Installation and Maintenance of a RAEGuard 2 PID

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INTRODUCTION

The Honeywell® RAEGuard 2 PID is a fixed photoionization detector (PID) that measures a broad range of Volatile Organic Compounds (VOCs). The RAEGuard 2 PID monitor operates in flow through mode. Housed in an explosion-proof stainless-steel enclosure, the RAEGuard 2 PID can be used in most environments, including hazardous environment applications for measuring toxic gases. Therefore, correct installation and maintenance is required to ensure effectiveness as a VOC monitor.

This technical note describes guidelines for installation, commissioning, testing, calibration and maintenance of the RAEGuard 2 PID and the factors that need to be considered.

INSTALLATION

This instrument can be installed as a stand-alone unit or as part of a multi-point VOC monitoring system.

Preface

It is vital to understand the gas and conditions to be measured. Many factors can impact the performance of an active sampling system, including dust, water condensation, gas condensation, and pressure within a duct.

Dust

Unless the particle size is less than 1 micron, the only impact on the performance is the filter replacement interval.

Water condensation

The RAEGuard 2 PID system is able to operate within a relative humidity range of 0 to 95%, non-condensing, without distortion of the actual VOC concentration reading. Nevertheless, water vapors are very often present within VOC samples, especially in many duct sampling applications. The sample temperature very often is high enough, and is higher than at the measurement point. On the way from the sampling point to the instrument, the sample gas is cooling. As temperature decreases, relative humidity (RH) of the water vapors in the VOC samples increases and may reach 100% or the dew point. If the temperature at the measuring point is lower than the dew point, water vapor may condense in the tubing, on the PID lamp, and on the PID electrodes. The amount of condensed water may be significant and may affect the accuracy of the measurement.

For example

If the sampling temperature is 122° F (50° C) and 40% RH, and at the measurement point the temperature is 77° F (25° C), about 10 g of water may condense from $1m^3$ of the sampling air within two (2) to three (3) days.

Presence of water must be considered at the lowest ambient temperature and the highest RH at the highest temperature in the sample line. This calculation must be performed when sampling from ducts (additional sampling equipment may be required). Honeywell recommends using a water-collecting filter; housing part number 490-0163-000 and filter replacement 490-0164-010 (pack of 10).

Figure 1. Water-collecting filter

Note: Filter housing and filter replacement elements are currently available only in North America. Contact Honeywell for more information. The filter is installed between the sample source and the instrument, at a location where the temperature does not exceed the instrument's rated operating temperature.

Target and background gases condensation

Many toxic gases have a low vapor pressure. Therefore, gas may become a liquid or a crystal even at very low concentrations if the temperature at the measurement point is lower than at the sampling point. This factor must be considered before selecting an active sampling system.

The following example illustrates the fundamentals of the vapor pressure issue:

Phenol

The Honeywell® RAEGuard 2 PID can be used in phenol factories all over the world. Phenol can crystallize from the gas phase to the solid phase when its vapor pressure in the gas state is higher than that of the sublimation vapor of the solid phenol. This process depends greatly on the temperature variations, since vapor pressures depend on them.

The approximate maximum Phenol gas concentrations in air at different temperatures are as follows:

- At 122° F (50° C): The maximum concentration of phenol is around 3600 ppm.
- At 77° F (25° C): The maximum concentration of phenol is around 440 ppm.

Pressure

Until pressure variation is within a specified range of 90 to 110 kPa, a monitoring instrument gives a correct reading. Make sure the pressure in the sampling duct does not exceed these values. Slightly exceeding them is acceptable, but the reading may be distorted. That distortion does not relate to the PID itself, which is rather stable in terms of pressure variation, but it does relate to sampling gas density variation.

Outdoor Installation

When installing a RAEGuard 2 PID outdoors, use a rain shield to protect the monitor. It is necessary to prevent water from being drawn into the sample stream.
There is a special rain guard cap that is mounted to the instrument inlet. In most cases, it prevents water from penetrating inside and allows correct instrument measurement.

Figure 2. Rain Guard Cap

Figure 3. Air-Drying Pre-Filter Kit

In some special cases with very harsh humidity conditions, an additional air-drying pre-filter kit. It can be added between an instrument and rain guard cap. The filter comprises a plastic housing with holders and can contain 15 to 20 plastic bags with CaCl2 as a water absorbent.

