CAST & EXTRUDED SHEET

Altuglas® EX and CN SRD

Acrylic sheet for acoustic barriers

Altuglas®

ALTUGLAS INTERNATIONAL
ARKEMA GROUP

INTRODUCTION

THE ALTUGLAS® BRAND NAME

Altuglas® is the registered trademark of Altuglas International for its polymethylmethacrylate (PMMA) products of all types: cast and extruded sheet, bath and shower products, granules for injection and extrusion, extruded tubes, glues and other products.

GENERAL PROPERTIES OF ALTUGLAS®

Altuglas® acrylic sheet is a thermoplastic, rigid and transparent material that has exceptional resistance to weathering and ageing.

Its properties of lightness, transparency, resistance to chemicals and sound insulation, together with its ease of machining and forming, make it the plastic material most specified by architects and town planners in designing transparent noise barriers.

ALTUGLAS® AND NOISE

Noise is increasingly considered to be a major nuisance, against which local authorities and town planners seek to protect residents. To restrict noise levels from traffic in towns, new projects make provision for putting expressways and urban motorways with embankments and / or covers.

When cuttings prove impossible, or when renovating an existing infrastructure, noise limitation requires installation of acoustic barriers between traffic routes and residential areas.

Road traffic is not the only cause of noise problems. Rail traffic, in particular high-speed trains, poses similar problems.

Other noise, unconnected with transport, can also be a nuisance to residents nearby and may require installation of acoustic barriers.

Altuglas® SRD meets the stringent requirements of noise abatement and has become the material of choice for designers, who are increasingly using transparent noise barriers.

Anti-dazzle protection has become a growing concern in road safety. To meet this requirement, Altuglas International can offer its Altuglas® Satin (single- or double-sided) and Altuglas® Frosted ranges.

ALTUGLAS® SRD SHEET

PROPERTIES OF ALTUGLAS® SRD

Altuglas® SRD sheet offers the following special advantages:

- Exceptional acoustic insulation.
- Maximum light transmission.
- Outstanding stability: high sheet rigidity makes low flexing possible.
- Excellent resistance to weathering, UV rays and corrosion: no yellowing or weakening.
- Excellent resistance to impact and stone chipping.
- Very easy maintenance: being non-porous, sheets can easily be washed with water or aqueous surface cleaning solutions. Altuglas® EX and CN SRD are resistant to solvents, thus allowing removal of graffiti. They also withstand gravel.
- Good fire resistance.

Altuglas® SRD is wholly recyclable.

THE RANGE

There are two types of Altuglas® SRD sheet:

- Extruded: Altuglas® EX SRD
- Cast: Altuglas® CN SRD

Both surfaces are protected by polyethylene film.

	Altuglas® EX SRD	Altuglas® CN SRD
Standard format	3050 x 2050 mm	3000 x 2000 mm
Thickness	15, 20 and 25 mm	15 and 20 mm
Colours		
. Clear	247.10000	193.10000
. Aqua Look	247.13032	193.13032
. Green	247.14018	193.14018
. Glass Look	247.14032	193.14032

In addition to these standard products, 3 special anti- dazzle products are available:

- **Altuglas® Frosted 248.10000 and 248.14032**: two matt non-reflective surfaces,
- **Altuglas® Dual Satin 138.10000 and 138.14032**: two matt non-reflective surfaces,
- **Altuglas® Mono Satin 136.10000**: a single matt non-reflective surface.

Also available to order, subject to minimum quantities:

- Sheets cut to special sizes,
- For Altuglas® EX SRD: sheets in widths up to 2700 mm,
- For Altuglas® EX SRD: sheets in special lengths up to 6 m; beyond that, contact Altuglas International Sales Department,
- Special colours.

For further information, see the Product Catalogue or contact Altuglas International Sales Department.

APPLICATIONS

The main fields of application for Altuglas® SRD are:

- Transparent acoustic barriers for road, motorway and railway networks,
- Public safety in stadiums and sports facilities,
- Airports,
- Protection for firing ranges,
- Acoustic insulation for machinery,
- Industries requiring noise barriers,
- Architecture and town planning,
- Special glazing.

