

## APPLICATION BRIEF



# Acoustic Leak Detection and Quantification for Through Valve Leakage... as Mandated by 40 CFR, Part 98

## INTRODUCTION

With recent legislation, the Environmental Protection Agency (EPA) has ruled for mandatory tracking and reporting of greenhouse gases for petroleum and natural gas systems.

Acoustic Emission (AE) technology has been developed as a solution for this inspection with both manual testing and permanent installations for the purpose of detecting and quantifying the leak rate.

### Current Condition:

Through valve leak detection has been an important issue for engineers and inspectors for many years. Valves were found to be leaking after expensive product went to the flare. This is too late in the process and the leaks needed to be found so the valves can be repaired or replaced. There needed to be a portable way of determining a through valve leak and estimating the quantity of leaking material.

### VPAC

MISTRAS Group has the instrument to correctly detect through valve leaks, the VPAC™. The VPAC™ is an acoustic emission instrument that has been the through valve leak detection standard for over 15 years. Based on over 10 years of research, the VPAC™ can estimate the quantity of material leaking through the valve using the accompanying proprietary software.

With over 400 systems currently in use, the VPAC™ is the instrument of choice for through valve leak detection.

The VPAC™ II unit is a handheld digital AE leak detector. It has been designed to replace the very successful VPAC™ and includes several improvements that are now possible with new technology advancements.

The user interface is simple and intuitive, and the unit retains all settings even when powered down. The instrument is powered by four rechargeable AA batteries which will last several weeks in typical use. Battery replacement and charging is quick and easy, so downtime is minimized.

The VPAC™ II unit contains all the features you need to determine if valves are leaking, where they're leaking, and at what rate they're leaking. The features of the VPAC™ II include:

- Stores a reading, as well as upstream and downstream readings, for up to 100 valves at a time
- Loads a complete testing route with valve names & physical properties from VPACwin™
- Calculates Leak rates directly on the unit
- Transfers all stored data to notebook or desktop PC with VPACwin™ software via a simple, wireless Bluetooth interface

## MANDATE 40 CFR.98.234.5

“ Use the acoustic leak detection device to detect through-valve leakage. When using the acoustic leak detection device to quantify the through-valve leakage, you must use the instrument manufacturer's calculation methods to quantify the through-valve leak. ”



# Acoustic Leak Detection and Quantification for Through Valve Leakage... as Mandated by 40 CFR, Part 98

## CASE STUDY

A valve under suspicion of leaking was identified and tagged to be tested. The inspector, using VPAC™, first cleaned debris from the valve, applied couplant to the valve area to be tested and placed the sensor on the valve body. The steady reading was stored in the VPAC™ and readings were taken upstream and downstream of the valve and also stored. The valve body had the highest reading and thus was determined to be leaking.

Once it has been determined that the valve is leaking, the maximum signal measurement (from the valve body), along with the pressure differential across the valve, the valve size and valve type are input into a proprietary algorithm (shown below). This algorithm calculates the leak rate in:

- liters per minute
- ft<sup>3</sup>/hr
- gal/hr
- Can convert the leak rate to tons per year and \$/yr loss
- Root based software compliant to 40CFR 98

In situations where the surface temperature at the measurement point is above 250 °F, direct coupling of the sensor to valve body is not possible. In these cases, a metal waveguide (shown at right) is used to couple the sensor to the test piece. The signal loss of the waveguide is taken into account when making the measurement.

## SENSITIVITY:

When used on gas systems, the VPAC™ system is capable of detecting leaks as small as 1 liter per minute. This is because the sensor is virtually on top of the leak source and attenuation of the signal is not a factor. Counting for standard pressure and temperature (14.696 psia and 60 °F), this corresponds to 2.12 SCF per hour.

## SERVICES:

The intelligent device allows the end user or MISTRAS Service inspectors to pre load the valve route directly into the device prior to taking readings. This saves significant time and helps validate the inspection. All information collected is easily transferred to a PC that generates fixed and custom reports documenting the inspections for submittal.

The screenshot displays the VPACwin software interface. The top window, titled 'VPAC II LEAK CALCULATION', shows a detailed report for a valve leak. The report includes fields for Company, Location, Date Created, and Contact. It also features a table with columns for Valve ID, Signal Level, Up Stream, Down Stream, Pressure Difference, Inlet Size, Valve Type, Seat Type, Valve Equation, Time of Test, Leak Rates (in l/min, ft<sup>3</sup>/hr, gal/hr), Fluid Density, Loss tons/yr, Cost Per Ton, and Total Loss Per Valve \$/yr. The total loss calculated is \$9,899,841. Below the report, there is a 'VPACwin' window showing a Bluetooth transfer screen with options to 'Discover', 'Connect', 'Disconnect', 'Load Past Results', 'Get Results', and 'Transmit Route'. The MISTRAS GROUP, INC. logo is visible at the bottom.

Above: VPACwin™ Leak Calculation and Bluetooth Transfer Screen

Left: VPAC™II kit shown with both standard and optional accessories



**WORLDWIDE HEADQUARTERS:**  
195 Clarksville Rd •  
Princeton Jct, NJ 08550 • USA  
T: +1.609.716.4000 • F: +1.609.716.0706  
E-MAIL: sales.systems@mistrasgroup.com

**CANADA  
CHINA  
FRANCE  
GERMANY  
GREECE**

T: +1.403.556.1350  
T: +86.10.5877.3631  
T: +331.498.26040  
T: +49.040.2000.4025  
T: +30.210.2846.801-4

**HOLLAND  
INDIA  
JAPAN  
MALAYSIA  
MIDDLE EAST**

T: +31.010.245.0325  
T: +91.22.2586.2444  
T: +81.33.498.3570  
T: +60.9.517.3788  
T: +973.17.729.356

**RUSSIA  
SCANDINAVIA  
S. AMERICA  
UK**

T: +7495.789.4549  
T: +46(0)31.252040  
T: +55.11.3082.5111  
T: +44(0)1954.231.612