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## INDIAN RAILWAYS



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## SPECIFICATION FOR ELECTRO-PNEUMATIC PRESSURISED FLUSHING SYSTEM (WITHOUT MOVING PARTS) FOR LHB TYPE COACHES.

### 1. PREAMBLE:

- 1.1. This technical specification covers general conditions, technical & operational requirements, design, supply, installation & commissioning, inspection, testing procedure of **specification for electro-pneumatic pressurised flushing system (without moving parts) for LHB type coaches.**
- 1.2. This specification also covers the preventive maintenance by supplier/vendor during warranty and AMC for post warranty period.
- 1.3. This technical specification covers general conditions, technical and operational requirements, inspection and testing procedure for electro-pneumatic pressurized flushing system (without moving parts) for LHB type coaches.
- 1.4. The flushing system has been conceived for convenient and efficient flushing: complete removal of faecal matter from the lavatory pan/commode with a minimum usage of pressurized water on a press of a button.

### List of normative standards for reference

Sl. No.	Standard	Description
1	EN50155	Railway applications — Rolling stock — Electronic equipment.
2	IS/IEC 60529	Degrees of protection provided by enclosure (IP code)
3	EN 61373	Shock & vibration tests of rolling stock equipments.
4	ELRS/SPEC/ELC/0019	Technical specification for electron beam irradiated/chemically cured cross linked thin walled flexible elastomeric cables with copper conductors.
5	IS:17050-2023	Degrees of protection provided by enclosures for electrical equipments against mechanical Impact (IK code)

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## 2. PARTICULAR REQUIREMENTS

- 2.1. Make in India policy of Govt. of India will apply
- 2.2. Electro-Pneumatic Pressurized flushing system (without moving parts) for LHB type coaches requires very high reliability of all crucial components. Hence all crucial parts /assembly shall be sourced from proven sources only.

**Note:** During tendering the firms shall comply the eligibility criteria specified by the purchaser.

- 2.3. Supplier / vendor should have design capability in the field of Electro-Pneumatic control system for customized application. Documentation and credential for successful completion of design, installation and after sales service for at least one such application shall be submitted by the vendor.
- 2.4. Firm should have ISO: 9001 certificate issued by NABCB accredited certification body / International Accreditation Forum (IAF) under Multilateral Recognition Arrangement (MLA) for its works address covering the items under manufacture, supply and installation etc. Firm should have established quality control system and organization to ensure quality of the product.
- 2.5. Firm should have well-established design facilities with qualified & competent design personnel and well established manufacturing facilities required for EPPFS (without moving parts)
- 2.6. Firm should have in-house testing facilities to test the performance of all critical components of the complete system.

## 3. DEFINITION OF TERMS USED:

- 3.1. **“EPPFS”** means Electro-Pneumatic Pressurized flushing system used in lavatory pan/commode with a minimum usage of pressurized water on a press of a button system for in passenger coaches.
- 3.2. **“Supplier”** means the firm/company on whom the order for the manufacture, supply, installation and commissioning and maintenance of the Electro-Pneumatic Pressurized flushing system (without moving parts) is placed or will be placed.
- 3.3. **“Purchaser”** means the Indian Railways on behalf of the President of the Republic of India who is purchasing the Electro-Pneumatic Pressurized flushing system (without moving parts).
- 3.4. **“Inspecting Authority”** means the Organisation or its representative nominated by the Purchaser to inspect the Electro-Pneumatic Pressurized flushing system (without moving parts) on his behalf.
- 3.5. The Research Designs and Standards Organization, Manak Nagar, Lucknow-226011 is here after referred to as **RDSO**.
- 3.6. Indian Railways is hereafter referred to as **I.R.**
- 3.7. In case of any clarification for any clause of this specification or drawings, the same shall be obtained from purchaser / ED Standard (Carriage), RDSO.

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#### 4. SCOPE OF WORK

- 4.1. Supply, installation, and commissioning including all the items / activities required for installation and functioning of the system shall be under the scope of Supplier.
- 4.2. Each lavatory shall be equipped with Electro-Pneumatic Pressurized flushing system along with required interconnections for electrical, pneumatic and water supply and all other items / fastener required for installation and commissioning of the system.
- 4.3. Plumbing connection from 3/4" / 1" socket of roof water tank ( 30 litre / 395 ltrs or 455 ltrs capacity ) to the pan /commode including all components required for the pressurized flushing system shall be in the scope of the Supply.
- 4.4. Isolating cock (1/4" BSP with both end female threads) and NRV (1/4" BSP) in the pneumatic line shall be provided to isolate the system for attending the faults occurred if any in the Pressuriser unit or in the pneumatic lines of EPPFS.
- 4.5. Apart from above, all other items/activities required for installation and functioning of the system shall be in the scope of Supply.
- 4.6. Water pressuriser unit along with required fittings (electrical / pneumatic/ water) with provision of mounting arrangement on a stainless steel AISI 304 frame suitable for mounting on existing stud provided behind attachment wall of lavatory module shall be in the scope of supply.
- 4.7. Electro pneumatic control panel suitable for mounting within the space envelop behind attachment wall of the lavatory module shall be in the scope of supply.

