NEPTUNE TECHNOLOGY GROUP

AUTHORIZED DISTRIBUTOR

NECO

Smart Solutions, Water Powered

Water Metering Technologies

Conducted by:

Kelly Byrd

Ohio Sales Manager

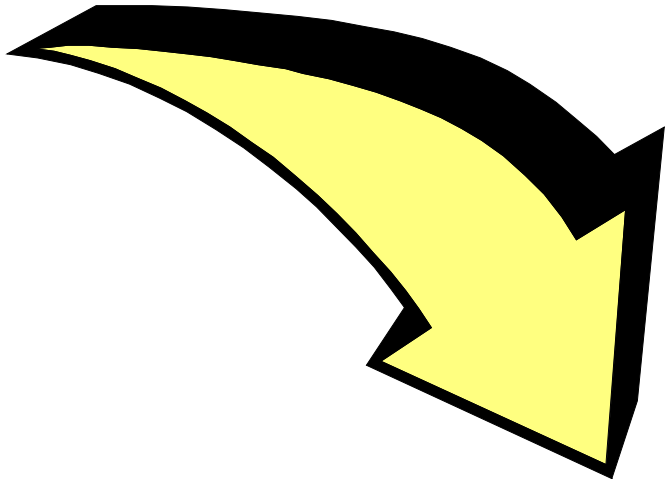
History of NECO

- **Founded in 1934 as a family owned and operated business based out of Cincinnati, Ohio**
- **Providing Distribution Sales & Services featuring Neptune Technology Group Meters & Meter Reading Products**
- **Neptune Technology Group has manufactured meters and related equipment for over 125 years**
- **Experience – 95% of our business is Meters & Reading Equipment**
  - **Remote Control Shut-Off Valves & Data Services**
- **Complete Services – Project Management, Meter & Infrastructure Installation and Hardware & Software Support**

Water Metering is for Revenue

How Is Revenue Lost?

- Meter Failures
- Meter Inaccuracies
- Misapplication
- Sizing
- Undetected Leaks
- Theft
- Other Free Water



Water Meter Types

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- Positive Displacement
  - **Nutating Disc**
  - Oscillating Piston
  - Rotating Cam
- Velocity Meters
  - **Single Jet, Multi Jet**
  - **Magnetic, Ultrasonic**
  - Thermal, Oscillating, Vane, Float, Coriolis

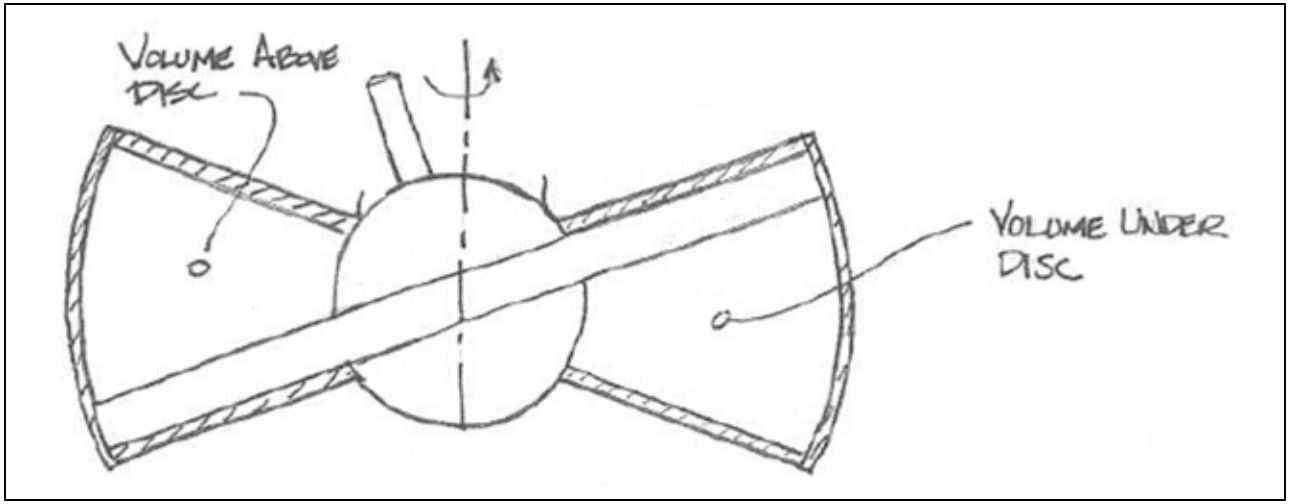
Positive Displacement –Nutating Disc

Advantages

- Excellent low flow accuracy
- Not affected by upstream flow disturbances
- Economical to produce

Disadvantages

- Limited in high flow rates by pressure losses
- Limited in size by forces on ball and disk.
- Mechanical wear



Nutating Disc

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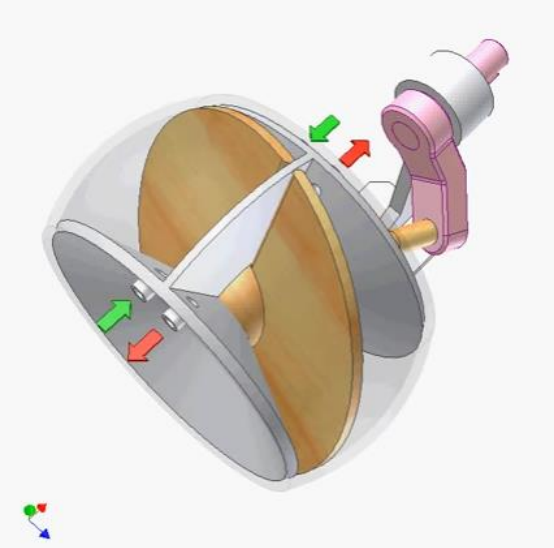
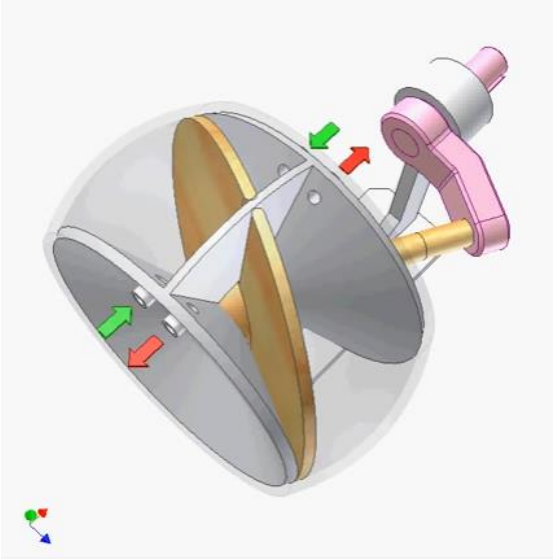
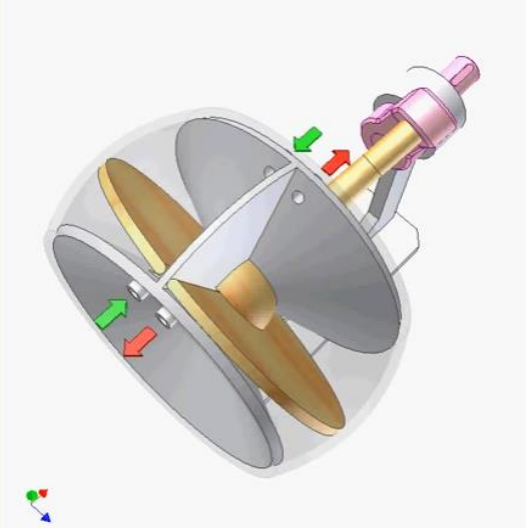
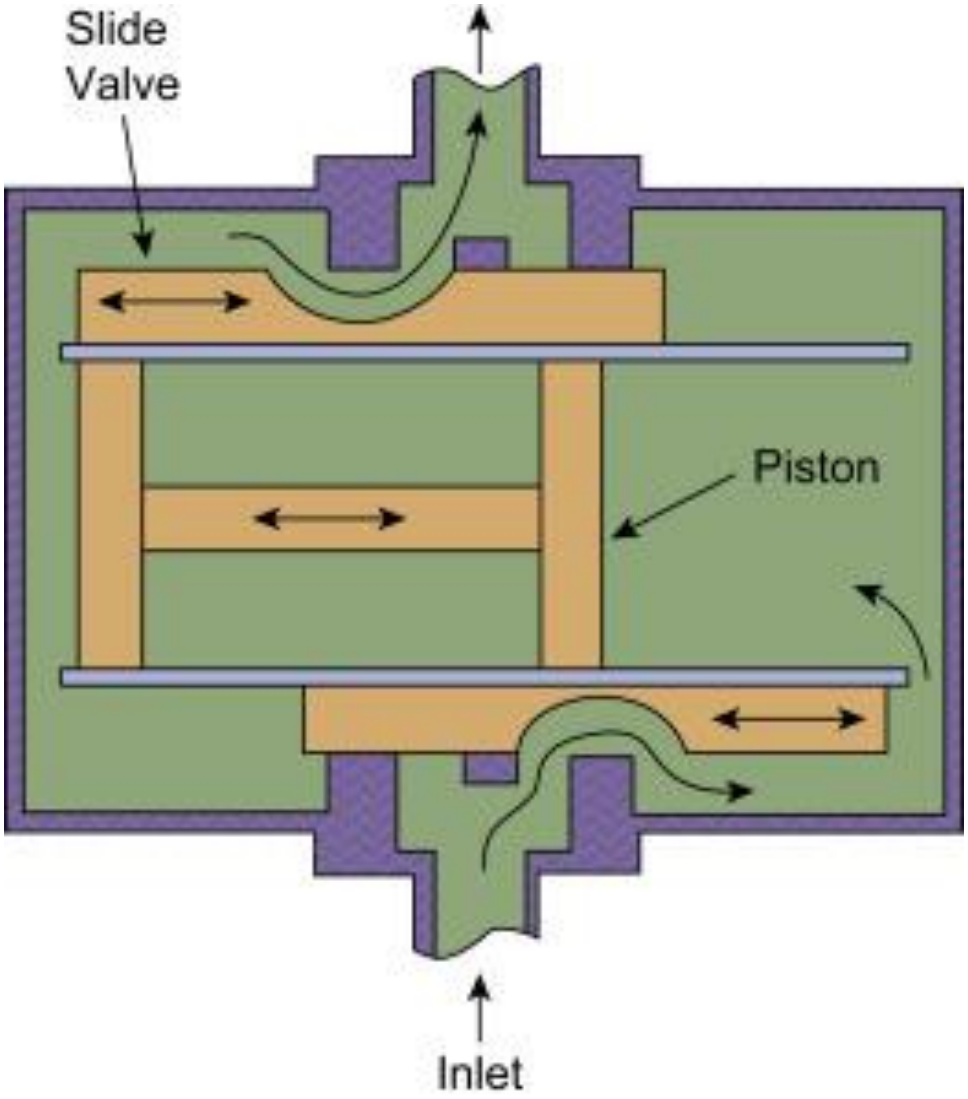


