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लखनऊ
स्थापित:1957

सत्यमेव जयते

Government of India
Ministry of Railways
Research Designs& Standards Organization
L U C K N O W
E S T T : 1 9 5 7

ALCo डीजल–विद्युत लोको में प्रयुक्त कम्पूटर निंयत्रित बेक प्रणाली हेतु एयर फलो इंडिकेटर की विशिष्टि ।

Technical specification of Air Flow Indicator (AFI) for Microprocessor Control Brake System applicable for ALCo Diesel-Electric locomotives

Specification Number	MP.0.01.00.33		
Version Number	01	**Date of Issue**	March' 2021

Brief Description
Technical specification of Air Flow Indicator (AFI) for Microprocessor Control Brake System applicable for ALCo Diesel-Electric locomotives

FOREWORD

1. This specification covers the description of equipment, general, functional, technical, testing, maintenance, and environmental requirements for the Air Flow Indicator for Microprocessor Control Brake System to be used in ALCo diesel locomotives on Indian Railways.

2. Air Flow Indicator is used in locomotives control stands for monitoring the status of brake pipe charging/abnormal air leakage to loco crew.

3. In the event of a conflict between this specification and any other standards or specification quoted herein, the requirement of this specification shall prevail.

4. The operation of Air Flow Indicator, in no way infringes/overrules the rules of normal train operation.

DISCLAIMER

This specification is based on the studies and trials conducted by RDSO. Although every care is taken in specifying details adequately and unambiguously, RDSO shall not liable for any kind of damages / losses incurred by any and all due to errors or omissions in this document. When using the information described herein, the user is ultimately responsible for their own actions, as well as the actions of subordinates and assistants, and the consequences arising therefrom.

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LIST OF AMENDMENTS

S. No.	Amendment Date	Version	Details
1	March' 2021	01	• Revision of clause no. 12 to incorporate Equivalent Indian Standards, field trial performance feedback format & acceptance criteria in compliance of MOM of the VC meeting on Specification/ STRs held on 29.08.2020 • Addition of Clause no. 15 (Preference to Make in India) in compliance of directives issued by GOI for promotion of Make in India policy. • Addition of Clause no. 16 (Vendor Changes in Approved Status) in compliance to Vigilance cell note no. 13/Vig/Policy dated 08.09.2016.

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LIST OF ANNEXURES

1 INTRODUCTION

Air flow indicator is a useful aid in providing visual indication to the driver of the brake pipe conditions in air brake trains. This can be interpreted in to information consisting of variation in brake pipe leakage, state of release of brakes following an application, operation of guard van valve, pulling of alarm chain in passenger train, breakage of brake pipe coupling or train parting. The unit is located on both the drivers control consoles.

2 OBJECTIVES AND SCOPE OF THE SPECIFICATION

The specification covers description of Air flow indicator and its general, functional, technical, testing, maintenance, and environmental requirements for use with Microprocessor controlled air brake system on ALCo locos.

3 TERMINOLOGY / ABBREVIATIONS

Abbreviations	Full form/Description
IEC	International Electro Technical Commission
RDSO	Research Designs & Standards Organization
AFI	Air Flow Indicator
DC	Direct Current
LED	Light Emitting Diode
BP	Brake Pipe
HP	High pressure
LP	Low pressure

4 DEFINITIONS

4.1 Throughout this specification and in any other specification here to annexed, the terms:

4.1.1 "Purchaser" means the President of the Republic of India;

4.1.2 "Tenderer" means Firm's/companies participating in the tender;

4.1.3 "Contractor" means any person, firm or company with whom the order for the supply of the stores to be placed;

4.1.4 "Sub-contractor" means any person, firm or company from whom the contractor may obtain any material or fittings to be used in the supply of or manufacture of stores;

4.1.5 "Supplier" means a party that supplies goods or services. A supplier may be distinguished from a contractor or subcontractor, who commonly adds specialized input to deliverables. Also called vendor;

4.1.6 "Manufacturer" means entity that makes a goods through a process involving raw materials, components, or assemblies, usually on a large scale with different operations divided among different workers. Commonly used interchangeably with producer.

