

RESTRICTED



QUALITY ASSURANCE INSTRUCTIONS
FOR

FUEL GAUGE SENDING UNIT

MT3 - IC 000CB

No CQA(HV)/QAI/FUEL GAUGE SENDING UNIT

APPLICABLE TO AJEYA TANK

CONTROLLERATE OF QUALITY ASSURANCE
(HEAVY VEHICLES)

AVADI , MADRAS - 600 054

RESTRICTED

IMPORTANT NOTES

NOTE : 1

This is only a provisional instruction and will be amended from time to time according to the requirement. No addition, deletion and reproduction will be done without the permission of Controller, CQA(HV) Avadi : Madras - 600 054.

NOTE : 2

Any instruction contained in this does not prejudice the terms and conditions of the contract what so ever. In case of any contradiction between the contents of this QAI and the clauses in the contract, the latter will prevail.

NOTE : 3

The stores should be manufactured strictly as per the drawings supplied by the Inspection Authority only and not as per the samples, if any received by the manufacturer for guidance purpose.

NOTE : 4

Any amendment issued by the AHSP shall be incorporated in the QAI and the records for the amendments carried out should be maintained as per the proforma at Appendix 'B'.

RESTRICTED

CQA(HV)/QAI/FUEL GAUGE SENDING UNIT

MINISTRY OF DEFENCE

DGQA

CONTROLLERATE OF QUALITY ASSURANCE (HEAVY VEHICLES)

AVADI MADRAS-600 054

QUALITY ASSURANCE INSTRUCTIONS

CQA(HV)/QAI/FUEL GAUGE SENDING UNIT

FOR

FUEL GAUGE SENDING UNIT TS-IC-000 Cb

APPLICABLE TO

AJEYA TANK

(NO OF SHEETS 22)

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C O N T E N T S

QUALITY ASSURANCE INSTRUCTIONS

CQA(HV)/QAI/FUEL GAUGE SENDING UNIT

FOR

FUEL GAUGE SENDING UNIT N73-1C-000C6

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PART - I

GENERAL

INTRODUCTION

The Quality Assurance Instruction for the Fuel Gauge Sending Unit W T3-1C-000 Cb

has been prepared based on the relevant design documents of the collaborators. The details of the materials of the various components forming part of this Fuel Gauge Sending Unit W T3-1C-000 Cb are given in the collaborators specifications such as GOST, OSZ, etc. etc. The various manufacturing processes adopted by the collaborators are available in the technological process sheets. These process instruction sheets are available with the AHSI i.e. The Controller, Controllerate of Quality Assurance (Heavy Vehicles), Avadi : Madras-54.

All clauses of this process documents having relevance to the quality of the Fuel Gauge Sending Unit W T3-1C should be taken note of and guidance taken for implementation while manufacturing and assembling the Fuel Gauge Sending Unit W T3-1C. The performance and other requirements laid down in this QAI are generally as per the relevant specifications and standards of the collaborators.

Aim

2. This QAI lays down various requirements of the Fuel Gauge Sending Unit W T3-1C-000 Cb and is issued to standardize the inspection procedures and acceptance norms. It aims at giving adequate information to the manufacturers on the quality requirements so that required quality control methods are established. This will also guide the Inspection Officers during the

inspection and, thereby will ensure that the accepted articles meet the stipulated standards.

SCOPE

3. This QAI sets out the inspection procedure and acceptance criteria for the Fuel Gauge Sending Unit. The

The

recommended quality assurance programme stipulated herein are mandatory and should be strictly adhered to.

4. These QAIs are liable for amendment as and when necessary by the AHSP.

5. For inspection purposes, only the latest issue of this QAI will be made applicable and required number of copies of this QAI can be obtained from the issuing authority i.e. The Controller, CQA(HV) Avadi Madras-54.

6. All queries of the QAI should be referred to the issuing authority.

7. For any departure from this QAI, the AHSP should be approached in writing and only after obtaining the written approval for the departure, manufacture should commence.

