



SHIM SELECTION GUIDE

PROPERTIES OF SHIMS

SIZE

The most important properties of shims are their ability to separate and adjust the spacing between items in construction. The thickness of a shim is chosen according to the depth of the space it is intended to maintain. The footprint is chosen according to handling and load distribution needs. A permanent shim should be sized to fit entirely within the joint, behind the finish materials and without interfering with any sealant that can be installed in the joint.

SHAPE

- **Flat Blocks** are used for simple conditions where spaces will be later filled with grout or sealant, such as joints in tilt-up concrete panel construction.
- **U-Shapes** fit around bolts and are useful for many systems of construction, including precast concrete cladding and curtain wall systems.
- **Wedges** are used anywhere wood is inappropriate and a gap needs filling.

COMPRESSIVE STRENGTH

Choose compressive strength that can withstand the expected dead loads, construction loads, and live loads that the shim will carry. Shims carry large loads over their small footprints during construction, before the final fastening is complete, so including a factor of safety is a good idea. See shim properties chart for compressive strengths available with different materials.

CREEP

Shims with compressive strength adequate to the task at hand won't deform under the expected loads. By contrast, materials like wood suffer from "creep" (deformation over

time), forcing installers to guess at the final compressed thickness when selecting shims. Choosing structural shims takes the guesswork out of installation. It is worth noting that creep can be a problem with high density polyethylene used as permanent support.

RESILIENCE

Resilience is the ability of a shim to compress under load, then return to its previous shape when the load is released. It is expressed in Rockwell Hardness and Shore D Hardness. Resilience is often required in glazing systems and other panelized cladding systems. When materials being separated are brittle, like glass or stone, the shim's job is to absorb some of the load imposed by movement of the system. Consult Glass Association of North America (GANA) standards for glazing systems and manufacturer's recommendations for other materials.

IMPACT RESISTANCE

Impact resistance is the shim's ability to withstand a sudden force, usually over a small area, without breaking or crushing. Impact resistance is often required for shims used to install glazing systems. When high impact resistance is required, high-impact polystyrene or PVC shims are often required.

RESISTANCE TO BRITTLE FAILURE

If very cold temperatures are expected during construction or the service life of the shim, brittle failure needs to be considered. The temperature at which cracking occurs should be below the expected ambient temperature. In some conditions, the shim can be retained in the joint with adhesive, making cracking less of a concern.

FIRE RESISTANCE

Shims that will remain permanently within an assembly may be required to be fire-resistant. In these cases, the following criteria may apply:

- Melting Point: Not less than 170° F, ASTM D1238.
- Flame Spread: Class A, under 25; Class B, 26-75; Class C, 76-200, ASTM E84.
- Smoke Developed: 450 or less for Classes A, B and C, ASTM E84.
- Noncombustibility: Pass/Fail, ASTM E136.
- UL 94 V-0, normally for computer components, is available for special requirements.

COMPATIBILITY

A compatible material does not react with or chemically affect the materials it touches. It will not transfer color or oils, produce stains, nor corrode the item being shimmed. It will also be unaffected by the adjacent materials. Polypropylene and polystyrene both excel in this feature, being unaffected by most construction materials. In fact, inert plastics are often used to separate dissimilar materials that would otherwise react with each other: separating aluminum from concrete, for instance, or aluminum from steel.

VERMIN AND DECAY RESISTANCE

Inert plastic shims can remain in place indefinitely, without contributing nutrients to unwanted organisms like mold or insects. Unlike wood and wood products, Grove Structural Shims do not rot or degrade.

EASE OF USE

- **Color Coding:** Shims are colored by thickness, simplifying and speeding selection and inspection in the field.
- **Stackability:** Stackable shims can fit virtually any size joint, from 1/32" to 6", by combining standard sizes. Grove Structural Shims can be banded together. They also are readily heat-welded at the edges, forming a permanent stack custom-built for the joint required.
- **Fitting:** In order to fit joint requirements, shims should be available in a variety of widths, and in shapes that are easily cut to size. Grove Structural Shims offers 6-inch and 8-inch wedge shims that are notched to be snapped at convenient lengths and depths.

THERMAL PERFORMANCE

Shims can act as a thermal break between conductive materials. Measured in BTU per hour or in Watts, the thermal conductance of plastic is lower than that of aluminum or steel. For example, shims can help reduce thermal transfer from cladding materials such as precast concrete into structural elements.

COMMON TYPES OF CONSTRUCTION WORK USING SHIMS

In general, shims are used to hold heavy objects in place until they are permanently attached with bolts, welding, grout, adhesive, or other methods. Examples of this use occur in many areas of construction. The list below is not exhaustive, but serves to demonstrate the versatility of shims.

