NEOPRENE CONNECTORS ACOUSTICAL FIELD TEST

Reprint of Field Test Report: Sound & Vibration Attenuation of Actual Installation
Conducted by: Bolt Beranek and Newman Inc., November 1976

A worthwhile flexible connector must be rugged and long lasting and provide sufficient flexibility and sound attenuation so that its insertion in a noisy system will reduce transmitted noise and vibration on a reasonably predictable basis.

We had worked extensively with braided metallic connectors, wire reinforced hose and conventional single and multiple arch rubber expansion joints before our exposure to the connectors illustrated on the page. While the older style hoses and expansion joints performed well mechanically in solving misalignment, expansion and vibratory fatigue problems, their effectiveness was both limited and unpredictable for noise attenuation.

These new Mason-Flex connectors offer new hope as the construction consists of multiple layers of nylon tire cord and chloroprene without steel wire. Thus, they can expand volumetrically in response to pressure changes to smooth our audible water pulsations. This report is but one of a series to gather data on many sizes. In this test, we are dealing with unanchored lightweight copper lines, so the connector is “looking into” an extremely flexible piping member. The Type MFTFU was used because of its small size and the need for screw ends.

MFTFU
Mason-Flex Twin-Sphere Union Connector

MFNC
Mason-Flex Single-Sphere Connector

MFTNC
Mason-Flex Twin-Sphere Connector

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The originally installed vibration eliminators were 3/4 inch I.D. with an overall length of 11 1/2 inches. The eliminator consisted of a fatigue resistant corrugated tin bronze seamless tubing core with bronze braid covering. Standard copper tube fittings were soldered on both ends of each unit (See Figure 1).

These vibration eliminators had been installed in May of 1973 to reduce the transmission of objectionable noise and vibration from a pressure booster pump to the living spaces of the house via the piping system. The application of these units did, in fact, attenuate vibration transmission and effectively reduce sound pressure levels measured in two bathrooms as shown in Curves 1 and 2.

However, during a period of three years between the installation date and May 1976, the objectionable noise and vibration returned to measured levels even higher than the original conditions prior to applying the initial units. Either the bronze connectors progressively lost their attenuation capabilities, the pump became increasingly noisy or both.

Shortly after vibration measurements were made on 4 August 1976, these units (four total) were removed physically from the piping system. Close visual examination revealed the units to be quite clean internally with the exception of apparently minimal corrosion and deposits. It had been suspected that perhaps corrosion and deposits (sediment) had clogged or stiffened the bellows corrugations internally, thereby reducing the effectiveness of the bellows. Although this does not appear to be the case, it is intended that the units will be further examined and tested in a metallurgy laboratory for determining, if possible, any malfunction of the units.

About 1 November 1976 the installation of four Mason Industries 3/4 inch Twin-Sphere MFTFU Union Connector vibration isolation units was completed (See Figure 2). The Mason units were installed in precisely the same locations as the original units which were removed (See Figure 3).

Because the Mason units were furnished with union ends, final connections to existing copper piping were made with short threaded plastic nipples and threaded female to sweat copper adapters each end of each vibration isolation unit. The plastic nipples also served as dielectric separators between dissimilar metals.

Vibration measurements were made in the same positions as those taken for the original units. The measurement position locations are shown in Figure 3. During the course of conducting sound and vibration measurements, the home intercom system was pressed into service to determine, from bathroom locations, whether the pump in the basement was operating or not.

Curves 1 and 2 graphically indicate the reduction in noise level in the two bathrooms resulting from the installation of the Mason units. A very significant noise attenuation was achieved from the pump impeller blade passage peak noise level in the 250 Hz octave band. The Goulds pump impeller has four blades, thus blade frequency increment 4 x 3450 / 60 = 230 Hertz. Related reductions in vibration acceleration levels may be noted at 250 Hz on Curves 3, 4, 5, 6 and 7 plotting measured vibration levels at measurement positions 2, 4, 6 and 8. It is further observed that rather dramatic attenuation of vibration occurs from the 250 Hz through the 8000 Hz octave bands at measurement positions noted above with the following exceptions.

