



Pall Corporation

Disc Tube™ Module System

Filtration Solutions
for Landfill Leachate

Filtration. Separation. Solution.™



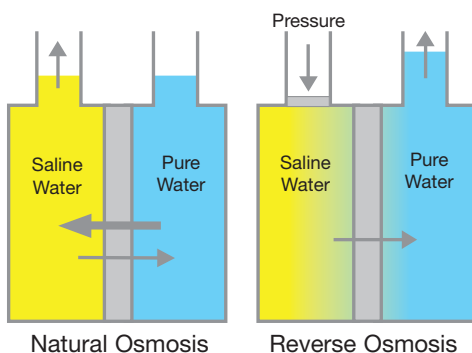
Disc Tube™ Module System

A major advance in Reverse Osmosis Technology

Reverse Osmosis Process

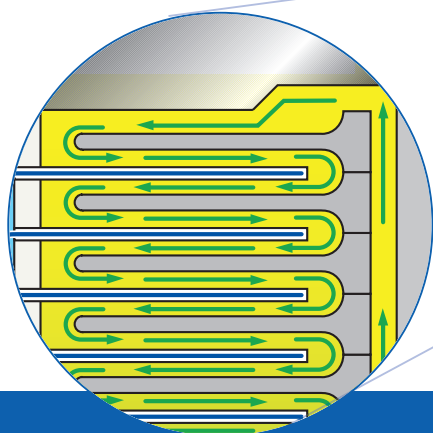
Natural osmosis occurs when two fluids of different salinity are separated by a semi-permeable membrane. The fluid with the lower salinity will pass through the membrane until the salt solution becomes equal on both sides of the membrane.

If pressure is exerted on the higher salinity solution the membrane allows desalinated, de-mineralized water to pass into the pure solution whilst it rejects the dissolved impurities, a process known as 'reverse osmosis' (RO).



The Pall Disc Tube (DT) module system is a membrane device designed to ensure molecular and ionic separation of the whole spectrum of pollutants in all aqueous environments: from suspended matter to the smallest ions, including colloids, bacteria, viruses and organic matter.

The Disc Tube module consists of a stack of molded ABS spacing discs separating membrane cushions which are formed from three octagonal layers which are welded to each other, ultrasonically at their periphery.



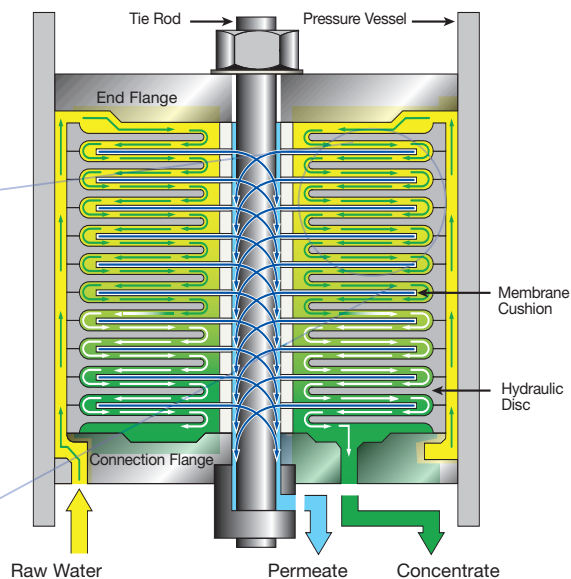
Advantages

The unique configuration of the Disc Tube module offers numerous advantages over traditional spiral or tubular membrane modules.

- Open channel configuration
- High turbulences of the feed stream
- Reduced risks of clogging or crystallization
- Evenly distributed and self-cleaning hydraulic circulation
- More effective cleanings
- Minimization of cross-flow rate
- Extended range of cut-off for nanofiltration membranes (500 g/mole, 270 g/mole) and for reverse osmosis (high flow rates, Standard 100 g/mole, high rejection)

Range of Applications

- Treatment of landfill leachate
- Cleaning of industrial waste waters
- Desalination of brackish water or sea water at ends of production of potable water
- Targeted molecular separation





Why the Disc Tube™ RO Module has become the preferred module for leachate treatment?