PRODUCT PROPERTIES

TECHNICAL SPECIFICATIONS

The table below gives typical specifications(1) for Altuglas® SRD sheet.

Characteristics		Test standard	Unit	Altuglas® EX SRD	Altuglas® CN SRD
Poisson coefficient		ISO 1183 - DIN 53479		0.35	0.35
Density			g/cm³	1.19	1.19
Noise abatement (DL R)	15 mm	EN 1793-2	dB	30	30
	20 mm			32	32
	25 mm			33	33
Noise abatement (R w)	15 mm	ISO 717-1	dB	31	31
	20 mm			33	33
	25 mm			35	35
Light transmission		ASTM D1003 - DIN 5036	%	92	92
Tensile strength		ISO 527 - DIN 53455	MPa	75	76
Bending strength		ISO 178 - DIN 53452	MPa	110	130
Modulus of bending elasticity		ISO 178 - DIN 53452	MPa	3250	3250
Charpy impact test, unotched		ISO 179/2D - DIN 53453	KJ/m²	11	12
Vicat B softening temperature		ISO 306 - DIN 53460	°C	111	120
Coefficient of linear expansion			mm/m/°C	0.065	0.065
Yellowing index (After 1,000 h. Xenon test to ISO 4892)		ASTM D 1925		+1	+0.7

(1) Values given in the table above are typical manufacturing values and must not be taken as guaranted minimum values.

IMPACT RESISTANCE

Altuglas® SRD sheet meets all impact tests prescribed by European standards for road and motorway noise barriers.

It is also resistant to shots from a .22 LR rifle using the following ammunition:

- Low charge, short range, RWS type Z,
- High velocity, long range (2400 m), Winchester type Super X.

DIMENSIONAL SPECIFICATIONS

Altuglas® SRD is manufactured to ISO 7823-1/2 with the following tolerances:

- Thickness: ± 5% for Altuglas® EX SRD and ± 10% for Altuglas® CN SRD.

TECHNICAL SPECIFICATIONS

LIMITING DEFORMATION VALUE UNDER LOAD

In general, current standards specify a limiting deformation value under load (sag) for panels used as noise barriers.

An essential value to be taken into account in determining the size of sheets, in addition to maximum permissible sag, is the maximum allowable stress (σ_{eqv}) for the material.

When using Altuglas® SRD, this value which takes account of the dynamic fatigue strength of the material, must not exceed **7 to 10 MPa**.

GUARANTEE

The essential properties of Altuglas® SRD sheet for noise barriers (light transmission, tensile strength and flexing modulus of elasticity) are guaranteed for 15 years:

Minimum guaranteed values after 15 years are:

- Light transmission: 87%
- Yellowing index: maximum 7
- Modulus of elasticity: 2700 MPa

COMPLIANCE WITH STANDARDS & ALTUGLAS® SRD CERTIFICATIONS

Altuglas® EX SRD and CN SRD sheet meet the following European standards:

- EN 1793, EN 1794, EN 14388 and EN 14389
- Germany: ZTV/Lsw '88

Altuglas International plants producing Altuglas® SRD sheet have been certified to ISO 9002.

Copies of certificates are available on request.

For further information, please contact Altuglas International Technical Services.