Note: Although an air-drying pre-filter helps prevent water penetration inside the instrument sample train, it may cause slower instrument response to VOCs and negatively impact proper instrument reading. This filter should not be used if water-soluble gases are monitored.

If the monitor is used in duct sampling applications, the risk of condensation is high and the above pre-filter kit may need to be installed to provide proper instrument readings.

Note: Consult Honeywell before installation.

COMMISSIONING RAEGUARD 2 PID

Ensure the power is correctly connected and meets the nominal requirements. Double-check for correct wiring. Be sure that instrument is grounded properly. Refer to the RAEGuard 2 PID User Guide for information on wiring and testing.

Assemble a tubing system for gas delivery from the sampling area to the instrument. The recommended tubing should be either stainless steel or Teflon. This type of tubing provides the minimum gas absorbing to the walls and reduces instrument reading distortion. Attach the tubing to the outlet to return the gas back to the gas stream or out of the zone of the personal working area in order to prevent possible contamination with toxic gases. There are no requirements for this portion of the tubing.

When all the necessary parts of the system are connected and the whole system is installed, perform a check for leaks. Disconnect the tubing from the sampling duct and block the tube inlet, or simply

block the tube inlet from the sampling area if there is no connection for the short period of time (usually for the several seconds). If there is no leak in the system, the pump stops working. Make sure that you are observing that the pump stops due to your action rather than due to the pump duty cycle. Resume pump work according to the User Guide. If there is a leak, perform failure analysis, fix system and make a final leak check using the procedure described above.

SERVICE AND CALIBRATION INTERVAL

Honeywell® recommends sensor module calibration if it does not pass a bump test (calibration check), no less than every six months, and filter replacement every six months. Note that these intervals are application dependent and directly relate to the gas exposure. Therefore, intervals should be adjusted accordingly. For the calibration procedure, follow the recommendations in the User Guide.

Note: A two-hour warm-up time is recommended before making critical measurements.

Honeywell recommends guidelines based on the correct use of filters:

1. Perform monthly bump test (calibration checks). If the system fails to pass, a full calibration must be done.
2. Replace filter, part number is 490-0164-010, at 6-month intervals unless a filter break-through is observed, requiring immediate replacement. Pre-filter filament replacement at 1 to 3 month intervals, and depends on the severity of humidity conditions.
3. Replace or clean the sensor and lamp at 12-month intervals.

Find out more:
www.honeywellanalytics.com

www.raesystems.com

Contact Honeywell Analytics:

Europe, Middle East, Africa
Life Safety Distribution GmbH
Javastrasse 2
8604 Hegnau
Switzerland
Tel: +41 (0)44 943 4300
Fax: +41 (0)44 943 4398
gasdetection@honeywell.com
Customer Service:
Tel: 00800 333 222 44 (Freephone number)
Tel: +41 44 943 4380 (Alternative number)
Fax: 00800 333 222 55
Middle East Tel: +971 4 450 5800 (Fixed Gas Detection)
Middle East Tel: +971 4 450 5852 (Portable Gas Detection)

Americas
Honeywell Analytics Distribution Inc.
405 Barclay Blvd.
Lincolnshire, IL 60069
USA
Tel: +1 847 955 8200
Toll free: +1 800 538 0363
Fax: +1 847 955 8210
detectgas@honeywell.com

RAE Systems by Honeywell
Phone: 408.952.8200
Toll Free: 1.888.723.4800
Fax: 408.952.8480

Asia Pacific
Honeywell Industrial Safety
7F SangAm IT Tower,
434, Worldcupbuk-ro, Mapo-gu,
Seoul 03922,
Korea
Tel: +82 (0) 2 6909 0300
Fax: +82 (0) 2 2025 0328
India Tel: +91 124 4752700
China Tel: +86 10 5885 8788 3000
analytics.ap@honeywell.com
Technical Services
EMEA: HAexpert@honeywell.com
US: ha.us.service@honeywell.com
AP: ha.ap.service@honeywell.com

Technical Services
ha.us.service@honeywell.com