conoco

RECEIVED

Interoffice Communication

To Environmental File

From V. M. Fisher

Date October 31, 1983

Subject Vinyl Chloride Emissions from Light Ends Column Vapor Overhead Line Leak
NON-REPORTABLE SUPERFUND & NON-REPORTABLE STATE 17.11 INCIDENT

On September 26, 1983 the Light Ends Column Vapor Overhead line developed a pinhole leak. Upon receiving a work order regarding the leak, the maintenance department immediately installed a clamp on the line temporarily stopping the leak. After many makeshift repairs, the clamp developed a pinhole leak on October 17, 1983. Attempts to stop this leak failed, and the Light Ends Column was shutdown on October 27, 1983 to install new piping to replace the leaking section. The amount of vinyl chloride leaked into the atmosphere did not represent a "reportable quantity" under the Superfund regulations and the National Response Center was therefore not notified of the release.

The amount of vinyl chloride released into the atmosphere was calculated to be 0.75 lbs./day or a total of 8.25 lbs. The "reportable quantity" under the Superfund regulations is 1 lb. in a 24-hour period. The State of Louisiana Department of Natural Resources was not notified because this leak is not regulated by the State of Louisiana Air Quality Regulation 17.11 protocol since it was not an emergency occurrence, episodic or accidental event, equipment malfunction or process malfunction. Attached are the calculations used in determining the quantity of vinyl chloride released to the atmosphere.

Virgil M. Fisher

Virgil M. Fisher
Process Engineer

br
cc: RAC-JWW-MLA-RB-DLD-SJR-MGH-ESW-JCL

VVC 000014220

C-102 Overhead Vapor Line Leak

$$\rho = \frac{MP'}{10.72\,T_2} = \frac{(81.83)(35)}{(10.72)(647)(1)} = 0.413\ \#/ft^3$$

Leak thru 1/32" pinhole

$$\omega = 0.525\ Y d_o^2 C \sqrt{\frac{\Delta P}{V_1}}$$

[#/sec]

$C = 0.60$
$Y = 0.70$
$d_o = .03125$
$\Delta P = 20$ psi
$\overline{V} = 2.42\ ft^3/lb$

$\omega = 0.00062\ \#/sec = 2.228\ \#/HR = 53.568\ \#/24\ HRS$

FM. LAB ANALYSIS LT. ENDS OVERHEADS 10/26/83

	Wt %	#/DAY
VCM	1.4%	0.7500
E+CL	39.4%	21.1058
CCl_4	6.3%	3.3748
CH/CL_3	30%	16.0704

File - LOVCA

SOUND LEVEL SURVEY

LAKE CHARLES VCM PLANT

FILE CH-098

OCTOBER 31, 1983

conoco

Interoffice Communication

To R. A. Conrad - Manager, Lake Charles VCM Plant

From W. G. Warren, Jr. - Medical Division, Ponca City, Oklahoma

Date October 31, 1983

Subject SOUND LEVEL SURVEY - LAKE CHARLES VCM PLANT (FILE NO. CH098)

Introduction

This sound survey was performed by W. G. Warren, Jr. and P. McCombs during the week of September 19, 1983, as scheduled with Steve Ashby. The purpose of the survey was to determine the extent of noise exposures confronted by personnel, to establish current noise levels throughout the plant, and to make recommendations on noise abatement procedures for problem areas. The results of the survey are on the exhibits, charts, and table attached, and are discussed below.

Current Regulations

Recommendations in this report are made in accordance with OSHA 29 CFR, Part 1910.95, Occupational Noise Exposure Standard; Hearing Conservation Amendment dated March 8, 1983 (outlined in Appendix "B").

Survey Description

All instruments used here, in accordance to OSHA Standards, conform to the following ANSI standards: ANSI S1.4-1983 for sound level meters; ANSI S1.25-1978 for dosimeters; and ANSI S1.11 (R1976) for octave band analyzers. Sound level meters were used to measure and to contour noise levels according to regions of constant sound pressure level in dBA. These contours were mapped for levels of 85 dBA and above, in 5 dBA increments, to determine where hazardous conditions may exist depending on exposure durations. The "A" scale designation of the decibel reading denotes a scale which is amplitude-weighted with frequency in sympathy with human hearing sensitivity. An octave band analyzer was used to distinguish the frequency characteristics of high noise equipment in order to identify the dominant noise sources and to suggest proper silencing devices. Sound level dosimeters were used to monitor 8-hour time-weighted average (TWA) exposure levels on employees in each job area on each work shift. OSHA's recommended action level for the implementation of a hearing conservation program is an 8-hour TWA of 85 dBA (or 50% exposure level). The employees chosen from each job area were selected as those most likely to encounter excessive noise during their work shifts. From this dosimetry information, a table was compiled listing levels of noise exposure with job description. This helps us to determine where warning signs should be posted and which employees (if any) need to be included in a hearing conservation program (those with 50% exposure or more). In some cases the noise dosage of employees is less than an 85 dBA 8-hour TWA yet exposures to noise hazard areas are still present. Dr. J. R. Drumwright should be contacted (Ext. 2794) for advice on frequency of audiometric exams for these employees. All other procedures listed in Conoco's Hearing Conservation Procedures Guide should be followed. See Appendix "A" for definitions of "Noise Hazard Areas" and guidelines for posting of "Warning Signs".

Results and Observations

Included in this report is the overall plot plan of the VCM Plant (See Drawing CH-029-NOIS-GA-13-D). Outlined on this drawing are areas covered by detailed drawings of the process areas with corresponding drawing numbers. Also outlined are the areas where noise levels were 85 dBA or more for both the 1981 survey and this 1983 survey. Several observations can be made from this comparison:

1. The added area above 85 dBA west of the control room is due to the relocation of air blower BL 302 (See Drawing CH-029-NOIS-GA-15-B for details). On start-up or shutdown, when total air is being by-passed through the exhaust stacks on BL 302, this area is especially noisy.

2. The increased noise area in Blocks 1 and 2 is due to the recent VCM expansion (See Drawing CH-029-NOIS-GA-14-D). There are several sources in this area that can be looked at for noise abatement.

3. The additional 85 dBA area around the chlorine compressor building is caused by the replacement of the motor drive on compresssor BL-605A. The old motor mute could not be installed on the larger motor.

4. A decrease in area above 85 dBA was noted around the incinerator unit. This was due to the east incinerator being down for cleaning and repair while this survey was in progress.

Dosimetry results are listed in Table 1. As can be seen in the table, no employee was overexposed to noise on the basis of an 8-hour TWA exposure limit of 90 dBA (or 100% exposure). However, one (1) of the thirty-eight (38) employees monitored exhibited an exposure level above the OSHA action level for participation in a hearing conservation program (an 8-hour TWA of 85 dBA or 50% exposure).

This exposure was to an insulator at 85.4 dBA TWA assigned to an area where noise levels ranged from 94 to 103 dBA. His length of time in this area was 45 minutes. This illustrates how maintenance personnel can easily have higher exposures depending on their area of assignment and length of time to complete the job. We can easily correct these kinds of exposures by requiring the wearing of hearing protection devices (HPD's) anytime personnel enter a "Noise Hazard Area". See Appendix "A" for definition of these areas. This, however, is not the ultimate solution to the problem.

Whenever possible, every effort should be made to abate noise on all equipment whose noise output at 3 feet is 95 dBA or more. This action will reduce the chances of employee noise exposures above the action level even if they forget to wear their HPD's.

From the above results we can conclude that this plant does not have an apparent noise exposure problem.

Recommendations

Our noise abatement program should begin with the loudest equipment (above 95 dBA) that affect the greatest area and/or the most personnel. With this in mind, we make the following recommendations:

1. Blower BL 302 - This blower is causing a considerable area to be above 85 dBA while in normal operating mode (See Drawing CH-029-NOIS-GA-13-D). Under upset conditions, we understand the shop areas 130' away are complaining of the noise. Upset conditions being start-up or shutdown (total air bypass). We feel the silencer on this unit may not be adequate. Replacement may be necessary. Lagging of the compressor discharge line and control valve may also be necessary. There is a small air bleed at 112 dBA that needs a discharge silencer (See Alwitco or Aeroacoustic Brochure attached).

2. Causes of the expanded 85 dBA area in Blocks 1 and 2 are several (See Drawing CH-029-NOIS-GA-14-D) for noise abatement were:

   (a) The exhaust system on Blower BL-301 should be lagged from the compressor up to and including the silencer. The welded support under the silencer should also be lagged. Lagging material should be Childers Muffl-lag or equal (see brochure attached).

   (b) Blower BL-302 appears to have a discharge piping noise problem as does the control valve to the southwest next to H-110B. Both of these problems probably could be alleviated by lagging as proposed above in (a).

   (c) Noise levels around Blower BL-501 are greater than 95 dBA and be reduced again by lagging of the discharge line and expansion joint overhead.

   (d) The line of control valves northeast of C203 are quite noisy, especially the control valve on the south end. The noise form these valves causes a very large area to be above 85 dBA. These valves are all insulated, but I suspect the insulation is for heat and not noise. The addition of an extra noise barrier, such as Muffl-Jack, over the existing insulation would reduce this noise to acceptable levels.

   (e) Control valves above H-308 to S-303 on the third deck near Reactors R301 to R303 are causing some areas above 95 dBA and the total deck around them plus part of the deck below to be above 85 dBA. Valves and connected pipe can be lagged for reduction of noise in this area.

3. The third area where noise levels have increased is around the Cl_2 Compressor Building (108 dBA inside).

   (a) One source is the replacement motor on BL-605A compressor. This motor is larger than the previous motor and therefore, the motor mute for the old motor does not fit. I doubt that, in its corroded condition, the old motor mute would have done any good anyway. Future motor mutes to be installed in this corrosive atmosphere should be made of stainless steel. I also would suggest that the motor mute on BL-605B also be scrapped and replaced with a stainless steel motor mute. The corrosive condition could clog the air passage through these mutes and cause the motors to overheat. The gear box on BL-605A is propagating noise of 108 dBA at three feet. Noise from this gear was abated another time by replacement of the gears. Perhaps the gears are getting bad again. I would suggest a detailed survey be made of this compressor.

4. We recommend that those items above chosen for noise abatement be referred to CED (Bill Lacey) for special noise study of equipment and recommendations for proper noise abatement methods and materials in addition to those given in this report.

5. Various air and steam bleeds throughout the plant could have small in-line silencers installed that would reduce localized noise sources considerably. Silencers made by Alwitco or equal are not expensive.

If we can be of any further assistance, or if you have any questions on the above report or Conoco's Hearing Conservation Program, please feel free to call.

W. G. Warren, Jr.
Supervisor
Noise Control

kb
cc w/att: T. G. Grumbles - Houston
S. R. Ashby, Safety - Lake Charles VCM Plant
B. G. Lacey, CED - Ponca City
Sonny Mukherjee - Ponca City
File CH-098

cc: E. L. DeWhitt, Jr., Ph.D. - Ponca City
J. L. Riddle, Ph.D. - Ponca City
J. R. Drumwright, M.D. - Ponca City

TABLE I

LAKE CHARLES CHEMICAL VCM PLANT

NOISE DOSIMETRY

SEPTEMBER 1983

	Description	8-Hr. TWA	% Exp
1.	Insulator	85.4	52.9*
2.	Boilermaker	83.5	40.6
3.	Operator 2nd	83.5	40.6
4.	Boilermaker	82.4	34.9
5.	Pipefitter	82.3	34.4
6.	Welder	82.2	33.9
7.	Welder	82.2	33.9
8.	Welder	81.3	29.9
9.	Pipefitter	80.6	27.2
10.	Welder	80.3	26.1
11.	Pipefitter	79.9	24.6
12.	Millwright	79.9	24.6
13.	Operator 2nd	79.6	23.7.
14.	Millwright	79.4	23.0
15.	Operator 2nd	78.8	21.2
16.	Boilermaker	78.7	20.9
17.	Operator 2nd	78.7	20.9
18.	Operator 2nd	77.8	18.4
19.	Operator 2nd	77.7	17.9
20.	Millwright	77.2	17.0
21.	Millwright Helper	76.9	16.2
22.	Millwright Helper	76.2	14.8
23.	Carpenter	75.5	13.4
24.	BM/Lead Man	75.4	13.2
25.	Shift Sueprvisor	74.7	12.0
26.	Electrician	74.2	11.2
27.	Pumper Loader	73.8	10.6
28.	Instrument Man	73.2	9.8
29.	Shift Supervisor	73.1	9.6
30.	Incinerator Operator	73.1	9.6
31.	Pumper Loader	73.0	9.4
32.	Instr./Lead Man	72.4	8.7
	Chief Operator	72.1	8.4
34.	Instrument Man	70.3	6.5
35.	Safety Supervisor	69.4	5.8
36.	Operator 1st (Board)	67.2	4.2
37.	Operator	64.2	2.7
38.	Incenerator Operator	61.4	1.9

*Indicates dosage above the action level (50% exposure) for inclusion in The Corporate Hearing Conservation Program.

Conoco Medical Division
Octave Band Analysis

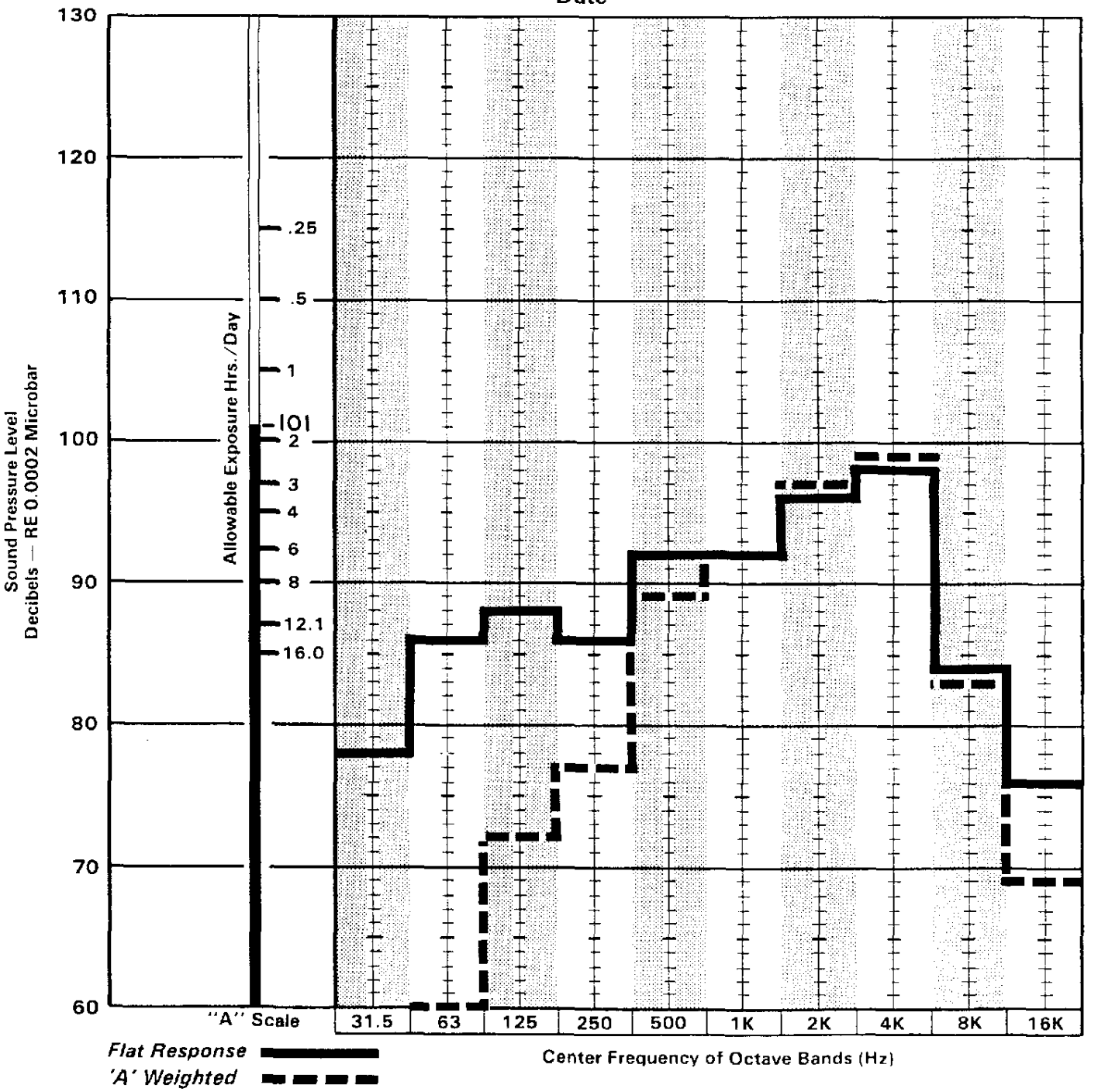
LAKE CHARLES - VCM PLANT
Location

Cl_2 COMPRESSOR BUILDING
Area

BL-605 B
Equipment Description

SEPT. 22, 1983
Date

Chart No. 1



Location of Analyzer: 3 Feet from motor intake.

Exposure (Hrs./Day) O.S.H.A. = 1.7 Hrs.

Comments: The motor should have a stainless stell motor mute installed.
See report for other comments.

VVC 000014229

Conoco Medical Division
Octave Band Analysis

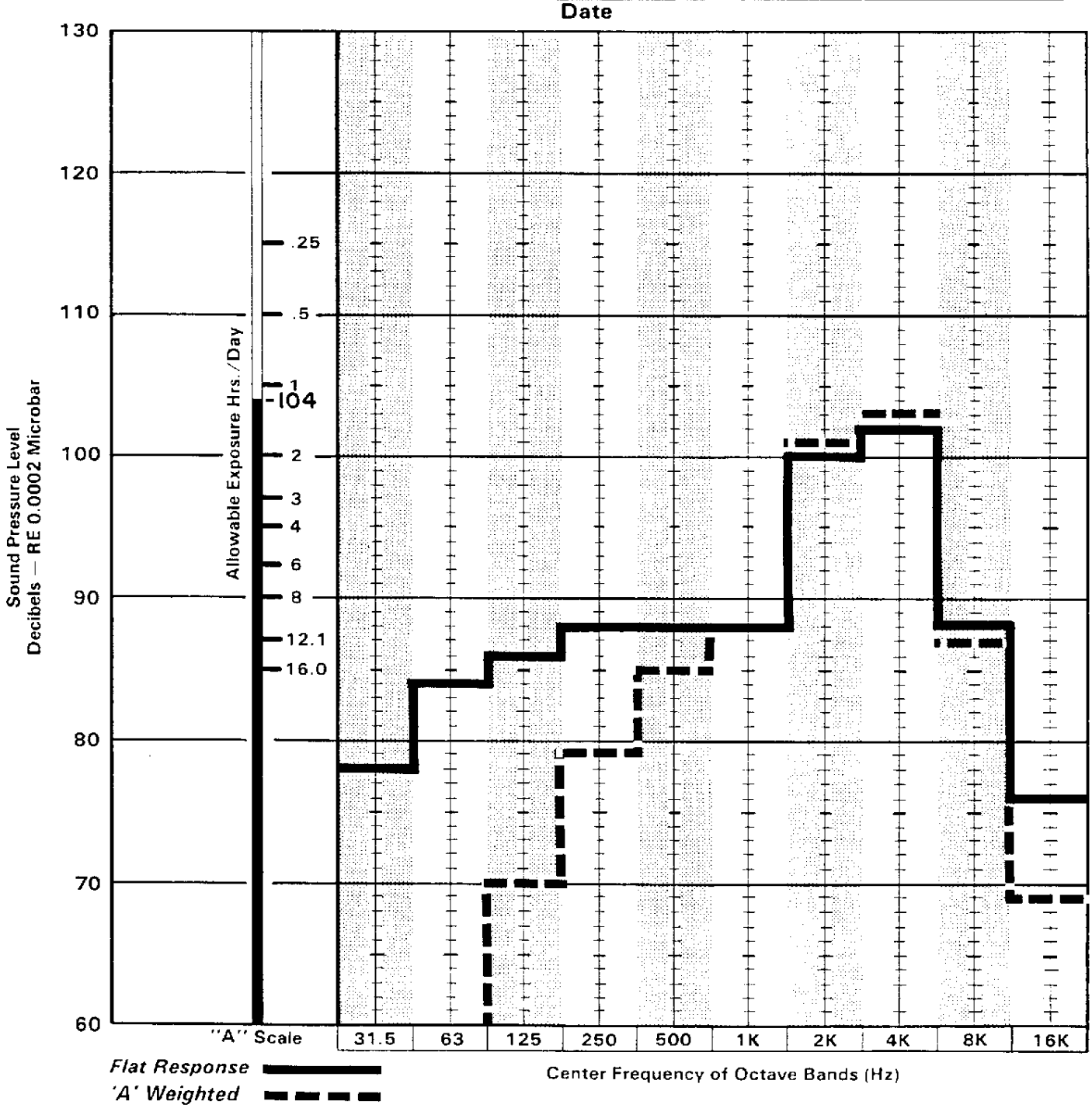
LAKE CHARLES - VCM PLANT
Location

Cl_2 COMPRESSOR BUILDING
Area

BL-605B
Equipment Description

SEPT. 22, 1983
Date

Chart No. 2



Location of Analyzer: 3 Feet from north side of gear box.

Exposure (Hrs./Day) O.S.H.A. = 1.3 Hrs.