1) Positions 2 and 4 at 1000 Hz: Acceleration levels only 1dB difference.

2) Position 6: No difference in attenuation detected.

Conclusion: The installation of the Mason-Flex connectors reduced the noise levels in the top floor bathroom from NC 38 to NC 15 and in the main floor bathroom from NC 42 to NC 22 as compared to the bronze connectors. No tests were run in 1976 on solid piping but it can be assumed these levels would have been as high or higher than those of the installed bronze connectors.

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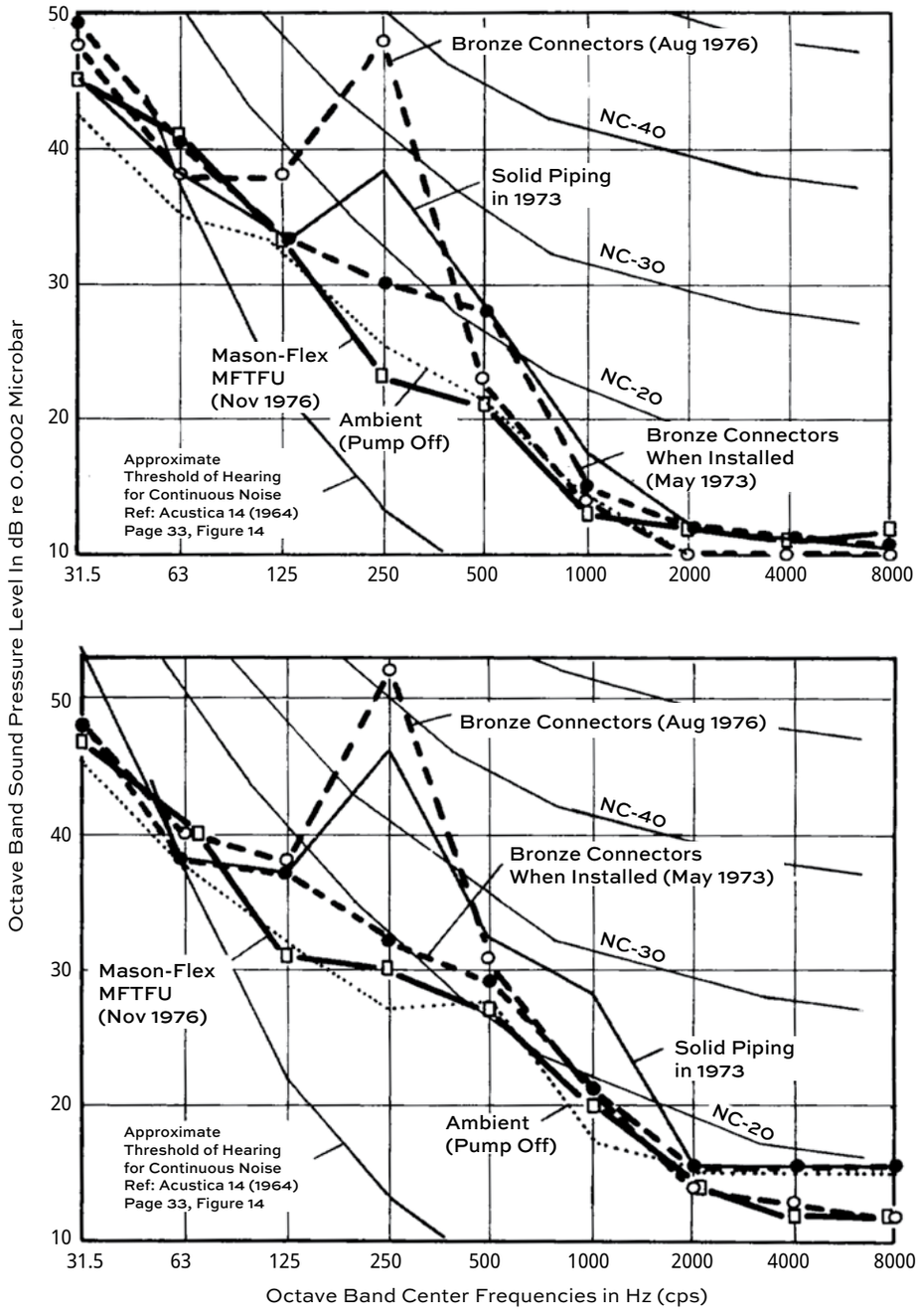

