MILITARY SPECIFICATION

CLOTH, CAMOUFLAGE PATTERN, DUCK, COTTON

This specification is approved for use by US Army Natick Research and Development Command, Department of the Army and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers one type of cloth, duck cotton, dyed and printed with organic colors to the prescribed 4-color U. S. Army Pattern (Camouflage).

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

CCC-C-419	-	Cloth, Duck, Cotton, Unbleached, Plied-Yarns Army and Numbered
PPP-P-1135	-	Packaging and Packing of Duck Fabrics (Cotton, Synthetic Fiber; Cotton-Synthetic Fiber Blends)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Natick Research and Development Command, Natick, MA 01760 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 8305

STANDARDS

FEDERAL

FLD-STD-4 - Glossary of Fabric Imperfections
FED-STD-191 - Textile Test Methods

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes

LAWS AND REGULATIONS

Rules and Regulations Under the Textile Fiber Products Identification Act

(Copies may be obtained without charge from the Federal Trade Commission, Washington, DC 20580.)

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3 REQUIREMENTS

3.1 Standard sample. The dyed and printed finished cloth shall match the standard sample for shade and shall be equal to or better than the standard sample with respect to all characteristics for which the standard sample is referenced (see 6.3).

3.2 First article. When specified (see 6.2), the contractor shall furnish a sample for first article inspection and approval (see 4.3 and 6.4).

3.3 Material. The base cloth before dyeing and printing shall be cloth cotton duck conforming to type III, 8.25 ounces per square yard (280 g/m^2) Army duck of CCC-C-419.

3.4 Color. The dyeing of the ground shade and the printing of the cloth shall be accomplished with organic colorants as specified (see 6.8) to provide a match to each of the four shades of the pattern and to provide the infrared reflectance levels specified in 3.6. The cloth shall be dyed to a ground shade matching the Yellow Green 354 area of the pattern and subsequently roller over-printed using 3 colors, Dark Green 355, Brown 356, Black 357 or the pattern may be obtained by 4 roller printing on dyed or undyed cloth, each area matching the specific colors of the pattern in accordance with the standard sample. The back of the cloth may be either natural color or dyed. Resin bonded pigment printing shall not be permitted. Printing by automatic screen process either rotary or flat is permissible in lieu of roller printing.

3.4.1 Labile sulfur. The use of dyes and compounds containing elementary sulfur capable of oxidation to sulfuric acid is prohibited. The dyestuff shall be chosen and applied so that the dyed and printed finished cloth shall contain no more labile sulfur than shown by the standard sample when tested as specified in 4.4. When a standard sample is not available, the dyed and printed finished cloth shall show no more than a slight trace of labile sulfur as defined in the test method specified in 4.4.

3.4.2 Matching. The color of the dyed and printed finished cloth shall match the standard sample under artificial daylight having a color temperature of 7500 kelvin, and shall be a good approximation to the standard sample under incandescent lamplight at 2800 kelvin.

3.4.3 Colorfastness. The dyed and printed finished cloth shall show fastness to laundering (after 3 cycles), perspiration, crocking and light equal to or better than the standard sample in respect to all areas of the pattern. When no standard sample has been established or designated as applicable to colorfastness, the dyed and printed finished cloth shall show "good" fastness to laundering (after 3 cycles), perspiration, and light, and shall show Munsell Value for crocking not lower than 8.5 except for Black 357, in which the Munsell Value for crocking shall be not lower than 6.5. Tests shall be made as specified in 4.5.

3.5 Pattern execution. The pattern shall reproduce the standard sample in respect to design, colors and registration of the respective areas. The pattern repeat of the dyed, printed and finished cloth shall be 17.0 ± 1.25 inches (432 ± 32 mm) (see 6.7). Each pattern area shall show solid coverage; skitteriness exceeding that shown by the standard sample in any of the printed areas will not be acceptable. When the standard sample is not referenced for pattern execution, a pattern drawing shall be provided and the pattern on the finished cloth shall match that of the drawing (see 6.2).

3.6 Infrared reflectance. The following reflectance values measured at 1 micron shall be achieved in the dyeing or printing, when tested as specified in 4.5 (see 3.4):

Color	Percent
Yellow Green 354	No lower than 58
Dark Green 355	28 ± 2
Brown 356	16 ± 2
Black 357	8 ± 2

3.7 Breaking strength. The breaking strength for the warp and filling direction of the finished cloth shall be not less than 90 percent of the untreated cotton duck as specified in table II of CCC-C-419 when tested as specified in 4.5 (see 3.3).