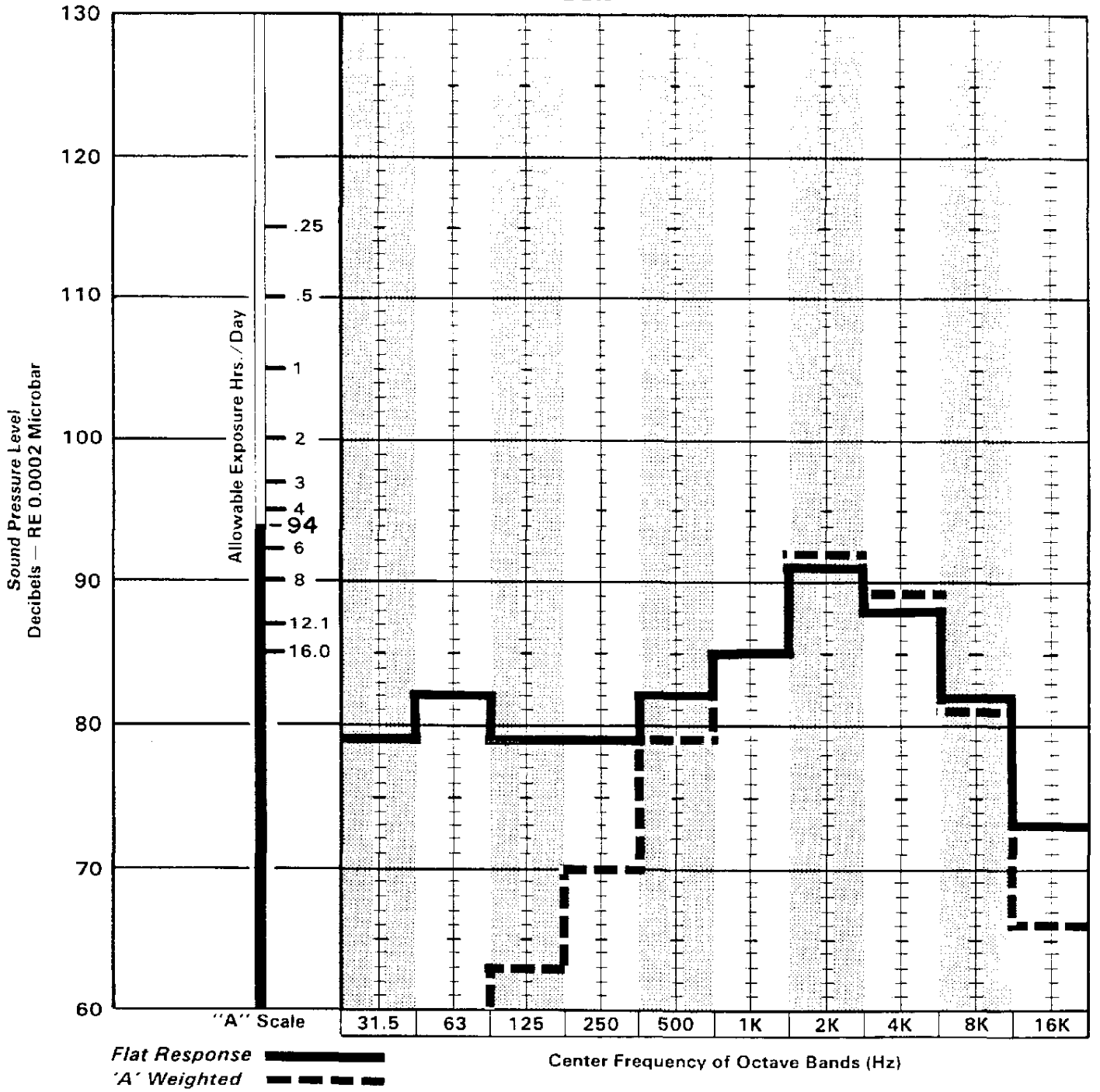
Comments: This unit may have some bad gear teeth that need replacing as was the case one other time several years ago.

VVC 000014230

Conoco Medical Division
Octave Band Analysis

Location
BLOCK 2 AREA
Area
BL-501 CENTRIFUGAL COMPRESSOR
Equipment Description
SEPT. 22, 1983
Date

Chart No. 3



Location of Analyzer: 3 Feet from west side of compressor.

Exposure (Hrs./Day) O.S.H.A. = 4.6

Comments: Discharge line to silencer may need to be lagged.

VVC 000014231

Noise Control Materials

MUFFL-JAC®

ACOUSTICAL JACKETING TESTED IN ACCORDANCE WITH ASTM E-90-70

DESCRIPTION

Childers **Muffl-Jac®** is a special composite jacketing of high quality lead laminated to Aluminum for the reduction of noise levels and protection of thermal insulation materials. It is designed to reduce the level of sound radiated by piping and equipment.

Standard Childers **Muffl-Jac** is supplied with an outer layer of high purity Aluminum, exhibiting good resistance to most weathering and corrosive environments, and an inner layer of lead. It is manufactured in rolls, sheets, or is pre-fabricated.

A 3/16" (.48 cm) corrugation is incorporated into standard **Muffl-Jac;** corrugated jacketing adds stiffness and strength, reduces glare from external light sources, allows for expansion of the jacketing, eliminating "coil break" over small size piping, and does not show dents as readily. Non-corrugated **Muffl-Jac** is also available for manufacture of pre-fabricated items such as flange and control valve body covers and gore elbows. For special uses, **Muffl-Jac** is available in a variety of metals, finishes, and with corrosion resistant film coating, as Ultrolon®

ADVANTAGES

Muffl-Jac is applied in one operation, unlike comparable products, thereby reducing application costs. **Muffl-Jac** may also be fabricated into fitting covers to control noise on valves, flanges, tees, etc. The acoustical effectiveness of **Muffl-Jac** is superior to the separate applications of lead and Aluminum, due to the special bonding properties of the adhesive. **Muffl-Jac** has high transmission loss characteristics, and also serves to protect underlying sub-structures and/or thermal insulations against mechanical abuse, weather, and corrosive environments.

Childers Products Company provides technical assistance in the choice, selection and applications of complete acoustical insulation systems for industry.

Childers **Muffl-Jac** has been tested by an independent acoustical laboratory in accordance with ASTM designation E 90-70, standard classification for determination of sound transmission loss. **Muffl-Jac** has an STC-26 rating. The graphs on the reverse side illustrate sound transmission loss and insertion loss data for **Muffl-Jac.**

USES

Childers **Muffl-Jac** is used over mineral fiber, glass fiber, or ceramic fiber insulations. It is applied over straight runs of piping, HVAC Ducting, casings, gearboxes, and other regular surfaces. **Muffl-Jac** may also be used to field fabricate enclosures or as sheet stock. For irregular surfaces, such as compressors, pumps, blowers, fittings, flanges and valves, Childers also offers MUFFL-LAG,™ an equally effective trowelable transmission loss compound.

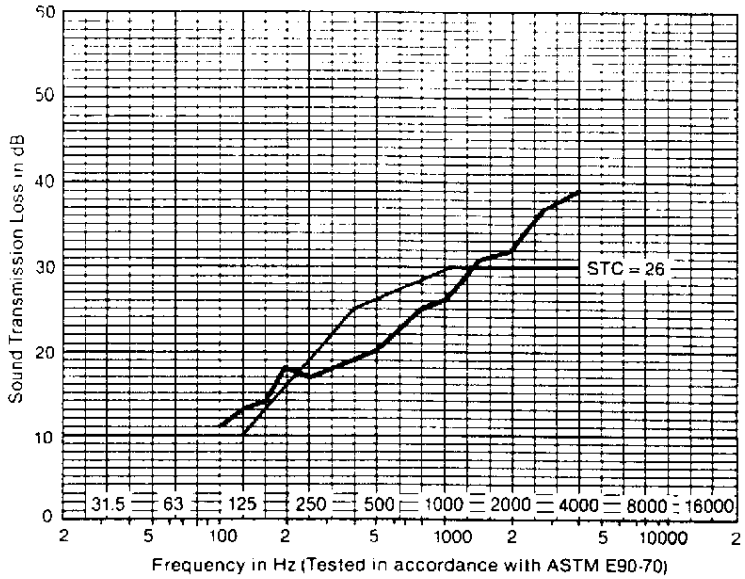
APPLICATION

Childers **Muffl-Jac** is applied in a similar manner as standard insulation metal jacketing. It is applied over the insulated surface, insuring a 2" (5.08 cm) overlap exists for each circumferential and longitudinal lap of jacketing. For vertical applications, mechanical supports should be applied to hold the insulation and **Muffl-Jac** in place and support the load. **Muffl-Jac** is then secured with strapping and wing seals.

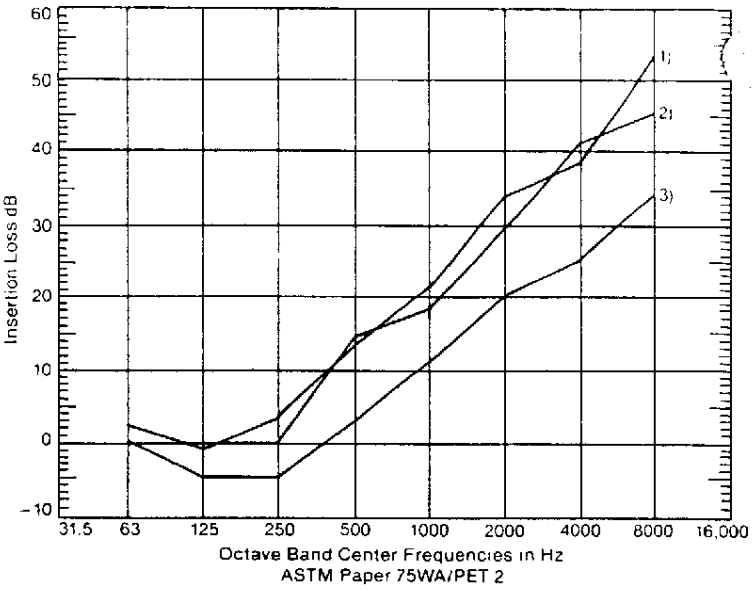
For maximum acoustical effectiveness, a separation should exist between the radiating surface and the **Muffl-Jac.** It is installed over glass fiber, mineral fiber, and ceramic fiber insulation at recommended thicknesses and densities. Like all transmission loss materials, **Muffl-Jac** must be sealed at all joints, laps, cutouts, and gaps with either Childers Chil-Joint® (CP-70) or silicone joint sealants.

MJE-781
Supersedes
MJE-1175

Test Report of Cedar Knolls Acoustical Laboratories



Insertion Loss Results for Typical Pipe Lagging Systems



Key

1) 1.3 lb/ft³ Muffl-Jac Over 2" Glass Fiber
2) 1.3 lb/ft³ Muffl-Jac Over 1" Glass Fiber
3) 2" of 4 lb/ft³ Density Glass Fiber

Test conducted on 3" dia. pipe

Hale, M. E. & Kugler, B. A.

VVC 000014233

P. O. Box 22228 (23350 Mercantile Rd.) Beachwood, Ohio 44122 (216) 464-8020

OTHER PLANTS AT:

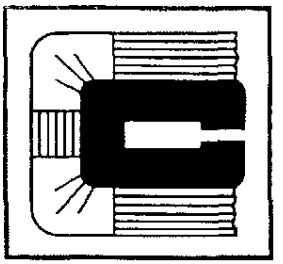
2061 Hartel St.
Bristol, PA 19007
(215) 943-7600
Telex 84-3408

1370 East 40th St.
Houston, TX 77022
(713) 691-3661
Telex 77-5164

1150 South Vail
Montebello, CA 90640
(213) 728-6306
Telex 67-3639

7305 Torbram Rd
Mississauga, Ont. L4T 1G8
(416) 676-1444
Telex 06-968800

15727 116th Ave.
Edmonton, Alta. T5M 3W1
(403) 452-4860
Telex 037-42697



MUFFL-LAG®

Noise Control Materials

HIGHLY EFFICIENT TRANSMISSION LOSS COATING FOR EFFECTIVE NOISE CONTROL TESTED IN ACCORDANCE WITH ASTM E-90-70

DESCRIPTION

Muffl-Lag® is a tough, durable, and flexible polymer based acoustical coating for use in conjunction with fibrous glass (minimum 4# density) or mineral fiber (minimum 8# density) and other insulations. It may be used over contours requiring sound attenuation. **Muffl-Lag** has excellent insertion loss characteristics, and a Sound Transmission Class rating of STC-28. **Muffl-lag** is waterproof, is thixotropic, is mechanical abuse resistant, and forms an air-tight seal. (1½ gallons or 5.677 liters supplied in a 2 gallon container, with separate containers of thickener and hardener in pre-measured quantities)

USES

Muffl-Lag is a superior noise control coating which was developed for use over surfaces such as piping, fans, HVAC Ducting, compressors, pumps, fittings, flanges, valves, and other large and irregular surfaces. It has found many applications in the Petro-Chemical, Power, Chemical Processing, Gas, and Heavy Fabrication Industries.

Muffl-Lag is gray in color, harmonizing with process equipment and Childers metal jacketing.

ADVANTAGES

Muffl-Lag is a highly efficient noise reduction coating which provides the necessary air-tight seal required for sound control. It has a rating of STC-28 (Sound Transmission Class). **Muffl-Lag** contains no lead, is easy to apply by trowel or palm, has high mass, sets up quickly, and cures to a limp condition. **Muffl-Lag** requires no maintenance; areas damaged are easily repaired by recoating the break with **Muffl-Lag.** When catalytically cured, **Muffl-Lag** remains permanently flexible to permit limited expansion and contraction.

After curing, **Muffl-Lag** will withstand temperatures up to 350°F (177°C) on the outer surface of the acoustical insulation, with no effect upon the coating. It is non-corrosive and impervious to most chemicals, acids, alkalis, and oils.

APPLICATION

Muffl-Lag is catalyzed by the addition of the hardener thoroughly mixed, and applied by trowel or palm over contours onto energy absorbent fibrous glass or mineral fiber insulation of specified thickness. The insulation is first secured in place and the **Muffl-Lag** applied to yield a finished .140" (.36 cm) film thickness after curing. **Chil-Glas #5 is recommended as the reinforcing membrane and shall be embedded between an initial tack coat and the finish coat of the material during its application in the liquid state.**

Note: Do not attempt to use Muffl-Lag to flash over adjacent metal surfaces. Use Chil-Joint™ CP-70 for flashing or sealing protrusions. Check with your Childers Sales Representative for additional information.

COLOR

Gray

WET WEIGHT

17 lbs./U.S. gal. approx.
2.04 kg/liter

AVERAGE NON-VOLATILE

95% by volume

SERVICE TEMPERATURE RANGE

(Temperature to which dry coating is subjected)
-10°F to 350°F
-23°C to 177°C

APPLICATION TEMPERATURE RANGE

(Including wind chill factor)
20°F to 100°F
-6°C to 38°C

CURING TIME

To touch—60 minutes
(Curing time will vary depending upon temperature, humidity, and amount of hardener used.)
Operational within 24 hrs. after application.

COVERAGE

11 sq. ft. per U.S. gallon
.27 sq.m./liter

CLEAN-UP

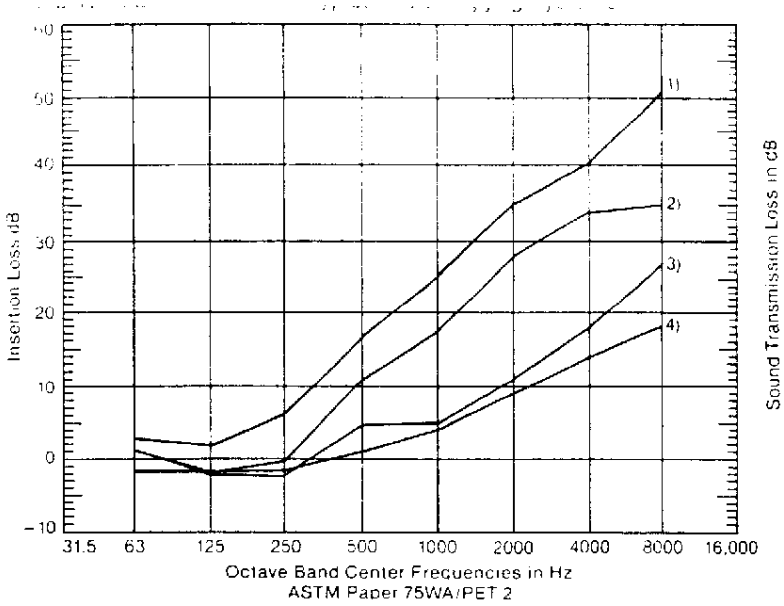
Methylene Chloride (use with adequate ventilation)

FLAME RETARDANCY

UL-94, SE-0 Vertical test (⅛")
FLAME SPREAD INDEX
$I_S = 24$ (ASTM E-162)
Flash Point (wet) 88°F (31°C) (Red Label)
Autoignition Temperature 914°F (490°C)

VVC 000014234

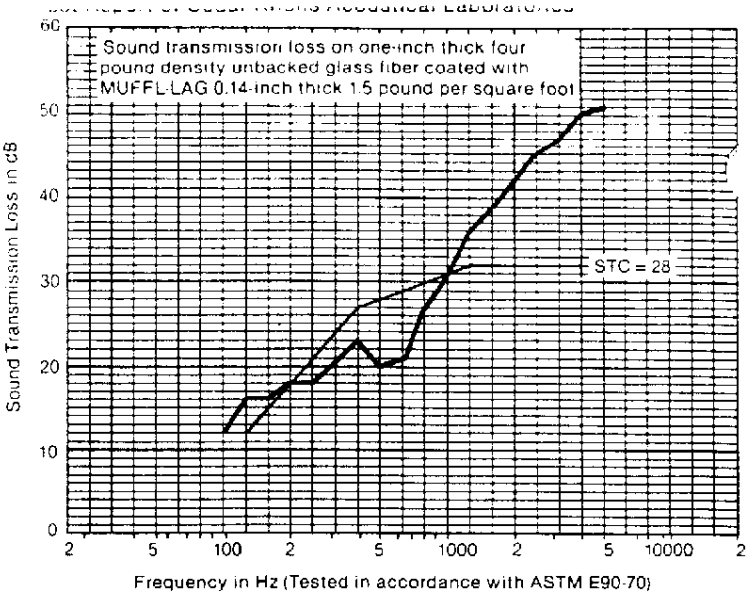
See other side for specifications and application information



Key

1) 1.5 lb/ft² Muffl-Lag Over 2" Glass Fiber
2) 1.5 lb/ft² Muffl-Lag Over 1" Glass Fiber
3) 1.5" Cellulose Blanket
4) 1" of 4 lb/ft² Density Glass Fiber

Test conducted on 3" dia. pipe



Hale, M. E. & Kugler, B. A.

Handling, Mixing & Application Instructions

STORAGE

1. Keep the materials stored in a cool location (approximately 50° to 80°F) (10°C to 26°C) prior to application.

2. Avoid prolonged storage. **Material must be used prior to six (6) months after date of manufacture.**

CAUTION: High temperatures will shorten the shelf life of this product. **Do not store in direct sunlight.**

MATERIALS & MIXING EQUIPMENT

1. 1½ gallons (5.677 l) of **Muffl-Lag** in 2 gallon container
2. 2 oz. (.059 l) squeeze bottle of thickener
3. 2 oz. (.059 l) squeeze bottle of hardener (part 2)
4. An air-operated paint type mixer with a 12" long shaft is recommended. **Caution: Electric mixers are not recommended.**

MIXING INSTRUCTIONS

To mix the total contents (percentages also apply)

1. Add a sufficient portion of the thickener squeeze bottle for desired viscosity to the contents of the bucket and blend in. Mix thoroughly for 1-2 minutes. Do not use more than 1 bottle of thickener per container of **Muffl-Lag,** as cure may be affected.
2. Add the contents of the hardener squeeze bottle to the mixed **Muffl-Lag** and thickener and blend in. When ambient temperatures are above 90°F (32° C) add only one half the contents of the hardener squeeze bottle to extend the pot life. Mix thoroughly for 1-2 minutes.

NOTES:

1. Unnecessary mixing beyond two minutes only reduces the time available for application prior to cure.
2. Part 2 (the hardener) should be handled with care. If contact with skin or eyes occurs, flush with water, and seek medical attention.
3. Be certain to wipe cling on side walls and base of container into mixture.

APPLICATION INSTRUCTIONS

The contents of the container in which the **Muffl-Lag** is shipped will cover approximately 16 square feet (1.5 sq.m) at the recommended dry film thickness of 0.14 inches (.36 cm).

1. Spread a thin coat over the surface to be treated. Using a trowel or other application tool, apply pressure to the coating when spreading to assure contact and impregnation of the glass or other type insulation being coated.
2. Embed Chil-glas #5 into coating.
3. Apply flood coat of **Muffl-Lag** to desired wet film thickness.

NOTE: To help determine proper wet film thickness, small swatches of desired dry film thickness can be attached to insulation using catalyzed **Muffl-Lag** as the adhesive, and used as a gauge.

4. **Use only in well-ventilated areas. Avoid prolonged breathing of vapors and prolonged or repeated contact with skin.**
5. For a detailed specification, contact your nearest Childers representative.

