TECHNICAL BULLETIN

CALIBRATION PROCEDURE
FOR
ADVANCED FLIGHT CONTROL SYSTEM (AFCS)
LINE TEST SET
P/N 145G0009-1

HEADQUARTERS, DEPARTMENT OF THE ARMY
8 JULY 1983

CHANGE NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 22 November 1989

Calibration Procedure

for

ADVANCED FLIGHT CONTROL SYSTEM (AFCS)
LINE TEST SET
P/N 145G0009-1

TB 55-4920-429-35, 8 July 1983, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1 and 2	1 and 2
21 and 22	21 and 22

2. Retain this sheet in front of manual for reference purposes.

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CALIBRATION PROCEDURE FOR ADVANCED FLIGHT CONTROL SYSTEM (AFCS) LINE TEST SET P/N 145G0009-1

Headquarters, Department of the Army, Washington, DC
8 July 1983

REPORTING OF ERRORS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or **DA Form 2028-2** located in the back of this manual direct to: Commander, U.S. Army Aviation Systems Command, ATTN: AMSAV-MMD, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

SECTION I

IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of the Advanced Flight Control System (AFCS) Line Test Set, P/N 145G0009-1, TM 55–4920-429-13 was used as the prime data source in compiling these instructions. The equipment being calibrated will be referred to as the TI (Test Instrument) throughout this bulletin.

a. Model Variations. None.

b. Time and Technique. The time required for this calibration is approximately 2 hour(s), using the dc and low frequency technique.

2. DA Form 2416 (Calibration Data Card).

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25-1. DA Form 2416 must be annotated in accordance with TB 750-25-1 for each calibration performed.

b. Adjustments to be reported on DA Form 2416 are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) follows the designated adjustment. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test Instrument Parameters	Performance Specifications
Power Input Requirements	113 to 117 vac, 395-405 Hz 28 vdc; ±0.5 vdc
Power Supply and Self Test Voltages AC Voltages (DMM)	Range: -3.6 vac or +3.6 vac Accuracy: ±0.34 vac Range: ±3.0 vac Accuracy: ±1.28 vac Range: ±6.0 vac Accuracy: ±2.8 vac
DC Voltages (DMM)	Range: 5.0 vdc Accuracy: ±0.1 vdc Range: -7.0 vdc or +7.0 vdc Accuracy: ±0.2 vdc Range: ±12.0 vdc Accuracy: ±1.15 vdc Range: -15.0 vdc or +15 vdc Accuracy: ±0.25 vdc Range: ±28.0 vdc Accuracy: ±1.0 vdc
Analog Voltmeter	Range: -2.0 to +20 vdc Accuracy: ±1.0 vdc
Resistance	Range: 1K ohm Accuracy: ±20 ohms Range: 10K ohm Accuracy: ±200 ohms Range: 100K ohm Accuracy: ±2000 ohms Range: 1.0 Meg ohm Accuracy: 20,000 ohms

SECTION II

EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Set, AN/GSM-286. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI.

5. Accessories Required. The accessories listed in table 3 are issued as indicated in paragraph 4 above and are used in this calibration procedure. When necessary, these items may be substituted by equivalent items, unless specifically prohibited.

6. Special Equipment Required. Table 4 identifies special equipment required for the calibration procedure.

Table 2. Minimum Specifications of Equipment Required

Item	Common Name	Minimum Use Specifications	Manufacturer, Model, and Part Number
A1	Autotransformer	Range: 113 to 117 vac 400 Hz Accuracy: ±1.0%	General Radio Model W10MT3AS3
A2	DC Power Supply	Range: 27.5 to 28.5 vdc	NJE Model CS 36CR30 (7907346-3)
A3	Digital Multimeter	Range: 113 to 117 vac Accuracy: ±0.5% Range: 4.9 to 30.0 vdc Accuracy: ±0.01% Range: 2.0 to 28.8 vac Accuracy: ±0.01%	Hewlett-Packard Model 3490A Option 060
A4	Resistance Standard	Range: 0 to 1 Meg ohm Accuracy: ±0.05%	Biddle Gray 601147-1 (7910328)

