



GOVERNMENT OF INDIA

MINISTRY OF RAILWAYS

Specification for Compact Modular Microprocessor Controlled

Air Brake System with Advanced Features

For Diesel-Electric Locomotives

Specification No. MP.0.01.00.24, (Rev.05)

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RESEARCH DESIGNS & STANDARDS ORGANISATION

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LIST OF AMENDMENTS

Amendment Date	Version	Revised Para	Remarks
March, 2021	03	Para 3.1	The requirement is already covered in RDSO ISO procedure available on website. Hence, Para deleted.
		Para 3.4.4, 4.10.2.1,4.11, 4.12.2, 4.13.2, 4.21, 4.21.2, 9.2.1 & 9.2.5	Revision of Para's to incorporate Equivalent Indian Standards
		Para 4.2	Para 4.2 revised for better clarity.
		Para 4.3	The requirement is already covered in Para 4.2. Hence, Para deleted.
		Para 4.6(Now Para 4.5)	To incorporate the size available on locomotive. Weight limit has been increased to avoid broad restriction.
		Para 4.10	To incorporate features of GE loco brake system as an alternate.
		Para 4.10.2.2	To incorporate features of GE loco brake system as an alternate.
		Para 4.10.2.4	To incorporate features of GE loco brake system as an alternate.
		Para 4.23	Para 4.23 revised for better clarity.
		Para 4.33	Para 4.33 revised for better clarity.
		Para 6	Auxiliary devices are independent of brake system. Hence, Para deleted.
		Para 9.1 (Now Para 8.1)	The requirement is already covered in RDSO ISO procedure available on website.
		Para 9.2.5(Now Para 8.2.5)	To include other reputed standards.
		Para 9.4(Now Para 8.4)	Field trial Quantity & field trial period are defined as per MP-M-8.1-1 (Latest Version). & Field trial performance feedback format added.
		Para 9.5	The requirement is already covered in RDSO ISO procedure available on website. Hence, Para deleted.
		Para 15(Now Para 14)	Revision of Para 15 as per ISO document no-QM-RF-7.1.3 Ver-2.0.
		Para 16(Now Para 15)	Addition of Para no. 16 (Preference to Make In India) in compliance of directives issued by GOI for promotion of Make in India policy.
Para 17(Now Para 16)	Addition of Para no. 17 (Vendor Changes in Approved Status) in compliance to Vigilance cell note no. 13/Vig/Policy dated 08.09.2016.		
Para 17 (New Para)	Addition of New Para date of enforcement as per Vigilance cell note no. 14/Vig/08/CT/46 dated 14.10.2015.		

May 2022	04	3.1	In reference to ED/QAM/RDSO letter no. QAM/Vendor Policy dated 15.02.22 for review of restrictive clauses and further discussion during, DG review meeting held on 17.03.22 in which the issue of restrictive clauses was discussed. To promote Government of India policy on "make in India" and for development of more vendors for the subject item (this item is having less than 3 vendors), the restrictive clause has been amended
		Para 8	Revision of Para 8 to incorporate Independent safety Assessors ISA
September 2022	05	Para 3.1 & 3.2	Revision of Para 3.1 as per RDSO QAM Note no. QAM/Vendor Policy dated 15.02.2022.

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Specification for Compact Modular Microprocessor Controlled Air Brake System with Advanced features For Diesel-Electric Locomotives

1. SCOPE

This specification covers the functional requirement of a Compact, Modular Microprocessor Controlled air brake system with better reliability and advanced features for Diesel-Electric locomotives like WDG-4, WDP-4, WDM-3D, WDG-3A, WDG-5 (5500 HP locomotive under development) etc. This specification covers the technical requirements as well as purchase, inspection, testing and acceptance requirements of such a system. It is expected to provide superior technical performance compared to the present CCB 1.5 system of NYAB/U.S.A/Knorr Bremse India Limited. Although this Microprocessor Controlled air brake system will be mostly fitted on new WDG4 & WDP4 diesel locomotives, it should be versatile enough to be compatible for fitment in other diesel locomotives also as mentioned above.

2. BASIC RELEVANT DATA OF LOCOMOTIVE

Basic data of diesel locomotive relevant to brake system is as under:

2.1 Capacity of compressor:

For ALCO locomotive

- i) At 350 rpm.(Idle speed) - 2130 lpm
- ii) At 1050 rpm (Max. speed) - 6390 lpm

For WDG 4/WDP 4 locomotive

- i) At 200 rpm.(Idle speed) - 990 lpm
- ii) At 950 rpm (Max. speed) - 5677 lpm

Note: The above compressor capacity caters to requirements of auxiliaries (para 6.0) in addition to brake system.

