# 6 DRAFT ARRANGEMENT

## 6.1 GENERAL REQUIREMENTS

6.1.1 Each outermost end of the trainset shall be equipped with a fully automatic mechanical, pneumatic, and electrical coupler system of the symmetrical, automatic, slack-free type (Scharfenberg Type 10). Couplers and apparatus, including attachment to the car body and underframe, shall meet or exceed the requirements of FRA Regulation 49 CFR 238, EN 12663-1 (vehicle category P-II) or DIN 25201. Coupler, yoke, draft gear, and carrier design and their integration into the vehicle shall be submitted for approval. **[CDRL C-6-01]**

6.1.2 End couplers, intermediate coupling assemblies, draft gear and associated components shall conform to the strength requirements per FRA Regulation 49 CFR 238. If draft gears are used at the intermediate coupling assemblies, their characteristics shall be designed to take into account the overall trainset ride quality.

6.1.3 Each cab end shall be provisioned to store a Type F coupler adapter and accompanying hose connections for use in rescue operations.

6.1.4 (deleted)

6.1.5 (deleted)

6.1.6 (deleted)

## 6.2 CONTRACT DELIVERABLES REQUIREMENT LIST

| CDRL | Title |
|---|---|
| C-6-01 | Coupler System Design |

# 7 DOORS

## 7.1 GENERAL REQUIREMENTS

7.1.1 All side and end door systems shall be designed and manufactured with an emphasis on addressing the following areas of concern:

7.1.1.1 Unsafe conditions for passengers or crew members
7.1.1.2 Train delays from malfunctioning side door equipment
7.1.1.3 System reliability in adverse operational and environmental conditions
7.1.1.4 Time and effort required for troubleshooting and repairs

7.1.2 A proposal shall be submitted of all doors systems addressing the four bullet points above in 7.1.1. **[PDRL P-7-01]**

## 7.2 EXTERIOR PASSENGER ENTRANCE DOORS

7.2.1 Passenger side entrance doors are to be electrically operated bi-parting sliding type doors located on the side of the car. Exterior passenger entrance door systems shall utilize a linear door operator. The door system shall comply with the latest revision of APTA specification APTA PR-M-S-018-10 and APTA PR-CS-S-012-02. The door design configuration for side loading doors shall be submitted to Metra for review and acceptance. **[CDRL C-7-01]** Minimum clear door openings shall be designed to load or unload a ADA bound passenger along with a regular passenger simultaneously. As a minimum, the door header shall provide no less than 5'-10" clearance over the mobility aid lift platform when in the raised position. Door openings shall be designed in compliance with ADA & FRA requirements and allow safe passenger loading. If provision exists for passengers to operate doors, such as at a terminal, the provision shall be touchless for both interior and exterior of car.

7.2.2 The door panels shall maintain both the internal and external vehicle aesthetics to the largest extent possible when closed. Door surfaces must be flat and in plane within 1/8". The door panels shall have a window of clear abrasion resistant polycarbonate or equivalent set in one piece, vulcanized, rubber glazing strips or aluminum sash, as required to comply with FRA Type II regulations. Doors shall be designed to provide sufficient strength and rigidity to withstand a force of 200 lbs. perpendicular to the door surface applied on an area 24" x 12", with a maximum deflection of 0.3" with the area's long axis parallel to that of the door, 2" from the door edge and centered within the height of the door. All door edges and openings shall be thoroughly sealed against moisture ingress. Each door shall be equipped with an interlocking rubber nosing, extending the full height of the door on the leading edge. When doors are closed the two interlocking nosing shall mate and form a weather-tight joint. Static seals shall be provided in the door opening to seal the door trailing edges when the doors are closed. An approved recessed door pull shall be provided on each side of each door leaf. The door pulls shall be installed in such a manner as to prevent moisture from entering into the core of the door panel.

7.2.3 The doors shall be supported from the top by means of a hanger/track assembly and shall be guided at the bottom in a manner providing freedom from rattles and squeaks. The door support and guide arrangement shall be easily available for adjustment and maintenance through the use of access doors or removable panels. Stops shall be provided at both ends of travel to protect the door and the operating mechanism. The stops shall be strong enough to withstand 8g impact of the door mass without damage. The door bottom guides shall be of a suitable type and the surface of the step tread shall be designed to minimize passenger slipping and tripping while allowing free movement of the doors. The design of both step tread and door guide shall provide for free drainage of moisture to the outside.

7.2.4 The linear door operator provided to operate the side doors shall be concealed so that it is not directly visible when the door is in the fully closed or open position.

7.2.5 The motion of the doors shall approximate simple harmonic motion and thereby provide cushioning in both opening and closing. A sensitive edge mechanism, per APTA specification PR-M-S-018-10, shall be provided in the door system to immediately reactivate the opening cycle upon striking any object. The speed of the doors shall be such that from the moment of actuating the appropriate door control buttons until the completion of the operation, including cushioning, the following times are obtained:

7.2.5.1 Opening 2.0 to 3.0 seconds
7.2.5.2 Closing 3.5 to 4.5 seconds, after time delay (reference section 7.1.7)

Adjustment shall be provided to enable these items to be maintained throughout the door operator life and shall be readily accessible.

7.2.6 The side entrance door control system shall be trainlined to permit operation of all side entrance doors on one side of the train from any individual car door control switch panel on the same side of the train. Each switch panel shall be fitted with six (6) push buttons arranged in two rows. Buttons shall be paired for opening and closing doors: 1) forward from the position, 2) locally and, 3) rearward from the position. Pairs of buttons shall be marked as follows: "LEFT", "LOCAL", and "RIGHT". The control panel shall be equipped with a key (Metra's standard coach key, Drawing M-250) operated mechanism to lock the buttons thus protecting against unauthorized operation of the doors and should have an escutcheon for the key per Metra drawing M-1952. The construction of the mechanism shall allow the key to be removed in the "OFF" position only and shall not cause the train door to change their position. The door control system shall feature a time delay for door closing. When a closing command is made (locally or trainlined) a door closing warning system consisting of an audio and visual alarm shall be activated immediately. The doors will begin closing four (4) seconds later. The door closing timing and announcement should match Metra's current fleet configuration. The Contractor shall submit a design to Metra for review and approval. **[CDRL C-7-02]**

7.2.7 A door lock function shall positively retain the door panel in the closed position without relying on electrical power. The lock shall automatically engage when the door panels at a doorway reach the closed position. A manual release device accessible to passengers shall be provided at each door location to release the door lock and allow the door panels to be manually opened in an emergency. Instructions for opening doors in an emergency shall be provided adjacent to the handle/device. Instructions shall be printed on photo luminescent material compliant with APTA Specification PR-PS-S-002-98, latest revision, Standard for Emergency Signage for Egress/Access of Passenger Rail Equipment.

7.2.8 External access for manual release of the door lock shall also be provided. Instructions for opening doors in an emergency shall be provided adjacent to the handle/device. Instructions shall be printed on retro-reflective material. The design and location of external manual releases shall be subject to Metra review and approval. **[CDRL C-7-03]**

7.2.9 Traction interlock with door controls is required. The Contractor shall submit a design to Metra for approval. **[CDRL C-7-04]**

7.2.10 Doors shall not open unless at zero speed, except a "This Door Only" or "Local" button shall function at all speeds when the Master Door Controller is keyed up. No traction effort shall be possible when any door is open, except a door which has been opened by the "This Door

Only" or "Local" button shall remain open if the Master Door Controller remains keyed on, as long as the speed is below 20mph according to APTA PR-M-S-018-10.