Table 3. Accessories Required

Item	Common Name and/or (Official Nomenclature)	Description and (Part Number)
B1	Adapter	Alligator to single banana plug (Black) (7907560)
B2	Adapter	Alligator to single banana plug (Red) (7907556)
B3	Adapter Box	SKD 4850-3 (7920530)
B4	Lead 1/	24 inch, single banana plug Terminations (Red) (7907497)
B5	Lead 1	24 inch, single banana plug Terminations (Black) (7907498)

1/ Four required

Table 4. Special Equipment

Item	Common Name	Description and (Part Number)
C1	Lead 1/	Miniature Pin Jack with 18 inc, No 16 wire attached to banana jack (fabricate)

1/ Four required

SECTION III

PRELIMINARY OPERATIONS

7. Preliminary Instructions.

a. The instructions outlined in this section are preparatory to the calibration process. Personnel should become familiar with the applicable sections before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name and item identification number as listed in tables 2, 3, and 4. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3 and for prefix C, see table 4.

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions.

NOTE

Unless otherwise specified, all controls and control settings refer to the TI.

8. Equipment Setup.

a. Set both TI MASTER Power switches to OFF. Observe TI analog meter for ZERO. If not, remove bottom front protective cover plate from meter and mechanical ZERO meter.

b. Push in the 3 circuit breakers.

c. Connect the test equipment as shown in figure 1.

d. Adjust Autotransformer (A1) for 115 vat, 400 Hz as indicated on digital multimeter (A3). Disconnect digital multimeter leads from connection A.

e. Connect digital multimeter leads to connection B and adjust DC power supply (A2) for 28 vdc ±0.5 vdc as indicated on digital multimeter (A3). Disconnect digital multimeter from connection B.

f. Set TI 115 vac POWER Switch to ON.

g. Set TI 28 vdc POWER Switch to ON.

h. Allow TI 30.0 minutes warm-up period for the TI DMM to settle out before performing calibration.

NOTE

TI Power supply adjustments are shown in figure 2.

