

Technical Specifications for movable furniture –

General Quality Standards and Certifications

- **Compliance with Standards:** All furniture shall comply with relevant **Indian Standards (BIS)** for design, materials, and safety. For library furniture, refer to IS 1829 (Part 1:1978 & Part 2:1993), IS 1883:1983 (metal shelving racks, adjustable type), and IS 4116:1988 (wooden shelving cabinets, adjustable type). Where an Indian Standard is not available, internationally recognized standards (ANSI/BIFMA, ISO) shall be followed for performance and safety.
- **BIFMA Certification:** Furniture should meet or exceed **BIFMA** standards for strength and durability in each category – e.g. **BIFMA X5.1** for office seating, **BIFMA X5.4** for lounge seating, **BIFMA X5.5** for desk and table products, **BIFMA X5.6** for panel-based workstations, and **BIFMA X5.9** for storage units. Independent test certification to these standards is preferred to ensure high quality.
- **Materials and Finish Quality:** Use **premium-grade materials** – high-density fiberboard (HDF) and seasoned solid hardwood for wood components, and prime quality CRCA/HR steel for structural parts. All wood shall be properly seasoned and treated for durability (termite-proof, minimal warping), and all steel parts shall be **rust-protected and powder coated** or enamel finished. Powder coating shall be per IS 13871 with at least 40–50 µm thickness for a smooth, hard finish. Finishes should be non-toxic and long-lasting (scratch and stain resistant).
- **Environmental and IGBC Criteria:** Furniture should contribute to green building goals – use **low-VOC** paints, adhesives, and finishes (e.g. GREENGUARD certified for indoor air quality) so that products meet the BIFMA X7.1 standard for low emissions. Wherever possible, use sustainably sourced wood (FSC certified) and recyclable or eco-friendly materials. Preference will be given to products with **IGBC/GreenPro** or equivalent green certifications, and those offering BIFMA “Level” sustainability certification for multi-attribute environmental performance.

Library Book Racks (Fixed Shelving)

- **Construction:** Provide heavy-duty **library shelving racks** designed for a ~3,00,000 **book collection**. Racks shall be of **fixed type** (anchored to floor or wall for stability) with modular **unit bays** that can be ganged together. Use robust steel sections for uprights (angles/channels conforming to IS 808 and IS 1977) and adjustable slotted posts at 50 mm pitch for shelf height adjustment. Welding and bolting shall be done neatly with smooth grinding at joints; no sharp edges or burrs (all edges to be rounded or deburred for safety).
- **Dimensions & Layout:** Standardize rack dimensions as per BIS guidelines for convenient access and load distribution. **Height** of each rack unit shall be about 2100–2200 mm (approx. 2175 mm as per IS 1829), allowing 6–7 adjustable shelves plus a base. **Depth** for double-faced racks ~450 mm (for back-to-back shelving) and for single-faced racks (against walls) ~230 mm. Typical **bay width** ~900–1000 mm (adjustable shelving length) for ease of handling books. Each double-faced bay (~900 mm on each side) holds roughly 150 books (estimate ~40 books per meter of shelf). Adequate aisle spacing shall be provided between rack rows as per library standards (at least 1.0–1.2 m clear aisle).

- **Load Capacity:** Shelves shall be engineered for **heavy loads – at least 60 kg per shelf** (per bay) without permanent deformation. The bottom-most shelf in double-faced units should support ~80 kg (since it carries books from both sides). Shelves must not sag under full load of books; use **minimum 0.8–1.0 mm thick steel** or 25 mm thick engineered wood panels for shelves, with reinforcements (bending/boxing or undercarriage stiffeners) as needed.
- **Design Features: Adjustable shelves** on clips or brackets to accommodate various book heights (standard shelf spacing ~350 mm center-to-center, adjustable in 50 mm increments). Provide **book stopper partitions** (bay dividers) for double-faced racks to prevent books from pushing through to the opposite side. Each shelf front edge shall have an integrated **label holder** groove or metal label frame for easy identification of sections. End-of-aisle panels or rack end boards should be provided (can be decorative wooden end panels for aesthetics, fixed onto steel structure). All racks must be **plumb and stable** – base plates or plinths should allow anchoring to floor; if free-standing, provide cross-bracing or wall fixings as required to prevent tipping.
- **Materials & Finish:** The primary structure (uprights, shelves) shall be of **mild steel** (CRCA) conforming to IS 513 or IS 1079, Grade O, with high-quality **powder coated finish** in approved color. The powder coat should be oven-baked, smooth and uniform, with a hard adherent film free of runs or scratches. Surface treatment before coating must include degreasing, pickling, and phosphating as per IS 3618 to ensure corrosion resistance. Minimum dry film thickness of 40 µm is required. If wooden shelving is used in select areas (for a heritage or premium look), components shall be **solid teakwood or high-grade HDF** board with laminate finish – but such shelves must still meet the same load criteria. Any wood parts should be finished with melamine polish or laminated surface for durability. All hardware (nuts, bolts) to be zinc plated or galvanized to prevent rust.
- **Standards and Testing:** The shelving system shall conform to **IS 1829 (Part 2): 1993** specification for library steel furniture and **IS 1883:1983** for adjustable metal racks. Fabrication tolerances, shelf deflection limits, etc., should follow these standards. In absence of a specific BIS test, shelves may be tested per **ANSI/BIFMA** shelf loading standards. Finished racks should also meet fire safety norms (materials with at least Class 1 surface spread of flame if applicable for large installations). A certificate of compliance to these standards and load tests should be provided.

Comfortable Seating (Reading Area Chairs)

- **Type and Design:** Provide **comfortable armchairs or lounge chairs** for reading areas and informal library seating. These chairs are typically stationary (non-wheeled), with a focus on support and comfort for extended sitting. The design shall include a **high supportive backrest** (ergonomically contoured) and comfortable seat with **ample cushioning**. Backrests should be slightly inclined and **curved** to match the lumbar curve, without overly restricting movement. Seat dimensions should be generous: approximately 450 mm seat height, 450–500 mm seat width and depth to accommodate users of all sizes. Armrests, if provided, should allow easy ingress/egress and support reading posture.
- **Construction & Materials:** The frame should be **heavy-duty hardwood** (such as teak/beechn) or metal (steel tubular frame) for strength and longevity. Joints in wooden frames must be double-dowelled or mortise-tenon glued and screwed; in metal frames, use

continuous welds ground smooth. **Cushioning:** Seats and backs to have high-density polyurethane foam (min. 40 kg/m³ density) or equivalent, with a softer top layer for comfort. The cushioning should retain shape over time without sagging. Where applicable, use webbing or spring support under the cushions for added comfort. The upholstery material shall be a **premium fabric or eco-leather** (leatherette) that is wear-resistant (minimum 30,000 rubs Martindale), fade-resistant, and easily cleanable. Fabric upholstery is preferred to be breathable; if leatherette is used, provision for ventilation (perforation or breathable design) is recommended to avoid sweating.

- **Ergonomics and Comfort:** Chairs shall incorporate **ergonomic features** suitable for reading posture – a **slightly reclined back (≈100° angle)**, padded armrests at a comfortable height, and **seat edge rounded (waterfall front)** to prevent pressure on thighs. The design should **allow slight rocking or flex** if possible (for example, a spring or flex-back) to enhance comfort during long reading sessions, but without compromising stability. If upholstery is not heavily padded, a **woven cane or mesh support** can be used for the seat/back to provide ventilation and slight yield as recommended in library standards. Noise-dampening pads or glides must be fitted on chair legs to avoid noise on floor movement.
- **Finish & Aesthetics:** All wood surfaces to be smoothly sanded and finished with **PU lacquer or melamine polish** in approved shade, showing the natural grain if solid wood is used. Metal frames, if any, to have powder coat finish in a color complementing the decor. Upholstery fabric color/pattern will be as per architect's approval, with **fire-retardant** treatment if required by safety codes. The finished look should reflect premium quality and blend with the library interior design.
- **Standards Compliance:** Chairs shall conform to **IS 3499 (Part 1):1985** for non-revolving chairs (covering materials, construction, and finish) as applicable. Key dimensions should follow ergonomic guidelines (e.g. ISO 9241-5 or BIFMA G1) for seat height, depth, and back support. Durability should be verified per **BIFMA X5.4** (Lounge and Public Seating) tests which include drop tests, leg strength, and seat load tests. The chairs must be able to support at least a 120 kg static load without structural damage (safety factor included). All foam and fabric should meet **flammability standards** (BS 5852 or CA 117) for fire safety in public spaces.

Ergonomic Chairs (Adjustable Work/Study Chairs)

- **Type and Usage:** Provide high-quality **ergonomic swivel chairs** for workstations, study carrels, and staff offices. These chairs shall be **revolving, tilting, and height-adjustable** to accommodate various user preferences. The design must promote correct posture for computer use or desk work over long periods.
- **Key Ergonomic Features:** Chairs shall have a **gas-lift height adjustment** mechanism allowing seat height roughly from 400 mm to 500 mm from the floor (covering 5th–95th percentile users). The seat pan should be at least 450 mm wide and 400 mm deep with a rounded front edge. A **five-star base** (preferably of polished aluminum or fiber-reinforced nylon) with **five rolling casters** is required for stability and smooth movement (casters to be twin-wheel and suitable for carpet/tile floors). The chair should provide **tilt mechanism with lock and tension control**, enabling the backrest to recline ~15° and lock upright. **Armrests** shall be provided – ideally 2D or 3D adjustable (height adjustable to fit under

tables, width or pivot adjustable for comfort). A **lumbar support** (adjustable height/depth) must be integrated into the backrest to support the lower back. Backrest should be high enough to support mid-back or shoulders (overall chair height not less than ~800 mm), and preferably with a **mesh back** or breathable upholstery for ventilation.

