

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

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CALIBRATION PROCEDURE FOR  
CONSTANT AMPLITUDE SIGNAL GENERATOR

AN/USM-272

AND

TEKTRONIX, TYPE 191

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Headquarters, Department of the Army, Washington, DC  
16 May 1988

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By Order of the Secretary of the Army:

**CARL E. VUONO**  
*General, United States Army*  
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**R. L. DILWORTH**  
*Brigadier General, United States Army*  
*The Adjutant General*

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 31 March 1988
 

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DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR

CONSTANT AMPLITUDE SIGNAL GENERATOR

AN/USM-272 AND TEKTRONIX, TYPE 191

Headquarters, Department of the Army, Washington, DC  
15 April 1987

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\*This bulletin supersedes TB 11-6625-2384-35, 2 August 1978, including all changes.

**SECTION I**

**IDENTIFICATION AND DESCRIPTION**

**1. Test Instrument Identification.** This bulletin provides instructions for the calibration of Constant Amplitude Signal Generator, AN/USM-272 and Tektronix, Type 191. The manufacturer's manual and TM 116625-2384-15 were used as the prime data sources 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 4 hours, using the dc and low frequency technique.

**a.** Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

**b.** Adjustments to be reported 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.

**2. Forms, Records, and Reports**

**Table 1. Calibration Description**

<b>Test instrument parameters</b>	<b>Performance specifications</b>
Amplitude (at 50 kHz into 50W load)	Range: 0.5 to 5 V Accuracy: ±3% of indicated amplitude Range: 50 to 500 mV Accuracy: ±4% of indicated amplitude Range: 5 to 50 mV Accuracy: ±5% of indicated amplitude
Frequency (into 50W load)	Range: 50 kHz and 0.35 to 100 MHz Accuracy: ±2%
Frequency response	Range: 0.35 to 100 MHz at .5 to 5.5 V Accuracy: £ ±3% from 50 kHz value

## 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.

**Table 2. Minimum Specifications of Equipment Required**

Item	Common name	Minimum use specifications	Manufacturer and model (part number)
A1	AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: $\pm 1\%$	General Radio, Model W10MT3AS3 or Ridge, Model 9020F (7910809)
A2	DC VOLTAGE STANDARD	Range: 0 to 5 V dc Accuracy: $\pm 0.01\%$	John Fluke, Model 332B/AF (332B/AF)
A3	DIGITAL VOLTMETER	Range: 0 to -12 V dc 0.0167 to 1.820 V rms Accuracy: $\pm 0.75\%$	Hewlett-Packard, Model 3490AOPT060 (3490AOPT060) Dana, Model 5000, or Dana, Model 5000 w/641
A4	DIFFERENTIAL VOLTMETER	Range: 0.9 to 1.1 mV Accuracy: $\pm 0.75\%$	John Fluke, Model 887AB/AN (887AB/AN)
A5	FREQUENCY COUNTER	Range: 50 kHz to 100 MHz Accuracy: 0.5%	Hewlett-Packard, Model 5345A (MIS-28754/1 Type 1) w/5355A and K87-59992A
A6	THERMAL CONVERTER	Range: 50 kHz to 100 MHz at 5 V Accuracy: $\pm 0.75\%$	Ballantine, Model 1394A (MIS-10221)

Table 3. Accessories Required

Item	Common name	Description (part number)
B1	ADAPTER	BNC jack to double banana plug terminations (7907592)
B2	ADAPTER	GR plug to BNC jack (MS75093)
B3	CABLE	CG-3364/U, GR-874 to GR-874, 50W, 5 ns (p/o TI)
B4	CABLE	36-in., RG-58/U; BNC to double banana plug terminations (7907471)
B5	LEAD <sup>1</sup>	32-in., single banana plug to test hook (black) (7915941-2)
B6	TERMINATION	DA-464/U, GR-874 to BNC plug, 50W (p/o TI)

<sup>1</sup>Two required.

### SECTION III

#### CALIBRATION PROCESS

##### 6. Preliminary Instructions

a. The instructions outlined in paragraphs 6 and 7 are preparatory to the calibration process. Personnel should become familiar with the entire bulletin 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 and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

c. 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 the TI are included in this procedure. Additional maintenance information is contained in the manufacturer's manual and TM 11-66252384-15 for this TI.

d. When indications specified in paragraphs 8 through 10 are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs 8 through 10. Do not perform power supply check if all other parameters are within tolerance.

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

##### 7. Equipment Setup

###### 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.**

- a. Connect TI to autotransformer (A1).

- b. Connect autotransformer to a 115-V ac source and adjust for a 115-V ac output.
- c. Set POWER switch to ON, and allow at least 5 minutes for TI to reach operating temperature.

