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JAPANESE AMMUNITION

C.I. AMM. TECHNICAL REPORT

SUPPLEMENT "A"
TO
TECHNICAL REPORT No. 29

CARTRIDGE Q.F. 75-M.M.
WITH
H.E., A.A., SHELL TYPE '90
FOR
75 MM. TYPE '88 FIELD/A. A. GUN.

NOTE—This Supplement should be inserted in Binder behind Parent Report.

COMPILED BY
THE CHIEF INSPECTOR OF AMMUNITION,
KIRKEE.

1945.

SUPPLEMENT "A" OF MAY 1945
TO
C.I. AMM. TECHNICAL REPORT NO.29

(This Supplement should be inserted behind Parent Report)

CARTRIDGE, Q.F., 75-MM., WITH H.E., A.A., SHELL, TYPE '90 FOR 75-MM., TYPE '88 FIELD/A.A. GUN.

FRAGMENTATION RECOVERY TRIALS
(By Superintendent, Proof & Experiments, Balasore)

The results of static fragmentation trials of two shell are reproduced below:-

Weight Group. (in Ozs.)	Weight & Fragments by Group. No. of Fragments. Shell No.1	Shell No.2	Total Weight of Fragments. Shell No.1	Shell No.2.	Percentage of Total Weight in Each Group. Shell No.1	Shell No.2.	Average.	Percentage of fragments in Each Group to Total fragments Shell No.1	Shell No.2	Average.
2 - 4	2	5	0- 4-12	0-11- 2	2.5	5.9	4.2	0.1	0.3	0.2
1 - 2	23	34	1-13- 4	2-12- 4	15.5	25.5	19.5	1.4	2.1	1.8
½ - 1	74	71	3- 3- 0	3- 0- 4	27.0	25.6	26.3	4.5	4.4	4.5
¼ - ½	112	103	2- 4-12	2- 3- 8	19.5	18.8	19.1	6.9	6.4	6.6
⅛ - ¼	145	128	1- 7- 4	1- 4- 2	12.3	10.7	11.5	8.9	7.9	8.4
1/25 - ⅛	255	233	1- 0- 8	0-15-14	8.8	8.4	8.6	15.6	14.4	15.0
Under 1/25	1018	1042	0- 8- 0	0- 9- 4	14.4	7.1	10.8	62.6	64.5	63.5
Total.	1629	1616	10- 9- 8	11- 8- 6						

2. Thes shell were A.A. shell Type '90 and were filled with Time Fuze, Type '89 (four time rings) adapted for electrical firing by connecting an electric igniter direct to fuze magazine. The shell below fuze were fitted with original gaines and filling.

SHELL No.1.

This had one yellow band round middle as in Plates B and D of parent Report. Shell body was manufactured in May 1941. Weight without fuze, gaine and filling - 11-lbs. 11-ozs. All brass fragments were excluded in the recovery and percentage recovery is therefore 90.7%.

SHELL No.2.

This had one yellow band below centring band, and a white band above driving band as shown in Plates B and C. Shell body manufactured in September 1939. Weight details as for Shell No.1. Percentage recovery - 98.7%.

METALLURGICAL ANALYSIS

(By Inspector of Metal and Steel, Ishapore)

3. The following empty components of this ammunition were forwarded to the Inspector of Metal and Steel, Ishapore, for metallurgical examination :-

(i) Two shell and two cartridge cases. These were numbered 213 and 214. Shell and case No.213 was typical of round shown in Plate D of parent Report. Shell and case No.214 was typical of round in Plate C.

(ii) One Time Fuze, Type '89 (four time rings) typical of fuze in Plates G, H and J.

(iii) One gaine typical of gaine in Plate F.

ANALYSIS.

4.

