

Sanding & Surface Preparation

A practical, manufacturer-neutral guide to industrial sanding machines and processes for wood, MDF, plywood, veneer and coated panels in India.

The objective is a consistent, fit-for-purpose surface for the next production step, while controlling material removal, defects, rework and total finishing cost. Select the **process first**, then the sanding head configuration, and finally the investment.

The central decision

A finer abrasive or a more complex machine is not automatically better. The correct sequence depends on the substrate, existing surface, coating system, component geometry and required acceptance standard.

Key facts at a glance

Wide-belt sanders

Calibrate and surface-sand flat MDF, plywood, veneer and solid-wood panels

Brush and profile sanders

Sand grooves, contours and shaped cabinet doors, raw or primed

Grit progression

Never skip more than one grit grade; P80 to P180 for raw wood

High-gloss finishing

P1000 to P2500, then buffing on a fully cured coating

Wood-dust safety

Wood dust causes cancer; extract at 20 to 25 m/s duct velocity

Decision measure

Cost per accepted panel, not machine price alone

What is new in this edition

- Sanding unit types with typical grit ranges and contact-roller hardness.
- Grit-to-micron reference based on the FEPA P-scale.
- Grit ranges by finishing stage and documented process recipes from Caple application trials.
- Reference specifications for calibrating, combination, profile and buffing machines.
- Site-readiness values, wood-dust exposure limits and extraction velocities with sources.

Scope: process education and equipment selection principles. Material-specific settings, abrasive sequences and performance expectations must be confirmed through trials and the applicable machine and coating instructions.

SECTION 01 / PROCESS SELECTION

Choose the sanding method

Each sanding operation solves a different manufacturing requirement.

Process	Purpose	Typical application
Calibration	Control thickness and remove planned stock	MDF, plywood and solid wood where appropriate
Raw surface sanding	Prepare an even substrate for later operations	Panels, solid wood and suitable veneer
Fine sanding	Refine texture and reduce visible machining marks	Prepared wood or panel faces
Primer / sealer sanding	Denib cured coating without cutting through	Painted shutters, doors and panels
Cross sanding	Transverse abrasive action; removes tape, glue lines and veneer joints	Veneered panels, specialist flat finishing
Superfinishing	Controlled final preparation with an oscillating pad belt	High-grade lacquer and high-gloss work
Brush / profile sanding	Reach contours, grooves and shaped details	Profiled cabinet doors and mouldings
Texturing / grain opening	Create an intentional decorative texture	Solid-wood finishes and decorative panels
Buffing / polishing	Refine a suitable, fully cured coating	High-gloss painted flat surfaces

Machine families

Machine type	Best suited to
Wide-belt sander	Calibration and surface sanding of flat panels, boards and frames; one to five heads
Abrasive planer / cutter-block unit	Heavy stock removal on solid-wood boards before sanding
Brush and disc sander	Profiled doors, mouldings, raw and primed shaped parts, grain opening
Edge and profile sander	Panel edges, radii and profiled edges
Vertical / long-belt / stroke sander	Edges, frames, small batches and manual finishing
Drum sander	Thin parts and small workshops; light calibration
Buffing machine	Polishing fully cured high-gloss coatings on flat panels

A process designation is not a guarantee of finish quality. Verify head arrangement, pressure control, belt size, minimum workpiece size, dust requirements and available options for the equipment proposed.

SECTION 02 / SANDING UNITS

Select the processing head

Wide-belt machines are built from standard units. The unit sequence defines what the machine can do.

