





PROVISIONA L SPECIFICATION FOR SQUIB (FILLED) FOR RDM PYROCUTTER

ISSUED BY DIRECTOR HIGH ENERGY MATERIALS RESEARCH LABORATORY SUTARWADI, PASHAN, PUNE-411 021 MINISTRY OF DEFENCE

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0. FOREWORD:

- 0.1 This specification has been prepared by the Director HEMRL, Sutarwadi, Pashan, Pune - 411 021.
- 0.2 This specification shall be used for tender enquiry, manufacture, quality assurance and procurement of Squib (Filled) for RDM Pyrocutter.
- Quality Assurance Authority for the items covered in this specification is Director HEMRL, Pashan, Pune-411021. Enquiries regarding this specification relating to any contractual conditions would be addressed to the Quality Assurance Authority names in the Tender or Contract. Other enquiries should be referred to:-

The Director,
High Energy Materials Research Laboratory,
PASHAN, PUNE-411021

0.4 Copies of this specification, drawings/instructions/guide, etc. can be obtained on payment from:--

The Director,
High Energy Materials Research Laboratory,
PASHAN, PUNE-411021

O.5 Specification is a live document and is therefore likely to undergo changes. Any major change in design should have approval of Director HEMRL, Pune-411021. Therefore, this specification holds good only for the supply order for which it is issued.

1. SCOPE:

1.1 This specification governs the manufacture, assembly, painting, marking, quality assurance, proof, and supply of Squib (Filled) to Drawing no. HEMRL Drg 1505, for RDM Pyrocutter.

2. RELATED SPECIFICATIONS:

2.1 Reference is made in this specification to -

Sl.no.	Material	Specification No.
Lo	Lead Ferrocyanide	IND/ME/769 except for Iron content which may be Upto 10.5% & purity not less than 96%. Average particle size 2-5 micron.
2.	Potassium chlorate Passing through 53 microns IS Sieve.	JSS 6810-42
3.	Lacquer, Nitrocellulose(APC-217)	JSS 8010-42
4.	Calcium silicide passing through 53 micron	IND/ME/387
5.	Lacquer, Nitrocellulose (APC-219)	JSS 8010-48
6.	Thinner i) Acetone 40 parts ii) Amyl acetate 40 parts iii) Toluene 20 parts	As specified in JSS 8010-42

- 2.2 The manufacturer shall also supply any other material necessary for the completion of the order, which must conform to the requirements of the appropriate current approved specification.
- 2.3 This specification is to be read in conjunction with the drawing/drawings quoted in the contract/order.
- 2.4 Wherever a reference is made to any documents in this specification, it should be taken as a reference to the latest edition of the documents unless otherwise stated.
- 2.5 Copies of the related documents are obtainable as follows:
 - a) Indian Standard Specifications () Bureau of Indian Standard
 - () Manak Bhavan,
 - b) British Standard Specifications () 9, Bahadur Shah Zafar Marg
 - () New Delhi 110 001.
 - c) IND/ME Specifications () The Controller,
 - () Controllerate of Quality
 - d) Joint Service SPEC. () Assurance (Mily Expl),
 - () Kirkee, Pune 411 003.
 - e) DEF Specifications () The Manager,
 - () HMSO Sales Section,
 - () British Information
 - () Services, Chanakyapuri,
 - () New Delhi 110 002.
 - f) IA Specifications
- () The Controller,
- () Controllerate of Quality
- g) CIA Specifications
- () Assurance (Ammunition)
- h) CQA(A) Specifications
- () Kirkee, Pune 411 003.

3. STANDARD PATTERN.

3.1 Any sample lent to the Manufacturer shall be used only as a guide to workmanship and not as a guide to detail. A standard pattern if obtainable from the Purchasing or Quality Assurance Authority, shall constitute the standard as regards any particulars or properties noted/defined in this specification.

