

**Addendum-2 to MMDTS 19027, Rev.-01 & Rev.-02**

Sub clause no. 7.9 added in MMDTS19027, Rev-1 & Rev-02 as given under:-

**Sub Clause 7.9:**

Coaching depots shall follow the maintenance schedule as prescribed in Annexure-C

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# Annexure C

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

S.N.	Activities	Trip / Weekly	Monthly	Six Monthly	SS1	SS2	SS3
1.	Activate the push button and check the correct functionality of flushing.	X					
2.	Check & ensure the connectivity of input power supply.	X					
3.	Check & ensure the Control panel is closed & firmly mounted.	X					
4.	Check and ensure the electric wires are intact & tied with cable tie properly clamped.	X					
5.	Check & ensure the push button and its mounting plate is firm.	X					
6.	Check & ensure the illumination light of push button is working.	X					
7.	Check & ensure the AFRL (Air Filter Regulator Lubricator) Unit input and output air connections are correct and in order; AFRL lubricant to be topped up as per requirement.	X					
8.	Check & ensure solenoid valve and air connections are correct and in order.	X					
9.	Check for moisture inside control panel: Control panel must be free of moisture to save electronic and electrical components.	X					
10.	Check & ensure Pressurizer Unit (cylinder) is firmly mounted and all hardware is properly tight.		X				
11.	Check the rusting of major parts. If rusted severely, replace the part.			X			
12.	Check & ensure the water inlet and outlet connections are correct & in order.	X					
13.	Check & ensure the Y-water strainer of coach is not choked, if choked clean it and tight properly for its functioning.		X	X			
14.	Check & ensure the Hose pipes are not worn out or squeezed (pinched) at bends. If found worn out or squeezed (pinched) at bends, replace the hose.		X				
15.	Check & ensure the silencer of cylinder middle cover & solenoid valves are not choked.		X	X			
16.	Check the condition of NRVs & if found choked clean it or replace it, if severely corroded.		X	X	X	X	X
17.	Check & ensure the functionality of the angle seat piston valve. If found not working. Overhaul the component & replace the parts if necessary.		X	X	X	X	X
18.	Check & ensure the functionality of the pressurizer unit. If found not working. Cylinder needs to be opened and check the scaling level for operation of Piston. Overhaul the component & replace the parts. While reinstallation, new nyloc nuts to be used.		X	X	X	X	X
19.	Check & ensure 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 water jet.		X	X	X	X	X
20.	Drain the mixture of AFRL (Air Filter Regulator Lubricator) Units.	X					
21.	AFRL (Air Filter Regulator Lubricator) unit to be replaced					X	
22.	Pneumatic tubes to be replaced.					X	
23.	Replace Angle seat piston valve, if required.					X	
24.	Ensure availability of passenger notification near the push button.		X				
25.	Check & ensure the functionality of the Manual push-button flush valve and confirm manual flushing is working fine.	X					

**Note:** Repair and maintenance of EPPFS on IR coaches shall be done by trained staff only. The Supplier shall provide training as mandated in clause 15 of this specification. The warranty related complaints may be registered CMM portal with complete details (Coach Number, Lavatory No., Name of the supplier, Name of non-functional item, and Symptoms in brief).

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Addendum-1 to MMDTS 19027,Rev.-01 & Rev.-02

Clause no.	Brief details in the Existing Rev-01/02	Clause included/modified
4.8	A Bypass or alternate flushing arrangements shall be provided by same flush button Switch, so as this system shall be remaining usable for ensuring proper flushing to transfer the fecal matter from the lavatory pan/western style bowl to Bio- tank including clean-ability, in case of non availability of power /air.	<b>Manual Push-Button Flush Valve:</b> - A separate manual push-button flush valve shall be provided for manual flushing. The material for manual push-button shall be Stainless Steel (AISI304). It shall have a metallic body integrated with a SS mounting plate (AISI 304) (70 mm × 70 mm × 2 mm).
7.4	The supplier must indicate the consumption of Power, Air and water.	All water and pneumatic lines along with their fittings shall be nominal size of ¼" and ¼", respectively. The Supplier shall specify the consumption of power, air and water in its offer documents.
Table-1. S.N. 1	Push Button Switch	In addition to the requirement already mentioned in MMDTS 19027 Rev-01/02, the following requirement shall also be applicable:- <ol style="list-style-type: none"> <li>1. The Electric push button (outer diameter 22mm) shall be minimum IP 67 compliant. It shall have SS AISI 304 body integrated with a SS AISI 304 mounting plate (70 mm × 70 mm × 2 mm).</li> <li>2. IP Rating: 67 or above</li> <li>3. SS AISI304 back cover is to be provided to cover back side of assembly for protection of electrical push button switch connector against water ingress and damage during coach cleaning. The dimension of the cubical box shall be 70mmx70mmx70mm size with suitable means for fitment and wiring.</li> </ol>
Table-1 SN.6	Pneumatic Fittings & Tubings	In addition to the requirements already mentioned in MMDTS 19027 Rev-01/02, all pneumatic fittings and collar (plug-n-play type) used in the system are required to be of Stainless Steel AISI 304.
Table-1 SN.7	Water Locking Unit:-	The material of angle seat valve shall be stainless steel AISI304 only.
Table-1 SN.8	Non-Return Valve (NRV)	The material for NRV shall be stainless Steel AISI 304 only.
Table-1 SN.9	Water pressurisation system:-	In addition to the requirements already mentioned in MMDTS 19027 Rev-01/02, the following requirements shall also be applicable:- <ol style="list-style-type: none"> <li>1. The water cylinder side piston and piston rod shall be of Stainless steel AISI 304.</li> <li>2. All mounting and clamping items shall be made of AISI-304.</li> <li>3. The water pressurization system shall comply to the mounting dimensions defined in Annexure A.</li> <li>4. The outer dia. of piston of air side and water side cylinder shall be approximately same.</li> </ol>
Table-1 SN.10	Note added to item no. 10 (Electro-Pneumatic Control Panel and Push Button switch panel)	In addition to the requirements already mentioned in MMDTS 19027 Rev-01/02, the following requirements shall also be applicable:- <ol style="list-style-type: none"> <li>1. MCB of suitable ratings is to be provided in the control panel.</li> <li>2. There shall be two separate control panels; one each for pneumatic and</li> </ol>

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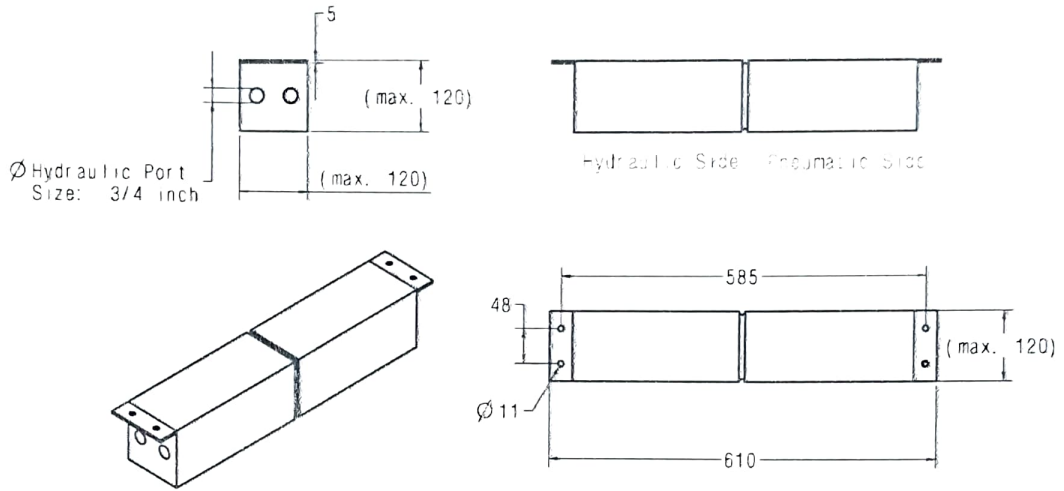


