



Application Notes

Ultrasonic Couplants

Ultrasonic couplants are used in virtually all contact testing applications to facilitate the transmission of sound energy between the transducer and the test piece. Couplants will typically be moderately viscous, nontoxic liquids, gels, or pastes. Their use is necessary because sound energy at the ultrasonic frequencies typically used for nondestructive testing is not effectively transmitted through air. Aside from attenuation effects, air represents a severe acoustic impedance mismatch with respect to both transducer wear plates and typical test materials. Even an extremely thin air gap between the transducer and the test piece will prevent efficient sound energy transmission and make conventional testing impossible.

A number of common substances such as water, motor oil, grease, and even some commercial products like hair gel can be used as ultrasonic couplants in many applications. However, for best results in high-temperature and normal incidence shear wave testing, it is necessary to use specially formulated couplants. The Olympus line of ultrasonic couplants includes five different products optimized for different applications. A description of each follows, listed according to their part code.

Couplant B2 – Glycerin

Glycerin is also a general purpose couplant. The advantages of using glycerin are that it is viscous and has a high acoustic impedance, making it the preferred couplant for rough surfaces and highly attenuating materials. Glycerin has an acoustic impedance of 2.42×10^6 kg/m²s (versus 1.61 for propylene glycol, approximately 1.5 for motor oil, and 1.48 for water). Glycerin's acoustic impedance closely matches that of plastics, and it is closer to that of metal than other common coupling liquids, providing more efficient sound transmission between the transducer and the test piece. In metal testing, glycerin typically provides a 3 to 6 dB increase in signal strength as compared to propylene glycol.

The disadvantage of using glycerin is that if it is not removed from the test surface, it can promote rusting or corrosion in some metals by absorbing and holding water from the atmosphere. It can also support the growth of mold if not removed. While glycerin is often recommended for testing castings due to its good acoustic properties, care should be taken to wash it out after use. Note that this corrosion effect does not occur in plastics, fiberglass, or composites, so glycerin may be freely used on those materials. The maximum recommended temperature for glycerin is approximately 200 °F (90 °C).

Couplant D12 – Gel

Gel type couplants are often recommended for rough surfaces such as sand-cast metals and fiberglass layups, where their high viscosity and relatively high acoustic impedance will maximize sound coupling in a situation where the transducer cannot make smooth contact with the test surface. Gel couplants are also usually employed in weld inspections where it is necessary to slide the transducer across a wide surface area. Here, the advantage is simply that gel can be quickly spread across a large area and that it will maintain good coupling as the transducer is scanned along the weld. Gels are also useful in inspecting overhead surfaces or vertical walls since they won't drip or run. Most gel couplants can be used on moderately hot surfaces up to approximately 200 °F (90 °C).

Couplant H-2 – High-Temperature Couplant

Couplant H-2 is a gel that can be used at elevated temperatures. Its manufacturer states that it can be used at temperatures up to 750 °F (398 °C) under certain open environment conditions. As with any high-temperature couplant, the user is responsible for determining that it is suitable for a given application.

Couplant I-2 – High-Temperature Couplant

Couplant I-2 is a gel that can be used at elevated temperatures. The manufacturer states that it can be used from –40 to 1250 °F (–40 to 675 °C).

Shear Wave Couplant – SWC-2

Normal incidence shear wave transducers require couplants of very high viscosity since liquids such as oil or glycerin will not support shear waves. Typically, sticky resins have been used for normal incidence shear wave coupling. Olympus' SWC-2 is a nontoxic, water-soluble organic substance of very high viscosity that is easy to apply and remove. Normally a very small amount should be placed on the face of the transducer or the test piece and then pressed into a very thin layer. Note that for optimum coupling, it is important that the couplant layer be thin, a small fraction of the test wavelength. Following testing, residue may be washed off with warm water. SWC-2 may be used at temperatures up to approximately 100 °F (38 °C).

Couplant and Adaptors

Couplant is almost always necessary to provide acoustic coupling between the transducer and the test piece. We offer various types of couplant to suit virtually all applications. We also offer adaptors that enable you to connect different types of cables and probes to your flaw detector.



Material Safety Datasheets (MSDS) datasheets for all Olympus couplants can be found online here:
<https://www.olympus-ims.com/en/msds-datasheets/>.

Silicon oil and propylene glycol are also commonly used couplants previously offered by Olympus. Generic versions should be readily available from chemical suppliers.

www.olympus-ims.com

OLYMPUS

OLYMPUS CORPORATION OF THE AMERICAS
48 Woerd Avenue, Waltham, MA 02453, USA, Tel.: (1) 781-419-3900
110 Magellan Circle, Webster, TX 77598, USA, Tel.: (1) 281-922-9300

For inquiries - contact
www.olympus-ims.com/contact-us

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