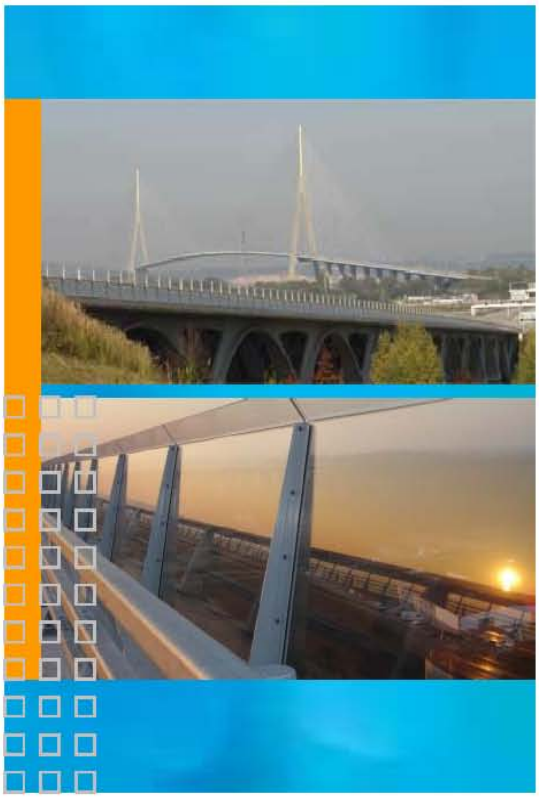
BIRD SAFETY

Acrylic sheets are highly transparent. This property, while highly desirable for the aesthetic aspects of Altuglas® barriers, is a real danger to birds, whose field of view does not enable them to see the sheets.

Several solutions to this problem are available:

- Use of coloured transparent sheets,
- Creation of visible bands by sanding, milling or screen-printing,
- Application of adhesive strips or decoration.

Certain devices providing protection against falling debris (such as metal mesh) also allow birds to identify obstacles better.



TECHNICAL SUPPORT

Altuglas International has a technical service comprising specialists equipped with the latest professional CAD software. These tools can be used to optimize the technical details of materials to be used, in accordance with constraints imposed by the designer.

MACHINING

Altuglas® EX SRD and CN SRD sheet is machined exactly as described in the Altuglas® CN/EX Technical Brochure.

Given the thickness of the sheet, excessive overheating during machining could cause some melting of the material.

It is strongly recommended, therefore, that tools be well sharpened and used with suitable cooling.

Cutting and drilling

Use tools identical to those for wood or light metal.

- Band-saw or portable saw with special or fine_toothed blades and, for very accurate sawing, a circular saw with blades having carbide-tipped teeth.
- Standard router with a high-speed head, fitted with a twin-toothed high-speed steel or tungsten carbide cutter.
- Drill fitted with a twist-drill bit for metal.

Cold bending

Cold bending in a single plane is possible, down to a minimum radius of 300 times the sheet thickness. This method of bending is economical and improves rigidity of the barrier.

Hot bending

Both surfaces of the sheet must be heated for bending.

The heated area should not be less than five times the sheet thickness.

Unlike Altuglas® CN SRD, no force should be applied to Altuglas® EX SRD during hot bending; simply let the material flow to the shape of the template under its own weight.

Forming

Forming is an operation requiring the whole sheet to be heated. This should be carried out in accordance with guidelines set out in the Altuglas® CN/EX Technical Brochure.

Sheets may be formed in a mould (hot moulding), or thermoformed by blow-moulding, vacuum moulding or mechanically using thermostatic moulds at 70 - 75°C for EX or at 80 - 85°C for CN. Avoid any sudden cooling.

GUIDELINES FOR USE

GENERAL

Where possible, it is advisable to adapt barrier dimensions to the standard Altuglas® EX and CN SRD sheet format, to limit wastage and avoid cutting operations on site.

In some cases, our very long Altuglas® EX SRD sheets make it possible to reduce installation costs significantly.

Where supported vertically, the sheet must not exceed the height of the supporting sections, in order to limit flexing of the sheet.

Hot bending of the upper edge can avoid the need to provide an upper flange for the framework.

For barriers installed on bridges, viaducts, flyovers or close to pedestrian crossings, road intersections or public places, a protective device against debris impact is generally required.

Installation of Altuglas® SRD sheet as acoustic barriers is generally achieved by:

- Factory mounting the sheet in a lined aluminium, stainless steel or galvanized steel section, subsequently inserted into the retaining structure on site,
- Flush fitting or directly mounting on metal, concrete or wooden elements on site.

(The first of these solutions allows assembly of the sheets in large modules. While slightly more expensive, it considerably reduces the time to install the barrier on site.)