7.2.11 The exterior passenger side loading doors shall have an emergency release mechanism that shall not require the availability of electric or pneumatic power per APTA standard APTA-PR-CS-S-012-02 latest revision. Neither shall the emergency release mechanism require the presence of any interlock signals (e.g. "low speed" or "zero speed" signals) for actuation. When actuated, the emergency release mechanism shall override any locks and it shall be possible to manually open the released door with a force not to exceed 35 lbf. The emergency release mechanism shall require manual resetting.

7.2.12 A system shall be provided to detect when the car is in motion per APTA Standard APTA-PR-M-S-018-10.latest revision. Motion detection may be local or trainlined. When motion is detected, opening of all doors on the car (except crew doors) shall be prevented. The Contractor shall submit a design to Metra for approval. **[CDRL C-7-05]** An exterior with a key (Metra's standard coach key, Drawing M-250) operated crew switch shall be provided to open/close for each set of side doors. The Contractor shall submit a design to Metra for approval.

## 7.3 INTER-CAR DOORS

7.3.1 Inter-car doors shall be capable of automatically (activation without touch) opening and closing, sliding type. Door system shall have a manual feature to open and close in case of loss of power. The automatic door shall operate the adjacent end door to enable passengers or crew members to move between cars. The doors shall slide in a straight line into door pockets placed on the inside of the end walls.

7.3.2 All doors and edges shall be sealed against moisture ingress. The door panel shall have a window of clear abrasion resistant polycarbonate set in one piece, vulcanized, rubber glazing strips or aluminum sash as required to comply with FRA Type II regulations. Glazing/elastomer materials shall meet the flammability and smoke emission standards per FRA regulation 49CFR part 238.103 and toxicity requirements per Boeing BSS-7239, or Bombardier specification SMP 800-C. Doors shall be designed to provide sufficient strength and rigidity to withstand a force of 200 lbs. perpendicular to the door surface applied on an area 24" x 12", with a maximum deflection of 0.3" with the area's long axis parallel to that of the door, 2" from the door edge and centered within the height of the door. Each door shall be equipped with rubber nosing, extending the full height of the door on the leading edge. When the door is closed, the nosing shall form an air tight seal with the door jamb.

7.3.3 The door closing and opening device (or door operator) must be provided in a concealed but readily accessible for maintenance.

7.3.4 The doors shall be of a service proven design and it shall be subject to Metra design review and approval. [CDRL C-7-10].

7.3.5 Body end doors shall be lockable from either side only by Metra's standard coach key (Drawing M-250).

7.3.6 An approved manually operated, rattle-free latching device shall be provided such that when in use, the device shall hold the doors in an open position

## 7.4 ELECTRIC LOCKER DOORS/CREW LOCKER DOOR

7.4.1 Lockable doors shall be provided for all electric lockers and crew lockers. Aesthetics of the doors shall match interior design of the car. Where practical, a recessed door pull shall be provided on the exterior face of each door. If needed electric locker doors shall be equipped with grilles at the top and bottom to allow circulation of air. Design of electric/crew locker doors shall be subject to Metra design review and approval. **[CDRL C-7-08]**

## 7.5 CONTROL STATION DOORS

7.5.1 On cab control cars, a door(s) shall be provided from the passenger area of the car to the control station. These door(s) shall be operable from outside the cab by a rotating handle and shall be operable from the inside by a panic crash bar, requiring no turning of a handle. The door(s) shall be lockable from the cab side with a manual slide, and on the passenger side by Metra's standard coach key. Each of the control station door(s) shall be designed with intrusion resistance that meets or is greater than that listed in Federal Aviation Administration (FAA) Advisory Circular (AC) 25.795-1A, dated 10/24/08. The Contractor shall submit the design of the control station door(s) for Metra review and approval. **[CDRL C-7-09]**

7.5.2 The door shall have a decal on the outside (facing into passenger compartment) per Metra drawing M-1968 stating "Warning – No Unauthorized Personnel Beyond This Point – Violators Will Be Prosecuted".

## 7.6 TOILET ROOM DOOR

7.6.1 The door from the passageway to the toilet room shall be automatically (activation without touch) open/close sliding type. Doors shall be designed to open and close manually in the event of power loss. The Contractor shall submit the design of the toilet room door system for Metra review and approval. **[CDRL C-7-11]** Minimum clear door opening per current ADA requirements, ANSI A117.1.

7.6.2 The door pull/passage set shall be lockable on the toilet side manually, and on the other side by Metra's standard coach key.

## 7.7 WEATHERSTRIPPING

7.7.1 Adequate weather stripping shall be provided to provide satisfactory seals at door openings where airtight weatherproof conditions are required.

## 7.8 HARDWARE

7.8.1 Recessed rubber bumpers are to be used on all hinged doors to prevent rattling. The bumpers are to be mounted with screws, or by other approved means. All exterior and interior lock sets, including cases, handles, pulls and escutcheons shall be of unpainted white bronze unless otherwise specified. Hinges shall be stainless steel.

## 7.9 FIRE SAFETY

7.9.1 All door components shall meet the flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 21.16 of this specification.

## 7.10 PROPOSAL DELIVERABLES REQUIREMENT LIST

| PDRL | Title |
|---|---|
| P-7-01 | Door System |

## 7.11 CONTRACT DELIVERABLES REQUIREMENT LIST

| CDRL | Title |
|---|---|
| C-7-01 | Side Loading Door Design and Configuration |
| C-7-02 | Side Loading Timing and Announcement |
| C-7-03 | External Door Release Design |
| C-7-04 | Traction Interlock |
| C-7-05 | No Motion/Zero Speed System |
| C-7-06 | Passenger Compartment Door Panel Design (If Applicable) |
| C-7-07 | Passenger Compartment Door Hold Open (If Applicable) |
| C-7-08 | Electric/Crew Locker Door |
| C-7-09 | Cab Door Panel Design |
| C-7-10 | Inter-Car Door Design and Configuration |
| C-7-11 | Toilet Door Design and Configuration |

# 8 CAR BODY INTERIOR

## 8.1 INTERIOR FINISH

### 8.1.1 GENERAL

8.1.1.1 Interior renderings of all levels of the car shall be submitted with the proposal cross sectional views of the car interior (both longitudinal and transverse) shall be included. Proposer shall note plan on how small passenger baggage (computer bags, backpacks, purses) will be accommodated for in the car design, including what percentage of seated passengers will have a location that can accommodate small baggage. **[PDRL P-8-01]**

8.1.1.2 Plastic and plastic faced material shall be integrally colored in the exposed face. It shall be of low glare unless otherwise specified. Samples of all surface treatments that are exposed to Metra's passengers or operating crews shall be submitted for approval. **[CDRL C-8-01]**

8.1.1.3 All material must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 21.16 of this specification.

### 8.1.2 SIDE FINISH

8.1.2.1 A formed panel made of thermoform plastic material, or alternative material meeting specified flammability and smoke emission standards, as stated in Section 21.16 shall form the window frame. The design and construction of the panel shall be subject to Metra review and approval. **[CDRL C-8-02]**

8.1.2.2 The interior surface of all toilet room walls are to be lined with stainless steel or a material suitable for this environment. Wall material shall be resistant to cleaner solutions, water, salt, other corrosive agents, etc.

8.1.2.3 The interior surface of all walls of the operator's stations in cab cars shall be lined with a non-glare material. Any area not conducive to non-glare material application, including desk and upper console, shall be painted flat black.

### 8.1.3 PARTITIONS, LOCKERS, ETC.

8.1.3.1 The air ducts in the vicinity of the overhead heaters (if used) shall be constructed of stainless steel.

8.1.3.2 A crew locker shall be provided in a location approved by Metra. One coat hook shall be provided inside wall in the crew locker.