DIVISION 03

Tilt-up Concrete: Level and align panels in preparation for final attachment.

Precast Concrete Panels: Align panels vertically and horizontally, and maintain joint spacings before final attachment.

DIVISION 04

Stone Masonry: Temporary and permanent joint spacing.

Stone Panel Cladding: Align panels vertically and horizontally, relieve stress while mortar sets.

Terra Cotta: Brittle materials can be temporarily cushioned with shims before being fixed or sealed into place.

DIVISION 05

Typically, structural steel is shimmed with steel shims. However, many other metal objects are shimmed temporarily with plastic shims before welding, grouting, or bolting into place. Plastic shims can also separate dissimilar metals or provide a thermal break.

DIVISION 06

Heavy wood member that would crush a wood shim can be shimmed with plastic shim. Typical applications include: heavy timber framing, glu-lam members, and prefabricated joists or trusses.

DIVISION 07

Wall and Roof Panels: Align panels, girts, and purlins.

DIVISION 08

Doors and Frames: Align frames while fastening in place.
Entrance, Storefront, and Curtain Wall Systems: Align members or panels, vertically and horizontally; separating glass panels, permanently or temporarily.
Blast-Resistant Doors and Windows: Extra resilience may be required for permanent shims.
Skylights and Sloped Glazing Systems: Alignment.
Louver Systems: Alignment.

DIVISION 09

Stone Flooring: Temporary spacing.
Interior Stone Cladding: Align panels.

DIVISION 10

Heavy objects such as directories, signage, and telephone kiosks can be aligned temporarily with shims before being permanently fixed into place. Tracks for folding, sliding, or coiling partitions can be shimmed for alignment and thus the smoother operation of the partitions. Shims can also be required for heavy-duty tub and shower doors, storage specialties, and flagpoles.

DIVISION 11

Heavy objects such as parking equipment and loading dock equipment can be aligned temporarily with shims before being permanently fixed into place.

DIVISION 12

Heavy objects such as metal benches, bleachers, and fixed audience seating can be aligned temporarily with shims before being permanently fixed into place.

DIVISION 13

Amusement park structures and equipment. Kennel enclosures and gates.

DIVISION 14

Elevators: Align rails and equipment. Escalators and moving walks. Lifts.

DIVISION 23

HVAC equipment can be aligned with shims before being permanently fixed into place.

SPECIFYING SHIMS

GENERAL

Shims are considered "accessories" and are appropriately specified with other parts of each building system.

PRODUCTS

Review the criteria listed above and include specification necessary to assure proper performance for project conditions. It is usually unnecessary for the specifier to require a specific shape or size of shim. When load bearing is important, specify that shims shall be solid, and that hollowed profiles will not be accepted.

EXECUTION

Execution requirements for shims should also be results-oriented. Example requirements may include:

- "Shims shall not remain permanently exposed to view, sun, or weather."
- "Hold shims back from face of panel at least two times joint width." (For mortar or grout joints)
- "Shims shall not intrude into depth required for sealant and backer rod specified." (For sealant joints)
- "Remove shims progressively as sealant is installed" (For movement joints in stone flooring)
- "Install shims to shed water. Horseshoe and keyslot shim openings shall face down." (For shims in cladding, outside the weather barrier)
- "Do not shim **[secondary structural members] [cladding members]** more than **[1/2 inch] <other dimension>** without written acceptance by **[Architect][Engineer]**."

PROPERTIES OF GROVE STRUCTURAL SHIMS

Property, Units	ASTM Test Method	Polypropylene	Hi-Impact Polystyrene	Polyethylene	ABS
Tensile Strength at Break, psi	D638	4500-6000	5200-7500	1,600-4,600	3,500-8,000
Elongation at Break, percent	D638	100-600	1.2-2.5	10-440	1.5-2.5
Tensile Yield Strength, psi	D638	4,500-5,400	3,100-4,400	2,600-4,400	5,700
Compressive Strength (Rupture or Yield), psi	D695	5,500-8,000	6,000-8,000	2,000-5,500	6,500-7,500
Flexural Strength (Rupture or Yield), psi	D790	6,000-8,000	10,000-14,600	2,000-6,500	10,500
Tensile Modulus, 10 ³ , psi	D638	165-225	330-475	50-500	375
Compressive Modulus, 10 ³ , psi	D695	150-300	480-490	50-150	130-310
Flexural Modulus, 10 ³ , psi	D790 at 73° F D790 at 200° F D790 at 250° F	170-250 50 35	380-490	70-350	380
Izod Impact, ft-lb/in of notch (1/8-in specimen)	D256A	0.4-1.2	0.35-0.45	1-20	2.00
Hardness: Rockwell Shore/Barcol	D785	R80-102 D2240/D2583	M60-75	D55-80	112

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