TB 9-6685-316-50

CHANGE 3

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR PRESSURE GAGE TESTERS MIL-T-2764B MANSFIELD AND GREEN MODEL 10-10525 (8598963 AND 8491213), MANNING, MAXWELL, AND MOORE MODEL 1305B-100 AND AMETEK MODEL R100

Headquarters, Department of the Army, Washington, DC
18 March 2002

TB 9-6685-316-50, 6 April 1977, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove Pages	Insert Pages
1 and 2	1 and 2
25 and 26	25 and 26

2. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

ERIC K. SHINSEKI
General, United States Army
Chief of Staff

OFFICIAL:

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Administrative Assistant to the Secretary of the Army

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CHANGE 2

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR PRESSURE GAGE TESTERS MIL-T-2764B MANSFIELD AND GREEN MODEL 10-10525 (8598963 AND 8491213), MANNING, MAXWELL, AND MOORE MODEL 1305B-100 AND AMETEK MODEL R100

Headquarters, Department of the Army, Washington, DC
1 April 1988

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DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR PRESSURE GAGE TESTERS MIL-T-2764B, MANSFIELD AND GREEN MODEL 10-10525 (8598963 AND 8491213) MANNING, MAXWELL, AND MOORE MODEL 1305B-100 AND AMETEK MODEL R100

Headquarters, Department of the Army, Washington, DC
6 April 1977

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedure, please let us know. Mail your letter or DA Form 2028 to: Commander, U. S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5230. A reply will be furnished to you. You may also send in your comments electronically to our e-mail address: 2028@redstone.army.mil, or FAX 256-842-6546/DSN 788-6546.

*This bulletin supersedes TB 9-6685-316-50, 8 May 73 including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Pressure Gage Testers MIL-T-2746B, Mansfield and Green Model 10-10525 (8598963 and 8491213 Manning, Maxwell, and Moore Model 1305B-100 and Ametek Model R100. The manufacturer's instruction manual was used as the prime data source in compiling these instructions. The equipment being calibrated will be referred to as "TI" (test instrument) throughout this bulletin.

a. Model Variations. The handpump and accessories are basically the same for all units. Pressure gage tester, Manning, Maxwell, and Moore Model 1305B-100 is designated to develop nominal pressure at standard gravity (980.665 cm/sec^2). Pressure gage tester Mansfield and Green Model 10-10525 1398963 and 8491213) are designed to develop nominal pressure at a gravity of 980.217 cm/sec^2 or 980.665 cm/sec^2. The gravity used in design is normally printed on the name tag in the pump carrying case. When replacing the piston and cylinder combination, specify the design gravity according to the name tag. The Ametek Model R100 is a replacement for the Mansfield and Green, Model 10-10525.

b. Time and Technique. The time required for this calibration is approximately 8 hours, using the physical technique.

2. Calibration Data Card, DA Form 2416

a. Forms records, and reports required for calibration personnel at all levels are prescribed by TM 38-750. DA. Form 2416 must be annotated in accordance with TM 38-750 for each calibration performed.

b. Adjustments to be reported on DA Form 2416 are designated (E) at the end of the sentence in which they appear. When adjustments am in tables, the (R) will follow 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
Pressure	Range: 10 to 2000 psi, using low pressure piston 25 to 10,000 psi, using high pressure piston Accuracy: ±0.15% of reading when calibrated at reference level ±0.25% of reading when calibrated at transfer level
Pressure gages	Ranges: 0 to 160 psi, 0 to 600 psi, 0 to 5000 psi, and 0 to 10,000 psi. Accuracy: ±0.25% of full scale

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment used in this calibration Procedure. This equipment is issued with secondary transfer standards calibration set NSN 6695-00-621-7877, and secondary reference standards calibration set NSN 4931-00-621-7878 and is to be used in performing this procedure. 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 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 accuracy ratio between the standard and TI. Where the four-to-one ratio can not be met, the actual accuracy of the equipment selected is shown in parenthesis.

5. Accessories Required. The accessories listed in table 3 are issued as indicated in paragraph 4 above and are to be 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	AVOIRDUPOIS[1] WEIGHT SET	Range: 1/64 oz to 10 oz in 12 weights Accuracy: NBS. Class S-1	(7909971)
A2	AVOIRDUPOIS[2] WEIGHT SET	Range: 1/128 oz to 8 oz in 10 weights Accuracy: NBS. Class C	Henry Troemner, AVOIR (7910419)
A3	GRAM WEIGHT SET[2]	Range: 1 to 500 grams Accuracy: Class C	Ohans Co. Inc., 2-301-5 (7907394)

See footnotes at end of table.

Table 2. Minimum Specifications of Equipment Required - Continued

Item	Common name	Minimum use specifications	Manufacturer and model (part number)
A4	DEADWEIGHT[2] PRESSURE TESTER (Certified)	Range: 10 to 10,000 psi Accuracy: 0.15% of reading	Mansfield and Green, Model 10-10525 (8598963)
A5	DEADWEIGHT[1] PRESSURE TESTER	Range: 10 to 10,000 psi Accuracy: 0.05% of reading	Mansfield and Green, Model RQ-100 (7911584)

[1]Secondary reference standards set.

[2]Secondary transfer standards set.

Table 3. Accessories Required

Item	Common name (official nomenclature)	Description (part number)
B1	BENCH LEVEL[1]	Starrett No. 88 Type II, Class B, Style 2, or equivalent (7902565)
B2	MEASURING TAPE	1/16-in. graduations (5210-287-3335, part of tool kit 7659911)

[1]Secondary transfer standards set.

6. Preliminary Instructions

a. The instructions outlined in this paragraph are preparatory to the calibration process. Personnel should become familiar with sections I, II, and III 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 to, item numbers prefixed with A, see table 2, and for prefix B, see table 3.

c. Visually, inspect TI far any signs of damage or deterioration.

d. Remove deadweight pressure tester (A5) (standard) from carrying case and place on clean, sturdy workbench with height of approximately 30 inches.

WARNING

One person should not attempt to lift or carry the sets of weights any distance. Each set weighs approximately 100 pounds.

e. Certify weights and pistons of TI in accordance with TB 9-6670-254-50 except do not issue a list of recorded readings. The standard weight tolerance class shall be class "C".

NOTE

The weights will be denoted by the nominal developed pressure throughout this bulletin. The TI and standard each have four sizes of weights plus two pistons. The nominal weight nominal developed pressure and quantity per unit are specified in table 4.

f. Remove oil filler plug on testers and fill reservoirs with hydraulic oil MIL-L-7870 (1 quart size, NSN 9150-00-263-3490 or 1 gallon size, NSN 9150-00-273-2397). Tighten filler plugs. Do not over tighten plug.

g. Bolt TI and standard to workbench approximately 15 inches apart.

h. Loosen vent plugs on deadweight pressure testers before use.

