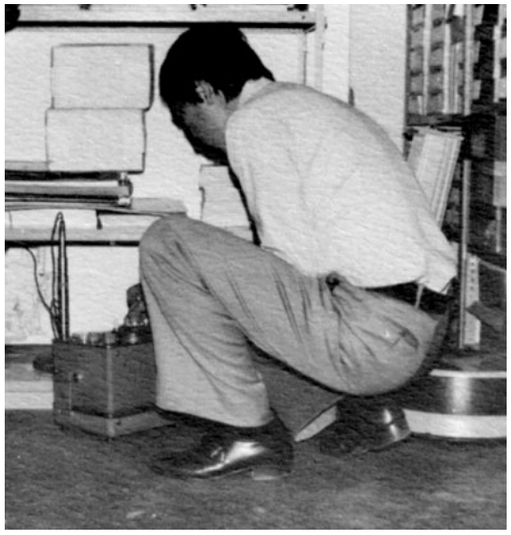
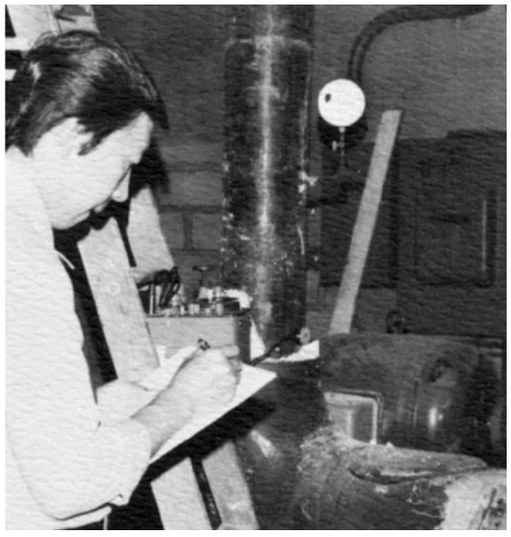
NEOPRENE CONNECTORS ACOUSTICAL FIELD TEST

Reprint of Field Test Report: CHILLED WATER PUMP PIPE RESONANCE NOISE
Conducted by: CERAMI AND ASSOCIATES, November 1976

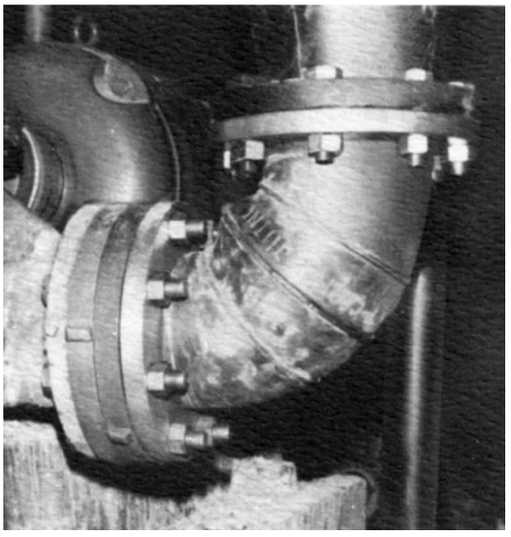


Noise measurement on 18th floor both before and after insertion of neoprene connectors.

Footed 5" x 8" el that was replaced by 5" MFTNC and 5" x 8" tapered reducer.

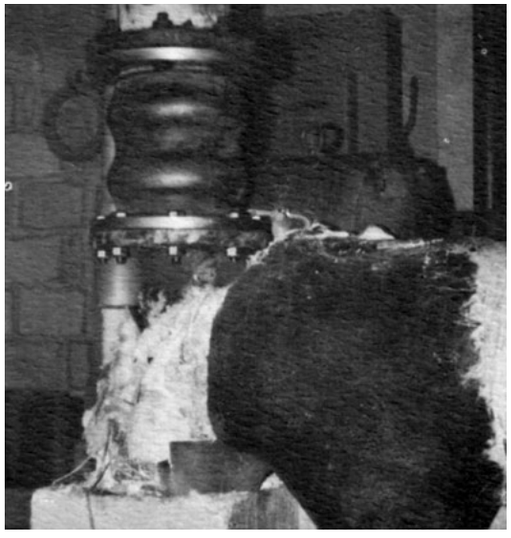


Vibration measurements being taken prior to installation of twin-sphere MFTNC connector in suction line.