4.1.7 "Inspecting Officer" means the person(s), firms(s) or department(s) and his deputies nominated by the purchaser to inspect the stores on his behalf;

4.1.8 "Engineers" means the Research Designs & Standards Organisation, Ministry of Railways, Manak Nagar, Lucknow – 226011.

4.2 In case of tenderer needs any clarification in respect of any clause of this specification or regarding the drawings the tenderer shall obtain it from Motive Power Directorate, RDSO.

5 BRIEF DESCRIPTION OF THE EQUIPMENT/COMPONENTS & SYSTEM REQUIREMENT

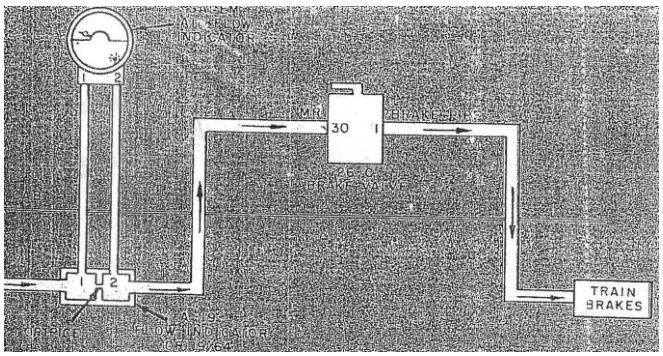
5.1 Air Flow Indicators to drawing no. SKDP-3933 shall be used for Microprocessor Controlled Brake on ALCo locomotives.

5.2 It is like a differential air pressure gauge with two pointers (Top pointer- red & Bottom pointer-white) and two connection ports (i.e '1' & '2' marked) with back face entry. On referring view from front of AFI the port 1 (also called HP) & 2 (also called LP) are located on Left side and Right side respectively.

5.3 Red pointer is called reference pointer, which is attached to a knurled knob and protrudes through the dial glass, so that it can be set manually in any desired position.

5.4 Pressure difference on its connection ports are sensed by the responsive mechanism within gauge assembly and transmitted to its indicating pointer (White) which moves on the scale.

5.5 The numerals appearing on the face of the dial shows the pressure level because of the air flowing through an orifice that has been placed within the locomotive brake system. The heavier the air flow the greater the pressure drop on the downstream side of the orifice resulting in a higher reading on the dial



Schematic of Interface of Air Flow Indicator to Microprocessor control Brake System

5.6 An additional 'Pressure adjusting knob' (needle valve) may be provided in low pressure pipe line near the AFI, if required for improving the feedback of pressure variation to achieve desired functionality.

5.7 A Red LED shall be placed in the Air flow indicator to indicate the crew whenever that rate of air flow exceeds a predetermined point on numeral on the dial face.

5.8 This is backlit type gauge having 16+2 LEDs of white colour. LED connections shall be in parallel.

6 GENERAL REQUIREMENTS

6.1 The sub-assemblies and components of the device shall be properly housed and shall be easily accessible for maintenance and inspection.

6.2 All electrical components shall be protected, enclosed and provided with mechanical dust proofing covers to avoid dust ingress and then mounted in a robust housing so that entire assembly is capable of withstanding shocks, vibration, electromagnetic induction & electrical surge etc as applicable.

6.3 The electrical wires shall be suitably numbered and properly tagged in order to facilitate identification. The electrical connections of positive and negative terminal shall be of different colours in order to distinguish between them. The wires shall be laid properly in a conduit. Loose and dangling wires will not be acceptable.

6.4 When the device is connected to the electric circuit in the locomotive, it shall be connected to the general wiring of the locomotive by plugs or any other suitable connections not requiring soldering.

6.5 It shall have provision to secure the 'LED' leading to prevent stressing their connection at the, LED'.

6.6 The LEDs shall work on DC supply source normally consisting of accumulator battery and/or an auxiliary generator. LEDs used shall be capable of working for their desired functioning from 60V DC to 120V DC power supply.

6.7 The visual indication light shall be prominent enough to be detected immediately on flashing.

6.8 If any pneumatic valves are used in the device, functioning of the valves shall not be affected by moisture, dirt, temperature, fluctuation of pressure etc.

