Device parameters for Wilcoxon's intrinsically safe certified sensors

An intrinsically safe vibration sensor system is composed of a certified safe accelerometer, an associated safety barrier, and the interconnecting cables.

When the accelerometer is certified to be safe for use in an explosive or potentially explosive atmosphere, there are certain requirements which must be met. The sensor must be installed in specific accordance with the associated installation drawing, which is approved during certification. The installation drawing approved during the certification process establishes the mechanical mounting and electrical connection requirements.

In many instances, the sensor must be connected to a safety barrier, which protects the sensor from harmful voltages and currents, in the event of a failure in either the sensor or the associated readout equipment. The safety barrier must be rated In compliance with the ratings established by the certifying agency. These ratings vary based on the type of certification, for instance, if one desires the sensor to be approved for use in a hydrogen atmosphere versus methane atmosphere, different ratings would normally apply. Safety barriers used with hazardous area accelerometer installations typically have five parameters of concern associated with them: voltage, current, power, capacitance, and inductance.

The open-circuit voltage available at the terminals of the barrier is V_{oc}. The short-circuit current that the barrier can sink is I_{sc}. The maximum capacitance that can be connected to the barrier apparatus is C_a while the maximum inductance that can be connected is L_a.

There are corresponding values for the vibration sensor. The voltage rating, V_{max} as determined by the certification agency, is the maximum voltage that can be applied to the terminals of the sensor. The current rating, I_{max}, is the maximum current that can be applied through the terminals of the sensor. The value of internal capacitance, C_i, and inductance, L_i, are also in the certifying documentation. When the sensor and barrier are connected together, the cable capacitance, C_{cable}, and inductance, L_{cable}, must be considered a part of the system. More recent approvals also factor in the total power applicable to the sensor, P_i, and the maximum power output, P_o, available from a barrier.

By comparing the rating of the vibration sensor with that of the barrier and taking the cable values and power into account, an appropriate safety barrier can be selected. As long as the ratings of the barrier satisfy the following equations, the installed system will meet the requirement for an intrinsically safe system.

V_{oc} must be equal to or less than V_{max}
I_{sc} must be equal to or less than I_{max} (or I_i)
C_a must be greater than or equal to $C_i + C_{cable}$
L_a must be greater than or equal to $L_i + L_{cable}$
P_i must be greater than or equal to P_o

$$V_{oc} \leq V_{max}$$
$$I_{sc} \leq I_{max}$$
$$C_a \geq C_i + C_{cable}$$
$$L_a \geq L_i + L_{cable}$$
$$P_i \geq P_o$$