THERMAL INSULATION MATERIALS — PRODUCT RANGE

All values are typical. Performance in service depends on installation, environment, and load conditions.

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1. **ASBESTOS TEXTILES**

Base fiber: chrysotile. Optional reinforcement: brass wire (0.15 mm), Inconel wire, or glass filament.

1.1 Asbestos Cloth

Continuous use limit: 400 °C.

Peak exposure: 550 °C (cumulative <1 h/day).

Thickness options: 1.5 mm, 2.0 mm, 3.0 mm.

Standard width: 1000 mm.

Areal weight, 2.0 mm: 1.3 ±0.1 kg/m².

Loss on ignition (800 °C, 1 h): ≤25%.

Tensile strength (warp): ≥800 N/50 mm (plain weave).

Weave: plain, 2/2 twill.

Applications:

Pipe and duct lagging in steam, hot water, and condensate systems up to 400 °C.

Welding curtains and spark shields in fabrication shops.

Gasket cloth for flanges, handholes, and manholes on low-pressure vessels.

Fabric backing for removable insulation pads on irregular equipment.

Characteristics:

Fibre inherently non-combustible; oxygen index >50%.

Moisture regain at 20 °C, 65 % RH: <2%.

Brass-wire-insert variants raise warp tensile by 30–50% over non-reinforced cloth (tested at 25 °C).

Weave-structure options allow bend radii down to 3× cloth thickness without tearing.

1.2 Asbestos Tape

Thickness: 1.5, 2.0, 3.0 mm.

Width range: 20, 25, 40, 50, 75, 100 mm.

Reinforcement: none, brass wire, or glass core.

Continuous temperature: 400 °C.

Typical tensile, 25 mm × 2.0 mm: ≥400 N.

Roll length: 25 m, 50 m.

Applications:

Pipe-wrapping on small-diameter lines (DN <80

where cloth handling is impractical.

Edge reinforcement of larger insulation mattresses.

Cable and wire harness heat protection in furnace areas.

Characteristics:

Width tolerance: ±1 mm; thick-edge free for uniform lap winding.

Brass-wire-reinforced tapes can carry 60% higher breaking load than plain tapes of the same section.

Roll-packed under moisture-proof film; delivered moisture content ≤3%.

1.3 Asbestos Rope

Construction: square-braided or twisted (3-ply).

Diameter: 6, 8, 10, 12, 16, 20, 25, 30, 40, 50 mm.

Density (square braided): 0.75–1.00 g/cm³.

Continuous temperature: 400 °C.

Moisture content at dispatch: ≤3.5%.

Typical linear mass: 6 mm ≈ 25 g/m; 20 mm ≈ 280 g/m.

Applications:

Gland packing on low-speed rotating shafts and valve stems in steam service.

Caulking of oven door grooves and kiln car seals.

Expansion joint filler in brick-lined flues.

Characteristics:

Square-braided ropes conform to irregular gap geometry; compression set after 25% squeeze at 200 °C for 2 h: <8%.

Wire-insert ropes withstand tensile stress up to 150 N on 10 mm dia. without core rupture.

Available in coils of 10-kg or 25-kg weight.

2. FIBERGLASS TEXTILES

Base fiber: E-glass (SiO_2 54%, Al_2O_3 14%, CaO+MgO 22%, B_2O_3 7%). Surface finish: heat-cleaned or vermiculite-coated.

2.1 Fiberglass Cloth

Continuous use limit: 550 °C.

Peak: 600 °C (<30 min).

Thickness: 0.20, 0.40, 0.65, 0.80, 1.00, 1.50 mm.

Width: 1000 mm, 1500 mm.

Areal weight, 0.65 mm: 600 ±30 g/m^2.

Tensile strength (warp), 0.65 mm: ≥1800 N/50 mm.

Weave: plain, twill, 8H satin.

LOI at 600 °C: ≤0.5%.

Applications:

Outer jacket of removable insulation pads for turbines, exhaust manifolds, and engines (vermiculite-coated grade).

Welding blankets where occasional sparks and slag contact occur.

Substrate for silicone-impregnated cloths used in flexible connectors.

Filter bag reinforcement in dust collectors operating below 260 °C.

Characteristics:

Heat-cleaned cloth retains <0.1% organic sizing; smoke emission is negligible at first heat-up.

Vermiculite coating raises short-term splash resistance to 1350 °C for molten metal drops.

Satin weave (8H) gives 20% higher drapeability than plain weave, measured as bending stiffness reduction.