#### 5. COACH OPERATING CONDITIONS

EPPFS (without moving parts) should function with full efficiency under following coach operating conditions.

##### 5.1. Car-body dynamics:

Equipment shall withstand satisfactorily the vibrations and shocks normally encountered in service as indicated below:

- |      |                                   |      |
|------|-----------------------------------|------|
| i)   | Maximum vertical acceleration     | 1.0g |
| ii)  | Maximum longitudinal acceleration | 3.0g |
| iii) | Maximum lateral acceleration      | 2.0g |

The vibrations are of sine wave form and the frequency vibration is between 1 Hz to 50 Hz. The amplitude 'a' expressed in millimeters is given as a function of f, by equations

$a = 25/f$  for values of f from 1 Hz to 10 Hz.

$a = 250/f^2$  for values of f exceeding 10Hz and up to 50 Hz.

In the direction corresponding to the longitudinal movement of the vehicle, the equipment is subjected for min. 2Hz to 50 Hz Vibrations of such a value that the maximum acceleration is equal to 3.0g. Maximum value for vibration level of the equipment shall be tested as per IEC 61373.

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5.2. **Coach-body displacement encountered under dynamic conditions.**

- i) Vertically-  $\pm 100$  mm
- ii) laterally -  $\pm 80$  mm
- iii) longitudinally-  $\pm 10$  mm
- iv) bogie rotation about center pivot-  $\pm 4^0$
- v) Maximum Speed of train - 160 KMPH

5.3. **Ambient Condition:**

- (i) Altitude : Sea level to 2500m
- (ii) Operating temperature :  $-10^0\text{C}$  to  $55^0\text{C}$
- (iii) Max. Temperature under Sun :  $70^0\text{C}$
- (iv) Relative humidity : 40% to 95%
- (v) The rainfall is fairly heavy.
- (vi) During dry weather, the atmosphere is likely to be dusty.
- (vii) Temperature variations can be quite high in the same journey or short period of time.
- (viii) Atmospheric pressure variation from sea level to high altitude may be experienced in same journey.
- (ix) Coaches operate in coastal areas with continued exposure to salt laden air.
- (x) Airborne contaminants like smoke, chemical vapours, conducting particals etc.
- (xi) Coaches may be subjected to frequent external washing with detergents and cleaning of toilets by cleaning agents.
- (xii) LHB type coach length over coupler is approximately 24 meters.

**6. SYSTEM INTERFACE AVAILABLE**

6.1. **Water Supply**

- 6.1.1. LHB AC coaches are fitted with roof water tank of 30 litre capacity is available over each toilet at a height of about 2030 mm from toilet floor. Water is pumped to these tanks from underslung water tanks. Supply from water tanks is under gravity flow.
- 6.1.2. LHB Non AC coaches are fitted with 395 ltrs or 455 litres water tank above each lavatory at 2030 mm height. Supply from these water tanks is under gravity flow.

6.2. **Pneumatic Supply**

- 6.2.1. A limited quantity of compressed air supply of 3.5 liters / minute / lavatory maximum can be made available at  $6\text{ kg/cm}^2$ . A separate reservoir of 75 liter connected to feed pipe is available in the coach exclusively for toilet system.
- 6.2.2. Requirement of compressed air per toilet / minute for the EPPFS system shall not exceed the limit as specified above. The requirement shall be clearly specified in the design documents by the Supplier.

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### 6.3. **Power Supply**

- 6.3.1. 24V DC supply is available in AC LHB Coaches & 110 V DC is available in Non-AC LHB coaches, supplies available in coaches may vary up to +/- 30% of the specified voltage.
- 6.3.2. Total peak power requirement per coach shall not exceed 50 watts. Power consumption / toilet shall be clearly specified by the Supplier.

## 7. **FUNCTIONAL REQUIREMENT OF THE EPPFS (WITHOUT MOVING PARTS)**

- 7.1. **Principal of operation of the system:** System shall be designed to utilise the compressed air (without employing any moving part) for water pressurisation in a pre filled water column & flushing of the lavatory pan /commode. In case of no water system should halt and Red colour indication should be displayed on electric flush switch.
- 7.2. Initiation of flush cycle shall done by pressing electric push button and water pressurisation through compressed air by operating of the pneumatic valves & pressurised water shall flush the commode/pan to transfer & push the fecal matter from commode/pan to the Bio tank.
- 7.3. The system shall be precisely designed to discharge optimum pressurised water only from commode/pan orifices and at the same time it shall be ensured that compressed air should not be discharge in lavatory pan / commode in any case.