RECOMMENDATIONS

It is essential to avoid deformation of sheets, breakage or displacement from their supporting structures.

To ensure this, the following recommendations must be observed:

- Use side mountings of an appropriate width, with fairly deep rebates of approximately

  50 - 60 mm.

  A 30 mm rebate depth is generally sufficient for the lower fixings.

The depth of the rebate should take account of:

- Waterproof joint thickness,
- The tolerance required to allow for thermal shrinkage of the sheet and absorption of moisture,
- Sheet dimensions and dimensional tolerances,
- Squeezing of sheets due to sagging,
- Errors in centring sheets during installation,
- A safety margin to avoid sheets coming out under loading.

The rebate width depends on the sheet thickness and joints used.

Select the right sheet size, taking account of manufacturing tolerances (-0, +3 mm per linear meter [(2)]) as well as thermal expansion, which for a generally assumed temperature swing of 40 °C causes a change in dimension of 3 mm per linear meter; to this must be added absorption of ambient humidity, which increases the value to 4 mm per linear meter. This value must be increased further if greater temperature variations are encountered in the region concerned.

[(2)] The dimensional tolerance is lower for cut sheet (-0, +2 mm, whatever the dimension).

MOUNTING

Example of correct sheet sizing, as a function of the spacing between posts (steps of 3000 mm):

L_{max} = P - [ep + ej + tol + dt]

Maximum width of sheet: (L_{max})

Spacing between posts: 3000 mm (P)

- Thickness of the central part of the HE 160A section: 8 mm (ep)
- Joint thickness x 2: 11 mm (ej)
- Maximum dimensional tolerance for the sheet: 9 mm (tol)
- Allowance for thermal expansion: 12 mm (dt)

L_{max} = 3000 – [8+11+9+12] = 2960 mm

Recommended width: 2955/2960 mm

MOUNTING

Insert U-shaped EPDM rubber seals between the sheets and metal sections or rebates in the mountings. Their dimensions should be appropriate for the thickness of the sheets concerned, protecting the edges and allowing them to slide.

To avoid any risk of using seals that are incompatible with PMMA, it is recommended that you consult Altuglas International Sales Department or your local distributor.

Restrict the clamping force. It should be sufficient to ensure a seal but must not prevent sheets from sliding.

Avoid any form of mounting that requires sheets to be drilled and bolted. If exceptionally bolts are used, they must not be located at the edges of sheets (minimum distance from the edge 100 mm).

Any such holes must be oversize, to allow movement due to thermal expansion or contraction. Insert two cylindrical T-shaped half-rings (made of EPDM rubber or Teflon) for optimum adjustment of clamping pressure.

CLEANING

Transparent acrylic sheet has a particularly smooth surface, which is self-cleaning in the rain when appropriately inclined.

Nevertheless, certain types of dirt may be more difficult to remove, such as soot, combustion products, herbicides and certain plant-care products, which may be deposited on the sheets. They may be cleaned off simply with a high-pressure jet of water, possibly with the addition of a surfactant.

REMOVAL OF GRAFFITI

Many items of public property and public places are targeted by " taggers", special attention being paid to transparent surfaces.

The majority of the paints and aerosols used contain aggressive solvents that can damage the sheet surface by altering its gloss and transparency.

To remove graffiti, it is normally necessary to use powerful solvents, contact time increasing with the age of the graffiti. There is a considerable risk of altering the optical properties of the sheet, therefore.

One way of resolving the problem is to apply special products that create an invisible barrier with anti-adhesive and water-resistant properties. Such a film does not prevent flyposting or graffiti, but makes removal easier.

