STATUS OF METER TESTING AND REPLACEMENT PROGRAM PER FINAL RATE ORDER IN DOCKET NO. 920199-WS

REPORT NO. 1

JUNE 30, 1993

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STUCK METER POLICY

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S S U

CUSTOMER SERVICE

Inter-office Correspondence

DATE: May 4, 1993

TO : Customer Service & Billing Personnel

FROM: Judy Sweat

RE : Stuck meter policy

Our policy for backbilling stuck meters has been approved for implementation, effective immediately. In accordance of our company policy, backbilling will be applied to "zero usage" only, this does not include "slow meters".

The backbilling will be done through adjustments and the customer will be backbilled for the time period of zero usage, up to a maximum of twelve months. The following procedure must be followed prior to backbilling a customer:

- Each office will be responsible for creating a P&C service order code# 430 to verify a stuck meter. If the meter is stuck an adjustment will be prepared by customer service personnel to backbill and/or adjust current bill charges. The adjustment will be prepared by the appropriate office responsible for billing the customer. The description on the adjustment will read ESTIMATED USAGE (bill date). These adjustments must be entered and approved prior to the billing. The reading for previous and current will be duplicated and the appropriate read dates will be used for previous and current.

- A customer notification letter will be prepared and mailed to the customer advising the customer of the backbilling adjustment for usage and payment arrangement options, if applicable. Each office will be responsible for the preparation and mailing of customer notification. This notification must be mailed to the customer on the same day of the adjustment. I am attaching a draft of the customer notification letters. There are two sample letters for your use, the first letter is for a customer who is being charged for more than one billing period and has the option of payment arrangements. The second letter is for a customer who has zero usage due to a stuck meter (meter stuck during last read cycle) and is not being backbilled.

- If the meter is stuck, customer service will create a "meter change" service order to be completed immediately. Please make sure these orders are completed in a timely manner so the customer will be billed accurately on the next bill date.

If you have any questions regarding these procedures, please call me.

cc: Forrest Ludsen
Helena Loucks
Karen Shofter
Allison Sweat

SSU

General Offices
Customer Service
1000 Color Place
Apopka, FL 32703
(407) 880-0100
1-800-432-4501

Date

Customer Name
Customer Address
City, State, Zip

Re: Customer No._____, estimated usage for stuck meter

Dear Customer Name,

We recently did a field investigation and discovered your meter was stuck and has not recorded your usage.

We have estimated your consumption based on twelve months of actual meter reads and usage. Your next bill will be adjusted for estimated consumption for the bill dates indicated on your bill.

Your bill represents estimated usage for more than one billing period, and you may choose to pay the total in _____ monthly payments of $_____ each, in addition to your current charges, by the due date on each bill.

A service order to replace your stuck meter has been issued and your meter will be changed as soon as possible.

If you have any questions, or if you would like to make payment arrangements, after you receive your bill, please call our customer service office at Local Telephone#.

Sincerely,

(Your Name)

General Offices
Customer Service
1000 Color Place
Apopka, FL 32703
(407) 880-0100
1-800-432-4501

Date

Customer Name
Customer Address
City, State, Zip

Re: Customer No._____, estimated usage for stuck meter

Dear Customer Name,

We recently did a field investigation and discovered your meter was stuck and has not recorded your usage.

We have estimated your consumption based on twelve months of actual meter reads and usage. Your next bill will be adjusted for estimated consumption for the bill dates indicated on your bill.

A service order to replace your stuck meter has been issued and your meter will be changed as soon as possible.

If you have any questions, please call our customer service office at Local Telephone#.

Sincerely,

(Your Name)

LARGE METER TESTING

S S U

Technical Services
Intra-company correspondence

TO: Dave Denny
Jim Ragsdale
Joe Roberts
Bill Williams

FROM: Frank Sanderson FS

DATE: January 15, 1993

SUBJECT: Cross Connection Control / Backflow Prevention Large Meter Testing

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The Cross Connection Control / Backflow Prevention Policy has been completed and copies have been distributed to the appropriate DER offices.

Each Region Manager will be responsible for designating employees to serve as Backflow Prevention Technicians in their respective regions. The persons designated as Backflow Prevention Technicians will be responsible for performing field surveys to identify all backflow devices, inspections of new installations, testing and records keeping.

Backflow Preventer testing equipment has been purchased and is available thru the Technical Services Department.

In addition to the backflow preventer test equipment Technical Services has purchased a meter tester to test commercial meters from 2" thru 10" in size. A seminar will be conducted by the manufacturer of the meter tester to provide hands on training in proper usage of the test unit.

As we discussed in our last meeting each manager should perform an evaluation of each large meter installation in their region to see if it meets installation requirements that will allow accurate testing. Proper installation diagrams are available from the Technical Services Department.

I would like a list of names from each Region Manager as to who will be serving as the backflow prevention contact person for each region, area etc. It would also be beneficial for me to know the extent of work, dollar requirement etc. that will be necessary to retrofit large meter installations to acceptable industry standards.

I would further suggest that the same persons designated to implement the backflow prevention program be responsible for large meter testing, training will be provided as stated above.

cc: Bert Phillips
Chuck Wood
Ralph Terrero
Forrest Ludsen
Judy Sweat
Ida Roberts

Large Meter Testing Program

1) Designate employees who are to receive training in the use of the Sensus large meter tester, and implement the large meter testing program.

2) Inspect each large meter installation for conformance to construction standards.

3) Provide materials and dollar amount to correct any deficiencies found in existing meter installations which would prevent accurate testing procedures.

4) Develope a record keeping system which shall contain meter manufacturer, model, serial number, size, location, installation date, date tested, test data, and who performed the test.

5) It is recommended that large meters, 2" and larger, be tested annually.

Cross Connection Control/Backflow Prevention Program

1) Designate employees who are to be responsible for implementation of the (CCC/BF) Cross Connection Control / Backflow Prevention Program.

2) Public notification of SSU Inc.'s CCC/BF Policy has been developed by Ida Roberts in form of a pamplet which may used for this purpose.

3) Develope a record keeping system which should contain all related data concerning the backflow prevention device, location, Manufacturer, model, size, commercial or residential, annual testing data, and who performed the test.

4) Perform a water system survey to identify any current or potential CCC/BF deficiencies.

5) Provide vehicle, tools, working space, and support to those chosen to perform this task.

METER REPLACEMENT
AND
MAINTENANCE DATA
1ST QUARTER 1993

S S U
CUSTOMER SERVICE
Inter-office Correspondence

RECEIVED JUN 1 8 1993

DATE: June 16, 1993

TO : [redacted]

FROM: Judy Sweat

RE : Meter Replacement Program - Response to FPSC

Enclosed are the customer inquiry reports for meter replacement and meter maintenance for the first quarter of this year.

It is my understanding that this information will be provided to the FPSC as part of our Meter Replacement / Maintenance Program. If you have any questions or need any additional information, please call me at ext. 101.

cc: Forrest Ludsen
Karen Shofter

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NORTH REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
4543	STAR RT 1 BOX 584	00436	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/29/93	2/01/93
2163	249 RIVER DRIVE	00442	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/17/93	2/18/93
4283	LOT 40 BLK 1 WHHP S	00447	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/13/93	1/14/93
4285	LOT 40 BLK 1 WHHP S	00447	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	2/09/93
4283	LOT 40 BLK 1 WHHP S	00447	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/05/93	3/05/93
999935	LOT 74 & 75 RIDGEWOOD	00470	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/04/93	1/05/93
10776	STAR RT 1 BOX 714 H-32 0165	00471	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/12/93	1/13/93
13326	4589 SPRINGMOOR DR E	00886	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/16/92	1/05/93
88618	12960 ARBOR LAKE DR	00886	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/01/93	2/02/93
15103	4729 MARINER PT DR	00886	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/08/93	2/10/93
93160	4467 WHISPERING INLET DR	00888	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/10/93	3/03/93
996222	258 NW CARGO WAY/GANN D	01894	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/03/93	2/04/93
16159	J.BRITTON;6632 NW WOODLAND DR	01894	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/08/93	2/15/93
16151	A.MINGLEDORFF;NW WDLND DR	01894	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/05/93	1/06/93
109341	MAYHAIR;LOT J-1, GENEVA WOODS	01279	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/03/93	2/04/93
15395	W. NIEMEYER: ALDERMAN ROAD	01298	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/29/93	2/05/93
14669	LOT 58 SEA MARSH RD.	01518	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/16/92	1/25/93
994205	3327 FAIRWAY OAK	01518	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/05/93	3/10/93
9253	4296 CAPTAINS WAY	01518	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/30/92	1/02/93
998 97	4278 CAPTAINS WAY	01518	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/13/93	2/08/93
[illegible]53	4296 CAPTAINS WAY	01518	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	1/22/93
989[illegible]74	LOT 28 CAPTAINS WAY/SUMM.BCH.	01518	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	1/22/93
5579	LOT 18 PLANTATION POINT	01518	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/02/93	2/03/93

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NORTH REGION
METER MAINTENANCE

CUST	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
992705	5447 POPULANTIC ST.,LOT B B3	01702	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/08/93	3/19/93
88125	352 GLENEAGLES DRIVE	01801	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/04/93	1/11/93
274663	1433 PURITAN ST	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/30/92	1/04/93
827939	2159 E HYDE DR	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/31/92	1/05/93
245161	2031 BARLINGTON DR	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/12/93	1/15/93
267571	1356 FREEPORT DR	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/02/93	2/03/93
827250	1801 TIVOLI DR	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/04/93	2/05/93
838464	2688 NEWMARK DR	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/08/93	2/09/93
196600	2361 WEATHERFORD DR	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/12/93	2/12/93
983625	2279 HAULOVER BLVD	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/15/93	2/16/93
189961	1889 ODHAM DR	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/17/93	2/19/93
263402	1187 MANITOBA ST	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/02/93	3/04/93
206930	2270 HAGEN AVE	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/09/93	3/10/93
767311	532 RICHMOND AVE	18001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/09/93	3/01/93
982526	719 E CLOVERLEAF BLVD	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/08/93	1/11/93
791391	3258 N TULSA DR	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/15/93	1/18/93
743211	2757 S HURON DR	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	1/20/93
187181	1491 LANDOVER AVE	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/22/93	1/25/93
21564	2948 KINGSWOOD AVE	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/22/93	1/25/93
995450	1849 SYLVIA DR	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/22/93	1/25/93
765761	1361 AZORA DR	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/27/93	1/28/93
755781	558 GIRALDA AVE	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/29/93	2/03/93
838862	1457 PORTOLA AVE	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/24/93	2/26/93

NORTH REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
249161	1888 S OLD MILL DR	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/25/93	2/26/93
175960	1591 PROVIDENCE BLVD	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/09/93	3/09/93
765751	1792 HONLAND BLVD	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/11/93	3/12/93
25199	766 E LACY CIR	18001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/29/93	3/30/93
281180	129 HIBISCUS WDS CT 3C	18001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/11/92	2/11/93
982026	719 E CLOVERLEAF BLVD	18001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/12/93	2/11/93
995450	1049 SYLVIA DR	18001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/02/93	2/11/93
731731	2624 ROXBORO AVE	18001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/10/93	2/12/93
267571	1354 FREEPORT DR	18001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/24/93	2/25/93
267571	1354 FREEPORT DR	18001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/26/93	3/26/93
249161	1888 S OLD MILL DR	18001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/11/93	3/26/93
175960	1591 PROVIDENCE BLVD	18001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/11/93	3/31/93

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NORTH REGION
METER MAINTENANCE

CUS..	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
3:23	LOT 2 BLK 4 RIVER PARK 1	00439	FOLLOW UP HBC/ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/27/93	1/28/93
3:23	LOT 2 BLK 4 RIVER PARK 1	00439	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/16/93	2/17/93
26419	LOT 82 ORANGE AVENUE	00448	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	3/10/93	3/11/93
26419	LOT 82 ORANGE AVENUE	00448	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	3/10/93	3/22/93
9:27	210 PINE ST	00463	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/13/93	1/14/93
995:39	LOT 6 & 7 BEACHERS POINT DRIVE	00472	FOLLOW UP HBC/ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/05/93	1/06/93
995:39	LOT 6 & 7 BEACHERS POINT DRIVE	00472	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/13/93	1/14/93
999:08	4955 WILD HERON WAY	00886	FOLLOW UP HBC/ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/05/93	1/06/93
13:32	12047 HIDDEN HILLS DRIVE	00886	FOLLOW UP HBC/ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/05/93	2/09/93
95:12	3922 MUIRFIELD BLVD E	00886	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/29/93	2/25/93
17:56	4841 BEACON DR EAST	00886	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	3/05/93	1/28/93
15393	W. NIEMEYER: ALDERMAN ROAD	01298	FOLLOW UP HBC/ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/18/93	1/20/93

CENTRAL REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
10129	2822 FLOWERTREE RD	00105	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/13/93	1/15/93
9[illegible]92	LOT 204 AVONSHIRE RD	00106	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/08/93	1/11/93
981[illegible]96	9858 BALMORAL CIRCLE	00106	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/01/93	2/02/93
5[illegible]07	6306 ESPERANZA	00106	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/01/93	2/03/93
8[illegible]60	6569 SIDON STREET	00106	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/01/93	2/03/93
10[illegible]83	10527 VIA DEL SOL	00106	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/05/93	3/16/93
11[illegible]91	9836 HEATON COURT	00106	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/05/93	3/16/93
997[illegible]35	3758 CAPETOWN DRIVE	00106	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/21/93	1/26/93
987[illegible]79	8112 BUCKSAW DRIVE	00106	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/25/93	1/27/93
5[illegible]88	3926 BIBB LANE	00106	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/25/93	1/27/93
979[illegible]56	10497 VIA DEL SOL	00106	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/26/93	1/28/93
5[illegible]04	6313 PAMLICO ST	00106	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/13/93	1/14/93
89[illegible]50	2216 STONINGTON AVENUE	00106	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/15/93	1/20/93
987279	8112 BUCKSAW DRIVE	00106	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/04/93	2/05/93
997535	3758 CAPETOWN DRIVE	00106	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/01/93	3/02/93
6018	LOT 195 AVONSHIRE RD	00106	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/25/93	3/26/93
5600	3926 BIBB LANE	00106	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/29/93	3/29/93
2351	118 JEMEL LOTS 9-10 BL D	00325	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/25/93	3/26/93
2616	129 HIGHLAND DR	00324	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/20/93	1/25/93
986719	110 HILLCREST	00330	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/19/93	3/01/93
985715	241 SHEPPARD ST L 9/10 B	00332	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/18/93	1/20/93
1584	965 SHALLOWFORD RD	00332	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/27/93	1/28/93
9596	600 LAKE DRIVE	00335	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/13/93	1/14/93

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CENTRAL REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
9363	127 DOLORES DRIVE	00336	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/29/93	3/30/93
107762	LOT 33 SUNRISE RD	00558	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/04/93	3/05/93
12198	28100 LOIS DRIVE	00567	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/21/93	1/22/93
94188	31642 INDIANA	00578	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/14/93	1/15/93
94 52	11830 HICKORY LANE	00578	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/15/93	1/15/93
995428	1303 MORAY COURT LOT 3M	00574	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/18/93	1/19/93
996013	5510 WILE ST	00780	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/29/93	2/16/93
995797	1661-A HOPE ST	00780	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/03/93	2/16/93
3359	1501 TALLAHASSEE	00780	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/01/93	2/02/93
998144	1675 HOPE STREET	00780	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/26/93	3/03/93
7691	255 E MIAMI TERR LOT 18	00781	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/05/93	1/07/93

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CENTRAL REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
10129	2822 FLOWERTREE RD	00105	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	12/31/92	1/04/93
4263	10613 SANDRIDGE COURT	00106	FOLLOW UP HBC/ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	12/01/92	1/13/93
991857	6106 BUCKSAW DRIVE	00106	FOLLOW UP HBC/ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/08/93	1/11/93
989615	8113 DEVILLE COURT	00106	FOLLOW UP HBC/ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/29/93	2/03/93
89958	2216 STONINGTON AVENUE	00106	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/04/93	1/14/93
88498	2748 LOGANDALE DRIVE	00106	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/13/93	1/14/93
6439	4012 STONEHAVEN DR	00106	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/25/93	1/27/93
97292	5037 M I T	00106	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/27/93	2/03/93
6592	9821 PEDDLERS WAY	00106	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/04/93	2/05/93
993426	4137 BIBB LANE	00106	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/24/93	3/16/93
978011	10491 VIA DELSOL	00106	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	12/14/92	2/02/93
9[illegible]72	8618 BAYLOR CIRCLE	00106	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/07/93	1/08/93
991458	8324 PAMLICO STREET	00106	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/07/93	1/08/93
998450	8121 DEVILLE COURT	00106	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/14/93	1/15/93
97292	5037 M I T	00106	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/04/93	2/05/93
989115	8113 DEVILLE COURT	00106	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/16/93	2/17/93
9792	401 E FIFTH STREET	00335	FOLLOW UP HBC/ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/18/93	2/23/93
5418	20 E SECOND STREET	00335	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	10/14/92	2/01/93
5037	695 HWY 419 APTS	00335	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	12/16/92	1/14/93
109380	410 AVENUE E	00335	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/05/93	2/08/93
9792	401 E FIFTH STREET	00335	BENCH TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	3/05/93	3/05/93
998444	1675 HOPE STREET	00780	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/09/93	2/16/93
7512	388 STATE BLVD	00781	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	12/30/92	1/11/93

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CENTRAL REGION
METER MAINTENANCE

Cu	SERVICE ADDRESS	PLANT	PROBLEM	RESOLUTION	TAKEN DATE	COMP DATE

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CENTRAL REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
998868	2454 JUSTY WAY	00196	BENCH TEST	430	METER REPLACED	1/05/93	1/14/93
991852	8104 BUCKSAW DRIVE	00186	BENCH TEST	430	METER REPLACED	1/13/93	1/14/93
[illegible]797	110 W PLYMOUTH	00526	ACCURACY TEST	430	METER REPLACED	12/31/92	1/07/93

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WEST REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
495	525 BLUEBIRD	00210	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/04/93	1/05/93
4803	128 COTTONTAIL LN	00212	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/05/93	3/08/93
95432	136 S BELLVIEW APT A&B 15/H	00987	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/04/93	1/05/93
105096	18 SWEETBAY CT LT 9 BK 96	00989	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/05/93	2/09/93
999609	10 GLENRIDGE CIR	00989	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/26/93	3/01/93
1[illegible]16	47 GOLFVIEW CT LT 51R BK BA	00989	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/05/93	1/06/93
991197	6 BEGONIAS CT L-20/B-169	00989	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/21/93	1/22/93
1[illegible]6	7 HOLLY CT LT 26 BK 10	00989	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/25/93	1/26/93
102586	42 GOLFVIEW DR LT 122R BK BA	00989	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/23/93	3/24/93
102162	6 HOLLY CT LT 6 BK 10	00989	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/18/93	1/19/93
19076	7330 RHINEBECK DRIVE	01429	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/02/93	3/03/93
19742	7534 TYSON DRIVE	01429	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/04/93	3/05/93
19790	11215 KAPOK AVENUE	01429	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/29/93	3/30/93
991795	11596 YELLOW WOOD LANE	01429	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/13/93	1/14/93
19525	7501 FOXBLOOM DRIVE	01429	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/14/93	1/15/93
19676	7810 ILEX DR.	01429	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/14/93	1/15/93
997525	11124 WHITE OAK LANE	01429	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/05/93	2/08/93
19101	10925 REXDALE AVE.	01429	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/19/93	2/22/93
998 80	11235 GLOVER RD	01429	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/25/93	2/26/93
19[illegible]76	7810 ILEX DR.	01429	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/10/93	2/11/93
19.42	7534 TYSON DRIVE	01429	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/11/93	3/12/93
23[illegible]52	9190 N CARESSA WAY	09001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/08/93	3/11/93
85[illegible]61	2856 W DEVON DR	09001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	1/22/93

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WEST REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
85661	2856 W DEVON DR	09001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/28/93	2/09/93
831510	5155 N LENA DR	09002	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/30/92	1/04/93
836344	4301 N CANARYWOOD TR	09002	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/23/93	2/26/93
836344	4301 N CANARYWOOD TR	09002	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	5/02/93	5/04/93
53481	3743 SW 157 ST RD	11001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/05/93	1/06/93
60322	15082 SW 58 CIRCLE	11001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	5/10/93	5/11/93
353	14436 SW 59 AV RD	11001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/31/92	1/04/93
55882	281 MARION OAKS LN	11001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/08/93	2/09/93
24[illegible]08	5435 SW 150 LN RD	11001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	5/12/93	5/12/93
42[illegible]40	1312 LARSEN LN	19001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/28/93	1/29/93
438180	2403 WISHING WELL WAY	19001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/18/93	2/19/93
983455	2026 DARLINGTON DR	19001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/22/93	2/24/93
848223	2507 AMBASSADOR AVE	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/08/93	1/11/93
998211	1093 DUNLAP AVE	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/15/93	1/18/93
994768	5280 ABAGAIL DR	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	1/20/93
663501	4330 GOLDCOAST AVE	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/20/93	1/20/93
625448	4250 BRISTOL AVE	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/20/93	1/27/93
991825	1108 COMMERCIAL WAY	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/21/93	1/22/93
710411	5158 LYDIA CT	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/21/93	1/22/93
400180	7563 LAMPLIGHTER ST	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/26/93	1/27/93
718191	295 RUSK CIR	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/26/93	1/27/93
838552	12447 ARSLAN LN	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/27/93	1/28/93
834592	6969 JENA RD	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/08/93	2/08/93

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WEST REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
1199	12151 CAVERN RD	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	5/11/93	5/12/93
998879	4145 JASON RD	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	5/12/93	5/15/93
566450	6270 KELVIN CT	27001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	5/26/93	5/29/93
988615	8172 ROYCREST LN	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/21/92	1/06/93
401281	164 RANDOLPH AVE	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/21/92	1/06/93
324330	10344 BANNOCK ST	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/06/93	1/06/93
720841	2517 MARINER BLVD	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/07/93	1/08/93
829145	10050 CARA ST	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/14/93	1/20/93
836518	10332 BELLTOWER ST	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/14/93	1/15/93
343398	11336 ELGIN BLVD	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/15/93	1/20/93
999554	6506 MARINER BLVD	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/15/93	1/18/93
537440	4353 UNION SPRINGS RD	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/15/93	1/18/93
57 54	11345 TUSCANNY AVE	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/18/93	1/19/93
722391	12364 DRAYTON DR	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/29/93	2/01/93
98 73	10020 HAYWARD RD	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/03/93	2/10/93
795571	175 GLENLOCK LN	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/05/93	2/08/93
839836	428 BRIARWOOD LN	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/08/93	2/17/93
998609	12459 BOYD LN	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/12/93	2/17/93
650181	5109 HARBINGER RD	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/15/93	2/17/93
420730	9463 HORIZON DR	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	5/08/93	5/10/93
995694	1316 MALONE AVE APT B	27001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	5/24/93	5/25/93
836460	6875 FREEPORT RD	27001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/11/92	1/12/93
643581	2327 DRESSEL AVE	27001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	5/11/93	5/12/93

WEST REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM	RESOLUTION	TAKEN DATE	COMP DATE

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WEST REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
643581	2527 DRESSEL AVE	27001	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	3/09/93	5/10/93

SOUTH REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
100.56	2415 QUIRT LANE 13/827/23	02201	FOLLOW UP HBC/ACCURACY TEST	101	VERIFIED METER READ AND CHECKED FOR LEAK - NO ADJUSTMENT	2/05/93	2/06/93

SOUTH REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
992429	2485 NE DIXIE HWY	00673	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	5/25/93	5/26/93
72585	1225 WHITNEY DRIVE	01601	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	2/05/93
75636	612 CERVINA DRIVE NORTH	01601	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/24/93	3/25/93
80242	340 CENTER CT	01601	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/25/93	3/30/93
71315	449 EDGEWOOD ROAD	01601	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/07/93	1/12/93
80811	517 VIA VENETO	01601	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/03/93	2/04/93
72965	1702 SKLAR CT	01601	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/03/93	3/04/93
82653	529 PARK ESTATES SQUARE	01602	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/26/93	1/26/93
72350	1624 BOB O LINK DRIVE	01602	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/29/93	3/30/93
74937	213 COMO DRIVE	01602	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/30/93	3/30/93
72782	1124 MISTI COURT	01602	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/24/93	2/25/93
959805	1585 RIODEJANEIRO 11/749/23	02201	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/17/93	3/19/93
186703	26158 RAMPART BLVD 8/757/23	02201	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/20/93	1/21/93
984405	1393 KINDEL CT 7/696/23	02201	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/22/93	2/02/93
187844	26448 RAMPART 1-7/761 FAIRWAY	02201	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/22/93	2/25/93
998264	1391 CAPRICORN BVD 16/685/23	02201	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/15/93	3/16/93
998931	25267 PUERTA DR 1/317/16	02202	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	1/28/93
998931	25267 PUERTA DR 1/317/16	02202	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/22/93	1/27/93
988444	24243 SASSAMAN CT LT 15 BLK 93	02202	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/25/93	3/26/93
19854	2583 LAKEVIEW DR	02901	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/04/93	1/04/93
17446	2201 ESTH UNIT 6 ST270	02901	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/08/93	1/11/93
5629	801 E JERSEY RD	02901	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/21/93	1/26/93
3918	305 N LEELAND HTS BLVD	02901	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/05/93	2/08/93

SOUTH REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
16[illegible]95	121 STARVIEW AV	02901	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/12/93	2/16/93
7[illegible]72	14 SAGEWOOD AVE	02901	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/24/93	2/24/93
10[illegible]86	5 BROADMOOR	02901	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/24/93	2/25/93
22[illegible]87	181 E JERSEY RD	02901	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/25/93	2/25/93
8[illegible]52	126 STETSON ST	02901	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/15/93	3/21/93
9[illegible]50	38 HOMESTEAD RD	02901	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/23/93	3/24/93
15[illegible]99	611 GRANDVIEW DR	02901	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/08/93	3/08/93
981[illegible]08	520 S BARFIELD DR	26001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/18/93	1/18/93
981[illegible]49	955 CAXAMBAS DR	26001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/27/93	1/28/93
980[illegible]99	996 SPRUCE CT	26001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/28/93	2/01/93
972[illegible]25	845 BALD EAGLE DR	26001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/02/93	2/02/93
971306	1641 PIEDMONT CIR	26001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/04/93	2/05/93
971354	1626 BRIARWOOD CT	26001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/08/93	2/16/93
971686	65 TAHITI RD	26001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/08/93	2/09/93
981238	848 W COPELAND DR	26001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/18/93	2/16/93
782750	1716 WAVECREST CT	26001	FOLLOW UP HBC/ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/08/93	3/16/93
838787	911 IRONWOOD CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/14/92	1/04/93
981253	1615 LUDLOW RD	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	12/15/92	1/04/93
980345	658 SOLANA CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/04/93	1/15/93
980462	1651 COLLINGSWOOD AVE	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/05/93	1/07/93
971056	560 N BARFIELD DR	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/11/93	1/19/93
981393	1839 INLET DR	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/15/93	1/18/93
981117	164 LANDMARK ST	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/18/93	1/28/93

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SOUTH REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
981427	473 S BARFIELD DR	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	1/19/93
981[illegible]55	21 PRIMROSE CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	1/20/93
980[illegible]56	1650 ORLEANS CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/19/93	1/25/93
994[illegible]18	1315 BAYPORT AVE	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/20/93	1/21/93
98[illegible]26	1240 MARLIN CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/21/93	1/25/93
2[illegible]17	190 SOCIETY CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/28/93	2/02/93
971[illegible]40	1754 PIEDMONT CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/28/93	2/01/93
21[illegible]54	1741 HAWAII CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/01/93	2/03/93
972[illegible]25	845 BALD EAGLE DR	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/02/93	2/04/93
23[illegible]95	1883 CALUSA CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/02/93	2/05/93
981[illegible]97	1051 S BARFIELD DR	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/04/93	2/05/93
970420	665 ROCKPORT CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/08/93	2/08/93
971[illegible]63	1586 JAMAICA CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/09/93	2/16/93
980352	400 WORTHINGTON ST	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/09/93	2/16/93
972266	504 TIGERTAIL CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/10/93	2/10/93
781770	1355 CAXAMBAS CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/11/93	2/16/93
980040	1133 WHITEHEART CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/19/93	2/19/93
980881	483 DRIFTWOOD CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/19/93	2/19/93
985139	700 SEAGRAPE DR	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/19/93	2/22/93
24674	1195 TWIN OAK CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/22/93	2/22/93
972240	685 CAMEO CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/23/93	2/23/93
971154	317 NASSAU CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/26/93	3/03/93
981164	1391 CAXAMBAS CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/03/93	3/03/93

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SOUTH REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
250	351 YELLOWBIRD ST	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/03/93	3/04/93
24875	350 ROCKHILL CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/04/93	3/04/93
971612	1347 JAMAICA RD	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/15/93	3/16/93
981158	1495 CAXAMBAS CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/15/93	3/16/93
980787	1131 TWIN OAK CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/18/93	3/19/93
970722	1299 MARTINIQUE CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/29/93	3/31/93
981701	1569 S BARFIELD DR	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/30/93	3/30/93
980479	457 ADIRONDACK CT	26001	ACCURACY TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/30/93	3/31/93
972745	579 ELKCAM CIR	26001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/06/93	1/06/93
991365	269 SUNFLOWER CT	26001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	1/18/93	1/19/93
992768	701 FAIRLAWN CT	26001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	2/08/93	2/09/93
981025	908 COLLIER CT 7UN	26001	BENCH TEST	161	ACCURACY TEST RESULTS WITHIN REQUIRED ACCURACY LIMITS-NO ADJ	3/02/93	3/02/93

SOUTH REGION
METER MAINTENANCE

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
971451	234 N BARFIELD DR	26001	FOLLOW UP HBC/ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	3/15/93	3/16/93
981403	1621 OSCEOLA CT	26001	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	1/22/93	1/22/93
971227	441 TARPON CT	26001	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/08/93	2/08/93
971227	441 TARPON CT	26001	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/09/93	2/08/93
971226	1627 WINDMILL AVE	26001	ACCURACY TEST	171	ACCURACY TEST RESULTS OUTSIDE REQUIRED LIMITS - ADJUSTMENT	2/26/93	3/05/93

CUSTOMERS INQUIRY REPORT

FROM: 1/01/93 TO 3/31/95

METER MAINTENANCE

GRAND TOTAL

PROBLEM CODE	DESCRIPTION	NUMBER OF INQUIRIES
160	ACCURACY TEST	147
155	FOLLOW UP HBC/ACCURACY TEST	90
170	BENCH TEST	50
		287

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NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
4525	STAR RT 1 BOX 562 LOT 68	00430	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/03/93
6928	12541 MISSION HILLS DR S	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/04/92	1/04/93
982690	12655 MISSION HILLS CIR S	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/12/93
87064	12737 MUIRFIELD BLVD S	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/12/93
91345	12851 MUIRFIELD BLVD	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/11/93
88426	3936 MUIRFIELD BLVD	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/11/93
88695	12788 MUIRFIELD BLVD N	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/11/93
985476	4455 HARBOUR NORTH CT	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	2/26/93
995519	4471 BEACON DR W	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	2/26/93
996705	2874 SAFESHELTER DR W	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	3/01/93
86737	4851 MEDWAY HALL PLACE	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/12/93
91311	4837 WALNUT GROVE CT LOT 9	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/11/93
25	4978 MAY BANK WAY	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/12/93
980547	CORNER/FULTON & MARTHA'S VINE	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/12/93
12731	11643 FRANCIS DRAKE DRIVE	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/08/93
12794	4620 MORRIS ROAD	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/15/93
12839	4527 JOCELYN ROAD	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/12/93
12877	4628 HARTMAN ROAD	00886	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/11/93
96036	4151 LEEWARD PT	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/25/93
986073	4112 HARBOUR WOODS W	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/25/93
984341	4545 HARBOUR ISLAND DR N	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/25/93
12357	4207 LEEWARD POINT DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/25/93
12326	11512 PORTSIDE DRIVE	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/25/93

NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
12381	4125 HARBOUR WOODS W	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/25/93
12263	4434 BEACON DRIVE	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/25/93
995827	4456 BAY HARBOUR N DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/25/93
12278	4488 BAY HARBOUR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/26/93
980662	11138 SAIL POINT LN LOT 56	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/26/93
983982	11187 SAIL POINT LANE	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/26/93
986773	11126 LANDS END LANE	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/22/93
984237	11307 BEACON DRIVE	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	2/03/93
4926	11331 BEACON DRIVE	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	2/03/93
13064	11325 WOODSONG LOOP N	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/26/93
981489	4853 TOCOBAGA LN	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/04/93
12303	4833 BEACON DRIVE EAST	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/26/93
12426	4853 WHITE BLUFF DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/26/93
88457	11449 LAUREL GREEN WAY	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/26/93
106294	CHAS BENN IRR/2ND ISL OF FT C	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/25/93
9... 54	11752 ALEXANDER COURT	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/26/93
104693	11465 SWEET CHERRY LN S L134	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/25/93
... 31	4833 DOVE TREE LANE	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/25/93
979629	11432 KINGSLEY MANOR WAY	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/29/93
984940	4973 MAYBANK WAY	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/26/93
89413	4979 RAVENAL PLACE	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/26/93
93278	11651 KINGSLEY MANOR WAY	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/03/93
105362	11715 SEAWARD COURT	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/25/93

NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
983399	11729 ALEXANDER COURT	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/03/93
15160	5051 MARINER POINT DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/03/93
105477	11724 MARTHAS VINEYARD COURT	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/03/93
12797	4642 MORRIS ROAD	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/04/93
105487	12542 MISSION HILLS DR S	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/03/93
108269	12529 TURNBERRY DRIVE	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/03/93
988648	12595 MASTERS RIDGE DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/03/93
109481	12538 MASTERS RIDGE DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/05/93
979389	12514 MASTERS RIDGE DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/29/93
985796	12489 TURNBERRY DRIVE	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/26/93
985780	12632 MISSION HILLS CIR N	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/01/93
103825	4044 SHOAL CREEK DR E	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/03/93
985795	3959 MUIRFIELD BLVD E	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/01/93
97668	12878 MUIRFIELD BLVD S	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/01/93
103868	12788 MUIRFIELD BLVD S	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/25/93
98074	12766 MUIRFIELD BLVD S	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/25/93
88220	12835 MUIRFIELD BLVD S	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/26/93
91343	12851 MUIRFIELD BLVD	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/26/93
9[illegible]794	13071 ISLEWORTH RIDGE CT	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/25/93
8[illegible]426	3958 MUIRFIELD BLVD	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/26/93
106[illegible]68	3946 MUIRFIELD BLVD E	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/26/93
978276	12850 MUIRFIELD BLVD N	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/26/93
988846	12754 MUIRFIELD BLVD N	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	2/02/93

NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
95115	3879 MISSION HILLS DR E	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/25/93
988618	12628 SHINNECOCK WAY	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/29/93	1/22/93
106783	12520 MISSION HILLS DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/22/93
13201	4350 SPRINGMOOR DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	2/03/93
13182	4589 SPRINGMOOR DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	2/03/93
92721	12082 HIDDEN HILLS DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	2/04/93
13343	12078 HIDDEN HILLS DR	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	2/04/93
94398	11685 HIDDEN HILLS DR E	00886	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	2/05/93
999582	12336 COBBLESTONE CIR	00886	POSSIBLE STUCK METER	430	METER REPLACED	5/08/93	5/09/93
8636	4358 FERN CREEK DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/04/93
8615	5443 HICKORY GROVE N	00888	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
8592	6137 THISTLEWOOD ROAD	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/05/93	2/23/93
7966	5458 GOLF COURSE DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/12/93	1/15/93
981435	4123 PINEY CREEK LN N/HOUSE	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/12/93	1/15/93
8646	4078 BRIARFOREST RD E	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/12/93	1/15/93
7994	5893 JIMTOM DRIVE	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/12/93	1/15/93
998388	3918 GUMWOOD DR. WEST	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	2/05/93
999181	3949 GUMWOOD DRIVE WEST	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	2/04/93
6253	3950 GUMWOOD DRIVE WEST	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	2/04/93
8901	4044 THICKET LANE	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	2/05/93
8023	3930 UNIVERSITY CLUB BLVD	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	3/04/93
8298	4261 POLO CT	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	1/25/93
9[illegible]46	4237 POLO CT	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	1/28/93

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NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
7917	5379 GOLF COURSE DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	3/31/93
6130	5235 RIVERTON ROAD	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/17/93
9[illegible]94	4052 GREENWILLOW LANE N	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/17/93
6311	4327 WHISPERING INLET DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	3/11/93
8780	4418 OAK BAY DR WEST	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/19/93
97741	4542 OAK BAY DR WEST	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/25/93
985907	5378 OAK BAY DR NORTH	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	3/11/93
995539	4553 OAK BAY DR WEST	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/19/93
978524	4417 MAYWOOD DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/18/93
982469	4375 MAYWOOD DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	3/11/93
18094	5364 TIMBERLINE DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/17/93
979619	5359 OAK BAY DR N	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/18/93
985952	5367 OAK BAY DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/19/93
981234	5455 OAK BAY DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/25/93
8624	4464 FERN CREEK DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/17/93
8497	3915 HICKORY GROVE DR S	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	3/11/93
103647	3961 LOCHLAUREL DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	3/11/93
986156	4113 WILCREST CIRCLE EAST	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/17/93
8252	5628 WILCREST CIRCLE S	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	3/11/93
8168	6058 SHADOW OAK CT	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	2/17/93
8819	4141 PINEY CREEK LANE W	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/02/93
8893	4062 GREENWILLOW LANE E	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/11/93
8815	3902 CHESTWOOD AVENUE	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/11/93

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METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
5..351	5745 JIMTOM DRIVE	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/04/93
7967	4019 ST ISABEL DRIVE	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/04/93
987370	4207 FAWNGROVE ROAD N	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/04/93
.535	6131 BRIARFOREST RD N	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/01/93
133	6151 BRIARFOREST RD N	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/01/93
6452	6015 GREENWILLOW COURT(MTRC=3)	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/01/93
6350	6039 GREENWILLOW COURT	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/04/93
99.716	6131 DAWNRIDGE RD	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/04/93
6356	6124 THISTLEWOOD RD	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/01/93
6355	6114 THISTLEWOOD RD	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/01/93
6236	3999 CROSS CREEK ROAD	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/01/93
6842	6053 ELMBURG CT	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/04/93
8035	3895 RAINTREE ROAD	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/01/93
980551	5867 GUMWOOD DR	00888	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	3/04/93
997212	5455 RIVER TRAIL RD S	00888	POSSIBLE STUCK METER	430	METER REPLACED	3/04/93	3/05/93
997447	3979 FERNGLEN DRIVE	00888	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
8055	3918 CHESTWOOD AVENUE	00888	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
997578	110 THOMAS CIRCLE	01279	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/25/93
14827	BCH. WOOD - BLDG. C	01510	POSSIBLE STUCK METER	430	METER REPLACED	3/09/93	3/12/93
980418	731 ST. ANDREWS CIRCLE	01801	POSSIBLE STUCK METER	430	METER REPLACED	2/23/93	3/04/93
186200	2022 ADELIA BLVD 0614001	18001	POSSIBLE STUCK METER	430	METER REPLACED	11/17/92	1/19/93
238380	798 STRATTON ST	18001	POSSIBLE STUCK METER	430	METER REPLACED	1/06/93	1/06/93
176956	1124 N PAGE DR	18001	POSSIBLE STUCK METER	430	METER REPLACED	1/12/93	1/13/93

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NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS		PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
184760	1522 MONICA ST		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/12/93	1/22/93
186330	1088 LAMPLIGHTER AVE		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/12/93	1/13/93
211380	2607 BEAL ST		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/13/93	1/14/93
984143	1882 COROLLA CT		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/08/93
247110	2001 BARLINGTON DR		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/19/93
246370	1132 FEATHER DR		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/19/93
246890	1120 ELKCAM BLVD	#3	18001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/21/93
251300	1985 S OLD MILL DR		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/21/93
266420	1137 BATON DR		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	1/22/93
267650	1339 FREEPORT DR		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	1/22/93
268460	1419 FREEPORT DR		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/21/93	1/22/93
213981	5209 FIFER DR		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/25/93	1/26/93
277390	1201 ABAGAIL DR		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/25/93	1/26/93
997168	1167 GIOVANNI ST		18001	POSSIBLE STUCK METER	430	METER REPLACED	1/25/93	1/26/93
21205	110 CYPRESS WDS CT	5C	18001	POSSIBLE STUCK METER	430	METER REPLACED	1/25/93	1/26/93
284391	130 JASMINE CT	12C	18001	POSSIBLE STUCK METER	430	METER REPLACED	1/27/93	1/30/93
286790	160 LIVE OAK CT	HB7-8-9	18001	POSSIBLE STUCK METER	430	METER REPLACED	1/27/93	1/30/93
235320	610 FAIRHAVEN ST		18001	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	2/17/93
23800	2082 W BARLINGTON DR		18001	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	2/19/93
275852	1540 PURITAN ST		18001	POSSIBLE STUCK METER	430	METER REPLACED	2/25/93	3/01/93
996113	1369 SAXON BLVD		18001	POSSIBLE STUCK METER	430	METER REPLACED	2/25/93	3/01/93
173290	1845 WAKEFIELD CIR		18001	POSSIBLE STUCK METER	430	METER REPLACED	2/25/93	3/01/93
174560	1463 WILTSHIRE AVE		18001	POSSIBLE STUCK METER	430	METER REPLACED	2/25/93	3/01/93

NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
246820	1682 FEATHER DR	18001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
1348	826 TRAFALGAR ST	18001	POSSIBLE STUCK METER	430	METER REPLACED	3/10/93	3/12/93
234328	1886 SAXON BLVD	18001	POSSIBLE STUCK METER	430	METER REPLACED	3/10/93	3/12/93
235140	1695 W FINDLAND DR	18001	POSSIBLE STUCK METER	430	METER REPLACED	3/10/93	3/12/93
240160	757 SULLIVAN ST	18001	POSSIBLE STUCK METER	430	METER REPLACED	3/10/93	3/12/93
836323	732 S HARTLEY AVE	18001	POSSIBLE STUCK METER	430	METER REPLACED	3/10/93	3/12/93
281181	2014 JESSAMINE CT	18001	POSSIBLE STUCK METER	430	METER REPLACED	3/25/93	3/25/93

NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS		PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
3969	STAR RT 417 LOTSBKO MARYLAND		00439	POSSIBLE STUCK METER	431	METER NOT STUCK	3/09/93	3/10/93
13573	12254 SPINEY RIDGE DR		00886	POSSIBLE STUCK METER	431	METER NOT STUCK	12/30/92	1/12/93
995717	ENTRNC HARBOUR ISLD IRRI		00886	POSSIBLE STUCK METER	431	METER NOT STUCK	12/30/92	2/26/93
999543	12081 ARBOR LAKE DR		00886	POSSIBLE STUCK METER	431	METER NOT STUCK	1/20/93	1/29/93
88537	12063 MUIRFIELD BLVD		00886	POSSIBLE STUCK METER	431	METER NOT STUCK	1/20/93	1/29/93
997212	5455 RIVER TRAIL RD S		00888	POSSIBLE STUCK METER	431	METER NOT STUCK	2/16/93	2/17/93
994325	3234 CEDAR		01702	POSSIBLE STUCK METER	431	METER NOT STUCK	12/31/92	1/04/93
87576	5133 KINGSLEY		01702	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/20/93
214798	0 DOYLE RD	614101	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	10/29/92	1/25/93
2[illegible]471	1108 W PAGE DR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/12/93	1/13/93
175[illegible]11	917 S SAXON BLVD		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/12/93	1/13/93
17[illegible]802	1612 MORENO TER		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/12/93	1/13/93
176751	1161 RAMBLE AVE		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/12/93	1/13/93
175370	1664 HASTINGS DR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/12/93	1/13/93
18[illegible]488	1550SFERGASON AVE		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/12/93	1/13/93
186[illegible]50	1676 PROVIDENCE BLVD	A-SPK	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/12/93	1/13/93
185120	1851SELKCAM BLVD		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/12/93	1/13/93
18[illegible]31	740 S SAXON BLVD		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/13/93	1/14/93
20[illegible]176	2211 ILLINOIS AVE		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/13/93	1/14/93
65[illegible]011	3030 MALCOLM DR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/18/93
197010	1155 LEEWARD DR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/18/93
642370	1298SBRIARWOOD AVE		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/18/93
704211	1266 FT SMITH BLVD		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/18/93

NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS		PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
826821	1476 WILTSHIRE AVE		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/18/93
998974	1861 BELSPRING AVE		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/18/93
214920	2857 BLUESTONE DR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
447	3175 POST ST		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
618	3527 LINWOOD CT		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
852189	2838 ARREMDONDA DR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
989936	682 SPREADING OAK AVE		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
972	730 ARLENE DR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
983649	978 N UNION CIR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/20/93
985179	2047 E PRAIRIE CIR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/20/93
268574	1323 STILLWATER AVE		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/20/93
797321	1599 ELKCAM BLVD		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/20/93	1/21/93
268342	974 WILMINGTON DR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/21/93	1/22/93
789440	1333 CLAYTON DR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/25/93	1/26/93
982113	2920 SNOW DR		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/25/93	1/26/93
280290	1185 CYPRESS WDS CT		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/25/93	1/26/93
997014	1980 ALSTER LANE		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/25/93	1/26/93
285450	128 HIBISCUS WDS CT	HB	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/25/93	1/26/93
997836	2254 HOWLAND BLVD		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/25/93	1/26/93
997468	2961 IRONDALE ST		18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/25/93	1/26/93
286500	150 WAX MYRTLE CT	HB 7-8	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/27/93	1/30/93
287540	1605 MAGNOLIA CT	1	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/27/93	1/30/93
287810	160 MAGNOLIA CT	10D	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/27/93	1/30/93

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METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
288900	2590 EUSTACE AVE (WELL)	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/27/93	1/28/93
6[illegible]1	417 PROVIDENCE BLVD	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/27/93	1/29/93
745300	220 ERIC JASON CT MOD-S	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/27/93	1/29/93
85[illegible]79	180 MAGNOLIA CT 6B	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/27/93	1/30/93
994800	190 HICKORY CT 4C	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/27/93	1/30/93
298490	2249 W DANA DR	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/02/93	2/02/93
216011	880 HANFORD DR	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/04/93	2/05/93
281364	501 S LACY CIR	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/10/93	2/15/93
283061	110 CYPRESS WDS CT 3C	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/12/93	2/13/93
1394	934 CRAWFORD ST SPRINKLER	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/12/93	2/12/93
838857	815 OSTEEN CEMETERY RD SPK	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/17/93	2/17/93
983707	5170 COURTLAND BLVD	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/17/93	2/17/93
253411	810 HALSTEAD ST	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	3/01/93
253790	1500SE LOMBARDY DR	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	3/01/93
995[illegible]60	2042 EL CAMPO AVE	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	3/01/93
998[illegible]55	2"FIRE HYD METER/875 ELKCAM	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	2/26/93
266[illegible]11	1497 LAVENDER ST	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	3/01/93
27[illegible]60	650 PYRAMID AVE	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	3/01/93
826[illegible]96	1425 AMBASSADOR AVE	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	3/01/93
17[illegible]30	919 VIVIAN TER	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	3/01/93
172891	1011 SAXON BLVD	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	3/01/93
191[illegible]80	3555 SAXON BLVD	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	3/01/93
286[illegible]32	150 WAX MYRTLE CT 9D	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/26/93	3/01/93

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NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
288470	164 PERIMETER DR SB	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/26/93	3/01/93
2143	253 BAYOU CIR	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/10/93	3/12/93
226400	10395 DELTONA BLVD	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/10/93	3/12/93
233271	1547 PIEDMONT DR	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/10/93	3/12/93
23[illegible]13	1506 SUNBIRD TER	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/10/93	3/12/93
23[illegible]291	1690STARRYTOWN AVE	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/10/93	3/12/93
284[illegible]58	140 ORCHID WDS CT 11C	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/11/93	3/12/93
285931	100 SWEET GUM WDS CT 8A	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/17/93	3/19/93
211058	2437 KIMBERLY DR	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/25/93	3/26/93
744141	2742 ELKCAM BLVD SPK	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/25/93	3/26/93
996163	1577 AMBOY DR	18001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/25/93	3/26/93
993783	1199 ENTERPRISE RD	18002	POSSIBLE STUCK METER	431	METER NOT STUCK	1/27/93	1/29/93
995480	201 STILLBROOK	18002	POSSIBLE STUCK METER	431	METER NOT STUCK	1/27/93	1/29/93

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3571

NORTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
979463	12490 TURNBERRY DRIVE	00886	POSSIBLE STUCK METER	440	VACANT PREMISE	12/30/92	1/12/93
19001	11607 HARBOUR WOODS S	00886	POSSIBLE STUCK METER	440	VACANT PREMISE	1/19/93	1/25/93
980547	CORNER/FULTON & MARTHA'S VINE	00886	POSSIBLE STUCK METER	440	VACANT PREMISE	1/20/93	2/03/93
12751	11643 FRANCIS DRAKE DRIVE	00886	POSSIBLE STUCK METER	440	VACANT PREMISE	1/20/93	2/04/93
999438	12021 HARBOR COVE DR S	00886	POSSIBLE STUCK METER	440	VACANT PREMISE	1/20/93	2/26/93
986216	12049 COBBLEWOOD LN N LOT23D	00886	POSSIBLE STUCK METER	440	VACANT PREMISE	1/20/93	2/04/93
979463	12490 TURNBERRY DRIVE	00886	POSSIBLE STUCK METER	440	VACANT PREMISE	1/20/93	2/02/93
8412	5673 HICKORY GROVE N	00888	POSSIBLE STUCK METER	440	VACANT PREMISE	2/16/93	3/11/93
.6	5803 PINEY CREEK LANE S	00888	POSSIBLE STUCK METER	440	VACANT PREMISE	2/17/93	3/02/93
8365	6161 DAMNRIDGE RD S	00888	POSSIBLE STUCK METER	440	VACANT PREMISE	2/17/93	3/01/93
16554	DRIVE-IN;N.LAMRENCE BLVD.	01094	POSSIBLE STUCK METER	440	VACANT PREMISE	2/02/93	2/03/93
188618	860 SAXON BLVD	10001	POSSIBLE STUCK METER	440	VACANT PREMISE	1/12/93	1/13/93
283991	130 JASMINE CT #3A	10001	POSSIBLE STUCK METER	440	VACANT PREMISE	1/27/93	1/30/93
709550	2701 DERBY DR	10001	POSSIBLE STUCK METER	440	VACANT PREMISE	2/02/93	2/03/93
997869	2971 IRONDALE ST	10001	POSSIBLE STUCK METER	440	VACANT PREMISE	2/02/93	2/03/93
997870	2920 FLYNN ST	10001	POSSIBLE STUCK METER	440	VACANT PREMISE	2/02/93	2/03/93
997871	2910 FLYNN ST	10001	POSSIBLE STUCK METER	440	VACANT PREMISE	2/02/93	2/03/93
997872	3154 CROTON AVE	10001	POSSIBLE STUCK METER	440	VACANT PREMISE	2/02/93	2/03/93
994929	1586 POLK AVE	10001	POSSIBLE STUCK METER	440	VACANT PREMISE	2/17/93	2/17/93
996954	3131 N COVINGTON DR	10001	POSSIBLE STUCK METER	440	VACANT PREMISE	2/17/93	2/17/93

CENTRAL REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
987225	3014 TRENTWOOD BLVD	00105	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
11080	2921 TRENTWOOD BLVD	00105	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
10110	2822 TRENTWOOD BLVD	00105	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
10058	3312 FLOWERTREE RD	00105	POSSIBLE STUCK METER	430	METER REPLACED	1/13/93	1/14/93
86991	8542 SIDON ST	00106	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
978116	3827 ORANGE LAKE DR	00106	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
985624	10165 UNIVERSITY BLVD PAR	00106	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
6013	NAUTILUS & BBQ	00106	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/27/93
5952	LOT 110 EXETER WAY	00106	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/05/93
5274	3224 TCU BLVD	00106	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/04/93
95049	9675 LK DOUGLAS PLACE	00106	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/05/93
88202	4322 SUN TREE BLVD	00106	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/03/93
16692	3007 VIA DOS BLVD	00106	POSSIBLE STUCK METER	430	METER REPLACED	3/25/93	3/29/93
91953	105 SAGE STREET	00323	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/03/93
997211	309 MAGNOLIA	00326	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/19/93
3054	MONTGOMERY ROAD	00330	POSSIBLE STUCK METER	430	METER REPLACED	12/29/92	1/20/93
991724	219 BRIARCLIFF DR	00330	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/05/93
107377	115 MOHAWK AVENUE	00330	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/10/93
3365	117 ALMA DRIVE	00330	POSSIBLE STUCK METER	430	METER REPLACED	3/09/93	3/10/93
96450	544 E TANGERINE	00332	POSSIBLE STUCK METER	430	METER REPLACED	12/29/92	1/21/93
1625	536 TANGERINE	00332	POSSIBLE STUCK METER	430	METER REPLACED	12/29/92	1/21/93
1481	508 ORANGE	00332	POSSIBLE STUCK METER	430	METER REPLACED	12/29/92	1/21/93
48	316 ALPINE ST	00332	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	2/01/93

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CENTRAL REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
1971	444 E OAKHURST STREET	00332	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	2/02/93
1800	513 WHITE OAK DR	00332	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/13/93
96313	1301 PRESSVIEW	00332	POSSIBLE STUCK METER	430	METER REPLACED	12/30/92	1/13/93
2121	115 MEADOWLARK	00332	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/13/93
1747	425 HIGHLAND STREET	00332	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/16/93
9760	340 E THIRD STREET	00335	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
88357	561 E FIFTH STREET	00335	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/14/93
985951	805 MELODY DRIVE	00335	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/14/93
9645	CORNER 419 & 11 LOT 14 B6	00335	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
9864	201 7TH ST TROP	00335	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/15/93
995591	36528 N SKYCREST BLVD	00551	POSSIBLE STUCK METER	430	METER REPLACED	1/13/93	1/15/93
1215	1901 N FERN CIRCLE	00552	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
86715	207 GLENN ST	00552	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
997219	215 BENTBOUGH DR	00552	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/04/93
1263	2031 S FERN CIR	00552	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/03/93
88834	BOX 974-A LOT 13 SPG LK R	00555	POSSIBLE STUCK METER	430	METER REPLACED	12/29/92	1/12/93
186437	LOT 18 A SPRING LK RD	00555	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/05/93
1372	1715 SPRING LK RD	00555	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/22/93
979936	1915 SPRING LK RD	00555	POSSIBLE STUCK METER	430	METER REPLACED	3/10/93	3/11/93
6908	LOT 42	00557	POSSIBLE STUCK METER	430	METER REPLACED	1/07/93	1/13/93
7174	37342 HAPPY LANE LOT 9	00558	POSSIBLE STUCK METER	430	METER REPLACED	3/05/93	3/08/93
18872	LOT 13 HOBBY WAY	00558	POSSIBLE STUCK METER	430	METER REPLACED	3/09/93	3/22/93
992836	37432 HOBBY WAY LOT 23	00558	POSSIBLE STUCK METER	430	METER REPLACED	3/09/93	3/10/93

CENTRAL REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
95[illegible]17	LOT 22 ORIG HAPPY LANE	00550	POSSIBLE STUCK METER	430	METER REPLACED	3/09/93	3/22/93
95[illegible]65	1222 LASALIDA WAY	00562	POSSIBLE STUCK METER	430	METER REPLACED	12/31/92	1/12/93
[illegible]942	05139 SYDNEY ROAD	00564	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/03/93
12[illegible]71	34299 ISLAND DRIVE	00566	POSSIBLE STUCK METER	430	METER REPLACED	3/25/93	3/26/93
12[illegible]80	89 TAMMI DRIVE	00567	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/03/93
9[illegible]345	11627 HICKORY LANE	00570	POSSIBLE STUCK METER	430	METER REPLACED	1/11/93	1/14/93
9[illegible]96	6 IMPERIAL DR	00570	POSSIBLE STUCK METER	430	METER REPLACED	1/12/93	2/05/93
94170	31642 HOWARD ST	00570	POSSIBLE STUCK METER	430	METER REPLACED	1/12/93	1/13/93
94286	11712 HICKORY LANE	00570	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/03/93
94159	31702 CLAYTON STREET	00570	POSSIBLE STUCK METER	430	METER REPLACED	3/09/93	3/11/93
92849	9840 JACKSON RD	00574	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/05/93
106728	34001 HIGHLAND RD	00574	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/05/93
996770	7 DURNESS COURT	00574	POSSIBLE STUCK METER	430	METER REPLACED	1/26/93	1/28/93
92480	17 EASTER ROSS COURT	00574	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/04/93
94547	1135 BEN MORE DRIVE LOT 3	00574	POSSIBLE STUCK METER	430	METER REPLACED	3/03/93	3/05/93
94551	1137 BEN MORE DRIVE LOT 3	00574	POSSIBLE STUCK METER	430	METER REPLACED	3/03/93	3/08/93
7529	2805 NEWCOMBE LANE	00781	POSSIBLE STUCK METER	430	METER REPLACED	2/02/93	2/04/93
989865	405 SUNSET BLVD	00781	POSSIBLE STUCK METER	430	METER REPLACED	3/04/93	3/05/93
7725	395 SUNSET BLVD.	00781	POSSIBLE STUCK METER	430	METER REPLACED	3/09/93	3/10/93

CENTRAL REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
4592	3938 GREENVIEW PINES CT	00106	POSSIBLE STUCK METER	431	METER NOT STUCK	12/31/92	1/04/93
5278	LOT 47 3316 TCU	00106	POSSIBLE STUCK METER	431	METER NOT STUCK	1/29/93	1/29/93
9058	LOT 44 DUNDEE WAY	00106	POSSIBLE STUCK METER	431	METER NOT STUCK	2/02/93	2/05/93
992661	2808 DELCREST DR	00106	POSSIBLE STUCK METER	431	METER NOT STUCK	2/18/93	2/19/93
106562	2758 DOBBINS DR	00106	POSSIBLE STUCK METER	431	METER NOT STUCK	3/10/93	3/11/93
994607	3881 BENTFORD CT-IRRIGATI	00106	POSSIBLE STUCK METER	431	METER NOT STUCK	3/10/93	3/11/93
984363	3881 BENTFORD COVE	00106	POSSIBLE STUCK METER	431	METER NOT STUCK	3/10/93	3/11/93
105807	6816 WOODFARE COURT	00106	POSSIBLE STUCK METER	431	METER NOT STUCK	3/10/93	3/11/93
0390	257 ALPINE STREET	00332	POSSIBLE STUCK METER	431	METER NOT STUCK	1/28/93	2/01/93
9360	401 E SIXTH STREET	00335	POSSIBLE STUCK METER	431	METER NOT STUCK	12/31/92	1/04/93
9719	550 E SECOND STREET	00335	POSSIBLE STUCK METER	431	METER NOT STUCK	2/02/93	2/04/93
978468	2929 ALTA ST	00562	POSSIBLE STUCK METER	431	METER NOT STUCK	12/31/92	1/05/93
993748	11304 HUGGINS ST	00566	POSSIBLE STUCK METER	431	METER NOT STUCK	1/11/93	1/13/93
996624	LOT 35 QUAIL RIDGE	00578	POSSIBLE STUCK METER	431	METER NOT STUCK	12/29/92	2/05/93
7645	775 HAVANA DRIVE	00781	POSSIBLE STUCK METER	431	METER NOT STUCK	1/07/93	1/11/93
7612	970 N TROPICANA CT	00781	POSSIBLE STUCK METER	431	METER NOT STUCK	1/07/93	1/08/93

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CENTRAL REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
862	LOT 51 PLUMOSA	88559	POSSIBLE STUCK METER	440	VACANT PREMISE	1/13/93	1/14/93

CENTRAL REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
980624	1130 DONEGAN AVENUE IRRI	00783	POSSIBLE STUCK METER	490	NO PROBLEM COULD BE FOUND TO JUSTIFY S/O	2/02/93	2/05/93

WEST REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
4714	307 TEMPLE COURT	00214	POSSIBLE STUCK METER	430	METER REPLACED	12/22/92	1/07/93
983974	9432 E. GOSPEL ISLAND RD,L 1/G	00987	POSSIBLE STUCK METER	430	METER REPLACED	5/30/93	5/31/93
11634	ZEHYRHILL VILLAGE	01427	POSSIBLE STUCK METER	430	METER REPLACED	12/07/92	1/07/93
995996	35138 DALE AVE	01427	POSSIBLE STUCK METER	430	METER REPLACED	1/04/93	1/05/93
19719	7516 TYSON DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/07/93
18863	7113 PALISADE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/12/93
18936	7216 PALISADE DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/12/93
19026	7317 PALISADE DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/12/93
19055	10835 FELSDALE AVENUE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/12/93
19126	10933 STAMFORD DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/12/93
19243	11341 ZIMMERMAN ROAD	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/12/93
.. 2	7611 BIRCHWOOD DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/07/93
19771	7541 TYSON DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/11/93
974258	7521 ARBORDALE DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/07/93
991656	10825 HILLCREST AVE.	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/11/93
994270	11224 TAMARIX AVENUE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/15/92	1/07/93
18892	10825 INGLEWOOD AVENUE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/11/93
19859	7731 ILEX DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/18/92	1/06/93
19872	7734 ILEX DR.	01429	POSSIBLE STUCK METER	430	METER REPLACED	12/18/92	1/07/93
19338	11240 NOME AVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	1/13/93	1/14/93
999136	11211 RHONDA AVENUE	01429	POSSIBLE STUCK METER	430	METER REPLACED	1/13/93	1/14/93
19950	7830 BIRCHWOOD DR.	01429	POSSIBLE STUCK METER	430	METER REPLACED	1/15/93	1/19/93
96159	7701 ILEX DR.	01429	POSSIBLE STUCK METER	430	METER REPLACED	1/15/93	1/19/93

WEST REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
98495	7905 IRONBARK DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	1/15/93	1/19/93
988109	11205 SNYDER AVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	1/15/93	1/19/93
19459	11234 KAPOK AVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	3/19/93	3/19/93
19429	7831 IRONBARK DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	4/05/93	3/23/93
19390	11230 LINDEN LANE	01429	POSSIBLE STUCK METER	430	METER REPLACED	4/05/93	3/23/93
19844	7740 TYSON DRIVE	01429	POSSIBLE STUCK METER	430	METER REPLACED	4/05/93	3/25/93
86180	2131 W GREENWAY PL	09001	POSSIBLE STUCK METER	430	METER REPLACED	2/05/93	2/09/93
84070	2481 W JONQUIL DR	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
85440	2161 W AUSTIN DR	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
23617	2199 W DEVON DR	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
99[illegible]127	2115 W DEVON DR	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
[illegible]88	9540 N BUNKER WAY	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
86480	2184 W DEVON DR	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
997581	2240 W GREENWAY PL	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
987084	2112 W HOWARD PL	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
86612	2140 W HOWARD PL	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
1836	9380 N CITRUS SPRINGS BLVD	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
87970	150 N GOLFVIEW DR	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
87170	2615 W GARDENIA DR	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
87180	2571 W GARDENIA DR	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/09/93
994352	9324 ELKCAM BLVD	09001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/10/93
61780	3974 SW 138 PL	11001	POSSIBLE STUCK METER	430	METER REPLACED	2/26/93	3/01/93
59440	4264 SW 148 ST	11001	POSSIBLE STUCK METER	430	METER REPLACED	3/17/93	3/17/93

WEST REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
996070	6135 PINEHURST DR	27001	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/04/93
392460	140 DANDELION CT	27001	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/04/93
652591	8225 PINEHURST DR	27001	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/04/93
402700	8401 VICKSBURG RD	27001	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/04/93
408411	8419 BALLUP RD	27001	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/04/93
416410	9115 MCCORMICK ST	27001	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/04/93
340490	10349 CHALMER ST	27001	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/04/93
997958	9325 HORIZON DR	27001	POSSIBLE STUCK METER	430	METER REPLACED	12/17/92	1/04/93
997982	1193 OVERLAND DR	27001	POSSIBLE STUCK METER	430	METER REPLACED	12/29/92	1/04/93
587160	359 UPLAND AVE	27001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/27/93
403500	8423 OMAHA CIR	27001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/21/93
999479	2210 DELTONA BLVD	27001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/22/93
1655	1345 LAREDO AVE	27001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/21/93
998496	1214 VENETIA DR	27001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/21/93
8[illegible]54	11119 ADDISON ST	27001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/21/93
518298	1407 LARKIN RD	27001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/21/93
52 31	4656 ELWOOD RD	27001	POSSIBLE STUCK METER	430	METER REPLACED	1/18/93	1/21/93
1961	5123 HIGATE RD	27001	POSSIBLE STUCK METER	430	METER REPLACED	1/26/93	1/28/93
392480	188 DANDELION CT	27001	POSSIBLE STUCK METER	430	METER REPLACED	2/11/93	2/18/93
404590	8350 COFIELD LN	27001	POSSIBLE STUCK METER	430	METER REPLACED	2/11/93	2/18/93
296955	4599 KIRKLAND AVE	27001	POSSIBLE STUCK METER	430	METER REPLACED	2/11/93	2/18/93
313520	12155 CORONADO DR	27001	POSSIBLE STUCK METER	430	METER REPLACED	2/11/93	2/18/93
995639	6451 TOLEDO RD	27001	POSSIBLE STUCK METER	430	METER REPLACED	2/19/93	2/19/93

5/14/93

LSG601C

CUSTOMERS INQUIRY REPORT

15:56:50

FROM: 1/01/93 TO 3/31/93

WEST REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
839302	10460 CHALMER ST	27001	POSSIBLE STUCK METER	430	METER REPLACED	2/19/93	2/24/93
410930	9069 HORIZON DR	27001	POSSIBLE STUCK METER	430	METER REPLACED	2/26/93	3/08/93
319021	9494 SPRING HILL DR	27001	POSSIBLE STUCK METER	430	METER REPLACED	3/08/93	3/19/93

00053 1583582

WEST REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
93890	911 FAIRLANE DR	80215	POSSIBLE STUCK METER	431	METER NOT STUCK	5/09/93	5/10/93
102484	8 JAMAICA ST LT 193 1/2 194	80989	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
105154	17 BVRSONIMA CT W LT 15 BK T	80989	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
105466	7 W WINGED FOOT CT LT 53 BK C	80989	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
977886	9 ELDER CT LT 7 BK 66	80989	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
987424	LOTS 27 + 28 BI TENNIS CT PKG	80989	POSSIBLE STUCK METER	431	METER NOT STUCK	2/25/93	2/26/93
991872	3708 NUGGET LANE	80992	POSSIBLE STUCK METER	431	METER NOT STUCK	1/11/93	1/13/93
982730	7750 TYSON DRIVE	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	12/15/92	1/11/93
986069	10834 NORWOOD AVE.	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	12/15/92	1/11/93
997477	11329 SCALLOP DRIVE	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	12/17/92	1/11/93
19818	7835 TYSON DRIVE	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	12/18/92	1/07/93
994704	7705 BIRCHWOOD DR.	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	12/18/92	1/11/93
19992	7825 ARBORDALE DR	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	12/18/92	1/07/93
19644	7528 BIRCHWOOD DRIVE	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/13/93	1/14/93
19585	11210 LINDEN LANE	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/19/93
19428	7825 IRONBARK DRIVE	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/19/93
19871	7750 ILEX DR.	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/19/93
19885	7835 BIRCHWOOD DR.	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/19/93
19889	11225 WHITE OAK LANE	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/19/93
19917	11214 TAMARIX AVENUE	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/19/93
92352	7741 HAWTHORN DRIVE	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/19/93
196	7835 GREYBIRCH TER.	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/19/93
989407	11114 TAMARIX AVENUE	81429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/22/93