2.2 Fiberglass Tape

Thickness: 0.30, 0.40, 0.65, 0.80, 1.00 mm.

Widths: 15, 25, 38, 50, 75, 100 mm.

Continuous temperature: 550 °C.

Roll length: 30 m, 50 m.

Reinforcement options: straight edge, wire-reinforced selvedge.

Applications:

Spiral wrapping on pipe sections before fitting rigid cladding.

Bundling of wire and thermocouple leads inside furnace enclosures.

Chafe protection for hoses near hot surfaces.

Characteristics:

Selvedge-reinforced tapes resist lateral tear propagation; tear strength (Elmendorf) >800 mN for 0.65 mm tape.

Width-dependent minimum bend radius: approximately 5× tape width for wire-insert selvedge.

Oil and solvent resistant; weight change after 24-h immersion in ASTM #1 oil: <0.5%.

2.3 Fiberglass Rope

Construction: twisted, square-braided, or round-braided over a glass core.

Diameter: 3, 5, 6, 8, 10, 12, 16, 20, 25, 30, 40, 50 mm.

Density (braided with core): 0.35–0.55 g/cm³.

Temperature limit: 550 °C (continuous).

Typical mass, 10 mm square braided: 45 g/m.

Minimum bending radius, 10 mm: ≈30 mm.

Applications:

Door seals on heat-treat ovens and bakery ovens.

Static joint packing on boiler access panels and smelter inspection ports.

Air-seal gaskets on low-pressure combustion-air ducts.

Characteristics:

Compressibility under 10 kPa load: ≥40% of original thickness, enabling sealing on uneven flanges.

Bulk density 0.35-0.55 g/cm³ keeps thermal storage low; equilibrium temperature reached within 2-3 min at 400 °C.

Core yarn provides 60% of tensile strength; sheath braid protects core from abrasion.

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3. CERAMIC FIBER TEXTILES

Base fiber: aluminosilicate (Al_2O_3+SiO_2 >97%). Zirconia-stabilized (ZrO_2 ~15%) grade available. Carrier matrix: E-glass filament or metal wire (304, Inconel 600).

3.1 Ceramic Fiber Cloth

Classification temperature, standard grade: 1260 °C.

Classification temperature, Zr-grade: 1430 °C.

Recommended continuous use: 1100 °C (standard), 1260 °C (Zr-grade).

Thickness: 1.5, 2.0, 3.0, 4.0, 5.0 mm.

Width: 1000 mm.

Areal weight, 2.0 mm: 1.2 ±0.1 kg/m^2.

Fiber density: ≈2.73 g/cm^3.

Linear shrinkage (1050 °C, 24 h): <2.5%.

Thermal conductivity (ASTM C177, 600 °C mean): 0.18 W/(m·K).

Tensile strength (warp), 2.0 mm: ≥1500 N/50 mm (with glass filament reinforcement).

Applications:

Furnace-door seals and curtain-type closures on car-bottom and bell-type furnaces (standard grade).

Expansion-joint fabric in reheat furnaces and reformers.

Lining attachment covers for bolts and anchors in hot-face linings.

Gaskets for high-temperature duct flanges in petrochemical heaters (Zr-grade).

Characteristics:

Fiber index of >50% after 24-h vibration test at 900 °C indicates minimal embrittlement.

Glass-filament-reinforced cloth: handling strength 2× higher than wire-insert grades at 600 °C.

Zr-grade cloth shows <1% linear shrinkage after 24 h at 1300 °C in oxidizing atmosphere.

Thermal conductivity at 1000 °C mean: 0.30 W/(m·K).

3.2 Ceramic Fiber Tape

Thickness: 2.0, 3.0, 4.0, 5.0 mm.

Width: 20, 25, 30, 40, 50, 75, 100, 150 mm.

Reinforcement: E-glass filament or stainless-steel wire.

Temperature rating: same as base fiber (wire reinforcement allows 650 °C limit of wire, but fiber governs).

Typical roll length: 25 m, 30 m.

Applications:

Wrapping of burner tubes and lance pipes in reheating lines.

Edge-sealing of ceramic-fiber module walls to prevent bypass leakage.

Insulation of thermocouple protection tubes in cracker furnaces.

Characteristics:

25 mm-wide tape can be hand-wound on pipes down to OD 15 mm without fiber breakage.

Wire-insert tape (304 wire 0.2 mm) maintains continuity after 100-cycle thermal shock test (room temp ⇄ 900 °C).

