

# aspec L-MS Compact Quadrupole Mass Spectrometer

For multi-component gas and dissolved gas/liquid phase analysis

Common application areas include:

- Catalyst Research
- Chemical reaction work
- Pure Gas quality checking
- Reactor process work
- Pin-point leak detection
- VOC analysis
- Residual Gas Analysis
- Medical gas transitions
- Environmental work

- Fermentation
- Semiconductor industry
- Combustion process analysis
- TGA-MS instrument combination
- Contaminated land and water
- Vacuum process work
- Furnace reactions and monitoring
- General off gas reactions
- Abatement and Filter testing



# Detailed Product Information

## The aspec L-MS Instrument:

This compact, robust designed, Laboratory bench-top Mass Spectrometer instrument incorporates all the latest Quadrupole and vacuum pumping technology housed in a robust case weighing less than 35kg.

Its unique design allows the user to purchase one instrument model and select and connect any one of a number of sample interface systems to match the application. The powerful analytical software allows data to be quickly collected and either displayed as a full mass spectra (showing all gas species present within a process) or quickly configured to measure specific gas components of interest and data log in real time. Both absolute, quantitative (% , ppm) data as well as qualitative data may be measured with this instrument.

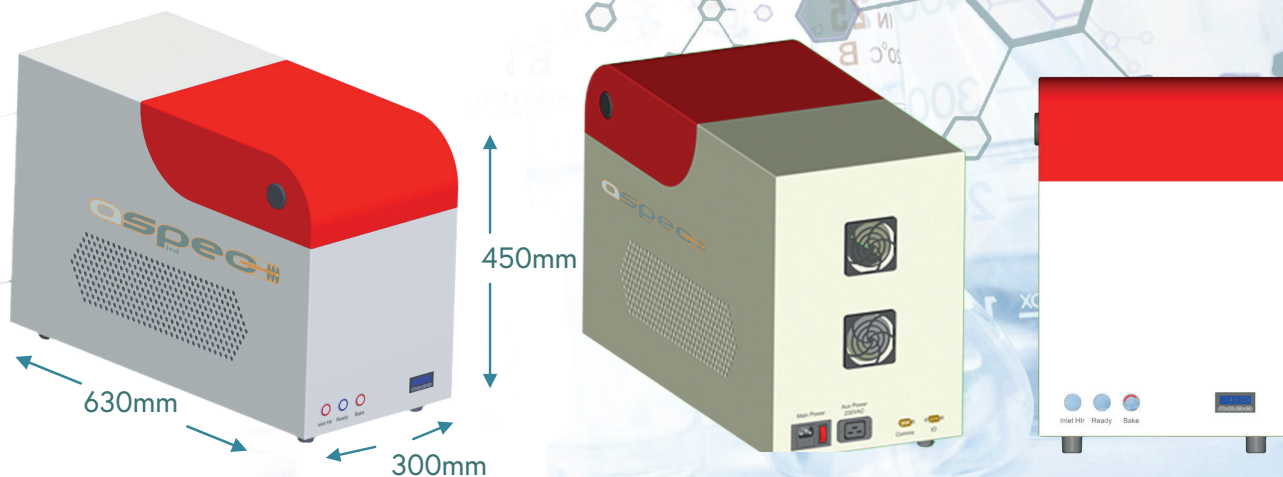
### Common gas components:

Below are typical, well proven, gas components measured by the aspec L-MS instrument. Up to maximum of 64 different gas species may be selected in one analysis method. The LDL,s shown below may vary with instrument configuration and overall gas composition

Gas Component	Detection Limit
Nitrogen	1ppm
Oxygen	1ppm
CO2	1ppm
Argon	1ppm
Helium	1ppm
Neon	1ppm
Hydrogen	1ppm
Methane	1ppm
CO	1ppm
Krypton	1ppm
1,3,Butadiene	1ppm
Benzene	<1ppm
HCL	10ppm
NH3	100ppm
SO2	1ppm
Chlorine	1ppm
Butene	1ppm
Acrylic Acid	1ppm
Ethylene/Oxide	10ppm
Cyclohexane	10ppm
COS	10ppm
HF	10ppm
Hexane	1ppm
H2SO4	10ppm
Styrene	1ppm
Propene	1ppm
Toluene	1 pair