## 8. **DESIGN REQUIREMENTS:**

- 8.1. The system offered must be modular in design, interchangeable, and reliable. All the equipment / components (pneumatic and electronics) shall be installed in a single casing to make it into a single interchangeable modular unit to be fitted within the space available behind the attachment wall.
- 8.2. All water and pneumatic lines along with their fittings shall be of nominal size  $\frac{3}{4}$ " and  $\frac{1}{4}$ ", respectively. The Supplier shall clearly specify the consumption of power, air and water during design approval stage.
- 8.3. All water pipelines and pipe fittings shall be of stainless steel (AISI 304) only. Interconnection between sub-assemblies if necessary may be made of nylon wire braided hoses as per IS: 12585-88, type-2 (less than 300 mm length) with suitable end fitting of SS 304 and shall be properly clamped.
- 8.4. All clamps, fasteners, mounting bracket, nuts (Nyloc type), bolts etc shall be of stainless steel (AISI 304).
- 8.5. All pneumatic operated water valve and quick couplings shall be of stainless steel (AISI 304). Polymeric fittings shall not be permitted.
- 8.6. All pneumatic tubing shall be made of polyamide material (PA12) confirming to DIN 74324.
- 8.7. The design of the flushing system shall have anti-theft and anti-corrosive measures for protection.

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- 8.8. The system should be designed to meet the maintenance schedule prescribed in Annexure A. Coaching depots shall follow the maintenance schedule as prescribed in **Annexure- A**.
- 8.9. EPPFS shall be designed to be operated on 24 V DC supply only, SMPS along with suitable capacity MCB and other control circuit shall be fitted inside the control panel.
- 8.10. Electrical cables used in this system shall be as per latest revision of the RDSO specification ELRS/SPEC/ELC/0019. All electrical connections must be sturdy, plug and play type and shall be properly clamped.
- 8.11. All electrical, electronics and pneumatic parts of system should be shock and vibration proof and should comply with IEC 61373, category-2.
- 8.12. All electrical & electronic components / system should comply with the requirements of EN 50155 specification & Degree of protection of control panel enclosure unit shall be IP65 as per IS/ IEC 60529.
- 8.13. Critical Parts / components of EPPFS system are listed in table-1, all critical Parts / components must be sourced from reputed OEM only whose products are proven and already in service for more than 5 years as specified in table 1.

**Table 1**

SN	Name of Component	Detail Description
1.	Electric Push Button Switch	1. <b>Type of operation</b> : - Industrial grade push button momentary type 2. <b>Mounting</b> : - Panel mounted (outer diameter 22mm) 3. <b>Degree of protection</b> : - IP67 as per IS / IEC 60529 4. <b>Impact resistance</b> : - IK10 rated as per IS:17050-2023 5. <b>Body material</b> : - Stainless steel 6. <b>Illumination</b> : - Ring illumination, Dual colour LED Green, Red 7. <b>Mechanical life test</b> : - Minimum 1 million operation cycle. 8. <b>Make of Push button:</b> - RS Pro, EOA, TE Connectivity, E-Switch
2.	Control Panel	1. <b>Mounting</b> : - on existing studs provided on lavatory wall behind attachment wall 2. <b>Degree of protection</b> : - IP65 as per IS / IEC 60529

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		<p>3. <b>Impact resistance</b> : - IK10 rated as per IS:17050-2023</p> <p>4. <b>Body material</b> : - Stainless steel AISI304 brush finish</p> <p>5. <b>Internal parts</b> :- All electrical / electronic/ pneumatic parts / assemblies shall be plug-n-play type and shock &amp; vibration proof.</p> <p>6. <b>Make of All Pneumatic fittings &amp; NRV:</b> Parker/Festo/SMC/Norgren/Janatics</p> <p>7. <b>Make of MCB, SMPS, Timer &amp; Relays :</b> ABB/ Bosch /Honeywell /Schneider /ITC Electrical Components / Selec / GIC /OMRON.</p>
3.	Water Pressurization System	<p>1. <b>Mounting</b> : - On Stainless Steel AISI304 frame on existing studs provided on lavatory wall behind attachment wall.</p> <p>2. <b>Body material</b> : - Stainless steel AISI304 brush finish</p> <p>3. <b>Water inlet point</b> : From top of the water cylinder.</p> <p>4. <b>Air inlet point</b> : From top of the tank</p> <p>5. <b>Water level sensor</b> : Capacitive Sensor</p> <p>6. <b>Make of all Air operated valve &amp; NRV:</b> CKD / Parker /Festo / SMC / Norgren</p> <p>7. <b>Leakage test</b> : water cylinder shall be done at 10 bar for 30 minutes. No leakage from cylinder &amp; connections is permitted.</p>
4.	Air Filter Regulator Lubricator (FRL) Unit	<p>A metal body air FRL unit shall be used to condition the pneumatic supply of the coach. Pressure regulator shall be set between the pressure of 2.5 to 3.5 kg/cm<sup>2</sup> for optimum performance.</p> <p><b>Make of FRL unit:</b> CKD /Parker / Festo /SMC /Norgren / Janatics</p> <p>Maintenance requirement of FRL shall be clearly spelt out</p>
5	Isolating cock & Y-strainer	<p>For isolation / maintenance purpose an isolating cock (3/4" BSP threaded) shall be provided in water line drawn from the overhead water tank.</p>

