No. S 38-70

GOVERNMENT OF INDIA

MINISTRY OF RAILWAYS

(RAILWAY BOARD)

INDIAN RAILWAY STANDARD SPECIFICATION

for

AUTOMATIC WARNING SYSTEM

(ac Inductive Type)

(Tentative)

Serial No. S38-70

Issued by

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0. FOREWORD.

0·1 This specification is issued under the fixed Serial No. S 38 ; the final number indicates the year of original adoption as standard, or in the case of revision, the year of last revision.

ADOPTED, 1970

0·2 This specification requires reference to the following specifications :—

IS : 589—Basic climatic and mechanical durability tests for electronic components.

IRS : S23—Electrical Signalling and Interlocking Equipment (Tentative)

IS : 694—PVC insulated cables C for voltages upto (Part-I). 1100 V) : Part I with copper conductors.

0·3 Wherever reference to the standard mentioned in clause 0·2 appears in this specification, it shall be taken as a reference to the latest version of the standard.

0·4 This standard is intended chiefly to cover the technical provisions and the provisions relating to the supply of the materails and does not include all the necessary provisions of a contract.

1. SCOPE

1·1 This specification covers the general, operational and technical requirements of Automatic Warning System hereafter referred to as AWS System and equipment specification.

1·2 This specification will need suitable elaboration at the time of tendering having a reference to the type of locomotives, braking and other requirements as specified by the Purchaser.

2. SYSTEM SPECIFICATION

2·1 General Requirements

2·1·1 The AWS equipment shall consist of :—

(*a*) Track Device

(*b*) Locomotive Device

(*c*) Ancilliary Equipment ; and

(*d*) Installation and Maintenance Testing Instruments.

2·1·2 The track device shall be passive and shall include necessary coils, cores, condensors and other auxilinries properly encased in a suitable material to make it difficult to pilfer and housed in a box with terminals brought out in a covered compartment of the same housing for external connections. This housing shall be capable of being fixed on to the sleepers by bolts and nuts. The track device shall be compatible with the locomotive device.

2·1·3 The track device is intended to warn the driver that he is approaching a stop signal and to automatically initiate the brake application as required and as explained hereinafter.

2·1·4 The locomotive device shall be compatible with the track device and shall consist of the following :—

(*a*) The locomotive coils and condensors properly housed in a weather-proof casing with the connections of the coils and condensors terminated on a multi-pinsocket.

(*b*) Multi-core cable with both ends terminated on multipin plugs to fit at one end in the multi-pin socket indicated in clause 2·1·4 (*a*) and at the other end in the multi-pin socket provided in the evaluation equipment mentioned in clause 2·1·5 (*b*). The length of the cable shall be prescribed by the indentor and it shall cover the distance between the two multi-pin sockets mentioned above and laid in such a manner as to be of no hindrance to the maintenance of the loco parts.

2·1·5 The ancilliary equipment of a locomotive device shall consist of the following :—

(*a*) Necessary bells, hooters, indicators and acknowledgement buttons/levers housed in proper boxes. The box housing the indications and acknowledgement buttons/levers shall be capable of being fixed in front of the driver in such a position as to be easily seen and operated by the driver.

(*b*) Evaluation equipment which shall receive indications from the locomotive device evaluate them and operate relay, indication lamp, hooter and bells as required.

(*c*) Arrangements for final action such as automatic application of brakes on locomotives, either directly or through vigilance or deadman's device on diesel/electric locomotives, electric multiple unit stock (EMU)/diesel multiple unit (DMU), where available.

(*d*) Arrangement for charging of batteries (see clause ·23·15·2).

2·1·6 The proper number of maintenance test kit which include testing instruments for aligning and adjusting of track devices and locomotive devices independently shall be provided. The number of each type of instrument shall be decided later by the Purchaser. Special installation tools and instruments, if necessary, shall also be provided.

2·1·7 The battery supply will be arranged by the Purchaser. The tenderer shall state load on the battery.

2·2 Operating Requirements

2·2·1 Normally a blue lamp shall remain lit up inside the cab indicating that the AWS system is in working condition.

2·2·2 When a locomotive passes over a track equipment and if the corresponding stop signal is showing a permissive aspect, a clearly audible bell shall ring in the cab for about 5 seconds. No visual indication need be provided, but the blue proving lamp shall extinguish during the operation of the bell, and reappear after the bell stops ringing.