Table 4. Mansfield Green, RQ-100 (Standard) and 10-10525 (TI) Weight and Piston Data

Nominal weight (lb)	Nominal developed pressure				Quantity	
	Test Instrument Piston		Standard Piston			
	Low range[1] (psi)	High range[2] (psi)	Low range[1] (psi)	High range (psi)	Test instrument	Standard
0.5	5	25	5	50	4	4
2.0	20	100	20	200	4	4
9.5	95	475	95	950	1	1
10.0	100	500	100	1000	18	8
0.5 (piston)	5	- - -	5	- - -	1	1
0.5 (piston)	- - -	25	- - -	50	1	1

[1]Piston area 0.1 in [2](low-range piston).

[2]Piston area 0.02 in. [3](high-range piston).

[3]Piston area 0.01 in. [3](high-range piston).

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met before continuing with the calibration.

NOTE

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

NOTE

When weight tables appear to be perfectly balanced before calibration weights are added, try calibration weights first on one weight table then the other. The balance must be affected by the specified amount of calibration weights.

7. Leakage

a. Performance Check

(1) Connect equipment as shown in figure 1, using the 0-160 psi pressure gage.

WARNING

This procedure involves pressures that could be hazardous to personnel. Exercise due caution at all times and wear safety glasses while performing checks.

(2) Level TI and deadweight pressure tester (A5) (standard) using level (B1).

(3) Install low-range pistons in cylinders of both units and place 95-psi weights (supplied with pressure gage testers) on low-range piston of n and standard.

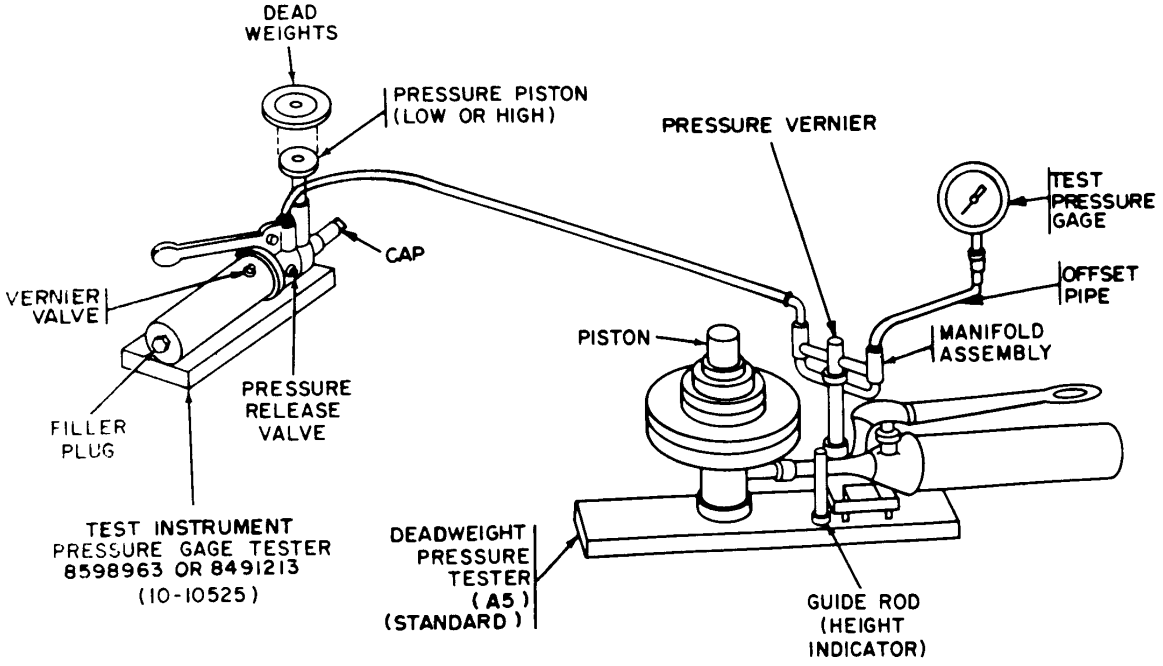

Figure 1. Pressure gage tester calibration - secondary reference equipment setup.

CAUTION

Continuously rotate pistons and weights in TI or standard cylinder housings whenever pistons am inserted or removed from housings or when applying pressure to prevent scoring or sticking in housing and damaging the piston guide and cylinder.

(4) Apply pressure to equipment setup, using handpump on TI and/or standard until bottom surface of either weight table is raised approximately 1/4 inch above either be TI or standard cylinder homing.

(5) Visually inspect equipment for leakage.

CAUTION

Avoid sudden changes in pressure. Do not abruptly release lease Pressure from system, and do not remove weights from piston until all pressure in system has been released.

(6) Release pressure from equipment setup.

(7) Replace 0-160 psi pressure gage with 0-10,000 psi pressure gage. Remove low-range piston and install high-range piston in n cylinder. Place the 475-psi and one 500-psi weight on the high-range piston of the TI.

(8) Remove low-range piston and cylinder from standard and install high-range piston and cylinder. Place the 950-psi weight on the high-range piston and cylinder of standard.

WARNING

To prevent injury to personnel and damage to equipment, exercise extreme caution when applying high pressure to system and avoid any sudden changes in pressure.

(9) Apply pressure to system while continuously rotating weights and pistons until one piston is approximately $^1/_4$ inch above either the TI or the standard cylinder housing.

(10) Visually inspect equipment setup and eliminate any leakage.

(11) Release pressure from TI and place enough weights on piston to test capacity of TI (10,000 Psi) and repeat (9) and (10) above. TI will not leak.

(12) Release pressure by slowly opening pressure relief valve (fig. 1).

(13) Repeat (6) through (12) above, using low-range piston assembly and 0-5000 psi pressure gage to test capacity of system at 2,000 psi. (High-range piston and cylinder must be installed in standard.)

b. Adjustments. No adjustments can be made.

8. Mansfield and Green, Model 10-10525 Calibration

a. Performance Check

NOTE

When using the low-range piston, in both the deadweight pressure tester (A5) (standard) and TI, the reference line of the standard is 3.50 inches above the reference line of the TI. This is equivalent to 0.1113 psi. A mass of $^3/_{16}$ oz must be placed on the TI to compensate for pressure developed by the fluid head.

(1) Install low-range pistons in cylinder housing on TI and standard.

(2) Connect equipment as shown in figure 1, using 0-5000 psi pressure gage.

(3) Place the 95-psi and nine of the 100-psi weights supplied with the TI on the TI piston.

(4) Place the 95-psi, eight of the 100-psi, four of the 20-psi, and four of the 5-psi weights supplied with (A5) on the standard piston.