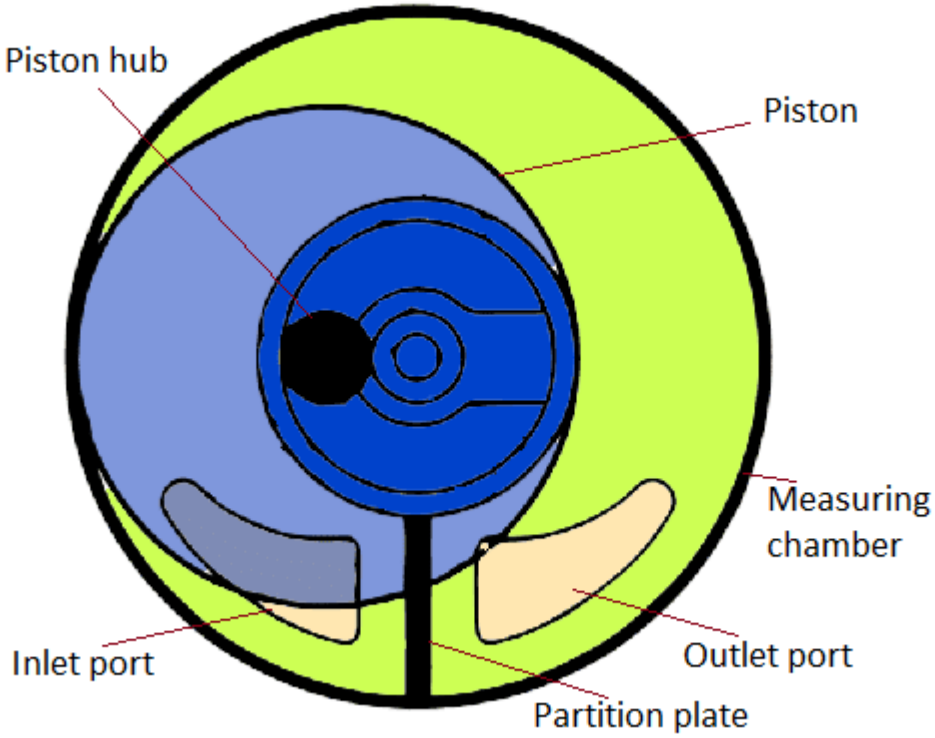




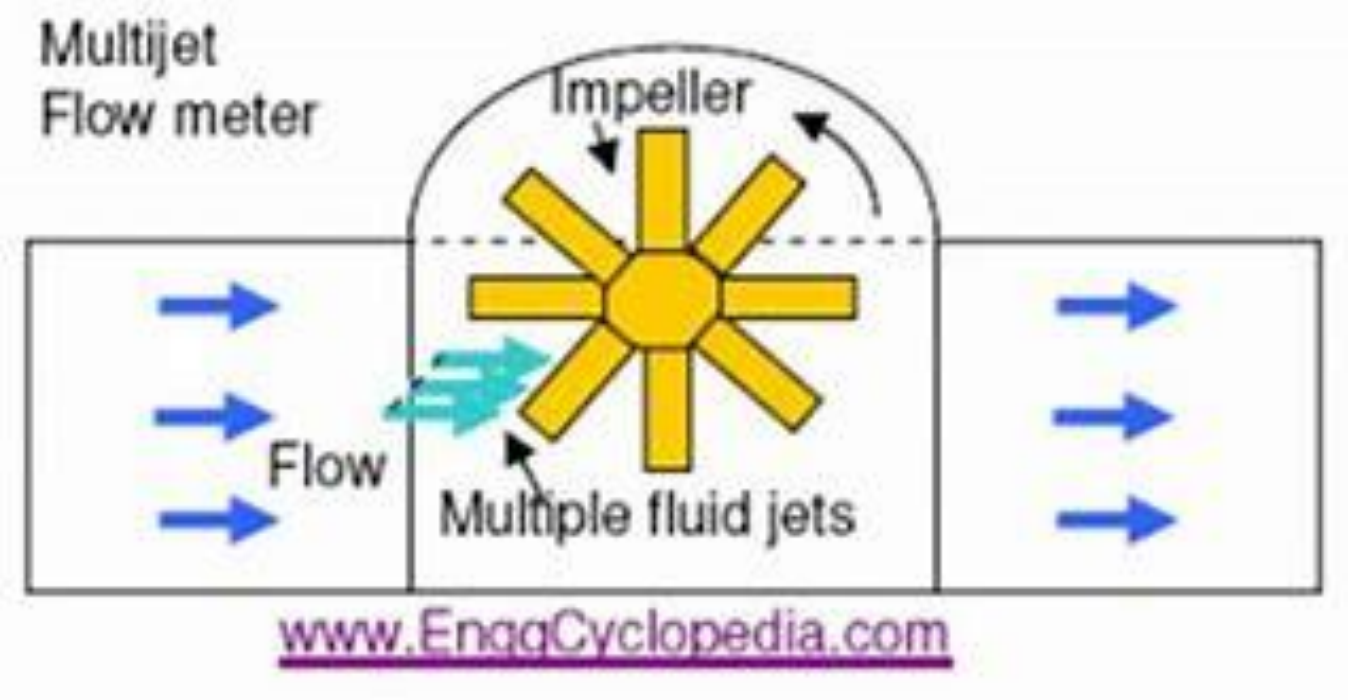
Positive Displacement – Sliding Piston



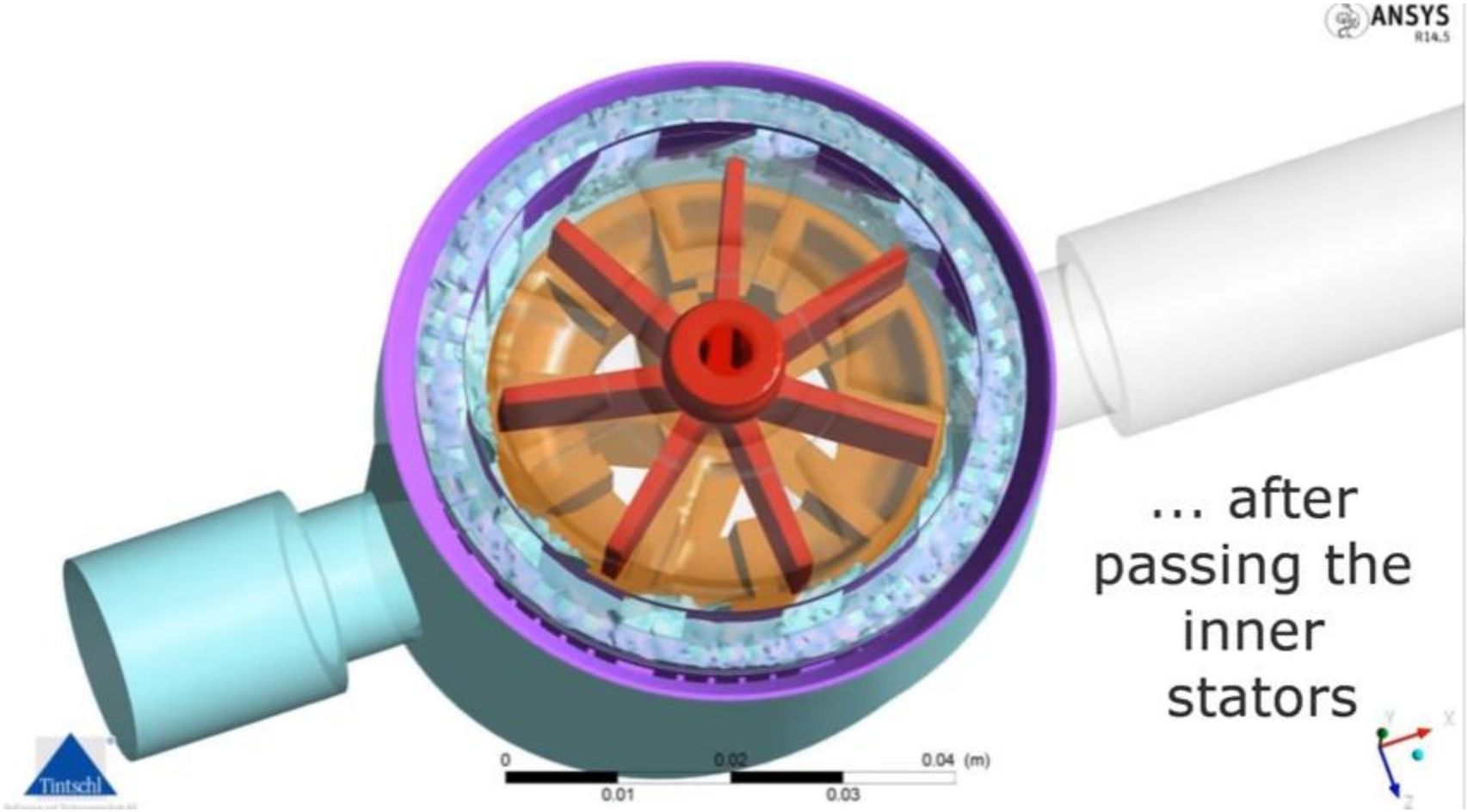
Positive Displacement – Oscillating Piston