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	For filtration of water scale etc, Y-strainer (3/4" BSP threaded) shall be provided in water line just after isolating cock. The Y branch shall be oriented downwards to avoid accumulated dirt to fall inside the system.  <b>Recommended Makes of isolating cock and Y strainer :</b> <i>Parker/Festo/ SMC/ Norgren/ Janatics / Atam Valves/Zoloto valves.</i>
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## 9. TECHNICAL REQUIREMENTS

- 9.1. This specification shall be read along with ICF Drawing ICF/SK3-6-3-246 Alt 'a'. for interface & references only. MDTs 214 Rev 12 or latest revision / amendment issued shall be referred for FRP modular toilet.
- 9.2. Electro-pneumatic control panel shall be installed on the lavatory wall (behind the attachment wall as per latest applicable drawings of FRP lavatory module as per MDTs 214 within the existing space available of 110 mm (maximum space). Drawing no. LE63202 (latest alteration) for Indian style pan bowl interface, LE63246 (latest alteration) for Western style bowl interface, 1.10113.0.30.400.002 (latest alteration) and 1.10113.0.30.400.004 (latest alteration) for mounting & bracketing interface for FRP modular toilets for AC coaches & drawing no. MI007851, MI008177 for Non AC LHB type coaches.
- 9.3. Besides above, this flushing system may be installed in the new variants for which supplier shall hold a review with concerned unit for its fitment plan. The referred drawings are only for reference, and layout of EPPFS (without moving parts) or drawings may change.
- 9.4. Dual colour LED (Red: not ready to flush) /Green: ready to flush) electric push button shall be installed on stainless steel (AISI 304) 2 mm thick of 70x70 mm mounting plate with a suitable IP65 junction box at the Standard height of 1300 ± 20 mm from floor level & at the identified location of the lavatory module for pressurised flushing.
- 9.5. The push button mounting plate shall have engraved markings "PRESS FOR AUTO FLUSH" and "स्वचालित फ्लशिंग के लिए दबाएं". Sticker for working instruction and graphic symbol shall be provided above the Electric push button as per drawing no. MLE64136.
- 9.6. The system shall be designed to work at 2.5-3.5 kg/cm<sup>2</sup> pneumatic pressure. The discharge of water in a single flush shall be 1.4 to 1.5 liters. Supplier should specify the consumption of air in litres/minute or litres/flushing operation, along with the offer. There should be no leakage of compressed air or water.
- 9.7. The required electric, pneumatic, and water consumption shall be taken from designated points in the respective coaches. Maximum pneumatic supply shall be limited to 3.5 litres /minute /lavatory (for 4 flush cycles / minute). Air shall be available 6 kg/cm<sup>2</sup> for the system.

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- 9.8. A manual bypass or alternate flushing arrangements shall be provided by separate flush button, so that system remains usable for ensuring proper flushing to transfer the faecal matter from the lavatory pan /western commode to bio-tank including clean-ability, in case of non availability of power /air. Material of manual flush valve mounting plate, body, push button and shall be AISI316 /CF8M.
- 9.9. Joint between manual flush button outlet & pressuriser cylinder shall be such to ensure minimal pressure loss by flow of pressurised water towards manual push button.
- 9.10. There should be no leakage more than 1% in 120 mins from system at 6 kg/cm<sup>2</sup> pressure & system should dispense of maximum water 1.5 litres in functional test at 3-5 kg/cm<sup>2</sup> pneumatic pressure.

#### 10. DUTY CYCLE:

- 10.1. The flushing system should be ready to flush within 15 seconds after each use, which includes time for discharge of 1.4 to 1.5 Litres of water within 3-4 seconds of pressing the Flush Button.
- 10.2. System shall be designed for minimum 150 flush cycles in 24 hours. The components of the system shall be designed to cater higher usage.