4. MANUFACTURE & ASSEMBLY:

- 4.1 All assemblies/components will be manufactured and assembled as per respective drawings.
- 4.2 The components must be manufactured strictly in accordance with the form and dimensions and from the material specified on the drawings.
- 4.3 Unless otherwise stated, the welding is to be done in accordance with IS:813
- 4.4 The protective finish is to be in accordance with the requirements shown on the drawings.
- 4.5 No component shall be altered or rectified in any way, without written authority of the Quality Assurance Officer.
- 4.6 Before filling operations are commenced, the materials must be submitted to the Quality Assurance Officer for such examination and testing as may be necessary to ensure that they are sound, free from flaws and comply with tests specified, in the relevant specification or this specification.
- 4.7 Prior to the filling the Contractor must ensure that all the components used in the filling assembly are cleaned inside and outside and that they are free from all traces of moisture and any foreign matter.

- 4.8 The explosives will usually be supplied to the Contractor, but should he be called upon to supply or procure them, they must conform to the current approved specification.
- 4.9 Any explosive supplied to the Contractor must not be used for any other purpose whatsoever other than that for which their use is covered by the drawing or by this specification or by any special instructions issued by the Quality Assurance Officer.
- 4.10 All the components after received by the filling factory will in good condition i.e free from dents, cracks, cuts or any other damage. They should whilst in their possession be kept in condition.
- 4.11 Should any components require repair/replacement that must be re-submitted to the Quality Assurance Officer.
- 4.12 The Squib (filled) for RDM pyrocutter shall comprise the components scheduled in the drawings issued to the manufacturer.
- 4.13 The Squib (empty & bridged) for RDM pyrocutter shall be obtained by the manufacturer assembled in lots, sub-lots and as far as practicable, they shall be filled in the same sequence.
- 4.14 The details of the components required for filling and assembly of the store are listed in para 14. Materials for the component should conform to the appropriate specification mentioned on the drawing.
- 4.15 The squib shall not be more than 6 months old from the date of filling, when assembled.

- 4.16 The filling of the squib (filled) is to be carried out in controlled atmosphere where the humidity is maintained at 60% or below. All components must be free from moisture and textile and paper components are to be dried before using.
- 4.17 Use only inspected and proved components/assemblies for preparing the squib (filled).

4.18 PREPARATION OF SQUIB (FILLED):

4.18.1 EQUIPMENTS & TOOLS:

i) Camel Hair brush no.6 - Artist quality

ii) Aluminium dishes - Flat bottomed with 5 cm

dia & 2.5 cm ht

iii) Ohm meter - Range 0 to 10 0hms with measuring current less than 10mA

4.18.2 SAFETY APPLIANCES:

- i) Safety goggles
- ii) Earthed aluminium sheet platform with safety screen
- iii) Explosive carrying wooden boxes with earthing arrangements.

4.18.3 PREPARATION OF SQUIB COMPOSITION:

The squib composition consists of -

i) Lead ferrocyanide - 40 parts

ii) Potassium chlorate - 50 parts

iii) Calcium silicide - 10 parts

iv) Nitrocellulose, binder - 2.5 "

(APC-217) (Volume sufficient to give 2.5 parts

of solid)

NOTES

- For a batch of 100 nos of squibs, a batch of 5 g of squib composition is to be prepared.
- Safety goggles should be worn by the Operator while preparing the squib composition.
- iii) An earthed aluminium sheet platform with safety screen should be used while mixing the dry ingredients and while mixing the composition with NC varnish by a brush.
- iv) The preparation and filling of squib composition should be carried out in a room with RH of 40 to 60 %.
- v) Ingredients (i, ii & iii) above should be dried at 100° C±5° C for 2 hours and after cooling, should be preserved in a desiccator before the preparation of the composition.

METHOD OF MIXING:

2.0 g of Lead ferro cyanide, 2.5 g of Potassium chlorate and 0.5 g of Calcium silicide are weighed and mixed thoroughly on a glazed paper. The mixture is then transferred to an aluminium dish (approx 5 cm dia & 2.5 cm ht) and required qty of APC-217 is pipetted out into the dish. A little quantity of thinner (solvent mixture) specified for the APC-217 is added as required and the wet mixture is then stirred well with the help of an Artist Hair brush no.6 to get the required consistency.

