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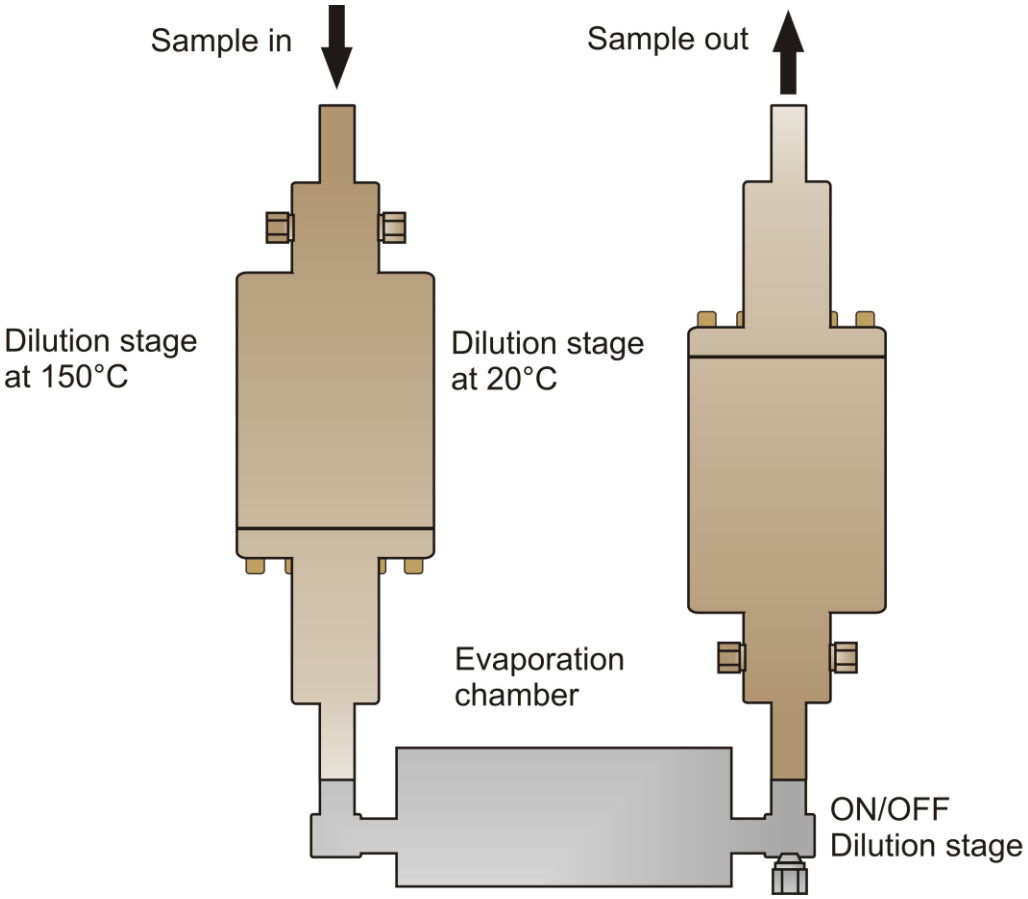
DEKATI ENGINE EXHAUST DILUTER (DEED) ACCESSORY NOTE

General

This document describes the available accessories for the Dekati Engine Exhaust Diluter (DEED).

Dekati Engine Exhaust Diluter (DEED)

The DEED (Dekati Engine Exhaust Diluter) is a dilution system that operates according to the PMP-group recommendations as described in the proposal ECE/TRANS/WP.29/GRPE/2007/8/Rev.1, Appendix A5. The DEED system has been designed to maximise ease of use and repeatability, while minimizing user-generated errors.



