

Master Training Program on Water (Water Supply, In-house Processing, End-of-Pipe) in Textile and Garment factories

Promotion of Sustainability in the Textile and Garment Industry in Asia - FABRIC

giz Deutsche Gesellschaft
für Internationale
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FABRIC Asia

Day 1: Presentation 5

Water Metering

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Water Meter Basics

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Introduction

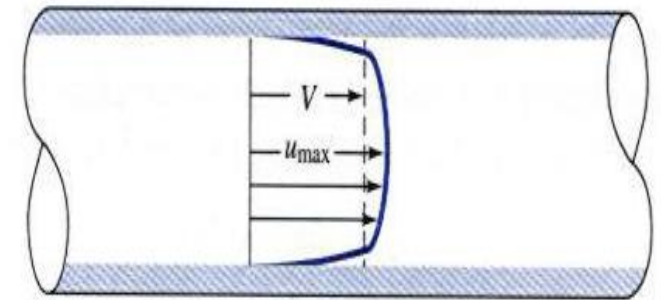


- Water meters are devices that are installed in a water pipe to measure the flow that goes through that pipe
- Knowing the quantity of water that is produced and distributed to different places helps in analysis
- Water meters can measure flow based on different methods. For example mechanic or electromagnetic
- It is important that water meters are sized, installed, and maintained correctly so that they will work well

Velocity Profiles

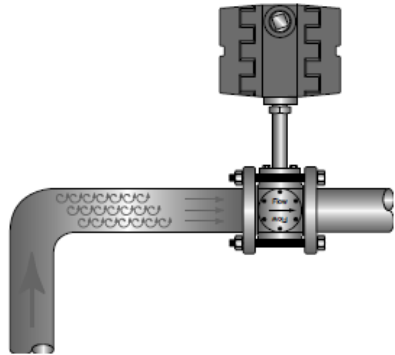
All flow meters are only accurate if the water has a uniform Velocity Profile around the pipe's centre axis:

- Upstream fittings have a bad effect on the profile, some fittings have a worse effect than others (e.g. butterfly valve)
- The fittings cause 'swirl' in the water which causes the meter to either under (-) or over (+) read the flow
- Some types of meters are less affected by turbulent flow than others (electromagnetic meters are better than mechanical)
- Turbulent flow can be avoided by keeping a straight pipe before and after the meter (no bends or fittings). All manufacturers state minimum upstream and downstream straight pipe lengths from the meter



Average velocity
at 1/8 diameter

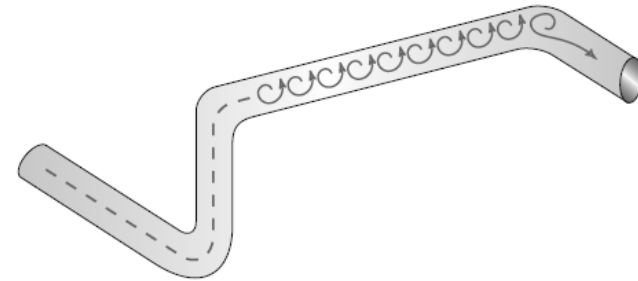
Distorting Velocity Profiles



Turbulence caused by bend or obstruction



Photo: Mohammad Abbas



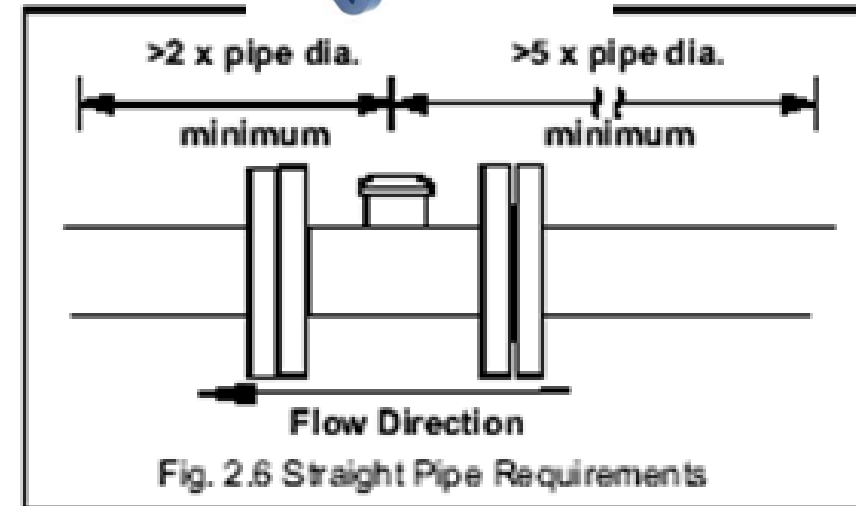
Swirl caused by two bends in different planes