2.2 Nominal bore diameters of four major pneumatic pipes used on air brake locomotive are as under:-

- Brake pipe - 32 mm
- Feed pipe - 32 mm
- Brake cylinder equalising pipe - 15 mm (For ALCO)
& 19 mm (For WDG4/WDP4 Loco)
- Main reservoir E.Q. pipe - 25 mm

2.3 Basic data related to locomotives is as under:

- i) Max. Weight of locomotive - 117T(WDP4 & WDM3D),
126T (WDG4)
123T (WDG3A)
- ii) No. of brake cylinders on loco - 8
- iii) Bore diameter of brake cylinder - 8 inches

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2.4 Length of the train is as under:

- | | | | |
|---|---------------------------|---|--------------------------|
| 1 | Air brake passenger train | = | 26 coaches |
| 2 | Air brake freight train | = | 58 BOXN |
| 3 | Locomotive used | = | Upto 5 nos. in multiple. |

2.5 Relevant data of coaches and wagons are as under:

S.No	Type of Rolling stock	Length of stock (in mm)	Brake pipe diameter (in mm)	Feed pipe diameter (in mm)
1.	Air brake coach	22297	25	25
2.	BOXN wagon	10713	32	-
3.	Diesel locomotive	17120	32	32

2.6 Maximum permissible speed of train:

Type of stock	Air brake stock
Passenger	160 kmph
Freight	100 kmph

2.7 Maximum down gradient - 1 in 30

2.8 Operating Voltage

The electro-pneumatic or electrical devices shall be suitable for 72 volts DC on diesel locomotive. The voltage variation on diesel locomotive may be between 48 and 90 Volts.

3. General Conditions

3.1 Facilities of the vendor applying for approval

The vendor should have qualified and competent design personnel acquainted with the design and manufacturing technology required for brake system manufacturing.

3.2 The vendor or its collaborator should have at least following facilities:

- 1 Manufacturing facilities required for manufacturing of Microprocessor Controlled air brake system and one well equipped electronic laboratory.
- 2 Testing facilities to test performance of Microprocessor Controlled air brake system and individual brake valves.

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3.3 Service Conditions

The equipment shall be capable of working satisfactorily under the service conditions indicated below:

3.3.1 Altitude

Mean sea level to an altitude of 1000 meters above mean sea level.

3.3.2 Temperature

0° C to 55° C. The air temperature inside locomotive may reach as high as 70° C.

3.3.3 Relative Humidity = Up to 100%.**3.3.4 Vibrations And Shocks**

Compliance to vibration testing in accordance with IEC-61373 or Equivalent Indian Standards.

3.3.5 Other Conditions

Equipment shall be capable of operating efficiently in spite of dirt, dust, mist, torrential rain, heavy sand or stone storms and presence of oil vapours and radiant heat etc. to which the rolling stock is normally exposed in service.

4. TECHNICAL REQUIREMENTS

- 4.1 The brake system offered should be Microprocessor Controlled air brake system of compact modular design with integrated electronic and pneumatic components. It should be compatible with air brake train with RDSO specification No.02-ABR-02.
- 4.2 The compact modular Computerised control brake system shall comprise of distributed electronics linked together through a network. Its electro-pneumatic control unit shall consist of modularised electro-pneumatic modular Line Replaceable Units (LRU), which shall work as intelligent units, communicate with each other through the network and control the development of all pneumatic control pressures. It should also have redundancy features with availability of back-up so that another system or internal redundancy feature takes over when one system fails. The details regarding availability of this feature should be submitted along with the offer.
- 4.3 The Electro-Pneumatic Control Unit shall be resistant to water intrusion, however it may not be water tight, and can be mounted in an enclosed area.
- 4.4 There should be a provision of Brake Controller selector switch (mounted on brake controller) with four positions (Lead, Trail, Helper, and Test) on each control stand.
- 4.5 It shall be panel mounted brake system of compact and modular design. The panel (Brake Rack) can be mounted either in the nose of WDG-4/WDP-4 locomotive, nose compartment of ALCO loco with roof mounted DBR or in the radiator compartment of 5500 HP WDG-5 locomotive.

The envelope size of the panel (mounted with the equipments) should be as compact as possible, and must not exceed 1300mm (L) X 580mm (W) X 775mm (H). The shape and size of the panel and layout of the equipment shall be such that the panel fits well in the locomotive with ample space for maintenance. There should be sufficient space to ensure that the line replaceable units of the brake system can be easily replaced in the locomotive on line i.e. without having to bring the locomotive in maintenance shed. All the LRU's/components should be mounted on one side of brake panel. The weight of the panel with equipment shall not be more than 350KG.

