Number (PIN) assigned.

1.7.2 Requirements. The differences, i.e., the variables, between the items defined by the drawing are tabulated. The common characteristics are delineated or stated once. Each individual item is identified by a PIN. Normally, a single pictorial representation is shown. For example, variable dimensions are coded by letters used as headings for columns in a tabulation block. Variables are entered in the table under the appropriate heading and on the same line as the relevant PIN. Alternate methods may be used to correlate the variations in characteristics to the individual items. The description for each tabulated item is as complete as that of an individual item described on the specific drawing type.

1.8 Combination of Drawing Types

The characteristics of more than one drawing type may be combined into a single drawing provided the resulting combination includes the data required by each of the individual types. For example, a modification kit drawing combines a description of the modification and the kit of items needed to accomplish the modification.

NOTE: The decision to combine drawings should be made cautiously. Combining drawing types should result in a significant advantage versus not combining and having separate drawings. Advantages of combining drawings should outweigh any potential disadvantages. Potential disadvantages resulting from combining drawings include

(a) increased complexity of the drawing, which may diminish clarity and usefulness

(b) frequent change activity to the drawing, which may increase the need to update associated record(s), material control data, manufacturing planning, microfilm, etc.

1.9 Ancillary Drawings

Ancillary drawings may be prepared to supplement end product drawings. Ancillary drawings may be required for management control, logistics purposes, configuration management, and other similar functions unique to a design activity. Ancillary drawings do not establish item identification. Inclusion of data in an ancillary drawing does not eliminate the need to prepare appropriate drawing types, including the applicable data as defined in this Standard.

1.10 Drawing Hierarchy

Based on the product structure of an item, the different types of drawings required may be prepared at any level of the drawing tree. See section 16.

2 REFERENCES

The following revisions of American National Standards form a part of this Standard to the extent specified herein. A more recent revision may be used, provided there is no conflict with this Standard. In the event of a conflict between this Standard and the references cited herein, this Standard shall take precedence.

ANSI/IEEE Std 91, Graphic Symbols for Logic Functions
ANSI/IEEE Std 991, Logic Circuit Diagrams
IEEE Std 315, Graphic Symbols for Electrical and Electronic Diagrams

Publisher: Institute of Electrical and Electronic Engineers (IEEE), 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08854-4141 (www.ieee.org)

ANSI/IPC-2221, Generic Standard on Printed Board Design
ANSI/IPC-2222, Sectional Design Standard for Rigid Organic Printed Boards
ANSI/IPC-2223, Sectional Design Standard for Flexible Printed Boards
ANSI/IPC-2225, Sectional Design Standard for Organic Multichip Modules (MCM-L) and MCM-L Assemblies
ANSI/IPC-D-310, Guidelines for Phototool Generation and Measurement Techniques
ANSI/IPC-D-325, Documentation Requirements for Printed Boards, Assemblies and Support Drawings
ANSI/IPC-D-350, Printed Board Description in Digital Form
ANSI/IPC-D-859, Design Standard for Thick Film Multilayer Hybrid Circuits
ANSI/IPC-DW-425, Design and End Product Requirements for Discrete Wiring Boards
ANSI/IPC-T-50J, Terms and Definitions for Interconnecting and Packaging Electronic Circuits
IPC-2224, Sectional Standard for Design of PWBs for PC Cards
IPC-D-351, Printed Board Drawings in Digital Form

Publisher: IPC — Association Connecting Electronics Industry, 3000 Lakeside Drive, Bannockburn, IL 60015 (www.ipc.org)

ASME Y14.1-2005 (R2010), Decimal Inch Drawing Sheet Size and Format
ASME Y14.100-2004, Engineering Drawing Practices
ASME Y14.2-2008, Line Conventions and Lettering
ASME Y14.31-2008, Undimensioned Drawings
ASME Y14.34-2008, Associated Lists
ASME Y14.35M-1997 (R2008), Revision of Engineering Drawings and Associated Documents
ASME Y14.41-2012, Digital Product Definition Data Practices
ASME Y14.44-2008, Reference Designations for Electrical and Electronics Parts and Equipment

Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5090; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

Cataloging Handbook H4/H8, Commercial and Government Entity Codes (CAGE)

Publisher: Defense Logistics Agency, Andrew T. McNamara Building, 8725 John J. Kingman Road, Fort Belvoir, VA 22060-6221 (www.dla.mil)

3 DEFINITIONS

The following definitions apply to terms used in this Standard.

3.1 Acceptance Criteria

acceptance criteria: the quality provisions, including inspection and test requirements, that establish the acceptability of an item. It may range from testing the item in its use environment, to verification of electrical/mechanical characteristics, to a simple visual inspection.

3.2 Administrative Control Number

administrative control number: a number assigned to one or more interchangeable purchased items by a vendor item control drawing for administrative purposes. An administrative control number may also be assigned to an item defined by an envelope drawing. The number also serves as the PIN for specifying such items in a parts list. The administrative control number is assigned in addition to the item identification assigned by the original design activity.

3.3 Artwork Master

artwork master: an accurately scaled, usually 1:1, pattern that is used to produce the production master.

3.4 As Applicable

as applicable: this term requires inclusion of those product definition elements necessary to establish end-product requirements.

3.5 Assembly

assembly: a number of parts or combination thereof that are joined to perform a specific function and subject to disassembly without degradation of any of the parts (e.g., power shovel-front, fan assembly, audio-frequency amplifier). (ASME Y14.100)

NOTE: The distinction between an assembly and a subassembly is determined by individual application. An assembly in one instance may be a subassembly in another instance where it forms a portion of a higher assembly. (ASME Y14.100)

3.6 Associated Data

associated data: any document referenced on an engineering drawing that establishes some portion of the engineering requirements.

3.7 Associated List

associated list: a tabulation of engineering information pertaining to an item depicted on an engineering drawing or by a set of drawings (e.g., application list, data list, index list, parts list, and wire list). (ASME Y14.34)

3.8 Burn-In

burn-in: to operate electronic items under specified environmental and test conditions to eliminate early failures and to stabilize the items prior to actual use.

3.9 Commercial and Government Entity (CAGE) Code

Commercial and Government Entity (CAGE) Code: a five-character code that provides a unique activity identifier used by the government for activity identification. This method of activity identification has also been widely adopted by industry. CAGE Codes are listed in Cataloging Handbook H4/H8. (ASME Y14.100)

3.10 Commercial Item

commercial item: an existing product, material, component, subsystem, or system sold or traded to the general public in the course of normal business operations at prices based on established catalog or market prices.

3.11 Computer Program/Software

computer program/software: a series of instructions that direct a computer to perform a sequence of operations that produce a desired output. This program may be stored on one or more physical media such as optical disk, magnetic tape, magnetic disks, or punched cards. The terms "computer program" and "computer software" are used synonymously.

3.12 Critical Application

critical application: uses where failure of the item would result in one or more of the following conditions:

(a) risk of personal injury or endangerment of life

(b) loss of or damage to equipment

(c) degradation of performance to a point that would jeopardize its capacity to fulfill its intended function

3.13 Design Activity

design activity: an organization that has, or has had, responsibility for the design of an item. (ASME Y14.100)

3.13.1 Current Design Activity

current design activity: the design activity currently responsible for the design of an item. This may be the original design activity or a design activity to which the design responsibility has been transferred. (ASME Y14.100)

3.13.2 Original Design Activity

original design activity: the design activity originally responsible for the design and identification of an item whose drawing number and activity identification are shown in the title block of the drawings and associated documents. (ASME Y14.100)

3.14 Design Activity Identification (DAI)

Design Activity Identification (DAI): the application of an identifier that distinguishes an activity or organization from another activity or organization. Examples of activity identification include activity name, activity name and address, or CAGE Code. (ASME Y14.100)

3.15 Design Disclosure Drawing(s)

design disclosure drawing(s): a drawing or set of drawings and associated data that delineates the detailed engineering requirements of an end product necessary for the fabrication, assembly, inspection, and test of the item.

3.16 Discrete Wiring Board

discrete wiring board: a base material upon which discrete wiring techniques are used to obtain electrical interconnections.

3.17 Drawing

drawing: an engineering document or data set that discloses, directly or by reference, by means of graphic or textual presentations, or by combinations of both, the physical or functional requirements of an item. (ASME Y14.100)

3.18 Drawing Tree

drawing tree: a block diagram or indentured list that identifies all drawings applicable to an end item or program and illustrates the next higher and subordinate relationships that exist between those drawings.

3.19 End Product (End Item)

end product (end item): an item, such as an individual part or assembly, in its final or completed state.

3.20 Inseparable Assembly

inseparable assembly: same as *part*. (ASME Y14.100)

3.21 Interchangeable Item

interchangeable item: an item that possesses functional and physical characteristics equivalent in performance to another item of similar or identical purposes, and is capable of being exchanged for the other item without selection for fit or performance, and without alteration of the items themselves or of adjoining items, except for adjustment. (ASME Y14.100)

3.22 Item

item: a nonspecific term used to denote any unit or product, including materials, parts, assemblies, equipment, accessories, and computer software. (ASME Y14.100)

3.23 Item Identification

item identification: the Part or Identifying Number (PIN) for a specific item along with the original Design Activity Identification (DAI). (ASME Y14.100)

3.24 Multiprogrammable Memory Device

multiprogrammable memory device: a memory device containing software instructions or data that can be changed in the device once programmed [e.g., Electrically Alterable Read-Only Memory (EAROM)].

3.25 Nationally Recognized Standard

nationally recognized standard: a specification or standard developed by or for a government activity or by a nongovernmental organization issued with the intent to establish common technical requirements.

3.26 Nongovernmental Organization

nongovernmental organization: a private sector association, organization, or technical society that conducts professional standardization activities (e.g., the planning, developing, establishing, and public coordination of standards, specifications, handbooks, or related documents) and is not organized for profit.

3.27 One-Time Programmable Memory Device

one-time programmable memory device: a memory device containing software instructions or data that cannot be changed in the device once programmed [e.g., Programmable Read-Only Memory (PROM), Programmable Array Logic (PAL)].

3.28 Part

part: one item or two or more items joined together that are not normally subject to disassembly without destruction or impairment of designed use (e.g., transistor, composition resistor, screw, transformer, and gear). (ASME Y14.100)

3.29 Part or Identifying Number (PIN)

Part or Identifying Number (PIN): the identifier assigned by the original design activity or by the controlling nationally recognized standard that uniquely identifies, relative to that design activity, a specific item. (ASME Y14.100)

3.30 Performance Specification

performance specification: a specification that states requirements in terms of the required results with criteria for verifying compliance, but without stating the methods for achieving the required results. A performance specification defines the functional requirements for the item, the environment in which the item operates and interfaces, and the interchangeability characteristics.

3.31 Printed Board

printed board: the general term for completely processed printed circuit and printed wiring configurations. This includes single-sided, double-sided, and multilayer boards with rigid, flexible, and rigid-flex base materials.

3.32 Printed Circuit

printed circuit: a conductive pattern composed of printed components, printed wiring, or a combination thereof that is formed in a predetermined arrangement on a common base.

3.33 Printed Component

printed component: a part, such as an inductor, resistor, capacitor, or transmission line, that is formed as part of the conductive pattern of a printed board.

3.34 Printed Wiring

printed wiring: a conductive pattern that provides point-to-point connections but no printed components in a predetermined arrangement on a common base.

3.35 Procuring Activity

procuring activity: the customer. (ASME Y14.100)

3.36 Production Master

production master: a 1-to-1 scale pattern that is used to produce one or more rigid or flexible printed boards within the accuracy specified on the master drawing (ANSI/IPC-T-50J).

3.37 Purchased Item

purchased item: a term that encompasses both commercial items and vendor-developed items.

3.38 Qualification

qualification: the formal process by which a manufacturer's product is examined for compliance with the procurement requirements of a source control drawing for the purpose of approving the manufacturer as a source of supply.

3.39 Reference

reference: to invoke associated data by callout on an engineering drawing. Such callouts may be located on the field of the drawing, in the general notes, in the parts list, or elsewhere on the drawing.

3.40 Reference Data

reference data: information, including dimensions, that does not govern production or inspection operations.

3.41 Run-In

run-in: to operate mechanical items under specified environmental and test conditions to eliminate early failures and to stabilize the items prior to actual use.

3.42 Specialized Segment of Industry

specialized segment of industry: a business entity having recognized expertise in developing or developing and manufacturing specific products or product lines to meet customer requirements.

3.43 Source Control Notation (SOCN)

Source Control Notation (SOCN): a four-letter marking code used to indicate that an item is a source control drawing item.

3.44 Subassembly

subassembly: two or more parts that form a portion of an assembly or a unit replaceable as a whole but having a part or parts that are individually replaceable [e.g., gun mount stand, window sash, recoil mechanism, floating piston, telephone dial, Intermediate Frequency (IF) strip, and terminal board with mounted parts].

3.45 Subcontractor

subcontractor: a design activity from whom design development is purchased. The subcontractor may or may not produce the design item.

3.46 Title Block

title block: the block located in the lower right corner of the drawing format that contains the primary drawing identification. (ASME Y14.1)

3.47 Type Designation

type designation: a combination of letters and numbers arranged in specific sequence to provide a short, significant method of identification.

3.48 Vendor

vendor: a source from whom a purchased item is obtained.

3.49 Vendor-Developed Item

vendor-developed item: a specialized version of a vendor's general product line that is not normally stocked as an off-the-shelf item but is procurable on order.

3.50 Work Package

work package: a group of related items that do not make up a complete assembly, with instructions for installing the items in a major assembly structure (e.g., a power supply and mounting hardware with instructions for installing them in a telecommunications satellite structure).

3.51 Abbreviations and Acronyms

AIA = Aerospace Industries Association
AID = Altered Item Drawing
ANSI = American National Standards Institute
ASME = The American Society of Mechanical Engineers
CAGE = Commercial and Government Entity
COM = Commercial
DAI = Design Activity Identification
DoD = Department of Defense
DWG = Drawing
EAROM = Electrically Alterable Read-Only Memory
EIA = Electronic Industries of America
GOV = Government
IAW = In Accordance With
ICRD = Identification Cross-Reference Drawing
IEEE = Institute of Electrical and Electronic Engineers
IF = Intermediate Frequency
IPC = Institute for Interconnecting and Packaging Electronic Circuits
MCM-L = Multichip Modules — Laminated
NDIA = National Defense Industrial Association

PAL = Programmable Array Logic
PIN = Part or Identifying Number
PL = Parts List
PROM = Programmable Read-Only Memory
REQT = Requirement
SAE = Society of Automotive Engineers
SCD = Source Control Drawing
SI = International System of Units
SID = Selected Item Drawing
SOCN = Source Control Notation
SPEC = Specification
STD = Standard
UOS = Unless Otherwise Specified
VICD = Vendor Item Control Drawing
VIN = Vehicle Identification Number
WBS = Work Breakdown Structure

4 LAYOUT DRAWING

4.1 Description

A layout drawing depicts design development requirements. It is similar to a detail, assembly, or installation drawing, except that it presents pictorial, notational, or dimensional data to the extent necessary to convey the design solution used in preparing other engineering drawings. Except as specified in para. 4.3(k), a layout drawing does not establish item identification. See Fig. 4-1

4.2 Application Guidelines

A layout drawing may be prepared for a complete end product or any portion thereof and is prepared as one of the following:

(a) a conceptual design layout to present one or more solutions for meeting the basic design parameters and to provide a basis for evaluation and selection of an optimum design approach

(b) a design approval layout to present sufficient detail of the design approach for cost estimating and design approval

(c) a detailed design layout depicting the final development of the design in sufficient detail to facilitate preparation of detail and assembly drawings

(d) a geometric study to develop movement of mechanical linkages, clearances, or arrangements

A layout is not normally used to fabricate equipment; however, a detailed design layout is sometimes used as an interim assembly drawing for development equipment.

4.3 Requirements

A layout drawing includes, as applicable

(a) location of primary components

(b) interface and envelope dimensions including a cross-reference to applicable interface documentation

(c) paths of motion

(d) operating positions

(e) critical fits and alignments

(f) selected materials, finishes, and processes

(g) wire, pneumatic, and hydraulic routing and sizes

(h) adjustments

(i) critical assembly details and sequence

(j) identification for selected purchased items and new design items

(k) identification for the assembly depicted (when the layout is to be used as an interim assembly drawing)

A layout is drawn to scale with sufficient accuracy and completeness for its intended use.

5 DETAIL DRAWING

A detail drawing provides the complete end-product definition of the part or parts depicted on the drawing. A detail drawing establishes item identification for each part depicted thereon.

5.1 Monodetail Drawing

5.1.1 Description. A monodetail drawing delineates a single part. See Figs. 5-1 and 5-2.

NOTE: A drawing detailing SHOWN and OPPOSITE parts using a single set of views is considered to be a tabulated monodetail drawing. See para. 1.7.

5.1.2 Application Guidelines. A monodetail drawing is prepared to provide maximum clarity in defining a part.

5.1.3 Requirements. A monodetail drawing delineates all features of the part including, as applicable

(a) configuration

(b) dimensions

(c) tolerances

(d) materials

(e) mandatory processes

(f) surface texture

(g) protective finishes and coatings

(h) markings

5.2 Multidetail Drawing

5.2.1 Description. A multidetail drawing delineates two or more parts in separate views or in separate sets of views on the same drawing. See Fig. 5-3.

5.2.2 Application Guidelines. A multidetail drawing is prepared to describe parts usually related to one another.

NOTE: The decision to use a multidetail drawing should be made cautiously so as to ensure that significant benefit(s) outweigh potential disadvantages such as those listed below that relate to how a drawing is affected when revising or tabulating a multidetail drawing.

(a) The same revision status applies to all details on a multidetail drawing; therefore, a change to one detail of the drawing may affect

the associated records of all other details (e.g., material control data and manufacturing planning).

(b) When tabulating individual parts that are detailed and defined on the drawing, additional details or tabulation blocks are added to detail or define the differences. See para. 1.7. Each individual tabulated item shall be identified. See para. 5.2.3. Tabulating may affect the sequence in the assignment of PINs for each item.

(c) Clarity and usefulness may be diminished resulting from increased drawing complexity.

5.2.3 Requirements. Each part delineation on a multidetail drawing shall meet the design definition requirements for a monodetail drawing. Each part shall be separately identified.

6 ASSEMBLY DRAWINGS

6.1 Assembly Drawing

6.1.1 Description. An assembly drawing defines the configuration and contents of the assembly or assemblies depicted thereon. See Fig. 6-1. It establishes item identification for each assembly. Where an assembly drawing contains detailed requirements for one or more parts used in the assembly, it is a detail assembly drawing and establishes item identification for each part detailed. See para. 1.8 and Fig. 6-2.

6.1.2 Application Guidelines. An assembly drawing is prepared for each group of items that are to be joined to form an assembly and that reflect one or more of the following:

(a) a logical level in the assembly or disassembly sequence

(b) a testable item

(c) a functional item

(d) a deliverable item

6.1.3 Requirements. An assembly drawing includes, as applicable

(a) two or more parts, subordinate assemblies, or a combination of these items.

(b) a parts list specifying the PIN for all items that become a part of the assembly.

(c) requirements for decorative or protective finishes, processes, settings and adjustments, and other relevant data necessary to complete the item as an assembly.

(d) depiction of the items in the assembly relationship, using sufficient detail for identification and orientation of the items. Details of a subordinate assembly are not normally repeated on the assembly drawing of a higher level.

(e) electrical items depicted as they are to be mounted; however, small electrical items mounted by wire connections only may be located either by depiction on the assembly drawing or inclusion in the pertinent connection diagram or wiring list. See paras. 14.4 and 14.6.

(f) cross-reference to applicable installation drawings, higher-level assemblies, schematic diagrams, test specifications, associated lists, etc.

(g) a PIN assigned to each assembly configuration.

(h) identification marking requirements.

Attaching parts (e.g., bolts, nuts, and washers) required to mount assemblies in next-higher assemblies are called out in the parts list of the drawing that defines that attachment. This is usually the higher-level assembly or installation drawing.

An assembly drawing may be tabulated in accordance with para. 1.7 by specifying variable items in the parts list. The pictorial representation depicts all tabulated versions. If necessary to depict differences, separate views may be used.

6.2 Inseparable Assembly Drawing

6.2.1 Description. An inseparable assembly drawing delineates two or more parts, subordinate assemblies, or a combination of these items that may be separately fabricated and are permanently joined (e.g., welded, brazed, riveted, sewed, glued, or other processes) to form an integral unit or part not normally capable of being disassembled for replacement or repair of individual pieces. It establishes item identification for the assembly. See Fig. 6-3.

6.2.2 Application Guidelines. An inseparable assembly drawing may be prepared in lieu of individual detail drawings for the parts of an inseparable assembly. For example, a welded or riveted bracket, a metal chest riveted together, or a canvas case sewed together may be covered by an inseparable assembly drawing without separate detail drawings. Individual pieces may be detailed in the assembled condition in lieu of separate detail views or drawings.

6.2.3 Requirements. An inseparable assembly drawing fully defines the end product as assembled. An inseparable assembly drawing includes, as applicable

(a) a PIN for all items that become a part of the inseparable assembly

(b) methods of assembly and requirements for finishes, processes, settings and adjustments, and other relevant data necessary to complete the item

(c) depiction of the items in the assembled condition, using sufficient detail for identification, orientation, and assembly of the items

(d) a PIN assigned to the assembly configuration

(e) identification marking requirements

7 INSTALLATION DRAWING

7.1 Description

An installation drawing provides information for properly positioning and installing items relative to their supporting structure and adjacent items, as applicable.

This information may include dimensional data, hardware descriptions, and general configuration information for the installation site. An installation drawing does not establish item identification except for a work package or kit. See para. 15.6 and Figs. 7-1 and 7-2.

7.2 Application Guidelines

An installation drawing is prepared to provide detailed installation information for the following:

(a) functionally related items, such as a control system, electrical system, or hydraulic system, that cannot be effectively shown on an assembly drawing of the item to which it belongs.

(b) an assembly that is so large or complex that the major assembly drawing cannot accommodate all relevant data. See Fig. 7-1.

7.3 Requirements

An installation drawing includes, as applicable

(a) overall and principle dimensions in sufficient detail to establish space requirements for installation, operation, and servicing, including clearance for

(1) opening of doors

(2) removal of plug-in units

(3) travel or rotation of any moving parts, including the centers of rotation, angles of elevation, and depression

(b) interface mounting and mating information (e.g., locating dimensions for attaching hardware).

(c) interfaces for pipe and cable attachments.

(d) references to interconnecting and cabling data and to associated lists.

(e) identification of and requirements for installation items not included in the parts list of the using assembly drawing.

(f) reference to the assembly drawing of the major item being installed.

(g) a parts list specifying the items to be installed. See para. 1.6.

(h) supporting structure and associated items that are not included in the installed items. Providing this information is optional. When shown, such items shall be depicted by phantom lines and identified as reference data. Reference data is indicated by enclosing the data in parentheses or by labeling it REF.

8 MODIFYING DRAWINGS

Modifying drawing types are altered item, selected item, and modification drawings. These drawing types are not used for items made from raw or bulk materials, items purchased in bulk lengths (e.g., extrusions, channel nuts, hinges, etc.), or such semiprocessed items as blank panels, castings, electronic equipment drawers, etc. For such items, use detail or detail assembly drawings. See sections 5 and 6, respectively.

8.1 Altered Item Drawing

8.1.1 Description. An altered item drawing delineates the physical alteration of an existing item under the control of another design activity or defined by a nationally recognized standard. The drawing type permits the required alteration to be performed by any competent manufacturer, the altering design activity, or a third party. It establishes a new item identification for the altered item. See Figs. 8-1 and 8-2.

8.1.2 Application Guidelines. An altered item drawing is prepared when alteration of an existing item is required. The current design activity shall not prepare an altered item drawing to alter items they have developed.

8.1.3 Requirements. An altered item drawing includes

(a) information necessary to identify the existing item's form, fit, function, and performance requirements prior to alteration, including the original item identification. Unless the item being altered is defined by a nationally recognized standard, this information shall be delineated on the altered item drawing, or provided by reference to a design disclosure drawing, a vendor item control drawing, or source control drawing, as applicable.

(b) complete details of the alteration.

(c) a PIN assigned to the altered item.

(d) reidentification marking requirements; the original item identification being replaced shall be removed or obliterated, if this can be done without damage to the item. However, microcircuit reidentification marking shall be in addition to the existing original marking and shall be visibly separate from and in no way interfere with the existing marking.

(e) a parts list. Providing this information is optional, unless the alteration necessitates any additional item(s) to produce the altered item.

(f) the notation ALTERED ITEM DRAWING adjacent to the drawing title block.

NOTE: An altered item may be delineated on the using assembly drawing provided requirements (a) through (e) are met and the item is noted ALTERED ITEM.

8.2 Selected Item Drawing

8.2.1 Description. A selected item drawing defines refined acceptance criteria for an existing item under the control of another design activity or defined by a nationally recognized standard that requires further selection, restriction, or testing for such characteristics as fit, tolerance, material in cases where alternate materials are used in the existing item, performance, reliability, etc. This drawing type generally permits selection to be performed by any competent inspection or test facility, including those of the original manufacturer, the selecting design activity, or a third party. See Figs. 8-3 and 8-4.

A selected item drawing establishes a new item identification for the selected item. Although visible physical modification is not performed, the item is, because of the selection technique employed, demonstratively different from other items that meet only the requirements imposed on the original item.

8.2.2 Application Guidelines. A selected item drawing is prepared when it is feasible to select from an existing group of existing items those items that, as applicable

(a) meet the required characteristics for a particular application

(b) pass additional tests or inspections imposed by the using design activity for characteristics not normally specified for the original item

(c) survive burn-in or run-in requirements

The current design activity shall not prepare a selected item drawing to select items they have developed.

8.2.3 Requirements. A selected item drawing establishes the detailed criteria on which selection of the item is based, including

(a) information necessary to identify the existing item's form, fit, function, and performance requirements prior to selection, including the original item identification. Unless the item being selected is defined by a nationally recognized industry or government standard, this information shall be delineated on the selected item drawing or provided by reference to a design disclosure drawing, a vendor item control drawing, or source control drawing, as applicable.

(b) full disclosure of the range of restricted characteristics (e.g., fit, tolerance, performance, and reliability).

(c) a PIN assigned to the selected item.

(d) reidentification marking requirements; the original item identification being replaced shall be removed or obliterated, if this can be done without damage to the item. However, microcircuit reidentification markings shall be in addition to the existing original marking and shall be visibly separate from and in no way interfere with the existing marking.

(e) the notation SELECTED ITEM DRAWING adjacent to the drawing title block.

NOTE: A selected item may be defined on the using assembly drawing provided requirements (a) through (d) above are met and the item is noted SELECTED ITEM.

8.3 Modification Drawing

8.3.1 Description. A modification drawing delineates changes to items after they have been delivered. When required for control purposes, a modification drawing shall require reidentification of the modified item. See Fig. 8-5.

8.3.2 Application Guidelines. A modification drawing is prepared to add, remove, or rework items to satisfy the user's requirements or to incorporate mandatory changes in delivered equipment, for example, those that affect safety, reliability, or application extension. A modification drawing is not a substitute for existing drawing types used to produce the item(s) prior to modification (e.g., detail and assembly drawings). Engineering changes are incorporated into the latter drawing types to the extent that future production is to reflect the modifications.

8.3.3 Requirements. A modification drawing contains complete information for accomplishing the changes including, as applicable

(a) instructions for the removal or installation of affected parts.

(b) special notes.

(c) item identification, including serial number, when used, of affected items prior to modification.

(d) effectivity [e.g., aircraft tail number and Vehicle Identification Number (VIN)] of items to be modified.

(e) instructions for reidentification of modified items.

(f) dimensions necessary to accomplish the modification. Dimensions shall be given from specific features that are readily identified and accessible, rather than from theoretical reference planes.

(g) a parts list identifying all items required for the modification. See para. 1.6.

(h) a list of special tools or equipment required or supplied.

(i) the notation MODIFICATION DRAWING adjacent to the drawing title block.

(j) instruction for disposition of unused holes, wires, removed items, etc. Providing this information is optional.

9 ARRANGEMENT DRAWING

9.1 Description

An arrangement drawing depicts the physical relationship of significant items using appropriate projections or perspective views. Reference dimensions may be included. An arrangement drawing does not establish item identification. See Fig. 9-1.

9.2 Application Guidelines

An arrangement drawing is prepared to convey a general description of the configuration and location of significant items. It is not normally used to control design.

9.3 Requirements

An arrangement drawing includes, as applicable

(a) sufficient views so that a general understanding of the configuration and location of significant items is conveyed

(b) overall, locating, and other general dimensions necessary to describe the configuration

(c) identities of significant items

(d) reference to applicable documents for further details, such as ancillary equipment documentation, system specifications, and associated lists

(e) the notation ARRANGEMENT DRAWING placed adjacent to the drawing title block

10 CONTROL DRAWINGS

A control drawing is a drawing disclosing engineering form, fit, function, and performance requirements for the acquisition of interchangeable purchased items of existing designs, or of items specially developed by vendors to the control drawing requirements. Control drawings permit the acquisition of commercial items and vendor-developed items from specialized segments of industry without disclosing details of designs or divulging proprietary vendor data.

Nonmandatory Appendix A provides guidance to aid in selecting the appropriate control drawing type. It should be used in support of the application guidelines for the specific drawing types.

10.1 Procurement Control Drawing

10.1.1 Description. A procurement control drawing provides criteria for performance, acceptance, and identification of purchased items by disclosing the engineering design characteristics required for control of interfaces and to ensure repeatability of performance. See Fig. 10-1.

10.1.2 Application Guidelines. A procurement control drawing may be prepared in lieu of another type of control drawing to specify criteria for the following:

(a) a purchased item

(b) the alteration of a purchased item or an item defined by a nationally recognized standard

(c) the selection of a purchased item or an item defined by a nationally recognized standard

(d) the development and qualification of a new item

(e) item identification

10.1.3 Requirements

10.1.3.1 A procurement control drawing includes, as applicable

(a) performance requirements to ensure that performance characteristics critical to the intended application are met

(b) envelope and interface dimensions to ensure physical interchangeability in using assemblies

(c) interface characteristics to ensure functional interchangeability in using assemblies

(d) qualification requirements necessary to verify that performance requirements and physical and functional interchangeability can be provided by each proposed source

(e) identification requirements including marking instructions, lot serialization, etc.

(f) procurement data (e.g., approved or suggested sources, and qualification requirements for procurement of the item from alternate sources)

(g) acceptance criteria to verify that requirements established by (a) through (f) are met by each item or lot of items received by the purchaser and to identify any variations between items or lots of items

10.1.3.2 A procurement control drawing shall include the notation PROCUREMENT CONTROL DRAWING adjacent to the drawing title block.

10.2 Vendor Item Control Drawing

NOTE: A vendor item control drawing was formerly called a specification control drawing or vendor item drawing.