Unit	What it does	Typical grit range
Roller (R)	Stock removal and calibration. Steel, hard rubber (about 85 Shore A) or soft rubber (about 30 Shore A) rollers.	P40 – P180
Cutter block (W)	Planes rough boards before sanding; removes heavy stock quickly.	Not applicable
Pad (P)	Fine sanding with a pneumatic or electronic segmented pad.	Up to P320 / P400
Combination (K)	Roller and pad in one unit; switch between calibration and fine sanding.	P80 – P320 / P400
Superfinish (F)	Pad with an oscillating chevron belt for very fine finishing.	P600 – P2000
Cross belt (T)	Transverse belt with pad; removes cross-grain marks, tape and glue.	P600 – P2000 (coarser for veneer)
Brushes (B)	Steel or abrasive-nylon filament brushes; open pores and texture surfaces.	By filament grade
Discs (D) / buffing	Rotating discs for profiles; cotton buffing brushes for cured gloss coatings.	P150 – P360 / polishing compound

Contact hardness: what it changes

Contact element	Typical role
Helically grooved steel roller	Heavy calibration and maximum stock removal
Hard rubber roller, about 85 Shore A	Calibration and accurate thickness control
Medium rubber roller, about 45–55 Shore A	General sanding after calibration; base-coat sanding
Soft rubber roller, about 20–30 Shore A	Fine sanding, veneer and lacquer sanding
Pad with semi-stiff insert	Fine sanding of solid wood and veneered panels
Pad with soft insert / segmented pad	Veneered and painted panels; protects edges and corners

Typical machine configurations

Configuration	Typical use
R + R	Calibrating machine for boards and panels
R + K (roller + combination)	Calibrate and finish-sand in one pass; most common panel-factory choice
W + R + R	Board planing and calibration for solid-wood production
T + R + K	Veneer sanding with a cross belt to remove tape and glue lines
R + P + F or T + R + F	Lacquer and high-gloss sanding sequences
B + B + D	Brush and disc sanding of profiled doors, raw or primed

Electronic segmented pads apply pressure only where the panel is, which reduces edge and corner breakthrough. A belt-wear optimiser or LED feed guide spreads abrasive wear across the full belt width.

SECTION 03 / ABRASIVES

Grit, particle size and progression

Use the FEPA **P-scale** (ISO 6344) when specifying abrasives. Up to about P220 the P-scale and the North American CAMI scale track closely; finer than P220 they diverge, so compare by particle size, not by the number.

FEPA grade	Approx. particle size	Typical role in woodworking
P60 – P80	260 – 190 µm	Calibration and heavy stock removal
P100 – P120	156 – 125 µm	Calibration finish and raw sanding
P150 – P180	100 – 82 µm	Final raw sanding before stain or sealer
P220 – P240	68 – 58.5 µm	Sealer and primer sanding
P320 – P400	46.2 – 35 µm	Lacquer intercoat sanding, pad sanding
P600 – P800	25.8 – 21.8 µm	Pre-polish, superfinishing
P1000 – P1500	18.3 – 12.6 µm	High-gloss preparation before buffing
P2000 – P2500	10.3 – 8.4 µm	Final high-gloss preparation

Particle sizes: FEPA P median (d50) values, approximate. Source: grit conversion reference listed in Sources.

Grit ranges by finishing stage

Stage	Solid wood	Veneer	MDF / panels
Pre-sanding (raw)	P80 – P220	P120 – P220	P80 – P150
Before staining	P150 – P180	P150 – P180	Not typical
Before wax or oil	P150 – P240	P150 – P240	Not typical
Primer / sealer sanding	P150 – P220	P220 – P320	P240 – P320
Lacquer intercoat	P240 – P600	P280 – P600	P320 – P600
High-gloss preparation	P1000 – P3000	P1200 – P2500	P1000 – P2500

Ranges consolidated from abrasive application guidance and Caple trial data; treat them as a starting point, not a prescription.

Progression rule

Do not skip more than one grit grade. Each grit must remove the scratches of the one before it; a jump from P80 to P220 leaves deep scratches that reappear under stain or lacquer. Clean the surface between grits so coarse particles are not dragged into finer stages.

Important distinction

Grit or particle size is not the same as finished surface roughness in microns, and it does not specify how much material will be removed. Both depend on machine settings, contact hardness, pressure, belt speed and the material.

SECTION 04 / PROCESS RECIPES

Documented sanding sequences

Sequences used in Caple application trials. Grits are FEPA P-grades; "120/180" means first head / second head in one pass.