5" MFNEC neoprene elbow installed in discharge line.

Note: Elbows discontinued, use MFTNC.



Twin-sphere 8" MFTNC connector installed in suction line.

MFTNC
MASON-FLEX
TWIN-SPHERE
CONNECTOR

MFNEC
MASON-FLEX
ELBOW CONNECTOR

Cerami

AND ASSOCIATES, INC.
ACOUSTICAL CONSULTANTS

Gentlemen:

In accordance with our recommendations, an acoustical test program was completed in which chilled water pipe resonance noise was attenuated by means of inserting flexible neoprene pipe connectors in the pump discharge and suction lines.

This report submits results of the test, and comments on our test findings.

A) Original Survey Findings

Towards the end of our job inspections of acoustical conditions in the newly completed 25 story annex building to the original American Home Products building at 684 Third Avenue, we detected a pure tone-like noise on the 18th floor of the new building, measured to be at 46 dB, peaking at 147 Hz. The level of noise was not overly high, but due to its pure-tone like quality, it was easily audible over the ambient noise.

The 147 Hz tone was subsequently traced to a pair of 75 H.P. chilled water pumps located on the 27th floor of the original building, transmitting the noise to the 18th floor of the new building via a pair of chilled water pipe risers which connected the pumps to new chillers located in a machine room below the 18th floor office space. The noise could be heard with either or both pumps running.

B) Cause of Noise

The acoustic energy transmitted to the 18th floor which peaked at 147 Hz was the product of the pump rotating speed, nominally at 1750 RPM, and the number of vanes in the pump impeller, which was 5. The peak tone therefore was at the impeller vane frequency.

The fact that the acoustic energy was telegraphed over nine floors to a remote location from the pumps, represented an acoustic phenomenon created by a resonance in the piping configuration, resulting in significant amplification in fluid pulsations occurring at the impeller vane frequency.

C) Test Objective

Having diagnosed the source of noise, the objective in any noise attenuation attempts should be to disrupt the acoustic standing wave pattern within the piping configuration. It was our opinion that a significant change in the pipe wall rigidity close to the source could provide just such a disruption.

Suitable products which have the potential of providing the acoustical results desired are neoprene flexible pipe connectors such as the Mason-Flex Connectors by Mason Industries, Inc., Hollis, N.Y.

With the client's approval, two Mason-Flex Connectors were installed for one of the two pumps as follows:

Suction Line: 8" diameter Mason Type MFTNC twin-sphere neoprene pipe connector.

Discharge Line: 5" Mason Type MFNEC elbow neoprene pipe connector.

Approximate locations of the installed flexible connectors are shown in the sketch sheet.

D) Test Results

Pipe wall vibration levels, which are good indicators of level of acoustic energy in the fluid flow, were measured at identical locations before and after the insertion of the Mason-Flexes.

Curves 1 through 6 depict the differences in pipe wall vibration at measurement locations indicated on the sketch sheet. It is apparent from the curves that reductions in vibration levels were most substantial at and around the original resonant frequency of 147 Hz. This type of reduction implies that an effective de-tuning of the original resonance had been achieved with the Mason-Flexes. Residual pipe wall vibrations are mainly random without any peculiar peaks which caused the pure tone noise transmission.

Further indication of the successfully de-tuned piping system can be seen on Curves 7 and 8 which show the before and after pipe wall vibration on the risers at the 18th floor.