10.2.1 Description. A vendor item control drawing provides an engineering description and acceptance criteria for commercial items or vendor-developed items that are procurable from a specialized segment of industry. The vendor's PIN, along with the vendor's DAI, is the item identification. It provides a list of suggested source(s) of supply, the vendor's item identification, and sufficient engineering definition for acceptance of interchangeable items within specified limits. The vendor item control drawing number with suffixed identifier, if applicable, establishes the administrative control number(s) for identifying the item(s) on engineering documentation. See Fig. 10-2.

10.2.2 Application Guidelines

10.2.2.1 A vendor item control drawing is used to provide

(a) a single administrative control number for use in engineering documentation whether one or more sources exist for the item.

(b) a means of documenting engineering requirements for a purchased item.

(c) documentation to ensure interchangeability of items each time purchased.

(d) coverage of items developed at private expense where the design is controlled by the originating design activity. It is not the intent of a vendor item control drawing to portray a complete design disclosure.

10.2.2.2 A vendor item control drawing shall not be used to delineate

(a) an item requiring qualification in advance of a procurement action.

(b) an altered item, selected item, or an item delineated by a nationally recognized standard.

(c) a purchased item upon which the purchasing activity has placed requirements in addition to those normally provided. Instead, the item shall be delineated on either an altered or selected item drawing, as appropriate. The addition of the administrative control number established by the vendor item control drawing does

not constitute item reidentification or alteration and shall not be used to reidentify the item.

10.2.2.3 The suggested source(s) listed on a vendor item control drawing are not intended to represent the only sources for the item.

10.2.3 Requirements. A vendor item control drawing discloses sufficient information to ensure identification and reprocurement of interchangeable items.

10.2.3.1 The drawing includes, as applicable

(a) configuration, defined pictorially or by description

(b) dimensions of the item envelope and applicable limits

(c) mounting and mating dimensions and applicable limits

(d) interface characteristics and applicable limits

(e) acceptance criteria as necessary for product performance verification

(f) performance, maintainability, reliability, environmental, and other functional characteristics

(g) schematic, interconnection, or other appropriate diagram to define item function or provide interconnection information

10.2.3.2 The drawing shall include

(a) the vendor and item identification listed under the heading SUGGESTED SOURCES OF SUPPLY. Two or more sources are desirable.

(b) the following note:

IDENTIFICATION OF THE SUGGESTED SOURCES OF SUPPLY HEREON IS NOT TO BE CONSTRUED AS A GUARANTEE OF PRESENT OR CONTINUED AVAILABILITY AS A SOURCE OF SUPPLY FOR THE ITEM(S).

(c) the notation VENDOR ITEM CONTROL DRAWING placed adjacent to the drawing title block.

10.3 Source Control Drawing

10.3.1 Description. A source control drawing provides an engineering description, qualification requirements, and acceptance criteria for commercial items or vendor-developed items procurable from a specialized segment of industry that provide the performance, installation, interchangeability, or other characteristics required for critical applications. The drawing provides a list of approved sources of supply and the vendor's item identification for the item(s) that have been qualified and approved for use in the critical application(s). The source control drawing establishes the source control item identification. See Fig. 10-3.

10.3.2 Application Guidelines

10.3.2.1 A source control drawing is used to provide

(a) a means of establishing engineering requirements for the selection, qualification, and acquisition of an item from commercial sources.

(b) identification of the items/sources qualified to meet the stated requirements for the specific critical application.

(c) documentation to ensure interchangeability of specified items in the stated application each time acquired.

(d) coverage of source-controlled items developed at private expense where the design is controlled by the originating design activity. It is not the intent of a source control drawing to define a complete design disclosure.

(e) an item identification, i.e., the source control drawing number and applicable suffix identifier, along with the DAI, for each qualified and approved item.

10.3.2.2 A source control drawing shall not be used to delineate

(a) an item that does not require qualification in advance of a procurement action. If qualification is not required, the item is normally a candidate for vendor item control drawing coverage.

(b) an altered item, selected item, or item delineated by a nationally recognized standard unless, in the latter case, qualification for the specific application(s) is required.

10.3.3 Requirements. A source control drawing discloses sufficient information to ensure identification and reprocurement of acceptable items.

NOTE: Preparation requirements for a source control drawing are identical to a vendor item control drawing except for identification of critical application(s), qualification and approval requirements, item identification, approved sources of supply in lieu of suggested sources of supply, and required notation.

10.3.3.1 The drawing includes, as applicable

(a) requirements of a vendor item control drawing specified in para. 10.2.3.1.

(b) qualification and approval requirements. Successful completion of qualification test requirements establishes a new item identification for the qualified item.

(c) an identifier assigned to the qualified item.

(d) reidentification marking requirements; the original item identification being replaced shall not be removed or obliterated. The reidentification markings shall be in addition to the existing original marking and shall be visibly separate from and in no way interfere with the existing markings. The source control identification shall include a DAI (e.g., CAGE Code, the notation SOCN, and the PIN).

10.3.3.2 The drawing shall include

(a) the vendor and item identification for each item that has been qualified and approved for use, listed under the heading APPROVED SOURCES OF SUPPLY. Two or more sources are desirable.

(b) identification of the specific critical application for which the item is approved.

(c) the following notes:

ONLY ITEMS DESCRIBED ON THIS DRAWING ARE APPROVED FOR USE IN THE APPLICATIONS SPECIFIED HEREON. A SUBSTITUTE ITEM SHALL NOT BE USED WITHOUT PRIOR APPROVAL BY THE QUALIFYING ACTIVITY.

IDENTIFICATION OF THE APPROVED SOURCES OF SUPPLY HEREON IS NOT TO BE CONSTRUED AS A GUARANTEE OF PRESENT OR CONTINUED AVAILABILITY AS A SOURCE OF SUPPLY FOR THE ITEM DESCRIBED ON THE DRAWING.

(d) the notation SOURCE CONTROL DRAWING placed adjacent to the drawing title block.

10.4 Envelope Drawing

10.4.1 Description. An envelope drawing discloses the basic technical data and performance requirements necessary for development or design selection of an item. The envelope drawing will establish an administrative control number for use in engineering documentation until development is complete or until vendor item identification is established. When item development is completed, envelope drawings normally evolve into detail drawings, specifications, or vendor item control or source control drawings, as applicable. See Fig. 10-4.

10.4.2 Application Guidelines. An envelope drawing is prepared to

(a) establish the technical definition necessary for development of a new item, or

(b) define requirements for vendor item selection, and

(c) provide an administrative control number, i.e., an envelope drawing number and suffixed identifier, if applicable, for use in engineering documentation until development is complete or until vendor item identification is established.

10.4.3 Requirements. Preparation requirements for an envelope drawing are identical to a vendor item control drawing or source control drawing, as applicable, except for the requirements of paras. 10.2.3.2 and 10.3.3.2. The drawing shall include the notation ENVELOPE DRAWING placed adjacent to the drawing title block. The vendor(s) developing the item may be specified.

11 INTERFACE DRAWING

11.1 Description

An interface drawing depicts physical and functional interfaces of related or cofunctioning items. It does not establish item identification. See Fig. 11-1.

11.2 Application Guidelines

An interface drawing is prepared to

(a) establish and maintain compatibility between items having a common boundary

(b) coordinate and control interfaces between related or cofunctioning systems

(c) communicate design decisions to participating design activities

An interface drawing may control one or more of the following types of interfaces: mechanical, electrical, hydraulic, pneumatic, interconnections, configuration, installation, operational sequence requirements, system switching, etc. Each interface type may be described in a separate interface drawing or in combination on a single drawing.

11.3 Requirements

11.3.1 An interface drawing includes, as applicable

(a) configuration and interface dimensional data applicable to the envelope, mounting, and interconnection of the related items

(b) complete interface engineering requirements (e.g., mechanical, electrical, electronic, hydraulic, pneumatic, and optical) that affect the physical or functional characteristics of the cofunctioning items

(c) any other characteristics that cannot be changed without affecting system interfaces

11.3.2 An interface drawing shall include the notation INTERFACE DRAWING placed adjacent to the drawing title block.

12 IDENTIFICATION CROSS-REFERENCE DRAWING

12.1 Description

An identification cross-reference drawing is an administrative-type drawing that assigns a compatible identifier to provide a cross-reference to the original incompatible identifier(s). This drawing does not establish item identification. See Fig. 12-1.

12.2 Application Guidelines

An identification cross-reference drawing is prepared to provide compatible identifiers for nationally recognized standards, customer-furnished equipment, etc., when original identifiers are too long, contain characters unacceptable for data processing, are identified by description only, etc. As an option, the listing of identification cross-reference identifiers may also be accomplished within a controlled database without the need to create a drawing.

12.3 Requirements

An identification cross-reference drawing shall include

(a) assignment of the compatible identifier(s)

(b) cross-reference to the original item identification or description

(c) the notation IDENTIFICATION CROSS-REFERENCE DRAWING adjacent to the drawing title block

12.3.1 The identification cross-reference drawing shall not specify any engineering or design requirements beyond those already contained in the drawings, specification, etc., governing the original item.

13 MECHANICAL SCHEMATIC DIAGRAM

13.1 Description

A mechanical schematic diagram depicts mechanical and other functional operation, structural loading, fluid circuitry, or other functions using appropriate standard symbols and connecting lines. Although it contains design information, it does not establish item identification of the item(s) delineated thereon. See Fig. 13-1.

13.2 Application Guidelines

When operating principles cannot be readily determined from a study of the assembly drawing, a mechanical schematic diagram is prepared to illustrate design information for any of the following:

(a) hydraulic or pneumatic systems

(b) complex mechanical systems (e.g., complex arrangement of gears, clutches, linkages, cams, etc.)

(c) rigging instruction involving wire, cable, rope, etc.

(d) critical structural items to display loading or lifting data

13.3 Requirements

A mechanical schematic diagram symbolically depicts elements of the unit, assembly, or system involved and displays the relation of each element by interconnecting lines. The elements may be arranged functionally or as they are actually arranged in their assembly or installed position, whichever is clearest for the specific diagram and its intended use. The diagram may use either single-line or complete pictorial presentation.

Loading diagrams for hoists and slings, flow diagrams for hydraulic or pneumatic control valves, simple unit flow diagrams, etc., can frequently be combined with the assembly or installation drawing. Hydraulic or pneumatic system diagrams, complicated rigging diagrams, complex mechanical function diagrams, etc., normally require separate drawings.

14 ELECTRICAL/ELECTRONIC DIAGRAMS

Electrical/electronic diagrams depict the elements or functions of electrical or electronic items using standard symbols in accordance with ANSI/IEEE Std 91 and IEEE Std 315, and connecting lines or data in tabular form. These diagrams do not depict items to scale. They contain design information and do not establish item identification for the item(s) depicted thereon. See Figs. 14-1 through 14-8.

14.1 Functional Block Diagram

14.1.1 Description. A functional block diagram depicts the functions of the major elements of a circuit, assembly, system, etc., in simplified form. See Fig. 14-1.

14.1.2 Application Guidelines. A functional block diagram is prepared to illustrate the functional relationship of major elements of an assembly, system, etc.

14.1.3 Requirements. A functional block diagram includes major circuit functions depicted by single lines, rectangular blocks, and explanatory notes or text. Graphic symbols or reference designations other than unit numbers are not normally used.

14.2 Single-Line Diagram

14.2.1 Description. A single-line diagram depicts the course of an electrical/electronics circuit or system of circuits, and the elements thereof using single lines, symbols, and notes. A single-line diagram conveys basic information about the operation of the circuit but omits much of the detailed information usually shown on schematic diagrams. See Fig. 14-2.

14.2.2 Application Guidelines. The single-line form of presentation provides for

(a) simplified diagrams of complex circuits

(b) diagrammatic representation of systems in which a single line represents a multiconductor circuit

14.2.3 Requirements. A single-line diagram includes, as applicable

(a) connections of major elements of a circuit represented by single-line graphic symbols in accordance with ANSI/IEEE Std 91 and IEEE Std 315

(b) the course of the main circuits, i.e., the connection of major components, shown in the most direct path and logical sequence

(c) electrical characteristics that are essential to an overall understanding of the system

14.3 Schematic Diagram or Circuit Diagram

14.3.1 Description. A schematic diagram depicts the electrical connections and functions of a specific circuit arrangement without regard to the physical shape, size, or location of the elements. See Fig. 14-3.

14.3.2 Application Guidelines. A schematic diagram is prepared to illustrate the detailed design of a circuit and to assist in tracing the circuit and its functions. It may be prepared for any level of assembly and may include one or more levels.

14.3.3 Requirements. A schematic diagram includes, as applicable

(a) symbolic representation of each element in the circuit with the symbols interconnected to depict circuit paths. Graphic symbols for both discrete parts (see IEEE Std 315) and logic elements (see ANSI/IEEE Std 91) may be used on the same diagram.

(b) reference designations in accordance with ASME Y14.44 and IEEE Std 315 for each item.

(c) values for such items as resistors, capacitors, and inductors.

(d) standard type designation, when assigned, for such items as semiconductor devices, microcircuits, electron tubes, etc. When no type designation is assigned to the specific configuration used in the circuit by a nationally recognized standard, the item may be identified on the diagram by reference designation only provided the item description is included in related documentation (e.g., the assembly drawing parts list).

14.4 Connection Diagram or Wiring Diagram

14.4.1 Description. A connection diagram drawing depicts the general physical arrangement of electrical connections and wires between circuit elements in an installation or assembly. It shows internal connections, but may include external connections that have one termination inside and one outside the assembly. It contains the details necessary to make or trace connections involved. See Fig. 14-4.

14.4.2 Application Guidelines. A connection diagram may be prepared to illustrate the connection of wires and circuit elements at any level of assembly or installation.

14.4.3 Requirements. A connection diagram includes, as applicable

(a) the physical relationship of circuit elements and their connections

(b) items identified by reference designations in accordance with ASME Y14.44 and IEEE Std 315

(c) terminal arrangements clearly identified

(d) wires numbered for reference

(e) wire and termination descriptions

14.5 Interconnection Diagram

14.5.1 Description. An interconnection diagram drawing depicts only external connections between assemblies, units, or higher-level items. See Figs. 14-5, 14-6, and 14-7.

14.5.2 Application Guidelines. An interconnection diagram is prepared to illustrate the interconnections between units, sets, groups, and systems.

14.5.3 Requirements. An interconnection diagram is prepared either as a wiring-type diagram, which shows each wire, or as a cabling-type diagram, which primarily shows cables but may also include wires. It does not necessarily show physical relationship.

14.6 Wiring List

14.6.1 Description. A wiring list consists of tabular data and instructions necessary to establish wiring connections. See ASME Y14.34 for drawing requirements.

14.7 Logic Circuit Diagram

14.7.1 Description. A logic circuit diagram depicts the logic functions of a system at any level of assembly. See Fig. 14-8.

14.7.2 Application Guidelines. A logic circuit diagram is prepared to

(a) illustrate logic functions

(b) facilitate circuit analysis and diagnosis of equipment problems

14.7.3 Requirements. A logic circuit diagram is prepared in accordance with ANSI/IEEE Std 991 and includes, as applicable

(a) logic functions depicted by logic symbols in accordance with ANSI/IEEE Std 91, connected by lines that represent signal paths

(b) pin numbers, test points, assembly boundaries, and nonlogic functions necessary to describe the physical and electrical aspects of the circuit

15 SPECIAL APPLICATION DRAWINGS

15.1 Wiring Harness Drawing

15.1.1 Description. A wiring harness drawing specifies the engineering requirements and establishes item identification for a wiring harness, i.e., a group of individually insulated conductors, including shielded wires and coaxial cables, held together by lacing cord or other binding. A wiring harness may or may not terminate in connectors, terminal lugs, or other similar fittings, and may include small electronic parts. See Fig. 15-1.

15.1.2 Application Guidelines. A wiring harness drawing is prepared when it is determined that a harness is to be fabricated as a discrete item, rather than individually connecting conductors during assembly.

15.1.3 Requirements. A wiring harness drawing defines the wiring harness configuration, i.e., form and termination points, by direct application of dimensions and tolerances, use of a reproducible grid system, or inclusion of horizontal and vertical graphic scales for determining the required dimensional data. The drawing includes, as applicable

(a) pictorial views.

NOTE: When pictorial wiring harness information is omitted, a note similar to the following shall be placed on the drawing: WIRING HARNESS CONFIGURATION IS DETERMINED AT ASSEMBLY OR INSTALLATION. Critical routing requirements are defined on the assembly or installation drawing.

(b) a wiring tabulation or reference to a wiring list that identifies wire numbers or color codes, circuit reference designations in accordance with IEEE Std 315 ("from-to" data), wire lengths, wire type and gage, termination methods, and other related data. See ASME Y14.34.

(c) instructions for fabrication of the harnesses, minimum bend radii for conductors, and cross-references to the using assembly or installation drawings and associated electrical diagrams.

(d) parts list specifying parts (e.g., connectors, terminal lugs, and similar fittings) and bulk materials (e.g., wire, sleeving, jacketing, and twine) required for the fabrication of the harness.

(e) applicable processes. Items used to install the harness (e.g., cable clamps) that are not an integral part of the harness are itemized in the using assembly or installation drawings.

(f) when the harness routing information is omitted, a note similar to the following:

HARNESS ROUTING CONFIGURATION TO BE DETERMINED AT ASSEMBLY OR INSTALLATION.

The assembly or installation drawing then specifies any critical routing requirements.

15.2 Cable Assembly Drawing

15.2.1 Description. A cable assembly drawing depicts an electrical cable assembly of defined length and establishes item identification for that assembly. The assembly consists of conductors (e.g., insulated wires, shielding, and coaxial cables) within a common molded or jacketed covering and has one or more ends terminated in connectors, terminal lugs, or similar fittings. See Fig. 15-2.

15.2.2 Application Guidelines. A cable assembly drawing is prepared to describe power, signal, radio frequency, audio, and general-purpose electrical cable assemblies including both single-run and branched cables.

15.2.3 Requirements. A cable assembly drawing includes, as applicable

(a) dimensions and tolerances for overall length and breakout locations. A simplified, single-line diagram is generally sufficient to define these requirements.

(b) identification of parts, bulk materials, and processes required for fabrication of the cable assembly.

(c) preparation of the cable ends.

(d) orientation and offset of connectors.

(e) maximum diameter of cable.

(f) minimum bend radii for wiring within the assembly.

(g) detail views of molded areas.

(h) conductor lay patterns (optional).

(i) identification band or other marking requirements.

(j) a wiring list, wiring diagram, or schematic diagram defining electrical connections and specifying wire number, color codes, and termination requirements.

(k) instructions for finish, special assembly, and storage (e.g., dust covers).

(l) test requirements.

Views in a cable assembly drawing need not be to scale.

15.3 Printed Board and Discrete Wiring Board Drawing Sets

15.3.1 Description. Printed board and discrete wiring board drawing sets consist of those drawings that define the configuration of printed wiring or printed circuit and discrete wiring boards and assemblies. They establish requirements for board fabrication, board assembly (e.g., mounting of electrical items and attaching hardware, etc.), and testing.

The term "board," as used in this Standard, includes all types of dielectric base materials (e.g., flex, rigid, or a combination thereof). The term "printed" applies to all circuitry patterns that are etched, deposited, screened, or bonded to the base material. The term "discrete wiring" applies to circuitry patterns that are defined by the routing and terminating of discrete wires to form point-to-point electrical connections.

A typical drawing set may include, as applicable, an assembly drawing, schematic diagram, master drawing, master pattern drawing, artwork, artwork master, and production master. A typical drawing relationship is shown in Fig. 15-3. The assembly and master drawing establish item identification for the assembly and board, respectively.

15.3.2 Application Guidelines. Printed board drawing sets are prepared to describe and control printed wiring or printed circuit boards and assemblies. Discrete wiring board drawing sets are prepared to describe and control discrete wiring boards and assemblies. Boards may be single-sided, double-sided, or multilayer.

15.3.3 Requirements. In addition to other drawing requirements specified in this Standard, design and documentation requirements of board drawing sets shall be in accordance with the specifications and standards referenced in paras. 15.3.3.1 through 15.3.3.7. Other standards and specifications referenced within these documents may also apply.

The individual drawing types that make up a printed board or discrete wiring board drawing set are listed in paras. 15.3.3.1 through 15.3.3.6. A short description is provided for informational purposes, and reference is made to the applicable specification or standard that defines requirements for this drawing type.

No indication is made to identify a specific combination of drawings that may be used to complete a printed board or discrete wiring board drawing set. An assembly and master drawing are normally required to provide complete end-item definition, but the use of a master pattern drawing, artwork and artwork master, and/or a production master is dependent on the type of board being designed, how it will be fabricated, and how the documentation will be used.

15.3.3.1 Board Assembly Drawing

(a) Printed Board Assembly Drawing. A printed board assembly drawing shows a printed board, separately manufactured components, and any information necessary to describe the joining of them to perform a specific function. See ANSI/IPC-2221, ANSI/IPC-2222, ANSI/IPC-2223, IPC-2224, and ANSI/IPC-2225 for design requirements and ANSI/IPC-D-325 for drawing requirements.

NOTE: "Circuit card assembly" is the general term used for titling assembly drawings that include electrical or electronic parts mounted on printed boards.

(b) Discrete Wiring Board Assembly Drawing. A discrete wiring board assembly drawing shows a discrete wiring board, separately manufactured components, and any information necessary to describe the joining of them to perform a specific function. See ANSI/IPC-DW-425 for design and drawing requirements.

15.3.3.2 Master Drawing

(a) Printed Board Master Drawing. A printed board master drawing shows the dimensional limits or grid locations that are applicable to any and all parts of a product, i.e., printed board, to be fabricated, including the arrangement of conductors and nonconductive patterns or elements; the size, type, and location of holes; and all other necessary information. See ANSI/IPC-2221, ANSI/IPC-2222, ANSI/IPC-2223, IPC-2224, and ANSI/IPC-2225 for design requirements and ANSI/IPC-D-325 for drawing requirements.

(b) Discrete Wiring Board Master Drawing. A discrete wiring board master drawing includes all information to guarantee fit, form, and function of the discrete wiring board and shall establish, as a minimum, interconnection techniques, wire type and gage, size, shape, location, and tolerance of all discrete wiring board features. Material, plating, marking, and coating requirements shall also be indicated, as applicable. See ANSI/IPC-DW-425 for design and drawing requirements.

15.3.3.3 Artwork. Artwork consists of an accurately scaled configuration used to produce the artwork master, production master, or master pattern drawing. See ANSI/IPC-D-310 for artwork generation requirements, and ANSI/IPC-2221, ANSI/IPC-2222, ANSI/IPC-2223, IPC-2224, ANSI/IPC-2225, and ANSI/IPC-D-325 for documentation requirements.

15.3.3.4 Artwork Master (Photoplot Master). The artwork master (photoplot master) is an accurately scaled, usually 1:1, pattern used to produce the production master. See ANSI/IPC-D-310 for phototool generation requirements, and ANSI/IPC-2221, ANSI/IPC-2222, ANSI/IPC-2223, IPC-2224, ANSI/IPC-2225, and ANSI/IPC-D-325 for documentation requirements.

15.3.3.5 Production Master. The production master is a 1:1 scale pattern that is used to produce rigid or flexible printed boards within the accuracy specified on the master drawing. See ANSI/IPC-2221, ANSI/IPC-2222, ANSI/IPC-2223, IPC-2224, ANSI/IPC-2225, and ANSI/IPC-D-325 for documentation requirements.

15.3.3.6 Master Pattern Drawing. The master pattern drawing is a reproduction of the original artwork, artwork master, or database prepared in drawing format. See ANSI/IPC-2221, ANSI/IPC-2222, ANSI/IPC-2223, IPC-2224, and ANSI/IPC-2225 for drawing requirements.

15.3.3.7 Digital Form of Printed Boards. Automated layout techniques (e.g., computer-aided) may be used to generate various aspects or descriptions (e.g., drill data, artwork, testing, etc.) of the printed board information and to document a digital form of the drawings that are a part of the printed board drawing set. See ANSI/IPC-D-350 for requirements on generating printed board descriptions in digital form, and IPC-D-351 for generating a digital form of printed board drawings.

15.4 Microcircuit Drawing Set

15.4.1 Description. A drawing set composed of drawings necessary to specifically define physical, electrical, and environmental criteria for a microcircuit (e.g., monolithic, thin and thick film, or hybrid circuit, etc.). It also establishes item identification.

A typical drawing set may include, as applicable, a master drawing, schematic, assembly, and artwork.

15.4.2 Application Guidelines. A microcircuit drawing set is prepared to establish the physical and functional characteristics necessary to ensure microcircuit interchangeability.

15.4.3 Requirements. In addition to other drawing requirements specified in this Standard, design and documentation requirements for microcircuit drawing sets shall be in accordance with ANSI/IPC-D-859 and its related referenced documents.

15.5 Undimensioned Drawing

15.5.1 Description. An undimensioned drawing defines the shape and other design features of an object at a precise scale predominantly without dimensions. It provides an accurate pattern of the feature or features of an item.

15.5.2 Application Guidelines. An undimensioned drawing is prepared to delineate items that can be fabricated by use of the patterns to produce the item or to produce a tool for use in fabricating the item. Its use as a contour definition drawing provides the definition of contoured surfaces for engineering references and for design of tooling. See para. 15.9.

15.5.3 Requirements. In addition to other drawing requirements in this Standard, design and documentation requirements for undimensioned drawings shall be in accordance with ASME Y14.31 and its related referenced documents.

15.6 Kit Drawing

15.6.1 Description. A kit drawing identifies an item or group of items with instructions for their use. The kit does not necessarily define a complete functional assembly. A kit drawing establishes item identification for the kit, not for the items in the kit. See Fig. 15-4.

15.6.2 Application Guidelines. A kit drawing is prepared when it is desired to identify all of the items required to perform a specific operation (e.g., maintenance, overhaul, modification, installation, conversion, or similar operations) in kit form.

15.6.3 Requirements. A kit drawing includes, as applicable

(a) a parts list of the contents of the kit, including the identification of each item. See para. 1.6.

(b) documents that are a part of the kit, itemized in the parts list.

(c) pictorial representations.

(d) special tool requirements for installation of the kit.

(e) retest or recalibration requirements.

15.7 Tube Bend Drawing

15.7.1 Description. A tube bend drawing establishes, by pictorial/coordinate or tabular delineation, or a combination thereof, end-product definition for a single or multiplane tube or inseparable tube assembly (e.g., a tube with end fittings). It establishes item identification for the bent tube or inseparable tube assembly. See Figs. 15-5 and 15-6.

15.7.2 Application Guidelines. Pictorial/coordinate tube bend drawings are used to accommodate different methods of manufacture (e.g., roll bending or vector tube bender). Tabular tube bend drawings are prepared to specify complete requirements and configuration of rigid or semirigid tubing for direct use in forming on a draw bending machine, i.e., the tube to be bent is clamped against a bending form that rotates and draws the tube through a pressure die and over a mandrel. Tubing of complex configuration may be described using a combination of pictorial/coordinate and tabular delineation.

15.7.3 Requirements

15.7.3.1 Pictorial/Coordinate Delineation. A pictorial/coordinate tube bend drawing is prepared as a detail, assembly, or detail assembly drawing. A pictorial/coordinate tube bend drawing includes, as applicable

(a) tube material

(b) end types

(c) identification and quantity of fittings

(d) dimensional requirements including bend radii, angles, end points and intersecting point coordinates, and overall lengths

(e) other data necessary to define design requirements

See Fig. 15-5.

15.7.3.2 Tabular Delineation. The drawing format and informational entries shall be in accordance with Fig. 15-6.

A tube bend drawing includes, as applicable

(a) the information required for the tube bending entered in the five columns shown in Fig. 15-6 as follows:

(1) Bend Number — the number of the bend to be performed. Bends are numbered consecutively from the "B" end of the tube.

(2) "C" Distance — the dimension, before bending, from the "A" end of the tube to the beginning point of the bend, i.e., the centerline of the radius block, to be performed.

(3) "F" Bend Radius — radius of the bend to be performed, measured from the centerline of the tube.

(4) "E" Turn Angle — the counterclockwise angle, as viewed from the "B" end, through which the tube is rotated from a zero reference plane established by Bend Number 1 to the plane of the bend to be formed.

(5) "G" Bend Angle — the clockwise angle through which the tube is to be bent. Counterclockwise bend angles are so noted. The bend angle is the finished angle and does not include spring back.

(b) the type of end (e.g., flare, bead, etc.) designated by the appropriate number, and the item identification of the required end fittings entered in the end fittings block. Any variation from the standard end types shall be noted in the type of end block.

(c) a PIN assigned to each bent tube and to each assembly consisting of a bent tube and end fittings.

(d) material requirements.

(e) stock tube size, specified as the outside diameter, wall thickness, and length "D" of the tube before bending, which includes the necessary allowance for beading or flaring the ends. This length does not include allowances that may be required for clamping when bends are near either end of the tube. These allowances, when required, are specified in a note.

(f) heat treatment requirements after bending and before or after attaching end fittings.

(g) finish requirements.

(h) identification marking requirements.

(i) required processes.

(j) test requirements and procedures.

(k) any other information required to fully describe the item.

15.8 Matched Set Drawing

15.8.1 Description. A matched set drawing delineates items that are matched and for which replacement as a matched set is essential. A matched set drawing establishes item identification. See Fig. 15-7.

15.8.2 Application Guidelines. A matched set drawing is prepared when the required dimensions, tolerances, or other characteristics of items can be specified only in terms of the matched relationship. This includes items that are interchangeable only as a set because of special requirements for machining, electrical characteristics, performance, etc. Under such conditions, a matched set drawing defines the matching relationship. Individual parts of the set may be delineated by the matched set drawing or by other drawings.

15.8.3 Requirements. The matched set drawing includes, as applicable

(a) the physical or functional mating characteristics of the matched items, i.e., set

(b) the PIN assigned to each of the parts and to the matched set

(c) discrete identification marking of the matched set

(d) the statement FURNISH ONLY AS A MATCHED SET or similar note

15.9 Contour Definition Drawing

15.9.1 Description. A contour definition drawing contains the mathematical, numeric, or graphic data elements used to describe a contoured surface. It establishes identification for the contoured surfaces delineated thereon. A contour definition drawing is a type of ancillary drawing. See para. 1.9 and Figs. 15-8, 15-9, and 15-10.

15.9.2 Application Guidelines. A contour definition drawing is prepared to define complex surface geometry that cannot be conveniently included in the detail drawing(s) of an item. Due to the complexity of a surface, the contour definition drawing may define two or more item surfaces on the same drawing.

15.9.3 Requirements. A contour definition drawing includes, as applicable

(a) mathematical equations for the contoured surface.

(b) tabulated coordinates point values. The spacing of these points is dependent upon the desired degree of curvature and the surface tolerance.

(c) graphic sections.

(d) a summary of features and relationships to more basic coordinate systems in appropriate combinations to define the contoured surface or the desired points on a contoured surface.