- **Materials & Construction:** The chair frame (seat and back support) should use **structural grade plastic or metal** – e.g. glass-filled nylon back frame or steel under-seat plate. The seat should have a firm inner plywood or injection-molded shell padded with **molded foam** (density ~45 kg/m³) for lasting comfort. The backrest may be foam-upholstered or mesh. All fabric or mesh used must be durable (min. 50,000 rubs) and preferably replaceable. The base's five legs to be of die-cast aluminum alloy (ADC12 grade or equivalent) or fiber-reinforced polymer, with a load capacity of at least 150 kg. The class-4 gas spring and tilt mechanism components shall be of steel with proper surface treatment. Fasteners must be high-tensile steel. The overall construction should be wobble-free and sturdy – *e.g.*, the chair must safely support 150 kg load on the seat without any instability or structural damage.
- **Adjustability & Comfort:** Chairs should support dynamic seating – **swivel 360°**, smooth height adjustment, and reclining. Tilt tension should be adjustable to user weight. If possible, include a **synchro-tilt mechanism** (backrest reclines at slightly higher ratio than seat) for better ergonomics. Armrests if adjustable should range roughly 180 mm to 250 mm above seat and be comfortably padded. Edges and corners of all components are to be rounded. Provide **pivoting backrest** or flex-back that follows user's back. Seat and back cushions (if upholstered) should be covered in breathable mesh/fabric that meets fire safety norms.
- **Finish & Appearance:** All visible plastic parts shall have uniform color and texture (color as per user selection, typically black or grey for base/arms). Metal parts (like the base or support brackets) can be chrome plated or powder-coated. The finish must be free of sharp mold lines or burrs. Logos of manufacturer (if any) should be discreet. Aesthetic design should be contemporary and professional, suitable for an executive library environment.
- **Standards and Certification:** Chairs must conform to **IS 3499 (Part 2):1985** – specification for revolving and tilting chairs, meeting all prescribed dimensional and safety requirements. Performance to be validated against **ANSI/BIFMA X5.1** standards for office seating (including back durability test, seat drop test, caster durability, swivel cycle test, etc.). The manufacturer should ideally have BIFMA membership or certification. Additionally, the chairs should comply with **BIFMA X7.1 (low VOC emissions)** and be GREENGUARD certified if possible, as these will be used in air-conditioned indoor spaces.

Study Tables (Reading Tables)

- **Design and Sizes:** Study tables for the reading areas shall be of sturdy construction with dimensions as per library standards. A typical **single-reader study table** shall be about **900 x 600 mm** in table top size, allowing ample space for books and writing. Larger tables for group study can be provided – e.g. a **3-person reading table ~2400 x 600 mm** (which can seat three readers on one side), or a four-person table ~1200 x 1200 mm square, etc., as per layout requirements. **Height** of the table top shall be around **750 mm** above floor, which is the standard desk height for writing comfort. For improved ergonomics during

long study hours, each table should have a modest **footrest bar** around 150 mm above the floor for readers to rest their feet. Table corners should be rounded or chamfered for safety.

- **Construction & Materials:** The table **top board** may be constructed from **High Density Fiberboard (HDF)** or **plywood** of at least 18 mm thickness, or blackboard, with a high-pressure laminate (HPL) surface on both sides. The laminate should be 1 mm thick decorative laminate (matt finish, scratch-resistant). Edges of the tabletop to be either **post-formed** or finished with hardwood lipping (minimum 20 mm thick) with rounded profile, securely glued and pin-nailed. The understructure/frame shall be either **solid wood** (teak/maple) or **steel**. If wood, legs should be 50 mm × 50 mm section timber or equivalent, with apron rails of ~25 mm thickness; all joints mortise-tenon or equivalent with reinforcement by corner blocks. If metal, legs and frame should be MS square tubes ($\geq 50 \times 50 \times 2$ mm) or fabricated steel sections, with proper gussets/bracing to prevent wobble. Steel components to be powder coated in an appropriate color. Each table should be robust enough to not deflect or wobble under concentrated load of at least 50 kg on the top.
- **Features: Drawer Units:** Some study tables (especially single-reader study carrels) should have an **under-desk pedestal** or drawer unit on one side for storage of personal items/books. This pedestal can have 1–2 drawers (with locks) and possibly an open shelf for bags. Drawers should run on smooth channels (telescopic slides) and be of metal or wood construction. **Wire Management:** If tables will be used with laptops or study lamps, provide cable grommets on the tabletop and a modesty panel or cable tray under the top for concealing wires. **Modesty Panel:** Larger tables should have a modesty panel (wood or metal) in the front for privacy and to improve rigidity, especially if placed in open areas. **Levelers:** Adjustable leveling glides to be provided on table legs (especially for metal frames) to account for floor unevenness.
- **Finish:** Wooden surfaces (if any) to be **polished or laminated**. For polished solid wood, use polyurethane (PU) polish or melamine polish in satin finish – it should be smooth, without roughness, and sealed against moisture. All laminate surfaces must be of uniform color/pattern as selected (with edge banding matching or in contrast as per design). Steel frames to have **powder coated finish** (min. 50 μ m) in standard colors like black, grey, or as specified. The finish should pass scratch resistance and corrosion tests (500-hour salt spray with no rust). Visible hardware like screws should be stainless or coated, and preferably concealed with caps.
- **Standards Compliance:** Design follows IS 1829 recommendations for library reading tables (size and height). The furniture should also align with **IS 5968:1981** (dimensions for office tables) if applicable, ensuring ergonomic height. Load-bearing capacity and durability should be tested per **BIFMA X5.5** (Desk/Table standard) – including deflection under load, stability (tip) test, etc.. All wood products (HDF/ply) must comply with IS 12406 (for MDF/HDF) or IS 303/710 (for plywood) regarding emission (E1 grade formaldehyde) and mechanical performance.

Office Tables (Work Tables)

- **Description:** Standard office tables are required for library staff offices or general use (e.g. librarians' desks, cataloging work tables). These **non-modular desks** are typically for one user, providing a work surface and some storage (drawers). Typical sizes may range from

1200 x 600 mm for a compact desk to **1500/1800 x 750 mm** for a larger table, depending on staff requirements. Height shall remain ~750 mm as standard.

- **Construction: Top surfaces** to be made of high-quality particle board, MDF, or plywood (18 mm or thicker) laminated with scratch-proof laminate (preferably post-formed front edge for durability). **Underframes** can be panel-end type (i.e. gable ends of boards) or with separate legs. Panel-end construction should use 25 mm thick pre-laminated boards for sides and modesty panel of 18 mm board. If using separate legs/frame, steel rectangular tube legs (e.g. 50 × 25 mm, 2 mm thick) or solid wood legs are acceptable, with cross bracing to ensure stability. Fasteners and inserts (like knock-down fittings) used in board constructions must be of high quality (minifix, etc.) to allow assembly/disassembly without loss of strength. Provide **CPU hanger/stand** and **keyboard tray** for computer workstations as needed. Each table should include a **drawer unit**: typically a box drawer and a file drawer on ball-bearing slides, built of 0.8 mm steel sheet or 18 mm board, lockable.
- **Ergonomics & Features: Modesty panel** in front (for privacy and to hide cables) made of matching board or perforated metal. **Cable management**: desks should have at least two 50 mm diameter cable grommet holes on the top, and provision below the desk (cable trays or clips) to route power/data cords neatly (especially for computer usage). Edges and corners must be smooth – all board edges finished with PVC edge band (2 mm thick on impact edges). If table is against a wall, allow for a gap or cut-out for running cables down. Weight capacity: the desk should support equipment like computers and books – at least 50 kg uniformly distributed on top without bowing.
- **Finish**: All laminate surfaces in the color/texture as per design (for instance, grey or beech woodgrain laminates). Exposed edges banded in matching PVC. Steel parts (legs, drawer fronts if metal) powder coated. If solid wood is used for any part, it shall be well seasoned and finished in PU polish. The overall finish should be professional and consistent with corporate office furniture quality.
- **Standards Compliance**: Office tables to adhere to **BIS** guidance for office furniture dimensions and safety. Where applicable, refer to IS 5277 for storage units (if file drawer included) and IS 1829/IS 1883 for shelving aspects. Desks should satisfy **BIFMA X5.5** performance tests (including stability under vertical and horizontal loads, strength of desk drawers, cycle testing for drawers, etc.). All particle boards or MDF used must be **E1 low-formaldehyde** as per IS 3087 / IS 12406. Ensure that no harmful substances (like lead in paints or VOCs beyond limits) are present, in line with IGBC healthy indoor environment criteria.

Executive Tables (Executive Desks)

- **Design and Size**: Executive tables are high-end desks for senior personnel or the chief librarian's office, reflecting premium quality. These are typically larger (e.g. **1800–2100 mm length × 900 mm depth** for the main desk) with additional side credenza or return units as required. Height is standard ~750 mm. The design should be elegant with clean lines – often a **freestanding desk with thick top and full panels**, possibly with modest overhangs. Include a **modesty panel** and possibly an extended conference overhang on the visitor side for small meetings.

- **Materials:** Use **top-grade materials** for an executive feel. The tabletop core may be plywood or MDF (25 mm or thicker) with **natural wood veneer finish** (e.g. oak, walnut, teak veneer) polished to a smooth sheen, or a high-end laminate (textured or high-gloss as specified). Solid wood lipping of wood like teak, beech or oak (at least 5 mm thick) should run all around the top edges for impact resistance and a rich look. The under-structure (panels or legs) can be made of **MDF/plywood with veneer**, or **metal** with cladding – for example, a steel frame providing support with wooden panels outside. Use of **leatherette writing pads** inlaid on the tabletop can be considered for a luxurious finish.
- **Features:** Provide **storage components** integrated into the desk: typically a pedestal of drawers (one shallow drawer for stationery and one or two deeper drawers for files) on one or both sides. Drawers to have soft-close channels and central locking mechanism. A **wire management system** must be built-in – concealed cable raceways for running power/LAN to the tabletop for computer, with flip-open cover outlets on the desk surface for power/USB. The desk should also include provisions for wire routing between the main desk and any return/side units (like an underside channel). **Drawer Construction:** Drawer fronts in matching veneer/finish; inner box in plywood or metal, mounted on telescopic slides. **Handles:** Use premium handles or push-open hardware for a sleek look. All locks should be of high quality (brass or equivalent) with a master key option if needed.
- **Structural Integrity:** Even with a stylish design, the desk must be structurally sound. If it has long spans (e.g. 2 m length) without intermediate support, ensure the top doesn't sag – use metal stiffeners or thicker core. The desk should support heavy loads (e.g. stacks of books or equipment) – at least **100 kg distributed load** capacity. Stability is crucial: if the design is 'floating top' style or has a single pedestal support, verify that it cannot tip with reasonable force. Leveling adjusters to be provided on base for leveling on uneven floors.
- **Finish:** Veneer surfaces shall be finished with **polyurethane (PU) polish** in open grain or closed grain finish as specified (matte or semi-gloss) – showing a uniform tone and free of blotches. Laminate surfaces (if used) should be of premium grade (e.g. high gloss or textured laminate, as per selection). All visible edges of boards to have matching veneer or solid wood trim. Metal components (like support frames or cable grommets) can be chrome plated or powder coated with a metallic finish. The overall appearance should exude executive quality, with meticulous attention to detail at joints and interfaces.
- **Standards Compliance:** The executive desk shall meet the same functional performance tests as other tables (**BIFMA X5.5** for structural performance). Additionally, any glass components (if included for tops or returns) should be tempered safety glass (as per IS 2553). Adhesives and finishes must comply with **IS 4200** series (for furniture finishing) ensuring no toxic emissions. Given the bespoke nature of executive furniture, manufacturer should provide a warranty for structural soundness and finish (e.g. polish not fading or peeling) and preferably have ISO 9001 quality certification.

