ALLIED INTERNATIONAL
CORPORATION

ACOUSTIC DIVISION

PRODUCTS AND SERVICES

Bulletin AC-1

ALLIED INTERNATIONAL CORPORATION

ACOUSTIC DIVISION

Expertise In Aerospace and Industrial Acoustic Attenuation

Allied International Corporation, specializing in acoustic attenuation, has been serving its customers in the United States, Europe, and the Far East for over 50 years. The Acoustic Division offers a complete line of acoustic products and services to help our customers solve the most demanding noise problems.

AEROSPACE APPLICATIONS

- Engine Inlets
- Engine Exhausts
- APU Inlets
- APU Exhausts
- ECU Ducts
- Bleed Air Exhausts
- Cooling Systems
- Diffusers
- Ram Air Systems

INDUSTRIAL APPLICATIONS

- Fans
- Ducts
- Air Compressors
- Mufflers
- In-line Silencers
- Moving Machinery
- Exhaust Vents
- Inlet Silencers
- Stacks

TRANSPORTATION APPLICATIONS

- Shipping / Naval
- High Speed Rail
- Locomotive
- Trucking
- Automobile
- Motorcycle
- All Terrain Vehicle
- Construction Equipment
- Mining Equipment

Allied International Also Performs These Services

- Measurement and analysis of noise source
- Isolation and identification of sources
- Treatment recommendations based on requirements of noise spectra, operating environment, weight, material costs, etc.
- Design and production of prototypes

RECTANGULAR
ECS SILENCER

BLEED AIR
ACOUSTIC SPLITTER

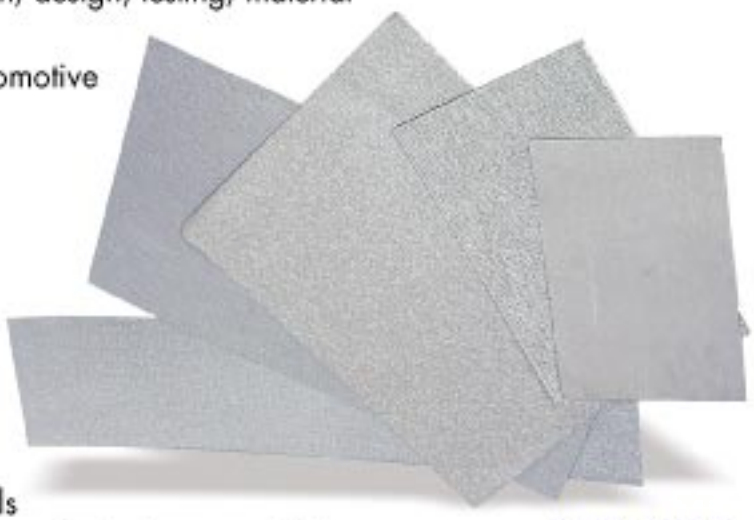
- Production of completed assemblies and subassemblies
- Installation of materials
- Testing and consulting

Allied International specializes in solutions customized to our client's needs. We take a comprehensive approach to problem analysis and treatment. Although most solutions share common elements, we always tailor our design and service to suit a customer's particular requirements.

ALLIED INTERNATIONAL ADVANTAGES

The Marketing and Engineering staff at Allied International has over 100 years of combined experience designing, manufacturing, and selling acoustic materials and assemblies. We offer a full complement of acoustic products and services, and strive to supply highly effective solutions at the lowest possible cost. We specialize in difficult applications where heat, corrosion, size, and weight are primary concerns. Using Allied International as your noise control solution provider offers the following advantages:

- Complete noise control solution including evaluation, design, testing, material supply, prototypes, and production
- Extensive aerospace, industrial, marine, and automotive noise control experience
- Passive and active noise control products
- "Off the shelf" and custom designed products ensuring the best value
- Metal fiber acoustic duct design using proprietary computer software
- Rapid design and prototype development
- Custom designed metal fiber acoustic materials for the most demanding applications
- Expertise in welding metal fiber acoustic materials
- Strategic partnerships providing state of the art manufacturing capabilities
- International marketing organization providing worldwide customer support