P. O. Box 22228 (23350 Mercantile Rd.) Beachwood, Ohio 44122 (216) 464-8020

OTHER PLANTS AT:

2061 Harter St
Bristol, PA 19007
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(416) 676-1444
Telex 06 968800

15727 116th Ave
Edmonton, Alta. T5M 3W1
(403) 452-4860
Telex 037 42697

this sheet supersedes all previous Muffl-Lag data sheets

VVC 000014235

NOISE INSULATION:

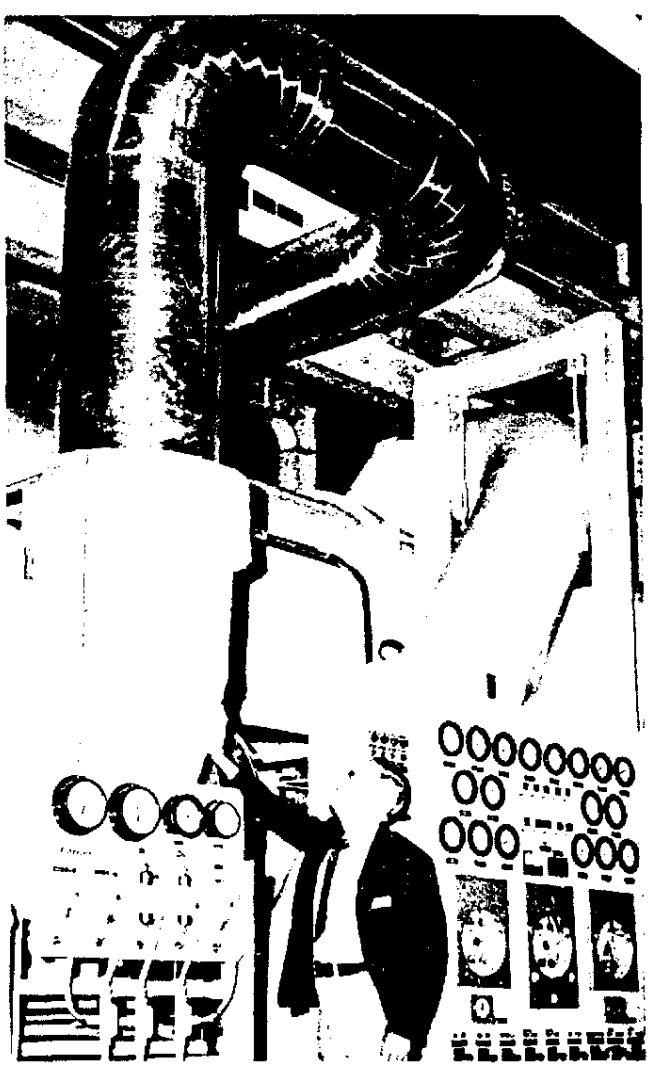
- If the treatment is not continued onto all surfaces of the quipment, some areas may still radiate noise escaping from untreated adjacent locations.
- Nearby walls or other structures associated with the equipment or building may reflect some of the escaping noise energy and alter "near field" readings significantly.

These conditions must be considered and understood by the contracting parties. Otherwise, a disappointed owner may feel he was cheated by a "sharpy" dealer.

The treatments that were applied to the noisy compressor are listed below:

1. To the compressor housing, 2 inch thick closed cell rubber (Armaflex type) was adhered to the surface as the energy absorbing material. All adjoining edges were cut to assure a snug-tight fit and sealed with joint sealant to prevent air and/or noise leaks. Muffl-Lag was selected as the noise barrier and was trowel applied directly onto the closed cell rubber and developed its own bond. Muffl-Lag was applied in a .140 inch thickness using Chil-Glas #5 membrane reinforcement. The trowel quality of Muffl-Lag simplified the application of the coating over the irregular surface contour and provided a complete air tight monolithic acoustical finish as part of the system.

2. To the discharge piping, 2 inch thick heavy density glass fiber was attached as the energy absorbing material. Tight fitting premolded glass fiber pipe covering was wired on with stainless steel Tie-Wire and then covered with Muffl-Jac as the nose barrier for the acoustical system employed on the less complex pipe shape. Muffl-Jac Gore Elbows were used on the variable diameter piping over the H.D. glass fiber from the compressor to the water chiller. All longitudinal and circumferential joints were sealed with Chil-Joint CP-70 to prevent noise leaks. The acoustical mastic was overlapped 3" by the metal and sealed with CP-70 at all such locations.



Verne Traudt inspects 5200-ton Chiller-Compressor #3 at the city power plant (left). Chiller #4 is seen (right), as well as compressor, and freon discharge line.

Reprinted from October 1977

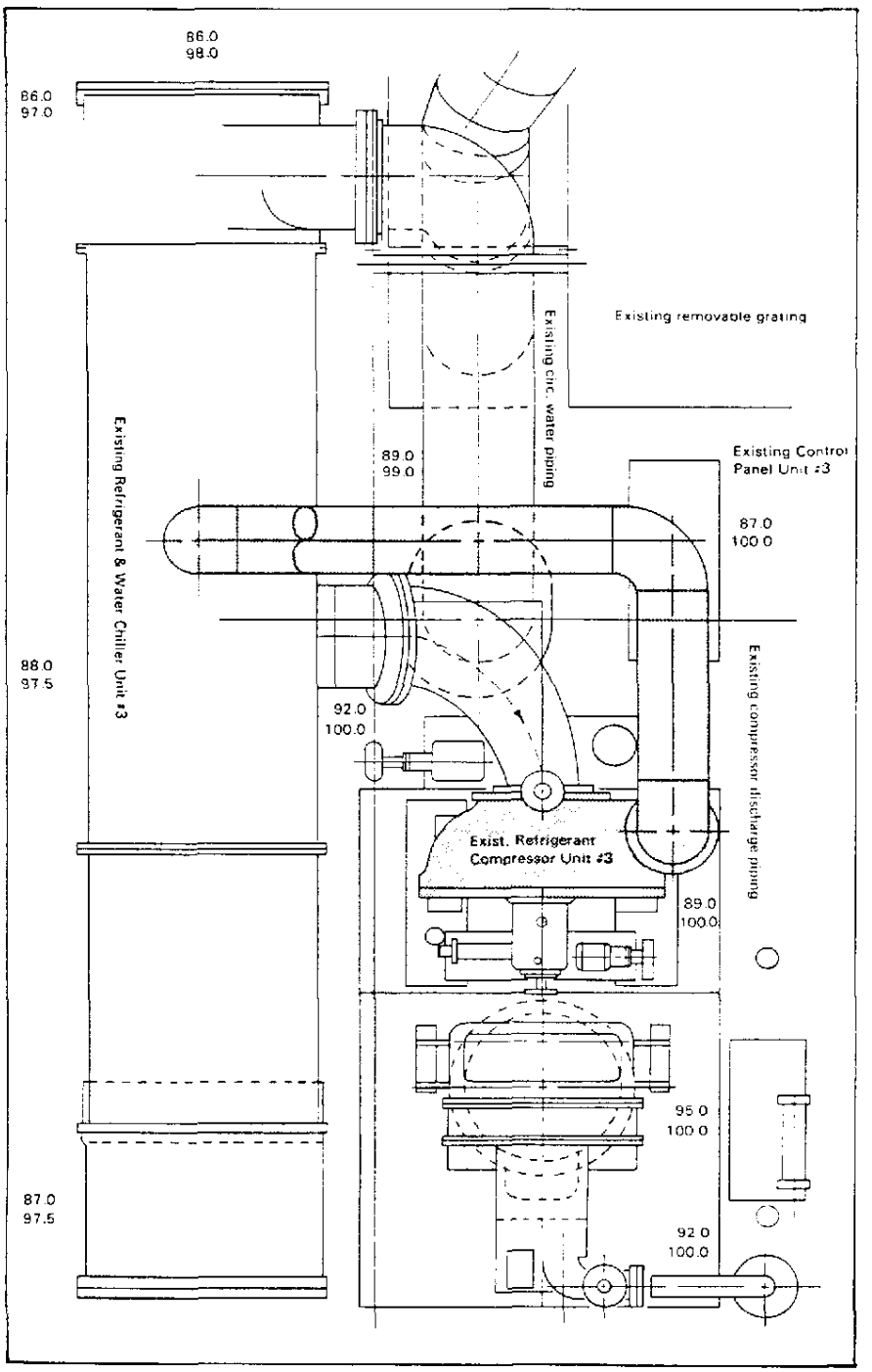
OUTLOOK

NOISE INSULATION

Larry Paulsen of Eagle Company in Lincoln, Nebraska, worked with Ken Holton of Childers Products Company of Cleveland, Ohio on an acoustical problem at the University of Nebraska. Verne Traudt, Manager of Utilities at the University, was concerned about the noise level around some large chiller-compressors and chiller piping. The problem was analyzed and treated with such success that Darwin Traver, Staff Acoustical Consultant of the Carrier Corporation in Syracuse, New York, and others in the field are now recommending this form of treatment for this and comparable type certrifugal compressor installations across the country.

The noise as indicated on the "contour" map was not reduced to the same degree everywhere it was measured subsequent to the treatment. This difference in reduction of noise levels is quite significant considing the type and thickness of materials applied, which was essentially equivalent on all surfaces treated. This is a graphic illustration of the variability of noise problems. The difference in effectiveness of reduction can be attributed to four primary factors:

- The extent of noise reduction will vary considerably with material differences in the construction of the equipment.
- The contribution of noise by other equipment which was not a factor in the initial survey may now be sufficient to show up and reduce expected efficiency.



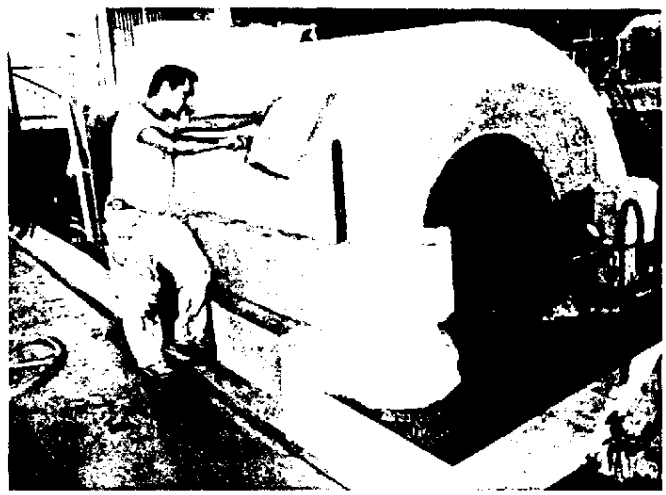
2" Fiber glass with Muffl-Jac*
2" Armaflex with Muffl-Lag*

UNION CARBIDE

Chemical Progress

JUNE, 1976

Protecting protection



Insulation is protection — against economic loss from vanishing BTU's; against injury to workers contacting hot tanks and pipes; against annoying and damaging noise. But, insulation needs protection against rain and sun, condensation and dirt, and Childers Products Company, headquartered in Cleveland, Ohio, with branch plants throughout the United States and Canada, has for years offered such protection with its metal jackets for piping and equipment and its mastics for rounded and irregular surfaces of spherical tanks and of valves, Tees, and other pipe line fittings. Last year, the company added another protective element to its line to handle the problem of noise.

As with its insulation-protecting products, Childers supplies sound attenuating agents in metal jacket and mastic forms. "Muffl-Jac" acoustical jacketing is a composite of lead and aluminum available in rolls, sheets, or prefabricated forms with smooth or embossed finish. If desired, "Muffl-Jac" sheets may be corrugated at the factory to add stiffness, reduce glare, allow expansion, and eliminate "coil breaks" over small piping. The adhesive joining the lead and aluminum was selected by the firm to provide better acoustical attenuation than that from separate applications of the two metals. Used over mineral fiber or glass fiber insulations, "Muffl-Jac" jacketing has an STC-26 rating in ASTM test method E 90-70 for determination of sound transmission class.

"Muffl-Jac" metal composites are readily applied over piping and cylindrical surfaces. For large irregular surfaces or to seal gaps, cutouts, and overlaps in a "Muffl-Jac" installation, Childers offers "Muffl-Lag" mastic, a tough, durable, flexible polymer applied by trowel or palm over fiber glass or other fibrous insulations (see the illustration). Its thixotropy allows vertical application without runs or sags. Its STC rating is 28 and the company will furnish information about its FDA status on request. Childers points out that, in addition to easy application, "Muffl-Lag" installations require minimum maintenance and are easily repaired if impact damage occurs. The product is available in various colors and functions as its own weatherproof finish. Moreover, it is formulated to be non-corrosive, to withstand temperatures up to 350°F., and to be impervious to most chemicals and oils.

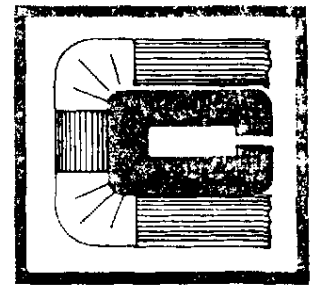
The Childers sound attenuation products are of more and more interest today with the increased attention to pollution — in this case sound pollution. At least equally important today are the firm's mastics and jackets to protect thermal insulations — to keep them at peak efficiency and thereby conserve as much energy as possible. And, the cost of installing a thermal insulation system makes protection of that system a true economy.

Childers manufactures some 15 types of coatings, sealants, and adhesives for protecting insulation in addition to its aluminum, steel, and stainless steel jacketing. Some are water base products, some solvent base, some 100 per cent solids. Fire-resistant, vapor barrier, and vapor permeability properties are available from Childers on request. The company displays the UL listing on all these mastics.

Childers cites "Vi-Cryl" mastic as an example of its line. The material is a tough, durable, UL-listed coating that spreads easily on all types of thermal insulations and on masonry. The company states that it gives unsurpassed mechanical and weather protection and is therefore suitable for exterior and interior application to hot, cold, or dual temperature surfaces. "Vi-Cryl" mastic supplies a breathing coating that allows vapors under pressure to pass through it — condensation in the insulation can thus escape. Eight standard colors are stocked; Childers will match other colors on special order.

"Vi-Cryl"C mastic is a modification of the basic "Vi-Cryl" product that uses a high percentage of cork filler to damp vibration and to give a roughened surface with additional area for evaporation of condensation. Corrosion protection is available by using inhibitive metal primers on underlying steel.

Choice of the best protection for insulation involves many engineering factors in which Childers and its customers consider the company an expert. The firm's experienced advice is a major factor in its success in its chosen field — as is its selection of quality raw materials — such as UCAR Latexes — for its products protecting protection.



ACOUSTICAL MATERIALS INSTALLATION PROCEDURES

The Leading Supplier of Noise Control Materials

INTRODUCTION

This specification provides a typical, historically successful method of treating pipes and equipment with a control treatment to reduce harmful noise levels by using a combination of fibrous or similar absorptive materials and a sound transmission loss barrier outer finish, to assist in complying with OSHA and EPA regulations and/or corporate requirements.

MATERIALS

2.1 Piping shall be acoustically insulated with sectional preformed pipe covering consisting of one of the following materials:

A. Minimum 4 pound per cubic foot density glass fiber, or (Note #10).

B. Minimum 8 pound per cubic foot mineral fiber, or (Note #10).

C. Minimum 10 pound per cubic foot ceramic fiber (stitched glass blanket insulation distributed by Pittsburgh Corning, Carborundum, or Burlington Industries).

When piping temperatures exceed the recommended operating temperatures of the above materials, calcium silicate insulation shall be employed as a thermal barrier to reduce interface temperatures at the energy absorptive layer to meet the manufacturer's recommendations. Note, calcium silicate does not contribute to noise reduction significantly and only adds to thickness of piping or equipment being insulated.

2.2 The weather proofing jacket shall be Muffl-Jac, a lead aluminum laminate (.016 aluminum bonded to .015 lead with a viscoelastic film) manufactured by Childers Products company. The jacket finish (smooth, corrugated, stucco embossed) shall conform to desired finishing standards. (Note #11)

In the areas of high corrosion, and/or in areas where a tough resistanc finish is required, Muffl-Jac may be supplied with stainless steel or Ultralon Muffl-Jac.

childers products company, inc.

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Ultrolon is a Tedlar coated aluminum manufactured by Childers Products Company.

To avoid fish mouthing at the longitudinal laps, Childers recommends a 2" hem.

For special applications, the lead can be laminated to metal of thicknesses up to .05. Note, thicker laminates add additional mass to acoustical treatments to assist in controlling low frequency acoustical problems.

INSTALLATION PROCEDURES - HOT SERVICE

3.1.1 The glass or mineral fiber insulation shall be applied to clean, dry surfaces.

3.1.2 If multiple layers are needed to obtain the desired thickness for additional noise reduction, the longitudinal and circumferential joints shall be staggered 2" and 90 degree respectively.

3.1.3 Longitudinal seams of the glass or mineral fiber insulation shall be tightly butted. To insure a tight and well-sealed seam, CP-82 adhesive as manufactured my Childers Products Company is recommended.

3.1.4 Adjoining sections of insulation must be firmly butted. To insure a tight, well sealed joint, CP-82 adhesive as manufactured by Childers Products Company is recommended.

3.1.5 To further secure the insulation to the pipe, secure the insulation with ½" x .020 Type 304 Stainless Steel strapping bands as manufactured by Childers Products Company.

3.1.6 All gaps in the insulation or joints shall be filled and sealed with a patching material combining loose insulation and CP-82 as manufactured by Childers Products Company.

3.1.7 Secure the jacket over the insulation with 3/4" x .020 Type 304 Stainless Steel strapping bands as manufactured by Childers Products Company. The bands shall be applied on 9" centers. Screws or rivets shall not be used. The longitudinal and curcumferential laps shall be 2" minimum with the longitudinal overlap located at 4 or 8 o'clock position.

3.1.8 All longitudinal and circumferential joints in the jacketing shall be sealed with CP-70 as manufactured by Childers Products Company.

3.1.9 All flashing requirements shall be done with CP-70 as manufactured by Childers Products Company unliss surface temperature exceeds 300 degrees F. If this condition exists, a silicone sealant such as Dow or G.E. silicone sealant shall be used.

3.2.1 Irregular Shapes
For flanges, valve bodies, elbows, the insulation shall be cut and fitted together to avoid gaps. All open spaces shall be packed with loose insulation and CP-82 as manufactured by Childers Products Company.

3.2.2 The exterior weatherproofing coating shall be Muffl-Lag as manufactured by Childers Products Company. The coating to be applied to provide an air-tight monolithic protective system. The cured film thickness shall be minimum of .140". When both acoustical mastic and metal are to be installed, it is recommended that the mastic be applied initially and allowed to cure. Where adjacent jacket to mastic sealing is required, use CP-70 sealing compound as manufactured by Childers Products Company. Apply the adjacent metal jacketing over the caulking and band. (Note #13)

3.3.1 If an all metal acoustical jacketing system is required, Muffl-Jac prefabricated, gore type elbows (lobster back style), as manufactured by Childers Products Company are available, starting with size 4" X 2". Each section of the gore elbow shall be individually sealed and banded. Screws and rivets shall not be used. Prefabricated control valve body covers, flange covers and tees are also available. (Note #11)

INSTALLATION PROCEDURES - COLD SERVICE

4.1 Cold piping requiring noise abatement shall have a base layer of Armaflex, (closed cell rubber sheet manufactured by Armstrong Cork) or approved equal. Material to be installed as the sound absorptive layer. Fibrous insulations with an ASJ jacket are also a possible absorptive layer. (Note #12)

4.2 The surface shall be clean and dry when Armaflex insulation or approved equal such as Rubatex or Halsted is applied.

4.3 Armaflex or approved equal shall be banded or adhered to the surface. If adhering, Armstrong 520 adhesive is recommended.

4.4 All gaps and voids shall be filled with strip insulation and Armstrong 520 adhesive.

4.5 The weatherproofing jacket shall conform to sections 2.2 or 3.2.2 depending upon the surface complexity.

4.6 Consideration shall be given to mitering joints of insulation and jacketing design where maintenance requires jacket system removal.

NOTES:

1). The use of metal screws and rivets must be avoided on noisy piping. They tend to vibrate out.

2). Foamglass tends to break down under loading and vibration. Armaflex or approved equal is recommended as an alternate material. If using an Armaflex-type product, a vapor barrier may be required. CP-32 or Encacel V as manufactured by Childers Products Company are recommended.

3. Thickness of insulation is not contained in this specification. Each situation is unique and thickness of insulation should be specified individually. (See attached data sheets.)

4. ASJ or FFJ finished do not contribute to the acoustical value of the insulation system and are usually not required except for piping requiring a vapor barrier.

5. To support the increased surface loading of the acoustical jacket system, stainless steel strapping bands are recommended instead of tie wire.

6. Muffl-Lag should not be used as a flashing compound.

7. Muffl-Lag should not be used over insulating cement. Childers Products Company cannot warrant Muffl-Lag when used over insulating cements. Insulating cements absorb vital components which may affect the curing and adhesion of the Muffl-Lag. Muffl-Lag should be used directly over fibrous insulations or compatible weather-proof coatings.

8. If vertical piping is included as a section of the acoustical part of a job, special attention and detail is necessary and we encourage you to contact your local Childers Products Company representative.

9. For appearance purposes on flanges and elbows, suitable metal flange covers and two piece elbows may be applied over the Muffl-Lag.

10. Exercise care concerning temperature limits of fibrous insulation. Binders may migrate at temperatures less than those listed in the manufacturer's technical data for thermal systems. Unless recommended by manufacturers, use of fiberglas above 350 degrees F and mineral fiber above 450 degrees F may cause fracturing of fibers in systems exhibiting vibrational energy.

11. Manufacture of items such as control valve body covers, flange covers, gore elbows, and tees require non-corrugated jacketing.

12. Insulation systems requiring a vapor barrier must be sealed when installed. Leaks will permeate the entire system unless vapor stops are installed. Leaks can also be caused by system abuse.