DRAWING

8. On placement of a firm supply order, a set of applicable certified drawings will be forwarded to the contractor and the respective Inspection officer.

SPECIFICATIONS

9. A set of Soviet specifications and texts connected with the fuel Gauge Sending Unit V13-IC-003e obtained from the AHSP. These comprise of GOST, OST, TYS, Tex s etc. Any clarification required on these documents should be obtained from the AHSP. Equivalence of the

specifications and standards will be decided only by the AHSP and should not be unilaterally decided. For any change in the specifications, standards or written texts, the AsHSP should be approached in writing. Only based on the AsHSP's written approval any alterations in the specifications can be effected and not otherwise.

PROCESS SHEETS

10. The process instruction sheets supplied by the collaborators are available with the AHSP. The relevant process sheets may be studied at the premises of the AHSP.

11. The contractors, after scrutiny of the concerned process sheets and connected paper particulars, should establish the necessary production and inspection facilities. Particularly the inspection test stands, fixtures, templates, gauges etc, should be provided as recommended in these process sheets.

TEST STANDS

12. Gauges, templates, test stands, inspection fixtures and instruments required for the quality assurance testing should be provided by the contractor. Any information available in the technological documents about the inspection requirements and test stands can be obtained from the AHSP. Contractor is at liberty to use any equivalent inspection system provided it meets the technical requirement of testing.

MATERIAL

13. The material used for the components of the Fuel Gauge Sanding Unit should be as per the materials indicated in the individual part drawings. All precautions should be taken by the manufacturers to use the correct grade of material

as stipulated in the design documents. In exceptional cases, any changes, considered essential with regard to the material or material grade should be referred to the AHSP for their approval in writing before undertaking the manufacture of the part.

14. The AHSP and the Inspection officer will be at liberty to draw material test specimens and samples from any stage of manufacture.

INTERCHANGEABILITY

15. The Contractors of Fuel Gauge ^{Sending Unit} should generally comply with the requirements indicated in the design documents with regard to material, construction and performance.

16. Efforts should be made by the manufacturer to adhere to the documents for the manufacture. However, due to any manufacturing constraints, if equivalents are to be used or marginal variations are to be adopted, the same will be got approved from the AHSP. But all the requirements as given in the inspection schedule (Quality Assurance Tests) will be fully complied with.

STANDARDS

17. The technical supply conditions for material and parts of the Fuel Gauge ^{Sending Unit} are given in the drawings, specifications. Manufacturers should ensure that the standard of manufacture and process employed are sufficient to meet the functional and reliability requirements.

SPECIAL NOTES

18. Fitment and performance of the Fuel Gauge Sending Unit should be compatible to the system.

19. Stores should be strictly manufactured only as per ^{and specifications} the drawings/supplied by the AHSP and not as per samples, if any received by the manufacturer for guidance purposes.
20. Inte-grated system check will be carried out as per the directions of the AHSP.
21. All bought-out articles should be checked by the incoming quality control section of the contractor. The scope and methodology of quality control of the incoming materials and parts should be established in consultation with the AHSP and the Inspection officer.
22. Any technical documents that should be made available to the AHSP and Inspection officer will be intimated by the concerned authorities. The contractor should provide free access to these documents for the scrutiny.
23. The requirement of technical documents such as operating instructions, service instructions, workshop-manuals, system layout etc, for the items and assemblies covered by this QAI, will be intimated by the AHSP and should be prepared and provided by the contractor. Sufficient copies of these documents should be supplied to the AHSP alongwith the first bulk supply. Vetting of these documents will be carried out by the AHSP.
24. Only after 100% pre-inspection by the contractor ^{Fuel Gauge Sending Unit}assy should be offered to the Inspection officer for inspection.
25. While tendering the Fuel Gauge Sending Unit for inspection, a test certificate indicating the tests carried out by the contractor should be given to the Inspection officer and the AHSP. The proforma of the certificate is given at Appendix 'A' of this QAI.