Velocity – Multiple Jet

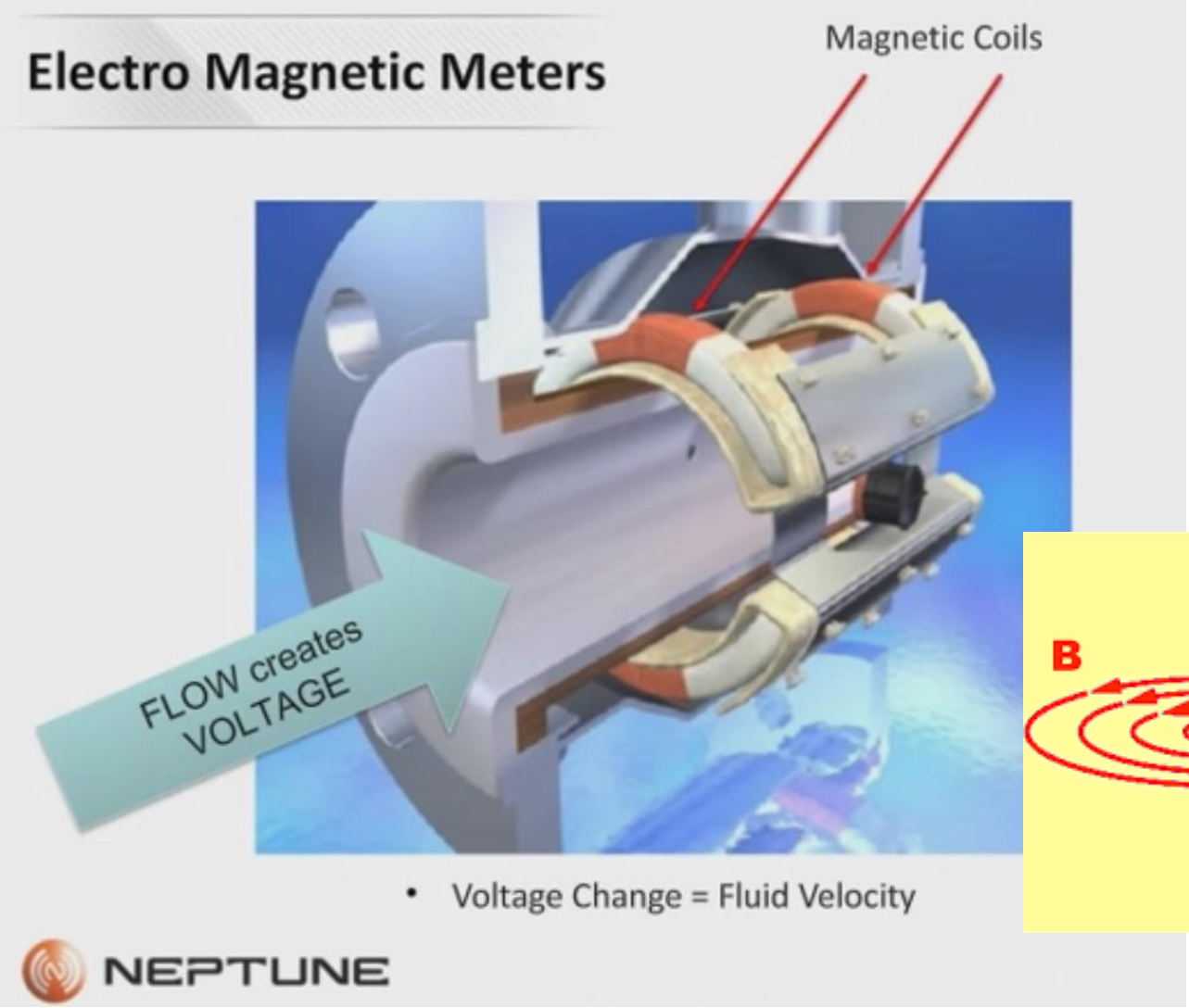


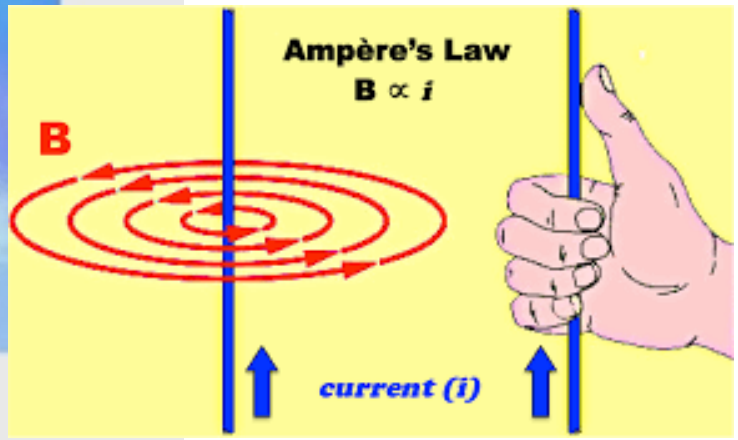
Velocity – Multiple Jet



Velocity – Electromagnetic

Velocity – Mag Meter





Velocity – Ultrasonic

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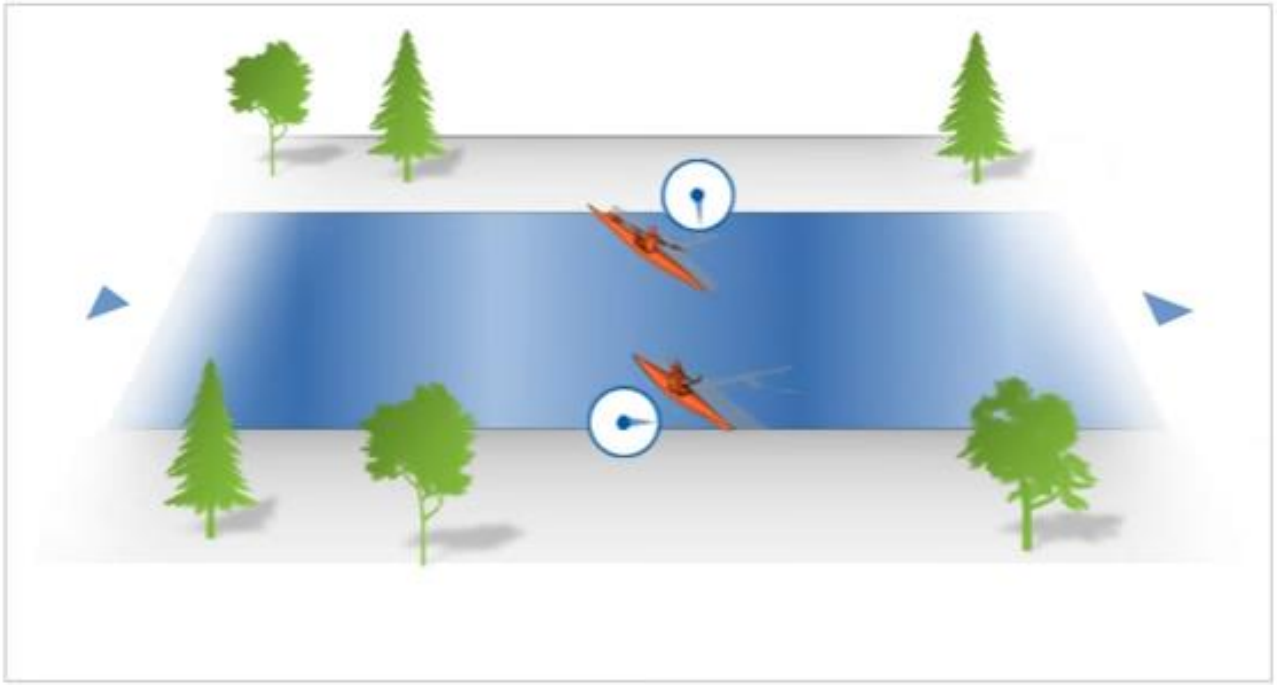
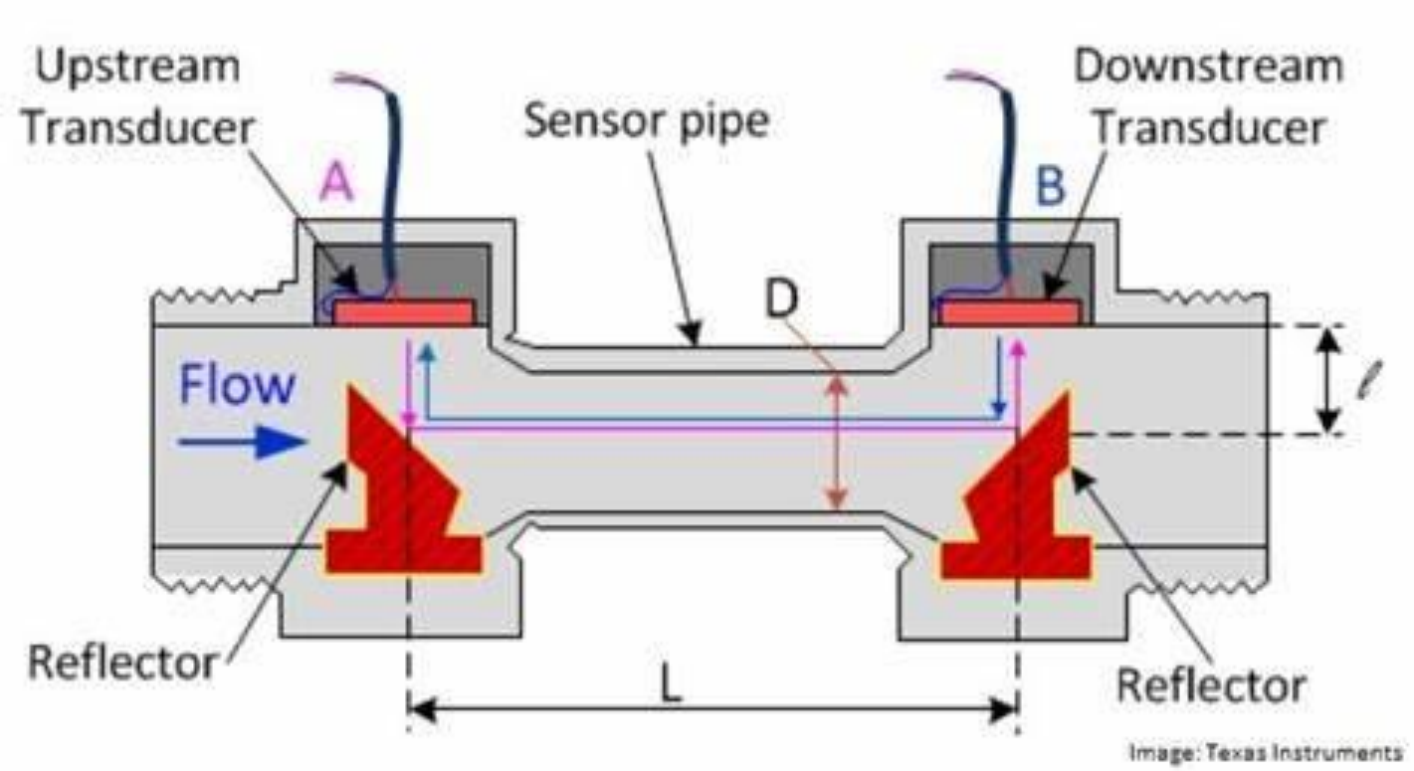
Measuring principle: Ultrasonic
Transit time difference



Velocity – Ultrasonic



Residential Meter Components

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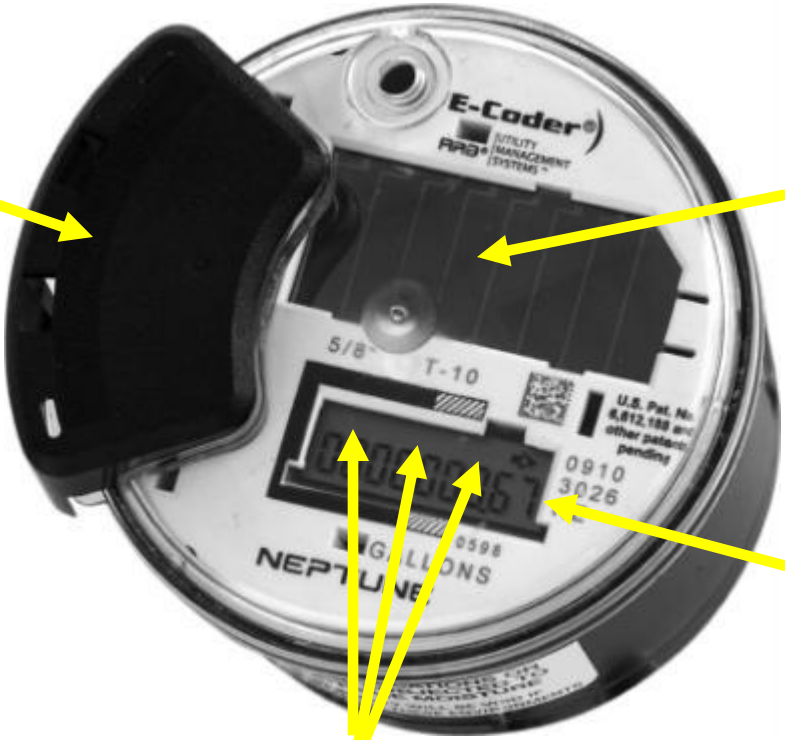
Register Options

Nutating disc or multijet measuring element

Brass or Plastic Maincase

Optional Bottom Cap

Register E-Coder Face



Communication wire connection

Solar Panel

Flow Indicator

Leak, Tamper & Backflow Indicator Icons

Register ProCoder

Transmitters

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Register/Transmitter Combo

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Data Output Methods

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Building Automation Systems

- Radio to Pulse
- Radio to Analog Signal
- Splitting for 2 Radios
- Remote Visual Display
- Radio to MODBus
- Pulse to Radio
- Analog to Radio
- All With Pass-Thru Radio!

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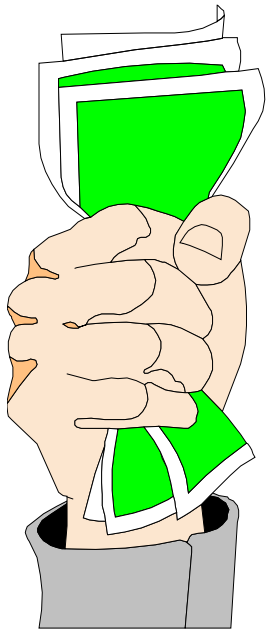
Commercial & Industrial Large Water Meters

Large Meter Revenue



- **Large meters = Large Revenue**
- **You can't afford to have them running inaccurately**
- **At just 5% off:**

Revenue	Loss
$10,000	$500
$50,000	$2,500
$100,000	$5,000
$500,000	$25,000

Large Meter Family

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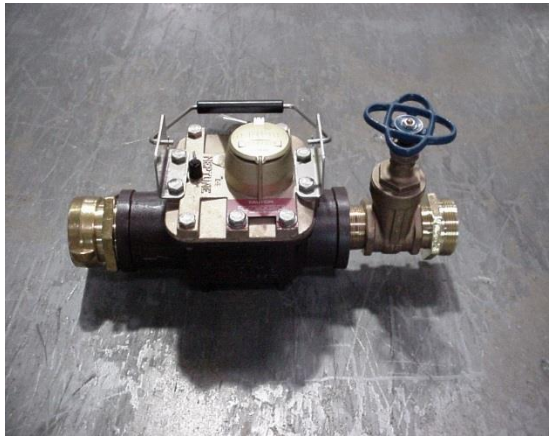
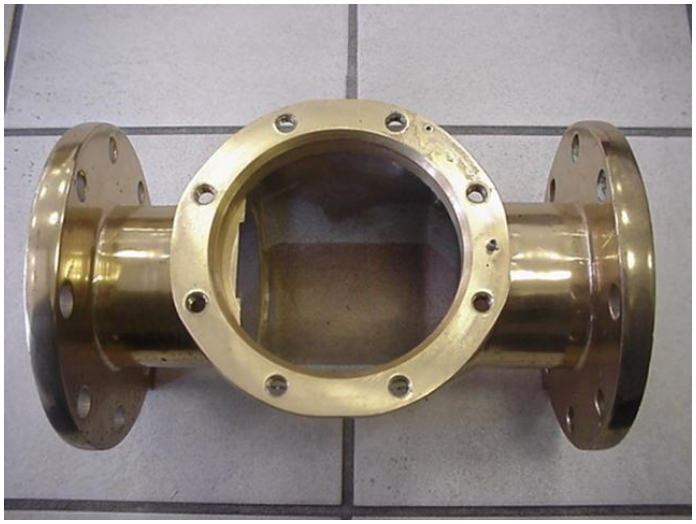
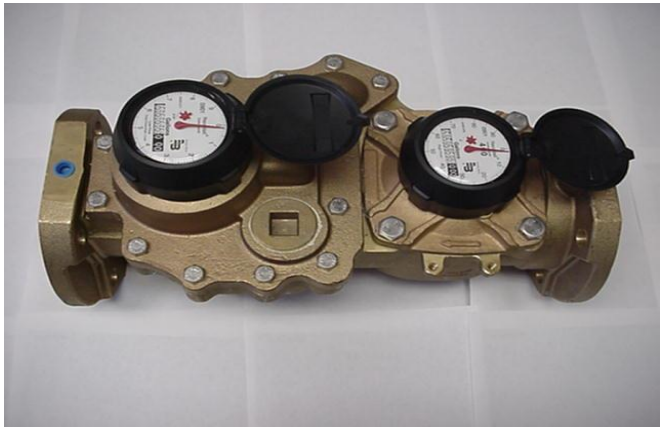


HP Turbines



- Cold Water Measurement
- EnviroBrass II (Lead Free)
- Velocity Meter
- 1 1/2” - 20” Sizes
- Flow Range: 4-6500 gpm
- Moderate to High Flow Rates
- Accuracy to within +/-1.5%
- Unitized Measuring Element
- Hydrodynamically Balanced
- Low Flow Sensitivity
- Accuracy Calibration Vane
- Optional TRICON/E3/S output