4.18.4 COATING AND WATER PROOFING:

The tinned copper wires connected by the nichrome wire are brought near by pressing with fingers, if required, (care being taken to avoid shorting of the two wires) and the bridges are dipped in the squib composition of desired consistency two or three times to build a smooth and spherical bead with a charge weight of 20 to 30 milligram on each bridge. The composition must be stirred before each and every dipping. A drying time of at least 30 minutes is allowed in between the two consecutive dips. The coated squibs are then dried for 2 hours at 55 to 60°C. After drying, the squib beads are given three waterproof coats of Ammunition protective composition No. 219, with a drying time of not less than 30 minutes in between the two consecutive coats. The waterproof coat should extend up to the top surface of the squib plug and cover the bead completely. The squibs are again dried for 2 hours at 55 to 60°C.

4.18.5 RESISTANCE TESTING:

The resistances of the squibs are then checked with a safety Ohm meter whose measuring current is not more than 10 mA. The squibs with resistance between 1.6 to 2.4 ohm should be accepted. The accuracy of the ohm meter should be ensured with the standard resistance, preferably of the value of 2.0 ohm.

MARKING:

- 5.1 A lot shall normally consist of approximately 200 nos. of squibs plus 40 nos. for test and should be serially labelled.
- 5.2 Any monogram or symbol used by the manufacturer for making the store shall be subjected to the approval of the Quality Assurance Officer and shall not be changed without his approval.

6. SAMPLES & QUALITY ASSURANCE:

- 6.1 ARRANGEMENTS FOR QUALITY ASSURANCE:
- 6.1.1 The manufacturers shall notify the Quality Assurance Officer that he is in a position to start work and shall inform him of all sub-orders placed in connection with the order at the same time they are placed.
- 6.1.2 The Quality Assurance Officer shall have access at all times, to all Departments of manufacturing plants which are concerned with the production and storage of materials or components under the order, at the Works either of the manufacturer or the sub-manufacturer and shall arrange for inspection to be carried out by his representatives as he considers necessary.

.2 QUALITY ASSURANCE OF MATERIALS:

- 6.2.1 Before proceeding to manufacture, all materials shall be submitted to the Quality Assurance Officer in batches. Each batch shall contain a quantity of material prepared under uniform conditions in respect of composition and manufacturing processes.
- 6.2.2 The manufacturer shall not take into use any material or components, until it has been accepted for its purpose by the Quality Assurance Officer, who may require the bulk of the material or the components to be sealed or bonded until results of tests or analysis of samples are available.

6.3 SAMPLES FOR TESTING:

6.3.1 The manufacturer shall prepare and supply free of charge, the material/components required by the Quality Assurance Officer required for testing purposes and shall provide the necessary facilities and apparatus which may be required for carrying out the test called for by the drawing or by this specification and other standard specifications.

- 6.3.2 The test species and samples will invariably be selected by the Quality Assurance Officer or his representative and will remain the property of the Government.
- 6.4 MAINTENANCE OF ATMOSPHERIC CONDITIONS:
- 6.4.1 The manufacturer must take steps to ensure that all components, prior to being filled, are free from all traces of damp.
- 6.4.2 After being dried, the components and material must be stored in a dry room till the filling operations are over.
- 6.4.3 The Quality Assurance Officer will periodically ascertain whether these conditions are being observed, and will prohibit the filling of any component or the use of any material, which has not been dried to his satisfaction.
- 6.5 SUBMISSION AND QUALITY ASSURANCE:
- 6.5.1 The manufacturer is expected to submit for quality assurance only satisfactory material and he shall be required to assume full responsibility for any material submitted which is found to be unsatisfactory.
- 6.5.2 The manufacturer will submit for acceptance of the material, components or assemblies called for in the order in suitably sized batches. The amount of material or no. of units that comprise a batch will be decided by the Quality Assurance officer after consultation with the manufacturer.
- 6.5.3 If the Quality Assurance Officer's examination of a proportion of batch of material, components or assemblies submitted to him reveals departures from the drawings and /or specification, the whole batch may be rejected.
- 6.6 RE-SUBMISSION OF REJECTED BATCHES:
- 6.6.1 Rejected batches may be re-submitted with the approval of the Quality Assurance Officer, where re-submission is permitted and the manufacturer elects to resubmit. The manufacturer shall first inspect the rejected batch, either for particular types or classes of defects, that caused the batch to be rejected, or for all types of classes

6.6.2 of defects as directed by the Quality Assurance Officer, and shall repair or remove all defectives of these types or classes. The mode of repair/rectification shall have the prior approval of the Quality Assurance Officer. The Quality Assurance Officer shall inspect a resubmitted batch for these types or classes of defects, using normal or tightened inspection at his discretion.