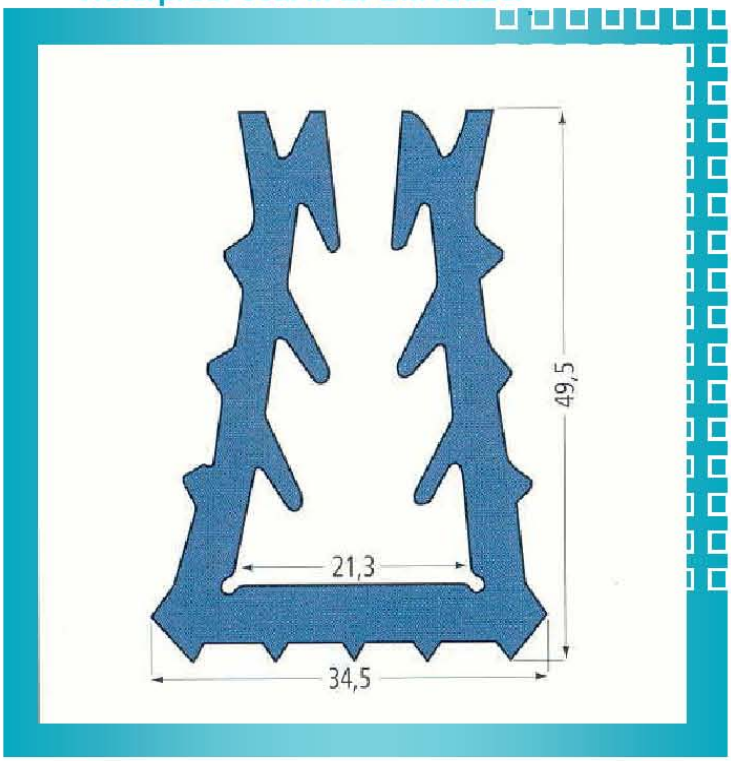
It is advisable that products for removing graffiti should only be used with great caution on PMMA.

In particular, we recommend that:

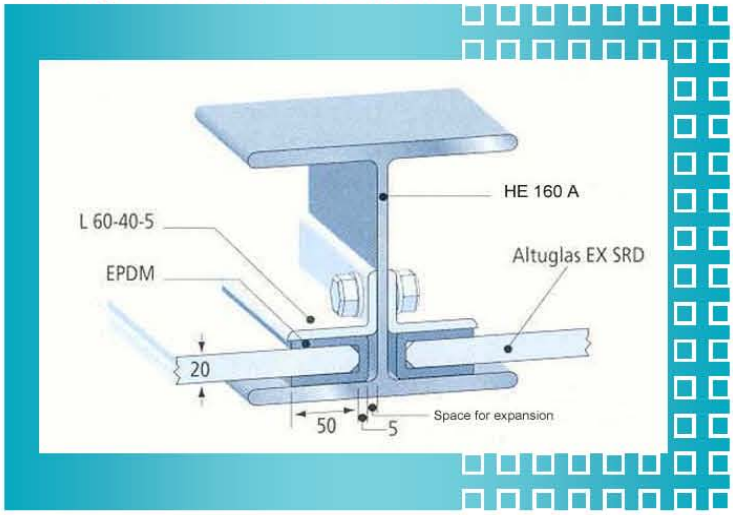
- General-purpose products should not be used,
- The supplier or manufacturer should always be asked for a certificate of compatibility with PMMA,
- For sheets that are cold bent, folded, hot bent or thermoformed, the product should first be tested on a sample panel; insist on a guarantee before application to bent or thermoformed sheets. The reason is that internal stresses (which may be caused by stresses during the forming processes) may be released due to the action of cleaning solvents, causing crazing or even local cracking of sheets.