WEST REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS		PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
997399	7721 IRONBARK DRIVE		01429	POSSIBLE STUCK METER	431	METER NOT STUCK	1/15/93	1/22/93
85470	9115 N CARESSA WAY		09001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/08/93	3/09/93
85750	9564 N BUNKER WAY		09001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/08/93	3/09/93
85770	9550 N BUNKER WAY		09001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/08/93	3/09/93
720090	8337 N UPLAND DR		09001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/08/93	3/09/93
990852	8327 N ELKCAM BLVD		09001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/08/93	3/09/93
610080	695 RIVERBAY CT		09001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/08/93	3/09/93
363160	1166 NEWHOPE RD		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/26/93
363570	7020 TARRYTOWN DR		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/26/93
992671	686 MERRIMAC LN		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/26/93
383710	1693 STILLWATER AVE		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/26/93
393220	7336 POND CIR	B	27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/26/93
402310	8603 ANNAPOLIS RD		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/21/93
986	1285 VALIANT AVE		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/21/93
836610	9279 PICKENS ST		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/21/93
1585	2269 BOLGER AVE		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/20/93
987	14152 REDWOOD ST		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/20/93
814000	4597 MARINER BLVD		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/20/93
339810	5040 ELWOOD RD		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
348940	4664 CHAMBER CT		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	1/18/93	1/19/93
986711	1085 BARLOW CT	I/M	27001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/09/93	2/16/93
485096	1442 AUTUMN RD		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/11/93	2/17/93
292980	9231 MARLER RD		27001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/11/93	2/17/93

WEST REGION
METER REPLACEMENT

CUST	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
29[illegible]50	9146 CENTURY DR	27001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/11/93	2/18/93
999[illegible]94	2026 LANDOVER BLVD	27001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/11/93	2/18/93
803[illegible]51	6394 COVEWOOD DR	27001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/11/93	2/18/93
1[illegible]68	1073 LARKIN CT	27001	POSSIBLE STUCK METER	431	METER NOT STUCK	2/11/93	2/18/93
22[illegible]13	1131 WEDGE WAY I/M	27001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/05/93	3/08/93
999[illegible]65	11053 VIA SANTIAGO CT	27001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/08/93	3/09/93
328[illegible]40	13594 LINDEN DR	27001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/08/93	3/12/93
357[illegible]20	6139 NANTUCKET LN	27001	POSSIBLE STUCK METER	431	METER NOT STUCK	3/23/93	3/24/93

SOUTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
14115	1709 NE 23RD TERRACE	00675	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	2/17/93
106289	2306 NE 19TH CT	00675	POSSIBLE STUCK METER	430	METER REPLACED	3/09/93	3/09/93
13992	1795 N E.24TH ST.EXT	00675	POSSIBLE STUCK METER	430	METER REPLACED	3/09/93	3/10/93
14249	1702 NE 25TH TERRACE	00675	POSSIBLE STUCK METER	430	METER REPLACED	3/16/93	3/17/93
73654	1718 LAKESIDE DRIVE	01601	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/20/93
73706	1747 CARIBBEAN CIR	01601	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/20/93
81439	1706 LAKESIDE DRIVE	01601	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/20/93
82236	1018 S VENICE BYPASS	01601	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/20/93
72194	484 E SHADE DR	01601	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	3/23/93
8[illegible]772	4151 SOUTH TAMIAMI TRAIL	01601	POSSIBLE STUCK METER	430	METER REPLACED	3/16/93	3/22/93
81507	1936 INNISBROOK CT	01602	POSSIBLE STUCK METER	430	METER REPLACED	12/16/92	1/15/93
7[illegible]563	905 E SHANNON CT	01602	POSSIBLE STUCK METER	430	METER REPLACED	12/16/92	1/12/93
8[illegible].26	391 LONGWOOD DRIVE	01602	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/20/93
8[illegible].025	IRRI METER REAR ENT L845	01602	POSSIBLE STUCK METER	430	METER REPLACED	1/19/93	1/20/93
7[illegible]769	426 MEXICALI AVENUE	01602	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/21/93
7[illegible]59	454 SUNNYSIDE DRIVE	01602	POSSIBLE STUCK METER	430	METER REPLACED	1/20/93	1/21/93
74352	114 SUNNYSIDE DRIVE	01602	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/19/93
7[illegible]508	980 BASS CT	01602	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	3/02/93
7[illegible]918	925 S. DORAL LANE	01602	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/19/93
74475	400 DORCHESTER DRIVE	01602	POSSIBLE STUCK METER	430	METER REPLACED	2/16/93	2/19/93
8[illegible]934	1086 E GONDOLA DR	01602	POSSIBLE STUCK METER	430	METER REPLACED	2/25/93	3/17/93
106564	26200 MADRAS CT 26829/830	02201	POSSIBLE STUCK METER	430	METER REPLACED	2/05/93	2/11/93
4481	9 W JASMINE RD	02901	POSSIBLE STUCK METER	430	METER REPLACED	1/25/93	1/27/93

SOUTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
[illegible]268	2 TANGELO CT	02901	POSSIBLE STUCK METER	430	METER REPLACED	2/17/93	2/18/93
10975	19587 S E ORCHIDTREE CT	02901	POSSIBLE STUCK METER	430	METER REPLACED	2/26/93	3/01/93
15878	1416 IRONDALE ST	02901	POSSIBLE STUCK METER	430	METER REPLACED	3/25/93	3/26/93
984408	1534 MAINSAIL DR 2	26002	POSSIBLE STUCK METER	430	METER REPLACED	1/07/93	1/18/93

00058 1588 3587

SOUTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
71968	405 GLEN OAK RD	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	12/16/92	1/11/93
77411	228 CENTER RD	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	12/16/92	1/11/93
77216	760 SUGARWOOD WAY	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	1/05/93	1/11/93
[illegible]82	807 BAVENO DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	1/19/93	1/20/93
78113	2111 S TAMIAMI TRAIL	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	1/19/93	2/01/93
[illegible]52	453 LONGWOOD DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	1/19/93	1/20/93
81545	936 HARBOR TOWN DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	1/19/93	1/20/93
82446	784 LOCARNO DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	1/19/93	1/20/93
75708	1748 CARIBBEAN CIR	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	1/19/93	1/20/93
79831	TAMIAMI TRAIL S	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	1/20/93	1/20/93
79669	694 ROMA ROAD	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/01/93	2/02/93
75220	211 MANTUA DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/01/93	2/02/93
81958	1570 QUAIL LAKE DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/01/93	2/02/93
79655	1250 COVEY COURT	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/01/93	2/02/93
73060	562 BRIARWOOD RD	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/16/93	3/11/93
72096	310 CENTER RD	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/16/93	3/26/93
77913	1718 SANDY CT	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/16/93	3/25/93
75329	377 SHAMROCK BLVD	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/18/93	2/19/93
76974	1795 POMELO DR	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/17/93
7[illegible]25	528 NEPONSIT DR S	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/11/93
75358	S TAMIAMI TRAIL	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/24/93
81754	720 LOCARNO DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/22/93
81399	726 ROMA ROAD	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/22/93

SOUTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
77577	719 LOCARNO DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/22/93
77592	227 WOODINGHAM LANE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/11/93
79553	796 GRADO DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/22/93
75592	621 VIA VENETO	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/22/93
81060	790 BAVENO DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/22/93
74475	TRAIN SW CENTER	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	3/16/93	3/22/93
7[illegible]598	415 LONGWOOD DRIVE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	3/16/93	3/30/93
[illegible]609	1759 CARIBBEAN CIRCLE	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	3/16/93	3/22/93
83[illegible]04	4137-B SOUTH TAMIAMI TRAIL	01601	POSSIBLE STUCK METER	431	METER NOT STUCK	3/16/93	3/22/93
79580	1194 HARBOR TOWN WAY	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	1/05/93	1/11/93
80799	312 ROMA ROAD	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	1/19/93	1/20/93
75723	975 JOLANDA CIRCLE	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	1/19/93	1/20/93
81757	430 BOXWOOD DRIVE	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	2/01/93	2/02/93
78229	528 CERVINA DRIVE SO	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	2/01/93	2/02/93
81967	795 CERVINA DRIVE NO	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	2/01/93	2/04/93
75571	502 VIA VENETO	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	2/01/93	2/02/93
78436	1811 OAKWOOD COURT	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	2/18/93	2/19/93
75629	888 GRADO DRIVE	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/22/93
75645	790 CERVINA DRIVE NORTH	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	3/22/93
74596	1400 OGDEN ROAD	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	3/16/93	3/22/93
7[illegible]651	CORNER BYPASS/BUSINESS	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	3/16/93	3/25/93
8[illegible]129	2117-A S TAMIAMI TR	01602	POSSIBLE STUCK METER	431	METER NOT STUCK	3/16/93	3/22/93
1[illegible]288	25333 SANDHILL BVD,C-2,586/640	02201	POSSIBLE STUCK METER	431	METER NOT STUCK	2/11/93	2/17/93

6/14/93 CUSTOMERS INQUIRY REPORT 15:56:58

CSG681C FROM: 1/01/93 TO 3/31/93 PAGE 31

SOUTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
101453	156 ANGOL ST 14/551/20	02201	POSSIBLE STUCK METER	431	METER NOT STUCK	2/11/93	2/17/93
101542	26044 PARANA DR 19/586/20	02201	POSSIBLE STUCK METER	431	METER NOT STUCK	2/11/93	2/17/93
995789	36 HILLSIDE, LOT 7/BLK 2	02601	POSSIBLE STUCK METER	431	METER NOT STUCK	1/13/93	1/14/93
24321	105 ALCALA AV	02901	POSSIBLE STUCK METER	431	METER NOT STUCK	2/23/93	2/23/93
20168	315 JEFFERSON AV	02901	POSSIBLE STUCK METER	431	METER NOT STUCK	3/03/93	3/04/93

6/14/93

CSG601C

CUSTOMERS INQUIRY REPORT

FROM: 1/01/93 TO 3/31/93

15:56:50

SOUTH REGION
METER REPLACEMENT

CUST.	SERVICE ADDRESS	PLANT	PROBLEM		RESOLUTION	TAKEN DATE	COMP DATE
14133	2351 NE 20TH CT	00675	POSSIBLE STUCK METER	440	VACANT PREMISE	1/11/93	1/12/93
98154	25522 BARINAS DR 48/509/20	02201	POSSIBLE STUCK METER	440	VACANT PREMISE	2/11/93	2/17/93
982567	26217B RAMPART BLVD TR J	02201	POSSIBLE STUCK METER	440	VACANT PREMISE	2/11/93	2/17/93

METER REPLACEMENT

GRAND TOTAL

PROBLEM CODE	DESCRIPTION	NUMBER OF INQUIRIES
430	POSSIBLE STUCK METER	560
		560

COMPREHENSIVE METER PROGRAM

3593

1594

SSU COMPREHENSIVE METER PROGRAM

TABLE OF CONTENTS

I. Introduction/Purpose

The following Comprehensive Meter Plan (CMP) is established to allow SSU to continue to provide the highest quality of service, accurate customer billing and efficient operation of our water/wastewater systems.

This CMP will cover all aspects regarding the water meter. The water meter is one of the most important components in our systems. The purpose or goal of the CMP is to allow SSU to:

- Establish procedures regarding water meters for uniformity throughout the state.
- Continue to provide quality of service with accurate and properly installed meters.
- Reduce the company's total unaccounted for water.
- Plan for future technologies regarding telemetry or remote meter reading systems.

II. Small Meters 5/8" x 3/4" to 1"

The following will outline all aspects regarding small meters. Currently SSU has over 140,000 small meters in Florida. Approximately 80% of SSU's existing meters are the "multi-jet" or "velocity" type and the remaining 20% are the "positive displacement" type. Both types of meters have features that are important to our operation. As SSU continues to evaluate the performance of the two different types of meters, more information will be obtained to ascertain if in future years we will purchase one type over the other.

II. A) Application

- Typically all residential customers will have a 5/8" x 3/4" meter. Corporate Development and/or the Operations Department will approve any larger size requested by a customer. It is important to install the proper size of meter for any application to minimize non-detected low flow usages.
- In cases of residential irrigation use, again the proper size of meter that will allow adequate flow (GPM) should be installed.
- Any commercial customer requesting meters will be coordinated through The Corporate Development Department to insure adequate size and type of meter is installed and appropriate connection fees are paid.

II. B) Specifications

The following specifications on small meters will be utilized. Any revisions in specifications will be jointly approved by the Engineering Department and Operations Department.

o **General** **5/8" x 3/4" to 1"**

Positive displacement meters will meet or exceed A.W.W.A standard C-700 and multi-jet meters will meet or exceed A.W.W.A standard C-708-76. All small meters will also meet the following specifications.

o **Maincase**

Maincases will be bronze (minimum of 75% copper) with laying lengths as outlined in the above mentioned A.W.W.A standards. The serial numbers will be stamped on the maincase and correspond with a stamped serial number on a plastic register lid.

o **Register**

The register will be a straight reading type with six (6) movable numbered wheels. The register will be dry and roll sealed. The registration will be in gallons. All registers will be equipped with a tamper-proof seal. Registers will have a low flow "leak" indicator.

o **Measuring Chamber**

See minimum specifications in above mentioned A.W.W.A. standards.

o **Warranty/Guarantee**

All meters will be guaranteed for a minimum of ten (10) years for accuracy and mechanical defects. Any meter that fails to meet the accuracy specifications as outlined in the above mentioned A.W.W.A. standard will be returned to the vendor for replacement or repair, at the expense of the vendor.

II. C) **Installation** **5/8" x 3/4" to 1"**

SSU currently utilizes different methods in small meter installations. The following will be a uniform procedure for the Operations Department when installing a new meter:

Upon receipt of a work order, Operations personnel will initiate the meter installation process. No meters are to be installed (pursuant to F.D.E.R. Regulation) until the new facilities (water mains, etc.,) are certified by the Engineer of record, accepted by Engineering, Operations and Corporate Development, and cleared for service by FDER.

The operations personnel should install new meters (services) on property corners to maximize the installation for future neighboring customers. Engineering will assist in new service locations for master planning, etc.,

It is important that the service line be flushed of debris and sand **prior** to installation of the new meter. The first thirty (30) gallons of registration is the critical time period of the new meter, and any debris will affect the accuracy and reliability of the new meter. Exhibit A & B attached to this CMP is the approved design for installation and may be revised from time to time by joint consent of the Engineering and Operations Department.

Note: Any customer that has a private well, irrigation system, and/or is a commercial type customer will be required to have an approved back-flow prevention device installed on the customer's side of the meter. The Operations Department will approve and inspect the installation of the back-flow preventors by the customer.

All private wells must be disconnected to the customers residence prior to a meter being installed.

II. D) **Testing** **5/8" x 3/4" to 1"**

Currently SSU tests small meters for accuracy at the request of the customer. This procedure will continue for 1992. Starting in 1993 operations will conduct random testing of small meters for an overall quality assurance. The Operations Department will establish a procedure and conduct this testing in systems of their choice.

When conducting an accuracy test the following procedure will be used.

- Customer initiates high bill complaint to a customer service representative.
- Customer Service issues work order to the Operations Department.
- Operation's personnel visits customer and verifies meter reading, checks for leaks, and determines if a field accuracy test is required.
- Results of field test are forwarded back to a customer service representative.
- Customer Service Representative will communicate results to the customer and the Utility and/or customer may request a certified bench test.
- In the event of a certified bench test, the operations person will re-visit the customer and replace the questioned meter with a new meter of the same size. The questioned meter will be sealed with inlet/outlet caps to keep debris out of the meter.
- In the Central Region the questioned meter is sent to the Apopka office and bench tested by an Operations Certified Technician. In the other three (3) regions the questioned meter is forwarded to a Certified Meter testing company.

- o The certified bench test results are forwarded to the customer service representative.
- o The customer service representative will communicate results with customer and adjust billing if applicable.
- o The questioned meter will not be re-installed if it is over five (5) years old or the cost of re-installation is greater than the value of the new meter.

Note: Typically a 5/8" x 3/4" meter costs less than $25.00, therefore the labor to re-install the original meter could be greater. Operations personnel will determine which meter will remain at the customer's location.

II. E) **Change Out - Repair/Rebuild**

In 1993 SSU will implement a change-out program on small meters. Currently the F.P.S.C. and Water Management Districts are setting guidelines for change-out of small meters every ten (10) years. It is not economically feasible for SSU to change out every meter that is 10 years or older in 1993. Operations will begin a change-out program in 1993, with a minimum of 5% change-out (State-wide) and increase the percentage annually, in increments of 1% to meet the above guideline.

It is not economically feasible to rebuild/repair small meters. The labor and materials required will exceed the new meter cost.

Notes: 1) When an operations personnel detects a stuck meter in the field it should be reported to a customer service representative, and/or if a customer service representative issues a work order on a stuck meter it will be field investigated by the Operations Department. Every month the meter is

stuck, SSU is not accounting for the customers consumption.

A new meter should be installed ASAP by the Operation's Department.

2) Operations will manage and dispose of salvage brass in accordance with SSU's salvage policy outlined in the Purchasing Manual.

II. F) Bid Solicitation

The Purchasing Department will conduct bid solicitations every twelve (12) months from meter companies. The bid solicitation will include the following:

- Length of contract and lock in price.
- Specification requirements as outlined in II. B) of this CMP.
- FOB destination and allocation to operations field offices as requested.
- Lead time for delivery.

III. Large (Master) Meters 1-1/2" to 10"

SSU currently has approximately 1,700 large meters throughout the state. Of the 1,700 large meters, approximately 1,400 are customer meters and the balance are plant flow meters. The large meters are less than 3% of our total number of meters, however it is estimated that approximately 15% of our total revenue is generated by large meters. Currently there is 200 - 3" and larger customer meters, and approximately 1,200 are 1 1/2" and 2" meters.

III. A) Application

It is very important that the proper type of large meter is installed for the designated use. Attached is Exhibit II, a reference guide on customer demand and applicable meter type). Please refer to this guide for reference purposes only. The installation (application) of large meters will be jointly approved by the Engineering, Operations and Corporate Development Departments. The installation of large plant flow meters will be approved by the Engineering and Operations Departments.

III. B) Specification

- o <u>General</u>

  Turbine type meters will meet or exceed A.W.W.A. standard C-701, and compound type meters will meet or exceed A.W.W.A. standard C-702.

- o <u>Maincase</u>

  All maincases will be bronze (minimum of 75% copper) with flanged ends.

1 1/2" to 10"

The serial number will be stamped on the main case and correspond with a stamped serial number on the register lid. No plastic register lids on large meters.

- o **Register**

  The register will be a straight reading type, dry, and roll-sealed. The registration will be in gallons.

- o **Warranty/Guarantee**

  All large meters will be guaranteed for one (1) year for accuracy and mechanical defects. Any meter that fails to meet the accuracy specifications as outlined in the above mentioned A.W.W.A. standard will be returned to the vendor for replacement or repair, at the expense of the vendor.

III. C) **Installation**

Typically, the installation of new large meters is done by the customer's contractor under SSU inspections. If the Operations or Engineering Departments decide to install the meter "in-house", the total cost of the large meter installation should be recovered from the new customer.

Prior to any new customer large meter installation, it is important that the Operations, Engineering and Corporate Development Departments are informed and jointly approve the installation.

Attached is Exhibit IV - A & B that shows the approved installation plan for above and below

ground large meter installations.

1 1/2" to 10"

The following installation procedures are applicable to new large meter installations.

- All 1 1/2" and 2" meters can be installed in "Jumbo" meter boxes similar to small meter installations. These meters may also be installed above ground. An approved backflow preventer is required on the customer's side of the meter. A test port is required on the customer side of the meter (minimum of 1" NPT).
- All 3" or larger meters should be installed above ground. In areas of limited space or possible vandalism, a below ground installation may be completed.
- In the case of a below ground installation, the pit (vault) must be constructed with a drain or sump pump to prevent flooding. The vault also must have an approved aluminum cover that can be locked.
- The installation must be installed with a bypass line that is equal to the largest diameter of the meter installed. The bypass line will be below ground and locked in the off position if feasible.
- The large meter must have as a minimum of a 1-1/2" NPT test port on the downstream side of the meter. Any meter 6" or larger will require a minimum of a 2" NPT test port.
- An approved back-flow preventer is required, and should be installed above ground and in-line with the meter and on the customer's side of the meter. It is the customer's responsibility to test and maintain the back-flow preventer,

however, the Operations Department may elect to test annually for quality assurance.

III. D) Testing **1 1/2" to 10"**

It is important that all 3" to 10" meters are tested annually for accuracy. All 1 1/2" and 2" meters will be tested in accordance with small meter testing procedures. Currently the operations Department conducts annual tests on the water plant flow meters. Starting in 1992 the Operations Department will conduct tests (see section IV - implementation) annually on all large meters. Operations and Purchasing will approve a certified consultant for testing of the large customer meters annually. Attached is Exhibit III, which is a bid solicitation, specification and qualification guideline for large meter testing. Exhibit III should be revised from time to time to reflect any changes in testing procedures.

An operational procedure (similar to the test procedure for small meters) should be used when testing large customer meters to communicate the purpose and results with a customer service representative.

III. E) Change-out, Repair/Rebuild

Large meters that are changed out by operations will be installed in accordance with the application/installation sections of the CMP. A cost analysis of change-out or repair/rebuild will determine if a new meter is installed or the old one is rebuilt. When any large meter is a change-out, operations will communicate with a customer service representative to insure proper billing of the customers account.

Any large meter that is repaired or rebuilt will be certified by an approved technician prior to

being put back in service.

III. F) Plant Flow Meters 1 1/2" to 10"

The Operations Department currently tests and maintains all water plant flow meters. This CMP will not attempt to define these procedures, however, Operations will incorporate the existing procedures in future revisions of this CMP.

This CMP has references on plant flow meters regarding annual testing and application. Due to numerous applications, the CMP is for reference only in this category.

IMPLEMENTATION SCHEDULE

IV. A) LARGE METERS - TESTING 1992

Based on a sample field survey conducted on fourteen (14) large meters in the Central Region, the Committee is recommending the following schedule to be implemented in 1992.

- o Operations conduct a site survey and accuracy test of all large meters in the state.
- o The Committee has obtained, through the Purchasing Department, three (3) certified consultants' proposals to conduct the test and survey.
- o Operations and Purchasing Departments will approve the certified consultants of their choice and conduct the testing as soon as possible. The testing should be completed by May 30, 1992.
- o Results of the survey and tests should be summarized and prioritized for implementation for change-out.

IV. B) LARGE METERS - CHANGE-OUT 1992

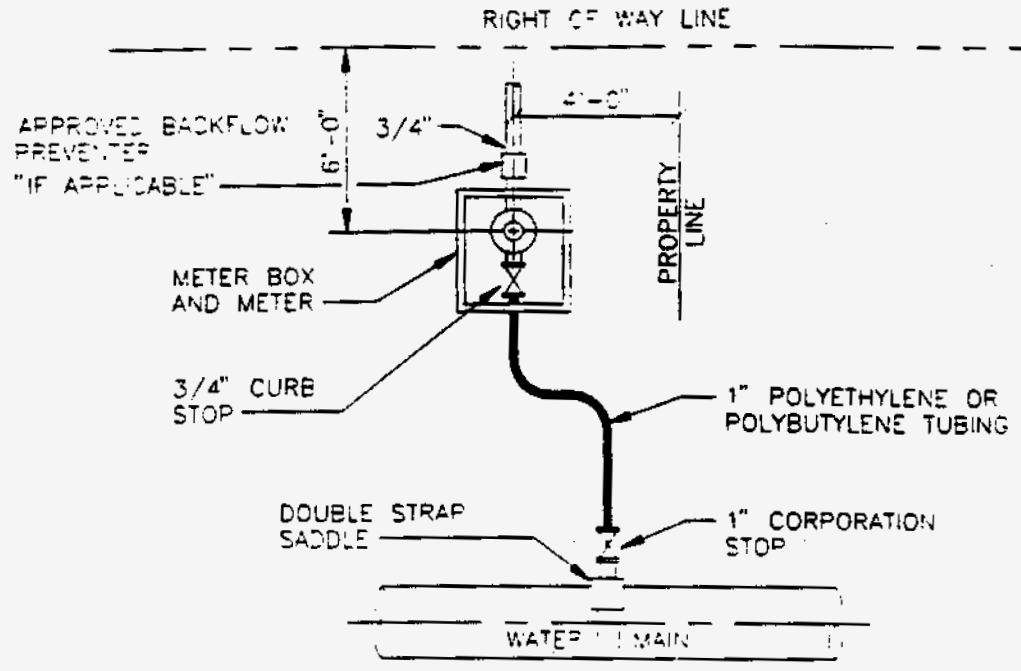
Based on the results of IV A) above the Operations Department should implement a change-out or repair schedule to accomplish the following:

- o Maximize quality of service and system efficiency.
- o Reduce system's unaccounted for water.
- o Install proper type of meter to provide all of the customers demands (uses).

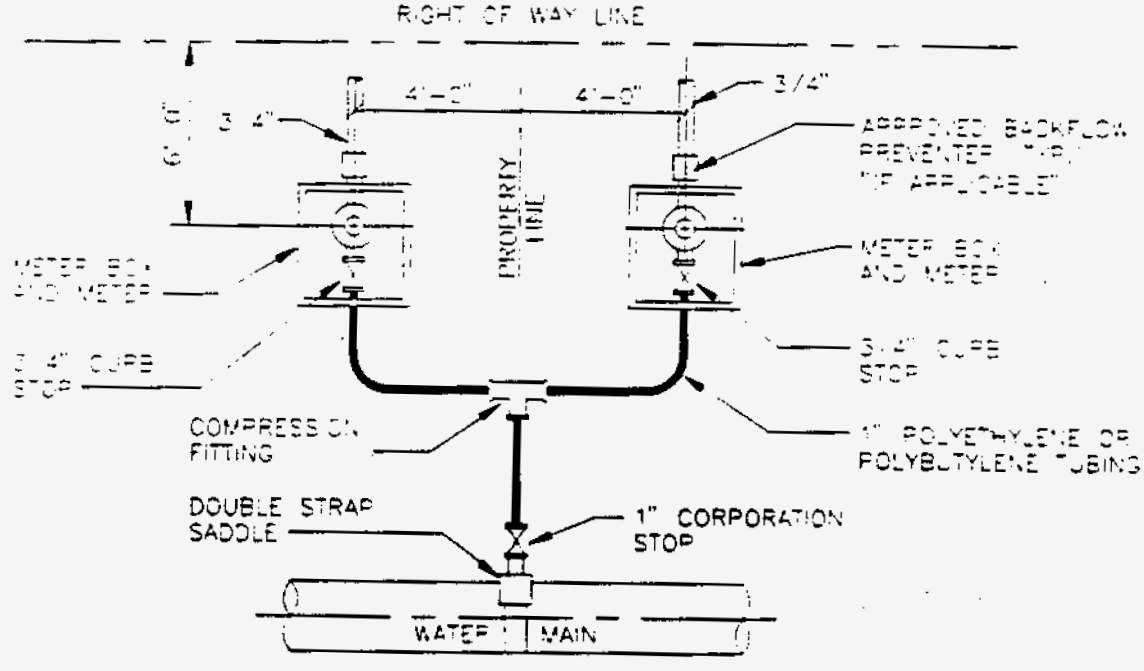
1 1/2" to 10"

The change-out program should commence in June of 1992 and be completed within twelve (12) months (June 1993). Based on prioritization of change-outs, SSU can justify the capital cost in 1992. Changes in 1992 will require the preparation of an "E-CAR". The balance of change-outs will be budgeted in 1993.

EXHIBIT I-B



SINGLE SERVICE



DOUBLE SERVICE

SSU SERVICES ENGINEERING	**TYPICAL WATER SERVICE CONNECTIONS**	PART 1 OF 1 CAD FILE EXHIB1B

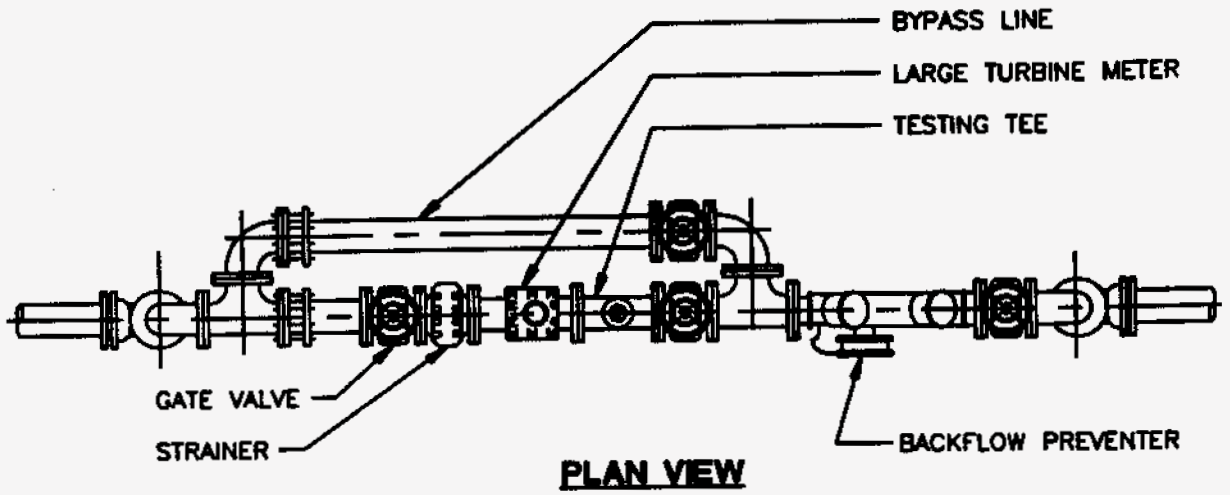
00079

3609
1610

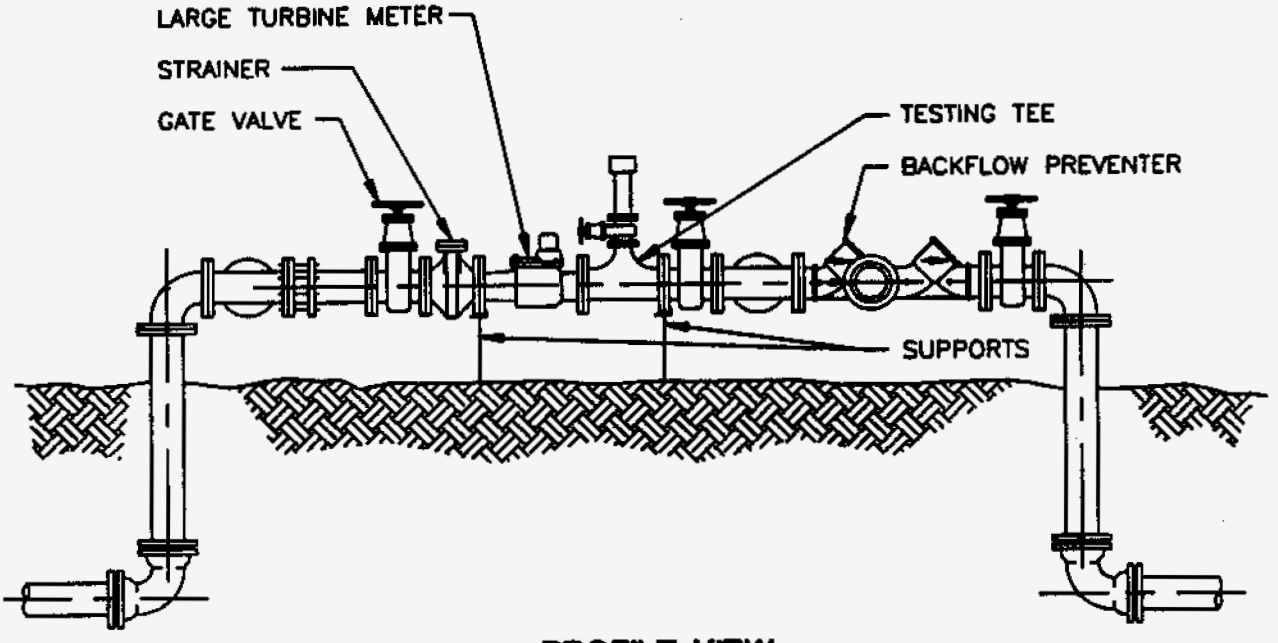
EXHIBIT II
REFERENCE GUIDE
LARGE METERS - CUSTOMER DEMAND

Meter Type & Size	Flow Characteristics "Normal Operating Range"	Recommended Customer Application	OTHER
1-1/2" - 2" Positive Displacement	1-1/2" - (1-100 GPM) 2" - (2-160 GPM)	Medium Apts., Motels, Shopping Centers & Large Irrigation Systems.	
2" - 8" Turbines	2" -(3 1/2 - 200 GPM) 3" -(4 - 450 GPM) 4" -(10 -1000 GPM) 6" -(20 - 2500 GPM) 8" -(40 - 4000 GPM)	Customer demand is constant. Large industrial and irrigation. Plant flow meters (Well discharge). Fire Sprinklers.	"Caution" Install when customer demand will not have low-flow uses.
3" - 8" Compound	3" -(1/2 - 350 GPM 4" -(1 - 1000 GPM) 6" -(1-1/2 - 1200 GPM) 8" -(2 - 1600 GPM)	Schools, Large Commercial hospitals, large hotels, multi-family projects, public buildings, & plant flow meter (discharge of pressure tank)	Install when customer use will have low & high flow range. Caution - may restrict fire flow demand.
6" - 10" Fire line	6" x 2" -(3 1/2 - 2500 GPM 8" x 2" -(3 1/2 - 4000 GPM 10" x 2" -(3 1/2 - 5500 GPM)	Same as compound customers, except when fire flow is part of customer demand.	Typically the large meter is fire flow registration and the bypass meter is normal consumption.