The final proof of the favorable test results was in the decrease in sound pressure level on the 18th floor. Curve 9 shows the before and after noise levels on the 18th floor, indicating a drop from NC-36 to NC-26.

The NC-26 sound level was measured at night when the entire building was shut down except for the chilled water pump with the new Mason-Flexes. Under such a quiet ambient condition, there was no audible signal whatsoever of the original pipe resonance noise.

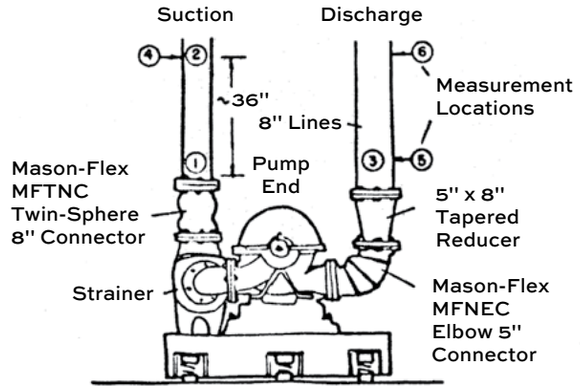
In view of the total success in attenuating the pipe resonance noise with the Mason-Flexes on one of the two pumps, it seems logical that the other chilled water pumps should also be furnished with the same flexible connectors to maintain quiet operation from both pumps.

Should you have any questions on the above, kindly advise.

Very truly yours,

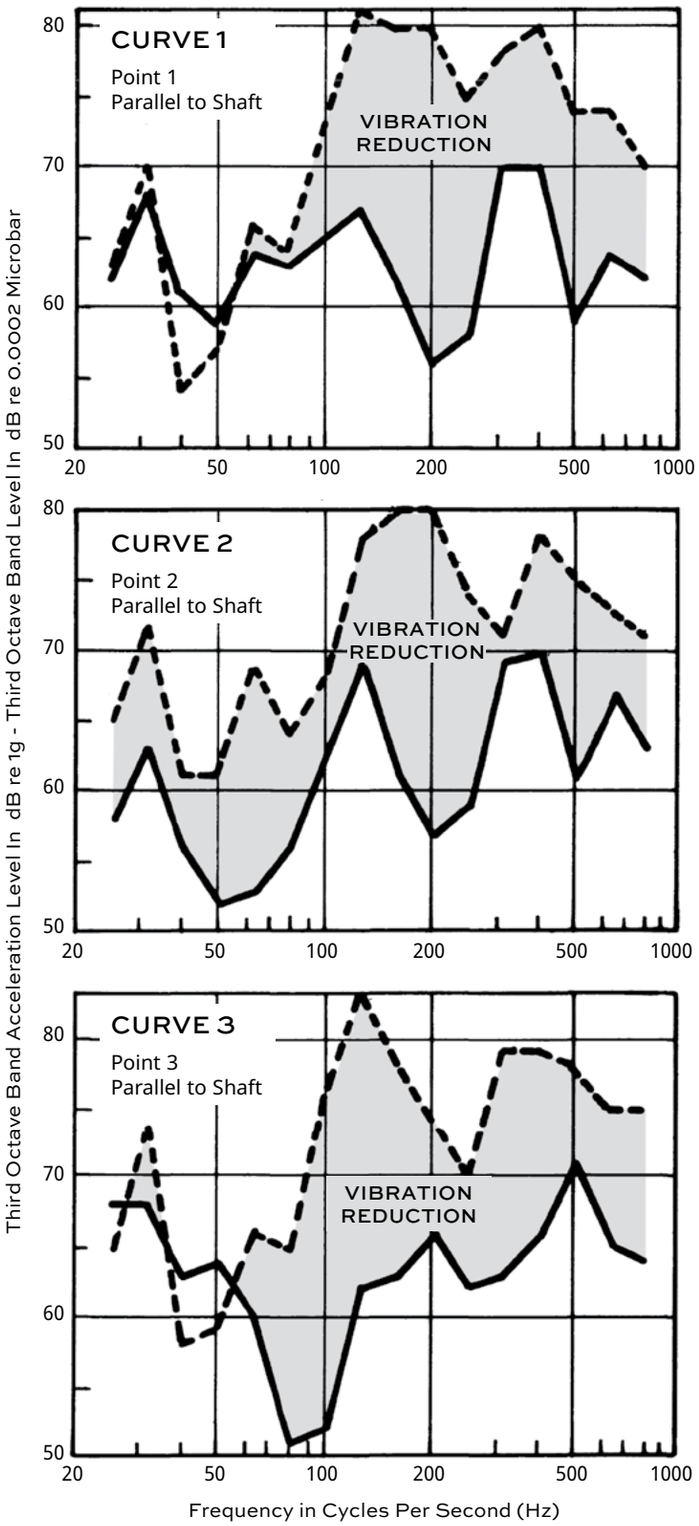
CERAMI AND ASSOCIATES, INC.