2·2·3 In case the stop signal is showing a danger aspect a hooter warning shall sound inside the cab. The blue proving lamp shall be extinguished and a white warning lamp shall be lit up.

2·2·4 If the driver acknowledges the warning referred to in clause 2·2·3 within 7 seconds by pressing a button/lever, the AWS system shall not initiate automatic brake application and the blue proving lamp shall be lit up. The hooter and white light shall, however, continue for another 7 seconds.

2·2·5 If the driver fails to acknowledge the warning within 7 seconds after the hooter starts sounding, the system shall proceed to apply brakes automatically.

2·2·6 When the brakes are applied automatically, it shall not be possible to release them till the train comes to a stop. The resetting button/lever shall be located in such a manner that it shall not be possible for the driver to operate the same, while the train is in motion and it may be accessible from the ground within easy reach of the driver.

2·2·7 Each instance of automatic brake application shall be recorded on an electric counter which shall be capable of being sealed.

2·2·8 Each instance of appearanace of danger aspect indication in the cab, as well as its acknowledgement shall be suitably registered. For this purpose, make contacts from suitable relays, shall be provided and wired upto the terminals.

2·2·9 *Additional Requirements in Automatic Territories*

2·2·9·1 When the automatic signal with 'A' marker showing a red aspect is passed, a red lamp shall be lit up inside the cab and it shall remain lit. This red lamp indication shall be cancelled when the driver passes the track device ahead and presses the acknowledgement button/lever provided for the purpose. The red indication while it is on, reminds the driver that he is to proceed ahead cautiously at a speed not exceeding 15 Kmph. In case the locomotive speed exceeds 20 Kmph., while passing over the track device of the red signal, automatic application of brakes shall take place immediately and the hooter shall sound. Resetting and recording of such automatic brake application shall be according to clauses 2·2·6 and 2·2·7.

2·2·9·2 During the period the red indication lamp is lighted, every time the speed of the train exceeds 20 Kmph., the hooter shall sound. In case the driver takes action and reduces the speed of the train to 20 Kmph. within 10 seconds of this warning, the hooter shall stop. The driver should then further reduce the speed to 15 Kmph. If the speed is not brought down to 20 Kmph. within the 10 seconds, as stated above, automatic application of brakes shall take place and the hooter shall continue to sound. Resetting and recording of each such automatic brake application shall be according to clauses 2·2·6 and 2·2·7.

2·2·9·3 On operation of the resetting button/lever, the brake application shall get cancelled and hooter shall stop. The red lamp indication shall, however, continue to remain lighted to remind the driver that he is still to proceed at 15 Kmph. Everytime the driver exceeds the speed of 20 Kmph. during the period the red lamp is on, action as indicated in clause 2·2·9·2 shall take piace.

2·2·10 It shall not be possible to mute the warning and automatic brake application by prior operation of the acknowledging button/lever. A suitable device shall be provided so that, if it is kept actuated beyond 3 seconds, the brakes would apply automatically.

2·2·11 The design of the circuit shall be such that the hooter and the white light appearing in the case of stop signal showing danger aspect shall not get automatically cancelled under any circumstances without acknowledgement by the driver.

2·3 Technical Requirements

2·3·1 The device shall be of Intermittent ac Inductive type and shall work as a 'point control system'.

2·3·2 The locomotive device and evaluation equipment shall work on 'Permanently Energised' principle and in the event of a fault, train must come to a stop as if conditions are as in clause 2·2·5.

2·3·3 Extraneous currents or other traction currents shall not be able to give a false indication/actuation.

2·3·4 The system shall be applicable to both single and double line sections of Broad Gauge (1676 mm.) and Metre Gauge (1000 mm).

2·3·5 The track and locomotive equipments shall be capable of being so installed that they do not infringe the relevant Broad Gauge or Metre Gauge Schedule of Dimensions of Indian Railways.

2·3·6 It shall be suitable for use on steam, diesel and electric locomotives of 1500V dc and 25 KV, 50 cycle ac type. It shall be capable of being used on Electrical Multiple Unit stock/Diesel Multiple Unit stock also. It shall not be affected by thyristors used in ac electric locomotives.

