



Department of consumer and corporate affairs / Ministère de la consommation et des corporations



STANDARDS BRANCH - DIRECTION DES NORMES

NOTICE OF APPROVAL - AVIS D'APPROBATION

NO.	S.WA - 844
DATE	August 11, 1973

A.O. SMITH - MODEL ATG AUTOMATIC TEMPERATURE COMPENSATOR

Manufacturer: A.O. Smith Meter Systems
Erie, Pennsylvania, U.S.A.

Apparatus Listed: Model ATG universal automatic temperature compensator for use on heated petroleum products (standard type) and liquefied petroleum gases (LPG type).

<u>Rating</u>	<u>Standard</u>	<u>LPG Type</u>
Ambient Temperature	-30 to 130 ^o F	-30 to 130 ^o F
API Gravity	0 to 110 ^o	--
Specific Gravity	1.075 to 0.580	0.600 to 0.500
Coeff. of Expansion	0.0003 to 0.001 (per ^o F)	0.0010 to 0.0025 (per ^o F)

Compensator Ranges (Standard Type)

0 - 150 ^o F	125 - 225 ^o F	175 - 375 ^o F
-50 - 100 ^o F	175 - 275 ^o F	225 - 425 ^o F
50 - 200 ^o F		275 - 475 ^o F
		325 - 525 ^o F

Compensator Ranges (LPG Type)

0 - 150^oF and -40 to 110^oF

Compensators with ranges 5^o or 10^oF below or above the range limits listed are also approved.

Application: The standard model ATG unit is approved for use on hot bunker and other oils that are normally heated for convenience in handling.

The LPG model ATG unit is approved for use on liquid propane and other liquefied gases.

SPECIAL CONDITIONS: The model ATG automatic temperature compensator may be used only under the following conditions:

- (1) Meters with compensators shall be used only on liquids for and under circumstances which have been authorized by the Standards Branch.
- (2) All meters shall be in fixed (that is, non-mobile) installations.
- (3) All meters shall be equipped with mechanically driven GROSS registers, but the GROSS register shall not take precedence in either size or location over the compensated (NET) register, and both registers shall be visible to the user.
- (4) All meters shall be equipped with a master calibrator between the meter body and the NET and GROSS registers, such that when this calibrator is adjusted, the two registers shall be affected equally.
- (5) All compensators shall be bench-tested by the manufacturer at 3 or more suitable temperatures covering the range of the compensator. If these tests are not witnessed by an Inspector, the test results and other particulars shall be sent to the Standards Branch, Ottawa.
- (6) Field adjustment of compensators shall be restricted to the use of the registration adjustment provided for that purpose; the gravity selector adjustment shall not be changed from its factory setting.
- (7) Following the initial setting of the registration adjustment dial on a newly installed compensator to obtain the proper relation between the GROSS and NET registers, subsequent adjustments at field tests shall not exceed one-half the tolerance permitted at that temperature.
- (8) All compensators requiring a larger adjustment than permitted in (7) or that have been in any way tampered with or repaired, as evidenced by a broken seal, shall be calibrated as in (5) before being placed into service.
- (9) All installations of meters with automatic temperature compensators shall have an accurate thermometer close to the thermal bulb of the compensator, and a well for a test thermometer, at least $\frac{1}{2}$ " I.D. and $3\frac{1}{2}$ " deep. (thin-walled for heat transfer).
- (10) Where a meter with compensator is used on a heated product, the temperature of the product shall be controlled so that it is within $\pm 30^{\circ}\text{F}$ of the mid-range of the compensator.
- (11) The compensated register shall be marked "gallons at 60°F " and any ticket used with the ticket printer on the compensated register shall have this same marking.
- (12) All compensators shall be marked with the serial number, model number, temperature range and API or specific gravity of the product for which the compensator is intended.

DESCRIPTION: The model ATG is fully described on A.O. Smith bulletin 1.6.4.1, copies of which are available at each District Office of Weights and Measures.

The same roller-disk mechanism which is used to vary NET registration with temperature is also used to adjust the NET calibration. For example, with the product at 60°F, the roller-disk mechanism is adjusted so that the NET register indicates the same as the GROSS register, and at other temperatures the compensator readjusts the roller-disk mechanism from this setting so that the NET register indicates compensated gallons. When calibration of the GROSS register is required because of meter wear, etc., the master calibrator ahead of the registers is used. When calibration of the NET register is required because of a shift in the "zero" of the compensator, the registration adjustment on the NET register is used.

TESTING AND TOLERANCES: Automatic temperature compensators shall be bench-and field-tested following procedures authorized by the Standards Branch.

At any test temperature, the figure obtained by dividing the NET by the GROSS register reading shall be compared with the volume reduction factor (VRF) for that temperature, using the ASTM-IP table corresponding to the API or specific gravity marked on the ATC.