Gas Component	Detection Limit
Vinyl Acetate	10ppb
Xylene	1ppm
DMS	100ppb
SO2	1ppm
MKB	1ppm
MEK	1ppm
Acetone	1ppm
Freon's	1ppm/0.01g/yr
Semicon Gas Component	
SF6	1ppm
SIF4	1ppm
SIH4	1ppm
WF3	1ppm
WF6	1ppm
NF3	1ppm
PH3	1ppm
F2	1ppm
CF4	1ppm
C2F6	1ppm
C3F8	1ppm
CHF3	1ppm
H2O	100ppm
Ar	1ppm
N2	1ppm
O2	1ppm

# aspec L-MS Technical Specification



## Hardware:

Air cooled. Robust enclosure, approx: 630 x 450 x 300mm. <35kg  
Mains input voltage: 90- 250vac. 50/60 Hz. <3A. (500watts)  
70-300l/sec Turbo Molecular Drag pump  
Chemical resistant diaphragm /sample pump  
Automated vacuum system control with integral full range vacuum gauge.  
1/4" swagelock.st/steel Multi application sample connection port  
Built in I/O: 4 x analogue o/p, 2 x analogue inputs, 2 x digital ports

## Analyser :

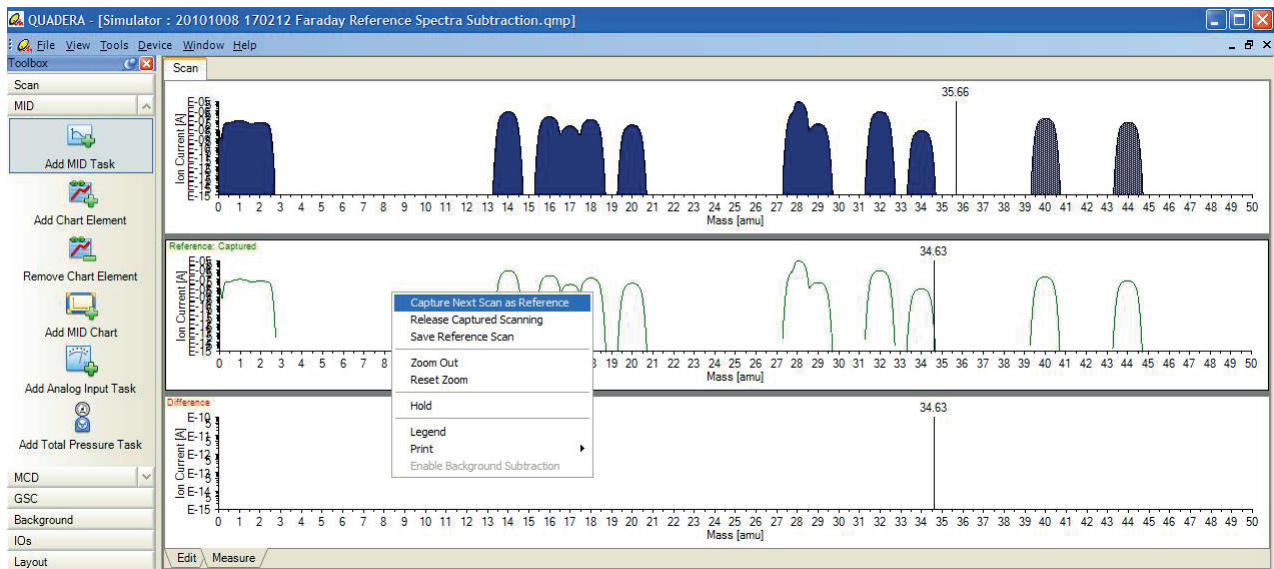
Electron Bombardment Ionization (EI)  
0-100, 0-200, 0-300 mass range options.  
Twin filament assembly (for reliability)  
Mass resolution max: 0.5 amu  
Detector type: Channeltron/Faraday combination

## Main Software Features:

Analogue scan. Linier and Logarithmic (across 9 decades) with reference subtraction feature  
Fast Histogram scan (< 4s, full mass range) with reference subtraction feature  
Trend mode up to 64 qualitative gas species  
Trend mode up to 64 quantitative gas species (% , ppm)  
Data manipulation program. ASCII conversion (also supports DDE)