15.10 Software and Memory Device Data

Drawings defining software such as instructions, or data that will be or is intended to be resident in a memory device or other type of media that becomes a part of the end item, shall be prepared as either a software installation drawing or altered item drawing, determined by whether the software is one-time programmable or multiprogrammable. See Fig. 15-11.

15.10.1 Memory Device Categories. For purposes of this Standard, memory devices are categorized as being either one-time programmable or multiprogrammable.

(a) One-time programmable devices shall be documented using the requirements of the altered item drawing (see para. 8.1).

(b) Multiprogrammable devices shall be documented using the requirements of the software installation drawing (see para. 15.10.2).

15.10.2 Software Installation Drawing

15.10.2.1 Description. A software installation drawing identifies the characteristics of the software, instructions for programming into the memory device, and its master media and physical location. Software programs will be identified by a PIN within the drawing form rather than defined using truth tables. This drawing does not establish item identification. See Fig. 15-11.

15.10.2.2 Application Guidelines. A software installation drawing is prepared when it is necessary to define the characteristics of the software, instructions for programming into a memory device, and its master media and physical location.

15.10.2.3 Requirements. The drawing shall identify

(a) the item to be programmed by PIN by referencing the original vendor's PIN or by providing a complete description of the item, or by vendor item control drawing or source control drawing if a nationally recognized standard is not available

(b) the PIN of the software, software version, and other characteristics such as operating system and version, programming language used, source file identification and version, and object file identification and version

(c) the physical location of the master software or data and the DAI of the repository having custody of the master software programs or data required to program items

(d) detailed instructions needed to load software into an item

(e) acceptance requirements in the form of a test procedure or checksum

15.10.3 Assemblies Containing Multiprogrammable Devices. Software or data that is programmed into a device at a higher level of assembly shall be documented using software installation drawing requirements. The device shall not be reidentified after programming or loading.

15.10.4 One-Time Programmable Devices and Multiprogrammable Devices Used as One-Time Programmable. Drawings describing the programming requirements of a one-time programmable device shall be prepared as altered item drawings. This type of drawing shall be prepared only for those devices that are permanently altered prior to installation into a higher level of assembly.

15.10.4.1 One-Time Programmable Devices and Media Requirements. The requirements for altered item drawings shall be in accordance with the requirements herein and the following:

(a) identification of the item to be programmed by PIN by referencing the original vendor's PIN or providing a complete description of the item, or by vendor item control drawing or source control drawing if a nationally recognized standard is not available

(b) PIN of the software, software version, and other characteristics such as operating system and version, programming language used, source file identification and version, and object file identification and version

(c) physical location of the master software or data and the DAI of the repository having custody of the master software programs or data required to program items

(d) detailed instructions needed to load software into an item

(e) acceptance requirements in the form of a test procedure or checksum

(f) altered item identification marking requirements

15.11 Alternate Parts Drawing

15.11.1 Description. The alternate parts drawing discloses parts, materials, and/or processes that may be interchangeable on an unlimited basis for any application in past, present, or future use. See Fig. 15-12. An alternate parts drawing provides a cross-reference listing of items that

(a) possess such functional and physical characteristics as to be equivalent in performance, reliability, and maintainability to another item of similar or identical purpose

(b) are capable of being exchanged for the other item

(1) without selection for fit or performance

(2) without alteration of the items themselves or of adjoining items, except for adjustment

The alternate parts drawing may be invoked via direct reference on a drawing or parts list, or within a referenced specification. Alternate parts drawings do not create item identification but merely provide a suitable cross-reference to interchangeable parts, materials, or processes. As an option, the listing of alternate parts may also be accomplished within a controlled database without the need of creating a drawing.

15.11.2 Application Guidelines. An alternate parts drawing is prepared to

(a) provide a listing of parts, materials, or processes that can be interchanged on assemblies without further consideration

(b) eliminate the need for costly and continual design changes to drawings and parts lists where newer, interchangeable items are available

(c) provide users with guidance and authorization to interchange items on an as-needed basis

(d) provide a method to implement across-the-board, systematic changes due to procurement difficulties

15.11.3 Requirements. The alternate parts drawing includes, as applicable

(a) a listing of the required item, its part number and name, and the acceptable alternate part number(s). This may be set up in a column or table format for ease of reading and use.

(b) any applicable drawing notes needed for explanations, references, etc.

All uses of the drawing within the design activity shall allow the use of the interchangeable item. The item to be interchanged shall not affect form, fit, or function.

16 DRAWING TREE

16.1 Description

A drawing tree is a block diagram or indentured list that identifies all drawings applicable to an end item or program. It illustrates the next higher and subordinate relationships that exist between those drawings. This is typically shown as a graphical representation of drawings linked in a hierarchical order beginning with the top assembly and ending at the lowest-level assembly or the lowest-item. See Fig. 16-1. These drawings are listed so that the relationship of each drawing can be established in the assembly structure.

16.2 Application Guidelines

A drawing tree may

(a) represent the entire product design showing relationships of parts and assemblies, serving as a starting point from which specific tasks can be identified and monitored

(b) clarify to the various engineering design organizations what must be developed and documented, and where it fits in the overall tree

(c) clarify the specific interfaces and their relationships, and help identify the need for controls

(d) provide the basis for the development of a Work Breakdown Structure (WBS)

(e) provide a basis for developing a manufacturing plan, test plan, quality plan, logistics plan, configuration management plan, maintenance plan, etc.

(f) provide a basis for scheduling design and development efforts, releases, manufacturing, testing, procurement, etc.

(g) provide a basis for developing traceability and serialization requirements

(h) aid in providing a scope to the size of a product effort in concise format

(i) provide a ready reference in assessing the impact of a proposed change

(j) provide the customer with definition, scope, and control information

16.3 Requirements

The drawing tree shall be structured in hierarchical order beginning with the top assembly drawing for the end item and ending at the lowest level of assembly or the lowest item. Each drawing included on the drawing tree shall be shown as an individual block or as an individual entry on the indentured list. Each authorized variation in configuration of the end item should be identified by a separate drawing tree. Only drawings should be included on a drawing tree.

16.3.1 Mandatory Entries. Each block or individual entry on the indentured list shall include, as a minimum, drawing number and drawing title. See Fig. 16-2.

16.3.2 Optional Entries. Optional items that may be added to the block or individual entry on the indentured list depending on the intended use include

(a) DAI, if not the same as the one applicable to the drawing tree

(b) drawing status (e.g., released or unreleased)

(c) drawing size

(d) change authority number

(e) the drawing WBS identifier

(f) reference designations when applicable at all levels where assigned

See Fig. 16-3.