13. Childers Chil Glas #5 is recommended as a reinforcing membrane and is usually embedded between an initial tack coat of the material during its application in the liquid state. Weaves other than 5 x 5 to the inch are not recommended.

14. Cryogenic acoustical insulation systems are not included in this specification. Please contact your local Childers Products Company representative for assistance.

WGW for your info

4-4

BULLETIN B-32 R2

BLOWOFF SILENCERS

THE AEROACOUSTIC CORP.

Is Pleased To Announce...

We Will Be Relocating Our Office And Factory

To

4876 VICTOR STREET
JACKSONVILLE, FLORIDA 32207
PHONE: (904) 731-3577

Effective June 12, 1978

THE AEROACOUSTIC CORP.
~~P.O. BOX 55 AMITYVILLE, NEW YORK 11701 516-226-6773~~
4876 VICTOR ST.
JACKSONVILLE, FLORIDA 32207
PHONE: (904) 731-3577

BLOWOFF SILENCERS

Whenever a gas under high pressure discharges into the atmosphere or to a lower pressure in a pipeline, a large amount of objectionable noise is generated.

A large steam boiler blowing off excess steam at 2600 p.s.i. through a power relief valve will generate noise levels of 140 db. at 50'. Noise levels of this magnitude will permanently damage the hearing of people in the vicinity of the discharge and will provoke neighborhood complaints from as far away as two miles. A type RBS (see Fig. 1) blowoff silencer will bring these levels down to a safe, under 90 dbA level at 50' and eliminate neighborhood complaints.

A small 1/4" air line, discharging 100 p.s.i. air from a pneumatic cylinder, will generate 100 db. 5' from the discharge. This is above the present OSHA 90 dbA limit for continual exposure. It is an annoying and distracting noise that can easily and cheaply be eliminated by using a small type SBL (see Fig. 2) blowoff silencer.

The noise of these discharges is generated by the turbulent reaction of the jet with the surrounding atmosphere plus the noise generated by the shock waves associated with supersonic flow.

The Aeroacoustic blowoff silencers quiet these jets by first diffusing the jet down to a relatively low subsonic velocity. The small type SBL depends entirely on the diffuser for its noise reduction. An acoustically absorptive section follows the diffuser section in the large type RBL, HBL, RBS and HBS silencers, providing the additional silencing required by large volume flow.

BLOWOFF SILENCER DESIGNATIONS

When the gas being silenced is dry (air, methane, etc.) and rain is kept out of the silencer, the less expensive types RBL and HBL silencers are satisfactory.

For use with steam or where rain can enter the silencer, types RBS and HBS must be used. The Models RBS and HBS incorporate our proprietary water resistant acoustic packing in the absorptive section to minimize the effect of water on their operation.

The Model SBL silencers are inexpensive units for flows below that of the smallest RBL series.

BLOWOFF SILENCER SIZING

The maximum permissible flows for Model RBL, RBS, HBL and HBS silencers are given in TABLE 1. These units will handle and silence any flow up to that tabulated. Exceeding the tabulated flow rates may result in damage to the silencers, so be certain of the design flow.

Flow rates for Model SBL's are given in TABLE 2.

CLUSTERING DISCHARGES

Models RBL, RBS, HBL and HBS can be provided with several inlet connections, to allow one silencer to service several discharge lines. Sizing is still based on maximum total flow per TABLE 1.

SILENCER EXIT & INTERNAL VELOCITY

The silencing effect can be negated because of aerodynamic noise generated within the silencer or by the silencer exhaust, if velocities exceed 300 ft/sec. Internal and exhaust velocities of Aeroacoustic Corp. Blowoff Silencers are well below this value if sized per TABLE 1.

BLOWOFF SILENCER ACOUSTIC PERFORMANCE

Fig. 3 gives dbA values at various distances from an unsilenced, vertical discharge steam jet, based on actual measurements of a typical system.

Figs. 4 and 5 give the corresponding noise levels, also based on actual measurements when using RBS and HBS blowoff silencers.

The small SBL silencer gives a 25 to 30 dbA reduction when used on 100 p.s.i. air.

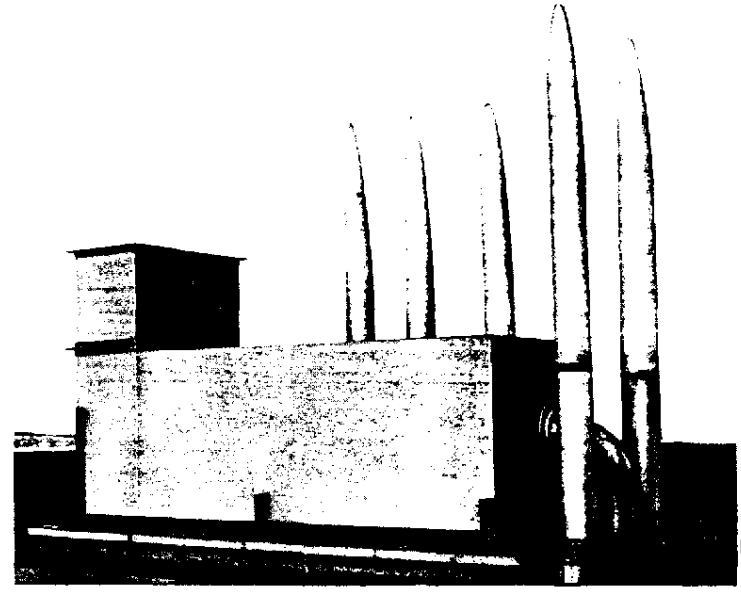


FIGURE 1 Long Island Lighting Company Northport Power Station 360,000 KW power control valve silencer (Blowoff Silencer) 220,000 PPH steam — 1,000° F — 2695 PSIG

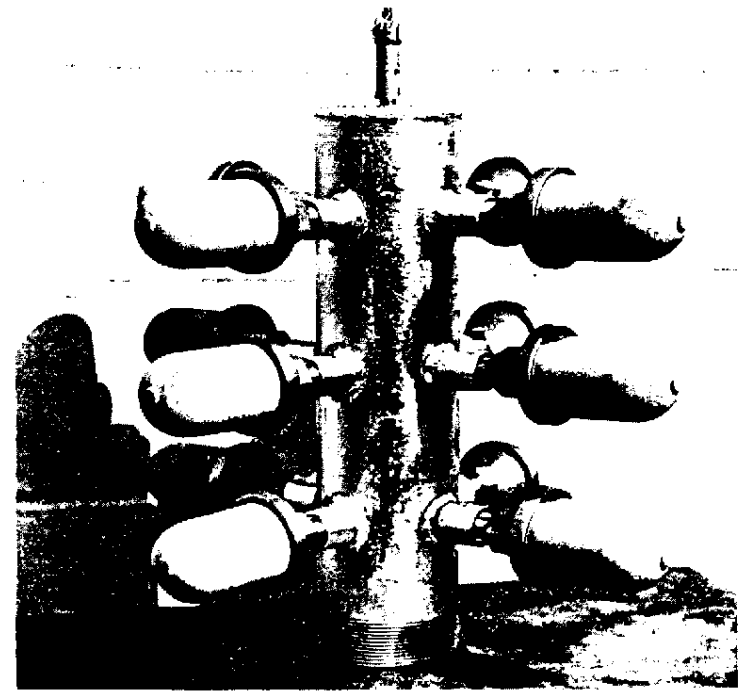


FIGURE 2 MODEL SBL 412

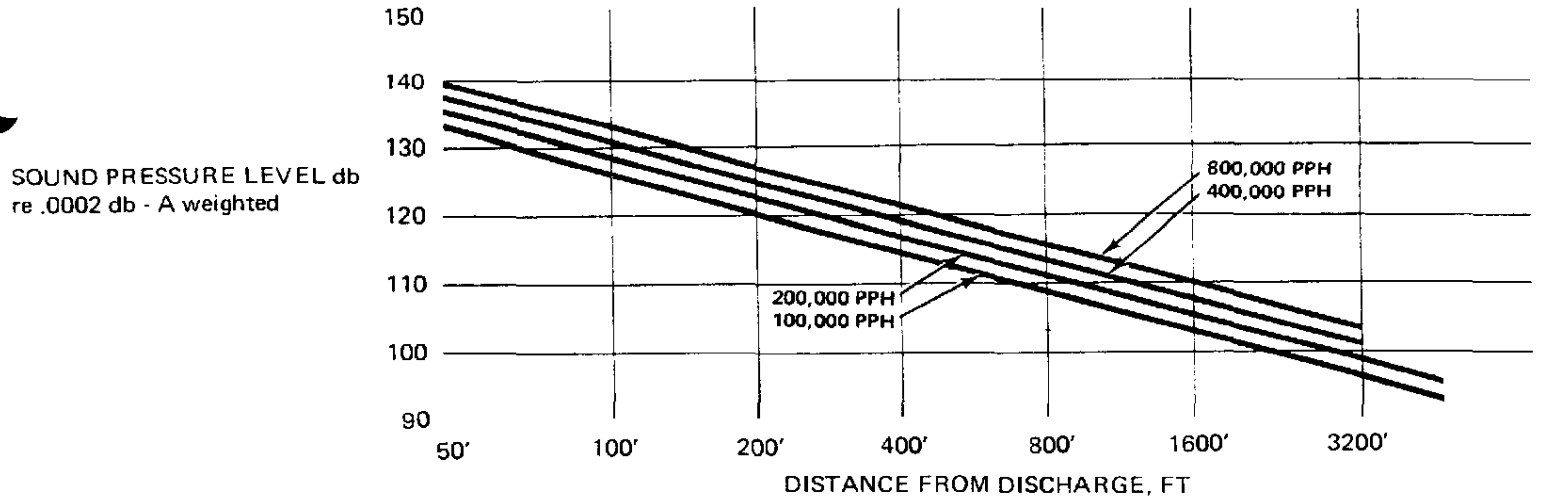


FIGURE 3. UNSILENCED STEAM JETS Over 200 PSIG; 1000°F

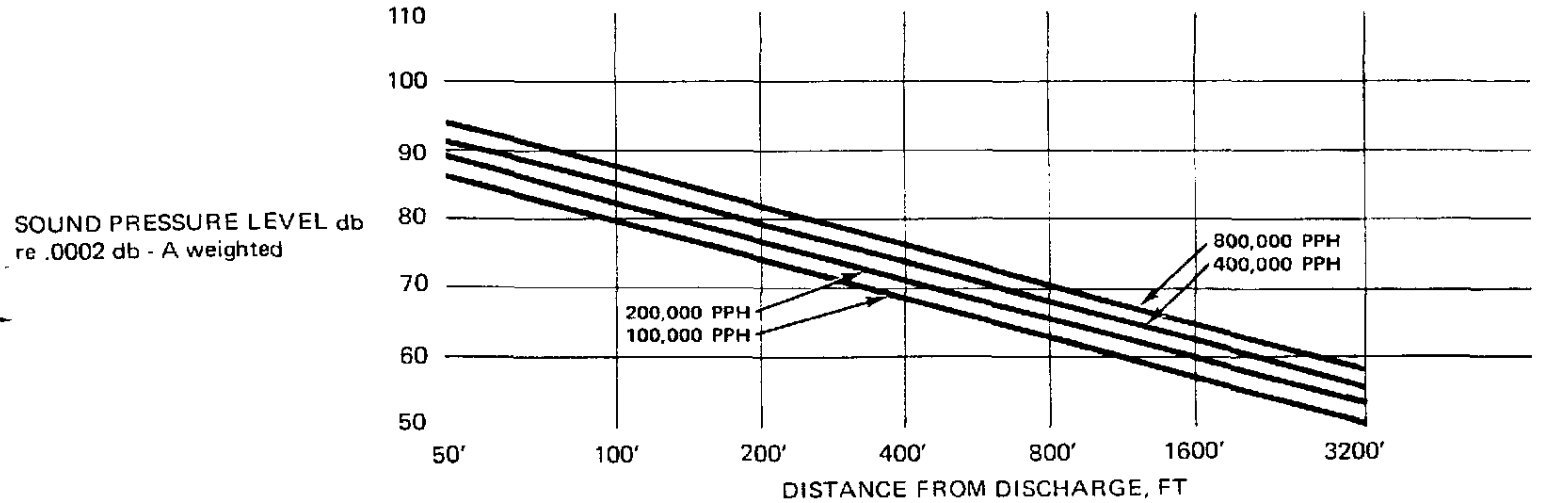


FIGURE 4. SILENCED STEAM JETS Model RBS SILENCER

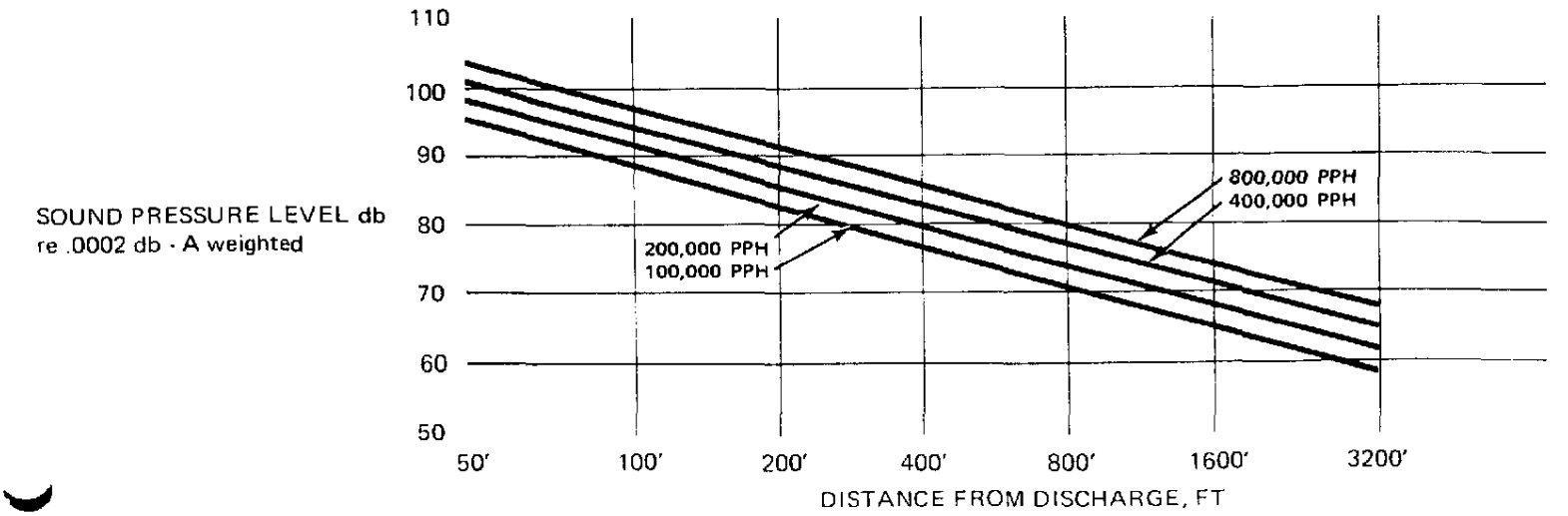


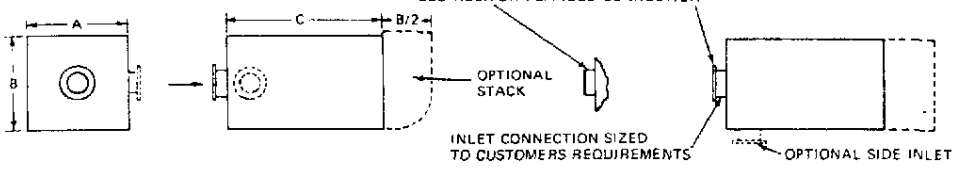
FIGURE 5. SILENCED STEAM JETS Model HBS SILENCER

X.515

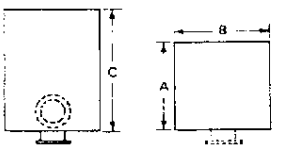
TABLE 1 — **MAXIMUM FLOW CAPACITIES – STEAM** — **MAXIMUM FLOW CAPACITIES – AIR**

Model No.	Dimensions, Inches A	B	C	Wt., Lbs.	Model RBS Silencer In 1000 PPH Steam 250°F	500°F	1000°F	Model HBS Silencer In 1000 PPH Steam 250°F	500°F	1000°F	Model RBL Silencer In 1000 PPH Air 60°F	250°F	500°F	Model HBL Silencer In 1000 PPH Air 60°F	250°F	500°F
-1	12	12	60	220	8.4	7.3	6	10.5	9.1	7.5	14	11.5	10	17.5	14.4	12.5
-1.5	12	18	60	275	12.6	11	9	15.8	13.7	11.2	21	17	15	26	21.5	18.8
-2	12	24	60	410	16.8	14.6	12	21	18.2	15	28	23	20	35	29	25
-3	12	36	60	550	25.2	22	18	31.5	27.5	22.5	42	34	30	52	43	37
-4	24	24	60	650	33.6	29.2	24	42	36.5	30	56	46	40	70	58	50
-5	24	30	68	780	42	36.5	30	52.5	44.5	37.5	70	57	50	87	72	62
-6	24	36	68	880	50.5	44	36	63	55	45	84	69	60	105	86	75
-7.5	24	45	68	1,050	63	55	45	78	69	56	105	86	75	131	108	94
-9	36	36	69	1,465	76	65	54	95	81	67	126	103	90	157	130	113
-10	36	40	75	1,685	84	73	60	105	91	75	140	115	100	175	144	125
-11	36	42	75	1,753	93	80	66	116	100	82	154	126	110	192	158	137
-12	36	48	75	1,902	101	88	72	126	110	90	168	138	120	210	173	150
-13.5	42	48	84	2,525	113	96	81	141	120	101	189	155	135	236	194	169
-16	48	48	84	3,275	135	117	96	169	146	120	224	184	160	280	230	200
-20	48	60	84	3,900	168	146	120	210	182	150	280	230	200	350	288	250
-25	60	60	84	4,740	210	182	150	263	229	188	350	288	250	437	360	312
-30	60	72	102	5,550	252	220	180	315	275	225	420	345	300	525	432	375
-36	72	72	102	6,210	303	260	216	380	325	270	504	415	360	612	520	450
-42	72	84	102	6,950	354	304	258	442	380	323	590	483	420	735	605	525
-49	84	84	108	7,940	412	354	294	515	442	368	685	565	490	857	707	612
-56	84	96	120	10,025	471	405	336	590	506	420	785	645	560	980	808	700
-64	96	96	123	11,200	540	462	384	675	580	480	900	735	640	1120	922	800
-72	96	108	123	12,350	605	520	431	755	650	540	1010	825	720	1260	1040	900
-81	108	108	123	13,900	695	607	486	870	760	610	1135	930	810	1410	1160	1010
-90	108	120	129	15,500	770	675	540	960	845	675	1260	1030	900	1570	1285	1120
-100	120	120	129	17,200	860	750	600	1070	940	750	1400	1150	1000	1750	1435	1250
-110	120	132	135	19,800	945	825	660	1180	1030	825	1540	1270	1100	1920	1580	1370
-121	132	132	135	21,800	1040	910	725	1300	1140	905	1700	1390	1210	2120	1740	1510
-132	132	144	141	23,800	1140	990	795	1420	1230	990	1850	1520	1320	2300	1900	1650
-144	144	144	141	26,000	1240	1080	865	1550	1350	1080	2020	1660	1440	2520	2070	1800

HORIZONTAL MOUNTING



VERTICAL MOUNTING



Single Unit

Multiple Units

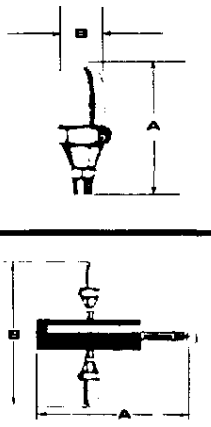


TABLE 2 TYPE SBL BLOWOFF SILENCERS

Model	Pipe Connection Size (IPS)	A in	B in	Discharge SCFM at ΔP across Silencer (Air) 1 PSI	10 PSI	100 PSI
SBL 1	1/4	1.92	0.83	8	25	79
2	3/8	2.56	1.06	14	45	143
3	1/2	4.14	1.70	28	87	275
4	3/4	6.60	2.60	54	170	540
42	1 1/2	11.0	15.1	108	340	1080
43	1 1/2	16.0	15.1	162	510	1620
44	2	16.0	15.5	216	680	2160
45	2 1/2	16.0	16.0	270	850	2700
46	3	21.0	16.0	324	1020	3240
48	3 1/2	16.0	17.1	430	1360	4300
410	3 1/2	21.0	17.1	540	1700	5400
412	4	21.0	17.6	650	2040	6500

BLOWOFF SILENCER CONSTRUCTION

The Blowoff Silencer has to handle very large amounts of energy, during its operating period and hence, has to be of very rugged construction.

For example steam, at 1,000°F and 1,000 PSI pressure, vented to atmosphere through a 4" valve, will flow at a rate of 910,000 PPH and dissipate energy equivalent to 141,000 horsepower. Unsilenced, this jet will produce 170 db of acoustic power referred to 10^{-12} watts.

The AeroAcoustic Blowoff Silencer dissipates this velocity energy in the silencer diffuser section. In order to handle these tremendous amounts of power, the internal diffuser section of the AeroAcoustic Type RBL Blowoff Silencers is made of 1/2" steel plate in the larger models.