Clause no.	Brief details in the Existing Rev-01/02	Clause included/modified
		<p>electric components. Pneumatic control panel shall house Solenoid valve (as has air exhaust port), AFR, pneumatic tubings and any other pneumatic components. Electrical control panel should house MCB, Timer, SMPS, electrical wirings or any other electric/electronic components.</p> <p>3. The control panels enclosure shall be powder coated with colour shade RAL DS 9000.)</p> <p>4. The overall size of both the control panel shall be as per Annexure-B.</p>
Table-1 SN.13	<u>New Clause</u>	<p><b>Provision of Y-strainer:-</b> A Y-strainer (3/4" BSP) of SS AISI 304 shall be installed in the SS water inlet line for the water pressurization system to filter, or strain, out particulates from water.</p> <p>1. The strainer shall be placed for easy frequent cleaning. The Y branch shall be oriented downwards to avoid accumulated dirt to fall inside the system.</p>
Note to Table-1	<u>New Note added</u>	<p><b>Note:</b></p> <p>1. All electric/electronic items should be able to withstand <math>\pm 30\%</math> voltage fluctuations. The Supplier shall submit the test reports from NABL or other accredited labs as per IEC 17025 for compliance.</p>

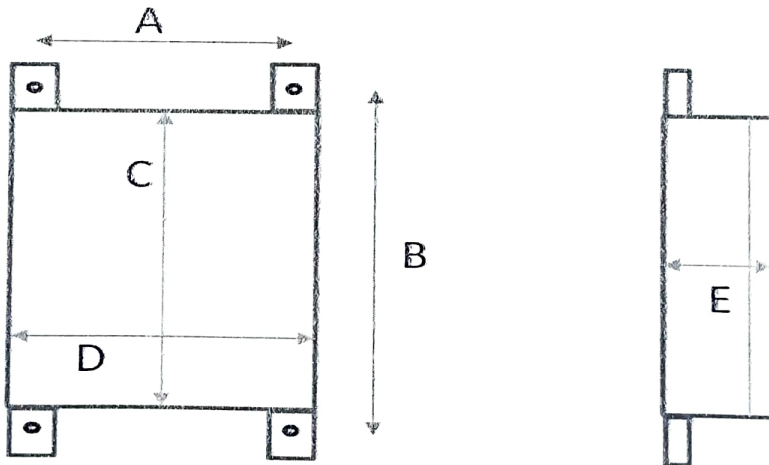
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Enclosure for water pressurizing systemAnnexure-BControl Panel Enclosure

Material for control Panel shall be Stainless Steel- AISI 304 (thickness-1 mm sheet). Control panels shall be powder coated with colour shade RAL DS 9000

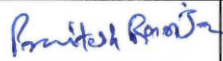


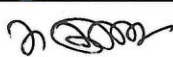


Dimensions in (mm)	A	B	C	D	E
Size for Control Panel no. 1 for (AFRL & Solenoid)	255	260	220	275	90
Size for Control Panel no.2 for (MCB, Timer SMPS and other electrical equipments)	255	240	200	275	90

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<b>SPECIFICATION</b>	<b>SCHEDULE OF TECHNICAL REQUIREMENTS FOR ELECTRO-PNEUMATIC PRESSURISED FLUSHING SYSTEM FOR LHB COACHES</b>	<b>MMDTS 19027, REV.- 1 Page 1 of 14 Date: 07.08.2020</b>
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Sh. Mahesh Kumar	CDE		07.08.2020	Approved

Rev. No.	Details of changes	Date
1.	1. In clause no. 1.4 corrected. 2. Clause no. 7.8 corrected. 3. Clause no. 10.4 corrected. 4. Clause no. 10.12 corrected. 5. In Clause no. 14.4 corrected.	07.08.2020

  
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## 1. PREAMBLE:

- 1.1. This technical specification covers general conditions, technical & operational requirements, inspection, testing procedure. This specification also covers the maintenance by supplier during warranty or for post warranty period.
- 1.2. Pressurized flushing system will provide adequate pressurised water for efficient flushing with cleanability and to transfer the fecal matter from the lavatory pan/western style bowl with minimum usage of pressurized water.
- 1.3. **Principal of operation of the system:** System shall be based on positive displacement type system having "piston-cylinder arrangement" type set-up for creating pressurized water supply without allowing water coming into contact with pressurized air. No other type of system shall be accepted as per this specification.
- 1.4. Flushing cycle should start with light pressing of an electric "Push to On" push button switch. This push button switch should be minimum IP 65 complaint or higher grading and have metallic body. It should glow and emit Green light indicating readiness of the system for starting flushing cycle. This push button should be installed at suitable, clearly visible location with a sticker indicating "PUSH FOR INSTANT FLUSH", at suitable height so that, it can be used by passengers of all age group/height. Sticker for working instruction shall be pasted above the push button having bilingual language i.e. Hind and English as well as in graphic symbol for ease of indication to users. Sticker and graphic symbol shall be as per drawing no. MLE64136.
- 1.5. All electrical, electronics and Pneumatic parts of system should be shock and vibration proof and should comply with IEC 61373, category-2. The components/system should also comply with EN50155 for environmental protection. The bidders should submit test reports from labs authorized for this testing along with their WTC for tests, for which test facilities are available at the firm's premises.

## 2. ELIGIBILITY CRITERIA:

- 2.1. Tenderer or their principal should be in the field of design, development and supplying of pneumatic control valves. Proof in this regard shall be submitted along with the tender.
- 2.2. Regular orders shall be placed on the tenderer or their principal/OEM should have supplied, installed & commissioned minimum 500 Coach set of positive displacement type Electro-pneumatic Pressurized flushing systems for LHB coaches to Railways/PU's. Proof in this regard shall be submitted along with the tender.
- 2.3. Firms not covered under clause 2.2, however they or their principal present in the field of Pneumatic control valves can be considered for developmental order/approval. However, they must comply all the technical and functional requirements & submit the test reports asked in the specification followed by prototype approval and field trial for 6 months in one coach set from the date of fitment.
- 2.4. Tenderer or their principal should have well-established manufacturing and testing facilities.

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Tenderer or their principal/OEM should have established quality control system and organization to ensure quality of the product and should be an ISO 9000 certified company or should have an internationally certified quality control system.

- 2.5 Tenderer must submit the Plant and machinery details & quality lab details along with the tender for manufacturing and testing of Electro-pneumatic Pressurize Flushing System.

### 3 SCOPE OF SUPPLY:

- 3.1 Electro-Pneumatic Pressurized flushing system should be supplied with all accessories including nuts, bolts, spring washers, safety wire and clamping as per requirement for installation of the system. System interface with car body shall be clearly specified and submitted along with offer. 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.
- 3.2 Supply, installation and commissioning will be in the scope of tenderer.
- 3.3 Plumbing connection from Auxiliary roof water tank (3/4" female pipe thread) of AC coaches/Roof water tank (1" female pipe thread) of Non-AC coaches to the bowl of Indian style/Western style for the pressurised flushing system is in the scope of tenderer. Water pipe lines and pipe fittings shall be with stainless steel material.
- 3.4 01 No. Isolating cock (3/4" BSP) in water line from Auxiliary roof water tank / Roof water tank and 1 no. Isolating cock (1/4" BSP with both end female thread) in pneumatic line shall be provided to isolate the system for attending the faults occurred if any in the Pressurised unit or in the pneumatic/water line.
- 3.5 All pneumatic fittings should have metallic body only. No plastic fittings or the fitting with plastic/nylon release sleeve etc shall be used.
- 3.6 Apart from above, all other items/activities required for installation and functioning of the system is under the scope of tenderer.