(5) Compute the deviation of the developed pressure from the nominal pressure of 1000 psi from the Report of Calibration furnished with the standard, using the following equations:

Equation 1.

$$dP\ 1000 - P_R \frac{g}{gc}$$

where: dP = difference between nominal pressure and developed pressure (psi).
1000 = nominal pressure (psi)
PR = Developed pressure (psi) from Report of Calibration furnished with the standard.
gc = local gravity (furnished with Report of Calibration)
g = 980.665 or 980.217 cm/sec^2 (design gravity of piston and cylinder combination).

(6) Compute the weight required to obtain a reference pressure from the equation:

Equation 2.

$$W = (dP)(0.1)$$

where: W = weight (lb) required to obtain a reference pressure.
dP = difference between nominal and developed pressure from equation 1 above.
0.1 = nominal piston area(in.^{2}).

(7) If dP of equation 1 above is positive (+), place a weight combination (using avoirdupois weight set A1) equal to W of equation 2 above (to the nearest nominal weight combination) on the standard.

(8) If dP of equation 1 above is negative (-), place a weight combination (using avoirdupois weight set A1) equal to W of equation 2 above (to the nearest nominal weight combination) on the TI.

(9) Apply pressure to equipment setup, using handpump while slowly rotating weights clockwise until one or both units are floating. Monitor nominal pressure, using pressure gage indication.

(10) Floating will be obtained when weights are rotating clockwise on both units with bottom surface on one weight table about 1/4-inch above cylinder.

(11) Place 1, 1/2, 1/16, and 1/32 oz of calibration weight from (A1) on the floating weight table. If this weight table falls and the opposite weight table rises, the TI is within tolerance. If this weight table does not fall, the TI is not within tolerance.

(12) Release pressure from equipment setup.

(13) Repeat (3) through (12) above for two extremes as shown in table 5. The 1000 of equation 1 above will be changed to the nominal pressure of table 5, and the calibration weight of step (11) will be changed to the calibration weight of table 5. The high range piston and cylinder must be installed in the standard for pressures above 1000 psi.

(14) At the nominal pressure of 1800 psi, if the dP of equation 1 above is positive, add $^1/_{10}$ of weight calculated in equation 2 above to the standard instead of the instructions of (7) above.

Table 5. Low and High Extremes (Low Range)

Nominal pressure (psi)	Weight combination test instrument and standard, including pistons				Calibration weight (oz)	
100	1-95				1/8 And 1/32	
	Low-range piston test instrument		High-range piston (standard)		(Standard) floating (oz)	Test instrument floating (oz)
	Qty	Press. Unit	Qty	Press. Unit		
1800	1	956	1	950	1/4 and 1/32	2, 1/2 and 1/4
	17	100	4	200		

(15) Install high-range pistons in cylinder housings of TI and standard.

(16) Install 0-10,000 psi pressure gage.

NOTE

When using the high-range piston in both the standard and TI the reference line of the standard is 6.09 inches above the reference line of the TI. This is equivalent to 0.1936 psi. A mass of $^1/_{16}$ oz must be placed an the TI to compensate for pressure developed by the fluid head.

(17) Place the 475-psi and nine of the 500-psi weights supplied with the 71 on the TI piston.

(18) Place the 950-psi and four of the 1000-psi weights supplied with the standard on the standard piston.

(19) Compute the deviation of the developed pressure from the nominal pressure of 5000 psi from the Report of Calibration furnished with the standard, using the following equation:

Equation 3.

$$dP = 5000 - P_R \frac{g}{gc}$$

Where: dP = difference between nominal pressure and developed pressure (psi).
5000 = nominal pressure (psi).
P_R = developed pressure (psi) from Report of Calibration furnished with the standard. gc = local gravity (furnished with Report of Calibration).
g = 980.665 or 980.217 cm/sec^2 (design gravity of piston and cylinder combination).

(20) If dP of equation 3 is positive (+), compute the additional weight required on the standard to obtain a reference pressure from the equation:

Equation 4.

$$W = (dP)(0.01)$$

where: W = weight (lb) to be added to standard to obtain a reference pressure (using avoirdupois weight set (A1), to the nearest nominal weights combination).
dP = difference between nominal and developed pressure from equation 3 above.
0.01 = nominal piston area of standard (in.^{2}).

(21) If dP of equation 3 is negative (-), compute the additional weight required on the TI to obtain a reference pressure from the equation.

Equation 5.
$W_2 = (dP)(0.02)$
Where: w_2 = weight (lb) to be added to TI to obtain a reference pressure (using weight set (A1) to the nearest nominal weights nation).
dP = difference between nominal and developed pressure from equation 3 above
0.02 = nominal piston area of TI ($in.^2$)

(22) Apply pressure to equipment setup, using handpump while slowly rotating weights clockwise until one or both units are floating. Monitor nominal pressure using standard pressure gage indication.

(23) Floating will be obtained when weights are rotating clockwise on both units with bottom surface of one weight table 1/4-inch above either the TI or standard cylinder housing.

(24) If the standard weight table is floating, place 1/4 oz 1/2 oz and 1/16 oz calibration weights from (A1) on the standard weight table. If the standard weight table falls and the TI weight table rises, the TI is within tolerance. If the standard weight table does not fall, the TI is not within tolerance.

(25) If the TI weight table is floating, place 1 oz, 1/2 oz and 1/16 oz calibration weights from (A1) on the TI weight table. If the weight table falls and the standard weight table rises, the TI is within tolerance. If the TI weight table does not balance the TI is not within tolerance.

(26) Release pressure from equipment setup.

(27) Repeat (18) through (26) above for two extremes as shown in. table 6. The 5000 of equation 3 above will be changed to the nominal pressure of table 6, and the calibration weights of paragraphs (24) and (25) above will be changed to the calibration weight of table 6.

Table 6. Low and High Extremes (High Range)

Nominal pressure (psi)	Weight combination, including high-range pistons				Calibration weight (A1)	
	Test Instrument		(Standard)		(Standard) floating (oz)	Test instrument floating (oz)
	Qty	Press. unit	Qty	Press. unit		
9000	1 17	475 500	1 8	950 1000	1, 1/4, 1/8, & 1/16	2, 1/2, 1/4 and 1/8
1000	1 1	475 500	1	950	1/8 & 1/32	1/4 and 1/16

b. Adjustments. No adjustments can be made.

9. Pressure Gages

a. Performance Check

(1) Disconnect high-pressure hose from standard (A5), and install low-range piston and 0-160 psi pressure gage (fig. 2).