EXAMPLES OF MOUNTINGS

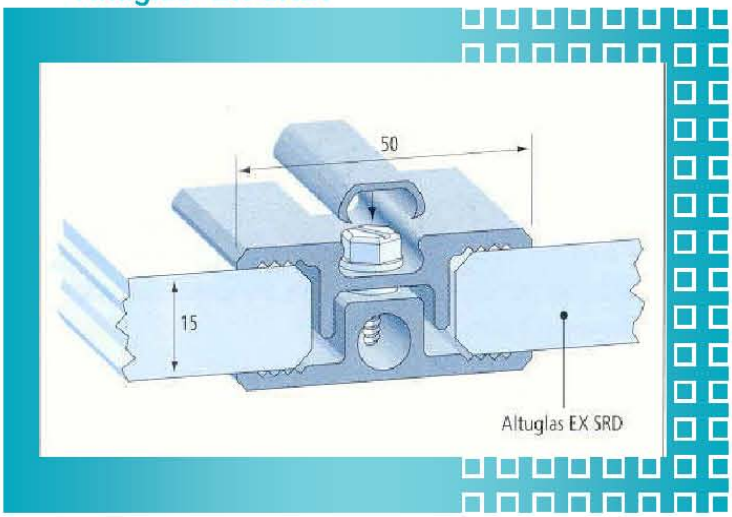
Waterproof seal in EPDM rubber



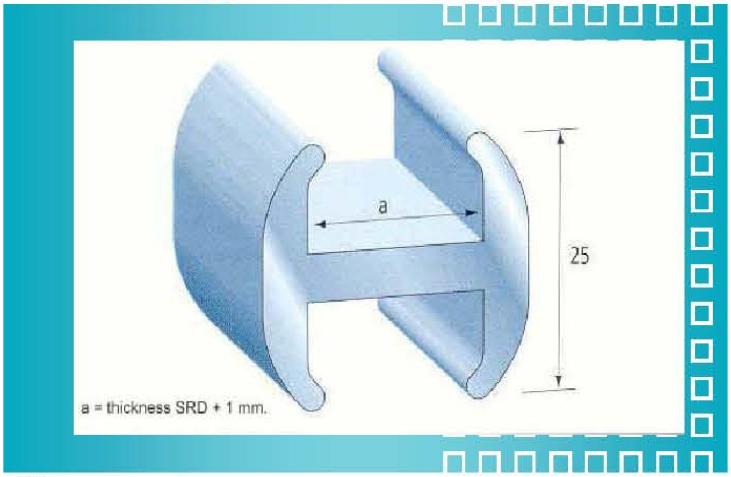
Example of barriers mounted in a steel structure



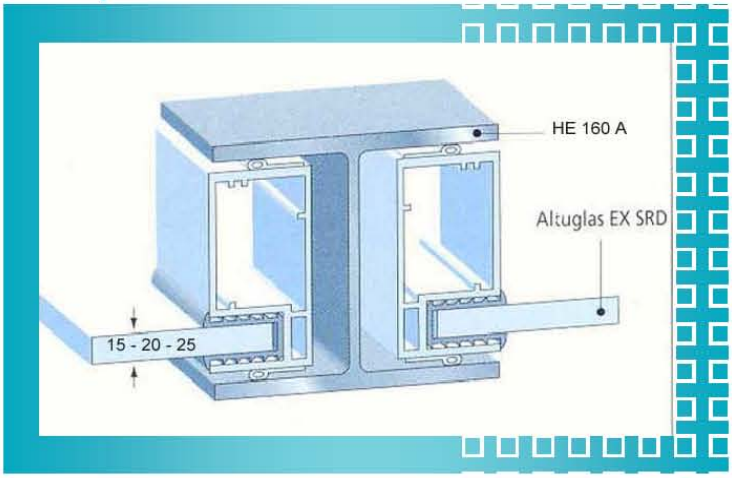
Example of split clamp in aluminium for Altuglas® EX SRD.



