

UL2 UREA DOSING SYSTEM

THE LIQUID-ONLY, EASILY
INTEGRATED SYSTEM
THAT'S ALWAYS ON.



ALWAYS ON



PIONEERING TECHNOLOGY

Cummins Emission Solutions were the first to introduce the UL2 Urea dosing system. This liquid-only dosing system helps reduce oxides of nitrogen (NOx) in both low-flow and high-flow Selective Catalytic Reduction (SCR) systems. The UL2 system is a liquid-only dosing system, commercially available and capable of meeting high-flow dosing rates of up to 20.5 kg/hr.

SUPPLY UNIT

The continual presence of Urea within the unit prevents doser crystallization, making the UL2 and our newest introduction, the UL2.2, the only liquid-only dosing systems on the market to offer freeze-robustness with improved reliability. Technological benefits of the UL2 include:

- Mounts to the chassis
- Heated by engine coolant
- Enhanced freeze-resistant components
- Contains optional integrated dosing controls to monitor injector, temperature and pressure sensors

DOSING UNIT

- Mounts to the decomposition reactor
- Cooled by urea recirculation; heated by electricity
- Contains proprietary pressure-swirl atomizer with reinforced 11-layer nozzle
- Enhanced freeze-resistant components
- Contains injector, temperature and pressure sensors



FLEXIBILITY AND EASE OF INTEGRATION

The UL2 system has a unique fluid recirculation system that allows the injector to be cooled by urea. Our system maintains its specified temperature range by using a cooler medium instead of traditional methods that use engine coolant. The benefits of this unique design include:

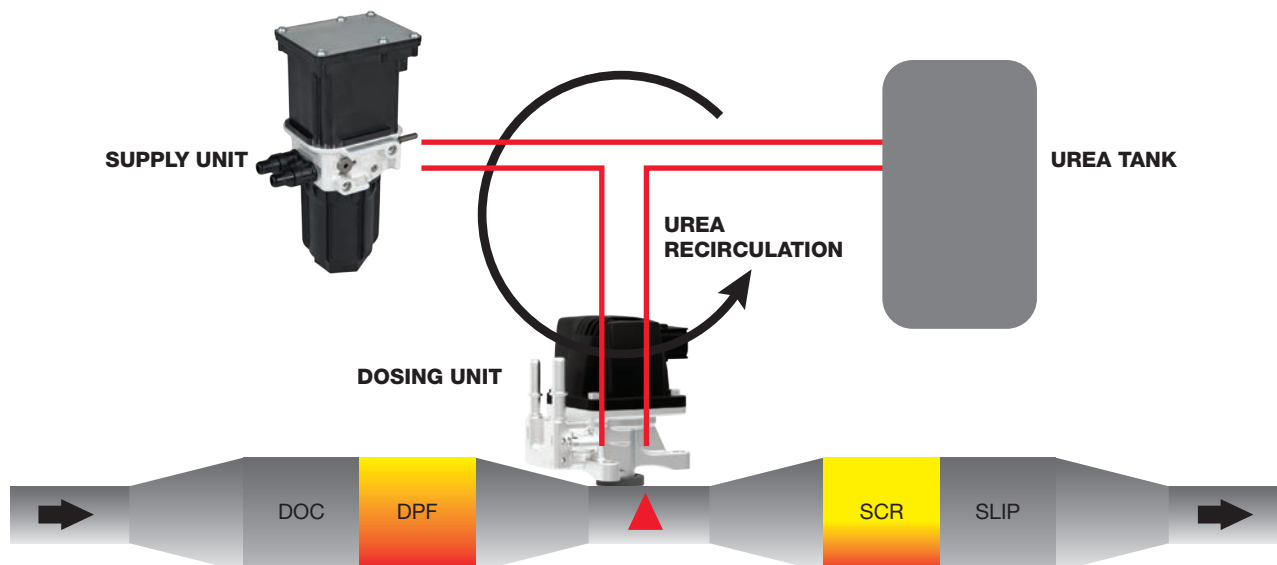
- Elimination of two cooling lines to the dosing unit, and the addition of only one urea line, reducing complexity of integration
- Optional circulated urea at key-off to counteract heat soak from the exhaust system, improving system reliability
- Automatic depressurization at system shutdown, adding proven reliability in freeze resistance

