DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE
FOR
AUXILIARY POWER UNIT-ELECTRONIC
SEQUENCE UNIT MULTIPURPOSE TEST SET
P/N 161226-200

Headquarters, Department of the Army, Washington D. C.
21 October 1987

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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 or DA Form 2028 (Recommended Changes to Publications and Blank Forms), to: Commander, U.S. Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

TABLE OF CONTENTS

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

Section I

IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of the Auxiliary Power Unit-Electronic Sequence Unit Multipurpose Test Set, P/N 161226-200. TM 55-4920-431-13 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 Variation. None.

b. Time and Technique. This time required for this calibration is approximately 2 hours, 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. DA Form 2416 must be annotated in accordance with TB 750-25 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). Identify the unit for each adjustment, i.e. 438A2R31.

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
Input Power Requirements	27.5 to 28.5 vdc
% RPM	Ranges: 20 to 120% RPM Accuracy: ±2.0% RPM (93.32Hz)
Temperature	Ranges: 300° to 1500°F Accuracy: ±35°F of reading

CHANGE

NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 29 JULY 1994

CALIBRATION PROCEDURE FOR AUXILIARY POWER UNIT-ELECTRONIC SEQUENCE UNIT MULTIPURPOSE TEST SET P/N 161226-200

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TB 55-4920-431-35, 21 October 1987, 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
7 and 8	7 and 8

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

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the Secretary of the Army
07140

DISTRIBUTION:
To be distributed in accordance with DA Form 12-34-E, block no. 1692, requirements for TB 55-4920-431-35.

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 Sets, 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	DIGITAL MULTIMETER	Range: 27.5 to 28.5 vdc Accuracy: ±0.45%	Hewlett-Packard Model 3490A (Option 060)
A 2	ELECTRONIC COUNTER	Range: 405Hz to 5693 Hz Accuracy: ±0.05%	Hewlett-Packard Model 5345A (MIS 28754 Type 1)
A 3	TEST OSCILLATOR	Range: 405Hz to 5693Hz	Hewlett-Packard Model 652A (MIS-10224)
A 4	DC POWER SUPPLY	Range: 27.5 to 28.5 vdc	NJE, Model CS36CR30 (7907346-2)

Table 3. Accessories Required

Item	Common Name and/or (Official Nomenclature)		Description and (Part Number)
B1	ADAPTER	1	BNC Plug to double banana jacks (MS 90578-1441)
B2	LEAD	2	24 in, No 18, single banana plug Terminations (Black) (7907498)
B3	LEAD	2	24 in, No 18, single banana plug Terminations (Red)
B4	TERMINATION		50 ohm feed through with BNC connectors (11048B)

1 Two required.

2 Four required.

Table 4. Special Equipment

Item	Common Name	Description and (Part Number)
C1	ADAPTER BOX	Solar, (ST93480)

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), 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 all switches on TI to down position.