#### 11. TESTING AND APPROVAL

- 11.1. The supplier / vendor shall submit the design details of the Electro-Pneumatic Pressurized flushing system (without moving parts) complying the technical, design requirements of this specification including layout drawings, coach interfaces required, integration requirement, operation and maintenance manual, including the requirement of spares and consumables for the approval by Vendor approving authority. Quality assurance plan covering all stages of manufacturing, quality control and testing at various stages of the sub-assemblies and final system shall be submitted for approval by vendor approving authority.
- 11.2. Supplier/vendors who have already met the requirements of para 11 of this specification by vendor approving authority shall be exempted to clause no. 11.3. However, in case of any design change / sub vendor change by supplier fresh prototype approval shall be required.
- 11.3. **PROTOTYPE APPROVAL:**
- 11.3.1. Prototype approval of the EPPFS system will be done by Vendor approving authority. Prototype approval shall be done as per approved QAP of the firm on test bench at firm's premises for verification of the technical, design requirements and testing of the system followed by actual fitment on a coach and successful functional test as per this specification. All the firms shall have necessary manufacturing and testing facility as per STR provided in **Annexure-C**
- 11.3.2. Four numbers of Electro-Pneumatic Pressurized flushing system (without moving parts) shall be offered for inspection. After dimensional check and visual inspection Prototypes shall be fitted in one coach for fitment and functional approval. The Supplier must incorporate any changes noticed during the prototype inspection without any additional cost.

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- 11.3.3. All moving parts of the system specially the push button, water & pneumatic valves, solenoid valves, etc are to be tested up to a minimum 3,00,000 cycles of continuous trouble free operation . The supplier / OEMs of the such components manufacturer may do this test and test certificate should be submitted before approval of the prototype.
- 11.3.4. Procurement of raw material shall be done from the authorized sources only. The Supplier has to submit proof of procurement of raw material from the OEM or from his authorized distributor by submitting invoice etc. at the time of inspection or whenever required by Railways.
- 11.3.5. Following parameters and system functionality will be checked during prototype approval

**A. DIMENSIONAL CHECK AND VISUAL INSPECTION:**

- i. Dimensional check as per design / interface drawing.
- ii. Air & water pipelines connections and verification of logic cycle.
- iii. Working of system controls & indications.
- iv. Water consumption per flush.
- v. Functional check of the flush cycle for transferability of waste and cleanability of lavatory pan.
- vi. Demonstration / testing of complete flush cycle.
- vii. Any other tests considered necessary.

Note: Actual working conditions shall be simulated i.e. cow dung slurry for normal working / choking / flooding of pan etc for design validation.

**B. DESIGN VALIDATION:** Validation of design / logic cycle on test bench against the design requirement during prototype approval for the following conditions :

- i. Failure of input compressed air supply during operation cycle.
- ii. Interruption / sudden failure of power supply.
- iii. Failure of input compressed air supply to the control panel in idle condition.
- iv. Accidental short circuit of push button during flush cycle.
- v. Accidental interchange of wires for indication & push button for flush.
- vi. Disconnection / loose wiring of water level sensor.
- vii. Manual operation of flush valve and its efficacy.
- viii. Any other condition which may result in non working of the system.

**C. TYPE TESTING:**

Type testing of EPPFS control panel, power supply and Electric push button assembly shall be done from any Govt. Lab or NABL accredited testing lab and test report shall be submitted to the vendor approving authority.

Type testing shall be done for all test (Mandatory & optional) as specified in clause 13.3.1 of EN50155 specification (latest revision).

Type testing shall include the testing of degree of protection of Electric push button for flush and control panel for IP67 and IP65 respectively as per IS/ IEC 60529 and Impact resistance test as per IS:17025 in a Govt. Lab or NABL

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accredited testing lab. Test reports for both test (Degree of protection and Impact resistance) for control panel and electric push button shall be submitted to the vendor approving authority.

#### D. ENDURANCE TEST:

1. Endurance Testing shall be done at manufacturer's premises (witnessed by Railway representative) for satisfactory operation of the system for **1.5 lakh cycles** as per test scheme detailed in **Annexure-B**. The validity of this test shall be two years from the date of issue of test certificate.
2. Video recording of the complete test shall be done. The same shall be accessible to nominated engineer through suitable telecommunication method.
3. For endurance testing following needs to be ensured:
  - i. Un-interrupted power supply, pneumatic and water supply for test bench.
  - ii. Availability of automated computerized in-house test bench with recording facility with vendor.
  - iii. Creation of restricted area for test bench with provision of visual inspection through transparent window / wall from outside restricted area.
4. Endurance test shall be considered pass if there is no event of failure of the system / components of the system.