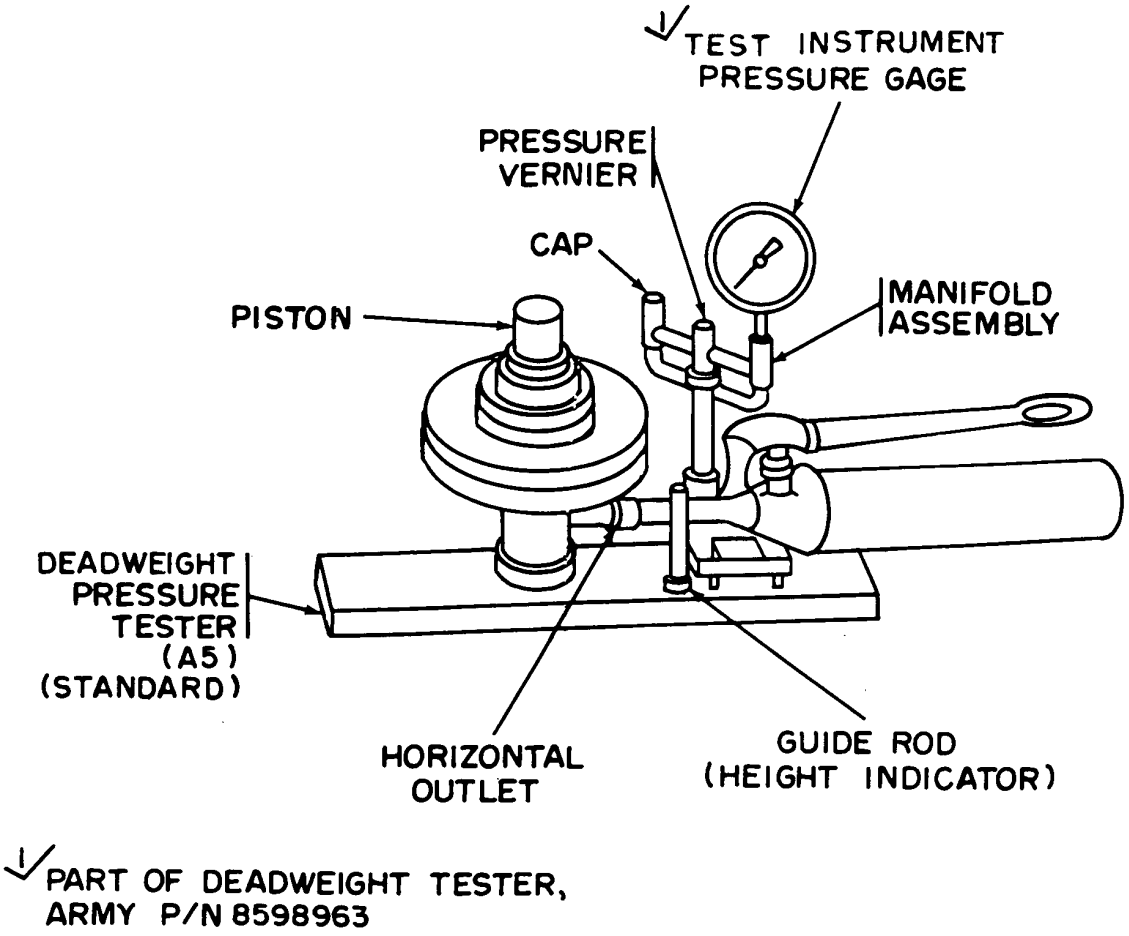

Figure 2. Test gage calibration - secondary reference equipment setup.

(2) Place four of the 5-psi weights on the piston to obtain a nominal pressure of 25 psi. Use weight calibration specified in the Report of Calibration furnished with the standard.

(3) Determine pressure developed value from the Report of Calibration furnished with the standard and apply pressure to equipment setup, manually rotating weights clockwise until bottom surface of weight table is 1/4 inch above cylinder (balanced and floating). If necessary, obtain exact balance using pressure vernier valve (fig. 2).

(4) Tap face of gage lightly. If gage does not indicate Pressure developed by weight combination from the Report of Calibration ±0.4 psi, perform **b** below.

(5) Repeat (2) through (4) above for values listed in table 7. If TI pressure gage does not indicate a value equal to the Pressure Developed value from the Report of Calibration for each weight combination and within each tolerance indicated, perform **b** below.

Table 7. Pressure Gage Accuracy

Nominal pressure	Tolerance[2]
0-160 psi gage	
50	± 0.4
100	± 0.5
150	± 0.4
0-600 psi gage	
100	± 1.5
200	± 1.5
300	± 1.5
400	± 1.5
500	± 1.5
0-5000 psi gage[3]	
1000	± 12.5
2000	± 12.5
3000	± 12.5
4000	± 12.5
0-10,000 psi gage	
1000	± 25
3000	± 25
5000	± 25
7000	± 25
9000	± 25

[1]Refer to Report of Calibration for weight combination.
[2]Allowable deviation from value specified on Report of Calibration for weight combination indicated.
[3]Install high-range piston.

CAUTION

Do not remove gage or weights until pressure has been released from system, and do not exceed pressure range of gage

b. Adjustments. (See figure 3)

(1) Deviations either plus or minus by a constant value are corrected by repositioning the pointer. Remove the bezel ring, loosen the locking screw (marked L) 1/4 turn, and adjust the screw marked "A." Tighten the locking screw and install the bezel ring.

(2) Deviations varying linearly over the range of the TI are corrected by repositioning the link screw. Remove the protective back or case from the mechanism, loosen the link screw and move in the slot of the sector as required. Tighten the link screw and install the protective back or case.