- 4.6 Even in case of failure of Computerised controlled brake system, it should be possible to work the loco with self power up to certain speed.
- 4.7 The brake system should be capable of giving graduated application and release of brake on locomotive as well as on train for air brake system.
- 4.8 There are two control stands/cabs on locomotive. At a time one control stand will be used to control loco/train and brake system. Driver's brake valves are to be provided on both the control stands/cabs. Arrangement should be there to make brake valves inoperative on control stand which is not being used to control loco/train and brake system. However, it should be possible to apply emergency brakes from the control stand, which is not being used.
- 4.9 **Driver's brake valve (Controller)**

The Brake valve (Controller) shall be electronic based, and act as interface between the Brake system and the Driver (Man-Machine Interface). The communication between driver's brake valve (Controller) and micro-processor based air brake system should be through optic fibre cable or a network. The interface cable provided for power supply or network connection must be shielded. Driver's brake valve (controller) shall have handles for operation of the Independent and Automatic brakes. The electronic brake valve controller shall also accommodate LCD display of limited advisory and diagnostic messages (in English) to the crew. Brake system shall have provision to apply emergency brake through electronic brake circuit. Apart from this, the electronics, the Electronic Brake valve should contain a cam-actuated pneumatic valve, which will create a pneumatic emergency when automatic handle is brought to 'emergency' position. Alternatively, Electronic Brake valve may contain a cam-activated limit switch to send an electrical signal for emergency brake application through independent EP solenoid valve & pneumatic exhaust valve mounted on manifold. The integrity of the circuit should always be monitored and a penalty application shall be made in case of any discontinuity in the circuit. Each of the two driver control stands of the locomotive shall be provided with Electronic Brake Valve (controller).

4.9.1 Independent brake valve

The locomotive brake system should be provided with self-lapping type independently operated brake valve on each control stand. The brake valve should have two positions namely 'Release' and 'Application'. In between Release and Application position, the brake cylinder pressure built up should be in proportion to the handle movement.

4.9.2 Automatic brake valve

4.9.2.1 Automatic brake valve shall be self lapping type and shall have separate 'Release' and 'Run' position as per UIC code or Equivalent Indian Standards. The 'Release' position should be spring loaded. Following positions should be provided on automatic brake valve:

- .1 Release position - spring loaded
- .2 Run position
- .3 Minimum reduction brake application
- .4 Full service application
- .5 Emergency application position

4.9.2.2 In 'Release' position of the brake handle, an increased area of communication between the MR (Main Reservoir) air feed and brake pipe charging valve should be available to facilitate quick recharging of air brake pipe. However, in 'Running position' of the automatic brake valve, the passage between MR and brake pipe charging shall be restricted for maintaining leakage in the train system. If brake system is capable of sensing a train line break-in-two with the help of air flow measurement and cut out the main reservoir from charging brake pipe, separate choke for Release-Run position is not required.

4.9.2.3 In between minimum and full service position, the brake pipe pressure built up/release should be in proportion to the handle movement. The BC pressure of loco however can be influenced by dynamic brake application when blended brake is operative.

4.9.2.4 In emergency position of brake valve handle, the brake pipe shall be vented to atmosphere through a sufficiently large diameter opening in such a way that the BP pressure comes to atmosphere level in 1 to 3 seconds maximum when the locomotive is tested separately. The emergency position in driver's brake valve should be independent of normal brake control system and should be available for use at all times at both the control stands/cabs, irrespective of the presence of locomotive or battery power, alternatively, system should be able to apply a penalty brake application in case of absence of locomotive or battery power with or without emergency application. Whenever emergency brake application occurs, engine should come to idle in co-ordination with Loco Control Micro-processor.

4.9.2.5 Independent and automatic brake valves shall be fitted on control stands such that movement of handle is in vertical plane with 'push to apply'.

4.9.2.6 It should be possible to release the locomotive brakes by the driver even when the partial or full service application brakes on trailing stock are made.

4.9.3 Assistant Driver's Emergency Brake Valve

In addition to the emergency brake application position on automatic brake valve, two Assistant Driver's emergency brake valves (one on or near each control stand) shall be provided for direct venting of brake pipe pressure during emergency by the driver /driver's assistant. Venting shall be through a sufficiently large diameter opening in such a way that the Brake pipe pressure comes to atmosphere level in 1 to 2 seconds when the loco is tested separately. During emergency brake application by emergency brake valve or through driver's automatic brake valve, system should go on penalty and engine comes to idle.

However this valve is not within the scope of supply of the vendor of Microprocessor Controlled Air brake system.

4.9.4 Microprocessor Controlled Brake System shall have sufficient safety provisions for acknowledgment of system penalty brakes, by the driver to prevent un-intended automatic release of brakes applied as a result of various penalties as above.

4.10 Distributor valve

4.10.1 A pneumatic back up protection has to be provided , so that even in case of failure of the CCB or because of power failure etc, brake will be applied. The back up protection is required also to ensure graduated application and release of brake in case the loco with micro-processor based air brake system is attached dead. If the Microprocessor Controlled Air brake system is with a distributor valve, it should be only of UIC approved type or Equivalent Indian Standards. However, if the offered system is without UIC type or Equivalent Indian Standards distributor valve, the application/release timings and other features of the system should be as per relevant UIC specification or Equivalent Indian Standards. The distributor valve should be compact so as to reduce the overall size of the system and maintenance requirement, while meeting all the functional requirements.