Compound Meters



TRU/FLO Compound

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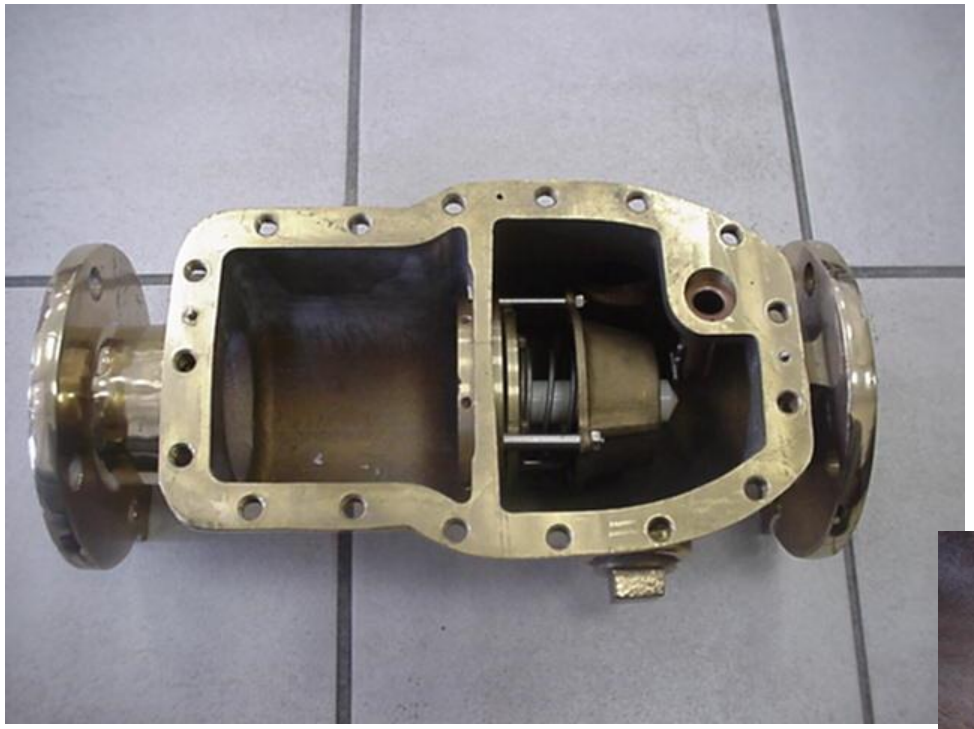
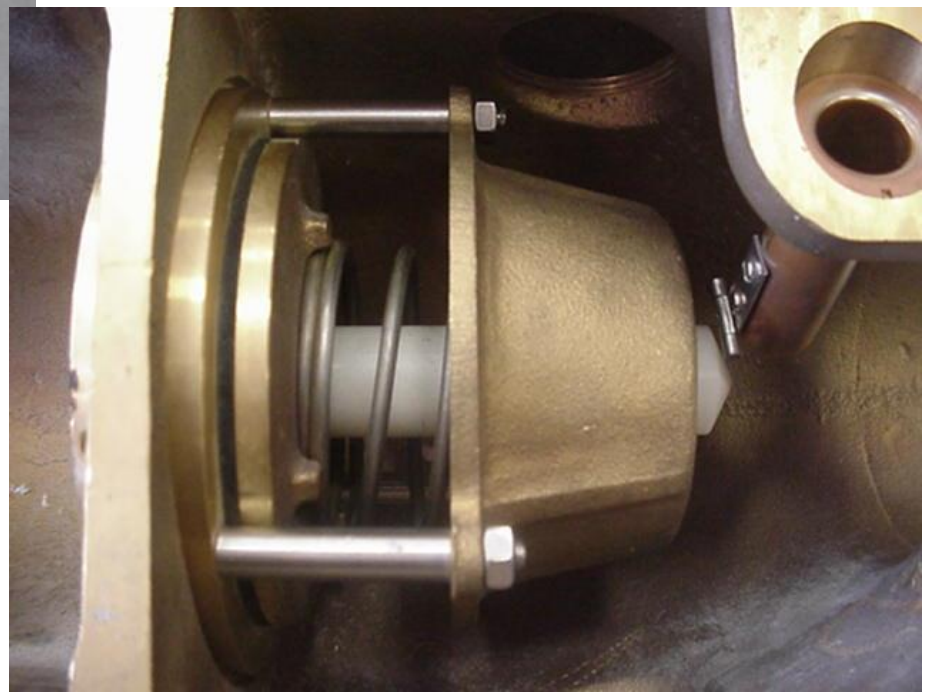
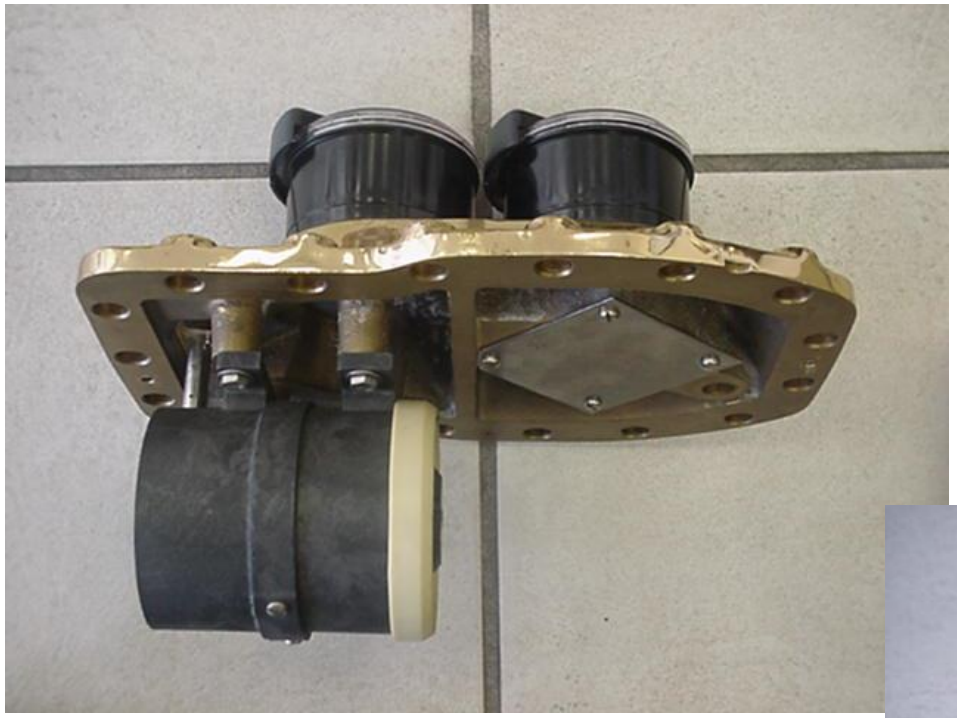
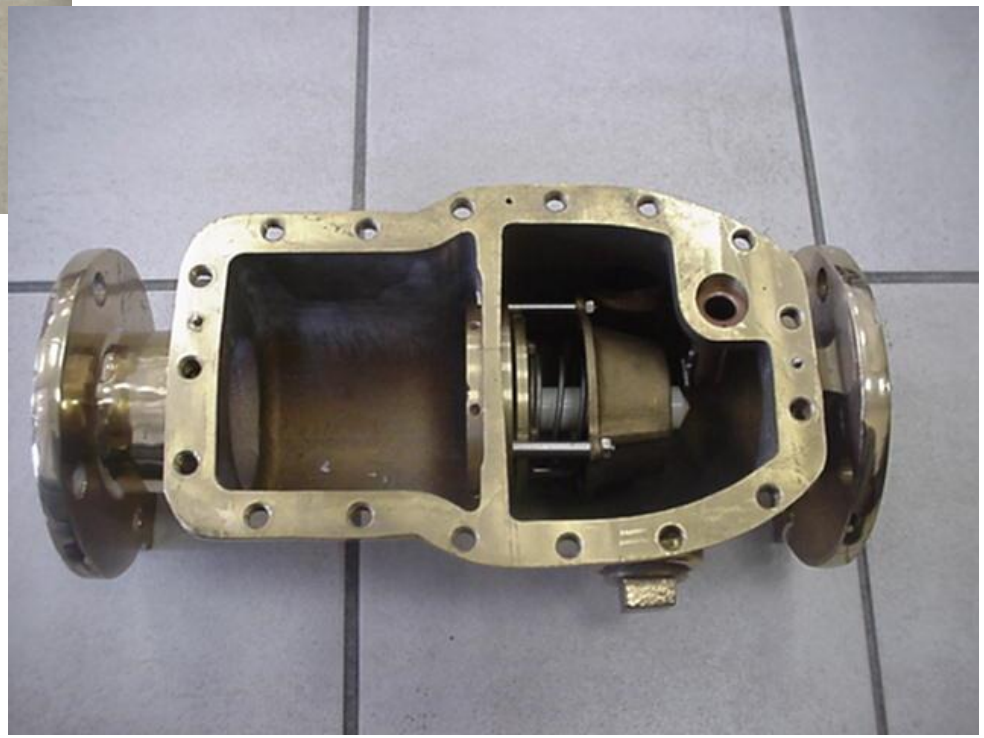


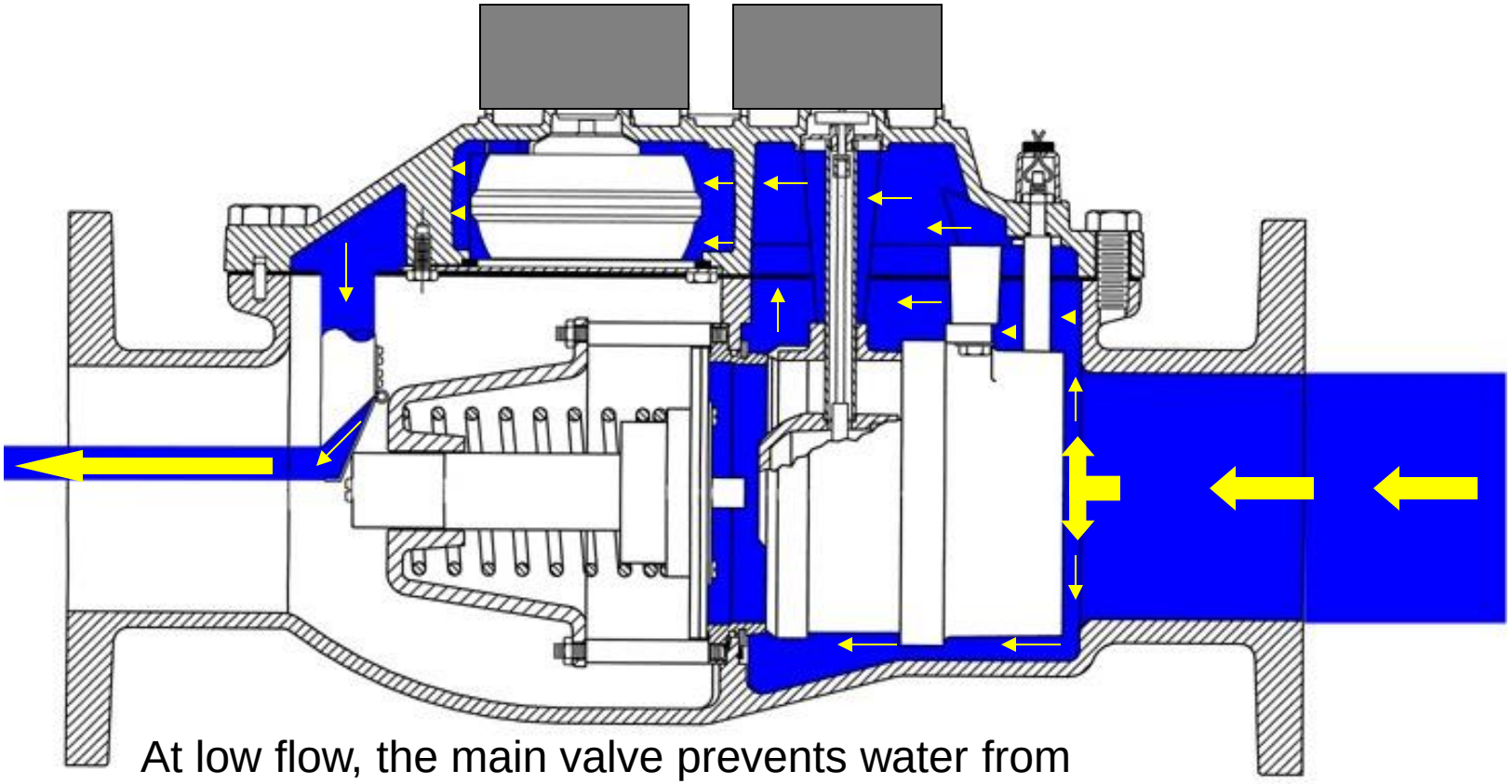


TRU/FLO Compound





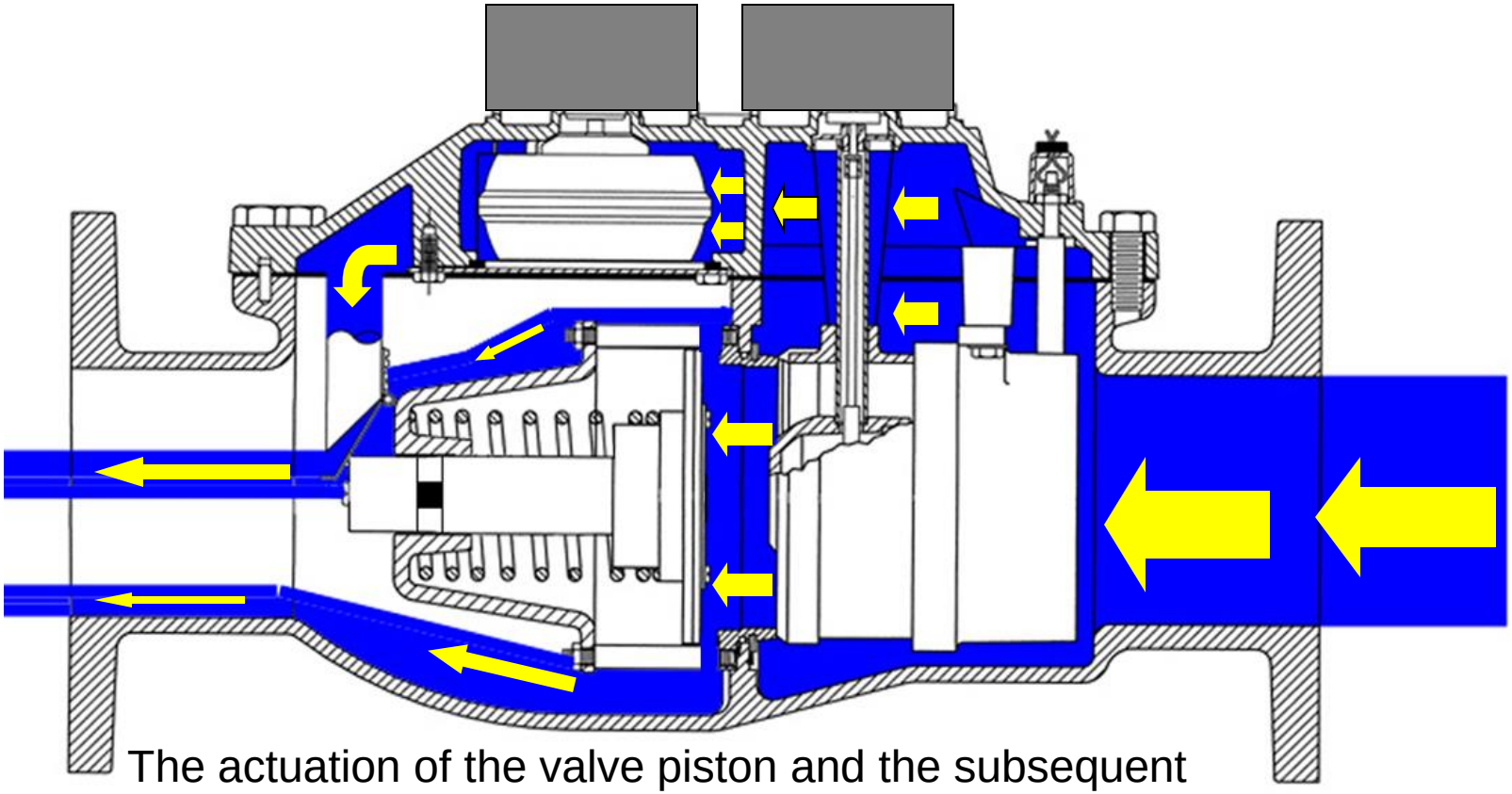
Low Flow



At low flow, the main valve prevents water from flowing through the Turbine element.