# Examples and typical data Features:

Scan data shows real time and ability to compare with collected reference data

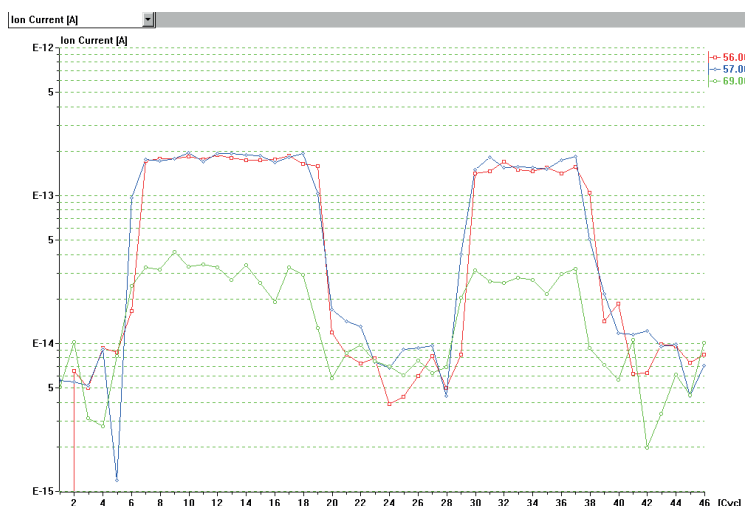


This screen shows a fast mass scan of all gases entering the instrument from a process. Note the aspect L-MS can measure across 9 decades of concentration ranges in a single scan. The instrument is therefore capable of measuring from ppb to 100% of many gas components with no modification. A full 200amu mass scan can be carried out in less than 4 seconds.

Collected data can then be compared to a gas/mass library for identification. Backgrounds can be collected, subtracted and displayed on one screen.

Live. Qualitative, trended, low level data showing concentration V real time.

This live trend data shows low level detection of Nitric Acid vapor in a semiconductor cleaning process. The concentration range falls within 100ppb to 50ppm. Analysis



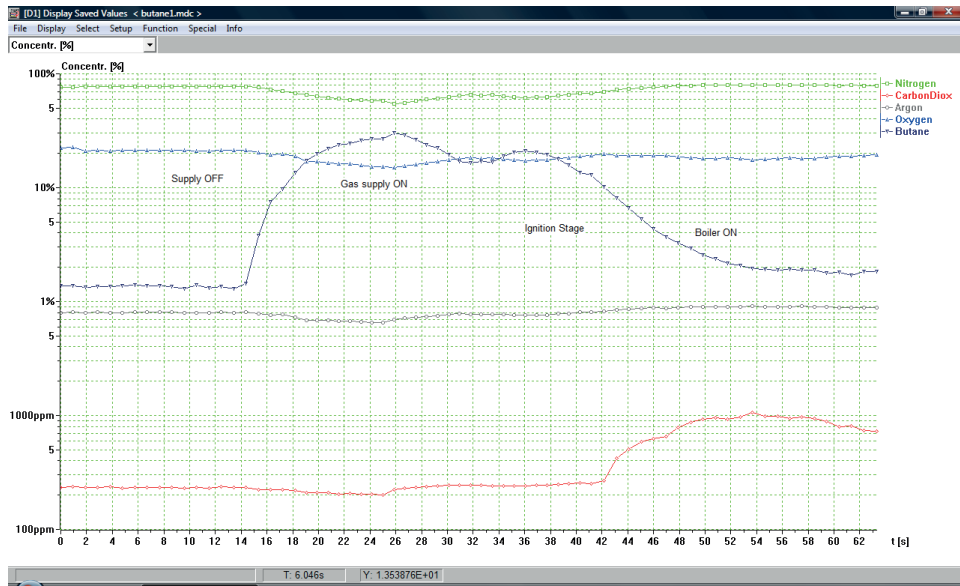
speeds may be down as low as 10ms / gas. Data is continuously stored in WRT time and may be reviewed at any time during analysis.

Up to 64 different separate gas components may be added by simply including the relevant mass number/s in the software analysis matrix.