#### 12. FIELD TRIALS:

- 12.1.1. After successful prototype approval of the complete system, 10 coach set shall be installed & commissioned by the vendor / supplier for field trials of at least 6 months before bulk supply, shortfall in trial period due to stabling of coaches or any other unforeseen reasons shall get extended.
- 12.1.2. Field trials shall be jointly monitored by concerned Zonal Railways /PUs and supplier/vendor as per trial scheme finalized by vendor approving authority for this purpose. Criteria for successful completion of field trial shall be 95% availability of the system installed, i.e. only 5 % failure shall be allowed for successful completion of trial.
- 12.1.3. Performance monitoring of the coaches fitted with electro-pneumatic pressurised flushing system (without moving parts) shall be done in actual train service based on reports of ZRs on CMM portal, as detailed below:
  - i) Proper and leak free connection in the complete system including air, water pipe lines and interface piping up from roof water tank to water Pressurization cylinder.
  - ii) Proper working of system including all assemblies, subassemblies and components fitted in this system and indications to achieve designated quality of performance.
  - iii) Proper functioning of the complete system including clean-ability.
  - iv) Maximum & minimum discharge of water during a flush shall be 1.5 litres & 1.4 litres. Pressurized water alone should discharge through the spray tube around the pan/commode.

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- v) Checking of full tightness of plug in type electric and pneumatic connections.
- vi) Physical condition of material like rusting, damage and surface cracks etc.
- vii) Details of alteration / maintenance done with coach number date and time.

### 13. INSPECTION:

- 13.1. The inspection will be carried out generally as per firm's approved drawings, RDSO drawing; firms approved QAP and any other specification given in with Electro-Pneumatic Pressurized flushing system (without moving parts).
- 13.2. The inspection of material will be carried out at firm's premises by authorized representatives of nominated Inspecting agency as per manufacturers drawing, physical & chemical properties, various critical dimensions as per approved Quality Assurance Program (QAP) as by vendor developing authority.
- 13.3. Contractor shall provide free of charge labour, material, tools, gauge and appliance etc. required by the inspecting authority for inspection at manufacturing location.

### 14. MARKING

- 14.1. Manufacturer's name plate with Purchase order no. & date, serial/batch number along with month and year of manufacture shall be fitted at a visible location for identification on major assemblies of the system supplied.
- 14.2. Sticker for working instruction and graphic symbol as per MCF drawing no. MLE64136 shall be approved vendor approving authority.
- 14.3. Each component of the system shall be permanently marked for traceability (laser marking, engraving, or riveted metal label) with the following details:

Manufacture's name :  
 Batch No. / SI no. :  
 Month & Year of manufacture :

### 15. PACKING

The supplier shall be responsible for the proper and adequate packing of the system to prevent damage in transportation, handling, and storage. List of all items supplied to be tabled in details with every package with description of item, quantity, manufacturer name, model number and year of manufacturing

### 16. DOCUMENTATION AND TRAINING

- 1.1. Following the acceptance of the prototype, contractor shall provide technical manuals as given below about the system in English. The information should be both printed and in electronic format and shall be provided to IR.
  - I. Operating and maintenance instructions including assembly procedure, troubleshooting and dismantling instructions in paper and electronic form.
  - II. Periodic Maintenance Schedule (Daily / Trip/ Monthly) in line with maintenance schedule of LHB & Train-set coaches.
  - III. Schematic diagrams of Installation & commissioning and their instructions
  - IV. Schedule of operating principles.

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- 1.2. The contractor shall provide theoretical and practical training to the staff of workshops and zonal railways for a period of 05 days free of cost. Supplier / vendor shall also be able to deliver optional testing equipments for supplied toilet system.