Workstations (Modular Office Workstations)

- **Description:** Provide **modular workstations** for library staff or patron computer areas. These typically consist of work surfaces with integrated partition panels (half-height panels for privacy and acoustics). Workstation units could be linear, cluster (e.g. 4-pack), or

cubicle style depending on layout. Each workstation should accommodate a computer, writing space, and basic storage (like under-desk pedestal or shelves).

- **Panel System:** Partition panels should be **tackable and sound-absorbing**, about 1200–1500 mm in height from floor (sufficient to define space while allowing light and oversight). Panels to have an aluminum anodized (or powder coated) frame structure and finished with fabric upholstery or laminate/acrylic as per design. Use **fire-retardant foam/fiber board** inside panels for noise reduction. The panels must be sturdy and have provision to attach work surfaces, shelves, or accessories. Panel junctions (90°, 120° or straight connectors) should be structurally secure, with leveling feet for stability. The system should be modular to allow reconfiguration if needed.
- **Work Surface:** The desk portion of the workstation shall use **particle board or MDF** of 25 mm thickness with laminate finish for durability. Typical size per person could be ~1200 mm width by 600 mm depth (for a single-sided workstation) or as required by design (e.g. corner L-shapes). Front edge to be post-formed or have PVC edge banding. Provide cut-outs or grommets on the worktop for cable management. Support the worktops on either panel hangers (cantilever brackets attached to panels) or leg supports. If using cantilevers, they should be heavy gauge steel brackets tested for load. If using legs, match them to panel system design (metal legs with levelers).
- **Storage and Accessories:** Each workstation should be equipped with at least one **mobile pedestal unit** (2-3 drawers, on wheels) that fits under the desk, constructed of laminated board or steel (with central locking). Additionally, **desktop shelves or overhead cabinets** may be mounted on the panel for extra storage (with clear height above desk of ~400 mm). Include accessory options like pin-up boards, whiteboard tiles on panels, paper trays or CPU holder mounted below desk, etc., as per user needs. All accessories should be compatible with the panel system (tool-free installation preferred).
- **Electrical Provisions:** The workstations must have integrated **electrical raceways** along the panels for safe routing of power and data cables. Panels should have a removable raceway cover at desk level or skirting level housing plug sockets, with capacity for wiring as per project requirements (e.g. 3 nos. 6/16A sockets and 2 data outlets per seat). All electrical components must be ISI marked and the system should allow daisy-chaining as per electrical design. There should be no exposed wires on the work surface – use cable trays and grommets effectively.
- **Materials Finish:** Panel fabrics to be **polyester or polypropylene blend**, inherently fire-retardant or treated to meet ASTM E84 Class A or equivalent. Color as per scheme (usually soothing, light colors for a library environment). Laminate for worktops should be of standard office grade (with resistance to wear, cigarette burn, etc.). Metal parts (panel frames, legs) powder coated (minimum 40 µm) in neutral colors (grey, white, etc.). All components should have a clean finish with no sharp edges (top of panels should have a protective cap).
- **Standards Compliance:** The modular workstation system shall meet **ANSI/BIFMA X5.6** standards for panel systems – this covers stability of panels (not toppling when force is applied), strength of attachments (like work surfaces on panels), etc. Work surfaces should also comply with BIFMA X5.5 for load and deflection. The foam and fabric in panels should meet **IS 110 (1983)** or relevant standards for smolder resistance. Electrical fittings must comply with **IS 732** (wiring code) and be certified. The entire system should carry a

GreenGuard or similar certification for low emissions due to the extensive use of composite wood and fabric (to align with IGBC requirements).

Storage Units (Cabinets, Shelves, and Filing)

- **Book Cases and Cabinets:** Provide **storage cabinets** for library use, including book cases, file cabinets, and glass-front display cabinets. **Steel book cases** (with hinged glass doors) for reference materials shall conform to IS 7761:1983 – generally a cabinet ~1.8 m height with four adjustable shelves, made of steel sheet (0.8–1.0 mm thick) and lockable glazed doors. **Glass-front cabinets** (for rare books or archives) shall conform to IS 7760:1985, having framed glass doors with locking and dust-proof sealing. For aesthetic areas, **wooden book cabinets** can be provided – constructed from plywood/board with veneer or laminate finish, toughened glass doors, and adjustable shelves on pins. All cabinets must have leveling feet and wall anchoring provision for safety.
- **Filing and Multi-Purpose Storage:** Include standard **steel filing cabinets** (4-drawer or 2-drawer units for A4 or FC size files) made of CRCA steel, 0.7 mm body and 0.8 mm drawer fronts. Drawers to slide on heavy-duty ball-bearing runners and have anti-tip mechanism (such that only one drawer can open at a time to prevent tipping). Each drawer with a handle and label holder, central locking for all drawers. Additionally, provide **wooden storage cupboards** for staff use (ex: 2 m high cupboards with double doors) using 18 mm pre-laminated board for body and doors, edge-banded, with 3-4 shelves inside, lockable handles. Hinges should be soft-closing Euro hinges or heavy piano hinges in steel almirahs.
- **Compartmental Shelving & Specialty Storage:** For periodicals and journals, provide tilted display racks with storage. For newspapers, wooden newspaper stands with rods. **Map cabinets** or plan file cabinets (if needed) should be flat file drawers (steel or wood) with appropriate size (A0/A1) and roller slides. **Lockers:** If patrons need lockers, provide units of lockers (each compartment ~300×450×500 mm) powder-coated steel with ventilation slots and locks. All such specialty items should be of equal quality standards.
- **Materials and Finish:** Steel storage units must be made from prime quality CRCA steel (confirming to IS 513). All welds to be spot or seam welded smoothly. After fabrication, all steel items shall undergo antirust surface treatment and be **powder coated** with epoxy-polyester powder, minimum 50 µm thickness, in approved shade (typically grey or beige). The finish should pass hardness and adhesion tests (no peeling on cross-hatch test, pencil hardness ≥ HB). Wooden cabinets if provided should use laminate finishes for heavy use areas; if veneer/polish is used, it should match other furniture and be properly sealed. Glass for doors must be 4 mm (for small doors) to 6 mm (for large doors) **toughened safety glass**. Locks should be brass or steel with nickel finish, all using a master key system if required.
- **Standards Compliance:** All storage furniture must adhere to relevant BIS standards: e.g., IS 3312:2021 for steel shelving cabinets (adjustable shelves), IS 7761 for book cases, IS 5244 for sliding drawer cabinets, etc. They should also meet **BIFMA X5.9** standards for storage units – including drawer cycle testing, door hinge tests, unit stability (tip test with open drawers), and shelf load tests. Weight capacities: each shelf in cabinets should hold ~40 kg, file drawers should hold ~30 kg of files, without deformation. If Eco-mark/GreenPro criteria are specified, materials should have certified eco-friendly coatings and recyclable content.

Mobile Compactors (High-Density Storage System)

- **General Description:** Mobile compactor units (also known as mobile shelving systems) shall be provided to maximize archival storage in limited space (ideal for less-used or archival books in a 3 lakh capacity library). The system comprises **movable shelving racks mounted on rails**, with one static bay at one end for stability. All compactor units shall be **mechanical drive type** (chain-and-sprocket drive with hand wheel) for ease of movement of heavy loaded racks.
- **Configuration & Dimensions:** The compactor system will consist of single-faced and double-faced shelving bays mounted on mobile bases. **Height:** Each bay approximately **1980 mm body height**, plus base frame and rail (total ~2080 mm from floor to top). **Bay Size:** Standard bay width ~915 mm (three feet) and depth 457 mm for single-faced, 914 mm for double-faced (two back-to-back units). Multiple bays can be conjoined to form a movable unit. For example, a typical configuration might be 3 bays per mobile unit, each bay ~915 mm wide, yielding a 2745 mm long double-faced mobile unit. **Shelves:** Each bay to have 5 compartments (4 adjustable shelves + 1 fixed bottom) by default, with shelf pitch adjustable in 25 mm increments. The **aisle space** (when opened) between two mobile units should be roughly 750–800 mm for user access.
- **Load Capacity:** The compactor shelving must be heavy duty – each shelf shall carry **minimum 70 kg** load uniformly. The entire mobile unit (multi-bay) base frame and wheels must support the total loaded weight without deformation. The design load per bay is high to accommodate dense storage (books, files) – e.g., a 4-bay double-faced unit ~3.6 m long should hold ~2800 kg in total (70 kg × 40 shelves), so factor of safety should be applied accordingly. The tracking and drive mechanism should allow a single operator to move a fully loaded unit with minimal effort (approximately <10 kg force).
- **Construction: Bodies/Carriage:** The shelving racks themselves to be constructed similar to fixed shelving (0.8–1.0 mm steel shelves, adjustable, with back/top cover panels). These rack bodies are bolted or welded onto a rigid **base frame** made of rolled steel sections (IS 2062 steel, 3.15 mm thick channel/frame). Base frames shall have guide wheel assemblies – at least **4 wheels per base frame** (for a 2-bay long unit) or more for longer units, made of cast iron or steel with nylon tread. Wheels mounted on **sealed ball bearings** and fixed to axles on the base frame. **Rail System:** Rails made of bright steel square bars (~25 mm) housed in a C-channel (2 mm thick) grouted to the floor. Rails must have end stoppers and an anti-derailment design. The rails should be perfectly leveled and aligned to prevent binding. **Drive Mechanism:** A chain-and-sprocket drive connects the hand wheel to the wheel axles of the unit. Turning the hand wheel translates into linear motion of the shelving unit. The chain drive shall be concealed inside a cover and include an **idle locking knob** to secure the unit when not in motion. Hand wheels should be robust (approx. 300 mm diameter, three-spoke with a polymer grip) for easy operation. Each mobile unit should also have a manual locking pin or knob that can lock it in a closed position for safety, and a central **locking bar** mechanism on the last unit to lock all units together when compacted.
- **Safety Features:** The system must include **anti-toppling** features – e.g. an anti-tip wheel or rail guiding mechanism that prevents the unit from tipping when heavily loaded and moved. **Safety locks** should be provided so that units do not accidentally roll (each unit with a brake or lock). Optionally, **push handles** or knob-type handles on the movable units’

sides can be given for manual positioning. When all units are closed together, a **central lock** (lever or lock bar) shall enable locking the entire block to prevent unauthorized access. Also include **aisle safety** reflectors or indicators if needed (to show if an aisle is occupied, for personnel safety in large installations).

