MIL-I-28947C(MC)
19 May 1993
SUPERSEDING
MIL-I-28947B(MC)
4 June 1991

MILITARY SPECIFICATION

ILLUSTRATIONS FOR STOCK LIST PUBLICATIONS: PREPARATION OF

This specification is approved for use by the U.S. Marine Corps, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers requirements for the preparation of illustrations intended for use with manuals prepared by or for the Marine Corps in production of repair parts stock list publications. This includes both stand alone Marine Corps Stock Lists (SL-3 and SL-4) and the illustrations used in the repair parts list that are part of a technical manual (&P's). It furnishes guidance in planning and selecting style and type of illustration, and establishes requirements for materials sizing, identification, and for the packaging of illustrations.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander (PSE), Marine Corps System Command, Quantico, Va. 22134-5080 by using the self-addressed Standardization Document Improvement Proposal (DD form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC TMSS

SPECIFICATIONS

MILITARY

MIL-P-4672	- Paper, Photographic, Black and White, Sensitized.

STANDARDS

MILITARY

MIL-STD-129	- Marking for Shipment and Storage.
MIL-STD-1388-2	- DoD Requirements for a Logistic Support Analysis Record.

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the documents cited in the solicitation (see 6.2).

DEPARTMENT OF DEFENSE

Industrial Security Manual for Safeguarding Classified Information (Attachment to DD Form 441)

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402.)

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification

(Application for copies should be addressed to the Uniform Classification Committee, Attn: Tariff Publishing Officer, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

AMERICAN TRUCKING ASSOCIATION

National Motor Freight Classification

(Application for copies should be addressed to the American Trucking Association, Attn: Traffic Order Section, 2200 Mill Road, Alexandria, VA 22314.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Restrictions. Illustrations prepared in accordance with this specification shall not employ the following techniques or methods:

a. The use of color.

b. The placement of captions or figure titles on illustrations, except when unavoidable.

c. The use of credit lines, trade names, manufacturer's or distributors names, symbols, or trademarks.

d. The use of cartoons.

e. The use of borders around a single illustration shall not be used, but borders may be used to separate multi-section illustrations on the same page (see figure 1).

f. The use of photographs (half tone type) for illustrations.

3.2 Planning the illustrations. Illustrations shall be carefully planned to furnish a pictorial identification of parts, tools, and/or equipment, insuring all important details are shown. The minimum number of illustrations essential for such purposes shall be used.

3.2.1 Method of illustrating. Existing and available illustrations shall be used where the planned illustrations are identical and they meet the requirements of this specification. All illustrations prepared shall be three-dimensional line illustrations (see 6.3.9), except for printed wiring boards and cables. These items do not require a three-dimensional illustration.

3.2.1.1 Line illustrations. The conception and treatment of a line illustration should be such to show the subject clearly and concisely. In the preparation of the line illustrations, drafting practices that are used in high-grade commercial instruction books should apply.

3.2.1.2 Sizing of illustrations. An illustration shall be sized to insure the most effective use of space in the final publication. An illustration shall be of sufficient size to provide clarity and legibility. The sizing of an illustration will be determined by (1) the number of parts to be called out and, (2) the detail required to show how an assembly is put together (see 3.9).

3.2.1.3 Assembled view (end item). An assembled view (see 6.3.2) shall be used as the lead illustration to identify the equipment covered by the publication. A lead illustration is defined as an illustration in the front of a publication showing the complete end item in a three-quarter front or rear view. When used as a lead illustration for a publication, the assembled view should show only the equipment with the background removed (see figure 2). When two or more overall views of the equipment are required, they shall be selected to reveal different aspects of the equipment or to display the surfaces of the assembled equipment which have unique and distinctive features.

3.2.1.4 Exploded view. An exploded view (see 6.3.5) shall be used to identify parts, or to illustrate the relationship of parts. The exploded view shall show a complete parts breakdown of an assembly or component (see figure 3). A complete parts breakdown shall be used to identify all individual parts. A partial disassembly may be used where identical parts are attached to a common chassis or panel and the display of the one part is typical of the others. For example, when showing hardware, if all are identical then you may show one exploded (screw, washers and nut) and the others in place. Parts in an exploded view shall be arranged in correct disassembled position and shall be shown in proportional size to each other. The spacing of parts in an exploded view shall achieve maximum clarity with economy of space. Flow lines (see 6.3.6) may be used to relate the exploded parts to each other.

3.2.1.5 Cutaway view. With the outside of an item or assembly shown (clearly so it may be identified), part of the outer shell or housing is "cut away" clearly showing parts that are on the inside (see figure 4).

3.2.1.6 Phantom view. There are two types of phantom views. (1) Showing an item phantomed in place for location or reference. (2) Showing the exterior of an assembly or parts as through clear material with the exterior phantomed and the interior parts or items with bold solid lines. Phantom lines are shown as dashed lines (see figure 5).

3.2.1.7 Illustrations other than exploded views. There is no requirement to show exploded views of assemblies and components which are basically electronic items such as printed circuit boards and cables. These items still require leader lines and callouts for each item shown on the illustration. Illustrations requiring multiple sheets to clearly show all components shall have a location indicator in the upper left corner of each sheet, showing the area to be illustrated (see figure 6, sheets 1 and 2).

3.2.1.8 Collection type illustrations. Collection type illustrations shall be used for showing groups of items, systems, major combinations of equipment, vehicles, groups, kits, outfits, sets, or any assortments used in a components lists (SL-3) (see figure 7).

3.2.1.8.1 Collection of tools. An illustration for a collection of tools (special tools required for components lists) shall show each tool clearly represented, without overlapping, and in correct relative size to each other (see figure 8).

3.2.1.8.2 Sets and kits. An illustration for a set or a kit shall depict the empty container and all the components grouped nearby in an orderly manner (see figure 9).

3.2.1.9 Combinations of types of illustrations. An illustration may be used to combine two or more types of views to clarify pictorial data. For example, an exploded view illustration may also show a small assembled view for the purpose of location or reference (see figure 11).

3.2.1.10 Illustrations for repair parts lists. Illustrations for repair parts lists shall be sized for printing a full page illustration (full page vertical or turn page). In manuals prepared by the contractor, the illustrations may be sized to allow space for a legend (see 6.3.8) on the same page, providing no more than ten callouts are required to identify the parts. Where the inclusion of such a legend is not feasible because of insufficient space on the illustration page, the legend will be placed on the page facing the illustration.

3.3 Components of an end item. Components and accessories for major end items shall be illustrated to show all items that are a part of the assembly or equipment (see figure 10).

3.4 Basic materials. Illustrations that are produced on a drawing board shall be prepared on durable material such as vellum, which will provide a white background when the illustration is reproduced photographically. If the illustrations are produced on a computer system the printer used should be: (1) at least 600 dots per inch type (2) able to produce sharp, well-defined camera-ready quality prints.

3.5 Line weights. Lines shall have sufficient weight and size to insure good reproduction when the illustration is reduced to final size. Darker or heavier lines on the outside of objects may be used to give form and depth; however, over emphasis by unnecessary shading shall be avoided.

3.6 Flow lines. The relationship of parts on an exploded view illustration may be aided by the use of flow lines. Flow lines shall be used where they assist in locating parts (see figure 3) or where the main line of exploded parts has been broken into two or more groups for convenience of layout on the page. Flow lines should not be used when the exploded view has relatively few parts and their assembled positions are obvious.