### 4 TECHNICAL REQUIREMENTS:

- 4.1 This specification no. MMDTS19027, Rev.-0 shall be read along with ICF Drawing ICF/SK3-6-3-246 Alt 'a'.
- 4.2 Electro-pneumatic panel shall be installed outside the lavatory panel (behind the attachment wall with ref. drawing no. MLE64129 Alt 'a' & MLE64130 Alt 'a') within the existing space available of 90mm (maximum space). Drawing no. LE63202 (latest alteration) for Indian style pan bowl interface, LS63119 (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, drawing no. LS10209 (latest alteration), LS10211 (latest alteration), LS10216 (latest alteration) for lavatory with SS tubular partition frame and ICF/SK3-6-3-246 Alt'a' are only for interface & references. Drawing no. MLS63104 Alt

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'b', MLG63116 Alt 'Nil' for Non-AC coaches lavatory with SS tubular partition frame and MLS63620 (latest alteration) , MLG63117 (latest alteration) and MLJ63016 Alt 'b' are for Non-AC coaches fitted with FRP Modular toilets, MLE63002(latest alteration) are for AC coaches fitted with FRP Modular toilets are only for interface & references.

- 4.3 Electro-pneumatic Pressurized flushing system should effectively clean the bowl and transfer the fecal matter to Bio digester tank with a minimum quantity of water at a pressure range between 2 Kg/cm<sup>2</sup> to 3 Kg/cm<sup>2</sup>. Maximum discharge of water during a flush shall be 1.5 litres. Pressurized water alone should discharge through the spray tube around bowl. No mix of air & water should be released in the bowl at the time of flushing.
- 4.4 All mechanical and pneumatic components of the pressurized flushing system shall operate under the conditions mentioned in clause no. 5 without any problems.
- 4.5 The required energy for the pressurized flushing system shall be provided from the pneumatic circuits of the coach. A limited quantity of 3.5 litres/minute/lavatory can be made available at 5 Kg/cm<sup>2</sup> to 6 Kg/cm<sup>2</sup> for the system. Tenderer should specify the consumption of air in litres/minute or litres/flushing operation, along with the offer and submitting prototype for approval.
- Also 110 V AC/DC supplies shall be available in the coach for operation of control circuit of the system. No power shall be provided for creating pressurised water supply.
- 4.6 The pressurize unit should be compact and robust. The Electro-pneumatic pressurized flushing system shall be designed for a usage of minimum 150 times within 24 hours.
- 4.7 No Leakage from System at 5 Bar Pressure & dispense of maximum water 1.5 Litres in functional test at 3-5 bar Pressure.
- 4.8 A Bypass or alternate flushing arrangements shall be provided by same flush button Switch, so as this system shall be remaining usable for ensuring proper flushing to transfer the fecal matter from the lavatory pan/western style bowl to Bio- tank including clean-ability, in case of non availability of power /air.
- 4.9 Firm has to mention the method of measurement of water pressure in maintenance Manual.

## 5 OPERATING CONDITIONS:

### 5.1. Ambient Conditions:

- (i) Altitude: Sea level to 2500m
- (ii) Operating temperature: 1°C to 55°C Max. Temperature under Sun: 70° C
- (iii) Relative humidity: up to 95%
- (iv) The rainfall is fairly heavy.
- (v) During dry weather, the atmosphere is likely to be dusty.
- (vi) Temperature variations can be quite high with-in range specified in the same journey or short

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period of time.

(vii) Coaches operate in coastal areas with continued exposure to salt laden air.

(viii) Coaches may be subjected to frequent external washing with detergents and cleaning of toilets by cleaning agents.

## 5.2. Car-body dynamics:

5.2.1. Equipment shall withstand satisfactorily the vibrations and shocks normal encountered in Service as indicated below:

- Maximum vertical acceleration 1.0g
- Maximum longitudinal acceleration 3.0g
- Maximum transverse acceleration 2.0g

5.2.2. The vibrations are of sine wave form and the frequency vibration is between 1 Hz to 50 Hz.

The amplitude 'a' expressed in millimetres 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.

5.2.3. In the direction corresponding to the longitudinal movement of the vehicle, the equipment is subjected for 2 min. to 50 Hz. Vibrations of such a value that the maximum acceleration is equal to 3g.

5.2.4. LHB type coach length over coupler is approximately 24 meters.

5.2.5. Coach-body displacement encountered under dynamic conditions.

- Vertically -  $\pm 100$  mm
- Laterally -  $\pm 55$  mm
- Longitudinally -  $\pm 10$  mm
- Bogie rotation about centre pivot-  $\pm 4^\circ$
- Maximum Speed of train - 160 KMPH.

## 5.3 SYSTEM INTERFACE AVAILABLE

### 5.3.1. Water Supply:

- There is one roof water tank of 30 litres capacity available over each toilet at a height of about 2030 mm from toilet floor in air-conditioned coaches. Water is pumped to these from under-frame mounted main water tanks. Water-flow to the flushing valve is by gravity. These roof water tanks are not pressurized and the water flow from these tanks is by gravity.
- For Non-AC LHB a coach, one overhead water tank of 455 litre tank capacity is available at the same height. The water flow from this tank to flushing line is by gravity.

### 5.3.2. Pneumatic Supply:

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- i. A limited quantity of air supply of around 15 lit/min./Coach can be made available connected to feed pipe at 6 kg/cm<sup>2</sup> with provision of one 75 litres reservoir in the coach exclusively for toilet system.
- ii. Requirement of compressed air per toilet used and per coach shall be clearly specified by the firm.

### 5.3.3 Power Supply:

- i. 110V DC supply is available in LHB AC and Non-AC coach circuits. This supply varies from 80V to 140V with 30% ripple in AC & Non-AC LHB (EOG) type coaches. The equipments shall be designed to withstand  $\pm 30\%$  voltage fluctuations.
- ii. Any Solenoid Valve or Electronic Item fitted should be able to withstand  $\pm 30\%$  voltage fluctuations. The bidders should submit test reports from labs authorized for this testing along with their WTC for tests, for which test facilities are available at the firm's premises.
- iii. ALL electrical/ electronic equipment and junction boxes shall be of suitable degree of protection IP 65 protection.
- iv. All electrical/electronic Components used in the system shall be as per IEC 61373 and EN 50155.
- v. Total peak power requirement per coach shall not exceed 50 watts.
- vi. Railway Grade Components are to be used in all electrical /electronic items.
- vii. Requirement of power shall be clearly specified by the supplier.

### 6 Duty Cycle:

The Electro-Pneumatic Pressurized flushing system should be ready to flush within maximum of 10 seconds after each use. This system may be used up to 150 times for defecations in 24 hrs.

### 7. DESIGN REQUIREMENT:

- 7.1 The system offered must be modular, robust, reliable, easy to operate and passenger friendly, maintenance free and must be supplied as a complete system to handle human waste transfer. It should take minimum possible time for replacement of modules. The supplier should indicate replacement time module wise.
- 7.2 The technical implications/reasons for capacity rating of important components of the system must be explained in detail by the supplier. Similarly, critical dimensions in the fixing and location drawings shall be clearly indicated by the supplier together with details of all mechanical and electrical interfaces between toilet system and the coach.

