

MONITORING INSTRUCTION FOR INSPECTION		Issue No. 01 Rev. No. 04
		Date of Issue 05.09.22
TUNGSTEN POWDER AS PER ARDE SPECIFICATION		HEPF/QA/SC/G/030
Rev no	Amendment	Date
4.	Test Certificate clause amended as per Noting No: HEPF/QCP&QAP/SC/65001/2022 Dt:03.09.22	05.09.22

SPECIFICATION : ARDE /SPECN/PNWH/MAT/TAP:2012
END USE : PREFRAGMENTS

- A INSPECTION CHECK TO BE CARRIED OUT AT FIRMS PREMISES: NIL
B INSPECTION CHECK TO BE CARRIED OUT ON RECEIPT AT FACTORY.



PILOT SAMPLE

1. The firm shall initially supply 2 kgs of Tungsten powder per batch/lot as Pilot Sample mentioning Batch no./Lot no. , Batch/Lot Qty. along with Test Certificates for each batch/lot indicating Chemical composition, Apparent Density, Average Particle Size. The firm shall also provide particle size distribution for each batch.

TABLE A

SL. NO.	CHARACTERITICS	SPECIFICATION / REQUIREMENT	SAMPLE SIZE
1	Visual	All the containers should be free from damages and ruptures	Each consignment
2	Packing	1) The material for each batch should be filled in double polythene film bags and shall be provided in weather tight sealed and reinforced steel drums (each drum 50kg capacity) having lifting rings provided at sides and top. 2) The packing shall be sea /air worthy to withstand any possible damage to drums during transit & handling. 3) Each drum should carry a tag indicating batch/lot no. And qty for proper identification. 4) In case the polythene film bags are found in open or ruptured condition inside the drum, the powder will not be accepted. 5) Such rejected material should be replaced by supplier at no cost basis.	
3	Marking	Each drum shall be subscribed with manufacturing lot/batch number/s, total no of containers comprising the batch/lot. Purchase order number and date of final sealing, date of manufacture and name of manufacturer	
4	Chemical Composition	As per Spec ARDE/SPECN/PNWH/MAT/TAP:2012	1 Sample per pilot batch/lot
5	Physical properties 1. Average Particle Size 2. Apparent Density		

NOTE:-

- One sample of 500gms (max) of powder shall be drawn from each pilot batch subject to chemical composition and physical properties testing.
- On getting satisfactory results for the pilot sample, the firm shall be given clearance for supply of bulk lots/batches

Bulk supply

- Inspection checks to be carried out on receipt at factory as per Table A
- If batch size more than 10,000kgs then for every 10,000kgs three representative samples shall be taken


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TABLE B: VERIFICATION OF ADEQUACY OF INSPECTION DOCUMENTS.


The supplier shall enclose the following inspection documents along with each supply including pilot samples.

SL. NO.	INSPECTION DOCUMENTS *
1	Manufacturers Test Certificate or Test certificate issued by any reputed laboratory confirming to the specification and meets the above mentioned technical specification separately for each lot/ batch for pilot and bulk supplies.
2	Packing slip indicating source, weight per drum, HEPF supply order no., powder lot / batch no. Etc.
3	Particle size distribution data of the powder for each batch / lot.
4	Guarantee / warranty certificate.
5	Certificate indicating date of manufacture and shelf life if stored in original sealed packing in ambient condition for each batch / lot.
6	In addition to the above soft copies of all the certificates mentioned in Table – A shall be sent to e- mail id's. happqa@ord.gov.in , mmhapp@ord.gov.in
Note	Explicitly deviation(s) if any such as typographical error, values, numeric, other parameter, etc is/are found in monitoring instruction of the above stores, the relevant standards conforming to the concerned specifications shall be referred to confirm the parameter

* - NOTE : HEPF supply order no. & qty. must be mentioned clearly in all above inspection documents.