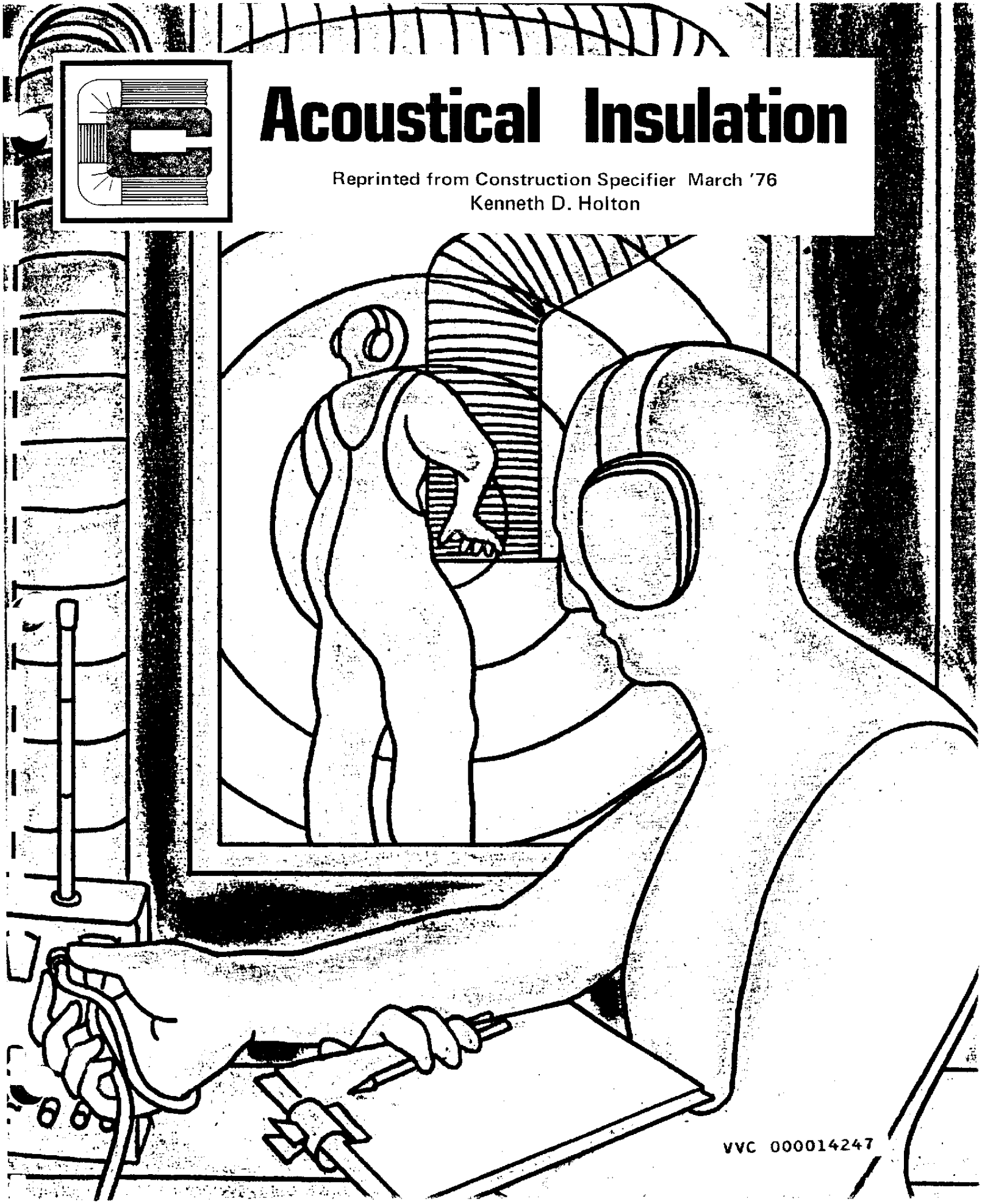
To be sure of getting a Blowoff Silencer that can do the job and also stand up under the tremendous forces involved in the blowoff gas velocity, specify the AeroAcoustic Type RBL or SBL Blowoff Silencer.

VVC 0000142

Acoustical Insulation

Reprinted from Construction Specifier March '76

Kenneth D. Holton



Historically, thermal insulation has been employed by the design engineer for essentially three basic reasons:

1. To conserve energy by reducing
   eat losses,
2. To maintain constant process temperatures, and
3. To prevent injury to personnel.

Now, a fourth, less obvious reason has been added by federal order:

4. To help industry provide a safe and healthful workplace by reducing potentially hazardous noise levels.

To determine what constitutes this environment and to insure that such conditions are being provided, two federal agencies, OSHA and EPA, are currently actively involved. OSHA is inspecting facilities to assure that measures are being taken to comply with the noise regulations set forth in the Occupational Safety and Health Act of 1970. Whereas the Environmental Protection Agency (EPA), established by the Noise Control Act of 1972, is provided with broader responsibilities and power to monitor all federal agencies engaged in environmental activity including noise abatement. Until recently these agencies had not been able to agree upon the maximum allowable noise exposure that provides a safe
nd healthful workplace for a major portion of the population.

OSHA prescribed a 90 decibel (A) weighing or 90 db (A) level for eight working hours.

EPA proposed an 85 db (A) level for eight working hours.

90 db(A) is considered by OSHA to be the upper limit of daily noise exposure that will not produce a disabling loss of hearing in more than 20% of a population exposed through a working lifetime of 35 years.

Because of the potential disabling effect on that 20%, EPA was reluctant to concede its position. However, in hearings recently concluded in Washington D.C., it was tentatively agreed that the 90 db(A) level will be the acceptable upper limit for an eight-hour daily exposure. But, for a sixteen-hour exposure, or more, 85 db(A) is the maximum limit. From the adopted curve, a twelve-hour exposure would require a noise level not exceeding 87.5 db(A). Some companies, in anticipation, have generally adopted 85 db(A) as the long-range upper limit and are using it as their present-day guide (Fig. 1).

This compromise agreement will remain in effect until findings based on regularly scheduled employee physical exams prove the exposure limits are adequate or inadequate. Tentative though it may be, this agreement has lessened, to a degree, the anxiety of many corporations faced with the costs of applying the type(s) of appropriate noise control. 5 db(A) may not seem an extreme difference, but the comparison of costs for various industry segments to achieve this difference is significant and is shown in Table 1 (Courtesy of *Business Week*, July 20, 1974 issue).

Realizing its position, industry is attempting to institute controls and practices by applying treatments it hopes will enable it to comply with the noise standards and the 1978 schedule.

To help industry meet the challenge, a new capability has emerged combining the talents of acoustical engineers with the products, knowledge and assistance from sources within the thermal insulation segment of industry.

Acoustical Insulation for Lagging Mechanical Equipment

Today thermal insulation is one of the primary materials of design selected to solve many of the noise problems associated with the function and design of mechanical equipment. Since noise is a form of energy, dissipation of that energy to reduce noise levels is an important aspect of design. Certain insulations, although excellent energy absorbers, can treat only a portion of a noise problem, usually the high frequency end of the noise spectrum. Therefore, it is usually a combination of materials such as insulations, jacketings, coatings and finishes that are used as a lagging system to totally combat such problems. Energy not absorbed by the insulation initially is reflected into the insulation by the acoustically treated jacketings, coatings and facings preventing much of the energy or noise from becoming airborne.

How effective the combination will be is a question. The usual method of measurement of noise reduction efficiency for flat panels is transmission loss* through a panel from a sound

* The reduction in magnitude of some characteristic of a signal between two stated points in a transmission system.

Figure 1:
OSHA's proposed new noise standard would set these time-weighted limits on employee noise exposure.

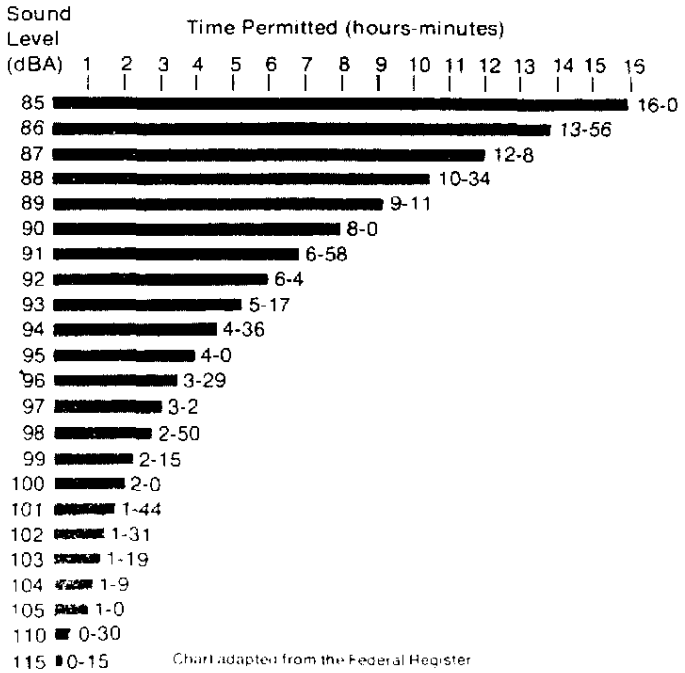


Chart adapted from the Federal Register

Table 1:
What it will cost industry to reduce noise

Industry	Total compliance cost Millions of dollars: EPA Proposed standard	OSHA Present standard	1971 capital investment
Utilities	$ 6,300	$ 3,200	$15,290
Nonelectrical machinery	4,200	1,400	2,803
Fabricated metal products	3,200	1,100	312
Transportation equipment	2,900	1,100	2,143
Textile mill products	2,700	1,100	610
Food & kindred products	2,600	590	2,693
Electrical machinery	2,300	780	2,125
Primary metals	1,900	900	2,803
Chemicals & allied products	1,400	1,100	3,438
Printing & publishing	1,000	870	1,733
Lumber & wood products	650	160	214
Furniture & fixtures	580	190	33
Stone, clay & glass	520	290	850
Paper & allied products	500	140	1,253
Rubber & plastics products	500	300	845
Petroleum & coal products	260	210	5,875
Tobacco	90	45	26
Apparel & related products	10	0	53
Leather & leather products	8	0	34
Total	$31,618	$13,480	$53,138

Data: Bolt Beranek & Newman Inc.

source to a sound receiver under acoustically controlled conditions. A sound transmission class (STC) rating is assigned based upon the results. This STC rating is a single number used for comparing flat partitions for general building design purposes. Yet, this same rating is being used as a guide in many cases, to determine the suitability of that system for application to curved surfaces of piping, compressors, pumps, turbines, valves, gear boxes, fans and duct work and other industrial type equipment.

The application of materials used or tested as flat partitions bears little relationship to the functionality of those same materials to the curved industrial equipment mentioned previously. STC should not be the only criterion utilized for design purposes until analyzed for use in critical frequency ranges prior to a specific application.

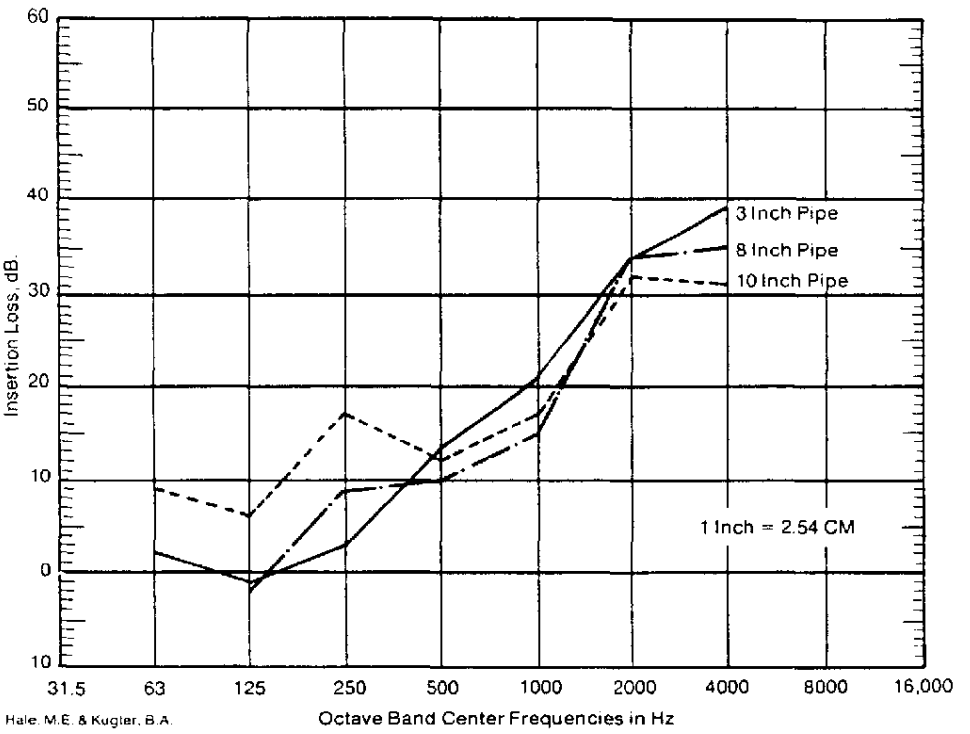
How then can one design for a given noise source and feel confident that the system derived is both effective and economically efficient, if little reliable data are available? The answer is, "very carefully!" To this purpose, all segments of the thermal insulation industry are presently undertaking investigative efforts in conjunction with acoustical engineers and testing facilities to provide the necessary information and/or the test methods to determine the effectiveness of an insulation system in controlling excessive noise.

Although it is the equipment that generates the acoustical energy and is the noise source, the noise is usually radiated throughout a plant by a related piping system. Therefore, the acoustical lagging of the piping as well as the source must receive attention when reducing noise levels throughout an existing plant. How do you treat piping tied in to a noisy compressor or a pump? The means of control are: source, path, and receiver.

In most cases, source control is the most economical. However, unless replacement with a quieter unit is possible, as well as practical, the alternate means are normally employed. The choice between path and receiver control is based upon plant operations and isolating the noise from the receiver or vice-versa, whichever is more practical or economical.

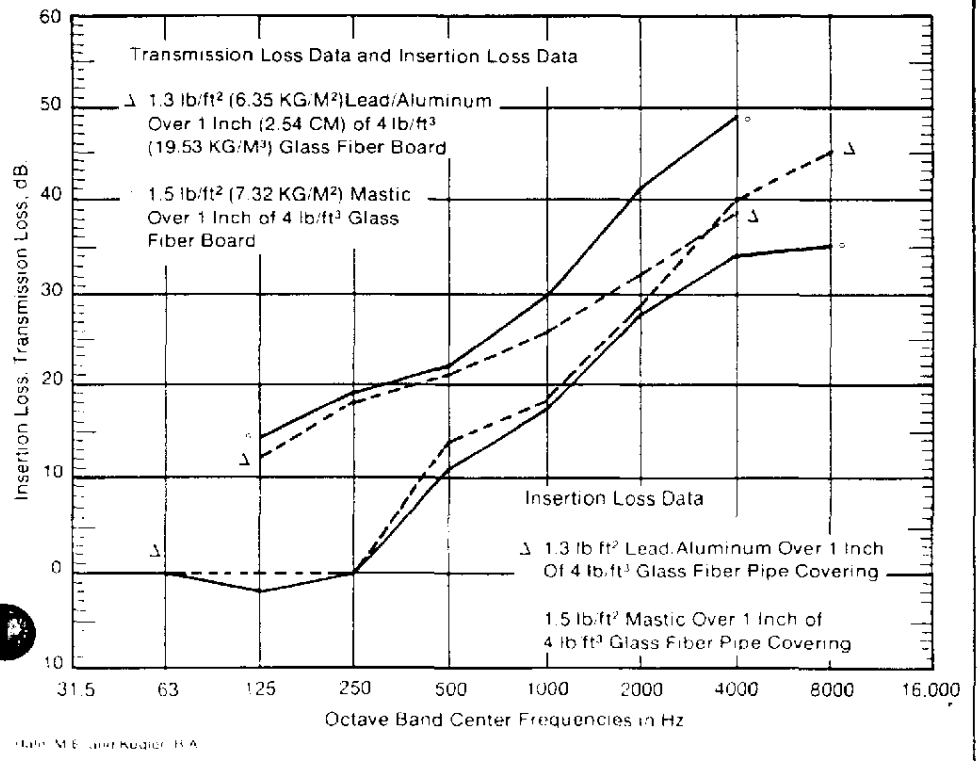
There are many ways to control noise. Vibration damping, vibration isolation, absorption, constrained layer construction, and, enclosures are all widely used alternates. But what are the most appropriate alternates? Why are certain type insulations and materials used or not used? What assistance can be expected of the suppliers of noise control systems or materials? Who should be called on to identify a noise problem? What type of reference information should be used? These are the questions to be answered and are the substance of this paper. To give the

Figure 3



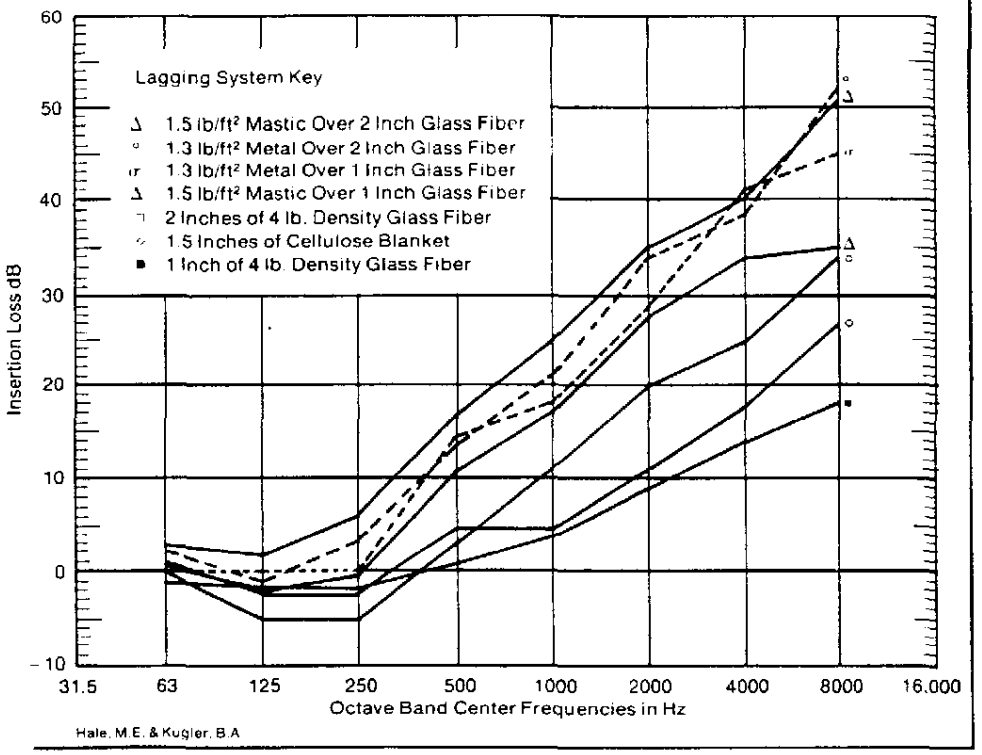
Additional information is developed to show:
1. Change in insertion loss of a pipe lagging treatment as a function of pipe diameter (Fig. 3).

Figure 2



2. The insertion loss results for typical pipe lagging systems (Fig. 4).

Figure 4



designer the direction and tools with which to develop the right lagging system to reduce noise levels and to help engineer the safe and healthful workplace industry is seeking.

Before actually discussing the fundamental considerations and details to be employed to reduce noise levels on piping or ducting and the related energy source, it is the writer's opinion that the validity of the recommendations be reviewed so that those individuals interested not only in the mechanics but also the theory are satisfied. Much of the information provided is through the courtesy of the American Society of Mechanical Engineers and the reports submitted to that organization at the Houston, Texas, Winter Meeting in December 1975. (References for reports will be given at the end of this paper.)

The reports evaluate several types of pipe lagging treatments and combinations of materials applied to piping, measuring performances under specific test conditions outlined in the papers themselves. The differences are significant between laboratory flat panel transmission loss test data ASTM E-90-70, and insertion loss data* obtained from lagging a noisy pipe with the same materials (Fig. 2).

From the differences shown in Figure 2, it is obvious that unless the critical frequencies are known, miscalculation *of potential decibel reduction can be* introduced and failure of the system performance can be the result.

* The test methods submitted to the ASTM-E-33 committee are being studied as potential standard methods.

3. Typical sound level* reductions achieved with acoustical laggings treatments for different sources** (Tables 1 and 2).

Table 1

Treatment	Test Valve Piping	Process Valve Piping	Process Compressor Piping
1 inch*** glass fiber	12	8	5
1.5 inch cellulose blanket	17	8	6
2 inch glass fiber	27	15	10
Mastic over 1 in. glass fiber	32	22	16
Metal over 1 in. glass fiber	33	23	18
Metal over 2 in. glass fiber	38	26	19
Mastic over 2 in. glass fiber	43	35	25

* A-weighted sound pressure levels in units of dBA.

** Peak noise levels occur in the respective piping at different octave band center frequencies, as follows: Test valve, 4 KHz; Process valve, 2 KHz; Process compressor, 1 KHz.

*** 1 *inch (in.) is equal to 2.540 centimeters (cm).*

Table 2

Pipe Lagging Materials

Treatment	Product	Supplier
Glass fiber	Preformed pipe cover	Certain-Teed Products
Cellulose blanket	K-13™ Acoustical Blanket	National Cellulose Company
Lead/ Aluminum	Muffl-Jac™ Acoustical jacketing	Childers Products Company
Mastic	Muffl-Lag™ Acoustical coating	Childers Products Company

Hale, M.E. & Kugler, B.A.

The materials used in conducting these tests were selected only to illustrate the variations in performance of materials in test and does not constitute endorsement or recommendation by the source.