4.10.2 The distributor valve shall have provision for goods / passenger selection to obtain brake application and release timings to match with the train requirements. Selection between these two modes should preferably be built in the software of Microprocessor Controlled Air brake system. However, manual arrangement for selection may be provided as an alternative. The distributor valve should be located in such a way in the panel that it can be easily replaced.

4.11 Multiple Operation

4.11.1 A maximum of 5 (five) locomotives can be used in multiple operation. In such cases, multiple operation with all functions of brake system should be possible for all locomotives provided with microprocessor based air brake system.

4.11.2 In case of parting between coupled locomotives, the brakes on the locomotives shall come on automatically. UIC type or Equivalent Indian Standards break-in-two protection should also be provided to bring the engine to idle r.p.m in all the locomotives through locomotive control microprocessor. There shall be complete isolation of brake cylinder equalizing pipe when parting between locomotives occur.

4.11.3 When the brake controller selection switch is in 'Lead' position, it should be possible to operate both the brake valves on locomotive. When the switch is in 'Trail' position, brake valves should be inoperative. However, in trail position, it should be possible to apply emergency brake. In Helper mode, it should be possible to operate the independent brake and also apply the emergency brake.

4.11.4 In case in leading locomotive, both control stands are wrongly set in 'Trail' position or both

control stands wrongly selected in 'Lead', it should not get powered. For this purpose a suitable interlock should be provided with locomotive microprocessor based control system.

4.11.5 Provision shall be made for utilising the compressor capacity of trailing locomotive for releasing the train brakes or during initial charging.

4.11.6 It should be possible to make multiple unit of locomotives provided with microprocessor based air brake system with locomotives with 28LAV-1 dual brake or IRAB-1 pure air brake systems in case of same type of locomotives. Applicable drawing for 28LAV-1 and IRAB-1 brake systems are the latest versions of SK.DP-2918 and 3100 respectively.

4.12 Overcharge Feature

4.12.1 The vendor shall provide an automatic overcharge feature, whenever the brake valve handle is placed in Release position.

4.12.2 Operation of overcharge feature shall increase the brake pipe pressure by 0.5 kg/cm² over the normal level of 5.0 kg/cm². The overcharge so created by this feature, should automatically be maintained till handle is placed in that position. The rate of drop in brake pipe pressure with the removal of such overcharge should be at uniform and slow rate so as not to cause brake application on any of the vehicles in the train. The dissipation time of BP pressure from 5.5 to 5.0 kg/cm² shall be as per UIC standards or Equivalent Indian Standards.

4.12.3 During assimilation or bleeding down of overcharge pressure it should be possible to apply normal brake. However, when the normal brakes are released remaining overcharge cycle should be completed.

4.13 Interface with dynamic brake

4.13.1 Brake system should be compatible with existing rheostatic dynamic brake provided on locomotives. During service braking through automatic brake, dynamic brake is the preferred operative mode, and as such dynamic brake shall be optimally used when the friction brake intervenes integrating the braking force when required, and replacing the dynamic brake when it is not available.

4.13.2 When dynamic brakes are applied, locomotive brakes should be cut off, if brakes are applied through automatic brake valve. However, in case of emergency brake application by driver's brake valve or by Assistant Driver's emergency brake valve, the dynamic brakes should 'cut-off' and locomotive brakes should apply.

4.13.3 In case train is being controlled by dynamic brake on locomotive and automatic brake on the trailing stock, if the dynamic brake fails, air brakes on locomotive should be automatically applied in proportion to the position of automatic brake handle.

4.13.4 The supplier shall offer Air / dynamic blending system. The details of equipment along with description and principle of operation should be submitted.

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4.14 Rubber components, such as diaphragm and ' o ' rings etc. whenever used on brake system and their controls shall be entirely suitable for humid and hot environmental conditions in India.

4.15 Overhauling of the pneumatic valves should not be required before eight years.

4.16 Self Test

There shall be a facility for conducting self test, as and when desired, in which the functioning of the brake system and its interface shall be checked thoroughly. In case the system does not pass the self test, the nature of fault shall be displayed. In case of serious fault affecting safety, the locomotive should not be allowed to move unless the fault is rectified.

4.17 Self Diagnostic Feature

Microprocessor Controlled air brake system should have self diagnostic and display feature. The display of fault should be such that it can be easily viewed by the crew, and will not require any opening of cover etc. It should have real time diagnostics which can identify component failures, apply the train brake automatically if safety is compromised and provide trouble shooting information for facilitating repair/replacement. It should be possible to monitor as well as conduct on-board trouble shooting using computer/laptop on fully charged and operational brake system on the locomotive. In case of a proven system, an exception can be made with the approval of RDSO. The vendor will provide complete detail along with additional feature, if any.