Photo: Mohammad Abbas

General Advice on Meter Installation

- Comply with manufacturers recommended minimum upstream and downstream straight pipe lengths from the meter
- Install the meter in the correct direction of flow
- Avoid fitting insertion and ultrasonic clamp-on meters on the top of the pipe where trapped air can distort the reading
- Ensure the pipe is always full of water



Extract from [ABB's Meter Installation Manual](#)

Water meter maintenance

- Water meters can get clogged, broken or worn due to dirty water.
- They can also age with time.
- For optimal benefit and use of water meters it is important to regularly inspect all types of water meters, clean and calibrate them



Water Meter types

Insertion, electromagnetic and clamp-on meters and their installation

Water meter Types

Production meters are large flow meters that are usually located:

- On the outlet of water treatment works
- On trunk / carrier mains / large diameter pipes

Generally there are three types:

1. Mechanical
2. Electromagnetic
3. Ultrasonic



Mechanical



Ultrasonic



Electromagnetic

Water meter Types

Mechanical Flowmeters

- Traditionally used
- No power required
- Can be damaged by poor quality water
- Strainer requires regular cleaning
- Available as a combination meter to capture both low and high flows

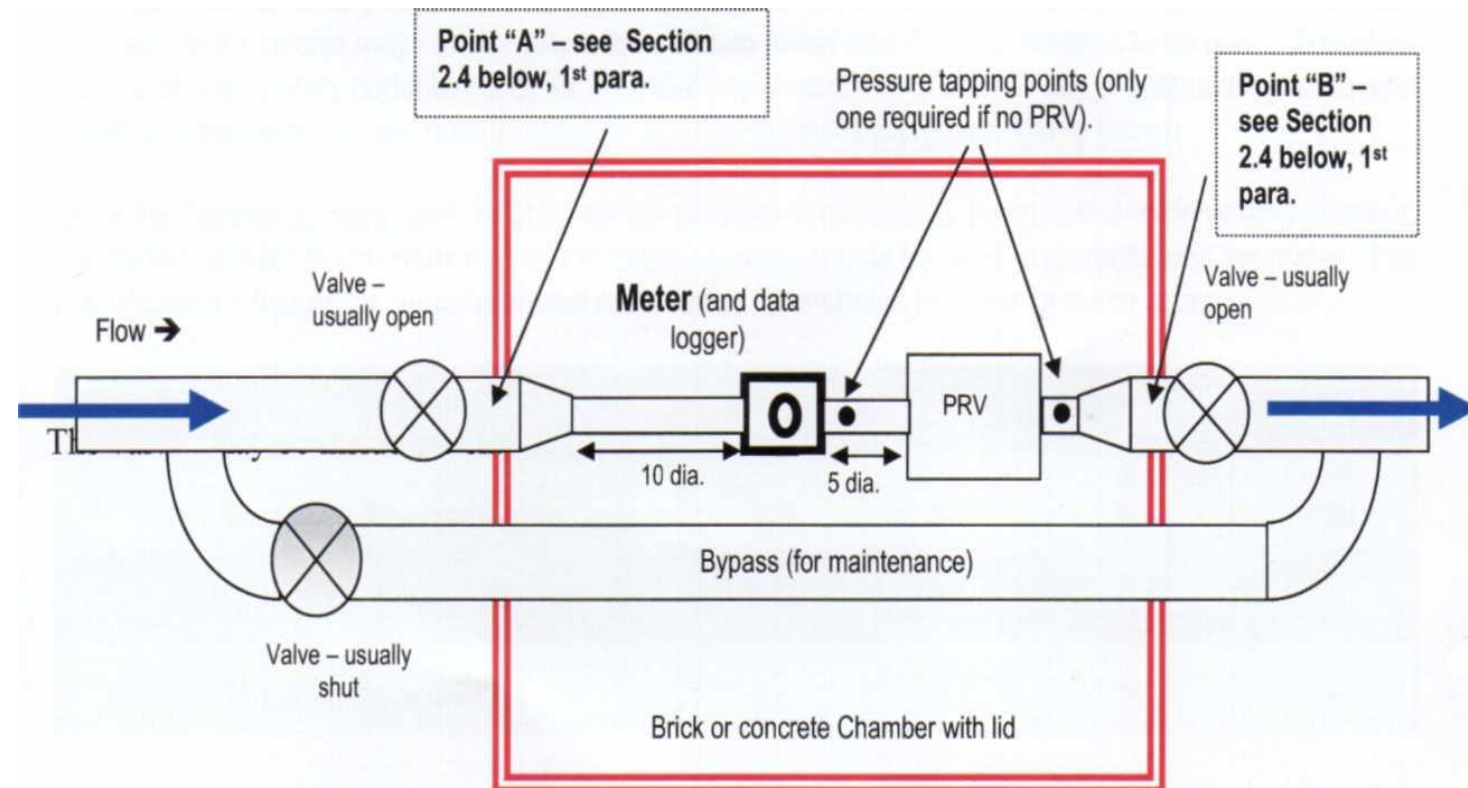
Specification	Value
Accuracy	± 5%
Meter Sizes	40 to 500 mm