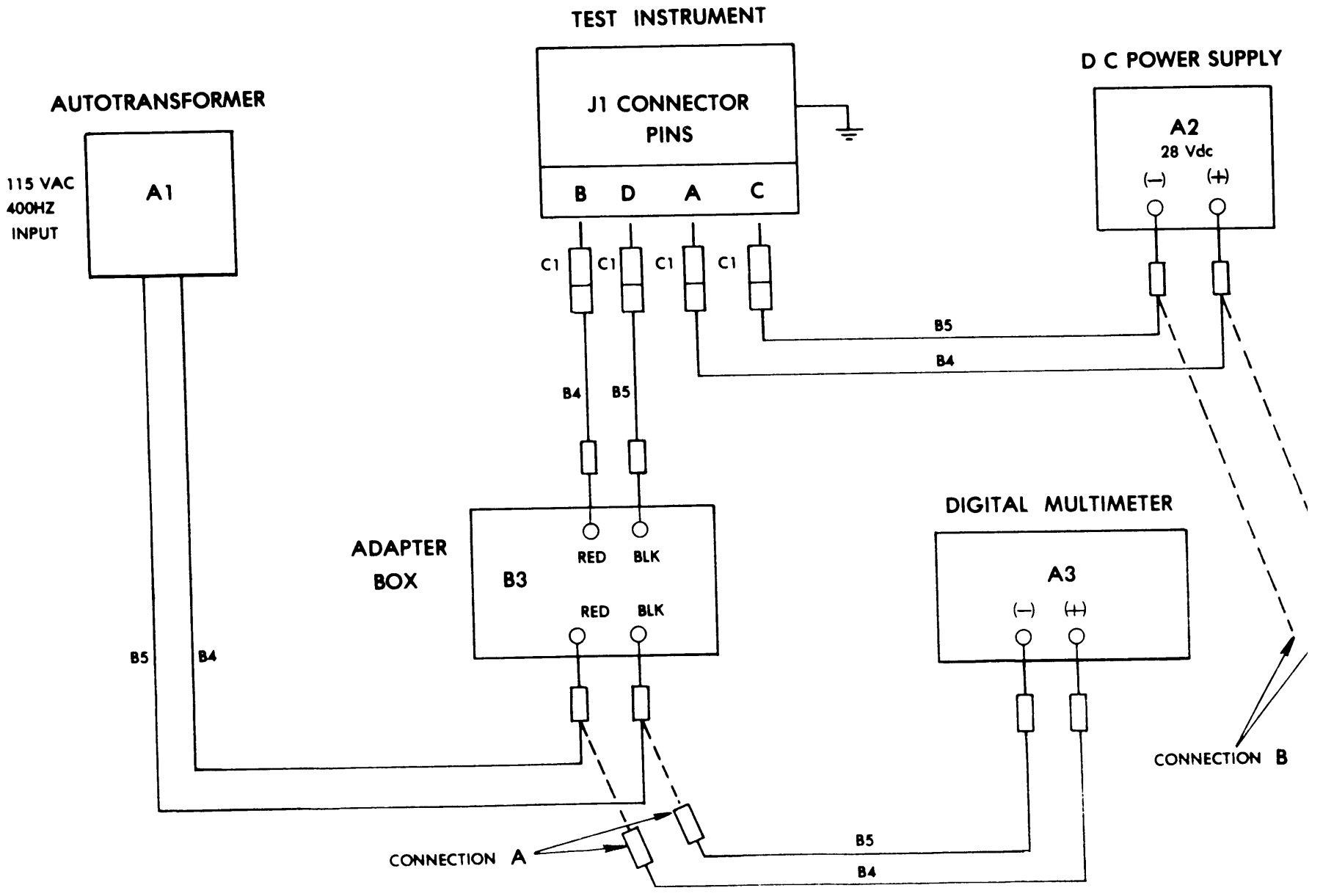

Figure 1. Equipment Power Setup.

SECTION IV

CALIBRATION PROCESS

NOTE

Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate TI are included in this procedure. Additional maintenance information is contained in TM 35-4920-429-13 for this TI.

CAUTION

Test equipment power will be switched OFF before making or removing jumper and/or test equipment connections.

9. Power Supplies Voltages.

a. Performance Check.

(1) Connect digital multimeter (A3) leads (B4) and (B5) to the TI HI/LO test point jacks position.

(2) Set TI 115 vac POWER switch to ON.

(3) Set TI 28 vdc POWER switch to ON.

(4) Set TI METER SOURCE to OFF and SELF TEST Switch to OFF position. TI will indicate 0000 ± 0005.

(5) Set TI METER SOURCE to SELF TEST and SELF TEST Switch to DISPLAY position. TM DMM will indicate +.8.8.8.8.

(6) Set TI SELF TEST to DM +5 vdc. Digital multimeter will indicate between 4.90 and 5.10 vdc. If not, perform b(1) and b(2) below.

(7) TI DMM will indicate between 4.90 and 5.10 vdc.

(8) Set TI SELF TEST switch to each switch position as listed in tables 5.0 and 6.0. Digital multimeter and TI DMM indicator will indicate within the limits specified.

(9) Set TI SELF TEST switch to the OFF position.

b. Adjustments.

(1) Remove screws from case and remove panel assembly.

(2) Adjust TI DC power supply PS5 for +5 vdc on digital multimeter (R).

(3) Adjust TI DC power supply PS3 for +15 vdc on digital multimeter (R). Repeat performance check 9a(8) above for this switch position.

(4) Adjust TX DC power supply PS4 for -15 vdc on digital multimeter (R). Repeat performance check 9a(8) above for this switch position.

(5) Adjust TI DC power supply PS2 for -15 vdc on digital multimeter (R). Repeat performance check 9a(8) above for this switch position.

(6) Adjust TI DC power supply PS1 for +15 vdc on digital multimeter (R). Repeat performance check 9a(8) above for this switch position.

Table 5.0 Voltage Source Test DC

	TI SELF TEST Switch Position	TI DMM Indicator and Digital Multimeter Indications (vdc) Min	Max
(R)	1/ DMM +15 vdc	14.75	15.25
(R)	2/ DMM -15 vdc	-14.75	15.25
(R)	3/ -15 vdc	-14.75	15.25
(R)	4/ +15 vdc	14.75	15.25
	- 7 vdc	6.80	7.20
	+ 7 vdc	6.80	7.20
	+12 vdc	10.85	13.15
	+28 vdc	27.0	29.0

1/ Perform TI DC power supply PS3 adjustment b(3) if not within tolerance (R).