Open Channel Technology

- Less susceptible to fouling and scaling
- Modules are easy to clean
- Suitable for silt density index (SDI) up to 5/15

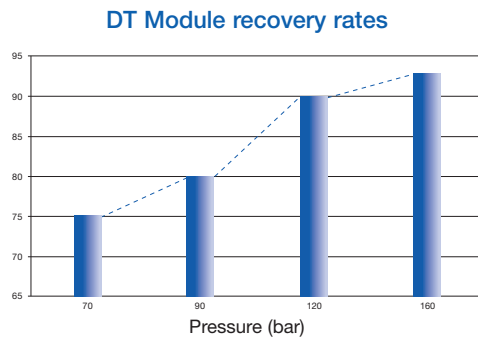
Easy Maintenance

- Module can be opened
- Module and membranes can be investigated
- Single membranes can be tested for best cleaning procedure
- Single membranes can be investigated at lab (EDX, Microscope)

Pressure Range (bar):	75	90	120	160
Recovery Rate (%):	80	85	90	93-95

Features of Pall DT Reverse Osmosis Systems

- Modular expandable design with one or multiple stages
- Recovery rates achievable by DT modules with staged RO Pressure (Base 18mS/cm)



- High pressure units maximize permeate yield (Recovery Rate)
- Mobile containerized units or *in situ* installation options
- No mechanical chemical pre-treatment necessary
- Small footprint
- Installation complementary to existing treatment plants
- 'Plug & Play' installation with short start-up period
- Capacity ranges from 1 – 25 m³/h per line
- Short or long-term rental opportunities
- Economic module exchange
- Worldwide service

What are the main challenges in the leachate treatment process?

- COD in landfill leachate is partially not biodegradable ("Hard COD")
- COD cannot be reduced sufficiently by classical Biological treatment, e.g. in public WWTP's
- High ammonia and total nitrogen contents require utmost treatment efficiency
- Salt content and heavy metals cannot be eliminated by conventional treatment methods

Conclusion: Reverse Osmosis is the only technology, capable of reducing almost all parameters!

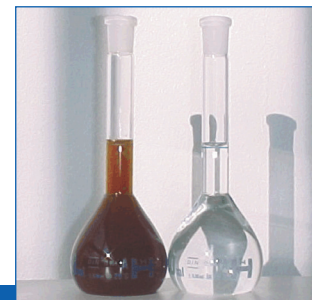
Characteristics of Pall's DT RO Systems for Landfill leachate treatment

- Best quality of product water (permeate)
- Small footprint
- Reliable at variations of quantity and quality
- Switch On / Switch Off operation possible
- 'Plug & Play' installation
- Treated leachate (permeate) can be discharged back to the environment or can be utilized for irrigation or process water.
- Modular, flexible construction

More than 220 Pall installations for leachate treatment are in operation worldwide!



Containerized units



The effects of RO on landfill leachate



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Technical Specifications

	Units	Medium Pressure Modules				High Pressure Modules		Special Design
		DTSE	DTSE-MP	DTGE	DTGE-MP	DTSE-HP	DTGE-HP	DTGE-HHP
Feed flow rate range (min. - max.)	l/h	250 -1600				400 - 1500		
Feed flow in operation	l/h	500 - 1200						
Maximum temperature (cleaning)	°C	45						
Maximum temperature (operation)	°C	40						
Maximum operating pressure	bar	75	90	75	90	120		160
Operating pressure in filtration	bar	30 - 70	40 - 90	30 - 70	40 - 90	90 - 120		80 - 150
Test pressure	bar	108	130	108	130	173		250
Overall length	mm	1200		1400		1200	1400	1400
Pressure vessel external diameter	mm	214	218	214	218	224		234
Pressure vessel internal diameter	mm	202						
Number of discs per tube	U	170		210		170	210	210
Total surface per tube	m ²	7.65		9.45		7.65	9.45	
Weight of a module (empty)	kg	58	74	66	82	72	88	120
Weight of a module (operation)	kg	64	80	74	90	80	96	128
Materials:								
Pressure Tube		FRP						
Watertight flange		Polyoxymethylene (POM)						
Pressure flange		Stainless Steel						
Spacing disc		ABS						

In leachate treatment and most waste water applications as a rough design value, the average output per module is 3 m³/day of pure water with a mean conversion rate varying from 75 % at medium pressure to 90 - 95 % at high pressure.

Value for DTGE Modules with Raw water conductivity is 10 - 15 ms/cm @ 25 °C



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