

EFFECTS OF CALIBRATION ON GAS METERING RELIABILITY, AND IMPRESSIVE RESULTS AFTER CALIBRATION

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1. INTRODUCTION

Especially gas measurement equipments should be operated properly to make income of a gas distribution company balanced. All of the consumed gas amount passes through gas meters and is invoiced to the gas users. As a result proper operation of gas meters has a direct relationship with income of gas distribution company and customer satisfaction. Meters must be maintained periodically in order to be controlled whether they operate properly. Periodical maintenance of gas meters includes below mentioned stages:

Gas meter is demounted from the line on which it is connected and parts which are connected to the installation are covered with a cap and shipped in suitable conditions. After preliminary control is made meter is cleaned. Meter results after being conditioned in laboratory environment are calibrated and measurement results are obtained. After repairs and adjustments are made, if necessary, its numerator is reset, seal is renewed and painted by the authorized officers. Finally these are labeled and packed. From now on the meter is ready to use.

In this article each stage of periodical maintenance will be explained in detailed form. Especially remarkable findings made after this operation related to 1 million meters in total which are calibrated every three years, the contributions of this operation to both gas users and gas distribution companies, the information received by meter producers on field performances of their meters, how measurement precision of gas meters by years changes, approximate life of meter, why unserviceable meters which are out-of-use are scrapped, unlawful gas utilization ratio and methods(physical intervention of the subscriber to the meter), the complaints of gas users while this operation is being applied and reduction techniques to be applied for these complaints and the measures to be taken for proper fulfillment of this operation from beginning to end shall be identified and results obtained shall be supported by numerical data and graphics.

2. PERIODICAL MAINTANANCE PROCESS

2.1 Meter Mounting- Demounting Operation:

Necessary security measures are made after subscribers are informed.

Necessary security measures are taken after subscribers receive information. Burning devices are closed and meter mounting-demounting operation is realized. The meters are photographed before and after mounting, final invoice relating to the former meter is arranged. Connection parts of the meter are turned off and packed for calibration. Informative brochure is sent to the subscribers who are not at home and dispatched to the laboratory at suitable conditions.



Figure 1. A photograph of mounting and demounting

2.2 Preliminary cleaning of meters: Meters are subjected to preliminary cleaning to remove dirt, rust, oil, paint, and label. Flex and connections on meters which are impossible to be removed in field conditions are demounted throughout this process.



Figure 2. Preliminary cleaning operations

2.3 Conditioning Process : Meters being applied preliminary cleaning are put into conditioning and kept in meter laboratories/ stations operating pursuant to the regulations by using adjusting gear.



Figure 3. Calibration operations

2.4 Calibration Process: Meters finalizing conditioning period are subjected to calibration to determine measurement error and pressure loss. Meters finalizing this operation with positive results, are reserved as convenient meters. Meters exceeding a pressure value of 2.2 mbar are scrapped. The adjusting gears of the meters found to be inappropriate based on the measurement error are altered and these meters are recalibrated. Meters with positive results are included in convenient meters. Meters which are impossible to be repaired with adjustment gear are scrapped due to measurement error inconvenience.

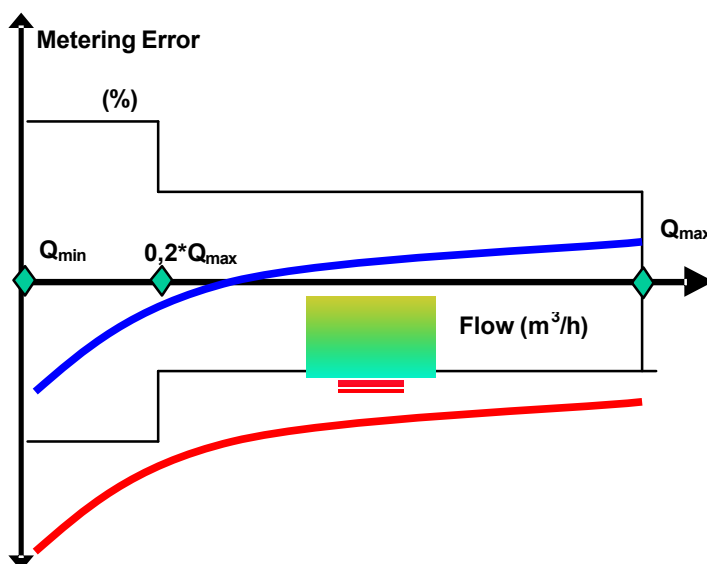


Figure 4. Metering error is adjusted by using gear

Meters whose calibrations are made are divided into 4 main parts: convenient meter list, inconvenient meter list, List of meters taken out-of service and interventional meter list and are recorded electronically.