- **Finish:** All steel components of the compactor (shelves, panels, frames, rails) are to be **pre-treated and powder coated**. The steel should be of prime quality (preferably **pre-galvanized or pre-coated sheets**) of thickness not less than 0.8 mm for shelves and 1.0 mm for load-bearing members. The powder coating (or epoxy paint) should be of 40–50 microns and of **baked enamel quality**, in a smooth semi-gloss finish (standard grey or as specified). The finish must withstand heavy usage – no peeling or chipping with repetitive movement. Apply rubber or PVC **buffers** between units to avoid metal contact and noise when closing. All nuts, bolts, and moving parts should be zinc plated or otherwise corrosion protected.
- **Standards Compliance:** The compactor system should generally comply with **IS 1553 (Design of Library Shelving)** recommendations for space utilization, and the fabrication with relevant BIS for steel shelving. While there is no dedicated BIS standard for mobile compactors, the system's performance should be tested to relevant international benchmarks. For example, **DIN EN 14073/14074** or similar standards for office storage regarding stability and strength may be referenced. The vendor should provide a test report or usage reference that the system can handle the stated loads. Tracks and mechanisms should conform to material standards (EN 31 for rails or equivalent). Furthermore, all aspects of the compactor should satisfy fire safety and building codes – e.g., if required, the compactor paint should be flame retardant, and the design should allow sprinkler penetration (typically open shelf design does). Warranty of at least **2 years** on moving parts and an assurance of after-sales service must be provided.

Lounge Furniture (Sofas and Soft Seating)

- **Items and Use:** Lounge furniture will be used in library lounge areas or waiting zones, comprising **sofas (1-seater, 2-seater, 3-seater)**, low **coffee tables**, and possibly **ottomans**. These should be of **premium quality and comfort**, inviting users to relax and read. The style should be modern yet durable, given the high usage in a public setting.
- **Sofa Construction:** Internal frame of sofas shall be made of **seasoned solid wood** (such as pine/salwood for internal structure) and/or a combination of wood and steel reinforcement. Joints in the frame must be strong (glued, screwed and corner-blocked). Seat support can be by steel sinuous springs or webbing straps with flame-retardant foam topping. Cushioning to be **multi-layered foam**: e.g., 12 cm thick seat cushions with high-density core ($\geq 35\text{--}40\text{ kg/m}^3$) and softer top layer for comfort, wrapped in polyester fiber. Back cushions can be softer (density $\sim 28\text{ kg/m}^3$) but should retain shape. Ensure that the seating has **adequate depth ($\sim 500\text{ mm}$)** and backrest height to support users comfortably. If loose cushions are used, they should have removable covers for cleaning.
- **Upholstery:** Use **high-quality upholstery fabric** or eco-leather. Fabric should be heavy-duty commercial grade ($\geq 30,000$ double rubs Wyzenbeek or Martindale) and **stain-resistant** (preferably with a stain guard treatment). All upholstery should be lock-stitched and reinforced; stress points to have piping or top-stitching. If leatherette (artificial leather) is used, choose grades that are UV-resistant (to avoid cracking/peeling) and soft to touch,

with a breathable layer if possible. Color and texture per design scheme (darker shades or patterned weaves may be preferred for hiding wear). Fire safety: upholstery should comply with **BS 7176 Medium Hazard** or equivalent (cigarette and match test).

- **Coffee Tables and Ottomans:** Coffee tables should have **hardwood or MDF tops** with veneer/laminate or glass top, and solid wood or metal legs. Edges of glass, if used, must be polished and glass should be tempered. Designs should avoid sharp corners (use chamfered or rounded corners for tables in lounge). Ottomans or poufs, if provided, should have the same build quality as sofas (wood frame, foam, upholstered) and ideally on glides or casters (locking) for mobility.
- **Feet and Details:** All sofas and chairs to have **solid wood or metal feet**, 50–100 mm high, with felt or rubber pads to protect flooring. Feet finished in polish or powder coat to match design. Bottom of sofas should allow clearance for cleaning underneath. Any decorative elements (buttons, tufting) should be secure and non-removable by users.
- **Finish & Appearance:** The lounge furniture pieces should present a **consistent aesthetic**. Wood parts (exposed legs or trim) to be polished in matching tone (e.g., walnut or wenge). Visible metal accents to be stainless steel or powder-coated as per design. The finishing of upholstery must be taut, with proper alignment of patterns if any, and no wrinkles. Cushions should recover shape after use (use foam with good resiliency or add siliconized fiberfill). Detailing such as tufted backs or piping is optional per style but must be executed to high standards. The overall impression should be that of comfort and luxury, aligning with a high-end library ambiance.
- **Standards and Durability:** Lounge seating should be built to **commercial durability standards** – capable of heavy daily use. It should conform to **ANSI/BIFMA X5.4** for lounge seating, which includes tests for leg strength, seat impact (drop test with 102 kg bag), and cyclic loading. Frames should last 10+ years; fabric and foam should maintain integrity for at least 5 years under normal use. Any foam should be **CertiPUR-US** certified or equivalent (low VOC, no harmful chemicals) to align with green requirements. Coffee tables to satisfy safety (if glass, to IS 2553 tempered glass standard) and stability (no tipping with a 15° load). All lounge furniture to come with at least 1-year comprehensive warranty.

Classroom Furniture (Training Room Setup)

- **Overview:** If the library includes a multi-purpose room or classroom for lectures, provide **classroom-style furniture** that is flexible and durable. This typically includes **student chairs (with or without writing tablets)** and **training tables** that can be rearranged. The furniture should support quick reconfiguration (stackable or folding where possible) and withstand frequent handling.
- **Student Chairs:** For adult users (college level), use **stackable chairs** with option of a folding writing tablet. Chairs should have a **one-piece molded seat/back shell** of high-impact polypropylene or a plywood shell with foam upholstery, mounted on a sturdy metal frame. The standard seat height ~450 mm, seat width ~400 mm. The frame to be 1.2 mm thick MS elliptical or round tube, epoxy powder coated. If writing tablets are provided, they should be made of MDF or polypropylene, anti-slip surface, and securely foldable to the side or rear. Tablet hinges must be robust (metal-on-metal joint) to survive heavy use. Weight capacity of chairs at least 120 kg. Alternatively, **folding tablet chairs** (metal

frame, fabric padded seat) could be offered, but ensure they lock safely when opened. Provide ganging hooks if chairs need to be aligned in rows.

- **Training Tables:** Use **lightweight folding tables** or flip-top modular tables for classroom use. Typical size: 1200 x 450 mm or 1500 x 500 mm per table, seating 2 participants. Tables should have **folding legs** or a flip-top mechanism so they can be stored compactly. Frame in MS steel tube (1–1.2 mm thick) with lockable folding joints. The tabletop of 18 mm particle board or plywood with laminate surface (prefer post-formed edges or PVC edge). Tables should be sturdy when deployed – locking devices to prevent accidental folding, and leg stabilizers to avoid wobble. Provide modesty panels if required for a more formal arrangement (could be removable).
- **Special Seating (if needed):** In case the library holds seminars, a few **ergonomic task chairs** could also be used in a classroom for instructors (same specs as ergonomic chairs above). But generally, classroom chairs should be simpler for bulk use.
- **Finishes:** Chairs: plastic shells in a color that complements the library (blue/grey etc.), UV resistant so they won't discolor. Metal frames powder coated black or grey. Tablet surfaces in black ABS or laminated board. Tables: laminate in light colors, frame coated in neutral shade. All finishes should be scratch resistant and easy to clean (important for high turnover use).
- **Standards Compliance:** Classroom chairs and tables should conform to **BIS standards for educational furniture** where available (e.g., IS 4837 for school chairs, IS 7139 for lecture halls – if applicable). They should also meet **BIFMA/ANSI** standards for safety: non-upholstered chairs can be tested per BIFMA X5.1 (structural adequacy for general seating). Drop tests, fatigue tests for tablet arms, etc., should be conducted. If stacking chairs are used, stability of stack (at least 10 high without tipping) must be ensured and chair design per ISO 7173 tests. All furniture must be **fire-safe** (plastic materials self-extinguishing UL94 HB or better, foam/fire retardant fabric if upholstered). Edges of tablets and tables to be smooth per IS 1003 (safety requirements for school furniture). The vendor should supply a sample for evaluation to confirm ergonomics and sturdiness before bulk supply.

Museum-Grade Showcases

- **Design & Aesthetics:** Freestanding horizontal (table-style) and vertical (upright) vitrines designed for public display and archival preservation. Aesthetics shall reflect the Nalanda legacy with classical wood, bronze, and glass tones in the exterior finish. The cases will feature a clean, frameless glass presentation for maximum visibility, supported by a discreet structural frame. Wooden or bronze-finished base cabinets/pedestals may be used to harmonize with heritage interiors, provided they are sealed and inert. Overall form and detailing should be elegant and unobtrusive to highlight the displayed artifacts.
- **Materials & Construction:** Each showcase shall have a rigid metal framework (welded steel or aluminum alloy) for structural stability, which may be clad with seasoned hardwood or bronze/brass trims for aesthetic appeal. All construction and trim materials must be **chemically inert**, suitable for long-term museum use – no off-gassing or acidic content that could harm artifacts. Interior linings, adhesives, and paints must be low-VOC and non-toxic. Use of powder-coated metal, glass, and other inherently non-emitting materials is required to meet green building and conservation standards. Wood components

(if any) shall be formaldehyde-free (E1 or better) and finished in water-based low-VOC sealants. Joints should be tight and dust-proof, with silicone or EPDM gaskets (non-outgassing) to seal all openings. Construction must comply with archival storage standards (ISO 11799 for document repositories) to ensure materials and design do not compromise a stable internal environment for artifacts.