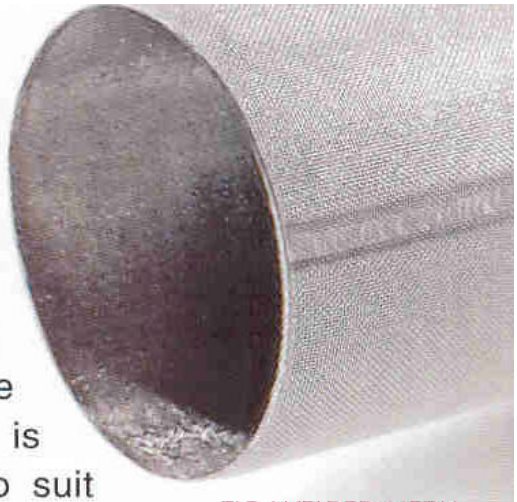
METAL FIBER ACOUSTIC PRODUCTS

STANDARD METAL FIBER ACOUSTIC PRODUCTS

SPECIFICATIONS	NOMINAL FLOW RESISTANCE (cgs Rayls)	ALLOY	SUPPORT	THICKNESS (inch)	NOMINAL AREA DENSITY (lb/ft^2)	NORMAL MINIMUM TENSILE STRENGTH (psi)	TYPICAL NON-LINEARITY FACTOR
AIC-1	35	434 SS	50 MESH/1 SIDE	0.045+/-0.006	0.67	6000	2.0
AIC-2	75	316L SS	60 MESH/1 SIDE	0.018+/-0.005	0.32	4000	1.6
AIC-3	35	FECRALY	18 MESH/2 SIDES	0.035+/-0.005	0.32	7000	2.0
AIC-4	30	316L SS	60 MESH/1 SIDE	0.018+/-0.005	0.30	4000	1.4
AIC-5	27	316L SS	18 MESH/1 SIDE	0.018+/-0.005	0.15	3200	1.5
AIC-6	35	316L SS	30% PERF/1 SIDE	0.023+/-0.006	0.62	20,000	1.4
AIC-7	35	316L SS	32% PERF/1 SIDE	0.025+/-0.005	0.83	20,000	1.4
AIC-8	30	316L SS	48 MESH/1 SIDE	0.014+/-0.005	0.14	3200	1.4
AIC-9	70	316L SS	18 MESH/2 SIDES	0.017+/-0.005	0.27	6500	1.6
AIC-10	10	316L SS	18 MESH/2 SIDES	0.040+/-0.005	0.79	6000	2.1

METAL FIBER ACOUSTIC PRODUCTS

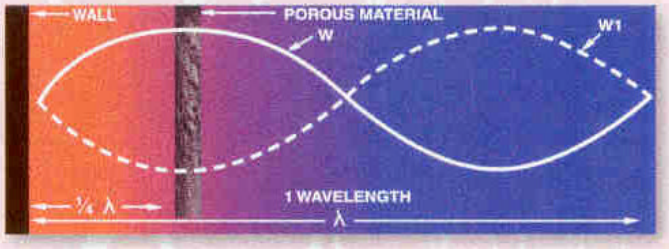
Allied International's acoustic face sheets are engineered, porous materials made by sinter bonding randomly oriented fine metal fibers. Fiber size, porosity, and thickness of the product are closely controlled to obtain desired flow resistance and mechanical properties. To enhance structural properties the fiber metal sheet may be reinforced with wire mesh or perforated plate. Photograph of typical product is shown to the right. Sheet properties can be tailored to suit specific applications.



TIG WELDED METAL FIBERLINER

HOW METAL FIBER ACOUSTIC SHEET ABSORBS SOUND

Metal fiber silencers all use the same treatment concept. The duct walls are made of porous metal that is supported by a spacing arrangement from a solid wall. The duct cross sectional dimensions, the fiber metal, and the depth of this spacing arrangement constitute a tuned system that is broadly effective in a desired frequency band. The overall effectiveness of the treatment depends on this tuning and the surface area of the duct that is treated. The treatment may be varied in different areas of the duct to broaden the overall tuning.



The figure above shows the particle velocity, W and W1, of a standing sound wave with wavelength λ. Maximum molecular movement occurs at approximately ¼ λ.

In tuning the duct liner, fiber metal is particularly effective for those frequencies that have standing wavelengths (λ) that match the duct cross sectional dimensions. The fiber metal is placed at the position of the maximum particle velocity of the standing wave. Friction from the movement of molecules through the porous material will convert sound energy to heat thereby reducing sound intensity. This reduction is highest if the porous material is placed where the air molecular movement is at a maximum.

The absorption of sound by fiber metal is greatest when its acoustical impedance (flow resistance) matches the impedance of air in the duct. If the impedance is too high, the material reflects the sound wave, as would a solid wall. If it is too low the sound wave freely travels through the material. In either case the sound attenuation is lower than maximum. When properly specified, the normal incidence absorption coefficient for fiber metal acoustic media is typically in the range of 0.80 to 0.95, with 1.00 being an ideal absorber.

