



NOVEMBER 2022

EventMobi

Have you downloaded the app yet?

I encourage you to do so, and get ready to participate in the Live Polls in this and future sessions.

Here we go!



PRODUCT INNOVATIONS

- 1- RO/UF Permeate Connector
- 2- CFH's Internal Support Rod (ISR)

Piedmont



DISTRIBUTOR SUMMIT

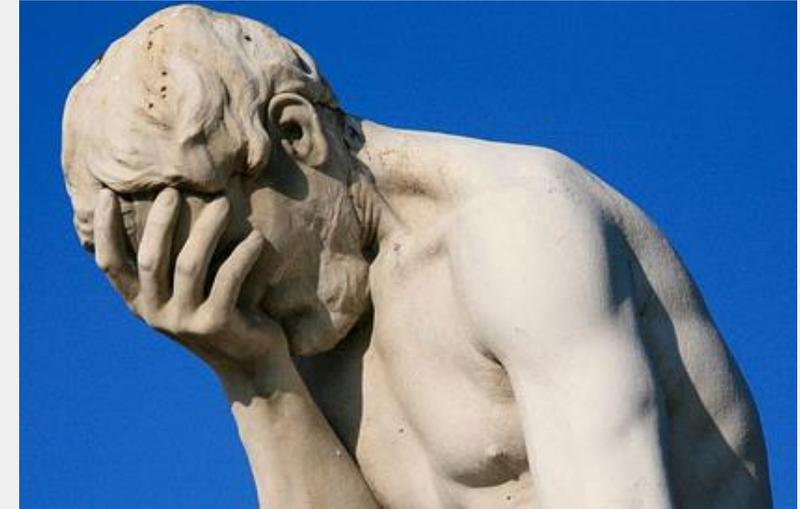
NOVEMBER 13-17, 2022



Permeate connectors

What's wrong with Permeate Connectors?

(Permeate connector: pipeline from membrane vessel to Manifold, in Reverse Osmosis and Ultrafiltration plants)



Permeate connectors

Rigid Permeate connectors:

Issue #1:

Access to change membranes



Permeate connectors

Rigid Permeate connectors:

Issue #2:



Assembly with large number of components to be glued together and pipes to be cut to size:

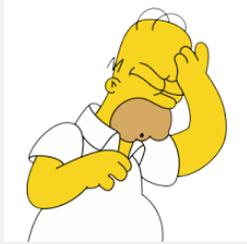
- Time consuming
- Leak risk (human error)
- Work accident risks (human factor)



Permeate connectors

Rigid Permeate connectors:

Issue #3:



Sampling port (efficient and representative).



Note: What if the sample port was always there, in each vessel, integrated in a cost-effective solution, without the need for expensive valves and fittings?

Permeate connectors

Rigid Permeate connectors:

Issue #4:

Probing (efficiently).

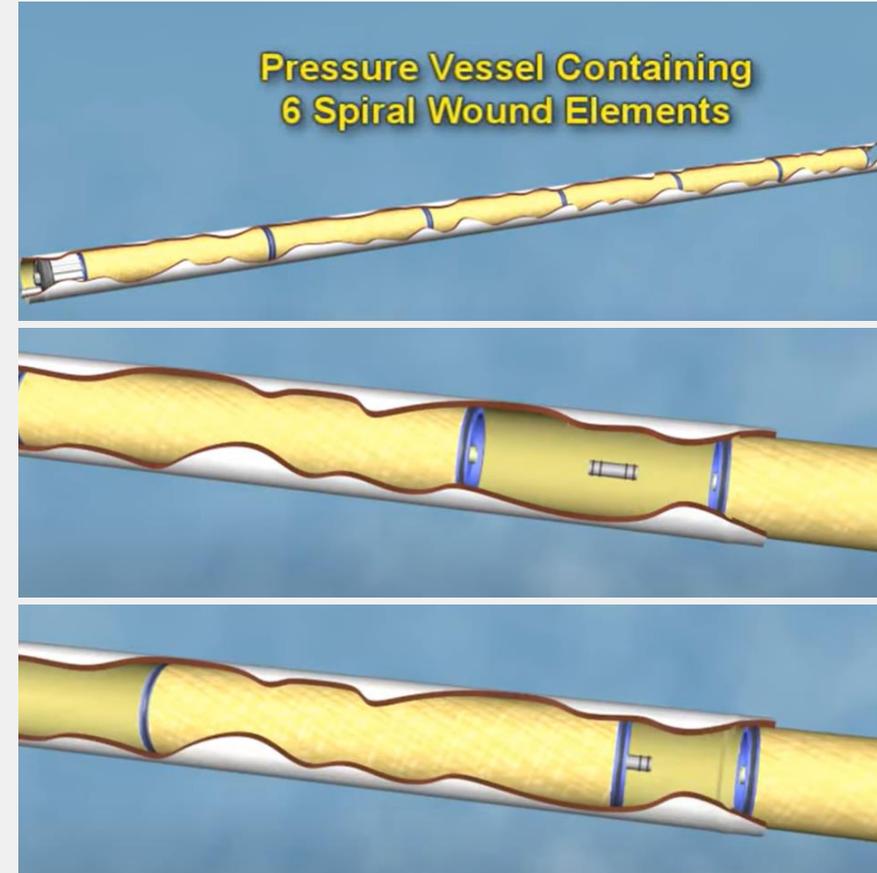


Permeate connectors

Rigid Permeate connectors:

Issue #4:

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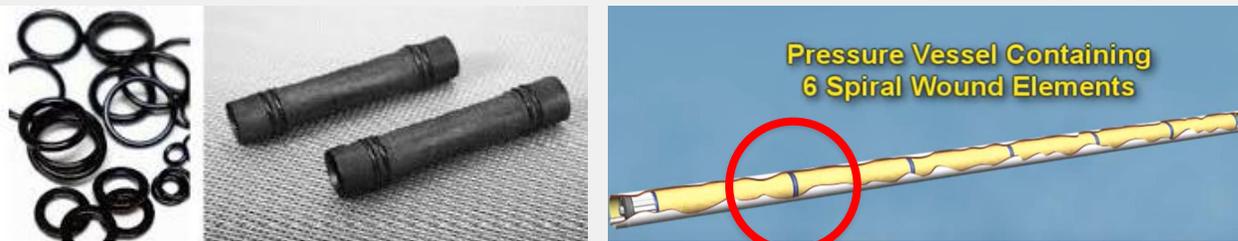
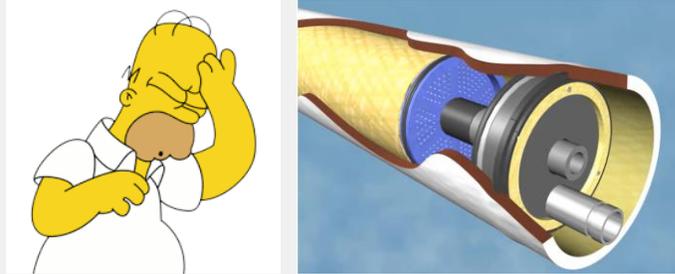


Permeate connectors

Rigid Permeate Connectors:

Issue #4:

Probing (efficiently).