4.18 There should be a provision of appropriate battery back up system or other arrangement so that time and date does not change in case of power failure or power off situation.

4.19 There should be an arrangement for isolation of brake system, for carrying out any welding activity in locomotive.

4.20 Brake system pressures and brake application / release timings

The brake system should be capable to maintain following pressure and brake release / application timings. Where timings are not given UIC standard or Equivalent Indian Standards timings can be taken to design brake system.

4.22.1 Pressure specification

Pressure	Values
Main reservoir pressure	8-10 kg/cm ²
Brake pipe pressure	5.0±0.1kg/ cm ²
Feed pipe pressure	6.0± 0.1 kg/cm ²
Full service- reduction in BP	1.6 to 1.8 kg/cm ²
Minimum service- reduction in BP	0.4 to 0.5 kg/cm ²
Maximum independent BC pressure (Arrangement should be there to adjust BC pressure)	For ALCO loco :3.5 kg/cm ² For EMD loco : 5.2 kg/cm ²

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Maximum auto brake cylinder (Arrangement should be there to adjust BC pressure).	1.8 kg/cm ²
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4.20.2 Standard timings

Application and release timings with automatic brake valve, shall be as per UIC specification (UIC CODE 540,5th edition) or Equivalent Indian Standards.

4.21 Pressure gauges

4.21.1 Following gauges are available in the driver cab to indicate air pressure level in various parts of the system.

- .1 MR pressure gauge
- .2 Feed pipe pressure gauge
- .3 Brake pipe pressure gauge
- .4 Airflow indicator
- .5 Brake cylinder pressure gauge
- .6 Any other gauge which is required as per the system offered.

The above gauges are not within the scope of supply of the vendor of Microprocessor Controlled air brake system. It is the responsibility of the vendor of Microprocessor Controlled air brake system to provide suitable signals for the above gauges.

Digital display in analog form for all the above mentioned pressures may be offered as an optional item.

4.22 Air Flow Sensor

Locomotive is to be provided with air flow sensor to show air flow to the brake pipe. The display of the sensor should indicate normal as well as abnormal/excessive air flow to the brake pipe. The microprocessor based control air brake system has to provide a pneumatic signal to the air flow indicator and digital signal to LCC through serial interface for digital display on DIALS.

4.23 Banking Operation

4.23.1 The brake system shall have necessary provision for using these locomotives as banking locomotives.

4.23.2 When locomotive is used for banking operation it should not be possible to charge / release the brakes from banking locomotive. However, it should be possible to apply emergency brakes on the train, if required, by the banking driver.

4.23.3 It shall be possible to apply & release locomotive independent brakes of bankers.

4.24 **Dead Engine Feature**

While hauling a dead locomotive as a trailing locomotive (MU pipe connected), provision shall be made for application and release of brakes on this locomotive from the leading locomotive. While hauling a dead locomotive as a piped vehicle (MU pipe not connected), provision shall be made for application and release of brakes with the help of distributor valve on this locomotive.

4.25 **Loss of Power Feature**

With voltage supply feed to Microprocessor Controlled air brake system getting disrupted there should be facility to apply brakes on train and locomotive by dropping brake pipe. Also with no voltage to Microprocessor Controlled air brake system there should be back up facility to apply brakes on locomotive and train through distributor valve.

4.26 **Bail off Feature (Release of Loco Brake)**

Release of an Automatic locomotive brake while retaining the train brake cylinder pressure can be accomplished by lifting the bail off ring on the independent valve handle. Locomotive brake will remain released unless the automatic handle is in emergency. In this case brakes will reapply when the bail off ring is released.

4.27 **Interface with Locomotive Microprocessor**

It is the responsibility of the vendor of Microprocessor Controlled air brake system to interface with locomotive microprocessor control system using RS 485 input/output electrical and communication interface.

4.28 **Interfacing with Piping and Wiring**

Interfacing with Piping and Wiring of the locomotive shall be responsibility of the vendor of Microprocessor Controlled air brake system.

4.29 Major overhauling of locomotives would be done in eight years. Microprocessor Controlled air brake system should be capable of working for eight years without major overhauling.

4.30 **Compatibility with Distributed Power System**

Purchaser has option to install distributed power system on the locomotive in future. The Microprocessor Controlled air brake system shall be compatible with Distributed Power System. The vendor will provide complete details.