Assembly joint in EPDM rubber

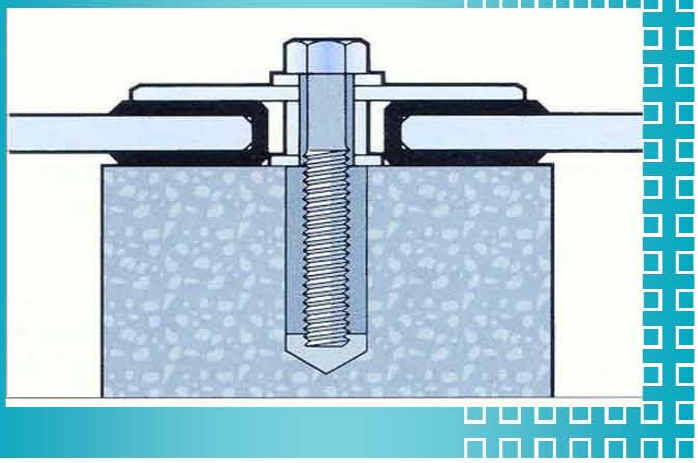


Example of barriers mounted in a steel structure

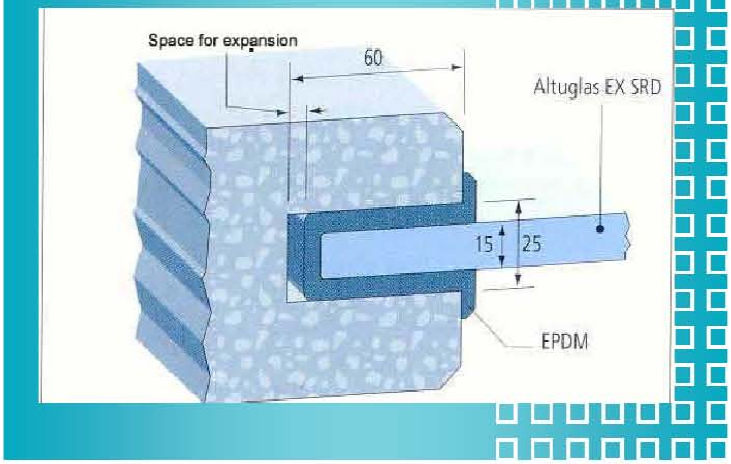


EXAMPLES OF MOUNTINGS

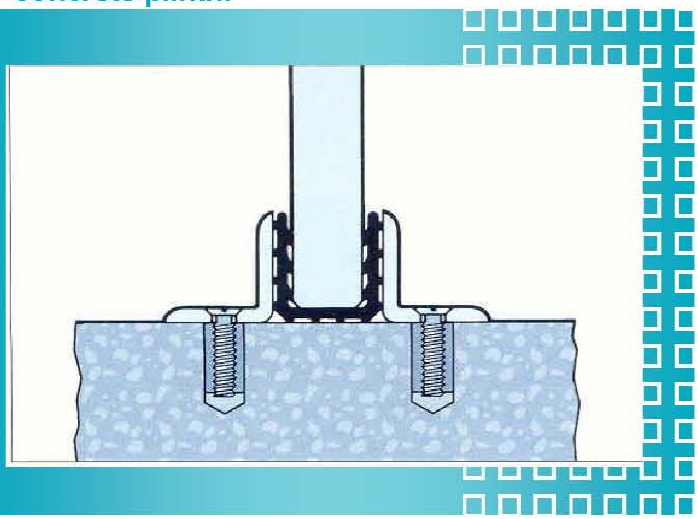
Two sheets, covered by a steel plate, clamped together against a concrete pillar. Pressure controlled by a T-ring.



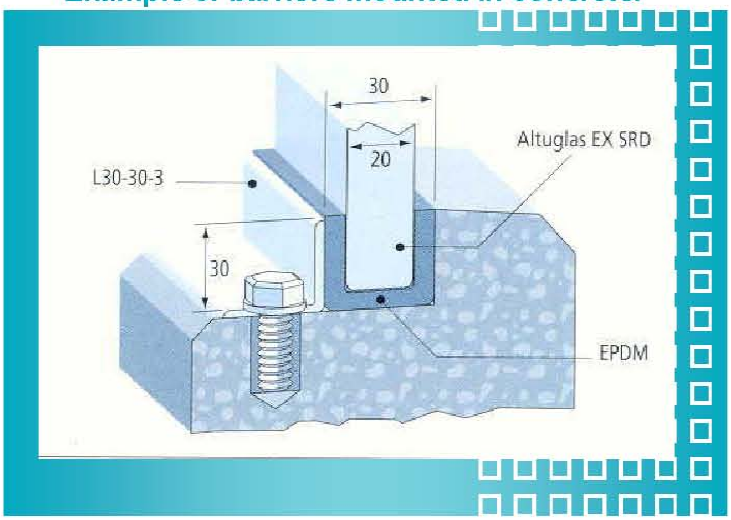
Example of barriers mounted in a concrete structure.