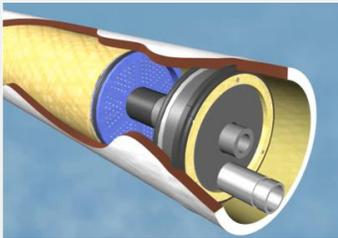


Permeate connectors

Rigid Permeate connectors:

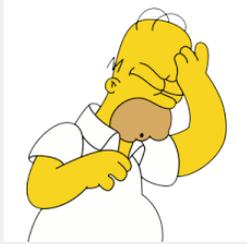
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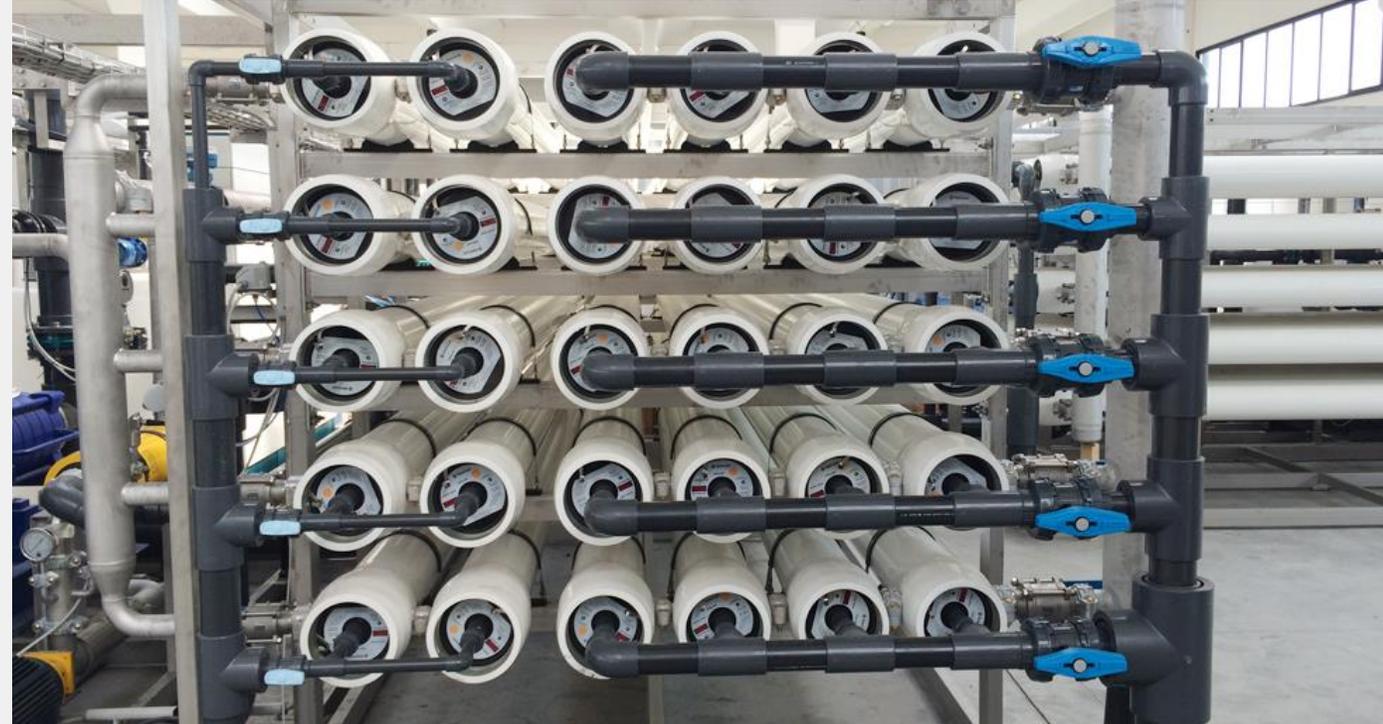
Permeate connectors

Rigid Permeate Connectors:



Issue #5:

Higher than ideal pressure drops due to inefficient piping hydrodynamics



Permeate connectors

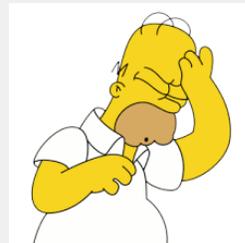
Individualized **Flexible** Permeate Connector Designs

A step in the right direction:

- 1- Access to change membranes
- 2- No need to use hazardous chemicals
- 3- Absorbs pipe misalignments



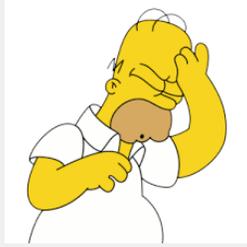
With some caveats!



Piedmont

h₂O
innovation[®]





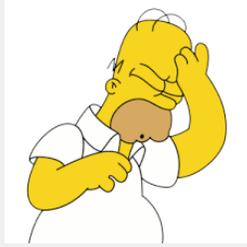
Permeate connectors

Flexible Permeate connectors:

Issue #2:

Expensive





Permeate connectors

Flexible Permeate connectors:

Issue #3:

Multiple parts from multiple manufacturers



**No Warranty on
the assembly**





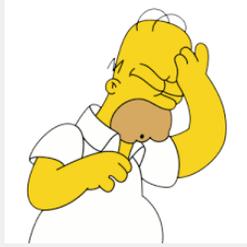
Permeate connectors

Flexible Permeate connectors:

Issue #4:

Human error: Leaks



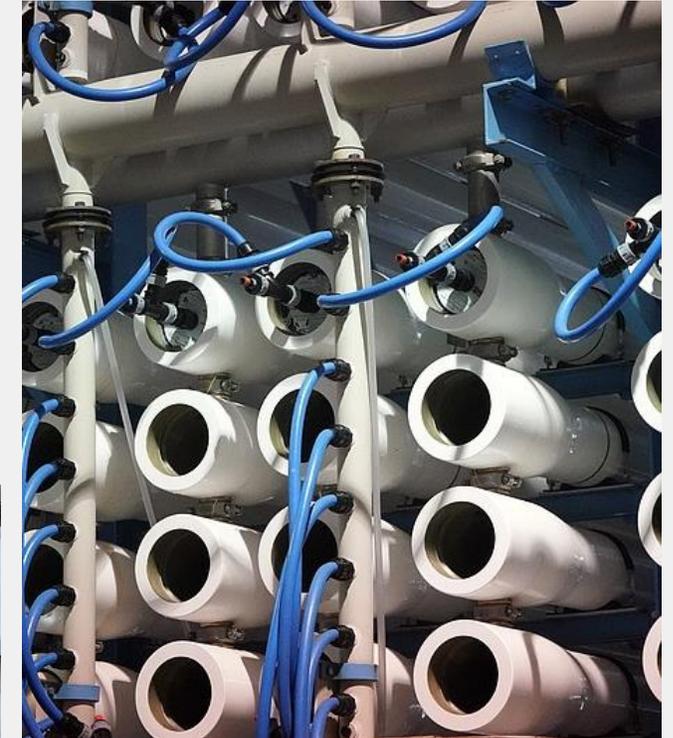


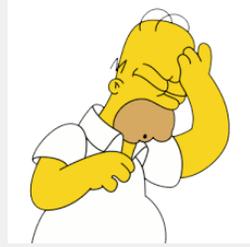
Permeate connectors

Flexible Permeate connectors:

Issue #5:

**Time consuming to replicate
and maintain during operation**





Permeate connectors

Flexible

Permeate connectors:

Issue #6:

Not the most uniform look





Permeate connectors

Flexible

Permeate connectors:

Issue #7:

Susceptible to corrosion



Live Poll (#1)

Main reason for insufficient maintenance of pipe leaks in RO and UF plants?

1. Too complicated (hard to access & execute).
2. There is no time (it would require a long plant shut-down or too many manhours to plan and execute)
3. Maintenance plan is not comprehensive enough.
4. Operators do not have the tools / resources for a quick repair.
5. All of the above.

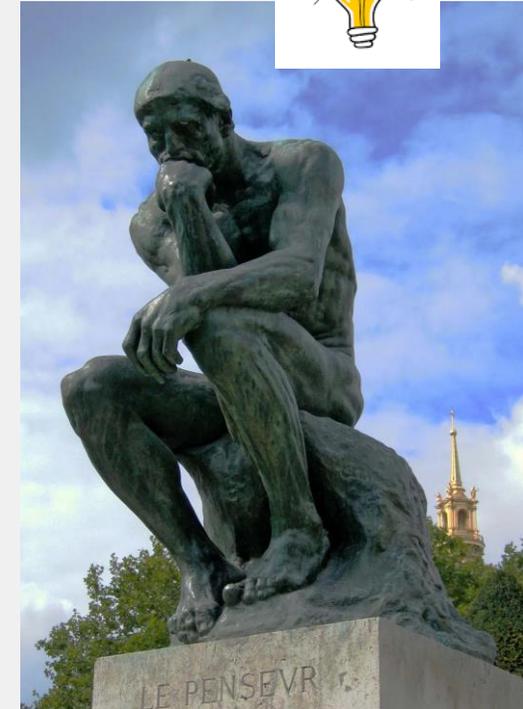


Rethinking Permeate connectors



What do we propose?

A Permeate Connection solution, integrated in a single product that has it all



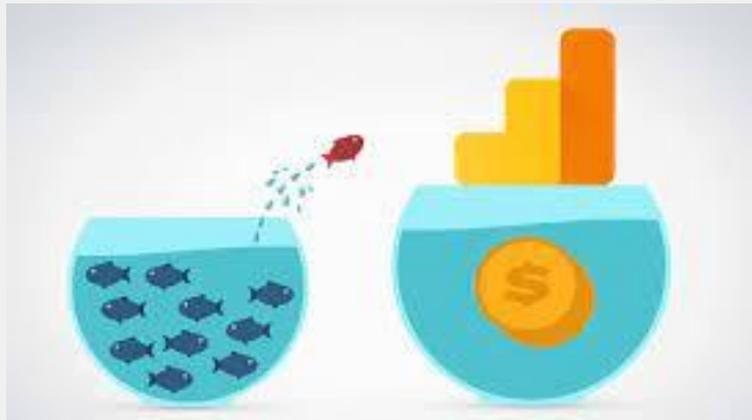
Permeate connectors (PiPerLink®)



Pi: Piedmont

Per: Permeate

Link: Connector



Permeate connectors (PiPerLink®)

Single product consisting of three parts:

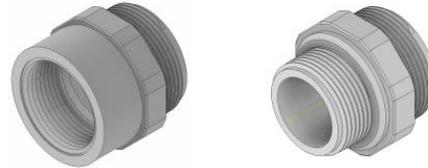
Each of them carefully **designed** and **manufactured** (injected and thermo-sealed) to ensure a **leak-free** solution



ELBOW



HOSE



ADAPTORS



Permeate connectors (PiPerLink®)

✓ CAPEX reduction

- Simplified purchase process (less resources needed in the purchasing phase).
- Simplified and more flexible RO/UF skid design.
- Warranted complete solution.
- Less manhours, tools, equipment, leak risks and H&S risks involved with assembly and installation.

✓ OPEX reduction

- Reduced preparation and installation time every time permeate connector or membrane maintenance is needed.
- Direct and indirect leak costs are avoided.
- H&S risks are minimized.



Permeate connectors (PiPerLink®)

BENEFITS:

1. Single SIMPLE product, configurable for each specific RO and UF case.
2. Allows for sample connection.
3. Allows for probing connection.
4. Easy installation.
5. Quick installation and maintenance (Time saver).
6. Simplifies membrane replacement.
7. Simplifies RO/UF skid designs.
8. Increases design flexibility.
9. Avoids leaks.
10. Avoids corrosion issues.
11. Reduces installation and operational costs.
12. Reduces pressure drop, thanks to improved hydrodynamic



Permeate connectors (PiPerLink®)

Main prospects to target:

Where there is pain!

1. OEMs/EPCs looking to simplify/optimize their designs.
2. OEMs/EPCs looking to optimize their procurement process.
3. OEMs/EPCs involved in plant operation and experiencing leak issues.
4. O&Ms experiencing challenging or frequent membrane replacements.
5. O&Ms experiencing leak issues.
6. O&Ms experiencing corrosion issues on permeate connectors.
7. OEMs/EPCs and O&M looking to reduce their H&S risks.
8. O&Ms with significant operator manhours constraints.