4.31 Up-gradation to EP Assist brake system for passenger stock shall be possible with add-on kit.

4.32 Data/Fault Logging, Diagnostics and Display

The system shall have built in data logging, diagnostics and trouble shooting, including indication of fault status, analysis of the fault data and provision of necessary information to drivers/maintainers. For analysis of fault , the data (essential informations for fault analysis) corresponding to the time of occurrence of fault should be logged along with the real times and date. This function may be executed by the Air Brake System either by itself or through Loco micro-processor control system by necessary exchange of fault data. This fault data shall remain active as long as fault log is active. It should be possible to retrieve all such data. All the logged faults must be chronologically recorded with the real date and time of the occurrence. The fault detection and diagnostics should be of comprehensive nature to include all possible faults, including wiring/connector faults. Any occurrence of fault should be immediately displayed. The fault messaging text shall include the displayed message, fault code, description, real time and date and trouble shooting advice (wherever applicable). It should be possible to recall all details of active fault log. Till the fault(s) details are downloaded, the same shall be considered active fault log.

4.33 Download of data

Suitable provision for downloading the data from locomotive to a computer should be provided. The system should have arrangement for down loading of fault data pack and information pack through common USB port or a serial port so that the data can be downloaded in a pen drive also either directly or through a Portable Test Unit or Laptop.

4.34 Factory and User settable parameters

The vendor should clearly indicate in their offer the list of factory settable and user settable parameters related to air brake system. It should be possible to dummy the user settable feature for a particular parameter (if user settable feature is provided), and in that case, the system shall operate in the default mode.

4.35 Software Change and Up gradation

Any software change as necessitated or felt during use must be proposed, mooted, tested and validated within 90 days. If this software change necessitates hardware change, it should be possible to do the same in situ. For this purpose a suitable simulator should be available by tenderer or its collaborator.

- 4.36 Change in performance, functionality and deviation(s) from scope, if any, of the proposed system shall be brought out clearly in the offer.

5. ADDITIONAL FEATURES ASSOCIATED WITH BRAKE SYSTEM

In addition to the basic technical requirements given in Para 4, following additional features should also be incorporated in the Microprocessor Controlled air brake system being offered:

5.1 Multi-Resetting Vigilance Control Device

5.1.1 The Vigilance Control Device (VCD) feature is provided to enhance the safety of locomotive operation by ensuring alertness of the crew all the time. The system shall be of multi - resetting type i.e. acknowledgement of the system is not only by means of pressing reset push button but by the other normal driving activities (i.e. throttle handling, dynamic brake application, operation of horns, sanders or application of brakes), of the driver during the train operation. This reduces the strain on the driver, as he is not required to press the reset push button always when operating other controls of the locomotive.

VCD feature has to be provided as a part of microprocessor based loco control system. But it is the responsibility of the supplier of microprocessor control air brake system to interface with locomotive microprocessor based control system.

5.2 Automatic indication of train parting and alarm chain pulling to the driver.

Brake system should be capable to indicate train parting, and Guard valve operation/ alarm chain pulling to the driver. This functional requirement is planned to be achieved through Air flow sensor, for which tentative specifications MP.0.01.00.18 (Rev 01 (for stand-alone type) & MP.0.01.00.22 (Rev 00) (for microprocessor compatible) for ALCO locomotives and MP.0.01.00.25 (Rev 00) for WDG-4/WDP-4 locomotives have been issued by RDSO. The microprocessor based control air brake system has to provide a pneumatic signal to indicate airflow. The tenderer should clearly indicate compatibility in this regard, and may also quote separately as an optional feature along with details of their system .

5.3 Automatic switching 'ON' of flasher light

5.3.1 Flasher lights have been provided with on both the sides of diesel locomotives to give indication of abnormal condition to driver of the train coming from other direction.

5.3.2 The flasher light should glow automatically in the direction of train movement in the following emergency / abnormal situations on the train.

1 Parting of a train

2 Emergency brake application by D1 Emergency Valve

Both situations correspond to air flow rate of above 1900 L.P.M. at FAD (approximately).

5.3.3 The flasher light should not glow automatically in the following condition

1 Brake application and release by driver

2 Alarm Chain Pulling, when air is vented through 8 mm choke from the train pipe (which correspond to air leakage rate of about 1400-1800 L.P.M. at FAD)

5.3.4 In above conditions, the flasher light should glow automatically and should not switch OFF due to brake application by the driver. Flasher light should continue to glow till such time above conditions remain on train or the driver switches it OFF manually by a separate reset switch to be provided by loco control system. However, system should be such that if power ON/OFF switch is in OFF position, even then the flasher light should again glow automatically if above conditions (Para 5.3.2) reappear on train. The brake system shall have the required

facility to provide necessary signal for the purpose to Loco Control system. The flasher light operation shall however be subject to the conditions as mentioned in para 5.3.2 & 5.3.3. The air brake system should be compatible to the requirements of auto-flasher light operation as mentioned above.

6. SCOPE OF SUPPLY

- 6.1 The scope of supply includes complete microprocessor controlled brake system as per this specification, along with all pneumatic and electronic components, hardware and software, and associated pipings (if any) , fittings , connectors, cables etc. required for integration of the system with locomotive and its various existing systems .
- 6.2 The following items shall not be in the scope of supply
- i Assistant Driver's Emergency Brake Valve
 - ii Air Flow sensor (Vendor should quote separately for this item)
 - iii Auxiliary Devices : Horns, Sanding, Wipers
 - iv Auto Flasher light
 - v Pressure Gauges

Although the above items are not included in scope of supply, but interfacing with microprocessor control air brake system is essential. Supplier of microprocessor control air brake system should make detailed study of the above items for interfacing purpose.