- **Glazing (Glass Panels):** Use **laminated safety glass** for all viewing panels (minimum two-layer laminated, each layer tempered). Glass should be ultra-clear, low-iron for true color rendering, and incorporate a UV-filter interlayer blocking $\geq 97\%$ of UV radiation. This protects sensitive items from light damage. Laminated safety glazing also provides high security – even if shattered, it remains in place, keeping the case sealed. Glass thickness shall be sufficient for large spans (e.g. 6+6 mm lamination or higher as needed to meet safety norms). All glazing must meet **IS 2553** (Indian safety glass standard) and/or EN 12150/EN 12543 for tempered/laminated glass. Exposed glass edges to be polished and set in silicone gaskets or bronze comes for a dust-tight fit. Where appropriate, apply an anti-reflective coating or glass treatment to minimize glare without affecting UV blockage.
- **Environmental Control:** The showcases must function as microclimate enclosures. They shall be tightly sealed with dust gaskets and minimal air exchange (target **<0.1 air changes per day**), achieved through continuous compression seals around doors/lids. Each case will include provisions for **relative humidity (RH) buffering**, such as a silica gel compartment or passive humidity control cassettes accessible to conservators. The design should maintain internal RH within a stable range (e.g. 45–55%) and temperature close to ambient, in line with PAS 198:2012 for environmental conditions. Materials inside (fabric linings, supports) must absorb no moisture or pollutants – use inert, **Oddy-tested** materials for all internal surfaces. **LED lighting** shall be integrated internally (if required) in a manner that isolates heat and UV from the objects. LEDs must emit no UV/IR and produce minimal heat; lighting levels should be adjustable and meet conservation guidelines (e.g. ≤ 50 lux for sensitive manuscripts). Any light fixtures ideally mounted outside the sealed volume or behind UV-filtered glass. Environmental monitoring ports (for data loggers or sensors) may be provided to track temperature/RH inside the case without opening.
- **Security & Locking:** Provide **secure locking mechanisms** to prevent unauthorized access or tampering. Cases should have flush, tamper-resistant locks (museum-quality barrel or pin tumbler locks) with key control restricted to authorized personnel. Locking may be multi-point for larger cases to ensure even gasket compression. The access doors/lids (whether top-opening for horizontal cases or side-opening for vertical cases) shall open smoothly – use gas spring assists or torque hinges for controlled motion so that heavy glass panels can be opened by one person safely. When closed and locked, there should be no pry points; the showcase should meet international museum security standards (e.g. EN 1627 class for resistance to forced entry, if applicable). All hardware inside the case (locks, hinges) should be hidden or minimally visible from the exterior to maintain a clean display appearance.
- **Lighting & Electrical:** Internal lighting (where included) will use conservation-grade **LEDs** with high color rendering ($\text{CRI} \geq 90$) to faithfully illuminate exhibits. LED strips or spots should be recessed in the case hood or base, with diffusers to prevent glare on glass. Wiring must be concealed, and heat from lights must be vented away or isolated (for example, fiber-optic lighting can be considered for zero heat inside case). No UV-emitting lights are allowed. There should be an option to regulate lighting intensity and to turn off

lights when the room is closed to minimize light exposure (since light damage to artifacts is cumulative). Electrical components should comply with IS 302 and IEC safety standards; a master cutoff switch for each case's lighting is recommended. If needed, provide cable management and the ability to route power inconspicuously (e.g., from floor conduits).

- **Dimensions & Configuration:** A variety of sizes are anticipated to suit different exhibit items. **Horizontal table cases** might be roughly 1200–1500 mm (L) × 800 mm (W) for the display deck, with a height of 1000–1100 mm (for comfortable viewing from above). **Vertical showcase vitrines** might be ~2000 mm tall, with footprints around 1000×1000 mm or as appropriate for objects. Both forms shall be built with modularity in mind – for example, standardized base cabinets and interchangeable glass hoods where possible – to ensure consistency. Each showcase will include leveling feet (to accommodate floor unevenness) and must allow discreet anchoring to the floor or wall for seismic/wind stability if required. Construction tolerances are tight: doors should fit with ≤1 mm gaps when closed to ensure effective sealing. Despite their large size, units should be movable in sections (base, glass hood, etc.) to facilitate installation through standard doorways and then assembled on-site.
- **Standards & Conservation Compliance:** **ISO 11799** (Information and documentation – Document storage requirements) and **PAS 198:2012** guidelines must be met or exceeded. This means the cases, when closed, create an environment that protects against light, dust, pollutants, and excessive fluctuation of climate. All interior materials (paints, adhesives, textiles, cushioning foams) must pass the **Oddy Test** and/or **Photographic Activity Test (PAT, ISO 18916)** confirming they won't harm paper, photographs, or artifacts over time. The showcases should be manufactured to professional museum case standards (as used by national archives or museums) – e.g., low air exchange rate, and provision for microclimate control. **Safety glass** certification is mandatory (e.g., UL 972 or EU equivalent for burglary resistance if displays include high-value items). In terms of structural performance, the cases must be sturdy and level, with no risk of toppling or collapse; if they are large freestanding units, they should comply with furniture stability standards (ANSI/BIFMA or EN 16121 for public space furniture). All finishes shall be **IGBC compliant** for low emissions – powder-coated metals, glass, and properly sealed woods are inherently low-VOC choices. The finished product should thus contribute to a safe environment both for the artifacts and for people (no toxic fumes, and sustainable materials where possible).

Newspaper and Magazine Display Units

- **Function & Layout:** These units will serve as high-visibility display racks for current newspapers and magazines, with integrated **under-storage** for back issues. Each unit shall be a **modular bay** that can stand alone or be ganged in a series. The design features sloped display shelves (angled for easy reading of titles) that hinge up or open to reveal storage compartments beneath. This “flip-up” periodical shelving system allows the latest issues to be on display while older issues are neatly stored yet easily accessible to readers. Units should encourage browsing: the displayed publications are presented face-out at a readable angle, and retrieval of back issues is convenient via the hinged shelf mechanism. The overall appearance should be neat and inviting, consistent with a modern library periodicals area, with no sharp edges or protrusions.

- **Dimensions (Typical):** A single-sided magazine/newspaper display unit is approximately **900 mm wide × 350 mm deep** (about 36" × 14") per bay, and about **1900 mm high** for a unit with 5 display tiers (or ~2200 mm for 6 tiers). Each display shelf is roughly 330–380 mm high to accommodate large format newspapers when closed. Depth of the under-shelf storage should be sufficient to hold stacked newspapers flat (≥ 300 mm clear internal depth). If double-sided units are used (for placement in open areas, accessible from both sides), the depth roughly doubles (~600–700 mm) while width and height remain similar^s. The system shall be modular, meaning additional bays can be attached side by side with shared vertical panels; this allows future expansion or reconfiguration. Adjustable leveling glides must be included at the base of each unit for stability on uneven floors.
- **Construction & Materials: Hybrid wood and metal construction** is required to balance durability with aesthetic warmth. The structural frame (uprights, shelf brackets, and internal supports) shall be made of heavy-gauge steel – e.g., 18-gauge for double-sided units, 22-gauge for single-sided shelves as a guideline – providing robust support for heavy stacks of paper. Vertical end panels and the hinged display shelves can be of engineered wood or plywood with veneer finish, or wood laminate on an MDF core, for a furniture-quality appearance. All wood products must be low-emitting (meeting formaldehyde **E1** or better) and **low-VOC** in finishes. Metal components: steel parts are to have a **powder-coated** finish (electrostatically applied and baked enamel) in a color that complements the wood (for instance, matte black, grey or bronze tone powder-coat along with woodgrain laminate). Powder coating ensures a smooth, inert surface with no VOC emissions and high durability against scratches. The steel frame should include **double-wall uprights** and **closed-back panels** for rigidity and to protect stored materials. Fasteners should be hidden where possible (use of cam locks or concealed screws) to prevent snagging and present a clean look. All exposed edges of wood must be rounded or covered with impact-resistant PVC/T-molding for safety and longevity.
- **Display Shelf Mechanism:** Each display shelf shall be a **hinged, flip-up panel** that can be lifted by users or staff to access the storage below. The hinge mechanism must be sturdy – preferably a continuous piano hinge or multiple heavy-duty hinges along the shelf width – to withstand frequent use. When opened, the shelf should stay up (either via a detent or friction stay) so a user can retrieve materials with both hands free. Optionally, incorporate a soft-close feature or damping mechanism to prevent the shelf from slamming shut. The angle of the display shelves should be roughly 10° from horizontal; this incline displays magazine covers or newspaper fronts clearly while keeping them in place. A small lip (20–25 mm) at the bottom of each shelf will ensure that individual issues do not slide off. The storage compartment beneath each shelf should have a **fixed flat shelf** to hold back issues. These compartments must accommodate the largest publication size in the collection – for example, broadsheet newspapers stored flat, which may require an internal width ~500 mm or more. Interiors of storage cubbies should be smooth powder-coated steel or laminated board for easy cleaning and to avoid staining the paper.
- **User Accessibility:** The units are intended for public use, so ergonomic placement of materials is important. The top display shelf should be no higher than ~1700 mm from the floor, to be reachable by most users. The bottom display tier should be elevated (with a closed base plinth of ~100–150 mm) to keep materials from being too low and to allow toe space. Lifting of the display shelves should require minimal effort; hinges and any assist mechanism should make them light to open. Signage or label holders shall be provided on

either the front of each shelf or on the end panels to identify the titles on display. For example, an acrylic label strip or metal card holder could be integrated. The design should also facilitate refilling by staff: shelves that **lift and slide back** (retract) into the unit are one acceptable approach, or those that simply hinge upward past 90°. All movements should be safe and intuitive.

- **Finish & Environmental Considerations: Surface finishes** must be durable and **low-emission**. Powder-coated metal (which is inherently non-emitting and contains no solvents) will be used on all steel parts. Wood surfaces will be finished with high-quality lacquer or polyurethane that is low in VOC (meeting IGBC green interior requirements for minimal off-gassing). The finish should be wear-resistant to withstand daily handling of periodicals. Colors/finishes will be selected in keeping with the library's design scheme – likely warm wood tones for the wood components and neutral or dark tone for metal. All materials should be **colorfast** under ambient lighting (no fading or off-gassing over time). From a conservation standpoint, while patrons will handle current issues, the storage of back issues inside the unit means materials should not introduce acidity or pollutants; thus, interior paint/laminate should be archival-quality or at least neutral pH. If any fabric or rubber parts are used (for example, a cushioned pad to hold up the display shelf when closed), they must be non-staining and stable. Regular cleaning of these units should be possible with mild cleaners, so finishes should be moisture-resistant and not prone to delamination.
- **Structural Performance & Safety:** The display units must be **structurally sound** and safe in a public environment. They should comply with relevant furniture strength and stability standards (such as **ANSI/BIFMA X5.9-2019** for storage units, which evaluates durability and tip-over safety). Each unit, when loaded with printed materials, should remain stable – if free-standing double-sided units are used, they may need a wider base or floor anchoring to prevent tipping. An **anti-tip kit** or bracket that secures single-sided units to walls is recommended for seismic safety and to prevent any pull-over by climbing. The hinged shelves, when flipped open, should not cause the unit to become front-heavy; internal counterweights or wall-fixing might be used if necessary. Load-bearing capacity: each display shelf should support at least 5–10 kg (a stack of periodicals) without deformation, and each storage compartment shelf should hold at least 20–30 kg of paper. The steel shelving and frame will easily meet this if of proper gauge, but the design must ensure no excessive shelf deflection (prefer <3 mm deflection under full load). All fasteners and connectors should be steel; critical load joints might use bolts and metal inserts rather than relying solely on wood screws. **Safety** features include smoothly finished edges, no pinch points in the hinge mechanism, and ideally a soft-close so that a dropping shelf won't injure fingers. The base of units should be enclosed to avoid litter accumulation and to give a built-in look. In summary, the units should be library-quality furniture: robust, stable, and built to last many years of daily usage while preserving the condition of stored newspapers and magazines.