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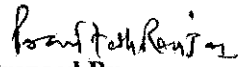
  
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- 7.3 The system should be so designed that day to day maintenance does not require.
- 7.4 The supplier must indicate the consumption of power, air and water.
- 7.5 The design of Electro-Pneumatic Pressurized flushing system shall be protection from pilferage and components used in this system shall be made of corrosion resistant material.
- 7.6 The system should neither impede free movement of the bogies nor the routine inspection and maintenance of various bogies/ coach sub-assemblies. To ensure this system shall be contained within the space envelope as mentioned earlier.
- 7.7 Bought out items from a reputed and established brand shall be used or made in-house for Electro-Pneumatic Pressurized flushing system.
- 7.8 Important Component fitted in Electro-Pneumatic Pressurized flushing system and their details must be as given under:

Table-1

S.No.	Name of Component	Detail Description
1.	Push Button Switch	<p>This push button switch should be minimum IP 65 compliant or higher grading with Metallic Body. Body of which should glow &amp; emit Green light indicating readiness of the system for starting flushing cycle. This push button should be installed at the height of <math>1300 \pm 20</math> mm from floor level of the lavatory at clearly visible location with a sticker indicating "PUSH FOR INSTANT FLUSH", at suitable height so that, it can be used by passengers of all age group/height. Sticker for working instruction shall be pasted above the push button having bilingual language i.e. Hindi and English as well as in graphic symbol for ease of indication to users. Sticker and graphic symbol shall be as per drawing no. MLE64136.</p> <p>The bidders should submit complete test reports from Manufacturer against IP65 complaint. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply.</p>

  
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2.	Electrical & Electronic Items Used	<p>All electrical, electronic parts of system should be shock and vibration proof and should comply with IEC 61373, category-2. The components/system should also comply with EN50155 for environmental protection. The bidders should submit complete test reports / statement of testing from Manufacturer against each test mentioned in EN50155. The test certificates should either from labs authorized for this testing or the firm should submit test certificates and WTC for tests, for which test facilities are available at the manufacturer's premises. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Railway Grade Components are to be used in all electrical /electronic items. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply.</p> <p>All Electronic Item fitted should be able to withstand <math>\pm 30\%</math> voltage fluctuations. The bidders should submit test reports from labs authorized for this testing.</p>
3.	Solenoid Valve Used	<p>Solenoid valve used must be EN 50155. Complete test report against each test mentioned in EN 50155 must be submitted. Also, it must be IEC 61373, category-2 tested. It must withstand if keep it in on situation with <math>\pm 30\%</math> Voltage tolerance as per EN 50155 Requirements. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply. Drawing of Solenoid Valve to be approved by MCF.</p>
4.	Pneumatic Valve	<p>Pneumatic Valve must be IEC 61373, category-2 tested. Complete test report against each test mentioned in IEC 61373, category-2 must be submitted. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply.</p>
5.	Air Filter Regulator Unit	<p>A Metal Body Pre Set Air Filter Regulator Unit to be Used. It must be IEC 61373, category-2 tested. Complete test report against each test mentioned in IEC 61373, category-2 must be submitted. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test</p>

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		certificate) of the manufacturer as per the approved drawing of this component at the time of supply. Pressure regulator shall be pre set value of approx. 3 kg/cm <sup>2</sup> from the OEM, which need not to have adjustment to regulate the prescribed pressure during fitment and installation to avoid undue incidence of not regulating the pressure during fitment and installation.
6.	Pneumatic Fittings & Tubing's	All the Pneumatic Fitting used in the system are of metal body with metallic collat. Pneumatic tubing material should be of Nylon material as per DIN 74324 to have longer life as per EN45554. No PU material tubes should be used. Pneumatic tubing material shall be covered with protective SS sleeves cover with material AISI 304 and shall be properly clamped.
	Water line Pipe & Fitting	Water Pipe line, Pipe Clamp, Fasteners, Mounting Bracket, Mounting Bolts with split pin, Mounting Nuts (Nyloc type) must be of Stainless Steel. Flexible water pipe shall be thermoplastic material as per IS: 12585-88, type-2. Flexible water pipe shall be covered with protective SS sleeves cover with material AISI 304 and shall be properly clamped.
7.	Water Locking Unit	Water Locking Unit must be Angle seat valve to avoid any restriction in flow and also suitable for Damped closing (Valves closes against flow direction). Material of angle seat shall be stainless steel as per AISI-304 or brass with black painted. It must be minimum ¾" port size or orifice size 20 mm. The Water Locking Unit must be IEC 61373, category-2 tested. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply.
8.	Non-Return Valve (NRV)	Non-Return Valve used in the Water Pressurization System must be of Stainless steel Body. NRV shall be fitted at inlet and outlet of water pressurizer cylinder. It must be minimum ¾" port size. The Non-Return Valve must be IEC 61373, category-2 tested. Complete test report against each test mentioned in IEC 61373, category-2 must be submitted.
9.	Water Pressurization System	In Water Pressurization system, water side components must be made of corrosion resistant material. Water Side barrel must be of Stainless steel as per RDSO specification RDSO/Spec C-K-201 (X5CrNi1810) with minimum ¾" port size at inlet and outlet of water barrel & air side barrel must be of Anodized Aluminium as

Prepared By *Ranjay*

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		per IS:738-1994, 63400-T6 (equivalent alloy(AA)U.S.A 6063) or higher grade. All the Front, Middle and Rear End Covers must be made of Stainless steel as per material RDSO specification RDSO/Spec C-K-201 (X5CrNi1810).The water Pressurization system must be IEC 61373, category-2 tested. Complete test report against each test mentioned in IEC 61373, category-2 must be submitted. The manufacturer has to submit detail drawings at the time of prototype approval. The manufacturer has to submit chemical test report of raw material of Water Pressurization System at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply.
10.	Electro-Pneumatic control Panel and Push button switch Panel	<p>EP control Panel and Push button switch Panel shall be modular and plug in type for easy fitment and maintenance. Firm has to provide a cover to protect EP control Panel and Push Button Switch panel (from outside the lavatory) protected by vandal resistant and shall comply IP 65 Compliant. Material of cover shall be as per AISI 304 (Thickness 1 mm) and electric shock resistant.</p> <p>The supplier shall indicate its size, location and fixing arrangement in the drawing, suiting to space envelope available mentioned in clause no. 4.2 of this specification.</p> <p>All electrical and pneumatic connections of the control panel shall be plug in type and shall be properly clamped.</p>
11.	Safety wire	Safety wire should be fitted at both end of Water Pressurization system clamping with the structural member of under frame (as per Table-2 of this clause given below) for ensuring safety of the system.
12.	Electric wire	Electric cable used in this system shall be as per RDSO specification ELRS/SPEC/ELC/0019 with latest revision. All electrical connection must be in plug and play, ensuring it should not come out due to vibration in the coach.

Table-2

S.No.	Description of Items	QPC	Drg. no.	Material specification	Remarks
1.	SS Wire cable Ø4 mm 6x7 L=700mm	2	IS:2266-2019	AISI-304	NIL

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2.	Bulldog Grip	6	IS-2361-2002	AISI-304	NIL

## 8. MARKING

Each unit of Electro-Pneumatic Pressurised Flushing system shall be legibly marked by hot stamping or indelible ink or metallic riveted sticker or Laser cutting at visible location with the following details:

- i) Manufacture's name
- ii) Batch No.
- iii) Year of manufacture.

## 9. PACKING

The supplier/vendor shall be responsible for proper and adequate packing Electro-Pneumatic Pressurised Flushing system in assembled condition before dispatch to prevent damage in transportation, handling and storage. The material shall be suitably packed as per packing no. mentioned in PO to avoid distortion damage etc. during transportation.

## 10. TESTING AND APPROVAL OF PROTOTYPE:

For the first time supply prototype approval shall be done by CDE/MCF.