7. LITERATURE AND DRAWINGS

- 7.1 The tenderer shall submit brake schematic diagram alongwith description of the complete system with the offer. Pamphlets covering schematic diagram, installation drawing of individual assembly shall be submitted alongwith the offer for proper appreciation of the system offered by the vendor.
- 7.2 The tenderer shall submit details along with overhauling periodicity for different valves and brake system as a whole. Offer should also include requirements of spares along with cost of each item for a period of 8 years. The cost of spares will also be given in the offer.
- 7.3 The tenderer shall also indicate the specification, testing procedures, maintenance facilities required for overhauling and proper upkeep of valves, equipments and the system.
- 7.4 The supplier shall submit copies of the instructional, maintenance and test specifications three copies per locomotive covering the following:
- .1 Assembly drawings of various components and schematic diagram with description of individual item and system as a whole.
 - .2 Assembly and disassembly instructions
 - .3 Trouble shooting instructions
 - .4 Testing procedure / specification of individual item
 - .5 Wearing limits of wearing components
 - .6 Rubber kit and spring details

- .7 Overall dimensions and mounting details of individual items
- .8 Particulars of cable entry, if any.
- .9 Weight of various components
- .10 Lubrication chart (equivalent indigenous lubricant may be indicated).

8 INSPECTION, TESTING AND APPROVAL

- 8.1 During the developmental stage, for proper control & monitoring, RDSO will be the Controlling Agency. The supplier shall submit its offer of equipment to RDSO along with all the details of equipment as per clause 8. The firm will be inspected to check capacity and capability as per the ISO Procedure. Manufacturer will be in constant touch with RDSO for design review and prototype development. If found suitable product will be taken up further for prototype inspection.
- 8.2 Prototype inspection
- 8.2.1 The prototype inspection including stage inspection will be carried out by representative of Motive Power Dte. of RDSO/Lucknow at manufacturer's premises. Alternatively, the firm may get these tests done through Independent Safety Assessors (ISA) and submit the report to RDSO. ISA to be selected from the panel of ISAs proposed by manufacturer, after ascertaining that these ISAs and their nominated test agencies are capable to certify complete air brake systems as per this specification and have accreditation as per ISO 17065, which is meant for conformity assessment for the bodies that provide certification.
- 8.2.2 In general the inspection will be carried out according to UIC/RDSO specifications or Equivalent Indian Standards. Detailed type tests inspection scheme will be submitted by the vendor. The test scheme should include testing of complete system as well as testing of individual brake valve/equipment. The test scheme should indicate stage inspection and final inspection on test bench as well as on locomotive. Vendor should get prior approval of test scheme from RDSO/ ISA before actually conducting prototype inspection.
- 8.2.3 There should be proper test equipment/test racks at manufacturer work's premises to conduct such tests. Manufacturer shall arrange for any additional testing required during the prototype approval as per the requirements of RDSO/ ISA. The vendor shall provide, without extra charges material, tools and any other assistance which the purchaser may consider necessary for any test, examination and dimensional checking.
- 8.2.4 The vendor shall, on demand make available manufacturing drawings and specifications to the inspecting authority/ ISA at the time of inspection. Vendor will also submit the test results of the test conducted by them.
- 8.2.5 During prototype inspection manufacturer certificates of components/valves/equipment which have been purchased from outside shall be produced as a proof of quality assurance.
- 8.2.6 Electronic equipment used in the system shall be tested in accordance with IEC-60571 or any other international standard/locomotive builder own standard equivalent to IEC 60571. These tests shall be carried out for prototype only. A certificate (original) from NABL accredited testing laboratory /or any other international reputed testing laboratory shall be considered

satisfactory for this purpose or as decided by ISA.

8.3 Inspection of fitment of the brake system on locomotive.

8.3.1 The installation of first system on diesel locomotive shall be the responsibility of the vendor. Assistance with regard to labour and other facility which are available in the production unit/work shop/diesel shed of Indian Railways would however, be provided to the vendor during prototype installation. Vendor will provide all necessary guidance and technology including any special tooling or wiring etc. required for satisfactory installation of the system on the locomotive.

8.3.2 The fitment aspect of the system will be checked on the locomotive by the representative of Motive Power Dte./ RDSO/Lucknow and purchaser/ ISA in presence of the vendor. It is the responsibility of the vendor of Microprocessor Controlled air brake system to interface with locomotive microprocessor control system. The inspection on locomotive will be carried out generally in accordance with vendor's test plan which will be approved by RDSO prior to testing.