3.8 Width. The finished width shall be as specified (see 6.2), and shall be the minimum acceptable width inclusive of selvages.

3.9 Nonfibrous material. The cloth prepared for printing shall contain no more than 2.5 percent starch and protein content (including chloroform-soluble and water-soluble material) when tested as specified in 4.5.

3.10 pH. The pH value of the water extract of the finished cloth shall be no lower than 5.0 nor higher than 8.5 when tested as specified in 4.5.

3.11 Shrinkage. The cloth shall be preshrunk and shall not shrink more than 3.0 percent in either the direction of the warp or of the filling when tested as specified in 4.5. The preshrinking process used shall not be identified by name or trademark either on the cloth, ticket or package.

3.12 Length and put-up. Unless otherwise specified (see 6.2), the cloth shall be furnished in continuous lengths, each not less than 40 yards. Each length shall be put up on full width rolls as specified in PPP-P-1135.

3.13 Fiber identification. Each roll of the dyed and printed finished cloth shall be labeled, ticketed for fiber content in accordance with the Textile Fiber Products Identification Act.

3.14 Workmanship. The dyed and printed finished cloth shall conform to the quality established by this specification. The demerit points per 100 square yards when calculated as specified in section 4 shall not exceed the established maximum point value.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Certificate of compliance. Where certificates of compliance are submitted, the Government reserves the right to check test such items to determine the validity of the certification.

4.2 Classification of inspection. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.3).
b. Quality conformance inspection (see 4.4).

4.3 First article inspection. When required (see 6.2), the preproduction sample submitted in accordance with 3.2 shall be visually inspected for appearance, color and finish. The sample shall be tested for physical properties in accordance with methods in 4.5.

4.4 Quality conformance inspection. Sampling for inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated hereinafter.

4.4.1 Component and material inspection. In accordance with 4.1 above, components and materials shall be inspected in accordance with all the requirements of referenced specifications, drawings and standards unless otherwise excluded, amended, modified or qualified in this specification or applicable purchase documents. The contractor shall submit a certificate of compliance stating that no resin bonded pigments have been used for the required colors are as specified in 3.4.

4.4.2 Examination of the end item. Examination of the end item shall be in accordance with 4.4.2.1 through 4.4.2.4.

4.4.2.1 Yard-by-yard examination. Each roll in the sample shall be examined on the face side only. When the total yardage in the roll does not exceed 100 yards, the entire yardage in the roll shall be examined. When the total yardage in the roll exceeds 100 yards, only 100 yards shall be examined. All defects as defined in Section I of FED-STD-4, which are clearly noticeable at normal inspection distance (3 feet) shall be scored and assigned demerit points as listed in 4.4.2.1.1 except that glossary numbers 1, 2, 3, 5, 14, 26, 27 and 29 shall not be scored unless they exceed three times the thickness of the yarn. Misdraws and reed marks shall be scored if they result in a clearly noticable separating of warp yarns. No linear yard (increments of 1 yard on the measuring device of the inspection machine) from any one roll within the sample shall be penalized more than 4 points. The sample size shall be 20 rolls selected from 20 containers. The lot shall be unacceptable if the points per 100 square yards of the total yardage examined exceeds 40.0 points. The lot shall be unacceptable if the points per 100 square yards of two or more individual rolls exceeds 60.0 points. If one roll exceeds 60.0 points per 100 square yards, a second sample of 20 rolls shall be examined for individual roll quality examination. The lot shall be unacceptable if one or more rolls in the second sample exceeds 60.0 points per 100 square yards. Point computation for lot quality and individual roll quality shall be as follows:

$$\frac{\text{Total points scored in sample} \times 3600}{\text{Contracted width of cloth (inches)} \times \text{total yards inspected}} = \text{Points per 100 square yards}$$

4.4.2.1.1 Demerit points. Demerit points shall be assigned as follows:

For defects 3 inches or less in any dimension	- one point
For defects exceeding 3 inches, but not exceeding 6 inches in any dimension	- two points
For defects exceeding 6 inches but not exceeding 9 inches in any dimension	- three points
For defects exceeding 9 inches in any dimension	- four points

The following defects, when present, shall be scored four points for each yard in which they occur:

Objectionable odor.
Width less than specified.
Skitteriness of pattern exceeds that shown by standard sample.
Pattern repeat less than 15.75 inches or more than 18.25 inches.
Excessive feathering or spew of pattern.
Pattern definition, distribution and color not equal to the standard sample.