Application	Typical head set-up	Sanding sequence
Painted MDF (lacquer system)	Hard roller 85 Shore A + combination with electronic segmented pad	1) Raw 80/120. 2) Base coat about 30 g/m ² , dry about 12 h. 3) 240/280. 4) 320/400. 5) 400/600. 6) Top coat. 7) 600/800 where denibbing is specified.
Veneered panels	Roller + sectional pad, or cross belt + roller + combination	Two heads: 120/180. Three heads: cross 120 + roller 120, then cross 180 + combination 180. The cross belt removes tape and glue lines.
Solid-wood board calibration	Cutter block or planing roller + two rollers	Planing 40/60 or 60/80, then 80/100 or 80/120.
Open-pore timber	Steel or brass brush + abrasive-nylon brush + sanding + air cleaning	Brush to open grain, nylon brush (grade 500), sand 120/180, rotary air-jet cleaning.
Open-pore veneer	Nylon brush + cross belt + roller	Nylon brush, cross 120 / roller 120, then 180/180, rotary air-jet cleaning.
High-gloss lacquer (3 heads)	Cross belt + soft roller 30 Shore A + superfinish; anti-static bar	Raw 320. Base coat. 320/400, then 600/800/800, 800/1000/1000, 1000/1200/1500. Buff, then remove swirl marks with fine polishing pads.
High-gloss lacquer (5 heads)	Five-head line at about 5 m/min feed and 5 m/s belt speed	Raw 320/400/600/600/800. Top coat 45–50 g/m ² , dry about 12 h. Sand 1000/1000/1200. Buff and remove swirl marks.
Profiled doors, raw and primed	Brush and disc sander, reversible rotation	One direction 150 then 180; reversed 320 then 360. Changing rotation lets each brush unit carry two grits.

Make the recipe yours

Record the approved grit set, feed speed, belt speed, pressure, roller hardness and coating weight for each product. Save it as a machine programme so that every shift repeats the accepted result.

SECTION 05 / OPERATING METHOD

From raw panel to finished surface

Use a documented, material-specific process rather than an improvised abrasive sequence.

Step	Activity	Process control
01	Inspect material	Check moisture, flatness, thickness, veneer integrity and defects.
02	Define removal	Identify the minimum necessary stock removal and tolerance.
03	Choose abrasive	Select grit, abrasive type and backing for material and finish.
04	Set parameters	Trial feed, belt speed and contact pressure within the machine maker's limits.
05	Sand progressively	Avoid large grit jumps, burning, scratches and over-sanding.
06	Clean and inspect	Remove dust with air-jet or brush cleaning; check dimensions and surface.
07	Apply sealer / primer	Follow the coating supplier's preparation, application and cure conditions.
08	Denib if specified	Lightly sand the cured coating without exposing the substrate.
09	Apply final coating	Allow the specified cure; polish only if suitable.
10	Approve and record	Inspect, note defects and save the approved recipe.

Typical operating ranges

Parameter	Typical range	Effect
Feed speed, wide-belt	3.5 – 20 m/min (variable)	Lower feed gives finer finish and more removal per pass
Belt speed	5 – 18 m/s	Lower speeds for lacquer and high gloss; higher for raw wood
Feed speed, brush and disc	0.6 – 8 m/min	Slow feed for detailed profiles
Brush speed	150 – 600 rpm (250 mm brushes)	Adjust for profile depth and filament grade
Disc speed	250 – 750 rpm	Higher speed for primer denibbing
Working air pressure	About 6 – 6.5 bar	Pad pressure, belt tension and cleaning blowers

Ranges collected from current machine specifications in Caple's library. Always work within the limits stated in the machine manual.

SECTION 06 / REFERENCE SPECIFICATIONS

What to compare when evaluating machines

Values from several industrial reference machines. They show typical sizes and features; actual values vary by model.