6.7 REPLACEMENT BY MANUFACTURER:

- 6.7.1 Formal acceptance of materials or components, by the Quality Assurance Officer, shall not relieve the manufacturer of his responsibilities for any parts, which may subsequently prove to be defective. If material or components from batches accepted after sampling inspection prove to be subsequently defective during examination or assembly, the manufacturer will be required to replace the defective material or components free of cost.
- 6.7.2 If the materials or finished or partly finished stores are expended or damaged in examination or test as stipulated in this specification or else where as a condition of acceptance, the manufacturer will be required to replace or repair, free of charge the no. of so expended or damaged, which becomes the property of the government.
- 6.7.3 Where finished stores are expended in proof, second proof or as stipulated in this specification or elsewhere as a condition of acceptance, the cost of the so expended will be borne by the consignee if the samples representing the lot have passed satisfactorily. Where a second proof or a special proof is requested by the manufacturer, a written request for such second proof/special proof should be obtained from the manufacturer including his willingness to bear the entire cost of such proof including that of all proof stores. In the case of rejected lots, cost of all the samples spent in all the proofs ,should be borne by the manufacturer.

7 METHOD OF QUALITY ASSURANCE:

- 7.1 The acceptance inspection shall be in accordance with IS-2500. Extracts from the relevant table from this specification used by the Quality Assurance Authority may be supplied to the manufacturer on request. A list showing classification of defects and AQLs to be adopted is attached as Appendix-A.
- 7.2 The Quality Assurance Authority reserves the right to inspect any unit of product within the batch in addition to operating sampling plant or plants associated with the specific AQL or AQLs.
- 7.3 The Quality Assurance Authority reserves the right to reject any batch which is found, during quality assurance to contain a critical defect, whether that critical defective forms part of a sample or not.
- 7.4 The Quality Assurance Authority will draw one or more samples from each batch, or at his option, draw samples from the production intermittently.
- 7.5 The manufacturer shall provide and maintain an effective inspection system acceptable to the Quality Assurance Officer covering the supplies against the order. The written description of the system will be considered acceptable when as a minimum it provides the inspection required by this specification and the related documents and also provides 100% examination of production for each listed critical defect. Results of all examinations and tests performed under this quality assurance system shall be made available to the Quality Assurance Officer. The manufacturer shall notify the quality Assurance officer of and obtained approval for any change to the written procedure that affects the degree of assurance required by this specification or other documents referred to therein.
- 7.6 The AQL mentioned for the purpose of acceptance is for the guidance of inspection and the manufacturer is expected to deliver a defect-free product.
- 7.7 In case of disputes about the inspection characteristics of an item, the verdict of the Quality Assurance Authority shall be final and binding upon the manufacturer.

8 TESTS:

8.1 LOTTING:

The lotting, sampling and acceptance procedure will be as per the specification "IS-2500" against the general inspection level -II with single sampling plan and normal inspection for the squib. The recommended lot sizes are :-

- (i) 151 280 nos.
- (ii) 281 500 nos. and
- (iii) 501 1200 nos

The corresponding sample sizes for Squib (filled) will be -

- (i) 32 nos
- (ii) 50 nos
- (iii) 80 nos

The defect analysis and AQLs are given in Appendix-A under para 4. Each lot of these squibs should meet the following requirements.

8.1.1 VISUAL:

The squib should be free from visual defects like dents, blow holes, air bubbles, incomplete filling and water proofing, odd shape and size, etc.