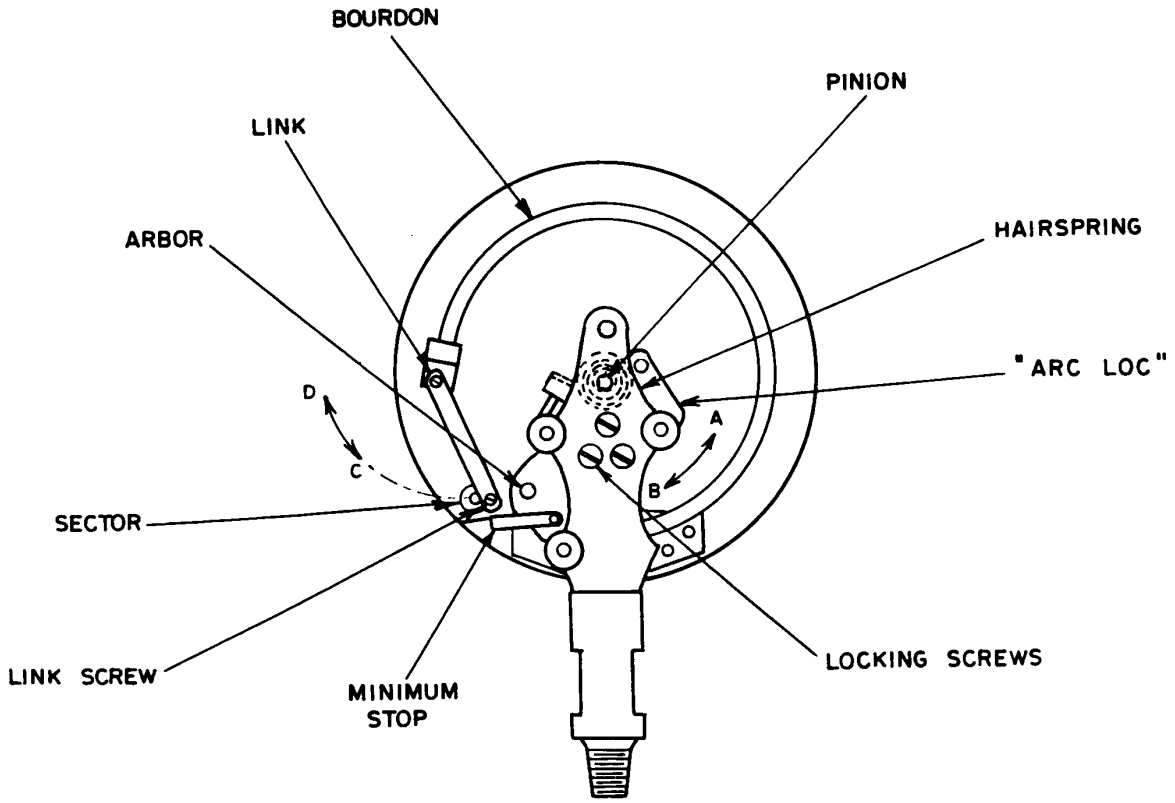

Figure 3. Typical pressure gage.

(3) Deviations varying non-linearly over the range of the TI are corrected by repositioning the arc-loc movement. Remove the protective back or case, loosen the three locking screws, and rotate the arc-loc movement as required. If the indications are first increasingly plus and then decreasingly plus, rotate the arc-loc movement in the direction “A”. If the indications are first increasingly minus and then decreasingly minus, rotate the arc-loc movement in direction “B”. Tighten the locking screws.

(4) Repeat (1), (2), or (3) as necessary to obtain indications within tolerance.

10. Final Procedure

a. Release pressure, remove all weights, and reinstall in carrying case.

b. In accordance with TM 38-750, annotate and affix DA Label 80 (US Army Calibration System). When the 11 cannot be a(adjusted within tolerance, annotate; and affix DA Form 2417 (Unserviceable or Limited Use) tag.

SECTION IV
CALIBRATION PROCESS (SECONDARY TRANSFER)

11. Preliminary Instructions

a. The instructions outlined in this paragraph are preparatory to the (calibration process. Personnel should become familiar with sections I, II, and IV 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. Visually, inspect TI for any signs of damage or deterioration.

d. Remove deadweight pressure tester (A4) (standard) from carrying case and place on clean, sturdy workbench approximately 30 inches high.

NOTE

Certify pressure gages to ±0.25 percent of full scale in accordance with TB 9-6685-319-50.

WARNING

One person should not attempt to lift or carry the sets of weights any distance. Each set weighs approximately 100 pounds.

e. Remove oil filler plug on tester and fill reservoirs with hydraulic oil NM-L-7870, (1 quart size, NSN 9150-00-263-3490 or 1 gallon size, NSN 9150-00-273-2397). Tighten filler plugs and open vent valves.

f. Bolt TI and standard to workbench approximately 15 inches apart.

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met before continuing with the calibration.

NOTE

When weight tables appear to be perfectly balanced before calibration weights are added, try calibration weights first on one weight table, then the other. The balance must be affected by the specified amount of calibration weights.

NOTE

When calibrating Mansfield and Green Model 10-10525, or Ametek Model R100 both the TI and standard have four sizes of weights and two pistons. Manning, Maxwell, and Moore Model 1305B-100 has five sizes of weights and two pistons. The nominal weight, nominal developed pressure, and quantity per unit for each model are specified in tables 8 and 9.

Table 8. Mansfield and Green (TI and Standard) 10-10525 or Ametek Model R100 Weight and Piston Data

Nominal weight (lb)	Nominal developed pressure				Quantity	
	Test instrument piston		(Standard) piston			
	Low range[1] (psi)	High range[2] (psi)	Low range[1] (psi)	High range[2 3] (psi)	Test instrument	(Standard)
0.5	5	25	5	25	4	4
2.0	20	100	20	100	4	4
9.5	95	475	95	475	1	1
10.0	100	500	100	500	18	18
0.5 (piston)	5	---	5	---	1	1
0.5 (piston)	---	25	---	25	1	1

[1]Piston area 0.1 in.[2] (low-range piston).

[2]Piston area 0.02 in.[3] (high-range piston).

[3]Piston area 0.01 in.[2] (high-range piston) (R100).

Table 9. Weight and Piston Data (Manning, Maxwell, and Moore 1305B-100 (TI). Mansfield and Green 10-10525 or Ametek Model R100 (Standard)

Nominal weight		Nominal developed pressure				Quantity	
		Test instrument piston		(Standard) piston			
Lb	Oz	Low range[1] (psi)	High range[2] (psi)	Low range[3] (psi)	High range[4 5] (psi)	Test instrument	(Standard)
.3125	5	5	25	---	---	1	---
.5	---	---	---	5	25	---	4
.625	10	10	50	---	---	3	---
1.25	20	20	100	---	---	2	---
2.0	---	---	---	20	100	---	4
2.5	40	40	200	---	---	3	---
6.25	100	100	500	---	---	18	---
9.5	---	---	---	95	475	---	1
10.0	---	---	---	100	500	---	18
.3125 piston	5	5	---	---	---	1	---
.3125 piston	5	---	25	---	---	1	---

See footnotes at end of table.

Table 9. Weight and Piston Data (Manning, Maxwell, and Moore 1305B-100 (TI). Mansfield and Green 10-10525 or Ametek Model R100 (Standard) - Continued

Nominal weight		Nominal developed pressure				Quantity	
		Test instrument piston		(Standard) piston			
		Low range[1]	High range[2]	Low range[3]	High range [4 5]	Test instrument	(Standard)
Lb	Oz	(psi)	(psi)	(psi)	(psi)		
.5 piston	---	---	---	5	---	---	1
.5 piston	---	---	---	---	25	---	1

[1]Test instrument nominal piston area 1.16 in.[2] (low-range piston).
[2]Test Instrument nominal piston area 1.80 in.[2] (high-range piston).
[3]Standard nominal piston area 0.1 in.[2] (low-range piston). (10-10525)
[4]Standard nominal piston area 0.02 in.[2] (high-range piston).
[5]Standard nominal piston area 0.01 in[2] high (high-range piston) (R100).

12. Leakage

a. Performance Check

(1) Connect equipment as shown in figure 4.