8.1.3.3 Cab lockers shall be lockable with a Metra standard coach key. The Contractor shall submit design specifications and drawings of each internal design of both the Engineer's side and observer's side locker for Metra approval. **[CDRL C-8-03]**

8.1.3.4 On cab control cars, a locker to house cab signal protective system and other equipment shall be installed. The lockers shall be lockable with a Metra standard coach key.

## 8.2 FLOORING

8.2.1 The flooring shall meet the 49CFR238 Appendix B and Boeing BSS 7239, or Bombardier SMP 800-C for toxicity, including a thirty-minute fire resistance test (testing to ASTM E119) per 49 CFR 238.103 and NFPA 130 with the car builder's structural configuration. All floor panels

shall be capable of withstanding the requirements of ASTM E119 when exposed for 30 minutes or greater on the carbody underside. Test reports must refer to 49CFR238 Appendix B testing condition and criteria, as well as the ASTM codes, and must be provided to Metra for review and approval. **[CDRL C-8-04]** Floor panels shall be as large as possible, but should only be as wide as the compartment it is in. Cab floor panels shall be able to stay if replacing adjacent floor panel and vice versa. Lavatory floor panel(s) shall not extend beyond the lavatory compartment. Floors shall be able to be replaced without cutting around lockers and compartments. Panels shall extend full width of the car (where possible) with all joints located over structural members. Floor panels shall be bonded to the floor beams to isolate them from the carbody structure. The floor shall be leveled to provide a flat surface. Height variations between panels shall be no greater than 0.030 inch. Gaps between panels shall be sealed against incoming dirt, moisture, and water using appropriate flexible sealant that allows for thermal expansion and contraction of panels. Design and details of the floor system shall be submitted to Metra for review and approval. **[CDRL C-8-05]**

8.2.2 The floor panels shall not deflect more than 1/250 of the shorter span between supports, up to a maximum of 0.170 inch, whichever is less, with a uniformly distributed AW3 load state.

8.2.3 Floor surfaces on all passenger and crew sections shall conform ASTM D2047 and ASTM C-1028 coefficient of friction shall be greater than or equal to 0.8 for both wet and dry conditions. Test reports must be provided to Metra for approval. The floor surface shall be hard and highly durable in order to last 40 years in service without major repair. Floor surface shall be easy to repair. Repaired area shall not be visibly detectable. Mechanical integrity of the floor panel shall be maintained after repair. ADA passenger locations in the car shall be designated with the proper ADA signage embedded into the floor. Signage areas shall have the same wear and slip characteristics as the main floor and be flush. Signage shall not be able to delaminate separately from main floor for the life span of the floor.

8.2.4 All interior stairway shall have uniform riser heights and tread depths in accordance to ADA guidelines. Stairways shall be designed to minimize the accumulation of water and have the same slip resistant characteristics as the main flooring. Tread nosing shall be designed with an ADA compliant profile and visual contrast. **[CDRL C-8-06** Cove moldings shall be either stainless steel or made of the same material and color as the floor surface. Coves shall have a minimum radius of 1" (25 mm) to ease cleaning, and shall be sealed to the floor surface. Low level exit path marking (LLEPM), if supplied on flooring, shall be fully integrated into and flush with the floor surface to present no tripping hazard and not delaminate separate from the floor surface. LLEPM may be either active or passive and be compliant with APTA standards PR-PS-S-004-99, latest revision. Passive LLEPM marking lines shall be High Performance Photo Luminescent material (HPPL) that complies with APTA standard PR-PS-S-002-98, latest revision. Wear resistance of the HPPL locations shall be the same as the floor covering and integrated in order to be flush with the floor surface and to prevent any separation, delamination and water infiltration. Floor surface inside the electric lockers need not conform to ADA guidelines for surface slip resistance. The Contractor shall submit floor surface specifications and samples for Metra review and approval.

8.2.5 Floor layout of passenger areas for entraining and detraining shall be designed such that water drains out of car to prevent slip surfaces to the extent possible.

8.2.6 Heated flooring, (if provided), shall be of construction with an integrated heating system. The heated flooring system shall be controlled and integrated into the vehicle's main HVAC system. The performance of the heating system shall be demonstrated through a dielectric test in representative conditions , an electrical fatigue test (no default after 200,000 on/off cycles of 30 seconds each), a high-voltage insulation test , and an impact test according to the UL 1693 standard (impact test with a 2" steel ball of 1.1 lbs dropped from a height of 79". Ground fault/

shock hazard requirements per APTA requirements. To the greatest extent possible, these panels shall be repairable without removing radiant floor heat panels from the car. An additional protection system LCDI - Leakage Current Detector Interrupter – shall be installed if needed. Design, details and test procedures of the heated floor system shall be submitted to Metra for review and approval.**[CDRL C-8-19]**

## 8.3 PASSENGER SEATING

### 8.3.1 GENERAL REQUIREMENTS

8.3.1.1 All seats shall conform to APTA Standard PR-CS-S-016-99, latest revision. Seats shall also conform to the FRA's requirements for retention of seat components, 49 CFR Part 238.

8.3.1.2 All components used in the seat and cushion assemblies shall meet the flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification.

8.3.1.3 An engineering design and ergonomic analysis shall be performed by the Contractor in conjunction with the seat manufacturer on the proposed seat design arrangement and installation and shall be submitted for Metra's approval. The analysis shall take into account all aspects of the seat design, including as a minimum the materials used in the seat construction, human factor related dimensions, passenger ingress and egress, cushion contours including lumbar support, seat pitch, cushion comfort, seat attachment method, and maintenance. Final approval of the detail design of the seat shall be after review of proposed samples. **[CDRL C-8-07]**

8.3.1.4 Contractor shall submit an in-depth analysis on life-cycle cost and comfort level for passenger with an average ride length of 1 hour to a maximum passenger ride of 2 hours. **[CDRL C-8-07]**

8.3.1.5 Seats shall either face each other at all emergency sash locations or have provisions to move seat to allow correct size unobstructed opening per 49 CFR Part 238.113.

8.3.1.6 All seat bottom cushion and backrest assemblies shall be secured to the frame in accordance with FRA Regulation 49 CFR Part 238.233 (as clarified by the FRA in their January 30, 2008 letter). When installed, cushion and backrest assemblies shall be secure in place insuring that they shall not cause any noise during car operation whether occupied or unoccupied. Seat cushions shall not be removable by passengers, but shall be removable by maintenance personnel within one minute with the use of nothing more than simple hand tools. Each seat cushion assembly shall be interchangeable with like assemblies. Seat cushion covering shall be transportation grade material subject to Metra approval. Seat covering material shall be able to be cleaned by at least three widely available commercial industrial cleaning agents that are known to be chemically compatible. **[CDRL C-8-08]** Seat covering physical properties shall be tested in accordance to the tests listed in Table 1. Alternate testing methods with supporting documentation to superior testing methods can be submitted for Metra review and approval in lieu of listed tests

| Table 1 | |
|---|---|
| **Physical Property** | **Test Method** |
| Total Weight | CFFA-700D |
| Thickness | CFFA-700C |
| Tensile Strength | CFFA-17 |
| Tearing Strength (Trapezoid) | CFFA-16C |
| Coating Fabric Bond | CFFA-3A |
| Stretch | CFFA-15 |
| Abrasion Resistance | CFFA-1a Wyzenbeek |
| Crocking | CFFA-7, dry |
| Blocking | CFFA-4 |
| Cold Resistance | CFFA-6A, 5# roller |
| Accelerated Weathering Resistance Test | CFFA-2,<br>A1, (SAE-J2412)<br>B1, (ASTM G155-13)<br>C1, (ASTM D4329) |

Metra will indicate the colors to be provided after notice to proceed. Covers (both bottom cushions and backrests) shall not require the use of tacks or staples for attachment nor shall they become disengaged under normal use (including patrons placing their feet between the cushion and backrest).