4.4.2.2 Examination for length.

4.4.2.2.1 Individual rolls. During the yard-by-yard examination, each roll in the sample shall be examined for length. Any length found to be less than the minimum specified or more than two yards less than the length marked on the ticket shall be considered a defect with respect to length. The lot shall be unacceptable if two or more rolls in the sample are defective in respect to length.

4.4.2.2.2 Total yardage in sample. The lot shall be unacceptable if the total of the actual lengths of rolls in the sample is less than the total of the lengths marked on the roll tickets. The rolls examined shall be those selected for the examination of individual rolls.

4.4.2.3 Examination for shade. During the yard-by-yard examination, each roll in the sample shall be examined for shade on the side that is being examined. Any roll that fails to meet the requirement for shade match in respect to all areas of the pattern shall be cause for rejection of the entire lot represented by the sample.

4.4.2.4 Examination for identification of pre-shrinkage process and non-compliance with Textile Fiber Products Identification Act. During the yard-by-yard examination, each roll shall be examined for these defects. The lot shall be unacceptable if two or more rolls in the sample contain identification of the pre-shrinkage process by name or trademark on the cloth or ticket, or are not labeled or ticketed in accordance with the Textile Fiber Products Identification Act (see 3.11 and 3.13).

4.4.3 Examination of preparation for delivery requirements. Examination shall be made in accordance with the provisions of PPP-P-1135 to determine that packaging, packing and marking comply with section 5 requirements.

4.5 Tests. The methods of testing specified in FED-STD-191, wherever applicable and as listed in table I shall be followed. The physical and chemical values specified in section 3 apply to the results of the determinations made on a sample unit for test purposes as specified in the applicable test method. The sample unit shall be 1/4 yard full width of cloth prepared for printing for determination of nonfibrous material and 4 continuous yards full width of the finished cloth for all other physical and chemical tests. The lot shall be unacceptable if one or more sample units fail to meet any test requirements specified. The lot size shall be expressed in units of one yard. All test reports shall contain the individual values utilized in expressing the final result. The sample size (number of sample units) shall be in accordance with the following:

Lot size (yards)	Sample size
800 or less	2
801 up to and including 22,000	3
22,001 and over	5

TABLE I. Test methods

Characteristic	Requirement paragraph	Test method
Cotton identification	3.3	1200 1/
Weight per sq. yd. (g/m^2)	3.3	5041
Presence of labile sulfur	3.4.1	2020
Colorfastness to:		
Laundering (after 3 cycles)	3.4.3	5610 and 4.5.1
Perspiration	3.4.3	5680 and 4.5.1
Light	3.4.3	5660 and 4.5.1
Crocking	3.4.3	5651 and 4.5.2

TABLE I. Test methods (cont'd)

Characteristic	Requirement paragraph	Test method
Infrared reflectance	3.6	4.5.3
Breaking strength:		
Warp	3.7	5100 2/
Filling	3.7	5100 2/
Nonfibrous material	3.9	2611
pH	3.10	2811
Shrinkage:		
Warp	3.11	5550
Filling	3.11	5550

1/ A certificate of compliance shall be submitted and will be acceptable for the stated requirement.

2/ All test results shall be averaged, and the average value shall be utilized in calculating the percent change from the untreated cloth specification value. Results shall be calculated to the nearest 0.1 percent.

4.5.1 When testing for colorfastness to laundering, perspiration and light, identical portions of the pattern in the submitted specimen and standard sample shall be selected for the test. Each individual shade in the pattern shall be evaluated and reported separately in accordance with the provisions of the applicable test method.

4.5.2 Colorfastness to crocking. When testing colorfastness to crocking, the individual shades of the pattern shall be so selected that only the specific shade being evaluated is included in the test area of the submitted specimen as well as of the standard. Individual shades in the pattern shall be evaluated and reported separately.