EXHIBIT IV-A



PLAN VIEW



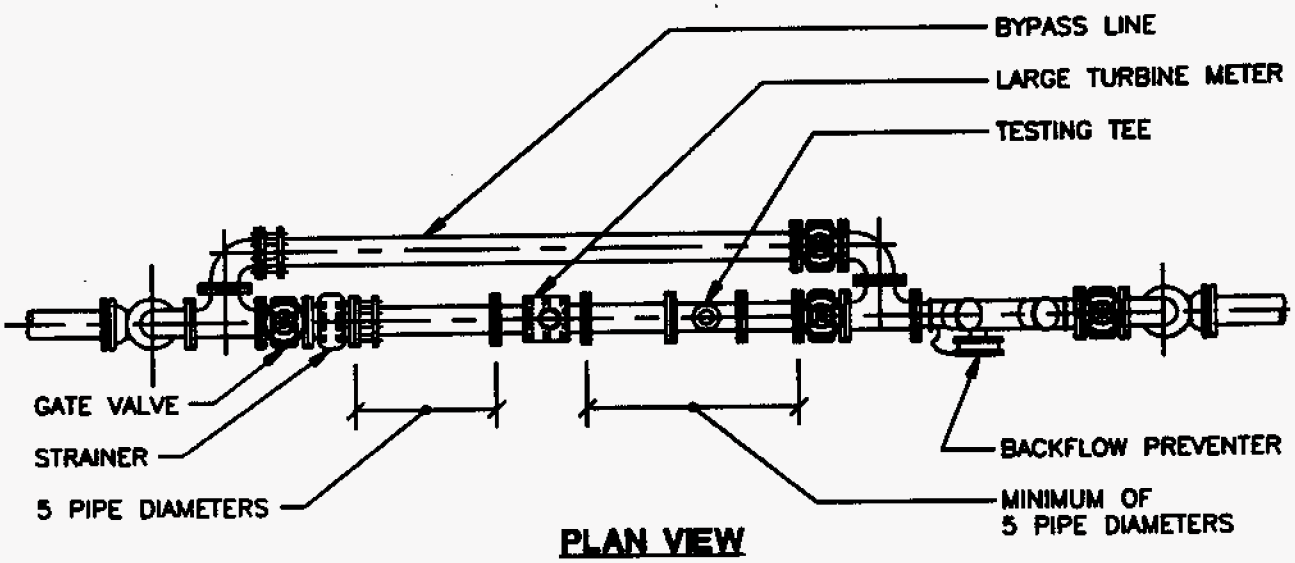
PROFILE VIEW

NOTES:

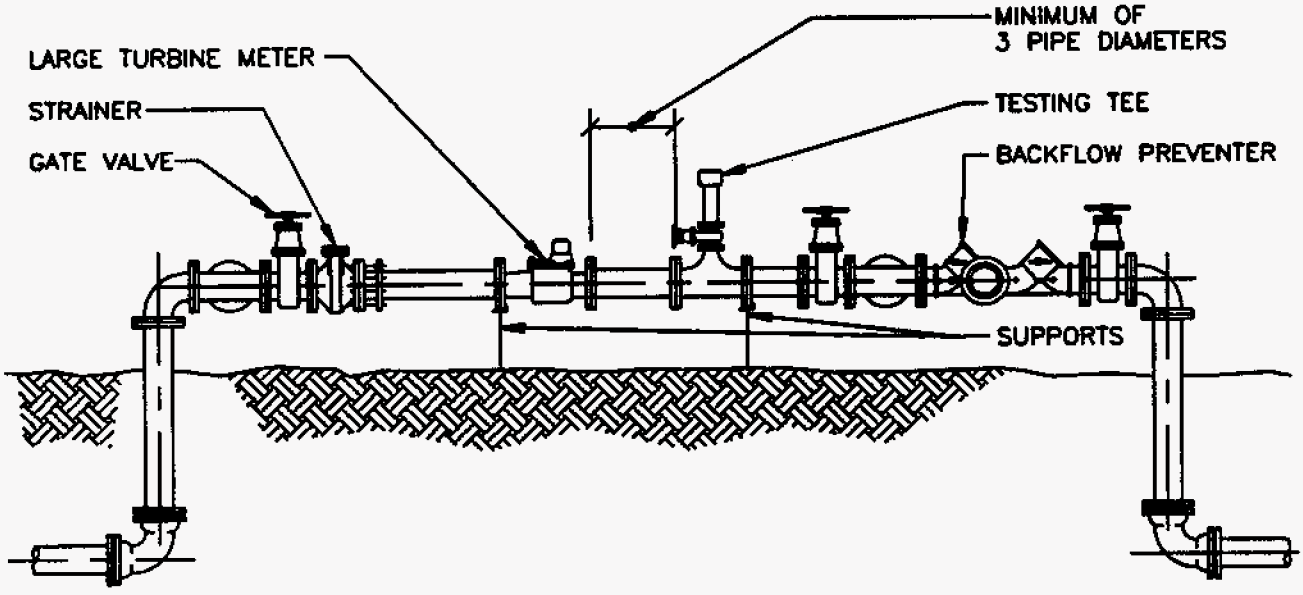
1. ALL ABOVE GROUND GATE VALVES ARE O.S. & Y. HAND WHEEL TYPE.
2. ALL ABOVE GROUND PIPING IS DUCTILE IRON WITH FLANGED ENDS, CLASS 51. ALL BELOW GROUND PIPING IS PVC WITH MECHANICAL JOINT DUCTILE IRON FITTINGS.

SSU ENGINEERING 1000 Color Place Apopka, Florida 32703 (407)-880-0058	**ABOVE GROUND LARGE METER INSTALLATION**	PART 1 OF 1 CAD FILE EXHIB-4A CIVIL

EXHIBIT IV-A



PLAN VIEW



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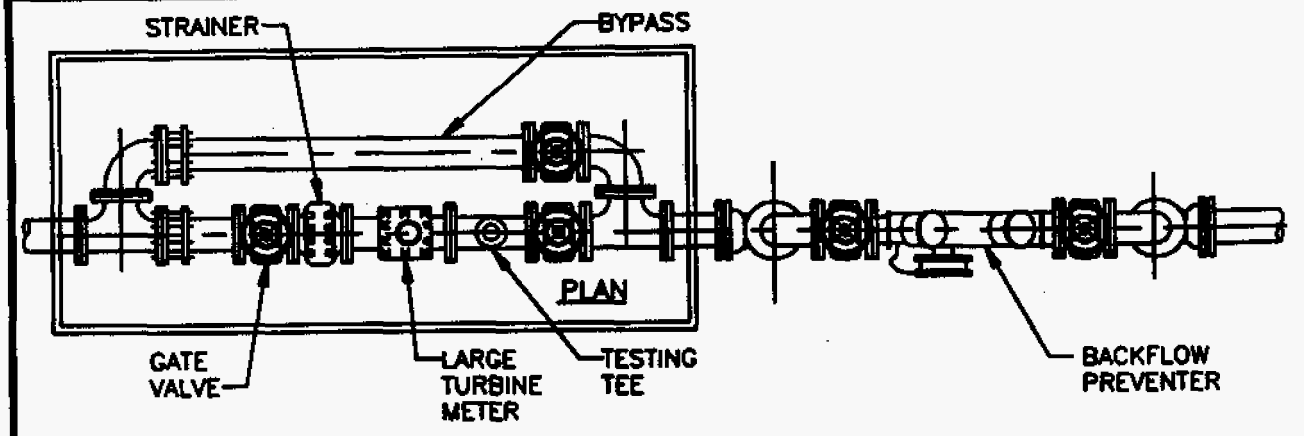
SSU ENGINEERING
1000 Outer Place
Apopka, Florida, 32703
(407)-880-0058

ABOVE GROUND LARGE METER INSTALLATION

PART 1 OF 1
CAD FILE EXHIB4A1
CIVIL

EXHIBIT IV-B



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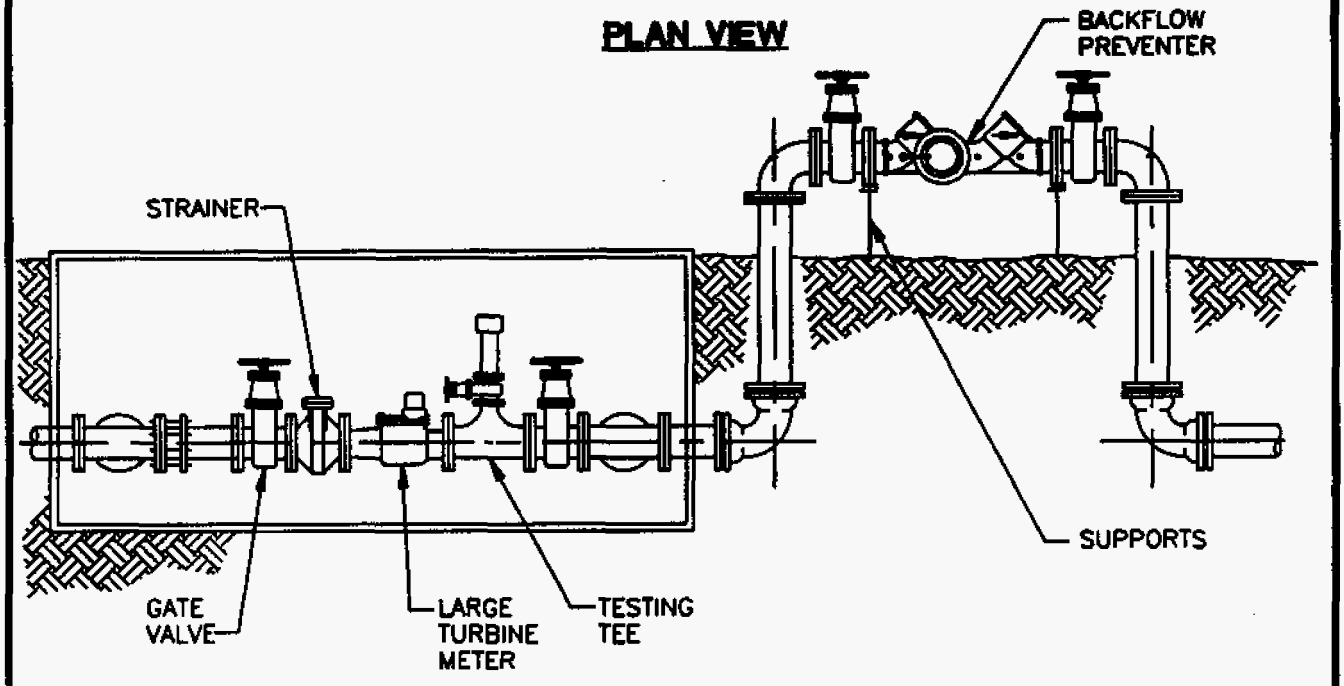

PROFILE VIEW

NOTES:

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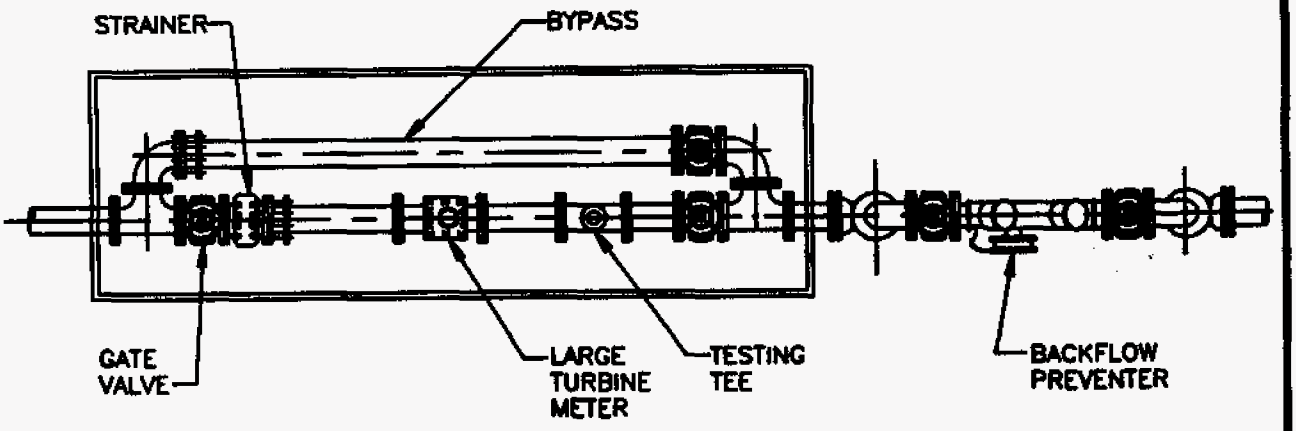
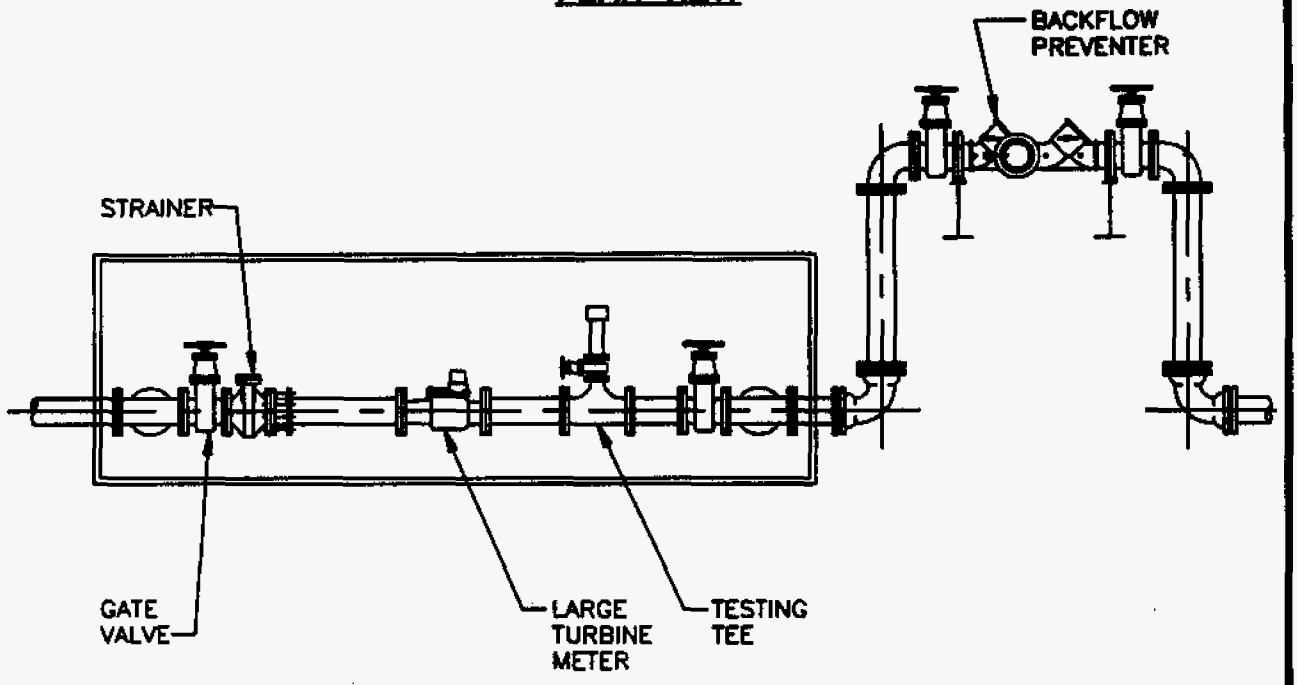
2. ALL ABOVE GROUND PIPING IS DUCTILE IRON WITH FLANGED ENDS, CLASS 51. ALL BELOW GROUND PIPING IS PVC WITH MECHANICAL JOINT DUCTILE IRON FITTINGS.
3. THE VAULT IS CONCRETE PRECAST TYPE WITH DUAL ALUMINUM HATCH WITH LOCK.
4. THE VAULT SHALL HAVE AN APPROVED DRAIN OR SUMP PUMP.

SSU ENGINEERING 1000 Color Place Apopka, Florida 32703 (407)-880-0058	**BELOW GROUND LARGE METER INSTALLATION**	PART 1 OF 1 CAD FILE EXHIB-4B CIVIL

EXHIBIT IV-B



PLAN VIEW



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SSU ENGINEERING 1000 Color Place, Apopka, Florida, 32703 (407)-880-0058	**BELOW GROUND LARGE METER INSTALLATION**	PART 1 OF 1 CAD FILE EXHIB4B1 CIVIL

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American Water Works Association
ANSI/AWWA C708-91
(Revision of ANSI/AWWA C708-82)

AWWA STANDARD

FOR

COLD-WATER METERS—MULTIJET TYPE

AMERICAN NATIONAL STANDARD

Effective date: Jan. 1, 1992.
First edition approved by AWWA Board of Directors June 20, 1976.
This edition approved Jan. 27, 1991.
Approved by American National Standards Institute Inc., Nov. 18, 1991.

Published by

AMERICAN WATER WORKS ASSOCIATION

6666 West Quincy Avenue, Denver, Colorado 80235

AWWA Standard

This document is an American Water Works Association (AWWA) standard. It is not a specification. AWWA standards describe minimum requirements and do not contain all of the engineering and administrative information normally contained in specifications. The AWWA standards usually contain options that must be evaluated by the user of the standard. Until each optional feature is specified by the user, the product or service is not fully defined. AWWA publication of a standard does not constitute endorsement of any product or product type, nor does AWWA test, certify, or approve any product. The use of AWWA standards is entirely voluntary. AWWA standards are intended to represent a consensus of the water supply industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed on the first page of the classified advertising section of *Journal AWWA*. The action becomes effective on the first day of the month following the month of *Journal AWWA* publication of the official notice.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review, and users are cautioned to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state on their own responsibility in advertising and promotional materials or on tags or labels that the goods are produced in conformity with particular American National Standards.

CAUTION NOTICE: The American National Standards Institute (ANSI) approval date on the front cover of this standard indicates completion of the ANSI approval process. This American National Standard may be revised or withdrawn at any time. ANSI procedures require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute Inc., 11 West 42nd Street, New York, NY 10036 (212) 642-4900.

Committee Personnel

The AWWA Standards Committee on Water Meters, which reviewed and approved this standard, had the following personnel at the time of approval:

Donald E. Jackson, *Chair*
James W. Smith, *Vice-Chair*
Donald J. Kullmann, *Secretary*

Consumer Members

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R.C. Graff, City of San Diego Water Utilities Department, San Diego, Calif.	(AWWA)
K.W. Grant, Louisville Water Company, Louisville, Ky.	(AWWA)
B.C. Grimm, Memphis Light, Gas, and Water Division, Memphis, Tenn.	(AWWA)
R.E. Howell, St. Lucie County Utility Services Department, Port St. Lucie, Fla.	(AWWA)
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L.M. Scott, Lincoln Water System District, Lincoln, Neb.	(AWWA)
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*Liaison, nonvoting

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Producer Members

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M.N. Kavouklis,* Hersey Products Inc., Athens, Ga.	(AWWA)
J.H. Kennedy,* Badger Meter Inc., Dallas, Texas	(AWWA)
D.J. Kullmann, Schlumberger Industries, Tallassee, Ala.	(AWWA)
W.C. Myers,* Master Meter Inc., Bullard, Texas	(AWWA)
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Jerry Potter, Master Meter Inc., Longview, Texas	(AWWA)
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Glenn Voss, McCrometer, Division of Ketema, Hemet, Calif.	(AWWA)
J.M. Warner, Hays, Division of Romac Industries, Lowell, N.C.	(AWWA)
A.J. Zacharias,* McCrometer, Division of Ketema, Hemet, Calif.	(AWWA)

*Alternate

Contents

Tables

Foreword

This foreword is for information only and is not a part of AWWA C708.

I. History of Standard. Current or inferential-type meters, through a progressive program of design and quality improvement, have attained the ability to accurately measure low flow rates. Multijet meters are a specific class of inferential meters.

In all inferential-type meters, the moving element is a rotor; and the basic principle of this meter is to design it in such a manner that, over the working range of the instrument, the speed of rotation of the rotor bears a linear relationship to the velocity of flow through the meter.

In multijet meters, the moving element takes the form of a multiblade rotor mounted on a vertical spindle within a cylindrical measuring chamber. The liquid enters the measuring chamber through several tangential orifices around the circumference and leaves the measuring chamber through another set of tangential orifices placed at a different level in the measuring chamber.

The materials section of the standard recognizes the advances that have been made in the development of nonmetallic materials for water meter construction. Several plastic materials are currently being used successfully for meter components. Several suitable plastic materials that have been recognized are included in this revision.

The first edition of the standard was approved by the AWWA Board of Directors on June 20, 1976. A revision was approved Feb. 1, 1982.

II. Information to Be Furnished by Purchaser. When placing orders for meters manufactured according to the provisions of this standard, it will be necessary for the purchaser to supply specific information regarding the following:

1. Standard used—that is, AWWA C708, Standard for Cold-Water Meters—Multijet Type.
2. Whether an affidavit of compliance will be required (Sec. 1.4).
3. Special materials required, if any, to resist corrosion if water is highly aggressive (Sec. A.4.3).
4. Size of meter (Sec. 3.1) and quantity required.
5. Modifications of test specifications (Sec. 3.9) if operating water temperatures will exceed 80°F (27°C) (Sec. A.4.2).
6. Type of connections for 1½-in. (40-mm) and 2-in. (50-mm) meters (Sec. 4.3).
7. Whether couplings (tailpieces) are to be furnished with ⅝-in. (16-mm) to 2-in. (50-mm) meters (Sec. 4.4) and whether components are to be of a copper alloy or a suitable engineering plastic (Sec. 2.9).
8. Whether companion flanges, gaskets, bolts, and nuts are to be furnished with flanged meters (Sec. 4.5) and whether companion flanges are to be made of a copper alloy, cast iron, or a suitable engineering plastic (Sec. 2.10).
9. Details of the register to be furnished; that is, US gallons, cubic feet, cubic metres, or other units; dry or wet register (Sec. 4.6).
10. If a direct-reading remote register or a remote encoder-type register is required (Sec. 4.7), to be specified in detail.
11. Whether warranty requirements will be specified (Sec. 1.5).

12. Whether main cases are to be fabricated of a copper alloy or a suitable engineering plastic (Sec. 2.2).

13. Whether meters are to be furnished with cast-iron, stainless-steel, copper-alloy, or suitable engineering plastic top or bottom covers (Sec. 2.11), if there is a preference. Corrosion protection required for cast-iron frost-protection covers (Sec. 3.6), if there is a preference.

III. Acceptance. Government legislative and regulatory bodies at national and state or provincial levels promulgate rules that may control the use of products described in AWWA C708. AWWA does not obtain or provide information about all of the actual or proposed regulations in the many involved jurisdictions. The user of this standard is cautioned to determine that the use of products described in this standard conforms to all applicable laws and regulations. Questions concerning laws and regulations should be referred to the appropriate regulatory agency.

Consensus standards have been developed for direct and indirect additives from products that come in contact with potable water. Manufactured products covered by AWWA C708 eventually may be required to be certified to meet those standards. Questions regarding additives should be referred to the appropriate state or provincial regulatory agency.

IV. Modification to Standard. Any modification of the provisions, definitions, or terminology in this standard must be provided in the purchaser's specifications.

V. Major Revisions. The major changes from the 1982 standard in this revision are:

1. The addition of a definition section.
2. Expansion of the references section.
3. Elimination of the warranty provisions.
4. Recognition in the materials section of the standard of the advances that have been made in the development of nonmetallic materials for water meter construction. Several engineering plastic materials are currently being used successfully for meter components. Because of the continuous development of new and improved materials, this standard will not require any one specific material but will cite typical examples of materials found in ASTM* standard specifications.
5. Modification of Table 1 to increase the safe maximum operating capacity and maximum rate for continuous-duty flow rates for 1½-in. (40-mm) meters.
6. Revision of the standard and appendix A to conform to current form, content, and style of AWWA standards.
7. Inclusion of "soft" metric equivalents throughout the text.
8. The addition of Sec. III, Acceptance, and Sec. IV, Modification to Standard, to the foreword.
9. The addition of Sec. A.7 to appendix A.
10. The addition of appendix B, Future Revisions, to the standard.

*American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

American Water Works Association

ANSI/AWWA C708-91
(Revision of ANSI/AWWA C708-82)

AWWA STANDARD FOR

COLD-WATER METERS— MULTIJET TYPE

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard covers the various types and classes of cold-water, multijet meters in sizes 5/8 in. (16 mm) through 2 in. (50 mm) for water utilities' customer service and the materials and workmanship employed in their fabrication. These meters register by recording the revolutions of a rotor set in motion by the force of flowing water striking the blades.

Sec. 1.2 Definitions

The following definitions shall apply in this standard:

1.2.1 *Manufacturer:* The party that manufactures, fabricates, or produces materials or products.

1.2.2 *Purchaser:* The person, company, or organization that purchases any materials or work to be performed.

1.2.3 *Supplier:* The party that supplies material or services. A supplier may or may not be the manufacturer.

Sec. 1.3 References

This standard references the following documents. In their latest editions, they form a part of this standard to the extent set forth herein. In any case of conflict, the requirements of this standard shall prevail. When reference is made to standards, the latest revision shall apply unless the date of the standard is also listed.

ANSI*/ASME† B1.20.1—Pipe Threads General Purpose (Inch), Table 6, Dimensions of External and Internal Straight Pipe Threads for Fixtures, (NPSM).

ANSI/ASTM B176—Standard Specification for Copper-Alloy Die Castings.

ANSI/AWWA C706—Direct-Reading Remote-Registration Systems for Cold-Water Meters.

ANSI/AWWA C707—Encoder-Type Remote-Registration Systems for Cold-Water Meters.

ANSI/ASTM D4066—Standard Specification for Nylon Injection and Extrusion Materials (PA).

ASTM‡ A48—Standard Specification for Gray Iron Castings.

ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

ASTM A159—Standard Specification for Automotive Gray Iron Castings.

ASTM A167—Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

ASTM A194—Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.

ASTM A276—Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

ASTM A493—Standard Specification for Stainless and Heat-Resisting Steel for Cold Heading and Cold Forging Wire.

ASTM A582—Standard Specification for Free-Machining Stainless and Heat-Resisting Steel Bars, Hot-Rolled or Cold-Finished.

ASTM B16—Standard Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines.

ASTM B30—Standard Specification for Copper-Base Alloys in Ingot Form.

ASTM B36—Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar.

ASTM B61—Standard Specification for Steam or Valve Bronze Castings.

ASTM B62—Standard Specification for Composition Bronze or Ounce Metal Castings.

ASTM B98—Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

ASTM B127—Standard Specification for Nickel-Copper Alloy (Monel) Plate, Sheet, and Strip.

ASTM B139—Standard Specification for Phosphor Bronze Rod, Bar, and Shapes.

ASTM B164—Standard Specification for Nickel-Copper Alloy (Monel) Rod, Bar, and Wire.

ASTM B271—Standard Specification for Copper-Base Alloy Centrifugal Castings.

ASTM B584—Standard Specification for Copper-Alloy Sand Castings for General Applications.

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*American National Standards Institute Inc., 1430 Broadway, New York, NY 10018.

†American Society of Mechanical Engineers, 345 E. 47th Ave., New York, NY 10017.

‡American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

ASTM D1248—Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

ASTM D2135—Standard Classification of Hard Rubbers.*

ASTM D2874—Standard Specification for Polyphenylene Oxide Molding and Extrusion Materials (PPO).†

ASTM D3011—Standard Specification for Reinforced and Filled Polystyrene, Styrene-Acrylonitrile, and Acrylonitrile-Butadiene-Styrene Molding and Extrusion Materials.‡

ASTM D3935—Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Materials.

ASTM D4067—Standard Specification for Reinforced and Filled Polyphenylene Sulfide (PPS) Injection Molding and Extrusion Materials.

ASTM D4181—Standard Specification for Acetal (POM) Molding and Extrusion Materials.

ASTM D4203—Standard Specification for Styrene-Acrylonitrile (SAN) Injection and Extrusion Materials.

ASTM E527—Standard Practice for Numbering Metals and Alloys (UNS).§

ASTM F467—Standard Specification for Nonferrous Nuts for General Use.

ASTM F468—Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.

Sec. 1.4 Affidavit of Compliance

The purchaser's specifications may require an affidavit from the manufacturer or supplier that the meters furnished comply with all applicable requirements of this standard.

Sec. 1.5 Basis for Rejection

Meters not complying with all requirements of this standard and the purchaser's specifications shall be rejected.

1.5.1 *Rejected meters.* The manufacturer shall bear the expense of replacing or satisfactorily correcting all meters rejected for failure to comply with this standard and the purchaser's specifications.

SECTION 2: MATERIALS**

Sec. 2.1 General

All materials used in the manufacture of water meters shall conform to the requirements stipulated in the following section. Where plastic materials are

*Discontinued by ASTM in 1989.

†Discontinued by ASTM in 1983.

‡Discontinued by ASTM in 1987.

§Copper Development Association, Greenwich Office Park 2, P.O. Box 1840, Greenwich, CT 06836.

**The compositions of all alloys in this section are subject to commercially accepted tolerances.

allowed, the manufacturer may furnish any plastic materials that meet the performance requirements specified; typical examples are provided.

2.1.1 Materials shall be selected for their strength and resistance to corrosion and shall not impart to the water objectionable taste, odor, or toxic substances in normalized concentrations exceeding the maximum contaminant levels (MCLs) as defined by the US Environmental Protection Agency (USEPA).

If engineering plastic materials are used, only virgin, or first-generation-grade, rigid engineering plastic materials shall be used in the manufacture of the main casings, covers, and bottoms; and these engineering plastic materials shall be compounded with ultraviolet stabilizers.

Sec. 2.2 Main Casings

Main casings shall be made of a copper alloy containing not less than 75 percent copper such as UNS C84400 or UNS C93200, or a similar copper alloy as listed in ASTM B584 (current edition); or a suitable engineering plastic such as polycarbonate (PC) per ASTM D3935, polyphenylene oxide (PPO) per ASTM D4067, nylon (N) per ANSI/ASTM D4066, or acetal per ASTM D4181.

All materials used in the construction of meter main cases shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 105°F (40°C) and shall not permanently warp or deform when exposed to temperatures up to 150°F (66°C) for 1 h.

Sec. 2.3 Register-Box Rings and Lids

Register-box rings and lids shall be made of a copper alloy containing not less than 57 percent copper, such as UNS C85700 or UNS C86200; or a similar copper alloy as listed in ASTM B584, or UNS C85800 as listed in ANSI/ASTM B176; or a suitable engineering plastic such as polycarbonate (PC) per ASTM D3935, polystyrene per ASTM D3011, acetal per ASTM D4181, or nylon (N) per ANSI/ASTM D4066.

All materials used in the construction of register-box rings and lids shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 105°F (40°C) and shall not permanently warp or deform when exposed to temperatures up to 150°F (66°C) for 1 h.

Sec. 2.4 Measuring Cages or Chambers

Measuring cages or chambers shall be made of a copper alloy containing not less than 85 percent copper such as UNS C92200 as listed in ASTM B61 or UNS C83600 as listed in ASTM B62; or a suitable engineering plastic such as polyphenylene oxide (PPO) per ASTM D2874, nylon (N) per ANSI/ASTM D4066, polyethylene per ASTM D1248, or polystyrene per ASTM D3011.

Measuring cages or chambers shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.5 Measuring Rotors

A rotor shall be made of vulcanized hard rubber such as those classified per ASTM D2135; or a suitable engineering plastic having sufficient rigidity and strength to operate at the rated capacity of the meter, such as polystyrene per ASTM D3011, polyphenylene sulfide (PPS) per ASTM D4067, or nylon (N) per ANSI/ASTM D4066.

Rotors shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.6 Rotor Spindles

Rotor spindles shall be made of phosphor bronze such as ASTM B139; one of the austenitic stainless steels listed in ASTM A276; nickel–monel alloys such as ASTM B164; vulcanized hard rubber as classified per ASTM D2135; or rigid thermoplastic compounds such as acetal resin per ASTM D4181, polycarbonate (PC) per ASTM D3935, or polyphenylene sulfide (PPS) per ASTM D4067.

Rotor spindles shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.7 Register Gear Trains

Frames, gears, and pinions of intermediate gear trains exposed to water shall be made of a copper alloy such as listed in ASTM B16, ASTM B36, and ASTM B98; stainless steels of either the austenitic or martensitic types listed in ASTM A276 or ASTM A582; or a suitable engineering plastic such as polyethylene per ASTM D1248, polystyrene per ASTM D3011, nylon (N) per ANSI/ASTM D4066, or acetal per ASTM D4181. If not exposed to water, gear trains may also be made of other suitable materials as per reference standards.

Frames, gears, and pinons of intermediate gear trains exposed to water shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.8 External-Case Closure Fasteners

External fasteners shall be made of a copper alloy containing not less than 57 percent copper such as a brass alloy UNS C27200 as listed in ASTM B36; a silicon–bronze alloy as listed in ASTM B98; any of the copper-based alloys specified for general fastener use as listed in ASTM F467 or ASTM F468; or stainless steels of the austenitic, ferritic, or martensitic types listed in ASTM A276, ASTM A493, and ASTM A582.

Fasteners for nonpressure containment assemblies may be made of a suitable engineering plastic such as polycarbonate (PC) per ASTM D3935, nylon (N) per ANSI/ASTM D4066, or acetal per ASTM D4181; or any of the aforementioned copper-based or stainless-steel materials.

Sec. 2.9 Coupling Tailpieces and Nuts

Coupling tailpieces and nuts shall be made of a copper alloy containing not less than 75 percent copper such as UNS C84400, UNS C93200, or similar copper alloy as listed in ASTM B30, ASTM B271, or ASTM B584; or a copper alloy as listed in ANSI/ASTM B176; or suitable virgin-grade engineering plastic such as polycarbonate (PC) per ASTM D3935, nylon (N) per ANSI/ASTM D4066, or polyphenylene sulfide (PPS) per ASTM D4067.

Sec. 2.10 Companion Flanges

Companion flanges shall be made of cast iron such as ASTM A48, ASTM A126, or ASTM A159; or a copper alloy containing not less than 75 percent copper such as

UNS C84400 or UNS C93200, or a similar copper alloy as listed in ASTM B584; or a suitable virgin-grade engineering plastic.

Sec. 2.11 Covers, Top or Bottom

Engineering plastic covers, top or bottom, shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 105°F (40°C) and shall not permanently warp or deform when exposed to temperatures up to 150°F (66°C) for 1 h. Breakable and nonbreakable top or bottom covers as specified in the purchaser's specifications shall be as follows.

2.11.1 *Breakable.* Breakable covers (frost-protection devices) shall be made of a cast iron such as those listed in ASTM A48, ASTM A126 or ASTM A159; or austenitic stainless steel such as those listed in ASTM A167; a copper alloy containing not less than 75 percent copper such as alloy UNS C84400 as listed in ASTM B584; or a suitable engineering plastic such as polyphenylene sulfide (PPS) per ASTM D4067, nylon (N) per ANSI/ASTM D4066, polycarbonate (PC) per ASTM D3935, or acetal per ASTM D4181. The design and composition of such components will be such that they will satisfy the break or yield requirements set forth in Sec. 3.5.