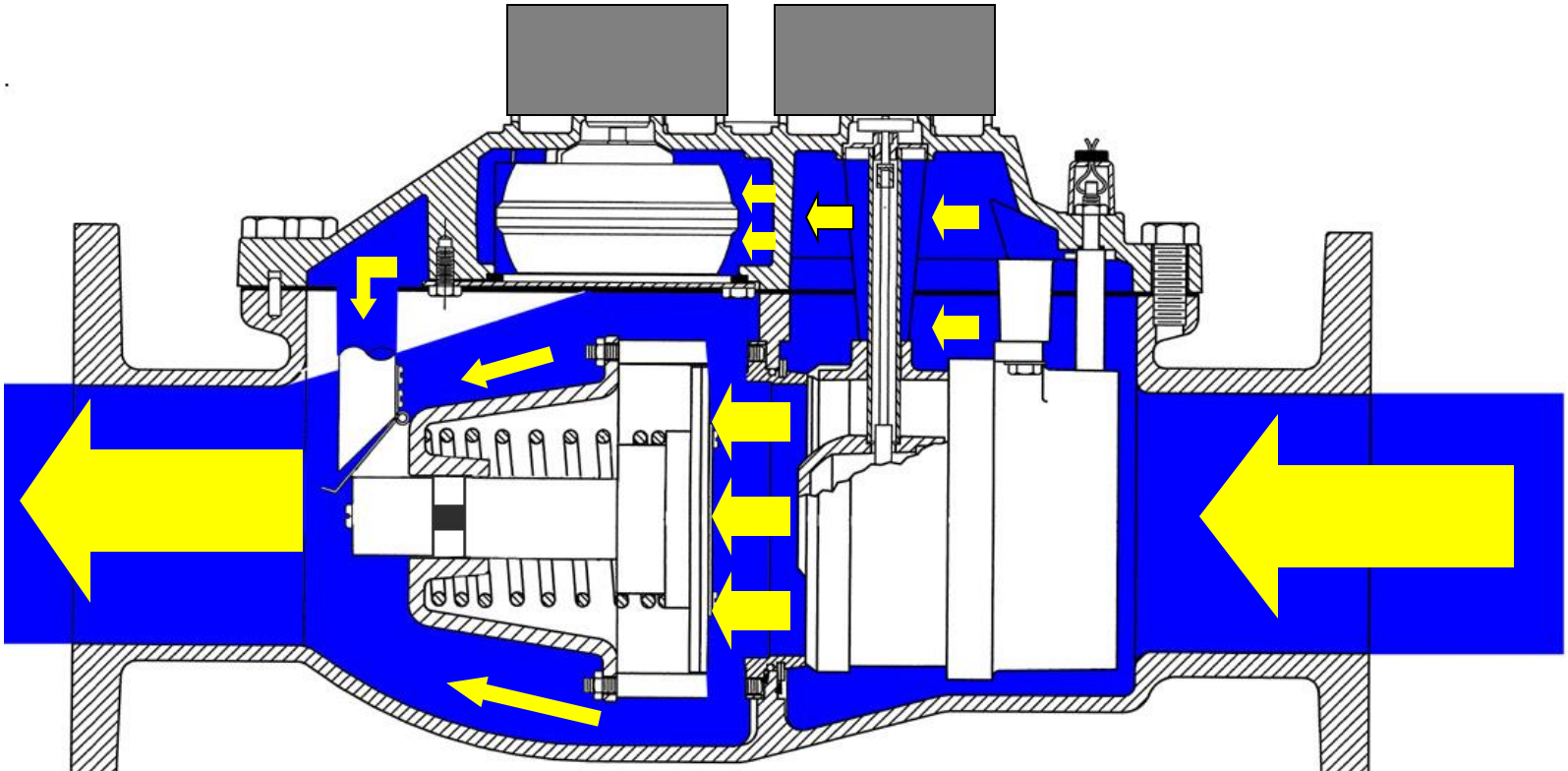
All water is diverted through the cover, into the T-10 chamber and out the throttle tube.

Crossover



The actuation of the valve piston and the subsequent reduction of flow through the T-10 chamber “shunts” a large volume of water through the turbine measuring element forcing the main valve open. Both the turbine and the T-10 are operating.

Intermediate & High Flow



At intermediate and high flow rates, the main valve is fully open and the majority of the water flows through the turbine. Water continues to flow through the T-10 at a greatly reduced rate. This helps “flush” the the T-10 while simultaneously insuring that it does not “over-speed”

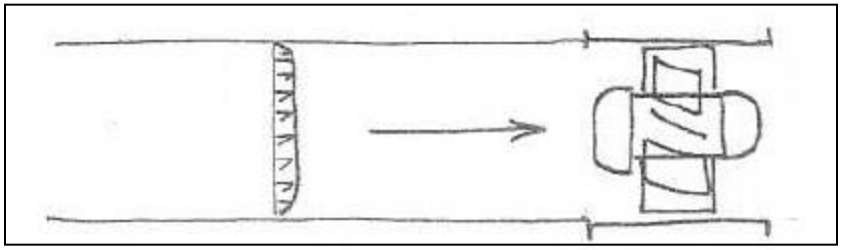
Low To High Continuous Flow Rates

- Apartment Buildings
- Motels
- Hotels
- Condominiums
- Mobile Home Parks
- Hospitals
- Schools
- Restaurants
- Dormitories
- Department Stores
- Shopping Malls
- Public Transportation Centers

WHERE PEOPLE LIVE, EAT & PLAY!!

Correct vs Irregular flows

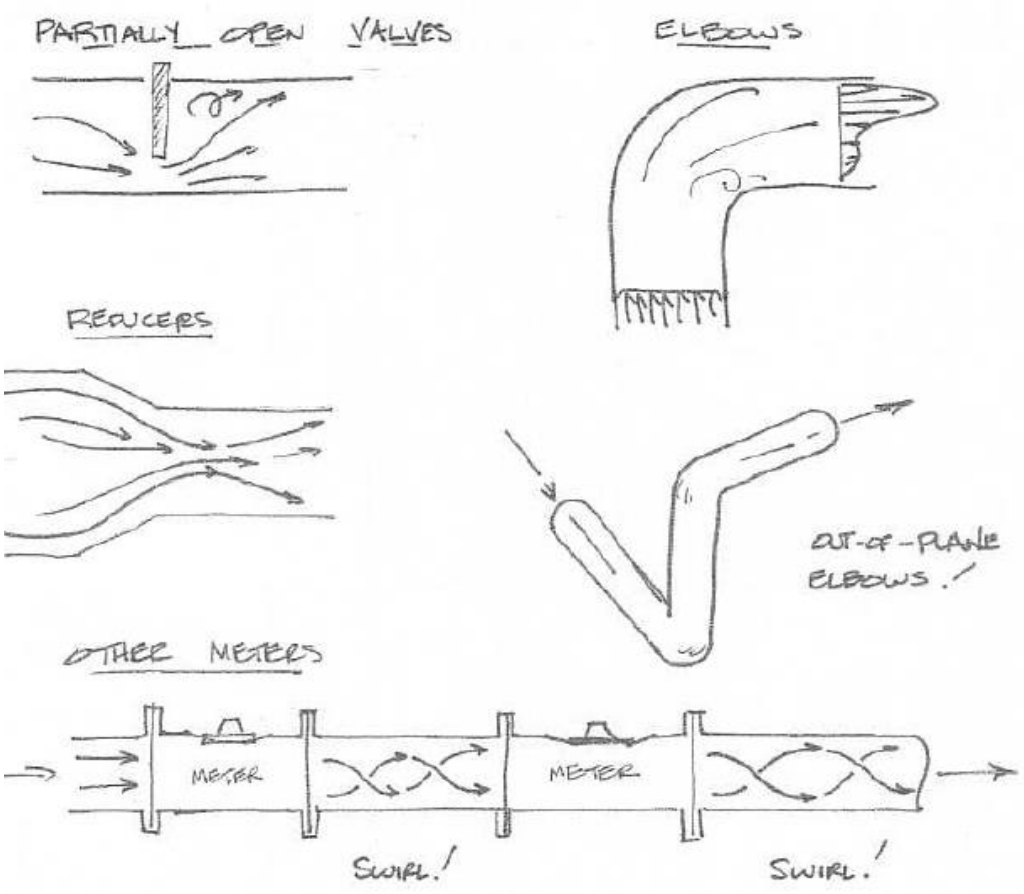
- **For best performance, a turbine meter expects a uniform velocity profile.**
- **No swirl is allowed.**



- **Generally speaking, 8-10 diameters of straight pipe upstream will correct velocity profile, but not always.**
- **This extra length promotes mixing, and helps to eliminate flow irregularities.**

Correct vs Irregular flows

- What causes irregular flows?



- **Generally, any abrupt change in the plumbing is a potential source of flow irregularities.**

Static Meters – Ultrasonic or Mag

- Velocity Meter
- 5/8” to 12” Sizes
- Flow Range: 0.05 to 2000 gpm
- Accuracy to within +/- 1.5%
- Low flow accuracy +/- 3%
- Fire Rated!
- No need for a strainer
- Guaranteed Accuracy
- Any Orientation is Fine

Need for Correct Sizing

Historical "Rule of Thumb":

- 3" meter for 3" pipe

Actual Realization:

- Flow capacity not always dictated by pipe size
- Low Flow Devices - e.g. ULF Toilets = less consumption
- Often consultants recommend larger meter due to future growth which never occurs
- Buildings/facilities no longer used for original intentions - e.g. processing plant now converted to office space

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Understanding AMR/AMI Meter Reading Technology

Smart Meters

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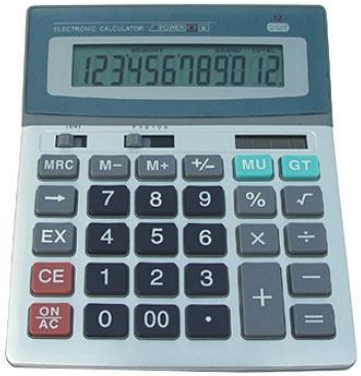
- High Resolution
- Leak/Burst Detection
- Reverse Flow Detection
- Tamper Detection
- Data Logging
- Pressure
- Temperature

- Actionable Information
- Improved Customer Service
- More Information to you

AMR vs AMI

- **AMR** – Automated Meter Reading



- **AMI** - Advanced Metering Infrastructure

AMR/AMI Market Drivers

- **Meter reading cost and time**
  - Repeated Trips
  - Access to Meter
  - Vehicle Costs
- **Meter reading safety**
  - Dogs
  - People
  - Weather
  - Driving
- **Liability insurance**
- **Hard-to-Read meters**
- **Other Work Needs Done**

AMR/AMI Market Drivers

- **Aging infrastructure**
  - Main maintenance
  - Fire hydrant maintenance
  - Distribution System Tampering
- **Customer Service**
  - Eliminate estimated reads
  - High water bill complaints
  - Excessive water use
  - Higher customer expectations
- **Department Efficiency**
  - What else needs attention?
  - Total Operating Budget
    - Man Hours
    - Vehicle Maintenance
- **Increase Cash Flow**
  - Shorten billing cycle

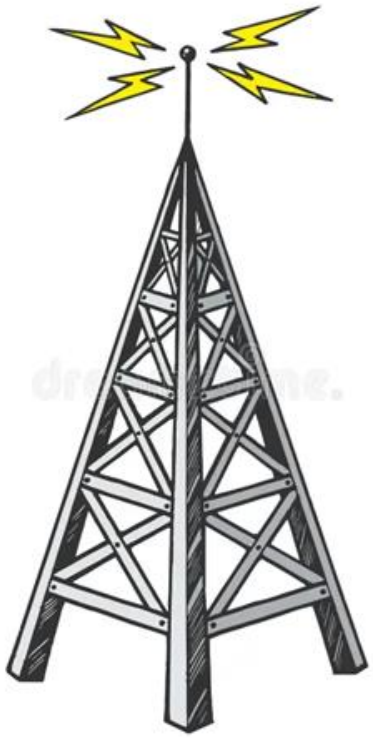
Types of AMI Systems

- Direct Communication
  - Collector antennas placed strategically throughout the reading area for total collection
  - Normally located on water towers, tall buildings and antenna towers
  - Power Limits
- Signal Hopping
  - Mesh – MIU to MIU
  - Mesh – MIU to Electric

Utility Owned Options

- Radio Frequency
  - 450 MHz – Fixed
  - 900 MHz – Open
  - 2.5 GHz - LoRaWAN
- Control
- Up-Front Costs
- Static Longevity

Network as a System Options

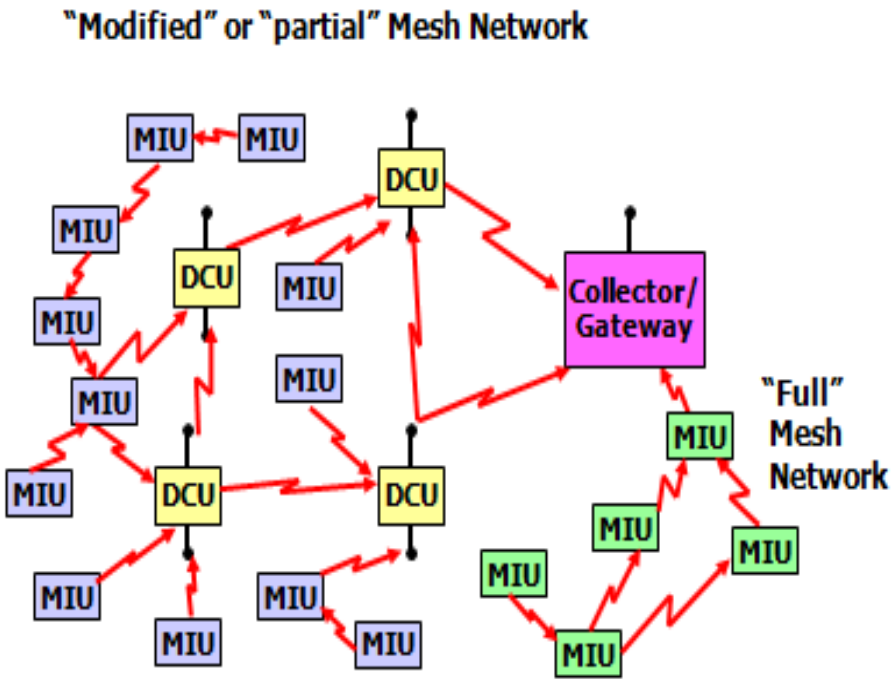


- Radio Frequency
  - 450 MHz – Fixed
  - 900 MHz – Open
  - 2.5 GHz – LoRaWAN
- Cellular

- No Maintenance
- Operating Costs
- Upgrades Over Time

Types of AMI Systems

- Mesh Network
  - Data Hops to next Transmitter
  - Data Hops to an Electric Meter
  - Self-healing System