**8. Amplitude Accuracy**

**a. Performance Check**

- (1) Connect digital voltmeter (A3) to OUTPUT using adapter, cable, and termination (B1, B3, and B6).
- (2) Position controls as listed in (a) through (d) below:
  - (a) AMPLITUDE switch to 5 and VARIABLE control to CAL.
  - (b) AMPLITUDE RANGE switch to .5-5V.
  - (c) FREQUENCY RANGE switch to 50kHz ONLY.
  - (d) Frequency dial to .5 on .35 to .75 scale.

(3) If digital voltmeter does not indicate between 0.171 and 0.182 V rms, perform **b** below.

(4) Adjust autotransformer (A 1) output from 105 to 125 V ac. Digital voltmeter indication will remain between 0.171 and 0.182 V rms.

(5) Adjust autotransformer output to 115 V ac.

(6) Set AMPLITUDE and AMPLITUDE RANGE switches to settings listed in table 4. If digital voltmeter does not indicate within limits specified, perform **b** below.

**b. Adjustments**

- (1) Connect negative side of digital voltmeter (A3) to collector of Q127 (fig. 1) and positive to center arm of potentiometer R55 (fig. 1) using leads (B5).
- (2) Set AMPLITUDE switch to 50 and AMPLITUDE RANGE switch to .5-5V.
- (3) Adjust potentiometer R55 for 1 V dc +.005-V indication on digital voltmeter (R).
- (4) Set AMPITUDE switch to 5.
- (5) Repeat a(l) above.
- (6) Adjust potentiometer R51 (fig. 2) for 0.177-V rms indication on digital voltmeter (R).

Table 4. Amplitude Accuracy

Test instrument		Digital voltmeter indications (V rms)	
AMPLITUDE switch settings	AMPLITUDE RANGE switch settings	Min	Max
10	.5-5V	0.342	0.364
15	.5-5V	0.514	0.546
20	.5-5V	0.685	0.728
25	5-5V	0.857	0.910
30	.5-5V	1.028	1.092
35	.5-5V	1.200	1.274
40	.5-5V	1.371	1.456
45	.5-5V	1.543	1.638
50	.5-5V	1.714	1.820
50	50-500mV	0.169	0.184
50	5-50mV	0.0167	0.0186

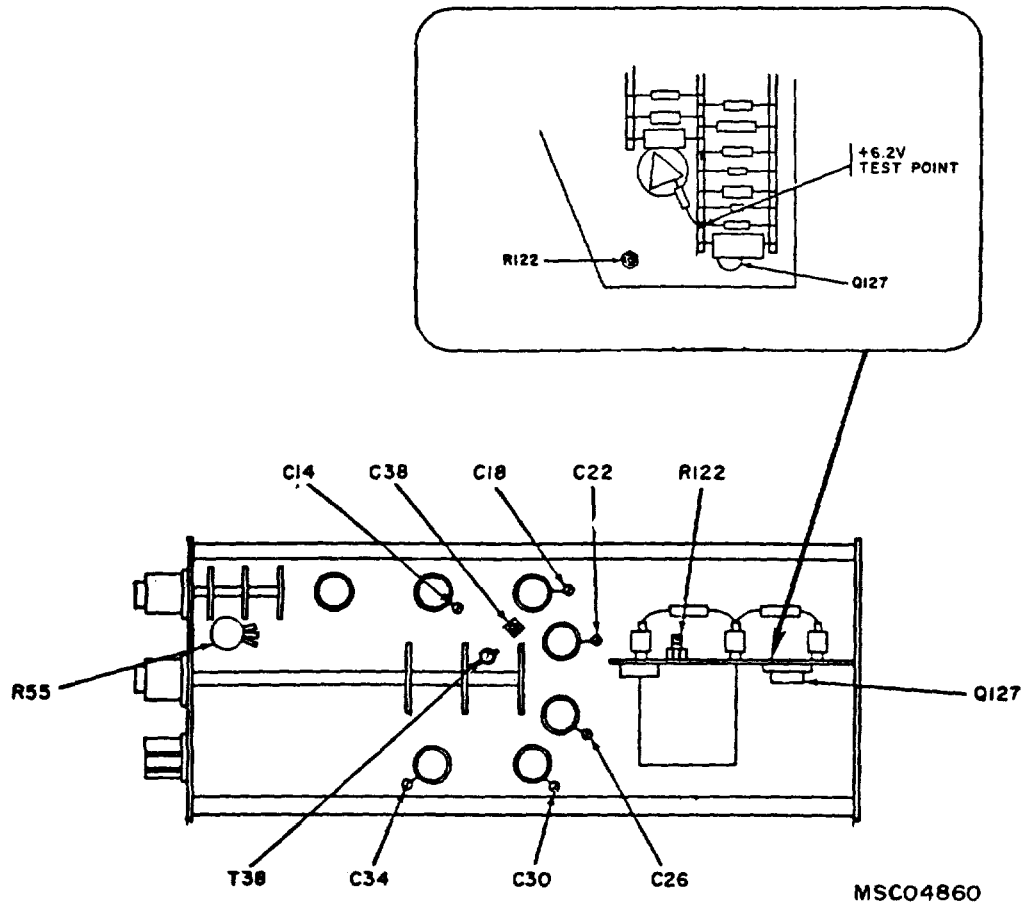


Figure 1. Test instrument - Right side view.

