Section 4 – Environmental Limits

4.1. Diaphragm Loading

It is important not to subject the silicon diaphragm to concentrated loading. It is designed for distributed pressure loading. Point or concentrated loading, such as pencil tips, tweezers, or other sharp objects pressed against the diaphragm will break the diaphragm!

The thinned areas of the sculptured diaphragms vary from 0.2 to 10 thousandths of an inch thick. They are quite rugged when loaded with distributed pressure load, but will not tolerate concentrated point loading.

4.2. Temperature

High Temperature Limit – Kulite specify a maximum operating temperature limit of 482°C for the XTEH-10L-190 and XTEH-10LAC-190 units. For applications where units are exposed to extreme temperatures for short time durations, the silicon diaphragm can be protected by ablative RTV coatings.

Low Temperature Limit – Kulite specify a minimum operating temperature of -196°C for the CT-375 cryogenic integrated sensor pressure transducer which is normally compensated between the temperatures of -196°C and 38°C.

4.3. Acceleration, Shock and Vibration

Environments of steady state acceleration, shock, and vibration may cause spurious output from a pressure transducer. However, Kulite transducers are very rugged and have been successfully used in very severe environments.

Most Kulite pressure transducers are qualified for at least 10,000g steady acceleration and 100g peak vibration.

However, if the shock or vibration environment contains significant energy at frequencies above 1/3 the resonance frequency of the transducers, it is possible to excite the resonance of the diaphragm. Then, unless the medium provides significant damping, the diaphragm may be broken.

Always handle transducers carefully and gently, like delicate instruments. The miniature cables are especially susceptible to damage.

4.4. RF and Magnetic Fields

Normally encountered magnetic and RF fields have negligible effect on the piezoresistive strain gage elements.. However, adequate isolation must be provided against ground loops and stray signal pickup. High intensity RF fields may require special shielding of the pressure transducer, cable, and amplifier.

Kulite's four conductor, shielded cables provide more than adequate shielding for most laboratory, field, and industrial environments. To prevent possible ground loops, the transducer case is normally insulated from .the cable shield. The shield should be grounded at the signal conditioner. The case will be grounded to its mounting structure, and to the medium being measured. In applications with a non-conductive mounting structure and low-conductivity media, special case grounding provisions may be required to provide maximum shielding.

Piezoresistive transducers are highly resistant to any effects of magnetic fields, even of very high intensity. They can, therefore, often be used in environments where other sensing mechanisms are not acceptable.

4.5. Sealing and Hermeticity

Kulite ultra miniature pressure transducers use epoxy sealing (between sensing diaphragm or module and case) against leakage through the pressure measuring system. For M10 and larger units, true welded hermetic sealing is generally employed with glass to metal sealed assemblies for the isolated pressure capsules and cable/ connector outlets.

4.6. Media Compatibility

Most specifications for pressure transducers refer to the "front" (pressure sensitive) end of the transducer. When discussing pressure media, pressure ratings, and temperature, the electrical lead end ("back") must be specified separately.

4.6.1. Pressure Sensitive End

Typical silicon “open” diaphragm pressure transducers are compatible with clean dry gases, noncorrosive, medium pH liquids, and common oils. They are not compatible with corrosives, high or low pH liquids, solvents which might attack epoxy, or long exposure to water.

Leadless technology silicon diaphragm pressure transducers can be used with any media which is compatible with stainless steel and silicon dioxide.

4.6.2. Electrical Lead End

The reference tube or reference pressure side of standard Kulite ultra miniature differential and gauge pressure transducers connects directly through a hole in the pedestal of the pressure capsule. Due to the small diameter of the tubes and passages into the capsule, care must be taken to ensure debris which may be present in the pressure media does not block these small passages.

With the leadless design of pressure transducers, only clean, non corrosive, non conductive liquids or gases may be used for the reference pressure media.

Aerospace differential and gauge units frequently employ Kulite’s patented dual diaphragm technology which permits the use of pressure media at both the pressure and reference ports which is compatible with stainless steel.

4.6.2.1. Sealing

Unless a transducer is designed with a hermetic connector outlet or uses a glass to metal seal header for the cable outlet, the back end of the unit must not be immersed in conductive or corrosive media.

The standard Teflon insulated wire used for lead exit does not seal against water intrusion and the electrical end of standard transducers cannot be submerged in water without damage.

4.6.2.2. Reference Port

The vent tube, on gauge units, must be kept open to local ambient pressure. In some applications it can be used as a reference port for differential pressure measurements. Maximum (burst) pressures for both pressure

side and reference side are specified on individual data sheets. The reference side of gage transducers is epoxy-sealed.

4.6.2.3. Case

Case material of most units is 17-4 PH or 300 Series stainless steel. Titanium is an option for some miniature units where weight or resistance to chemical attack is of specific importance. Compatibility should be checked for any medium or environment other than clean, dry, non-conductive gasses.

4.7. Nuclear Radiation

Kulite has carried out testing with piezoresistive pressure transducers with some success. Please consult the factory for further details.