## Live. Trended data showing quantitative "concentration V real time" data

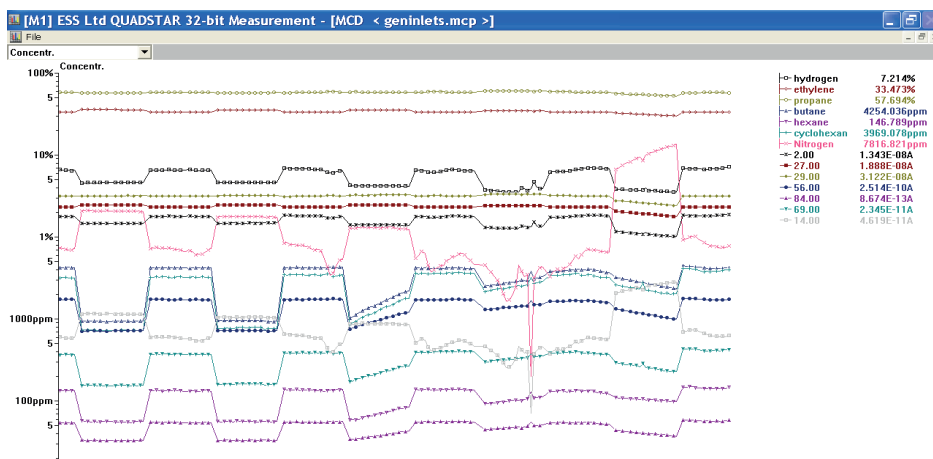
Shown below is the trend data taken from a municipal boiler vent. The Butane and CO<sub>2</sub> concentrations can be clearly seen varying during the ignition stage. The Butane gas concentration initially rises before ignition and then drop off once lit. The CO<sub>2</sub> signal rises during combustion as expected.



Absolute Concentration verses time values (ppb, ppm, %) are possible by creating a matrix in software that contains the gas component, the relevant mass number/s and the maximum span concentration of the gas component of interest. There is only a need for a single "span" gas mixture to be provided to make a calibration of concentration and takes only a few seconds to perform. It is also possible to make a "zero" gas calibration if extra low concentration are expected within the analysis.

## Typical Polyethylene Catalyst application

Complex hydrocarbons may be selected, calibrated and monitored in real time showing gas component separation and typical response times.



# Inlet Configuration

- The aspec L-MS Mass Spectrometer comes with an integral high quality vacuum system and Quadrupole Mass Spectrometer analyser. Over 10 years of continuous improvement both in High Vacuum and compact gas analyzer has been incorporated into this design.
- Great effort has been taken to ensure the instrument gives trouble free operation and as stable results as possible.
- A number of sample interface systems have been developed for the aspec instrument to allow connection to a process and two of the most common are described below:

## The fast response Capillary inlet

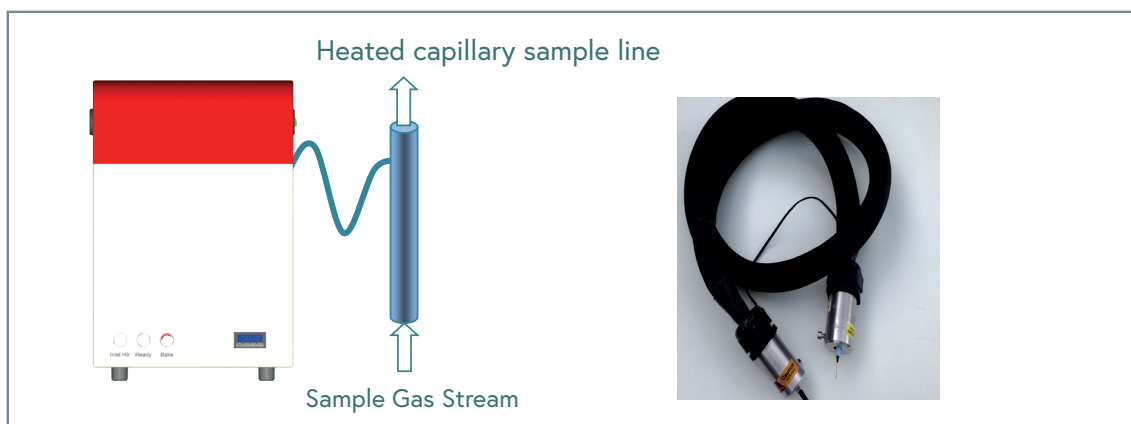
This sample inlet consists of a 2m, flexible, heated sample line that continuously draws 20ml of sample gas into the instrument in less than 100ms. It may be connected directly to any sample point where the pressure falls between 0.5 and 2.5bar.

