

Table-I

Materials	Active materials	Lead Alloys			
	Max impurities (% by weight)	Pb-Sb Alloy		Pb-Ca Alloy	
		Max impurities (% by weight)	Additive (#) (% by weight)	Max impurities (% by weight)	Additive (#) (% by weight)
Iron	0.002	0.005	-	0.001	-
Copper	0.003	0.05	-	0.002	-
Arsenic	0.001	-	0.20-0.25	0.002	-
Silver	0.004	0.004	-	0.002	-
Bismuth	0.03	0.03	-	0.01	-
Nickel	0.001	0.005	-	0.002	-
Antimony	0.005	-	1.65±0.1	0.005	-
Tin	0.001	-	0.02-0.04	-	0.30±0.05
Zinc	0.002	0.002	-	0.002	-
Aluminum	-	-	-	-	0.018-0.03

(Percentage are in maximum unless shown otherwise)

Grade	Antimony %	Lead %	Arsenic %	Tin %	Copper %	Bismuth %	Iron %	Zinc %	Silver %
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PbSb 1	0.8-1.2	Remainder	—	—	0.05	0.06	0.005	0.001	0.02
PbSb 2	1.8-2.2	Remainder	—	—	0.05	0.06	0.005	0.001	0.02
PbSb 5	4.5-5.5	Remainder	—	—	0.05	0.02	0.005	0.001	0.008
PbSb 6	5.5-6.5	Remainder	—	—	0.05	0.02	0.005	0.001	0.008
PbSb 8	7.5-8.5	Remainder	—	—	0.05	0.02	0.005	0.001	0.008
PbSb 10	9.5-10.5	Remainder	—	—	0.05	0.02	0.005	0.001	0.008
PbSb 5Sn	5.2-5.8	91-92	0.8-1.0	1.7-1.9	0.05	0.02	0.005	0.001	0.008

Note. # Additive values are indicative

Table 1 Chemical Composition of Lead-Antimony Alloys

Notes:

1. The limits of Arsenic and tin shall be subject to agreement between the Supplier and the purchaser and grades except grade PbSbSn.
2. Other impurities do not preclude the possible presence of other unnamed elements. However, analysis shall regularly be made only for the impurities tested in the table.

TABLE II
Dimensions of Tapered Terminals

Terminal Type	Dimensions of D (mm)		Types
	(+)	(-)	
Small	14.7 + 0 - 0.3	13.0 + 0 - 0.3	12V20AH, 12V32AH, 12V35AH, 12V45AH
Standard	19.5 + 0 -0.3	17.9 + 0 - 0.3	12 V 55 AH 12 V 60 AH 12 V 70 AH 12 V 88 AH 12 V 92 AH 12 V 100 AH 12 V 120 AH 12 V 130 AH 12 V 135 AH 12 V 150 AH 12 V 180 AH 12 V 200 AH

Note 1:- Tolerance on D may be taken as $\pm .03$ mm at present,

2:- Height of terminals 17 } +3 mm
 } -1 mm

4.6 **Electrolyte**

The sulphuric acid and water used for the preparation and maintenance of electrolyte shall conform to IS 266: 1993 and IS 1069:1994 respectively.

4.7 **General Construction Requirements:**

The batteries consist of six elements (for 12V Bty) and three elements (for 6V Bty) connected in series and is housed in a plastic monobloc container. Each element consists of + ve plate, - ve plate and separators. The construction of batteries and the choice of the materials used therein shall be governed by consideration of the preference required.

4.8 **Battery containers and Cell Lids:**

Normally materials for a particular type of battery container and cell lids shall be of Polypropylene. The material shall comply with the requirements of IS 1146. The material must resist action by sulphuric acid and shall not liberate any substance which will contaminate the electrolyte and impair the life and efficiency of the battery. The material must be capable of withstanding temperature between- 30 °C to +70°C.

4.9 **Connecting bars and Terminal posts:**

Connecting Bars and terminal posts must be made of antimonial Lead or antimonial lead coated brass or copper.

4.10 **Paint:** An acid resistant paint conforming to IS: 157 (Latest issue) must be used.