Particulars.	Shell No.213.	Shell No.214
A. SHELL BODY (EMPTY).		
1. Identification Marks.		
(a) In paint.	Body painted with yellow band midway between the driving bands and red at mouth.	Body painted with white colour band immediately above lower driving band pair and yellow immediately below upper driving band and red at mouth.
(b) Stamps Marked. on body. Note:- No stampings on base of both the shell.	阪 9 五 十 昭 (Sept. 1940)	11 四 十 昭 (Nov. 1939)
2. Type of Screw Thread.	Right handed.	Right handed.
3. Weight of shell (Lbs). (Empty body).	11 - 0 - 4	11 - 0 - 4
4. Major Dimensions (Ins.)		
(a) Height	10.15	10.17
(b) Outside diameter on mid length of body.	2.920/2.925	2.923/2.925
(c) Outside diameter on driving bands:		
Lower bands.	3.020/3.021	3.018/3.018
Upper Bands.	2.946	2.945
(d) Diameter of Cavity.	1.85	1.85
(e) Thickness of Base.	1-11/32	1-11/32
(f) Wall Thickness:		
At 2⅛" from base	.595	.60

Particulars.	Shell No.213	Shell No. 214
(f) (f) Wall Thickness (Ins.)		
At $2\frac{1}{8}$" from base	.595	.60
" $2\frac{3}{4}$" " "	.60	.605
" $3\frac{1}{2}$" " "	.565	.57
" $5\frac{1}{2}$" " "	.535	.535
" $6\frac{1}{2}$" " "	.475	.49
" 8" " "	.38	.39

Note:- The shell were machined outside to form a tapering wall. The machining was concentric.

5. Hardness (on surface of Shell) Brinell (3000 Kgs./10-mm. ball)

At shoulder	321	269
At Mid body	350	277
Under lower driving band	340	286

6. Tensile Strength.

Yield strength.	50.0 tons/sq.in.	34.0 tons/sq.in.
Ultimate Tensile strength.	69.0 "	56.0 "
Elongation on Gauge length = 4 Area of active section.	14.6%	18.0%
Reduction of Area.	50.0%	50.0%

Note:- Test pieces were taken from wall in the governing region.

7. Analysis (Percentage)

Carbon.	0.66	0.56
Manganese.	0.61	0.91
Silicon.	0.20	0.19
Sulphur.	0.016	0.018
Phosphorus.	0.017	0.044
Nickel.	Trace	Trace
Chromium.	"	"
Molybdenum.	"	"
Tungsten.	"	"

Note:- Trace = Under .05%.

8. Base Fracture.	Good	Good
9. Method of Manufacture.	Both the shell have been made by hollow piercing followed by bottling, heat-treating and machining both outside and inside cavity.	

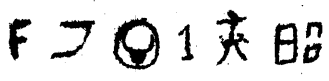
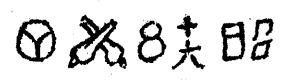
Particulars.	Shell No.213	Shell No.214.
10. Remarks.	The machining on the shell, both interior and exterior, was very good and some corrosion was noticed in case of Shell No.213 under the paint. No base plates were fitted on the shell.	

B. DRIVING BANDS.

(The shell were fitted with three sets of driving bands - two at the bottom and one near shoulder).

1. Hardness (V.P.H. at 10 Kilo.).		
(a) On lower pair of bands.	138 136	138 133
(b) On single band near shoulder.	98.5	100
2. Flattening Test (Hot and Cold)	Satisfactory	Satisfactory
3. Analysis (Percentage).		
(a) Lower pair of bands.		
Copper.	98.2 97.7	98.27 98.33
Silicon.	1.22 1.57	1.49 1.44
Nickel.	Nil. Nil.	Nil. Nil.
Tin.	Under .005 Under .005	Under .005 Under .005
Phosphorus.	Under .005 Under .005	Under .005 Under .005
Zinc.	Trace. 0.12	.06 Trace.
Bismuth.	Under .0002 Under .0002	Under .0002 Under .0002
Iron.	0.48 0.54	0.28 0.12
(b) Upper Single Driving Band.		
Copper	99.93	99.95
4. Method of Manufacture.	In both cases, the driving bands had been made from solid drawn tube.	