Prototype shall be checked as per following:

- 10.1 One prototype sample of Electro-Pneumatic Pressurized flushing system shall be submitted to Designs at MCF for inspection. Prototype shall be fitted in one coach (at least 1 no. of Indian style and 1 no. of western style lavatory) for fitment and functional approval. Supplier must incorporate any changes noticed during the prototype inspection without any additional cost.
- 10.2 Dimensional checked as per drawings submitted by the firm.
- 10.3 The tenderer has to submit description and installation drawings with sufficient details to evaluate the system design. Sticker for working instruction and graphic symbol as per drawing no. MLE64136 shall be got approved by CDE/MCF, for the first time supply only.
- 10.4 The tenderer has to submit all tests certificates as per mentioned in clause no. 7.8 of this specification. This test certificates should contain details of test conducted and measurements recorded. The test certificates should either from labs authorized for this testing or the firm should submit test certificates and WTC for tests, for which test facilities are available at the

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manufacturer's premises.

- 10.5 Procurement of raw material should be done only from the authorized distributor of following reputed stainless steel manufacturers; M/s SAIL or M/s Jindal. The tenderer has to submit proof of procurement of raw material from OEM or from his authorized distributor.
- 10.6 The tenderer has to submit test certificate of all raw materials of all critical components/assemblies fitted in this system.
- 10.7 **Life Cycle Test-** The tenderer shall enclose a certificate from a NABL approved Lab for a satisfactory trouble-free operation of the system for minimum 10 Lakhs Cycles for approval.
- 10.8 The tenderer has to submit complete maintenance manuals including trouble shooting and dismantling instructions in paper and electronic form. Firm has to clearly mention about the maintenance schedule of the system.
- 10.9 The tenderer has to submit Machinery and plant, testing facility available at firm premises and Quality control system.
- 10.10 The tenderer has to submit list of spare parts in details used in this system with manufacturer name, model number, year of manufacturing and cost.
- 10.11 Field trial shall be jointly monitored by Zonal Railways/PUs and concerned supplier as per trial scheme finalized for this purpose. Criteria for successful completion of field trial shall be elaborated in trial scheme.
- 10.12 Performance monitoring of the coaches fitted with Electro-Pneumatic Pressurised Flushing System for field trial shall be done in actual train service for a minimum period of 6 months on one coach set, after successful prototype approval with an objective to monitor the following:
  - 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 discharge of water during a flush shall be 1.5 litres at a pressure range between 2 Kg/cm<sup>2</sup> to 3 Kg/cm<sup>2</sup>. Pressurized water alone should discharge through the spray tube around bowl.
  - v. Checking of full tightness of plug in type electric and pneumatic connections.
  - vi. Physical condition of material like rusting, damage and surface cracks.

  
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vii. Details of alteration/maintenance requirement with coach number date and time.

10.13 Bulk manufacturing will be commenced only after clearance of prototype. Regular supplies are to be made as per approved prototype only.

10.14 If tenderer upgrade any components/ sub-system fitted in the system, he shall get it approval by CDE/MCF before its implementation.

10.15 Tenderer has to submit MOU and all documents (mentioned in S. No. 10.3 to 10.10 of this specification) from OEM/manufacture, if tenderer is not a manufacturer.

#### 11. SPARE PARTS:

11.1 The tenderer shall indicate in an itemized list, the life expectancy of components subjected to wear under Indian conditions.

11.2 The tenderer shall ensure the availability of spare parts or replacement parts of the supplied system for a period of at least 15 years. List of spares and its cost shall be submitted along with the offer for tender. This shall be irrespective of the fact whether the vendor/supplier or his sub vendor/(s) have stopped manufacturing of the equipment/(s) to the design supplied to Indian Railways.

#### 12. INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS (IPR):

Indian Railway shall not be responsible for infringement of IPR arising due to similarity in design of Electro-Pneumatic Pressurised Flushing System with compaction arrangement, manufacturing process, components used in design, development and manufacturing equipment and any other factor, which may cause such dispute. The entire responsibility to settle any such disputes/ matters lies with the manufacture/supplier.

#### 13. WARRANTY:

Tenderer shall ensure minimum warranty for satisfactory performance of the Electro-Pneumatic Pressurised Flushing System for 72 months from the date of fitment or 84 months from the date of supply, whichever is earlier. During warranty, the tenderer shall rectify the equipment by replacing or repairing components at his cost without affecting the service of the coach attached to the train, however warranty is applicable on manufacturing defects. Warranty period would get extended on pro-rata basis if warranty replacements/repairs is not provided within 5 days of notice. If tenderer fails to provide warranty in 5 days of notice. Railway reserves the right to cancel balance contract.

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#### 14. INSTALLATION AND COMMISSIONING:

- 14.1 The mounting and installation of Electro-Pneumatic Pressurised Flushing System on the designated coach/coaches shall be carried out by the vendor/supplier at consignee's premises or the place decided by the consignee/purchaser/Indian Railway. The space envelope for fitment of Electro-Pneumatic Pressurised Flushing System has been given at clause no. 4.2 of this specification.
- 14.2 The Electro-Pneumatic Pressurised Flushing System installed and commissioned shall be checked by the vendor/supplier for proper functionality and performance.
- 14.3 The vendor/supplier shall follow all the safety measures and precautions at the time of installation & commissioning of Electro-Pneumatic Pressurised Flushing System at the site.
- 14.4 The installed and commissioned Electro-Pneumatic Pressurised Flushing System shall be subjected to a field trial of 6 months from the date of commissioning on LHB coaches for supplies made by first time tenderers.

#### 15. TRAINING:

The vendors/supplier shall arrange free of cost training to Indian Railways personnel involving in operation, maintenance and trouble shooting of Electro-Pneumatic Pressurised Flushing System. The venue and period of training should be mutually agreed between supplier/vendor and purchaser/consignee/ Indian Railways.

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Name	Designation	Signature	Date	Level
Pranitesh S. Ranjan	SSE / Design	<i>Pranitesh Ranjan</i>	06.08.2022	Prepared
Abhinav Yadav	SME / Design-III	<i>Abhinav Yadav</i>	06.08.2022	Agreed
Lalit Kishore	Dy. CME / Design	<i>Lalit Kishore</i>	06.08.2022	Reviewed
Mohammad Saquib	CDE		06.08.2022	Approved

#### Amendment History:

Rev.	Date	Change in Brief
1.	07.08.2020	1. Clause no. 1.4 corrected. 2. Clause no. 7.8 corrected. 3. Clause no. 10.4 corrected. 4. Clause no. 10.12 corrected. 5. Clause no. 14.4 corrected.
2.	05.08.2022	1. Eligibility criteria (Clause no. 2) deleted.

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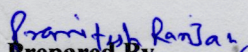
**1. PEREAMBLE:**

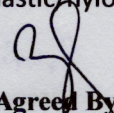
- 1.1. This technical specification covers general conditions, technical & operational requirements, inspection, testing procedure. This specification also covers the maintenance by supplier during warranty or for post warranty period.
- 1.2. Pressurized flushing system will provide adequate pressurised water for efficient flushing with cleanability and to transfer the fecal matter from the lavatory pan/western style bowl with minimum usage of pressurized water.
- 1.3. **Principal of operation of the system:** System shall be based on positive displacement type system having "piston-cylinder arrangement" type set-up for creating pressurized water supply without allowing water coming into contact with pressurized air. No other type of system shall be accepted as per this specification.
- 1.4. Flushing cycle should start with light pressing of an electric "Push to On" push button switch. This push button switch should be minimum IP 65 complaint or higher grading and have metallic body. It should glow and emit Green light indicating readiness of the system for starting flushing cycle. This push button should be installed at suitable, clearly visible location with a sticker indicating "PUSH FOR INSTANT FLUSH", at suitable height so that, it can be used by passengers of all age group/height. Sticker for working instruction shall be pasted above the push button having bilingual language i.e. Hind and English as well as in graphic symbol for ease of indication to users. Sticker and graphic symbol shall be as per drawing no. MLE64136.
- 1.5. All electrical, electronics and Pneumatic parts of system should be shock and vibration proof and should comply with IEC 61373, category-2. The components/system should also comply with EN50155 for environmental protection. The bidders should submit test reports from labs authorized for this testing along with their WTC for tests, for which test facilities are available at the firm's premises.

