

MDA TORRNADO™

Innovative Deaeration Technology with Simplified Operation and Maintenance

WHY MDA TORRNADO™?

MDA *Torrnado*™ takes deaeration technology to the next level by **eliminating the need for rotating equipment.**

MDA *Torrnado*™ is designed to achieve stringent treated dissolved oxygen specifications below 10 ppb from within a compact configuration. Flexible, modular units use available waste or utility streams, enabling efficient integration with new or existing systems. Eliminating rotating equipment leads to safe, reliable operation while minimizing maintenance needs.

Advantages of **MDA *Torrnado*™** include:

- Improved footprint and weight savings
- Reliable performance with high uptime
- Capital cost savings
- Minimal maintenance requirements
- Reduced chemical and power consumption

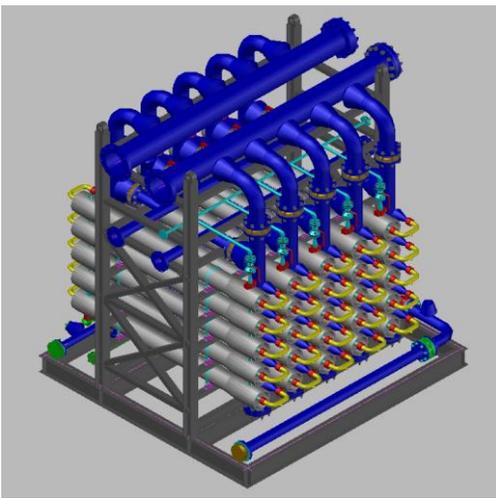
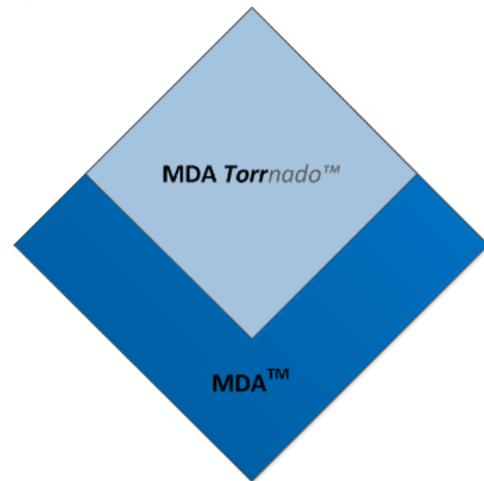


Photo: Water Standard MDA™ Torrnado skid.

FOOTPRINT SAVINGS

The innovative **MDA *Torrnado*™** design enables footprint savings of over 25% relative to standard MDA™ systems.



WHEN TO USE MDA TORRNADO™

Dissolved oxygen removal is a crucial component of process designs in a wide range of applications. By mitigating corrosion and bacterial growth, dissolved oxygen removal technology extends the lifespan of pipelines and equipment and preserves the integrity of unique assets, such as offshore reservoirs.

MDA *Torrnado*™ applies when:

- A liquid or gas waste stream is available for use as motive fluid – RO/NF concentrate, cooling water effluent, utility air, etc.
- The pressure and flow rate of the waste stream meets minimum criteria.

MDA TORRNADO™ PRODUCT

Water Standard offers three standard **MDA Tornado™** skid-mounted packages. These flexible, modular units can be easily integrated into larger processes, making use of waste streams (e.g. RO concentrate) or utility flows to achieve stringent dissolved oxygen demands. The units can be combined to accommodate larger flows, or customized to meet project-specific requirements.

Model #	Capacity (bpd)	Weight (kg)		Footprint (m ²)	Power Requirement (kW)	N ₂ Feed Required (Nm ³ /hr)	N ₂ Purity	Vacuum Pressure (Torr)	Outlet Oxygen (ppb)
		Dry	Operating						
WSMDA-T 4x4 - 16	30,000	4,300	5,500	9	0.1	14	99.99%	125	< 10
WSMDA-T 5X5 - 25	50,000	5,400	7,000	11	0.1	21			
WSMDA-T 6X6 - 36	80,000	6,700	8,800	12	0.1	31			

The standard scope of supply includes:

- Membrane skid package with ASME coded pressure vessels
- Static vacuum system
- Nitrogen generator
- All necessary equipment redundancy
- Piping, valves, instrumentation, and controls
- Optional CIP skid package with tank, pump, and filter

HOW IT WORKS

3M’s proven Liqui-Cel® technology uses hollow fiber membranes to remove gases from liquids. The liquid is passed over the outside (shell) of the hydrophobic membrane, while the gas is stripped from the liquid using a static vacuum system and sweep gas on the inside of the fiber (lumen).

Water Standard’s designs allow for uninterrupted operation during cleanings and oxygen removal to <10 parts per billion (ppb), without chemical oxygen scavenger.

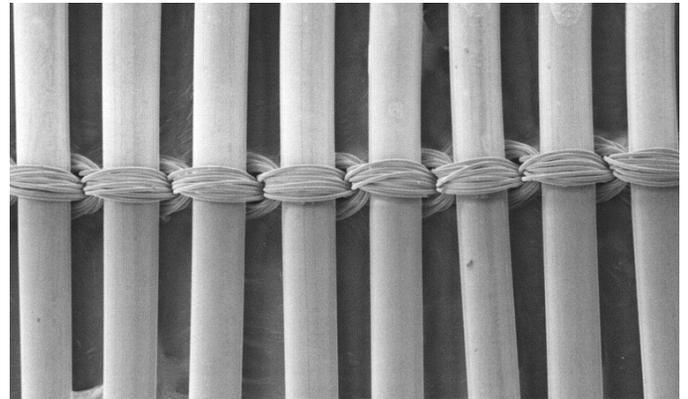


Photo: Liqui-Cel® microporous hollow fiber array.