Convenient meters after first calibration, are defined as meters in total which are made suitable directly after calibration or adjustment. These meters are reused.

Inconvenient meters, includes inconvenient, impossible to be repaired after adjustment and adjustable after first calibration. This list becomes crucial in terms of calibration statistics of meters being demounted from gas line.

Meters taken out of service, includes inconvenient meters or meters which are impossible to be made suitable physically or metrological during all processes, calibration process is included.

Interventional meters, includes the meters to which meter user gives physical damage and prevents normal functioning of the meter in all periodical inspection processes.

2.5 Resetting Operation: Numerators of meters which are convenient after calibration are reset by reverse turning. After resetting, low pressured air is transmitted to meters and numerator sections are controlled because of probable standing of the index of gas meters at a fixed point.



Figure 5. Resetting Operation

2.6 Sealing Operation: After resetting, meters are sealed in accordance with Measures and Adjustments Law with number 3516 of Turkish Ministry of Industry and entered in the official repair notebook.

2.7 Painting and packing operation: Meters are subjected to painting process based on the original colors and brightness. Warning and calibration labels are pasted on meters after painting and these are packed properly and made ready for shipment.



Figure 6. Painting Operation



Figure 7. Photographs of meters before and after painting

3.EVALUATION OF PERIODIC INSPECTION RESULTS BASED ON TABLES AND GRAPHICS

Table 1. Distribution of Meters after Inspection

Distribution of Periodic Inspection Results		
CLASS	TOTAL	RATIO
CONVENIENT METERS AFTER FIRST INSPECTION	782.383	%78,25
METERS MADE SUITABLE AFTER ADJUSTMENT	95.595	%9,53
METERS CONFORMED AS OUT OF SERVICE	119.490	%11,97
INTERVENTIONAL METERS	2.532	%0,25
TOTAL PERIODICAL INSPECTION	1.000.000	%100

Figure 8. Measurement error averages of meters which are inconvenient in the first calibration