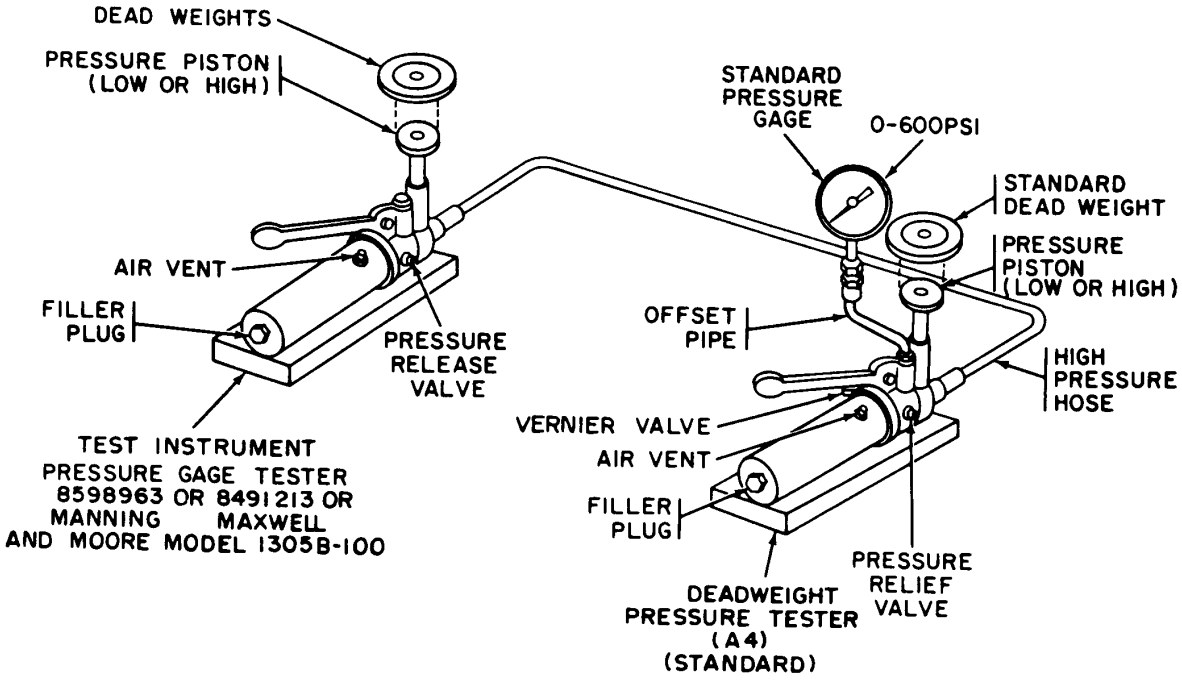

Figure 4. Pressure gage tester - secondary transfer equipment setup.

WARNING

This procedure involves pressures that could be hazardous to personnel. Exercise due caution at all times while performing checks. Ensure that system is free of air.

(2) Level TI and deadweight pressure tester (A4) (standard) using bench level (B1).

(3) Install low-range pistons in cylinders of TI and standard and place 95-psi weight (100 psi weight combination for model 1305B-100) on low-range piston of TI and standard.

CAUTION

Continuously rotate pistons and weights in deadweight cylinder housings whenever pistons are inserted or removed from housings, or when applying Pressure, to prevent scoring or sticking in housing and damaging the piston guide and cylinder.

(4) Apply pressure to equipment setup, using hand pump on TI and/or standard until bottom surface of either weight table is $^{1}/_{16}$ inch above either the TI or standard cylinder housing (fig. 4).

(5) Visually inspect equipment for leakage.

CAUTION

Avoid sudden changes in pressure. Do not abruptly release pressure from system and do not remove weights from piston until all pressure in system has been released.

(6) Release pressure from equipment setup, and replace the 0-600 psi pressure gage with 0-10,000 psi pressure gage (fig. 4). Remove low-range pistons and install high-range pistons in the TI and standard cylinder housings. Place 475-psi weight and one 500-psi weight on each piston.

WARNING

To prevent injury to personnel and damage to equipment, exercise extreme caution when applying high pressure to system and avoid any sudden changes in pressure.

(7) Apply pressure to TI while continuously rotating weights and pistons until either or both pistons are $^{1}/_{16}$ inch above the TI and standard cylinder housings.

(8) Visually inspect equipment setup for leakage.

(9) Release pressure from TI and place enough weights on each piston to test at capacity (10,000 psi) and repeat (7) and (8) above. The system will not leak.

(10) Release pressure by slowly opening pressure relief valve (fig. 4).

(11) Repeat (6) and (7) above, using low-range piston assemblies and 0-5000 psi gage to test capacity of system at 2,000 psi.

b. Adjustments. No adjustments can be made.

13. Mansfield and Green, Model 10-10525 or Ametek Model R100 Calibration (Standard and TI Having Same Design Gravity).

a. Performance Check

(1) Install low-range pistons in cylinder housing of TI and deadweight pressure tester (A4) (standard).

(2) Connect equipment as shown in figure 4, using standard 0-600 psi pressure gage (part of A4).

(3) Place the standard and TI 95-psi weights on their respective weight tables.

(4) Apply pressure to equipment setup, using handpump while slowly rotating weights clockwise until one or both units are floating. Monitor nominal pressure using pressure gage indication. (Nominal pressure is 100 psi.)

(5) Balance will be obtained when weights are rotating clockwise an one or both units with bottom surface of weight table $1/4$ inch above either the TI or standard cylinder housing.

(6) Place a $1/8$, $1/32$ and $1/64$ oz weight from avoirdupois weight set (A2) on the weight table that is floating. If this weight table falls and the other rises the TI is within tolerance. If the opposite tables does not rise, the TI is not within tolerance.

CAUTION

Bleed pressure from system prior to removal of any weight.

(7) Replace the standard and TI 95-psi weights with one 10-psi weight on each weight table. Repeat (4) through (6) above.

(8) Replace the TI 100-psi weight with a different 100-psi weight. (Do not replace the standard 100-psi weight.) Repeat (4) through (6) above. Repeat this process until each 100-psi weight has been checked.

(9) Replace the standard and TI 100-psi weight with one 20-psi weight on each weight table. Repeat (4) and (5) above.

(10) Place a $1/32$ and $1/64$ oz weight from avoirdupois weight set (A2) on the weight table that is floating. If this weight table falls and the other rises, the TI is within tolerance. If the opposite table does not rise, the TI is not within tolerance.

(11) Replace the TI 20-psi weight with a different 20-psi weight. (Do not replace the standard weight.) Repeat (4), (5), and (10) above. Repeat this process until each 20-psi weight has been checked.

(12) Place one 20-psi weight and one 5-poi weight on weight table of standard and TI. Repeat (4), (5), and (10) above, except use a $^{1}/_{32}$ oz and $^{1}/_{64}$ oz weight in (10)above.

(13) Replace the TI 5-psi weight with a different 5-psi weight without replacing the standard weight. Repeat steps (4), (5) and (10) above. Repeat this process until each TI
5-psi weight has been checked.

(14) Replace the standard 0-600 psi pressure gage with the 0-5,000 psi pressure gage.