If sampling directly from a gas stream there may need to be a flow  $>50\text{ml}/\text{min}$  so no back streaming and dilution of the sample occurs.

Sample gas flows into the instrument where it is automatically separated into 2 streams. One stream is quickly drawn into the main analyser vacuum chamber and is analysed by the Mass Spectrometer. The balance gas travels through the internal chemical sample pump and either vented to ambient or into a controlled ventilation duct if hazardous gases are present.

### Fast response Capillary inlet Technical Information:

- Capillary length STD 2m (may be supplied between 1m to 10m lengths)
- Capillary purge/response time  $<100\text{ms}$ .
- Sample flow rate into instrument:  $20\text{ml}/\text{min}$  (may be reduced if required)
- Construction: Fused silica glass lined with st/steel heated outer sheath. (Minimum bend radius, 200mm)
- Terminations: 6mm swage lock fitting with replaceable ferrule.
- Heating line temperature: Supplied in 60 or 200 deg C versions



## The Membrane Barrier Inlet

When sampling from conditions that contain or have a risk of a high water or liquid present you may connect the aspect L-MS instrument to the process using a "Membrane Barrier" sample Inlet.

The membrane barrier separates the internal high vacuum and Mass Spectrometer analyser from the sample. If there is a strong presence of liquids or liquid droplets the membrane barrier will prevent them from entering the internal vacuum and prevent contamination and possible damage.

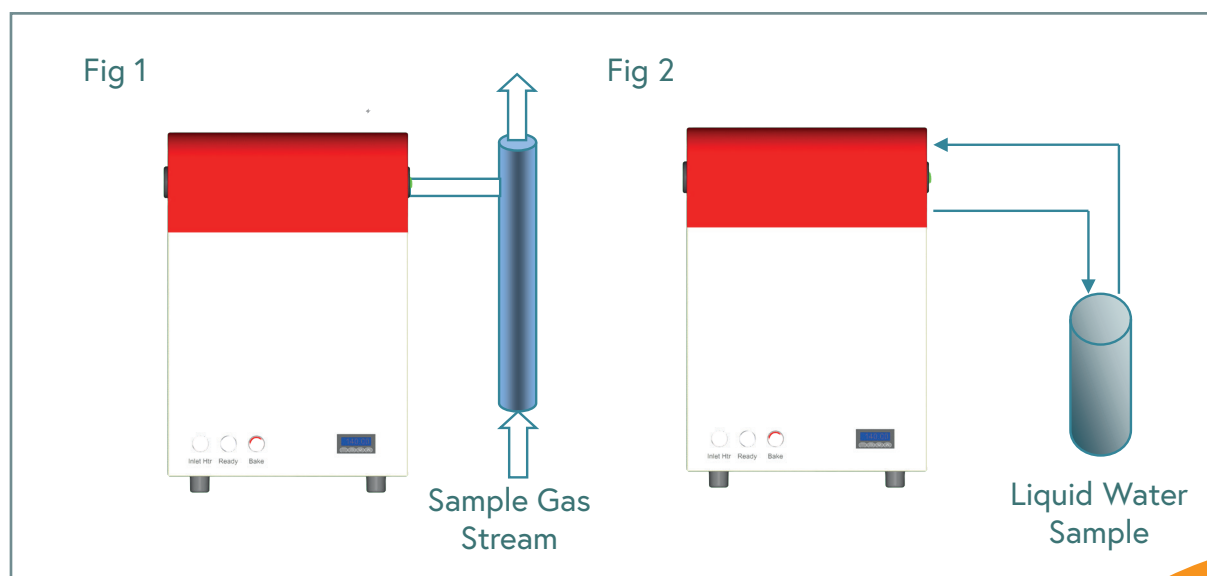
The special membrane material allows either the gas phase or dissolved gases present in the liquids to pass quickly into the instrument for analysis.

As well as preventing unwanted liquids from entering the analyser itself it has the additional benefit of favoring many VOC components making it suitable for low level measurement of many volatile gas components such as Benzene, Toluene and Xylene. (BTEX).

Fig 1. Shows the simple connection between the instrument and the potentially saturated process gas. Gas quickly migrates through the membrane barrier into the instrument for analysis with a response time of less than 10ms.