A *lagging system designed to reduce noise levels* consists essentially of an absorber over the surface radiating the noise, and a noise barrier sometimes referred to as a septum. The absorbers are primarily thermal insulations and the barriers are usually dense, metal or mastic exterior finishes.

The following charts are compiled as guides to simplify the selection of materials presently available and used successfully in the design of such a lagging system.

Acoustical Insulation for Lagging Application

Type	Description	Advantages	Disadvantages
1. Inorganic Glass Fiber	1 to 3#/cu. ft. density blanket	• Low cost • Efficient energy absorber • Easily applied	• Compress and compact under fastening, loading and vibration
2. Inorganic Glass Fiber	4 to 7#/cu. ft. density board and pipe covering	• Excellent energy absorption quality • Dimensionally stable with acoustical surface loadings • Easily installed	• Requires cutting to conform to unusual shapes • Requires mechanical or adhesive attachment to surfaces • Moderate service temps
3. Mineral Wool	4 to 6#/cu. ft. Board	• Excellent energy absorption quality • Easily installed	• Compress and compact under loading and vibration • Fibers separate under trowled coatings • Requires mechanical or adhesive attachment to surfaces
4. Mineral Wool	7 to 12#/cu. ft. Board and pipe covering (Densities higher than those shown are not recommended)	• Excellent energy absorption quality • Easily installed • Dimensionally stable under accoustical surface loadings	• Requires cutting to conform to unusual shapes • Requires mechanical or adhesive attachment to surfaces
5. Calcium Silicates	12 to 14#/cu. ft. Board and pipe covering	• Used as thermal breaks for absorptive type insulations	• Cannot be used for absorptive purposes • Adds additional weight to structure without acoustical benefit
6. Cellulose Fiber	3.5#/cu. ft.	• Excellent absorption qualities • Can be spray-applied	• Area clean-up after spraying • Must be tamped after spraying • Susceptible to water damage • Deforms under loadings • Limited continuous service temperatures
7. Cellular Glass	8.5#/cu. ft.	• Vapor barrier type insulation	• Limited absorptive capacity • Adds additional weight to structure • Limited service temperatures • Damping materials often required for use as a noise barrier
8. Flexible Urethane Foam (Rigid urethane foam board and pipe covering not recommended)	2#/cu. ft.	• Easily installed • Light Weight	• Low service temperature range • Poor fire resistance • Toxic by-products from burning • Compacts under attachments and surface loadings • Higher limiting frequencies than other type insulations
9. Ceramics	to 18#/cu. ft.	• Thermal break for more efficient energy absorbing type insulations	• Cannot be used for absorptive purposes • Adds additional weight to structure

Note: There are other insulations that are effective acoustically also, such as Gypsum and particle board. However, due to their nature, they do not lend themselves to curved surface applications.

Materials Guide

Noise Barriers for Lagging Applications

Type	Description	Advantages	Disadvantages
1. Lead	½ to 3#/sq. ft	• Limpness, mass	• Easily damaged • Requires additional mechanical attachment and sealants to obtain air-tight seal • Requires protective finish for USDA and FDA approvals and prevention of corrosion
Lead-Laminated to:	.75 to 3.25#/sq. ft. combined laminated weights	• Limpness, mass plus the following:	
2. Aluminum (3003-H-14)	.016" thickness	• Ease of handling • Mechanical and chemical protection	• Requires additional mechanical attachments and sealants to complete installation
3. Galvanized Steel	.010 to .040" thick	• Fire resistive • Mechanical protection	• Requires additional mechanical attachments and sealants to complete installation • May require structural redesign to carry weight in heavier thicknesses • Potential corrosion
4. Stainless Steel	.010 to .016" thick	• Corrosion and fire resistance • Mechanical protection	• Requires additional mechanical attachments and sealants to complete installation • Costs
5. Coated Metals	.010 to .040" thick	• Corrosion and fire resistance • Mechanical protection	• Requires additional mechanical attachments and sealants to complete installation • May require structural redesign to carry weight in heavier thicknesses
6. Heavy Gauge Metals	.032 to .050'' thick	• Mass	• Requires additional mechanical attachments and sealants to complete installation • May require structural redesign to carry weight in heavier thicknesses • Potential corrosion
7. Asphalt Roofing Felts	.40 to .50#/sq. ft.	• Ease of application	• Requires additional mechanical attachments and sealants to complete installation • Poor mechanical resistance • Limited noise barrier characteristics
8. Lead Filled Vinyls	¾# to 3#/sq. ft	• Mass, limpness • Easy fabrication and installation	• Requires additional mechanical attachments and sealants to complete installation • Flammability characteristics • Low temperature stiffness
9. Lead Filled Coatings	15 to 20#/gallon	• Mass, limpness • Ease of application • Monolithic covering to irregular or simple surface contours	• Poor chemical resistance • Limited application temperature range • Toxicity • Requires ventilation during application • Potential lead oxide hazard • Requires multiple coats to obtain necessary dry film thickness • Extended drying time between coats lengthens application time • Relatively limited operating service temperature range
10. Lead Free Coatings	17#/gallon	• Mass, limpness • Ease of application for monolithic coverings to irregular or simple shapes • Single coating application to build required thickness • Fast set	• Two or three components • Requires mixing • Limited working time • Reinforcing membrane recommended • Ventilation recommended
11. Sealants—polysulfides	11.0#/gallon	• Retains flexibility through operating life • Inexpensive	• Not effective as a noise barrier material • Limited to sealing laps and joints of construction materials • Ventilation recommended

Note 1: It is sometimes less expensive to protect the person(s) from the noise source by using personnel enclosures consisting of panels of conventional building materials. An enclosure should be investigated and selected in order to insure proper protection from the type and extent of noise to which the person(s) is exposed.

Note 2: Heavy, limp vinyl curtains and partitions are also used as noise barriers but unless the degree of isolation between sources and receiver(s) within a room is essentially 100% complete, the installation may be ineffective and a total waste of money.

Note 3: Absorbent materials such as fiberglass louvers and baffles only reduce the reflection of the generated noise and cannot reduce noise levels below those emanating from the source. The effectiveness of the absorbent surfaces increases with distance from the source.

Considering the available data and materials, the noise problem itself must be clearly and properly defined.

Sound is a unique force and continues to test even the knowledgeable engineer with the extent of its influence on design. Because this influence is a form of energy, an improper or inadequate installation may have ramifications of unknown proportions. Therefore, to avoid failure and related costs, it is essential that basic acoustical engineering precede any installation. An effective engineering program embodies three phases:

1. *Definition*—Noise control problems must be clearly defined. A trained person is required to determine the main source of noise especially in a complex, multi-source environment.

2. *Competence*—It requires specific technical competence to solve noise control problems and to develop alternate solutions. Recommendations may take the form of revised work traffic patterns along with other treatments. The nature and extent of such treatments for an entire plant necessitates varied studies and recommendations.

3. *Evaluation*—The selection of the appropriate solution from alternatives requires evaluation in terms of dollars as well as effect.

Obviously then, knowing how to overcome typical industrial noise control problems depends on:

1. Identifying the noise source.
2. Selecting the correct materials.
3. Applying the treatment to the affected area.
4. Measuring the effectiveness of the installation.

Installation is no less an important contributor to the solution of the problem than any other aspect of design considered to this point. Improper application or careless attention to any of the details associated with good workmanship will detract from, if not prevent, reaching design goal levels.

Therefore, it is necessary that the tradesmen who will be installing noise control materials have the training enabling him to produce a proper and quality job. It is here that organizations such as the National Insulation Contractors Association are so important in seeing their members are kept informed about products which affect the type and extent of work in the insulation field. Other trades groups such as the Heat and Frost Insulators Union with their apprentice training programs are vital in assuring industry of a qualified source of labor.

When specifications are generated, it is also helpful to consider the type of labor conducive to producing a successful job. Disputes over jurisdictional control can be eliminated thereby preventing unnecessary delays and costs and potential misapplication.

In realizing the importance of specifications, we must recognize that noise control treatments will be exposed to the same environments as conventionally designed thermal insulation installations. Allowing that the nature of the insulation treatment between acoustical and thermal happens to be distinct, the conformity to codes and standards must not be dismissed. From an appearance viewpoint, many successful noise reducing installations consist to a great degree of the same exterior materials applied over conventional insulations for regular pipe lagging treatments, except that the noise barrier has been added. This makes it possible for the engineering of both acoustical and thermal treatments to appear similar, have each perform its distinct function, yet comply with established codes and standards.

Because of the dissimilarity of contributing noise factors to each noise problem, the selection and application of materials must be individually considered. Therefore, it would be an impossible, as well as an impractical task to attempt to write a "typical" specification for a lagging treatment for a pipe system. However, the following points should be considered in each specification.

A specification calling out preformed insulation and a noise barrier for a typical pipe lagging application should direct attention to the following detail:

1. Apply absorptive insulation with a snug, tight fit at all joints, longitudinal and circumferential. If a thickness of two inches or more is specified, apply the insulation in multiple layers, staggering all joints. Pack all openings with loose insulation using rubber based adhesives. Do not pack with insulating cements.

2. Avoid the use of pins and clips to secure insulation. Each pin transfers noise energy from the weld or adhesive contact point along the pin to the clip and if in direct contact with a metal jacket, will act as openings in the treatment.

3. For elbows, two-piece preformed glass fiber insulation covers can be used having equivalent thicknesses to the pipe lagging. The elbows can also be field cut from the pipe insulation and applied to an equivalent thickness assuring snug, tight fit at all joints.

4. For other items like flanges in the system, the same treatment should be applied in the most efficient manner.

5. Isolate all saddles and hangers structurally tied to the piping with sound absorbing and/or vibration isolation materials such as closed cell rubber. If isolation is not practical, then coat the exposed surfaces of those items with a vibration damping compound.

6. The noise barrier jacketing, usually metal jacketing such as an aluminum and lead laminate is used for the straight runs of piping. To properly install the jacketing one should overlap at least two inches and band the overlapping seams. Caulking all longitudinal and circumferential seams is recommended. Rivets or screws tend to loosen under vibration and therefore are not recommended, unless no other means of attachment can be used!

7. Stainless steel bands should be placed at nine inch centers along the pipe lagging. Expansion springs may be included in the attachment if piping or equipment diameters exceed six feet.

8. Care should be taken to keep all cuts and openings for projections as tight as possible. Seal such openings with a non-hardening, non-shrinking type caulking compound. The lagging treatment should be applied like a vapor barrier installation to be effective.

9. For irregular surfaces appropriate acoustical coatings may be used in place of the metal jacketing.

To help obtain the desired thickness of coating, one can pre-cast sheets of ½ the desired dry film thickness. Cut swatches (approximately one inch square) to be adhered to the insulation's surface at convenient locations using a touch of the coating itself as the adhesive. Then firmly trowel a thickness of the coating to the acoustical insulation surface to the depth equal to the thickness of the swatch. Embed a #5 reinforcing, open-weave fiberglass fabric into the wet coating. The swatches will help prevent the fabric from being forced to the insulation's surface.

Follow this by applying a second swatch atop the previously applied swatch sandwiching the glass fabric. Finally, apply the finish coating to a thickness equal to that of the second swatch. This method will give the recommended dry film thickness.

If only the first coat can be applied because of circumstances, be certain the reinforcing fabric is applied before the coating sets up. The second coat can be applied anytime thereafter.

11. If the acoustical coating is used on irregular surfaces and the metal jacketing is used on piping in conjunction, be certain that the mastic is overlapped at least three inches by the jacketing and banded and caulked at the extreme end of

the overlapping jacketing.

12. Expansion joints and vessels may require more elaborate application detail and should be treated individually.

13. Acoustical enclosures may also be prepared from the same materials used to lag the piping but their installation and/or attachment to a piping system should be carefully evaluated.

14. *Consult your acoustical* engineer and supplier of acoustical materials for any additional assistance.

It is the writer's objective to alert the prospective purchaser of any noise control installation, whether simple or complex, to the fact that he can avoid mistakes and keep costs to a minimum by recognizing that his problem is distinct, that specific engineering is essential, and the installation must be completed by competent people.

As stated earlier, one should proceed very carefully in solving and treating noise control problems. Successful installations have been developed and installed by and for:

Company	*Equipment*	*Materials*
National Steel & Shipbuilding	Ballast Pumps	Fiberglas & Acoustical Coating
Public Service of N.J.	Compressors	Fiberglas & Acoustical Coating & Acoustical Jacketing
Scott Graphics	Boiler piping	
DuPont	Fluid bed Cooler	Fiberglas & Acoustical Jacketing
Union Carbide	Vacuum Jet	Mineral wool & Acoustical Jacketing
ARCO	Piping	Fiberglas & Acoustical Coating
AMOCO	Process Valving	Fiberglas & Acoustical Coating
GULF	Process Piping	Fiberglas & Acoustical Jacketing
Tow Motor	Boiler Piping	Fiberglas & Acoustical Coating

Note: Company names included in the above listings do not infer endorsement of products referred to in the article.

Definitions

1. db(A)—is a one number weighting expression of a sound pressure level read from a scale indicator contained within a sound level meter. Such a db(A) decibel reading is made possible by exciting an indicator needle via the sound pressures generated by the noise incident on the microphone portion of the meter.

The A weighted sound pressure level or A scale abbreviated by the letters dbA or db(A) equates a single number indicator used widely to rate the relative loudness at a sound (noise source) heard by the human ear. So when any readings are taken, the designation attributed to the scale used is associated with the decibel measurement.

There are normally three weighting networks in a sound level meter: A, B, and C. The "B" scale has fallen into disuse whereas the "C" scale is used when the critical frequencies do occur in the lower portion of the noise spectrum.

2. Transmission loss is the reduction in magnitude of some characteristics of a signal between two stated points in a transmission system.

3. Insertion loss is defined as the acoustic difference at a given point before and after inserting a sound absorber or barrier between the point and the noise source.

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A-8

noise control

DIRECTORY

ALLIED WITAN COMPANY

AIR EXHAUST MUFFLERS

FOR:

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Steam

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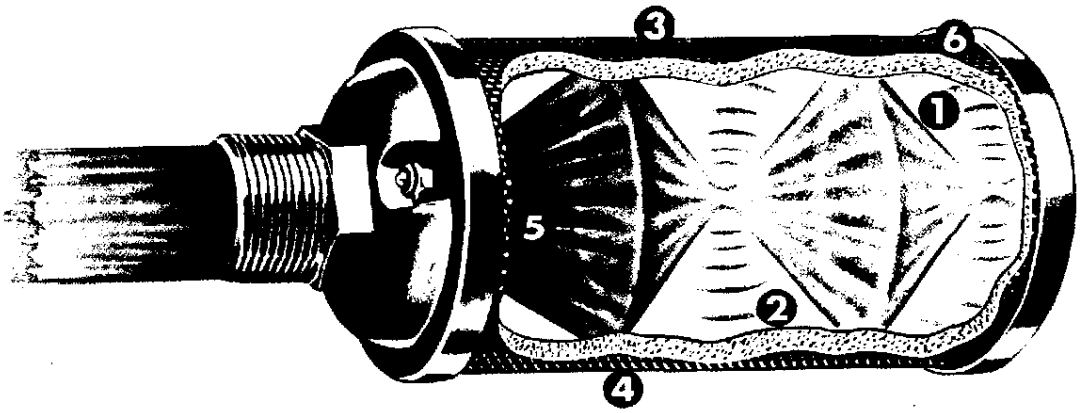


ADVANTAGES

1. Noise cancelled by interposing sound waves.
2. Multiple stage velocity deceleration.
3. Disseminator completely dissipates harmful exhaust blast.
4. Radial full-flow design.
5. Obstruction free expansion chamber.
6. Capacious peripheral exhaust surface diffuses air blast, lowers velocity and reduces noise.

The Allied Witan Atomuffler Design for Noise Control —Stops Noise Before It Starts

Kill the air blast that causes it and you completely prevent the deafening roar of air exhaust noise—before it even starts. Furthermore, let the air stream literally destroy itself—by effectively dividing and turning it back upon itself. This, with no need for baffles, packing or screening, is the basic principle of the Allied Witan Atomuffler system of air exhaust noise control.

As it enters the muffler at high velocity, the air exhaust mass is effectively redirected and subdivided into separate, infinitely smaller air streams. Directed in a continuous stream at the wall of the obstruction-free expansion chamber, they rebound freely to collide head-on with opposing air streams of equal force at a point pre-determined by the design of the muffler.

At the greatly reduced velocity thus effected, the air is then softly dispersed through the openings in the large area disseminator surface provided by the perforated cylinder wall of the muffler . . . free of noise, with negligible impairment of mechanical efficiency, and with complete protection to personnel from injurious air blast.

With the proved ability to eliminate deafening, nerve-wracking air exhaust noise, the Allied Witan Atomuffler Design for Noise Control has for many years been widely utilized in thousands of plants for providing better, more pleasant working conditions, for safety, and for protecting and insuring the physical welfare of employees.

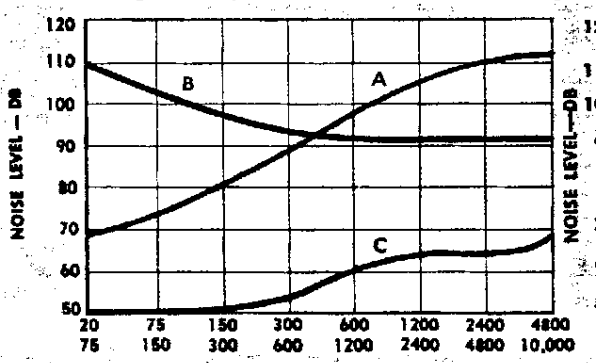
With sound intensity attenuations as high as 10^4, documented by qualified sound engineers, Allied Witan Air Exhaust Mufflers will more than meet the requirements for satisfactory reduction of noise levels—whether it be for already established shop practice, or pending regulatory legislation.

PERFORMANCE DATA

Atomuffler has set the industry standards for years in sound control applications the world over and are now setting the pace in space. Witness the fact that Atomuffler is specified on missile projects where no compromise can be made on efficiency, dependability or performance. Not only does the Atomuffler possess superior sound silencing properties but its value as an air diffuser is unsurpassed in the muffler field. Air diffusion positively prevents troublesome air flow and dangerous after-blasts.

The Atomuffler's unique patented system is a new approach to sound control and is uncomplicated in use and installation and widely recommended by leading casualty insurance companies and safety engineers throughout the world.

You can be confident of getting the ultimate in noise reduction, advanced muffler design, exceptional service and economy, when you specify . . . Atomuffler.

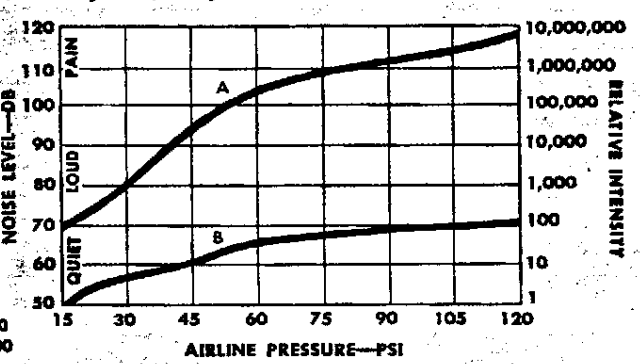


Frequency Band Noise and Attenuated Levels (Decibels)—Curve A—noise level when exhaust air is discharged directly into atmosphere without a muffler (note—noise level in the higher frequency bands exceeds accepted danger level, Curve B).

Curve B—Injurious noise level. Prolonged exposure to noise exceeding this level can result in progressive hearing loss.

Curve C—Attenuated level when ATOMUFFLER is attached to the exhaust opening of air equipment.

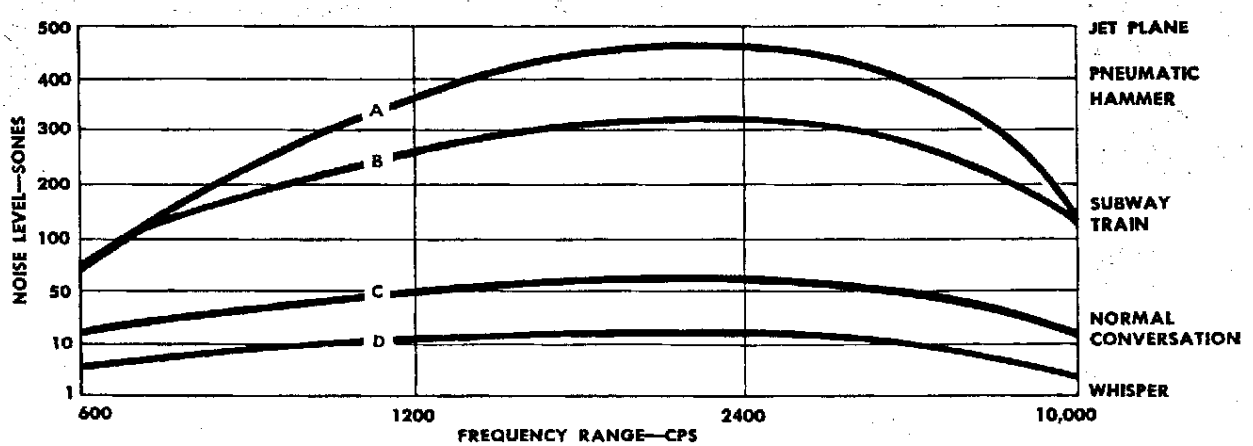
Shaded area illustrates the effective elimination of air exhaust noise with an Atomuffler used on air-operated equipment.