3.7 Callouts, arrows and leader lines. Callouts (see 6.3.3) consisting of numbers only, shall be used with leader lines (see 6.3.7), or arrows (see 6.3.1) on the illustration. Parts shall be called out by the leader line or arrow touching the part and extending clear of the assembly for placement of the callout (see figure 6).

3.7.1 Assignment of callouts. Callouts on an illustration shall be Arabic numerals in sequence, starting with number 1. These callout numbers shall be placed in a clockwise numerical sequence around the illustration beginning at the eleven o'clock position. Parts grouped together by brackets to show relationship within an assembly or subassembly shall have callout numbers in the clockwise manner starting with the callout for the assembly or subassembly, then going inside the bracket to reference all of the parts of the assembly. An assembly which is shown on the illustration but broken down on a subsequent figure shall be referenced to the subsequent figure and shall not be identified by a callout (see figure 5). If a figure has more than one sheet, the callouts should start with one on the first sheet and continue at eleven o'clock on the next sheet with the next highest number (see figure 6, sheet 1 & 2).

3.7.2 Cross reference list. The contractor shall furnish a cross reference list on a separate typed sheet for each figure (which may be more than one illustration). The cross reference list shall provide the following information: (1) the figure key callout from the illustration, (2) the noun name for the item as shown in the provisioning data, (3) a provisioning line item sequence number (PLISN). In a contractor prepared publication the cross reference list may be on the same sheet as the final illustration, if space will permit and no more than ten callouts are required. Larger cross reference lists shall be on the page that faces the illustration. If the figure has more than one page, the cross reference list should come after the last page.

3.7.3 Identical parts. Identical parts on an assembly within a figure will be identified by the same callout. However, on a multi-subassembly illustration, identical parts with a bracket may have a different callout. For example, a screw used in an assembly may have a different callout than the same screw used in another place on the figure.

3.7.4 Applying callouts, leader lines, and arrows. Arrows and leader lines shall be straight without crossing other leader lines, and (if necessary) may contain only one bend. Callouts, leader lines and arrows shall be placed in a logical arrangement to prevent long leader lines and crowding of the illustration. Leader lines should not run parallel to flow and axis lines or at an angle which may cause confusion with the object lines on the illustration. Leader lines should be bold and be of a good consistency and size (no less than a 0 line weight), but should not overpower the artwork. When a leader line must cross an object line(s), a "white shadow" should appear along the uppermost edge of the leader line, to ensure the correct item is called out. Special care should be taken to ensure that leader lines and their "white shadow" do not obscure important details. Leader lines and arrows should be the same size throughout an illustration package.

3.7.5 Callout size and type face. Type face used in callouts shall be of mechanical type and shall not be freehand lettering. Type face of helvetica medium, or equal should be used. Callouts should be eight to ten points in size. Lettering that is less than eight points at printed size is not acceptable.

3.8 Identifying illustrations. The figure title and number should appear on each page of each figure outside of the image area for the preliminary and final illustrations.

3.8.1 Figure number. Each illustration shall be identified by a figure number of arabic numerals, assigned in consecutive sequence within a single publication. Figures should be sequenced in a topdown breakdown fashion after the order of the provisioning parts list (PPL). For example, figure 1 should be the end item with no callouts. Figure 2 should be the end item exploded out with items called out that are, (1) first in the PPL and, (2) not broken out later as an assembly. Figure 3 shall be the assembly broken down in the PPL. Figure 4 and all other figures as needed shall follow in order of the PPL. The assemblies in each figure should be broken down completely before going on to the next figure.

3.9 Topdown breakdown. A breakdown shall be accomplished by sequencing all parts comprising the end item in a lateral and descending "family tree/generation breakdown" order. This breakdown shall consist of the end item including all components, listing every assembly, subassembly, and parts which can be disassembled, and/or be replaced. All parts are listed in their relation to the end item, component, or assembly in which they are contained. This relationship is shown by means of an indenture code.

3.10 Reproduction of illustrations. Illustrations shall be reproduced in accordance with high quality commercial standards. Workmanship and materials used shall contribute to copy prints which accurately and clearly reproduce the original illustrations.

3.10.1 Copy prints. Copy prints shall conform to the following:

3.10.1.1 Quality of copy prints. The quality of copy prints shall be sharp and clear. Copy prints shall be prepared on standard printing paper as specified in MIL-P-4672. For a single publication, the copy paper of one manufacturer and one type of emulsion shall be used.

3.10.1.2 Number of copy prints required. Three copy prints of each of the final illustrations shall be furnished.

3.11 Sample illustrations. At the request of the procuring activity, the contractor shall furnish artwork specimens representative of the contractor's preparation techniques (package of sample documentation). Artwork shall have each item identified by figure key callouts cross referenced to the applicable line item in the provisioning list (per para 5.3 of MIL-STD-1388-2). A cross reference listing shall accompany each exploded view. The artwork should consist of a breakdown of a component of the equipment under contract. Sample illustrations will be reviewed with the technical documentation package.

3.12 Preliminary illustrations. The contractor shall furnish, in accordance with the provisioning performance schedule required by MIL-STD-1388-2, two copies of each illustration prepared for the end item assemblies and components under contract. Assemblies and components shall be illustrated to the degree required to identify the parts of such assemblies and components listed in the provisioning list including attaching hardware. Each figure illustration shall include a cross reference list when callouts are required. Normally the end item illustration will not require any callouts.

3.13 Final illustrations. Upon receipt of preliminary illustrations approval from the procuring activity, the contractor shall proceed with the preparation of the final illustrations. Final illustration package shall consist of three 8-1/2 x 11 (inch) glossy copies of the finalized original illustrations with a maximum image area of 7 x 8-1/2 (inch), and three copies of cross reference lists of all the finals. Final illustrations shall be submitted in accordance with the provisioning performance schedule required by MIL-STD-1388-2.

3.14 Workmanship. Illustrations shall be of quality comparable to high-grade commercial instruction books and catalogs. Illustrations shall meet the standards of quality and drafting practices established by the graphic arts profession. Illustrations shall depict clearly, accurately, and as economically as possible the equipment and its pertinent information called for in the provisioning parts list. Illustrations shall allow for minimum loss of detail and contrast in reproduction. Within a single volume or group of related volumes, a consistent style, technique, and workmanship shall be utilized in the illustrations.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspections required to ensure illustration accuracy. Except as otherwise specified in the contract or order, the contractor may use his own facilities for the performance of the inspections. The Government reserves the right to perform any of the inspections set forth in the specification, where deemed necessary to ensure that the contractor's services conform to prescribed requirements.

4.2 Unacceptable final illustration package. For illustrations prepared as specified herein, the following reproducible artwork shall be unacceptable in the final illustration package:

a. Brown line prints, photostats, bromides and prints made by similar process.

b. Out-of-focus or blurred camera-ready artwork.

c. Line illustrations containing weak or broken lines.

d. Illustrations containing illegible callouts.

5. PREPARATION FOR DELIVERY

5.1 Packaging and packing. Packaging and packing of illustrations shall be in containers complying with Uniform Freight Classification rules, National Motor Freight Classification rules or with other rules applicable to the mode of transportation.

5.2 Marking. In addition to any special markings called for by contract or order, packages and shipping containers shall be marked as specified in MIL-STD-129.