2/ Perform TI DC power supply PS4 adjustment b(4) if not within tolerance (R).

3/ Perform TI DC power supply PS2 adjustment b(5) if not within tolerance (R).

4/ Perform TI DC power supply PS1 adjustment b(6) if not within tolerance (R).

Table 6.0 Voltage Source Test AC

TI SELF TEST Switch Position	TI DMM Indicator and Digital Multimeter Indications (vac)	
	Min	Max
+ 3.6 vac	3.26	3.94
- 3.6 vac	3.26	3.94
13.0 vac	11.72	14.28
26.0 vac	23.20	28.80

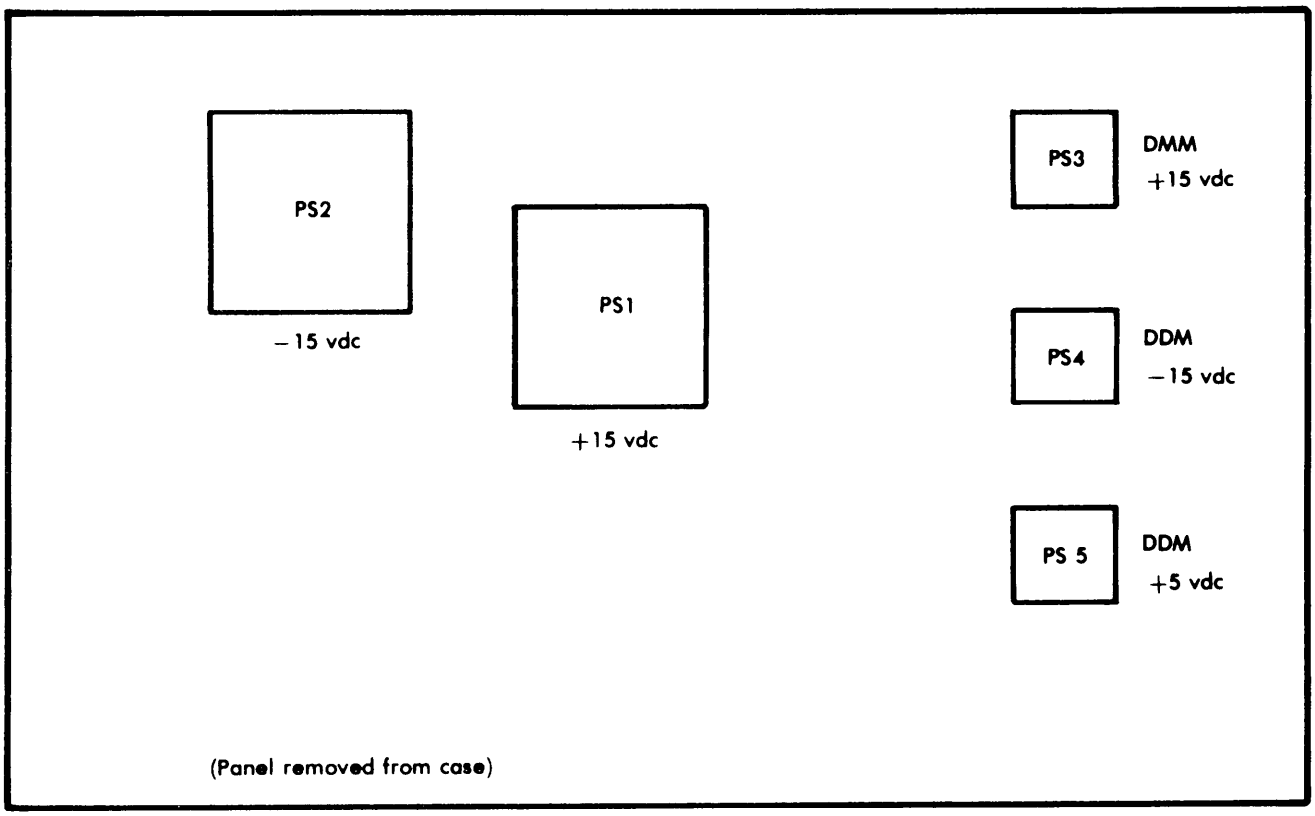

Figure 2. DC Power Supplies Adjustment Locations.