Noise Level and Attenuated Level (At Various Air Line Pressures)—Curve A—noise level when exhaust air is discharged directly into atmosphere without a muffler.

Curve B—attenuated level when ATOMUFFLER is attached to the exhaust opening of the equipment.

Shaded area illustrates the effective elimination of air exhaust noise with an ATOMUFFLER used on air-operated equipment.



FACTS ABOUT NOISE

Curve A—magnitude of loudness when exhaust air is discharged directly into atmosphere without a muffler.

Curve B—Exposure to noise above this level is difficult to endure, hearing loss can result from continuous exposure, protection required.

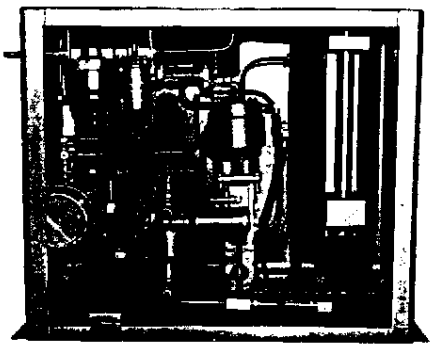
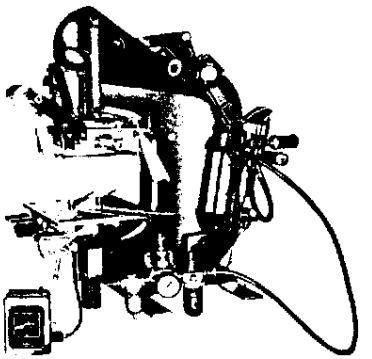
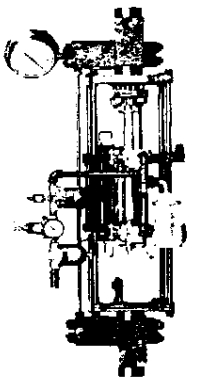
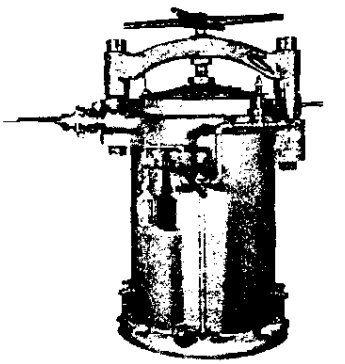
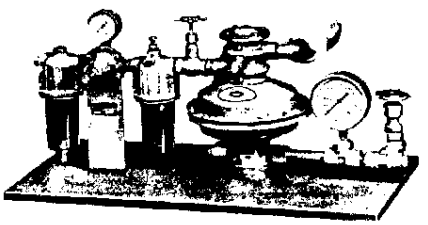
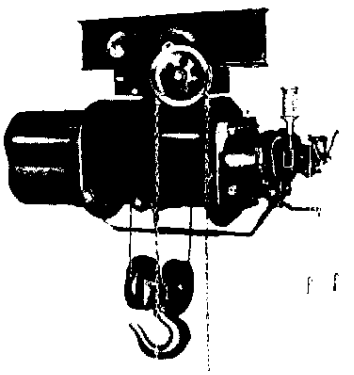
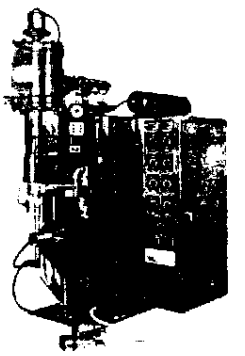
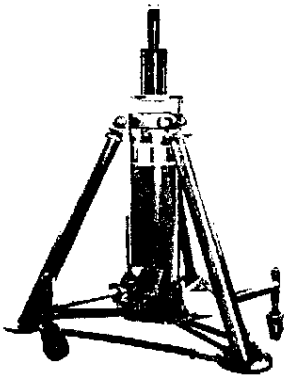
Curve C—Exposure to noise above this level causes fatigue, poor efficiency and costly errors, protection recommended.

Curve D—attenuated level when ATOMUFFLER is attached to the exhaust opening of the equipment.

Shaded area illustrates the effective elimination of air exhaust noise with an ATOMUFFLER used on air-operated equipment.

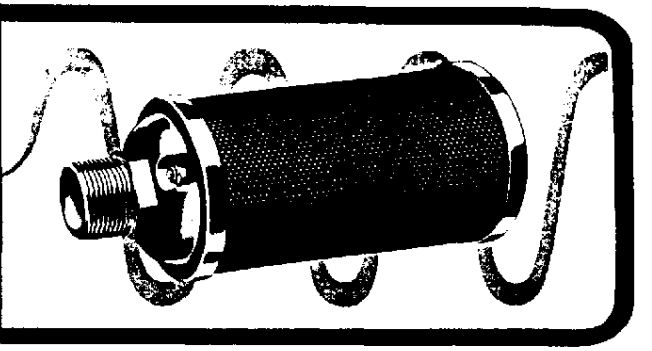
This graph was prepared to show exhaust noise loudness in sones ranging from loud to soft as distinguished by the human ear. In defining loudness sones differ from decibels in that a decibel is a numerical value indicating intensity of noise, whereas sones indicate the actual loudness as heard by the human ear.

WELDING EQUIPMENT FOUNDRY EQUIPM
RS AND PUMPS AIR PRESSES AND HOIS
S ASSEMBLY EQUIPMENT AIR TOOLS MC
ED CLUTCHES AND PRESSES AIR BOOSTE
FTS SIMULATION CHAMBERS MEAT PACI
EF & CONTROL VALVES FOOD PROCESSI
ERIES CHEMICALS TIRE TREADING EQUIP

Air Exhaust Muffler

EP TYPE—SINGLE CHAMBER



. . . WITH THE ALLIED WITAN ATOMUFFLER DESIGN FOR NOISE CONTROL

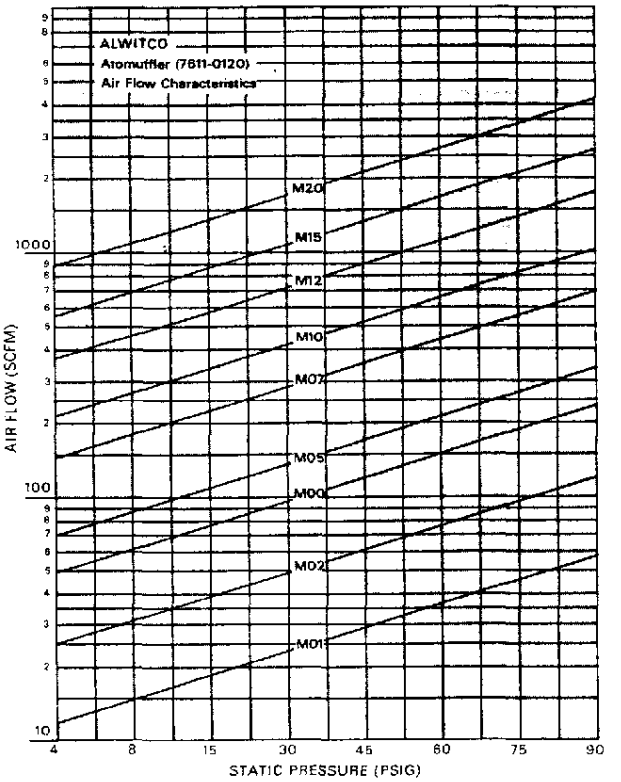
Stops Noise Before it Starts

Description—Page 1 **Noise Control Data—Page 2**

Thoroughly proved by years of use in thousands of plants, Atomuffler EP Type Air Exhaust Mufflers more than meet all requirements for the effective control of air exhaust noise from air cylinders, valves, tools, hoists, clutches and other air operated devices—with negligible impairment of operating efficiencies.

Like all Allied Witan Atomufflers, the EP Type Muffler is constructed with an expansion chamber completely free of obstructions, from which the exhaust air, at reduced velocity, is softly dispersed through the openings of the perforated cylinder wall of the muffler—free of noise and providing complete protection to personnel from injurious air blast.

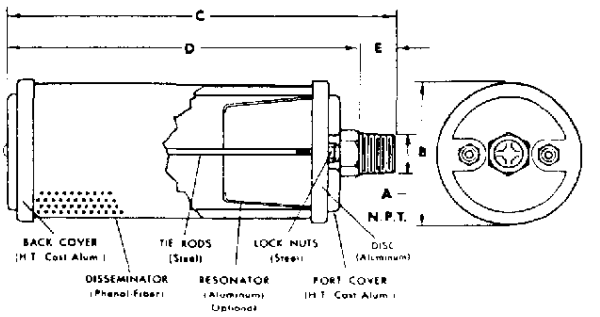
Constructed entirely of corrosion resistant material for maintenance-free performance, EP Type Mufflers are supplied with standard male pipe thread connections for quick, easy attachment to the air exhaust port and may be mounted in any position.

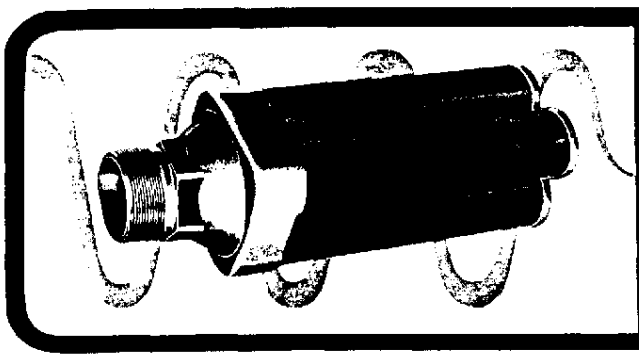


EP TYPE 4-44 SERIES SPECIFICATIONS

Model	M01	M02	M00	M05	M07	M10	M12	M15	M20
A	⅛	¼	⅜	½	¾	1	1¼	1½	2
B	1⅞	1⅞	2⅛	3¼	3⅜	3⅜	3⅞	5⅛	5⅛
C	3	4	4¾	5½	6¾	8	8¼	13¼	18¼
D	2⅝	3½	4¼	5	6⅛	7¼	7¼	12	17
E	⅜	½	½	½	⅝	¾	1	1¼	1½
Wght./lb.	.25	.31	.50	.62	.75	1.0	1.0	4.0	5.0
Exhaust Surface Area/IN²	4.6	7.1	12.2	16.9	24.1	31.8	39.9	79.5	119.3

(All dimensions in inches)





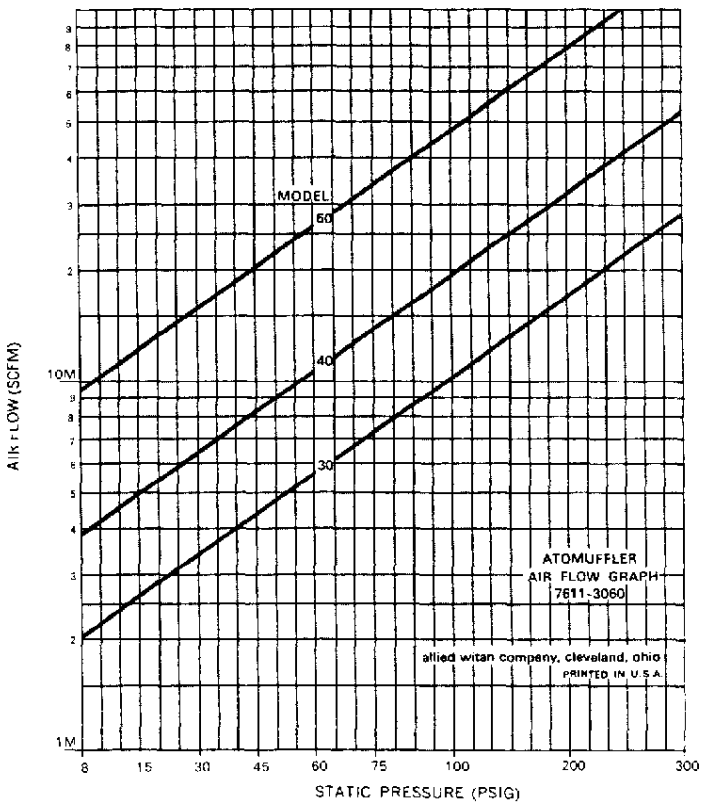
Air Exhaust Muffler

EP TYPE—MULTI-CHAMBER

. . . WITH THE ALLIED WITAN ATOMUFFLER DESIGN FOR NOISE CONTROL

Stops Noise Before it Starts

Description—Page 1 **Noise Control Data—Page 2**



Developed by Allied Witan for effectively eliminating the roar of air exhaust blast created by large, air operated equipment, the Atomuffler EP Type Multi-Chamber Air Exhaust Muffler gives you these outstanding advantages:

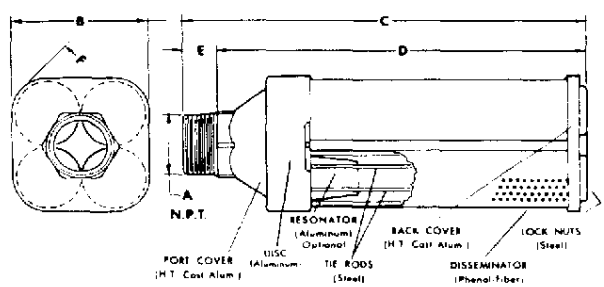
Large total exhaust area provided by the combination of the perforated surfaces of four exhaust cylinders insures soft, quiet dispersement of large volume, high velocity exhaust—quietly and with negligible reduction in the operating efficiency of the equipment.

Compact multi-chamber design, incorporating four air exhaust cylinders into relatively limited space, eliminates necessity for otherwise bulky, heavy unit requiring undue amount of space—provides unit that is lightweight, more economical, and is easier to handle and maintain.

Like all EP Type Single Chamber Air Exhaust Mufflers, each of the four air exhaust cylinders in the EP Type Multi-Chamber model is constructed with an expansion chamber completely free of obstructions, from which the exhaust air, at reduced velocity, is softly dispersed through the openings of the perforated cylinder wall of the muffler—free of noise and providing complete protection to personnel from injurious air blast.

Constructed entirely of corrosion resistant material for maintenance-free performance, EP Type Multi-Chamber Air Exhaust Mufflers can be quickly attached to the air exhaust port with a simple pipe thread connection and may be mounted in any position.

NOTE: For extremely demanding service, EP Type Multi-Chamber Mufflers can be supplied, when specified, with special heavy duty all metal cylinder wall disseminators.



EP TYPE 4-A SERIES SPECIFICATIONS

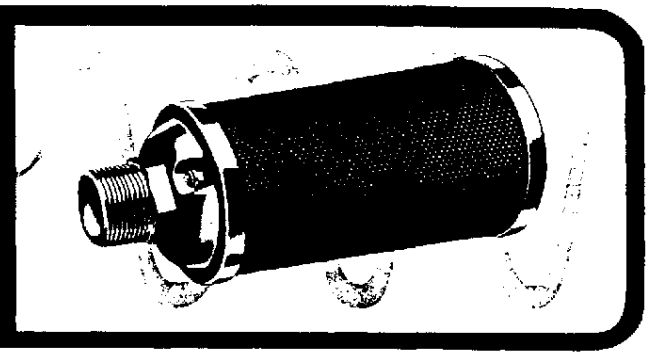
Model	M30	M40	M60
A	3	4	6
B	6¾	7¾	10⅞
C	23½	23½	30¾
D	15⅞	21¼	27⅝
E	2⅛	2¼	3⅛
F	8¼	9⅜	13⅛
Wght./lb.	11	14	26
Exhaust Surface Area/IN²	294.4	344.0	636.4

(All dimensions in inches)

Patented

Air Motor Muffler

SINGLE CHAMBER



. . . WITH THE ALLIED WITAN ATOMUFFLER DESIGN FOR NOISE CONTROL

Stops Noise Before it Starts

Description—Page 1 **Noise Control Data—Page 2**

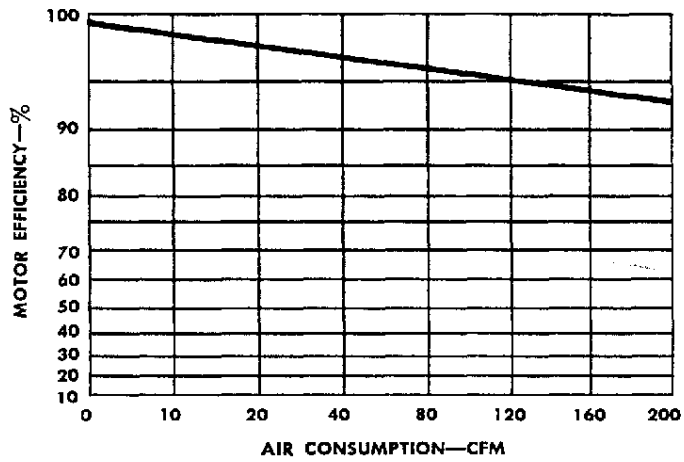
The EP Type 4-44 Series Muffler is particularly applicable for silencing the objectionable whine created by air motor exhausts.

Like other mufflers with the Atomuffler design for noise control, this 4-44 Series Air Motor Muffler is constructed with a unique obstruction-free expansion chamber, from which the exhaust air, at greatly reduced velocity, is softly and quietly dispersed through the extra large disseminator area provided by the perforated cylinder wall of the muffler.

With negligible mechanical impedance, the 4-44 Series Air Motor Muffler effectively eliminates the air exhaust noise, with little impairment of the air motor operating efficiency.

Ordinarily supplied with standard pipe thread connections for quick, direct attachment to the air exhaust port, Air Motor Mufflers can also be supplied, when specified, with special inlet fittings to fit your particular equipment.

Note: For use with air motor starters used on trucks, trailers and other vehicles, Air Starter Mufflers are specially constructed and assembled to withstand road vibration. To order, add suffix "AV" to part number of model required. Example: EP Type-4-44 Series Model M10-AV.



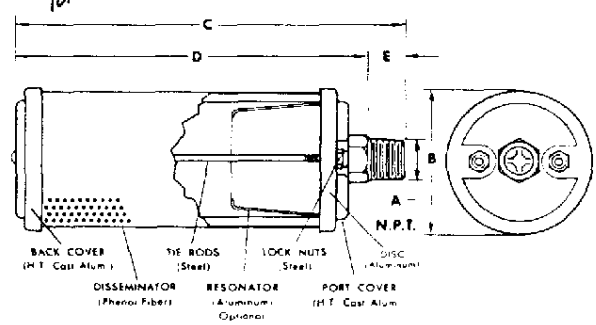
From Nix Supply Co.
Tulsa, Okla 74127

$14.05 10/2/78

EP TYPE 4-44 SERIES SPECIFICATIONS

Model	M01	M02	M00	M05	M07	M10	M12	M15	M20
A	⅛	¼	⅜	½	¾	1	1¼	1½	2
B	1⅞	1⅞	2⅝	3¼	3⅜	3⅞	3⅞	5⅛	5⅛
C	3	4	4¾	5½	6¾	8	8¼	13¼	18¼
D	2⅝	3½	4¼	5	6⅛	7¼	7¼	12	17
E	⅛	½	½	½	⅝	¾	1	1¼	1¼
Wght./lb.	.25	.31	.50	.62	.75	1.0	1.0	4.0	5.0
Exhaust Surface Area/IN²	4.6	7.1	12.2	16.9	24.1	31.8	39.9	79.5	119.3

(All dimensions in inches)



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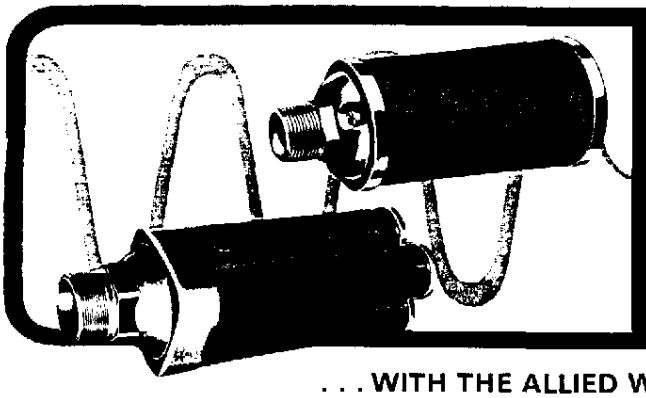


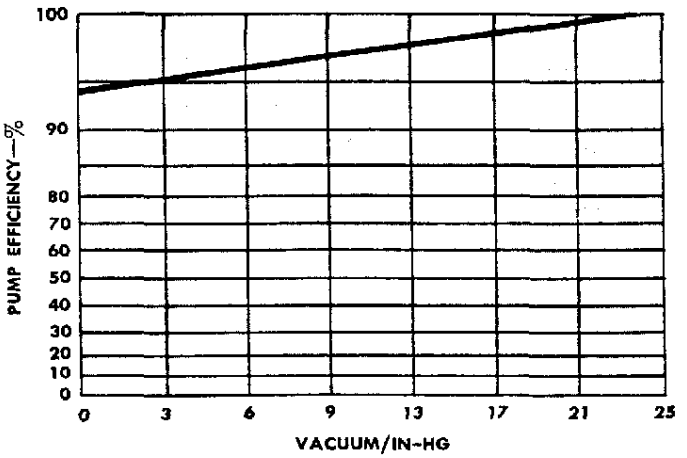
Vacuum Pump Muffler

VP TYPE

. . . WITH THE ALLIED WITAN ATOMUFFLER DESIGN FOR NOISE CONTROL

Stops Noise Before it Starts

Description—Page 1 **Noise Control Data—Page 2**

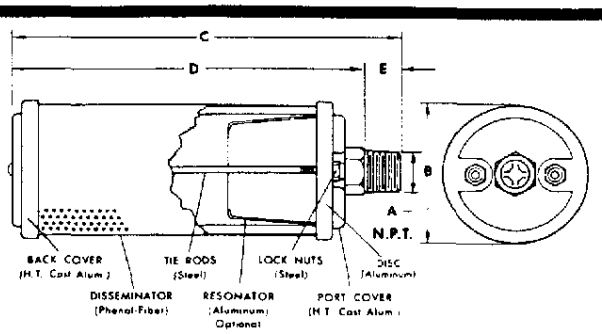


VP Type Mufflers are designed to muffle the annoying and distractive noise of vacuum pump exhausts. An efficient and inexpensive addition to your pump, they are recommended for expirators, suction apparatus, vacuum frames, chucks, simulation chambers, transfer and control devices—where quiet and efficient pump performance is essential.