8.1.2 FUNCTIONAL TEST: RDM PYROCUTTER SQUIB

SI. No.		Requirements	Qty/samples to be tested	Method
1.	Resistance	2.0±0.4 ohms	100 %	With a meter whose measuring current does not exceed 10 mA.
2,	Max. No-Fire Current	150 mA	8/13/20 nos.	A steady DC of 150 mA should be passed through th squib for a period of 5 seconds. No squib should fire. All the squibs used in this test will be destroyed immediately after the test by firing at 1A.
3.	Minimum All-Fire Current	500 mA	do	A steady DC of 500 mA should be passed through the squib for a period of 5 seconds. All squibs should function within 5 seconds.
4.	Delay of functioning at 1A.	Not more than 15 ms	do	The delay of functioning of the squibs at a steady DC of 1A, measured by a photocell & timer should be not more than 15 ms.
5.	Charge Weight (including water proof coat)	Between 22 & 35 mg	8/11/20	This squib shall be weighed and fired at a DC of 1A. The fired debris will be brushed off the squib plugs. The squibs will again be weighed together. The difference between two weights should be between 176 & 280 mg/242 & 385 mg/440 & 700 mg.

9. PACKING AND DELIVERY:

- 9.1 The squib (filled Drg no. HEMRL/RDM Pyrocutter/1505) shall be packed in the current approved package and in accordance with the current approved package.
- 9.2 The manufacturer will ensure that the lot consisting of assemblies from same lot are used. The manufacturer will submit for acceptance of assemblies, called for in the manufacture in suitable sized lots. The amount of material or quantity or components or no. of units will be decided by the Quality Assurance Officer.
- 9.3 If assemblies are required to be transported to other unit of the manufacturer's work for final assembly or for any other purpose, these must be adequately protected to avoid damage of any kind.
- 9.4 If rocket propulsion unit filled, are required to be delivered outside manufacturer's work, they must be packed in standard packages approved by the Quality Assurance Officer.

10. RESPONSIBILITY FOR SAFETY:

10.1 Nothing in this specification shall relieve the manufacturer of the responsibility for the safety of his operations.

11. SUGGESTIONS FOR IMPROVEMENT:

11.1 Any suggestion for improvement in the document may be forwarded to :

The Director,

High Energy Materials Research Laboratory,

PASHAN, PUNE-411021

12. APPENDICES:

- 12.1 Defects and Defect Classification and AQL for the store/components are enclosed as Appendix-A.
- 12.2 Schedule of proof and sentencing criteria are enclosed as Appendix-B.

13. LIST OF DRAWINGS:

13.1 The details of the components required for assembly of the store are listed below. Materials for the components should conform to the appropriate specification mention on the drawings.

Sl.no.	Components/Assembly	Drawing No.	No. per set
1.	Squib (Filled) for RDM Pyrocutter	HEMRL/RDM Pyr	ocutter
2,	Squib plug (Bridged)	/1505 do	1505/1
3,	Squib Plug (Empty)	do	1505/2

- 2.1.1 Critical Defects: One hundred percent examination shall be performed for critical defects. All components containing such defects shall be rejected. Similarly a batch or a lot shall be rejected if it fails in a test classified as critical.
- 2.1.2 Major & minor Defects: Examination for major and minor defects shall be performed on a class basis in accordance with classification of defects using applicable sampling plans and acceptance criteria of specification IS-2500.

3. ACCEPTANCE QUALITY LEVELS:

3.1 The acceptable Quality Levels for defects shall be as follows:

Percent
As per para 4.1 Group No.1 of
do

4. CLASSIFICATION OF DEFECTS:

4.1 The visual, dimensional, electrical and load test defects shall be classified as follows. The AQLs for major and minor defects are applicable groupwise.