5.3 Security requirements. All classified material shall be prepared for transmission in accordance with the Industrial Security Manual for Safeguarding Classified Information attachment to DD-441 Security Agreement DoD.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful.)

6.1 Intended use. The illustrations furnished under this specification are intended for use in the preparation of illustrated technical repair parts publications and components lists, and for other identification purposes.

6.2 Ordering data. Purchasers should exercise any desired options offered herein and ensure that procurement documents specify the title, number, and date of this specification.

6.3 Definitions. For the purpose of this specification, the following definitions should apply:

6.3.1 Arrow. An arrow is a straight black line with an arrowhead, extending from a callout to a part or point identified.

6.3.2 Assembled view. An assembled view is a representation of an exterior view of assembled equipment as it normally appears to the human eye, without shading.

6.3.3 Callout. A callout is a number used to identify a part on an illustration.

6.3.4 Copy print. A copy print is a positive print in reproduction size (with a 7" x 8-1/2" image area) made on standard photographic printing paper.

6.3.5 Exploded view. An exploded view is a representation of parts of equipment in proportionate size and three-dimensional projection, grouped in proper relation to other parts to show assembly or disassembly and usually shown grouped on a line-of-assembly axis.

6.3.6 Flow line. A flow line is a dashed line (usually depicted as a common center line) used on an illustration to relate disassembled parts to each other.

6.3.7 Leader line. A leader line is a straight black line without an arrowhead extending from a callout to a part or point identified.

6.3.8 Legend. A legend is a tabular identification of parts appearing with an illustration on a printed page.

6.3.9 Line illustration. A line illustration is an illustration prepared in black and white by the means of ink, film lead, or computer aided drafting (CAD) system, representing the subject by means of lines that will produce a clear, sharp black line when reproduced.

6.4 Subject term (key word) listing.

Cutaway views
Drawings
Phantom view
Photographs
Stock list publications
Technical Manuals
Topdown breakdown

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

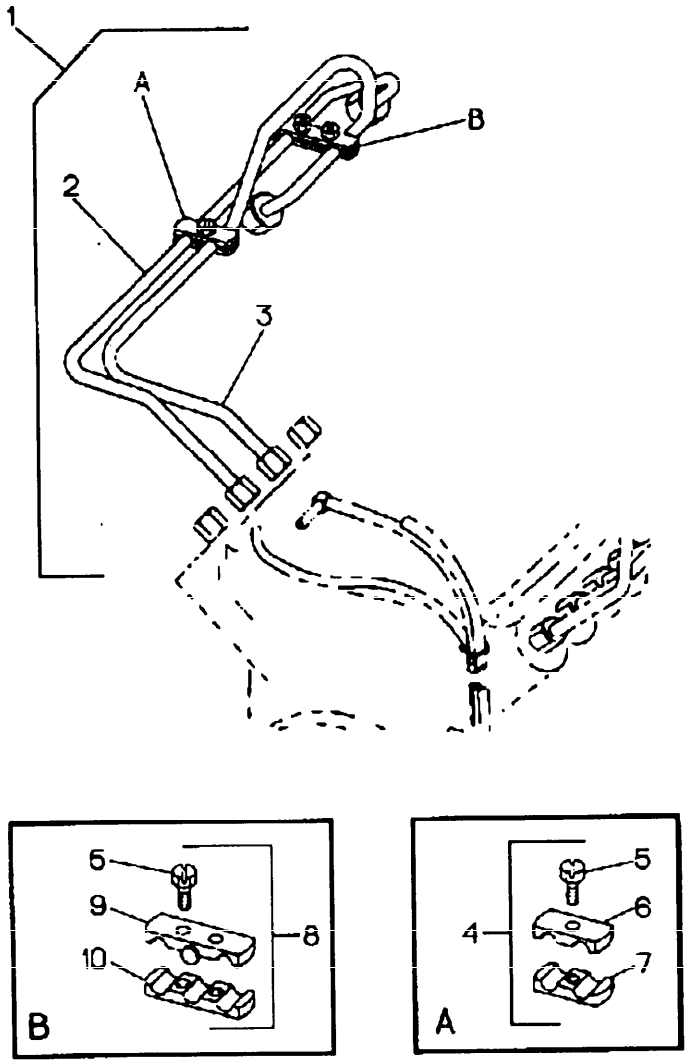


FIGURE 1. Line illustration with details and borders.

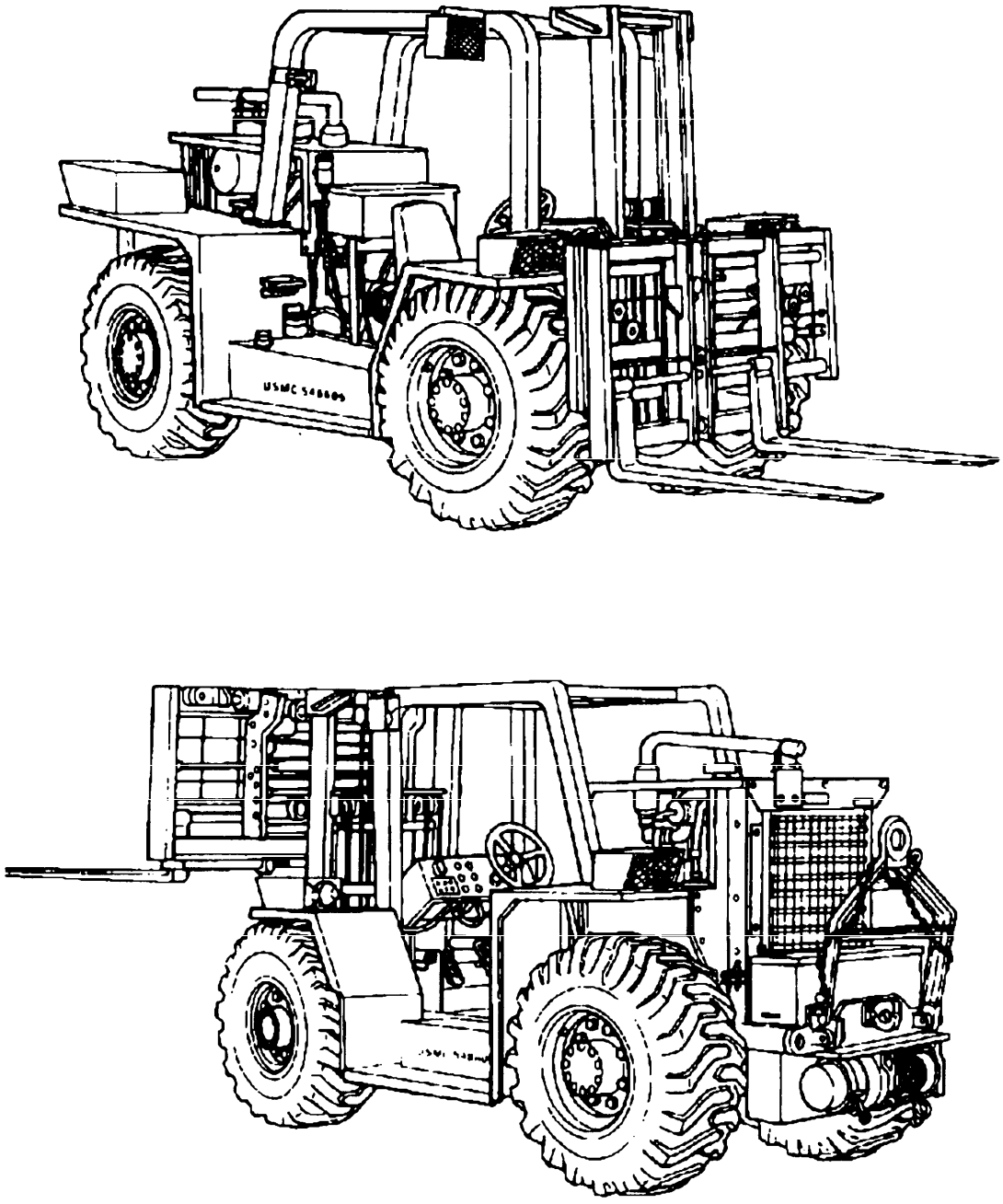


FIGURE 2. End item, line illustration.