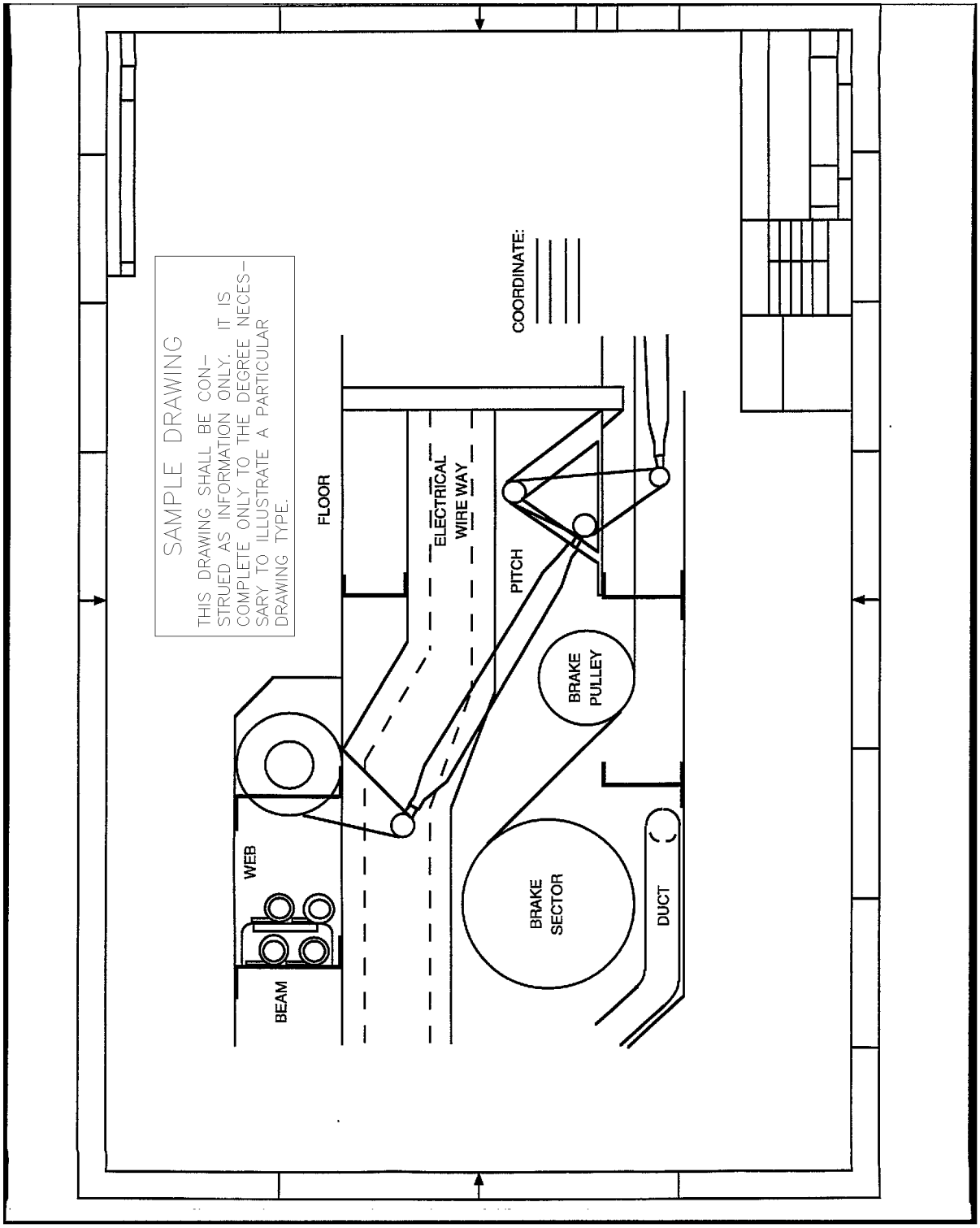


Fig. 4-1 Layout Drawing

Fig. 5-1 Monodetail Drawing

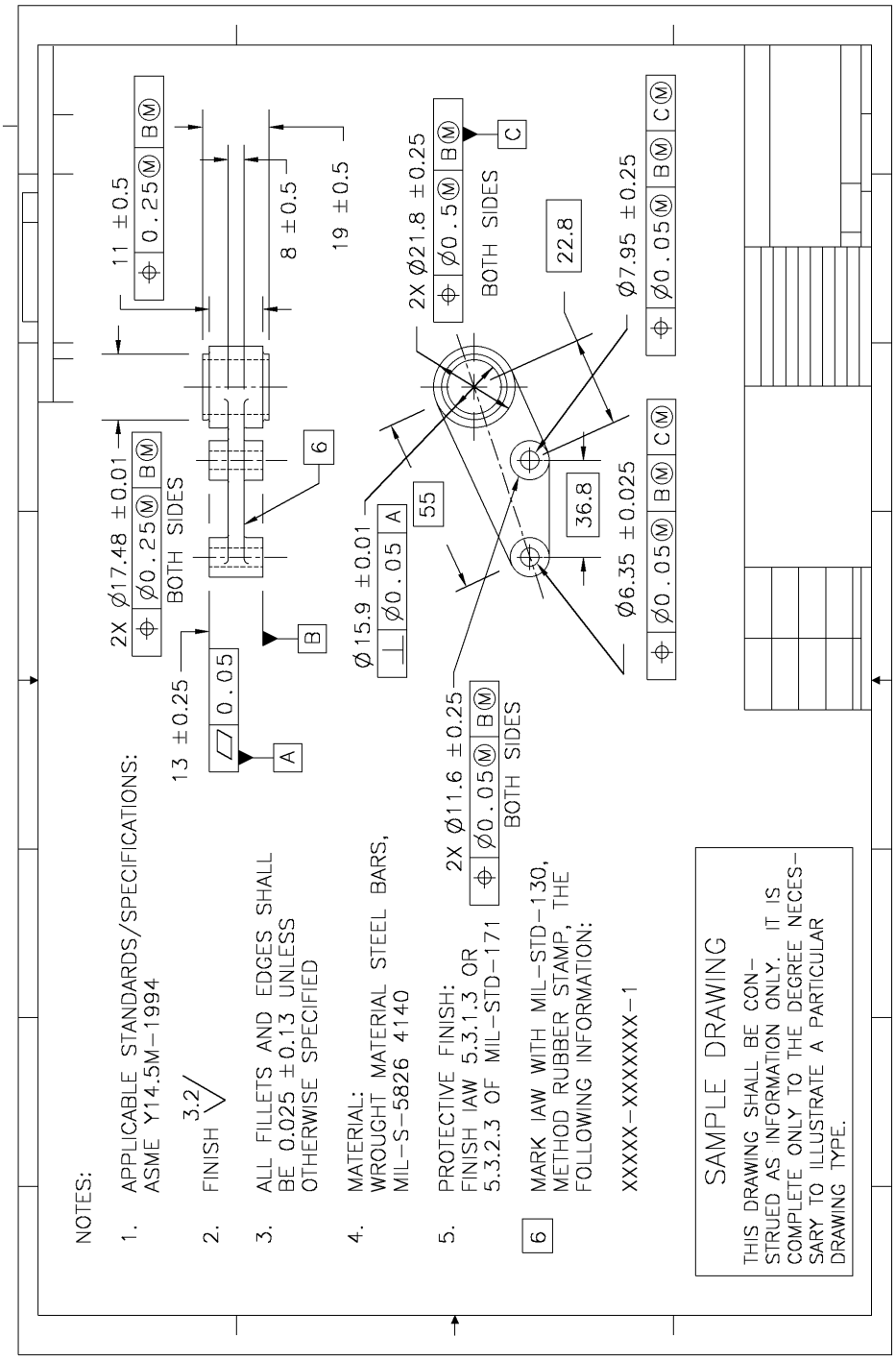


Fig. 5-2 Tabulated Monodetail Drawing

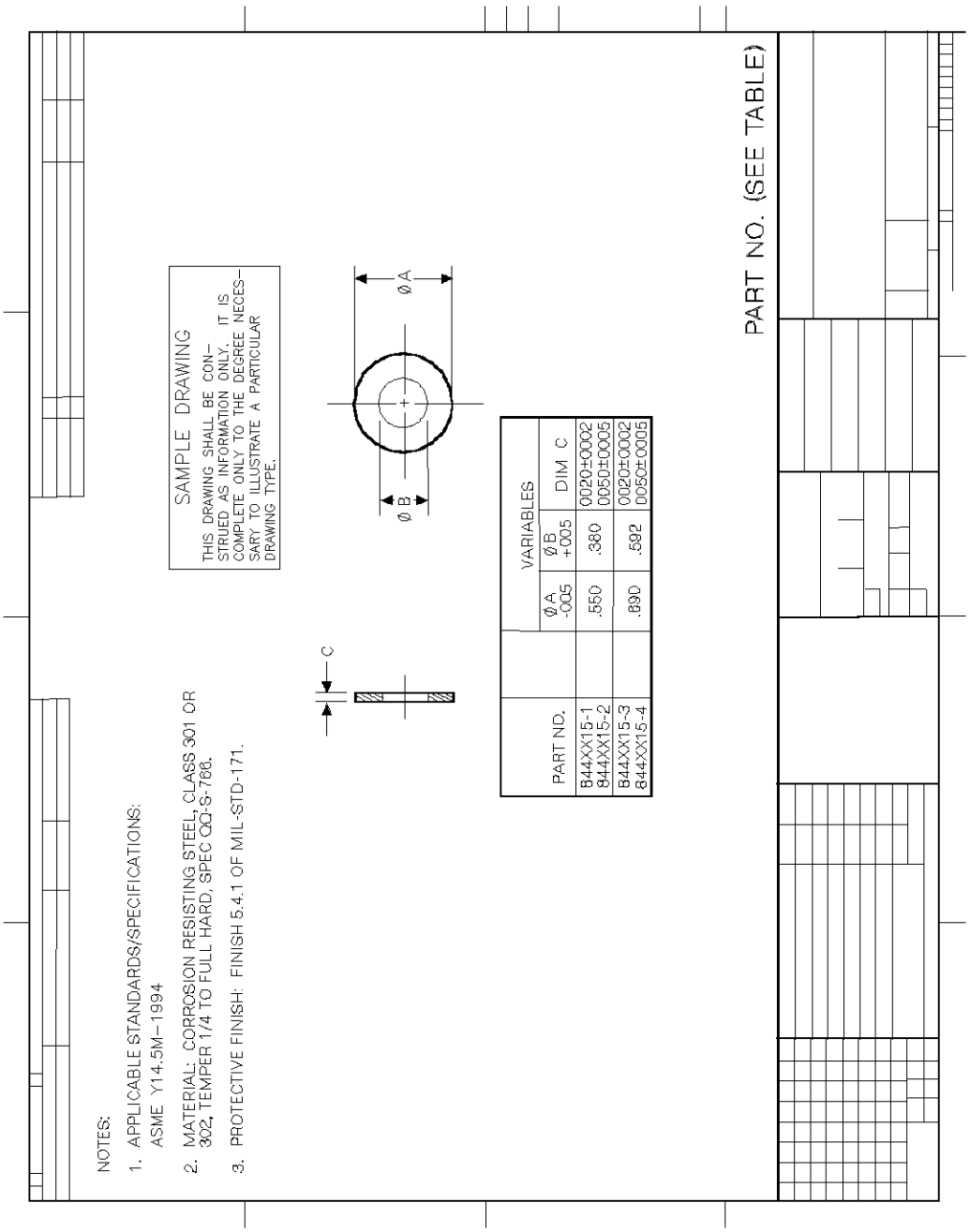


Fig. 5-3 Multidetail Drawing

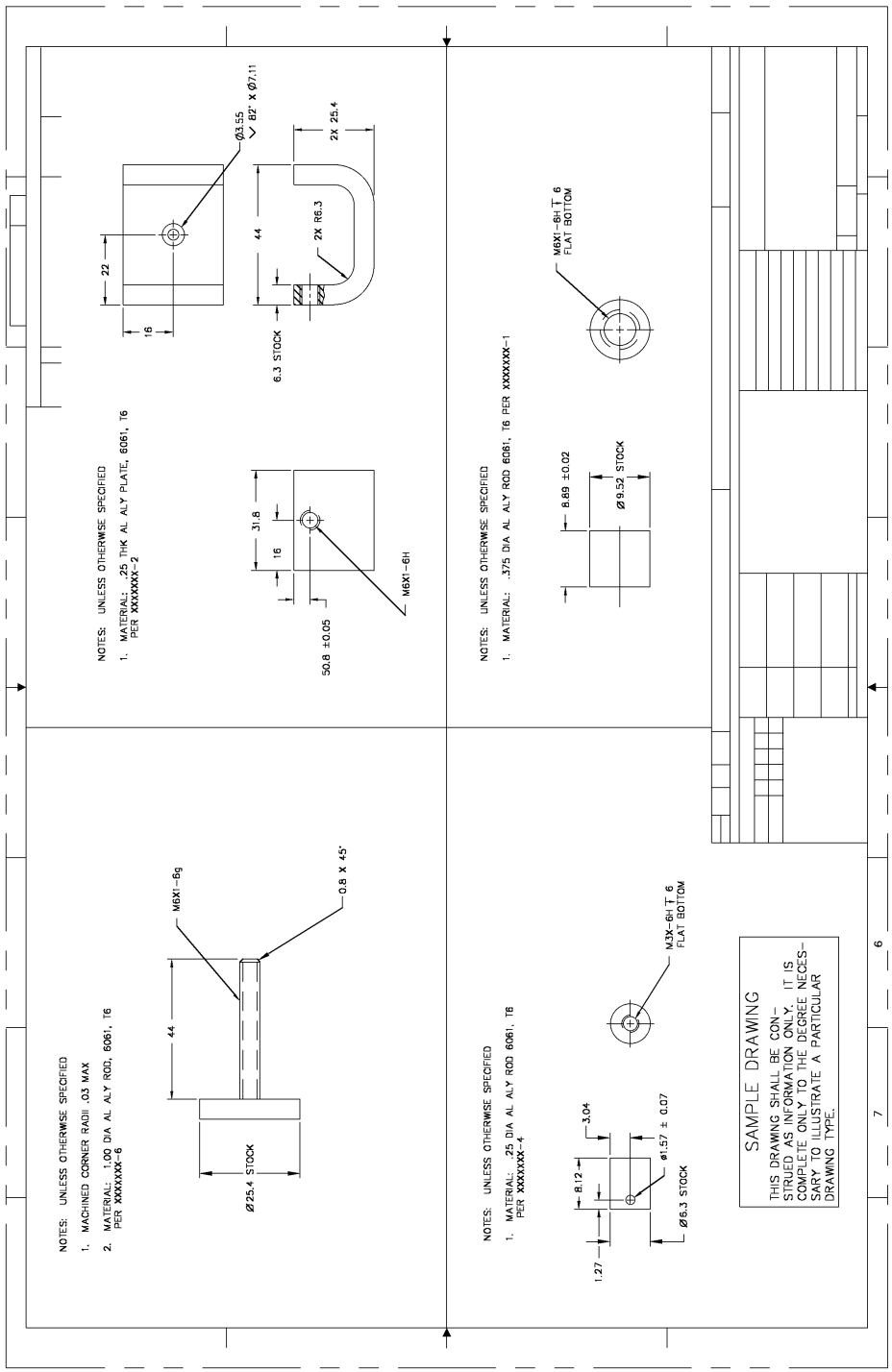


Fig. 6-1 Assembly Drawing

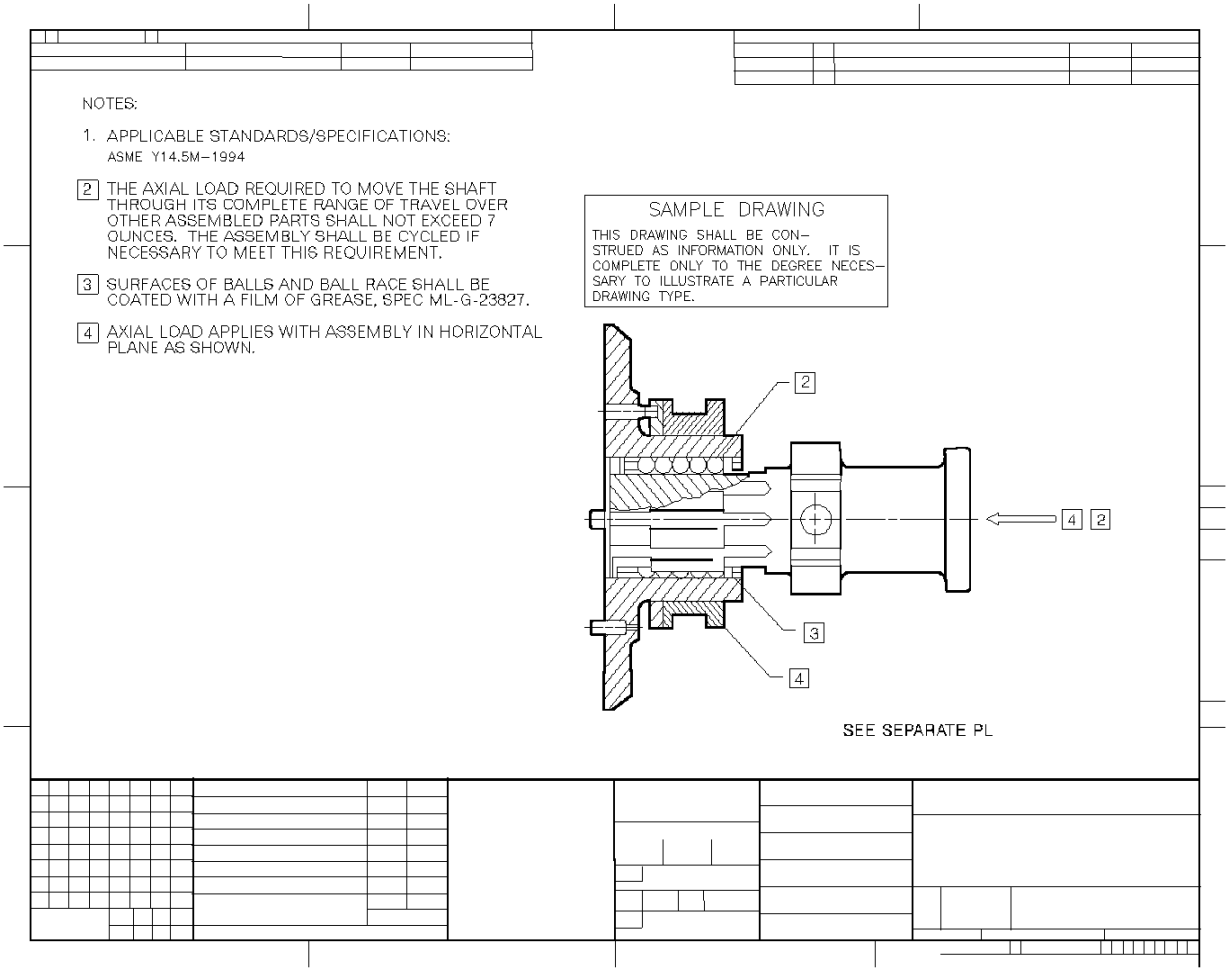


Fig. 6-2 Detail Assembly Drawing

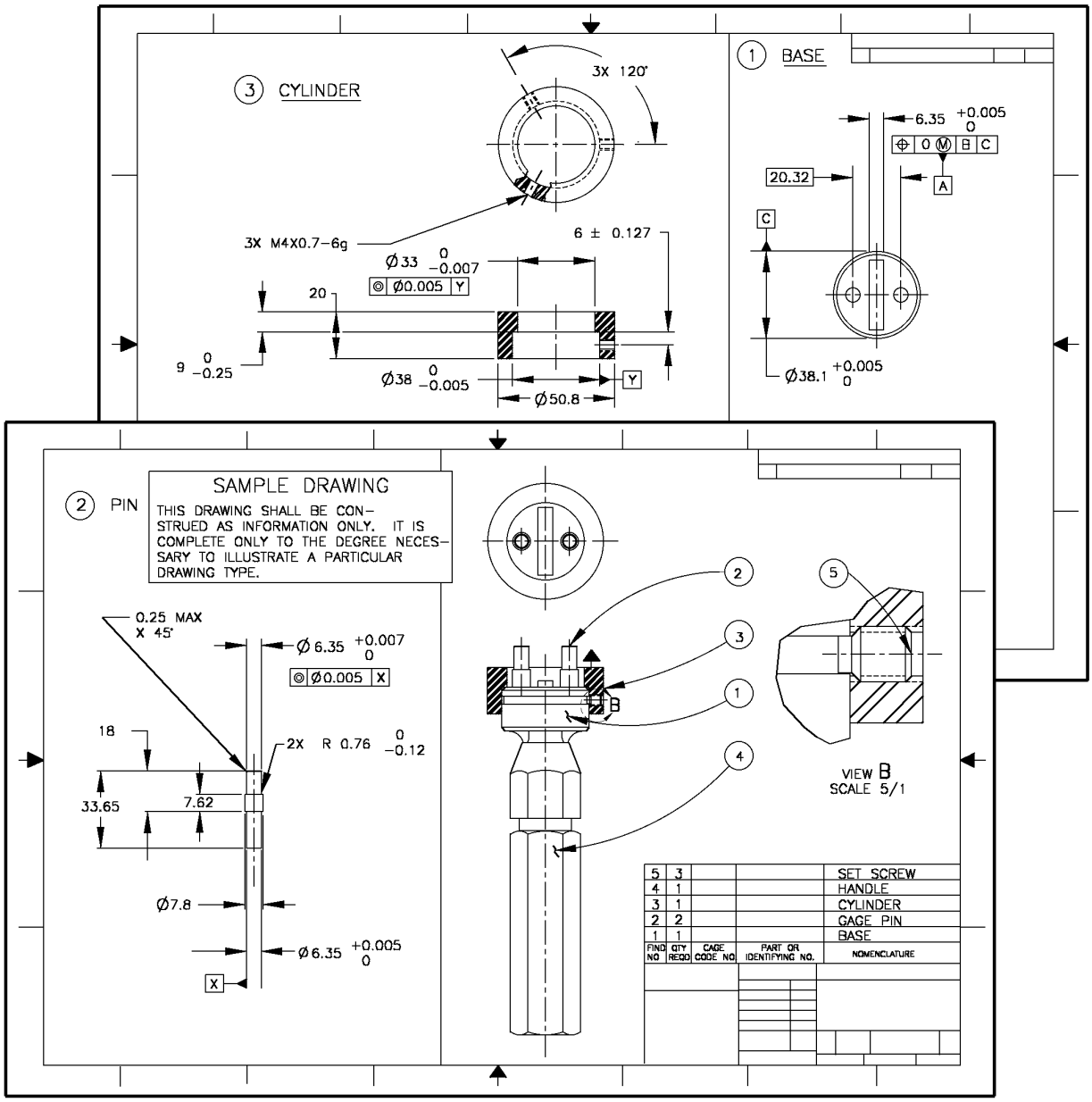


Fig. 6-3 Inseparable Assembly Drawing

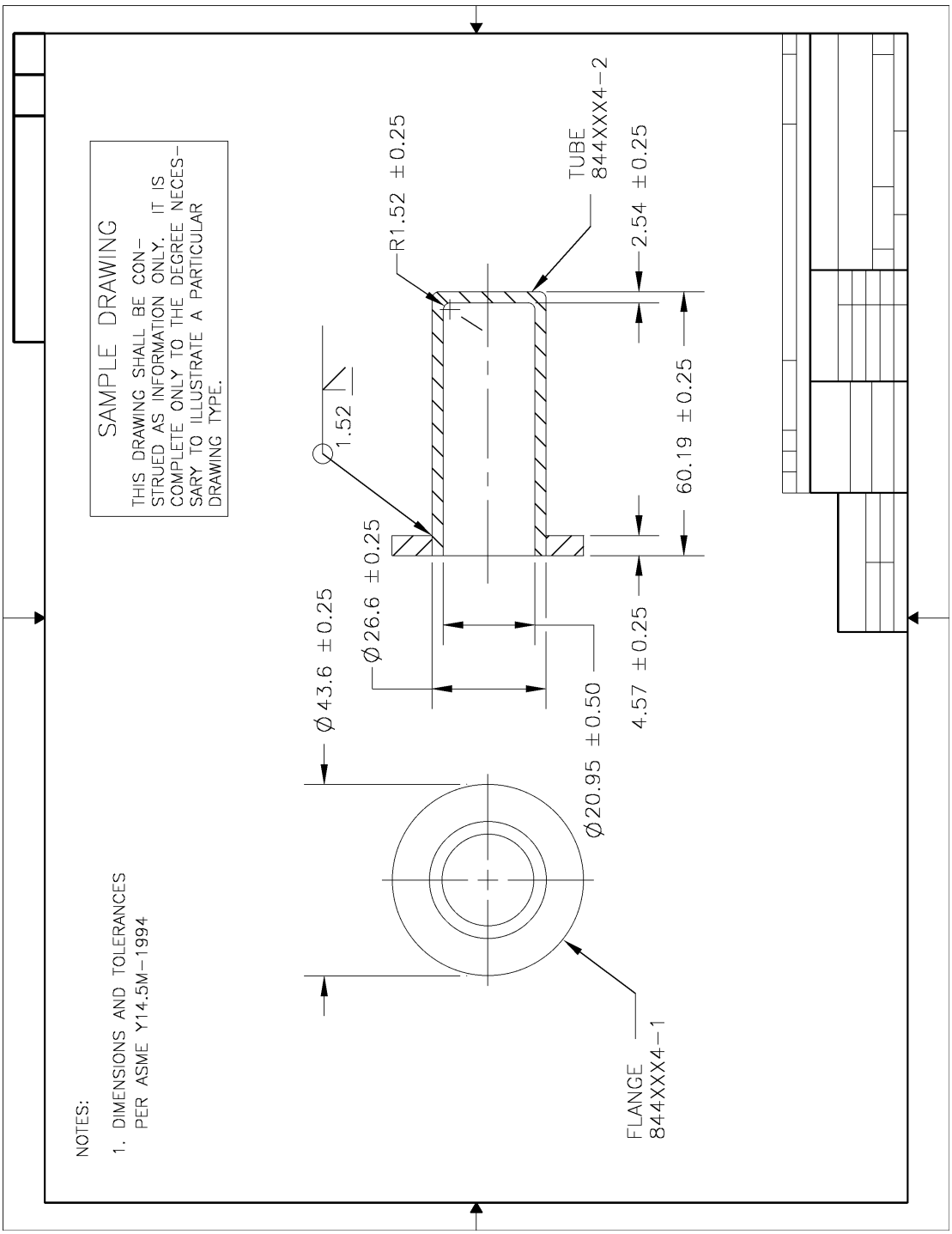
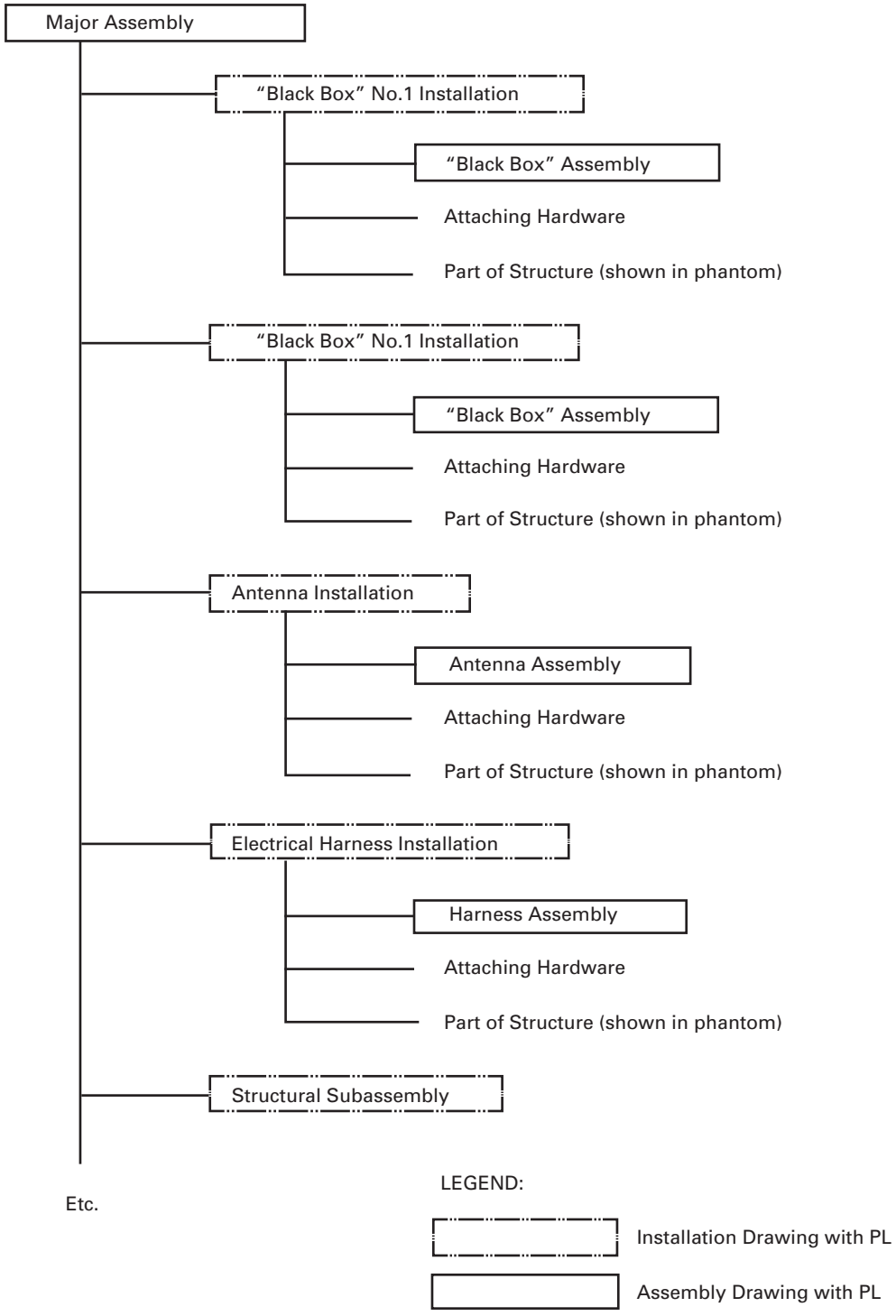


Fig. 7-1 Indentured Relationship of Installation Drawings (Depicting Work Packages)



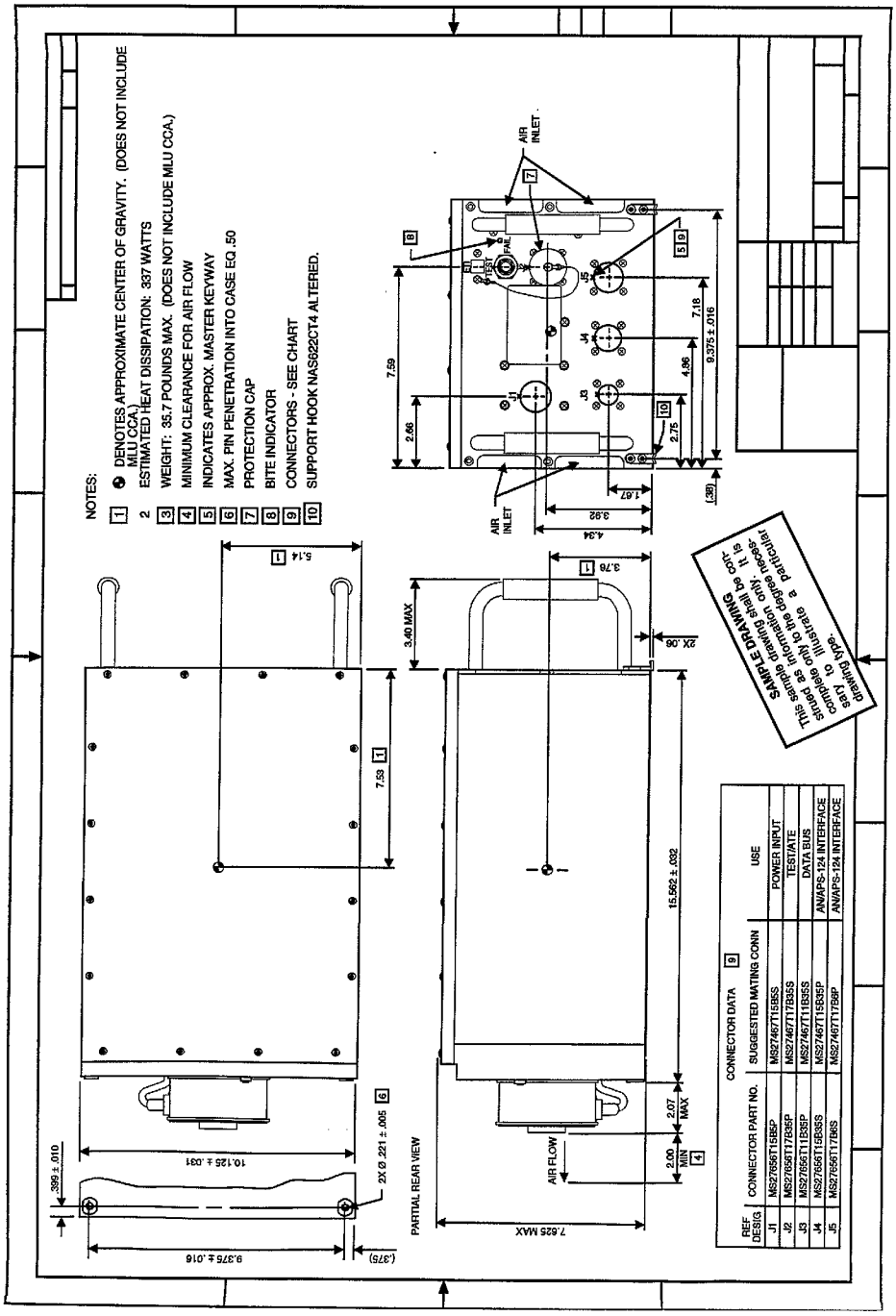


Fig. 7-2 Installation Drawing

Fig. 8-1 Altered Item Drawing (Mechanical Alteration)

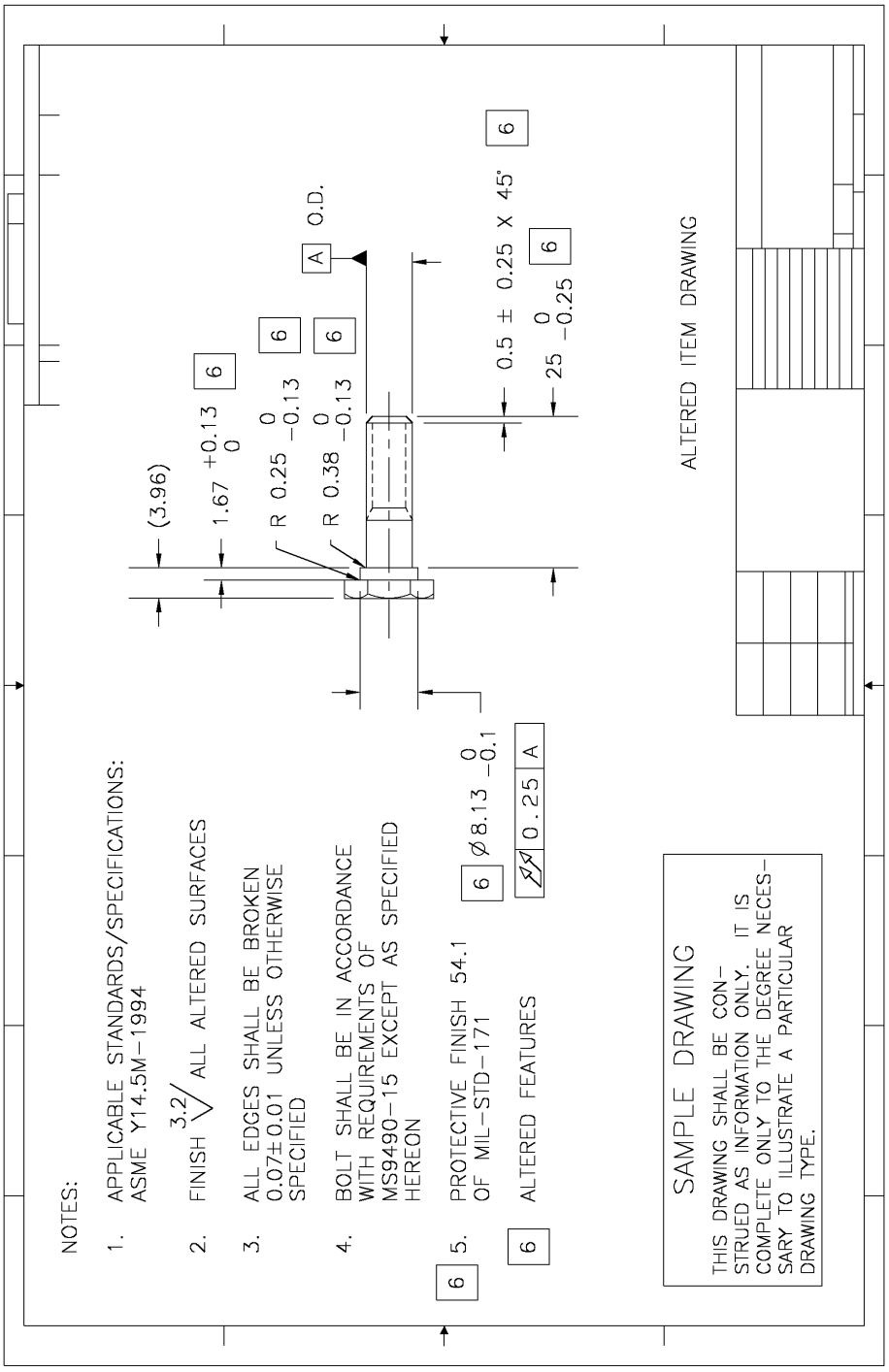
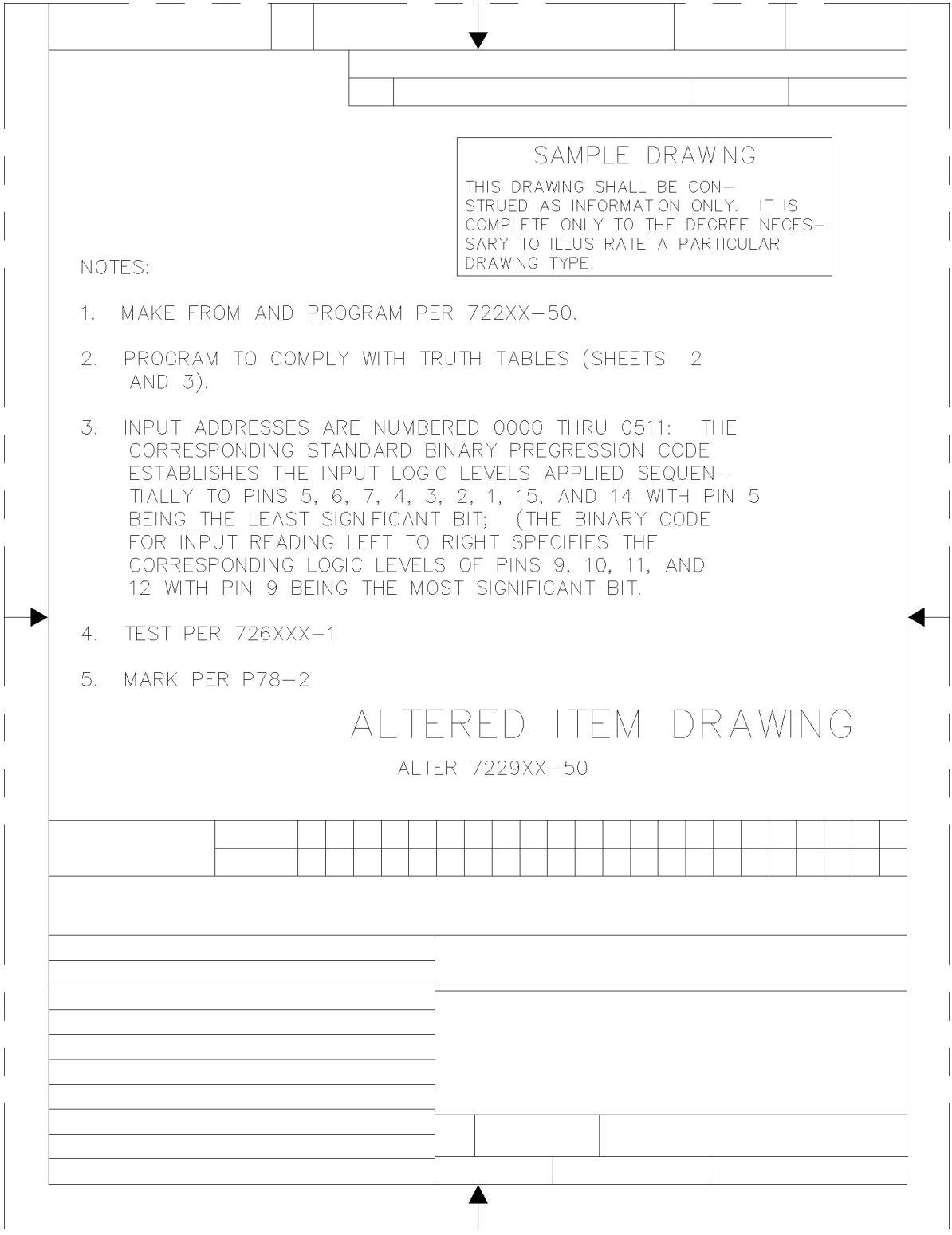


Fig. 8-2 Altered Item Drawing (Electrical Alteration)



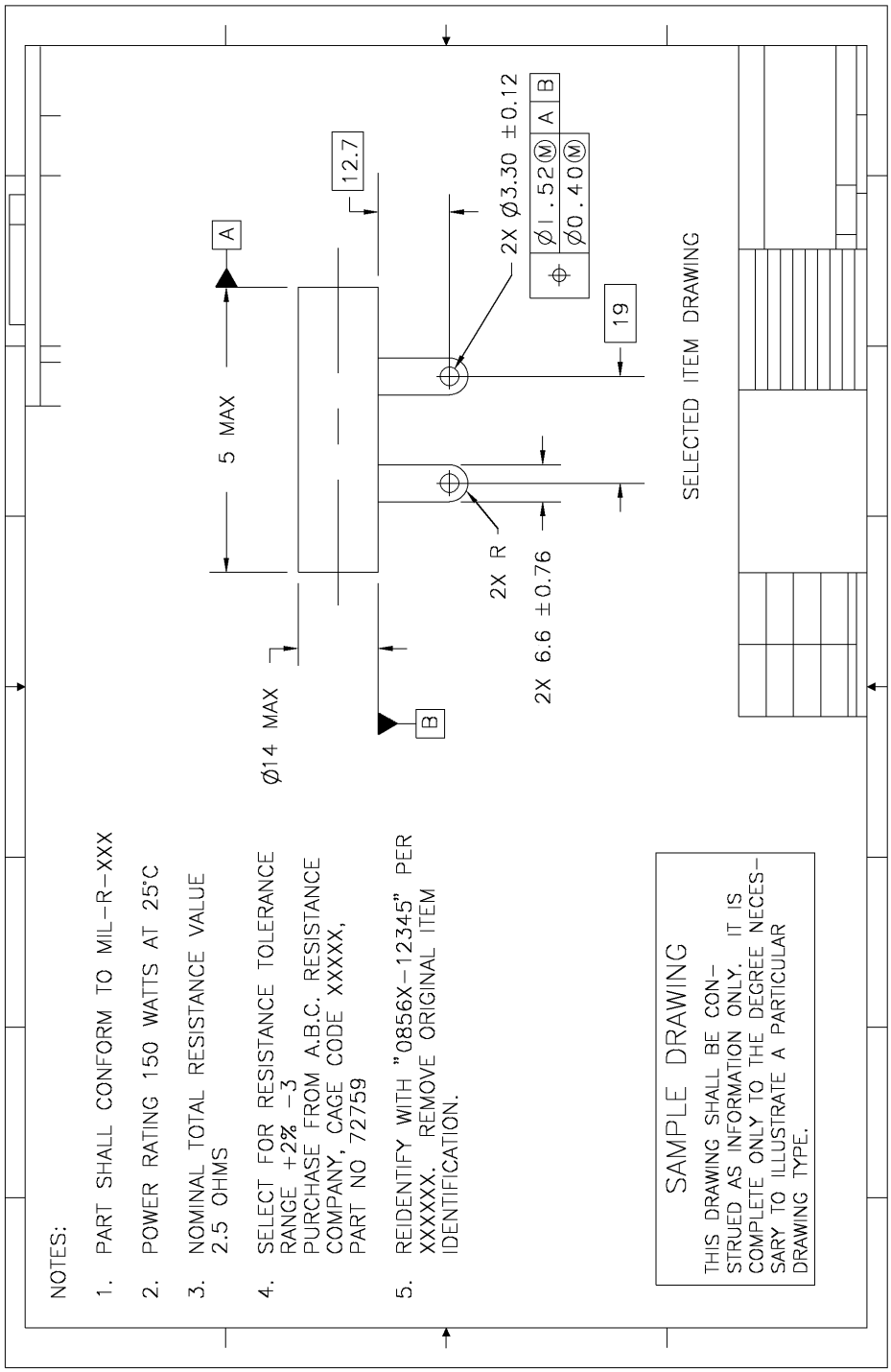


Fig. 8-3 Selected Item Drawing (Mechanical Selection)

Fig. 8-4 Selected Item Drawing (Electrical Selection)

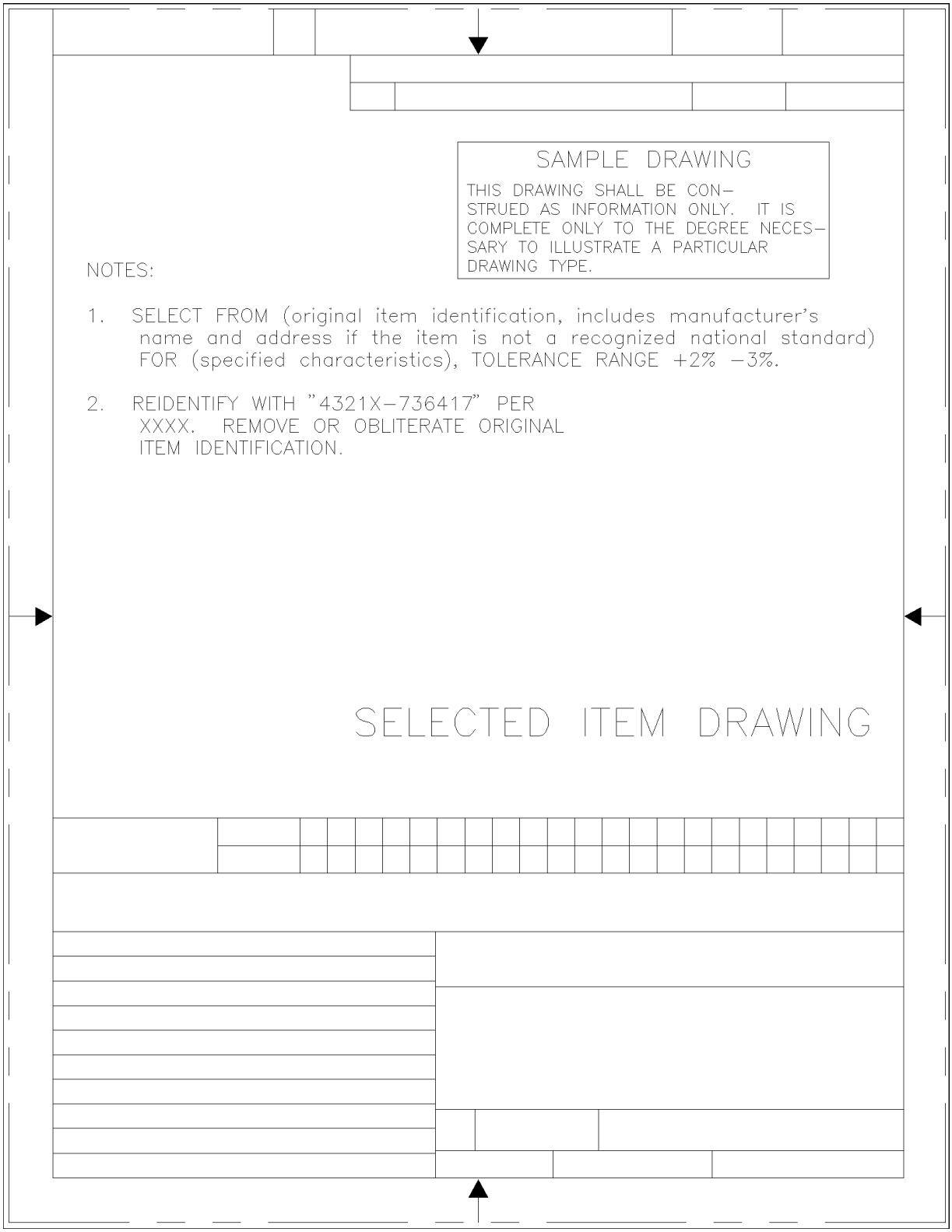
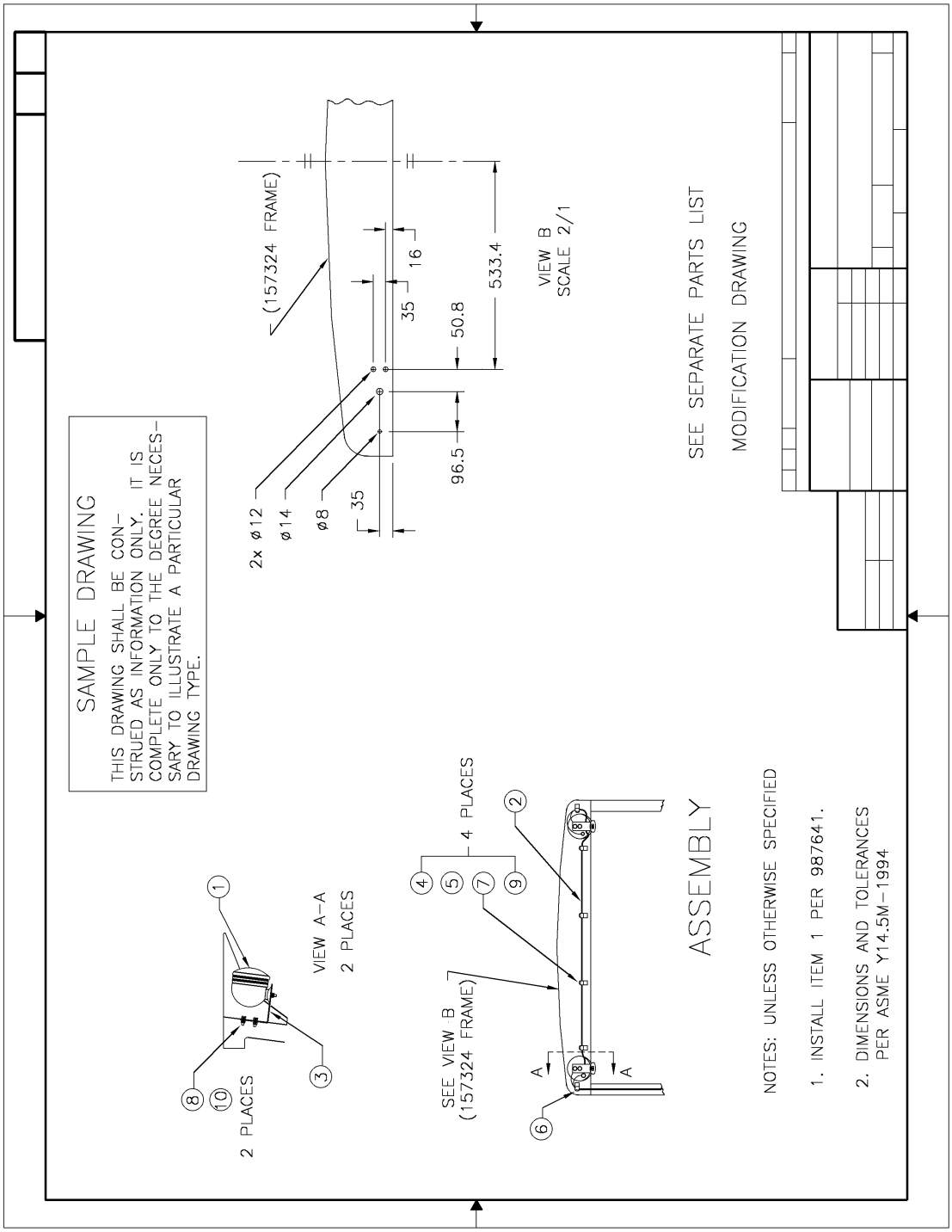


Fig. 8-5 Modification Drawing



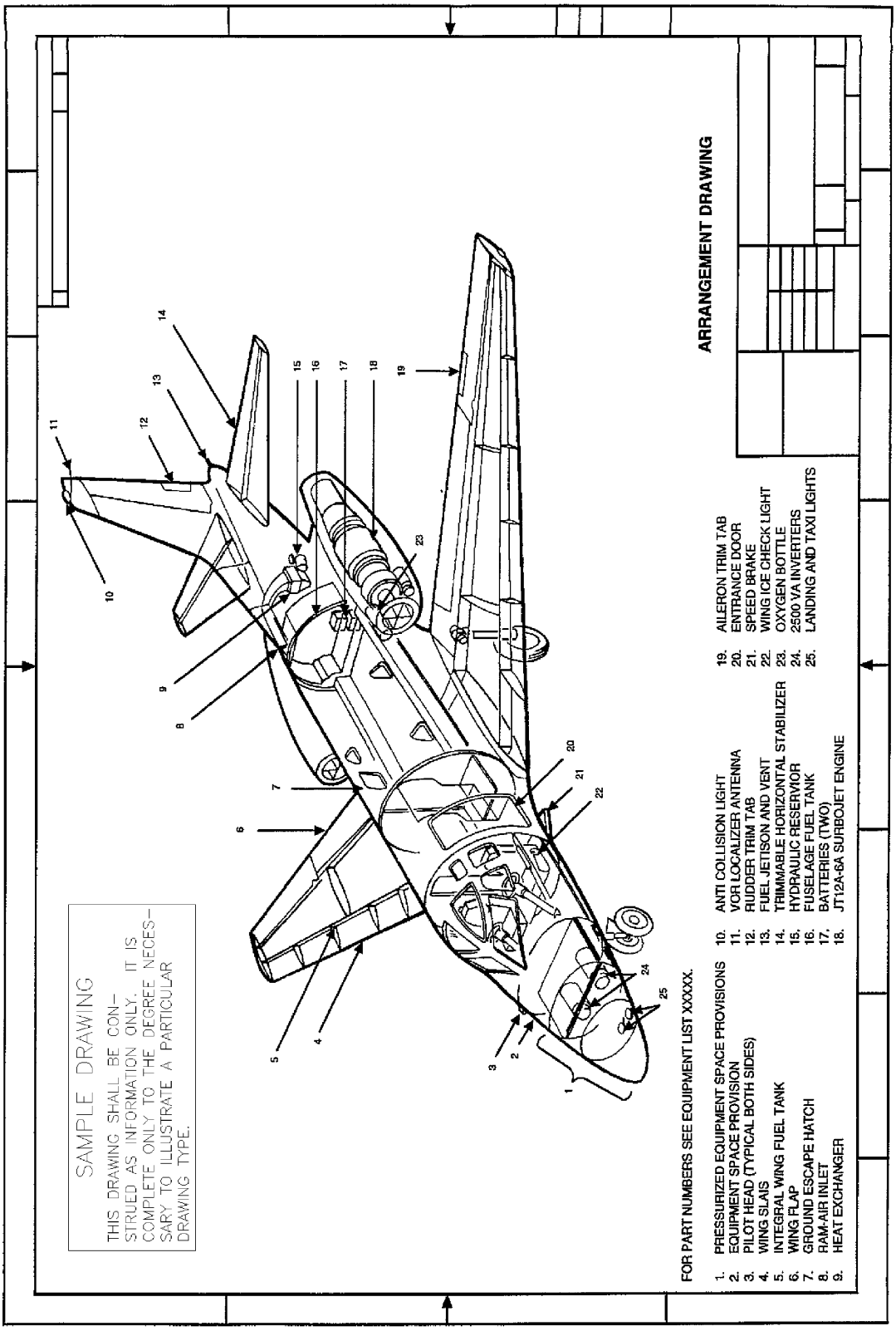


Fig. 9-1 Arrangement Drawing (Pictorial)