Fig 2. Shows the membrane barrier mounted inside the instrument and also includes a small liquid pump that draws liquid sample across the internal membrane barrier and back into the sample or away from the sample of interest. Again, dissolved gas within the liquid sample quickly migrates into the analyser for analysis by the mass spectrometer.

It may be necessary to fit a commercially available inline filter if there is a risk of particle contamination and this can easily be fitted externally to the aspect L-MS instrument.

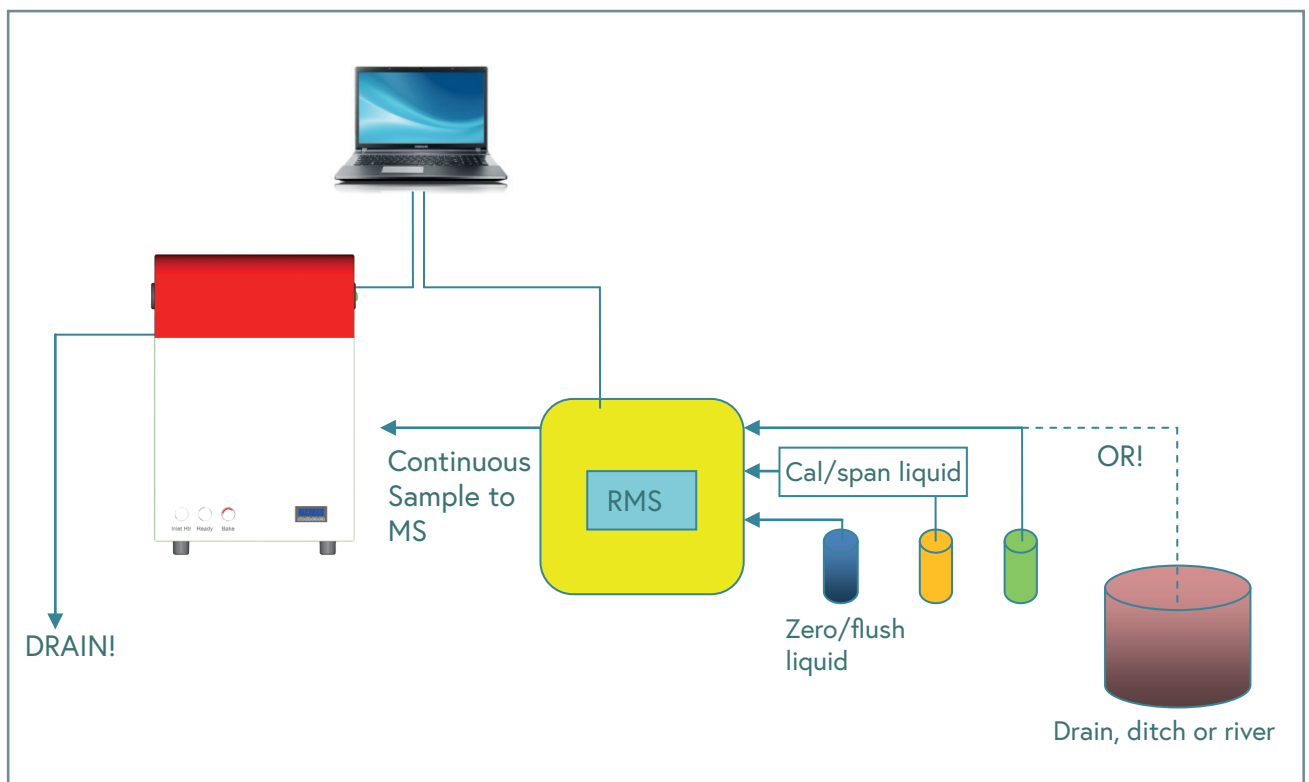


# Additional Options

## Remote Membrane Sampler (RMS) For Liquid Analysis

This IP64 unit allows direct, On-Line sampling of liquids for the continuous measurement of the dissolved gases within a liquid and is ideal for environmental contamination work..

It simply plugs directly into the aspect L-MS system, with no modifications to the MS instrument.



The RMS unit is a robust, self contained liquid sampler consisting of several electronic sample valves, Variable sample rate Peristaltic Pump. Logic control and sample stream indicators.

Control is via a dedicated simple user interface that allows the user to easily select between a: "Zero/Flush" solution, "Cal/Span" solution and "Sample" solution either from a container or directly from a source under investigation such as drain, ditch, river etc.





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