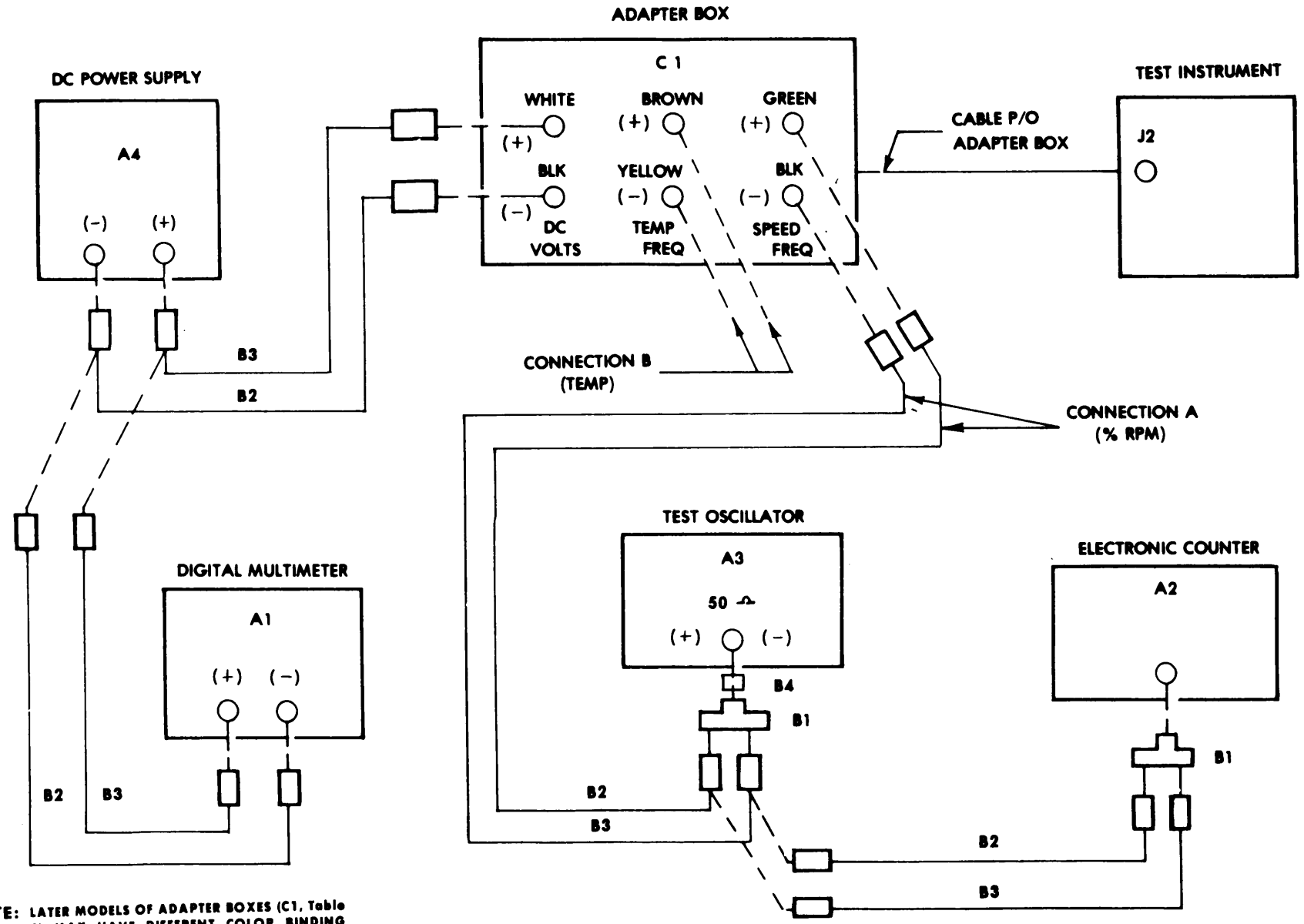
b. Check both TI meters for mechanical zero and adjust if necessary.

c. Connect test equipment as shown in figure 1 connection A.

d. Adjust DC power supply (A4) for 28 vdc $\pm$ 0.5 vdc as indicated on digital multimeter (A1).

CAUTION

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



NOTE: LATER MODELS OF ADAPTER BOXES (C1, Table 4) MAY HAVE DIFFERENT COLOR BINDING POSTS AND IDENTIFIED DIFFERENTLY. IF THERE IS NO CONNECTOR THE ADAPTER BOX CABLE THEN CONNECTS THE FOUR LEADS AS SHOWN BELOW FOR THE J2 CONNECTOR. PINS A (-) AND Z (+) ARE FOR 28 vdc. PINS G AND H ARE TEMP AND SPEED CONNECTIONS.

Figure 1. Speed / Temperature - Equipment 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 to calibrate TI are included in this procedure. Additional maintenance information is contained in TM 55-4920-431-13 for this TI.

9. Speed Indicator.

a. Performance Check.

(1) Set TI REMOTE switch to the UP position.

(2) Set TI MASTER POWER switch to ON.

(3) Adjust test oscillator (A3) Amplitude control for 3 Yolts output and frequency controls for an indication of 20% RPM on TI Speed Indicator. Electronic taunter (A2) will indicate between 840Hz and 1027Hz. If not, perform b(1) thru (4) below.

(4) Adjust test oscillator frequency controls for each TI % RPM speed indications as listed in table 5. Electronic counter will indicate within the limits specified. If not, perform b(1) thru (5) below as required.

(5) Set TI POWER to OFF.

(6) Disconnect leads from adapter box (C1) connection A.

b. Adjustments.

(1) Remove TI instrument panel from case and disconnect cable connector from FREQ/ANALOG CONVERTER.

(2) Remove 4 mounting screws from FREQ/ANALOG CONVERTER and pull out of case.

(3) Remove 8 screws from back cover of FREQ/ANALOG CONVERTER' cable connector.

(4) Adjust test oscillator for 5599Hz indication on electronic counter. Adjust potentiometer R2 on TI FREQ/ANALOG CONVERTER as shown in figure 2 for 120% RPM indication on TI. Repeat technique 9A(3) above.

(5) Repeat technique 9a(4) above.

Table 5. Speed Indicator % RPM Check

TI Speed Indicator % RPM	Electronic Counter	Indication (Hz)
	Min	Max
40	1773	1960
60	2706	2893
80	3640	3826
100	4573	4759
120	5506	5693

NOTE: 1.0% rpm = 46.66 Hz

10. Temperature Indicator.

a. Performance check.

(1) Connect test oscillator (A3) leads to connection B input jacks yellow and brown on adapter box (C1) in figure 1.