The ratio $\frac{\text{NET}}{\text{GROSS}}$ shall be within the range:

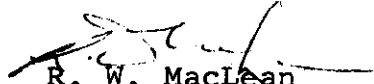
$(\text{VRF} - 0.0020 - 0.0002 \Delta T)$ to $(\text{VRF} + 0.0020 + 0.0001 \Delta T)$

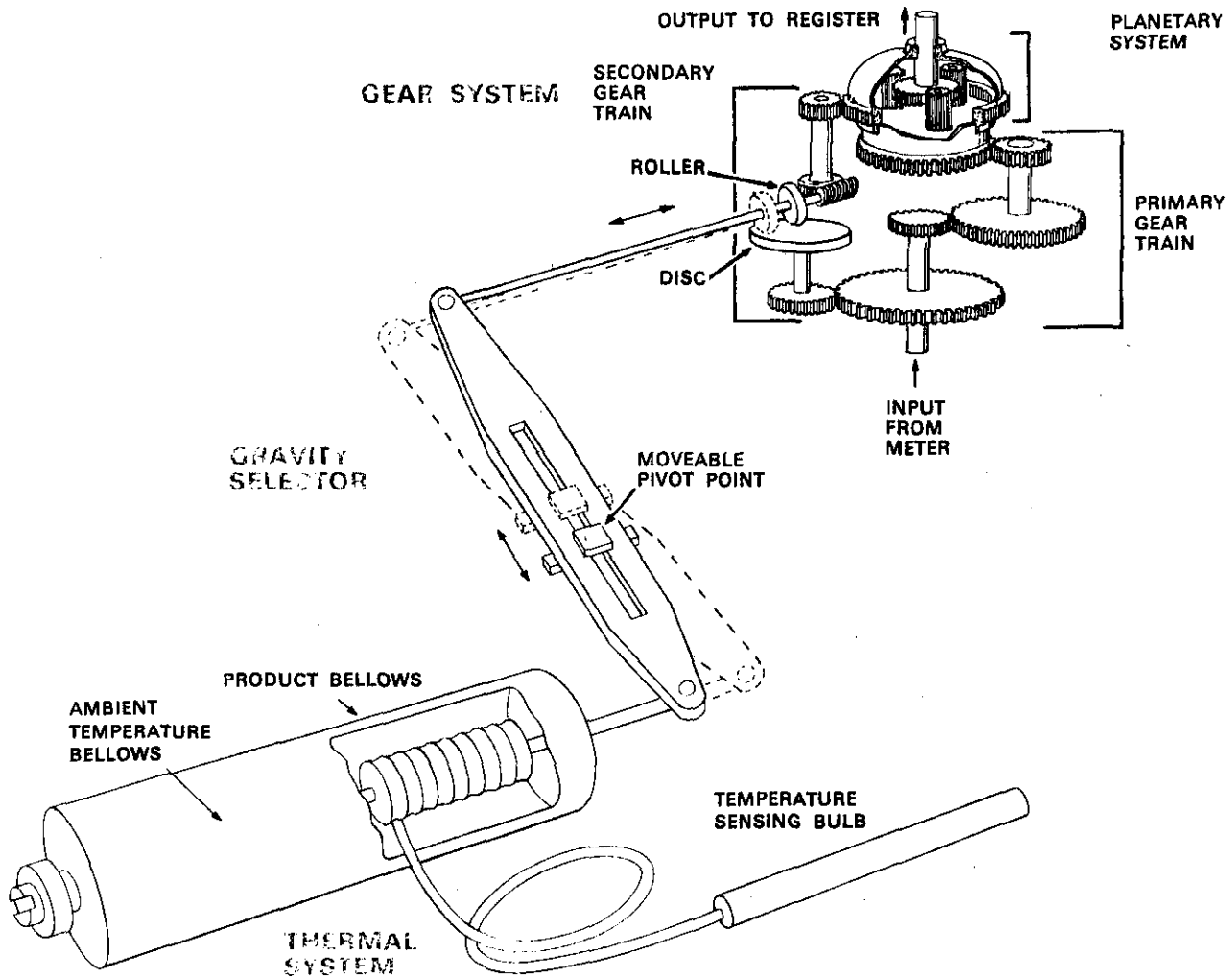
Where ΔT is the difference between the test temperature and the mid-range of the compensator and shall be 30°F or less; that is, on bench and field tests, no increase in tolerance shall be permitted beyond the limits allowed with a ΔT of 30°F, or VRF -0.008 and VRF +0.005.

On two out of three consecutive tests the ratios $\frac{N}{G}$ shall agree to within 0.001 (ΔT constant).

REFERENCES: G 1151-57/S505-745; GL 1151-57/S505-745

CONDITIONS OF APPROVAL: Approval is granted under the Weights and Measures Act, R.S.C., 1970, c.W-7, and Regulations thereunder (P.C. 6894) for use in Canada under the general conditions of P.C. 6894, and under any special conditions listed above.


R. W. MacLean
Director-General
Standards Branch



The Gear System of the ATG consists of primary, secondary and planetary gear sub-systems. The output of the primary gear train is 13 % greater than the input in the standard ATG and 31 % greater in the LPG-ATG. Correction is accomplished by subtracting. The secondary gear train subtracts revolutions from the ATG output shaft through the planetary gear system. The rate of this subtraction (percent change) is determined by the ratio position of the roller on the disc.

The roller and disc integrator is a variable speed transmission device which automatically combines the effects of thermal linear motion (produced by the thermal and gravity selector systems) and gross meter revolutions. It is part of the secondary gear train and determines the amount of subtraction from the primary gear train.

Position of the roller on the disc is controlled by product temperature through the thermal and gravity selector systems. Disc rate is fixed in direct proportion to gross metered volume. A reduction in product temperature moves the roller toward the center of the disc resulting in fewer roller revolutions. Fewer revolutions of the roller result in a reduction of the amount of subtraction from the primary gear train, producing higher net registration. Increasing liquid temperatures, of course, have an opposite effect since the roller is moved toward the outer edge of the disc, increasing roller revolutions per disc revolution. Subtraction through the planetary system is greater resulting in lower net registration.

The roller and disc integrator serves as a control element thus the primary gear train carries the majority of the accessory torque load.

Diagram from A.O. Smith Bulletin 1.6.4.1