2.11.2 *Nonbreakable.* Nonbreakable covers shall be made of austenitic stainless steel such as those listed in ASTM A167; a copper alloy containing not less than 75 percent copper such as UNS C84400 as listed in ASTM B584; or a suitable engineering plastic such as polyphenylene sulfide (PPS) per ASTM D4067, nylon (N) per ANSI/ASTM D4066, polycarbonate (PC) per ASTM D3935, or acetal per ASTM D4181. The design and composition of such components will be such that they will satisfy the break or yield requirements set forth in Sec. 3.5.

SECTION 3: GENERAL DESIGN

Sec. 3.1 Size

The operating and physical characteristics in Table 1 and Table 2 shall determine the nominal size of meters.

Sec. 3.2 Capacity

The nominal capacity ratings and the related pressure loss limits shall be the same as those listed in Table 1 for the safe maximum operating capacities.

Sec. 3.3 Length

The lengths of the meters shall be the face-to-face dimensions of spuds or flanges and shall be those listed in Table 2.

Sec. 3.4 Pressure Requirement

Meters supplied in accordance with this standard shall operate without leakage or damage to any part at a continuous working pressure of 150 psi (1050 kPa).

Sec. 3.5 Plastic Meter Pressure Casing, Cover, and Bottom Design

The design of the plastic meter pressure casings, covers, and bottoms shall meet the following requirements:

Table 1 Operating Characteristics

Meter Size		Safe Maximum Operating Capacity		Recommended Maximum Rate for Continuous Duty		Maximum Pressure Loss at Safe Maximum Operating Capacity		Normal Test Flow Limits		Minimum Test Flow	
in.	*(mm)*	*gpm*	*(m^3/h)*	*gpm*	*(m^3/h)*	*psi*	*(kPa)*	*gpm*	*(m^3/h)*	*gpm*	*(m^3/h)*
⅝	(16)	20	(4.5)	10	(2.3)	15	(105)	1–20	(0.2–4.5)	¼	(0.06)
⅝ × ¾	(16 × 20)	20	(4.5)	10	(2.3)	15	(105)	1–20	(0.2–4.5)	¼	(0.06)
¾	(20)	30	(6.8)	15	(3.4)	15	(105)	2–30	(0.5–6.8)	½	(0.11)
1	(25)	50	(11.4)	25	(5.7)	15	(105)	3–50	(0.7–11.4)	¾	(0.17)
1 ½	(40)	100	(22.7)	50	(11.3)	15	(105)	5–100	(1.1–22.7)	1 ½	(0.34)
2	(50)	130	(29.5)	65	(14.8)	15	(105)	8–130	(1.8–29.5)	2	(0.45)

Table 2 Physical Characteristics

Meter Size		Meter Length				Meter Casing Spuds*		Coupling (Tailpieces)			
		Screw Ends		Flange Ends		Nominal Thread Size		Length		Nominal Thread Size	
in.	*(mm)*	*in.*	*(mm)*	*in.*	*(mm)*	*in.*	*(mm)*	*in.*	*(mm)*	*in.*	*(mm)*
⅝	(16)	7 ½	(191)	—		¾	(20)	2 ⅜	(60.3)	½	(13)
⅝ × ¾	(16 × 20)	7 ½	(191)	—		1	(25)	2 ½	(63.5)	¾	(20)
¾	(20)	9	(229)	—		1	(25)	2 ½	(63.5)	¾	(20)
1	(25)	10 ¾	(273)	—		1 ¼	(32)	2 ⅝	(66.7)	1	(25)
1 ½	(40)	12 ⅝	(321)	13	(330)	2	(50)	2 ⅞	(73.0)	1 ½	(40)
2	(50)	15 ¼	(387)	17	(432)	2 ½	(64)	3	(76.2)	2	(50)

*See Sec. 4.3.2 for additional information on meter casing spuds.

3.5.1 Pressure casings, covers, and bottoms shall be designed to be watertight and capable of withstanding, without exceeding the yield strength of the material or being structurally damaged, a hydrostatic pressure of two times the rated maximum working pressure (300 psi [2100 kPa] minimum) for a period of 15 min.

3.5.2 Nonbreakable pressure casings, covers, and bottoms shall be designed to withstand a burst pressure of at least four times the rated maximum working line pressure (600 psi [4200 kPa] minimum). Breakable covers and bottoms shall be designed to have a burst pressure of at least three times the rated maximum working line pressure (450 psi [3100 kPa]). Components shall be watertight at 150 psi (1050 kPa) after being subjected to a minimum of 100,000 pressure cycles of 100 to 300 psi (700 to 2100 kPa) in 1.5 s and a hold time of 1 min, followed by an immediate release of pressure to the 100-psi (700 kPa) lower limit.

Sec. 3.6 Frost-Protection Devices

Frost-protection devices, when provided, shall be of such design that they will yield or break under normal freezing conditions in order to minimize damage to any other parts of the meter. The internal portion of the top or bottom covers designed to afford frost protection may be protected from corrosion by an inner lining or coating that is suitable for contact with potable water.

Sec. 3.7 Markings

The meter size and the direction of flow through the meter shall be marked permanently on the outer case.

Sec. 3.8 Accessibility

Meters larger than 1 in. (25 mm) shall be designed to allow for easy removal of all interior parts without disturbing the connections to the pipeline. A tubular strainer, when placed at the meter inlet spud, shall be excluded from this requirement.

Sec. 3.9 Registration Accuracy

Meters shall meet the following requirements for accuracy with water at a temperature less than 80°F (27°C).

3.9.1 *Normal flow limits.* At any rate of flow within the normal test flow limits set forth in Table 1, the meter shall register not less than 98.5 percent and not more than 101.5 percent of the water that actually passes through it.

3.9.2 *Minimum flow rate.* From the minimum test flow rate to the lowest normal test flow rate set forth in Table 1, the meter shall register not less than 97 percent and not more than 103 percent of the water that actually passes through it.

Sec. 3.10 Calibration Adjustment

Multijet-type meters may be fitted with a means of altering the flow–rotor speed relationship. If external to the meter, a method of sealing must be provided.

SECTION 4: DETAILED DESIGN

Sec. 4.1 Main Case

All meters shall have an outer case with separate, removable measuring chambers or cages in which the rotor operates. Cases shall not be repaired in any manner. The inlet and outlet of the main case shall have a common axis. Flanges shall be parallel.

Sec. 4.2 External-Case Fasteners and Seals

All external fasteners and seals shall be designed for easy disassembly following lengthy service without the use of special tools or equipment.

Sec. 4.3 Connections

Main case connections for 1½-in. (40-mm) and 2-in. (50-mm) meters shall be either spuds on both ends or flanges on both ends, as required by the purchaser's specifications.

4.3.1 *Casing spuds.* Casing spuds for all ⅝-in. (16-mm), ⅝-in. × ¾-in. (16-mm × 20-mm), ¾-in. (20-mm), and 1-in. (25-mm) meters shall have external straight threads conforming to ANSI/ASME B1.20.1.

4.3.2 *Casing spuds for larger meters.* Casing spuds for 1½-in. (40-mm) and 2-in. (50-mm) meter models shall have either external straight threads conforming

to ANSI/ASME B1.20.1 or internal taper pipe threads (of a 1½-in. [40-mm] or 2-in. [50-mm] size, respectively) conforming to ANSI/ASME B1.20.1.

4.3.3 *Casing flanges.* Casing flanges shall be the oval type. The number of bolt holes and the diameter of the bolt holes and bolt circle shall be as listed for companion flanges in Table 3.

Sec. 4.4 Meter Couplings (Tailpieces)

Meter couplings shall be provided if required by the purchaser's specifications.

Sec. 4.5 Companion Flanges

Companion flanges, gaskets, bolts, and nuts shall be provided if required by the purchaser's specifications. Companion flanges shall be tapped, 1½ in. (40 mm) or 2 in. (50 mm), as required, with internal-taper pipe thread as specified in ANSI/ASME B1.20.1. Dimensions shall be those listed in Table 3.

Sec. 4.6 Registers

Registers shall be straight-reading and shall read in US gallons, cubic feet, or cubic metres as specified by the purchaser.

4.6.1 *Types of registers.* Registers may be either the dry or wet type.

4.6.1.1 The permanently sealed dry-type register shall be encased in a metal and glass enclosure and shall not be in contact with the water being measured. Provisions to adapt remote-type registers (Foreword, Sec. II.10 and Sec. 4.7) to the meters may require the use of suitable engineering plastic materials.

4.6.1.2 The wet-type register may be in contact with the water being measured (see Foreword, Sec. II.9).

4.6.2 *Number wheel numerals.* The numerals on the number wheels of straight-reading registers should be not less than 5/32 in. (3.97 mm) in height and readable at a 45° angle from the vertical.

4.6.3 *Lock and side gears.* The register lock and side gears shall be fastened securely to the number wheel as a single part.

4.6.4 *Tumbler pinions.* The tumbler pinions shall mesh accurately at the turnover points with the lock and side gears of the adjacent number wheels.

4.6.5 *Main and pinion shaft.* Both main and pinion shafts shall be secured in the register frame or register plates so that they cannot move out of position. The pinion shaft shall be designed so that there is no possibility of its bending and allowing the pinion to skip at the turnover point.

4.6.6 *Maximum and minimum indications.* The maximum indication of the digits appearing on the first number wheel and the minimum capacity of the register shall be those listed in Table 4.

Table 3 Flange Dimensions

Meter Size		Diameter Bolt Hole Circle		Number of Bolt Holes	Minimum Diameter Bolt Holes		Minimum Thickness at Bolt Hole		Minimum Thickness at Hub	
in.	(mm)	in.	(mm)		in.	(mm)	in.	(mm)	in.	(mm)
1 ½ (flange, oval)	(40)	4	(102)	2	11/16	(17.5)	9/16	(14.3)	13/16	(20.6)
2 (flange, oval)	(50)	4 ½	(114)	2	¾	(19.1)	5/8	(15.9)	⅞	(22.2)

Table 4 Maximum Indication on Initial-Dial and Minimum Register Capacity

Meter Size		Maximum Allowable Indication of Initial Dial			Minimum Allowable Capacity of Register		
in.	(mm)	ft^3	gal	m^3	$10^6\ ft^3$	mil gal	$10^6 m^3$
⅝	(16)	1	10	0.1	0.1	1	0.1
⅝ × ¾	(16 × 20)	1	10	0.1	0.1	1	0.1
¾	(20)	1	10	1	1	10	1
1	(25)	10	100	1	1	10	1
1 ½	(40)	10	100	1	1	10	1
2	(50)	10	100	1	1	10	1

4.6.7 *Test index circle and hand.* The register shall provide test index circles that shall be divided into 10 equal parts. The hand or pointer shall taper to a sharp point and shall be set accurately and held securely in place.

4.6.8 *Center-sweep test hands.* If registers are furnished with center-sweep test hands, there shall be an index circle located near the periphery of the register and graduated in 100 equal parts, with each tenth graduation numbered.

4.6.8.1 The hand or pointer shall taper to a point and shall be accurately set and securely held in place.

4.6.8.2 The quantities indicated by a single revolution of the test hand shall be those listed in Table 4 for initial dial.

Sec. 4.7 Register Boxes

The name of the manufacturer shall be on the lid of the register box. The serial number of the meter shall be on the lid or register box ring. The lid shall protect the lens, and the lens shall be securely held in place. If specified by the purchaser, provisions shall be made to adapt a direct-reading remote-type register (ANSI/AWWA C706) or encoder-type remote register (ANSI/AWWA C707).

Sec. 4.8 Measuring Chambers or Cages

The measuring chambers or cages shall be self-contained units firmly seated and easily detached and removed from the main case. Measuring chambers or cages shall be secured in the main case so that the accuracy of the meter will not be affected by any distortion of the main case that might occur when operating with a pressure less than 150 psi (1050 kPa).

Sec. 4.9 Strainers

All meters shall be provided with strainer screens installed in the meters. Strainer screens shall be rigid, snug-fitting, easy-to-remove and have an effective straining area at least double that of the main-case inlet.

Sec. 4.10 Tamper-Resistant Features

Register box retainers, external regulation devices, and coupling nuts, if furnished, shall be equipped with tamper-resistant features. If drilled for seal wires, seal wire holes shall not be less than 3/32 in. (2.38 mm) in diameter.

APPENDIX A

Supplemental Information

This appendix is for information only and is not a part of AWWA C708.

SECTION A.1 UNITS OF MEASURE

The majority of water meters presently in service in the United States register in either US gallons or cubic feet. With the availability of the metric system, the user may now determine the most suitable unit of measure from the three available—US gallons, cubic feet, or cubic metres.

SECTION A.2 TESTS

Sec. A.2.1 Capacity and Pressure Loss Tests

Capacity tests are tests of the design of a meter. Once a meter of each size of a given design has been tested for pressure loss at safe maximum operating capacity, it should not be necessary to test others of the same design.

The pressure loss should be determined by use of two identical piezometer rings of the same diameter as the nominal size of the meter being tested. The piezometer rings must be free from any burrs where the holes are drilled through the wall of the ring. No fewer than four holes should be provided, drilled in pairs on diameters at right angles to each other. The inlet ring should be set close to the meter at a distance of eight diameters or more below the nearest upstream stop valve or fitting. The outlet ring should be placed at a distance of 8 to 10 diameters from the outlet of the meter. The diameter of the inlet and outlet pipe should be the same as the nominal size of the meter to be tested. The rings are to be connected to a suitable DP cell or manometer with measurement capability of 0.1 psi (0.7 kPa). If a manometer is used, provisions should be made for the complete removal of air from the apparatus, and the installation should be such that air will rise to the air outlets.

Provisions must be made for traps to prevent accidental expulsion of mercury into the test line when using mercury manometers. If measurements of U-tube manometers are to be made at relatively high flow rates, it is necessary to read both sides of the manometer column simultaneously to compensate for irregularities in the diameter of the manometer U-tube and to avoid errors caused by fluctuations. (NOTE: Other appropriate types of manometers may be used.) The pressure loss of inlet and outlet piping from meter to piezometer rings shall be deducted in determining meter pressure loss.

Sec. A.2.2 Pressure Tests

A pressure test should be made on each size of a particular design of meter furnished. The test pressure should be 300 psi (2100 kPa) static, which may be produced by use of a hand pump or any other available device. The meter should be tested for accuracy before and after it has been pressure-tested to determine if there has been any distortion that could affect the registration. If satisfactory results are obtained, it is unnecessary to make more than one pressure test on each size of a given design of meter.

Sec. A.2.3 Accuracy Tests

All meters should be tested for accuracy of registration at flow rates and test flow quantities in accordance with Sec. 3.9 of AWWA C708 and AWWA Manual M6—*Water Meters—Selection, Installation, Testing, and Maintenance.* If the purchaser does not have suitable means for testing, the manufacturer should be requested to furnish a certificate showing that each meter has been tested for accuracy of registration and that it complies with accuracy and capacity requirements of AWWA C708.

Sec. A.2.4 Testing Multijet Meters

Some multijet meters may possibly give erroneous meter readings when subjected to multiple testing on the conventional displacement test bench. Provisions must be made for removing entrained air ahead of the meters. When two or more meters are tested simultaneously, the space between meters should be at least five diameters to avoid false readings caused by turbulence. Test equipment should provide full bore diameter for each meter size, and a constant, nonpulsating water flow should be provided.

SECTION A.3: TESTING EQUIPMENT

The measuring device used to determine the amount of water discharged in testing should be designed to provide accuracy to within 0.25 percent of the actual quantity. Tanks and scales should be tested and calibrated at least once a year and records kept of such tests and calibrations.

SECTION A.4: REGISTRATION ACCURACY

In a multijet-type meter, the motion of the measuring element (rotor) is transmitted by a system of gearing to the register, which records the flow in convenient units of measure. The gearing translates the motion of the element into the unit of measure indicated by the register. The registration is thus directly dependent on the number of revolutions of the element. The registration is a true measure of flow only when the meter has been properly calibrated. After proper calibration, the meter will continue to register correctly only so long as the element continues to make the required number of cycles for each unit of quantity passed through the meter. If any condition should develop whereby the element is compelled to make other than the required number of cycles per unit of quantity passed through the meter, the regis-

tration will not be accurate. Under ordinary working conditions, several factors may cause inaccurate registration after comparatively short intervals. The more important of these are excessive wear, extreme temperatures, corrosion, material in suspension, and the presence of entrained air in the lines.

Sec. A.4.1 Excessive Wear

Excessive wear of the moving parts of the meter may be caused by improper setting or by overspeeding because the meter used is too small for the water demand. The results of excessive wear are slippage and underregistration. Excessive wear in the register-reduction gearing may cause the gears to slip or to bind. In either case, if the meter does not stop entirely, underregistration will result. To avoid excessive wear, it is recommended that meters be installed in a horizontal position and that excessive speeds be avoided. The safe maximum operating capacities listed in Table 1 of AWWA C708 are the maximum rates of flow at which water should be passed through the meter. The maximum rate should extend only for short periods of time and at infrequent intervals. Maximum flow could be destructive if continuous. For continuous 24-h service, multijet-type meters should not be operated at flows greater than approximately one half of the safe maximum operating capacities as listed in Table 1 of AWWA C708.

Sec. A.4.2 Temperature Extremes

Cold-water meters are not affected by temperatures up to approximately 80°F (27°C). The accuracy limits set forth in Sec. 3.9 of AWWA C708 may have to be modified for temperatures higher than 80°F (27°C). High temperatures can cause expansion of rotors and create unusual friction or binding. The result is slippage and underregistration or complete stoppage of the meter. Lower temperatures have no noticeable effect on the working parts of the meter unless the water freezes, which will cause damage to the meter. To avoid troubles caused by temperature extremes, meters should be located where they will be protected from heat, direct sunlight, and freezing.

If the authority having jurisdiction so requires, at locations where hot water from heating systems is not allowed to expand back through the meter, a backflow-prevention device consistent with the degree of hazard and a pressure-and-temperature relief valve should be installed sufficiently downstream of the meter.

Sec. A.4.3 Corrosion

All metals used in the construction of a meter are affected by the corrosive action of water, although the action is very slow with most potable waters. It should be recognized, however, that when meters are used in highly aggressive waters, it may be necessary to use materials that are more resistant to attack. The solution of the corrosion problem requires a high degree of experience and knowledge, and the manufacturer should be consulted for assistance.

Sec. A.4.4 Materials in Suspension

Foreign material carried in suspension has a tendency to deposit on the rotor and other parts of the meter, thus affecting registration. Meters provided with strainers will retain the larger particles in suspension, but the strainer will soon become clogged if the water is not kept reasonably free from suspended matter. Sand is especially destructive, and care should be exercised to keep sand from reaching the meters.

Sec. A.4.5 Entrained Air

Entrained air in water lines will result in inaccurate registration of the meter. This inaccuracy can result in a substantial overregistration under certain circumstances. In addition, entrained air can cause meter damage and premature wear, thus precautions should be taken to either eliminate or minimize this condition.

SECTION A.5: PERIODIC TESTS

Meters properly selected as to size and type will give satisfactory service over a long period of time without attention only if operated under ideal conditions. Under ordinary conditions, meters must be given some care if they are to function properly. In most cases, it is impossible to ascertain, without an actual test, whether a meter in service is registering with the required degree of accuracy. Consequently, to ensure reliable meter measurements, it is essential that all meters be subjected to periodic tests.

Sec. A.5.1 Time Intervals

The interval between tests and the method of conducting them must be governed largely by local conditions. Many state or provincial regulatory commissions specify intervals between tests on both a time and quantity basis. Under average conditions, the intervals between tests should not exceed the limits set forth in Table A.1. The time interval between tests should be based on local conditions and amount of consumption. Section A.4 should be reviewed in its entirety prior to the establishment of test intervals for individual utilities. The interval between tests may be increased 50 percent for meters with magnetic couplings and self-lubricating gear materials.

SECTION A.6: METER STORAGE

Meters should be stored in a location not subject to unduly high or low temperatures. When the meters are to be stored outdoors for an extended period of time, they should be covered to protect them from exposure to direct sunlight.

Table A.1 Most Frequently Used Intervals Between Meter Tests

Meter Size *in.*	Meter Size *(mm)*	Years Between Tests
5/8	(16)	10
3/4	(20)	8
1	(25)	6
1 1/2	(40)	4
2	(50)	4

SECTION A.7: INSTALLATION

All instruction manuals supplied by the manufacturer should be reviewed in detail before installation of meters. It is recommended that new service lines be flushed prior to installing the water meter. A spool piece of a length matching the meter to be installed should be used in place of the installed meter when flushing. An old meter with the measuring element removed could be used in place of the spool piece.

Sec. A.7.1 Electrical Grounded Pipe Systems

"AWWA opposes the grounding of electrical systems to pipe systems conveying drinking water to a customer's premises."* At the time the attached edition of AWWA C708 was published, the latest revision to the AWWA policy statement on the grounding of electrical circuits to water pipes had been adopted on Jan. 28, 1980, and reaffirmed on Jan. 25, 1987. However, it must be recognized that many pipe systems continue to be used as a grounding electrode system.

Section 260-81 (A) of the National Electrical Code (NEC) requires that "continuity of the grounding path or bonding connection to interior piping shall not rely on water meters."† Most utilities require permanent ground strapping around meters to prevent accidents to serviceworkers changing meters. All meters, both metal and plastic, should be permanently ground strapped. This is especially important for plastic meter couplings, which are nonconductors of electricity.

Sec. A.7.2 Misaligned Pipes

Meters should be set in a horizontal position, protected from freezing, damage, and tampering. The line opening in which the meter is to be set should match the lay length of the meter, allowing slight additional space for coupling gaskets. The service line configuration should have straight piping, which is necessary for proper flow conditioning both upstream and downstream of the meter. The meter should not be used to straighten misaligned pipes because of the potential for damage to the meter. This is especially true when meters with plastic threads are installed in outdoor pits. Installing meters with plastic threads in outdoor pit settings where the service lines are subjected to continual misalignment due to ground shifting should be avoided unless a meter set or other specialty connectors are used. Proper alignment of piping during installation and prior to the meter installation can be facilitated by the use of a spool piece of the proper length.

Sec. A.7.3 Meter Installation Methods

To prevent cross threading at installation, set the meter between the coupling nuts with the direction of flow through the meter corresponding to the direction of flow in the system. Engage the coupling nuts to the threaded meter ends. Check to

*"Statements of Policy on Public Water Supply Matters: Grounding of Electric Circuits on Water Pipe." In 1989–90 *Officers and Committee Directory*. AWWA, Denver (1987).

†Available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02169.

ensure that the nuts are properly aligned to avoid cross-threading damage to the threaded meter ends.

An effective method for properly starting meter coupling nuts is to position the nut squarely against the meter spud end. Turn the nut counterclockwise (in reverse) while holding the nut against the meter spud end. When the first threads on both the coupling nut and the meter spud end coincide, a slight clicking or snap will be heard as the nut moves into the starting position. Turn the nut clockwise to complete the connection.

On plastic-thread systems, avoid using pipe wrenches on the meter body itself. After the coupling nut has engaged the first thread of the meter, tighten the coupling nut clockwise by hand until it is tight, and then apply a partial turn with an open-end wrench. Do not overtighten. Pipe dope and sealants are not required or recommended. Soft rubber gaskets, rather than fiber or leather washers, are recommended for plastic meter thread systems.

Sec. A.7.4 Placing Meter in Service

After the line has been thoroughly flushed, open the shut-off valve slowly to pressurize the service line to the meter setting. Slowly open the inlet side valve, which will fill the meter with water. Check for leaks around the meter and connections. Open the meter outlet side valve slowly to pressurize the consumer side of the system. Open a consumer faucet slowly to allow entrapped air to escape. Turn off the faucet.

APPENDIX B

Future Revisions

This appendix is for information only and is not a part of AWWA C708.

The AWWA Standards Committee on Water Meters considered revisions to AWWA C708 that are not included in this edition. Future editions of AWWA C708 may include

- A revision increasing the safe maximum operating capacity for 2-in. (50-mm) meters from 130 gpm (29.5 m^3/h) to 160 gpm (36.4 m^3/h).
- A revision requiring placement of a meter serial number on the meter case.

American Water Works Association
AWWA C700-90
(Revision of ANSI/AWWA C700-77)

AWWA STANDARD

FOR

COLD-WATER METERS—
DISPLACEMENT TYPE, BRONZE MAIN CASE

Effective date: Oct. 1, 1990.
First edition approved by AWWA Board of Directors June 9, 1921.
This edition approved Jan. 28, 1990.

AMERICAN WATER WORKS ASSOCIATION

6666 West Quincy Avenue, Denver, Colorado 80235

AWWA Standard

This document is an American Water Works Association (AWWA) standard. It is not a specification. AWWA standards describe minimum requirements and do not contain all of the engineering and administrative information normally contained in specifications. The AWWA standards usually contain options that must be evaluated by the user of the standard. Until each optional feature is specified by the user, the product or service is not fully defined. AWWA publication of a standard does not constitute endorsement of any product or product type, nor does AWWA test, certify, or approve any product. The use of AWWA standards is entirely voluntary. AWWA standards are intended to represent a consensus of the water supply industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed on the first page of the classified advertising section of *Journal AWWA*. The action becomes effective on the first day of the month following the month of *Journal AWWA* publication of the official notice.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review, and users are cautioned to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state on their own responsibility in advertising and promotional materials or on tags or labels that the goods are produced in conformity with particular American National Standards.

CAUTION NOTICE: The American National Standards Institute (ANSI) approval date on the front cover of this standard indicates completion of the ANSI approval process. This American National Standard may be revised or withdrawn at any time. ANSI procedures require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018 (212) 354-3300.

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*Alternate

Contents

Foreword

This foreword is for information only and is not part of AWWA C700.

I. History of Standard. For the past century, no tool available to water utilities has played a greater part in the conservation of water than the water meter. It has reduced waste and distributed the cost of operating a water system in the most equitable manner possible.

Although patents were issued earlier, it is thought that the first meter actually produced in the United States was made in 1857. It was a positive-displacement type with reciprocating pistons. This design consisted of two cylinders and pistons with inlet and outlet ports arranged so that while water in one cylinder was discharging the other was filling. Water flowing through the meter was subject to pulsation and high friction loss. Other types of displacement meters manufactured before the turn of the century were the rotary piston, oscillating piston, and nutating disc. Only the oscillating and nutating types remain in production today as they have proved satisfactory for metering domestic water services.

Standardization of water meters was a matter of concern for many years before the first standard was adopted. An AWWA committee appointed in 1913 proposed the adoption of standards on overall meter lengths and connections in 1915 and 1916. The standards were not adopted officially but were recorded in the Proceedings for 1915* and for 1916.†

The New England Water Works Association (NEWWA), in separate action, appointed a committee in 1916 that produced drafts of standards in 1917. Action on adoption or publication was delayed on the recommendation of manufacturers.

In 1916, the meter manufacturers, who for several years had worked informally on the matter of meter standards, formally organized a meter standards committee on which most of the meter manufacturers were represented. The records indicate that those who were not represented were kept informed of the committee's activities and given the opportunity to comment on drafts of proposed standards.

On Mar. 9–10, 1920, the AWWA and NEWWA committees met for the first time as a joint committee to review drafts of a proposed standard that had been prepared by the manufacturers' committee. Subcommittees appointed at that meeting prepared a final draft that was approved by the joint committee and submitted to both associations for approval. AWWA adopted the standard on June 9, 1921, and NEWWA adopted it on Sept. 14, 1921. The standard, the first for any type of meter, was titled "Standard Specifications for Cold Water Meters, Disc Type."

The first revision of the standard was approved as tentative by AWWA on Oct. 31, 1941. The effective date of the standard was delayed until Jan. 1, 1943. On Mar. 15, 1943, it was approved by NEWWA. The document was advanced from tentative to standard by AWWA on May 10, 1946.

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*AWWA Proceedings 35th Year, *Journal of the American Water Works Association*, 3:283 (1915).

†AWWA Proceedings 36th Year, *Journal of the American Water Works Association*, 2:690 (1916).

Emergency alternative provisions were imposed by the War Production Board from Dec. 1, 1942, to Jan. 8, 1945. Emergency provisions were imposed again on Jan. 31, 1952.

The next edition of the standard was approved by AWWA as tentative on Jan. 23, 1961, and was later advanced to standard without revision on Feb. 11, 1964, and subsequently revised on Jan. 24, 1971, and May 8, 1977.

II. Information Regarding Use of This Standard. This standard provides for several options and alternatives that purchasers must designate if they wish to exercise the options or if they have a preference among the alternatives. Also, several items must be specified by purchasers to describe completely the type, size, and quantity of meters required. All such items, options, and alternatives are summarized in the following itemized list. Purchasers should review each one and then make the appropriate provisions in the purchaser's specifications to describe specific requirements.

1. Standard used—that is, AWWA C700, Standard for Cold-Water Meters—Displacement Type, Bronze Main Case.

2. Whether meters are to be furnished with nutating discs or oscillating pistons (Sec. 1.1), if there is a preference.

3. Whether an affidavit of compliance (Sec. 1.4) and certificate of testing for accuracy (Sec. A.3.3) are required.

4. Whether warranty requirements will be specified (Sec. 1.5.2).

5. Size of meter (Sec. 3.1 and Tables 1 and 2) and quantity required.

6. Whether corrosion protection is required for cast-iron frost-protection covers (Sec. 3.5), if there is a preference.

7. Modifications of test specifications (Sec. 3.8), if operating water temperature will exceed 80°F (27°C).

8. Whether meters in sizes ½ in. through 1 in. are to be of split-case or frost-protection-type design (Sec. 4.1.1).

9. Whether meters are to be furnished with cast-iron, stainless-steel, copper alloy, or suitable engineering plastic top or bottom covers (Sec. 2.9), if there is a preference.

10. Whether ½-in., ½-in. × ¾-in., ⅝-in., ⅝-in. × ¾-in., ¾-in., and 1-in. meters are to be furnished with coupling nuts and tailpieces (Sec. 4.2.1.1 and Sec. 4.2.1.2), and whether tailpieces are to be of a copper alloy or a suitable engineering plastic (Sec. 2.11).

11. Whether 1½-in. and 2-in. meters are to be furnished with flanged ends or threaded ends (Sec. 4.2.2).

12. Whether flanged meters are to be furnished with companion flanges, gaskets, bolts, and nuts (Sec. 4.2.2), and whether companion flanges are to be bronze, cast iron, or of a suitable engineering plastic (Sec. 2.12).

13. Details of register (Sec. 4.3) to be furnished, where there is a preference, with regard to

a. whether the registers shall be read in US gallons, cubic feet, or cubic metres, and

b. whether the registers shall be permanently sealed or have replaceable change gears.

14. If a direct-reading remote register or an encoder-type remote register is required (Sec. 4.3), specify in detail.

15. Special materials required, if any, to resist corrosion if water is highly aggressive (Sec. A.5.3).

III. Developing Technology. At the time this standard was published, formal research was continuing on several aspects of meters. This extensive research includes a re-examination of nutation/oscillation speeds, maximum head-loss criteria, extended-wear testing of meters, domestic demand profiles, and so forth.

IV. Metrication. Measurements in the tables in this standard are given in US customary units. Metric conversion factors are listed in Table F.1.

V. Major Revisions. The major changes to the 1977 standard in this revision are

1. The title has been changed to indicate that the standard is for bronze-case meters.
2. All references to 3-in. and larger meters have been deleted. This change was made because meter manufacturers no longer manufacture displacement meters in these sizes.
3. Sec. 1.2, Definitions, has been added.
4. The materials section of the standard recognizes the advances that have been made in the development of nonmetallic materials for water meter construction. Currently, plastic materials are being used successfully for water meter components, and because of continual development of new and improved materials, this standard will not require any one specific material but will cite typical examples of materials defined by American Society for Testing and Materials specifications typically used at this time in construction of water meters.
5. A requirement that the manufacturer's meter serial number be imprinted on the outer case was added (Sec. 3.9).
6. The requirement that the register be the same one used during testing has been deleted.
7. Only reference to straight-reading registers has been listed.
8. Sec. 1.5 has been revised regarding warranties.
9. References to ½-in. and ½-in. × ¾-in. size meters have been added.
10. The maximum pressure loss at safe maximum operating capacity in Table 1 has been changed from 13 psi to 15 psi for ⅝-in., ⅝-in. × ¾-in., ¾-in., and 1-in. meters.
11. Pitch diameters have been removed from Table 2.
12. Appendix B, Future Revisions, has been added.

Table F.1 Metric Conversion Factors

Unit of Measure	Conversion Factor	Resulting Unit of Measure
cubic feet (ft^3)	× 2.83×10^{-2}	= cubic metres (m^3)
degrees Fahrenheit (°F)	× (°F − 32)/1.8	= degrees Celsius (°C)
inches (in.)	× 25.4	= millimetres (mm)
millimetres (mm)	× 0.0394	= inches (in.)
pounds per square inch (psi)	× 6.89×10^{-3}	= pascals (Pa)
US gallons (gal)	× 3.79×10^{-3}	= cubic metres (m^3)

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American Water Works Association

AWWA C700-90
(Revision of ANSI/AWWA C700-77)

AWWA STANDARD FOR

COLD-WATER METERS— DISPLACEMENT TYPE, BRONZE MAIN CASE

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard covers the various types and classes of cold-water displacement meters with bronze main cases, in sizes ½ in. through 2 in., and the materials and workmanship employed in their fabrication. The displacement meters covered, known as nutating-disc or oscillating-piston meters, are positive in action because the pistons and discs displace or carry over a fixed quantity of water for each nutation or oscillation when operated under positive pressure.

Sec. 1.2 Definitions

The following definitions shall apply in this standard:

1.2.1 *Manufacturer:* The party that manufactures or produces the displacement-type water meter covered by this standard.

1.2.2 *Purchaser:* The party entering into a contract or agreement for the purchase of displacement-type water meters according to provisions of this standard.

1.2.3 *Vendor:* The party entering into a contract or agreement to supply displacement-type water meters according to the provisions of this standard; the seller. A vendor may or may not be the manufacturer.

Sec. 1.3 References

This standard references the following documents. In their latest editions, they form a part of this standard to the extent set forth herein. In any case of conflict,

the requirements of this standard shall prevail. When reference is made to standards, the latest revision shall apply unless the date of the standard is also listed.

ANSI*/ASME† B1.20.1—General Purpose Pipe Threads (Inch).

ANSI/AWWA C706—Standard for Direct-Reading Remote-Registration Systems for Cold-Water Meters.

ANSI/AWWA C707—Standard for Encoder-Type Remote-Registration Systems for Cold-Water Meters.

ASTM‡ A48—Standard Specification for Gray Iron Castings.

ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

ASTM A159—Standard Specification for Automotive Gray Iron Castings.

ASTM A167—Standard Specification for Stainless and Heat-Resisting Chromium–Nickel Steel Plate, Sheet, and Strip.

ASTM A276—Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

ASTM A493—Standard Specification for Stainless and Heat-Resisting Steel for Cold Heading and Cold Forging Wire.

ASTM A582—Standard Specification for Free-Machining Stainless and Heat-Resisting Steel Bars, Hot-Rolled or Cold-Finished.

ASTM B16—Standard Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines.

ASTM B36—Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar.

ASTM B61—Standard Specification for Steam or Valve Bronze Castings.

ASTM B62—Standard Specification for Composition Bronze or Ounce Metal Castings.

ASTM B98—Standard Specification for Copper–Silicon Alloy Rod, Bar, and Shapes.

ASTM B103—Standard Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar.

ASTM B127—Standard Specification for Nickel–Copper Alloy (UNS N04400) Plate, Sheet, and Strip.

ASTM B139—Standard Specification for Phosphor Bronze Rod, Bar, and Shapes.

ASTM B164—Standard Specification for Nickel–Copper Alloy Rod, Bar, and Wire.

ASTM B176—Standard Specification for Copper-Alloy Die Castings.

ASTM B271—Standard Specification for Copper-Base Alloy Centrifugal Castings.

ASTM B584—Standard Specification for Copper Alloy Sand Castings for General Applications.

ASTM D1248—Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

*American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

†American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

‡American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

ASTM D1788—Standard Specification for Rigid Acrylonitrile–Butadiene–Styrene (ABS) Plastics.

ASTM D2135—Classification of Hard Rubbers.

ASTM D2874—Standard Specification for Polyphenylene Oxide Molding and Extrusion Materials. (Discontinued in 1983.)

ASTM D3011—Specification for Reinforced and Filled Polystyrene, Styrene-Acrylonitrile, and Acrylonitrile–Butadiene–Styrene Injection Molding and Extrusion Materials. (Discontinued in 1987.)

ASTM D3935—Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Material.

ASTM D4066—Standard Specification for Nylon Injection and Extrusion Materials (PA).

ASTM D4067—Standard Specification for Reinforced and Filled Polyphenylene Sulfide (PPS) Injection Molding and Extrusion Materials.

ASTM D4101—Standard Specification for Propylene Plastic Injection and Extrusion Materials.

ASTM D4181—Standard Specification for Acetal (POM) Molding and Extrusion Materials.

ASTM D4203—Standard Specification for Styrene-Acrylonitrile (SAN) Injection and Extrusion Materials.

ASTM D4507—Standard Specification for Thermoplastic Polyester (TPES) Materials.

ASTM D4549—Standard Specification for Polystyrene Molding and Extrusion Materials (PS).

ASTM E527—Standard Practice for Numbering Metals and Alloys (UNS) (SAE J 1086).*

ASTM F467—Standard Specification for Nonferrous Nuts for General Use.

ASTM F468—Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.

Sec. 1.4 Affidavit of Compliance

The purchaser's specifications may require an affidavit from the manufacturer or vendor that the meters furnished under the purchaser's order comply with all applicable requirements of this standard.

Sec. 1.5 Basis for Rejection

Meters not complying with all requirements of this standard and the purchaser's specifications shall be rejected.

1.5.1 *Rejected meters.* The manufacturer shall bear the expense of replacing or satisfactorily correcting all meters rejected for failure to comply with this standard.

1.5.2 *Workmanship and materials.* The manufacturer shall repair or replace, without charge, those parts in which a defect has developed within a year's time of shipment, on return to the manufacturer or on proper proof of a defect. AWWA standards do not contain details on manufacturers' warranties. Purchasers should review warranties offered by meter manufacturers and consider applicable warranty protection provided by individual state statute.

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*Also refer to Copper Development Association, Greenwich Office Park 2, P.O. Box 1840, Greenwich, CT 06836-1840.

SECTION 2: MATERIALS

Sec. 2.1 General

All materials used in the manufacture of water meters shall conform to the requirements stipulated in the following section. Where plastic materials are allowed, the manufacturer may furnish any plastic materials that meet the performance requirements specified; typical examples are provided.

2.1.1 Materials shall be selected for their strength and resistance to corrosion and shall not impart to the water objectionable taste or odor, nor toxic substances in normalized concentrations exceeding the maximum contaminant levels (MCLs) as defined by the US Environmental Protection Agency (USEPA).

Sec. 2.2 Pressure Casings

Water meter main cases shall be made of a copper alloy containing not less than 75 percent copper, such as UNS C84400 or UNS C93200, or a similar copper alloy as listed in ASTM B584.

All materials used in the construction of meter main cases shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 105°F (40°C) and shall not permanently warp or deform when exposed to temperatures up to 150°F (66°C) for 1 h.

Sec. 2.3 Register-Box Rings and Lids

Register-box rings and lids shall be made of a copper alloy containing not less than 57 percent copper, such as UNS C85700 or UNS C86200; or a similar copper alloy as listed in ASTM B584 or UNS C85800 as listed in ASTM B176; or a suitable engineering plastic, such as polycarbonate (PC) per ASTM D3935, acetal per ASTM D4181, nylon (N) per ASTM D4066, or propylene per ASTM D4101.

All materials used in the construction of register-box rings and lids shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 105°F (40°C) and shall not permanently warp or deform when exposed to temperatures up to 150°F (66°C) for 1 h.

Sec. 2.4 Measuring Chambers

Measuring chambers shall be made of a copper alloy containing not less than 85 percent copper, such as UNS C92200 as listed in ASTM B61 or UNS C83600 as listed in ASTM B62; or a suitable engineering plastic, such as polyethylene per ASTM D1248, polyphenylene oxide (PPO) per ASTM D2874, polystyrene per ASTM D3011, styrene-acrylonitrile (SAN) per ASTM D4203, or polyphenylene sulfide (PPS) per ASTM D4067.

Measuring chambers shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.5 Pistons and Discs

Pistons and discs shall be such that the specific gravity approximately equals that of water and shall be made of a vulcanized hard rubber, such as those classified per ASTM D2135; or a suitable engineering plastic, such as polystyrene per ASTM D3011, polyphenylene sulfide (PPS) per ASTM D4067, styrene-acrylonitrile (SAN)

per ASTM D4203, polyphenylene oxide (PPO) per ASTM D2874, or polycarbonate (PC) per ASTM D3935.

Pistons and discs shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.6 Measuring-Chamber Diaphragms

Measuring-chamber diaphragms shall be made of monel, such as UNS N04400 as listed in ASTM B127; phosphor bronze as listed in ASTM B103; or austenitic stainless steel as listed in ASTM A167; a hard rubber as classified per ASTM D2135; or a suitable engineering plastic, such as nylon (N) per ASTM D4066, polyphenylene sulfide (PPS) per ASTM D4067, polyphenylene oxide (PPO) per ASTM D2874, or styrene-acrylonitrile (SAN) per ASTM D4203.

Measuring-chamber diaphragms shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.7 Piston/Disc Spindles, Thrust Rollers, and Thrust-Roller Bearing Plates

Piston/disc spindles, thrust rollers, and thrust-roller bearing plates shall be made of monel UNS N04400 per ASTM B164; phosphor bronze per ASTM B139; austenitic stainless steel as listed in ASTM A276; vulcanized hard rubber as classified per ASTM D2135; or a suitable engineering plastic, such as acetal resin per ASTM D4181, polycarbonate (PC) per ASTM D3935, polyphenylene sulfide (PPS) per ASTM D4067, or thermoplastic polyester (TPES) per ASTM D4507.

Piston/disc spindles, thrust rollers, and thrust-roller bearing plates shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.8 Register Gear Trains

Frames, gears, and pinions of gear trains shall not be exposed to water and shall be made of metals such as copper alloys per ASTM B16, brass alloys per ASTM B36, silicon–bronze alloys per ASTM B98; or any copper-based alloys per ASTM F467 and ASTM F468; stainless steel, such as those listed in ASTM A276, ASTM A493, and ASTM A582; or suitable engineering plastics, such as acrylonitrile–butadiene–styrene (ABS) per ASTM D1788, polycarbonate (PC) per ASTM D3935, thermoplastic polyester (TPES) per ANSI/ASTM D4507, polystyrene (PS) per ASTM D4549, or acetal per ASTM D4181.

Register gear trains shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.9 Covers, Top or Bottom

If engineering plastic materials are used in the manufacture of top or bottom covers, only virgin or first-generation grade, rigid engineering plastic materials compounded with ultraviolet stabilizers shall be used. Engineering plastic covers, top or bottom, shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 105°F (40°C) and shall not permanently warp or deform when exposed to temperatures up to 150°F (66°C) for 1 h.

Breakable and nonbreakable top or bottom covers, as specified in the purchaser's specifications, shall be as follows:

2.9.1 *Breakable.* Breakable covers (frost-protection devices) shall be made of cast iron, such as those listed in ASTM A48, ASTM A126, or ASTM A159; austenitic stainless steel, such as those listed in ASTM A167; a copper alloy containing not less than 75 percent copper, such as UNS C84400 as listed in ASTM B584; or a suitable engineering plastic, such as polycarbonate (PC) per ASTM D3935, polyphenylene sulfide (PPS) per ASTM D4067, nylon (N) per ASTM D4066, acetal per ASTM D4181, or thermoplastic polyester (TPES) per ASTM D4507. The design and composition of such components will be such that they will satisfy the break or yield requirements set forth in Sec. 3.10.

2.9.2 *Nonbreakable.* Nonbreakable covers shall be made of austenitic stainless steel, such as those listed in ASTM A167; a copper alloy containing not less than 75 percent copper, such as UNS C84400 as listed in ASTM B584; or a suitable engineering plastic, such as polycarbonate (PC) per ASTM D3935, polyphenylene sulfide (PPS) per ASTM D4067, nylon (N) per ASTM D4066, or thermoplastic polyester (TPES) per ASTM D4507. The design and composition of these components shall be such that they will satisfy the break or yield requirements set forth in Sec. 3.10.

Sec. 2.10 External-Case Closure Fasteners

External fasteners shall be made of a copper alloy containing not less than 75 percent copper, such as the wrought alloys covered by ASTM B16 (for example, UNS C36000); a brass alloy, such as UNS C27200 as listed in ASTM B36; a silicon–bronze alloy as listed in ASTM B98; any of the copper-based alloys specified for general fastener use in ASTM F467 or ASTM F468; or stainless steels of the austenitic, ferritic, or martensitic types as listed in ASTM A276, ASTM A493, and ASTM A582.

Fasteners for nonpressure containment assemblies may be made of a suitable engineering plastic, such as polycarbonate (PC) per ASTM D3935, nylon (N) per ASTM D4066, acetal per ASTM D4181; or any of the aforementioned copper-based or stainless-steel materials.

Sec. 2.11 Coupling Tailpieces and Nuts

Coupling tailpieces and nuts shall be made of copper alloys containing not less than 75 percent copper, such as UNS C84400 or UNS C93200, or a similar copper alloy as listed in ASTM B584; or, when so specified by the purchaser's specifications, of a suitable virgin-grade engineering plastic, such as polycarbonate (PC) per ASTM D3935, nylon (N) per ASTM D4066, or polyphenylene sulfide (PPS) per ASTM D4067.

Sec. 2.12 Companion Flanges

Companion flanges shall be made of cast iron, such as those listed in ASTM A48, ASTM A126, or ASTM A159; or, when so specified by the purchaser's specifications, of a copper alloy containing not less than 75 percent copper, such as UNS C84400 or UNS C93200, or a similar copper alloy as listed in ASTM B584; or, when so specified by the purchaser's specifications, of a suitable virgin-grade engineering plastic.

SECTION 3: GENERAL DESIGN

Sec. 3.1 Size

The operating and physical characteristics listed in Tables 1 and 2 shall determine the nominal size of meters.

Sec. 3.2 Capacity*

The nominal capacity ratings and the related pressure-loss limits shall be the same as those listed in Table 1 for the safe maximum operating capacities.

Sec. 3.3 Length

The length of the meters shall be the face-to-face dimensions of the spuds or flanges listed in Table 2.

Sec. 3.4 Pressure Requirement

Meters supplied under this standard shall operate without leakage or damage to any part at a continuous working pressure of 150 psi (1050 kPa).

Sec. 3.5 Frost-Protection Devices

Frost-protection devices, when provided, shall be of such design that they will yield or break under normal freezing conditions in order to minimize damage to any other part of the meter. The internal portion of the top or bottom covers, designed to provide frost protection, may be protected from corrosion by an inner lining or coating.

Sec. 3.6 External-Case Closure Fasteners

All external-case closures, such as rings, clamps, screws, bolts, cap bolts, nuts, and washers, shall be designed for easy removal following lengthy service.

Sec. 3.7 Accessibility

Meters larger than 1 in. shall be designed for easy removal of all interior parts without disturbing the connections to the pipeline.

Sec. 3.8 Registration Accuracy

Meters shall meet the following requirements for accuracy with water at a temperature less than 80°F (27°C):

3.8.1 *Normal flow limits.* At any rate of flow within the normal test-flow limits as listed in Table 1, the meter shall register not less than 98.5 percent and not more than 101.5 percent of the water that actually passes through it.

3.8.2 *Minimum flow rate.* At the minimum test-flow rate to the lowest normal test-flow rate as listed in Table 1, the meter shall register not less than 95 percent and not more than 101 percent of the water that actually passes through it.

*See Sec. A.3.

Table 1 Characteristics of Displacement-Type Meters

Meter Size in.	Safe Maximum Operating Capacity gpm	Maximum Pressure Loss at Safe Maximum Operating Capacity psi	Recommended Maximum Rate for Continuous Operations* gpm	Minimum Test Flow† gpm	Normal Test-Flow Limits† gpm	Maximum Number of Disc Nutations or Piston Oscillations	
						per 10 gal	per ft³
1/2	15	15	7.5	1/4	1–15	875	657
1/2 × 3/4	15	15	7.5	1/4	1–15	875	657
5/8	20	15	10	1/4	1–20	580	435
5/8 × 3/4	20	15	10	1/4	1–20	580	435
3/4	30	15	15	1/2	2–30	333	250
1	50	15	25	3/4	3–50	153	115
1 1/2	100	15	50	1 1/2	5–100	67	50
2	160	15	80	2	8–160	40	30

*See Sec. A.5.1.
†See Sec. 3.8.

Table 2 Dimensional Design Limits for Meters and External Connections

Meter Size in.	Meter Length*		Meter-Casing Spuds	Coupling Tailpieces	
	Threaded Spud Ends in.	Flanged Ends in.	Nominal Thread Size in.	Length in.	Nominal Thread Size in.
1/2	7 1/2		3/4	2 3/8	1/2
1/2 × 3/4	7 1/2		1	2 1/2	3/4
5/8	7 1/2		3/4	2 3/8	1/2
5/8 × 3/4	7 1/2		1	2 1/2	3/4
3/4	9		1	2 1/2	3/4
1	10 3/4		1 1/4	2 5/8	1
1 1/2	12 5/8	13	1 1/2†		
2	15 1/4	17	2†		

*± 0.03 in.
†Internal threaded spuds.

Sec. 3.9 Markings

The size, model, and direction of flow through the meter shall be marked permanently on the outer cases of all meters. The manufacturer's meter serial number shall be imprinted permanently on the outer case.

3.9.1 *Register-box markings.* The name of the manufacturer shall be marked permanently in the lid of the register box. The serial number of the meter shall be imprinted on the lid.

Sec. 3.10 Plastic Covers, Top or Bottom Design

The design of plastic covers, top or bottom (Sec. 2.9), shall meet the following requirements:

3.10.1 Covers, top or bottom, shall be designed to be watertight and capable of withstanding, without exceeding the fatigue limit of the material or being structurally damaged, a hydrostatic pressure of two times the rated maximum working pressure (300 psi [2100 kPa] minimum) for a period of 15 min.

3.10.2 Covers, top or bottom, not designed to break shall be designed to have a burst pressure of at least four times the rated maximum working-line pressure (600 psi [4200 kPa] minimum). Breakable covers, top or bottom, shall be designed to have a burst pressure of at least three times the rated maximum working-line pressure (450 psi [3100 kPa]). Components shall be watertight at 150 psi (1050 kPa) after being subjected to a minimum of 100,000 pressure cycles of 100–300 psi (700–2100 kPa) in 1.5 s and a hold time of 1 min and followed by an immediate release of pressure to the 100-psi (700-kPa) lower limit.

SECTION 4: DETAILED DESIGN

Sec. 4.1 Main Casing

All meters shall have an outer case with separate, removable measuring chambers. Cases shall not be repaired in any manner. The inlet and outlet shall have a common axis. Connection flanges shall be parallel.

4.1.1 *Small-size meter casings.* Casings of meters in sizes ½ in. through 1 in. shall be of either frost-protection or split-case design, as designated by the purchaser's specifications.

Sec. 4.2 Connections

4.2.1 *½-in., ½-in. × ¾-in., ⅝-in., ⅝-in. × ¾-in., ¾-in., and 1-in. meters.* Main-case connections for meters ½-in. through 1-in. sizes shall be meter-casing spuds having external straight threads conforming to ANSI/ASME B1.20.1. When a ½-in. or ⅝-in. meter is furnished with connections for a ¾-in. pipe, the spud dimensions shall be as shown for the ½-in. × ¾-in. or ⅝-in. × ¾-in. sizes.

4.2.1.1 Coupling nuts, if required by the purchaser's specifications, shall have internal straight pipe threads conforming to ANSI/ASME B1.20.1.

4.2.1.2 Coupling tailpieces, if required by the purchaser's specifications, shall have external taper pipe threads conforming to ANSI/ASME B1.20.1 and internal diameters that are approximately equal to the nominal thread size of the tailpiece. Lengths and thread sizes shall be as listed in Table 2.

4.2.2 *1½-in. and 2-in. meters.* Main-case connections for 1½-in. and 2-in. meters shall be either spuds on both ends or flanges on both ends.

4.2.2.1 Spuds shall have internal taper pipe threads conforming to ANSI/ASME B1.20.1.

4.2.2.2 Flanges shall be faced and drilled and shall be of the oval type. The drilling shall be on the horizontal axis; the number of bolt holes and the diameters of the bolt holes and bolt circle shall be as listed for companion flanges in Table 3.

4.2.2.3 Oval companion flanges, gaskets, bolts, and nuts shall be provided if required by the purchaser's specifications. Companion flanges shall be faced, drilled,

Table 3 Flange Dimensions

Meter Size *in.*	Minimum Thickness at Bolt Hole *in.*	Diameter of Bolt Circle *in.*	Number of Bolt Holes	Diameter of Bolt Holes* *in.*	Thickness at Hub *in.*
1 ½	9/16	4	2	11/16	13/16
2	5/8	4 ½	2	11/16	7/8

*Minimum.

Table 4 Maximum Indication on Initial Dial and Minimum Register Capacity

Meter Size *in.*	Maximum Allowable Indication of Initial Dial			Minimum Allowable Capacity of Register (Millions)		
	ft^3	*gal*	m^3	ft^3	*gal*	m^3
½	1	10	0.1	0.1	1	0.01
5/8	1	10	0.1	0.1	1	0.01
¾	1	10	0.1	1	10	0.1
1	10	100	1	1	10	0.1
1 ½	10	100	1	10	100	1
2	10	100	1	10	100	1

and tapped in conformance with ANSI/ASME B1.20.1. Dimensions shall be as listed in Table 3.

Sec. 4.3 Registers

Registers shall be straight-reading, permanently sealed by the manufacturer or have replaceable change gears, and shall read in US gallons, cubic feet, or cubic metres as specified in the purchaser's specifications. Registers shall not be in contact with the water that is being measured. The minimum capacity shall be as listed in Table 4.

4.3.1 *Configuration.* Register gear trains shall be located in the register compartment. Piston oscillations or disc nutations shall be transmitted by magnetic couplings.

4.3.2 *Number-wheel numerals.* The numerals on the number wheels of registers shall not be less than 3/16 in. in height and should be readable at a 45° angle from the vertical.

4.3.3 *Mechanism details.* The register lock and side gears shall be fastened securely to the number-wheel discs and hubs. The tumbler pinions shall mesh accurately at the turnover points with the lock and side gears of the adjacent number wheels. Both main and pinion shafts shall be so secured in the register frame, register plates, or both that they cannot come out of position. Pinions may be mounted in partition plates between the number wheels. The pinion shaft shall be designed so that there is no possibility of its bending and allowing the pinion to skip at the turnover point. Reduction gears and pinions shall run free on fixed shafts or

be fixed on shafts that run free in the register frame, register plates, or both and shall be constructed so that they cannot become unmeshed.

4.3.4 *Test hands.* Registers shall be furnished with center-sweep test hands with an index circle located near the periphery of the register and graduated in 100 equal parts, with each tenth graduation being numbered. The hand or pointer shall taper to a point, and shall be set accurately and held securely in place. The quantities indicated by a single revolution of the test hand shall be as listed in Table 4 for initial dial indication.

4.3.5 *Register boxes.* The lid shall be recessed and shall overlap the register box in order to protect the lens. The lens shall be held securely in place.

4.3.6 *Registers—remote type.* If required by the purchaser's specifications, the register type shall be a direct-reading remote register (AWWA C706) or encoder-type remote register (AWWA C707).

Sec. 4.4 Measuring Chambers

The measuring chambers shall be self-contained units, smoothly finished, firmly seated, and easily removed from the main cases and shall not be produced as part of the main cases. Measuring chambers shall be secured in the main cases so that the accuracy of the meter will not be affected by any distortion of the main case that might occur when operating with a pressure less than 150 psi (1050 kPa).

Sec. 4.5 Pistons and Discs

Pistons and discs shall be smoothly finished. Disc plates, whether flat or conical, shall be either reinforced or equipped with thrust rollers. Discs may be one piece or composed of a plate with two half-balls. The piston and disc spindles shall be fastened securely. The disc nutations or piston oscillations shall not exceed the quantities listed in Table 1.

Sec. 4.6 Strainers

All meters shall either be provided with strainer screens installed in the meter or be self-straining by means of an annular space between the measuring chamber and the external case. Strainer screens shall be rigid, fit snugly, be easy to remove, and have an effective straining area at least double that of the main-case inlet.

Sec. 4.7 Tamper-Resistant Features

Register-box screws, locking pins, case bolts, and inlet and outlet coupling nuts, if furnished, shall be equipped with tamper-resistant features. If drilled for seal wires, seal-wire holes shall not be less than 3/32 in. in diameter.

APPENDIX A
Supplemental Information

This appendix is for information only and is not a part of AWWA C700.

SECTION A.1: UNITS OF MEASURE

The majority of water meters presently in service in the United States register in either US gallons or cubic feet. With the availability of the metric system, the user may now determine the most suitable unit of measure from the three available—US gallons, cubic feet, or cubic metres.

SECTION A.2: REGISTER DIAL TYPES

The recommended water meter register is the straight-reading type. Although the round-reading type is still in existence, it is no longer manufactured. The round-reading type is more often misread, and the problem is further complicated if more than one make of meter is used in a single water system. Also, it is more difficult to print postcards for customer reading when two or more makes of meters with round-reading registers are used.

SECTION A.3: TESTS

Sec. A.3.1 Capacity and Pressure-Loss Tests

Capacity tests are tests of the design of a meter. Once a meter of each size of a given design has been tested for pressure loss at safe maximum operating capacity, it should not be necessary to test others of the same design.

The pressure loss should be determined using two identical piezometer rings of the same diameter of the nominal size of the meter being tested. The piezometer rings must be free from any burrs where the holes are drilled through the wall of the ring. No fewer than four holes should be provided, drilled in pairs on diameters at right angles to each other. The inlet ring should be set close to the meter at a distance of eight diameters or more below the nearest upstream stop valve or fitting. The outlet ring should be placed at a distance of 8 to 10 diameters from the outlet of the meter. The diameter of the inlet and outlet pipe should be the same as the nominal size of the meter to be tested. The rings are to be connected to a suitable DP cell or manometer with a measurement capability of 0.1 psi. If a manometer is used, provisions should be made for the complete removal of air from the apparatus, and the installation should be such that air will rise to the air outlets.

Provisions must be made for traps to prevent accidental expulsion of mercury into the test line when using mercury manometers. If measurements of U-tube manometers are to be made at relatively high flow rates, then it is necessary to read both sides of the mercury column simultaneously to compensate for irregularities in the diameter of the manometer tube and to avoid errors caused by fluctuations. (Other appropriate types of manometers may be used.)

The pressure loss of inlet and outlet piping from meter to piezometer rings shall be deducted in determining meter pressure loss.

Sec. A.3.2 Pressure Tests

A pressure test should be made on each size of a particular design of meter furnished. The test pressure should be 300 psi (2100 kPa) static, which may be produced by use of a hand pump or any other available device. The meter should be tested for accuracy before and after it has been pressure tested to determine whether there has been any distortion that could affect the registration. If satisfactory results are obtained, it is unnecessary to make more than one pressure test on each size of a given design of meter.

Sec. A.3.3 Accuracy Tests

All meters should be tested for accuracy of registration at flow rates and test-flow quantities in accordance with Sec. 3.8 of AWWA C700-90, Standard for Cold-Water Meters—Displacement Type, Bronze Main Case; and *Water Meters—Selection, Installation, Testing, and Maintenance.** If the purchaser does not have suitable means for testing, the manufacturer should be requested to furnish a certificate showing that each meter has been tested for accuracy of registration and that it complies with the accuracy and capacity requirements of AWWA C700.

SECTION A.4: TESTING EQUIPMENT

The measuring device that is used to determine the amount of water discharged when testing should be designed to provide measuring accuracy to within 0.25 percent of the actual quantity. Tanks and scales should be tested and calibrated at least once a year and records kept of such tests and calibrations.

SECTION A.5: REGISTRATION ACCURACY

In a displacement meter, the motion of the measuring element (piston or disc) is transmitted by a system of gearing to the register, which records the flow in convenient units of measure. The gearing translates the motion of the element into the unit of measure indicated by the register. Thus, the registration is directly dependent on the number of nutations or oscillations of the element. The

*Water Meters—Selection, Installation, Testing, and Maintenance, AWWA Manual M6, AWWA, Denver (1986).

registration is a true measure of flow only when the meter has been properly calibrated. After proper calibration, the meter should continue to register correctly only so long as the element continues to make the required number of cycles for each unit of quantity that passes through the meter. If any condition develops whereby the element is compelled to make other than the required number of cycles per unit of quantity that passes through the meter, then the registration will not be accurate. Under ordinary working conditions, several factors may cause inaccurate registration after comparatively short intervals. The more important of these are excessive wear, extreme temperatures, corrosion, materials in suspension, and the presence of entrained air in the lines.

Sec. A.5.1 Excessive Wear

Excessive wear of the moving parts of the meter may be caused by improper setting or by overspeeding because the meter is too small for the water demand. The results of excessive wear of the measuring chamber are slippage and under-registration. Excessive wear in the register reduction gearing may cause the gears to slip or bind. In either case, if the meter does not stop entirely, under-registration will result. To avoid excessive wear, meters should not be operated at excessive speeds. The safe maximum operating capacities listed in Table 1 of AWWA C700-90 are the maximum rates of flow at which water should be passed through the meter for only short periods of time and at infrequent intervals. Maximum flow could be destructive if continuous. For continuous 24-h service, displacement meters should not be operated at flows greater than approximately one half the safe maximum operating capacities as listed in column 4 of Table 1 of AWWA C700-90.

Sec. A.5.2 Temperature Extremes

Cold-water meters are not affected by temperatures of up to approximately 80°F (27°C). For temperatures higher than 80°F (27°C), meters with slightly larger clearances than usual should be used and the accuracy limits, as set forth in Sec. 3.8 of AWWA C700-90, may have to be modified. High temperatures can cause the expansion of pistons and discs and create unusual friction or bind the parts in the chambers. The results are slippage and under-registration or complete stoppage of the meter. Lower temperatures have no noticeable effect on the working parts of the meter unless the water freezes, which will cause damage to the meter. To avoid the problems caused by temperature extremes, meters should be located where they will be protected from extreme heat, direct sunlight, and freezing.

If the authority having jurisdiction so requires, at locations where hot water from heating systems is not allowed to expand back through the meter, a backflow-prevention device, consistent with the degree of hazard, and a pressure-and-temperature-relief valve should be installed sufficiently downstream of the meter.

Sec. A.5.3 Corrosion

All the metals used in the construction of a meter are affected by the corrosive action of water, although the action is very slow with most potable waters. However, it should be recognized that when meters are used in highly aggressive waters, it may be necessary to use materials that are more resistant to corrosive attack. A

high degree of experience and knowledge is required to solve corrosion problems, and the manufacturer should be consulted for assistance.

Sec. A.5.4 Materials in Suspension

Foreign material carried in suspension has a tendency to fill the spaces between the measuring element and the measuring chamber, thus affecting registration. Meters provided with strainers will retain the larger particles in suspension, but the strainer will soon become clogged if the water is not kept reasonably free from suspended matter. Sand is especially destructive, and care should be exercised to keep sand from reaching meters.

Sec. A.5.5 Entrained Air

All water meters will record the presence of entrained air in the lines inaccurately; this inaccuracy can result in substantial over-registration under certain circumstances. In addition, entrained air can cause meter damage and premature wear; precautions should be taken to either eliminate or minimize this condition.

SECTION A.6: PERIODIC TESTS

Meters properly selected as to size and type should give satisfactory service over a long period of time without attention only if operated under ideal conditions. Under ordinary conditions, meters must be given some care if they are to function properly. In most cases it is impossible to ascertain without actual testing whether a meter in service is registering with the required degree of accuracy. Consequently, to ensure reliable meter measurements, it is essential that all meters be subjected to periodic tests. The intervals between tests and the methods for conducting them must be governed largely by local conditions. Many state regulatory commissions specify intervals between tests on both a time and quantity basis. The most frequently used intervals between tests are set forth in Table A.1.

Sec. A.6.1 Time Intervals

The time interval between tests should be based on local conditions and the amount of consumption. Sec. A.5 should be reviewed in its entirety before establishing test intervals for individual utilities. The interval between tests may be increased by 50 percent for meters with magnetic couplings and self-lubricating gear materials.

Table A.1 Most Frequently Used Intervals Between Meter Tests

Meter Size—*in.*	Years Between Tests
½	10
⅝	10
¾	8
1	6
1 ½	4
2	4

SECTION A.7: METER STORAGE

Meters should be stored in a location that is not subject to unduly high or low temperatures. When the meters are to be stored outdoors for an extended period of time, they should be covered to protect them from exposure to direct sunlight.

SECTION A.8: INSTALLATION

Any and all instruction manuals supplied by the manufacturer should be reviewed in detail before installation of meters. It is recommended that new service lines be flushed prior to installing the water meter. A spool piece of a length matching the meter to be installed should be used in place of the installed meter when flushing. An old meter with the measuring element removed could be used in place of the spool piece.

Sec. A.8.1 Electrical Grounded Pipe Systems

"AWWA opposes the grounding of electrical systems to pipe systems conveying drinking water to a customer's premises."* At the time this edition of AWWA C700 was published, the latest revision to the AWWA policy statement on the grounding of electrical circuits to water pipes had been adopted on Jan. 28, 1980, and reaffirmed on Jan. 25, 1987. However, it must be recognized that many pipe systems continue to be used as a grounding electrode system.

Sec. 260-81(A) of the National Electrical Code (NEC) requires that "continuity of the grounding path or bonding connection to interior piping shall not rely on water meters."† Most utilities require permanent ground strapping around meters to prevent accidents to workers changing meters. All meters, both metal and plastic, should be permanently ground-strapped. This is especially important in the case of plastic meter couplings, which are nonconductors of electricity.

Sec. A.8.2 Misaligned Pipes

Meters should be set in a horizontal position and protected from freezing, damage, and tampering. The line opening in which the meter is to be set should match the lay length, allowing slight additional space for coupling gaskets. The inlet and outlet sides of the meter should be axially aligned to the service pipes. The meter should not be used to straighten misaligned pipes because of the potential for damage to the meter. This is especially true when meters with plastic threads are installed in outdoor pits. Installing meters with plastic threads in outdoor-pit settings where the service lines are subject to continual misalignment due to ground shifting should be avoided unless a meter set or other specialty connectors are used.

Sec. A.8.3 Meter Installation Methods

To prevent cross-threading at installation, set the meter between the coupling nuts with the direction of flow through the meter corresponding to the direction of

*"Statements of Policy on Public Water Supply Matters: Grounding of Electric Circuits on Water Pipe." In *1989–1990 Officers and Committee Directory*, AWWA, Denver (1989).

†Available from the National Fire Protection Association, Quincy, MA 02171.

flow in the system. Engage the coupling nuts to the threaded meter ends. Check to ensure that the nuts are properly aligned to avoid cross-threading damage to the threaded meter ends.

An effective method for properly starting meter coupling nuts is to position the nuts squarely against the meter spud end. Turn the nut counterclockwise (in reverse) while holding the nut against the meter spud ends. When the first threads on both the coupling nut and the meter spud end coincide, a slight clicking or snap will be heard as the nut moves into the starting position. Turn the nut clockwise to complete the connection.

On plastic thread systems, avoid using pipe wrenches on the meter body itself. After the coupling nut has engaged the first thread of the meter, tighten the coupling nut clockwise by hand until it is tight, and then apply a partial turn with an open-end wrench. Do not overtighten. Pipe dope and sealants are not required or recommended. Soft rubber gaskets, rather than fiber or leather washers, are recommended for plastic thread systems.

Sec. A.8.4 Placing Meter in Service

After the line has been thoroughly flushed, open the shutoff valve slowly to pressurize the service line to the meter setting. Slowly open the inlet side valve, which will fill the meter with water. Check for leaks around the meter and connections. Open the meter outlet side valve slowly to pressurize the consumer side of the system. Open a consumer faucet slowly to allow entrapped air to escape. Turn off the faucet.

APPENDIX B
Future Revisions

This appendix is for information only and is not part of AWWA C700.

The AWWA Standards Committee on Water Meters considered revisions to AWWA C700 that are not included in this edition. Future editions of AWWA C700 may include a requirement to mark the size of individual meters on the dial face (Sec. 3.9).

American Water Works Association
ANSI/AWWA C702-86
(Revision of AWWA C702-78)

AWWA STANDARD

FOR

COLD-WATER METERS—COMPOUND TYPE

AMERICAN NATIONAL STANDARD

First edition approved by AWWA Board of Directors May 24, 1923.
This edition approved June 22, 1986.