4.11 **Components parts and Assembly:** The materials, constructions, dimensions and finish of the components shall be as per the relevant detail specification/drawings. General requirement and their assembly shall be governed by the following:-

- a) **Grid Plates** : Plates shall not be used which have any missing pellets of active material below the lug and the missing pellets should not be more than 2 in adjacent or maximum 3 in isolation.. It will be verified during assembly that all plates of a group are of the same polarity. Plates shall be of the number, thickness size and weight necessary for specified performance and shelf life.
- b) **Inter cell connectors:** The inter cell connector shall be of lead alloy except when an alternative form of connector is required by the user. They shall be of such cross section so as to conduct the current flow during High Discharge tests safely. It should be free from the blowholes and other deteriorations.
- c) **Containers:** Containers shall not be scarred, clipped, cracked and distorted. The surfaces shall have a smooth finish being free from blowholes, rough spots, blisters, other flaws or defects.
- d) **Elements:** The place elements when assembled in the containers shall be so close fitting that the end plates are firmly supported. The element should not come out even if the container is inverted after assembly.
- e) **Terminal:** The terminals shall be of the type required by the drawing, battery terminal post will be tapered and of a section to suit the cable connectors. These shall be of the types given in the relevant drawings. Metal parts shall be of lead or brass or copper. If made of brass or copper, these shall be lead coated in accordance with IS 1654:1992. All terminals shall be correctly and securely positioned. They shall be free from corrosion surface irregularities or other defects which impair their contact making properties.
- f) **Polarity of terminal:** The indication of polarity + and – OR “P” and “N” shall be Clearly moulded / embossed adjacent to the terminals on the upper surface of the lid of the battery. The polarity of positive and negative marking shall be finished with RED and BLUE / BLACK paint respectively as shown below.

POSITIVE TERMINAL
+ or P (in red)

NEGATIVE TERMINAL
- or N (in blue/black)

- g) **Vent plug:** Vent plugs shall be of the anti-splash /non spillable/semi non spillable type with preferably more than one exit holes and shall allow the gases to escape freely. However, side venting system is also acceptable provided overall dimensions of the battery remain unchanged.
- h) **Electrolyte level indicator:** A suitable electrolyte level indicator indicating lower and upper limits shall be fitted to facilitate checking of electrolyte level. The material used shall be acid proof and shall not deteriorate during service .

- 4.12 **Mass:** Mass shall be measured when the battery is fully charged and electrolyte is adjusted to the level specified by the Supplier.
- 4.13 **Dimensions & Tolerances:** Where official drawings are quoted they are to be taken as mandatory. Copies of each drawing may be obtained from Authority Holding Sealed Particulars (AHSP) Viz., Controllerate of Quality assurance Electronics, Bangalore on payment.
- 4.14 Normal engineering tolerances as per IS 2102 shall be applicable on all dimensions which are without specified tolerance in the relevant drawings of Batteries.

5.0 CONSTRUCTION

- 5.1 The design of the battery shall aim at the following:-
- Minimum mass/volume to Ah capacity ratio (Optimum energy density).
 - Capability to withstand possible physical and electrical abuses under field conditions.
 - Essential electrical performance characteristics like long Shelf life, good charge retention, long life cycle and excellent reliability with least maintenance.
 - Capability for storage, transportation, handling and operations under wide range of climatic conditions.
 - Capability to accept charge from existing service chargers with minimum technical supervision.
- 5.2 The following information shall be legibly and indelibly marked on each battery by punching / moulding / screen printing, If specified:
- Srl No. of battery.
 - Defence Cat No.
 - Month and Year of Manufacture
 - Supplier's Name and type
 - Country of Manufacture
 - Nomenclature, Rated Voltage & Rated Ampere Hour Capacity.
 - Special instructions to be screen printed/engraved/embossed/sticker preferably on the top surface or on any other surface of the battery, easily visible by the users.**

Date of charging	To be mentioned by the firm
Date of next charging	Every three months from last charging
Mode of Charging	CC/CV
Charging Voltage/Current	To be mentioned by the firm
Caution	Do not keep bty idle for period more than 6 months
Battery Special Handling instructions for safety warning and precautions.	
Open Circuit Voltage & Specific gravity of fully charged btys	to be declared by the firm

- (h) Government Mark i.e. broad Arrow (↑) in a suitable size as given in the relevant drawing of the battery depending upon the battery container as per Drg No. EL13401 (metric). The Arrow shall be filled with an acid resistant paint of any contrasting colour to the container which is distinctly visible.
- (i) Screen printing shall be done or a sticker of a good quality, which does not peel off during normal use, may also be used for indicating nomenclature of Battery. However, sticker shall not be used for making Govt mark i.e. (↑)
- (j) Upper and lower electrolyte level in case of transparent containers.