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DGM /P (USER SECTION)
MEMBER / MI COMMITTEE

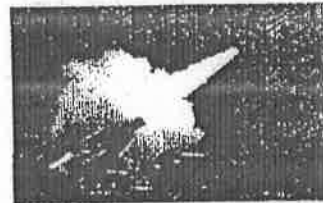

SRÉENIVASA RAO BODALA
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CHAIRMAN

ISSUED BY
STANDARD CELL
MIS No.: 220330 dt: 15/9/22
DATE: 21/9/22 SIGNATURE

**SPECIFICATION NO. :
ARDE/SPECN/PNWH/MAT/TAP:2012**

Issue : 1.0

Rev No : 1



**Specifications for Elemental Powders
of
TUNGSTEN ALLOY SPHERE**



ISSUED BY

ARMAMENT RESEARCH AND DEVELOPMENT ESTABLISHMENT

**PASHAN, PUNE - 411021
DRDO, MINISTRY OF DEFENCE
GOVT. OF INDIA**

SEPT 2012

SPECIFICATIONS OF TUNGSTEN POWDER FOR USE IN
MANUFACTURE OF TUNGSTEN Alloy FRAGMENTS

1. Preamble

- 1.0 The Tungsten alloy projectiles / fragments (TAPS) of different types like spheres, cubes & cuboids are used in various types of warheads. These TAPS are manufactured through the Powder metallurgy route using a mixture of three types of Elemental Powders in specific proportions. The major constituent is Tungsten powder, and the AHSP specifications state the composition of W in the Tungsten Alloy as 94 to 96 %.
- 1.1 The necessity of preparing this specification has arisen, as the Quality Assurance plan for the fragments states that the chemical composition of the batch mixture should be within the specified range as per drawing, but does not state anything about the specification of input raw material like Tungsten, to be used for manufacture of these TAPS.
- 1.2 HAPP had been so far manufacturing the TAPS with the Tungsten powder available at HAPP, procured for manufacturing of FSAPDS as per CQA(M)-58 specification. The CQA(M) -58 specifications specifically governs the supply of Elemental Powders for manufacture of FSAPDS projectiles. The specification has been particularly made to cater the manufacture of Penetrator blanks for FSAPDS, incorporating stringent chemical composition, Performance conformity test and Type testing that are required only for Penetrator blanks.
- 1.3 Hence, there is a need to frame separate specification of Tungsten powder for manufacture of the TAPS, incorporating the requirements of TAPS.
- 1.4 Accordingly, this document outlines the specification of Tungsten Powder to be specifically used for manufacture of TAPS of different sizes.

2. Foreword

- 2.1 This specification has been prepared for HAPP, Trichy in consultation with Defence Metallurgical Research Laboratory, Hyderabad and allied establishments.
- 2.2 The specification is approved by Heavy Alloy Penetrator Project, Trichy Ministry of Defence (OFB), and is mandatory for use in defence services.
- 2.3 Supplier of Raw materials are subject to approval by The General Manager, HAPP, Trichy or his authorized representative.
- 2.4 Any queries/ clarification relating to the materials of this specification should be referred to The General Manager, HAPP, Trichy or his authorised representative.

- 2.5 The Inspecting Officer for Raw Material shall be The General Manager, HAPP, Trichy or his authorized representative.

3. Scope and Definition

- 3.1 This specification relates to the Procurement, Inspection and Quality Control of Tungsten Powder for use in manufacture of fragments to be used in warheads.
- 3.2 **Apparent Density** - It is the weight of a unit Volume of Loose Powder expressed in grams per cubic centimeter. This characteristic defines the actual volume of occupied by a mass of loose powder.
- 3.3 **Average particle Size** - Expressed in Microns, when tested as per the specification.