**2. Eligibility Criteria:** Deleted

**3 SCOPE OF SUPPLY:**

- 3.1 Electro-Pneumatic Pressurized flushing system should be supplied with all accessories including nuts, bolts, spring washers, safety wire and clamping as per requirement for installation of the system. System interface with car body shall be clearly specified and submitted along with offer. 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.
- 3.2 Supply, installation and commissioning will be in the scope of tenderer.
- 3.3 Plumbing connection from Auxiliary roof water tank (3/4" female pipe thread) of AC coaches/Roof water tank (1" female pipe thread) of Non-AC coaches to the bowl of Indian style/Western style for the pressurised flushing system is in the scope of tenderer. Water pipe lines and pipe fittings shall be with stainless steel material.
- 3.4 01 No. Isolating cock (3/4" BSP) in water line from Auxiliary roof water tank / Roof water tank and 1 no. Isolating cock (1/4" BSP with both end female thread) in pneumatic line shall be provided to isolate the system for attending the faults occurred if any in the Pressurised unit or in the pneumatic/water line.
- 3.5 All pneumatic fittings should have metallic body only. No plastic fittings or the fitting with plastic/nylon release sleeve etc shall be used.

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3.6 Apart from above, all other items/activities required for installation and functioning of the system is under the scope of tenderer.

#### 4 TECHNICAL REQUIREMENTS:

4.1 This specification No. MMDTS19027, Rev.-0 shall be read along with ICF Drg. ICF/SK3-6-3-246 Alt 'a'.

4.2 Electro-pneumatic panel shall be installed outside the lavatory panel (behind the attachment wall with ref. drawing no. MLE64129 Alt 'a' & MLE64130 Alt 'a') within the existing space available of 90mm (maximum space). Drawing no. LE63202 (latest alteration) for Indian style pan bowl interface, LS63119 (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, drawing no. LS10209 (latest alteration), LS10211 (latest alteration), LS10216 (latest alteration) for lavatory with SS tubular partition frame and ICF/SK3-6-3-246 Alt'a' are only for interface & references. Drawing no. MLS63104 Alt 'b', MLG63116 Alt 'Nil' for Non-AC coaches lavatory with SS tubular partition frame and MLS63620 (latest alteration) , MLG63117 (latest alteration) and MLJ63016 Alt 'b' are for Non-AC coaches fitted with FRP Modular toilets, MLE63002(latest alteration) are for AC coaches fitted with FRP Modular toilets are only for interface & references.

4.3 Electro-pneumatic Pressurized flushing system should effectively clean the bowl and transfer the fecal matter to Bio digester tank with a minimum quantity of water at a pressure range between 2 Kg/cm<sup>2</sup> to 3 Kg/cm<sup>2</sup>. Maximum discharge of water during a flush shall be 1.5 litres. Pressurized water alone should discharge through the spray tube around bowl. No mix of air & water should be released in the bowl at the time of flushing.

4.4 All mechanical and pneumatic components of the pressurized flushing system shall operate under the conditions mentioned in clause no. 5 without any problems.

4.5 The required energy for the pressurized flushing system shall be provided from the pneumatic circuits of the coach. A limited quantity of 3.5litres/minute/lavatory can be made available at 5 Kg/cm<sup>2</sup> to 6 Kg/cm<sup>2</sup> for the system. Tenderer should specify the consumption of air in litres/minute or litres/flushing operation, along with the offer and submitting prototype for approval.

Also 110 V AC/DC supplies shall be available in the coach for operation of control circuit of the system. No power shall be provided for creating pressurised water supply.

4.6 The pressurize unit should be compact and robust. The Electro-pneumatic pressurized flushing system shall be designed for a usage of minimum 150 times within 24 hours.

4.7 No Leakage from System at 5 Bar Pressure & dispense of maximum water 1.5 Litres in functional test at 3-5 bar Pressure.

4.8 A Bypass or alternate flushing arrangements shall be provided by same flush button Switch, so as this system shall be remaining usable for ensuring proper flushing to transfer the fecal matter from the lavatory pan/western style bowl to Bio- tank including clean-ability, in case of non availability of power /air.

4.9 Firm has to mention the method of measurement of water pressure in maintenance Manual.

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## 5. OPERATING CONDITIONS:

### 5.1. Ambient Conditions:

- (i) Altitude: Sea level to 2500m
- (ii) Operating temperature: 1°C to 55°C Max. Temperature under Sun: 70° C
- (iii) Relative humidity: up to 95%
- (iv) The rainfall is fairly heavy.
- (v) During dry weather, the atmosphere is likely to be dusty.
- (vi) Temperature variations can be quite high with-in range specified in the same journey or short period of time.
- (vii) Coaches operate in coastal areas with continued exposure to salt laden air.
- (viii) Coaches may be subjected to frequent external washing with detergents and cleaning of toilets by cleaning agents.

### 5.2. Car-body dynamics:

5.2.1. Equipment shall withstand satisfactorily the vibrations and shocks normal encountered in Service as indicated below:

- a. Maximum vertical acceleration 1.0g
- b. Maximum longitudinal acceleration 3.0g
- c. Maximum transverse acceleration 2.0g

5.2.2. The vibrations are of sine wave form and the frequency vibration is between 1 Hz to 50 Hz.

The amplitude 'a' expressed in millimetres 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.

5.2.3. In the direction corresponding to the longitudinal movement of the vehicle, the equipment is subjected for 2 min. to 50 Hz. Vibrations of such a value that the maximum acceleration is equal to 3g.

5.2.4. LHB type coach length over coupler is approximately 24 meters.

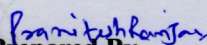
5.2.5. Coach-body displacement encountered under dynamic conditions.

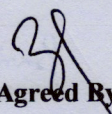
- i) Vertically -  $\pm 100$  mm
- ii) Laterally -  $\pm 55$  mm
- iii) Longitudinally-  $\pm 10$  mm
- iv) Bogie rotation about centre pivot-  $\pm 4^\circ$
- v) Maximum Speed of train - 160 KMPH.

## 5.3 SYSTEM INTERFACE AVAILABLE

### 5.3.1. Water Supply:

- i. There is one roof water tank of 30 litres capacity available over each toilet at a height of about 2030 mm from toilet floor in air-conditioned coaches. Water is pumped to these from under-frame mounted main water tanks. Water-flow to the flushing valve is by gravity. These roof water tanks are not pressurized and the water flow from these tanks is by gravity.
- ii. For Non-AC LHB a coach, one overhead water tank of 455 litre tank capacity is available at the same height. The water flow from this tank to flushing line is by gravity.

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### 5.3.2. Pneumatic Supply:

- i. A limited quantity of air supply of around 15 lit/min./Coach can be made available connected to feed pipe at 6 kg/cm<sup>2</sup> with provision of one 75 litres reservoir in the coach exclusively for toilet system.
- ii. Requirement of compressed air per toilet used and per coach shall be clearly specified by the firm.