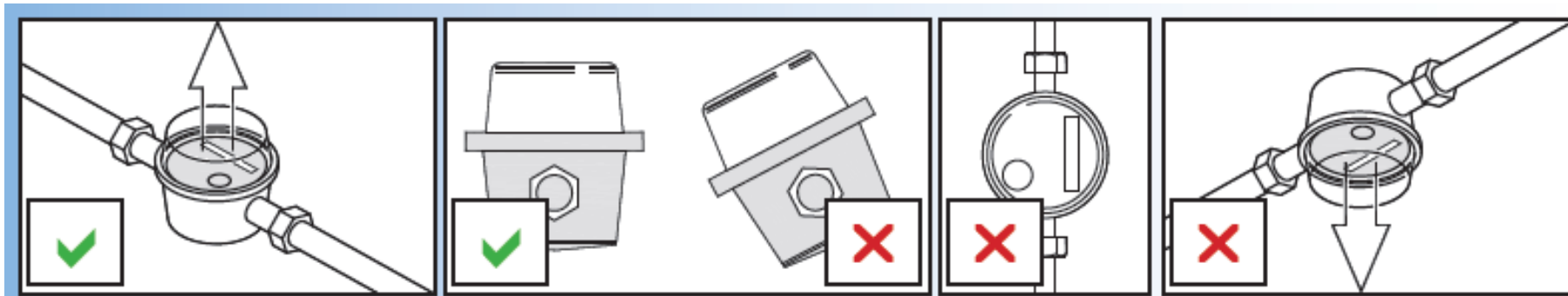
Water meter Types

Mechanical Meters – Installation

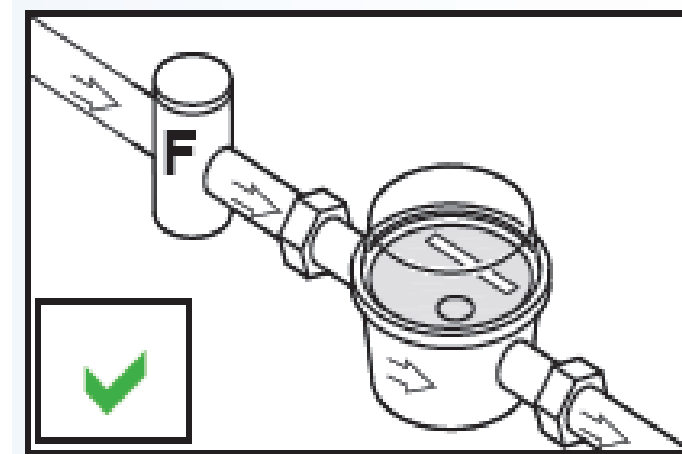
- Installed in a chamber
- Usually on a bypass arrangement to easily allow maintenance and replacement
- Minimum 10D and 5D upstream and downstream straight length pipe