(15) Remove all weights from the standard and TI pistons. Place the 95-psi weight and seventeen 100-psi weights on the standard and TI.

(16) Repeat (4) and (5) above.

(17) Place up to, but not more than, $2^{7}/_{8}$ oz of weight on the weight table that is floating. If this table falls and the other rises, the TI is within tolerance. If the other table does not rise, the TI is not within tolerance.

(18) Replace the low-range pistons with high-range pistons in both the TI and standard.

(19) Place 475-psi weights on the standard and TI weight tables.

(20) Repeat (4) and (5) above.

(21) Place up to, but not more than $^{5}/_{32}$ oz of weight on weight table that is floating. If this table falls and other table rises, the TI is within tolerance. If he other table does not rise, the TI is not within tolerance.

(22) Replace the 0-5000 psi pressure gage with the 0-10,000 psi pressure gage.

(23) Place one 475-psi weight and fifteen 500-psi weights on the standard and TI weight tables (8,000 psi nominal pressure).

(24) Repeat (4) and (5) above.

(25) Place up to, but not more than, $2^{9}/_{16}$ oz of weight on the weight table that is floating. If this table falls and the other table rises the TI is within tolerance. If the other table does not rise, the TI is not within tolerance.

b. Adjustments. No adjustments can be made.

14. Mansfield and Green, Model 10-10525 or Ametek Model R100 Calibration (Standard and TI having different Design - Gravities).

a. Performance Check

(1) Install low-range pistons in cylinder housing of TI and deadweight pressure tester (A4) (standard).

(2) Connect equipment as shown in figure 4, using standard 0000 psi pressure gage (part of A4).

(3) Place the standard and TI 95-psi weights on their respective weight tables.

(4) Apply pressure to equipment setup, using handpump while slowly rotating weights clockwise until one or both units are floating. Monitor nominal pressure, using pressure gage indication. (Nominal pressure is 100 psi.)

(5) Balance will be obtained when weights are rotating clockwise on one or both units with bottom surface of weight table $^1/_4$ inch above either the TI or standard cylinder housing.

(6) Place a $^1/_{16}$ oz weight from the avoirdupois weight set (A2) on the deadweight tester designed for a gravity of 980.665 cm/sec^2.

(7) Place a $^1/_8$, $^1/_{32}$, and $^1/_{64}$ oz weight from avoirdupois weight set (A2) on the weight table that is floating. If this table falls and the other rises, the TI is within tolerance. If the opposite table does not rise, the TI is not within tolerance.

CAUTION

Bleed pressure from system prior to removal of any weight.

(8) Replace the standard and TI 95-psi weights with one 100-psi weight on each weight table. Repeat (4) through (7) above-.

(9) Replace the TI 100-psi weight with a different 100 psi weight. (Do not replace the standard 100-psi weight.) Repeat (4) through (7) above. Repeat this procedure until each 100-psi weight has been checked.

(10) Replace the standard and TI 100-psi weight with one 20-psi weight on each weight table. Repeat (4) and (5) above. (Nominal pressure 25 psi).

(11) Place a $^1/_{64}$ oz weight from the avoirdupois weight set (A2) on the deadweight tester designed for a gravity of 980565 cm/sec^2.

(12) Place a $^1/_{32}$ and $^1/_{128}$ oz weight from avoirdupois weight set (A2) on the weight table that is floating. If this table falls and the other rises, the TI is within tolerance. If the opposite table does not rise, the TI is not within tolerance.

(13) Replace the TI 20-psi weight with a different 20-psi weight. (Do not replace the standard weight.) Repeat (4), (5), (11), and (12) above. Repeat this process until each TI 20-psi weight has been checked.

(14) Place one 20-psi weight and one 5-psi weight on weight table of standard and TI. Repeat (4), (5), (11) and (12) above, except use a $^1/_{32}$ oz and $^1/_{64}$ oz weight in(12) above.

(15) Replace the TI 5-psi weight with a different 5 psi weight without replacing the standard weight. Repeat steps (4), (5), (11), and (12) above except use a $^1/_{32}$ and $^1/_{64}$ oz weight in (12) above. Repeat this procedure until each 5-psi weight has been checked.

(16) Replace the standard 0-600 psi pressure gage with the 0-5000 psi pressure gage.

(17) Remove all weights from the standard and TI weight tables. Place the 95-psi weight and seventeen 100-psi weights on the standard and TI weight tables.

(18) Place $1\frac{5}{16}$ oz of weight from the avoirdupois weight set (A2) on the deadweight tester designed for a gravity of 980.665 cm/sec^2.

(19) Repeat (4) and (5) above.

(20) Place up to, but not more than $2\frac{7}{8}$ oz of weight on the weight table that is floating. If this table falls and the other rises, the TI is within tolerance. If the other table does not rise, the TI is not within tolerance.

(21) Replace the low-range pistons with high-range pistons in both the TI and standard.

(22) Place 475-psi weights on the standard and TI weight tables. (Nominal pressure is 500 psi.)

(23) Place a $\frac{1}{64}$ oz weight from the avoirdupois weight set (A2) on the deadweight tester designed for a gravity of 980.665 cm/sec^2.

(24) Repeat (4) and (5) above.

(25) Place up to, but not more than 512 oz of weight on weight table that is floating. If this table falls and the other rises, the TI is within tolerance. If the other table does not rise the TI is not within tolerance.

(26) Replace the 0-5000 psi pressure gage with the 0-10,000 psi pressure gage.

(27) Place one 475-psi weight and fifteen 500-psi weights on the standard and TI weight tables (8,000 psi nominal pressure).

(28) Place $1\frac{11}{64}$ oz of weight from the avoirdupois weight set (A2) on the deadweight tester designed for a gravity of 981665 cm/sec^2.

(29) Repeat (4) and (5) above.

(30) Place up to, but not more than, $2\frac{9}{16}$ oz of ,weight on the weight table that is floating. If this table falls and the other rises the TI is within tolerance. If the other table does not rise, the TI is not within tolerance.

b. Adjustments. No adjustments can be made.

15. Manning, Maxwell, and Moore Model 1305B100 Calibration (Design Gravity of Standard 980.217 cm/sec^2)

a. Performance Check

(1) Install low-range pistons in cylinder housing of TI and deadweight pressure tester (A4) (standard).

(2) Connect equipment as shown in figure 4 using standard 0-600 psi pressure gage.

(3) Place one standard and one TI 100-psi weight on their respective weight tables

(4) Place 0.048 oz of weight on TI to compensate for deign gravity of standard.

(5) Apply pressure to equipment setup, using handpump while slowly rotating weights clockwise until one or both units are floating. Monitor nominal pressure, using pressure gage indication. (Nominal pressure is 105 psi.)

(6) Balance will be obtained when weights are rotating clockwise on one or both units with bottom surface of weight table 1/4 inch above either the TI or standard cylinder housing.