Manuscript Display and Storage Units

- **Flat Display Cases for Manuscripts:** These are table-top style **manuscript display showcases** for exhibiting rare books, manuscripts, or documents under controlled conditions. Each case shall be a low, horizontal vitrine with a lockable glass lid.

Construction will parallel that of museum-grade cases, with an inert powder-coated metal or wood frame and UV-filtering safety glass top. The glass viewing panel (typically the entire top surface) must be **laminated UV-filter glass** to protect delicate manuscripts from light damage. The case interior (deck) will be lined with archival fabric or board – e.g., a neutral cotton fabric or suede over acid-free board – to provide an elegant backdrop and cushion for displayed items. Materials inside must all be PAT-certified (Photographic Activity Test passed) for safe contact with paper and photographs. The display area should accommodate an opened manuscript at a comfortable angle: include internal adjustable book cradles or wedges (made of Ethafoam or similar inert foam, with fabric covering) so that books can be propped open without strain on the binding. The lid should open on concealed hinges or assisted lifts; once closed, it should seal dust-tight with a rubber gasket. **Locks** are required on each case (small cam locks or flush barrel locks) to prevent public access. Internally, provide a small compartment or tray for **silica gel** or other humidity buffer, or design the case volume to work with the building's HVAC to maintain roughly 50% RH. In essence, these display cases act as microclimate enclosures for single or small groups of manuscripts. Dimensions might be on the order of 1000 mm (L) × 750 mm (W) for the display area, with an overall height of ~1100 mm when on its supporting stand (for viewing). The base or stand for each case should be sturdy and match the case's finish (wooden pedestal or powder-coated steel legs, etc.). All finishes on the interior must be matte to avoid glare and not attract attention away from the exhibit item. Lighting for these cases is generally external (room lighting); if internal lights are used, they must be low-intensity LEDs with strict controls. In sum, the manuscript display cases shall offer museum-level preservation: **UV protection, inert environment, secure locking, and climate buffering**, all while presenting the document in an accessible manner. They must meet the same standards as the museum showcases described above (ISO 11799, PAS 198 compliance, Oddy/PAT tested materials, etc.), scaled to manuscript-sized objects.

- **Archival Flat-File Storage Cabinets:** In addition to display, the library requires **archival storage units with drawers** for manuscripts and other flat items (such as maps, prints, oversized documents). These shall be flat file cabinets (plan file type) of the highest conservation quality. **Construction:** use solid, heavy-gauge steel throughout, with fully **welded** frame and reinforced corners for longevity. The steel shall be treated to be **non-corroding** – either galvanized or given a protective powder coat – ensuring no rust or metal migration onto stored materials. Drawers must slide on **ball-bearing telescopic slides** or **stainless steel tracks with ball rollers**, providing smooth, easy operation even when fully loaded. Each drawer will have a **safety stop** to prevent it from pulling out entirely and dumping contents. Drawers should also have **cushioned bumpers** to dampen impact when closed. The interior of each drawer and cabinet must be entirely inert: the powder-coat paint applied should be baked and fully cured, with no residual solvent (the coating shall be **solvent-free, non-reactive** epoxy/polyester, giving a smooth, hard finish). Inside surfaces can be lined with removable acid-free liner paper or board, but this is optional if the paint finish itself has passed Oddy/PAT tests (many high-quality flat files are used unlined). The design should prevent dust ingress – typically, a flanged back and tight tolerances around drawers; some models include a thin felt or rubber seal at drawer fronts. The cabinet base shall either be an enclosed steel plinth (raising the bottom drawer off the floor to protect from any water on floor and to put it at usable height) or a leg frame; stacking of modules is possible (e.g., two 5-drawer units stacked for 10 drawers total) and

if so, provide interlocks to secure stacked units. **Dimensions & Capacity:** The drawers should be sized to store large manuscript folios flat. A common standard is to accommodate A0 paper (841 × 1189 mm) internally. For instance, a 5-drawer cabinet might have internal drawer tray dimensions ~1300 × 900 mm to allow for oversized archives. Drawer height around 50 mm (useful height) is typical for documents – enough to store a boxed manuscript or a small stack of papers. The cabinet should support heavy loads; each drawer may be rated for ~30-40 kg. Handles on drawers shall be sturdy aluminum or steel pulls, preferably recessed to avoid snagging. A labeling holder on each drawer front is required for cataloging contents.

- **Environmental Safeguards:** Manuscripts in storage are highly sensitive, so the cabinets must not contribute any pollutants. All materials used should pass the **PAT (ISO 18916)** indicating safe contact with photographic emulsions and papers. This includes paints, gasketing materials, adhesives, etc. If drawer liners or pads are provided, they must be acid-free (pH neutral or slightly alkaline buffer for paper items) and lignin-free. No felt or foam that off-gasses should be in direct contact – if cushioning is needed, use polyethylene foam that has been tested for archival use. Ventilation for the cabinet is optional; generally, flat files are not tightly sealed, which allows the ambient climate (provided by the air-conditioned, humidity-controlled library) to percolate. The storage room conditions should meet ISO 11799 recommendations (around 18-20°C, 40-50% RH). However, to ensure **stable micro-environment**, the cabinet could accommodate silica gel if needed – e.g., a small slot for desiccant canisters in a drawer (though ideally the ambient environment suffices). **Fire safety:** While not a requirement in the brief, it's noted that metal flat files offer some fire resistance. If fire-rated cabinets are needed, that could be a separate specification; at minimum, the steel should be thick enough to provide a heat buffer (and obviously, absolutely no flammable finishes). The units should also prevent pest ingress – tight fits and possibly pest-resistant strips (e.g., felt seals treated with insect repellent) can be considered.
- **Locking & Security:** The storage cabinets shall have a **central locking system**. A single key turn should lock all drawers simultaneously (common bar lock mechanism). The lock should be of good quality (steel cam lock with brass keys, or even a digital code lock if specified) to protect valuable manuscripts. When locked, all drawers must be secured in the closed position. Additionally, an **anti-tip** interlock is critical: opening one drawer should automatically lock out the others from opening, to prevent center of gravity from shifting forward. This is standard on many flat file systems and must be included for safety, especially if the cabinet is not anchored. The cabinets can be designed to be bolted together side by side (if multiple units in a row) and/or bolted to the wall or floor for earthquake safety – anchor points or brackets should be provided.
- **Standards & Durability:** These units should meet or exceed **ANSI/BIFMA X5.9** standards for storage furniture, ensuring they have been tested for **safety, strength, and longevity**. This includes cycle testing of drawers (tens of thousands of open/close cycles with rated loads) and stability tests. The heavy-gauge steel, welded construction, and quality hardware specified are aimed at delivering decades of trouble-free use. All drawers should operate quietly and smoothly even when fully loaded. Paint finish shall be high-quality – resistant to chipping and corrosion (e.g., 50 µm powder coat thickness, ASTM B117 salt spray tested). **Compliance with ISO 11799** means the storage meets archival standards for protecting documents – the cabinets contribute to that by providing physical

protection (no bending or light exposure) and using materials that do not degrade the items. Also, per ISO 18911 (which covers photographic film storage but by extension relevant to paper), storage enclosures and cabinets should be made of non-corroding metal or inert plastic, a criterion fully met by these steel powder-coated cabinets. In summary, the manuscript storage cabinets are to be of **museum-grade quality**, providing safe, accessible, and long-lasting flat storage. They come complete with all necessary features (locks, labels, etc.) and carry a substantial warranty (the expectation is at least 5 years manufacturer's warranty). Installation will include placing them on proper level bases and verifying drawer alignment and smoothness.

Microfilm Storage Cabinets

- **Description:** Purpose-built **steel cabinets** shall be provided for the long-term storage of microforms (including 16mm/35mm microfilm reels and microfiche jackets). Each cabinet is typically a tall unit with multiple drawers or trays designed specifically to hold microfilm in its various formats. The cabinets will be free-standing, with a footprint that optimizes space (e.g., approximately 500 mm wide × 600 mm deep for a cabinet holding many reels, and ~1800 mm height). The total quantity and configuration will depend on capacity needs, but each unit should maximize storage density while ensuring easy retrieval and compliance with archival standards.
- **Materials & Build:** Construct the cabinets from high-quality **cold-rolled steel**, minimum 1.0–1.2 mm thickness for walls and drawers, with reinforced panels to prevent flexing. All metal components must be **non-ferrous or treated to resist corrosion** over time – galvanized or zinc-plated steel is preferred, followed by a durable powder-coat finish. Archival standards emphasize that enclosures for film be made of non-corroding, non-deteriorating materials, hence the exclusive use of protected metal (or approved plastics) in these cabinets. The finish will be a light-colored powder coating (to allow easy visibility of any dust and discourage pest hiding), which is inert and **emits no VOCs** after curing. **No wood** is to be used internally, and any plastic or rubber components (like drawer mats or bumpers) must be stable and non-degrading (e.g., silicone rubber, polypropylene, or polyethylene that meet archival criteria). The cabinet's structural design should include a **sturdy frame and an anti-tip base** (wider kick plate or provision to bolt to floor) because microfilm reels can be weighty when many are stored together.
- **Storage Format & Interiors:** The cabinet must accommodate **microfilm rolls and fiche** in an organized manner. For rolls: drawers can have separators or **slots sized for standard microfilm reel boxes**. For example, a common approach is shallow drawers with metal dividers creating rows where each 100' or 100'×35mm reel in its archival box can sit upright. Alternatively, a cabinet may employ pull-out **tray drawers** with grooves for plastic microfilm cartridges. For microfiche: a different section or separate drawers with taller height can be provided, with adjustable wire dividers to keep fiche envelopes upright. Flexibility is key – the shelving or divider system should be somewhat adjustable to handle various microform sizes and future changes. Each drawer should extend at least 90% to allow easy access to items at the back. Inside surfaces need to be **smooth and burr-free** to avoid snagging film boxes or cutting personnel – all edges should be rolled or deburred. Drawers must support the weight of a full load of film without distortion (reinforced bottom panels if wide). **Capacity:** As a guideline, a single cabinet with five drawers might hold

on the order of 1000+ rolls of microfilm (depending on drawer size and arrangement) or tens of thousands of fiche; specific capacity to be confirmed based on collection volume.