8.3.2 SEAT DESIGN

8.3.2.1 All seating parts and hardware shall be corrosion resistant to but not limited to: water, commercially available cleaners, road salt, etc.

8.3.2.2 Seat assembly weight shall be minimized to the extent practical by the seat manufacturer.

8.3.2.3 Tops of seatbacks shall have a headrest for each passenger position. A diagonal slope at the aisle end shall accept a handgrip. The handgrip shall be rubber coated steel or alternate approved transit grade material suitable for the commuter car environment, subject to review and approval by Metra, and positioned such that no striking hazard to face or head of seated passengers is presented, even in the case of an emergency stop or other unusual condition. The aisle side handgrip should be attached to the seat such that the mounting hardware is recessed or hidden.

8.3.2.4

8.3.2.5 Armrests shall be provided for all seating locations and may be static or foldable. The foldable armrest(s), if supplied, shall be able to rotate in between the up and down positions and shall be flush with the seat back while in the up position. Aisle side armrests shall be static and of close loop design as to prevent injury to passenger from catching passenger bags, clothing, etc. The armrest shall be removable without requiring the disassembly of the seat in order to replace a damaged or defective armrest. The armrest shall be approved transit grade material suitable for the commuter car environment and pass APTA and 49 CFR Part238.103 requirements. Design is subject to Metra review and approval.

8.3.2.6 A cup holder shall be provided for as many seating locations as possible. The cup holder opening shall be able to accommodate a range of beverage containers readily used the food industry and travel style containers up to a diameter of 3-1/2 inches.

8.3.2.7 Seat backrest cushion assembly design shall be submitted to Metra for review and approval. The seatback cushion assembly-to-frame latching mechanism shall be easily disengaged by hand without tools. The latch/release mechanism shall be easily accessible to Metra personnel but concealed from passenger view. The latch mechanism shall be demonstrated for approval after award of the contract.

8.3.2.8 Low Level Exit Path Marking (LLEPM) shall be incorporated on the seat assembly. Marking design and high performance photo luminescent (HPPL) material shall meet all APTA requirements and must be submitted to Metra for review and approval.

8.3.3 FOLDING SEAT

8.3.3.1 Folding seats shall be provided where necessary and subject to all APTA and FRA tests. Design is subject to review and approval by Metra.

8.3.3.2 Seat construction, components, and attachments shall be of sufficient strength to withstand without permanent deformation (defined as + 0.125 inches) the testing requirements of APTA Standard PR-CS-S-016-99, latest revision or the loads listed below, whichever is more stringent **[CDRL C-8-09]**:

8.3.3.3 APTA 5.1.1 Backrest Strength: 300 lbs. per passenger uniformly distributed perpendicular to the plane of the seat back in the rearward and forward direction, three (3) inches below the top of the back or 36 inches above floor, whichever is lower

8.3.3.4 APTA 5.1.2 Grab Handle Strength: 300 lbs. on hand grip in a horizontal direction, rearward and forward.

8.3.3.5 APTA 5.1.3 Vertical Seat Strength: 450 lbs. per passenger uniformly distributed vertically downward on the front edges of the seat cushion.

8.3.3.6 APTA 5.1.4 Armrest Strength: 250 lbs. horizontal to the armrests in both directions on the armrests. 150 lbs. for folding center armrest(s) if applicable.

8.3.3.7 APTA 5.1.4 Armrest Strength: 250 lbs. vertically downward on the armrests. 150 lbs. for folding center armrest(s) if applicable.

8.3.3.8 APTA 5.1.5 – 5.1.7: As applicable with optional supplied equipment. Performed as dictated in APTA Standard PR-CS-S-016-99, latest revision

8.3.3.9 APTA 5.2 Dynamic Sled Testing: Performed as dictated in APTA Standard PR-CS-S-016-99, latest revision

8.3.3.10 APTA 5.3.2 Lateral Seat Attachment Test: Performed as dictated in APTA Standard PR-CS-S-016-99, latest revision

8.3.3.11 APTA 5.3.3 Vertical Seat Attachment Test: Performed as dictated in APTA Standard PR-CS-S-016-99, latest revision

8.3.3.12 APTA 5.3.4 Forward-Facing Seat Attachment Test: Performed as dictated in APTA Standard PR-CS-S-016-99, latest revision

8.3.3.13 APTA 6.1 Mechanisms: As applicable with optional supplied equipment. Life cycle test criteria shall be submitted to Metra for review and approval prior to APTA testing.

8.3.3.14 APTA 6.2 Cushions and Upholstery: Each unique seat assembly shall be dynamically tested, jounce and squirm as follows:

8.3.3.14.1 180 pound load on bottom cushion
8.3.3.14.2 110 pound load on back cushion
8.3.3.14.3 200,000 jounce cycles @ 100 cycles per minute
8.3.3.14.4 4,000 squirm cycles @ 4 cycles per minute

Foam should show no signs of tearing, shearing, or significant loss of height. Cushion covering shall show no signs of tearing or ripping and should remain attached to cushion pan or structure. Seat covering stitching should show no signs of unraveling or breakage.

8.3.4 Seat Equipment List

8.3.4.1 The seat shall have one (1) USB A and one (1) USB-C port each, location subject to Metra approval (reference Section 11.6.3). The USB parts shall be removable without having to disassemble the seat. **[COPL CO-8-02]**

## 8.4 PARCEL RACKS

8.4.1 A continuous closed type parcel rack, extending to the longest length practical, shall be provided in each side of the passenger sections (if applicable) and shall incorporate longitudinal restraints, with mounting brackets providing lateral restraints. Parcel racks shall be sized to fit a typical computer bag, back pack, small carryon luggage, etc that passengers may bring in revenue service. A parcel racks should be sized to accommodate storage for a maximum amount of seated passengers. The Contractor shall submit the parcel rack design to Metra for review and approval. **[CDRL C-8-10]**

## 8.5 ACCESSIBILITY PROVISIONS

8.5.1 The cars built to these specifications shall comply with regulation 49 CFR Part 38, subpart E. All provisions for passengers with disabilities must be documented, including passage and turning routes, and all clearances for mobility aids shall be submitted with proposal. **[PDRL P-8-02]** The Contractor shall also be guided by the latest issue of the following, to the extent that the following do not conflict with the above requirements, which shall govern:

8.5.1.1 Title 49, Code of Federal Regulations, Part 37 Transportation for Individuals with Disabilities.

8.5.1.2 Title 49, Code of Federal Regulations, Part 609 (Transportation for Elderly and Handicapped Persons)

8.5.1.3 ICDB Accessibility Standards Illustrated manual.

8.5.1.4 ANSI A117.1, American National Standard for buildings and facilities - providing accessibility and usability for physically handicapped people.

8.5.2 All entry and exit, passage, and turning routes to and from mobility aid positions shall conform to the requirements of the ANSI A117.1 as to clearances, turning radii and pathway impediments. All requirements for reaching, control and device activation, and other use of manual dexterity imposed by car-borne equipment shall also comply with ANSI A117.1. In all cases, the Contractor shall take into account all potential hazards related to hand, knuckle and finger clearances of persons operating mobility aids, as well as potential hazards to others created by mobility aid operation. Bulkheads and partitions in the route of mobility aids between the entryway and the mobility aids positions shall not incorporate any wings protruding into the aisle.