Types of AMI Systems

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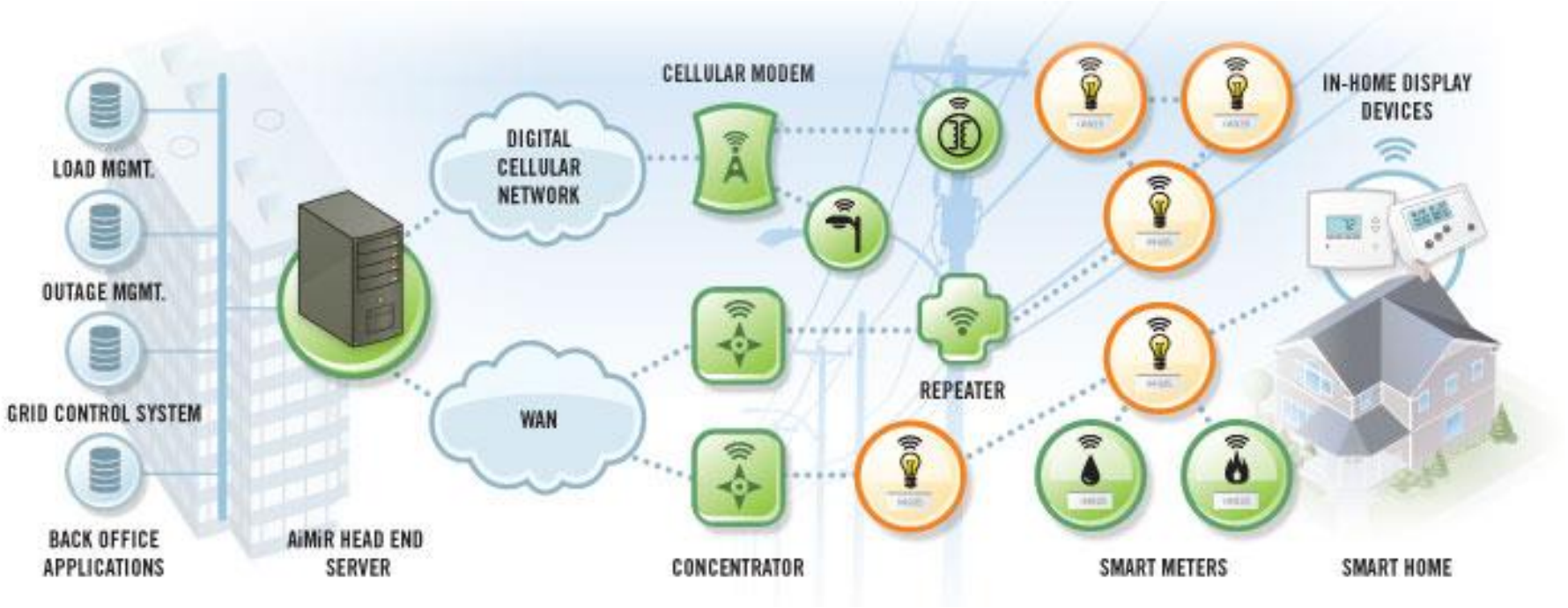
- Combined System



Smart Meters = Value Throughout the Utility

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General Management

- Accurate bills
- Proactive water leak notification
- Financial accountability
- Resource conservation

Customer Service

- Improved operational efficiency
- High water bill complaint resolution

Finance

- Improved cash flow
- Reduced unaccounted-for-water
- Improved bottom line

Meter Reading Department

- Fast Meter Reading
- Encoder technology
- Guaranteed accurate readings

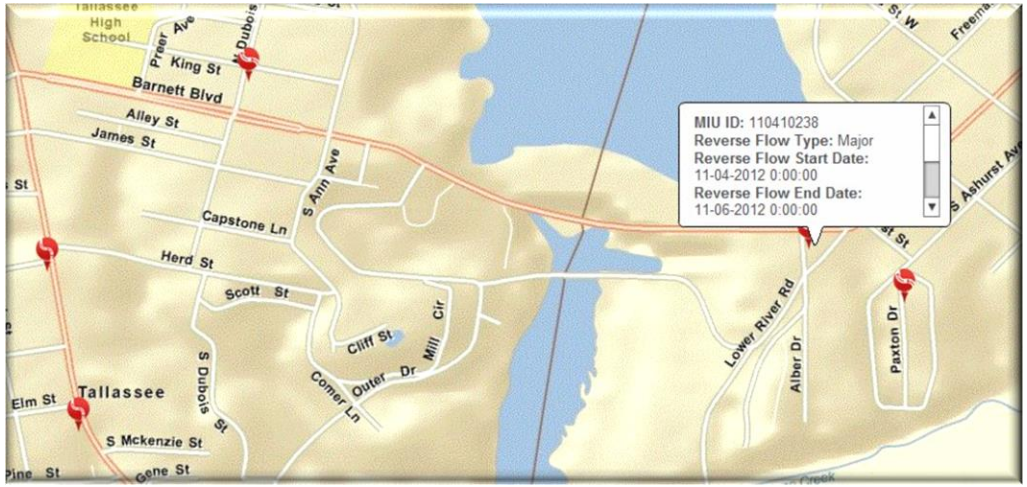
Maintenance

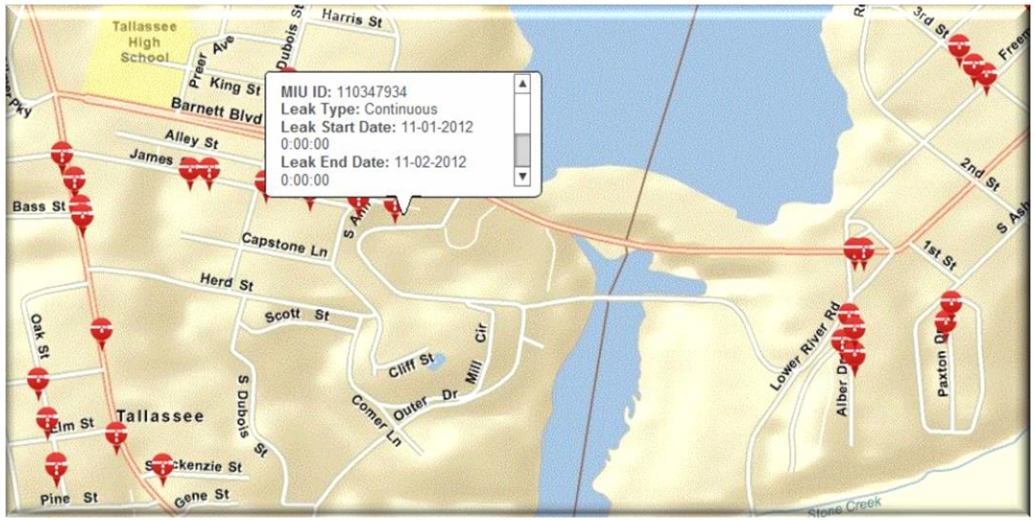
- Service order reduction – leaks, tamper, backflow
- Enhanced trouble-shooting tools

Mapping

- Identify areas of concern or interest such as:

- Leak
- Reverse Flow
- Zero Consumption
- Soft-Disconnect
- Not Heard From
- Major Reverse Flows



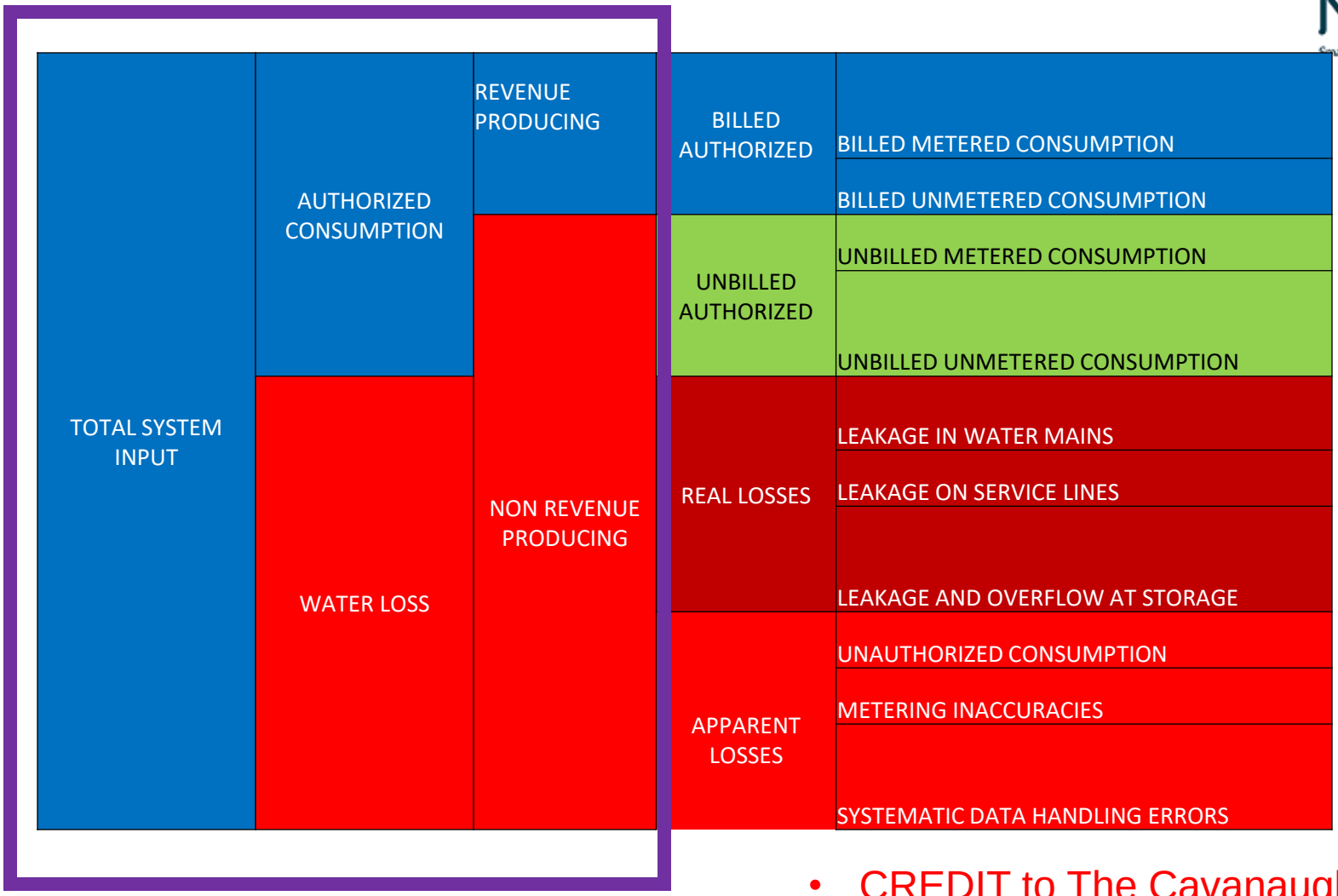


- Missed
- Inactive with Usage
- Collector Types
- Collector Status
- All Endpoints
- Continuous Leaks
- Endpoint Groups

Apparent Water Loss

- EXPENSIVE
- ACCOUNTABILITY
- CONSERVATION
- EPA IS WATCHING
- CREDIT TO THE AWWA
- CREDIT TO The Cavanaugh Group
- How can a meter supplier help?

Total Water Balance



- CREDIT to The Cavanaugh Group

Total Water Loss

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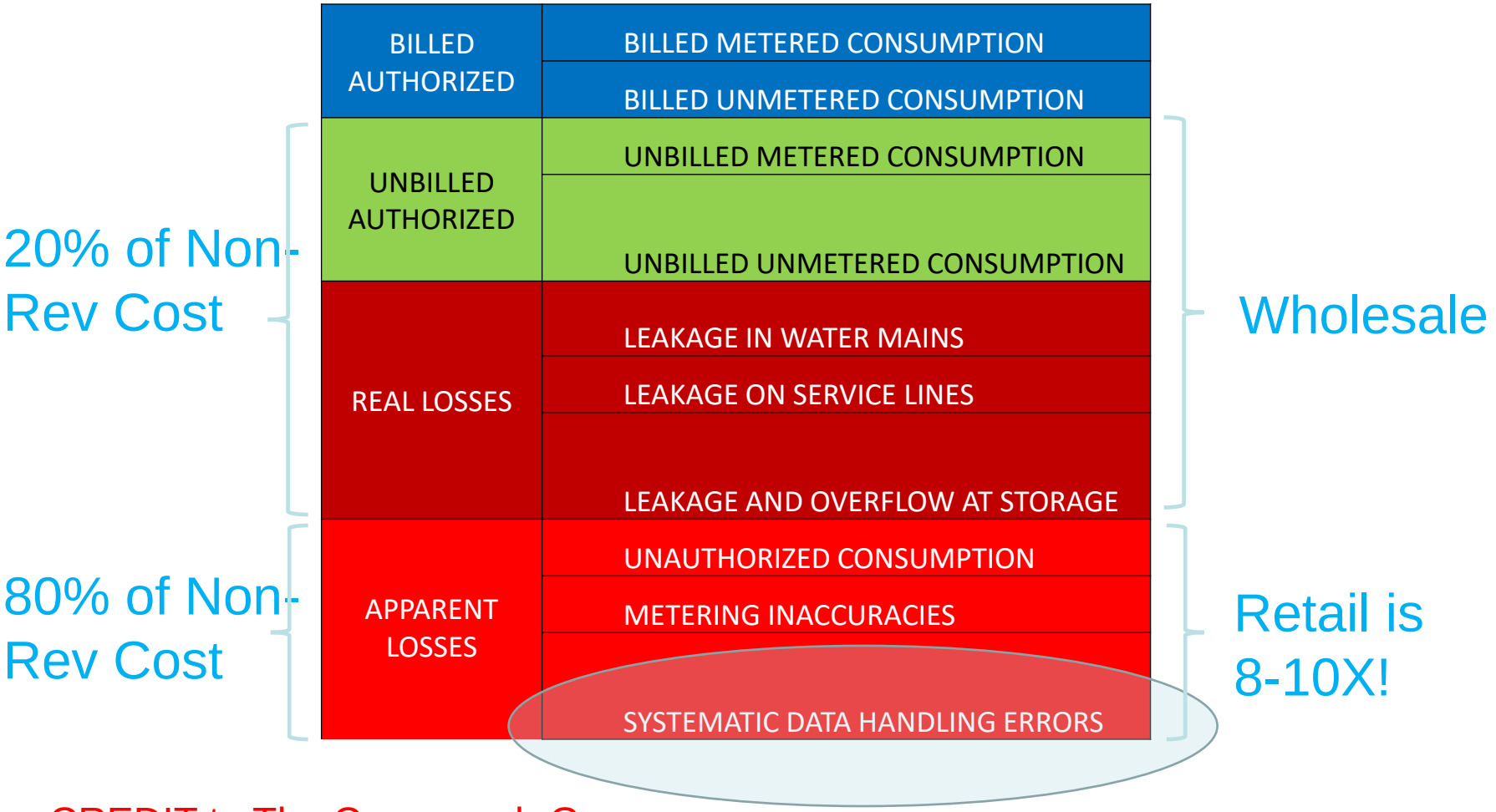


- CREDIT to The Cavanaugh Group

Meter Reading Data Integrity

Input Readings

Billing

File Transfers Must be Accurate!