4.5.3 Infrared reflectance. The infrared reflectance shall be determined by recording the spectral reflectance relative to MgO or $BaSO_4$ at 1 micron using a spectrophotometer sensitive in this range (see 6.5) or using a photometer (see 6.6). The photometer is calibrated with vitreous enamel gray standards of varying reflectance, certified by the National Bureau of Standards. Readings shall be reported to the nearest percent unit. The value of each shade of the pattern shall be determined and reported separately.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or C as specified (see 6.2).

5.1.1 Levels A and C. The cloth, put up as specified, shall be packaged in accordance with the applicable requirements of PPP-P-1135.

5.2 Packing. Packing shall be level A, B or C as specified (see 6.2).

5.2.1 Levels A, B and C. The cloth shall be packed in accordance with the applicable requirements of PPP-P-1135.

5.3 Marking. In addition to any special marking required in the contract or order, shipments shall be marked in accordance with the requirements of PPP-P-1135.

6. NOTES

6.1 Intended use. The cloth covered by this specification is intended for use in camouflage clothing and helmet.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number and date of this specification.
(b) First article (see 3.2, 4.3 and 6.4).
(c) Pattern drawing, if required (see 3.5).
(d) Width required (see 3.8).
(e) Minimum length if other than specified (see 3.12).
(f) Selection of applicable levels of packaging and packing (see 5.1 and 5.2).

6.3 Standard sample. For access to standard sample, address the procuring office issuing the invitation for bids (see 3.1).

6.4 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of paragraph 7-104.55 of the Armed Services Procurement Regulations. The first article should be a pre-production sample. The first article should consist of 5 yards of the finished cloth. The contracting officer should include specific instructions in all procurement instruments, regarding arrangements for inspection and approval of the first article.

6.5 Spectrophotometer. The basic instrument for measuring the infrared reflectance is the General Electric Spectrophotometer, but other instruments such as the Beckman DU or DK and the Cary 14 Spectrophotometers have been used (see 4.5.3).

6.6 Photometer. A photometer capable of providing the measurements is available from Hunter Associates Laboratory, Fairfax, VA. Details of instumental layout may be obtained from the U. S. Army Natick Research and Development Command, Natick, MA 01760, Code: DRDNA-VTC. Components of such an instrumenc are (see 4.5.3):

Lamp - GE 1209
Lens - 43 mm Conza
Filters - 2" x 2", 1 measuring, 2 calibrating transmission
Phototube - 930 type (S1 surface)
Helipot - 10,000 ohm (10 turn)
Battery 45 volt for phototube circuit power
Transformer - Primary 95-125V, 60 cyc.
- Secondary 25 Va, 6.3 V
Transformer, Filament - Primary 110V, 50/60 cyc.
- Secondary 6.3V-1A
Galvanometer - 0-10 scale, sensitivity .002 micron amp/mm

See figures 1 and 2 for instrument and figure 3 for transmission of calibrating (C1 and C2) instrument filters H-1.

6.6.1 Colorimeter. An alternate instrumenc is the photometer with 0°-45° geometry fitted with an S-1 surface phototube and a Corning 2540 filter of appropriate thickness. Such an instrument is the D-40 Colorimeter also available from Hunter Associates Laboratories. Other photometers of comparable performance characteristics may be used with an S-1 surface phototube and a Corning 2540 filter.

6.7 Pattern printing. The contractors are cautioned to insure that the cloth is properly set so that the final pattern dimensions and shrinkage will be within the limits of 3.5 and 3.11. Mercerization may be required to attain the shrinkage requirement.

6.8 Dye formulation. The areas of the pattern have been found to be satisfactory when dyed or printed with the following colorants:

Yellow Green 354

Vat Green 28
Vat Brown 1, C.I. 70800
Vat Violet 13, C.I. 68700 (or Vat Brown 33)

Dark Green 355

Vat Brown 33
Vat Green 3, C.I. 69500
Vat Black 30

Brown 356

Vat Brown 33
Vat Violet 13, C.I. 68700
(or Vat Black 30)

Black 357

Vat Black D4
or
Vat Blue 20, C.I. 59800
Vat Brown 33
Sulfur Black 6, C.I. 53295

6.9 Metric equivalents. Metric equivalents, indicated in parentheses throughout this document, are based on practices, conversion factors, and symbols specified in ASTM E 380 Standard for Metric Practice, and are for information only. In each instance, the value stated in US customary units shall be controlling.