- **Ventilation & Environmental Control:** Microfilm is very sensitive to heat and humidity. Cabinets should allow some **air exchange** with the surrounding environment to avoid microclimates that trap moisture (which could promote vinegar syndrome in acetate film). At the same time, they should limit dust ingress. The design solution is to include small **ventilation openings** or louvered sections – typically at the top or back of the cabinet – which permit air flow but are baffled to block dust. These openings might be fitted with fine dust filters. The overall storage environment must be maintained as per **ISO 18911:2010** recommendations: for **extended-term** microfilm storage, a **cool, dry, stable climate** is required (about $\leq 21^{\circ}\text{C}$ and 20–30% RH). While room HVAC provides this, the cabinet should not significantly impede the environment from reaching the film. Avoid airtight seals on drawers; a slight gap is acceptable and even beneficial for airflow (besides, truly airtight enclosures are not recommended for film due to off-gassing of acetic acid from degrading acetate film). If needed, humidity-control packets (silica gel) can be placed inside drawers, but ideally, consistent external climate obviates this. It is crucial that no felt or foam lining in the drawers will trap moisture or emit VOCs. The cabinet material itself (steel) and powder coat are neutral and will **not contribute to contamination or moisture**; this aligns with archival best practice that storage cabinets be inert and protective. Optionally, hygrometer strips or temperature/RH data loggers could be placed in representative drawers to monitor conditions without opening them frequently.
- **Security & Accessibility: Locking mechanisms** should be in place to secure the microfilm collection. A central lock (ideally with a captive key or combination lock to avoid lost keys) can secure all drawers at once. Given the high value of archival microfilm, consider a lock that's robust (e.g., a pin tumbler lock with duplicate keys controlled by the institution). Each drawer should have a handle that allows comfortable grip; consider recessed handles to avoid catching clothing. **Anti-tip safety** is mandatory: typically, an interlock will allow only one drawer to open at a time. This prevents accidental tipping even if drawers are heavily loaded at full extension. Additionally, the cabinet should have provisions to be bolted to a wall or another cabinet bank for increased stability (especially if very narrow but tall). Drawers should slide quietly and have an end-of-travel dampening so they don't slam (this also protects the film contents from sudden jarring). For quick identification, each drawer or compartment will have an indexed labeling system (either holder for paper labels or an engraved plate) so staff can organize contents (e.g., by roll range or fiche number).
- **Compliance & Longevity:** These microfilm cabinets must adhere to **ISO 18911** standards not just for environment but for materials: the standard and related guidelines (e.g., ANSI IT9.2) specify that storage enclosures for film be made of archival-quality materials and that they ensure longevity of the media. By using powder-coated steel and acid-free boxes within, this requirement is met. In practice, polyester-base silver gelatin microfilm stored under proper conditions has a life expectancy of **500+ years**, and the cabinets are part of providing those "proper conditions." Therefore, the fabrication quality should target a similarly long service life. There should be no plasticizers, paint volatiles, or outgassing substances in the cabinet that could lead to film deterioration (like causing **redox blemishes or vinegar syndrome**). The cabinet should also hold up mechanically over time – guides and slides must retain alignment. Testing to a furniture standard (BIFMA or

equivalent) for **drawer durability and tip stability** is recommended to ensure robustness. All design and production processes should follow ISO 9001 quality guidelines. The delivered cabinets should come with at least a **5-year warranty**, and ideally a certification or statement that they meet archival storage requirements (some manufacturers provide test results or Oddy/PAT certificates for their powder coating and gasket materials). The cabinets will protect microforms from physical damage (no bending or crushing), light (opaque metal keeps light out), and dust, while keeping them readily accessible to authorized users. In sum, they form a **secure, climate-friendly, and compliant** microfilm storage solution for the library.

Retractable Awnings (Motorized Cassette-Type)

- **General Description:** Provide **motorized retractable awnings** for two large terrace quadrants (2nd floor level), offering approximately **200 linear meters of coverage** in total. The system shall use **full-cassette, folding-arm awnings**, meaning when retracted the awning fabric and arms are completely enclosed in a protective cassette housing. This design choice is to ensure durability in a monsoon-prone climate – the cassette shields the fabric and mechanism from rain, wind, and UV when not in use. Multiple awning units will be installed in series to cover the total span (exact sizing of each unit to be determined by manufacturer's standard lengths and site structural considerations). The awnings will extend out to provide shade and rain cover for the terrace, and fully retract into the cassette near the building facade when not needed. They must be architecturally integrated and minimally intrusive visually (cassette can be mounted to a soffit or wall and finished to match building colors).
- **Structure & Materials:** The awning frames, including the **cassette housing, roller tube, arms, and support brackets**, shall be made of high-strength **extruded aluminum** alloy (6063-T5 or equivalent) for an optimal strength-to-weight ratio. All aluminum components must be **powder-coated** with a durable outdoor-grade finish (polyester powder coating, UV-stabilized) to prevent corrosion, even in humid and rainy conditions. The coating color will be as per architect's approval (likely a neutral or metallic tone that blends with the facade). Critical load-bearing pieces (e.g., arm joints, connecting pins) may be of **stainless steel** for added strength and corrosion resistance. The folding arms shall incorporate internal tension systems – either twin stainless steel cables or **double chain** linkage coupled with springs – to keep the fabric taut and to absorb wind shocks. Arm profiles should be robust (minimum 50 × 20 mm cross-section or as engineering dictates) and engineered to **withstand wind loads** without permanent deformation. All pivot and hinge points in the arms must use maintenance-free bushings or bearings (e.g., Teflon-lined or bronze bearings) to ensure smooth operation and long life. Mounting brackets (wall or soffit mount depending on site) should be heavy gauge steel or aluminum, with at least 3 fixation points each, designed to distribute loads into the building structure safely. The **structural performance** of the installed awnings must meet **EN 13561** requirements for wind resistance: specifically, achieve **Wind Resistance Class 2 or higher**, which corresponds to sustaining roughly **Beaufort force 5 winds (~30–38 km/h) without damage**. Higher performance (Class 3, Beaufort 6) is desirable for extra safety in sudden gusts. Supporting calculations or certifications from the manufacturer should be provided. Additionally, the arms and fabric assembly must be able to shed rainwater effectively; a minimum pitch of

about 14° from horizontal when extended is recommended so that rain does not pool. The frame should include integrated rain gutters or drip edges if water runoff could otherwise enter the building or cause concentrated streams. All fasteners (bolts, nuts) used in assembly and installation shall be **stainless steel (A2/A4 grade)** or hot-dip galvanized, to prevent rust staining and ensure longevity.

- **Awning Fabric:** The awning canopy shall be made of premium **solution-dyed acrylic fabric**, engineered for outdoor use. This fabric must be inherently **UV-resistant, fade-resistant, water-repellent, and mildew-resistant**, with the color pigments extruded into the fibers for maximum colorfastness. Weight of the fabric should be on the order of 290–320 g/m², giving a balance of strength and flexibility. It should have a high **UPF (Ultraviolet Protection Factor)**, blocking at least 90–98% of UV rays to protect occupants and underlying materials from UV exposure. A waterproofing treatment (such as fluorocarbon coating) is required so that light rain beads off; the fabric should also resist mold/mildew growth (it being **breathable** helps prevent condensation and mildew). Seams in the fabric (if any, for larger widths) must be heat-sealed or double-stitched with UV-stable thread (e.g., Teflon/PTFE thread) to prevent deterioration. The front edge of the fabric will be attached to an aluminum front bar which in turn connects to the folding arms. The **valance** (if specified) should be removable and also made of the same solution-dyed acrylic, with a scallop or straight edge as per design; it too should be UV and weather resistant. The fabric color/pattern will be chosen by the library (solid colors likely); it should have at least **Class 7-8 lightfastness** on the Blue Wool scale, ensuring minimal fading over years of sun exposure. When retracted into the cassette, the fabric is protected from the elements, further extending its life. Typical manufacturer warranties on such fabrics are 5–10 years; the specification should require a durable grade (e.g., Sunbrella or equivalent) with a **minimum 5-year no-fade warranty**. In summary, the fabric will retain its strength and appearance for many monsoon seasons, and any soiling (dust, bird droppings) can be cleaned with mild soap without damaging the material.
- **Operation & Automation:** The awnings will be equipped with **electric tubular motors** housed inside the roller tubes. These motors should be properly sized for the width and projection of each awning (with a safety margin in lifting torque). The system will allow **group and individual control** of the awnings. Controls include wall-mounted switches at convenient locations and remote control transmitters. Crucially, the system shall integrate **weather sensors** for automatic retraction: at a minimum, **wind sensors** that detect excessive wind and trigger the awnings to retract to avoid damage. The wind sensor could be an anemometer type or accelerometer type mounted on the lead bar – it must be calibrated to retract at a safe threshold (e.g., when winds approach Beaufort 5, well before structural limits). Additionally, **rain sensors** should be installed – typically rain sensors will close the awning upon detecting sustained rainfall, to prevent water pooling and to protect the fabric. (If the terrace use requires it, a **sun sensor** can also be included to deploy the awning when strong sunlight is detected and retract at dusk, but this is optional.) The control system will likely be a central automation unit that takes input from sensors and overrides manual commands as needed for safety. All motors and controllers must conform to **IEC/EN electrical safety standards** and be rated for outdoor use (motor casings IP54 or better for dust/water resistance). A manual override (hand crank) is required for each awning motor, allowing it to be closed in case of motor or power failure. The automation should have **obstacle detection** – if an awning is retracting and encounters an obstruction

(or is hindered), the motor should stop to prevent damage. Wiring for power and sensors will be concealed in cable ducts or within the building structure as much as possible; weatherproof junction boxes and conduits to be used for any exposed runs. The entire system should be integrable with the building management system (BMS) if present, or at least have a central disable switch (for maintenance).