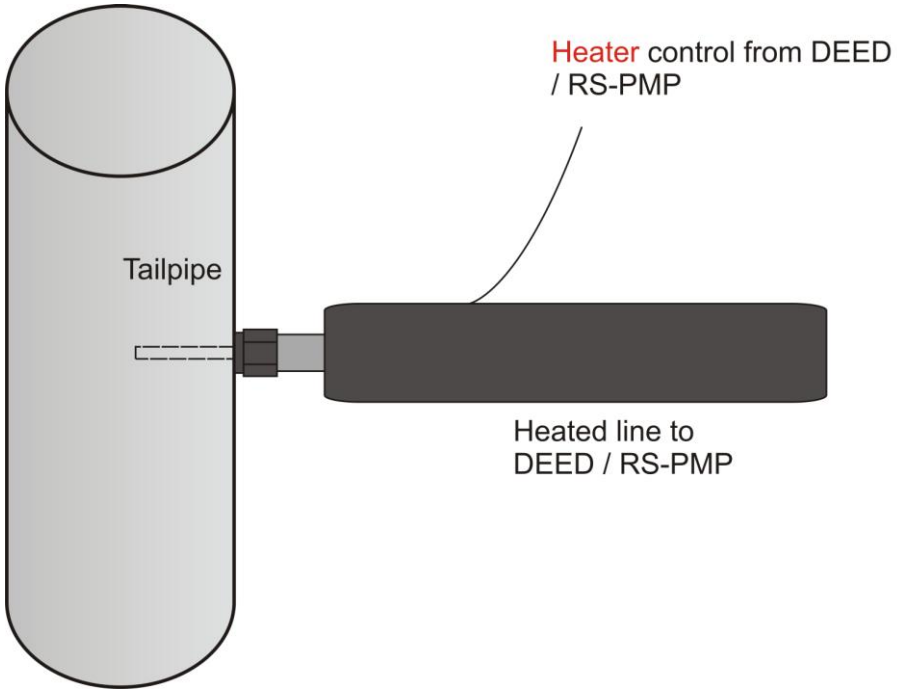
Accessories

The following accessories are available for the DEED system:

- DEED-150 POST-DPF sampler
- DEED-300 PRE-DPF sampler
- DEED-400 Stack sampling accessories
- DEED-500 PMP compliant cyclone
- DEED-900 AK-protocol sotware
- FPS-4001 Pressurised air filtration and drying unit

DEED-150 POST-DPF sampler

If the particle number measurements are carried according to the PMP protocol, the sample for the conditioning unit should be taken from a CVS tunnel. However if there is no CVS tunnel available in the test cell, then the conditioning system must be connected directly to the tailpipe. The DEED-150 post-dpf sampler is designed to make connecting to the tailpipe easy and simple. The DEED-150 is most suitable for post-dpf conditions, where particle concentrations are low although it can also be used with vehicles without exhaust aftertreatment. The schematic of DEED-150 is presented in the figure below:



The DEED-150 is connected to the tailpipe with a 10mm Swagelok™ and uses a perforated probe to draw the sample from the tailpipe. The entire line from the tailpipe to the DEED inlet is heated to approximately 60 degrees celcius to avoid condensation of water. The heated line temperature is controlled automatically by the DEED system to optimal value. For the user there is no need to adjust any operation parameters from the DEED system when using the DEED-150 post-dpf sampler.

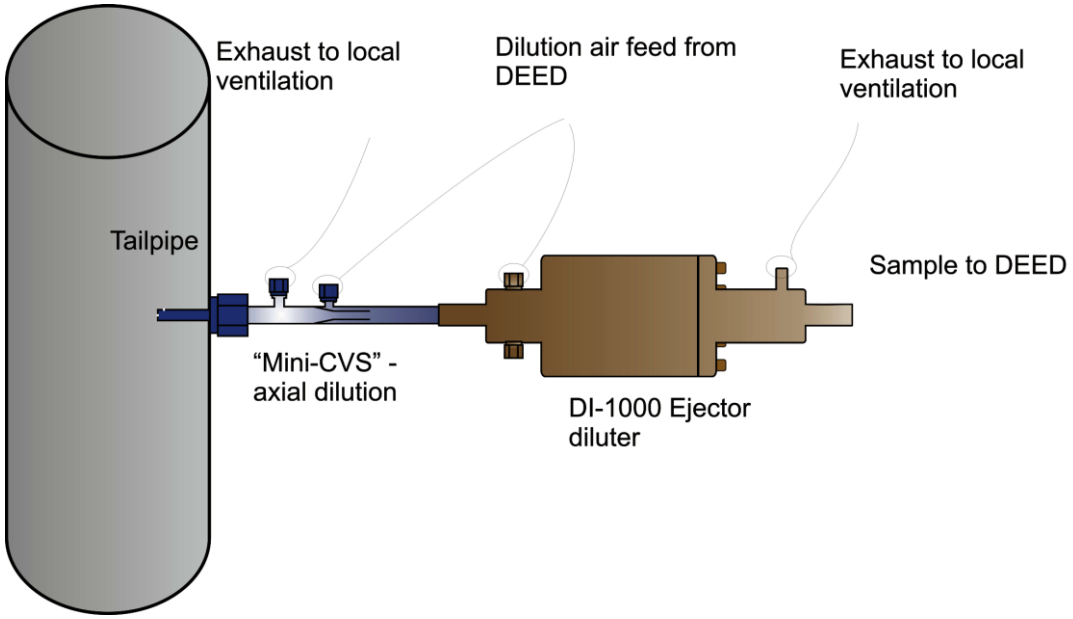
The DEED-150 specifications are listed below:

- Dilution ratio
  - N/A
- Connection to tailpipe
  - 10mm Swagelok™ (provided with order)
- Connection to DEED
  - 10mm Swagelok™ (provided with order)
- Heater power
  - 200 W
- Sample temperature range
  - 0-400 degrees Celcius

When the DEED-150 accessory is used, it is highly recommended to connect the DEED sample exhaust back into the tailpipe to avoid changes in the dilution ratio due to pressure fluctuations.