Fig. 10-1 Procurement Control Drawing

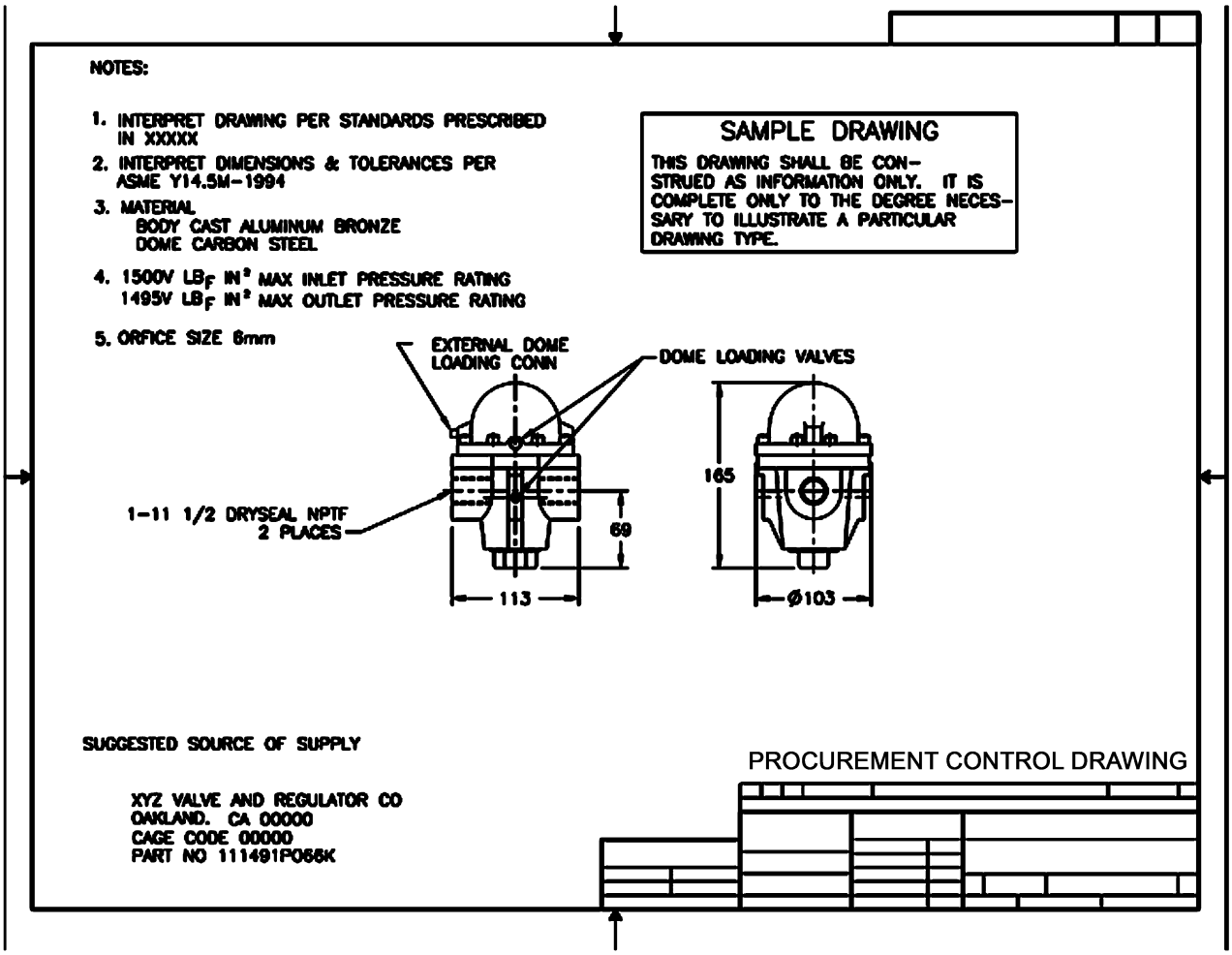


Fig. 10-2 Vendor Item Control Drawing

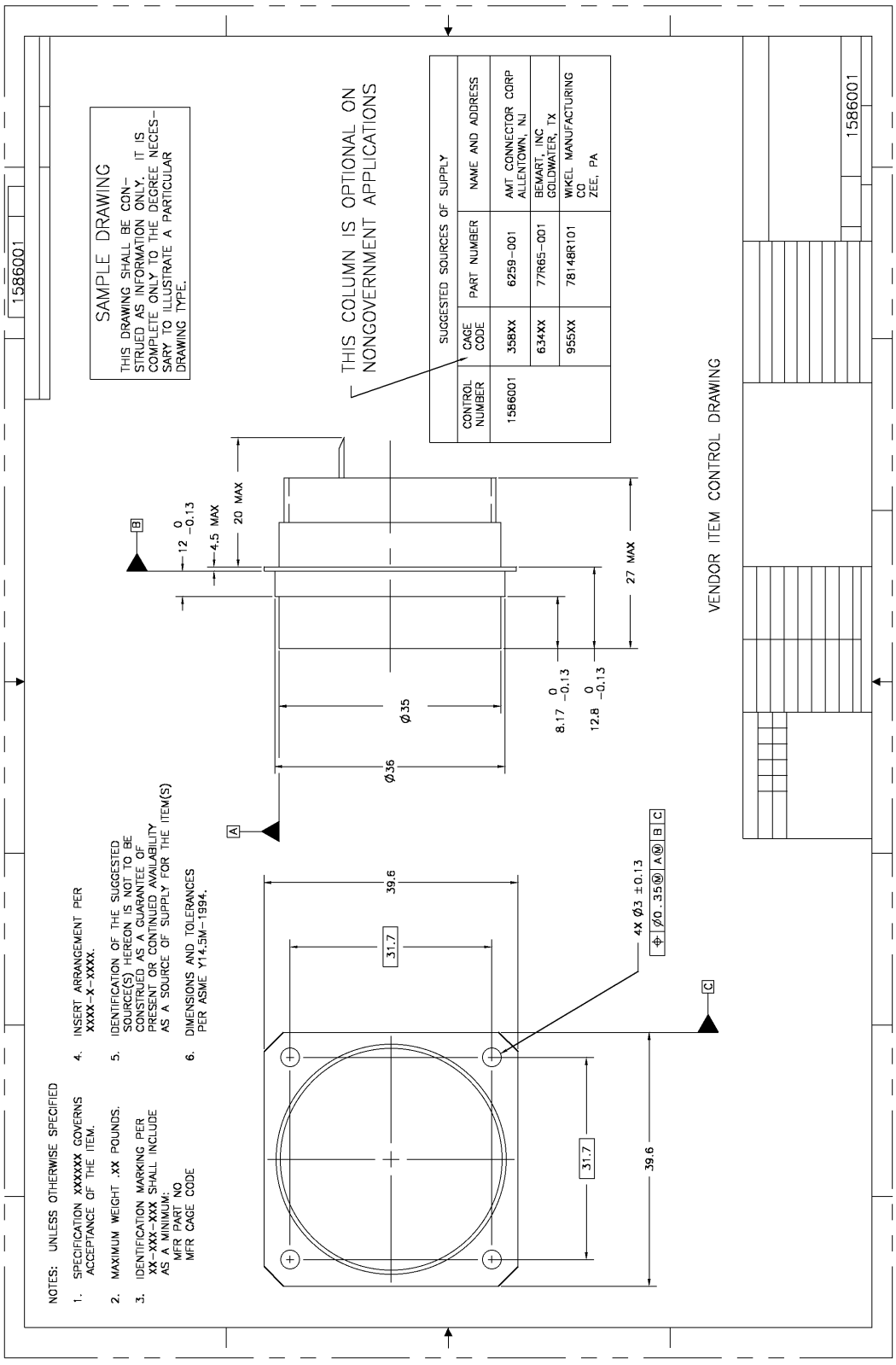
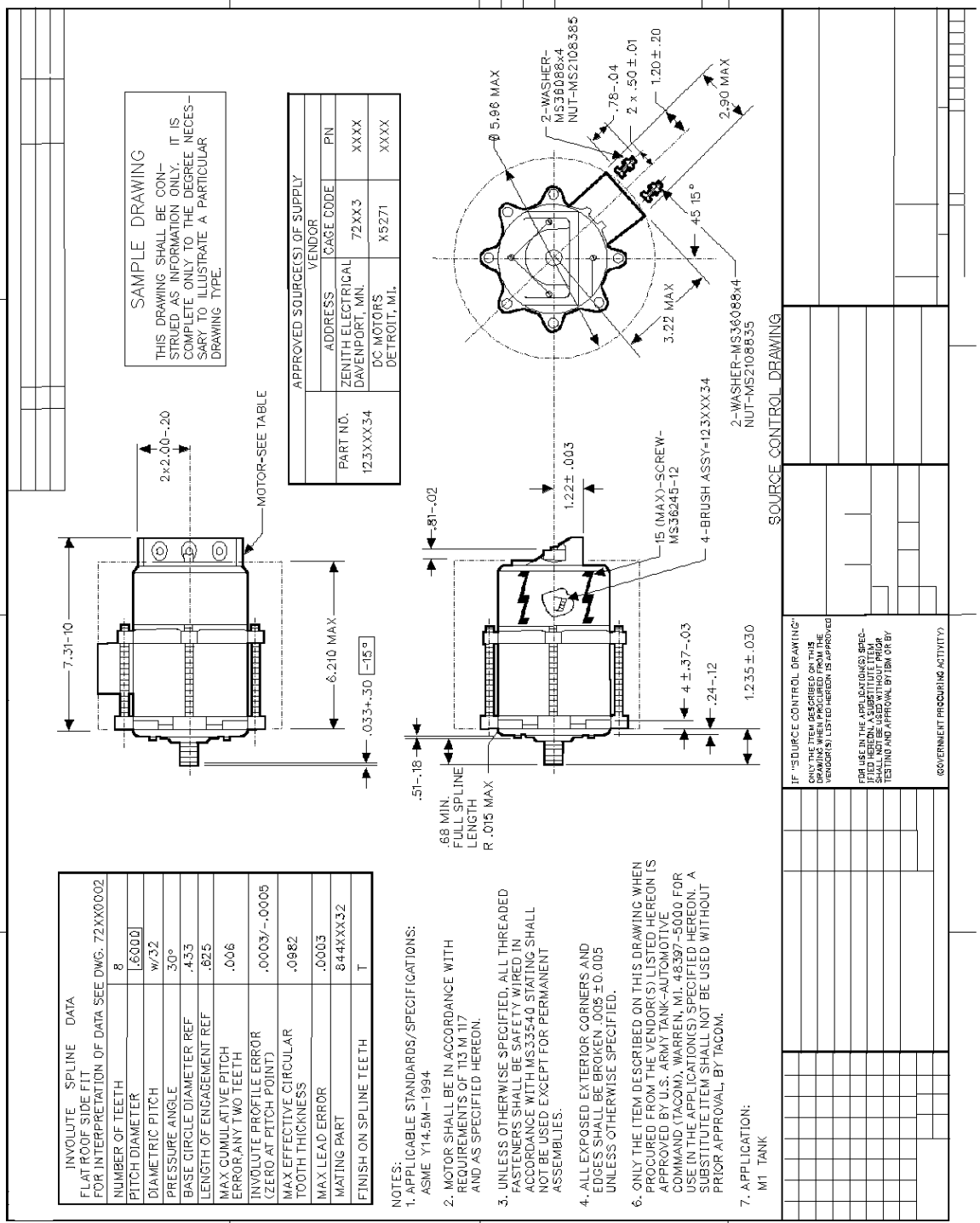


Fig. 10-3 Source Control Drawing



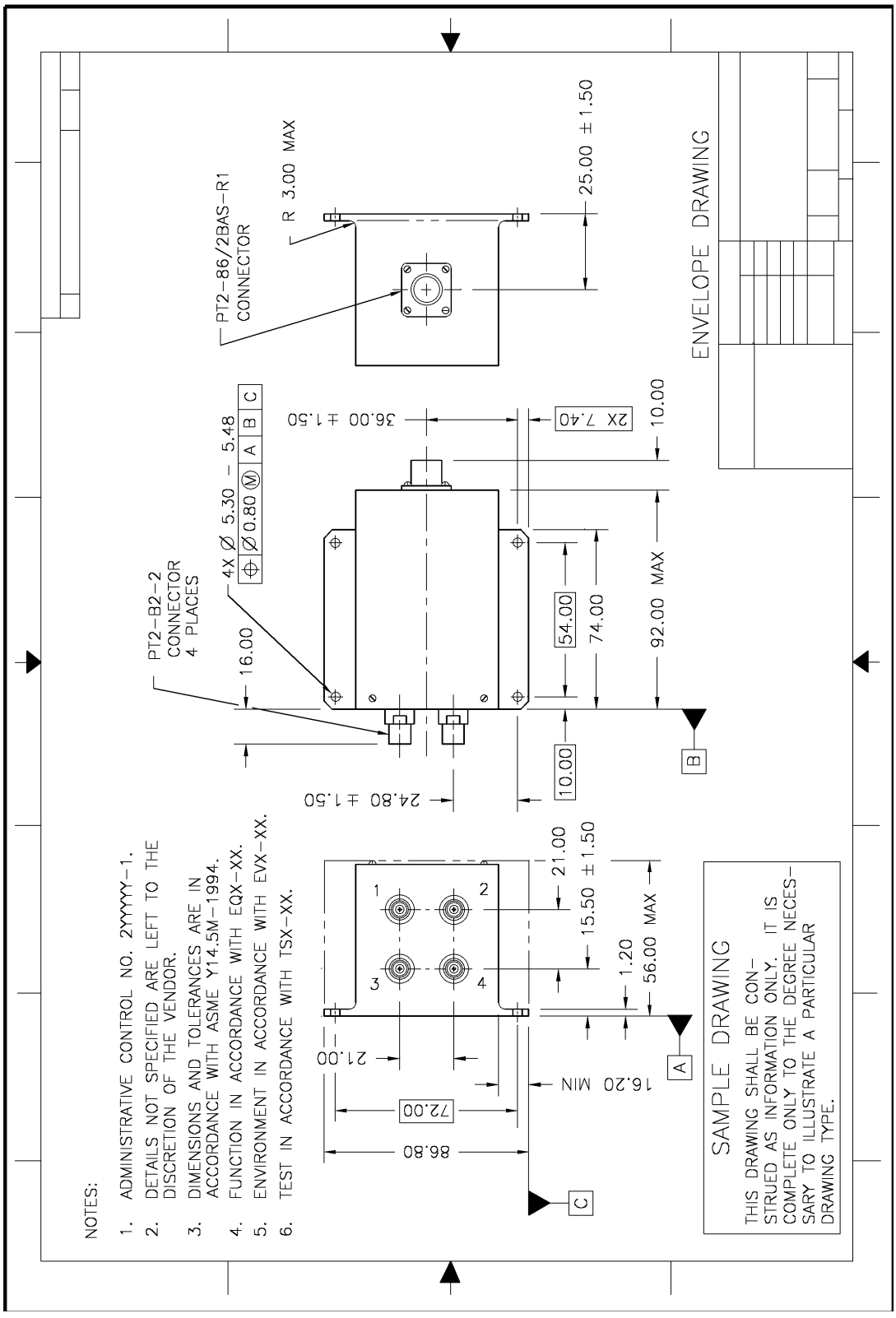


Fig. 10-4 Envelope Drawing

Fig. 11-1 Interface Drawing

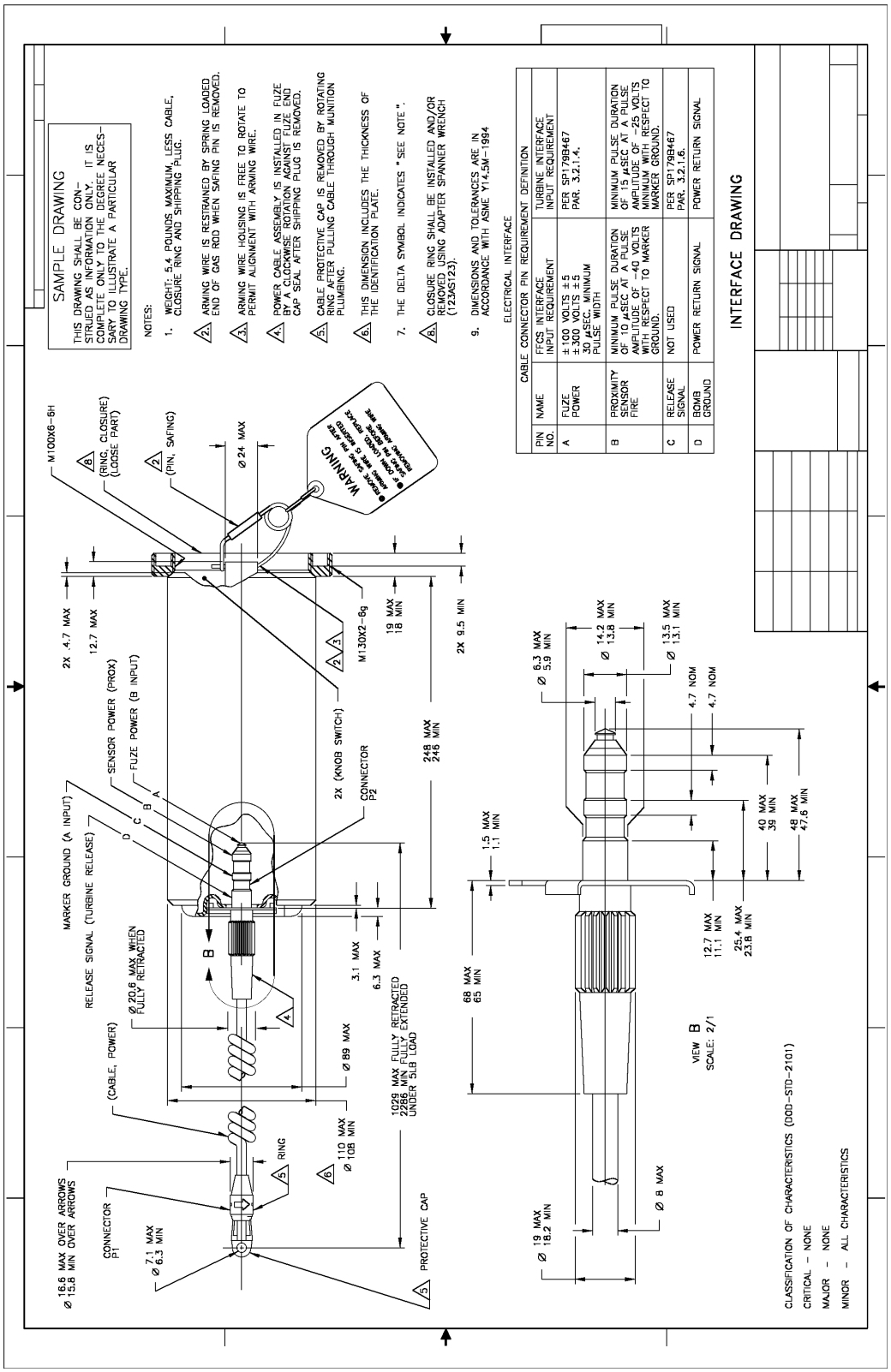


Fig. 12-1 Identification Cross-Reference Drawing

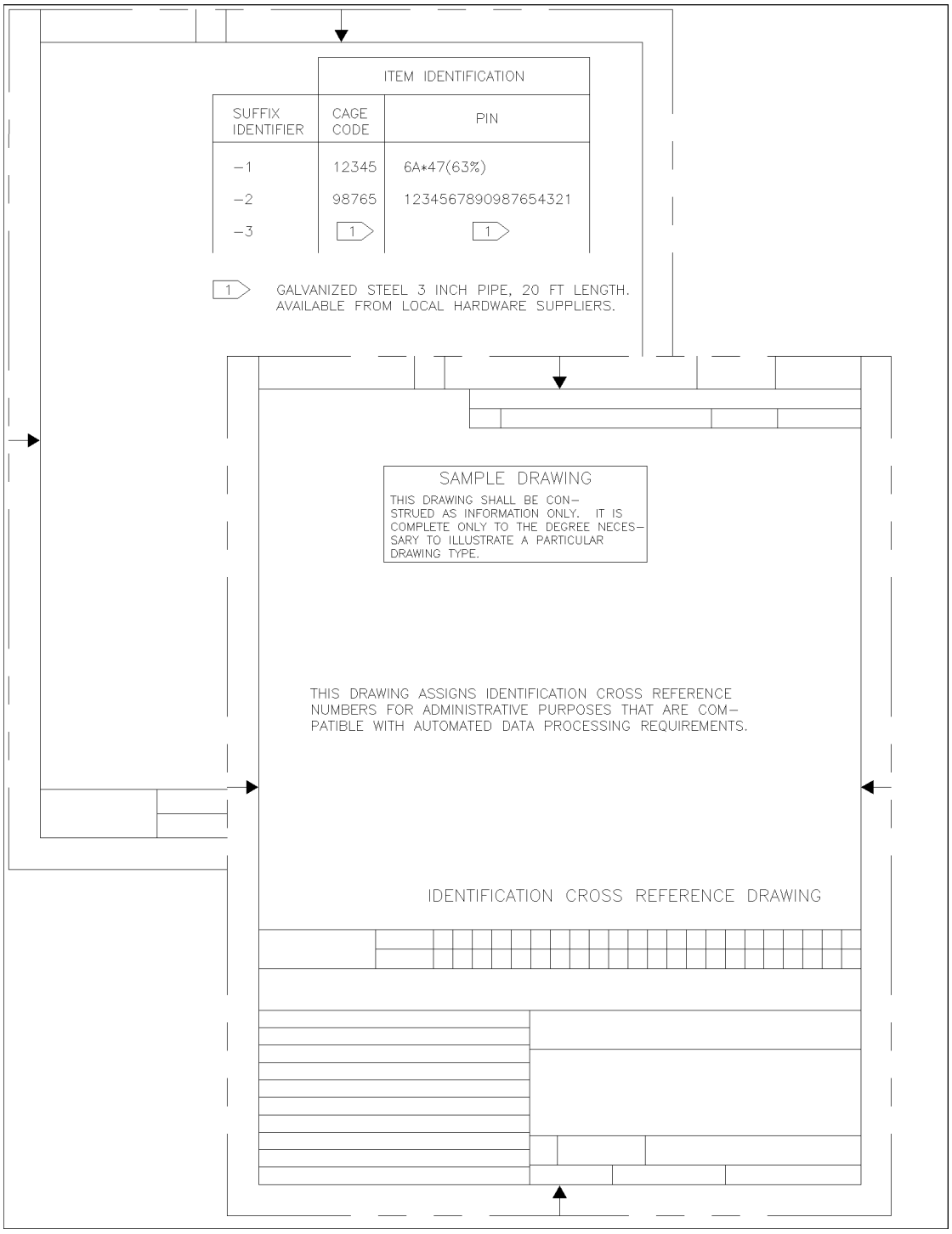
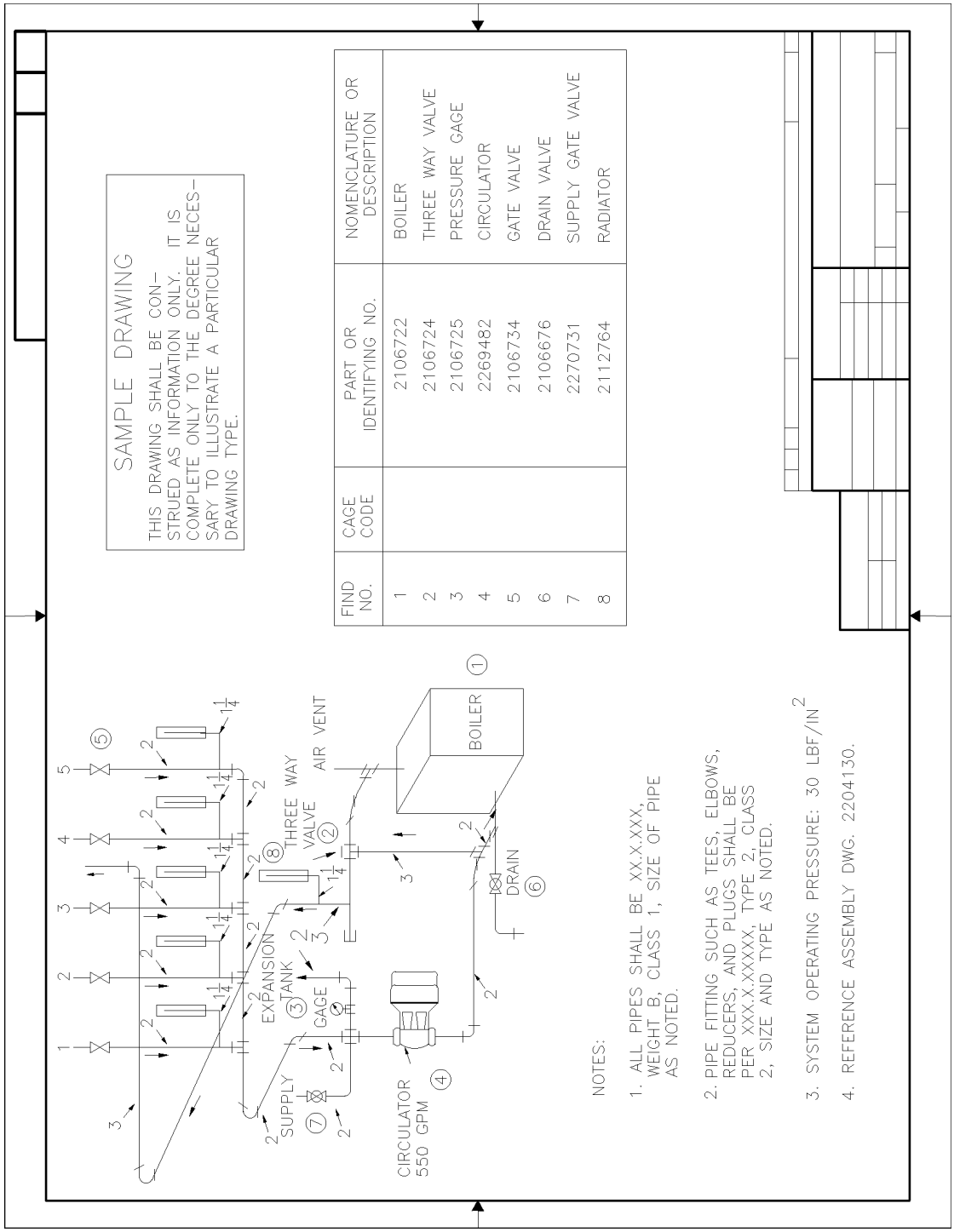