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26. Before undertaking any testing, Inspector should ensure that they are using only calibrated measuring instruments and gauges. The contractor should maintain a calibration record sheet for all the measuring instruments and gauges. This record sheet will be periodically checked by the Inspection officer. Inspection officer may also undertake calibration tests under his supervision and control. Inspection officer will also check the inspection fixtures, gauges and templates periodically.

27. Inspector should punch the acceptance mark (V⁺ Mark) on the body of the Fuel Gauge Sending Unit only after ensuring that the Fuel Gauge Sending Unit comply to the requirement of the QAI.

28. The working place and environment of the inspection area should be clean and be such that it does not affect the test-stand instrumentation or components under inspection.

29. The minimum testing time for completing the climatic and dynamic tests is approximately six months. Contractor is advised to submit the samples for testing, taking into account this lead time.

30. Samples which have under-gone the climatic, dynamic or endurance tests should be "YELLOW BANDED" on the outer casing. The yellow banded samples should NEVER be consumed in production or service. For all queries on Yellow banding of samples, AHSP should be consulted in writing. Proper records for co-relating the S.No. and date code of the Yellow banded samples should be made available to the AHSP by the Inspection officer.

31. Any sample which has failed in the climatic, dynamic or endurance test should NOT be yellow banded, but should be returned to the contractor.

32. All markings on the parts, assys, name plates, inspection plates, etc. should be done only in ENGLISH and not in any other language. In case of any doubt, AHSP should be consulted in writing. The location of markings, name plate and instruction plate should be as per the connected part of assy drawing.

33. Type approved Connectors, Plugs, Cables, switches, Relays, Diodes, Transistors, Circuit Breakers, Fuse Units, bulbs and other electrical and electronic hardwares shall be used. Type approval certification for these electrical and electronic hardwares should be obtained from the electronic discipline AHSP (i.e. The Controller, Controllerate of Quality Assurance(Electronics), Bangalore. Suppliers of the main article will be responsible for obtaining the type approval certification from the concerned AHSP.

34. Accepted and cleared stores should bear the stamp or stencilling mark of the inspection staff. This acceptance marking should be placed in a visible location of the articles cleared.

35. The packing of all supplies should be made such as to withstand the climatic, transportation and handling severities. Deterioration of the articles in storage is NOT permissible.

36. The packages should bear the full identification of the supplies and the contractor.

PART II

DESCRIPTION

37 Fuel Level Indicating System consists of a micro Ammeter and two Sending Units. The sending units to Drg Nos VT3-1C-000 Cb are used for sensing the level of fuel in the RH & LH Fuel tanks.

38 The sending units are made up of two Aluminium pipes separated Electrically from each other by Air. The capacitance of the Sending Units will vary depending on the level of Fuel (depends on the length of the tube immersed in fuel) due to the variation of di-electric strength. The head of the sending unit incorporated a printed circuit which converts the DC supply into pulses. The out put terminals are connected to the ammeter. The value of current passing through the ammeter depends upon the resistance (impedance) offered by the sending unit, which in turn depends upon the level of the fuel.

39 A circuit diagram for (fuel level system) connecting two sending units with Ammeter is given in figure (1)(Page 16).

SEVERITY

40 The sending units are liable for transportation, storage and operation at temp. -50°C to $+50^{\circ}\text{C}$, humidity $95 \pm 3\%$.

PART III

QUALITY ASSURANCE TESTS

41 Selection of sample should be made as per the random sampling table.

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CLASSIFICATION OF TESTS

42 The various tests to be carried out are classified as given below:

- a) Class 'A' Tests are those that are to be carried out on 100% of all supplies.
- b) Class 'B' tests are functional tests that are to be carried out on random samples picked up as per IS 2500 Part I Level IV with A Q L 1.5
- c) Class 'C' tests are type, periodic and reliability tests carried out on 1% of supplies picked up at random.

PILOT / BULK INSPECTION

43 Contractor should tender six pilot samples representing the bulk supplies to the Inspection Officer for the pilot sample evaluation.

44 Pilot samples should bear Serial number and in addition to this, they should bear identification mark as PS1, PS2, PS3, PS4, PS5 and PS6.