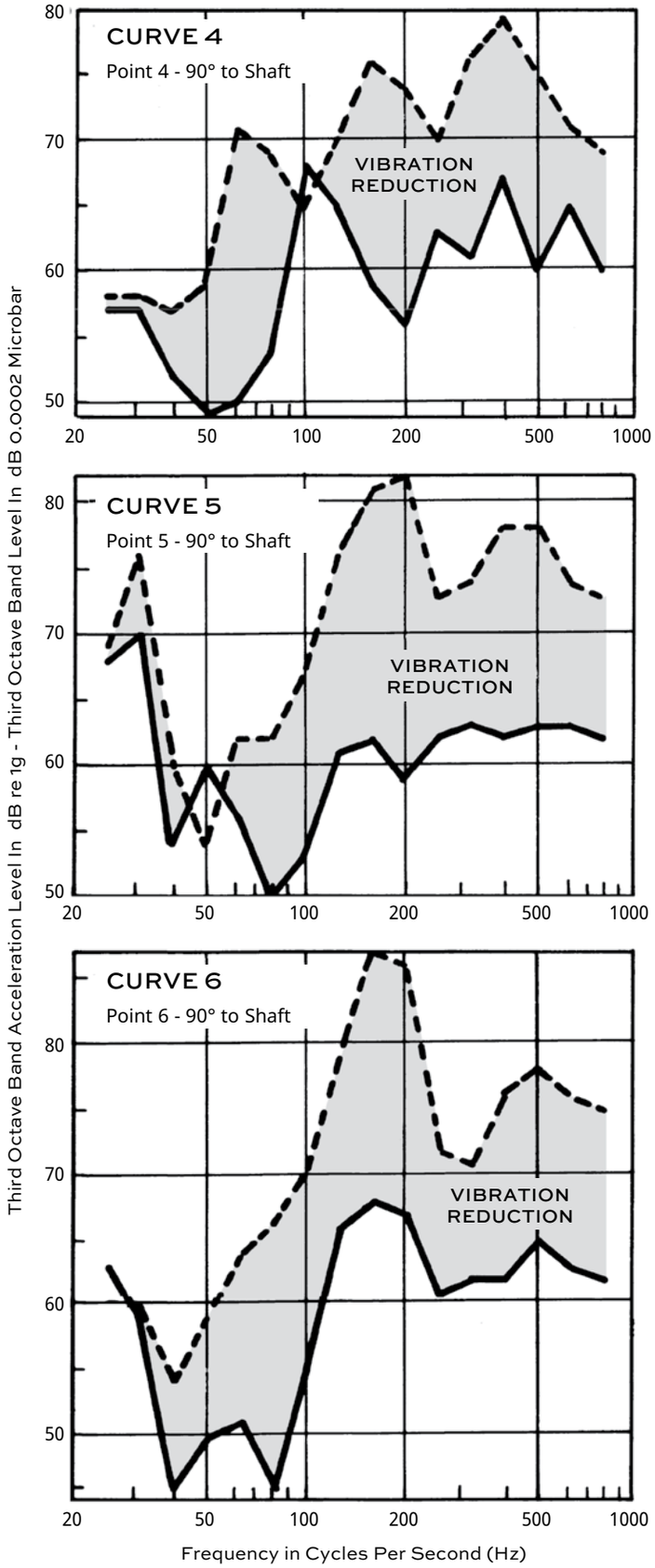
Submitted by: Fred Shen, P.E., Senior Consultant



Pipe Wall Vibration **Before** Insertion of Flexible Neoprene Connector.