DEED-300 Pre-dpf sampler

The DEED-300 Pre-dpf sampler enables connecting the DEED system to pre-dpf conditions, where typically particle concentration, pressure and temperature are high. Due to the innovative design, the DEED-300 always keeps a constant total dilution ratio regardless of pressure and temperature conditions inside the tailpipe. The DEED-300 increases the total dilution ratio of the DEED system by adding two additional dilution stages. Additional dilution ensures that the concentration in the DEED sample outlet is below 10000 particles/cc even when sampling from high pre-dpf particle concentrations. The DEED-300 schematic can be seen below:



The DEED-300 uses a small orifice to sample exhaust from the pre-dpf conditions. A part of the sample is lead to a "Mini-CVS" axial diluter, while the excess raw sample is lead to the local exhaust. The sample is drawn from the "Mini-CVS" to the DI-1000 Ejector diluter where it is further diluted and led onward into the DEED system. The exhaust from the DI-1000 and the DEED system should also be led into the local ventilation system. The specifications of the DEED-300 pre-dpf dilution system are presented below:

- Dilution ratio
  - Constant at approx. 40 (individually calibrated)
- Connection to tailpipe
  - 12mm Swagelok™ (provided with order)
- Connection to DEED
  - Sampling hose with connector (provided with order)
- Sample temperature range
  - 0-600 degrees Celcius

DEED-400 stack sampling accessories

DEED-400 enables the use of the DEED-100 system for stack sampling. Representative stack sampling is achieved by using a 90° bent probe with Dekati SAC-100 isokinetic nozzles or alternatively the Dekati SAC-65 cyclone. After the probe, the sample is kept at flue gas temperature in the DEED-150 heated line before undergoing dilution in the DEED-100 system. DEED-400 package includes the following parts:

- DEED-150 heated line
- IPR-123 90° bent 12mm pipe

- IPR-122 12mm pipe/3/8” female thread to allow connection with SAC-100 nozzles
- IPR-142 12mm/10mm pipe
- Connection to DEED inlet

SAC-65 cyclone and SAC-100 isokinetic nozzles are NOT included in DEED-400, but are available as accessories from Dekati Ltd.

DEED-500 PMP-compliant cyclone

PMP-recommendation allows a cyclone to be placed before the inlet of the conditioning system. The purpose of the cyclone is to protect the number counting device from large particles that may be present in the sample. The cyclone must have a d_{50} cutpoint between 2.5 and 10 micrometers during operation.

The DEED-500 cyclone connects directly to the DEED inlet, no additional parts or connectors are needed for operation.

DEED-500 specifications are presented below:

- Cutpoint
  - Between 2.5 and 10 µm @ normal DEED operating flow
- Temperature range
  - 0-200°C
- Inlet
  - 10mm outer diameter pipe
- Outlet
  - ½” female thread, direct connection to DEED inlet with provided connector

FPS-4001 Pressurised air filtration and drying unit

When aerosol from a combustion source is diluted, it is important that the dilution air is dry and particle free. FPS-4001, the pressurized air drying and filtration unit can be used to condition the pressurized air according to our standards.

Importance of conditioning dilution air
Humidity in dilution air can cause several problems in the measurements. If humidity is high enough, condensation may occur inside instruments causing unpredictable problems. In addition, DEED system flows are calibrated with dry air and humidity can cause difference to calibrated values.

If dilution air contains particles, they are directly seen as a background concentration in measurements. This is especially important when doing low concentration combustion measurements, such as automotive exhaust measurements after a DPF.

Specifications:

- Coarse particle filter
  - Separation efficiency 95 %
  - Operating temperature 0-50 °C
- Submicrometer particle filter
  - Separation efficiency over 99,999% for part. > 0.01µm
  - Operating temperature 1.5-50 °C
- Diffusion dryer
  - Pressure dew point reduction 20° K
  - Operating temperature 2-60 °C