8.5.3 Each car shall have provisions for two (2) ADA designated locations. An approved number of retractable jump seats, or alternative design, as described in section 8.3, shall be provided in each ADA position for use by ambulatory passengers when mobility aids are not present.

8.5.4 The width of each passageway shall be dictated by the needs of the ADA lift mounting. The stanchion assembly shall be located in such a manner as to avoid potential hazards related to the hands of patrons while the mobility aid lift is in use. The mobility aid lift shall be installed such that a continuous threshold/lower track is maintained for the entire width of the side entrance door opening.

8.5.5 A mobility aid lift shall be provided on each side of each car, to permit the raising and lowering of passengers in mobility aids, or between station platform level and car level floor height. The ADA lift system and setup shall be subject to Metra review and approval. **[CDRL C-8-11]**

8.5.6 The station platform height shall be assumed by the Contractor to range from between top of rail to 8" above top of rail. The lift shall stow in an enclosure when not in use.

8.5.7 The entire lift shall be modular in design to facilitate removal of the lift for servicing. Weather resistant enclosure(s), with provisions to drain any accumulation of moisture shall be provided to protect components. The enclosure supporting frame should be designed to allow full access of the ADA lift for maintenance.

8.5.8 The lift platform shall conform to the length and width requirements of 49 CFR Part 38 Subpart E Paragraph 38.95[b][6]. The surface of platform shall be treated with an approved skid resistant material. The lift platform shall be equipped with a barrier at both the inner and outer ends, which shall automatically rise to contain a mobility aid and prevent roll off during operation (either in powered or manual modes). When lift platform has been fully lowered, the outer barrier flap shall lower and shall serve as a transition surface between the mobility aid lift and the station platform. When the lift is fully raised, the inner barrier shall lower and aid in transition between lift and vestibule. Side rails shall be permanently fixed to the platform to prevent side roll off.

8.5.9 The platform shall be capable of safely lifting and lowering loads of up to 800 pounds (363 Kilograms) in either powered or manual modes, without lift platform deflection in excess of 3 degrees. There shall be no failure mode, in either manual or powered, loaded or unloaded operation, in which the lift platform is capable of uncontrolled free fall.

8.5.10 Handrails shall be provided on both sides of the platform for safety of the rider when the lift is in use and for the safety of other passengers when it is not. The handrails shall not contain any electrical circuitry or switches.

8.5.11 The mobility aid lifts shall be circuit breaker protected. Control of the lifts shall be local and side-specific. The lift controls shall be interlocked with the car's air brake system and locomotive control system.

8.5.12 A switch, keyed to Metra's standard coach key, shall be provided for each lift in an approved location. When in the "on" position, power is provided to the lift (enabling its controls), a magnet valve is energized to apply brakes to the individual car, a signal is provided to the controlling cab and the amber indicator lights (one next to the switch, with sun shield and the exterior pilot lights) are energized. These events will also be triggered when the key switch is in the off position and the lift is manually deployed (pulled out).

8.5.13 Two (2) sets of operating controls shall be provided for each lift. The first set of operating controls shall be mounted in the enclosure or interior of the car. The second set of operating controls shall be the same as above but mounted in an enclosure in the carbody in the vicinity of the doors (when facing the doors from the outside).

8.5.14 The enclosure shall have a weatherproof cover. A lock, keyed to Metra's standard coach key shall retain the cover in the closed position. When the cover is opened, the controls in the enclosure shall be activated, with the controls in the enclosure or interior disabled.

8.5.15 An audible signal shall be activated when the mobility aid lift is activated.

8.5.16 The logic circuitry of the mobility aid lift shall prevent a lift platform from being lowered unless it has been fully deployed. It shall be possible however to stow a lift in powered mode in any position.

8.5.17 When raising the lift under power from the lowered position the outer barrier shall automatically close and will operate normally regardless if the barrier was lowered automatically or manually. No manual correction will be required to reposition the barrier.

8.5.18 In the event of a lift failure or a power failure, it shall be possible to operate the lift to and from any position in the raise/lower cycle, whether loaded or unloaded, and to stow and deploy the lift platform by hand if it is unloaded. Operation in this manual mode shall not damage the lift or any of its components.

8.5.19 Under powered operation, a complete cycle of deploying the platform, lowering the lift platform to station platform height, raising it to floor height, and stowing the lift platform, shall take a minimum amount of time.

8.5.20 In manual mode, this operation shall take no longer than three times the maximum time allowed for the powered cycle, when operated by a person of average manual dexterity. Any operation in manual mode, including operation under load, shall require no more than average strength, with no more than the equivalent of 40 pounds (18 kilograms) lifting force required, except that the force required to initially breakaway to deploy can be up to 60 pounds (27 kilograms).

8.5.21 A pilot light (reference section 10.4.2) shall be installed on each side of the car directly below door open indicator. These shall illuminate on both sides of the car when a wheel-chair lift is energized, regardless of the actual position of the lift.

## 8.6 TOILET ROOM

8.6.1 The toilet room shall be in a location that is easily accessible for ADA passengers.

8.6.1.1 The spatial arrangement and equipment provided shall conform to the requirements of regulation 49 CFR Part 38 and ANSI Standard A117.1 latest revision and is subject to approval of Metra. **[CDRL C-8-12]** A hinged access door shall be provided in the toilet room for servicing of the water tank and other related equipment.

8.6.2 One (1) set of equipment, as listed below, shall be provided in the toilet room:

8.6.2.1 One (1) toilet, meeting latest U.S. Public Health standards. The flush button shall be wall mounted.

8.6.2.2 One (1) retention tank having a minimum usable capacity required for sanitation use as required for revenue service. Proposer shall determine sizing based on expected passenger usage between servicing at a Metra service yard.

8.6.2.3 The tank shall be heated and the heaters activated when ambient temperature is less than 40 degrees Fahrenheit, see section 9.6.2. The tank shall be constructed of 12 gage stainless steel and equipped with clean-outs and emptying provisions. The tank shall also have an approved sight or liquid level meter to indicate an approximately full retention tank. In addition, the tank shall be equipped with a sensor that will illuminate an LED indication in the vicinity of the toilet empty line that will indicate when the toilet retention tank is at 75% capacity. The design of the system provided shall be subject to Metra approval. **[CDRL C-8-13]**

8.6.2.4 Lines between the tank and the toilet shall be stainless steel pipe, with stainless steel fittings. Lines shall be as short as possible, pitched toward the tank and free of "traps". The tank, the lines between the tank and the toilet, plus the emptying line shall be heated to prevent freeze-up. Emptying line shall be equipped with a 4 inch "Camloc" fitting and dust cover.

8.6.2.5 One (1) approved wall mount soap dispenser with touchless activation. Soap dispenser shall be mounted near the sink.

8.6.2.6 One (1) approved 2 roll toilet paper holder.

8.6.2.7 One (1) approved electric hand dryer with touchless activation

8.6.2.8 One (1) soiled towel receptacle

8.6.2.9 One (1) approved folding type coat and hat hook.

8.6.2.10 One (1) mirror of 1/4" coated polycarbonate set in a rolled stainless steel frame. The mirror shall be at least 9" wide by 12" high.

