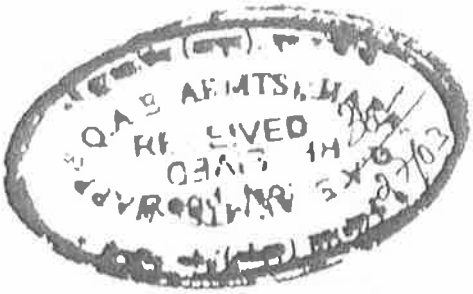

ISSUE: JULY 2017
AMENDMENT NO. - 01
CQAM-58: 2017

RAKSHA MANTRALAYA
MINISTRY OF DEFENCE
DEPARTMENTAL SPECIFICATION

SPECIFICATION FOR GOVERNING SUPPLY OF ELEMENTAL POWDERS FOR MANUFACTURE OF FSAPDS PROJECTILES

ISSUED BY:

CONTROLLERATE OF QUALITY ASSURANCE (METALS)
MINISTRY OF DEFENCE (DGQA)
GOVERNMENT OF INDIA
P.O- ICHAPUR -NAWABGANJ
DIST-24 PARGANAS (NORTH)
WEST BENGAL

RECORD OF AMENDMENTS

Amendment	Sub-headings to which amendment pertains	Authority	Incorporated by name and rank in block letters	Initials
The word "Powder" is replaced by word "Tungste Powder" in clause No. 4.4	Clause No. 4.4	This Controllerate letter No. CQA(M) / QA-2 / T-72 / FSAPDS / Vol- 10, Dt. 14th Aug 2017.	-	-
Validity of Approved source increased to five years	Clause No. 6.8	-- do --	-	-

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SPECIFICATION FOR GOVERNING SUPPLY OF ELEMENTAL POWDERS FOR MANUFACTURE OF FSAPDS PROJECTILES

DEPARTMENTAL SPECIFICATION

1. FOREWORD

1.1 This specification has been prepared by Controllerate of Quality Assurance (Metals), Ichapur in consultation with Defence Metallurgical Laboratory, Hyderabad and allied establishments.

1.2 This specification is approved by Controllerate of Quality Assurance (Metals), Ministry of Defence (DGQA) and is mandatory for use in defence services. The information contained in this specification is not to be communicated either directly or indirectly to press or any person not authorised to receive it.

1.3 This specification is the property of the Ministry of Defence (DGQA) and must be returned to the **Controller, Controllerate of Quality Assurance (Metals), Ichapur on demand.**

1.4 Copies of this specification can be obtained from the **Controller, Controllerate of Quality Assurance (Metals), Post – Ichapur Nawabganj, District – 24 Parganas (North), West Bengal.**

2. Scope and Definition

2.1 This specification relates to Procurement, Quality Control and Quality Assurance of Elemental Powders i.e. Tungsten (W), Nickel (Ni), Iron (Fe), Cobalt (Co), Molybdenum (Mo) for manufacturing of FSAPDS projectiles.

2.2 For the purpose of this specification the following expressions shall have the meaning as under:-

a) "Quality Assurance Authority" shall mean the Controller, Controllerate of Quality Assurance (Metals), Ministry of Defence (DGQA), Government of India, P.O. Ichapur-Nawabganj, Dist 24 Parganas (North), West Bengal, Pin – 743 144.

b) "The Manufacturer" shall mean the person or persons, firm or firms, company or companies who have contracted to manufacture and supply the elemental powders for which this specification applies.

c) "The Quality Assurance Officers" shall mean the Quality Assurance Officer nominated by the Controller, Controllerate of Quality Assurance (Metals), Ichapur, for undertaking the Quality Assurance of the elemental powder.

d) 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 occupied by a mass of loose powder.

e) PERFORMANCE CONFORMITY TEST – This test is carried out to evaluate Density, UTS and % Elongation of sample prepared by Compaction & Sintering of elemental powders in specified proportion.

f) AVERAGE PARTICLE SIZE – Expressed in Microns, when tested as per the specification.

3. General Requirements

3.1 Manufacturer shall provide the following when submitting the powders for approval by the Quality Assurance Authority:

a) Sufficient quantity of powders as required for conducting the tests.

b) Test certificate for various tests carried out by the manufacturer for the powder supplied.

3.2 Marking: - Each container of powder shall have subscribed over it the batch / lot number, total no. of containers comprising the batch / lot, date of manufacture and name of manufacturer.