45 Pilot samples are tendered only after being thoroughly pre inspection by the Contractors. The Contractors will give sufficient advance information before tendering the pilot samples, so that the inspectors and AHSP can suitably plan their inspection programme.

46 The Quality Assurance Tests for Fuel gauge Sending Unit V T3-1C-000Gb to be carried out are given as below:

<u>TESTS</u>	<u>CLASS OF TESTS</u>	
	<u>PILOT</u>	<u>BULK</u>
a) Component Inspection	All '6' Samples	B
b) Process Inspection	- do -	B
c) Assy Inspection	- do -	B
d) Interchangeability Test	- do -	C
e) Material Test	All Components	C
f) Visual Examination	All '6' Samples.	A
g) Dimensional Check	- do -	B
h) Calibration	- do -	A
j) Absolute Error	- do -	A
k) Relative Error	- do -	A
l) Endurance Test	PS-6.	C
m) Environmental Test	PS 2 & 3	C
n) System Check on Vehicle	PS 4 & 5	C
o) Preservation and Packing	All '6' Samples	A

47 It would be preferable to conduct test a, b, c, d & e above at stage inspection during manufacture of stores.

VISUAL INSPECTION (Class 'A' Test)

48 During the visual inspection, check for the following:-

- a) Proper Finish and Good workmanship
- b) Completeness of set as per relevant drawing
- c) Absence of sharp corners and burrs
- d) External damages not allowed
- e) Proper marking.

DIMENSIONAL CHECK (Class 'B' Test)

49 Components/Assy which can not be checked after final assy shall be checked at stage inspection for dimensions/technical conditions as per relevant part/assy drawings.

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52. till the tanks is empty.

The recommended values of marking on sending unit for different sector is given below. The marking noted on the sending unit should not differ from the values given in the table below :-

Level	Sector						
	0	1	1 - 2	2 - 3	3 - 4	4 - 5	1 - 0
HTY	528		440	358	265	154	0
D1	+/-25		+/-25	+/-25	+/-35	+/-35	+/-35
D2	+/-50		+/-50	+/-50	+/-75	+/-75	+/-75

Where HTY- is the marking made on the sending unit in mm. This corresponds to the unmarked sector of the indicator.

D1 - is the absolute error in mm under normal climatic condition at a supply voltage of 27 +0/-1 Volt.

D2 - is the absolute error in mm under climatic condition -50 to +50 °C at a supply voltage of 27 +2/-5 volt.

Absolute Error (Class 1st Test):

53. The absolute error (D) is the difference between the actual reading noted on the sending unit and the value of HTY given in the table above. Absolute error of the sending units shall be checked and the magnitude of the error should be within the limits indicated in the table above.

Relative error (Class 1st Test):

54. The relative error is the ratio of the max absolute error (D max) to the maximum fuel level (H max) expressed as percentage. The relative error (d) of the sending units shall be checked and the same shall be 8% max for normal climatic condition and 15% max for climatic condition -50 to +50°C. The relative error shall be calculated as per the formula given below :-

$$\text{Relative error } d = \frac{D \text{ max}}{H \text{ max}} \times 100 \quad \text{ie} = \frac{D \text{ max}}{528} \times 100$$

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ENDURANCE TEST (Class 'C' Test)

55 Endurance Test on sending Unit shall be carried out as per the condition given below:

- a) Duration of endurance Test : 500 hours
- b) No of cycles : 10 cycles
- c) Duration of each cycle : 50 hours
Minimum continuous run should not be less than : 8 hours
- d) Test voltage First Cycle : 22 V
Second Cycle : 29 V
Third to 10th cycle: 27 +0/-1V
- e) Fuel Level in the tank : Half the capacity

56 After completion of each cycle, the absolute error shall be checked and the same should not be more than the values given in the table at para 8 above.

ENVIRONMENTAL TEST:

56 Fuel Gauge Sending Unit WT3-1C-000 Cb shall be tested for the following environment test. The conditions and Test procedure shall be as per CVRDE/DSC/0007/1981 or JSS-55555.