### 5.3.3 Power Supply:

- i. 110V DC supply is available in LHB AC and Non-AC coach circuits. This supply varies from 80V to 140V with 30% ripple in AC & Non-AC LHB (EOG) type coaches. The equipments shall be designed to withstand  $\pm$  30% voltage fluctuations.
- ii. Any Solenoid Valve or Electronic Item fitted should be able to withstand  $\pm$  30% voltage fluctuations. The bidders should submit test reports from labs authorized for this testing along with their WTC for tests, for which test facilities are available at the firm's premises.
- iii. ALL electrical/ electronic equipment and junction boxes shall be of suitable degree of protection IP 65 protection.
- iv. All electrical/electronic Components used in the system shall be as per IEC 61373 and EN 50155.
- v. Total peak power requirement per coach shall not exceed 50 watts.
- vi. Railway Grade Components are to be used in all electrical /electronic items.
- vii. Requirement of power shall be clearly specified by the supplier.

### 6. Duty Cycle:

The Electro-Pneumatic Pressurized flushing system should be ready to flush within maximum of 10 seconds after each use. This system may be used up to 150 times for defecations in 24 hrs.

### 7. DESIGN REQUIREMENT:

- 7.1 The system offered must be modular, robust, reliable, easy to operate and passenger friendly, maintenance free and must be supplied as a complete system to handle human waste transfer. It should take minimum possible time for replacement of modules. The supplier should indicate replacement time module wise.
- 7.2 The technical implications/reasons for capacity rating of important components of the system must be explained in detail by the supplier. Similarly, critical dimensions in the fixing and location drawings shall be clearly indicated by the supplier together with details of all mechanical and electrical interfaces between toilet system and the coach.
- 7.3 The system should be so designed that day to day maintenance does not require.
- 7.4 The supplier must indicate the consumption of power, air and water.

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- 7.5 The design of Electro-Pneumatic Pressurized flushing system shall be protection from pilferage and components used in this system shall be made of corrosion resistant material.
- 7.6 The system should neither impede free movement of the bogies nor the routine inspection and maintenance of various bogies/ coach sub-assemblies. To ensure this system shall be contained within the space envelope as mentioned earlier.
- 7.7 Bought out items from a reputed and established brand shall be used or made in-house for Electro-Pneumatic Pressurized flushing system.
- 7.8 Important Component fitted in Electro-Pneumatic Pressurized flushing system and their details must be as given under:

**Table-1**

<b>S.No.</b>	<b>Name of Component</b>	<b>Detail Description</b>
1.	Push Button Switch	<p>This push button switch should be minimum IP 65 compliant or higher grading with Metallic Body. Body of which should glow &amp; emit Green light indicating readiness of the system for starting flushing cycle. This push button should be installed at the height of 1300±20 mm from floor level of the lavatory at clearly visible location with a sticker indicating "PUSH FOR INSTANT FLUSH", at suitable height so that, it can be used by passengers of all age group/height. Sticker for working instruction shall be pasted above the push button having bilingual language i.e. Hindi and English as well as in graphic symbol for ease of indication to users. Sticker and graphic symbol shall be as per drawing no. MLE64136.</p> <p>The bidders should submit complete test reports from Manufacturer against IP65 complaint. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply.</p>
2.	Electrical & Electronic Items Used	<p>All electrical, electronic parts of system should be shock and vibration proof and should comply with IEC 61373, category-2. The components/system should also comply with EN50155 for environmental protection. The bidders should submit complete test reports / statement of testing from Manufacturer against each test mentioned in EN50155. The test certificates should either from labs authorized for this testing or the firm should submit test certificates and WTC for tests, for which test facilities are available at the manufacturer's premises. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Railway Grade Components are to be used in all electrical /electronic items. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this</p>

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		<p>component at the time of supply.</p> <p>All Electronic Item fitted should be able to withstand <math>\pm</math> 30% voltage fluctuations. The bidders should submit test reports from labs authorized for this testing.</p>
3.	Solenoid Valve Used	<p>All Solenoid Valve used must be EN 50155. Complete test report against each test mentioned in EN 50155 must be submitted. Also, it must be IEC 61373, category-2 tested. It must withstand if keep it in on situation with <math>\pm</math> 30% Voltage tolerance as per EN 50155 Requirements. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply. Drawing of Solenoid Valve to be approved by MCF.</p> <p>Solenoid valve should be able to withstand <math>\pm</math> 30% voltage fluctuations. The bidders should submit test reports from labs authorized for this testing.</p>
4.	Pneumatic Valve	<p>Pneumatic Valve must be IEC 61373, category-2 tested. Complete test report against each test mentioned in IEC 61373, category-2 must be submitted. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply.</p>
5.	Air Filter Regulator Unit	<p>A Metal Body Pre Set Air Filter Regulator Unit to be Used. It must be IEC 61373, category-2 tested. Complete test report against each test mentioned in IEC 61373, category-2 must be submitted. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply. Pressure regulator shall be pre set value of approx. 3 kg/cm<sup>2</sup> from the OEM, which need not to have adjustment to regulate the prescribed pressure during fitment and installation to avoid undue incidence of not regulating the pressure during fitment and installation.</p>
6.	Pneumatic Fittings & Tubing's	<p>All the Pneumatic Fitting used in the system are of metal body with metallic collat. Pneumatic tubing material should be of Nylon material as per DIN 74324 to have longer life as per EN45554. No PU material tubes should be used. Pneumatic tubing material shall be covered with SS sleeves and shall be properly clamped.</p>

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7.	Water line Pipe & Fitting	Water Pipe line, Pipe Clamp, Fasteners, Mounting Bracket, Mounting Bolts with split pin, Mounting Nuts (Nyloc type) must be of Stainless Steel. Flexible water pipe shall be thermoplastic material as per IS: 12585-88, type-2. Flexible water pipe shall be covered with SS sleeves.
8.	Water Locking Unit	Water Locking Unit must be Angle seat valve to avoid any restriction in flow and also suitable for Damped closing (Valves closes against flow direction). Material of angle seat shall be stainless steel as per AISI-304 or brass with black painted. It must be minimum $\frac{3}{4}$ " port size or orifice size 20 mm. The Water Locking Unit must be IEC 61373, category-2 tested. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply.
9.	Non-Return Valve (NRV)	Non-Return Valve used in the Water Pressurization System must be of Stainless steel Body. NRV shall be fitted at inlet and outlet of water pressurizer cylinder. It must be minimum $\frac{3}{4}$ " port size. The Non-Return Valve must be IEC 61373, category-2 tested. Complete test report against each test mentioned in IEC 61373, category-2 must be submitted.
10.	Water Pressurization System	In Water Pressurization system, water side components must be made of corrosion resistant material. Water Side barrel must be of Stainless steel as per material specification AISI-304 & air side barrel must be of Anodized Aluminium as per IS:737-86, 64000 HP or EN AW 6082 T6 or higher grade. All the Front, Middle and Rear End Covers must be made of Stainless steel as per material specification AISI-304. The water Pressurization system must be IEC 61373, category-2 tested. Complete test report against each test mentioned in IEC 61373, category-2 must be submitted. The manufacturer has to mentioned model no. and brand name in drawings submitted by firm at the time of prototype approval. Firm has to submit WTC (work test certificate) of the manufacturer as per the approved drawing of this component at the time of supply.
11.	EP control Panel and Push button switch Panel	<p>EP control Panel and Push button switch Panel shall be modular and plug in type for easy fitment and maintenance. Firm has to provide a cover to protect EP control Panel and Push Button Switch panel (from outside the lavatory) protected by vandal resistant and shall comply IP 65 Compliant. Material of cover must have fire resistance properties and electric shock resistant.</p> <p>The supplier shall indicate its size, location and fixing arrangement suiting to space envelope available mentioned in clause no. 4.2 of this specification.</p>

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		All electrical and pneumatic connections of the control panel shall be plug in type and shall be properly clamped.
12.	Safety wire	Safety wire should be proved at both end of Water Pressurization system in case of emergency for ensuring safety of the system as per Table-2 given below.
13.	Electric wire	Electric cable used in this system shall be as per RDSO specification ELRS/SPEC/ELC/0019 with latest revision. All electrical connection must be in plug and play, ensuring it should not come out due to vibration in coach.

