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ADAPTATION OF EPA METHOD 5 FOR RAW DIESEL EXHAUST SAMPLING

MDEC 202

Canada

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WHAT'S EPA METHOD 5

PROCEDURE FOR INDUSTRIAL STACK SAMPLING DEVELOPED AND QUALIFIED BY THE AMERICAN ENVIRONMENTAL PROTECTION AGENCY (EPA)

METHOD 5 WAS DESIGNED FOR PARTICULATE SAMPLING BUT HAS EVOLVED TO ENCOMPASS THE CAPTURE OF MANY COMPOUNDS



M5 EQUIPMENT SETUP – APEX INSTRUMENTS



WHAT'S EPA METHOD 5

WHAT IS THE PURPOSE OF M5 EQUIPMENT?

- I. TO CAPTURE A SAMPLE FROM AN EXHAUST STREAM
- 2. TO MEASURE THE VOLUME OF EXHAUST SAMPLED
- 3. TO ENSURE ISOKINETIC SAMPLING CONDITIONS ARE MAINTAINED

Modular Sample Case

Probe Assembly

Umbilical Cable

And in Case of Street of S



THERMOCOUPLE



STACK

WHAT'S EPA METHOD 5

WHY WAS M5 USED?

TO CAPTURE AND ANALYZE FOR THE PRESENCE OF POLYCYCLIC AROMATIC HYDROCARBON (PAH) COMPOUNDS PRE AND POST DIESEL PARTICULATE FILTER

WHY NOT VDI XXX PROCEDURE?

PROVIDES CONTINUITY WITH PREVIOUS PUBLISHED STUDIES

AVAILABILITY OF EXPERIENCED LAB SUPPORT IN NORTH AMERICA



DUPONT XAD RESIN



WHAT WAS DONE BEFORE



WHAT CHANGED?









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FROM STACK TO LAB

CHALLENGES OVERCOME

- THERMAL MANAGEMENT
- HIGH STACK PRESSURE
- EXTREME FLOW-RATE VARIABILITY
- OCCUPATIONAL SAFETY CONCERNS

DEVIATIONS FROM METHOD 5



THERMAL MANAGEMENT

PROBLEM:

DIESEL RAW EXHAUST TEMPERATURES EXCEED THOSE COMMONLY FOUND IN INDUSTRIAL STACKS



THERMAL MANAGEMENT

STANDARD PRACTICE:

- STACK PORT OPENED WHILE
 EXHAUST IS FLOWING
- TRAVERSE STACK WITH PITOT ARRAY THROUGH OPEN PORT
- SAMPLE PROBE SEALED WITH
 RAGS TO PROTECT AGAINST ICE
 MELT



- 2016 MTU ONSITE ENERGY



THERMAL MANAGEMENT



HIGH STACK PRESSURE



HIGH STACK PRESSURE



VALIDATED M5 EQUIPMENT OUTSIDE

STANDARD OPERATING PRESSURES:

- INSTALLED TRIAL M5 SAMPLE TRAIN IN HIGHEST PRESSURE LOCATION (PORT#I)
- SLOW RAMP FROM IDLE TO RATED POWER
- VERIFIED GLASSWARE / INTERNAL SEALS COULD WIDTHSTAND 53 in H₂O STACK PRESSURE





EXTREME FLOW-RATE VARIABILITY





WIDE RANGE OF EXHAUST TEMPERATURES AND FLOW RATES NECESSITATED THE USE OF ALMOST THE FULL BREADTH OF STANDARD NOZZLE SIZES.

SOME ENGINES MAY OUTPUT FLOW RATES THAT EXCEED THE CAPACITY OF STANDARD EQUIPMENT TO MAINTAIN ISOKINETIC SAMPLING



OCCUPATIONAL SAFETY CONCERNS

STANDARD STACK SAMPLING PRACTICES TOO DANGEROUS TO UNDERTAKE

- OPEN PORT PITOT TRAVERSAL
- LIVE EXCHANGE OF SAMPLE TRAIN COMPONENTS

37°C TEST CELL TEMPERATURE

- OPERATOR H&S CONCERNS
- · ICE MELT

NOISE

- · OPERATOR H&S CONCERNS
- · COMMUNICATION







DEVIATIONS FROM METHOD 5 USE OF AVERAGING PITOT TUBES INSTEAD OF FULL TRAVERSAL



DEVIATIONS FROM METHOD 5 MASKED PERCENTAGE OF STACK

10.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross sections, the minimum duct diameter shall be 30.48 cm (12 in.); for rectangular cross sections, the width (shorter side) shall be at least 25.4 cm (10 in.).



LIMMITATIONS OF FIXED INFRASTRUCTURE



DEVIATIONS FROM METHOD 5

NUMBER OF DIAMETERS FROM BENDS

6 10.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or **??**reaction of the constant over a distance of 10 or **??**reaction of the constant over a distance of 10 or **??**reaction of the constant over a distance of 10 or **??**reaction of the constant over a distance of 10 or **??**reaction of the constant over a distance of 10 or **??**reaction of the constant over a distance of 10 or **?**reaction of the constant over a distance of 10 or **?**reaction of the constant over a distance of 10 or **?**reaction of the constant over a distance of 10 or **?**reaction of the constant over a distance of 10 or **?**reaction of the constant over a distance of 10 or **?**reaction of the constant over a distance of 10 or **?**reaction over a distance over a d







 LIMMITATIONS OF FIXED INFRASTRUCTURE



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