57 Climatic Tests:

a) High Temperature Test

- Temperature : 85°C ± 3°C
- Duration : 16 Hrs
- Recovery Period : 2 to 4 hours

b) Low Temperature Test

- Temperature : -40°C ± 3°C
- Duration : 3 hours
- Recovery period : 2 to 4 hours

c) Rapid Temperature Cycline Test

- | | | |
|----------------------------------|---------------|-------------|
| <u>Hot Chamber:</u> Temperature | : 55°C ± 3°C | } One Cycle |
| RH | : 30% max | |
| Duration | : 3 Hrs | |
| <u>Cold Chamber:</u> Temperature | : -40°C ± 3°C | } One Cycle |
| Duration | : 3 Hrs | |
| No of Cycles | : 2 | |
| Recovery period: | 2 to 4 hrs | |

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d) Mould Growth Test

Temperature : 29°C ± 1°C
Duration : 28 days
Recovery Period : 2 to 4 Hrs

e) Damp Heat

Temperature : 40°C ± 2°C
RH : Not less than 95%
Duration : 16 Hrs
Recovery Period : 2 to 4 Hrs.

g) Corrosion (Salt)

Temperature : 35°C ± 2°C
RH : 90% to 95%
Spray duration : 2 hrs once in seven days
Storage duration: 28 days
Recovery period: 2 to 4 Hrs

DYNAMIC TEST

58 Vibration Test: The applicable test with sequence of testings are:

<u>Frequency</u>	<u>Acceleration</u>	<u>Displacement</u>	<u>Duration for 3 Axes (in Hrs)</u>
10	1.0	2.0	1.5
20	2.0	1.0	4.5
30	3.0	0.6	3.0
40	4.0	0.6	3.0
50	4.0	0.4	1.5
60	4.0	0.3	1.5
80	4.0		1.5
100	4.0		1.5
120	4.0		1.5
			<u>-----</u> Total : 19.5

59 Shock Test

Pulse Shape : Half Sine Pulse
Acceleration (max) : 400 M/S²
Pulse Duration : 16 M/S
No of shocks : 3 shocks in each face/
direction (Total 18 shocks)

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60 After completion of every Climatic test and Dynamic Test, Visual Examination to be carried out to assess the deterioration and damages of Assys/Parts and IR also shall be checked.

61 After completion of environmental test, check for Absolute Error/Relative Error as post environmental test.

SYSTEM CHECK ON VEHICLE

62 Fuel Gauge Sending Unit shall be fitted on higher assy of the vehicle and performance of Fuel Gauge Sending Unit shall be checked on the Vehicle.