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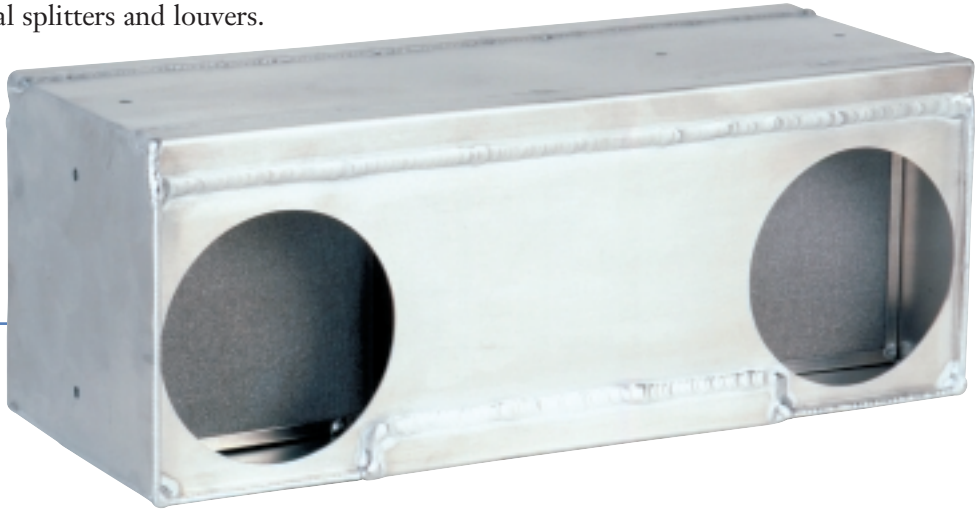
Acoustic Attenuation Solutions for the Aviation Industry

Allied International Corporation's Acoustic Engineering Division specializes in the engineering, design, test and manufacture of passive acoustical devices. Allied has developed a low-cost resistive acoustical media, AIC-1. AIC-1 is a vacuum sintered stainless steel media that has demonstrated superior acoustical performance compared to other, higher-cost, acoustical media. Manufactured products include welded liners, bleed air silencers, fabricated circular and rectangular silencers, acoustical splitters and louvers.

Allied International AIC-1 acoustical media offers distinct advantages over other acoustic media in a wide spectrum of aviation applications, such as high and low pressure ECS ducting, APU inlets and exhausts, nacelles and fan ducts and any limited space application.



Learjet 45 ECS low pressure cockpit and cabin silencer. Note that one silencer accommodates flow to cockpit and cabin, effectively combining two silencers in one unit.

Services and Solutions for Airframe Manufacturers, OEMs and Modification Facilities

Allied International takes the trial and error out of complete acoustic attenuation solutions for airframe and equipment manufacturers and aircraft modification facilities. Allied understands that acoustic problems typically become apparent well after aircraft/interior design finalization and, usually, late in the certification or approval/customer acceptance process. Remedies must be developed rapidly and within significant dimensional and weight constraints. Allied offers total customer support in the rapid development of cost-effective solutions while maintaining the highest level of quality assurance. *Services include:*

- Noise measurement and analysis
- Source isolation and identification
- Solution modeling
- Treatment recommendations
- Static acoustical testing of design concepts
- Prototype design and fabrication
- Manufacture of subassemblies or complete assemblies

Allied also supplies AIC-1 material stock in a wide range of configurations for various applications.

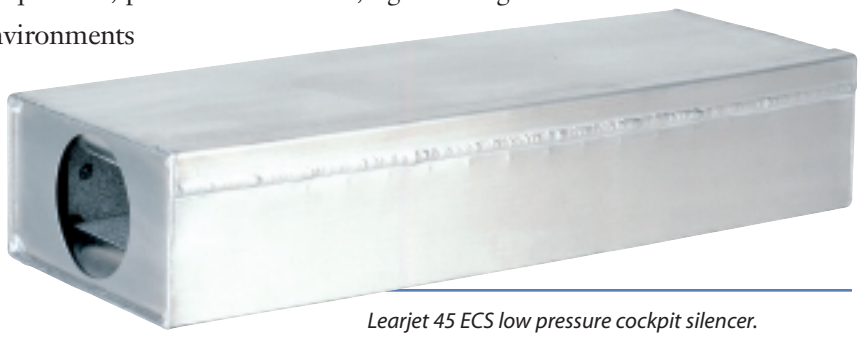
AIC-1 Advantages

Allied International's AIC-1 offers a number of strong advantages over other sound-absorbing materials in aviation applications. It is more effective in attenuating high frequencies than perforated metal plate and is far more durable and maintainable than most absorbent materials.

Learjet 45 high pressure cabin ECS silencer. Note the extremely compact form factor for a high pressure silencer.

Allied International AIC-1 Resistive Acoustic Media

- Vacuum-sintered stainless steel
- Easily fabricated into conical, circular or rectangular configurations
- Exceptional performance, especially at higher frequencies, permits smaller size, lighter weight
- Withstands high-temperature, high-moisture environments
- Exceptional corrosion and erosion resistance
- Low pressure drop (Δp) in silencer applications
- Non-absorptive—easily cleaned and sanitized
- Non-flammable
- Cost-competitive



Learjet 45 ECS low pressure cockpit silencer.

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