Note: Screen printing/Hot punching/moulding of cat part No., month & year Of Mfr is acceptable on smaller btys like 12V 2.5Ah, 12V 5Ah & 12V 20Ah.

6. DIMENSIONS AND TOLERANCE

- 6.1 The overall dimensions of the battery and tolerance shall be as specified in the relevant drawing. Capacities, overall dimensions and mass (with electrolyte of $1.280 \pm .01$ specific gravity at 27°C) shall conform to Table XII. In case the tolerances are not specified in the drawing then they shall conform to tolerances as per IS 2102.
- 6.2 The Mass of the battery with electrolyte shall be as per specified value mentioned in Table XII.
- 6.3 Tolerance for temperature where not specified shall be $\pm 2^{\circ}\text{C}$.
- 6.4 The dimensions of respective battery will conform to CQAL drawings only wherever applicable. This will be highlighted in the supply order as contractual clause wherever applicable.

7. WORKMANSHIP AND FINISH

- 7.1 All parts shall be manufactured and assembled in accordance with the latest engineering techniques and with excellent workmanship.
- 7.2 The hardware items like terminals, studs, intercell connectors, fasteners, etc. shall be protected against corrosion.
- 7.3 The battery container shall be of plastic material and shall be acid resistant/self-extinguishing type.
- 7.4 The cell assemblies shall be tightly packed inside the outer case of the battery so that there is no relative movement and the cells are adequately protected on all sides from mechanical shocks.

8. PACKING OF BATTERY

- 8.1 The individual battery shall be packed and sealed in appropriate / polythene cover and then put in corrugated/cardboard carton before being packed in suitable packing material lined with rubberized coir/ thermocol. All associated items accompanying the battery shall be packed and put in the same carton case along with the battery.
- 8.2 The design of the suitable packing material shall be such that it is sturdy and easy to handle and be able to sustain transportation hazard. Preferably these shall be of reusable type. The supplier shall be responsible for safe delivery of stores at the consignee's end and transit damage if any shall be promptly attended to by him.
- 8.3 The nomenclature and DS Cat No. of btys, make, date of manufacture, quantity and Srl No. of batteries inside and handling instructions shall be marked on the packing case in addition to consignee and consignors address.

8.4 MARKING

- 8.4.1 The indication of polarity + and - shall be clearly moulded / embossed adjacent to the terminals on the upper surface of the lid of the battery.
- 8.4.2 Manufacturer's/Supplier's Instruction giving details regarding climatic classification, charging rate of (I₅) current/Voltage and maintenance shall be supplied with each battery.

9.0 PRE-INSPECTION OF SUPPLIES BY SUPPLIER

- 9.1 Manufacturer/Supplier shall satisfy themselves that the btys manufactured are in accordance with the contract and fully conform to the specification by carrying out thorough pre-inspection of each lot/batch before actually tendering for inspection to QA Authority.
- 9.2 A declaration by the Manufacturer/Supplier that necessary pre-inspection tests have been carried out on the btys tendered and the same are fit for inspection. Results of tests and findings if any shall be tendered along with the challan. The declaration shall include the method followed in pre-inspection showing features checked, tested and also accompanied by the test reports.
- 9.3 In case of supply against Defence Order, the Manufacturer/Supplier shall ensure that incoming materials and products are not used or processed until it has been inspected or otherwise verified as conforming to specified requirements. Quality records shall be maintained by the Manufacturer/Supplier to demonstrate achievement of the required quality and effective operation of the Quality system.

- 9.4 The inspecting officer or his representative shall be afforded the right to verify at such Manufacturer/Supplier premises or upon receipt that the purchased incoming materials conform to specified design requirements. In order to ensure monitoring and verification of materials, production process etc, a quality audit and a quality surveillance plan in consultation and concurrence with the QA officer will be drawn before production/commencement of supply.