Cartridge filter housing's Internal Support Rods (ISR)



Cartridge filter housing's Internal Support Rod (ISR)

Introduction:

Once again, Piedmont **taking the lead** in SWRO innovations in peripheral equipment and components

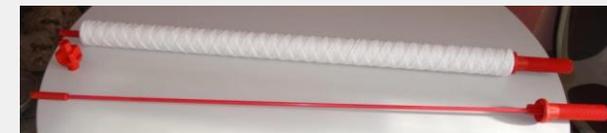
1- in 2002 Piedmont became the first to launch to the market Duplex and Super Duplex grooved couplings.



Introduction:

Once again, Piedmont taking the lead in SWRO innovations in peripheral equipment and components

2- in 2015 Piedmont designed the most revolutionary ISR yet, where all their parts where thermo-welded together and solving key common issues with its anti-rotation notch and high-speed nut, to ensure a proper seal and avoid common by-pass.



Piedmont

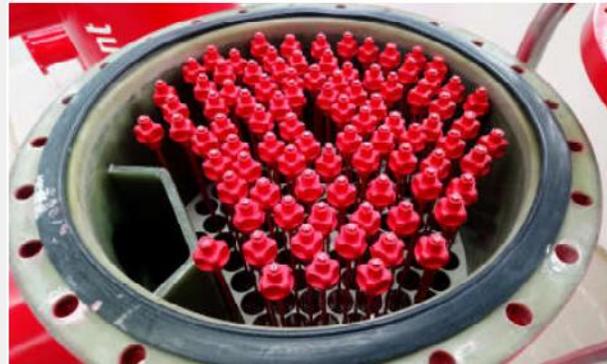
h₂O
innovation®



Introduction:

Once again, Piedmont taking the lead in SWRO innovations in peripheral equipment and components

3- Now, Piedmont pushes the envelope once again, by redesigning its already innovative ISR and minimizing pressure drop.



Piedmont



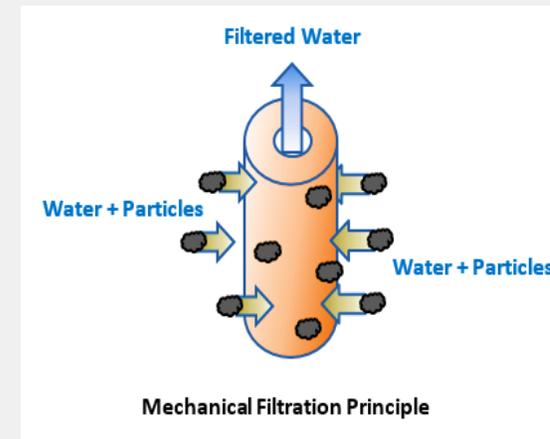
Cartridge filter housing's Internal Support Rod (ISR)

A consolidated filtration technology.

With room for improvement?

FRP cartridge filter housing designs for SWRO are only a few decades old at most.

Small design improvements can make a big difference.



Cartridge filter housing's Internal Support Rod (ISR)

Room for improvement?



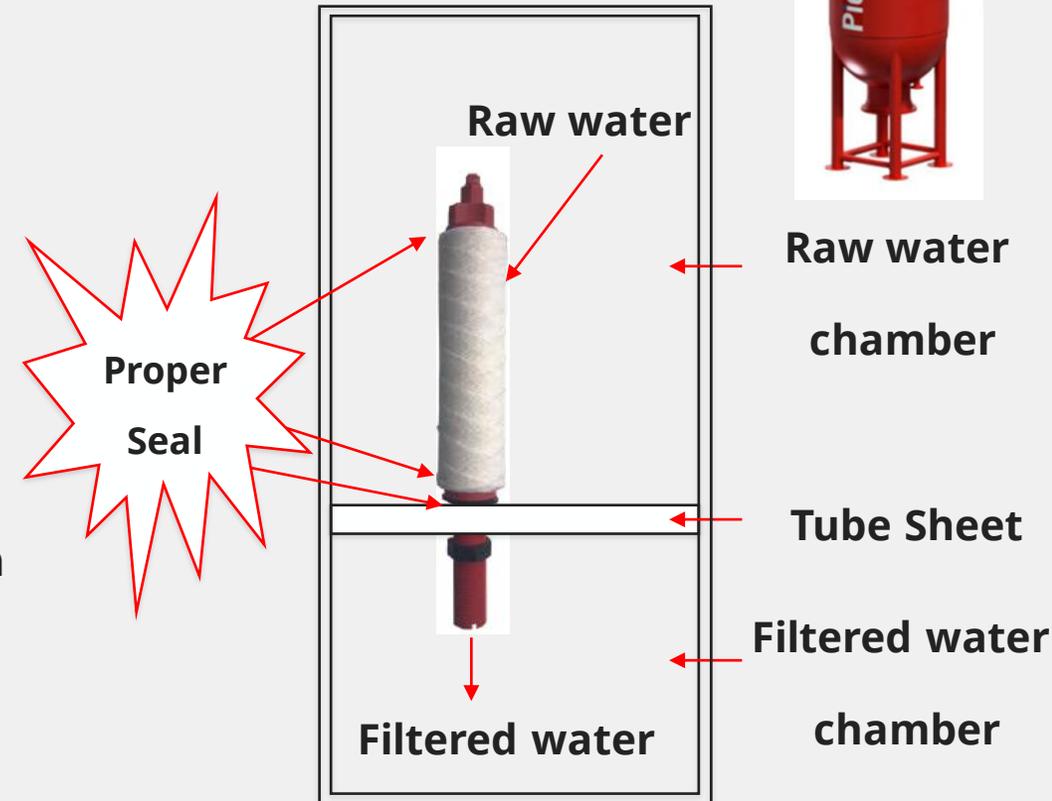
Small design improvements
do make a big difference.



Cartridge filter housing's Internal Support Rod (ISR)

Ensure proper positioning and seal of each cartridge element:

- Tube sheet holds Internal Support Rods (ISRs).
- Cartridges are inserted through the ISR and secured in place by knife edge ISR extremes, at Tube Sheet and High-Speed Nut (end cap).
- ALL feed water passes through the cartridge filter then through the ISR casing into the filtered water chamber.