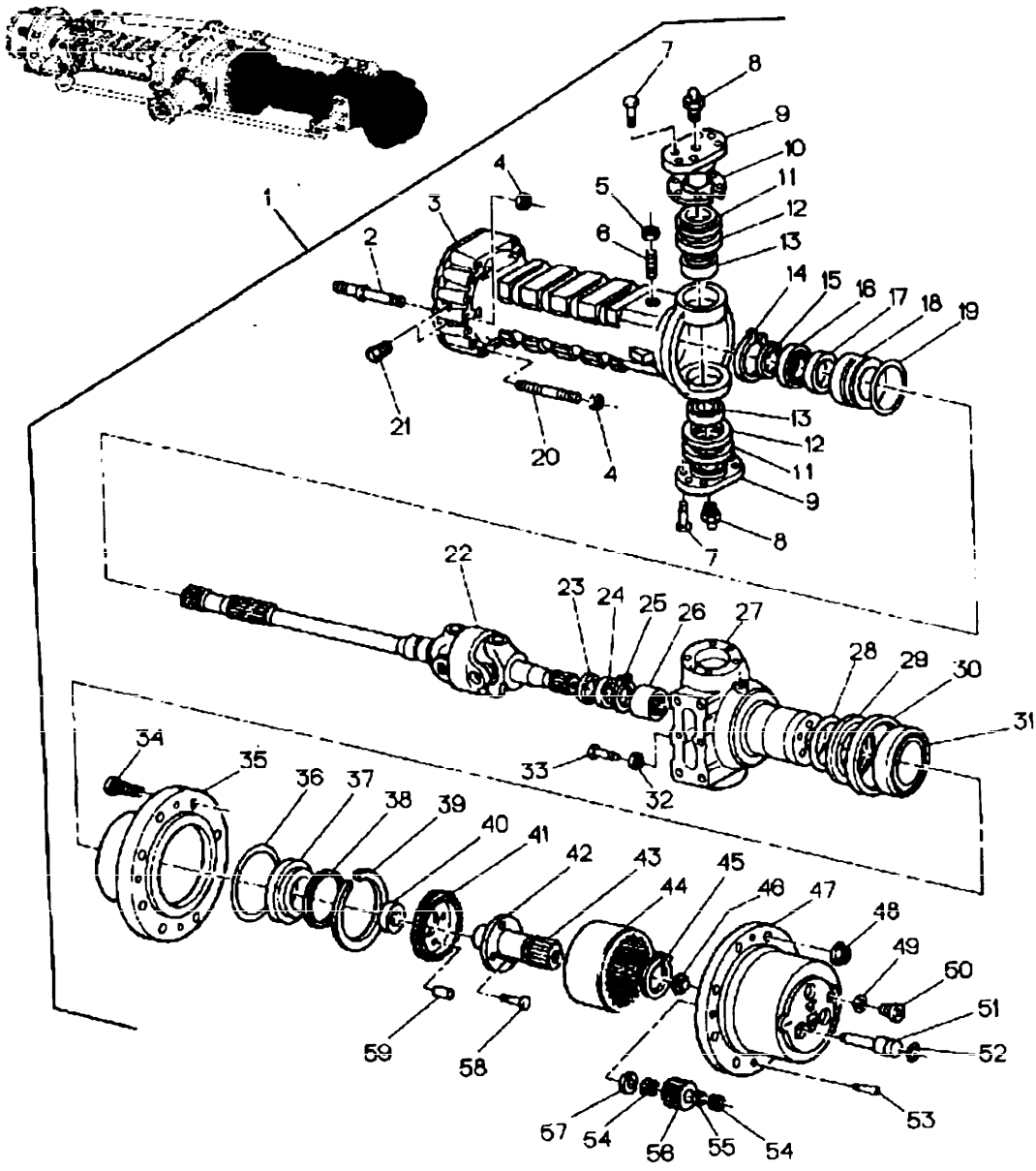


FIGURE 3. Exploded view line illustration.

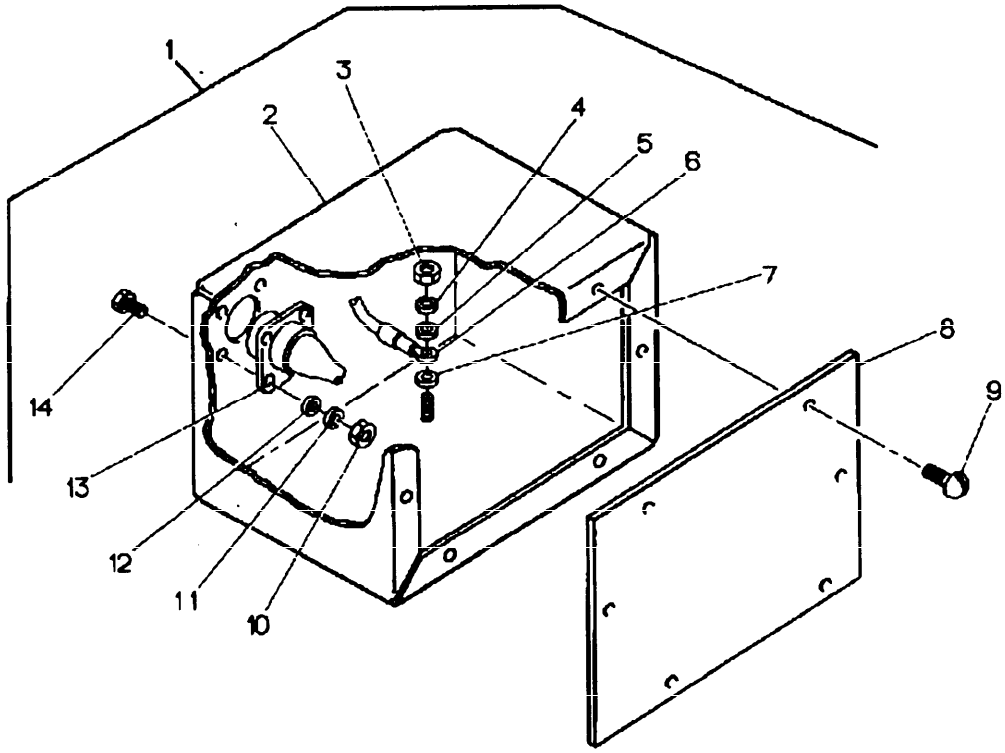


FIGURE 4. Cutaway view illustration.