Custodian:

Army - GL

Review activities:

Army - MD
DLA - CT

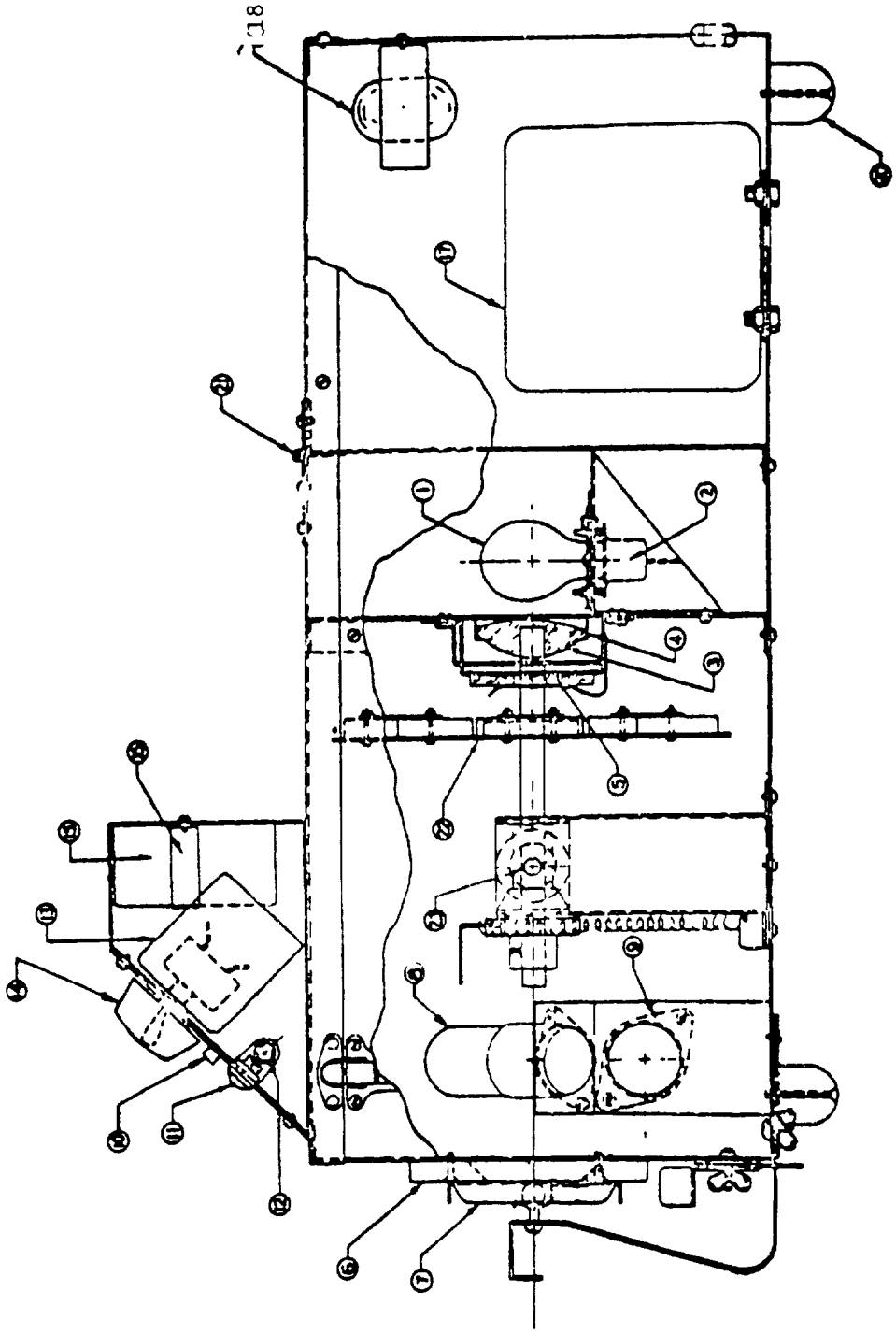
Preparing activity:

Army - GL

Project No. 8305-A718

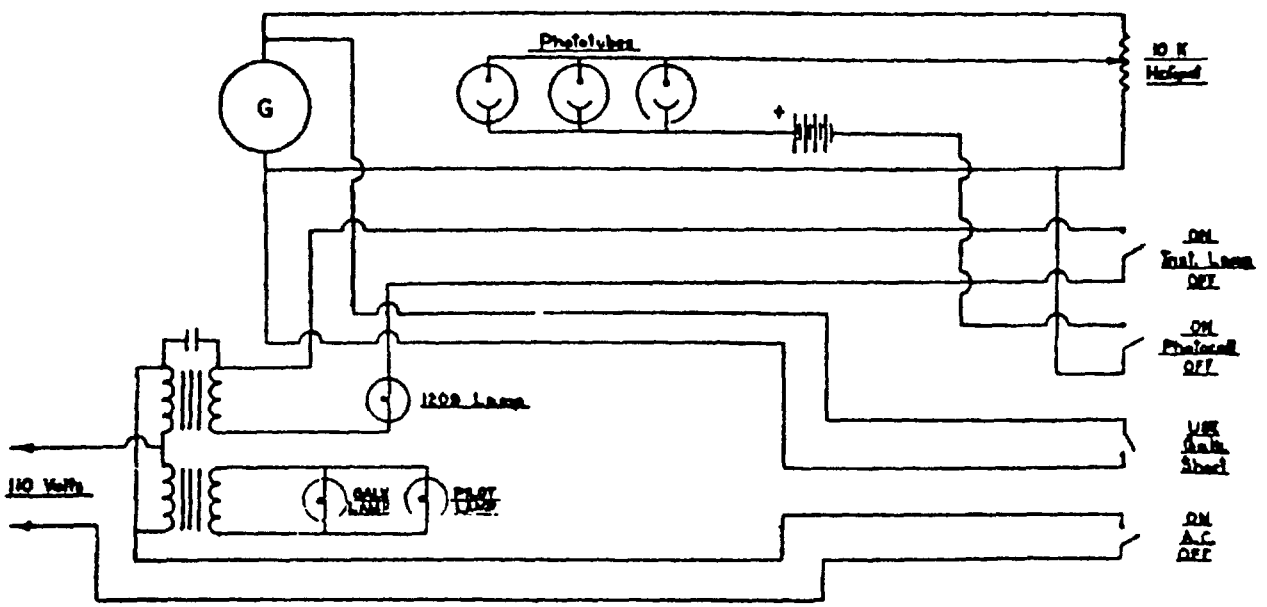
PARTS LIST FOR INFRARED PHOTOMETER MODEL M1

No. on Drawing	Description
1	Lamp, G. E. 1209
2	Lamp Base
3	Lens 43 mm. Conza
4	Lens Ring
5	Filter, 2x2", Transmission, Specified by the US Army Natick Research and Development Command
6	Bakelite Base 3/8" x 3-5/8" x 4-3/4" w. 1-1/2" hole
7	Clamp, Specimen
8	Phototubes (1930 type having characteristics specified by the US Army Natick Research and Development Command) Three required
9	Tube Sockets, Octal. Three required
10	Switches (SPST). Four required
11	Pilot Light Bracket
12	Light, Pilot, G. E. No. 40
13	Helipot, 10,000 ohm (10 turn)
14	Knob for Helipot
15	Battery, 45 volt, Burgess #XX30
16	Clip, Battery
17	Transformer, Sola, Pri. 95-125, 60 cy., Sec. 25 VA 6.3V
18	Transformer, Filament, Pri. 110 V., 50/60 cy., Sec. 6.3V1A
19	Galvanometer, Cat. (#3405 HH (Rubicon Co., Phila. PA))
20	Feet, Large, Rubber. Four required
21	Hinges. Two required
22	Filter Disc (Four-hole)
23	Right Angle Drive