CURVE 1

TOP FLOOR BATHROOM

Airborne Sound Pressure Levels

CURVE 2

MAIN FLOOR BATHROOM

Airborne Sound Pressure Levels

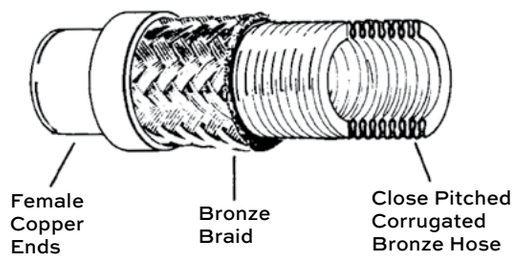

FIGURE 1

Originally installed vibration eliminator, bronze core, bronze braid covering, 3/4" ID x 111/2" long.

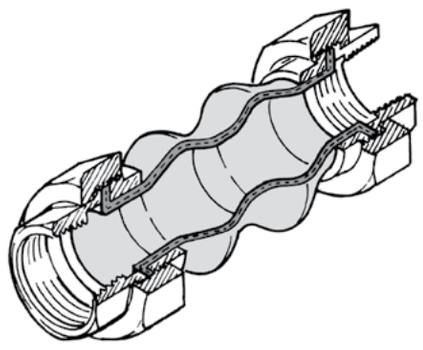

FIGURE 2

MFTFU Mason-Flex Twin-Sphere Connector used as replacement for the original eliminators.

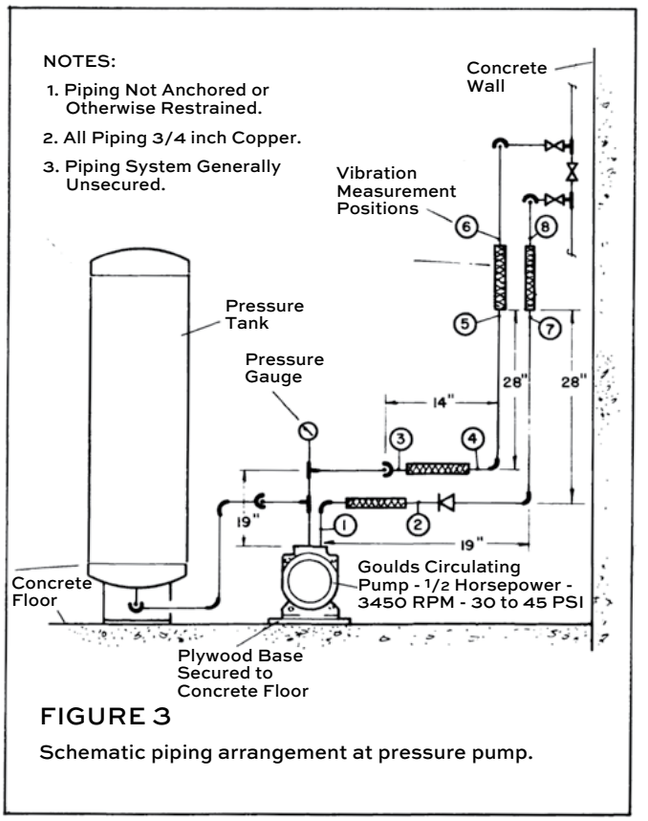

FIGURE 3

Schematic piping arrangement at pressure pump.