10.0 QUALITY ASSURANCE

- 10.1 The onus of building Quality into the product will rest with the Manufacturer/Supplier. Since, Manufacturer/Supplier is the first party quality assurer. The sample picked up from the production lot should be able to demonstrate the stated performance as per the specifications. Control sample testing will be done from samples picked up from production lots.

- 10.1.1 Control samples will be picked up from the bulk cleared and will be sent to AHSP/QA Agency for Control sample testing. Clearance of bulk supply will not wait for completion of Control samples test. However; in case of failure of control sample in functional / electrical test, entire lot represented by control samples will be replaced by the Manufacturer/Supplier on his own risk and cost in situ.

10.2 Status of Manufacturer/Supplier

- 10.2.1 The Manufacturer/Supplier should be registered for the type of battery for which SO/ rate contract is placed.
- 10.2.2 The Manufacturer/Supplier which are not registered with DGQA and have quoted against open tender enquiry or other form of tender enquiry for procurement of btys must get assessed prior to placement of supply order as would be intimated by order placing authority as per JSG 015:03:2007 by DGQA to ascertain their capability to manufacture of the btys.
- 10.2.3 The Manufacturer/Supplier must be certified for the current ISO 9001 for Quality Management System (QMS)& ISO 14001 for Environmental Management System (EMS).However, OHSAS certification for Safety Management System is desirable.

10.3 Quality Assurance Procedure

The Manufacturer/Supplier shall ensure that quality is built into the product in conformance to the specified requirements by the following methods:-

- (i) Inspection of input materials, components and batteries, in the course of manufacture and completed batteries to ensure that the requirements are being met and that the necessary standard of workmanship and

process control is being maintained and proper records of the above materials are being kept.

- (ii) Inspection of batteries and representative samples (control sample) for the tests as specified in the relevant clauses of specification.
- (iii) The Manufacturer/Supplier has to carry out all in- house tests as per clause 12.1.9 and the relevant test results must be available for audit by the QA officer.

11.0 SAMPLING PROCEDURE

- 11.1. **Lot** : All the batteries of the same type, design and ratings manufactured by the same plant during the same period using same process and materials and offered for inspection at a time, shall constitute a lot. The number of batteries to be selected from the lot shall be in accordance with column 2 & 3 of the Table shown below:-

Table showing lot size, sample size & criteria for conformity

Table III
SAMPLING PROCEDURE
(Ref Para 11))

Lot Size	Sample Size (No. of samples selected)			Criteria for Acceptance (No. of Defective Samples)		
	Ist Stage n	IInd Stage n	Total 2n	C1	C2	C3
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Up to 50	2	--	2	0	0	0
51-300	3	--	3	0	0	0
301-500	5	5	10	0	2	2
501-1000	8	8	16	0	2	2
1001 & above	13	13	26	0	3	4

- 11.2 Each of the sample battery selected in the first stage as per column 2 of Table above will be subjected to all the class 'B' acceptance tests except water consumption test. The number of samples required and acceptance criteria for the tests have been specified in the notes of **Table V.A** battery shall be declared defective if it fails in one or more of the class 'B' tests.
- 11.3 If the number of defective samples is zero C1 (at col.5) the lot shall be considered as conforming to the specified requirements and shall be accepted.
- 11.4 If the number of defective samples is equal to or greater than C2(col.6) the entire lot shall be rejected.
- 11.5 If the number of defective samples is greater than zero C1(at col.5) but less than C2 (col.6) a further sampling of the same size (col. 3) is done and these 2nd stage samples are subjected to all the class 'B' tests as done before.

11.6 If the number of defectives in 1st and 2nd stages combined is less than C3 (col.7) the lot shall be accepted. Otherwise the entire lot shall be rejected.

11.7 The above sampling plan shall be made applicable only when smooth production flow of the battery has started and supply of not less than 200 batteries is made or if the firm has supplied the same type of batteries in bulk (of not less than 200) earlier and the last consignment has been supplied not earlier than one year before tendering the present lot. The audit of test records and test results will be carried out by the QA agency as per the table below based on lot size of battery produced.