GENERAL LAYOUT OF COMPONENTS - NLABS INFRARED PHOTOMETER MI

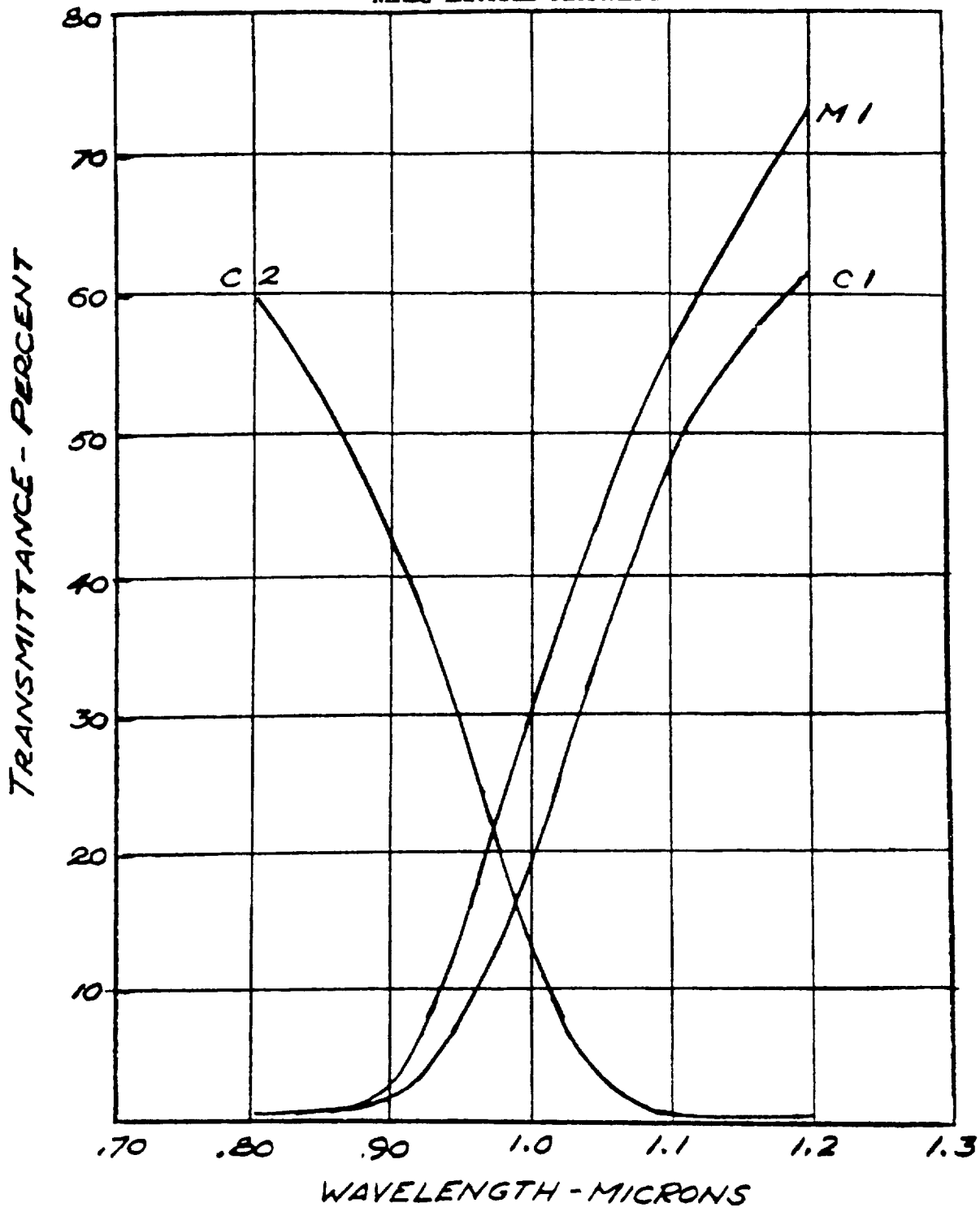
Figure 1



CIRCUIT DIAGRAM INFRARED PHOTOMETER

Figure 2

Figure 3
SPECTRAL TRANSMITTANCE CURVE FOR M1, C1 AND C2 FILTERS
NLABS INFRARED PHOTOMETER



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DOCUMENT IDENTIFIER *(Number)* AND TITLE

MIL-C-44014(GL)

CLOTH, CAMOUFLAGE PATTERN, DUCK, COTTON

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

☐ VENDOR ☐ USER ☐ MANUFACTURER

1 ☐ HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? ☐ IS ANY PART OF IT TOO RIGID RESTRICTIVE LOOSE OR AMBIGUOUS? PLEASE EXPLAIN BELOW

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C REASON FOR RECOMMENDED CHANGE(S)

2 REMARKS

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