6.9 The system shall have proper filters at all the sensing ports to prevent any malfunctioning.

6.10 The equipment shall work satisfactory for the MR pressure up to 11 kg/cm2.

7 FUNCTIONAL REQUIREMENTS

7.1 The Air flow indicator shall show immediately the rate of air flow to the brake system as follows:

- It shall indicate the flow of air in brake pipe on dial of the air flow indicator,
- The flow indicating pointer (white) shall indicate more than approximately '2' mark on the dial on releasing of Auto brake after Full service application. When Brake pipe is full recharged this pointer shall return to initial position.
- It shall expose the 'RED' light emitted diode (LED) whenever the rate of air flow exceeds the '5' numeral on the dial face to alert the crew of an abnormal flow rate.

7.2 The flow indicator shall read within 3 % of full scale i.e approx± ½ mark. It shall be taken with UP & DN direction, normally at 5 & 10 marks of scale.

8 TECHNICAL REQUIREMENTS

8.1 The gauge dial shall have Black background with white letters and graduations.

8.2 Gauge shall have ports of back face entry.

8.3 Backlit LEDs & 'RED' indicator LED used shall be capable of working for their desired functioning from 60V DC to 120V DC power supply. Same power input wire shall be used for these LEDs.

9 ENVIRONMENTAL/CLIMATIC REQUIREMENTS

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

9.1 Altitude: - Mean sea level to an altitude of 1200 meters.

9.2 Relative Humidity:- Up to 100 %

9.3 Temperature (Ambient air):-

a) Maximum temperature

Stabled Locomotive under sun : 70 deg. C

On board Working loco under sun : 55 deg. C

b) Minimum temperature : - 5 deg. C

c) Average temperature : 47 deg. C

9.4 Ambient conditions: The equipment shall be capable of operating efficiently in spite of dust, dirt, mist, torrential rain, heavy sand or snow storms, presence of oil vapors and radiant heat, coastal area etc. to which rolling stock is normally exposed in service

9.5 The part of the Air flow indicator, if exposed to solar radiation during normal usage, shall remain unaffected by it.

10 MAINTENANCE AND DIAGNOSTIC AID

10.1 Supplier shall arrange to supply along with the equipment, maintenance manuals of the equipment, one with each 5(or less) Air flow indicator. Manual shall contain information pertaining to dimensional drawings of assembly indicating mounting arrangement, principle of operation, maintenance schedules, trouble shooting, details of special tools if required, parts catalogue and testing procedure of the equipment being supplied. Updated position of modifications shall also be incorporated.

10.2 Adequate number of coloured wall charts showing pictorial view of components along with part nos. will be given. The copies of Maintenance Manual and wall charts are meant for wider circulation for Railways and fresh copies shall be furnished as stipulated even if there are no changes in the manual and wall charts furnished against earlier contract.

10.3 Training of purchaser's personnel for operation and maintenance shall be given by the contractor free-of-charge. Demonstration of the working of the device on locomotive shall be given by the contractor free-of-charge.

11 GUARANTEE/WARRANTY

11.1 The supplier shall be responsible for any failure or damage to equipment provided in the locomotive due to defective design, materials, and workmanship up to a period of 24 months after commissioning on the locomotive or 36 months from the date of supply, whichever is earlier. The supplier shall replace/ repair within reasonable time, such equipment during the warranty period at his cost. The period

of warranty shall be extendable in case of recurring problems attributable to defective design, material or manufacturing. The supplier's liability in this respect of any complaints, defects and /or claim shall be limited to the furnishing and installation of replacement parts free of any charge.

11.2 The supplier shall be responsible for carrying out all the modifications at his cost on any part of the equipment during the period of warranty required for satisfactory operation of the equipment as per this technical specification. For any technical decision the final authority from the purchaser's side shall be with RDSO.