Data Input Methods

- Account Info
- Address
- Reading Method
- Meter Size
- Manual Multiplier?

Dial Reading

Gallons

1000's of Gallons
100's of Cubic Feet

OLD METHOD:
Read Only the Moving White Wheels

CURRENT METHOD:
Read Using Standard Rules

Cubic Feet

Dial Reading

Gallons

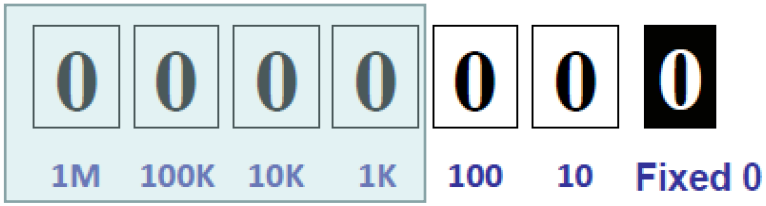
Larger meters have more fixed zeros

Compound meters may require reading two registers with different rules!

Cubic Feet

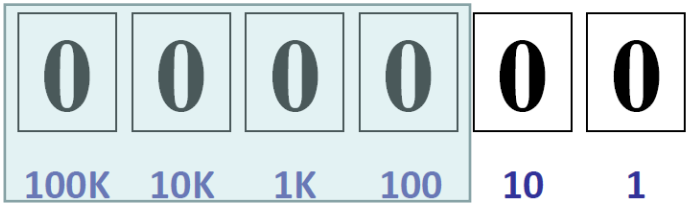
Direct Read Rules

5/8”, 3/4”, 1” Gallons

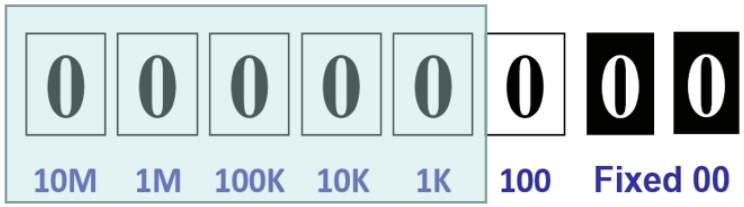


4 Dials

5/8”, 3/4”, 1” Cu. Ft

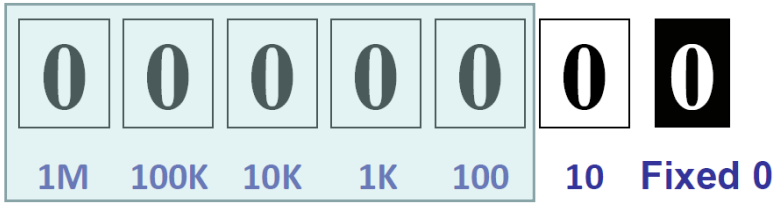


1 ½”- 4” Gallons

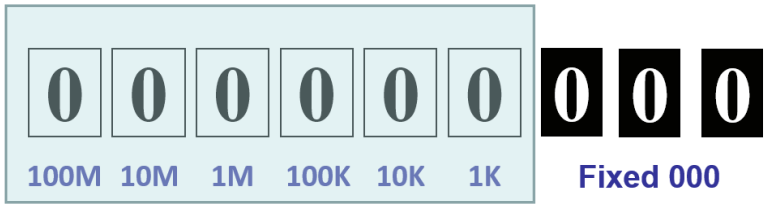


5 Dials

1 ½”- 4” Cu. Ft.

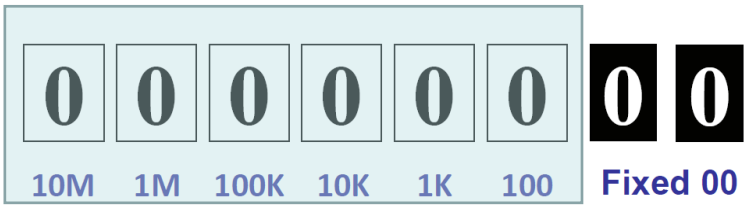


6”-12” Gallons



6 Dials

6”-12” Cu. Ft.



Automation

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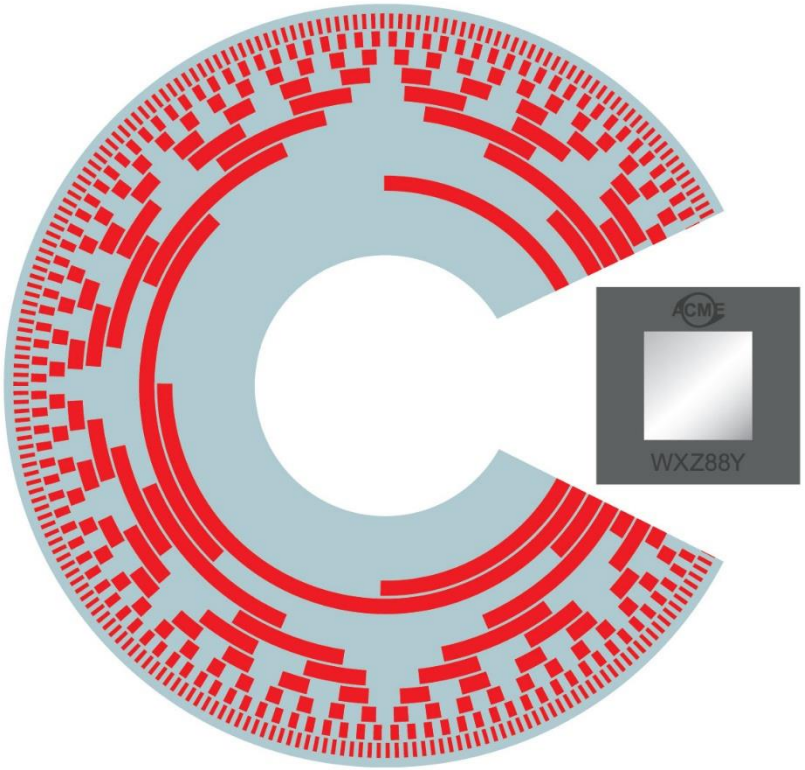
Then we needed to automate meter reading

Encoder Output Technology

Absolute Encoders



Pulse Output

Encoder Output Technology

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First Generation Encoders 4 or 6 Dials?

First Generation Radios: 6 Digits

Encoder Output Technology

Now we can:

- Program Registers
- Program Radios
- Program Software to read various reading methods and dial numbers

But we also deal with:

- Programming Errors
- Meter readers can’t obviously tell what the read should be
- We look at the actual meters less often

High Resolution Registers

Second Generation Encoders capability

8+ wheel

8 Dials

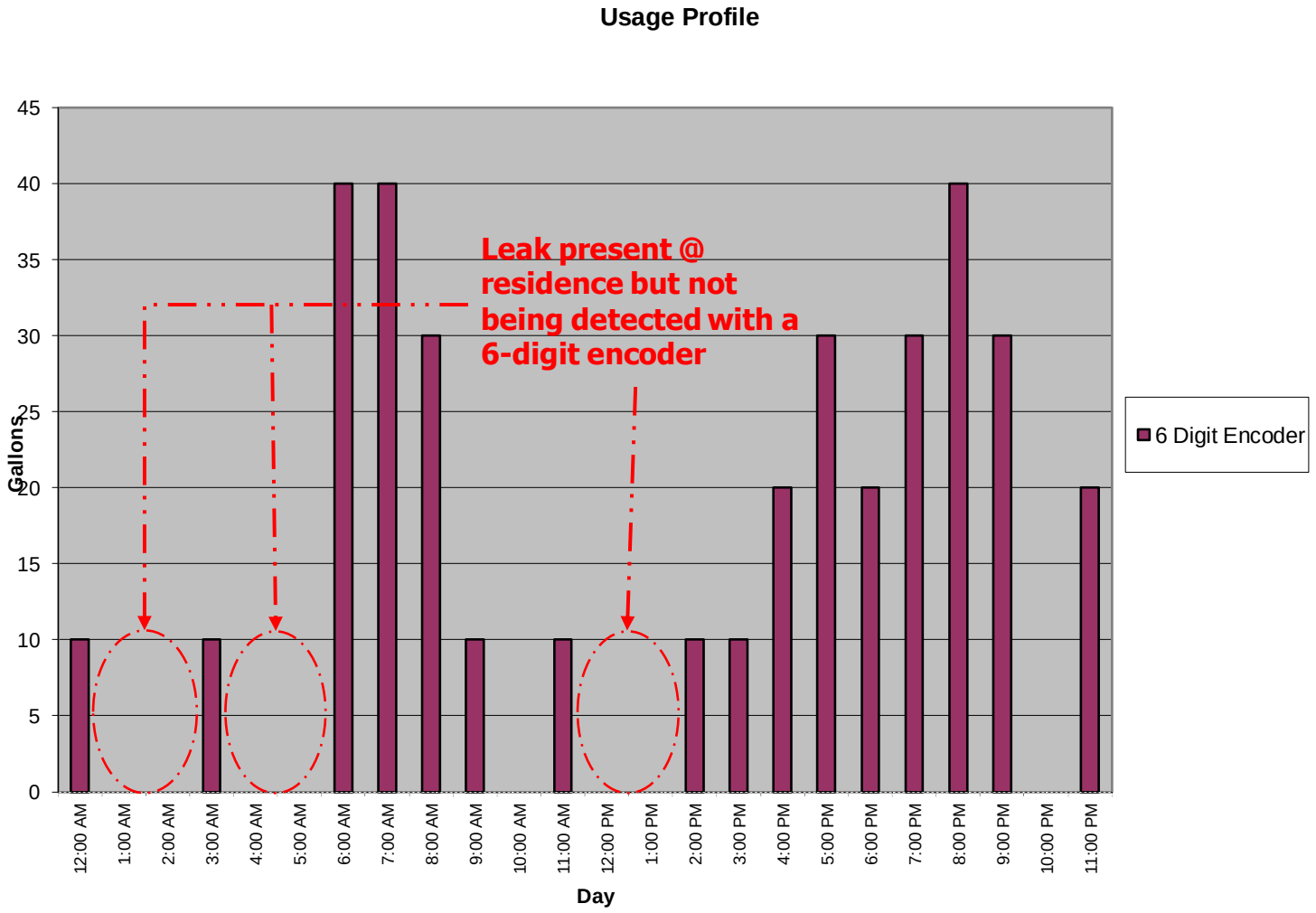
9 Dials

10 Dials

8 Digit Radios
Leak Detection Capability

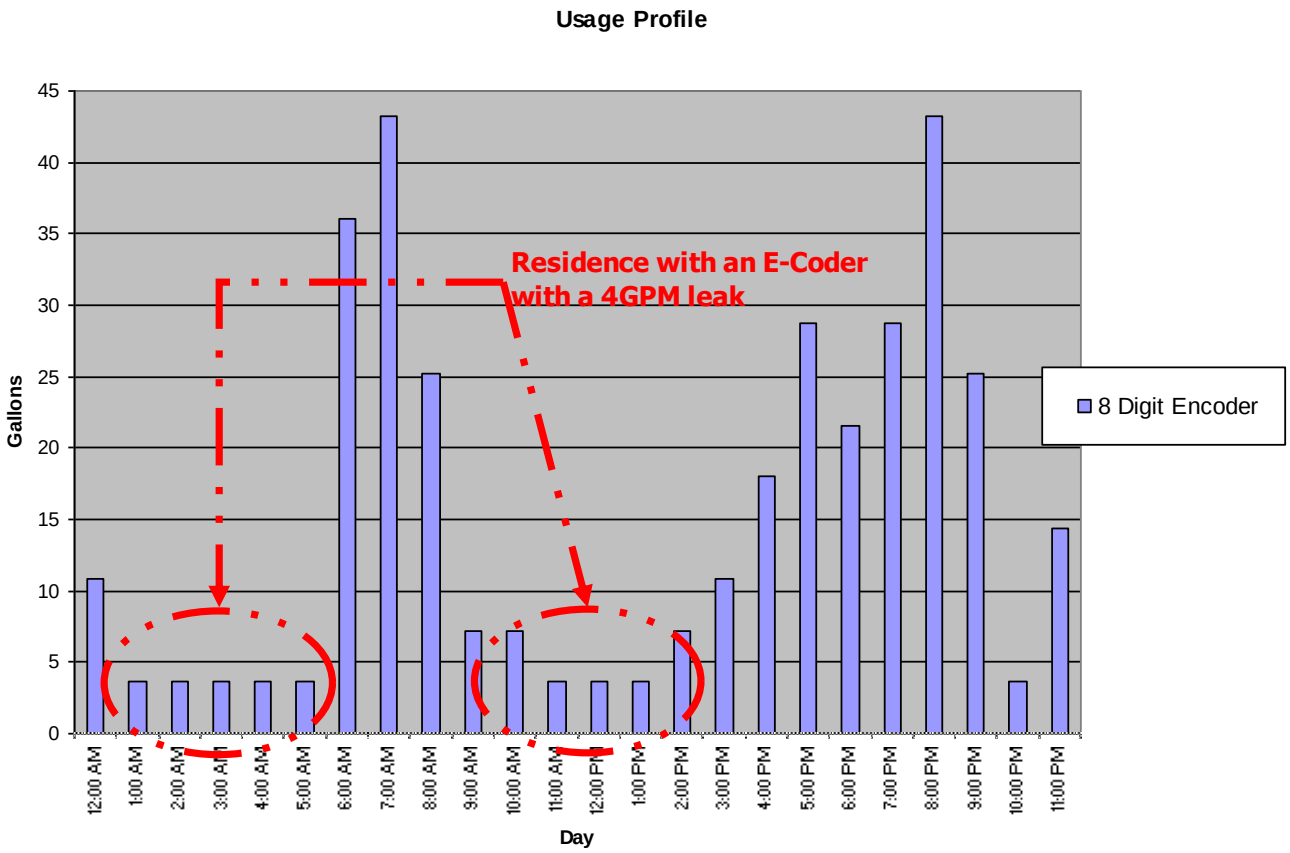
Leak Detection without High Resolution

- Undetected leak standard with 6-digit resolution



Leak Detection With High Resolution

- **8 Digit Resolution = 1/100 GPM**
- **True Leak Detection Demands High Resolution**