Fig. 13-1 Mechanical Schematic Diagram



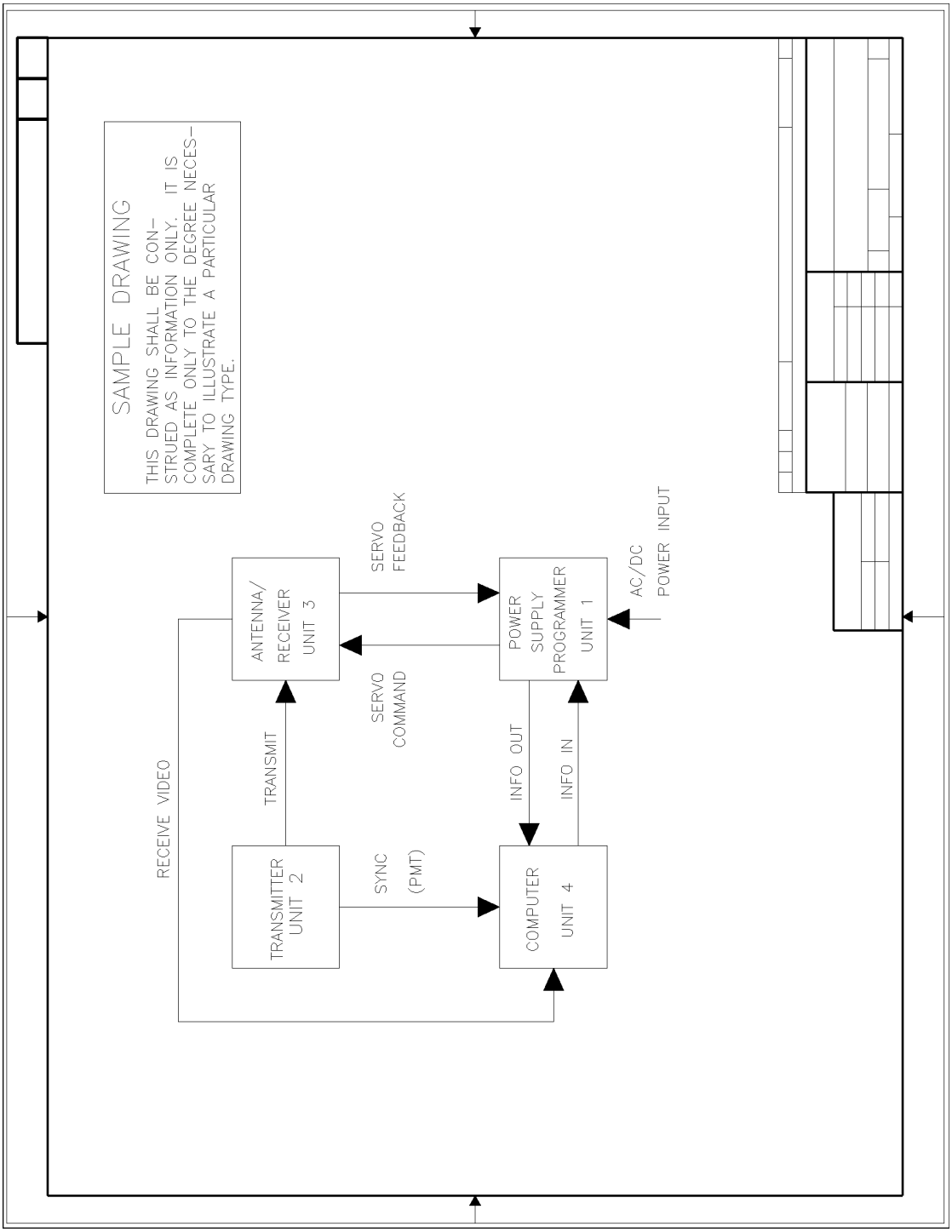


Fig. 14-1 Functional Block Diagram

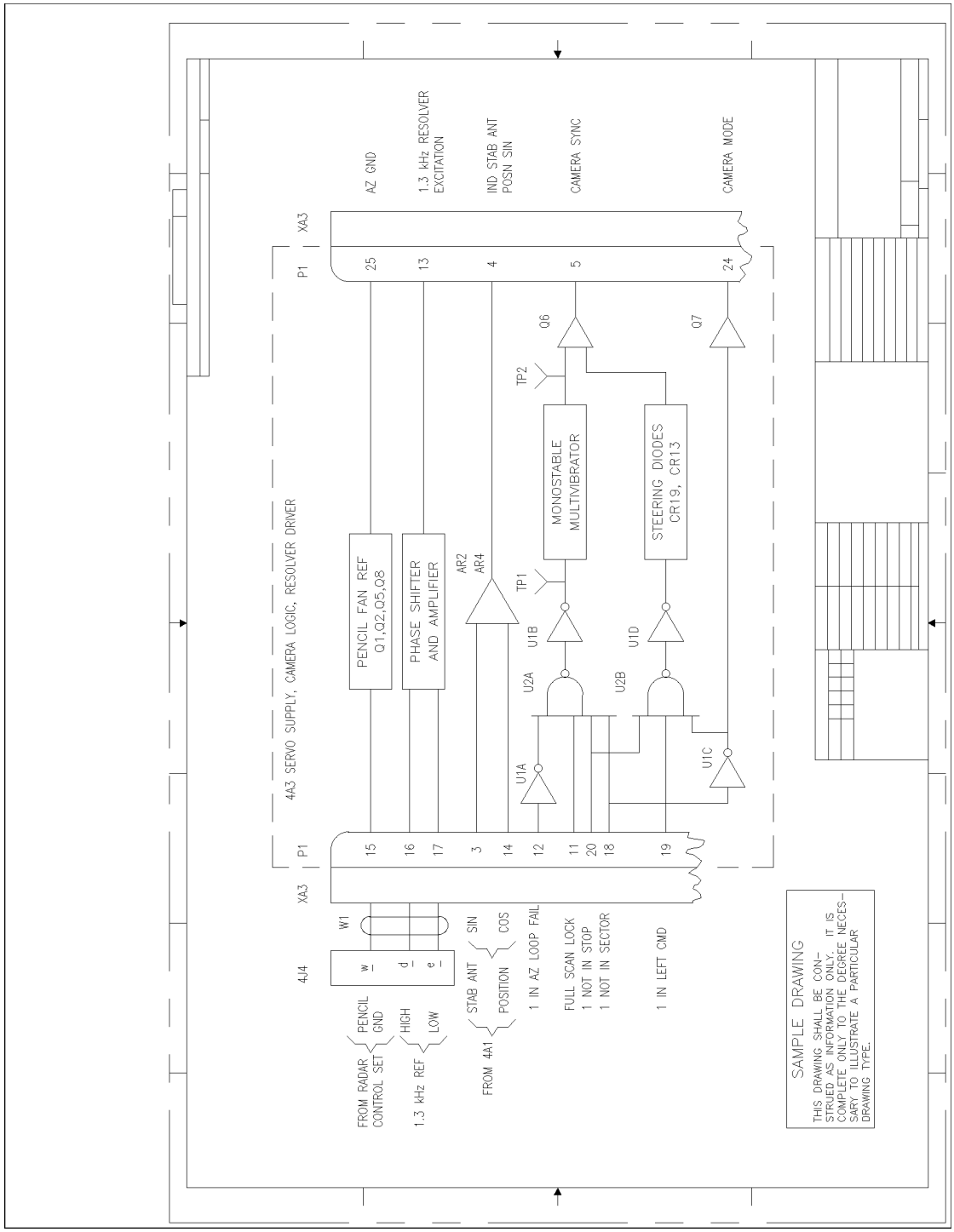


Fig. 14-2 Single-Line Schematic Diagram

Fig. 14-3 Schematic Diagram

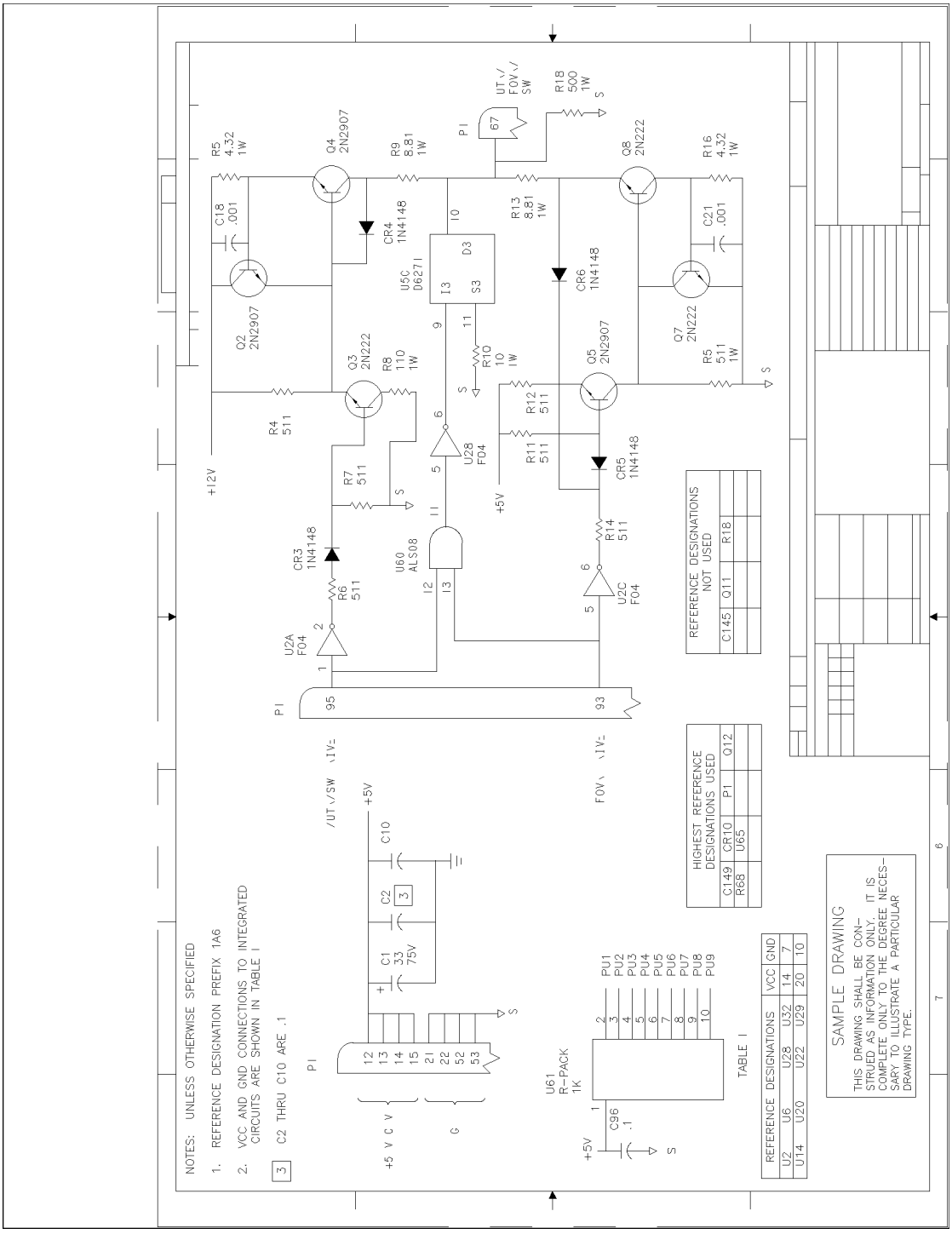
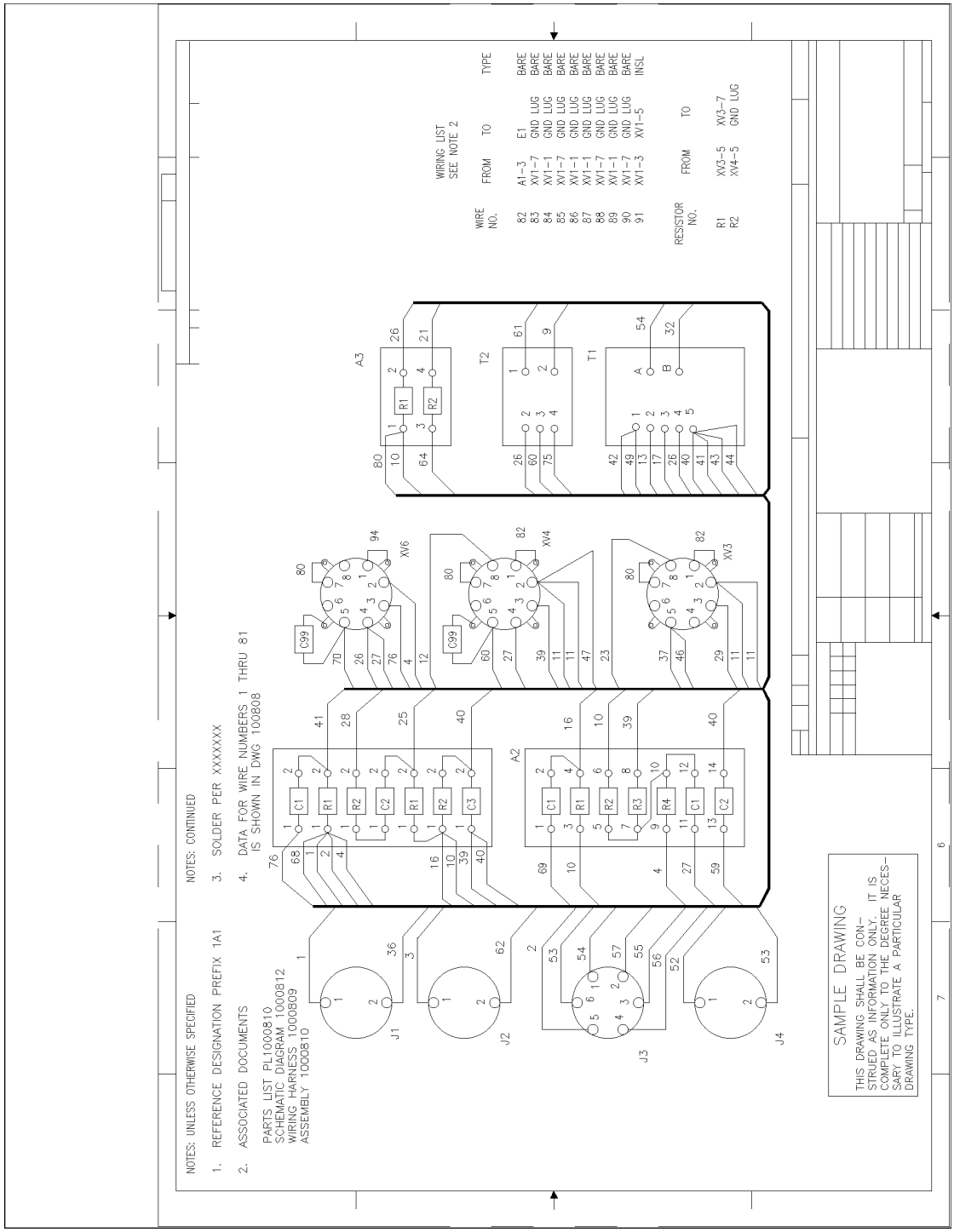


Fig. 14-4 Connection Diagram



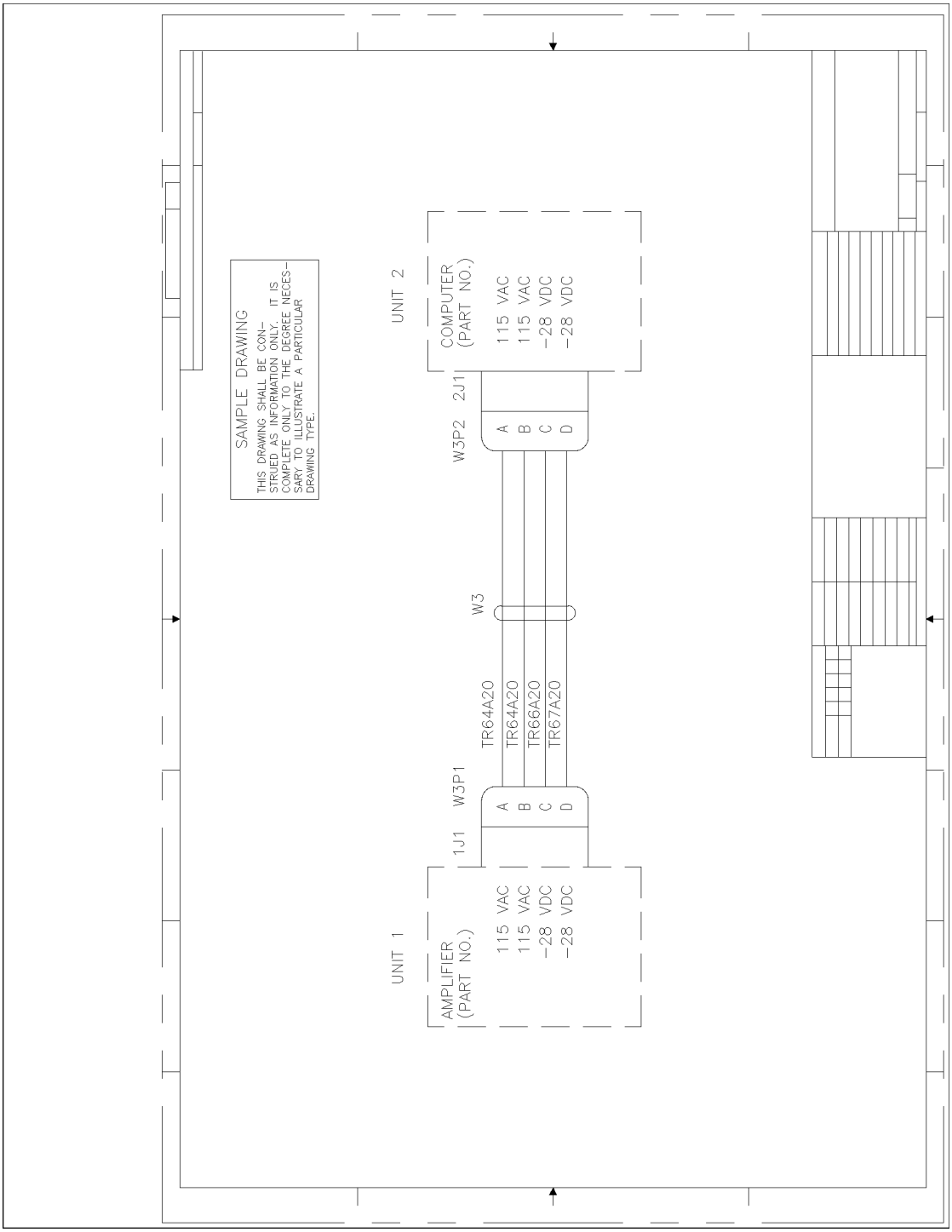


Fig. 14-5 Interconnection Diagram (Point-to-Point, Simple)

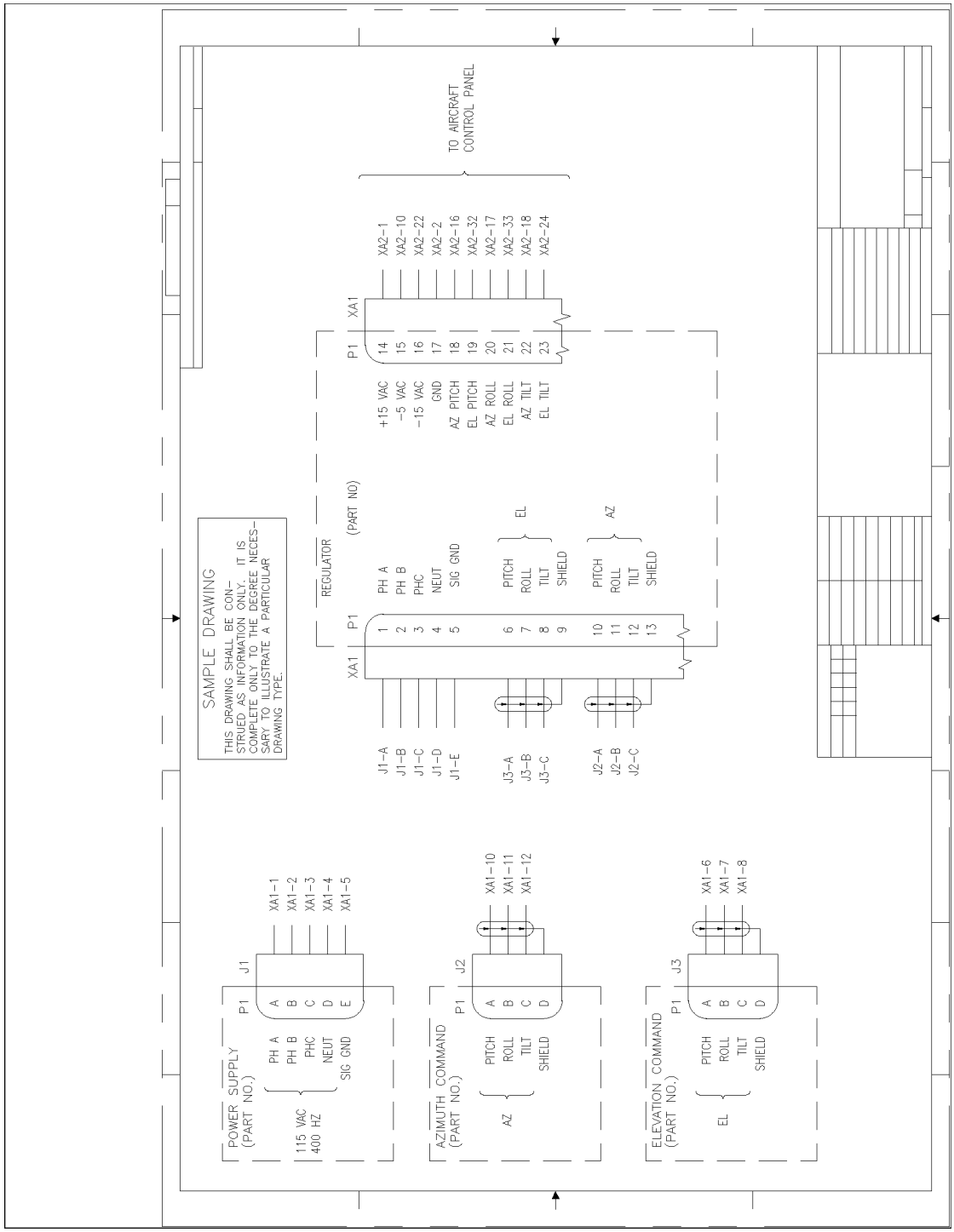


Fig. 14-6 Interconnection Diagram (Point-to-Point, Complex)

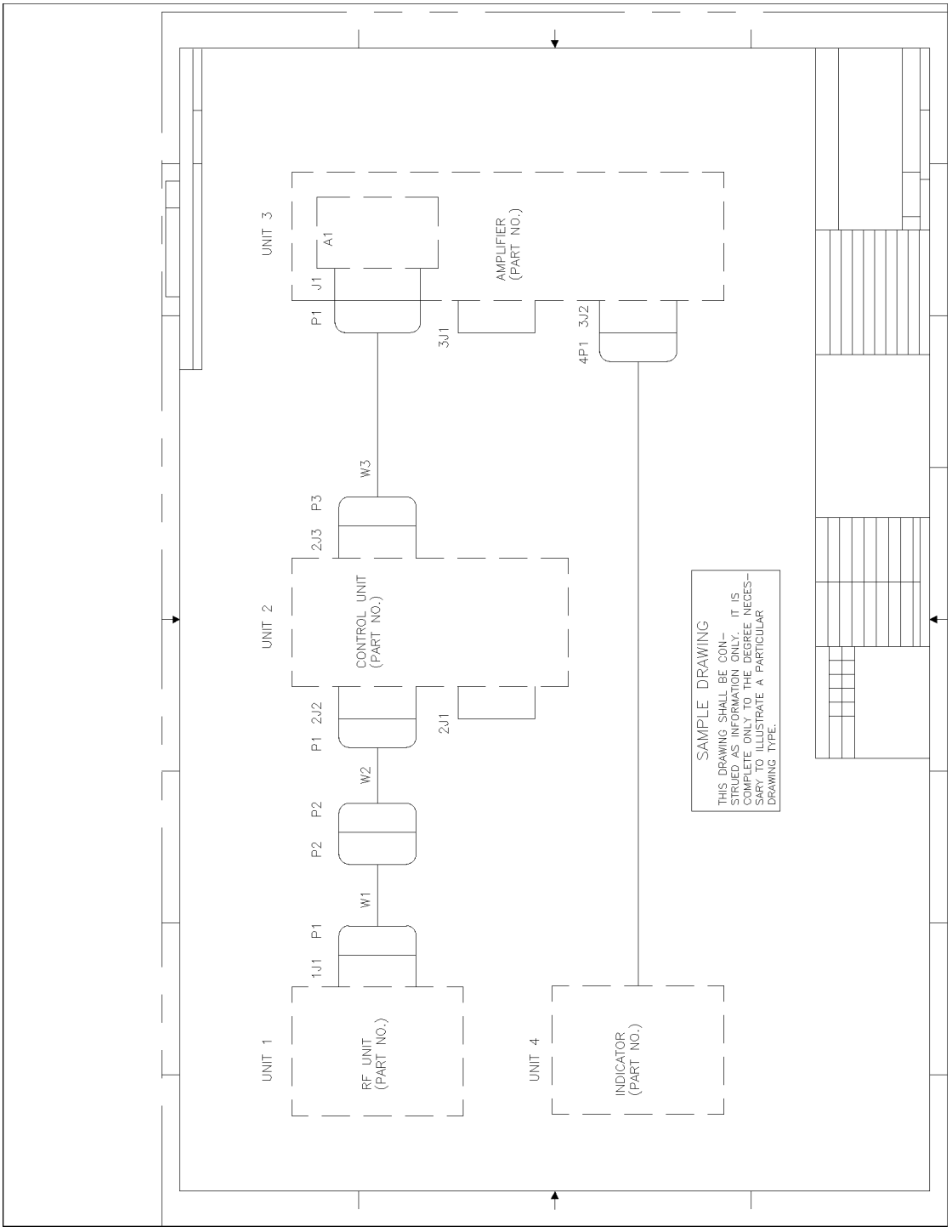


Fig. 14-7 Interconnection Diagram (Cabling Type)

Fig. 14-8 Logic Circuit Diagram

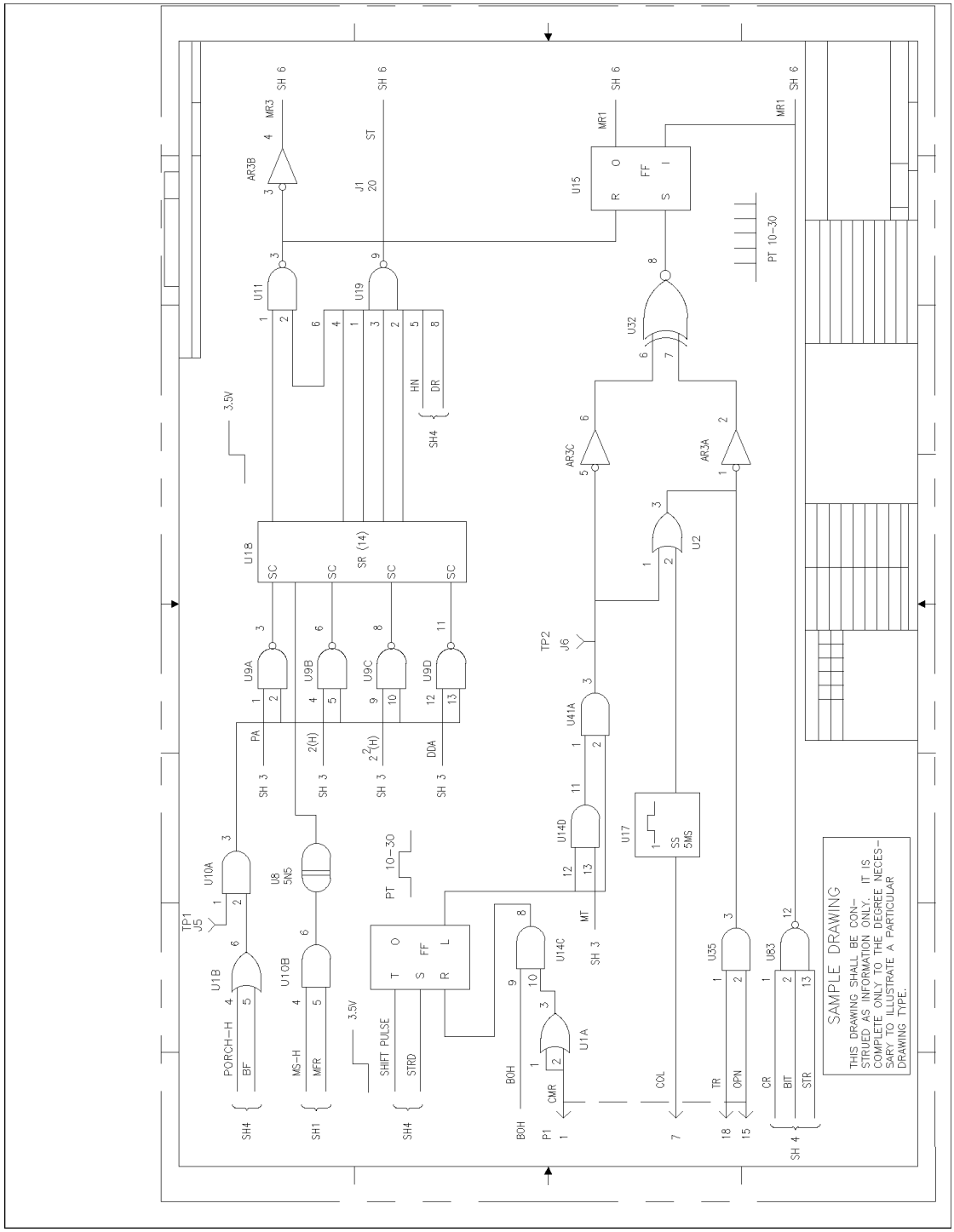


Fig. 15-1 Wiring Harness Drawing

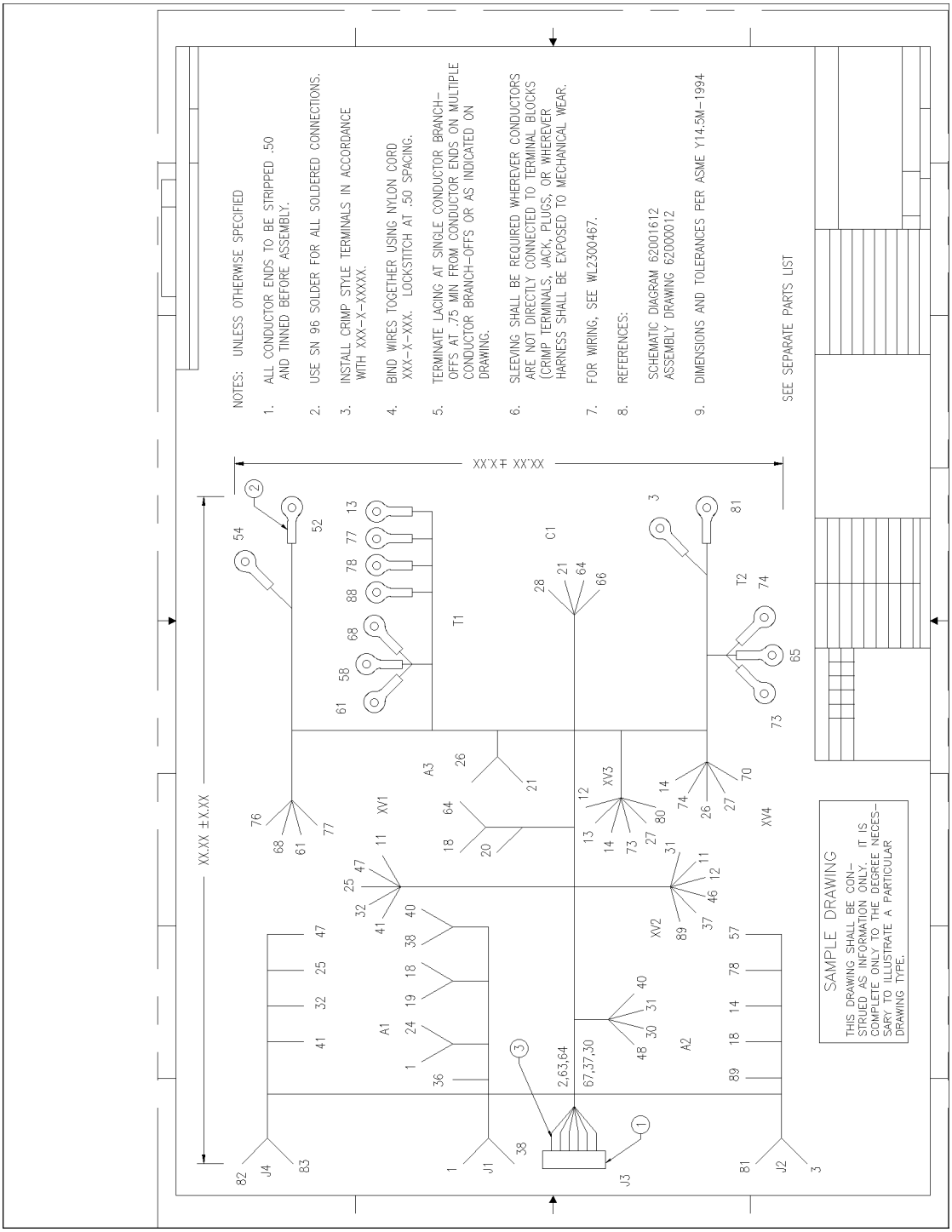


Fig. 15-2 Cable Assembly Drawing

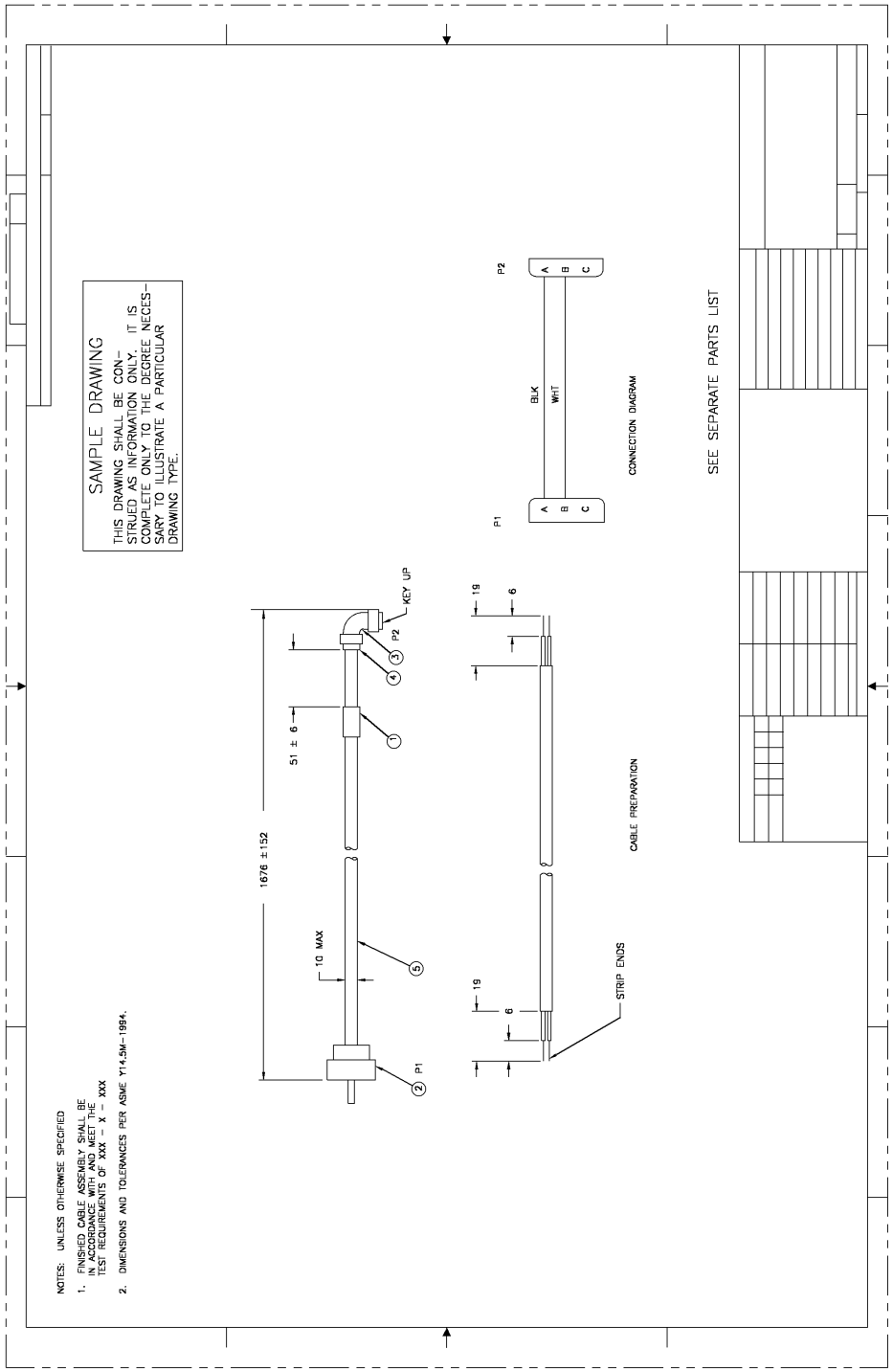


Fig. 15-3 Indentured Relationships of Printed and Discrete Wiring Board Documentation (Typical)