Group No.	Assembly/component With drawing no.	Classification and feature
	Squib (Filled) for RDM Pyrocutter HEMRL/1505	Major Defects: As per para 4.18.5 resistance test. AQL is 2.5 General Inspection Level-II: i) Resistance is outside the specified limit ii) Flickering, open & short resistance Visual Test: As per 8.1.1 AQL is 0.4 General Inspection Level-II i) Dent ii) Incomplete water proofing iii) Odd shape & size iv) Crack on the bead v) Peeling of water proof coating vi) Blow hole Resistance Test on the 100% Test samples As per 8.1.2 sl.no. (1). AQL is 0.4 General Inspection Level-II Resistance of all the test samples are recorded with numbered labels. i) Resistance outside the range by more than 0.03 Ohms ii) Resistance is open ,flickering or short

Group No.	Assembly/component With drawing no.	Classification and feature
		Max. No-Fire Current Test as per 8.1.2 sl.no.2 AQL is 1.0 General Inspection Level-II
		Before No-Fire Current Test :
		Resistance of all the test samples are again measured & recorded before putting them in the firing circuit. i) If the resistance defers by more than 0.3 Ohm from the value recorded under 8.1.2.sl no.1
		After No-Fire Current Test:
		 ii) Resistance changes by more than 0.1 ohm. iii) Resistance flickers, open or short. iv) Squib functions.
		Note: All the squibs used in this test will be destroyed immediately after this test by firing at 1.0 A.
		Min. All-Fire Current Test as per 8.1.2. sl.no.3
		AQL is 0.4 General Inspection Level-II
		In continuation with the resistance condition of the sl.no.2 from slno.1 of 8.1.2.
		 i) Very dull report with hissing noise. ii) The bead of the squib does not function. (with all the options like resistance intact or changes, resistance open, short or flickers).

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Group No.	Assembly/component With drawing no.	Classification and feature
escond an acceptant		Delay of Functioning as per 8.1.2. sl.no.4
		AQL is 0.4 General Inspection Level-II
		In continuation with the resistance criteria of sl.no.2 from sl.no.1 of 8.1.2.
		 i) Squib functions with delay exceeding 15.5 ms ii) Squib fails to function.
		Charge Wt. average per squib as per 8.1.2. sl no. 5:
		AQL is 0.4 General Inspection Level-II
		 i) Average charge wt exceeds 40 mg ii) Average charge wt less than 22 mg
	1	Minor Defects:
		Visual Test: As per 8.1.1 AQL is 1.5
		General Inspection Level-II
		i) Air bubble (s)
		Resistance Test on the 100% Test samples
		As per 8.1.2 sl.no. (1). AQL is 1.5
		General Inspection Level-II
		Resistance of all the test samples are recorded with numbered labels.
		 Resistance outside the range by not more than 0.03 Ohm.

Group No.	Assembly/component With drawing no.	Classification and feature
		Max. No-Fire Current Test as per 8.1.2. sl.no.2
		AQL is 1.0 General Inspection Level-II
		In continuation with the resistance condition of the sl.no.2 from sl.no.1 After No-Fire Current Test- i) Resistance changes by less than 0.1 Ohm but more than 0.03 Ohn after NFC test.
		Delay of Functioning as per 8.1.2. sl.no.4:
		AQL is 1.0 General Inspection Level-II
		In continuation with the resistance criteria of sl.no.2 from sl.no.1 of 8.1.2.
		i) Squib functions with delay exceeding 15 ms but less than 15.5 ms.
		Charge Wt. average per squib as per 8.1.2. sl no.5:
		AQL is 1.0 General Inspection Level-II
		Average charge wt exceeds 35 mg but less than 40 mg.

APPENDIX-B

SCHEDULE TO PROOF & SENTENCING CRITERIA FOR SQUIB (FILLED) FOR RDM PYROCUTTER.

1.	Type of proof	
2.	Lot size	
3.	Sample size	
4.	Address to which proof samples are to be sent.	
5.	Method of identification To be used on each Squib plug.	
6.	Item to be provided by proof establishment.	,
7.	Estimated mass of squib Plug.	:
3.	Arrangement for proof	:
Ų.	Observations required	:
0.	Record	1
1.	Recovery & disposal	*

RECORD OF AMENDMENTS

Amendment Amendment Authority Amended by Signature
Pertains to
Sl. No./para no./
No. Date column no. Name & Appointment Date

(IN BLOCK LETTERS)

TR-RDMS 1/1005,22052001/P.1-26