8.6.2.11 Stainless steel, 1-1/2 in. dia. Handholds properly oriented for ADA passenger use

8.6.2.12 One (1) fold-down transfer seat designed per ADA requirements.

8.6.2.13 One optical smoke sensing type smoke alarm with battery back-up (main car battery).

8.6.2.14 One (1) approved wall mount stainless steel sink. Sink shall have touchless activation.

8.6.3 WATER SUPPLY

8.6.3.1 The supply side of the water system shall be designed for potable water conforming to FDA (Food and Drug Administration) regulations. Water shall also be provided for flushing the toilet and supplying the sink (if applicable). The water system and tank are to be cleaned before the cars are delivered in accordance with United States Public Health regulations.

8.6.3.2 The entire system, with the exception of the water tank (which is to be isolated) shall be pressurized to 150 lbs. and checked for leaks.

8.6.3.3 A single stainless steel water tank shall be furnished. Proposer shall determine sizing based on expected passenger usage between servicing at a Metra service yard. The tank shall be suitably insulated to prevent the formation of condensate on its exterior. The tank shall be vented to the roof, permitting the fill pipes to drain. Access to the tank shall be provided for maintenance. A grille, will permit circulation of heated or cooled air around the water tank. The water tank shall be designed to withstand a hydrostatic test of fifty (50) pounds per square inch.

8.6.3.4 Two (2) approved water filling nozzles shall be provided. They should be located at the toilet end of the car, one on each side. One nozzle is to be used as a fill and the other to act as an overflow drain. These shall be enclosed in a self-draining stainless steel box, covered by a spring-loaded hinged stainless steel door for sanitary protection.

8.6.3.5 A suitably-sized interconnecting network of insulated copper piping shall be furnished, using sweat type fittings except where removal of components dictates the use of compression fittings. Piping shall be joined, using silver solder. It shall be suitably clamped to prevent rattles.

8.6.3.6 A combination shut-off / drain valve with metal identification tag shall be provided adjacent to the toilet. Location of the valve is subject to Metra approval. **[CDRL C-8-14]**

8.6.3.7 All piping must be installed in such a manner as to avoid formation of air pockets or, water pockets when the system is drained.

8.7 MISCELLANEOUS INTERIOR

8.7.1 Coat hooks shall be provided for as many seating locations as possible. Style and location subject to review and approval by Metra.

8.7.2 Ticket clips shall be provided for passenger seating and for the flip seats at the mobility aid positions. The location and design of ticket clips shall be approved by Metra. **[CDRL C-8-15]**

8.7.3 Waste receptacles, a minimum of two (2), shall be installed in each car. The receptacle location and mounting is subject to the approval of Metra. **[CDRL C-8-16]**

8.7.4 Two (2) appropriate keys shall be provided per car for any other locking devices used other than pencil locks.

8.7.5 Each car shall be equipped with two (2) emergency tool kits, one on each end of the car consisting of the following: 1 ea. dry chemical type fire extinguisher; 1 ea. 18 inch ripping chisel, 1 ea. LED Flashlight, and 10-pack box of glow sticks. On B-end only, 1 ea. Hot box stick shall be included in emergency tool kit. The tools shall be mounted in a case with a clear plastic front. The clear plastic shall be etched in an "X" to facilitate access in emergency situations. The case shall be sized to accommodate the above equipment plus Metra's standard first aid kit (applied by Metra.). The chisel and flashlight kit shall be marked with "Property of Metra".

8.7.6 One announcement holder, per Metra Drawing M-166 and made of polycarbonate shall be provided on each car

8.7.7 (deleted)

8.7.8 On odd numbered cab control cars, provision shall be made for the installation of a flush mount enclosure for an automated external defibrillator. Defibrillator enclosure should primarily be constructed of stainless. Any glazing shall be mounted to allow replacement of the glazing. Appropriate signage shall identify the location of the AED unit. Details of location and installation of the defibrillator shall be submitted to Metra for review and approval. **[CDRL C-8-17]** The alarm of the defibrillator cabinet shall be designed to accommodate standard AA or AAA batteries that easily can be replaced on an annual basis.

8.7.9 The Contractor shall propose a bicycle rack system that shall be able to handle between two and five (5) bicycles in the Priority Seating Areas if those areas are not being utilized for passengers. The bicycle racks shall be capable of storing bicycles without any bicycle component interfering with passenger circulation in the main aisle way. Bike racks shall have the capability to lock the frame of a bicycle to the rack assembly using a standard U-shaped type lock. Bike racks shall be designed to accommodate bicycles with tires up to 2.5 in. wide. The Contractor shall submit the design of this system to Metra for review and approval. **[CDRL C-8-18]**

8.7.10 One (1) baby changing station shall be provided in toilet room.

8.7.11 A minimum of two (2) touchless hand sanitizer dispensing units shall be installed in each car, at least one (1) on each end of the car. Touchless hand sanitizer units shall be battery or car low voltage circuit operated and hold hand sanitizing packets with a minimum of a 700 mL packet.

## 8.8 PROPOSAL DELIVERABLES REQUIREMENT LIST

| PDRL | Title |
|---|---|
| P-8-01 | Carbody Interior |
| P-8-02 | Accessibility (ADA) Provisions |

## 8.9 CONTRACT DELIVERABLES REQUIREMENT LIST

| CDRL | Title |
|---|---|
| C-8-01 | Interior Material Samples |
| C-8-02 | Wall Panels |
| C-8-03 | Cab Locker Designs (Engineer and Fireman Side) |
| C-8-04 | Floor Fire Test |
| C-8-05 | Flooring System |
| C-8-06 | Anti-Skid Design |
| C-8-07 | Seat Ergonomic Assessment |
| C-8-08 | Cushion Covering and Material |
| C-8-09 | Seat Dynamic and Static Testing |
| C-8-10 | Parcel Rack Design |
| C-8-11 | Mobility Aid Lift System |
| C-8-12 | Toilet Room/Equipment Arrangement |
| C-8-13 | Retention Tank Level Indication |
| C-8-14 | Toilet Shut-Off/ Drain Valve |
| C-8-15 | Ticket Clip Installation and Design |

| | |
|---|---|
| C-8-16 | Waste Receptacle |
| C-8-17 | Automated External Defibrillator |
| C-8-18 | Bicycle Racks |
| C-8-19 | Heated Floor |

8.10 CONTRACT OPTIONAL PROPOSAL LIST

| COPL | Title |
|---|---|
| CO-8-01 | (deleted) |
| CO-8-02 | USB Ports |

# 9 HEATING, VENTILATION AND AIR CONDITIONING

## 9.1 GENERAL REQUIREMENTS

9.1.1 Each car shall be equipped with a heating, ventilation and air conditioning system to automatically provide the specified interior temperatures specified herein. These systems shall perform this function with or without the variable internal heat loads such as passengers, lighting and miscellaneous electrical apparatus, or external factors such as solar heat gain and frequency of door openings. All material must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 21.16 of this specification. Proposer shall propose general description and requirements. The rating and design of the equipment shall be in accordance with ASHRAE Standard 37 or EN 14750-1 (passenger compartment) climate zone 3 and EN 14813-1 (operator cab) winter climate zone 3 and summer climate zone 2. The air conditioning equipment shall be tested per EN 14750-2 (passenger compartment) Test Row 1 and EN 14813-2 (operator cab) Test Row 2. **[PDRL P-9-01]**

9.1.2 The HVAC system shall maintain the car's interior temperature, including the engineer's cab (if applicable), to a specified programmable temperature range parameter in all circumstances described in EN 14750-1 (passenger compartment) and EN 14813-1 (operator cab) for winter climate zone 3 and summer climate zone 2..

9.1.3 The car temperature shall recover within 4 degrees F of the required interior vehicle temperature within three minutes maximum following a two-minute door opening of all doors on one side of the car. It shall be demonstrated that this requirement can be met during two hours of continuous door cycling of thirty seconds open and 2 minutes closed for 1 hour at the design conditions in both heating and cooling modes.