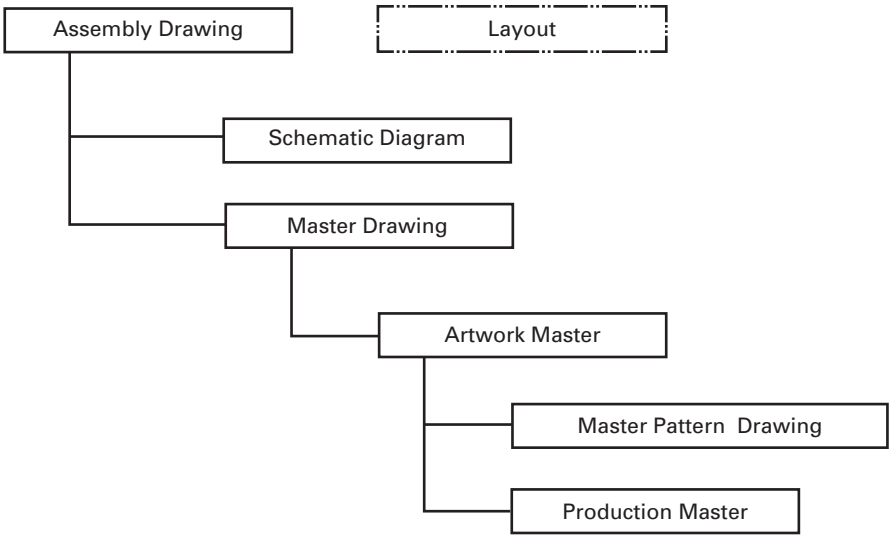
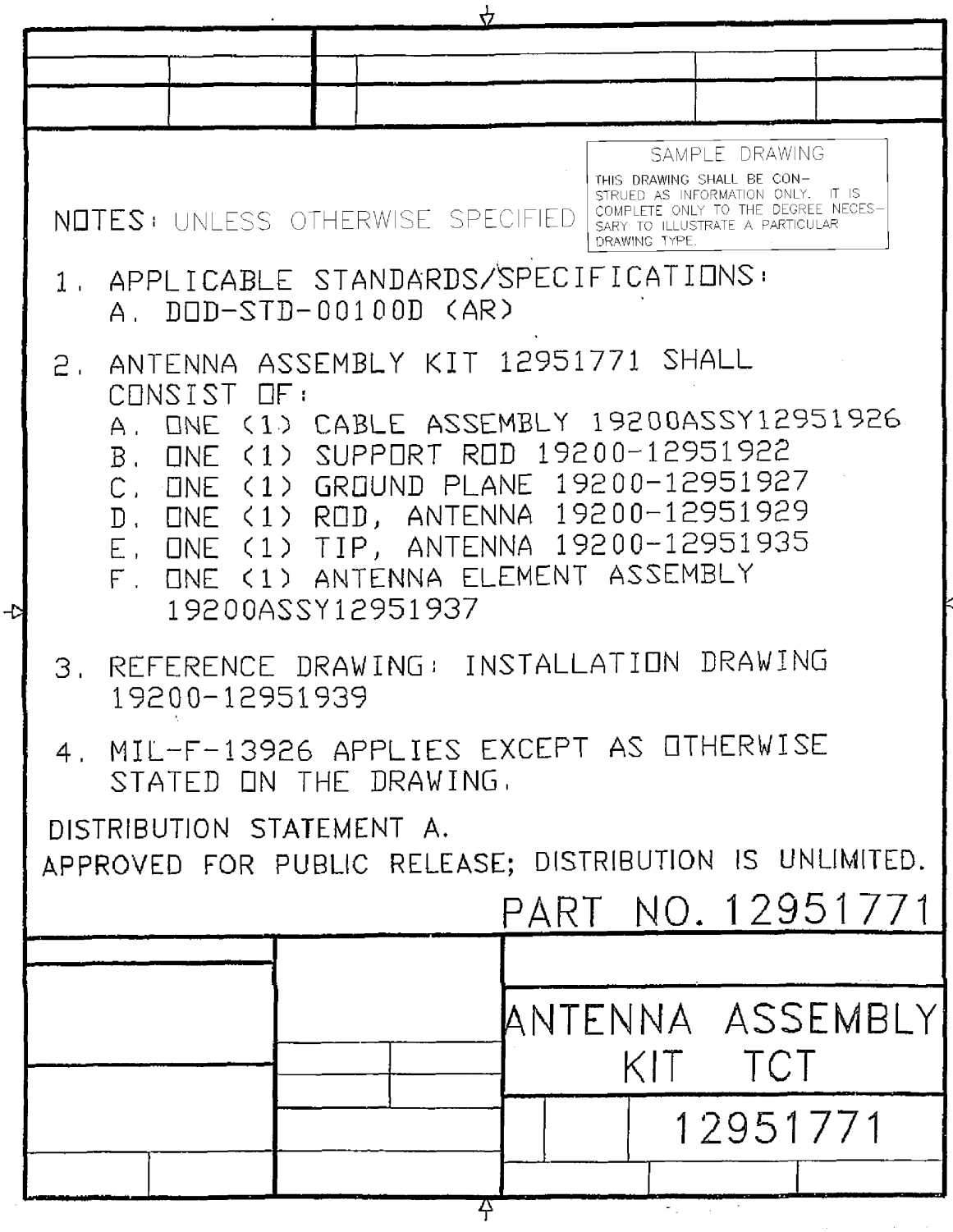


Fig. 15-4 Kit Drawing



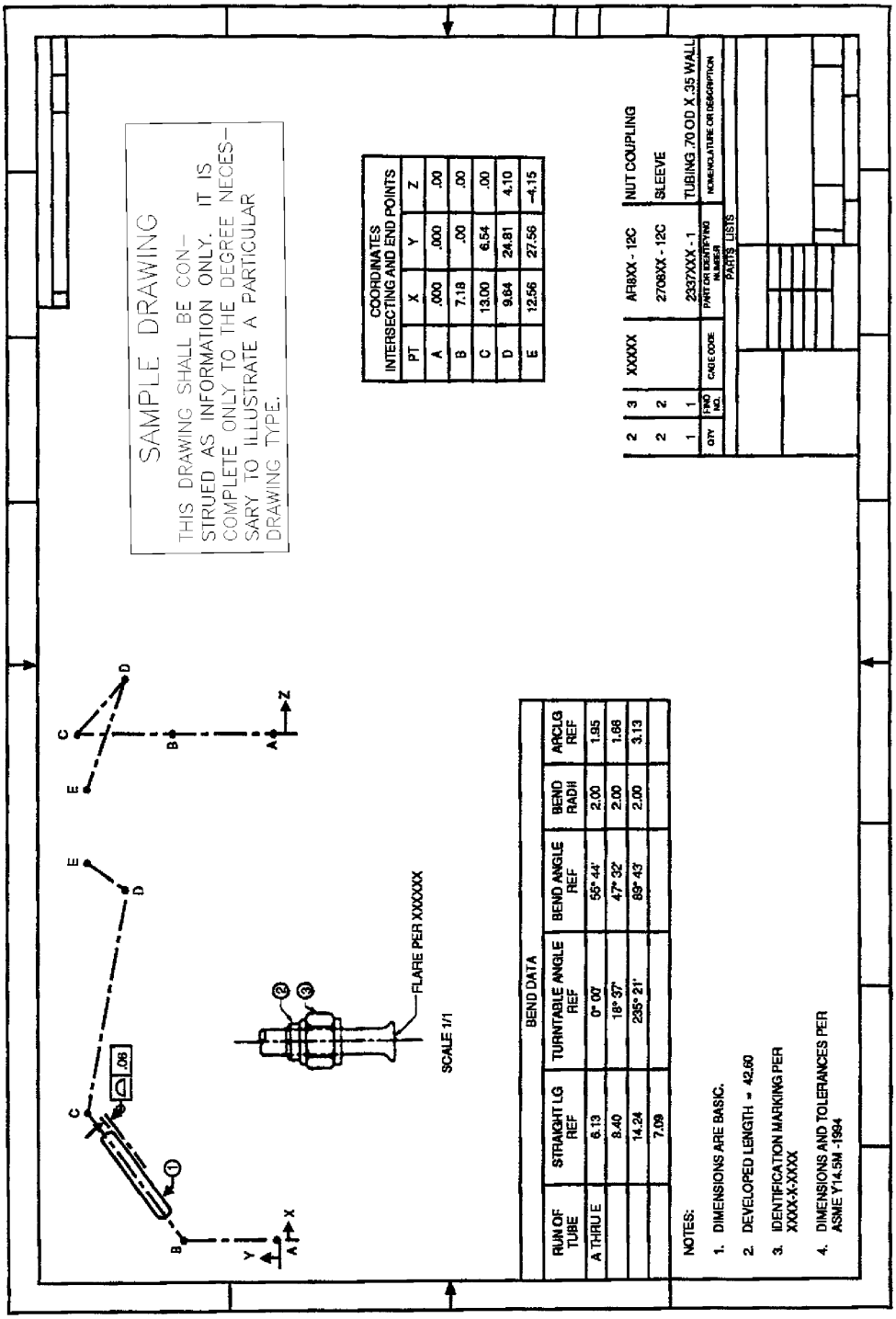
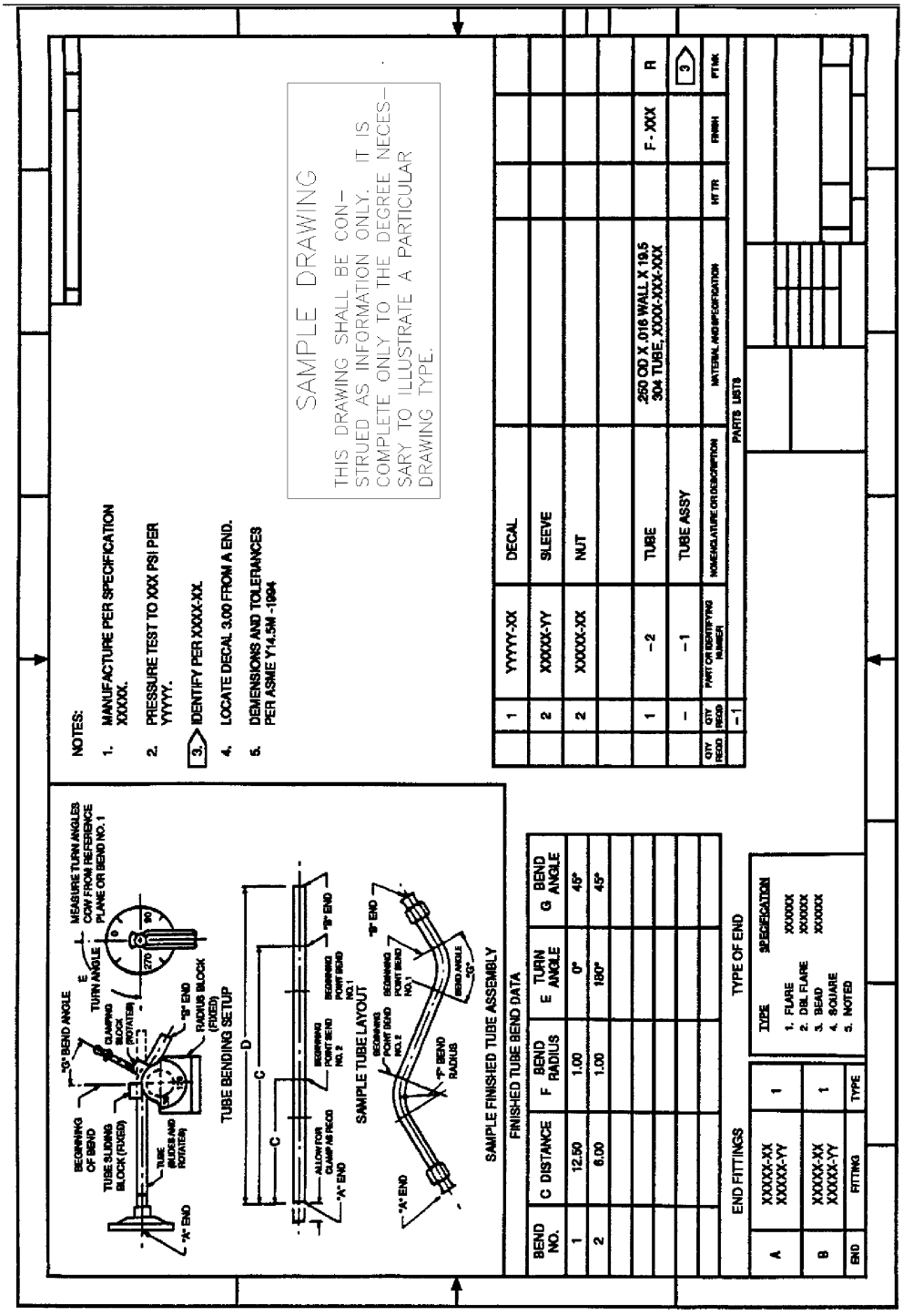


Fig. 15-5 Tube Bend Drawing (Pictorial/Coordinate)

Fig. 15-6 Tube Bend Drawing (Tabular)



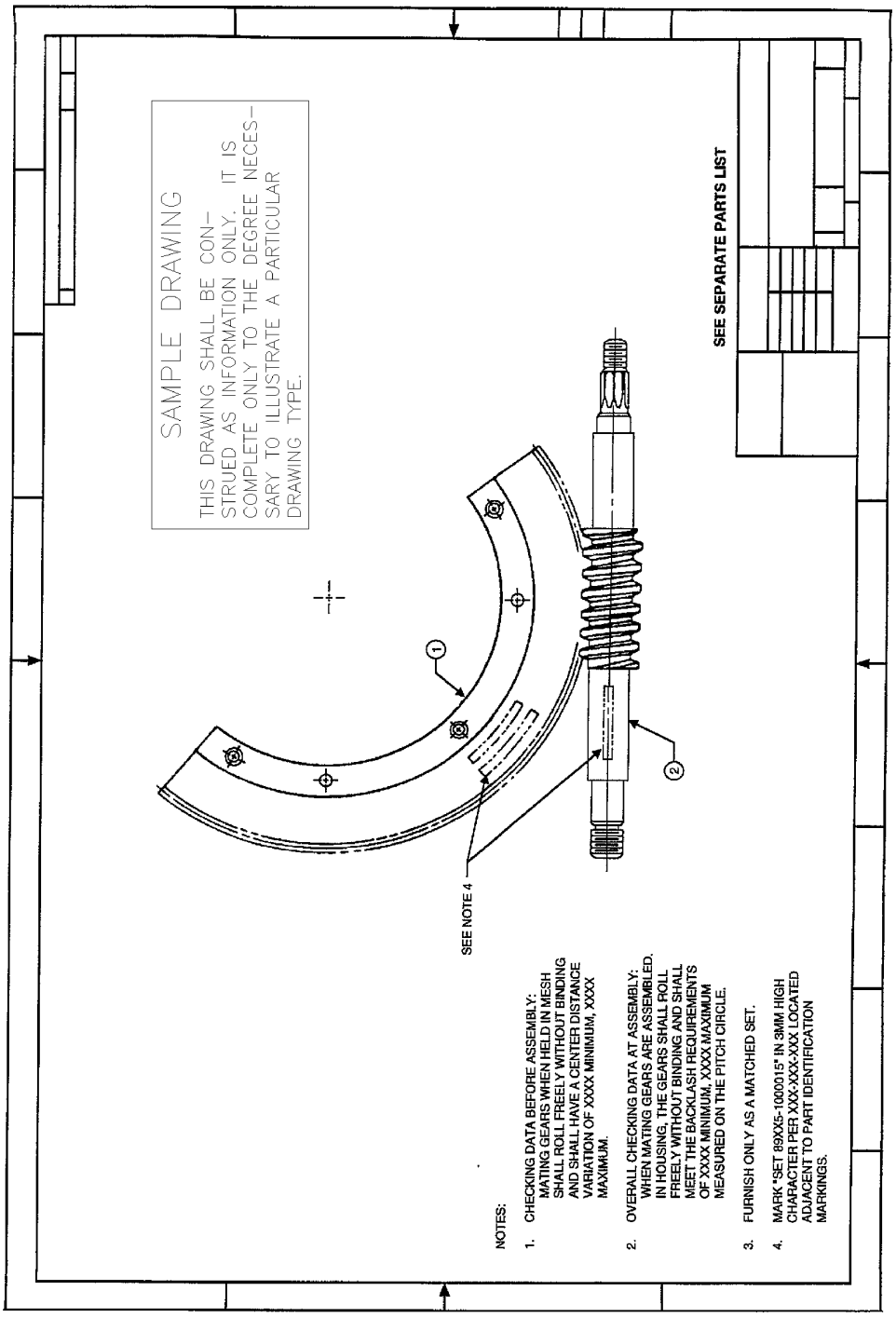
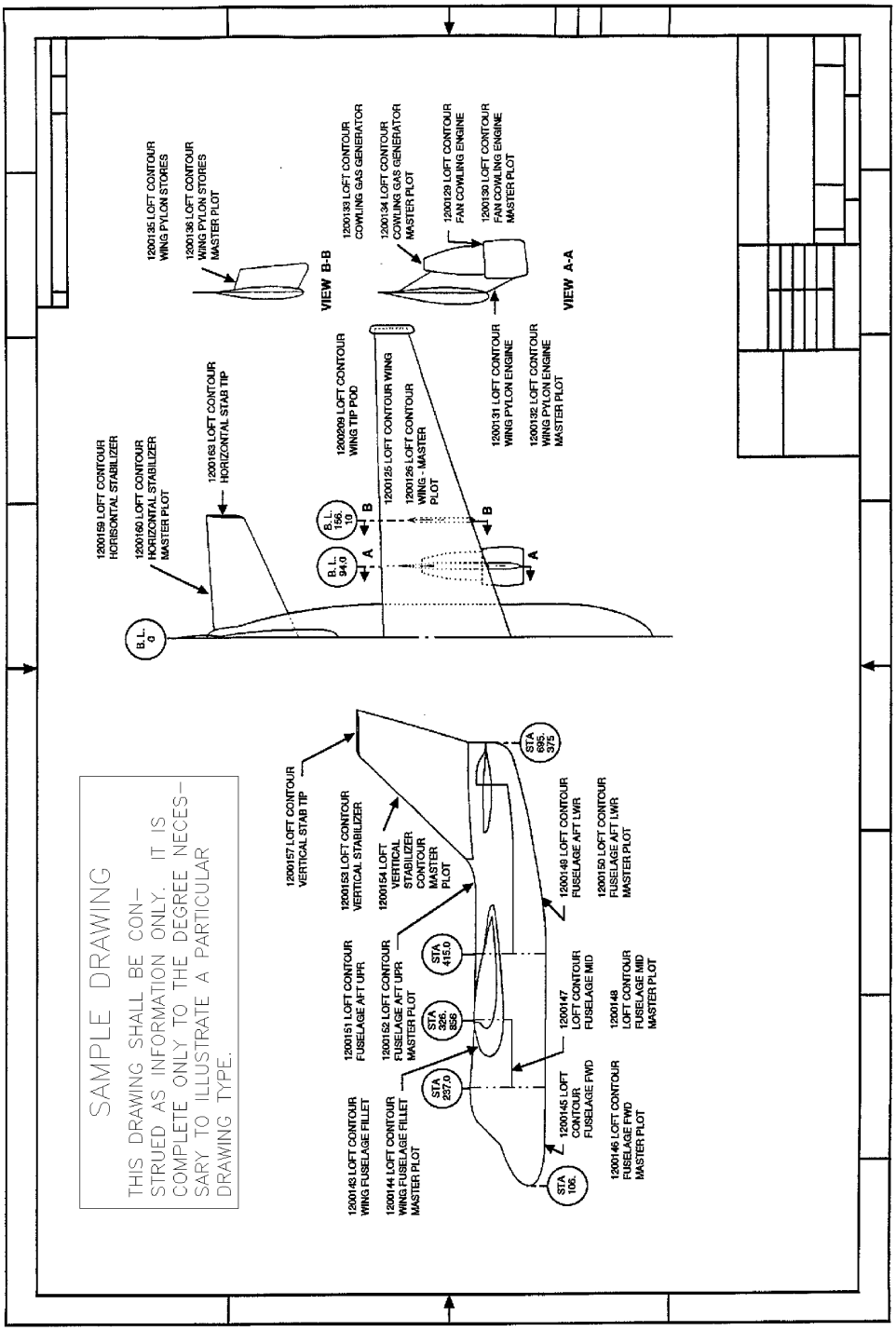


Fig. 15-7 Matched Set Drawing

Fig. 15-8 Contour Definition Drawing (Index)



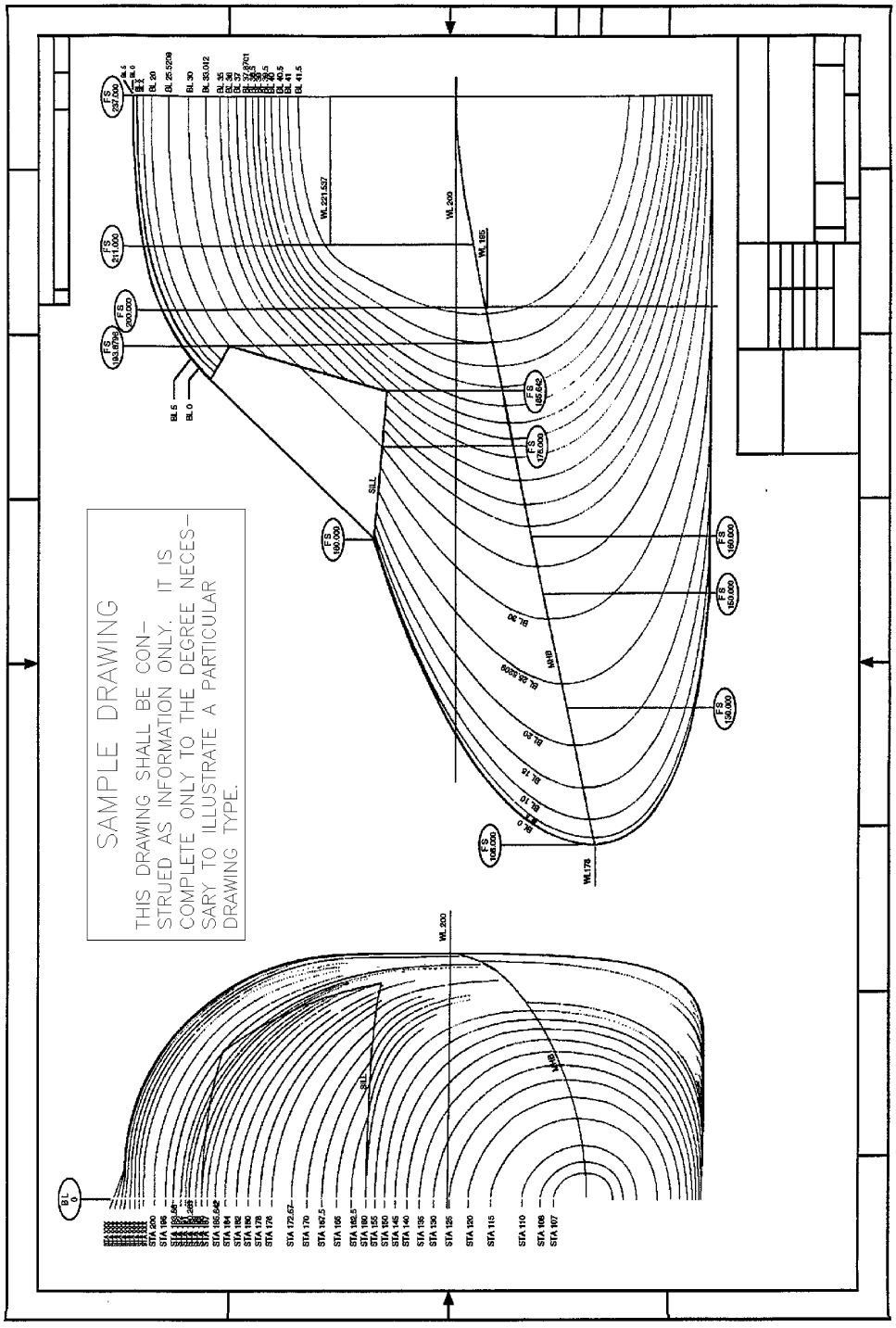
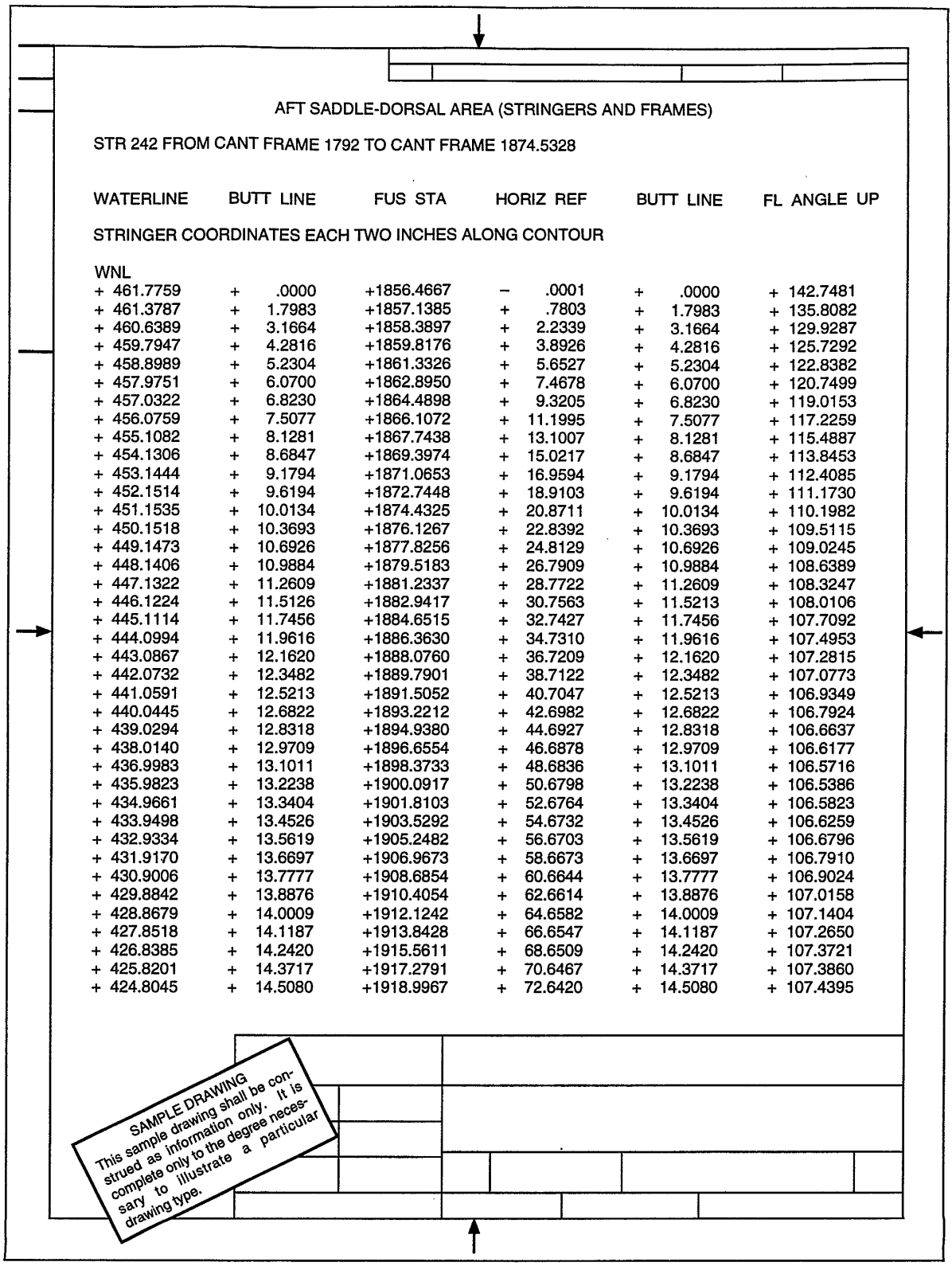