2·3·7 It shall be capable of being linked to 'Vigilance' or 'Deadman's device' on the Diesel and Electric locomotives, EMU/DMU.

2·3·8 It shall be capable of being linked to the vacuum brake system used on Indian Railways. It shall also be capable of being linked to the air brake system used on Electric/Diesel Multiple Units.

2·3·9 In the case of steam locomotive, it would be sufficient if brakes are caused to be applied by :—

(*a*) Venting the train pipe to the atmosphere ; and

(*b*) Stopping steam supply to ejector.

In the case of diesel and electric locomotives the system shall not only operate the brakes but also cut off power.

2·3·10 It shall be applicable to speeds upto 200 Kmph. both on straight and curved tracks.

2·3·11 The receiver on the locomotive shall be so located and mounted that it would function correctly over the limits of transverse and vertical movements on the appropriate parts of the locomotive/EMU/DMU relative to the centre of track. These limits are as under :—

(*a*) Transverse	...	±40 mm.
(*b*) Verticals	...	±50 mm.

2·3·12 Where the system does not tolerate sufficient air gap, the mounting of the receiver shall be adjustable within ±45 mm. minimum to cater for the static displacements like wheel tyre wear etc.

2·3·13 The adjustments shall be secured against severe vibrations.

2·3·14 A suitable sealed device shall be provided to isolate the AWS on the locomotive in the event of any fault.

2·3·15 *Power Supply.*—

2·3·15·1 The locomotive equipment shall be workable from the dc battery supply indicated below :—

(*i*) 24 V dc battery supply (fluctuation +20% to —10%) in case of steam locomotive.

(*ii*) 110V dc nominal varying from 68 V to 136V dc in case of electric locomotive and EMU stock.

(*iii*) 72V dc nominal varying from 43V-to 87V in the case of diesel locomotive.

2·3·15·2 Arrangements for charging the 24V battery from steam locomotive generator giving an output of 32V at 100. cps shall be incorporated in steam locomotive equipment.

2·3·15·3 The power consumption shall be low.

3. EQUIPMENT SPECIFICATION

3·1 General

3·1·1 The design of the track equipment shall be such that it is not damaged by infringing parts of the rolling stock. Suitable ramps, where necessary, shall be provided for the purpose.

3·1·2 The track and locomotive equipment shall be robust and housed in casings which are water proof and their operation shall not be affected by vibrations, shock, temperature changes, humidity and other severe operating conditions to be expected in railway working.

3·1·3 The electronic parts of the equipments shall be solid state.

3·1·4 The modules liable to develop faults shall be plug-in type to enable the replacement of the defective ones quickly. Plugged-in parts shall be secured in position against vibrations.

3·1·5 Parts of the same Manufacturer shall be interchangeable.

3·1·6 Printed circuits shall invariably be used in electronic circuits.

3·1·7 The units shall be fabricated from industrial grade components.

3·1·8 Chassis and cabinets shall be so designed that chassis assembly can be readily replaced.

3·1·9 All component parts shall be so arranged and mounted as to be easily accessible and replaceable without appreciable disturbance to other parts of the unit.

3·1·10 Mounting for semi conductor devices shall be so designed that the device may be removed or installed without damage.

3·1·11 The various types of relays used shall, conform to the relevant BS, BRS, AAR or any other specification to be approved by the Purchaser.

3·2 **Chassis, front panels and mounting details**

3·2·1 Chassis, front panels and mounting details shall be either aluminium alloy or steel.

3·2·2 If steel is used, all parts shall be given a corrosion resisting treatment after all machine operations have been completed.

3·2·3 If aluminium is used, front surface shall be etched prior to finishing.

3·2·4 Adequate rigidity shall be provided to prevent undue distortion.

3·2·5 Terminal boards, printed circuit boards and medule circuit cards shall be of non-hygroscopic insulating material of such nature that under any specified service condition, or in the process of etching, mounting of components and soldering, the insulating material shall not be damaged.

3·3 **Wiring**

3·3·1 All wiring shall be with PVC insulated cable complying with IS : 694 (Part I)*.

3·3·2 Wiring shall be colour coded or otherwise marked to differentiate between various types of circuits.

3·3·3 Where insulated leads pass through holes in the chassis the hole shall be equipped with ebonite grommets having a smooth finish.