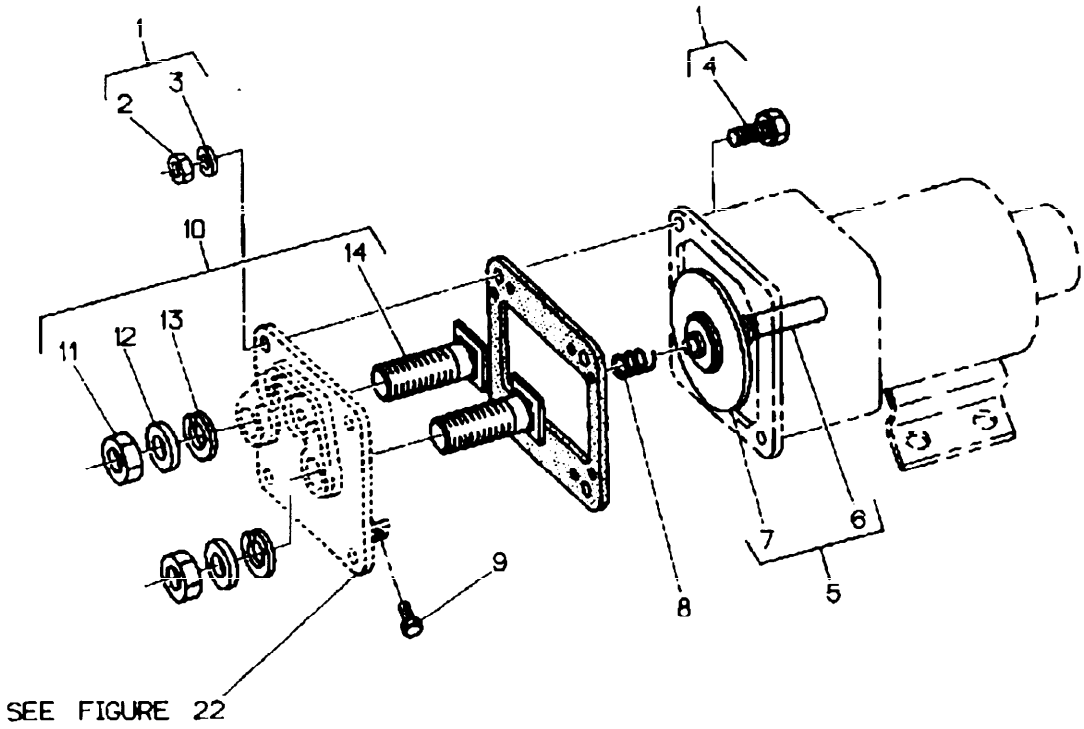


FIGURE 5. Phantom view illustration.

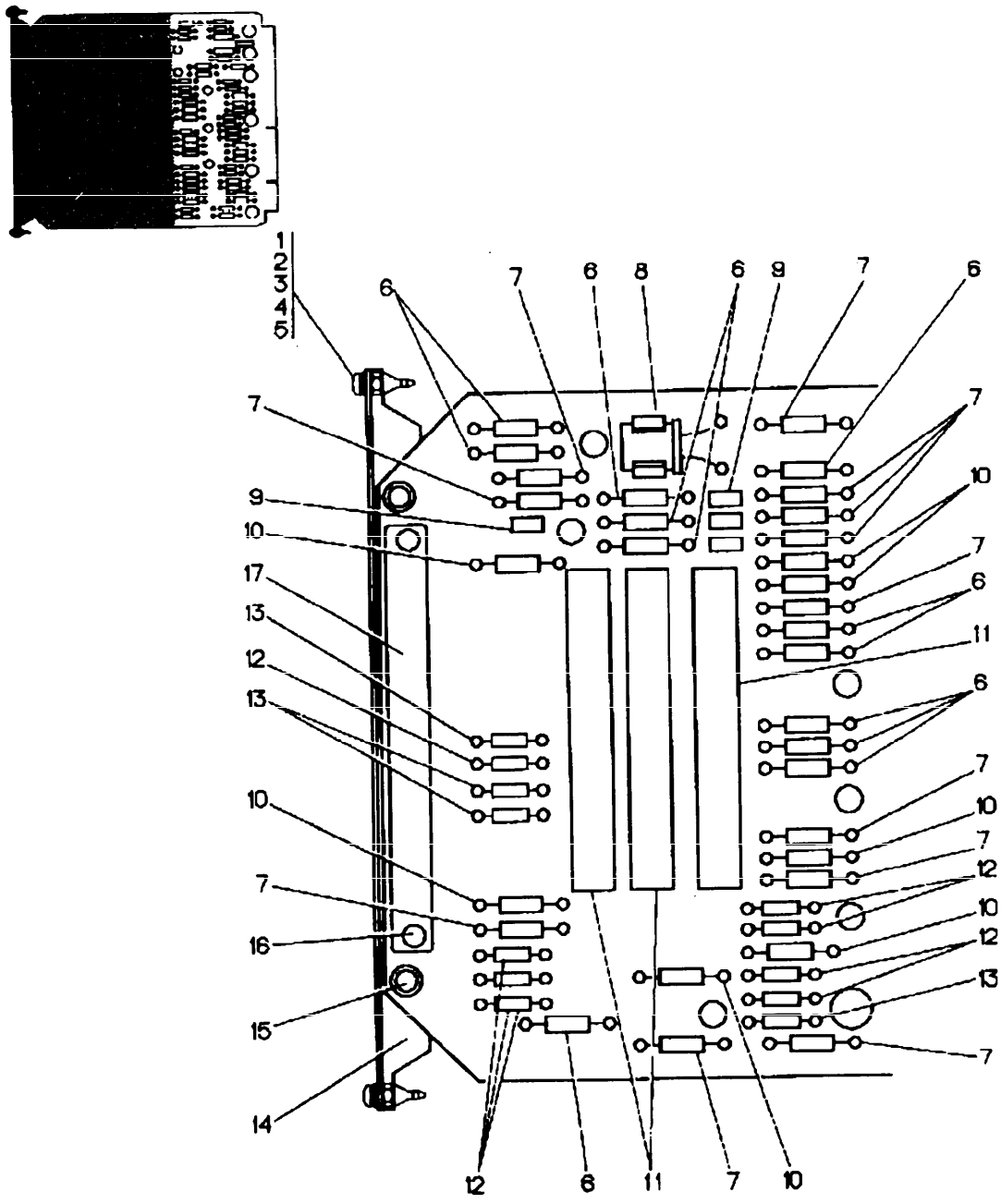
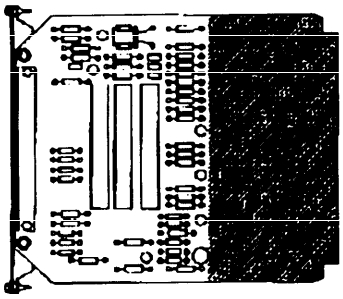


FIGURE 6. Printed circuit card illustration. (sheet 1 of 2)