Fig. 15-9 Contour Definition Drawing (Pictorial)

Fig. 15-10 Contour Definition Drawing



AFT SADDLE-DORSAL AREA (STRINGERS AND FRAMES)

STR 242 FROM CANT FRAME 1792 TO CANT FRAME 1874.5328

STRINGER COORDINATES EACH TWO INCHES ALONG CONTOUR

WATERLINE	BUTT LINE	FUS STA	HORIZ REF	BUTT LINE	FL ANGLE UP
WNL					
+ 461.7759	+ .0000	+1856.4667	− .0001	+ .0000	+ 142.7481
+ 461.3787	+ 1.7983	+1857.1385	+ .7803	+ 1.7983	+ 135.8082
+ 460.6389	+ 3.1664	+1858.3897	+ 2.2339	+ 3.1664	+ 129.9287
+ 459.7947	+ 4.2816	+1859.8176	+ 3.8926	+ 4.2816	+ 125.7292
+ 458.8989	+ 5.2304	+1861.3326	+ 5.6527	+ 5.2304	+ 122.8382
+ 457.9751	+ 6.0700	+1862.8950	+ 7.4678	+ 6.0700	+ 120.7499
+ 457.0322	+ 6.8230	+1864.4898	+ 9.3205	+ 6.8230	+ 119.0153
+ 456.0759	+ 7.5077	+1866.1072	+ 11.1995	+ 7.5077	+ 117.2259
+ 455.1082	+ 8.1281	+1867.7438	+ 13.1007	+ 8.1281	+ 115.4887
+ 454.1306	+ 8.6847	+1869.3974	+ 15.0217	+ 8.6847	+ 113.8453
+ 453.1444	+ 9.1794	+1871.0653	+ 16.9594	+ 9.1794	+ 112.4085
+ 452.1514	+ 9.6194	+1872.7448	+ 18.9103	+ 9.6194	+ 111.1730
+ 451.1535	+ 10.0134	+1874.4325	+ 20.8711	+ 10.0134	+ 110.1982
+ 450.1518	+ 10.3693	+1876.1267	+ 22.8392	+ 10.3693	+ 109.5115
+ 449.1473	+ 10.6926	+1877.8256	+ 24.8129	+ 10.6926	+ 109.0245
+ 448.1406	+ 10.9884	+1879.5183	+ 26.7909	+ 10.9884	+ 108.6389
+ 447.1322	+ 11.2609	+1881.2337	+ 28.7722	+ 11.2609	+ 108.3247
+ 446.1224	+ 11.5126	+1882.9417	+ 30.7563	+ 11.5213	+ 108.0106
+ 445.1114	+ 11.7456	+1884.6515	+ 32.7427	+ 11.7456	+ 107.7092
+ 444.0994	+ 11.9616	+1886.3630	+ 34.7310	+ 11.9616	+ 107.4953
+ 443.0867	+ 12.1620	+1888.0760	+ 36.7209	+ 12.1620	+ 107.2815
+ 442.0732	+ 12.3482	+1889.7901	+ 38.7122	+ 12.3482	+ 107.0773
+ 441.0591	+ 12.5213	+1891.5052	+ 40.7047	+ 12.5213	+ 106.9349
+ 440.0445	+ 12.6822	+1893.2212	+ 42.6982	+ 12.6822	+ 106.7924
+ 439.0294	+ 12.8318	+1894.9380	+ 44.6927	+ 12.8318	+ 106.6637
+ 438.0140	+ 12.9709	+1896.6554	+ 46.6878	+ 12.9709	+ 106.6177
+ 436.9983	+ 13.1011	+1898.3733	+ 48.6836	+ 13.1011	+ 106.5716
+ 435.9823	+ 13.2238	+1900.0917	+ 50.6798	+ 13.2238	+ 106.5386
+ 434.9661	+ 13.3404	+1901.8103	+ 52.6764	+ 13.3404	+ 106.5823
+ 433.9498	+ 13.4526	+1903.5292	+ 54.6732	+ 13.4526	+ 106.6259
+ 432.9334	+ 13.5619	+1905.2482	+ 56.6703	+ 13.5619	+ 106.6796
+ 431.9170	+ 13.6697	+1906.9673	+ 58.6673	+ 13.6697	+ 106.7910
+ 430.9006	+ 13.7777	+1908.6854	+ 60.6644	+ 13.7777	+ 106.9024
+ 429.8842	+ 13.8876	+1910.4054	+ 62.6614	+ 13.8876	+ 107.0158
+ 428.8679	+ 14.0009	+1912.1242	+ 64.6582	+ 14.0009	+ 107.1404
+ 427.8518	+ 14.1187	+1913.8428	+ 66.6547	+ 14.1187	+ 107.2650
+ 426.8385	+ 14.2420	+1915.5611	+ 68.6509	+ 14.2420	+ 107.3721
+ 425.8201	+ 14.3717	+1917.2791	+ 70.6467	+ 14.3717	+ 107.3860
+ 424.8045	+ 14.5080	+1918.9967	+ 72.6420	+ 14.5080	+ 107.4395

SAMPLE DRAWING
This sample drawing shall be construed as information only. It is complete only to the degree necessary to illustrate a particular drawing type.

Fig. 15-11 Software Installation Drawing

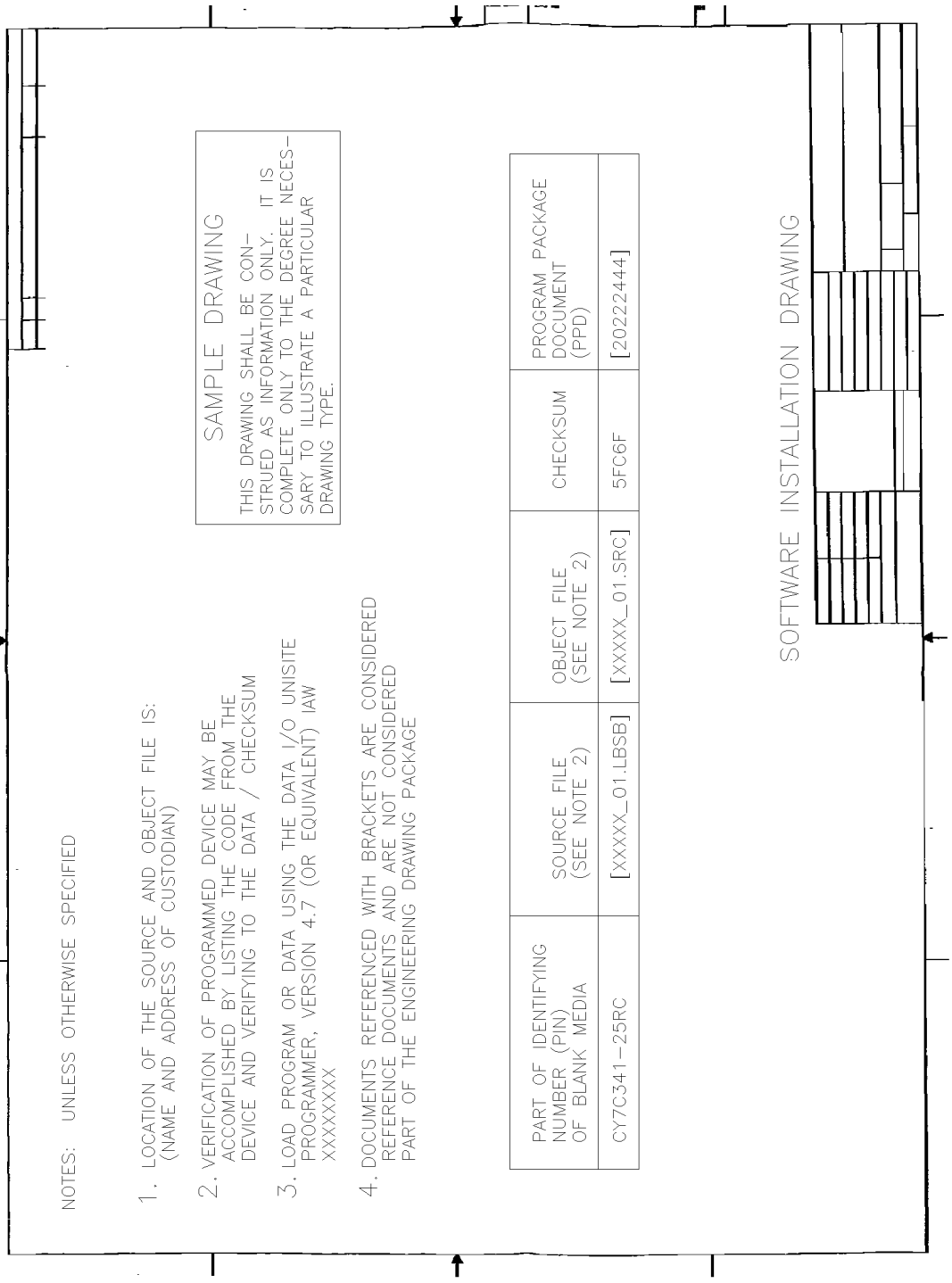


Fig. 15-12 Alternate Parts Drawing (Cover Sheet Not Shown)

PARTS

Always read this list from the left hand column entitled “REQUIRED PART NUMBER’. Alternate part number(s) are listed to the right in increasing order of preferred use. Where more than one line of acceptable alternate part numbers is shown, read line-by-line in normal text manner.

* indicates the required part number and its acceptable alternate part number(s) must have the same dash number.

REQUIRED PART NUMBER	NOTE	PART NAME	ACCEPTABLE ALTERNATE PARTS
AS100026		LOCKWIRE	AS3510
MS9020-XX	1	PACKING, PREFORMED, "O" RING	AS3578-9XX
MS9021-XXX	2	PACKING, PREFORMED	AS3578-XXX
MS9241-*		PACKING, PREFORMED	AS3551-*
MS9068-*		PACKING, PREFORMED	AS3582-*
MS35276-XX*	3	SCREW, MACHINED, DRILLED FILLISTER HEAD SLOTTED	MS35276-2XX
MS35276-1XX*	3	SCREW, MACHINED, DRILLED FILLISTER HEAD SLOTTED	MS35276-3XX

NOTES:

3. DASH NUMBERS PER INTERCHANGEABILITY TABLE IN NASM35276

2. MS9021-XXX IS REPLACED BY AS3578-XXX (EXACT SUFFIX)

1. MS9020-XX IS REPLACED BY AS3578-9XX (9 + EXACT SUFFIX)

SIZE	DAI	DWG. NO.	REV.
A			
SCALE: NONE		SHEET 2	

Fig. 16-1 Drawing Tree

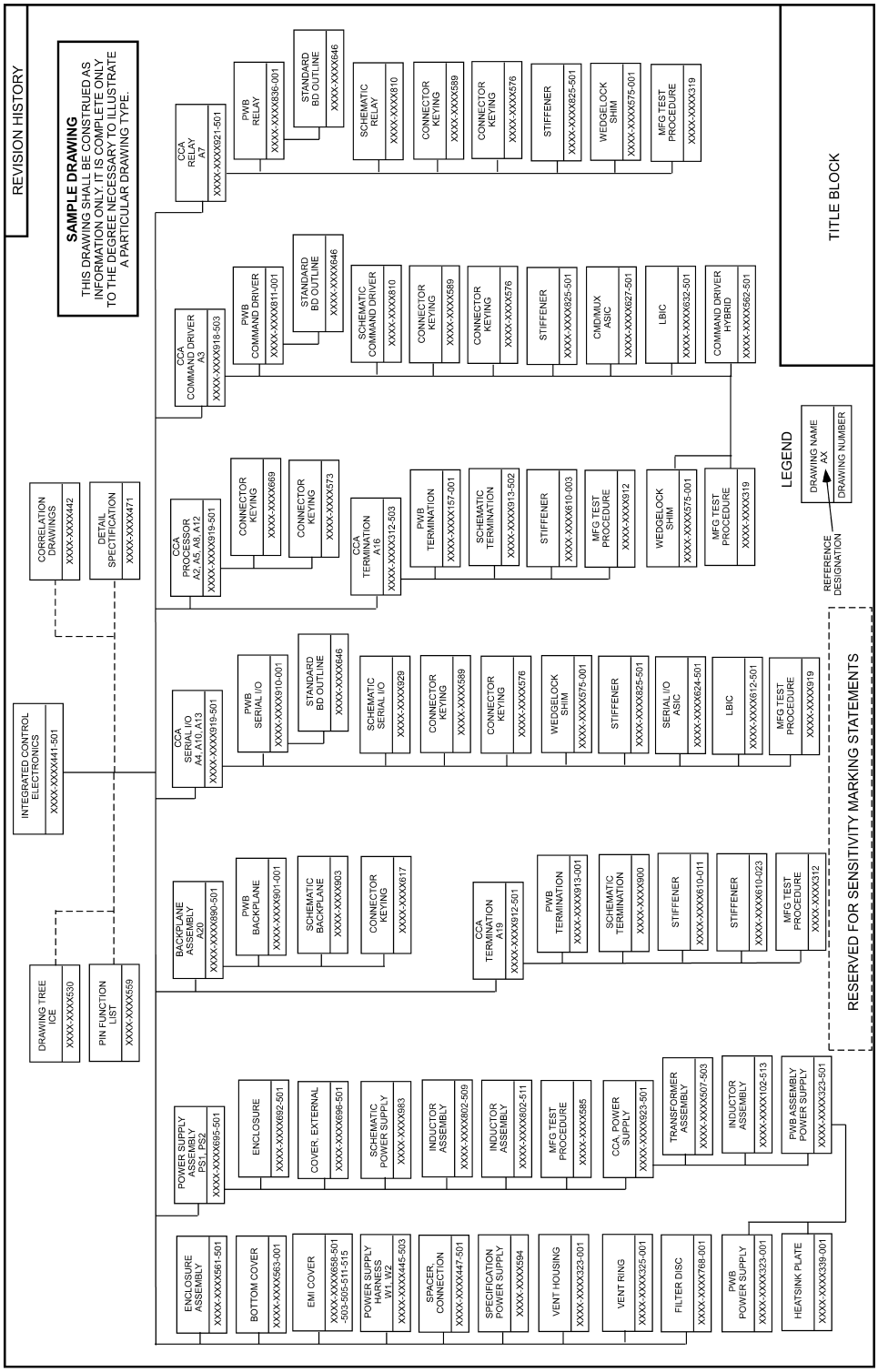


Fig. 16-2 Block Entry Example (Mandatory Entries)

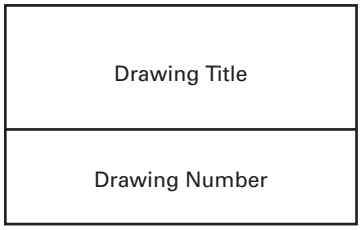
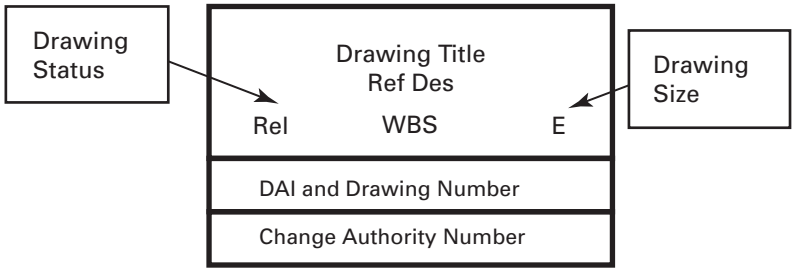


Fig. 16-3 Block Entry Example (Includes Optional Entries)



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NONMANDATORY APPENDIX A
SELECTION OF DRAWING TYPES

A-1 INTRODUCTION

This Nonmandatory Appendix provides additional guidance for the selection of drawing types contained in ASME Y14.24-2012. Proper use will minimize preparation of nonstandard drawing types.

A-2 GROUPINGS

Table A-1 categorizes the basic drawing types defined in sections 4 through 14 and defines the relationship between these types and the special application drawings defined in section 15.

A-3 SELECTION

The types of drawings to be prepared are based on
(a) contractual requirements, when applicable
(b) type of item involved
(c) development phase of the item
(d) intended use of the drawing package

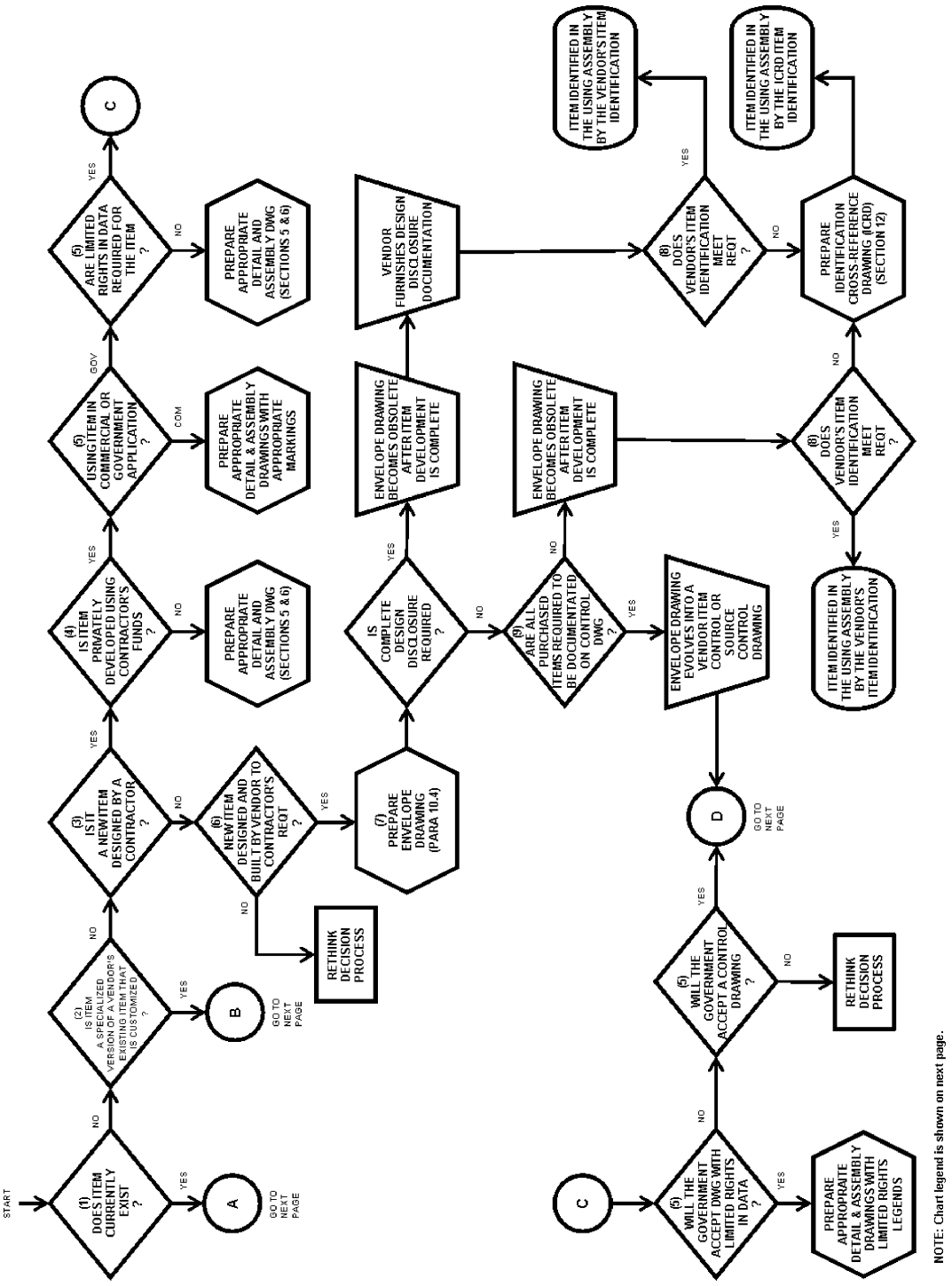
Figure A-1 provides guidance for selecting drawing types for procured items. This figure illustrates the selection process for the Department of Defense (DoD) application. However, the same selection process and documentation may be used in a commercial application if desired.

Normally, in a commercial environment, the contractor or customer does not require extensive detail and documentation for purchased items, the alteration or selection of purchased items or nationally recognized standard items, the development of a new item, or the reidentification of an item. A procurement control drawing may be used instead of a vendor item control, source control, altered item, selected item, envelope, or identification cross-reference drawing to provide the minimum detail necessary for commercial requirements. See para. 10.1.

Table A-1 Functional Grouping of Drawing Types

Design Information Drawings (No Direct Hardware Control)	Hardware and Software Drawings (Fabrication and Kit Control)	Control Drawings (Interchangeability Control)
Layout drawing (section 4) Contour definition drawing (para. 15.9)	Layout drawing [para. 4.3(k)]	Procurement control drawing (para. 10.1)
Installation drawing (section 7)	Detail drawing (section 5) Monodetail drawing (para. 5.1) Multidetail drawing (para. 5.2) Master drawing (para. 15.3.3.2) Tube bend drawing (para. 15.7) Contour definition drawing (para. 15.9) Software installation drawing (para. 15.10.2)	Vendor item control drawing (para. 10.2)
Arrangement drawing (section 9)		Source control drawing (para. 10.3)
Interface drawing (section 11)		Envelope drawing (para. 10.4)
Mechanical schematic diagram (section 13)		Identification cross-reference drawing (section 12)
Functional block diagram (para. 14.1)		Microcircuit drawing set (para. 15.4)
Single-line diagram (para. 14.2)		
Schematic diagram or circuit diagram (para. 14.3)	Assembly drawing (section 6) Assembly drawing (para. 6.1) Inseparable assembly drawing (para. 6.2) Wiring harness drawing (para. 15.1) Cable assembly drawing (para. 15.2) Board assembly drawing (para. 15.3.3.1) Tube bend drawing (para. 15.7)	
Connection diagram or wiring diagram (para. 14.4)		
Interconnection diagram (para. 14.5)		
Wiring list (para. 14.6)		
Logic circuit diagram (para. 14.7)		
Drawing tree (section 16)		
	Installation drawing [para. 7.3(h)]	
	Modifying drawings (section 8) Altered item drawing (paras. 8.1, 15.10.4, 15.10.4.1) Selected item drawing (para. 8.2) Modification drawing (para. 8.3)	
	Wiring list (para. 14.6)	
	Artwork (para. 15.3.3.3)	
	Artwork master (para. 15.3.3.4)	
	Production master (para. 15.3.3.5)	
	Master pattern drawing (para. 15.3.3.6)	
	Undimensioned drawing (para. 15.5)	
	Kit drawing (para. 15.6)	
	Matched set drawing (para. 15.8)	

Fig. A-1 Decision Diagram for Determining Applicable Drawing Types for Procured Items



NOTE: Chart legend is shown on next page.

Fig. A-1 Decision Diagram for Determining Applicable Drawing Types for Procured Items (Cont'd)

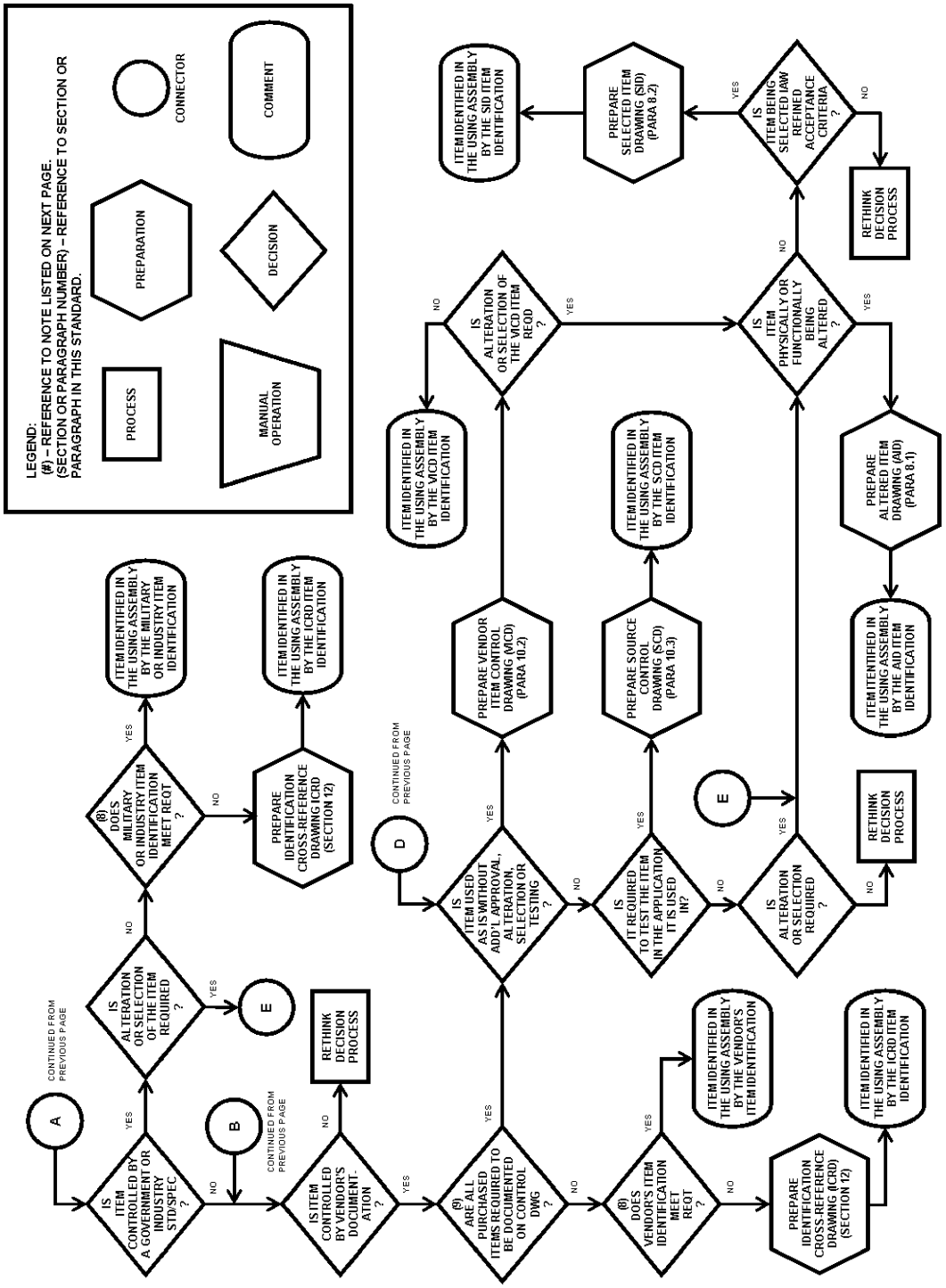


Fig. A-1 Decision Diagram for Determining Applicable Drawing Types for Procured Items (Cont'd)

NOTES:

(1) An existing item is an item that is currently sold or traded.

(2) Also referred to as a "vendor-developed item."

(3) Any item for which the configuration (e.g., size, shape, tolerance, finish, etc.) is developed and specified by the design activity shall be considered the design activity's design. If the item is subcontracted to a vendor to be manufactured, i.e., the design activity's design documentation is submitted to the vendor, it is still considered the design activity's design regardless of whether a vendor's proprietary process is required in manufacturing it.

(4) See below.

(a) COMMERCIAL APPLICATION. If a customer is buying design disclosure drawings of the item that is being designed and built, negotiations shall be made between the design activity and the customer to determine how a design activity's proprietary design information will be protected. One option available to a design activity is to copyright their design information.

(b) GOVERNMENT APPLICATION. If a customer is buying design disclosure drawings of the item that is being designed and built, a design activity may prepare documentation with limited rights legends to protect their proprietary information. A careful analysis of the contract and a review and approval with the customer should be made prior to determining the proper method of documenting the item.

(5) See below.

(a) COMMERCIAL APPLICATION. If the data is being sold to a commercial customer, contractual agreements may be made between the design activity and the customer limiting the customer's use of the data. A design activity may protect their data by applying a proprietary legend, copyright, or both to their drawings.

(b) GOVERNMENT APPLICATION. A design activity may protect their data by limiting the government's right in using the data. An appropriate limited rights legend and suitable markings, if needed, may be added to the drawing to indicate limitations in the use of the data. In some contractual situations, the government may not accept data with limited rights but will allow the design activity to document their design, i.e., the end item, on an appropriate control drawing, i.e., a vendor item control drawing or source control drawing. The design activity is identified as a source of supply on the drawing. A careful analysis of the contract and a review and approval with the customer should be made prior to determining the proper method of documenting the item.

(6) The design activity supplies basic technical information and performance requirements about an item to a subdesign activity, i.e., a vendor. This data may be detailed in a procurement specification that is referenced on an envelope drawing, or all design parameter data may be included on the drawing, i.e., the procurement specification is not needed. The subdesign activity designs and builds an item that meets the design activity's design parameters. The subdesign activity is the controlling design activity for the item.

(7) If required, design disclosure drawings are purchased from the subdesign activity and included in the design activity's drawing package. Envelope drawings are only temporary drawings and become obsolete after development of the item is complete. However, applicable control drawings may be evolved from them. See Fig. A-1. An envelope drawing should never be referenced on a using assembly unless it is later removed or is replaced with the appropriate item identification.

(8) See below.

(a) COMMERCIAL APPLICATION. Item identification may consist of a PIN of the item along with the DAI. If the original item identification cannot be used due to its length or contains characters unacceptable for data processing, an identification cross-reference drawing may be created to assign an acceptable identifier.

(b) GOVERNMENT APPLICATION. An acceptable item identification consists of a valid CAGE Code of the responsible design activity plus the PIN that includes the controlling document number and optional suffix.

EXCEPTION: The part number of a government or industry standard item may or may not include the controlling document number as a part of the item identification. If the original item identification cannot be used due to its length or contains characters unacceptable for data processing, an identification cross-reference drawing may be created to assign an acceptable identifier.

(9) See below.

(a) COMMERCIAL APPLICATION. Unless otherwise specified by contract, a design activity may choose to document all purchased items on applicable control drawings for traceability and interchangeability purposes. If not, the envelope drawing becomes obsolete and the design activity shall rely solely on the vendor's item identification for subsequent procurements of the item.

(b) GOVERNMENT APPLICATION. The contract should specify whether purchased items will be documented on applicable control drawings or vendor item identifications will be used.

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