Raw water chamber

Tube Sheet

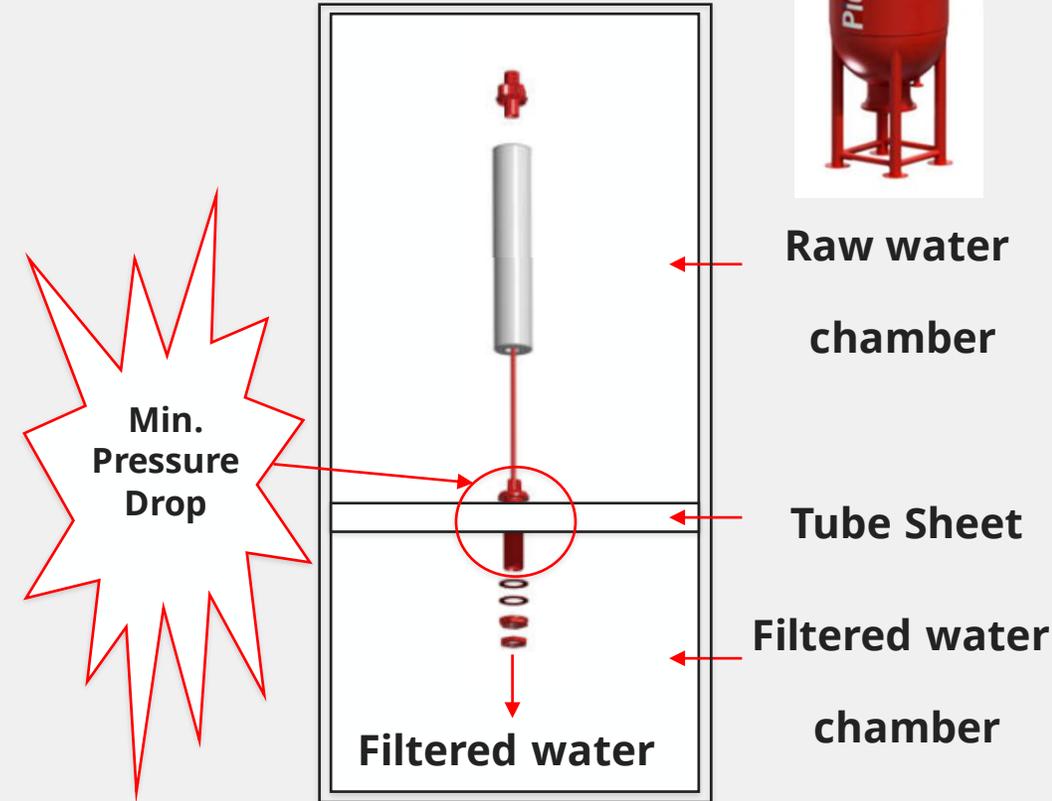
Filtered water chamber



Cartridge filter housing's Internal Support Rod (ISR)

Minimizing pressure drop of the ISR:

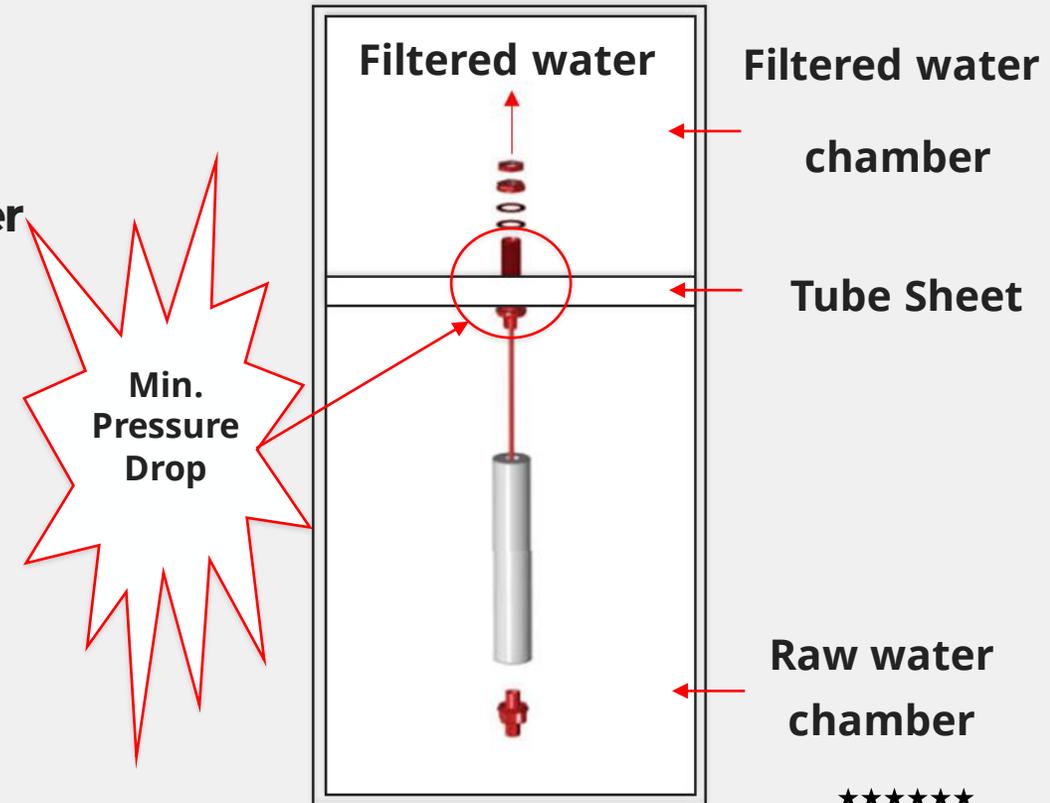
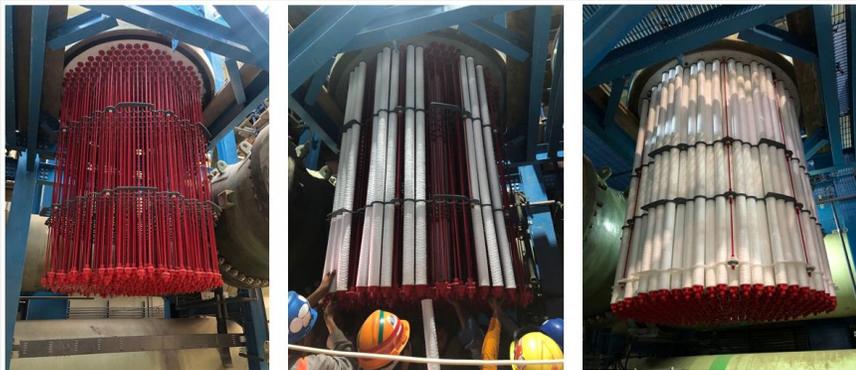
- Internal Support Rod (ISR) offers resistance to filtered water flow at tube sheet level.
- Maximizing cross sectional area is the key to drastically reducing pressure drop of cartridge filter housings.