3·3·4 Only non-corrosive soldering flux shall be used.

3·3·5 All wires connected to terminals which require soldering shall be securely fastened to the terminals by crimping the terminals firmly on the wire or the wire on the terminals before soldering, and shall not depend on solder for mechanical strength. Special care shall be taken to avoid dry solders.

*PVC insulated cables (for voltages upto 1100V): Part I with copper conductors.

3·3·6 Wire size and electrical connections shall be consistent with service requirements.

3·3·7 The length and type of the connecting cable between the track magnets and the controlling relays shall be indicated by the Purchaser so that the tenderer shall provide suitable arrangements in the track device to compensate the effects of the cable.

3·4 **Acessibility of parts**

3·4·1 All circuit components shall be so mounted in the chassis assemblies as to permit their replacement without appreciable disturbance to other components.

3·4·2 All switches and controls shall be mounted in such a manner as to permit their convenient replacement without removal of other units.

3·4·3 All sub chassis, modules or circuit boards shall be mounted in such a manner as to permit their convenient replacement without appreciable disturbance to either assemblies or components.

4. INSPECTION AND TESTING

4·1 Inspection and tests shall be carried out to ensure that all requirements of this specification and all specifications mentioned and drawings supplied, if any by Purchaser, are complied with.

4·2 **Acceptance Tests**

4·2·1 *Type Tests*

4·2·1·1 *Climatic Test.*—The equipment shall comply with the climatic and evironment tests as per IS : 589* to the severity conditions laid down in the Appendix 'C' of this Specification.

4·2·1·2 To obtain a Type Approval Certificate, the Manufacture or Supplier shall submit to the Testing Authority sufficient number of samples, for conducting all the tests as per this specification. The samples shall be selected at random from the regular production lots so as to be as representative as possible of the type under consideration.

*Basic climatic and mechanical durability tests for electronic components.

4·2·1·3 A Type Approval Certificate shall be issued to the Manufacturer if samples pass all the prescribed tests in accordance with this specification.

4·2·1·4 A Type Approval Certificate once issued shall not be valid if a change in the design, construction, material used or manufacturing process is made subsequently, unless this change has the approval of the Purchaser or his nominee.

4·2·1·5 *Maintenance of Type Approval.*- At the end of the validity period of 3 years or earlier, if necessary, the Testing Authority may call for fresh samples for type testing for the purpose of maintenace of the Type Approval.

4·2·1·6 *Rejection and Retesting.*—If the relays fail in any test, the Testing Authority may consider the requirements of Type Approval as not having been satisfied and may call for fresh samples not exceeding double the original number for the purpose of retesting. In such a case a detailed report on the tests carried out shall be furnished to the Manufacturer after incorporating in the equipment any modification considered necessary. The specific test or tests to be carried out shall be at the discretion of the Testing Authority, who may wish to carry out all the related tests whether or not the earlier tests were satisfactory. In all cases, for the repeat tests to be carried out on the second set of samples, twice the number of samples originally used for the specific test in the first series shall be used. If in the second series, no single failure occurs, the equipment shall be considered to have passed the Type Tests.

4·2·2 *Routine Tests.*—

4·2·2·1 *Di-electric Test.*—With electronic unit, if any, removed, the equipment shall withstand the di-electric tests in accordance with clause 14·3·2·1 of IRS Specification No. S23*.

4·2·2·2 *Insulation Resistance Tests.*—After conducting the di-electric tests stated in the above sub-clause, the insulation resistance test shall be made in accordance with clause 14·3·2·2. of IRS Specification No. S23*.

4·2·3 *Performance Test.*—The equipment to be accepted shall be tested so as to comply with the operational requirements as specified in clause 2·2 and also against clause 2·3·11, when installed according to clause 2·3·5.

4·2·4 The Inspecting Authority shall carry out routine test and performance test on a percentage of the lot to be inspected.

4·2·5 The sampling plan for acceptance purposes shall be subject to agreement between the Purchaser and Supplier. In the absence of any such specific agreement, the double sampling plan given in Table No. I shall be adopted.

Table No. I.