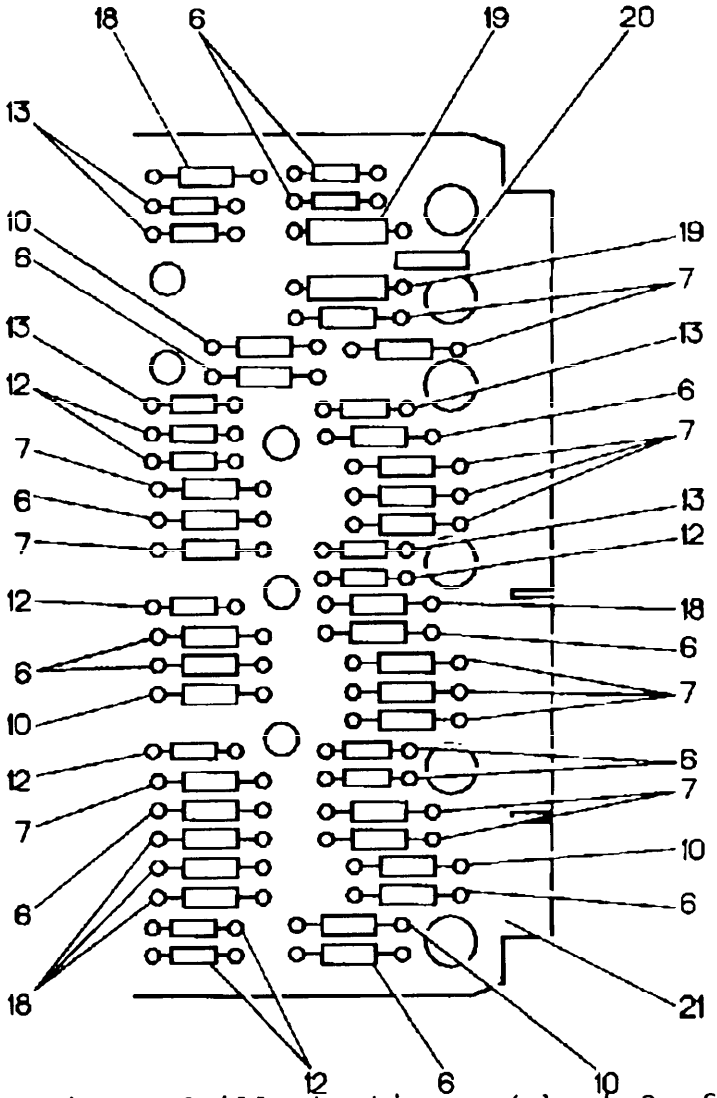


FIGURE 6. Printed circuit card illustration. (sheet 2 of 2)

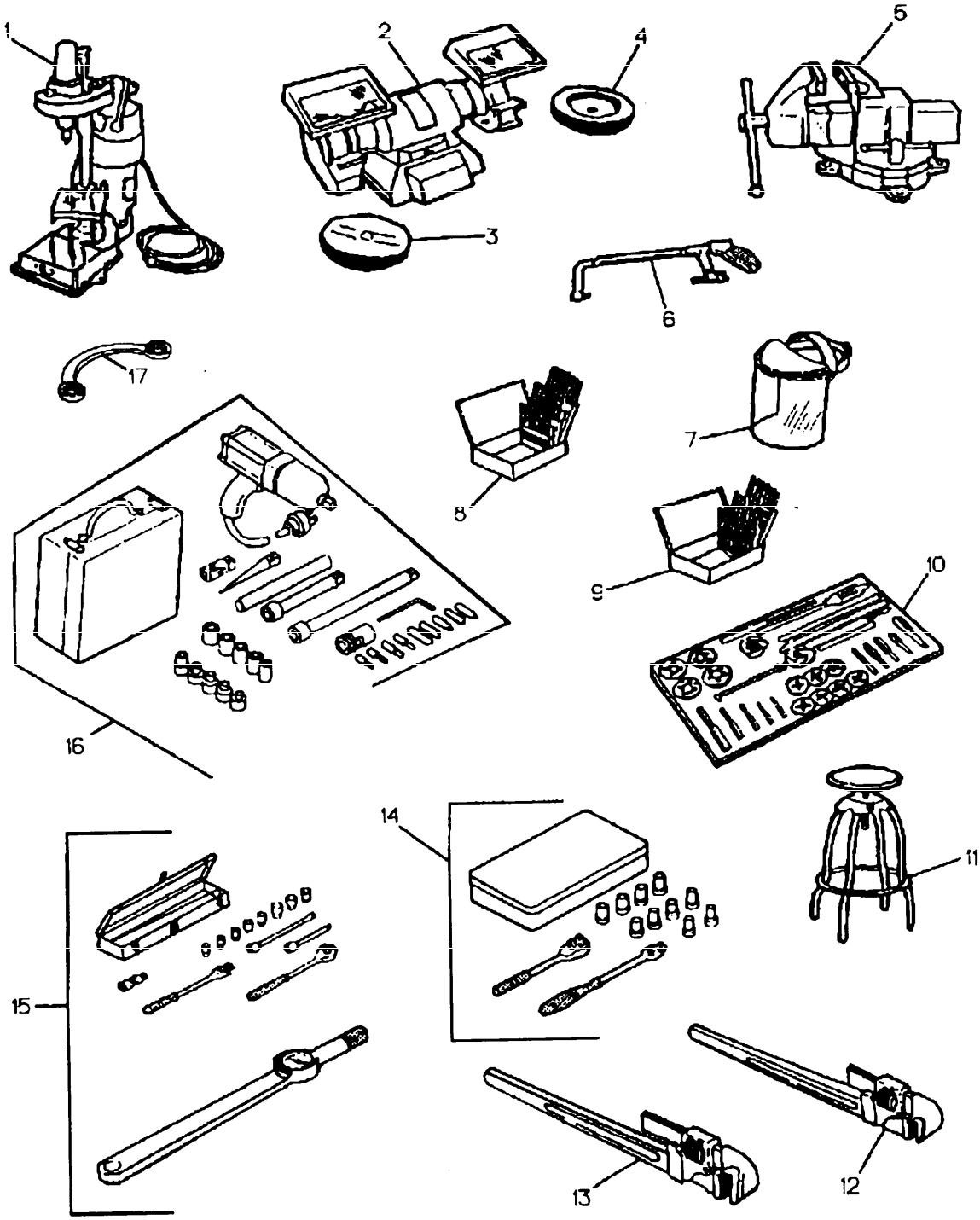


FIGURE 7. Collection type illustration.