Table-2

S.No.	Description of Items	QPC	Drg. no.	Material specification	Remarks
1.	S.S Wire cable Ø4 mm 6x7 L=700mm	2	IS:2266-2019	AISI-304	NIL
2.	Bulldog Grip	6	IS:2361-2002	AISI-304	NIL

## 8. MARKING

Each unit of Electro-Pneumatic Pressurised Flushing system shall be legibly marked by hot stamping or indelible ink or metallic riveted sticker or Laser cutting at visible location with the following details:

- i) Manufacture's name
- ii) Batch No.
- iii) Year of manufacture.

## 9. PACKING

The supplier/vendor shall be responsible for proper and adequate packing Electro-Pneumatic Pressurised Flushing system in assembled condition before dispatch to prevent damage in transportation, handling and storage. The material shall be suitably packed as per packing no. mentioned in PO to avoid distortion damage etc. during transportation.

## 10. TESTING AND APPROVAL OF PROTOTYPE:

For the first time supply prototype approval shall be done by CDE/MCF.

Prototype shall be checked as per following:

- 10.1 One prototype sample of Electro-Pneumatic Pressurized flushing system shall be submitted to Designs at MCF for inspection. Prototype shall be fitted in one coach (at least 1 no. of Indian style

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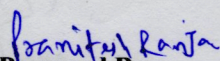
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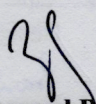


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and 01 no. of western style lavatory) for fitment and functional approval. Supplier must incorporate any changes noticed during the prototype inspection without any additional cost.

- 10.2 Dimensional checked as per drawings submitted by the firm.
- 10.3 The tenderer has to submit description and installation drawings with sufficient details to evaluate the system design. Sticker for working instruction and graphic symbol as per drawing no. MLE64135 shall be got approved by CDE/MCF, for the first time supply only.
- 10.4 The tenderer has to submit all tests certificates as per mentioned in clause no. 7.8 of this specification. This test certificates should contain details of test conducted and measurements recorded.
- 10.5 Procurement of raw material should be done only from the authorized distributor of following reputed stainless steel manufacturers; M/s SAIL or M/s Jindal. The tenderer has to submit proof of procurement of raw material from OEM or from his authorized distributor.
- 10.6 The tenderer has to submit test certificate of all raw materials of all critical components/assemblies fitted in this system.
- 10.7 **Life Cycle Test-** The tenderer shall enclose a certificate from a NABL approved Lab for a satisfactory trouble-free operation of the system for minimum 10 Lakhs Cycles for approval.
- 10.8 The tenderer has to submit complete maintenance manuals including trouble shooting and dismantling instructions in paper and electronic form. Firm has to clearly mention about the maintenance schedule of the system.
- 10.9 The tenderer has to submit Machinery and plant, testing facility available at firm premises and Quality control system.
- 10.10 The tenderer has to submit list of spare parts in details used in this system with manufacturer name, model number, year of manufacturing and cost.
- 10.11 Field trial shall be jointly monitored by Zonal Railways/PUs and concerned supplier as per trial scheme finalized for this purpose. Criteria for successful completion of field trial shall be elaborated in trial scheme.
- 10.12 Performance monitoring of the coaches fitted with Electro-Pneumatic Pressurised Flushing System for field trial shall be done in actual train service for a minimum period of 6 months on 5 coach sets, after successful prototype approval with an objective to monitor the following:
- 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.
  - Proper working of system including all assemblies, subassemblies and components fitted in this system and indications to achieve designated quality of performance.
  - Proper functioning of the complete system including clean-ability.

  
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<b>Specification</b>	<b>Schedule of Technical Requirements for Electro-Pneumatic Pressurised Flushing System for LHB coaches</b>	<b>MMDTS 19027, REV.- 2 Page 11 of 12 Date:06.08.2022</b>
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iv. Maximum discharge of water during a flush shall be 1.5 litres at a pressure range between 2 Kg/cm<sup>2</sup> to 3 Kg/cm<sup>2</sup>. Pressurized water alone should discharge through the spray tube around bowl.

v. Checking of full tightness of plug in type electric and pneumatic connections.

vi. Physical condition of material like rusting, damage and surface cracks.

vii. Details of alteration/maintenance requirement with coach number date and time.

10.13 Bulk manufacturing will be commenced only after clearance of prototype. Regular supplies are to be made as per approved prototype only.

10.14 If tenderer upgrade any components/ sub-system fitted in the system, he shall get it approval by CDE/MCF before its implementation.

10.15 Tenderer has to submit MOU and all documents (mentioned in S. No. 10.3 to 10.10 of this specification) from OEM/manufacture, if tenderer is not a manufacturer.

#### **11. SPARE PARTS:**

11.1 The tenderer shall indicate in an itemized list, the life expectancy of components subjected to wear under Indian conditions.

11.2 The tenderer shall ensure the availability of spare parts or replacement parts of the supplied system for a period of at least 15 years. List of spares and its cost shall be submitted along with the offer for tender. This shall be irrespective of the fact whether the vendor/supplier or his sub vendor/(s) have stopped manufacturing of the equipment/(s) to the design supplied to Indian Railways.

#### **12. INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS (IPR):**

Indian Railway shall not be responsible for infringement of IPR arising due to similarity in design of Electro-Pneumatic Pressurised Flushing System with compaction arrangement, manufacturing process, components used in design, development and manufacturing equipment and any other factor, which may cause such dispute. The entire responsibility to settle any such disputes/ matters lies with the manufacture/supplier.

#### **13. WARRANTY:**

Tenderer shall ensure minimum warranty for satisfactory performance of the Electro-Pneumatic Pressurised Flushing System for 72 months from the date of fitment or 84 months from the date of supply, whichever is earlier. During warranty, the tenderer shall rectify the equipment by replacing or repairing components at his cost without affecting the service of the coach attached to the train, however warranty is applicable on manufacturing defects. Warranty period would get extended on pro-rata basis if warranty replacements/repairs are not provided within 5 days of notice. If tenderer fails to provide warranty in 5 days of notice. Railway reserves the right to cancel balance contract.

#### **14. INSTALLATION AND COMMISSIONING:**

14.1 The mounting and installation of Electro-Pneumatic Pressurised Flushing System on the designated coach/coaches shall be carried out by the vendor/supplier at consignee's premises or the place decided by the consignee/purchaser/Indian Railway. The space envelope for fitment of Electro-Pneumatic Pressurised Flushing System has been given at clause no. 4.2 of this specification.

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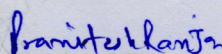
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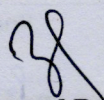
- 14.2 The Electro-Pneumatic Pressurised Flushing System installed and commissioned shall be checked by the vendor/supplier for proper functionality and performance.
- 14.3 The vendor/supplier shall follow all the safety measures and precautions at the time of installation & commissioning of Electro-Pneumatic Pressurised Flushing System at the site.
- 14.4 The installed and commissioned Electro-Pneumatic Pressurised Flushing System shall be subjected to a field trail of 6 months from the date of commissioning on LHB coaches for supplies made by first time tenderers.

**15. TRAINING:**

The vendors/supplier shall arrange free of cost training to Indian Railways personnel involving in operation, maintenance and trouble shooting of Electro-Pneumatic Pressurised Flushing System. The venue and period of training should be mutually agreed between supplier/vendor and purchaser/consignee/ Indian Railways.

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