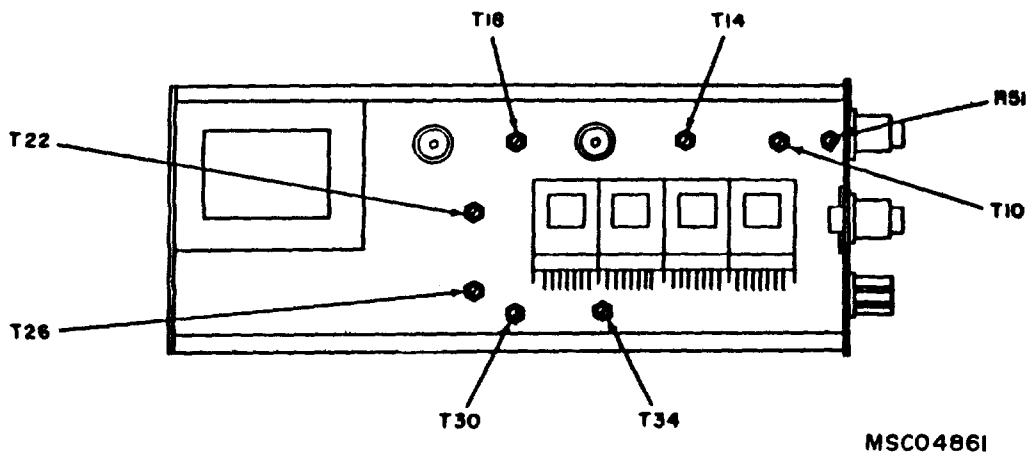


Figure 2. Test instrument - left side view



(7) Repeat (1) through (6) above as necessary to compensate for interaction of adjustments.

**9. Frequency Accuracy.**

**a. Performance Check.**

(1) Connect frequency counter (A5) to OUTPUT, using cable and termination (B3 and B6).

(2) Position controls as listed in (a) through (d) below:

(a) AMPLITUDE switch to 50.

500mV.

(b) AMPLITUDE RANGE switch to 50-

.35-.75.

(c) FREQUENCY RANGE switch to

scale.

(d) Frequency dial to .75 on .35.75

(3) If frequency counter does not indicate between 735 and 765 kHz, perform b below.

(4) Position TI controls as listed in table 5. If frequency counter does not indicate within limits specified, perform corresponding adjustment listed in table 5.

Table 5. Frequency Accuracy

Test instrument		Frequency counter indications (MHz)		Adjustments (R)
FREQUENCY RANGE switch settings	Frequency dial settings	Min	Max	
.35-.75	.35	0.343	0.357	T14 (fig. 2)
.75-1.6	1.6	1.568	1.632	C18 (fig. 1)
.75-1.6	.75	0.735	0.765	T18 (fig. 2)
1.6-3.6	3.6	3.528	3.672	C22 (fig. 1)
1.6-3.6	1.6	1.568	1.632	T22 (fig. 2)
3.6-8	8	7.840	8.160	C26 (fig. 1)
3.6-8	3.6	3.528	3.672	T26 (fig. 2)
8-18	18	17.640	18.360	C30 (fig. 1)
8-18	8	7.840	8.160	T30 (fig. 2)
18-42	42	41.160	42.840	C34 (fig. 1)
18-42	18	17.640	18.360	T34 (fig. 2)
42-100	100	98.00	102.00	C38 (fig. 1)
42-100	42	41.160	42.840	T38 (fig. 1)
50 kHz ONLY	.5	0.049	0.051	T10 (fig. 2)

**b. Adjustments.** Adjust C14 (fig. 1) for frequency counter indication of 750 kHz (R).

**10. Frequency Response**

**a. Performance Check**

(1) Connect equipment as shown in figure 3, connection A.

(2) Position controls as listed in (a) through (c) below:

- (a) AMPLITUDE switch to 50.
- (b) AMPLITUDE RANGE switch to .5-5.
- (c) FREQUENCY RANGE switch to 50

kHz ONLY.

(3) Record differential voltmeter (A4) indication as V1.

(4) Connect equipment as shown in figure 3, connection B.

(5) Adjust dc voltage standard (A2) output until value of V1 is indicated on differential voltmeter. Record dc voltage standard indication.

(6) Adjust dc voltage standard to +3 percent of value recorded in (5) above. Record differential voltmeter indication as V2.