- **Wind Resistance & Safety Features:** Because these awnings are in a location subject to high winds (including storm gusts during monsoon), safety is paramount. The specified **Class 2 wind resistance (or better) per EN 13561** means the awning can remain extended in moderate winds (~Beaufort 5). In practical terms, any wind stronger than that should trigger automatic retraction via the sensors. The arms and mounting must endure not just steady wind but turbulence and sudden gusts; hence, factor of safety in the arm design and bracket anchoring should be high (wind force on a fully extended awning of large size can be significant). The supplier should provide data or simulation results for wind load capacity. If a higher class awning (Class 3) is available and within budget, it is recommended to further ensure performance in windy areas – Class 3 would correspond to ~Beaufort 6 (strong breeze, 39–49 km/h). In any case, **during very high winds or storms, awnings must be retracted**; the system should fail-safe (e.g., if power is lost and wind is high, the manual override can be used quickly). The structure must also account for **rainwater**: while not intended to hold a lot of weight, the awning fabric under a downpour will catch water until it runs off. The arms and fabric tension should support this without tearing. Awnings should never be left out in extreme weather – this will be stated in O&M manuals – but the design should cover typical monsoon rain intensity. The front bar should have integrated channels or drip edges to guide runoff to the sides rather than letting water dump in the middle. All moving parts like arm joints should incorporate **locking pins or safety straps** to prevent the arms from flipping upwards in case of sudden wind uplift. When retracted, the cassette should have a **locking mechanism** or tight closure that keeps the awning securely rolled up and arms folded, so wind cannot deploy or flutter it (many systems have a motor brake and/or a clip lock for this purpose). Every unit should have **limit switches** set so that it stops at full extension (to prevent over-stressing the arms) and at full retraction (so the motor stops when the awning is safely in the cassette). The installation contractor must strictly follow the manufacturer's guidelines for substrate and fasteners – likely using expansion anchors or through-bolts into concrete beams, etc., at spacing dictated by load calculations. After installation, each awning's operation (manual and automatic) and sensor function should be tested in various conditions.
- **Standards & Compliance:** Aside from EN 13561 (which governs many aspects like operating effort, wind load, and endurance), the awning system components should carry a **CE mark** (for those sourced from Europe) or equivalent certification demonstrating conformity. This implies compliance with the Machinery Directive, Low Voltage Directive, EMC Directive, etc., for the motor and controls. If there are any relevant Indian Standards (IS) for awnings or outdoor fabrics (e.g., IS for textiles weather resistance), they should be complied with – typically international standards are referenced. The fabric should meet **fire safety standards** for awnings (for instance, NFPA 701 or equivalent) if the application demands flame retardancy – not explicitly stated, but often public buildings consider this. **IGBC considerations:** the powder-coated aluminum structure and acrylic fabric are both low in VOC emissions (and often recyclable at end of life). By using a long-lasting, modular shading device, the design supports energy efficiency (reducing solar

gain) – this can contribute to green building points. All paints and materials used should be free of heavy metals and toxic chemicals (RoHS compliant motors, lead-free paints). Documentation should be provided for the fabric’s UV resistance and mold resistance claims (often per ASTM or ISO fabric tests). The vendor should also supply an **operation & maintenance manual** and training, since proper use (retraction in high winds, periodic cleaning of fabric, etc.) will be essential to the longevity and safety of the system.

- **Warranty & Maintenance:** The awning assembly (fabric, motor, structure) shall come with robust warranties: generally, ~10 years on the aluminum hardware and 5 years on the fabric and motor is expected at this quality level. The supplier must assure availability of spare parts (fabric panels, arm components, motors) for a reasonable period (at least 10 years). Maintenance requirements are minimal but important: periodic inspection of brackets, tightening of any bolts, cleaning the fabric (per manufacturer’s guidelines, e.g., with mild soap every 6 months), and checking the sensor calibration. The motors are typically maintenance-free but might need occasional limit adjustment. The specification should call for **all sensor systems to be tested** at handover (e.g., simulate high wind to see auto-retraction). Because of the scale (200 m coverage), the units should have a centralized control option to retract all awnings quickly in case of an incoming storm. **Safety notices** (like “Awnings must be retracted in winds above X km/h”) should be provided to facility managers. In conclusion, the retractable awning system shall be a state-of-the-art installation that provides shade and rain protection while withstanding the region’s harsh weather. It will comply with international standards for performance and safety, use top-grade materials (solution-dyed acrylic and powder-coated aluminum) for longevity, include smart automation (wind/rain sensors) for protection, and be backed by warranties – ensuring a **reliable, low-maintenance shading solution** for the library’s terraces.

Heavy-Duty Library Book Trolley

1. Scope - Design, manufacture, supply, and installation of **heavy-duty, low-noise, maneuverable book trolleys** for library operations (shelving, circulation, sorting, inter-stack movement). Trolleys shall be robust for continuous daily use, ergonomically safe, and finished for long service life in an indoor, air-conditioned environment.

2. Capacity & Configuration

- **Payload (minimum): 200 kg** uniformly distributed per trolley without permanent deformation.
- **Typical form factors (any or mix as scheduled):**
 - **A-Frame (double-sided)**, 2 or 3 tiers, sloped shelves.
 - **U-Frame (single-sided)**, 2 or 3 tiers, sloped or flat shelves.
 - **Tub/return trolley** with removable bins for returns & re-shelving.
- **Shelf geometry:**
 - **Usable shelf length:** 800–900 mm per side.
 - **Shelf depth:** 250–300 mm (books), 350 mm (folios/oversize variant).
 - **Shelf pitch (sloped types):** 7–12° with **30–40 mm** front lip (book retainer).

- **Adjustability:** at least **2 positions** per shelf (flat/sloped) or interchangeable flat and sloped shelves.

3. Ergonomics & Handling

- **Overall height:** 1000–1100 mm (top handle).
- **Handle height:** 950–1050 mm; **grip Ø** 30–38 mm; continuous push bar both ends (for two-way use) with non-slip sleeve.
- **Trolley footprint:** ≤ 950 (L) $\times$ 520 (W) mm for standard model; turning aisle ≤ 1200 mm.
- **Noise:** rolling and structure-borne noise **< 65 dB(A)** on finished floors at rated load.
- **Edges:** all corners radius ≥ 2.0 mm; no burrs; finger-safe gaps.

4. Materials & Construction

- **Frame/uprights:** CRCA/MS tube/formed sections ≥ 1.6 mm thick; welded or bolt-together with structural gussets.
- **Shelves:**
 - Steel ≥ 1.0 mm with swaged/stiffened ribs **or** 18 mm **HDF/ply** with 1.0 mm HPL both faces & 2 mm PVC edge.
 - Flat shelves to include anti-drum pads or EVA liners to cut noise & shock.
- **Base:** boxed steel base with integrated caster mounting plates (no single-point screw studs).
- **Fasteners:** zinc-plated 8.8 grade or SS; nyloc nuts where accessible.
- **Bump protection:** full-perimeter **replaceable thermoplastic bumper** (≥ 10 mm thick) at skirting height + corner guards.
- **Book stops/dividers:** removable steel/ABS dividers at 150–250 mm pitch; tool-less fit.

5. Surface Preparation & Finish

- **Pretreatment:** multi-stage degrease + phosphate.
- **Powder coat:** thermoset epoxy-polyester; **DFT** $\geq 60\text{--}80\text{ }\mu\text{m}$, smooth matte/satin; hardness $\geq$ HB; adhesion 4B/5B (cross-hatch).
- **Boards (if used):** E1/E0 low-emission; laminate wear-resistant; no exposed raw edges.
- **Colour:** as approved (library palette); contrasting edge/bumper optional for visibility.
- **VOC/Green:** low-VOC coatings/adhesives; materials recyclable; IGBC-aligned.

6. Mobility System (Casters)

- **Quantity:** 4 swivel casters; 2 with **total-lock brakes** (wheel + swivel).
- **Diameter:** 125 mm (5") minimum; tread **non-marking PU/TPR**; shore A 80–95.
- **Bearings:** sealed precision ball bearings (wheel) + thrust bearing (swivel).
- **Load rating:** ≥ 120 kg per caster (≥ 480 kg aggregate safety margin).
- **Fixtures:** top plate with 4-bolt pattern to reinforced base; SS fasteners.
- **Debris guards:** integral hair/string guards; optional floor-friendly thread guards.

- **Performance:** zero flat-spot at 24 h standstill under full load; low starting/rolling resistance.

7. Stability & Safety

- **Anti-tip:** CG within wheelbase at full load; **tip test on 10° ramp** without overturning (brakes applied).
- **Brake hold:** total-lock must hold at 5° **slope** with full load.
- **Hand safety:** crush/pinch protection at handles; shelf lips rounded; no exposed fastener threads.
- **Labels:** SWL (safe working load), model, serial, month/year of manufacture, maintenance cues.

8. Dimensions (reference standard model)

- **Double-sided A-frame, 3-tier:** 900 (L) × 500 (W) × 1050 (H) mm; shelf clearances 320/320/320 mm; lip 35 mm; slope 10°.
- **Single-sided U-frame, 2-tier (oversize):** 900 × 520 × 1050 mm; top flat shelf 350 mm deep, bottom flat 350 mm; lip 25 mm.

(Exact sizes to be finalized in shop drawings to suit book formats & aisle widths.)

9. Optional Variants / Add-Ons

- **RFID/return bins:** removable tote boxes (food-grade PP) with barcode/RFID tag.
- **Document cradle:** soft cradles for folios/rare books (inert foam + fabric).
- **Anti-static kit:** ESD strap/chain for archives where static control is needed.
- **Accessories:** clip-on label rails, end-panel signage, handheld scanner holster.

10. Testing & Acceptance (factory + site)

1. **Static load test:** 200 kg UDL for 24 h; no permanent deformation (> 2 mm shelf sag) or weld/fastener failure.
2. **Dynamic roll endurance:** 10 km at 3–4 km/h over mixed surface incl. 3 mm thresholds every 10 m at full load; no caster flat-spot, loosening, or structural cracks.
3. **Brake test:** hold on 5° incline for 1 h, no creep.
4. **Tip test:** on 10° side/fore-aft tilt without overturn.
5. **Finish tests:** adhesion (ASTM D3359), impact (ASTM D2794), and 240 h salt-spray (ASTM B117) on coupons—no blistering/rust creepage > 2 mm.
6. **Noise check:** ≤ 65 dB(A) at operator ear height on polished floor, full load, steady run.

11. Compliance & References

- **Steel sheet/tube:** CRCA to IS quality (e.g., IS 513/IS 1079 grade or equivalent), structural MS to IS 2062 or equivalent.

- **Powder coating & pretreatment:** good industry practice (phosphating before powder); finish free of pinholes/runs.
- **Casters & wheels:** industrial grade conforming to recognized norms (e.g., ISO/EN industrial caster performance) for load & endurance.
- **Ergonomics:** anthropometrics per adult workforce; handles within 50th–95th percentile reach; push forces minimized via bearing/tread selection.
- **Environment:** low-VOC components; boards E1/E0; recyclable steel/aluminum; packaging recyclable.

(Where a cited Indian Standard is not explicit for trolleys, international/industry tests above shall govern.)

12. Documentation & Deliverables

- **Shop drawings:** GA, sections, shelf details, caster plates, bumper profiles, clear dimensions & tolerances.
- **QA pack:** material mill certificates, finish test reports, caster load ratings, weld maps.
- **O&M manual:** cleaning, lubrication (if any), caster replacement, brake adjustment, spare parts list.
- **Warranty: 3 years** comprehensive on structure, welds, casters, and finish (excluding abuse/abrasion from misuse).
- **Spares:** 2% casters (each type), bumpers, handle grips, fastener kit per batch.

13. Execution

- **Samples/Mock-up:** 1 pre-production trolley of each type for approval (fit/finish, roll test, noise).
- **Packing:** corner-protected, film-wrapped; KD (knock-down) or fully assembled as approved; all fixings bagged & indexed.
- **Installation/Commissioning:** brake function check, caster torque check, leveling, operator handover & safety briefing.