9.1.4 All system components shall be service-proven and supported by design and test data, adequate to demonstrate compliance with the specified requirements. Details of the system capacity and performance calculation, design, arrangement, installation, and operation of the HVAC system shall be submitted to Metra for review and approval. **[CDRL C-9-01]**

## 9.2 HEATING

9.2.1 The cars shall be electrically heated using 480 volt, 3-phase, 60 Hz A.C.

9.2.2 The system shall be thermostatically controlled with convection heaters in combination with the HVAC system.

9.2.3 The heating system shall be designed and adequately sized to maintain interior temperature as specified in EN 14750-1 (passenger compartment) and EN 14813-1 (operator cab) for winter climate zone 3 and summer climate zone 2.. Main heat shall be divided into stages or shall be a single stage operating with a modulating switching device. If multi-stage heat is chosen, the stages shall be designed to minimize the cycling of heat contactors.

9.2.4 Floor heat shall be provided either by electric heaters mounted behind heater guards, or an industry proven floor surface heating solution. If a floor surface heating solution is proposed, details of the design, installation, and arrangement of the floor surface heating solution shall be submitted to Metra for review and approval. **[CDRL C-9-02]** If conventional floor heating is utilized, the heater guards shall be of special design to prevent the surfaces coming in contact with passengers from exceeding 125 degrees F and shall be designed to maximize passenger foot space to the greatest extent possible.

9.2.5 The forced air heaters and radiant floor heaters shall be protected against over temperature.

9.2.6 Layover heat will be manually activated after the car is parked and is connected to a source of head end power. Layover heat control is to be part of the HVAC automatic controls.

9.2.7 Layover heat shall be provided by convection heaters in combination with the HVAC system and shall close the fresh air damper. Layover heat shall maintain an interior temperature of 50 degrees F ± 5 degrees F. This set layover temperature shall be made programmable through the control display in the driver's cab.

9.2.8 Each cab shall be equipped with manually controlled heaters. These heaters shall be controlled via the driver's display. The Contractor shall propose a method of heating and cooling the driver's cab by using a separate cab specific HVAC system.

9.3 VENTILATION

9.3.1 The ventilation system shall be designed to maintain a uniform temperature throughout the car. The temperature within that unit shall be within the limits of EN 14750-1 and EN 14813-1 for winter climate zone 3 and summer climate zone 2.

9.3.2 All ducts and plenum chambers shall be insulated to prevent the formation of condensate on their exterior.

9.3.3 Each system shall deliver to the vehicle interior ten percent (10%) of the total airflow of each HVAC unit as fresh air or as defined in the EN 14750-1. The HVAC system shall automatically control the fresh air intake. The fresh air openings of the HVAC system shall be designed to prevent infiltration of snow and water.

9.3.4 Flexible transition ducts of approved material shall connect the passenger supply distribution ducts to each evaporator blower

9.3.5 All flexible transition ducts shall be installed so that it is not under stress and shall be clear of surrounding obstruction when units are in operation. The ducts shall be equipped to allow it to clip on at least one end to ensure ease of replacement or HVAC unit removal. These ducts shall withstand, without damage, the minimum and maximum temperatures and the flexing experienced.

9.3.6 Air ducting shall be insulated and constructed of an approved material. All insulation shall be applied to the outside of the duct.

9.3.7 (deleted)

9.3.8 Ventilation system shall be balanced so that the carbody, with doors closed, maintains a positive pressure at any speed, with the fresh air dampers open and the evaporator blowers for both systems operating normally.

9.3.9 A disposable pleated filter element(s) MERV5 shall be provided in the return and fresh air intake(s) of each HVAC unit. As an option the contractor shall look into an enhanced HVAC filtering system.

9.3.10 An exhaust outlet for the toilet shall be provided by considering a constant negative pressure difference between toilet system and the exterior. The design and function shall be subject to Metra review and approval. **[CDRL C-9-03]**

9.4 AIR CONDITIONING

9.4.1 All subject cars in the trainset shall be equipped with air conditioning equipment comprising of a minimum of one (1) self-contained compact unit. The units shall be roof mounted or located in a location for ease of maintainability and replacement.

9.4.2 Each self-contained unit shall be removable in less than 4 hours and require minimal tooling and facilities. Each unit shall consist of one or more compressor/condenser sections and one or more evaporator sections with electric heating, and an independent control panel.

9.4.3 Each HVAC system should have enough redundancy built in, so that basic failures don't lead to a total loss of the respective HVAC system. Refrigerant for these units may be R-407C, 134A or an approved alternative refrigerant that conforms to 40 CFR Part 42. Type of refrigerant shall be subject to Metra review and approval.

9.4.4 The units shall be constructed using stainless steel or aluminum to the greatest extent possible.The hardware for mounting the units shall have enough safety factor incorporated, so that the failure in one of the bolted connections does not lead to unsafe scenarios. .

9.4.5 (deleted)

9.4.6 The mounting of the air conditioning units shall incorporate damping to cushion and limit longitudinal movement. The units shall be equipped with vibration isolator, sized to minimize transmission of vibration of the units to the car body.

9.4.7 Each package HVAC unit shall be individually removable with the use of a crane without removing any additional roof equipment.

9.4.8 The structure of the units shall permit the entire unit to be removed without damage, and appropriate lifting lugs or eyes shall be incorporated. HVAC unit shall be designed to remove condenser fan, compressor, filter dryer, expansion valves and solenoid valves without the removal of entire unit from car. The entire arrangement is subject to Metra review and approval. **[CDRL C-9-04]**

9.4.9 The power for the air conditioning system shall be derived from the car's power distribution. Power for the control of the air conditioning system shall be determined by the contractor. Low voltage DC control power may be used with the approval of Metra.

9.4.10 All motors for the evaporator, condenser and compressor shall have overload protection of all three phases, mechanically interlocked to remove all power to the devices on activation in order to prevent a single phase condition. All component and devices must operate satisfactorily within the voltage variation parameters as established by the National Electrical Code, without any effect on the longevity of the components or devices.

9.4.11 The refrigerant compressors shall be accessible hermetic (semi-hermetic) reciprocating or scroll type, sized to the proper capacity required of the HVAC system. The Contactor may propose an HVAC unit with multiple compressors working in tandem. Eliminators shall be provided in an approved manner to prevent transmission of compressor vibration to the air conditioning unit frame and suspension.

9.4.12 Condenser and evaporator coils shall be constructed of seamless copper tubing, copper headers with copper fins or aluminum and stainless steel side plates and framing. No crevices or closures shall be permitted, which would hinder cleaning. The Contractor may propose alternative coil materials and fin layouts.

9.4.13 The HVAC systems condensate should be drained directly out of the system and into the roof drainage system of each car.

9.4.14 The condenser fan shall be powered by the car's power system voltage. The fans and their motors shall be of service proven design.

9.4.15 Direct (not belt driven) driven condenser fan and evaporator blower utilizing the car's power system voltage. The fans and their motors shall be of service proven design.

9.4.16 Evaporator blower housings shall be fastened in manner that focuses on secureness and ease of replacement.

9.4.17 The units shall also have within the self-contained assembly at least the following as needed:

9.4.17.1 Filter drier
9.4.17.2 Moisture indicator
9.4.17.3 Suction and discharge shutoff valves (liquid line);
9.4.17.4 Refrigeration charging valves
9.4.17.5 Receiver tank
9.4.17.6 Solid state high and low safety pressure switches and modulation pressure switch (or sensors with a microprocessor control system)
9.4.17.7 Test gauges, liquid filled, suitable for vibration and shock of the railroad environment
9.4.17.8 A test mode to override temperature control signals

9.4.18 All refrigeration piping shall be of service proven design. The tubing shall be pre-formed where possible and shall be assembled with as few fittings as practical.