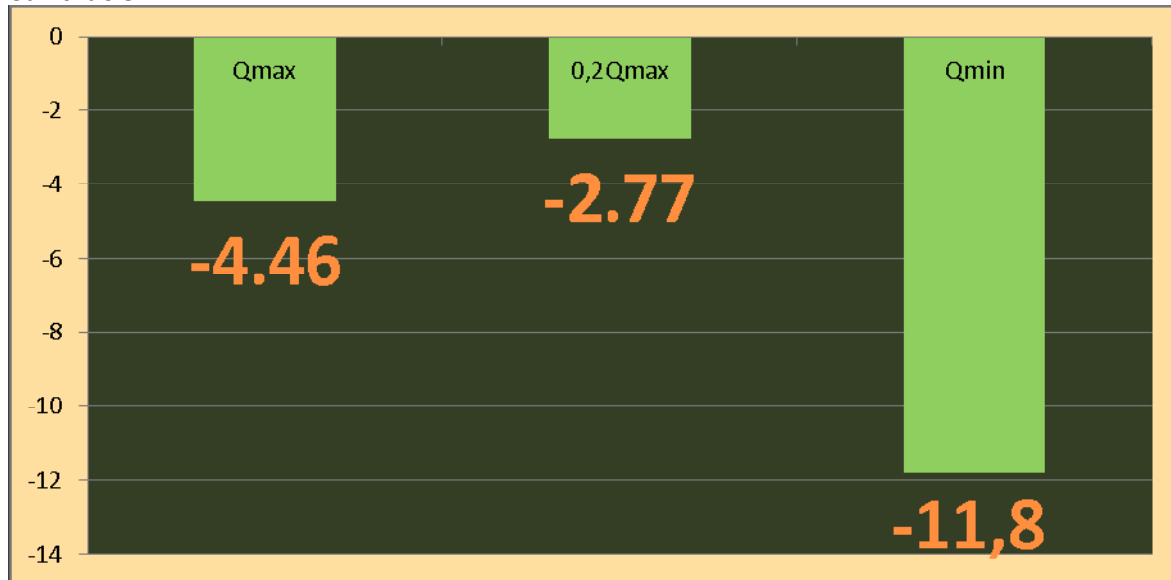


Table 2. Statistics of Scrapped Meters

Statistics of Scrapped Meters		
REASONS TO SCRAP	PIECE	PERCENTAGE
(-) MEASUREMENT ERROR	54.728	48,15%
(+) MEASUREMENT ERROR	8207	7,22%
DAMAGED BODY	19.935	17,54%
LOUD OPERATION	7471	6,57%
MEASUREMENT GROUP ERROR	18.927	16,65%
PRESSURE LOSS IS HIGH	2868	2,52%
OTHER(VARIOUS)	1515	1,33%
TOTAL	113.651	

Table 3. Details of Customer Complaints

DETAILS OF COMPLAINTS RESULTS		
REASON OF NOTICE	PIECE	PERCENTAGE
GAS LEAKAGE	976	15
METER DOES NOT SHOW GAS FLOW	1.314	20
THE INDEX OF GAS DOESN'T TURN ALTHOUGH GAS FLOW IS PROVIDED	1.496	22
SOUND IN METER	1.823	27
METER IS DIRTY-OLD	463	7
OTHER(METER TRADEMARK, METER IS TURNING FAST)	658	10
TOTAL	6730	100

Tablo 4. Reasons for Intervention

INTERVENTION DETAILS RESULTS		
REASONS FOR INTERVENTION	ADET	YÜZDE ORAN
Outlet pipe has been punctured	92	4
Numerator panel is subjected to physical effect.	1.466	58
Seal of the meter is damaged.	763	30
Measurement group of the meter has been subjected to physical effect.	81	3
Other	130	5
TOTAL	2532	100

4. EVALUATION AND RESULTS

As is shown in the graphics and tables mentioned above;

- 78% of meters have been confirmed to be solid and long-wearing as a result of first calibrations.
- 12% of meters are confirmed to be out of use.
- According to the statistics of meters out of service, the biggest percentage belongs to mismeasurement of the meter.

- 2532 meters in total have been attempted to be used unlawful gas by gas users and 58% numerator panels of these meters have been subjected to physical disturbances.
- According to the subscribers' notices, load functioning of the meter is determined to affects comfort conditions negatively.

As a result of this study, below mentioned results are obtained based on the data received.

- Mechanic gas meters are inclined to make mismeasurement as time passes based on continuous utilization.
- Periodical inspection is required to be made for a period shorter than 10 years based on mismeasurement. Considering that especially high consumption meters is much less than others and these meters are considered as an important income for gas distribution companies, the said meters must be calibrated in shorter periods (at most 2 years).
- Adjusting measurement errors based on the results of meter calibrations or in case of meters not making measurement being scrapped, gas distribution companies will be able to reduce measurement loss with a percentage of 3-4%.
- Some of the reasons of damages observed in measurement groups after a long period of operation are confirmed to be based on low quality of some materials used and over time deformation of materials.
- It has been observed that environmental (heat, humidity) factors shorten the expected life the meter.
- It has been confirmed that the main reason of body damages is to use putty on meter connections, flex-meter coupling is joined with the effect of putty and meter becomes irremovable. In order to prevent such misapplications solvable material should be used in these connections and mounting operators should be trained in this perspective.
- Net data is received relating to the expected life of the meters these data were shared with meter firms and recommendations such as quality increasing and emphasizing on research and development studies were made.

REFERENCES:

- [1] Ozarpa C., Converting Natural Gas Into Cash , Gas & Power Turkey Energy Summit Conference 2010, April 2010, Ankara, Turkey
- [2] IGDAS, Technical Specification of Domestic Installations, 2008
- [3] Customer Services Regulations of the Energy Market Regulatory Authority, Turkey, 2002
- [4] OIML, Vocabulary of Terms in Legal Metrology, France, 2000
- [5] Boul, D. , Crane, P. , and Hunt, A. Fundamentals of Natural gas for IGDAS, 1999.