#### **17. WARRANTY AND SPARES.**

- 1.1. Supplier /vendor shall be liable for warranty of 72 months including compulsory CAMC (Comprehensive Annual Maintenance Contract) from the date of fitment. CAMC of the EPPFS (without moving parts) shall be part of supply order and the supplier / vendor shall make arrangements for day to day maintenance as well as scheduled maintenance of with EPPFS (without moving parts) to make it operational at all times. Firms should indicate yearly CAMC cost of the system separately in the offer however offers shall be evaluated on the complete cost of the system. Payment of CAMC shall be paid on quarterly basis.
- 1.2. Spares & consumables required shall be all inclusive part of CAMC. Strict provisions of imposing penalty on vendors for unreasonable downtime and repeated failures of the components / sub-assemblies shall be ensured by purchaser.
- 1.3. The warranty period would get extended on a pro-rata basis if warranty repairs / replacement are not provided within 5 days of notice. If supplier / vendor fails to provide warranty services within 5 days of notice, Railway reserves the right to take action as per extant rules.
- 1.4. Minimum 04 (four) Preventive maintenance visit(s) per year has to be undertaken by the supplier / Vendor during the warranty period. During these preventive maintenance visit(s), the supplier / vendor should attend the scheduled maintenance, as specified in OEM's technical manual and supplier / Vendor should also change the parts which are required to be changed as per OEM's technical manuals to achieve 72 months warranty.
- 1.5. CAMC offer should provide details of the spares (indicating Make/OEM) and their recommended frequency of replacement, cost etc. Supplier /vendor shall ensure the availability of spare parts of the supplied system for a period of at least 10 years.
- 1.6. Supplier / vendor shall submit the report of preventive /scheduled maintenance carried out during CAMC to the purchaser /consignee.

#### **18. INFRINGEMENT OF PATENT RIGHTS:**

The supplier /Vendor are required to give undertaking on "INFRINGEMENT OF PATENT RIGHTS". The undertaking shall be as under:

Indian Railway shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of similar components in the design and development of this item and any other factor not mentioned herein which may cause such dispute. The entire responsibility to settle any such disputes/ matter lies with the supplier / Vendor.

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Details / design / documents given by them are not infringing any IPR and they are responsible in absolute and full measure instead of Railways for any such violation. Data, specification and other IP as generated out of interaction with Railways shall not be unilaterally used without the consent of RDSO and rights of Railway / RDSO on such IP as acceptable to them.

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# ANNEXURE-A

## SCHEDULE OF MAINTENANCE OF EPPFS

S.N.	Activity	D1	D2	D3	SS-I	SS-II	SS-III
	<b>Scheduled maintenance</b>	<b>Trip</b>	<b>1 month</b>	<b>6 months</b>	<b>18 months</b>	<b>3 years</b>	<b>6 years</b>
1	Check for any continuous leakage from in the pan/commode. If yes check the manual flush valve and air operated pilot valves.	√					
2	Activate the push button (electrical push button and manual flush valve) for correct functioning of flushing cycle in normal and bypass mode.	√					
3	Check that flushing system is ready to use within 10-12 sec of pressing the electrical switch button. If not check the setting of Timer Unit.	√					
4	Check & ensure the Push button cover is firmly tight.	√					
5	Check and ensure the illumination light of Push Button is working.	√					
6	Check and ensure the connectivity of the input power supply	√					
7	Check and ensure the PANEL Box is closed & firmly mounted.	√					
8	Check for moisture inside the control panel: Control Panel having electrical items must be free of moisture.	√					
9	Check and ensure Wires are intact & tied with cable tie.	√					
10	Check & ensure Solenoid valve and air connections are correct and in order.	√					
11	Check & ensure the AFRL input and output air connections are correct and in order.	√					
12	Drain the AFRL unit	√					
13	Check the lubrication oil level in AFRL unit and topped it before it reached the minimum level.	√					
14	Check & ensure Pressurizer Unit (Cylinder) is firmly mounted.	√					
15	Clean the Y-strainer		√				
16	Check and ensure that Hose Pipes are not worn out or squeezed (pinched) at bends. If found worn out or squeezed (pinched) at bends, replace the hose.	√					
17	Check and ensure that solenoid valves are not choked.		√				

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18	Check and ensure the water discharge from the Pan/commode bowls is satisfactory. If not, then perforated holes of spray ring in the Pan/Commode bowl assembly to be cleaned with metal brush & pressurized jet.		√				
19	Check the condition of NRVs and air operated pilot valves & if found choked, clean it or replace it, if severely corroded.			√			
20	Check for rusting of the Major Parts, replace if severely rusted.			√			
21	Replace the Y-strainer <b>(Must Change)</b>			√			
22	Replace the Silencer of Solenoid valve. <b>(Must Change)</b>			√			
23	Clean the scaling of the cylinder barrel				√		
24	Replace mechanical float & water level sensor mechanism. <b>(Must Change)</b>					√	
25	Replace the air operated pilot valves & Quick Exhaust Flow Control Valve <b>(Must Change)</b>					√	
27	Replace Pneumatic Tubes and Water Hoses <b>(Must Change)</b>					√	
28	Replace the AFRL unit <b>(Must Change)</b>					√	
29	Replace the Solenoid <b>(Must Change)</b>					√	
30	Replace the Relays & Timer Unit <b>(Must Change)</b>						√
31	Replace Push fittings (Elbow, straight connector and Tee) <b>(Must Change)</b>					√	