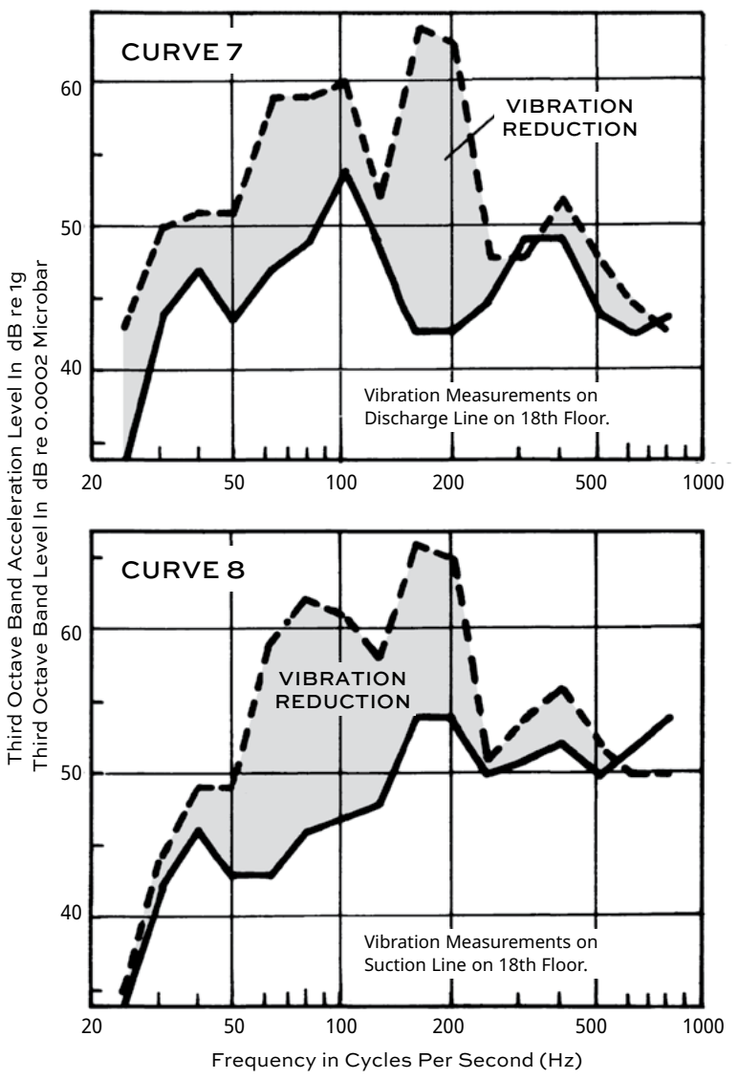
Pipe Wall Vibration **After** Insertion of Flexible Neoprene Connector.

