Medium Density Fiberboard (MDF) – Standard & Moisture Resistant – Technical Material Specification

1.0 Material Overview & Common Uses

Medium Density Fiberboard (MDF) is an engineered wood product manufactured by breaking down hardwood or softwood residuals into wood fibres, combining them with wax and a resin binder, and forming panels under high temperature and pressure. Standard MDF offers a smooth, uniform surface ideal for painting, veneering, and machining. Moisture Resistant (MR) MDF incorporates a water-resistant resin system and often a fungicide additive, providing improved dimensional stability in humid environments. Common industrial applications include cabinet doors, shelving, furniture components, interior trim, mouldings, speaker enclosures, and store fixtures. MR MDF is specified for kitchen cabinets, bathroom vanities, and other areas subject to occasional moisture exposure.

2.0 Core Technical Properties & Sizing

- Density: Standard MDF 700–800 kg/m³; MR MDF 720–850 kg/m³ (typical range per CSA O132.2 / ANSI A208.2).
- Thickness tolerance: ±0.20 mm for panels up to 18 mm; ±0.30 mm for panels 19–30 mm (per ANSI A208.2 Grade 130).
- Standard panel sizes: 4 ft x 8 ft (1220 mm x 2440 mm); also available in 5 ft x 8 ft (1525 mm x 2440 mm) and custom cut-to-size.
- Modulus of Rupture (MOR): Minimum 24 MPa for Standard MDF; minimum 26 MPa for MR MDF (ANSI A208.2).
- Modulus of Elasticity (MOE): Minimum 2500 MPa for Standard MDF; minimum 2800 MPa for MR MDF.
- Internal Bond (IB) strength: Minimum 0.60 MPa for Standard MDF; minimum 0.70 MPa for MR MDF.
- Thickness swell (24-hour water soak): Standard MDF ≤ 12%; MR MDF ≤ 8% (per ANSI A208.2).
- Formaldehyde emission: E1 grade ≤ 0.1 ppm (per CARB Phase 2 / EPA TSCA Title VI); E0 grade available upon request.
- Moisture content at time of manufacture: 5–9% (oven-dry basis).
- Hardness (Janka): Not typically rated for MDF; surface hardness is measured via screw withdrawal resistance (face ≥ 800 N, edge ≥ 600 N per ANSI A208.2).

3.0 Processing, Machinability & Application

MDF machines cleanly with sharp carbide-tipped tooling. The homogeneous structure allows for intricate routing, drilling, and edge profiling without tear-out. Dust extraction is critical due to fine airborne particles. MR MDF requires slightly slower feed rates to prevent resin buildup on tooling. All MDF should be acclimated to the fabrication environment for 48–72 hours before machining to minimize dimensional movement.

- Cutting: Use carbide-tipped saw blades with 60–80 teeth for clean edges; recommended feed rate 10–15 m/min for 18 mm panel.
- Routing: Use compression spiral bits (up-cut/down-cut combination) to minimize chipping on both faces; spindle speed 18,000–22,000 RPM; feed rate 4–6 m/min.
- Drilling: Standard HSS or carbide twist drills; peck drilling recommended for depths > 3x diameter to clear dust.
- Edge banding: Apply PVC, ABS, or wood veneer with hot-melt adhesive (EVA or PUR); pre-sand edges with 180-grit to remove fuzz.

- Sanding: Use 120–220 grit aluminum oxide paper; avoid excessive pressure to prevent burnishing.
- Gluing: PVA (white glue) or polyurethane adhesive recommended; clamp pressure 0.5–1.0 MPa for 30–60 minutes.
- Painting: Prime with solvent-based or water-based primer (two coats); topcoat with acrylic or polyurethane enamel; sand between coats with 320-grit.
- Fastening: Use coarse-thread screws designed for particleboard; pre-drill pilot holes for diameters > 3.5 mm to prevent splitting.
- CNC machining: Use climb milling strategy; vacuum hold-down with 20–25 inHg; tool change interval every 200–300 linear metres for carbide bits.

4.0 Common Defects & Quality Control

- Reject if surface delamination (blistering) exceeds 25 mm in any dimension or if more than 2 blisters per 1 m².
- Reject if edge chipping or fuzzing exceeds 1.5 mm depth on machined edges (visible without magnification).
- Reject if thickness variation exceeds ±0.30 mm across the panel diagonal (measured at four corners and centre).
- Reject if surface pits or voids exceed 2 mm diameter or 0.5 mm depth, or if more than 3 such defects per 0.5 m².
- Reject if panel is out-of-square by more than 1.5 mm over 1220 mm length (measured diagonally).
- Reject if warp (bow or twist) exceeds 1.5 mm over 1220 mm length when laid on a flat surface.
- Reject if moisture content is below 4% or above 10% (oven-dry basis) at time of delivery.
- Reject if formaldehyde emission exceeds 0.1 ppm (E1 limit) per CARB/EPA certification documentation.
- Reject if visible mould or fungal growth is present on any surface (MR MDF must show no fungal growth after 7-day ASTM D3273 test).
- Acceptable minor defects: Single hairline crack < 10 mm length not penetrating through thickness; colour variation within normal production range.

5.0 Storage, Handling & WHMIS Guidelines

- Store panels flat on a level surface, supported by 100 mm x 100 mm stickers spaced at maximum 600 mm centres to prevent sagging.
- Maintain storage environment at 18–24°C and 40–55% relative humidity; avoid direct contact with concrete floors (use vapour barrier).
- Acclimate panels to fabrication environment for minimum 48 hours before machining; stack with spacers for air circulation.
- Shelf life: Indefinite when stored in stable conditions; MR MDF resin performance degrades after 12 months if exposed to >60% RH.
- FIFO protocol: Rotate stock by manufacturing date; use oldest panels first to minimize moisture uptake and warp risk.
- WHMIS classification: Not classified as a hazardous product under WHMIS 2015 when in solid panel form. Dust generated during machining is classified as a hazardous substance (CAS 9004-34-6, cellulose).
- Hazards: Wood dust is a known carcinogen (IARC Group 1) and respiratory sensitizer; formaldehyde may be released during machining (TLV-TWA 0.3 ppm).
- Mandatory PPE: NIOSH N95 respirator (or half-face with P100 filters) during all machining/sanding operations; safety glasses with side shields; hearing protection (earplugs or earmuffs) for noise > 85 dBA.
- Engineering controls: Use local exhaust ventilation (LEV) with minimum capture velocity of 1.5 m/s at source; maintain dust collection system with HEPA filtration for fine particles.
- Spill procedure: Sweep or vacuum dust immediately; do not use compressed air for cleanup. Dispose of waste in sealed containers labelled 'Wood Dust – Combustible'.
- Fire safety: MDF dust is combustible; maintain housekeeping to prevent dust accumulation > 1/8 inch on surfaces. Use Class D extinguisher for metal fires (if applicable) or Class A for wood fires.

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