**Maintenance schedule of flushing system at coaching depots and workshops by user Railways**

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## **Annexure-B**

### **Test scheme of Electro Pneumatic Pressurised Flushing System (without moving parts) for 1.5 lakh cycles**

#### **Testing facility requirement**

1. Test bench with a suitable height for mounting the Electro Pneumatic flushing system.
2. Availability of continuous air supply with pressure 6 kg/cm<sup>2</sup> for testing with maximum working pressure (3.5 kg/cm<sup>2</sup>) & minimum working pressure 2.5 kg/cm<sup>2</sup> to conduct 1.5 lakh cycles of operations. Air having relative humidity of 60% to 70 % shall be used for the purpose.
3. Availability of continuous power supply of 110V DC to conduct 1.5 lakh cycles of operations.
4. Availability of continuous water supply to conduct minimum 1.5 lakh flushes. It is recommended to recycle the water as much as possible. Water shall be hard water (more than 120 PPM) & actual flushing with water shall be done. Compatible water tank with similar head as detailed in this specification & toilet pan/commode shall also be required.
5. Entire test setup shall be subjected to sinusoidal vibrations at 10 Hz with amplitude of 0.5 g in vertical, lateral & longitudinal directions during testing. Supplier shall have in house testing facility.

#### **Test scheme**

1. Provide the list of all items/components (with identity) available in the EPPFS to be subjected to 1.5 lakh cycles of continuous trouble free operations.
2. An electronic counter to be attached to the system to count the number of flush cycles.
3. Conduct testing of 1 lakh cycles at maximum working pressure (3.5 kg/cm<sup>2</sup>) & remaining 50,000 cycles at minimum working pressure 2.5 kg/cm<sup>2</sup>.
4. Maintain the records of testing (number of cycles with date and time).
5. System fault log shall be recorded every day. Every event of failure of power, air, or water supply shall be recorded and test can be resumed after the recovery of sufficient power or air or water.
6. In case of system failure due to the fault of any component, the test shall be repeated from the beginning after the remedial action. Records shall be maintained for all such events and preserved for inspection if required
7. Frequency of test cycle shall be 3-5 cycles per minute.
8. Major components to be checked and their status (functional/not-functional) to be recorded every 25000 cycles (with videos and photographs) as prescribed below.

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Sl. No.	Item	25x10 <sup>3</sup>	50 x10 <sup>3</sup>	.....		
1	Electric Push Button Switch					
2	SMPS					
3	Timer					
4	Solenoid Valve					
5	Relays					
6	Y-Strainer					
7	Water Pressurization System					
8	Mechanical Float Valve					
9	Water level sensor/any pther suitable mechanism for the purpose					
10	Air Operated Pilot Valve					
11	Quick Exhaust Flow Control Valve					
12	Air Filter Regulator Lubricator (AFRL) unit					
13	Manual Push-Button Flush Valve					
14	Pneumatic Fittings & Tubings					
15	Water Pipe & Fitting					
16	Electric wire					
17	Volume of water discharge (ml)					
18	Air leakage from system (Yes/No)					
19	Water leakage from system (Yes/No)					
20	Temperature of Water Pressurization System (pneumatic side) (°C)					
21	Ambient temperature (°C)					
22	Check the creeping of moisture into the electronic circuit inside control panel					

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### **Annexure- C**

#### **Schedule of Technical Requirements**

All Manufacturer and supplier of the EPPFS system must comply the following Schedule of Technical Requirements (STR):

##### **Manufacturing Facilities and assembling line:**

1. All the manufacture & Supplier of EPPFS shall have in-house manufacturing facilities like plasma / laser cutting machine, suitable capacity bending machine, heavy duty drilling machine, TIG welding machine setup, etc all machine shall be suitable for working on stainless steel item being manufacturing for use in EPPFS.
2. Firms shall have in-house facilities for finishing of stainless steel items / product such grinding machine, brushing, buffing machines and cleaning pickling and passivation plant etc.
3. Firm shall have well equipped assembly line having tools and plant and equipment for assembling of the complete system i.e. bench wise, screw driver set, wrench, torque wrench and work bench with required stocking bins of items required for assembling the product.
4. Standard electrical, water and pneumatic fittings of specific make or standard specified in the specification shall be bought out with proof of purchase.

##### **Testing facilities:**

1. Firms shall have well equipped testing facilities like steel scales, stainless steel machinist square set, spirit level, venire scale, screw gauge, go & no go gauges for threaded fittings of required size, weighing machine etc.
2. In-house testing facility for endurance testing of 1.5 lacs cycles of complete assembled system.
3. In-house physical & chemical testing facilities for testing of metallic items for better quality control.
4. In-house surface finish checking instrument for quality control during manufacturing & finishing.

Note: Timely calibration of tool, equipment & machinery shall be ensured .

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