3.3 Packing: - The material should be filled in double polythene film bags and shall be packed in weather tight sealed and reinforced steel drums having lifting rings provided at sides and top. The drum shall be packed in sea worthy crates, which should be sturdy to withstand any possible damage to drums during transit & handling. Each drum shall be super scribed with manufacturing Lot no., Purchase Order number and the date of final sealing. In case the polythene film bags are found in open or ruptured condition inside the drum, the powder will not be accepted. Such rejected material should be replaced by the supplier at no cost basis.

4. QUALITY ASSURANCE

4.1 The elemental powders shall be procured from AHSP approved / satisfactory evaluated sources only.

4.2 Selection of Elemental Powder samples: Three representative samples of appropriate weight, each from a different container, covering each batch / lot of powder received shall be drawn by the Quality Assurance Officer for the purpose of verifying physical and chemical requirements stipulated in this specification. Powder samples drawn from the containers shall

be sealed in airtight polythene container and batch / lot no. with associated details marked on it.

4.3 The powder shall be tested for the following properties:

4.3.1 CHEMICAL COMPOSITION

Samples as drawn above shall be subjected to chemical analysis by adopting standard methods for compliance with the requirements of this specification stipulated in clause 5.1.

4.3.2 PHYSICAL PROPERTISE

4.3.2.1 Each sample as drawn above shall be tested for Apparent Density as per ASTM Designation B – 417- 82 and Average Particle size as per ASTM Designation B – 330- 82 for compliance with the requirement of this specification stipulated in clause 5.2.

4.3.2.2 Particle size distribution data shall be obtained from the supplier for reference only.

4.3.3 PERFORMANCE CONFORMITY TEST

4.3.3.1 This testing is applicable to powders to be approved for new source of supply only, except in case of Tungsten Powder, when the test shall be carried out in all cases of suppliers.

4.3.3.2 With the powder remaining after physical & chemical testing as per clause 4.3.1 & 4.3.2, one blank shall be compacted, sintered, heat-treated by mixing with other approved powders as per approved manufacturing procedure for carrying out Performance Conformity test to evaluate mechanical properties. Three test pieces shall be machined as per sketch No. CQAM /58/1, CQAM /58/2 & CQAM/58/3. The powder shall be accepted on satisfying minimum requirement of physical properties as stipulated in clause 5.3.

4.3.3.3 If one, out of 3 test pieces fails, 2 more test pieces shall be machined from the original left over blank and tested (in case of clause 6.7, if one, out of three test piece from any lot of sample corresponding to a ton of powder fails, two more test pieces from a particular lot shall be machined from original blank and shall be tested). The sample shall be cleared, if results are satisfactory in retesting for both the test pieces (in case of clause 6.7 the sample shall be cleared if result is satisfactory in retesting of all samples).

4.3.3.4 If more than one test pieces fail in PCT, the samples shall be sentenced as rejected. (However, in case of bulk supplies if more than one sample fails, a 2nd set of test pieces shall be prepared from a new blank and all the 3 test pieces should pass for the lot to be accepted). In case of clause 6.7, the lot of one ton corresponding to the sample shall be sentenced as rejected if more than one test piece fails

4.4 Tungsten Powder supplied by approved source, if found acceptable as per clause 4.3.1, 4.3.2 and 4.3.3 shall be approved for manufacture of FSAPDS projectiles.

5 ACCEPTANCE CRITERIA

5.1 Chemical composition: As per Appendix 'A'

5.2 PHYSICAL PROPERTISE: -

	'W'	'Ni'	'Fe'	'Mo'	'Co'
Apparent Density	3.9 – 4.3 gm/cc	0.75 – 0.95 gm/cc	2.6 – 3.1 gm/cc	0.7 – 1.8 gm/cc	0.7 – 1.2 gm/cc
Average particle size	3.0 –5.0 Microns FSS	2.6 –3.3 Microns FSS	5.0 –6.0 Microns FSS	3.0 –6.0 Microns FSS	1.2 –1.6 Microns FSS

5.3 PERFORMANCE CONFORMITY TEST:-

i) Density - 17.12 ±0.12 gm / cc

ii) UTS - 850 Mpa min

iii) % El - 20 min (GL = 11.35mm)

5.4 DEVIATION

Following deviations are allowed on Chemical Composition and Physical Properties obtained on powders supplied by approved source only:-

5.4.1 Impurities up to 10% exceeding the maximum limit are allowed.

5.4.2 OXYGEN CONTENT AS GIVEN BELOW ARE ALLOWED

a) 1000 ppm max for Tungsten Powder.