Lot consisting of	First sample size (N1)	Second sample size (N2)	Combined sample size (N1 + N2)	Acceptance number (C1)	Rejection number (C2)
1	2	3	4	5	6
Under 25 ..	3	6	9	0	2
25 to 50 ..	7	14	21	0	3
51 to 100 ..	10	20	30	0	3
101 to 200 ..	13	26	39	0	5
201 to 300 ..	20	40	60	1	5
301 to 500 ..	25	50	75	1	6
501 to 800 ..	35	70	105	2	7
801 to 1300 ..	50	100	150	3	10
1301 to 3200 ..	75	150	225	5	12
3201 to 8000 ..	100	200	300	6	17
8001 and above..	150	300	450	9	24

*Electrical Signalling and Interlocking Equipment (Tentative).

4·2·6 The number of equipment (N1) as given in Col. 2 shall be first selected and subjected to the acceptance tests. If in the first sample the number of defective equipment that is those failing in one or more acceptance tests, is less than or equal to the corresponding acceptance number (C1) given in Col. 5 the lot shall be considered as conforming to the requirements of the acceptance tests. If the number of defective equipment in the first sample is greater than or equal to the rejection number (C2) given in Col. 6 the lot shall be considered as not conforming to the requirements of the acceptance tests. If the number of defective equipment in the first sample lies between (C1) and (C2) a second sample of size (N2) as given in Col. 3 shall be selected and subjected to acceptance tests. If in the combined sample, the number of defective equipment is less than (C2), the lot shall be considered as conforming to the requirements of acceptance tests, otherwise not.

4·2·7 *Method of Selection.*—The equipment for acceptance tests shall be selected at random from atleast 10% of the packages. For random selection of packages, all the packages in the lot shall be arranged in a serial order and every r th package shall be selected until the requisite number of packages is obtained, 'r' being the integral part of :—

$$\left(\frac{\textit{Total No. of packages in the lot}}{\textit{Total No. of packages to be selected}}\right).$$

From each package, equal number of equipment shall, as far as possible, be drawn to make up the sample size required for the acceptance tests.

4·2·8 *Test Report.*—A complete test report of all the tests conducted shall be submitted, giving the detailed observations made in every case and actual values recorded. Specific mention shall be made wherever the equipment has failed to comply with the requirements and also indicating as to how far it has failed to comply.

4·2·9 *Disposal of Samples.*—Sample equipment which have been subjected to Type Tests mentioned in clause 4·2 shall not form part of the supply.

5. MANUFACTURE

5·1 The Manufacturer shall ensure that in addition to all the provisions of this specification, the requirements of other specifications referred to in this specification as far as they are applicable and any specifications prescribed by the Purchaser are fully complied with.

5·2 Workmanship, limits and fits, insulating materials, electromagnetic coils, electrical contacts and springs, terminals, wiring, rejection, marking and identification, packing and warranty shall be in accordance with the requirements in IRS Specification No. S23*.

5·3 The Manufacturer shall have suitable inspection facilities and testing equipment at their works.

APPENDIX 'A'

INFORMATION TO BE SUPPLIED BY THE PURCHASER

A—1. The types of locomotives including brake system (Clauses 1·2 and 2·1·5 (*c*).

A—2. The length of the multi-core cable required (Caluse 2·1·4.)

A—3. The length and type of the connecting cable (Caluse 3·3·7)

APPENDIX 'B'

INFORMATION TO BE SUPPLIED BY THE TENDERER

B—1. The load on the battery for locomotive equipment (Caluse 2·1·7).

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*Electrical Signalling and Interlocking Equipment (Tentative)

APPENDIX 'C'

OUTLINE OF TESTS AND DEGREES OF SEVERITY

For climatic testing of equipment (Caluse 4·2·1·1)

Sl. No.	*Test.*	*Degrees of severity.*		
1	Cold ...	—25°C		
2	Dry heat ...	+85 C		
3	Damp Heat (long term) ...	37 C to 27°C, RH : 95 to 100% during 28 days.		
4	Damp Heat (accelated) ...	55°C RH : 95 to 100% 2° cycles of 24 hours each.		
5	Vibration.—	*Sweep range c/s.*	*Displacement peak to peak).*	*Duration for fatigue test.*
	(*a*) Resonance Search.			
	(*b*) Fatigue			
	Severity II ...	10 to 55.	1·5 mm.	6 hours.
6	Mould Growth ...			
7	Salt Mist (Severity II).			4 days.
8	Dust ...			

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