Mechanical Meters for domestic use

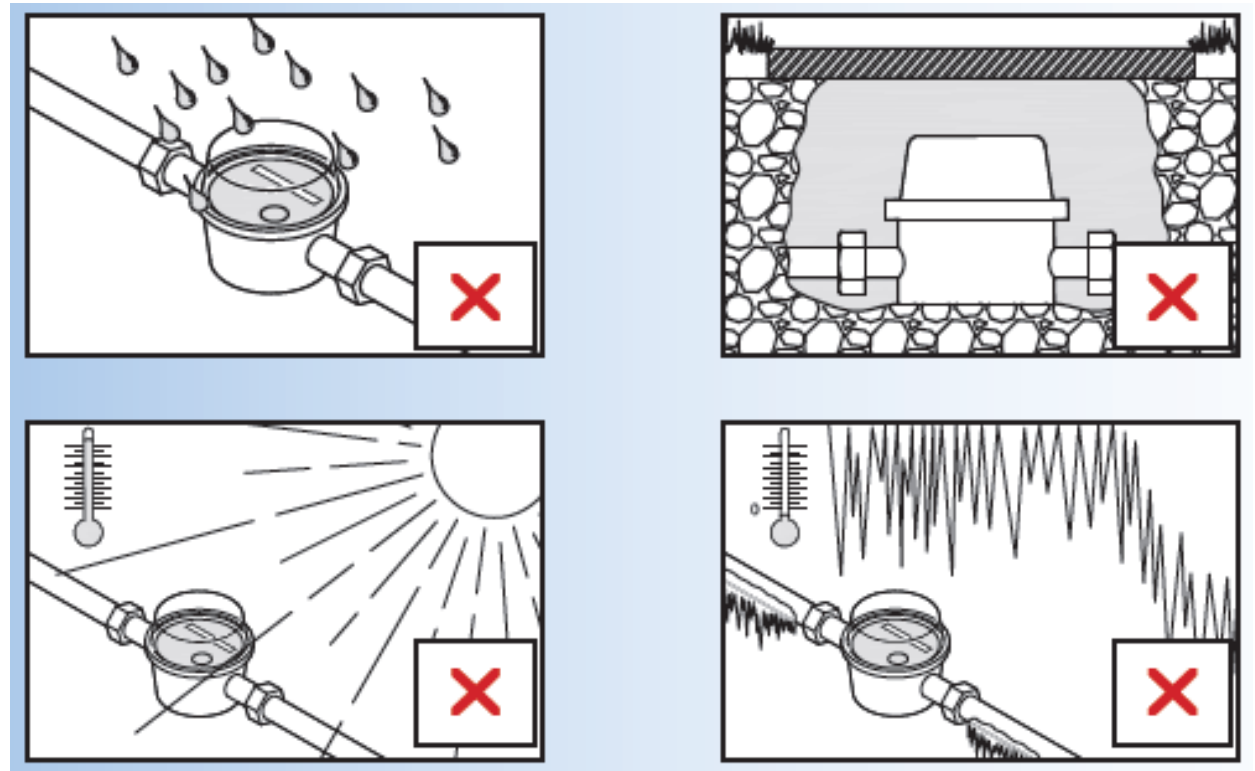


10 X pipe diameter in length



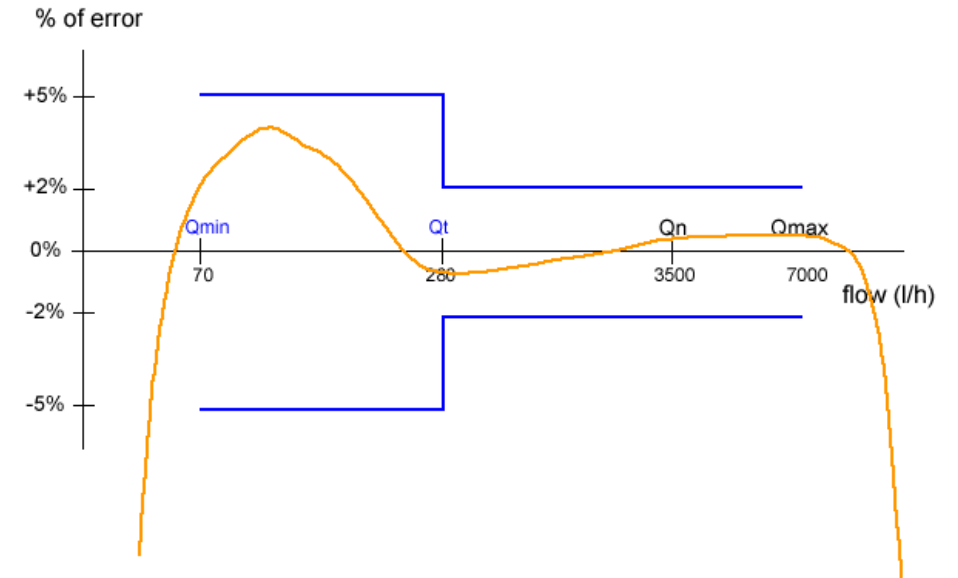
Installation of Mechanical Meters for domestic use

- The meters are designed only for use with clean water
- a strainer is recommended upstream of the meter. The strainer should be installed at least 10 x diameter of straight pipe before the meter, to avoid turbulent flow.



Sizing of Mechanical Meters for domestic use

- Water meters should be sized between transitional flow Q_t (the point at which the meter is accurate) and nominal flow Q_n (everyday flow)
- A water meter receiving the maximum flow for more than 1-2 minutes will be damaged
- At low flows, the meter is not accurate. Minimum flow is the flow required to operate and record on the meter
- Never use maximum flow as a basis for sizing the meter



Accuracy curve of a meter compared to an accuracy range

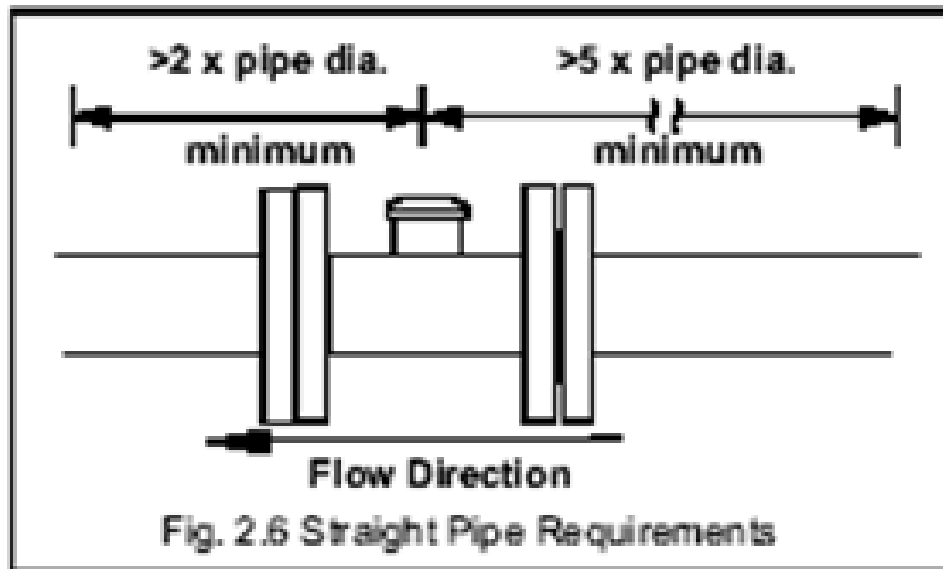
Electromagnetic flowmeters

- Example manufacturers are ABB, Elster, Siemens and Badger Meter
- Usually AC powered
- Full bore meter with no moving parts – not easily damaged
- Can be buried

Specification	Value
Flow range	? m/s
Accuracy	$\pm 1 \%$
Pipe Size	up to 2,600 mm



Electromagnetic flowmeter - Installation



Extract from [ABB's Meter Installation Manual](#)



Ultrasonic flowmeters

- Battery or AC powered, not suitable for permanent installation
- Very useful for checking the accuracy of other meters
- Easy target for theft
- Essential that pipe material and lining is known



Specification	Value
Flow range	? m/s
Accuracy	$\pm 1 \%$
Pipe Size	Up to to 7,600 mm

Water Meter in Textile Industry

What do we see in Textile Factory

- Lack or incomplete metering infrastructure
- Wrong type of meters or position of meters or no maintenance in meters
- Metering infrastructure with inadequate collection and/or processing of data.