(7) If the standard is floating, place a 1/8 and 1/32 oz weight from avoirdupois weight set (A2) on the standard. If the TI weight table is floating, place a 1/16 and a 1/32 oz weight on the TI weight table. If the table to which weight has been added falls and the other rises the TI is within tolerance. If the opposite table does not rise, the TI is not within tolerance.

(8) Replace the TI 100-psi weight with a different 100-psi weight without replacing the standard 100-psi weight. Repeat steps (4) through (7) above. Repeat this procedure until each TI 100-psi weight has been checked.

(9) Repeat the above technique for each TI weight as indicated in table 10. The gravity compensation weight of column 1 of table 10 should replace the weight specified in (4) above.

Table 10. Low-Range Piston Calibration

Test instrument			Standard	
Gravity COMPENSATION WEIGHT (OZ)	Weights to place on test instrument (psi)	Calibration weight (added mass) (oz)	Weights to place on (standard) (psi)	Calibration weight (added mass) (oz)
0.048	100	1/16 and 1/32	100	1/8 and 1/32
0.020	40	1/32 and 1/64	two 20	1/16
0.011	20	1/64	20	1/32
0.016	One 20[1] and one 10	1/32	One 20 and two 5	1/32 and 1/64
0.014	One 20[1] and one 5	1/32	One 20 and one 5	1/32 and 1/64

[1]Weight not replaced for calibration using smaller weights.

(10) Replace the standard 0-600 psi pressure gage with the 0-5000 psi pressure gage

(11) Remove all weights from the standard and TI weight tables. Place eighteen 100-psi -weights an the standard and TI weight tables (nominal pressure 1805 psi).

(12) Place 53/64 oz of weight on the TI to compensate for different design gravities.

(13) If the standard if floating, place 2 7/8 oz of weight from the avoirdupois weight set (A2) on the standard. If the TI weight table if floating, place 1 oz of weight on the TI weight table. If the table to which weight has been added falls and the other rises, the TI is within tolerance. If the opposite table does not rise, the TI is not within tolerance.

(14) Replace the low-range piston with the high-range piston in the TI and standard, and install the 0600 psi pressure gage.

(15) Repeat (3) through (7) above for the TI weight indicated in table 11. The gravity compensation weight of column 1 of table 11 should replace the weight specified in (4) above.

Table 11. High-Range Piston Calibration

Test instrument			Standard	
Gravity compensation weight (oz)	Weights To place on test instrument (psi)	Calibration weight (added mass) (oz)	Weights to place on (standard) (psi)	Calibration weight (added mass) (oz)
0.048	500	1/16 and 1/32	500	1/8 and 1/32

(16) Replace the standard 0-600 psi pressure gage with the 0-10,000 psi pressure gage.

(17) Place eighteen 500 psi weights on the standard and TI (nominal pressure 9,025 psi).

(18) Place 53/64 oz of weight on the TI to compensate for different design gravities.

(19) If the standard is floating, place 2 7/8 oz of weight from the avoirdupois weight set (A2) on the standard. If the TI weight table is floating, place 1 13/16 oz of weight on the TI weight table. If the table to which weight has been added falls and the other rises, the TI is within tolerance If the opposite table does not rise, the TI is not within tolerance.

b. Adjustments. No adjustments can be made.

16. Manning, Maxwell, and Moore Model 1305B100 Calibration (Design Gravity of Standard 980.665 cm/sec^2).

a. Performance Check

(1) Install low-range pistons in cylinder housings of TI and deadweight pressure tester (A4) (standard).

(2) Connect equipment as shown in figure 4 using standard 0-600 psi pressure gap.

(3) Place one standard and one TI 100-psi weight on their respective weight tables.

(4) Apply pressure to equipment setup, using handpump while slowly rotating weights clockwise until one or both units are floating. Monitor nominal pressure using pressure gage indication. (Nominal pressure is 105 psi).

(5) Balance will be obtained when weights are rotating clockwise on one or both units with bottom surface of weight table 1/4 inch above either the TI or standard cylinder housing.

(6) If the standard is floating, place a 1/8 and a 1/32 oz weight from avoirdupois weight set (A2) on the standard. If the TI weight table is floating, place a 1/16 and a 1/32 oz weight on the TI weight table. If the table to which weight has been added falls and

the other table rises, the TI is within tolerance. If the opposite weight table does not rise, the TI is not within tolerance.

(7) Replace the TI 100-psi weight with a different 100-psi weight without replacing the standard 100-psi weight. Repeat steps (4) through (6) above. Repeat this procedure until each TI 100-psi which has been checked.

(8) Repeat the above technique for each TI weight as indicated in table 12.

Table 12. Low-Range Piston Calibration

Test instrument		Standard	
Weights to place on test instrument (psi)	Calibration weight (added mass) (oz)	Weights to place on (standard) (psi)	Calibration weight (added mass) (oz)
100	1/16 and 1/32	100	1/8 and 1/32
40	1/32 and 1/64	two 20	1/16
20	1/64	20	1/32
One 20[1] and one 10	1/32	one 20 and two 5	1/32 and 1/64
One 20[1] and one 5	1/32	one 20 and one 5	1/32 and 1/64

[1]Weight not replaced for calibration using smaller weights.

(9) Replace the standard 0-600 psi pressure gage with the 0-5000 psi pressure gage.

(10) Remove all weights from the standard and TI weight tables. Place eighteen 100-psi weights on the standard and TI weight tables (nominal pressure 1805 psi).

(11) If the standard is floating, place 2 7/8 oz of weight from the avoirdupois weight set (A2) on the standard. If the TI weight table is floating, place 1 13/16 oz of weight on the TI weight table. If the table to which weight has been added falls and the other table rises, the TI is within tolerance. If the opposite weight table does not rise, the TI is not within tolerance.

(12) Replace the low-range piston with the high-range piston in the TI and standard, and install the 0-600 psi pressure gage.

(13) Place one standard and one TI 500-psi weight on their respective weight table.

(14) Repeat (4) through (6) above.

(15) Replace the standard 0-600 psi pressure gage with the 0-10,000 psi pressure gage.

(16) Place eighteen 500 psi weights on the standard and TI (nominal pressure 9,025 psi).

(17) If the standard is floating, place 2 7/8 oz of weight from the avoirdupois weight set (A2) on the standard. If the TI weight table is floating, place 1 13/16 oz of weight on the TI weight table. If the table to which weight has been added falls and the other table rises, the TI is within tolerance. If the opposite weight table does not rise, the TI is not within tolerance.

b. Adjustments. No adjustments can be made.

17. Final Procedure

a. Release pressure, remove all weights, and reinstall in carrying case.

b. In accordance with TM 38-750, annotate and affix DA Label 80 (US Army Calibration System), when the TI cannot be adjusted within tolerance, annotate and affix DA Form 2417 (Unserviceable or Limited Use) tag.

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