12 TESTS & VERIFICATION

12.1 Type Test

Type test shall be carried out on 2 units of Air flow indicator (one loco set). If RDSO feels necessary to conduct type test on some more units, the samples will be picked up at random for further validations of design and drawings. This option shall be exercised by RDSO based on the performance of the unit till design is validated. Once design is validated the final approval shall be given by the RDSO. Following shall comprise type tests:

S.N	Test	Details
1	Visual & Dim. checks	As per Annexure-I
2	Performance Test	As per Annexure II
3.	Effect of voltage variation	As per IEC 60571 or Equivalent Indian Standards, In addition to this firm to submit their suppliers (maker's) test certificate for LEDs.
4.	Insulation resistance test (with wiring harness)	As per IEC 60571 or Equivalent Indian Standards,
5.	Shock tests (complete assembly)	As per Annexure III
6.	Endurance test	As per Annexure III
7.	Any other test specified in the approved QAP as well as desired by purchaser.	As per QAP or as specified by the purchaser

12.2 Routine test

Following shall comprise the routine tests and shall be conducted by the manufacturer on each equipment and the test results will be submitted to the inspection authority before acceptance tests.

a) Visual & dim. checks - As per Annexure-I.
b) Performance test - As per Annexure-II.
c) Effect of voltage variation - As per IEC 60571 or Equivalent Indian Standards,
In addition to this firm to submit their suppliers (maker's) test certificate for LEDs.
d) Insulation resistance test(with wiring harness) - As per IEC 60571 or Equivalent Indian Standards.
e) Any other test specified in the approved QAP or desired by manufacturer - As per QAP or as specified by the purchaser.

12.3 **Acceptance test**

Acceptance test (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 Air flow indicator as unit as per the requirement of the purchase order, for inspection after complete checking by them. The test results of every unit will be submitted to the inspecting authority. Inspecting authority shall carry out all tests necessary to prove that the equipment fulfills the Functional/Technical requirements, covered in this specification. However, following tests shall be mandatory.

a) Visual & dim. checks - As per Annexure-I.
b) Performance test - As per Annexure-II.
c) Effect of voltage variation - As per IEC 60571 or Equivalent Indian Standards, In addition to this firm to submit their suppliers (maker's) test certificate for LEDs.
d) Insulation resistance test(with wiring harness) - As per IEC 60571 or Equivalent Indian Standards.
e) Any other test specified in the approved QAP or desired by manufacturer - As per QAP or as specified by the purchaser.

12.4 **Field trial:**

After successful prototype development and testing, field performance of equipment shall be monitored as specified by RDSO. Supplier shall arrange commissioning, testing & field trials of the prototype equipment in service jointly with Railways/RDSO and shall depute team of engineers to Railway field units for this purpose. Assistance with regard to labour and other facilities which are available in the sheds/production units would, however, be provided to the supplier during prototype installation.

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.

13 PAINTING, LABELING AND MARKING

The equipment shall be appropriately painted for aesthetics and protection. The parts, connection ports, mounting points etc shall be clearly marked in a manner that these are easily readable and remain legible over the lifetime of the equipment. ID plate having Name of Component, Make, Sl. No, Date of Manufacture, Ratings shall be provided on assembly.

14 PACKAGING AND DELIVERY/SHIPMENT IF DIFFERENT FROM IRS

The equipment consists of sensitive and fragile components. These should be packed with precautions required to prevent damage in transit. All requirements of IRS conditions for packaging and delivery shall be applicable.

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 22.01.2021 (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 effect from 1st April'2021.

Annexure-I

A. Visual Check

Sr. No.	Specified			Standards	Observed	Remarks
a)	Month & Year of Manufacturer			Yes		
b)	Name of Manufacturer			Yes		
c)	Painting Quality & Finish of Gauge.			OK		
d)	Backlit type Gauge			Yes		
e)	Colour of sub parts,	Dial,		Black		
		Pointers	Top	Red		
			Bottom	White		
		Backlit LEDs,		White		
		Figures,		White		
		Cables,		White/Black		
		Flange edge, Face & Bezel of flange		Black		
		Indicator Light		Red		
f)	PVC pluge /Rubber cap on shank.			Yes		
g)	Teflon coated cable (1mm thick)			Yes		
h)	Port connections with Back face entry.			Yes		
i)	Ports marked (view from back of AFI)	Right side port (HP)		1		
		Left side port (LP)		2		
j)	Scale marking			0-14		
k)	Gauge should be free from corrosion, Dust particles & Sharp Edge.			OK		
l)	Check for tightness of fasteners & the visual damages			OK		
m)	Dial of polycarbonate material			Yes		
n)	PVC cover for circuit (if applicable)			Yes		