Meter Reading Challenges

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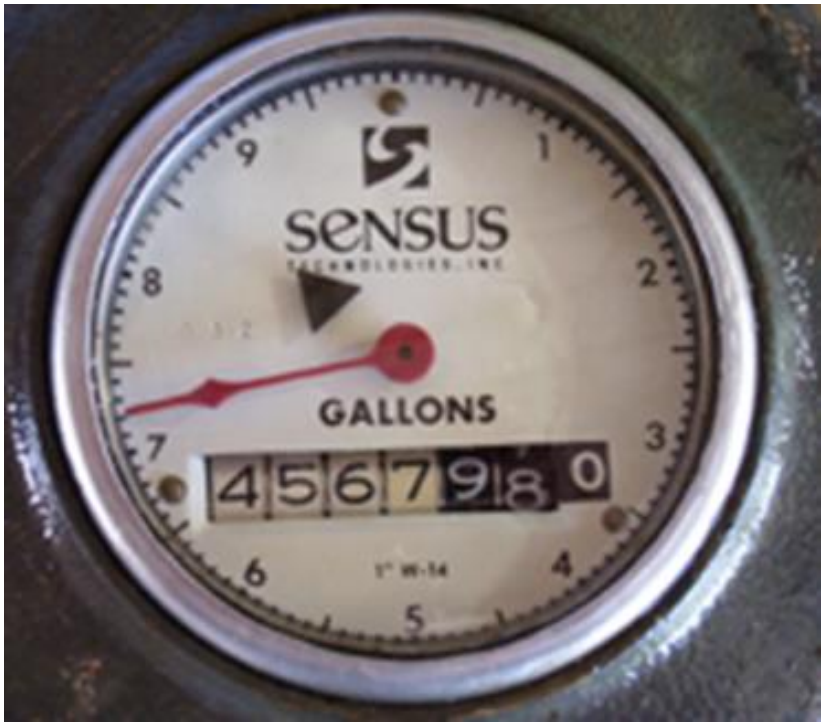
Different Reading Methods Look Different!

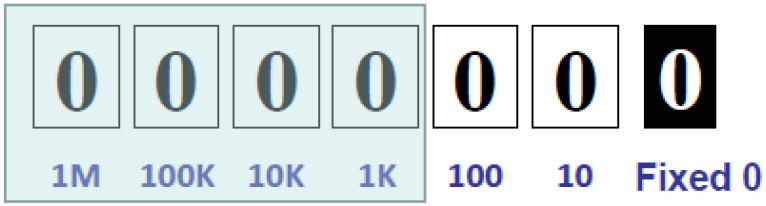


Reading in 1000's of Gallons via:

- **Direct Read: 4567**
- **Touch Pad, 4 Dials: 4567**
- **Touch Pad, 5 Dials: 45679**
- **Touch Pad, 6 Dials: 456798**
- **Radio, 6 Digit: 456798**
- **Radio, 8 Digit: 45679800**
- **With Tablet & App: 4567980.0**

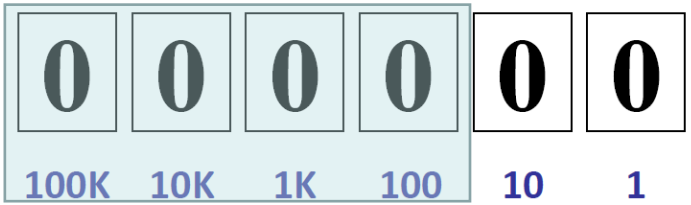
Dial Reading Rules UNCHANGED!

5/8”, 3/4”, 1” Gallons

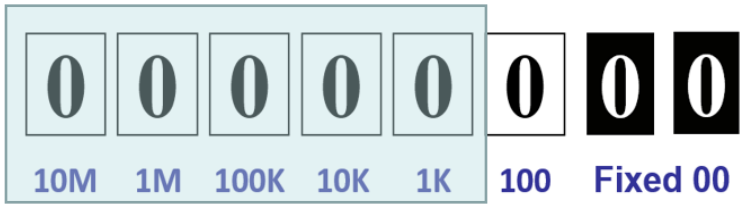


4 Dials

5/8”, 3/4”, 1” Cu. Ft

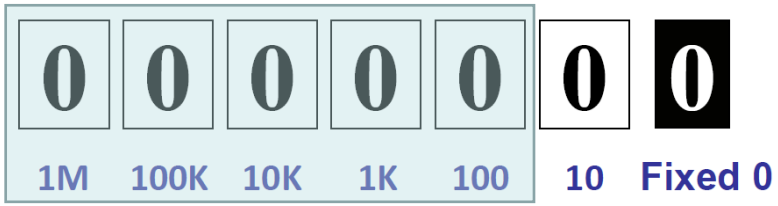


1 ½”- 4” Gallons

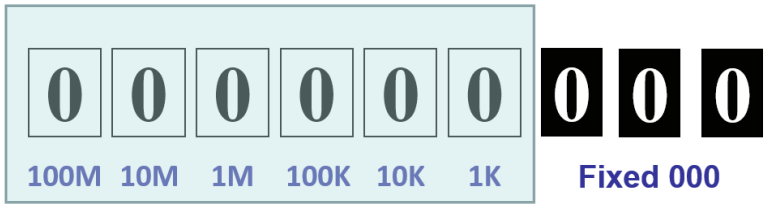


5 Dials

1 ½”- 4” Cu. Ft.

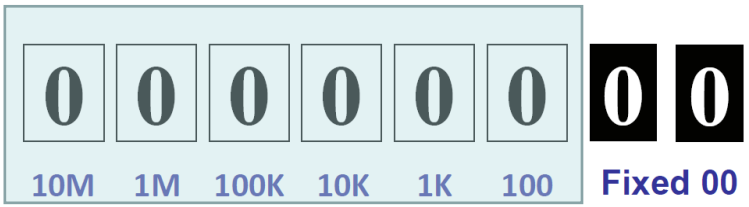


6”-12” Gallons



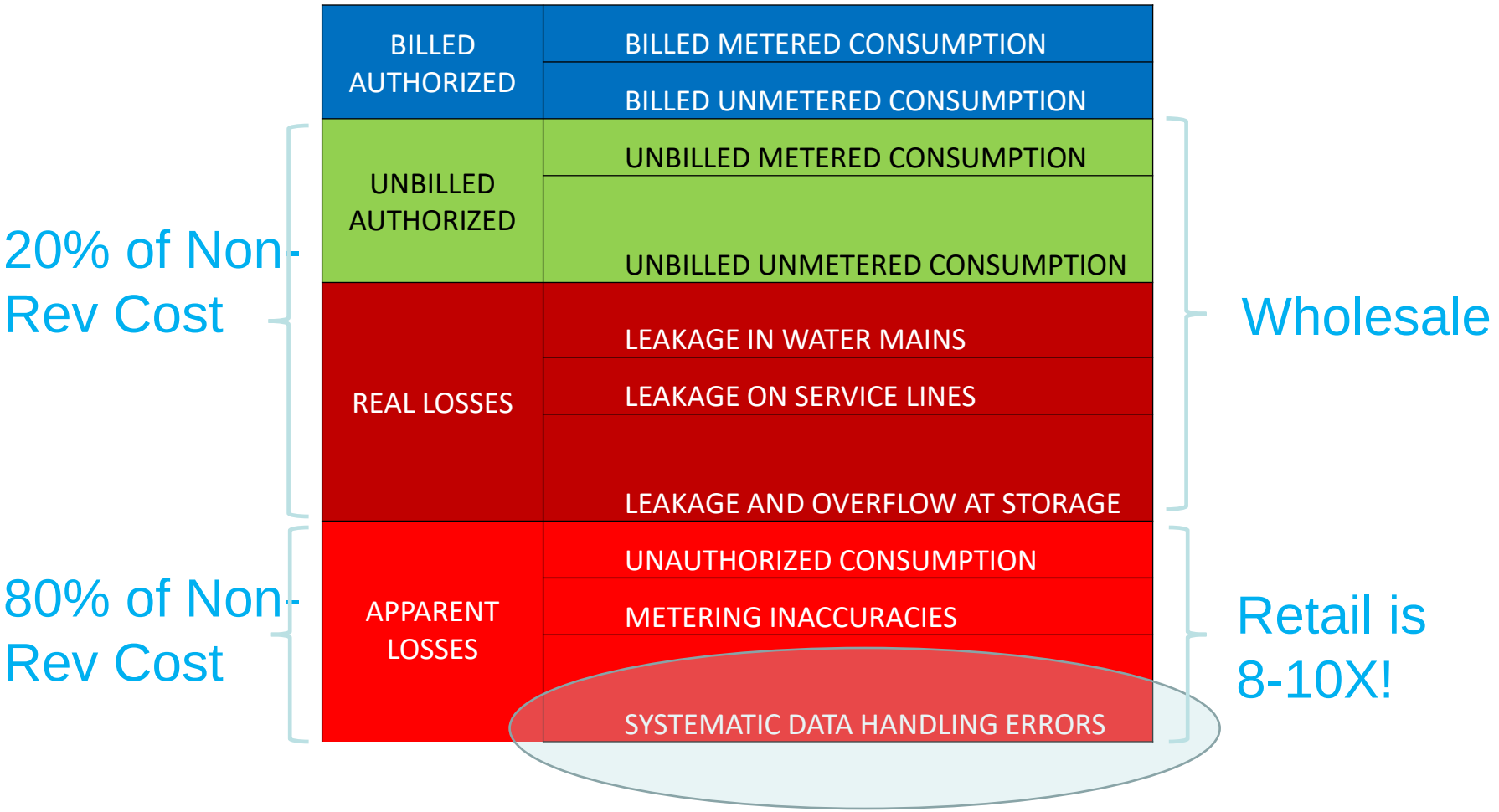
6 Dials

6”-12” Cu. Ft.



Fortunately, and by Design, the Reading Rules Stay the Same!

Apparent Water Loss



Data Auditing Recommended

- Internal
- Auditing Firm
- Meter Supplier
- Software Supplier

Water Loss Audit Software

AWWA Free Water Audit Software v5.0

Email Address:	bbecker@necowater.com
Telephone | Ext.:	513 623-9990
Name of City / Utility:	
City/Town/Municipality:	
State / Province:	Select a state / province from the list
Country:	
Year:	Select Type...
Start Date:	Enter MM/YYYY numeric format
End Date:	Enter MM/YYYY numeric format
Audit Preparation Date:	
Volume Reporting Units:	
PWSID / Other ID:	

Value can be entered by user

Value calculated based on input data

These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions

The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet

Enter the required data on this worksheet to calculate the water balance and data grading

Comments

Enter comments to explain how values were calculated or to document data sources

Performance Indicators

Review the performance indicators to evaluate the results of the audit

Water Balance

The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard

A graphical summary of the water balance and Non-Revenue Water components

Water Loss Audit Software

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? Click to access definition
+ Click to add a comment

Water Audit Report for: << Please enter system details and contact information on the Instructions tab >>
Reporting Year:

WATER LOSSES (Water Supplied - Authorized Consumption) 0.000

Apparent Losses

Pcnt: Value:

Unauthorized consumption: + ? 0.000 0.25%

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies: + ?
Systematic data handling errors: + ?

Apparent Losses: ?

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: ?

WATER LOSSES:

NON-REVENUE WATER

NON-REVENUE WATER: ?

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains: + ?
Number of active AND inactive service connections: + ?
Service connection density: ?

n/a (not applicable). select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero.

1. Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter. Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated.

2. Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing. Existing paper records gathered and organized to provide cursory disposition of meter population. Customer meters are tested for accuracy only upon customer request.

3. Conditions between 2 and 4

4. Reliable recordkeeping exists; meter information is improving as meters are replaced. Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory). A limited number of the oldest meters are replaced each year. Inaccuracy volume is largely an estimate, but refined based upon limited testing data.

5. Conditions between 4 and 6

6. A reliable electronic recordkeeping system for meters exists. The meter population includes a mix of new high performing meters and dated meters with suspect accuracy. Routine, but limited, meter accuracy testing and meter replacement occur. Inaccuracy volume is quantified using a mix of reliable and less certain data.

7. Conditions between 6 and 8

8. Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters.

9. Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters.

Apparent Water Loss

With all the changes over the years in register resolution, reading methods, transmitters and software, it is critical to audit your data to ensure accurate meter reading.

You must work with both your meter and billing software suppliers to confirm accuracy.

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QUESTIONS?

Thank You for Your Time and Attention!

Kelly Byrd
NECO