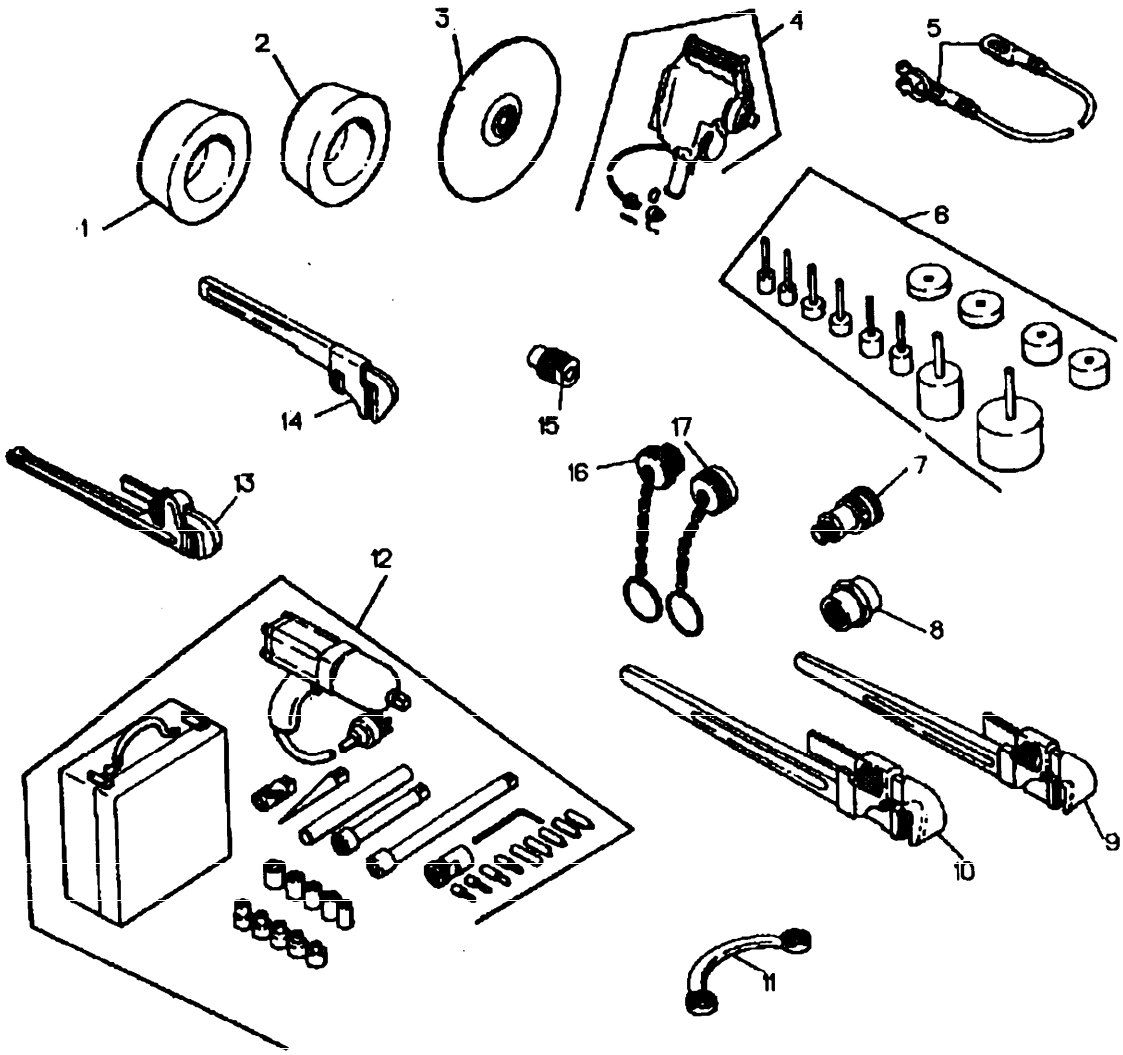


FIGURE 8. Collection of tools illustrations.

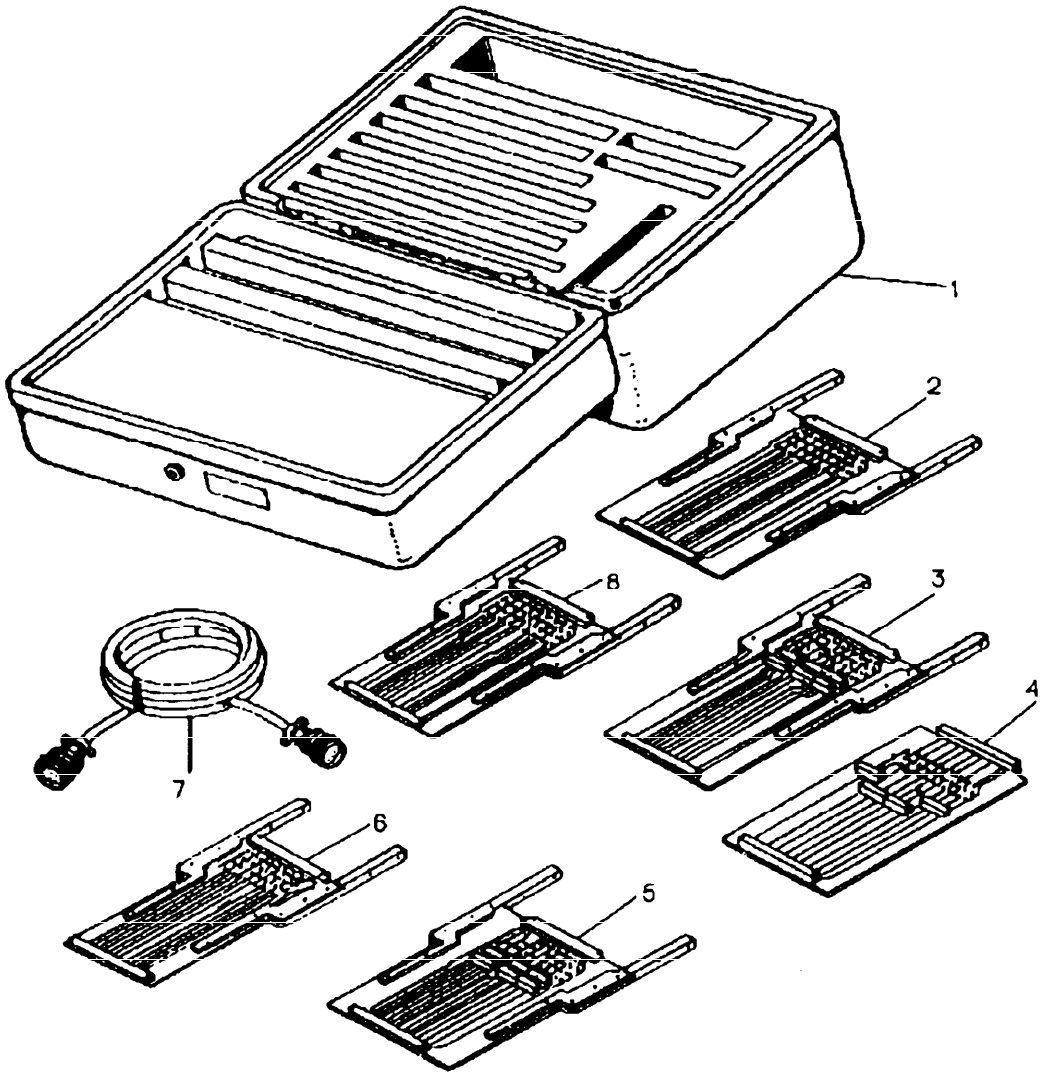


FIGURE 9. Sets and kits illustration.