Total No. of Batteries	Percentage of Batteries to be tested	Decision on acceptance
First 25 – 50	100 %	Acceptance of only those samples which are conforming to specification.
50 to 200 or more	10%	Acceptance of lot if no defect is noticed. If defects are noticed on one or more samples, carry out double sampling plan of 8 nos. each and acceptance limit as per table given above. (The 10% sample test may be taken as first and second stage sampling. If the number of batteries comes less than 16, the remaining samples may be taken. If already the tested samples exceed 16, double sampling plan with 13 samples for each stage may be carried out).

12. PRODUCT SPECIFICATION

12.1. Acceptance Tests:

Tests conducted on bulk supplies. These tests comprise of Class "A" Tests (on 100% of the lot) and class "B" Tests (As per sampling plan given in Para11.0). These tests are listed at Table V.

12.1.1 The Manufacturer/Supplier shall provide the Regional Quality Assurance Establishment, free of cost, all test facilities for satisfying himself that the stores are being manufactured in accordance with this specification and for this purpose the Regional Quality Assurance Establishment must have free access to the Supplier/sub-contractor premises at all reasonable times during the run of the contract.

12.1.2 On receipt of supply order, the Manufacturer/Supplier shall prepare production schedule and QA plan and submit to Regional Quality Assurance Establishment.

12.1.3 The Manufacturer/Supplier shall submit bill of material, which should contain details of the components (bought out and fabricated in-house), specification, drawing and source of supply. In case of any unavoidable change of source/grade/specification for any component, the Manufacturer/Supplier shall intimate QA authority with detailed justification for the change and the prior approval of the QA authority shall be obtained. However, such changes w.r.t. the approved bill of materials shall be restricted to barest minimum.

- 12.1.4 The Manufacturer/Supplier shall produce the test reports received from their supplier of components and materials and these shall be produced to QA agency during quality audit.
- 12.1.5 The Manufacturer/Supplier shall carry out inward goods inspection of the components, materials procured from outside as well as quality checks on the components fabricated in-house. These quality records shall be maintained and produced to QA agency during quality audit.
- 12.1.6 The Manufacturer/Supplier shall intimate Regional Quality Assurance Establishment as soon as 40 to 50% of the raw materials/components for the lot likely to be offered are available with him.
- 12.1.7 Regional Quality Assurance Establishment shall verify conformance to the bill of materials by auditing the procurement records of the firm. Regional Quality Assurance Establishment shall carry out surveillance checks, which may also include testing of some of the components/materials. The Manufacturer/Supplier shall make test facilities available either in-house or at any of the accredited test laboratories.
- 12.1.8 The Manufacturer/Supplier shall intimate Regional Quality Assurance Establishment detailed production schedule well in advance so that they can plan and carry out process audit.
- 12.1.9 The Manufacturer/Supplier shall carry out in-house tests as indicated in the table IV below on the assembled batteries to verify conformance to the specification and shall offer the stores to QA agency only when he is satisfied that the stores meet the requirements. The Manufacturer/Supplier will ensure availability of all the necessary test equipments to demonstrate the conduct of the tests. In house test results will be valid for tendered lots as long as there is no change in input material, process of manufacturing and conforms to the specification. The stores shall be tendered for QA checks along with the pre-inspection report.

Details of In-House Tests to be carried out by the Manufacturer/Supplier: The following test will be carried out as per Table IV by the supplier in addition to other tests being carried out on each supply order and results will be submitted to the QA agency along with the call letter.

TABLE IV**(In-House Tests)**

Srl No.	Classification of Tests	Title of Tests	Test Para.
Total 10 samples			
	General	Physical & Visual Examination Dimensions, weight and layout Marking Air Pressure	15.1&15.2 15.3 15.4 15.9
(a) Group 1, (on 02 samples)			
		5 Hrs Capacity test High rate discharge at room temp High rate discharge at -15 ⁰ C Life Cycle test *	15.5 15.6.3 15.6.1 15.10
(b) Group 2, (on 02 samples)			
		5 Hrs Capacity test Cold cranking At -18 ⁰ C Overcharge Endurance Test*	15.5 16.2 15.12
(c) Group 3, (02 samples)			
		Charge Acceptance 5 Hrs Capacity Vibration Robustness of handles Robustness to fastening High Voltage	15.8 15.5 15.11 15.7 15.14 15.17
(d) Group 4, (on 02 samples)			
		5 Hrs Capacity Electrolyte Retention Test Retention of Charge* Drop test (applicable for 12 V 20 Ah)	15.5 15.16 15.15 17.1
(e) Group 5, (on 02 samples)			
		5 Hrs Capacity Reserve capacity Water Consumption Test *	15.5 16.1 16.3