C. CARTRIDGE CASES.

1. Identification Marks.		
Stamped on Base.		
	NAGOYA ARSENAL (Jan. 1941)	(Aug. 1941)
2. Type of Screw Thread.	Right handed.	Right handed.
3. Major Dimensions (Ins.).		
(a) Length	19.53	19.53
(b) Diameter on head.	3.704	3.705
(c) Diameter under head.	3.373	3.377

Particulars.	Shell No. 213.	Shell No. 214.
(d) Diameter at 12".	3.07 - 3.072	3.07 - 3.072
" " Mouth.	3.12	3.12
Note:- Outside diameter of the case in each case tapers .025" per inch down to a length of 13" from under head.		
(e) Thickness of Base.	.218/.245	.254/.259
(f) Thickness of Flange.	.140	.135
(g) Wall thickness:		
At ½" from head.	.159	.164
" 1" " "	.115	.104
" 6" " "	.057	.052
	(Taper uniform)	(taper uniform)
" 8" " "	.055	.050
"18" " "	.040	.038
Note:- Taper between 8" and 18" uniform.		

4. Hardness.	Surface	Section	Surface	Section
(i) Base				
At 1½" from axis of case.	178	160	178	179
At 1" --do--	153	133	123	134
At ½" --do--	156	133	123	124
At ¼" --do--	135	120	123	124
(ii) On Boss.		118		102
		116		108
(iii) On Wall:				
At ⅛" from base.		173		179
Under head (.15" from flange).	160		193	179
¼" from head.	177	173	125	122
½" " "	166	163	156	134
1" " "	179	160	161	156
2" " "	193	175	175	164
4" " "	176	175	157	164
5" " "	170	170	156	164
5½" " "	170			
6" " "	170		155	150
8" " "	166		136	
10" " "	148		124	
12" " "	145		109	
14" " "	142		97	
16" " "	139		94.5	
Mouth.	121		93.2	

5. Analysis (Percentage).		
Copper.	61.22	61.88
Iron.	0.51	0.48
Lead.	Trace	Trace
Tin.	"	"
Antimony.	"	"
Bismuth.	<.0002	<.0002
Silicon.	0.072	0.056
Nickel	Nil.	Nil.
Aluminium.	Trace	Trace

Particulars.	Shell No. 213.	Shell No. 214.
6. Macro & Micro Structures.	The cases showed fine grain in general and coarse grained boss.	
7. Method of Manufacture.	Made by the process of hot stamping from cast bar followed by suitably adjusted drawing and heading. The case was machined on head and boss and the annulus inside between boss and wall.	
8. Remarks.	Two cartridge cases numbered 213 and 214 for the shell at para "A" were received. The primer boss of Case No. 214 was eccentric to the axis of the case. The outside of the primer boss was machined on both the cases. The cases as received were slightly distorted at mouth. The general structure of the case was good and the draws were well adjusted. The material is a 60/40 type of brass with additions of iron and silicon as refiners. The use of 60/40 type of brass on this and other cases previously examined and in course of investigation appears to be a standard practice with the Japanese.	

D. EXPLODER CONTAINERS FOR THE SHELL AT PARA 'A'.

1. Identification Marks.	Nil.	Nil.
2. Major Dimensions. (Ins.).		
Length.	4.1"	4.1
Outside diameter of holder,		
Near mouth.	1.255	1.25
Near base.	1.185	1.186
Thickness of base	0.078	0.077
Wall thickness of holder		
Near mouth.	0.112	0.113
Near base.	0.078	0.082
3. Hardness.	130 138	155 160
	Uniform throughout the length of container.	
4. Analysis (Percentage).		
Carbon.	0.27	0.33
5. Method of Manufacture.	Both the containers had been machined from solid hot rolled mild steel bars and machined outside to tapering diameter on the holder portion.	
6. Remarks.	The containers were well japanned both inside and outside. The threads were R.H.	

Particulars. Shell No. 213.

E. GAINE.

1. Identification of Marks. B区为7大十日□

Stamped on body. (July 1941).

2. The Spring (Conical helical compression)

(i) Dimensions:(Ins.)

Outside dia. at one end (top).	0.972
Outside dia. at other end (Bottom).	1.166
Wire diameter.	0.064
Free height.	1.5
Number of active coils.	3
Solid Height.	5/16"

(ii) Hardness. 590 V.P.H.