Clamping in a shallow channel on a concrete plinth.



Example of barriers mounted in concrete.



ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
ΥΠΟΥΡΓΕΙΟ ΠΕ.ΧΩ.Δ.Ε
ΓΕΝ. Δ/ΝΣΗ ΠΕΡΙΒΑΛΛΟΝΤΟΣ
Δ/ΝΣΗ Ε.Α.Ρ.Θ.
ΤΜΗΜΑ ΚΑΤΑΠΟΛΕΜΗΣΗΣ ΘΟΡΥΒΟΥ

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ΠΡΟΣ : ΔΥΝΑΜΙΚΗ ΑΚΟΥΣΤΙΚΗ –
Ν. ΚΩΛΕΤΤΗΣ & ΣΙΑ Ε.Ε.
Βεντούρη 47, Αθήνα 155 62

ΘΕΜΑ : Βεβαίωση καταλληλότητας

ΣΧΕΤ. : α. Αίτηση της Δυναμικής Ακουστικής – Ν.Κωλέττης & ΣΙΑ ΕΕ με αριθμ. πρωτ. ΔΕΑΡΘ 131760/23-4-04 με επισυναπτόμενα τεχνικά χαρακτηριστικά
β. Εγγραφό μας με αριθμ. πρωτ. 58368/18-7-01
γ. Φυλλάδιο με τεχνικές προδιαγραφές εκπόνησης οριστικής μελέτης ηχοπετασμάτων (ΥΠΕΧΩΔΕ, 2001)

Σε συνέχεια του σχετικού (β) εγγράφου μας με το οποίο εγκρίθηκαν οι τεχνικές προδιαγραφές των ηχοπετασμάτων για την αντιθορυβική προστασία από την λειτουργία της Αττικής Οδού και των μέχρι σήμερα αποτελεσμάτων από τις εφαρμογές που έχουν υλοποιηθεί σε επιλεγμένα σημεία, έχει επιτευχθεί η αναμενόμενη ακουστική προστασία των περιοίκων.

Σε συνέχεια λοιπόν της σχετικής (α) αίτησης σας και βάσει των πιστοποιητικών και τεχνικών προδιαγραφών που έχουν εκδοθεί και ισχύουν για το διαφανές ηχοανακλαστικό πέτασμα τύπου PMMA Altuglas EX-SRD πάχους 20 mm που έχει χρησιμοποιηθεί στις παραπάνω εφαρμογές, βεβαιώνεται η καταλληλότητα του υλικού αυτού για προστασία από οδικό κυκλοφοριακό θόρυβο.

Να σημειωθεί ότι σε κάθε περίπτωση πρέπει να τηρούνται τα αναφερόμενα και στο σχετικό (γ) τεχνικό φυλλάδιο με τις προδιαγραφές εκπόνησης οριστικής μελέτης ηχοπετασμάτων για προστασία από οδικό κυκλοφοριακό θόρυβο (έκδοση Τμήματος Καταπολέμησης Θορύβου, Σεπτέμβριος 2001).

Ο ΤΜΗΜΑΤΑΡΧΗΣ

Γ. ΠΑΠΑΓΙΑΝΝΟΠΟΥΛΟΣ

ΕΣΩΤΕΡ. ΔΙΑΝΟΜΗ

1. Αρχείο Δ/νσης ΕΑΡΘ
2. Αρχείο Τμήματος Θορύβου

ΑΚΡΙΒΕΣ ΑΝΤΙΓΡΑΦΟ
Προϊστ. του Γρ. Γραμματείας Δ'
c/a

Ο. ΓΙΑΝΝΑΚΗ