Verification Statement

Identification of the independent verifier	CMC Research Institutes (CMCRI)
Identification of the tester/verifier	Saskatchewan Research Council (SRC)
Identification of the applicant	Providence Photonics
Date of Issue	September 30, 2018
Identification of the statement	QL320 quantitative optical gas imaging technology

Summary of the Description of the Technology

The QL320 quantitative optical gas imaging technology is based on the US Patent and Trademark Office Patent No. 9,225,915 B2. It is designed to be used with only FLIR GF320/GFx320 handle-held gas detection cameras to provide a quantitative measurement of the leak rates for most of the hydrocarbons. The QL320 analyzes the infrared image from the FLIR camera and analyses the picture intensity, on a pixel by pixel basis. Each plume pixel is a representative of a gas column between the camera and the background. At a given temperature difference between the plume and the background, pixel intensity is proportional to the molecules in the gas column; hence it can be used to predict the quantity of the gas.

Summary of Verification of the Test Results

Initial controlled field trial campaign

SRC conducted the field trial measurements on methane in the fall of 2017. Statistical analysis confirmed the reproducibility of the results at both studied flow rates of 2 litres per minute (lpm) and 10 lpm, which concludes the reliability of the measurements in the range between 2 lpm to 10 lpm. The study confirmed significant effect of ΔT (temperature difference between the ambient (gas) and background of the leak-point), distance from the camera, and their combination on the measurements. In spite of the reproducibility of the results, some measurements resulted in zero readings mostly under the condition of ΔT being 4°C and 5°C with the flow rate of 2 lpm. The significant impact of ΔT emphasizes the selection of appropriate environmental conditions during measurements and consideration of a proper distance between camera and target.

Verification testing campaign

Measurements were conducted by SRC in May and June 2018 on methane and two different gas mixtures (i.e., A and C defined in SRC Spring Field Trial Report, dated September 2018). Statistical analysis confirmed the significant effect of gas composition on the received signal hence necessitates the calibration based on the gas composition. In gas type C, more than 70% of the readings were within an accuracy range of ±30% compared to the actual flow rates of 5 lpm and 10 lpm, whereas in methane and gas type A the frequency distribution of the readings within the accuracy range was less than 70%. This again confirms the sensitivity of readings to low flow rates and gas composition, and results from this testing suggest that for flow rate lower than 2 lpm measurement data might not have sufficient accuracy. This also shows, based on this test, the technology did not yield accurate measured data for a gas with more than 80% methane.

It was observed that light reflection from pipe insulation (or adjacent infrastructure) interferes with the received signal, particularly at the low flow rate of 1 lpm. Notch boundary setting and adjustment of plume threshold were suggested by Providence Photonics to improve the quality of the readings. The results showed notching improved the quality of data in gas type A and at both flow rates of 1 lpm and 10 lpm. Despite the increase in the frequency distribution of readings within the accuracy range of ±30% of the actual flow rate, statistical analysis could not support the impact of notching for methane, which again shows the poor accuracy of the system measuring gas with high content of methane in these tests. Furthermore, analysis of variance (ANOVA) showed there is a statistically significant difference between the gas types (and composition) at the flow rates of 5 lpm, whereas the difference in the readings was not statistically significant at the flow rate of 10 lpm. Further evaluation of the results using a paired comparison (t-test), showed the instrument is less likely to differentiate between the gas types at the higher tested flow rate of 10 lpm.

Summary of Verified Performance Conditions

Overall, it can be stated that the current QOGI technology is mostly accurate under moderate environmental conditions and flow rates as mentioned above and described in reports made by SRC and CMCRI. An operator can expect have

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±30% measurement accuracy with a gas type similar to gas type C (4.0% nitrogen, 10.0% carbon dioxide, 55.5% methane, 11.5% ethane, 10.0% propane, 6.0% butane, 3.0% pentane) with a leak rate between 5 lpm and 10 lpm under moderate environmental conditions similar to those experienced during this test. Details can be found in the report written by SRC and the verification report by CMCRI (dated November 2018). Further development is required to obtain more accurate results under extreme conditions and for various gas compositions.

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