9.4.19 If roof mounted units are proposed, the bottoms of each unit shall have collection pans under the evaporator section and the condensing section. Condensate is directed directly onto the car roof and led into roof drainage system. Horizontal runs shall have a downward pitch.

9.4.20 The drain lines shall be routed to the underside of the car, located so that the condensate shall drain clear of all underfloor equipment and running rails. The number of fittings and bends shall be minimized and, where used, shall be of large radii for ease of unplugging. The drain piping shall be insulated to preclude condensation.

9.4.21 (deleted)

9.4.22 The evaporator and condenser pans, along with all surfaces of the unit shall be insulated, if needed to prevent condensation.

9.5 TEMPERATURE CONTROL

9.5.1 The heating and cooling controls shall consist of a single heating and cooling control display per driver's cab. The controls shall be arranged for automatic changeover from heating to cooling.

9.5.2 Each temperature control display shall enable authorized personnel to toggle the HVAC system between the normal "ON" operating mode, the layover mode, and an off mode. The off mode shall not disable the operation of the anti-freeze protection circuits. The target temperature for the normal operating mode shall be set to achieve an interior temperature of 72 degrees F within the limits of EN 14750-1 (Passenger compartment) and EN 14813 (Operators cab). The target temperature shall be programmable by personnel with privileges within the range of 68 degrees F to 76 degrees F, if alterations are necessary.

9.5.3 The controls shall be an electronic based, positive, non-hunting type to ensure proper operation of the air comfort sub-systems. The design and arrangement of the controls shall be subject to Metra review and approval. **[CDRL C-9-05]** The use of programmable logic controllers and/or microprocessors is preferred. The controls should be equipped with non-proprietary Portable Test Equipment (PTE) software/ports that would enable personnel with higher levels of access to adjust the temperature parameters for heating, modulated cooling and cooling, and accessing diagnostic data such as fault and download history.

9.5.4 Temperature sensors shall be located behind the return air screen in the return air duct, at the fresh air inlet (may be used for anti-freeze protection), supply air sensor at the HVAC main duct, and at minimum one in the passenger area. Evaporator coil sensors shall be used to detect the build-up of ice on the evaporator coil. All sensors shall be properly utilized by the controller to optimize temperature control and provide diagnostic data for maintenance, servicing, and testing.

9.5.5 Pressure transducers shall be provided to allow the temperature controller to monitor and indicate the suction and discharge line pressures. The temperature controller shall be capable of displaying diagnostic data or uploading diagnostic data via the PTE software program. Faults and download history shall be logged and accessible to technicians.

9.5.6 Automatic damper controls shall be furnished as part of the temperature control system.

9.5.7 An indicator and monitor display shall be furnished in to indicate the status of the heating and cooling equipment. The displays shall be located in each driver's cab . The display shall indicate which stages of heating or cooling have been called for by the settings of the climate control panels and shall indicate whether the heating or cooling being called for is functioning. The panel or panels shall also indicate fresh air temperature, supply air temperature, return air temperature, suction line pressure and discharge pressure, and any on-going faults.

9.6 ANTI-FREEZE PROTECTION

9.6.1 Anti-freeze protection shall be provided at each side entrance door and shall be of sufficient capacity to prevent the formation of ice at these locations (> 40° F. surface temperature @ -20° F.). The design of such system shall be included in door system design review and shall be subject to Metra design review and approval. **[CDRL C-7-01]**

9.6.2 (deleted)

9.6.3 Anti-freeze protection shall also be provided for the water tank, piping from the tank to the basin and toilet, the drain from the water basin in the toilet room, water filling pipes, and the water line and retention tank under the car. Design for heating of the retention tank shall either

be an immersion heater, Metra preferred, or a heating pad. Design of system shall be subject to Metra design review and approval. **[CDRL C-9-06]**

9.6.4 A water freeze dump valve shall be provided for the toilet water system. The location and the specific heating system used for the water freeze dump valve shall be subject to Metra review and approval. **[CDRL C-9-07]**

9.6.5 All heaters shall activate antifreeze circuits at ambient temperatures of 40 degrees F or below, and shall de-activate antifreeze circuits when ambient temperatures rise above 50 degrees F.

## 9.7 PROPOSAL DELIVERABLES REQUIREMENT LIST

| PDRL | Title |
|---|---|
| P-9-01 | HVAC System |

## 9.8 CONTRACT DELIVERABLES REQUIREMENT LIST

| CDRL | Title |
|---|---|
| C-9-01 | HVAC System – Design and Installation |
| C-9-02 | Floor Surface Heating Solution (If Applicable) |
| C-9-03 | Toilet Room Exhaust |
| C-9-04 | HVAC Unit Lifting Provision |
| C-9-05 | Temperature Control Arrangement |
| C-9-06 | Retention Tank Heater |
| C-9-07 | Water Freeze Dump Valve |

# 10 LIGHTING

## 10.1 GENERAL REQUIREMENTS

10.1.1 This section describes interior and exterior lighting that shall be provided on both trailer type and cab car type trainsets.

10.1.2 Interior lighting shall be designed to enhance passenger comfort visually and illuminate areas evenly without glare or dark areas at critical locations. The lighting shall enhance the appeal of interior furnishings, while providing for maximum passenger and crewmember safety. All interior and exterior lighting shall conform to the latest applicable APTA, EN/IEC standards and FRA regulations. All interior and exterior lighting shall have proven service railroad operations or need to be approved by Metra.

10.1.3 Exterior lighting shall feature maximum and efficient illumination and indication to passengers and crew members.

10.1.4 Lighting shall be provided in a minimum of two modes: Normal and Emergency.

10.1.5 Lighting shall be provided using energy efficient Light Emitting Diode (LED) technology in all instances

10.1.6 All lighting components shall use efficient and environmentally sustainable components, as well as being recyclable to the greatest extent practicable.

10.1.7 For each type of car proposed, the Contractor shall provide Metra a detailed interior and exterior lighting plan for Metra to review. The plan shall include the type of lighting, lighting arrangement (including any switches, ballast, control, lamp styles), fixture type, voltage, color temperatures, illumination levels in the interior of the car at specified locations for all lighting modes, and compliance with appropriate emergency lighting and signage regulations, standards, and recommended practices. A description of power consumption and voltage levels in the various modes of operation shall be included in the proposal. The details of the design, installation, and arrangement of the lighting solution shall be submitted to Metra for review and approval. **[CDRL C-10-01]**

10.1.8 (deleted)

10.1.9 All lighting and associated lighting electronics shall be tested and conform to all applicable sections of Standard EN 50155 (including EN 50121-3-2), IEC 61373, 49 CFR 238 Appendix B, and NFPA 130. Certification to applicable APTA, applicable EN/IEC standards, and FRA criteria shall be provided by the contractor upon the request of Metra. **[CDRL C-10-02]**

## 10.2 INTERIOR AND PASSENGER COMPARTMENT LIGHTING

10.2.1 The coach sections shall be provided with an approved arrangement of LED fixtures. Alternate lighting technology, such as service-proven OLED lighting, may be proposed for Metra review and approval.

10.2.2 The lighting system shall: not produce objectionable glare, not deteriorate rapidly in effectiveness through the collection of dirt, permit easy cleaning and renewal of lighting elements, and be free of rattles and vibration when in service.