Carrier burn-out: glass filament loses strength above 600 °C; remaining ceramic fiber body still provides insulation function.

3.3 Ceramic Fiber Rope

Structure: square-braided with a ceramic fiber core; round braided; twisted.

Diameter: 6, 8, 10, 12, 16, 20, 25, 30, 40, 50, 60 mm.

Density (square braided): 0.45–0.60 g/cm³.

Continuous use: 1100 °C (1260 °C peak).

Mass example, 20 mm square braided: ≈280 g/m.

Minimum suggested compression in gland: 25–30%.

Applications:

Soaking-pit cover seals and coke-oven door seals.

Slide-gate plate surrounds in steel ladles.

Packing of peephole frames and observation ports on high-temperature furnaces.

Characteristics:

Square-braided rope recovers >90% of original thickness after 25% compression at 800 °C for 100 h.

Density 0.45-0.60 g/cm³ provides 30-35% air volume; thermal conductivity at 600 °C: 0.14 W/(m·K).

Length per coil standard: 25 m (diameters 6-20 mm), 15 m (25-50 mm), 10 m (>50 mm).

4. GRAPHITE TEXTILES

Base fiber: PAN-based carbon/graphite filament. Carbon content ≥99%. Inert-atmosphere capability, air-atmosphere limits apply.

4.1 Graphite Cloth

Carbon assay: ≥99.2%.

Ash content: ≤0.5%.

Thickness: 0.30, 0.40, 0.60, 0.80, 1.00 mm.

Width: 1000 mm.

Areal weight, 0.40 mm: 350 ±15 g/m^2.

Air atmosphere limit, continuous: 450 °C.

Inert/vacuum limit: 2800 °C.

Tensile strength (warp): ≥800 N/50 mm (0.40 mm).

Electrical resistivity (through-thickness): ≈0.05 Ω·cm.

Weave: plain, 2/2 twill.

Applications:

Heating elements and susceptors in vacuum-furnace insulation packages.

Static charge-dissipating covers for electronic component handling.

Gaskets in high-temperature vacuum and inert-gas flange connections.

Electrode-backing fabrics in fused-salt electrolysis cells.

Characteristics:

Resistivity 0.05 Ω·cm allows current-carrying capability of 15 A per cm width for 0.40 mm cloth.

Loss of mass after 100 h in air at 450 °C: <2%.

In argon at 2500 °C, tensile retention >90% after 1 h.

No outgassing of binder decomposition products; vacuum weight loss <0.1% at 2000 °C.

4.2 Graphite Tape

Cut from cloth or woven as narrow tape.

Thickness: 0.40, 0.60, 0.80 mm.

Width: 15, 20, 25, 30, 40, 50 mm.

Temperature as cloth.

Roll length: 20 m, 30 m.

Applications:

Electrode and terminal wrapping in induction-melting furnaces.

Anti-seize thread sealant on high-temperature bolts (air service).

Flexible ground straps for moving furnace parts.

Characteristics:

Width tolerance ±0.5 mm; fray-free edges when cut by ultrasonic knife.

Electrical resistance along tape length: ≈0.3 Ω per meter (0.40 mm × 25 mm).

Tensile breaking load for 25 mm × 0.40 mm: ≥200 N.

4.3 Graphite Rope

Structure: braided expanded graphite filament yarns; core can be pure graphite yarns.

Diameter: 4, 6, 8, 10, 12, 16, 20 mm.

Density: 0.80–1.20 g/cm³.

Air limit: 450 °C; inert limit: 2800 °C.

Typical linear mass, 8 mm: 70 g/m.

Sulfur content: <200 ppm.

Applications:

Gland packing on valves and centrifugal pumps in heat-transfer fluid loops (inert conditions).

Sealing rings for crystal-growth and sintering furnaces operating in argon or nitrogen.

Static seal for vacuum-chamber lids and ports (bake-out cycles up to 250 °C).

Characteristics:

Low sulfur content (<200 ppm) avoids nickel-alloy stress corrosion in contact with Inconel parts.

Density 0.80-1.20 g/cm³ results in lower leakage than braided carbon-fiber packings (tested at N_2 pressure 0.7 MPa, gland load 15 MPa).

Self-lubricating; friction coefficient against steel shaft: 0.08-0.12 dry.

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5. REMOVABLE INSULATION JACKETS

Custom-fabricated for valves, flanges, steam turbines, pumps, exhaust piping, and irregular equipment. Design based on heat-loss calculation and surface temperature target.