Approved by American National Standards Institute, Inc., Jan. 9, 1987

AMERICAN WATER WORKS ASSOCIATION

6666 West Quincy Avenue, Denver, Colorado 80235

AWWA Standard

This document is an American Water Works Association (AWWA) standard. It is not a specification. AWWA standards describe minimum requirements and do not contain all of the engineering and administrative information normally contained in specifications. The AWWA standards usually contain options that must be evaluated by the user of the standard. Until each optional feature is specified by the user, the product or service is not fully defined. AWWA publication of a standard does not constitute endorsement of any product or product type, nor does AWWA test, certify, or approve any product. The use of AWWA standards is entirely voluntary. AWWA standards are intended to represent a consensus of the water supply industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed on the first page of the classified advertising section of the *Journal AWWA*. The action becomes effective on the first day of the month following the month of *Journal AWWA* publication of the official notice.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public; its existence does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review, and users are cautioned to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state on their own responsibility in advertising and promotional materials or on tags or labels that the goods are produced in conformity with particular American National Standards.

CAUTION NOTICE: The ANSI approval date on the front cover of this standard indicates completion of the ANSI approval process. This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018 (212) 354-3300.

Committee Personnel

The AWWA Subcommittee on Compound and Fire-Service Meters, which developed this standard, had the following personnel at the time:

King Moss II, *Chairman*
G.H. Swenson, *Vice-Chairman*
W.E. Evensen
James Kenny

The AWWA Standards Committee on Water Meters, which reviewed and approved this standard, had the following personnel at the time of approval:

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Donald Jackson, *Vice-Chairman*
D.J. Kullmann, *Secretary*

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* Alternate

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Foreword

This foreword is for information only and is not a part of AWWA C702.

I. History of Standard. The first compound-type water meter was developed in 1914 when it became evident that there was a need for a measuring device combining a valve with a small displacement-type bypass meter. The new meter would, by design, divert and register water at flow rates below the minimum flow-rate capability of the main water-line meter, which was usually of the turbine type.

Initially, standard meters of the turbine type and displacement type were assembled into units with suitable valves. Main-line meter cases were first made of cast iron, but after five or six years, some were made of bronze. In the field, meters were also converted to the compound type by the attachment of bypass meters and diversion valves.

Currently, some compound-type meters are made almost entirely of bronze in single main-line cases. Others, in all sizes, continue to be constructed with cast-iron cases. Some compound-type meters are assembled units, particularly those in large sizes. Compound-type meters have application in commercial, industrial, and institutional services where wide ranges of flow rates are encountered.

The first standard that covered compound-type meters was adopted by the New England Water Works Association (NEWWA) in March 1923 and by the American Water Works Association (AWWA) on May 24, 1923. Specifications were later revised and issued as AWWA C702-47 on July 25, 1947. A second revision was issued as AWWA C702-70 on Jan. 26, 1970, and a third revision was issued as AWWA C702-78 on Jan. 28, 1978.

II. Metrication. The tables in this standard are stated in US customary units. Throughout the body of the standard, rounded-off metric equivalents are set in parentheses next to the US customary units. Metric conversion factors are listed in Table F.1.

Table F.1 Metric Conversion Factors

US Customary Unit	Conversion Factor	Metric Equivalent
inch (in.)	× 25.4	millimetre (mm)
millimetre (mm)	× 0.03937	inch (in.)
US gallon (gal)	× 3.785412×10^{-3}	cubic metre (m^3)
cubic foot (ft^3)	× 2.831685×10^{-2}	cubic metre (m^3)
pounds per square inch (psi)	× 6.894757×10^{3}	pascal (Pa)
degree Fahrenheit (°F)	(°F-32) × 5/9	degree Celsius (°C)

III. Information Regarding Use of This Standard. When placing orders for meters manufactured in accordance with this standard, the purchaser should include specific information about the following in the supplementary specifications:

1. Standard used—that is, AWWA C702, Standard for Cold-Water Meters—Compound Type.
2. Whether an affidavit of compliance (Sec. 1.3), a certificate of testing accuracy (Sec. A.3.3), or both, are to be furnished.
3. Limitations on acceptable materials (Sec. 2.1), if any.
4. Restrictions on corrosion-resistance treatment process (Sec. 2.8), if any.
5. Sizes of meters (Sec. 3.1) and quantity required.
6. Length of filler piece (Sec. 3.3), if required.
7. Modifications of test specifications (Sec. 3.6) if operating water temperatures will exceed 80°F (27°C) (Sec. A.5.2).

8. Round or oval flanges on 2-in. (50-mm) meters (Sec. 4.3.1).

9. Whether companion flanges, gaskets, bolts, and nuts (Sec. 4.4) are to be furnished, and designation of flange material (Sec. 2.9) if other than cast iron is desired.

10. Whether or not main casing is to be furnished with tapped boss for field-testing purposes (Sec. 4.5).

11. Details of register to be furnished: US gallons, cubic feet, cubic metres, or other units; with or without center-sweep test hand; open or hermetically sealed (Sec. 4.6).

12. Whether or not an encoder-type register, direct-reading remote register, or an adaptor (Sec. 4.7) is required.

13. Whether or not meters are to be furnished with strainers (Sec. 4.14).

14. Special materials required, if any, to resist corrosion if water is highly aggressive (Sec. A.5.3).

IV. Major Revisions. The major changes made in this revision of the standard are

1. The spelling of the metric unit "metre" has been made where necessary throughout the standard.

2. All sections that refer to "synthetic polymer" have been changed to "engineering plastic."

3. The use of spring-loaded automatic valves has been incorporated into Sec. 2.10.

4. Round-reading registers, formerly described in Sec. 4.6.1, have been eliminated because they are no longer manufactured.

5. References to stuffing boxes in Sec. 4.7 and Sec. 4.11 have been eliminated.

6. Sec. 4.7 has been changed to include direct-reading remote-type registers (AWWA C706, Standard for Direct-Reading Remote Registration Systems for Cold-Water Meters).

American Water Works Association

AWWA C702-86
(Revision of AWWA C702-78)

AWWA STANDARD FOR

COLD-WATER METERS—COMPOUND TYPE

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard covers the various types and classes of cold-water compound-type meters in sizes 2 in. (50 mm) through 10 in. (250 mm) and the materials and workmanship used in their fabrication. Compound meters shall consist of a combination of a main-line meter of the turbine type for measuring high rates of flow and a bypass meter of appropriate size for measuring low rates of flow. The compound meter shall have an automatic valve mechanism for diverting low rates of flow through the bypass meter.

Sec. 1.2 References

This standard references the following documents. In their latest revision, they form a part of this standard to the extent specified herein. In case of conflict, the requirements of this standard shall prevail.

ANSI* B1.20.1—Pipe Threads, General Purpose (Inch) (ASME).

ANSI B16.1—Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.

AWWA C706—Standard for Direct-Reading Remote Registration Systems for Cold-Water Meters.

AWWA C707—Standard for Encoder-Type Remote-Registration Systems for Cold-Water Meters.

Sec. 1.3 Affidavit of Compliance

The purchaser may require an affidavit from the manufacturer or vendor that the meters furnished under the purchaser's order comply with all applicable requirements of this standard.

*American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

Sec. 1.4 Basis for Rejection

Meters not complying with all requirements of this standard and the purchaser's supplementary specifications shall be rejected.

1.4.1 *Rejected meters.* The manufacturer shall replace or satisfactorily repair all meters rejected for failure to comply with this standard.

1.4.2 *Workmanship and materials.* The manufacturer shall repair or replace, without charge, those parts in which defects have developed within a year of shipment. This shall be done on the return of the defective parts to the manufacturer or on proof of a defect; however, this warranty shall not apply if the meter has been modified with replacement parts not made by the manufacturer of the meter.

SECTION 2: MATERIALS

Sec. 2.1 Choice of Materials

Unless otherwise specified by the purchaser, the manufacturer may furnish any of the materials specified in each of the following subsections. The compositions of all alloys are subject to commercially accepted tolerances.

Sec. 2.2 Main Casings

Main casings shall be either of a copper alloy containing not less than 75 percent copper or of cast iron that is protected by a corrosion-resistant coating or other anticorrosion treatment.

Sec. 2.3 Register-Box Rings and Covers

Register-box rings and covers shall be made of a cast-copper alloy containing not less than 75 percent copper, forged or die cast-copper alloy containing not less than 57 percent copper, or a suitable engineering plastic.

Sec. 2.4 Measuring Cages or Chambers

Measuring cages or chambers shall be made of a copper alloy containing not less than 85 percent copper or of a suitable engineering plastic.

Sec. 2.5 Measuring Turbines and Discs

Turbines and discs shall be made of vulcanized hard rubber or suitable engineering plastic that shall be as near to the specific gravity of water as possible. They shall have sufficient dimensional stability to retain operating clearances at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.6 Disc and Turbine Spindles

Measuring-chamber spindles shall be made of phosphor bronze, stainless steel, monel, ceramic, or suitable engineering plastic.

Sec. 2.7 Intermediate Gear Trains

Frames, gears, and pinions of intermediate gear trains exposed to water shall be made of a copper alloy containing not less than 85 percent copper, or of other suitable noncorrosive metals, or of a suitable engineering plastic.

When not exposed to water, intermediate gear trains may be made of other suitable materials.

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When not exposed to water, intermediate gear trains may be made of other suitable materials.

Sec. 2.8 External Fasteners (Casing Bolts, Studs, Nuts, Screws, and Washers)

External fasteners shall be made of a copper alloy containing not less than 57 percent copper, or of stainless steel, or of steel treated to resist corrosion by a process acceptable to the purchaser. Fasteners for nonpressure assemblies may be made of a suitable engineering plastic.

Sec. 2.9 Companion Flanges

Companion flanges shall be made of cast iron or, when specified by the purchaser, of a copper alloy containing not less than 75 percent copper.

Sec. 2.10 Automatic Valves

The valve weights shall be of lead, or of a copper alloy containing not less than 75 percent copper, or of a copper-alloy shell loaded with lead. The valve and supplemental hinge pins or spindles shall be of a copper alloy containing not less than 75 percent copper, or of stainless steel, or of monel; and all valve and supplemental weight-hinge bearings shall be bushed with hard rubber, or with bronze, or with other suitable bushing material. If the valve contains a clapper, it shall be faced with a removable semihard seat. Valve seats shall be made of a copper alloy containing not less than 75 percent copper or shall be made of a suitable engineering plastic. If the meter has a spring-loaded automatic valve, the valve design shall meet all applicable elements of the above standard requirements.

SECTION 3: GENERAL DESIGN

Sec. 3.1 Size

The nominal sizes of meters (Table 1) shall be the same as the nominal sizes of the casing connections.

Sec. 3.2 Capacity

The nominal capacity ratings and the related pressure-loss limits shall be as shown in Table 1 for the safe maximum operating capacities.

Sec. 3.3 Length

Maximum overall lengths of the meters, face to face of spuds or flanges, shall not be greater than those shown in Table 2. A flanged spool may be used to increase the length of a shorter meter to meet this requirement.

Sec. 3.4 Pressure Requirement

Meters supplied under this standard shall operate without leakage or damage to any part at a working pressure of 150 psi (1050 kPa).

Sec. 3.5 Interior Parts

Meters shall be designed for easy removal of all interior parts without disturbing connections to the pipeline.

Sec. 3.6 Registration Accuracy

Meters shall meet the following requirements for accuracy with water at a temperature less than 80°F (27°C).

3.6.1 *Normal flow rate.* The meter shall register not less than 97 percent and not more than 103 percent of the water actually passed through it at any flow rate within the

Table 1 Operating Characteristics

Meter Size *in.*	Safe Maximum Operating Capacity *gpm*	Maximum Flow Rate for Continuous Duty *gpm*	Maximum Allowable Loss of Head at Safe Maximum Operating Capacity *psi*	Normal Test Flow Rate Limits *gpm*	Minimum Test Flow Rates *gpm*
2	160	80	20	2–160	¼
3	320	160	20	4–320	½
4	500	250	20	6–500	¾
6	1000	500	20	10–1000	1½
8	1600	800	20	16–1600	2
10	2300	1150	20	32–2300	4

Table 2 Meter Dimensions

Meter Size *in.*	Maximum Overall Length *in.*
2	29
3	38
4	40
6	52
8	56
10	68

Table 3 Changeover Flow Rates

Meter Size *in.*	Difference in Flow Rate *gpm*
2	20
3	30
4	30
6	40
8	75
10	100

normal test flow-rate limits specified in Table 1, except in the registration of flow rates within the changeover from bypass meter to main meter.

3.6.2 *Changeover flow rate.* The beginning of the changeover is when the accuracy of registration falls below 97 percent due to the operation of the automatic valve mechanism, and the end of the changeover is when the accuracy of registration again reaches 97 percent. The registration at these changeover flow rates shall not be less than 90 percent and not more than 103 percent. The difference in the flow rate at the beginning and at the end of the changeover shall not exceed the figures listed in Table 3.

3.6.3 *Minimum test flow rate.* Not less than 95 percent of actual flow shall be recorded when a test is made at the minimum test flow rate shown in Table 1.

Sec. 3.7 Markings

The size, model, and direction of flow through the meter shall be cast or stamped on the outer case of all meters. Meters composed of independent units in separate housings shall have this information cast or stamped on each unit.

3.7.1 *Register boxes.* The name of the manufacturer shall be permanently impressed on the lid of the register box. The serial number of the meter shall be imprinted on the lid.

SECTION 4: DETAILED DESIGN

Sec. 4.1 Main Case

All meters shall have outer cases with separate removable measuring chambers. Castings shall not be repaired in any manner. The inlet and outlet shall have a common axis. Connection flanges shall be parallel.

Sec. 4.2 External Case Screws, Bolts, Nuts, and Washers

All external screws, bolts, cap bolts, nuts, and washers shall be designed for easy removal after lengthy service.

Sec. 4.3 Main Case Connections

All main case connections shall be flanged. (See Table 4 for diameter and drilling.)

4.3.1 *2-in. meters.* The flanges for 2-in. (50-mm) meters shall be either oval or round, as specified by the purchaser, and shall be as shown in Table 4. The drilling of oval flanges shall be on the horizontal axis.

4.3.2 *Meters larger than 2-in.* The flanges for 3-in. (75-mm), 4-in. (100-mm), 6-in. (150-mm), 8-in. (200-mm), and 10-in. (250-mm) meters shall be of the round type, faced and drilled, and shall conform to ANSI B16.1 for cast-iron or bronze pipe flange, class 125.

Sec. 4.4 Companion Flanges

Companion flanges of the same size and type as the meter flanges, gaskets, bolts, and nuts shall be provided if specified by the purchaser. Round companion flanges shall be faced, drilled, and tapped in accordance with ANSI B1.20.1, and shall conform to ANSI B16.1 for cast-iron pipe flange, class 125. See Table 4 for diameter, drilling, and thickness specifications. Oval flanges shall be as shown in Table 4.

Sec. 4.5 Tapped Bosses

If required by the purchaser's supplementary specifications, meters shall be provided with tapped bosses on the top of the case near the outlet for field-testing purposes.

Sec. 4.6 Registers

Registers shall be straight reading subject to the limitations in this section and shall read in US gallons (gal), cubic feet (ft^3), cubic metres (m^3), or other units as specified by the purchaser. Except for those instances when test conditions require the use of a different register, the register shall be the same register that was on the meter when it was tested for accuracy.

4.6.1 *Straight-reading registers.* In straight-reading registers, the register lock and side gears shall be fastened securely to the number-wheel discs and hubs. The tumbler pinions shall mesh accurately, at the turnover points, with the lock and side gears of the adjacent number wheels. Both main and pinion shafts shall be secured in the register frame and/or register plates that they cannot get out of position. The pinion shaft shall be so designed that there is no possibility of its bending and allowing the pinion to skip at the turnover point. The numerals on the number wheels of straight-reading registers shall not be less than 5/16 in. (5 mm) in height and shall be readable at a 45° angle from the vertical.

Table 4 Physical Characteristics of Companion Flanges

Meter Size	Diameter of Bolt Hole Circle *in.*	Number of Bolt Holes	Diameter of Bolt Holes *in.*	Minimum Thickness	
				At Bolt Hole *in.*	At Hub *in.*
2 flange (oval)	4½	2	¾	⅝	⅞
2 flange	4¾	4	¾	⅝	⅞
3 flange	6	4	¾	¾	1 5/16
4 flange	7½	8	¾	15/16	1 5/16
6 flange	9½	8	⅞	1	1 9/16
8 flange	11¾	8	⅞	1⅛	1¼
10 flange	14¼	12	1	1 1/16	1 15/16

4.6.2 *Hermetically sealed registers.* If the register is hermetically sealed, gears and pinions shall run free on fixed shafts or be fixed on shafts that run free in the register frame and/or register plates, and shall be constructed so that they cannot be unmeshed.

4.6.3 *Test circles.* Registers shall have a test circle that shall be divided into 10 equal parts. Registers with a center-sweep test hand shall have the test circle located on the periphery of the register and graduated in 100 equal parts, each tenth graduation numbered. The maximum quantity indicated by a single revolution of the test hand and the minimum capacity of the register shall be as listed in Table 5.

Table 5 Maximum Indication on Test Circle and Minimum Register Capacity

	Main Unit			
Meter Size *in.*	Maximum Allowable Indication on Test Circle		Minimum Allowable Capacity of Register (in millions)	
	ft³	*gal*	*ft³*	*gal*
2	10	100	10	100
3	10	100	10	100
4	100	1000	10	100
6	100	1000	100	1000
8	1000	10 000	100	1000
10	1000	10 000	100	1000

4.6.3.1 The maximum indication on the test circle and the minimum register capacity of the bypass unit shall be in accordance with the AWWA standard for the type of meter used as the bypass unit.

4.6.4 *AWWA standard straight-reading register.* A new model of meter, as distinguished from modifications of existing models, supplied under this standard shall be equipped with an AWWA standard straight-reading register. The register shall be of the center-sweep test-hand type with the test circle located on the periphery of the register and graduated in 100 equal parts, each tenth graduation numbered. Registration construction shall conform in all other details to the previously mentioned requirements.

4.6.5 *Coordinator registers.* The meter may be equipped with a coordinator so that the readings of both sections can record on a single register. The register construction shall conform to the previously mentioned requirements; the maximum quantity indicated by a single revolution of the test hand and the minimum capacity of the register shall be as listed in Table 5.

Sec. 4.7 Register Boxes

The lid shall be recessed and shall overlap the register box to protect the lens. The lens shall be held securely in place. When the intermediate gear train is located in the register compartment, the register compartment shall be sealed. If a meter is equipped with a hood, the register-box lid may be omitted, in which case the serial number shall be imprinted on the hood. Provision shall be made to adapt direct-reading remote-type registers (AWWA C706) or encoder-type registers (AWWA C707) if required by the purchaser's supplementary specifications.

Sec. 4.8 Intermediate Gear Trains

Intermediate gear trains may be mounted on the measuring chamber or cage or in the main casings. When not exposed to water, they may also be combined with or mounted adjacent to the register gearing. Gear trains exposed to water shall be of the oil-enclosed

type, shall have separate housings or shall form housings with the main casings or measuring chambers, and shall operate in a suitable lubricant. Gear trains made of corrosion-resistant metals or engineering plastics may be exposed to water.

Sec. 4.9 Measuring Chambers or Cages

The main-line section chambers or cages shall be self-contained units firmly seated and easily detached and removed from the main case. Chambers or cages with turbines that have revolving spindles shall have removable bearings for such spindles. Chambers or cages with stationary spindles on which the turbines revolve shall provide rigid, centrally located fasteners for the spindles. The spindles shall be removable. The main-line section chambers or cages shall be interchangeable in all meters of the same size, make, and model.

4.9.1 *Bypass chamber.* The bypass-section chamber shall be of a type covered by an AWWA standard. The chamber shall be a self-contained unit, firmly seated and easily removed from the case, and shall not be cast as part of the outer case. The chamber shall be secured in position in the outer case so that any slight distortion of the case that might occur under 150-psi (1050-kPa) pressure will not affect the accuracy of the meter.

Sec 4.10 Measuring Turbines and Discs

Measuring turbines that have revolving spindles shall rotate on spindles supported by bushings or replaceable bearings. Turbines that rotate on stationary spindles shall also have bushings or replaceable bearings. The plates of disc pistons, whether flat or conical, shall have metal reinforcements or shall be equipped with thrust rollers.

Sec. 4.11 Magnetic Couplings

When intermediate gear trains are located in the water compartment of the main or bypass section of the meter, the revolutions of the train output spindles shall be transmitted to the registers by means of magnetic couplings through the meter case. When intermediate gear trains are located in the register compartments, the revolutions shall also be transmitted by magnetic couplings.

Sec. 4.12 Automatic Valves

The automatic valve shall be of a type suitable for such purpose. It shall close by force. The weight of the valve and any supplemental force imposed on it shall offer sufficient resistance to the incoming water to divert all small rates of flow through the bypass meter until such time as the flow rate through the meter is great enough to ensure efficient operation of the main measuring section. Valve hinge pins or spindles shall be bushed. Valve seats shall have a satisfactory width of face and shall be held firmly in place. A clapper or swing-type valve shall be provided with a removable, semihard seat.

Sec. 4.13 Bypass Meter

The physical and operating characteristics and dimensions of the bypass meter shall be in accordance with the AWWA standard for the type of meter used as the bypass.

Sec. 4.14 Strainers

Meters may be provided with strainers. Strainers, if provided, shall be rigid, shall be easily removed, and shall have an effective straining area at least double that of the main-case water inlet.

Sec. 4.15 Seal-Wire Holes

Register-box screws shall be drilled for seal wires. Seal-wire holes shall be not less than 3/32 in. (2 mm) in diameter.

APPENDIX A

General Meter Information

This appendix is for information only and is not a part of AWWA C702.

SECTION A.1: UNITS OF MEASUREMENT

The majority of water meters presently in service in the United States register in either US gallons or cubic feet. With the adoption of the metric system, users may now determine which unit of measure best satisfies their needs from the three available types of registration —US gallons, cubic feet, or cubic metres.

SECTION A.2: REGISTER TYPES

Water-meter registers may be of the straight-reading or round-reading type. Although the round-reading register is no longer manufactured, many are still used by various water utility systems. The round-reading type is more often misread, and the problem is further complicated if more than one make of meter is used in a single water system. It is also more difficult to print postcards for customers to read when two or more makes of meters with round-reading registers are used. It is recommended that the straight-reading type of register be adopted as standard to eliminate these difficulties.

SECTION A.3: TESTS

Sec. A.3.1 Capacity and Pressure-Loss Tests

Capacity tests are tests of the design of a meter. When a meter of each size of a given design has once been tested for capacity, it should not be necessary to test others of the same type. The pressure loss should be determined by the use of two identical piezometer rings of the same diameter as the nominal size of the meter that is being tested. The piezometer rings must be free from any burrs where the holes are drilled through the wall of the ring; no fewer than four holes should be provided, drilled in pairs on diameters at right angles to each other. The inlet ring should be set close to the meter at a distance of eight diameters or more below the nearest upstream stop valve or fitting, and the outlet ring should be placed at a distance of between 8 and 10 diameters from the outlet of the meter. The diameter of the inlet and outlet pipe should be the same as the nominal size of the meter to be tested. The rings are to be connected to a mercury U tube by rubber or metallic tubing and equipped with an accurate, adjustable scale for measuring the difference in mercury level. Provision should be made for the complete removal of air from the U tube and tubing, and the installation should be such that air will rise to the air outlets. If measurements are to be made at relatively high flow rates, it will be necessary to read both sides of the mercury column simultaneously to compensate for irregularities in the diameter of the glass U tube and to avoid errors due to fluctuations. The pressure loss of inlet and outlet piping from meter to piezometer rings shall be deducted in determining the meter pressure loss.

maximum rates of flow at which water should be passed through the meters for short periods of time. They are the peak loads that the meters should undergo only at infrequent intervals and would be destructive if continuous. For continuous 24-h service, compound-type meters should not be operated at flows greater than those shown in AWWA C702, Table 1, column 3.

Sec. A.5.2 Temperature Extremes

Cold-water meters are not affected by temperatures up to about 80°F (27°C). For temperatures higher than 80°F (27°C), meters with slightly larger clearances than usual should be used, and the accuracy limits set forth in AWWA C702, Sec. 3.6 may have to be modified accordingly. Excessively high temperatures can cause expansion of the turbine and piston or disc, creating unusual friction or causing the parts to bind in their chambers. The result will be slippage and underregistration or complete stoppage of the meter. Low temperatures have no noticeable effect on the working parts of the meter; however, if the water freezes, damage to the meter will certainly occur. To avoid complications caused by temperature extremes, meters should be placed at locations where they will be protected from heat and frost. If the authority having jurisdiction so requires, at locations where hot water from heating systems is not allowed to expand back through the meter, a backflow prevention device consistent with the degree of hazard and a pressure-and-temperature relief valve should be installed sufficiently downstream of the meter.

Sec. A.5.3 Corrosion

All metals used in the construction of a meter will be affected by the corrosive action of water, although the action is very slow with most potable waters. It should be recognized, however, that when meters are used in highly aggressive waters, it may be necessary to use materials that are more resistant to attack. The solution of the corrosion problem requires a high degree of experience and knowledge, and the meter manufacturer should be consulted under such circumstances for assistance.

Sec. A.5.4 Materials in Suspension

Foreign material carried in suspension has a tendency to fill the spaces between the turbine vanes and cause overregistration. Such overregistration is not limited to turbine-type meters. Meter installations provided with strainers should retain the larger particles in suspension, but the strainer will soon become clogged if the water is not kept reasonably free of suspended matter. A partially clogged strainer can cause uneven flow distribution through the meter, with resultant error in registration.

SECTION A.6: PERIODIC TESTS

Meters properly selected as to size and type should give satisfactory service over a long period of time without attention, if operated under ideal conditions. Under ordinary conditions, meters must be given some care if they are to function properly. In most cases, it is impossible to ascertain without an actual test whether a meter in service is registering with the required degree of accuracy. Consequently, to ensure reliable meter measurements, it is essential that all meters be tested periodically. The interval between tests must be governed largely by local conditions. Many state regulatory agencies specify intervals between tests, on both a time and quantity basis. Under average conditions, the intervals between tests should not exceed the limits as set forth in Table A.1.

Table A.1 Average Recommended Interval Between Meter Tests

Meter Size *in.*	Interval Between Tests* *years*
2	4
3	3
4	2
6	1
8	1
10	1

*Based on normal usage and conditions. Sec. A.5 of this appendix should be reviewed in its entirety prior to establishing test-year intervals for the individual utility.

SECTION A.7: METER STORAGE

Meters should be stored in a location that will not be subject to unduly high or low temperatures.

SECTION A.8: BYPASS SHUTOFF VALVES

Shutoff valves may be installed on the inlet and outlet ends of the bypass metering section for the purpose of removing the bypass chamber without interrupting flow through the main section of the meter.

SECTION A.9: SERVICE BYPASS AROUND METER

A service bypass around the meter on a large meter installation is recommended. The bypass should be sized to at least satisfy the minimum demand of the consumer.

American Water Works Association
ANSI/ AWWA C701-88
(Revision of ANSI/AWWA C701-78)

AWWA STANDARD

FOR

COLD-WATER METERS—TURBINE TYPE, FOR CUSTOMER SERVICE

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John P. Sullivan Jr.
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Contents

Foreword

This foreword is for information only and is not a part of AWWA C701.

I. History of Standard. A booklet published in Hamburg, Germany, in 1790 by Benjamin Gottlob Hoffman described a form of current meter developed by Reinard Woltman that may be considered to be the first practical meter for measuring flowing air and water. Originally, it was thought that the meter could not be adapted for use in enclosed pipe. However, through substantial changes in design and construction, the present current meter evolved.

The first AWWA specifications for water meters of various types were published in 1923. These were revised in later years, and the first standard that dealt solely with current type meters was approved July 25, 1947. It was AWWA C701-47, Standard Specifications for Cold-Water Meters—Current Type. The standard was revised in 1970 and designated AWWA C701-70, Standard for Cold-Water Meters—Turbine Type for Customer Service.

Between 1923 and 1947 the propeller-type current meter was developed for pump-station discharge, irrigation, and main line measurement. This meter differs from the original design in that it does not use a measuring cage around the turbine. The propeller operates directly within the pipeline itself or within the main meter body. The propeller-type meters had operating characteristics different from current-type meters; these differences led to the development of AWWA C704-50, Standard Specifications for Cold-Water Meters—Current Type, Propeller Driven. This standard was revised in 1970 and designated as AWWA C704-70, Standard for Cold-Water Meters—Propeller Type for Main Line Applications. The 1970 version was reaffirmed without revision in 1975 and 1984.

The 1978 revision of AWWA C701 included an added distinction between class I and class II types of turbine meters. Class I meters are those previously covered by AWWA C701-70 and class II meters are the newer in-line high-velocity type characterized by lower head loss, greater low-flow sensitivity, and tighter accuracy tolerances over a wider flow range. Details of the performance differences are listed in Table 1 of AWWA C701.

II. Information Regarding Use of This Standard. This standard provides for several options and alternatives that the purchaser must specify if choosing to exercise the options or if there is a preference among the alternatives. In addition, several items must be specified by the purchaser to describe completely the type, size, quantity, and other characteristics of the meters required. All such items, options, and alternatives are summarized in the following list. The purchaser should review each item in the list and then make the appropriate provisions in the supplementary specifications to describe specific requirements.

1. Standard used—that is, AWWA C701, Standard for Cold-Water Meters—Turbine Type, for Customer Service.
2. Meter class—class I or class II (Sec. 1.1).
3. Whether an affidavit of compliance (Sec. 1.4) and certificate of testing for accuracy (Sec. A.3.3) are required.
4. Whether a specific warranty is to be required (Sec. 1.5).
5. Whether pressure castings (main casings) are to be made of copper alloy or of cast iron treated for corrosion resistance (Sec. 2.2), and whether there is a

Table F.1 Metric Conversion Factors

US Customary Unit	Conversion Factor	Metric Equivalent
inches (in.)	× 25.4	= millimetres (mm)
gallons (gal)	× 3.785412×10^{-3}	= cubic metres (m^3)
cubic feet (ft^3)	× 2.831685×10^{-2}	= cubic metres (m^3)
pounds per square inch (psi)	× 6.894757	= kilopascals (kPa)
pounds per square inch (psi)	× 6.894757×10^{-3}	= megapascals (MPa)
degrees Fahrenheit (°F)	− 32 × 5/9	= degrees celsius (°C)

preference for the materials specified for the various meter components (Sec. 2.3 through Sec. 2.10).

6. Size of meter (Sec. 3.1 and Tables 1 and 2) and quantity required.

7. Type of connections for 1½-in. and 2-in. meters, whether couplings (tailpieces) are to be furnished on meters with spuds, and whether round or oval flanges are required on flanged meters (Sec. 4.3.1).

8. Whether companion flanges, gaskets, bolts, and nuts (Sec. 4.4) are to be furnished with flanged meters.

9. Details of register (Sec. 4.5) to be furnished, including
   a. unit of measure—US gallons, cubic feet, cubic metres, or other.
   b. position—permanently sealed or open.
   c. test hand—with or without sweep test hand.

10. Whether a direct-reading remote register or an encoder-type register is required (Sec. 4.6).

11. Special materials required, if any, to resist corrosion if water is highly aggressive (Sec. A.5.3).

III. Major Revisions. The major changes from the 1978 standard made in this revision are:

1. A definitions section has been added (Sec. 1.2).
2. Sec. 1.5.2 now states that AWWA standards do not include warranties.
3. References to hermetically sealed registers have been modified to list permanent seals (Sec. 4.5).
4. Sec. 4.10 now refers to tamper-resistant features rather than just seal-wire holes.
5. The appendix attached to AWWA C701 has been updated.
6. The term *engineering plastic* replaces the term *synthetic polymer* throughout the standard.
7. Numerous modifications to conform to modern AWWA form and content have been added.
8. Metric units have been included where appropriate. Conversion factors are listed in Table F.1.

American Water Works Association

AWWA C701-88
(Revision of ANSI/AWWA C701-78)

AWWA STANDARD FOR

COLD-WATER METERS—TURBINE TYPE, FOR CUSTOMER SERVICE

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard covers the various classes of cold-water turbine meters in sizes $1^1/_2$ in. through 12 in. for water works customer service and the materials and workmanship employed in their fabrication. The turbine meters covered by this standard are divided into class I and class II meters. Both classes of meters register by recording the revolutions of a turbine set in motion by the force of flowing water striking its blades.

1.1.1 *Class I.* Class I meters are the vertical-shaft and low-velocity, horizontal-shaft models.

1.1.2 *Class II.* Class II meters are the in-line, horizontal-axis, high-velocity-type turbines characterized by lower head loss and a wider normal operating flow range than class I models.

Sec. 1.2 Definitions

In this standard the following definitions shall apply:

1.2.1 *Manufacturer*: The party that manufactures or produces the meter covered by this standard.

1.2.2 *Purchaser*: The party entering into a contract or agreement for the purchase of meters in accordance with the provisions of this standard.

1.2.3 *Vendor*: The party entering into a contract or agreement to supply water meters according to the provisions of this standard; the seller. A vendor may or may not be the manufacturer.

Sec. 1.3 References

This standard references the following documents. In their latest revision, they form a part of this standard to the extent specified herein. In any case of conflict, the requirements of this standard shall prevail.

ANSI* B16.1—Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.

ANSI/ASME† B1.20.1—General Purpose Pipe Threads (Inch).

AWWA C706—Standard for Direct-Reading Remote-Registration Systems for Cold-Water Meters.

AWWA C707—Standard for Encoder-Type Remote-Registration Systems for Cold-Water Meters.

Sec. 1.4 Affidavit of Compliance

The purchaser may require, in supplemental specifications, an affidavit from the manufacturer or vendor that the meters furnished in accordance with the purchase order comply with all applicable requirements of this standard.

Sec. 1.5 Basis for Rejection

Meters that do not comply with all requirements of this standard and the purchaser's supplementary specifications shall be rejected.

1.5.1 *Rejected meters.* The manufacturer shall bear all expenses of replacing or satisfactorily correcting all meters rejected for failure to comply with this standard.