(7) Adjust dc voltage standard to -3 percent of value recorded in (5) above. Record differential voltmeter indication as V3.

(8) (Deleted)

(9) Reconnect equipment as shown in (fig. 3), connection A.

(10) Set FREQUENCY RANGE switch to each range POSITION, and at each range POSITION rotate the frequency dial throughout this range. Differential voltmeter will indicate between V2 and V3 for frequencies from 350 kHz to 100 MHz.

**b. Adjustments.** No adjustments can be made.

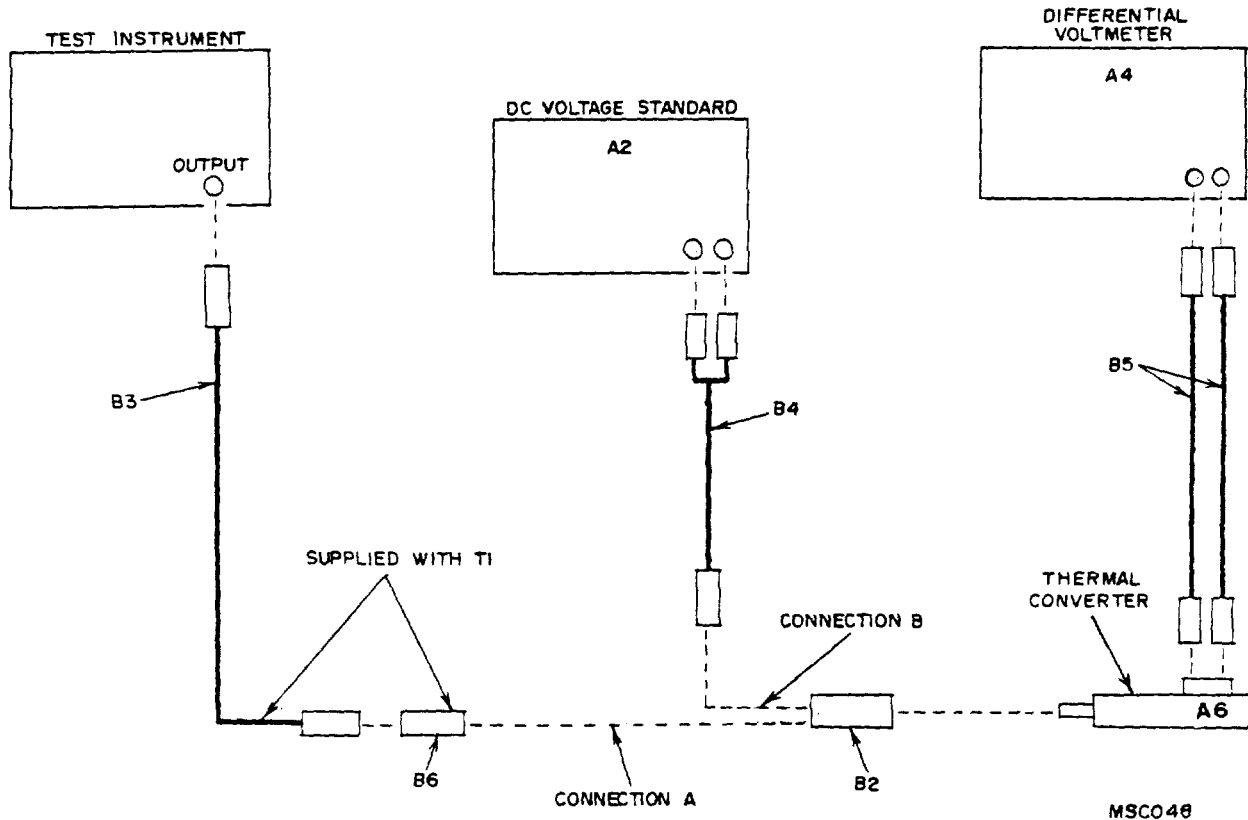


Figure 3. Frequency response - equipment setup

**11. Power Supply**

**NOTE**

**Do not perform power supply check if all other parameters are within tolerance.**

**a. Performance Check.** Connect digital voltmeter (A3) between collector of Q127 (fig. 1) and chassis ground using leads (BS). If digital voltmeter does not indicate between -10.45 and -11.35 V dc, perform **b** below.

**b. Adjustments.** Adjust R122 (fig. 1) for -11 V dc indication on digital voltmeter (R).

**12. Final Procedure.**

**a.** Deenergize and disconnect all equipment and reinstall protective cover on TI.

**b.** Annotate and affix DA Label/Form in accordance with TB 750-23.

By Order of the Secretary of the Army:

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


Official:

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

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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 decigrams = .035 ounce  
 1 decagram = 10 grams = .35 ounce  
 1 hectogram = 10 decagrams = 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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