b) 2000 ppm max for Nickel Powder

c) 5500 ppm max for Cobalt Powder

d) 1500 ppm max for Molybdenum Powder

e) 2000 ppm max for Iron Powder

5.4.3 Apparent density value of ± 10% of specified value are allowed.

6. PROCEDURE FOR APPROVAL OF ELEMENTAL POWDERS FROM NEW SOURCE

6.1 The Firm shall supply the following information to Quality Assurance Authority for evaluation.

a) Company profile
b) Source & Nature of Raw Material
c) Process adopted stating the equipments, facilities with respective capacities
d) Quality Assurance Plan
e) Customer List with address & Performance Certificate

6.2 After satisfactory evaluation, the firm shall supply the Pilot sample as per clause 6.2.1

6.2.1 A powder sample as mentioned below representing a homogeneous lot shall be provided by the manufacturer as a Pilot sample for approval by AHSP / Resident QAO.

Tungsten Powder - 12 Kg
Nickel, Iron, Cobalt, Molybdenum Powder - 2 Kg

6.2.2 The pilot sample shall be tested as per clauses 4.3.1, 4.3.2 & 4.3.3 for its Chemical Composition, Physical Properties & Performance Conformity Test.

6.3 On getting satisfactory results on Pilot sample, Quality Assurance Authority shall give clearance for placement of Development Order.

6.4 A Development Order for Approval of Elemental Powder from New Source shall be placed for the following quantity:-

i)	Tungsten Powder	- 2 MT
ii)	Nickel Powder	- 100 Kg
iii)	Iron Powder	- 100 Kg
iv)	Cobalt Powder	- 3 Kg
v)	Molybdenum Powder	- 5 Kg

6.5 The powders received as per clause 6.4 shall be tested for its Chemical composition, Physical Properties and Performance Conformity Test as per clause 4.3.1, 4.3.2 & 4.3.3 respectively. On getting satisfactory results of these tests, these five powders (W, Ni, Fe, Co & Mo) and its suppliers shall be approved for supply of such powder.

6.5.1 Tungsten powder (only) supplied by new source, if found acceptable as per 4.3.1, 4.3.2 & 4.3.3 shall be subjected to Type testing as per the requirements of CQA(A)/PS/GS/183(a) for Shot 125mm FSAPDS or Appendix 'C' & Appendix 'B' to CQA(A), Specification CQA(A) – 5708 for Shot 120mm FSAPDS i.e. 5 No. each for Penetration proof (SNT & TNT) & one series of 8 No. for consistency at + 55°C.

However, results of the Type testing will be recorded for information and shall not be linked with the acceptance of Tungsten Powder. In case of failure in Type testing, a joint

investigation by HAPP & SQAE (A), HAPP to find out the root causes of failure and remedial measure to be undertaken based on outcome of joint investigation, and to be implemented within a period of one / two months.

6.6 The bulk shall be tested as per clause 4.2 & 4.3

6.7 In case the firm supplies bulk directly without pilot, the samples shall be selected from the bulk and the test shall be carried out as given below : -

Three samples shall be selected from each ton of powder supplied. These samples shall be tested as per clauses 4.3.1, 4.3.2 and 4.3.3 for its Chemical Composition, Physical Properties & Performance Conformity Test. On acceptance of test results, lot supplied will be cleared for Type test. For type testing samples will be selected from each ton of powder (Tungsten) supplied and shall be subjected to test as per clause 6.5.1 and on getting satisfactory results on type testing, the powder & its supplier shall be approved for supply of such powder.

6.8 The new source approved as above shall be considered as approved source, unless there is a break of more than five years either in supply of powder or in production of powder at the manufacturer's facility.