What can be measured can be managed but **NO** one-size-fits-all solution

- Provide a simple overview of main patterns of water use to evaluate overall water efficiency of production
- Provide a baseline water use in specific units and by specific equipment before efficiency measures are put in place, in order to evaluate the effectiveness of those measures.
- Evaluate new equipment to ensure it is performing to manufacturer specifications.
- Provide real-time data on performance of existing water-intensive processes and equipment to evaluate whether they are being operated efficiently and without equipment malfunction.

What can be measured can be managed but **NO** one-size-fits-all solution

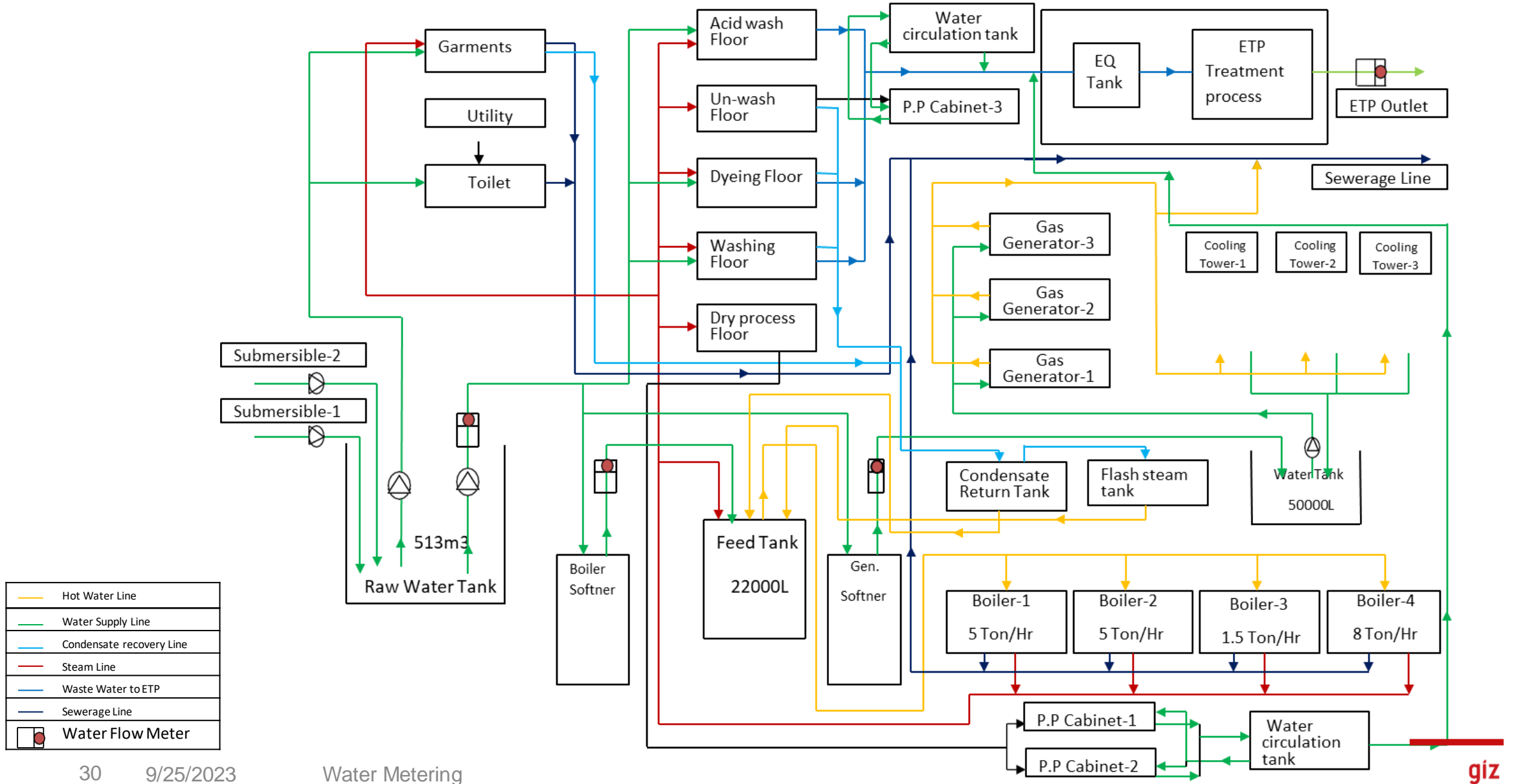
- Provide detailed data on water use to customers seeking to understand more about the life cycle performance of their products.
- Similar equipment or processes running in different workshops can be benchmarked against each other, or against a database of historical resource use to further increase performance insight.
- Use portable temporary meters to spot-check performance of subsystems where issues are suspected and validate other meter and billing data.
- Integrate benchmark resource consumption with other information systems