1.5.2 *Workmanship and materials.* The manufacturer shall repair or replace, without charge, those unmodified parts in which a defect has developed within a year's time of shipment, on their return to the manufacturer or on proper proof of a defect. AWWA standards do not contain details on manufacturers' warranties. Purchasers should review warranties offered by meter manufacturers and consider applicable implied warranty protection provided by individual state statute.

SECTION 2: MATERIALS

Sec. 2.1 Choice of Materials

Unless otherwise specified by the purchaser, the manufacturer may furnish any of the materials specified in each of the following subsections (Sec. 2.2 through Sec. 2.10). The composition of all alloys in this section are subject to commercially accepted tolerances.

Sec. 2.2 Pressure Castings (Main Casings)

Main casings shall be of either a copper alloy containing not less than 75 percent copper; or of cast iron protected by a corrosion-resistant coating; or have other corrosion-resistant treatment, as specified by the purchaser.

---

*American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

†American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

Sec. 2.3 Register-Box Rings and Covers

Register-box rings and covers shall be made of a copper alloy containing not less than 57 percent copper or of a suitable engineering plastic.

Sec. 2.4 Measuring Cages or Chambers

Measuring cages or chambers shall be made of a copper alloy containing not less than 85 percent copper or of a suitable engineering plastic.

Sec. 2.5 Measuring Turbines

Turbines shall be made of vulcanized hard rubber or suitable engineering plastic having sufficient rigidity and strength to operate at the rated capacity of the meter. The material shall have a specific gravity as near as possible to that of water. Turbines shall have sufficient dimensional stability to retain working dimensions at working temperatures up to 80°F (27°C) and shall not warp or deform when exposed to operating temperatures of 100°F (38°C).

Sec. 2.6 Turbine Spindles

Turbine spindles shall be made of phosphor bronze, stainless steel, monel, or other suitable corrosion-resistant material.

Sec. 2.7 Intermediate Gear Trains

Intermediate gear trains exposed to water shall be made of a copper alloy containing not less than 85 percent copper; or of other suitable corrosion-resistant metals; or of a suitable engineering plastic. If not to be exposed to water, intermediate gear trains may be made of other suitable materials.

Sec. 2.8 External Fasteners (Casing Bolts, Nuts, Screws, and Washers)

Casing bolts, nuts, screws, and washers shall be made of a copper alloy containing not less than 75 percent copper; or of stainless steel; or of steel treated to resist corrosion by a process to be approved by the purchaser. Fasteners for nonpressure assemblies may be made of a suitable engineering plastic.

Sec. 2.9 Coupling Tailpieces and Nuts

Coupling tailpieces and nuts shall be made of a copper alloy containing not less than 75 percent copper.

Sec. 2.10 Companion Flanges

Companion flanges shall be made of cast iron or, when so specified by the purchaser, of a copper alloy containing not less than 75 percent copper.

SECTION 3: GENERAL DESIGN

Sec. 3.1 Size

The nominal sizes of meters (see Table 1) shall be the same as the nominal sizes of the casing connections.

Table 1 Operating Characteristics

Nominal Meter Size *in.*	Safe Maximum Operating Capacity *gpm*	Maximum Rate for Continuous Duty *gpm*	Maximum Loss of Head at Safe Maximum Operating Capacity* *psi*	Normal Test-Flow Limits *gpm*
Class I—Vertical-Shaft and Low-Velocity Horizontal Type				
1½	100	50	15	12–80
2	160	80	15	16–120
3	350	175	15	24–250
4	600	300	15	40–400
6	1250	625	15	80–1000
8	1800	900	15	140–1600
10	2900	1450	15	225–2500
12	4300	2150	15	400–4000
Class II—In-Line (High-Velocity) Type				
2	160	100	7	4–160
3	350	240	7	8–350
4	630	420	7	15–630
6	1400	920	7	30–1400
8	2400	1600	7	50–2400
10	3800	2500	7	75–3800
12	5000	3300	7	120–5000

*Does not include strainer, which may be required in some applications.

Sec. 3.2 Capacity

The nominal capacity ratings and the related pressure-loss limits shall be the same as those shown in Table 1 for the safe maximum operating capacities.

Sec. 3.3 Length, Width, and Height

Maximum overall meter length, face to face of spuds or flanges, shall not be greater than shown in Table 2. A filler piece may be used to increase the length of a shorter meter to meet this requirement. Meter width and height shall not be greater than shown in Table 2. The distance from the centerline of the meter outlet to the lowest point on the meter bottom shall not be greater than shown in Table 2.

Sec. 3.4 Test Plugs

The test plug is optional for the manufacturer.

Sec. 3.5 Pressure Requirement

Meters supplied under this standard shall operate without leakage or damage to any part when operated continuously at a working pressure of 150 psi (1050 kPa).

Sec. 3.6 Accessibility

Meters shall be designed for easy removal of all interior parts without disturbing the connections to the pipeline. Straightening vanes need not be removable while the meter case is still connected in line.

Table 2 Meter Dimensions for Class I and Class II Turbine-Type Meters

Meter Size in.	Maximum Dimensions			
	Length in.	Width in.	Height in.	Centerline of Outlets to Base in.
1 1/2 (screw)	12 3/4	9	17	6 1/2
1 1/2 (flange)	13	9	17	6 1/2
2 (screw)	15 1/2	9 1/2	20	8 1/2
2 (flange)	18	9 1/2	20	8 1/2
3	24	14	28	13 1/2
4	29	15 1/2	28	14
6	36 1/2	21	31	15 1/2
8	43 3/4	27 1/2	31	16
10	60	29	35	20 1/2
12	68	31	42	21

Sec. 3.7 Registration Accuracy

Meters shall meet the following requirements for accuracy with water at a temperature less than 80°F (27°C).

3.7.1 *Class I.* Class I meters shall register not less than 98 percent and not more than 102 percent of the water that actually passes through at any rate of flow within the normal test flow limits set forth in Table 1.

3.7.2 *Class II.* Class II meters shall register not less than 98.5 percent and not more than 101.5 percent of the water that actually passes through at any rate of flow within the normal test flow limits set forth in Table 1.

Sec. 3.8 Markings

The size, model, and direction of flow through the meter shall be cast on the outer case. Meters that conform to AWWA class II shall have this designation and the meter serial number permanently indicated on the external surface of the meter.

3.8.1 *Register boxes.* The name of the manufacturer shall be cast in the lid of the register box. The serial number of the meter shall be imprinted on the lid. If the lid is omitted because the meter is equipped with a remote register, the serial number shall be imprinted on the upper main-case cover.

SECTION 4: DETAILED DESIGN

Sec. 4.1 Main Case

All meters shall have an outer case with a separate, removable measuring chamber or cage in which the turbine operates. Castings shall not be repaired in any manner. The inlet and outlet shall have a common axis. Connection flanges shall be parallel.

Table 3 Meter Connections—Companion-Flange Dimensions

Meter Size *in.*	Meter Coupling Tailpiece Length *in.*	Bolt Hole Circle Diameter *in.*	Number of Bolt Holes	Bolt Hole Diameter *in.*	Minimum Thickness—*in.* At Bolt Hole	Minimum Thickness—*in.* At Hub
1 1/2 (flanged oval)	—	4	2	5/8	9/16	13/16
1 1/2 (screw)	2 7/8	—	—	—	—	—
2 (flanged oval)	—	4 1/2	2	3/4	5/8	7/8
2 (flanged round)	—	4 3/4	4	3/4	5/8	7/8
2 (screw)	3	—	—	—	—	—
3		6	4	3/4	3/4	1 3/16
4		7 1/2	8	3/4	15/16	1 5/16
6		9 1/2	8	7/8	1	1 9/16
8		11 3/4	8	7/8	1 1/8	1 3/4
10		14 1/4	12	1	1 3/16	1 15/16
12		17	12	1	1 1/4	2 3/16

Sec. 4.2 External-Case Screws, Bolts, Nuts, and Washers

All external screws, bolts, cap bolts, nuts, and washers shall be designed for easy removal after long service.

Sec. 4.3 Main-Case Connections

4.3.1 *1 1/2-in. and 2-in. meters.* Main case connections for 1 1/2-in. and 2-in. meters shall be either spuds on both ends or flanges on both ends, as required by the purchaser's supplementary specifications.

4.3.1.1 Meter spuds shall be tapped 1 1/2 in. and 2 in., as required, with ANSI/ASME B1.20.1 internal-taper pipe thread.

4.3.1.2 Flanged connections shall be faced and drilled and shall be of the round or oval type, as required by the purchaser's supplementary specifications. The number of bolt holes and the diameter of the bolt holes and bolt circle shall be as set forth in Table 3.

4.3.1.3 Meter couplings (tailpieces) shall be provided if required by the purchaser's supplementary specifications.

4.3.2 *3-, 4-, 6-, 8-, 10-, and 12-in. meters.* Main-case connections for 3-, 4-, 6-, 8-, 10-, and 12-in. meters shall be flanges. The flanges shall be of the round type, faced and drilled, and shall conform to ANSI B16.1 cast-iron pipe flange, class 125. (ANSI/AWWA C115/A21.15* flanges also match class 125 ANSI B16.1 flanges.) See Table 3 for diameter and drilling.

Sec. 4.4 Companion Flanges

Companion flanges, gaskets, bolts, and nuts shall be provided if required by the purchaser's supplementary specifications. Dimensions shall conform to Table 3.

*ANSI/AWWA C115/A21.15, American National Standard for Flanged Ductile-Iron and Gray-Iron Pipe With Threaded Flanges.

4.4.1 *1 1/2-in. and 2-in. meters.* Companion flanges shall be faced, drilled, and tapped, 1 1/2 in. or 2 in., as required, with ANSI/ASME B1.20.1 internal-taper pipe thread.

4.4.2 *3-, 4-, 6-, 8-, 10-, and 12-in. meters.* Companion flanges shall be faced, drilled, and tapped with ANSI/ASME B1.20.1 cast-iron pipe thread and shall conform to ANSI B16.1 cast-iron pipe flange, class 125. (ANSI/AWWA C115/A21.15 flanges also match class 125 ANSI B16.1 flanges).

Sec. 4.5 Registers

Unless the requirements of Sec. 4.5.2 apply, registers shall be straight-reading, either permanently sealed by the manufacturer or open, and shall read in US gallons, cubic feet, cubic metres, or other units, as specified by the purchaser. The register mechanism shall not be in contact with the water that is being measured.

4.5.1 *Register odometers.* The numerals on the odometer wheels shall not be less than 3/16 in. in height and should be readable at a 45°angle from the vertical.

4.5.1.1 The register lock and side gears shall be fastened securely to the odometer wheel discs and hubs. The tumbler pinions shall mesh accurately at the turnover points with the lock and side gears of the adjacent odometer wheels. Both main and pinion shafts shall be so secured in the register frame, register plates, or both that they cannot come out of position. The pinion shaft shall be so designed that there is no possibility of its bending and allowing the pinion to skip at the turnover point.

4.5.1.2 If the register is permanently sealed, gears and pinions shall run free on fixed shafts or shall be fixed on shafts that run free in the register frame, register plates, or both, and they shall be constructed so that they cannot become unmeshed. Pinions may operate between odometer wheels mounted in partition plates.

4.5.1.3 The maximum indication of digits appearing on the first odometer wheel and the minimum capacity of the register shall conform to Table 4.

4.5.1.4 The register shall have a test index circle, which shall be divided into 10 equal parts. The hand or pointer shall taper to a sharp point and shall be accurately set and securely held in place.

4.5.1.5 If registers are furnished with center-sweep test hands, then there shall be an index circle located near the periphery of the register and graduated into

Table 4 Maximum Indication on Initial Dial and Minimum Register Capacity

Meter Size	Maximum Allowable Indication on Initial Dial			Minimum Allowable Capacity of Register (millions)		
in.	ft^3	*gal*	m^3	ft^3	*gal*	m^3
1 1/2	10	100	1	10	100	.1
2	10	100	1	10	100	.1
3	10	100	1	10	100	.1
4	100	1000	10	10	100	1
6	100	1000	10	100	1000	1
8	1000	10,000	100	100	1000	10
10	1000	10,000	100	1000	1000	10
12	1000	10,000	100	1000	10,000	10

100 equal parts, each tenth graduation being numbered. The hand or pointer shall taper to a point and shall be accurately set and securely held in place. The quantities indicated by a single revolution of the test hand shall be those shown in Table 4 for initial dial.

4.5.2 *Standard straight-reading register.* A new model of meter, as distinguished from modifications of existing models first supplied under this standard in 1978 or thereafter, shall be equipped with a straight-reading register of the center-sweep test-hand type, with the test circle located on the periphery of the register and graduated in 100 equal parts, each tenth graduation being numbered. Register construction shall conform to all applicable requirements of Sec. 4.5.1.

Sec. 4.6 Register Boxes

The lid shall be recessed and shall overlap the register box to protect the lens. The lens shall be securely held in place. All compartments of meters that have stuffing boxes exposed to the atmosphere shall be provided with 1/8-in. diameter drain holes. When a meter is equipped with a remote register, the register-box lid may be omitted. Provision shall be made to adapt encoder-type registers per AWWA C707 or direct-reading remote-type registers per AWWA C706, if such registers are required by the purchaser's supplementary specifications.

Sec. 4.7 Intermediate Gear Trains

Intermediate gear trains may be mounted on the measuring chamber or cage or in the main casing. When not exposed to water, they may be combined with or adjacent to the register gearing. Intermediate gear trains located in the line of flow shall be of the oil-enclosed type or shall be constructed of self-lubricating materials. They shall have separate housings or shall form housings with the main casing or measuring chamber and shall operate in a suitable lubricant.

Sec. 4.8 Measuring Chambers or Cages

The measuring chambers or cages shall be self-contained units, firmly seated and easily detached and removed from the main case. Chambers or cages with turbines that have revolving spindles shall have removable bearings. Chambers or cages with stationary spindles on which the turbine revolves shall have rigid, centrally located fastenings for the spindles and bushings or the bearings shall be replaceable.

Sec. 4.9 Strainers

Meters may be provided with strainers. Strainers, if provided, shall be rigid, easily removable, and have an effective straining area at least double that of the meter main-case inlets.

Sec. 4.10 Tamper-Resistant Features

Register-box screws, locking pins, main-case top, adjustment vanes, and inlet and outlet coupling nuts, if furnished, shall be equipped with tamper-resistant features. If drilled for seal wires, seal-wire holes shall not be less than 3/32-in. in diameter.

APPENDIX A
Supplemental Information

This appendix is for information only and is not a part of AWWA C701.

SECTION A.1: UNITS OF MEASUREMENT

The majority of water meters currently in service in the United States register in either US gallons or cubic feet. With the availability of the metric system, the user now may select from three units of measure—US gallons, cubic feet, or cubic metres.

SECTION A.2: REGISTER TYPES

Water-meter registers must be of the straight-reading (odometer) type on new meters. Although the round-reading register is no longer manufactured, many are still in use throughout the country in various water utilities.

The round-reading register is more often misread than the straight-reading register, and the problem is further complicated if more than one make of meter is used in a single water system. It is also more difficult to print postcards for customers to record meter readings when two or more makes of meters with round-reading registers are used. It is recommended that the straight-reading (odometer) type of register be adopted as standard to eliminate these difficulties.

SECTION A.3: TESTS

Sec. A.3.1 Capacity and Pressure-Loss Tests

Capacity tests are tests of the design of a meter. Once a meter of each size of a given design has been tested for pressure loss at safe maximum operating capacity, it should not be necessary to test others of the same design. If a strainer is included in the meter assembly, care should be taken to account for additional pressure loss through the strainer, which is in addition to the pressure loss through the meter.

The pressure loss should be determined using two identical piezometer rings of the same diameter as the nominal size of the meter being tested. The piezometer rings must be free from any burrs where the holes are drilled through the wall of the ring. No fewer than four holes should be provided, drilled in pairs on diameters at right angles to each other. The inlet ring should be set close to the meter at a distance of eight diameters or more below the nearest upstream stop valve or fitting. The outlet ring should be placed at a distance of 8–10 diameters from the outlet of the meter. The diameter of the inlet and outlet pipe should be the same as the

nominal size of the meter to be tested. The rings are to be connected to a suitable DP cell or manometer with measurement capability of 0.1 psi. If a manometer is used, provisions should be made for the complete removal of air from the apparatus, and the installation should be such that air will rise to the air outlets.

Provisions must be made for traps to prevent accidental expulsion of mercury into the test line when using mercury manometers. If measurements of U-tube manometers are to be made at relatively high flow rates, then it is necessary to read both sides of the manometer column simultaneously to compensate for irregularities in the diameter of the manometer U tube, and to avoid errors caused by fluctuations. (Other appropriate types of manometers may be used.) The pressure loss of inlet and outlet piping from meter to piezometer rings shall be deducted in determining meter pressure loss.

Sec. A.3.2 Pressure Tests

A pressure test should be made on each size of a particular design of meter furnished. The test pressure should be 300 psi (2100 kPa) static, which may be produced by use of a hand pump or any other available device. The meter should be tested for accuracy before and after it has been pressure tested to determine whether there has been any distortion that could affect the registration. If satisfactory results are obtained, it is unnecessary to make more than one pressure test on each size of a given design of meter.

Sec. A.3.3 Accuracy Tests

All meters should be tested for accuracy of registration at flow rates and test-flow quantities in accordance with *Water Meters—Selection, Installation, Testing, and Maintenance** (hereafter referred to by the short title, Manual M6, *Water Meters*). If the purchaser does not have suitable means for testing, the manufacturer should be requested to furnish a certificate showing that each meter has been tested for accuracy of registration and that each meter complies with the accuracy and capacity requirements of AWWA C701, Standard for Cold-Water Meters—Turbine Type, for Customer Service, when tested in accordance with Manual M6, *Water Meters*.

SECTION A.4: TESTING EQUIPMENT

The measuring device that is used to determine the amount of water discharged when testing should be designed to provide measuring accuracy to within 0.25 percent of the actual quantity. Tanks and scales should be tested and recalibrated quarterly or at least semiannually, and records of such tests and calibrations should be kept.

**Water Meters—Selection, Installation, Testing, and Maintenance.* Manual M6. AWWA, Denver, Colo. (1986).

SECTION A.5: REGISTRATION ACCURACY

In a turbine meter, the motion of the turbine is transmitted by a system of gearing to the register, which records the flow in convenient units of measurement. The gearing translates the motion of the turbine into the unit of measurement indicated by the register. The registration is thus directly dependent on the number of revolutions of the turbine. The registration is a true measure of flow only when the meter has been properly calibrated. After proper calibration, the meter will continue to register correctly only so long as the turbine continues to make the proper number of cycles for each unit of quantity that passes through the meter. If any condition develops whereby the turbine is compelled to make fewer than the proper number of cycles per unit of quantity passed through the meter, the meter will under-register. If it is compelled to make more than the proper number of cycles, it will over-register. Under ordinary working conditions several factors may cause inaccurate registration after comparatively short intervals. The more important of these are excessive wear, extreme temperatures, corrosion, improper installation, materials in suspension, and the presence of entrapped air in the lines.

Sec. A.5.1 Excessive Wear

To avoid excessive wear, the meter should be set in a horizontal position, be provided with proper flow conditioning in accordance with the manufacturer's recommendations, and be sized large enough for the water demand so that it is not run at excessive speeds. The results of excessive wear of the turbine or measuring chamber are slippage and under-registration. Excessive wear of an intermediate gear train may cause the gears to slip or bind. In either case, if the meter does not stop entirely, under-registration will result. The safe maximum operating capacities given in Table 1 of AWWA C701 are the maximum rates of flow at which water should be passed through the meter for only short periods of time at infrequent intervals. Maximum flow rates, if continuous, could be destructive to the meter. For continuous 24-h service, meters of the turbine type should not be operated at flows greater than those shown in column 3, Table 1, AWWA C701.

Sec. A.5.2 Temperature Extremes

Cold-water meters are not affected by temperatures of up to about 80°F (27°C). For temperatures higher than 80°F (27°C), meters with slightly larger clearances than usual should be used, and the accuracy limits set forth in Sec. 3.6 of AWWA C701 may have to be modified. High temperatures can cause expansion of a turbine and create unusual friction or bind the turbine in its chamber. The result is slippage and under-registration or complete stoppage of the meter. Lower temperatures have no noticeable effect on the working parts of the meter unless the water freezes, which may cause damage to the meter. To avoid problems caused by temperature extremes, meters should be located where they will be protected from heat and freezing.

If the authority having jurisdiction so requires, at locations where hot water from heating systems is not allowed to expand back through the meter, a backflow-prevention device consistent with the degree of hazard and a pressure-

and-temperature-relief valve should be installed sufficiently downstream of the meter.

Sec. A.5.3 Corrosion

All metals used in the construction of a meter are affected by the corrosive action of water, although the action is very slow with most potable waters. It should be recognized, however, that when meters are used in highly aggressive waters it may be necessary to use materials that are more resistant to corrosive attack. The solution of the corrosion problem requires a high degree of experience and knowledge, and the manufacturer should be consulted for assistance.

Sec. A.5.4 Improper Installation

Turbine-meter registration accuracy can be assured only when the meter has been properly installed and calibrated in accordance with the manufacturer's recommendations and/or Manual M6, *Water Meters*. Accuracy of registration and longevity of turbine meters depends on a swirl-free, uniform flow-velocity profile both upstream and downstream of the meter (see Manual M6, *Water Meters*).

Sec. A.5.5 Materials in Suspension

Foreign material carried in suspension has a tendency to fill the space between the turbine vanes and to cause over-registration. Such over-registration is not limited to turbine-type meters. Meters provided with strainers will retain the larger particles in suspension, but the strainer will soon become clogged if the water is not kept reasonably free of suspended matter. A partially clogged strainer can cause uneven flow distribution through the meter, resulting in error of registration. Sand is especially destructive, and care should be exercised to keep sand from reaching meters.

Sec. A.5.6 Entrapped Air

All water meters will record the presence of trapped air in the lines as inaccurate registration; this inaccuracy may result in a substantial over-registration in certain circumstances. In addition, entrained air can cause meter damage and premature wear; precautions should be taken to either eliminate or minimize this condition.

SECTION A.6: PERIODIC TESTS

Meters properly selected as to size and type will give satisfactory service over a long period of time without attention only if operated under ideal conditions. Under ordinary conditions, meters must be given some care if they are to function properly. In most cases it is impossible to ascertain, without actual testing, whether a meter in service is registering with the required degree of accuracy. Consequently, to ensure reliable meter measurements, it is essential that all meters be subjected to periodic tests. The interval between tests and the method of conducting them must be governed largely by local conditions. Many state regulatory commissions specify intervals between tests on the basis of time or quantity. Under average conditions, the intervals between tests should not exceed the limits set forth in Table A.1.

Table A.1 Average Recommended Intervals Between Meter Tests

Meter Size *in.*	Years Between Tests
1 1/2	4
2	4
3	3
4	2
6	1
8	1
10	1
12	1

SECTION A.7: METER STORAGE

Meters should be stored in a location that is not subject to unduly high or low temperatures. If meters are to be stored outdoors for an extended period of time, they should be covered to protect them from direct sunlight.

SECTION A.8: INSTALLATION

Any and all instruction manuals supplied by the manufacturer should be reviewed in detail before installation of meters. It is recommended that new service lines be flushed prior to installing the water meter. A spool piece of a length matching the meter to be installed should be used in place of the installed meter when flushing. An old meter with the measuring element removed could be used in place of the spool piece.

Sec. A.8.1 Electrical Grounded Pipe Systems

"AWWA opposes the grounding of electrical systems to pipe systems conveying drinking water to customer's premises."* At the time this edition of AWWA C701 was published, the latest revision to the policy statement of AWWA on the grounding of electrical circuits to water pipes had been adopted on Jan. 28, 1980, and reaffirmed on Jan. 25, 1987. However, it must be recognized that many pipe systems continue to be used as a grounding electrode system.

Section 260-81 (A) of the National Electrical Code (NEC) requires that "continuity of the grounding path or bonding connection to interior piping shall not rely on water meters." Most utilities require permanent ground strapping around meters to prevent accidents to workers changing meters. All meters should be permanently ground strapped.

*"Statements of Policy on Public Water Supply Matters: Grounding of Electric Circuits on Water Pipe." In *1987-88 Officers and Committee Directory*, AWWA, Denver, Colo. (1987).

Sec. A.8.2 Misaligned Pipes

Meters should be set in a horizontal position, protected from freezing, damage, and tampering. The line opening, between inlet and outlet valves and other appurtenances, in which the meter is to be set should be large enough to accommodate the laying length of the meter, coupling gaskets, strainer (if installed), and straight piping necessary for proper flow conditioning both upstream and downstream of the meter. (See Manual M6, *Water Meters*, regarding class I or class II turbine-meter installations for a detailed discussion of turbine-meter-installation considerations.) The meter should not be used to straighten misaligned pipes because of the potential for damage to the meter. Proper alignment of piping during installation and prior to the meter installation can be facilitated by the use of a spool piece of the proper length.

Sec. A.8.3 Placing Meter in Service

After the service line has been thoroughly flushed and the meter installation completed, filling the service line and meter with water should be accomplished by slowly opening the inlet valves and allowing trapped air to be released slowly at the highest point available. Rapid expulsion of large slugs of entrained air should be avoided because of possible damage to the meters internal measuring mechanism.

SPECIFICATION - WATER METERS

General:

All meters shall be positive displacement type only, utilizing either a nutating-disc or a oscillating-piston measuring element. All meters shall meet or exceed AWWA standard C-700 as most recently revised. Consideration will be given to meters exceeding these standards.

Physical Dimensions:

Meters shall have the following physical dimensions:

SIZE	Laying Length	Meter Ends
5/8" X 3/4"	7 1/2"	male threaded
1"	10 3/4"	male threaded
1 1/2"	13"	oval flange
2"	17"	oval flange

Body:

All meters shall be of a split case design. All meters shall have a bronze main housing with access plate of bronze or engineered polymer. Securing bolts shall be stainless steel or brass. No plastic main housings will be accepted. For in-line testing purposes, all 1 1/2" and 2" meters shall include a tapped test plug or tapped spool pieces.

Register:

All registers must be straight reading, hermetically sealed, registering in U.S. gallons. No water-filled registers or registers incorporating change gears will be accepted. All register lenses shall be heat treated glass, and shall be tempered or annealed for extra strength. All registers shall be guaranteed for a minimum of **ten years**.

Register Box, Lid, and Screws:

All register box enclosures and lids shall be bronze or synthetic polymer. However, register lid must support the weight of the meter and remain intact if carried by the lid only. All screws utilized to attach register to the main case shall be stainless steel or bronze. No exceptions. No plastic screws or plastic push pins will be accepted. All screws and enclosures shall be drilled to accept sealing wire.

Meter Testing and Serializations:

All meters provided must be factory tested. Flow rates and accuracy requirements shall be those as prescribed by AWWA standard C-700. These test results shall be printed on a test tag which will be attached to each new meter. Each test tag will also have the serial number of the meter clearly printed on it. The serial number shall also apppear on the top of the register lid as well as the top portion of the main case. Serial numbers stamped on the side of the main case will not be accepted.

Acceptable Manufacturers:

For the purpose of standardization and reduced parts inventory cost, the following shall be construed as the only acceptable meter manufacturers. No other meter manufacturers will be considered at this time.

SENSUS TECHNOLOGIES (ROCKWELL)
BADGER
NEPTUNE

Literature:

Each bidder will be required to send (2) sets of descriptive literature, pressure loss charts, and accuracy charts for each model bid. Published warranties shall also be sent in bid package. Failure to do so will result in rejection of bid.

Specifications:

Any deviation from specifications indicated herein must be clearly pointed out; otherwise, it will be considered that items offered are in strict compliance with these specifications, and successful bidder will be held responsible thereof. Deviations must be explained in detail.

Scrap Meters:

Bidders are encouraged to submit a brass meter scrap price. This price item will be considered in the bid evaluation. All scrap meters provided shall be brass, no plastic and/or iron bodied meters will be furnished. Within thirty (30) days upon request of the Utility Company, the successful bidder shall have made arrangements with purchasing department personnel, and have all scrap meters removed. It is the responsibility of the successful bidder to pay all freight cost incurred in this process.

Performance:

Efficient service is essential. Therefore, if it is ascertained that the holder of the contract is unable to make delivery within reasonable time and it becomes necessary to make procurement from other than the holder of the contract, the Company may do so.

Evaluation/Award:

All bids will be avaluated and recommendations will be made for award on the following information:

1. Meet specification requirements
2. Data on performance evaluation
3. Unit cost
4. Delivery time
5. Trade in allowances

PERFORMANCE EVALUATION

5/8" x 3/4" METER
Manufacturer_____ Model_____

Maximum Capacity_____ G.P.M.

Normal Operating Range_____to_____G.P.M. + 1.5%

Pressure loss through meter at AWWA max. capacity_____P.S.I.

Published accuracy warranty_____years or _____million gallons, whichever occurs first.

Low Flow Accuracy_____% at _____G.P.M.

1" METER
Manufacturer_____ Model_____

Maximum Capacity_____ G.P.M.

Normal Operating Range_____to_____G.P.M. + 1.5%

Pressure loss through meter at AWWA max. capacity_____P.S.I.

Published accuracy warranty_____years or _____million gallons, whichever occurs first.

Low Flow Accuracy_____% at _____G.P.M.

1 1/2" METER
Manufacturer_____ Model_____

Maximum Capacity_____G.P.M.

Normal Operating Range_____to_____G.P.M. + 1.5%

Pressure loss through meter at AWWA max. capacity_____P.S.I.

Published accuracy warranty_____years or _____million gallons, whichever occurs first.

Low Flow Accuracy_____% at _____G.P.M.

2" METER
Manufacturer_____ Model_____

Maximum Capacity_____G.P.M.

Normal Operating Range_____to_____G.P.M. + 1.5%

Pressure loss through meter at AWWA max. capacity_____P.S.I.

Published accuracy warranty_____years or_____million gallons, whichever occurs first.

Low Flow Accuracy_____% at _____G.P.M.

SSU

METER TEST REPORT

P.O. No. _____ Invoice No. _____

Utility Name _____ Service Date _____

Meter Size _____ MFR _____ Serial No. _____

Meter Type _____ Meter Location _____

BY-PASS ☐ INLET VALVE ☐ OUTLET VALVE ☐

METER READINGS

☐ GALLONS

☐ CU. FT.

BEFORE TEST

Fire Line Register _____

High Flow Register _____

Low Flow Register _____

AFTER TEST

Fire Line Register _____

High Flow Register _____

Low Flow Register _____

FLOW RATES (in g.p.m.)

☐ METER INOPERATIVE BEFORE TEST

BEFORE TEST

Fire Line _____

High Flow _____

Low Flow _____

Total _____

AFTER TEST

Fire Line _____

High Flow _____

Low Flow _____

Total _____

METER CONDITION DATA

☐ Accuracy OK - no repair necessary _____

☐ Foreign Material Jamming Meter _____

☐ Low Flow Element Faulty _____

☐ High Flow Element Faulty _____

☐ Gear Train Inoperative _____

☐ Valve Section Faulty _____

☐ Register Inoperative _____

☐ Combining Drive Faulty _____

☐ Fireline Section Inoperative _____

☐ Parts Eroded-aggressive Water _____

~~9,183~~ 3713 1714

METER ACCURACY REPORT

☐ GALLONS ☐ CUBIC FEET

ACCURACY BEFORE REPAIR

QTY. RUN TEST METER	FLOW RATE (G.P.M.)	QUANTITY DELIVERED – UTILITY METER					
		LOW FLOW ELEMENT	HIGH FLOW ELEMENT	FIRELINE ELEMENT	TOTAL QTY. DELIVERED	% CORRECTION FACTOR	% ACCURACY

ACCURACY AFTER REPAIR

QTY. RUN TEST METER	FLOW RATE (G.P.M.)	QUANTITY DELIVERED – UTILITY METER					
		LOW FLOW ELEMENT	HIGH FLOW ELEMENT	FIRELINE ELEMENT	TOTAL QTY. DELIVERED	% CORRECTION FACTOR	% ACCURACY

		CHANGE GEAR DATA		
		MAINLINE	CURRENT	DISC
Register Gear	Found			
	Left			
St. Box Gear	Found		00184	
	Left			

Test Performed by:

Witnessed by: 3714

1715

METER REPLACEMENT PROGRAM STATUS

3715

1716

S S U

Technical Services
Intra-company correspondence

TO: Gary Morse

FROM: Frank Sanderson

DATE: June 18, 1993

SUBJECT: Meter Replacement Program

Chapter two, section E, of the Comprehensive Meter Program (CMP) addresses SSU's meter change out program. The CMP states that SSU will change out 5% of it's meters (approximately 7500 meters) during 1993.

The CMP did not address the manpower requirements nor funding needed to implement the meter change out program for 1993. This will necessitate pushing back full implementation of a meter change out program until January of 1994 to allow funding to be provided through the budgeting process. However between 1500 - 2000 meters will be changed out this year.

To date, Customer Service has issued service orders which have resulted in the replacement of approximately 500 low registering or stuck residential water meters state wide.

The Operations Team has reviewed the water and wastewater consumption report prepared by Monica Smitherman and the Unaccounted for Water Report prepared by Operations Administration. Based on these two reports, the following water and wastewater systems have been selected for meter change outs.

South Region
Lehigh & Marco Island (select older areas)
Leisure Lakes / Covered Bridge

West Region
Spring Hill (select older areas)
Palm Terrace / CL Smith / Ell Nar
Oak Forest
Salt Springs
Lake Gibson

Central Region
University Shores (select older areas)
Apple Valley
Morningview
Venetian Village

North Region
Woodmere & Beacon (select older areas)
Palm Port
Park Manor

I have requested that John Hilton contact several underground contractors for quotes to perform meter change outs. An outside contractor may be SSU's only recourse to achieving the goals as set forth by Charles Sweat's sworn testimony to the Public Service Commission and The Comprehensive Meter Programs recommendations.

An approximation of the costs to replace 7,500 meters to meet the afore mentioned goal of 5% replacement of residential meters in 1993 would be in the $275,000.00 to $300,000.00 range. This figure would include the cost of meters and installation.

Periodic updates will be provided to keep you posted as to the progress of the meter change out program.

/csd

cc: Bert Phillips
Dave Denny
Jim Ragsdale
Joe Roberts
Bill Williams
Priscilla Wampler
Charles Sweat
Judy Sweat
Karen Shofter

3717
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