(iii) Test

Load required to compress spring so that the collar just touches the tongues of the arming ferrule (spring height at this stage was 9/16"). 6 lbs.

Load for compressing spring alone to 11/32" at which height of spring the collar groove engages the tongues of the arming ferrule. 9 lbs.

(iv) Method of Manufacture. Made from piano spring wire by cold coiling. The spring was well lacquered. There was no metallic coating on the spring.

3. Arming Ferrule.

(i) Hardness. 165/170 V.P.H.

(ii) Analysis. Copper 79.56%
Nickel 20.4%
(made from 80/20 quality cupro-nickel).

(iii) Test

Load required to push collar over the 4 tongues of the ferrule to engaging position with the spring in working position. 192 lbs.

(iv) Method of Manufacture. Made from solid drawn ½" dia. .034" thick tube of cupro-nickel.

4. Collar.

(i) Hardness. 112/117 V.P.H.
(ii) Analysis. (Copper 58.05%
(Lead 0.18%
(Aluminium.23%

Particulars.	Shell No. 213.
(iii) Method of Manufacture.	Machined from solid.
Note:- All the brass-parts have been machined from the solid.	
5. Body.	
(i) Hardness	96 - 112 (From axis outside).
(ii) Analysis.	(Copper 59.2% (Lead 00.61%
(iii) Method of Manufacture	Machined from the solid.
F. FUZE TYPE '89 (FOUR TIME RINGS).	
1. Identification Marks. Stemped on body.	阪[illegible]12五十日 (Dec. 1940).
2. Striker Spring (Cylindrical helical compression)	
(i) Dimensions: (Ins.).	
External diameter.	.365
Wire diameter.	.042/.0425
Free height.	.59 / .60
Number of active coils.	$2\frac{1}{2}$
Solid Head.	0.2
(ii) Test.	Lead — Ht. of Spring. 7-lbs. — .45-in. 15-lbs. — .3/.31-in. 21-lbs. — .2-in.
(iii) Hardness.	598 V.P.H.
(iv) Method of Manufacture.	Cold coiled from piano spring wire and lacquered. No protective metallic coating.
3. Body, Timing Rings.	The components showed hardness value varying between 100 and 110. They had been made from 60/40 quality brass containing .6% lead by hot stamping followed by machining.
4. Striker Sleeve.	Machined from the solid from 60/40 quality brass, (V.P.H. 120).
5. Remarks.	The components showed no special features of metallurgical interest.
G. NOSE PLUGS.	
1. Nose Plug.	Made of Mild Steel (B.H. No. 122/130). Machined from solid.

APPRECIATION.

A. Shell Bodies.

The use of a relatively high yield strength is of interest but it is apparent that difficulties have been experienced in obtaining uniform results as the two shells tested showed 34 and 50 tons per square inch yield.

The shell having been heat-treated after bottling is an unusual feature as the normal and more convenient practice is to heat-treat in the forging stage but it is possible this practice has been followed in order to avoid machining difficulties associated with the wide variation in strength recorded on the heat-treated shell.

On one of the two shell received, a tendency to serious local corrosion underneath the paint on the cavity is an undesirable feature.

B. Driving Bands.

The use of a silicon copper (1.4% silicon) for the lower pair of driving bands is noteworthy but as this feature has not been encountered in other types of Japanese shell examined, the silicon appears to have been introduced deliberately to stiffen up the shear strength of the band to enable it to compete with engraving stresses on firing.

C. Cartridge Cases.

Apart from the cases having been made from 60/40 brass by a preliminary hot stamping operation, a feature which appears to be general in all types of Japanese 75-mm. Cartridge Cases so far examined, there are no outstanding features.

D. Gaine.

E. Fuze, Type '89.

The use of 60/40 type brass with the relatively low lead content of .6% and its correspondingly relatively poor machine-ability indicates either that a higher lead content would be incompatible with the shell fillings or that the Japanese were not unduly worried about machining capacity at the time the components were made, (i.e. July 1941 and December 1940).

CHIEF INSPECTORATE OF AMMUNITION,
INDIA, KIRKEE.

FIRST ISSUE,
28th May 1945.