PRESERVATION AND PACKING

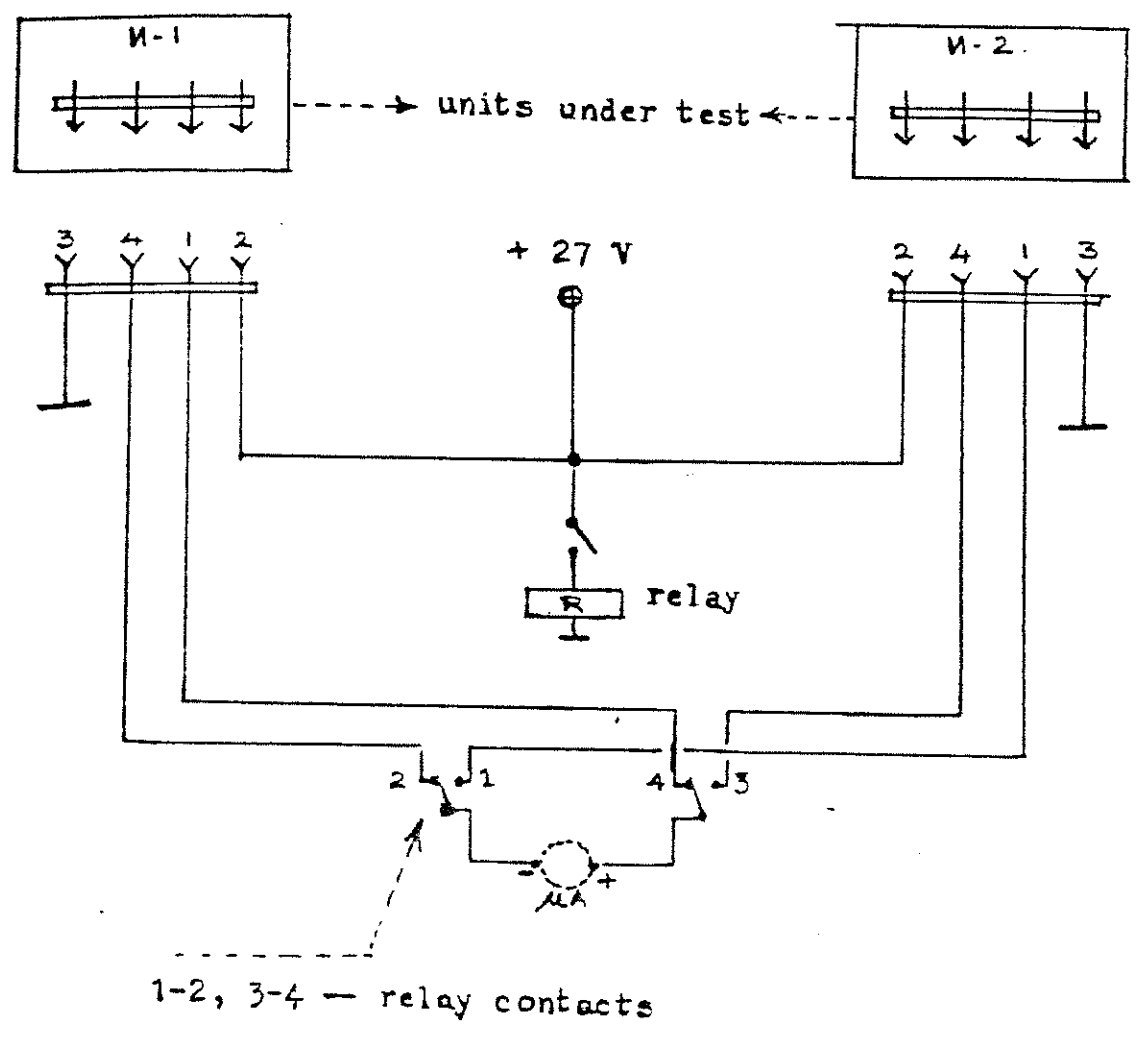
63 Fuel Gauge Sending Unit shall be properly preserved and packed with identification Slip and test certificate, for despatch to consignee so as to avoid damages during transit/storage. Suitable marking shall be made on the package for proper identification to avoid mix up with others stores.

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Figure-1

CIRCUIT DIAGRAM FOR CONNECTING
TWO SENDING UNITS WITH AMMETER



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TEST CERTIFICATE

CERTIFIED THAT FUEL GAUGE SENDING UNIT V T3-1C-000Cb
TO S.NO WITH DATE OF
MANUFACTURE HAS BEEN TESTED/CHECKED FOR
THE FOLLOWING TESTS AND TENDERED FOR PILOT/BULK INSPECTIO

<u>S.No.</u>	<u>Test</u>	<u>Remarks</u>
--------------	-------------	----------------

FUEL GAUGE SENDING UNIT V T3-1C-000 COMPLY TO TECHNICAL
REQUIREMENTS OF QAI DGA (RV)/QAI/SENDING UNIT

ISSUE NO DATED

CERTIFICATE NO:

DATE:

SEAL:

Sd/-

FIRM'S QUALITY DEPT

Sd/-

QUALITY ASSURANCE
OFFICER (DGQA)