The UL2 system can accommodate varying dosing line lengths, allowing the distance between the supply and dosing unit to be chosen more freely, without affecting controls technology. The benefits of this modular design include:

- Extended urea transfer line lengths of up to 15 meters, with no extra adaptation of the application parameters required
- The ability to apply dosing units in multiples for high-horsepower engine applications

Furthering this system's flexibility in vehicle integration, the supply unit has the option of controls technology via the electronic dosing unit. This technology offers the following built-in capabilities:

- | | |
|--|------------------------------------|
| ■ Supply unit pump control | ■ Heating control |
| ■ Dosing unit injector control | ■ Heating element control |
| ■ Pressure and temperature sensor controls | ■ Diagnostic and handling controls |



DESIGNED FOR FREEZE-ROBUSTNESS

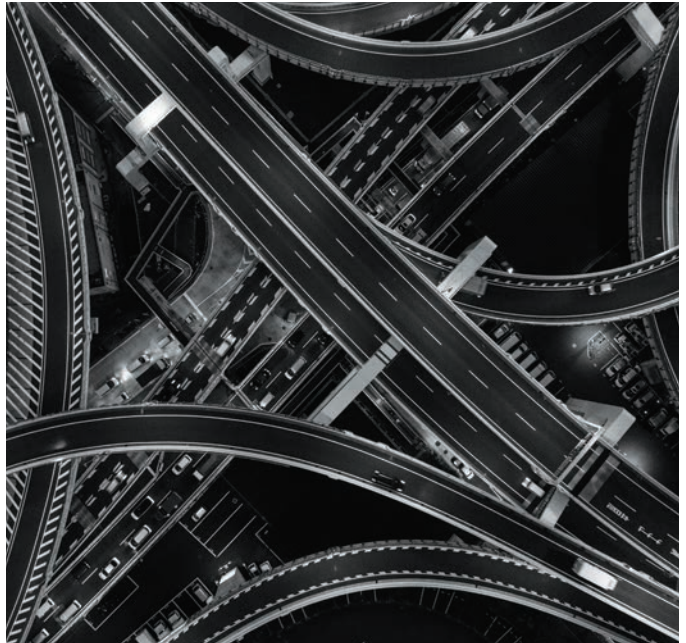
Urea is continually present within the unit to prevent doser crystallization and clogging. The benefits of this technology include:

- Eliminating the need for power after key-off, providing freeze-robustness
- Quicker dosing readiness at key-on; avoids priming issues with pump, as no purging is necessary
- Quicker NOx treatment and prevention of crystallization, as urea is always present in system
- Prevents system damage during intentional or unintentional interruption of power to the vehicle

INNOVATIVE TECHNOLOGY TO ENHANCE PERFORMANCE

The proprietary design of the UL2 system offers many features that optimize dosing spray performance. This reduces deposit formations and enhances mixing capabilities to significantly improve reliability. The benefits of our technology include:

- A pressure-swirl atomizer, which offers customized spray angles and flow rates
- Reduction of droplet size to as low as 24 microns SMD, promoting improved NOx conversion efficiency
- A diverter valve for high-horsepower usage, which diverts pressure to allow more urea to be released for high-flow optimization



ELIMINATING UREA CHALLENGES

The UL2 system has been designed to withstand and overcome many urea challenges that other competitive systems cannot tolerate during the dosing process. Our superior system has successfully undergone urea compatibility testing to:

- Use potted electrical components to prevent infiltration
- Utilize static-only sealing to avoid urea leakages and short circuits
- Prevent crystallization by continually keeping urea present within the unit