10. Analog Meter.

a. performance Check.

NOTE

TI analog meter indicates -2 to +2 volts or -20 to +20 volts.

(1) Observe that digital multimeter (A3) leads (B4) and (B5) are still connected to the TI HI/LO binding posts.

(2) Observe that TI METER SOURCE switch is still in the SELF TEST position.

(3) Set TI 115 vac and 28 vdc POWER switches to ON.

(4) Set TI SELF TEST switch to -7 vdc. Digital multimeter will indicate between -6.0 and -8.0 vdc. Observe indication on TI analog meter for -7.0 vdc ±1.0 vdc.

(5) Set TI SELF TEST switch to each switch position as listed in table 7. Digital multimeter and TI analog meter will indicate within the limits specified.

(6) Set TI SELF TEST and METER SOURCE switches to OFF.

(7) Disconnect digital multimeter leads from TI binding posts.

b. Adjustments. No adjustments can be made.

Table 7.0 Analog Meter

TI SELF TEST Switch Position	TI Analog Meter and Digital Multimeter Indication vdc	
	Min	Max
7.0 vdc	6.0	8.0
-15.0 vdc	-14.0	-16.0
15.0 vdc	14.0	16.0

11. Resistance Test.

a. Performance Check.

(1) Connect resistance standard (A4) leads (B4) and (B5) with adapters (B1) and (B2) to the TI J1-H (HI) and J1-J (LO) connector.

(2) Position TI controls (a) thru (e) as follows:

(a) LEFT A SELECT CONTINUITY switch to 00.

(b) RIGHT A SELECT CONTINUITY switch to 09.

(c) LEFT B SELECT CONTINUITY switch to 00.

(d) RIGHT B SELECT CONTINUITY switch to 08.

(e) METER SOURCE switch to CONTINUITY.

(3) Set TI 115 vac power and 28 vdc power switches to ON.

(4) Set resistance standard to “O” settings. TI DMM will indicate 0.000 ±0.002.

(5) Adjust resistance standard controls (A4) for 1,000 ohms. TI DDM will indicate between .980K and 1.020K ohms.

(6) Adjust resistance standard controls for each setting as indicated in table 8. TI DMM will indicate within the limits specified.

(7) Disconnect test equipment from TI J1-H and J1-J connector.

(8) Set TI CONTINUITY switches to 00.

(9) Set METER SOURCE switch to CONTINUITY position. TI digital display indicator will read +9.77 to +10.23.

b. Adjustments. No adjustments can be made.

Table 8. Resistance Check

Resistance Standard Setting (ohms)	TI DMM Indication (K ohms)	
	Min	Max
10,000	9.800	10.20
100,000	98.00	102.0
1,000,000	980.0	1020.0

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12. Final procedure.

a. De-energize and disconnect all equipment and reinstall protective cover on TI.

b. when all parameters are within tolerance, annotate and affix DA Label 80 (US Army Calibrated Instrument). When the TI receives limited or special calibration, annotate and affix DA Label 163 (US Army Limited or Special Calibration). When the TI cannot be adjusted within tolerance, repair the TI in accordance with the maintenance manual. When repair is delayed for any reason or the TI cannot be repaired with local resources, annotate and affix DA Form 2417 (US Army Calibration System Rejected Instrument) and inform the owner/user accordingly in accordance with TB 750-25-1.

By Order of the Secretary of the Army.

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

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TB 55-4920-429-35	8 Jul 83	Calibration Procedure for Advanced Flight Control System (AFCS) Line Test Set P/N145G0009-1

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO
6	2-1 a		
B1		4-3	
125	line 20		

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 Cylenders. The engine on my set only has 4 Cylenders. Change the manual to show 4 Cylenders.

Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is Called a shim - Please Correct one or the Other.

I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is Wrong. Please give me a good NSN

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, PFC (268) 317-7111

SIGN HERE John Doe
JOHN DOE

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C