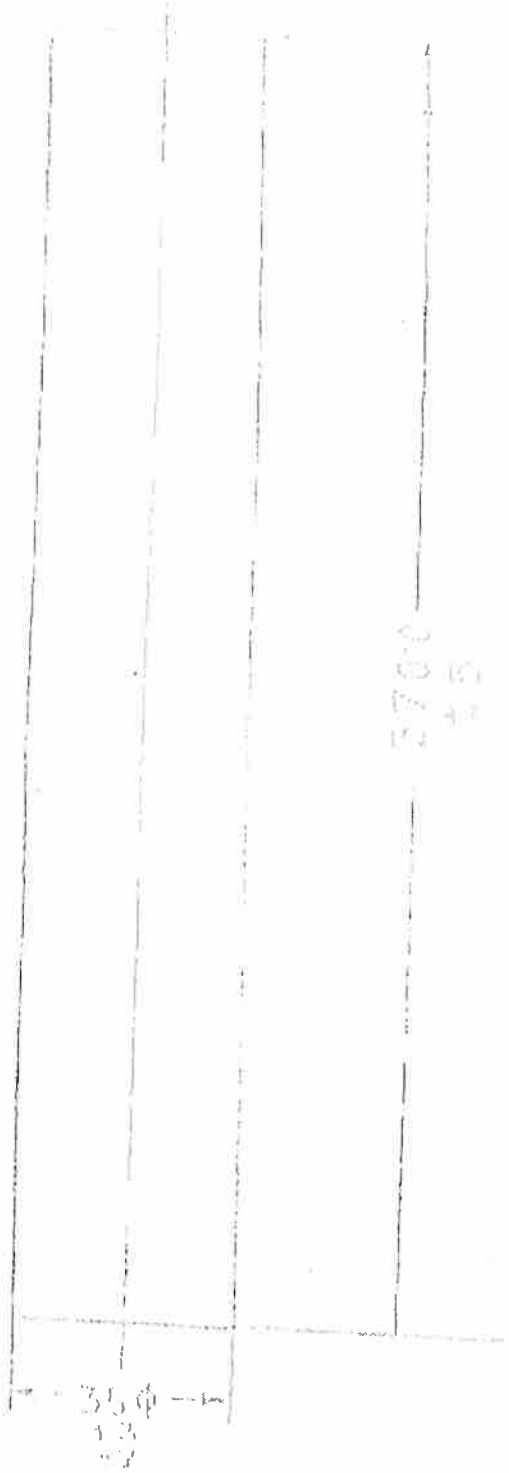
POWDER COMPOSITION

EACH ELEMENTAL POWDER SHALL CONFORM TO THE FOLLOWING COMPOSITION:-

POWDER	W% min	Ni% min	Co% min	Fe% min	Mo% min	Ca ppm max	Al ppm max	Mg ppm max	K+Na ppm max
Tungsten	99.9	-	-	-	-	40	20	15	30
Nickel	-	99.7	-	-	-	-	-	-	-
Cobalt	-	-	99.7	-	-	250	50	125	-
Iron	-	-	-	99.5		20	-	-	-
Molybdenum	-	-	-	-	99.9	50	-	-	-

POWDER	Cu ppm max	Mn ppm max	Sn ppm max	As ppm max	Sb ppm max	Ti ppm max	Bi ppm max	Si ppm max	C ppm max
Tungsten	20	15	20	10	-	-	10	40	40
Nickel	-	-	10	-	10	-	-	-	2500
Cobalt	100	50	100	-	-	-	-	-	400
Iron	-	50	-	-	-	-	-	-	500
Molybdenum	-	-	30	-	-	20	-	-	100