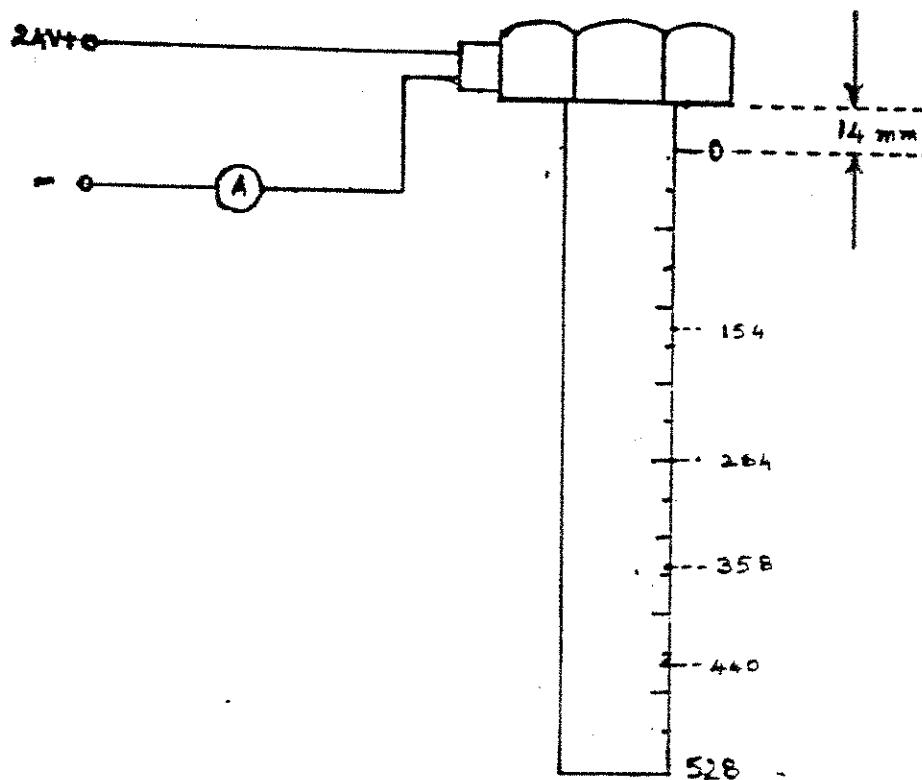
50 Dimensions/Technical conditions of sending unit shall be checked as per the main drawings given below:

a) V-T3-IC-000 Cb

b) V-T3-IC-000 F4

Calibration (Class 'A' Test):

51 For calibration the size of fuel tank used for testing shall be as used on the vehicle. The fitment of sending units shall also be as fitted on the fuel tank of the vehicle. Necessary arrangement shall be made to take the level on the sending units in the fuel. The sending unit shall be marked as shown in the figure (from 0 to 528 mm) given below. "0" mark should start 14 mm below the head as shown :-



- a) Fill the tank to the capacity.
- b) Keep the sending unit in the tank till the zero level of sending unit.
- c) Switch on the supply.
- d) Note the reading on the indicator. It should show fuel at the same time, note the marking on the sending unit.
- e) Drain the fuel till the reading is between 4-5 on indicator. Note the marking on the sending unit.
- f) Drain the fuel further till the reading is 3-4. Note the marking on the sending unit.
- g) Carryout the same procedure for reading in the various sectors and the corresponding marking on the sending unit.

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APPENDIX

TEST CERTIFICATE

CERTIFIED THAT DRIVER'S INSTRUMENT
TO S.NO _____ HAS BEEN
MANUFACTURE _____
THE FOLLOWING TESTS AND TENDERED FOR

S.No.

Test

Rate

THE DRIVER'S INSTRUMENT PANEL / ASSY / COMPLY TO TECHNICAL
REQUIREMENTS OF QAI COA(HV)/QAI/70/PACKAGE 'A'

ISSUE NO DATED

CERTIFICATE NO: _____

DATE: _____

SEAL: _____

Sd/-

FIRM'S QUALITY DEPT

Sd/-

QUALITY ASSURANCE
OFFICER (DGQA)

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