B. Dimension Check (Tolerance as per standard mentioned in the Drg. SKDP-3933)

Sr. No.	Specified (As per Drawing)	Standards	Observed	Remarks
a)	Flange in Sq.	127 mm		
b)	Bezel Dia	114 ±1 mm		
c)	Case Dia	106 mm		
d)	CRS of mounting holes in sq.	108 mm		
e)	Dia of mounting Holes	5.5 mm X 4 nos		
f)	Case & Bezel Height	62 mm		
g)	Air connection center to center	35 mm		
h)	Distance of shank centre line from CL of Case	25.4mm		
i)	SQ. Mounting Flange thickness	3.2mm		
j)	Thread size of shank (HP & LP)	¼" Taper Pipe thread to IS:554 (male)		
k)	Length of shank	4.76+15.88mm		
l)	No of LED	16+2		
m)	For union nut	3/8" BSP		

Annexure-II

Performance Test

Test description	Standards	Observation
(i) Leak test: • Keeping the port 2 open and apply pressure of 10 PSI to port-1 and pointer reading should be 10± ½ mark. Check the air leakage at port 2, bracket surface and body surface using soap water solution. • Apply 140 PSI to port 1 and port 2 and check leakage at bracket surface and body surface using soap water solution.	No leakage No leakage	
(ii) Pneumatic test: The Air Flow indication pointer exposes the 'RED Indicator LED' whenever flow Exceeds '5' numeral on dial face (Red LED shall work with 60 -120V DC).	Should expose Red indicator LED	
(iii) Accuracy Test (Calibration): The AFI shall be subjected to pressure equal to the maximum scale value and shall be maintained at that pressure for not less than 1 hour. After that the pressure is released and without recalibration or adjustment, the gauge shall be tested for accuracy with readings taken both up and down the scale.	The error in indication, with either UP & DN, at 5 & 10 marks shall not exceed ± ½ marks.	As per table given below

Observation of Air flow indicator:

S. no.	Conduct test maintaining HP line pressure in the range 120-140 PSI Readings to be seen in master gauges (in PSI) on HP & LP Line	HP line pressure	LP line pressure	Reading on AFI Gauge	Remarks (OK/ Not OK)
Up direction					
1.	Keep HP & LP line pressure equal				
2.	Keep LP line pressure 5 PSI lower than HP line pressure				
3.	Keep LP line pressure 10 PSI lower than HP line pressure				
Down direction (Raise flow to indicate 14 marks on scale and then record reading on return at 10 and 5 marks)					
4.	Keep LP line pressure 10 PSI lower than HP line pressure				
5.	Keep LP line pressure 5 PSI lower than HP line pressure				
6.	Keep HP & LP line pressure equal				

Annexure-III

Shock & Endurance Test

Shock Test	**Endurance Test**
The gauge shall be subjected to a shock test, shaking with an acceleration of 30 m/s^2 at a frequency of 80 to 120 shocks per minute for a period of not less than 2 hours. After this test the AFI gauge error should not change by more than ± ½ marks.	The gauge will be subjected to a pressure fluctuation of 25% to 75% of maximum scale value. The frequency of fluctuation will be kept subject to system need/per minute for a minimum 15000 cycles. After testing the error/difference at 5 & 10 marks of the gauge before and after the endurance test shall be within ± ½ marks.

Observation on Air flow indicator:

S. no.	Conduct test maintaining HP line pressure in the range 120-140 PSI Readings to be seen in master gauges (in PSI) on HP & LP Line	HP line pressure		LP line pressure		Reading on AFI Gauge		Remarks (OK/ Not OK)
		Before test	After test	Before test	After test	Before test	After test	
Up direction								
1.	Keep HP & LP line pressure equal							
2.	Keep LP line pressure 5 PSI lower than HP line pressure							
3.	Keep LP line pressure 10 PSI lower than HP line pressure							
Down direction (Raise flow to indicate 14 marks on scale and then record reading on return at 10 and 5 marks)								
4.	Keep LP line pressure 10 PSI lower than HP line pressure							
5.	Keep LP line pressure 5 PSI lower than HP line pressure							
6.	Keep HP & LP line pressure equal							