Metering Coverage in Textile Factory

Coverage	Expected accomplishment	Extent of analysis
Tier 1	Main supplies are metered.	Factory
Tier 2A	Some but not all workshops are equipped with submeters.	Factory and workshop
Tier 2B	All workshops are equipped with submeters.	
Tier 3	Major energy-consuming machines are fully metered for monitoring and targeting, along with meters at the workshop level.	Factory, workshop, and equipment

Source: NRDC Guide to Metering in Textile Mills 2013

An Illustration of Water Metering



Water Meter Reading issue

Tempering, illegal use

Water reading issue

- The state and use (or non-use) of water meters plays a large role in consumption data
 - ✓ Illegal consumption
 - ✓ Meter by-passes and tampering
- Meter inaccuracies
 - ✓ Volume under-recorded by revenue meter due to its condition or wrong sizing or installation

Meter Tampering

Meter tampering is illegally altering meter so that it under-reads. Common methods are:

1. Inserting a pin or needle to stop the totaliser moving
2. Blocking the meter inlet or chamber
3. Placing a powerful magnet to break the magnetic coupling of impellers and gears
4. Reversing the meter
5. Temporary removal of the meter
6. Hitting the meter hard – some meters now come with an impact warning system
7. Cutting or damaging the impellor



To complete the water balance, we have to identify the reduced consumption of these tampered meters

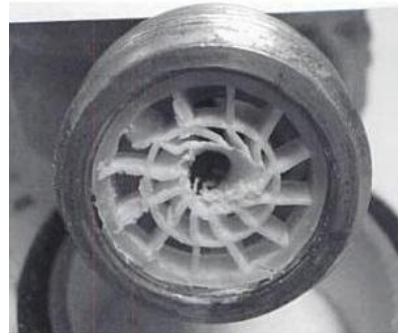
Examples of Meter Tampering



Pipe used to partially bypass water meter.



Water meter removed and replaced with straight pipe.



Meter Errors

Almost all meter errors result in them under-reading: the meters will read less than the actual water volume being consumed. Consequently, a proportion of the consumed water is not billed to the customer – loss in revenue

Meter errors can be caused by:

- Incorrect sizing
- Their class
- Their condition:
 - ✓ Age
 - ✓ Water quality
 - ✓ Maintenance regime
- Incorrect installation
- Meter tampering

Meter Installation



Meter sampling surveys can be organised to find out issues with water meters caused by:

- Meter size
- Meter age
- Meter maintenance
- Meter installation

Conclusion



- Water flowmeter is essential to understand and measure the water consumption in textile factory
- The extent of the measurement and corresponding analysis depends on the type of textile units, desire of the management to restrict the use of water
- The type of water flowmeter are mainly three and some of them are suitable in specific application
- Installation, size and age affects the meter reading.

Reference

- NRDC Guide to Metering in Textile Mills 2013
<https://www.nrdc.org/sites/default/files/CBD-Metering-Guide.pdf>
- IHE DELFT- Institute for water education in partnership with UNESCO

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