4. General Requirement

- 4.1 The Supplier shall provide the following to the Inspection Officer or his authorized representative, for Inspection and testing of the Powders supplied
- a) Sufficient Quantity of Powders as required for conducting the Tests.
 - b) Test certificates for the Chemical composition test and the physical property tests as per clause 6.1 & 6.2 of this specification, carried out on each batch of powder, by the supplier at his premises before dispatch. The batch/lot size of powder shall be defined by the supplier in his quotation.
- 4.2 **Packing** - The material should be packed in a double polythene film bags duly sealed and shall be packed in weather tight sealed and reinforced steel drums having lifting rings provided at sides and top. The drum should be packed in seaworthy/roadworthy crates, which should be sturdy to withstand any possible damage to the drums during transit and Handling.
- 4.3 **Marking** - Each Drum shall be superscribed with Batch/Lot no. Purchase order no., Quantity in the Drum, date of manufacture, Name of the manufacturer, and date of final Sealing. Each crate shall carry the following details on a Paper duly sealed in a Water proof polythene cover and attached to the crate:
Name of the Manufacturer, Purchase Order No. The Consignee, The Order Quantity, The Batch /Lot no., Date of Manufacture, Date of Crating, Total nos, of drums in the crate, Total Quantity.

5. Quality Assurance

- 5.1 The supplier shall provide a Tungsten powder sample of 2 kgs representing a homogenized batch/ Lot, from each batch/lot of Tungsten powder as a Pilot Sample for inspection, testing and approval of the purchaser prior to bulk dispatch. The Pilot sample should comply to the chemical composition and Physical properties stipulated at Clause 6.1 and Clause 6.2 respectively.

- 5.2 The supplier shall provide a Test Certificate to this effect from a National/International Accredited Laboratory for the each batch of powder supplied.
- 5.3 One sample of 500 gms (max.) of powder shall be drawn from each pilot batch and subjected to Chemical composition and Physical properties testing.
- 5.4 The Chemical Composition test shall be carried out by adopting standard methods for compliance with the requirements of this specification as stipulated at Clause 6.1.
- 5.5 The sample shall be tested for physical properties like Apparent/bulk Density and Average Particle Size using Standard Testing methods for compliance with the requirements of this specification as stipulated at Clause 6.2.
- 5.6 On successful completion of the tests, the purchaser shall accord clearance for supply of Bulk lots/batches.
- 5.7 Each Bulk lot/batch shall be subjected to chemical composition and physical properties testing. Three representative samples of 500 gms (max) each shall be taken randomly from each batch and tested for the above parameters using standard methods for compliance with the requirements of this specification as stipulated at Point Clause 6.1 and Clause 6.2 respectively. In case the batch size is more than 10000 kgs, for every 10000 kgs three representative samples shall be taken.

6.0 ACCEPTANCE CRITERIA

6.1 Chemical Composition (Tungsten Powder)

The chemical composition shall conform to :

W	-	99.90 % min. (by difference on Gas free Basis)
Ca	-	50 ppm max
Al	-	20 ppm max
Mg	-	15 ppm max
K+Na	-	30 ppm max
Cu	-	20 ppm max
Mn	-	20 ppm max
Sn	-	20 ppm max
As	-	20 ppm max
Bi	-	20 ppm max
Si	-	40 ppm max
C	-	40 ppm max
S	-	10 ppm max
P	-	20 ppm max
O	-	2000 ppm max

6.1.1 Physical Properties

The Physical Properties of the Powder shall conform to :

Average Particle Size	-	3.0 to 6.0 Microns FSS
Apparent Density	-	3.0 to 5.0gm/cc

6.2 Chemical Composition (Nickel Powder)

The chemical composition shall conform to :

Ni	-	99.70 % min.
Sn	-	10 ppm max
Sb	-	10 ppm max
S	-	10 ppm max
P	-	20 ppm max
C	-	3000 ppm max
O	-	2000 ppm max

6.2.1 Physical Properties

The Physical Properties of the Powder shall conform to :

Average Particle Size	-	2.2 to 3.3 Microns
Apparent Density	-	0.5 to 0.95 gm/cc

6.3 Chemical Composition (IRON Powder)

The chemical composition shall conform to :