HRD TESTS FOR KOLOS TATRA BTY 12V 200AH SHALL BE CARRIED OUT AS PER 16.4

***Note:** -The efficacy of long duration tests like life cycle, overcharge endurance, retention of charge and water consumption tests shall be established by the supplier/ manufacturer to satisfy himself the requirements specified. These tests may not applicable for every lot offered. However, the records shall be maintained and produced when QA agency ask as a part of their quality audit. These test reports shall be valid provided there is no change in input material, design and process with respect to the offered lot. However, QA officer may undertake QA checks of the offered lot based on their confidence level and past performance of the firm.

13 CLASSIFICATION OF TESTS**13.1 Acceptance Tests**

The normal sequence of test followed during Acceptance tests:-

- (a) Physical & Visual Examination.
- (b) Dimension, Layout and Weight.
- (c) Marking
- (d) 5-h Capacity test.
- (e) High rate discharge test at room temperature
- (f) High rate discharge test at -15°C
- (g) Reserve Capacity
- (h) Water consumption test
- (h) Strength of Terminals

The above tests will be carried out as classified in Table V below.

TABLE V
ACCEPTANCE TEST FOR MT BTYS
(Ref Para 13.1)

Srl No.	Classification of Test	Title of Test	Test Clause No.
(a) Class "A" Tests ((on 100% of the lot)			
(i)	General	Physical & Visual Examination Marking	15.1&15.2 15.4
(b) Class 'B' Tests (as per Clause 11.1)			
(i)	General	Physical & Visual Examination Dimensions, Layout & Weight Marking Strength of Terminals	15.1&15.2 15.3 15.4 15.13
(ii)	Electrical	5Hr Capacity HRD at room temp HRD at -15°C Reserve Capacity Water Consumption Test	15.5 15.6.3 15.6.1 16.1 16.3

HRD TESTS FOR KOLOS TATRA BTY 12V 200AH SHALL BE CARRIED OUT AS PER 16.4

Notes:-

1. In respect of supply order with quantity on order being 200 or less, the water consumption test (clause 16.3) only, Shall be carried out on 1 sample from each 50 Nos. on order or 2 samples if offered in single lot.

2. In respect of supply order with quantity on order being more than 200, the water consumption test (clause 16.3) only, Shall be carried out on minimum 2 and maximum 3 samples from each lot offered.
3. Water consumption test to be carried out on the samples which have been subjected to class "B" tests as mentioned in table V.
4. In case of failure of any sample(s) in the water consumption test, the test will be repeated on double the number of failed samples. Failure of even a single sample in repetition of water consumption test will lead to the rejection of the entire lot.
5. The water consumption test will be carried out on the samples picked up on first two lots offered by the Manufacturer/Supplier. However, on the successful result of first two lots of the store of same Supply Order and depending on the confidence level of QA officer, the Water consumption test for subsequent lots may be done away provided that **"the material and processes used in manufacturing of the current lot of the stores is the same as those used in the first two lots which have undergone water consumption test successfully"**. Accordingly, a certificate shall be obtained from the Manufacturer/supplier by the QA Officer.

13.2 Control Sample Tests:

These tests are listed at Table VI. Number of tests to be conducted on control samples will be prerogative of government QA agency. QA agency may decide to carry out all the tests or selectively important test only. Criteria for selection of tests will depend upon past performance of control samples and confidence level of QA agency to ensure the quality of the stores.