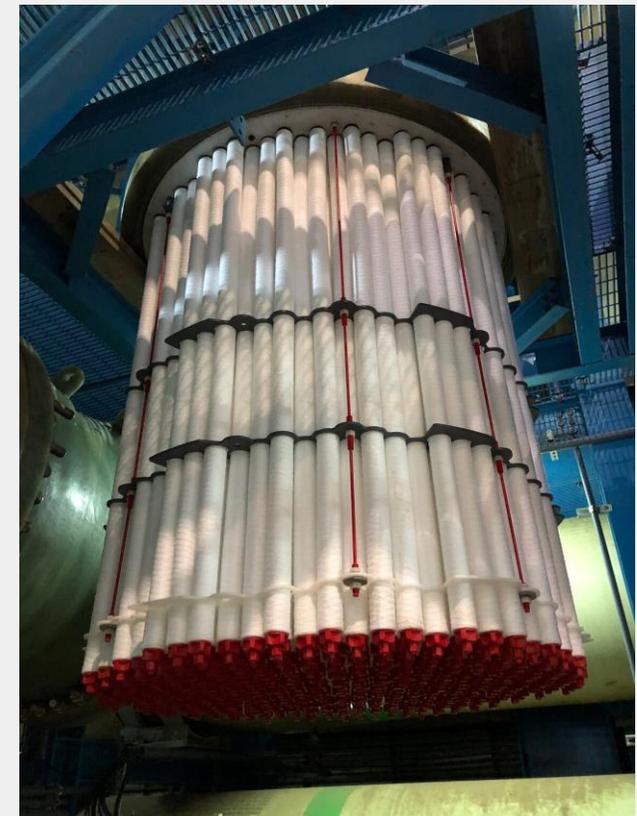
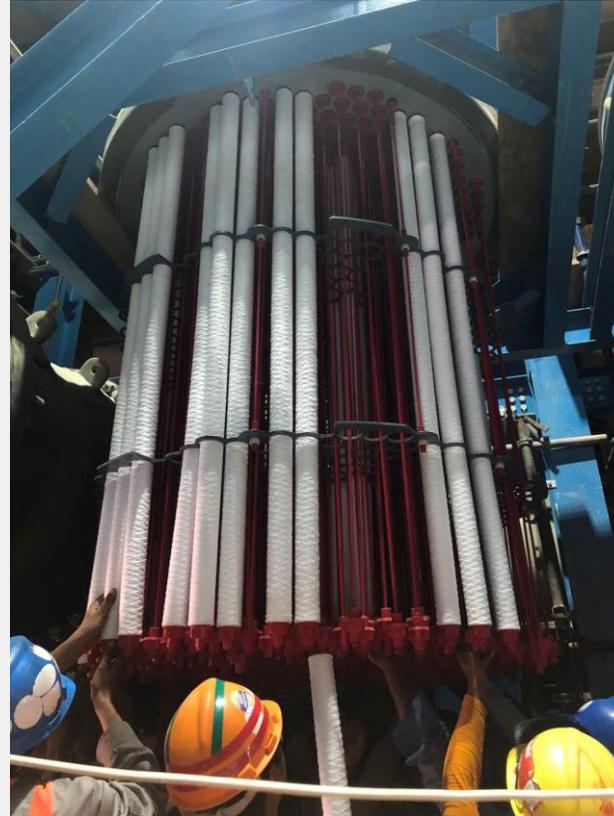
Cartridge filter housing's Internal Support Rod (ISR)

ISR installed in CFH fed from bottom:

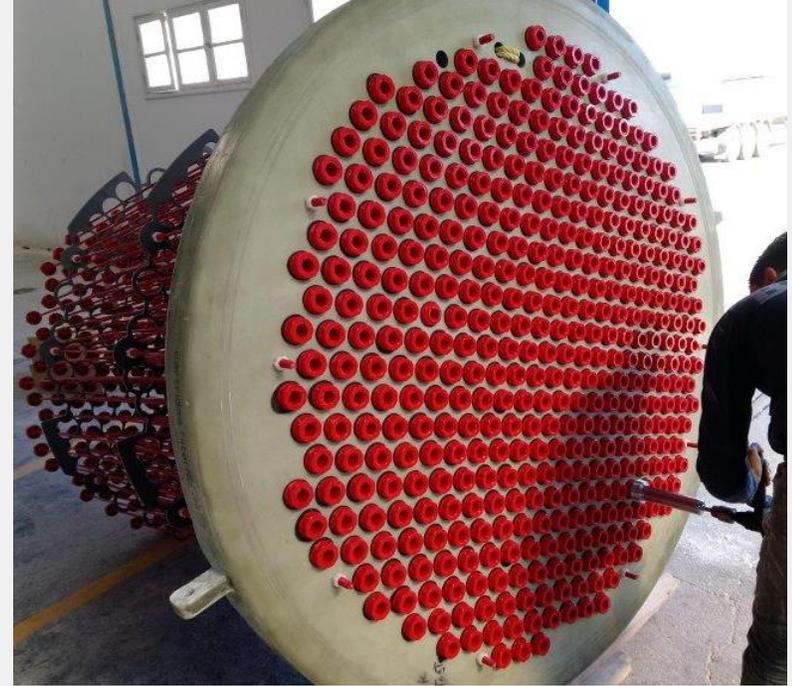
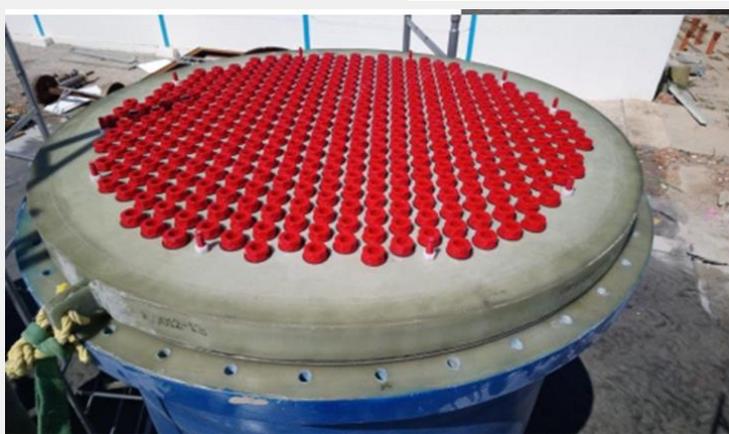
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Cartridge filter housing's Internal Support Rod (ISR)