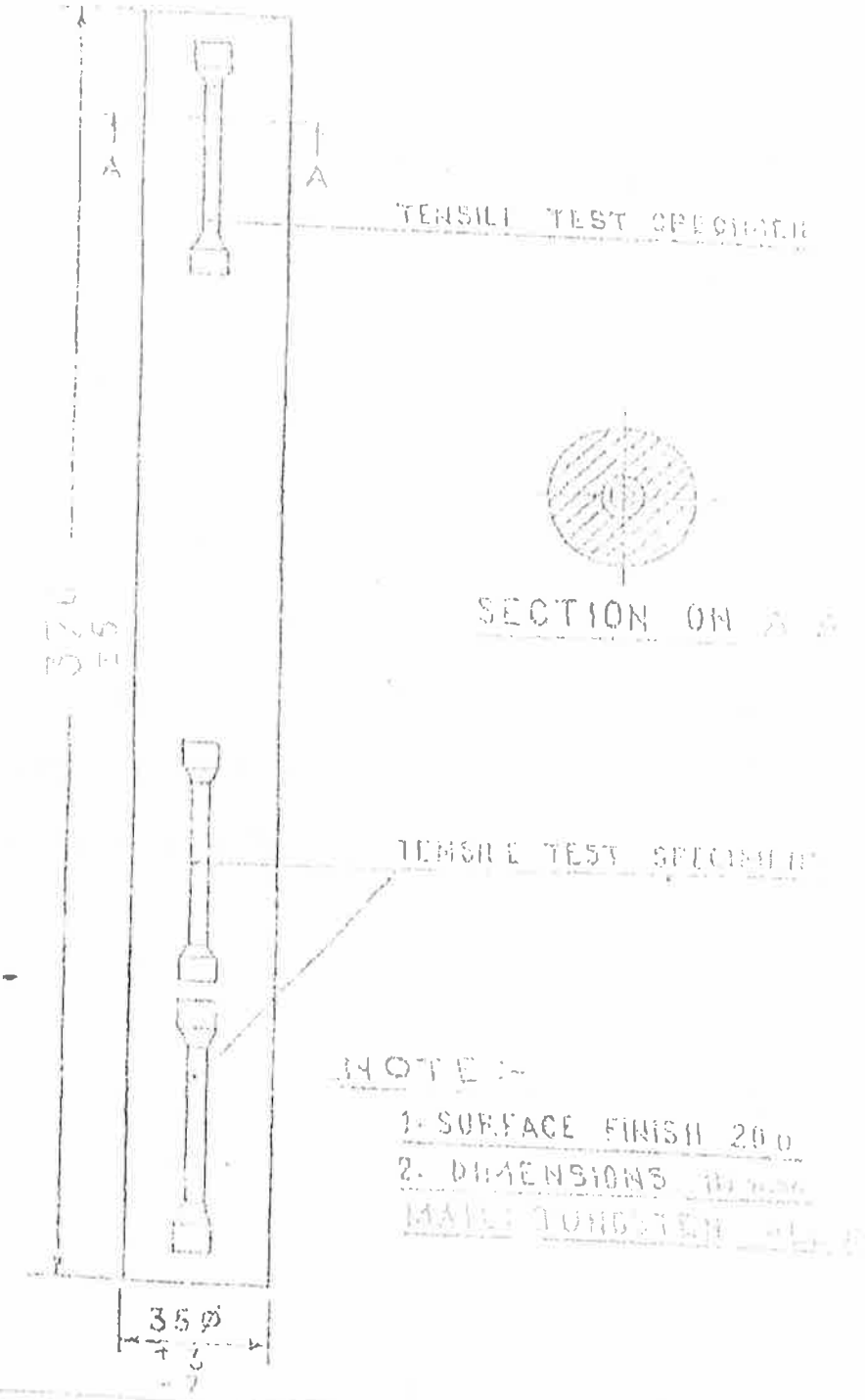
POWDER	S ppm max	O ppm max	Na ppm max	P ppm max	Cr ppm max	Pb ppm max	Zn ppm max	Ag ppm max	Total specified impurities
Tungsten	10	750	-	10	-	-	-	-	Not to exceed 0.10%
Nickel	10	2000	-	10	-	-	-	-	Not to exceed 0.40%
Cobalt	50	5000	100	50	50	-	50	100	Not to exceed 0.60%
Iron	10	2000	-	10	150	10	-	-	Not to exceed 0.25%
Molybdenum	10	1000	-	-	50	20	-	-	Not to exceed 0.10%



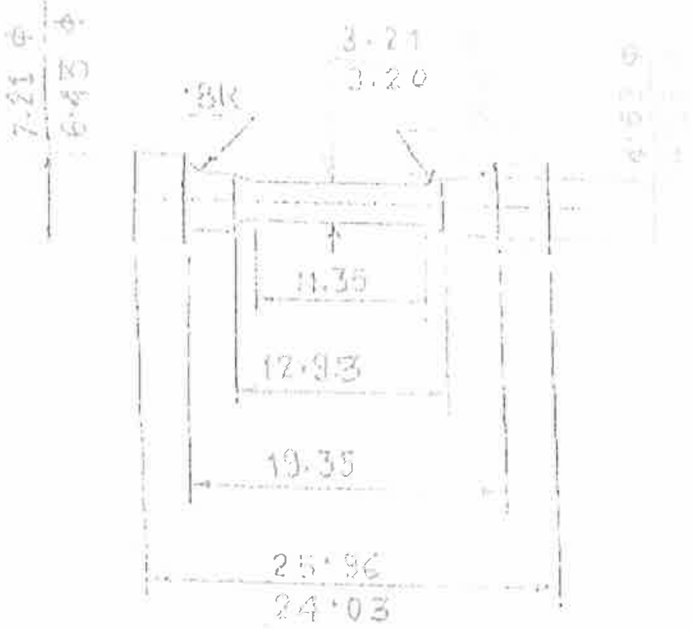
NOTE:

1. SURFACE FINISH 20μ
2. DIMENSIONS ARE IN
MATL : TUNGSTEN AL

HEAVY ALLOY BLANKS	SKETCH NO. CQAM / 58/1



LOCATION OF TEST SPECIMENS PENETRATOR 105mm /120mm /125mm / FSAPDS HEAVY BLANKS DIAMETER LARGER THAN 25mm	SKETCH No. **CQAM/58/2**



MACHINING FINISH: Ra =

EMERY GRIT 220 FINISH: Ra - 0.50μ

DIMENSIONS ARE IN mm

MTL. TUNGSTEN ALLOY

ROUND TENSILE TEST PIECE	SKETCH No. CQAM/58/3