Attenuation of the irritating exhaust pulsations is achieved by an obstruction-free expansion chamber, from which the exhaust air, at lowered velocity is softly dispersed through the openings in the large area cylinder wall disseminator of the muffler . . . free of noise and without causing mechanical impedance.

Mufflers are ordinarily supplied with standard pipe threads for direct connection to the exhaust port of the pump. Where required, they can also be supplied with special inlet fittings to fit your particular equipment. Constructed entirely with corrosion-resistant materials.

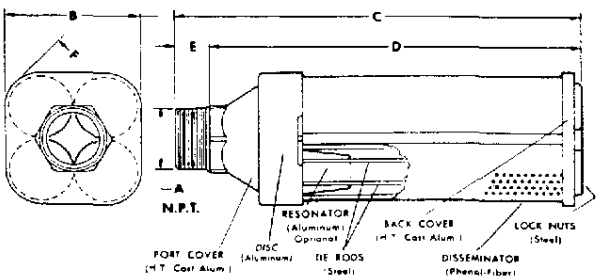
Note: For handling of extremely high vacuum applications, VP Type Mufflers will be furnished, when specified, with special heavy duty all metal cylinder wall disseminators.



VP TYPE 4-44 SERIES SPECIFICATIONS

Model	V01	V02	V00	V05	V07	V10	V12	V15	V20
A	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2
B	1 7/8	1 7/8	2 3/8	3 1/4	3 3/8	3 7/8	3 7/8	5 1/8	5 1/8
C	3	4	4 3/4	5 1/2	6 3/4	8	8 1/2	13 1/4	18 1/4
D	2 5/8	3 1/2	4 1/2	5	6 1/4	7 1/4	7 1/4	12	17
E	3/8	1/2	1/2	1/2	5/8	3/4	1	1 1/4	1 1/4
Wght./lb.	.25	.31	.50	.62	.75	1.0	1.0	4.0	5.0
Exhaust Surface Area/IN²	4.6	7.1	12.2	16.9	24.1	31.8	39.9	79.5	119.3

(All dimensions in inches)



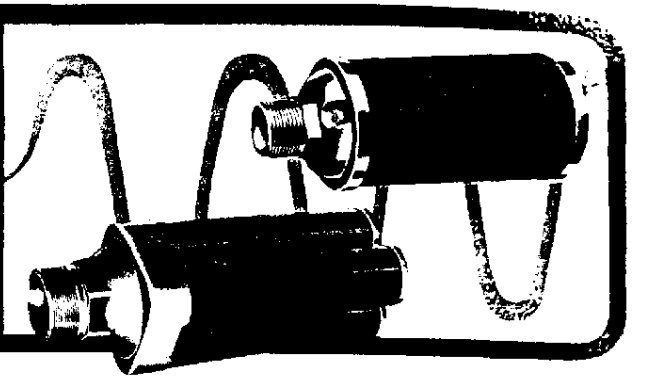
VP TYPE 4-A SERIES SPECIFICATIONS

Model	V30	V40	V60
A	3	4	6
B	6 3/4	7 3/4	10 7/8
C	23 1/2	23 1/2	30 3/4
D	15 7/8	21 1/4	27 5/8
E	2 1/8	2 1/4	3 1/8
F	8 1/4	9 1/8	13 1/8
Wght./lb.	11	14	26
Exhaust Surface Area/IN²	294.4	344.0	636.4

(All dimensions in inches)

Filter Silencer

FS TYPE



The FS Filter-Silencer is a highly efficient dual-stage filter plus an effective muffler for equipment such as compressor intakes, pressure blowers and pumps, reservoir vents, and gear housing breathers, used wherever it is essential that air be free of contamination.

FEATURE BENEFITS:

- Dual-stage depth filtration filters out extremely fine dirt particles.
- Excellent attenuation of noise for quieter operation.
- Performs equally well at high or low velocities.
- Simple and easy to service.
- Long service life.

Filter elements are designed for heavy duty and sized for high flow rates and continuous operation. Filter elements consist of two separate independent filters providing positive filtration and protection of vital equipment from damaging airborne dust.

Elements can be cleaned, if necessary, simply by detaching and immersing the entire Filter Silencer unit in any readily available solvent. Replacement filter elements for Filter Silencer units can be obtained from the factory.

SPECIAL APPLICATIONS

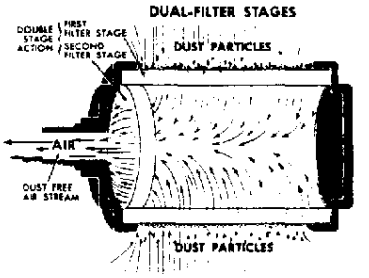
FS Filter Silencer . . . For Use As a "Dehydrator"

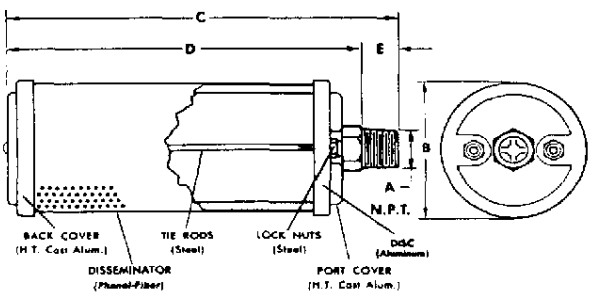
When required for removal of excessive moisture from the air, FS Filter Silencer units can be ordered complete with Adsorptive Agents (Desiccant, etc.) prepacked in Filter Silencer cylinder by the factory. Replacement supplies of Desiccant may also be ordered separately.

FS Filter Silencer . . . With Activated Carbon

To provide an inexpensive, effective method for protecting vital equipment from corrosive air contaminants, FS Filter Silencers are available with cylinders prepacked with Activated Carbon at the factory. Replacement supplies of Activated Carbon only also available separately.

Write to the factory for further details.

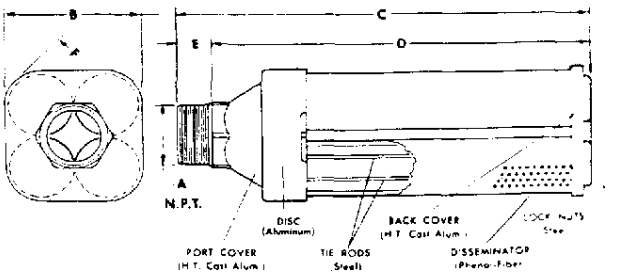




FS TYPE 4-44 SERIES SPECIFICATIONS

Model	F01	F02	F00	F05	F07	F10	F12	F15	F20
Flow Rate—CFM	6	9	16	61	69	81	139	205	345
A	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2
B	1 7/8	1 7/8	2 5/8	3 1/4	3 3/8	3 7/8	3 7/8	5 1/8	5 1/8
C	3	4	4 3/4	5 1/2	6 3/4	8	8 1/4	13 1/4	18 1/4
D	2 5/8	3 1/2	4 1/4	5	6 1/8	7 1/4	7 1/4	12	17
E	3/4	1/2	1/2	1/2	5/8	3/4	1	1 1/4	1 1/4
Wght./lb.	.25	.31	.50	.62	.75	1.0	1.0	4.0	6.0

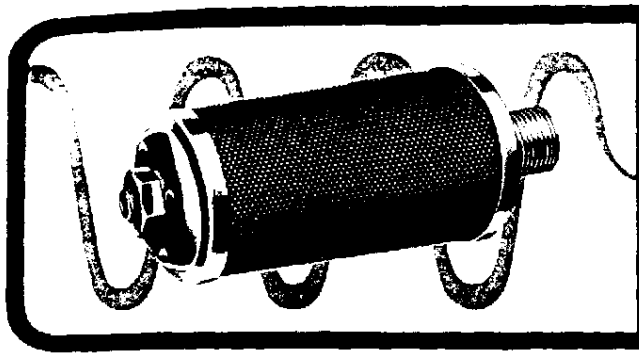
(All dimensions in inches)



FS TYPE 4-A SERIES SPECIFICATIONS

Model	F30	F40	F60
Flow Rate—CFM	670	750	950
A	3	4	6
B	6 3/4	7 3/4	10 7/8
C	23 1/2	23 1/2	30 3/4
D	15 7/8	21 1/4	27 5/8
E	2 1/8	2 1/4	3 5/8
F	8 1/4	9 3/8	13 1/8
Wght./lb.	11	14	26

(All dimensions in inches)



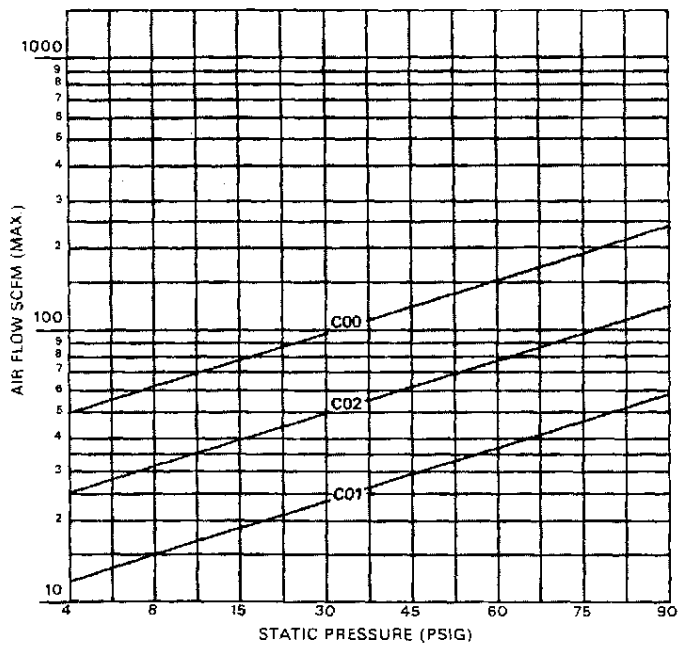
Speed Control Muffler

CS TYPE

. . . WITH THE ALLIED WITAN ATOMUFFLER DESIGN FOR NOISE CONTROL

Stops Noise Before it Starts

Description—Page 1 **Noise Control Data—Page 2**



Note: Ordinarily supplied with male pipe threads from ⅛" through ⅜ inches, CS Type Mufflers can also be satisfactorily used for pipe sizes larger than ⅜ inches. With ample capacity to regulate the flow of larger pipe sizes, the CS Type Model C00 Muffler (see table), with the use of a simple reducing bushing, can be quickly and easily installed into the exhaust port of the air operating valve.

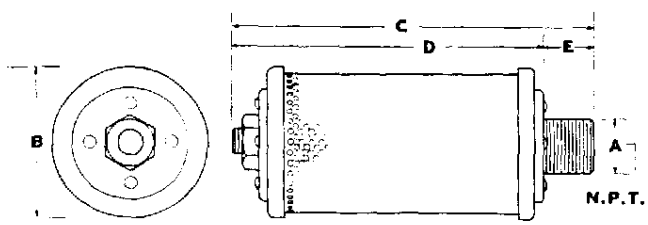
Inexpensive, and highly effective for eliminating air exhaust noise, the CS Type Speed Control Muffler provides the added feature of speed control for air operated devices.

Connected directly to the exhaust port of the air operating valve, CS Type Mufflers are extensively used to regulate cylinder or actuator speeds on welders, presses, riveters, stitching equipment, etc.—wherever it is desirable to regulate air flow for the control of cycle time, and to reduce wear and tear on the equipment.

Adjustment to the cylinder speed desired is accomplished by regulating the flow of exhaust air through the muffler, simply by turning an external adjustment screw which accurately varies the orifice opening of the muffler, from closed to full flow. Ample latitude provided by adjustment screw insures smooth even adjustment of air flow—makes it easy for operator to "zero in" to exact setting required. Securely locked at the required setting with a locknut, the adjustment screw cannot be removed or blown from the muffler.

Constructed with the Allied Witan Atomuffler design for noise control, the CS Type Muffler is provided with an expansion chamber completely free of obstructions, from which the exhaust air, at reduced velocity, is softly and quietly dispersed through the openings of the cylinder wall of the muffler—with nothing remaining of the high pitched noise often characteristic of metered air discharge applications.

CS TYPE SPECIFICATIONS

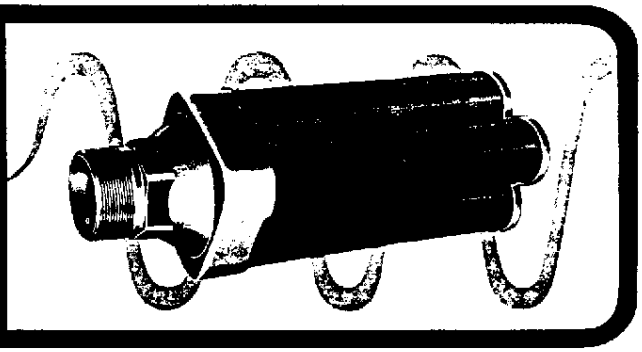


Model	C01	C02	C00
A	⅛	¼	⅜
B	1⅞	1⅞	2⅝
C	3	4	4¾
D	2⅝	3½	4¼
E	⅜	½	½
Wght./lb.	.31	.37	.56

(All dimensions in inches)

Steam Exhaust Muffler

SM TYPE



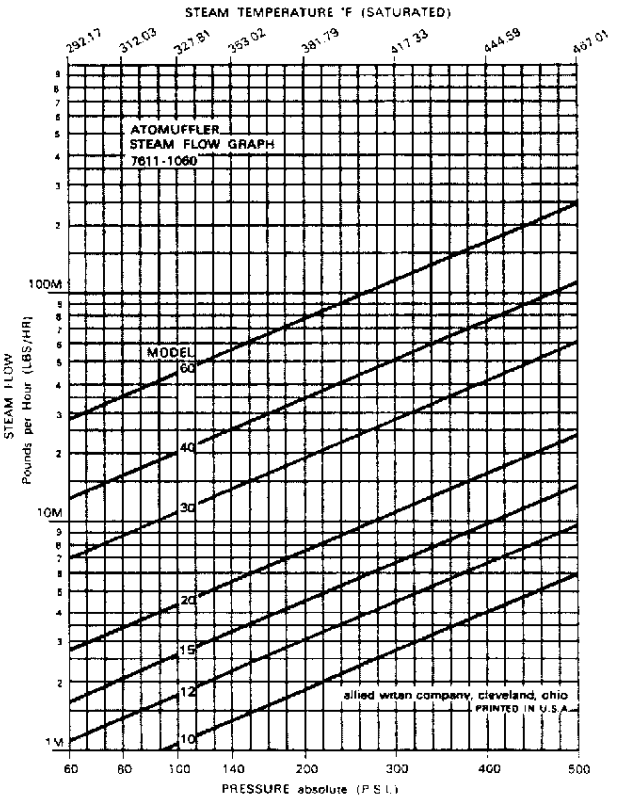
Low in cost, compact, lightweight and easy to handle, SM Type Mufflers effectively silence the annoying and objectionable noise created by steam exhaust outlets.

Unlike other mufflers for steam exhaust service, they are constructed with expansion chambers completely free of obstructions, in which the exhaust steam is expanded, then disseminated at reduced velocity through the perforated cylinder wall openings of the muffler–without noise, and with negligible mechanical impedance.

As an additional safeguard for meeting the requirements of unusually demanding applications, SM Mufflers are supplied with heavy duty metal cylinder wall disseminators for successfully combating the otherwise potentially damaging effects of high flow rate and temperatures up to 1000° Fahrenheit.

Constructed of corrosion resistant materials and treated with a special coating for resistance to conditions where alkalis could be a problem.

For quick, direct connection to steam exhaust ports, SM Mufflers are supplied with standard pipe thread connections in a full range of sizes from 1 to 6 inches.

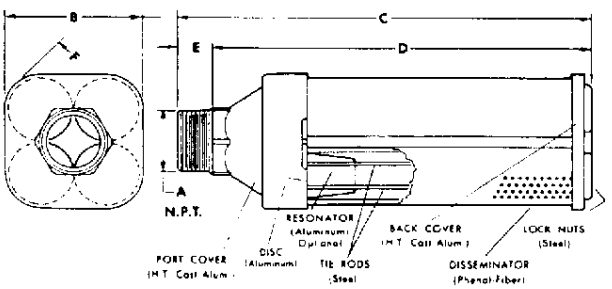


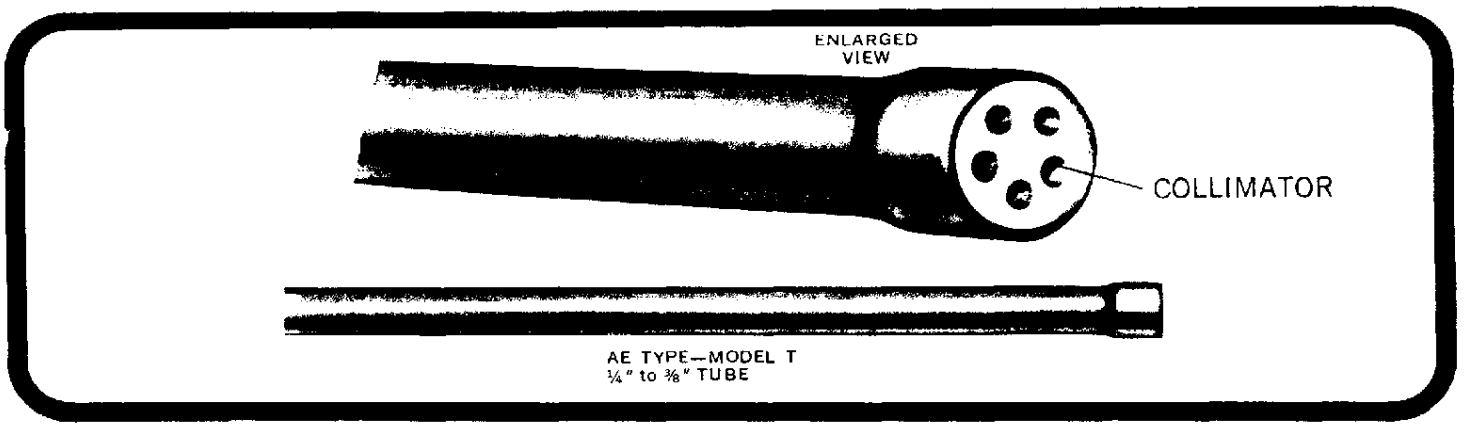
ALLIED WITAN COMPANY
13805 PROGRESS PARKWAY
CLEVELAND, OHIO 44133

SM TYPE SPECIFICATIONS

Model	S10	S12	S15	S20	S30	S40	S60
A	1	1¼	1½	2	3	4	6
B	3⅞	3⅞	5⅛	5⅛	6¾	7¾	10⅞
C	8	8¼	13¼	18¼	23½	23½	30¾
D	7¼	7¼	12	17	15⅞	21¼	27⅞
E	¾	1	1¼	1¼	2⅛	2¼	3⅛
F					8¼	9⅜	13¼
Wght./lb.	1	1	4	5	11	14	26
Exhaust Surface Area/IN²	31.8	39.9	79.5	119.3	294.4	344.0	636.4

(All dimensions in inches)





Tube Type Air Ejector Muffler

AE TYPE — MODEL T

Pinpoints Highly Concentrated Air Stream for Noise-Free Parts Ejection

Units are made with the unique air savings collimator muffler insert mounted in a tube. Permanently installed in a 12" length of copper tubing, the collimator accurately directs a highly concentrated and intensified air stream to the exact point required.

Uses less air to do the job—*as much as 75% less.* Drastically cuts air consumption and operating cost. Reduces noise level well below OSHA requirements.

Easily bent, the tube may be cut to any desired length and positioned to suit set-up. Makes it easy to get into even extremely tight quarters.

Supplied with either ¼" or ⅜" tubing. Can be quickly connected to air line with standard tube fittings.

SPECIFICATIONS
AE TYPE — MODEL T

MODEL	T28	T38
Tube Diameter	¼	⅜
Overall Length	12	12

Air Ejector Collimator Muffler Insert

AE TYPE — MODEL I

For Direct Installation into Air Hole Outlets of Dies, Molds, and Other Equipment.

Used for Air Ejection, Eduction, Blow-offs, Wipes and Air Cleaning.

These collimator muffler inserts are used where it is necessary to drill air holes directly into the equipment. Provides a highly concentrated air stream with intensified thrust for effective noise-free ejection.

They can be easily installed directly into the air hole outlet, merely by drilling or reaming the proper hole size to accommodate the collimator muffler insert.

SPECIFICATIONS AE TYPE — MODEL I

MODEL	I08	I18	I28	I38	I48	I68	I88
Diameter	⊥	13/32	17/32	21/32	53/64	1 1/64	1 1/4
Length	⊥	13/32	15/32	9/16	5/8	23/32	13/16

Allied Witan Company • 13805 Progress Parkway • Cleveland, Ohio 44133

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