- 13.2.1 **Clearance of bulk supply will not await completion of control sample testing. However, in case of failure of control sample in functional / electrical test, entire lot represented by control samples will be replaced by the Manufacturer/Supplier on his own risk and cost in situ.**
- 13.2.2 The responsibility of building in Quality into the product will rest with the Manufacturer/Supplier and assurance of same will be checked by the QA agencies. Control sample testing will be done from samples picked up from production lots. Number of samples to be drawn for test shall be decided based on the lot size offered for bulk Quality check.
- 13.2.3 The control samples drawn from the lot will be treated as a true representative of the particular lot and the results of the test on these samples will be applicable to the entire quantity comprising the lot.
- 13.2.4 Government QA agency may check the process capability of firm any time during production. Manufacturer/Supplier should be able to demonstrate the quality of the product any time during its manufacture.

- 13.3 **Sampling Scheme and Criteria for Acceptance:** A recommended sampling scheme and criteria for the acceptance of lots for various lot sizes is given in Para 11 and table thereto.

TABLE VI
(Control Sample Test)
(Ref Para 13.2)

S. No.	Title of Test	Clause. No.	1	2	3
(i)	Physical & Visual Examination	15.1&15.2	✓	✓	✓
(ii)	Dimensions, Layout & weight	15.3	✓	✓	✓
(iii)	Marking	15.4	✓	✓	✓
(iv)	Charge acceptance	15.8	-	-	✓
(v)	5Hr Capacity	15.5	✓	✓	✓
(vi)	HRD at -15 ⁰ C	15.6.1	✓	✓	✓
(vii)	HRD Test at Room Temp	15.6.3	✓	✓	✓
(viii)	Cold Cranking	16.2	✓	-	-
(ix)	Life cycle	15.10	✓	-	-
(x)	Retention of charge	15.15	-	✓	-
(xi)	Over charge endurance	15.12	-	✓	-
(xii)	Reserve Capacity	16.1	-	-	✓
(xiii)	Water Consumption Test	16.3	-	-	✓
(xiv)	Electrolyte retention test	15.16	-	-	✓
(xv)	Strength of Terminals	15.13	-	-	✓
(xvi)	Robustness of handles	15.7	-	-	✓
(xvii)	Vibration	15.11	-	-	✓

HRD TESTS FOR KOLOS TATRA BTY 12V 200AH SHALL BE CARRIED OUT AS PER 16.4

14.0 **EQUIPMENT**

14.1 **Voltmeter and Ammeter**

The voltmeter and ammeter used shall be of an accuracy class not inferior to 0.5 in accordance with IS 1248 (Part 2):2003 (Third Revision).

14.2 **Thermometer**

A thermometer with an appropriate scale shall be used for measuring temperature and one division of graduated scale shall represent at the most 1 ° C. The accuracy of the calibration shall be not less than 0.5 ° C.

14.3 **Hydrometer**

The specific gravity of the electrolyte shall be measured by a hydrometer provided with a graduated scale, one division of which shall represent at the most 0.005 unit of specific gravity. The accuracy of calibration shall be not less than 0.005 unit of specific gravity.

14.4 Instrument for Measuring Length

For measuring overall dimensions, a caliper or metal ruler shall be used of accuracy not inferior to 0.5 mm.

14.5 Weight Measuring Equipment:

For measuring of weight of battery and loss of weight in water consumption test to an accuracy of $\pm 0.05\%$.

14.6 HRD tester

14.7 Constant Current/Constant Voltage Discharge Tester

14.8 Charge & Discharge Life Cycle Tester

14.9 High Voltage tester

14.10 Equipment To check Impurities percentage in Lead / Lead Alloys

14.11 Thermal Chamber (Range -30°C to $+75^{\circ}\text{C}$)

14.12 Automated Acid filling & Acid level checking facility

Note: The list of equipment mentioned above is non-exhaustive. Battery manufacturers should have all the essential manufacturing & test facilities in plant which are required for manufacturing Quality battery as per this specification.

15.0 METHODS OF TEST AND REQUIREMENTS**15.1 Visual Examination.**

The surface of the battery shall be clean. There should not be any runs of lead, bubbles, pits and cracks on the body of the battery. Conformance of the components to the relevant drawings shall be ensured during the assembly stage.

15.2 Physical Examination

For acceptance tests the batteries shall be checked for conformance to 13.1 only.