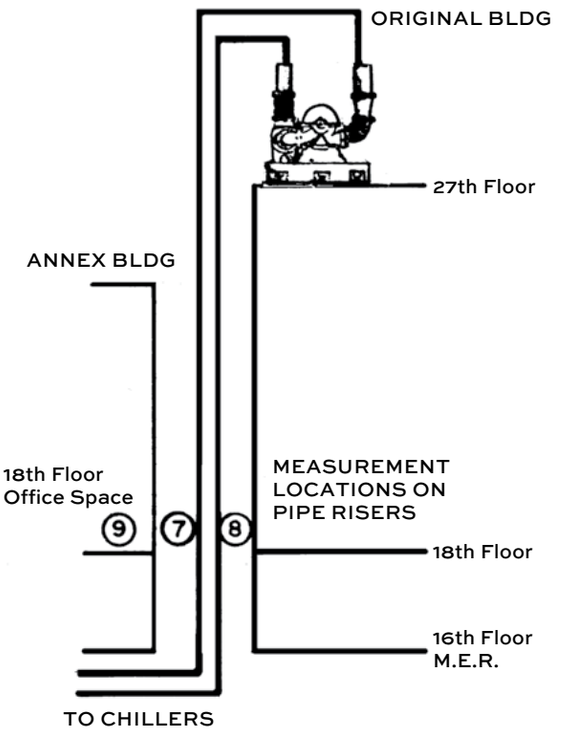


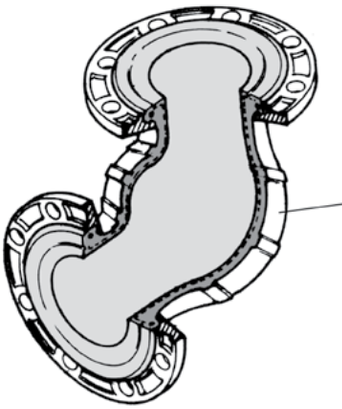


Pipe Wall Vibration **Before** Insertion of Flexible Neoprene Connector. (Curves 7 and 8)

Pipe Wall Vibration **After** Insertion of Flexible Neoprene Connector. (Curves 7 and 8)

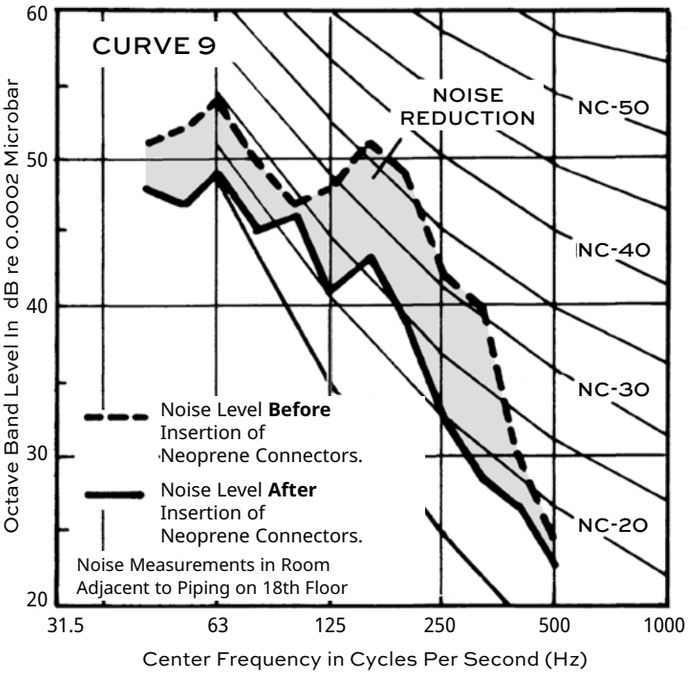


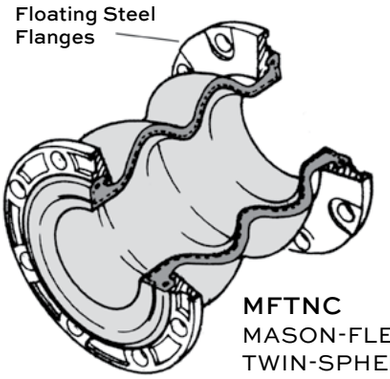




MFNEC
MASON-FLEX ELBOW CONNECTOR

Nylon Tire Cord Reinforced Neoprene Construction





Floating Steel Flanges

MFTNC
MASON-FLEX TWIN-SPHERE CONNECTOR

Cerami AND ASSOCIATES, INC.