Insulation layer: ceramic fiber needle blanket, density 128 or 160 kg/m³.

Standard layer thickness: 25, 38, 50, 75, 100 mm.

K-value of insulation blanket at 200 °C mean: 0.045 W/(m·K).

Outer cover material: silicone-impregnated fiberglass cloth (continuous 260 °C) or PTFE-coated cloth (continuous 260 °C, chemical resistant).

Outer cover thickness: 0.6 mm, tensile ≥2000 N/50 mm.

Fastening: 304 stainless steel hooks + lacing wire, or strap with buckle.

Case data, valve jacket on DN100 gate valve, medium 350 °C: ambient 25 °C, jacket surface temperature measured 48 ±3 °C (bare valve surface 310 °C). Heat loss reduction: 84–87%.

Maximum service temperature of the jacket (internal face): 1100 °C (ceramic fiber), 650 °C (glass fiber + wire mesh composite).

Applications:

Steam-turbine casing and valve insulation in power plants.

Gate, globe, and butterfly valve insulation on hot-oil circuits (up to 350 °C medium).

Pump-casing wraps for heat-transfer fluids.

Flange pairs on reactor piping where frequent opening is required.

Exhaust-manifold covers on marine and stationary engines.

Characteristics:

Jacket surface temperature with 50 mm ceramic-fiber fill, medium 350 °C, ambient 25 °C: 55 °C ±5 °C (measured).

Heat loss through 50 mm jacket: <200 W/m² at delta T = 300 K.

Cover-cloth tear strength: >150 N (single-rip method, ASTM D2261).

Fastening system allows removal/reinstallation in <2 min by one operator, without tools in the standard hook-and-lacing version.

PTFE-coated cover withstands 30-day immersion in 10% HCl at 23 °C with <1% tensile loss.

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6. INDUSTRIAL FIRE BLANKETS & FELTS

6.1 Fire Blanket (Welding / Spark Protection)

Material: vermiculite-coated fiberglass cloth, or ceramic fiber cloth with red-coat coating.

Thickness: 0.8, 1.0, 1.2 mm.

Standard sheet size: 1000×1000 mm, 1200×1800 mm, 1500×2000 mm.

Temperature capability, short-term (splash/molten metal): 1350 °C.

Continuous service: 550 °C (fiberglass), 1000 °C (ceramic).

Weight, ceramic-fiber blanket 1.0 mm: 900 ±50 g/m².

Grommet spacing along edge: 300 mm.

Applications:

Vertical shielding during arc welding and cutting in workshops.

Draping over cables, hoses, and instrumentation near hot-work zones.

Emergency smothering of small incipient fires on workbenches.

Insulation wrap around pre-heat torch operations on weld joints.

Characteristics:

Ceramic-fiber blanket with red coating passes 60-second vertical flame test (no afterflame, no hole formation).

Vermiculite-coated glass cloth: melt-hole diameter <10 mm after 2-second contact with 1350 °C steel droplet.

Grommets spaced at 300 mm allow suspension on scaffold tubes; pull-out force per grommet >200 N.

Foldable to 1/10 of open area; packing density approx. 10 m^2 per transport case.

6.2 Insulating Felt / Board

Material: ceramic fiber felt, binder-less or with minimal organic binder.

Density grades: 128, 160, 200, 220 kg/m^3.

Size: 1200×600 mm, 1000×500 mm; thickness 5, 6, 10, 12, 20, 25, 30 mm.

Classification temperature: 1260 °C (standard), 1400 °C (Zr-grade).

Linear shrinkage (1050 °C, 24 h): ≤2% for 128 kg/m^3 grade.

Thermal conductivity at 400 °C: 0.10 W/(m·K) (128 kg/m^3).

Available with aluminum foil facing (scrim-reinforced, 0.1 mm foil, adhesive rated 120 °C).

Applications:

Backup insulation behind dense refractories in ladles and tundishes.

Gasket die-cutting stock for furnace sight-glass frames.

Vibration-damping lining under expansion-joint fabric.

Heat shields between burner tiles and steel support structures.

Characteristics:

Binder-less felt retains 90% of tensile strength after 100-h soak at 1000 °C.

Compression modulus (128 kg/m^3): 0.5-0.8 MPa at 10% strain; allows form-fit installation.

Zr-grade board withstands 1400 °C peak for 12 h with <1.5% linear shrinkage.

Aluminum-faced board reflects >85% of radiant heat below 2 μm wavelength; surface emissivity ≈0.05.