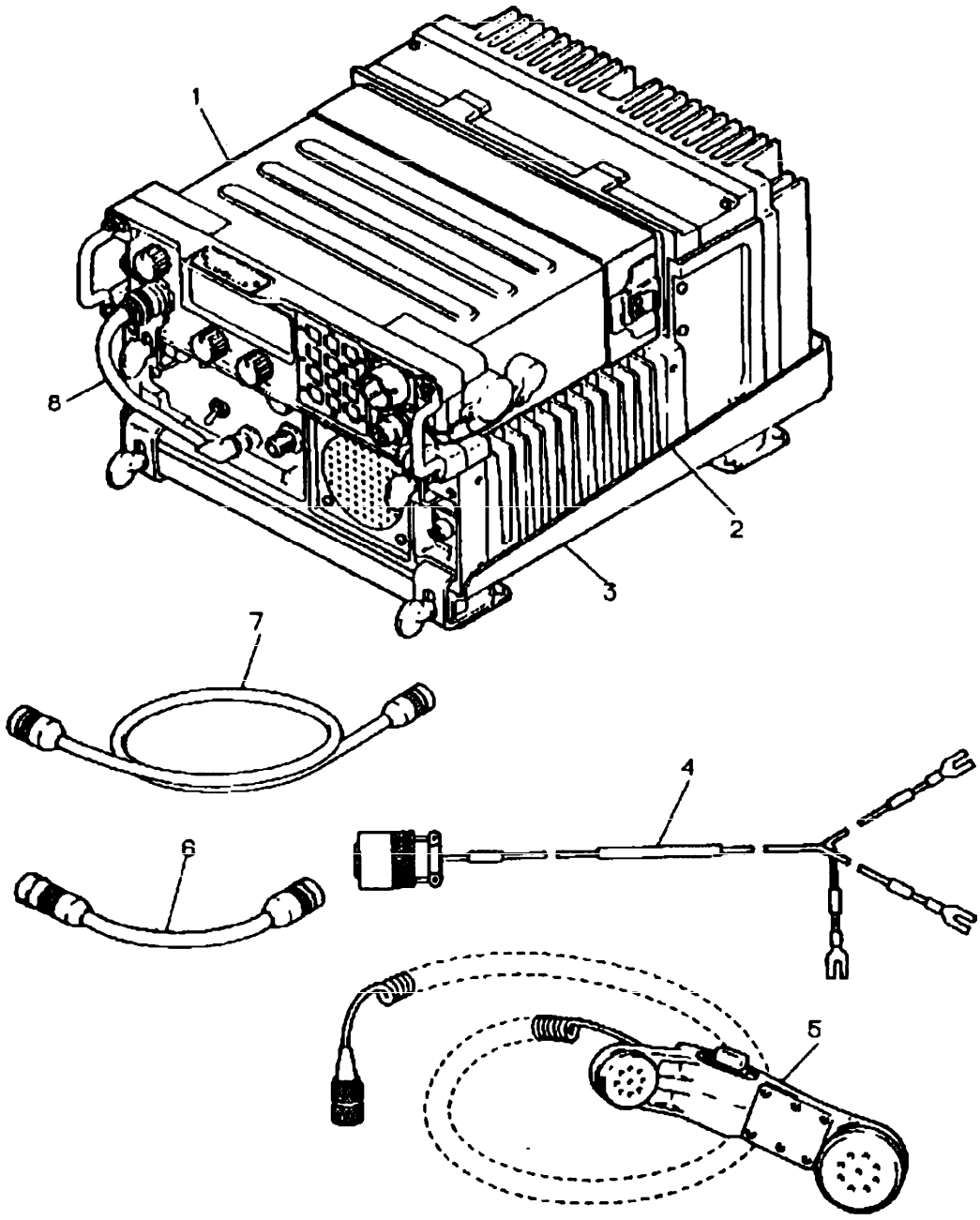


FIGURE 10. Components of an end item illustration.

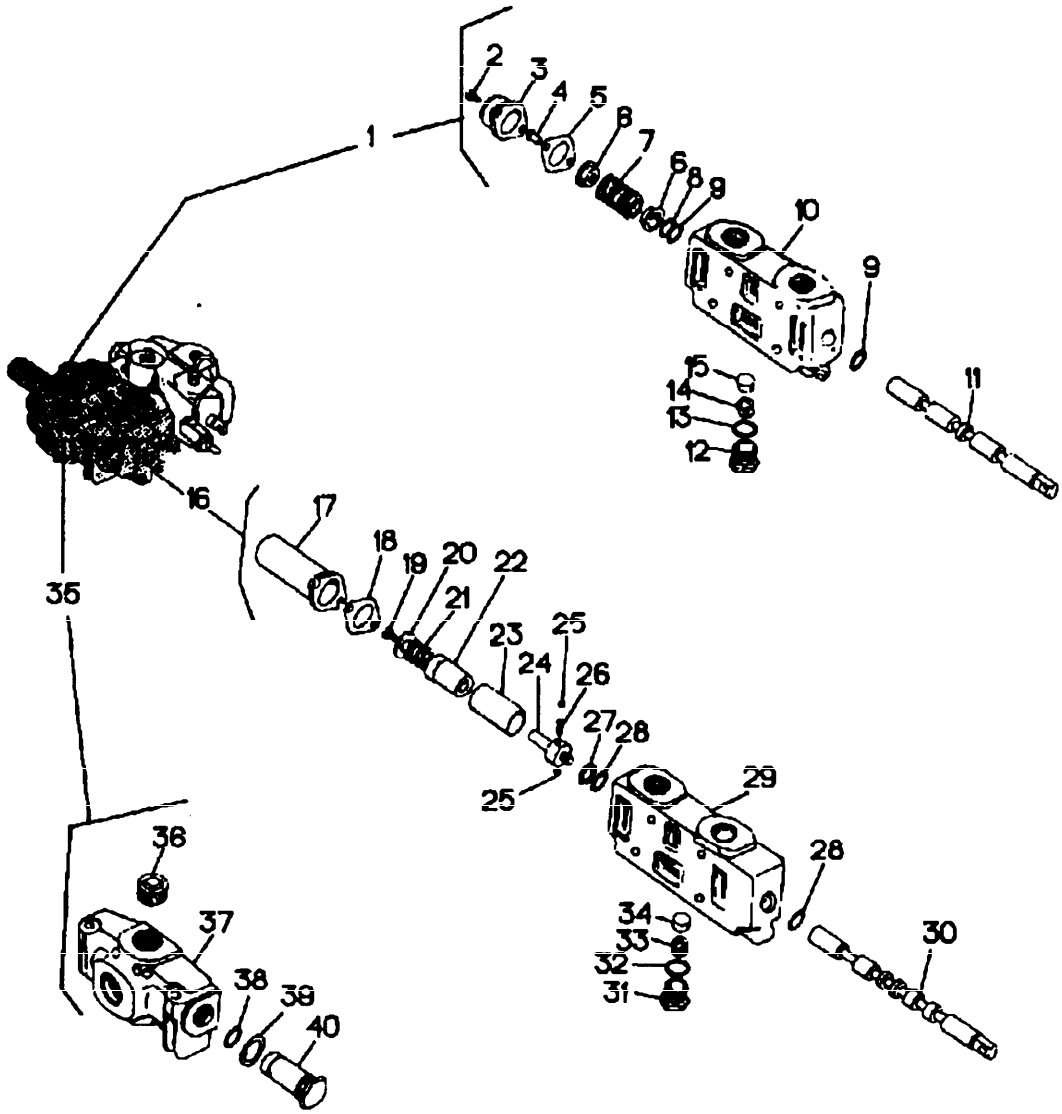


FIGURE 11. Combination of types of illustrations.

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CONCLUDING MATERIAL

Preparing activity:

Navy - MC

(Project TMSS-N250)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-I-28947B	4 June 1991

3. DOCUMENT TITLE

ILLUSTRATIONS FOR STOCK LIST PUBLICATIONS: PREPARATION OF

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (Include Area Code)	
Commander, Marine Corps Systems Command (PSE-C/S)	(1) Commercial 703-640-4584	(2) AUTOVON 278-4584
c. ADDRESS (Include Zip Code) Program Support Directorate 2033 Barnett Avenue Suite 315 Quantico, VA 22134-5010	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	