UL2 UREA DOSING SYSTEM SPECIFICATIONS

Technical Characteristics	Unit	UL2			Cummins Advantages
Dosing Rates (At 100% DC and 9 bar rel.)	Kg/hr	5.1	11.7	16.7	Greater flexibility
Dosing Accuracy (Reflects only the values at End of line (0km). Lifetime values are different)	% error	+/- 3.5	+/- 5	+/- 7	Better reliability

Application Robustness	Unit	UL2			Cummins Advantages
Installation Angle	Relative to 0°	-135 to +135	-135 to +135	-135 to +135	Greater flexibility
Temperature Limit	DEF inlet (°C)	65	65	65	Easy to integrate
	Ambient (°C)	130	130	130	Easy to integrate
Vibration Capability		Specific customer profiles available like ISO 16750.3			Easy to integrate
Freeze Robustness	°C	-40	-40	-40	Better reliability
Purge Time	sec	0	0	0	Ease of operation
Injector Cooling		Urea cooled	Urea cooled	Urea cooled	Lower TCO
Urea Purging		Not required	Not required	Not required	Emission improvement
Injection Line Diameter (SM to DM)	mm	5-7.5	5-7.5	5-7.5	Greater flexibility
Doser Voltage	volt	12V and 24V	12V and 24V	12V and 24V	Greater flexibility
Screen/Filter	µm	Screen DU 31	Screen SU 190	Filter SU 30	Improved protection for DU failures

LEADERS THROUGH EXPERIENCE AND EXPERTISE

Cummins Emissions Solutions (CES) is a global leader in the design, manufacture and integration of exhaust aftertreatment solutions. CES offers individual system components to fully integrated aftertreatment systems that meet ever-higher demands for efficiency, durability and optimized performance levels for on-highway commercial vehicles and off-highway heavy equipment markets.

We leverage our unrivalled technical understanding to offer the right technology and support, committing millions of dollars annually to research and development (R&D) to ensure we are always one step ahead of constantly evolving environmental and industrial regulations.

Our reputation for continually meeting the highest standards combined with a flexible, customer-orientated approach ensures we deliver correct and timely solutions for every project.

CUMMINS DOSING TECHNOLOGY BUSINESS

CES' urea dosing technology offers best-in-class spray capabilities and easy vehicle integration features. Market leading OEMs rely on Cummins' components to meet the most stringent emission regulations, including Euro VI/EPA 2013 On-highway standards and Stage V and Tier 4 Final Off-highway regulations. Our global presence makes us accessible to customers across the world and our broad product portfolio of urea dosing systems offers the best fit to any SCR application, while providing market leading performance.

QUALITY AND VALUE

Engineering and innovation are only as good as a company's ability to manufacture and deliver the highest quality product at the best value.

We have an unrivalled dosing production capacity and capability to build systems in different regions like Mexico, China, Europe, America and India.

This enables economies of scale that others can't match. The proximity of manufacturing centers to our global customers helps to lower transportation costs and ensure timely delivery.



2,400+

employees across
five continents



7

manufacturing facilities
and seven engineering
& commercial centers
worldwide



10+

years of emission
solutions experience

FEATURES OF UL DOSING TECHNOLOGY

FROST ROBUSTNESS

- Quick dosing readiness and NOx treatment
- Prevention of crystallization
- Elimination of power need after engine key-off
- Quicker dosing readiness at engine key-on, avoiding pump priming and purging
- Electrical heating enabling fast thawing even at very low temperatures

FLEXIBILITY AND EASE OF INTEGRATION

- Simplified design
- Fluid recirculation cools injector and counteracts heat soak from exhaust
- Option of controls technology
- No negative effect of DEF within solenoid

PRESSURE SWIRL ATOMIZER

- Small spray droplet size
- Large customized spray angle (Design variability from 30° to 90°)
- Customized flow rates
- Elimination or reduction of deposits

CONSTANT DEF-COOLING

- Enabled through return flow orifice
- High effective cooling of dosing unit
- Pressure decrease to ambient without energy loss

PRESSURE SENSOR

- Sensor within the dosing unit
- Closed loop pressure control at injection nozzle
- Dosing amount independent from installation position





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