15.3 Dimensions, Layout & Weight : The dimensions and layout shall be checked for Conformance to Table XII

15.4 Marking The batteries shall be checked by visual inspection for conformity with clause 8.4 & 5.2.

OR

IS Specification/approved Drawing of supplier in case Defence requirement exist

15.5 Capacity (5-h rate)

The 5-h capacity shall be determined by discharging of fully charged battery at a constant current of $I = 0.2C_5$ amperes to a final terminal voltage of 10.50 V/5.25V for 12V/6V bty under the following conditions:

(a) Time to commence discharge

After fully charged battery has stood an open circuit for 2 to 12h

(b)	Electrolyte level	Between +1 mm to -5 mm from upper Level marked on battery.
(c)	Electrolyte temperature during discharge	20 to 35 ° C
(d)	Intervals of recording current, Voltage and temperature readings	Every 30 min
(e)	Intervals of noting electrolyte specific gravity	Before start and on completion of discharge.

15.5.1 Temperature correction

The capacity obtained by multiplying the discharge current in amperes by the discharge duration in hours shall be corrected to the standard reference temperature 27 ° C as follows:-

$$C_{27} = \frac{C_t}{1 + 0.01(t-27)}$$

Where

- C_{27} = 5-h capacity at an average electrolyte temperature of 27 ° C.
 C_t = 5-h capacity at an average electrolyte temperature t, and
t = mean of initial and final electrolyte temperature in degrees Celsius.

15.5.2 Requirement

Batteries tested shall reach the rated 5-h capacity during the course of the first three cycles after initial charge. Alternatively the battery will be deemed to have passed the capacity test if it meets 95% of the rated 5-h capacity in the first discharge.

15.6 High Rate Discharge

15.6.1 High Rate Discharge at -15°C

The high rate discharge is tested at -15°C under the following conditions:

- Before a high rate discharge test, the battery shall be subjected to a 5-h capacity test.
- The batteries under test shall comply with the conditions given in Table VII.
- The battery shall be discharged at the current specified against its type in Table IX down to a terminal voltage of 6.00 V. The terminal voltage shall be taken at 5 To 7 s and at 30 s intervals thereafter.

Table VII
Test Conditions
(clause 15.6)

Condition	Requirement
Minimum period the fully charged battery shall Stand for stabilization	16 h
Temperature of electrolyte at start of discharge	(a) $(-15 \pm 2^\circ \text{C})$ (b) Room Temp ($27 \pm 2^\circ \text{C}$)

15.6.2 Requirement

The battery shall meet the minimum terminal voltage specified after 5 to 7 s or 30 s respectively and the minimum duration to 6.00 V in Table IX.

Note: If the battery fails to reach the values specified in Table IX, two more tests may be carried out up to a total of three high rate discharges.

15.6.3 High Rate Discharge at Room Temperature:

The high rate discharge is tested at room temperature under the following conditions:

- (a) Before a high rate discharge test, the bty shall be subjected to a 5-h capacity test.
- (b) The batteries under test shall comply with the conditions given in Table VII.
- (c) The battery shall be discharged at the current equal to $3.5C_5$. The terminal voltage shall be as per requirement in table below.

15.6.4 Requirement

The battery shall meet the minimum discharge time specified in the table below.

Initial temperature of Electrolyte in $^\circ \text{C}$	Discharge Current (Amps)	Minimum discharge Time	Final Voltage	
			6 V bty	12 V bty
$27 \pm 2^\circ \text{C}$	$3.5C_5$	4 Min 0 Secs	4.0 V	8.0 V
$27 \pm 2^\circ \text{C}$ (Special btys)	$3.5C_5$	2 Min 30 Secs	4.0V	8.0 V

15.7 Robustness of Handles.

(i) **Method for Hinges Type Handles:** - A load equal to twice the weight of the battery along with electrolyte is attached to one handle of the battery and the other handle is lifted with the help of a steel camp of length four inches attached to a lifting device for hinge type of handles fixed in the middle of the battery. Batteries fitted with hinges type of handles on the sides will be lifted with the help of a steel/wooden bar passing through both the handles. The battery is lifted to a height of one meter with a speed of 0.2m/sec followed by smooth lowering. The process shall be repeated 5