8.4 After successful prototype development and testing, development order will be placed A Microprocessor Controlled Air Brake System shall be subjected to field trial. Quantity of Microprocessor Controlled Air Brake System to be subjected to field trial and field trial period shall be as per RDSO document no- MP-M-8.1-1 (Latest Version). Field performance feedback format is as under:

S. No.	Shed/ Rly.	Loco No.	Date of fitment	Date of failure, if any	Reason of failure	Remarks

The acceptance criteria of field trial shall be the satisfactory field performance of equipment.

8.5 Regular inspection

Regular inspection of the equipment shall be carried out by the purchaser or his nominee. The supplier shall provide, without extra charges, for material, equipment, tools and any other assistance, which the purchaser or his nominee may consider necessary for any test and examination. The supplier shall make available manufacturing drawings and material specifications of the components to the inspecting authority at the time of inspection.

Supplier will offer brake system for inspection after complete checking by them. The test results of every brake system will be submitted to the inspecting authority. Inspecting authority shall carry out all tests necessary to prove that the equipment fulfils the technical requirements, covered in this specification.

9. PERFORMANCE GUARANTEE

The equipment supplied by the vendor shall guarantee the equipment against design and manufacturing defects for a period of two years from the date of commissioning. Notwithstanding anything that may be specified in this specification, the final responsibility for suitability of the design shall lie with the vendor who shall undertake to carry out all modifications and alterations to equipment supplied by them for satisfactory functioning in accordance with this specification as may be necessary during guarantee period. Such modification shall be carried out on all units by the vendor free of cost.

Any damage or unsatisfactory performance of any equipment noticed during the guarantee period shall be rectified or replaced free of cost. The replaced components shall further be under guarantee for two years from the date of their fitment. If replaced component gives unsatisfactory performance in service, it shall be replaced by modified and improved component by the vendor free of cost.

10. AFTER SALE SERVICE

The vendor shall post one of their engineers in the base shed where such equipment is installed for a period of one year after installation and it shall be the responsibility of the vendor for satisfactory operation of the equipment for this period. Indian Railways maintenance staff shall be associated with the vendor's engineer throughout this period. The engineer would impart necessary training to the maintenance and operation staff free of cost.

11. INDIGENISATION

In case the offered system is being manufactured in country other than India, vendor shall arrange for manufacture of equipment in India by transferring the technology to a suitable organization in India. The vendor will give stage wise details of indigenization program.

12. DEVIATIONS

- 12.1 The vendor shall submit clause wise comments from the specification and shall indicate the deviations, if any with the reasons thereof.
- 12.2 Any deviation from the standards laid down in this specification, with a view to improve the performance of the equipment shall be given with details. Supporting documents for such suggestion shall also be given with the offer.

13. TRAINING

- 13.1 Sufficient number of technicians / engineers /officers shall be trained in consultations with the purchaser / RDSO so that adequate staff is available in the field for maintenance. This training shall be at the vendor works and diesel sheds for a suitable period and shall cover maintenance and testing, brake system and design, quality control and trouble shooting.
- 13.2 Adequate numbers of maintenance manual covering schedule maintenance, maintenance

practices, testing , maintenance tools , spare etc and wall charts showing pictorial view of components along with part numbers will be given. These maintenance manuals and wall charts are meant for wider circulation for Railways and fresh copies will be given with each order even if there are no changes in the design.

14. **QUALITY ASSURANCE PLAN (QAP)**

Supplier shall submit their internal quality assurance program in accordance with RDSO ISO procedures.

Supplier shall, on demand by RDSO/ Purchaser/ Inspecting authority nominated by RDSO/ Purchaser, make the records of checks carried out during internal quality assurance available for scrutiny.

14.1 Revision of QAP

QAP is required to be revised with approval of RDSO in case of a change any of the following

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- Change in Quality Control Organisation Set-up.
- Change of official working in Quality Control Organisation.
- Change in machines, which may affect the process/method/mode of production.
- Change of conventional machines by CNC machines.
- Change in control over incoming material such as, Sublet vendor Inspection Criteria
- Change in control over process.
- Change in control over product.
- Change in control over system.
- Addition of any corrective action taken to improve the system by the vendor.
- Alterations suggested by RDSO in the intervening period since last approval.

15. **PREFERENCE TO MAKE IN INDIA :**

The Government of India policy on “make in India” shall apply.

16. **VENDOR CHANGES IN APPROVED STATUS:**

All the provisions contained RDSO’s ISO procedures laid down in Document No. QO-D-8.1-11, dated 28.07.2022 (Titled “Vendor- changes in approved status”) and subsequent version/amendment thereof, shall be binding and applicable on the successful vendor/vendors in the contract floated by Railways to maintain of products supplied to Railways.

17. **DATE OF ENFORCEMENT**

The date of enforcement of the specification is with immediate effect i.e. date of issue of specification.