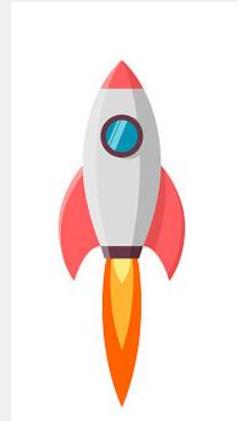
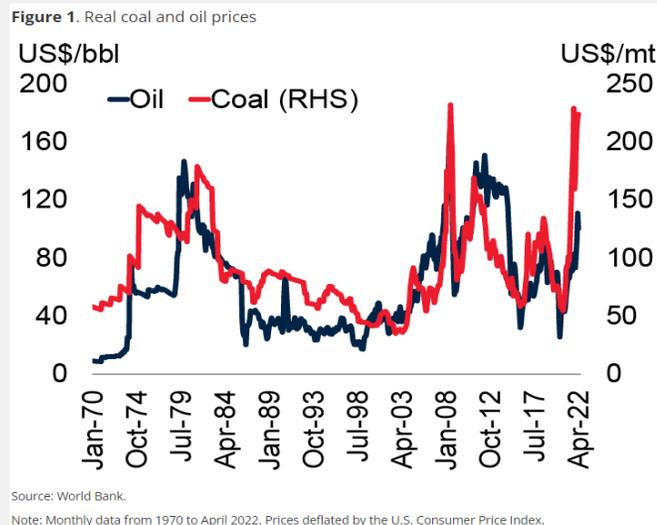


Cartridge filter housing's Internal Support Rod (ISR)



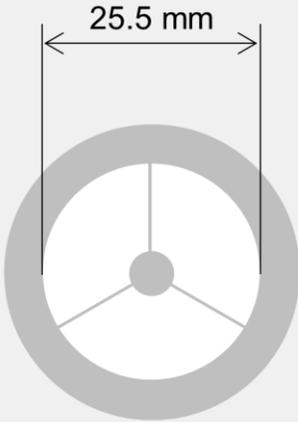
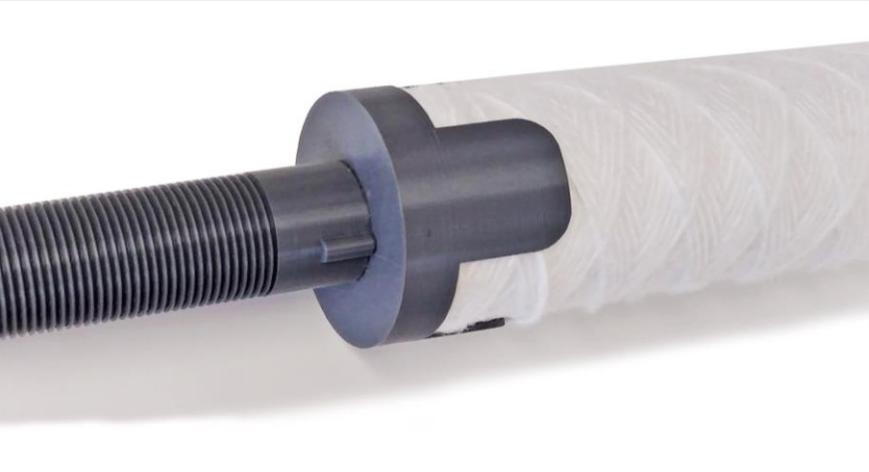
ISR's Relevance

With **energy cost** skyrocketing, and **CO2 emissions** becoming a more important consideration by corporations, energy savings become more relevant than ever in RO and UF plant operations.

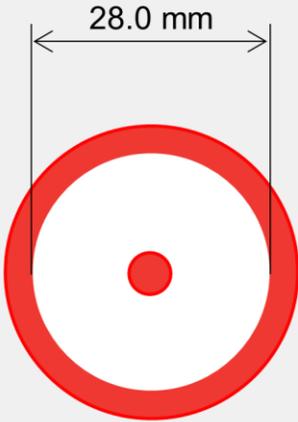


New Internal Support Rod: (Largest viable cross-sectional area)

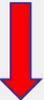
Minimizes pressure drop: Minimizing **energy consumption** and **CO2 emissions** in this equipment.