Parameter	Calibrating sander (R + R)	Two-head sander (R + K)	Veneer sander (soft rollers)
Working width	1,350 mm	1,350 mm	1,300 mm
Working thickness	3 – 180 mm	4 – 170 mm	2.5 – 120 mm
Belt size	1,370 × 2,150 mm	1,370 × 2,150 mm	1,330 × 2,620 mm
Contact rollers	180 mm; steel and 85 Shore A	140 mm 85 Shore A + 160 mm 45 Shore A with pad	320 mm; about 26 and 22 Shore A
Motors	15 kW per unit	11 kW main motor; 2-speed option	Per head; ammeter monitoring
Feed speed	4 – 20 m/min, inverter	4.5 / 9 m/min; 3.5 – 18 m/min option	0 – 19 m/min
Belt speed	Fixed	9 / 18 m/s (2-speed)	Up to 12 m/s
Extraction	About 4,070 m ³ /h at 25 m/s	About 5,500 m ³ /h; 2 × 195 mm outlets	Per maker's data

Profile and buffing machines

Parameter	Brush and disc sander	High-gloss buffing machine
Working width	650 – 1,300 mm	650 mm or 1,200 mm
Main tools	250 mm brushes and 115 mm discs; reversible rotation; oscillation	Cotton buffing brush tilted about 3° to the axis; reversible
Speeds	Brushes 150 – 600 rpm; discs 250 – 750 rpm	Brush about 960 rpm
Feed	0.6 – 8 m/min	0.8 – 8 m/min, with reversal
Work holding	Vacuum or pressure rollers	Vacuum hold-down for small panels

Safety and control features to look for

- Over-thickness switch and hand-safety bar at infeed; front and rear emergency stops.
- Automatic head brake; lockable isolator; auto-stop on belt break, loss of tension, belt run-off or loss of air.
- Motor overload protection, IP54 or better motors, anti-kickback infeed roller.
- Digital thickness readout, motorised table, ammeters and stored programmes for repeatable recipes.

SECTION 07 / FACTORY READINESS

Site readiness, dust and fire safety

Utility	Typical requirement (two-head 1,350 mm sander, 11 kW)
Power supply	400 – 415 V, 3-phase + neutral + separate earth, 50 Hz; transformer where no neutral is available
Cable and protection	4-core 10 mm ² cable (size by run length) through a 4-pole 40 A MCB or MPCB
Voltage stabiliser	25 – 30 kVA where supply voltage fluctuates
Earthing	Dedicated, tested earth; minimum 8 mm copper or 10 mm aluminium conductor
Compressed air	6.5 bar at the machine from an 8 – 12 bar supply; at least 12 mm line; dry air through an air dryer
Air consumption	About 26 cfm per oscillating belt cleaner (52 cfm with two)
Dust extraction	2 × 195 mm outlets; about 5,500 m ³ /h
Installation	Forklift or pallet truck; operator and maintenance technician present; about 2 days with trial panels

Confirm every value against the pre-installation sheet of the machine you select.

Wood dust: health limits

Reference	Limit (8-hour time-weighted average)
IARC classification	Wood dust is carcinogenic to humans (Group 1): sinonasal and nasopharyngeal cancers
European Union, Directive (EU) 2017/2398	Hardwood dust 2 mg/m ³ (3 mg/m ³ until 17 January 2023); applies to all wood dust in mixtures
United Kingdom, HSE	Hardwood 3 mg/m ³ ; softwood 5 mg/m ³ ; mixtures take the hardwood limit

Extraction and fire prevention

- Design ductwork for an air transport velocity of about 20 – 25 m/s (BS EN 12779), as advised by a competent extraction engineer.
- Use the machine maker's stated air volume at each extraction outlet; keep duct runs short with few bends.
- Use conductive, earthed ductwork to discharge static; inspect and clean ducts regularly.
- Never connect wood and metal sanding dust, or other incompatible dust streams, to a common system.
- Machine guards, interlocks, brakes and safety circuits must not be bypassed; isolate before belt changes.

SECTION 08 / QUALITY CONTROL

Measure quality, not just appearance

Check the accepted finished component and the repeatability of the process.

Acceptance checklist

- Thickness and flatness meet the part specification.
- No unacceptable straight scratches, swirl marks or burn marks.
- Edges and corners preserved without coating or veneer breakthrough.
- No raised fibres, dust residue or uncontrolled abrasive marks.
- Coating adhesion, gloss and colour meet the specified test criteria.
- Rework and rejection recorded by product and shift.