Fe	-	99.5 % min.
Cr	-	150 ppm max
Pb	-	10 ppm max
Ca	-	40 ppm max
Mn	-	50 ppm max
S	-	10 ppm max
P	-	20 ppm max
C	-	500 ppm max
O	-	2500 ppm max

6.3.1 Physical Properties

The Physical Properties of the Powder shall conform to :

Average Particle Size	-	5.0 to 7.5 Microns
Apparent Density	-	2.0 to 3.5 gm/cc

SCOPE OF WORK

(PR No. 2200229 Dt, 12/09/2022)

Job Description: Recovery of Pure Tungsten Powder from Tungsten Heavy Alloy Solid Scrap and End Pieces

- 1) HEPF, Trichy shall provide the Tungsten Heavy Alloy Scrap in the form of Turning & Boring and solid scrap bearing the following Composition:
Tungsten – 89 to 90%
Nickel + Iron + Cobalt + Other Elements – Balance
- 2) The firm has to recycle the Scrap using Hydrometallurgy / Pyrometallurgy or any other suitable process to obtain Pure Tungsten Powder of the Specification mentioned below:

Chemical Composition: W – 99.9%

Other Elements in ppm max.

Si	Ca	Al	Mn	Mg	As	Bi	Sn	Cu	K+Na	S
40	50	20	20	15	20	20	20	20	30	10
P	C	O								
20	40	2000								

Physical Properties:

Average Particle Size : 3 to 6 Microns

Apparent Density : 3.0 to 5.0 gm/cc

- 3) The Firm shall provide / supply 100% Quantity of Tungsten powder output (as per ARDE specification enclosed as Annexure "A") produced from processing of Scrap provided by the HEPF.
- 4) The firm shall lift the Scrap from HEPF, Trichy by their own arrangement. The firm shall deliver the processed Pure Tungsten Powder to HEPF, Trichy in properly sealed moisture free steel container of 50 kg capacity along with Test certificates.
- 5) The Firm shall submit suitable Bank Guarantee towards the value of scrap as estimated by HEPF, Trichy, before lifting the scrap.
- 6) **Acceptance of Supply:** The Tungsten Powder will be accepted as per the Monitoring Instruction for Inspection No. HEPF/QA/SC/G/030 Issue No. 01 & Rev. 04 dated 05/09/2022 (enclosed as Annexure "B").


AWM/R&D


OIC/PM

QUALIFICATION CRITERIA FOR TECHNICAL BID

(PR No. 2200229 Dt, 12/09/2022)

01. The Firm should have the facilities required for the complete recycling process, i.e. for conversion of Tungsten Heavy Alloy Solid Scrap to Tungsten Powder. The details of all the essential equipments should be given by the firm as per the following tabulation:

Sl. No.	Equipment	Output Capacity per day
01		
02		
03		

02. Firm shall confirm that it has the Technical capability and processing facilities which can provide **minimum 0.72 kg** of Tungsten Powder (as per ARDE specification) for every 1 kg scrap collected from HEPF, Trichy.
03. The Firm should provide a detailed process flow chart as well as quality plan indicating the various steps being followed by the firm for conversion of scrap to Tungsten Powder.
04. The Firm should indicate the various quality checks being carried out during the process to ensure that the output quality of Tungsten Powder is as per the required specification.
05. The Firm should also give a list of the laboratory equipments available in-house for carrying out the various tests to ensure quality output.

Sl. No.	Equipment	Details of Equipment
01		
02		
03		

06. In case the Firm is taking help from external laboratories for testing and evaluation of certain parameters, then the Firm should give necessary details of the external laboratories, like the address, facilities available with the laboratories, etc.
07. The Firm should have executed at least one supply order of minimum 3 ton of Tungsten Powder with purity of 99.9 % and above. The Firm should submit a proof of successful execution in this regard.


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