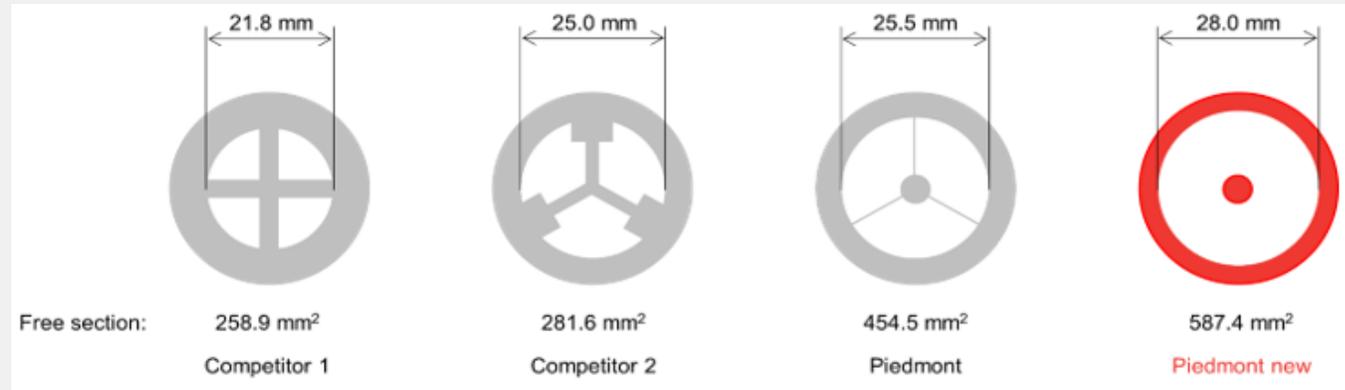
454.5 mm²
Piedmont



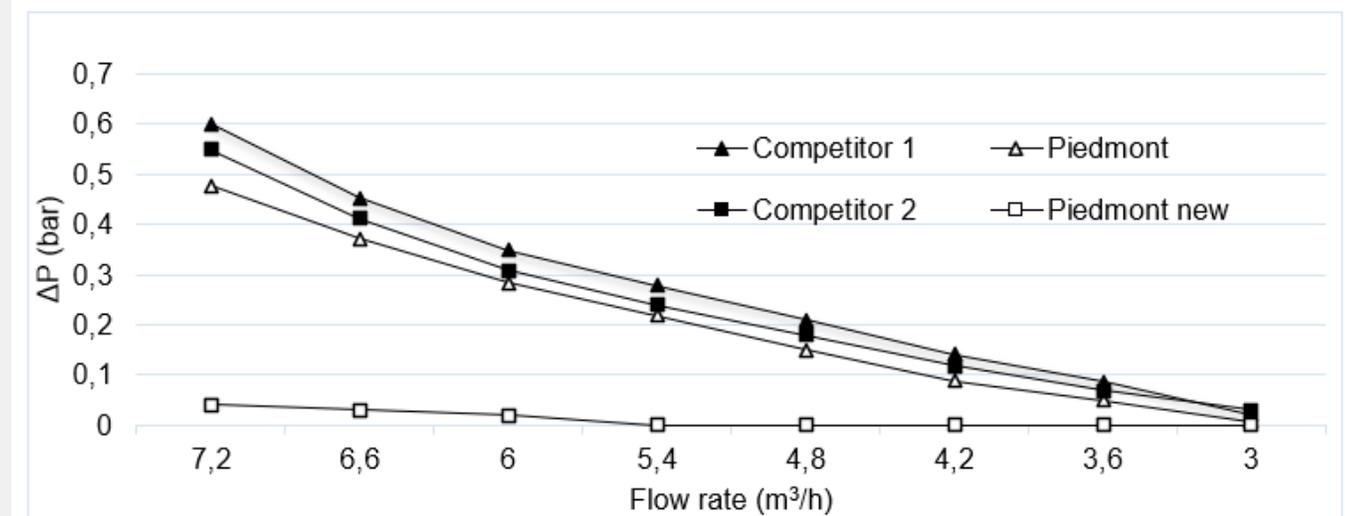
587.4 mm²
Piedmont new



Cross sectional area of cartridge filter ISR at the tube sheet



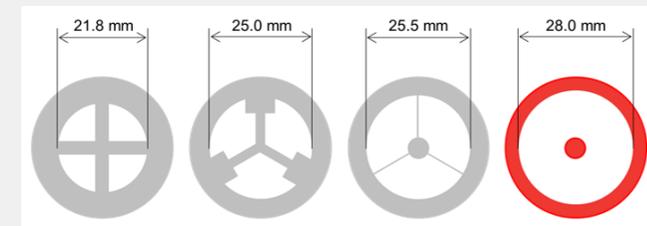
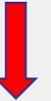
Pressure drop (ΔP) across a cartridge filter housing as a function of flow rate



Filter Housing's Internal Support Rod (ISR)

Case study: Payback Calculation - Considerations

- 100,000 m³ /day (4167 m³/h) SWRO plant
- Number of cartridge filter housings: 6 housings with capacity for 129 cartridges of 70" length
- Flow per cartridge: 5.39 m³/h
- Number of Internal Support Rods: 129 per filter, 774 in total.
- Specific Energy Consumption (SEC): 4 kWh per 1 barg and 100 m³/h
- Type of support rods initially installed: Competitor 1
- Initial DP in the old support rods: 0,2025 barg
- Price of new ISR: 30 USD/each
- Electricity price: 0,068 USD per kWh



Filter Housing's Internal Support Rod (ISR)

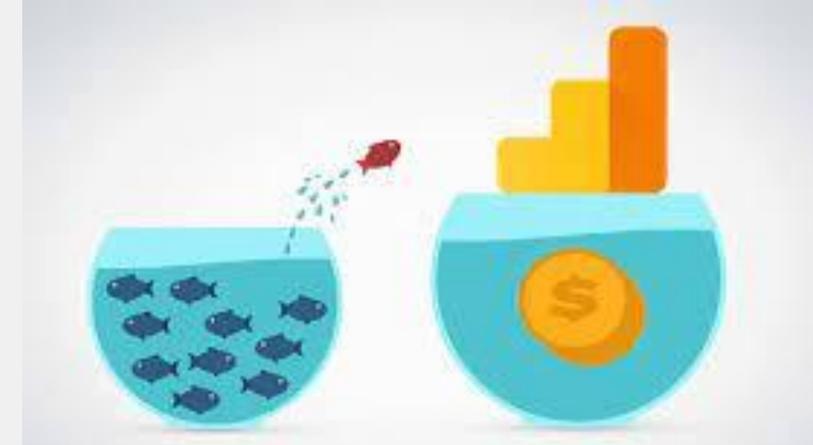
Case study: Results - OPEX reduction

- Total investment for 774 ISRs: 23,220 USD
 - DP after new ISR installation: ≈ 0 barg
 - Energy savings per year: 295,887 kWh
 - Total annual energy cost savings: 20,120 USD
 - CO2 emissions saved: 118 tons per year
 - Payback: 1 year, 1 month and 26 days.
- 86,65% recovered in the first year.



ISR Retrofits – **The biggest sales opportunity**

- The new ISR are compatible with existing cartridge filter housings and provide a drastic improvement with a small investment.
- It is easy to retrofit existing filter housings with the new ISR! (you and us are the team of experts that will guide the client in the process.)



Internal Support Rod (ISR) - **Retrofits**

The new ISR are compatible with most FRP cartridge filter housings installed in large and medium size SWRO plants?



Internal Support Rod (ISR) - **Retrofits**

To retrofit existing filter housings with the new ISR is **EASY** and it **PAYS** for itself in months.



Internal Support Rod (ISR)

Main prospects to target:

Where there is pain?

1. OEMs/EPCs looking to improve energy efficiency in their designs.
2. OEMs/EPCs with sustainability goals and looking to reduce CO2 emissions.
3. OEMs/EPCs involved with plant operation and experiencing cost increases.
4. O&Ms experiencing any type of challenges with their cartridge filter housings (e.g. complicated, labour intensive and unreliable cartridge support systems).
5. O&Ms experiencing bypass issues with their cartridge filter housings.
6. O&Ms looking to improve plant pre-treatment.



Live Poll (#2)

Who do you think will be the main type of client for these New Internal Support Rods (ISR)?

1. OEMs/EPCs/O&M focused on minimizing OPEX (energy efficiency).
2. Those focused on ESG and Sustainability goals (CO2 reduction, etc.)
3. Operating teams currently using complicated, labour intensive and unreliable cartridge filter support systems.
4. All of the above.



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WATER COMPANY
OF THE YEAR 2020