Common defects: first checks

Observed issue	Initial process investigation
Visible scratches	Previous machining marks, grit progression, skipped grades, contaminated or worn abrasive.
Burn marks / heat	Excessive contact pressure, dwell, belt speed, abrasive loading, belt cleaning.
Edge over-sanding	Pad segment control, sensing, workpiece support and pressure.
Uneven thickness	Calibration setting, roller condition, conveyor belt and workpiece variation.
Clogging / loading	Dust extraction, air-jet belt cleaner, workpiece contamination, abrasive choice.
Tape or glue lines on veneer	Add a cross-belt stage; check veneer thickness before raising pressure.
Raised fibres after priming	Moisture content, sealer sanding step, coating preparation guidance.
Dust specks in lacquer	Static charge on the panel; add an anti-static bar and clean between stages.
Swirl marks after buffing	Buffing compound, brush condition; finish with fine polishing pads.
Poor coated finish	Cleanliness, coating cure, film thickness and sanding compatibility.

SECTION 09 / OPERATIONAL ECONOMICS

Sanding cost & ROI

The relevant decision is the cost per accepted finished component, not only the purchase price or motor rating.

Core measure

Cost per accepted panel = Relevant production costs ÷ Number of accepted panels. Use a consistent time period and include the costs that change or are attributable to the operation.

Cost / performance driver	What to measure
Abrasives	Belts, discs and brushes used per accepted unit; belt life and change intervals
Labour and handling	Direct labour time, loading, unloading and manual touch-up
Utilities	Electricity, compressed air and dust extraction
Surface finishing	Primer and coating usage (g/m ²) and preparation time
Quality losses	Rework, scrap, rejection and customer complaints
Reliability	Maintenance spending and unplanned downtime
Output	Accepted units per shift and the true bottleneck
Investment	Machine, installation, training, finance and lifecycle costs

Eight questions before selecting a solution

01

Which substrate and thickness range will be processed?

02

Are components flat, profiled, curved or coated?

03

Is the objective calibration, raw sanding, denibbing, texturing or polishing?

04

What are the smallest and largest component dimensions?

05

What finish-quality criteria must be met?

06

How many accepted pieces are required per shift?

07

Are extraction, air supply, power and space suitable?

08

What investment and payback are commercially acceptable?

Recommended next action

Test representative parts with documented abrasives, settings and inspection criteria. Then compare throughput, rework, consumables and cost before approving a process or equipment choice. Caple arranges application trials: WhatsApp +91 70454 59931 or visit caple.in.

SOURCES

References and data sources

Grit-to-particle-size values (FEPA P, ISO 6344)

<https://pro-graad.com/blogs/blog-1/fepa-cami-grit-conversion-chart>

Grit progression rule

<https://www.totalboat.com/pages/how-to-prep-sand-wood-guide>

IARC Monograph 100C: Wood dust

<https://www.ncbi.nlm.nih.gov/sites/books/n/iarcmono100c/a015/>

Directive (EU) 2017/2398, hardwood dust limit

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017L2398>

HSE: Wood dust exposure limits

<https://www.hse.gov.uk/woodworking/wooddust.htm>

HSE WIS23: Wood dust, controlling the risks (BS EN 12779 velocity)

<https://www.hse.gov.uk/pubns/wis23.pdf>

HSE WIS32: Safe collection of wood waste, fire and explosion

<https://www.hse.gov.uk/pubns/wis32.pdf>

Online version

https://www.caple.in/categories/sanding_machines/2574649000004303125

Internal data

- Caple sanding process chart: application recipes from customer trials.
- Manufacturer specifications and pre-installation sheets for wide-belt, veneer, brush-and-disc and buffing machines held in Caple's library (brand-neutral summary).
- Abrasive manufacturer application guidance on grit ranges by finishing stage.

Educational process reference. Not a machine operating manual, binding specification, coating recipe, safety assessment or guaranteed ROI. Specific performance requires application testing and verification. Regulatory limits shown are for reference; follow the rules that apply at your site.