(2) Set TI Power switch to ON.

(3) Adjust test oscillator Frequency controls for indication of 300°F on Tl temperature indicator. Electronic counter (A2) will indicate between 405 and 443 Hz. If not, perform b(1) thru (4) below.

(4) Adjust test oscillator frequency controls for each TI °F temperature indications as listed in table 6. Electronic counter will indicate within the limits specified. If not, perform b(1) thru (6) below as required.

(5) Set TI POWER to OFF.

(6) Disconnect leads from adapter box connection B.

b. Adjustments.

(1) Remove TI instrument panel from case and disconnect cable connector from FREQ/ANALOG CONVERTER.

(2) Remove 4 mounting screws from FREQ/ANALOG CONVERTER and pull out of case.

(3) Remove 8 screws from back cover of FREQ/ANALOG CONVERTER and place back in case with open side up and connect FREQ/ANALOG CONVERTER cable connector.

(4) Adjust test oscillator for 424Hz indication on electronic counter. Adjust potentiometer R23 ZERO adjustment on TI FREQ/ANALOG CONVERTER as shown in figure 2 for 300°F indication on T1.

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(5) Adjust test oscillator for 1089Hz indication on electronic counter. Adjust potentiometer R27 SPAN adjustment on TI FREQ/ANALOG CONVERTER as shown in figure 2 for 1500°F indication on TI.

(6) Repeat technique b(4) and (5) above for optimum adjustments.

11. 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.

Table 6. Temperature Indicator (F) Check

TI Temperature Indicator Indication (F)	Electronic Counter Indication (Hz)	
	Min	Max
600	571	610
900	737	775
1200	904	942
1500	1068	1110

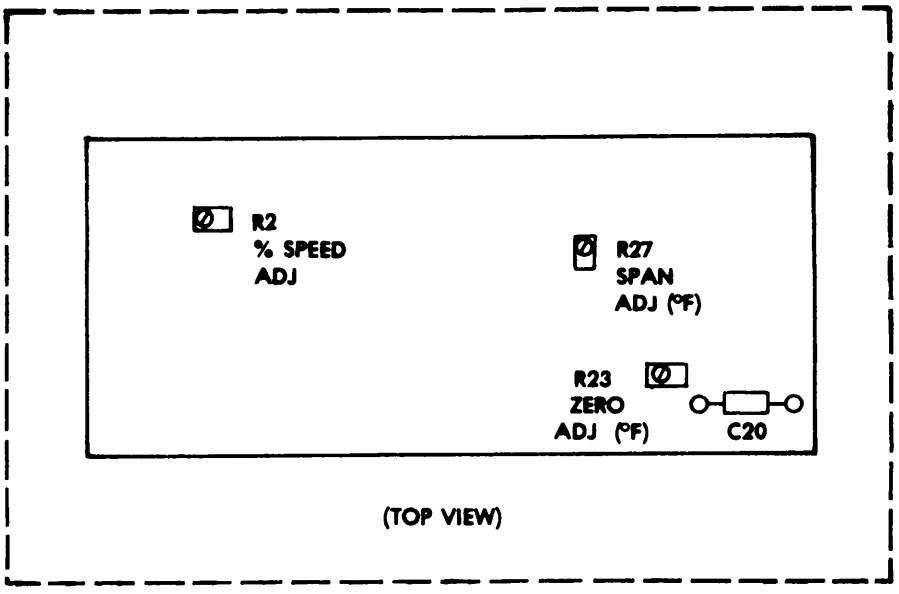

Figure 2. Speed/Temperature - Adjustment Locations

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States~rmy
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-34B, Requirements for TMDE/ Calibration & Repair: Organizational.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
PFC JOHN DOE
COA, 3d ENGINEER BN
FT. LEAVENWOOD, MO 63108

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TB 55-4920-431-35	21 Oct 1987	APU Test Set

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 2 910-00-762-3001. 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

DA FORM 1 JUL 79 2028-2

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DRSTS-M Overprint 1, 1 Nov 80

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

TEAR ALONG PERFORATED LINE

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2, 1 Nov 80

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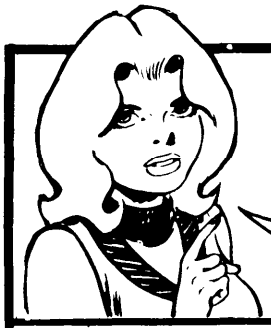

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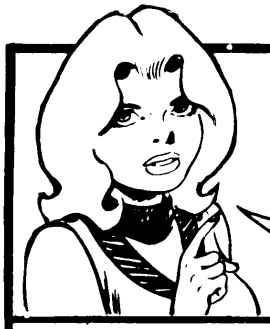

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The Metric System and Equivalents

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 milliliters = .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

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