Australian Military Small Arms Ammunition Production 1888 - 2003.

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Foreword

The production of ammunition in Victoria in the 1890's was a significant event which untimately lead to major developments in Australia's Defence Industry and to Scientific Research and Development Capability. For those interested in examining the history of Military Small Arms Ammunition manufacture in Australia, available information is scattered and difficult to access.The purpose of this book therefore was to bring together for the first time the fragments of this history and to show how and why the industry evolved in the way that it did. I have borrowed heavily from the writings of J.K. Jensen and the annual reports of the Munition Supply Board. Some information has also been attributed to the periodic publications of the Australian Cartridge Collectors Association. The source of the material used in this book is acknowledged where applicable in appropriate footnotes. For the purposes of this book I have adopted the definition of small arms ammunition as being of maximum calibre 0.5" (12.7mm).

This book has been designed as an electronic publication which may be viewed with the freely distributed Adobe Acrobat Reader. Reader Version 5 or latter is required. By presenting the book in this form distribution is simplified. In addition graphics can contain much more detail than is available in a standard printed format. Many of the graphics will reveal their full detail when viewed at a high ‘zoom’ value, using the Adobe Acrobat Reader. Navigation through the book can be achieved by clicking on the page number in the Index or the section name in the Table of Contents. This will transport you directly to that section of the book.

Photographs have in some cases been enhanced to improve contrast or brightness using Adobe Photoshop, otherwise they represent actual specimens. The first nine chapters follow the evolution of ammunition manufacturing from the 1880’s to the present time. The remaining chapters describe in more detail, the particular types of ammunition made over the years.

This project has been encouraged and assisted by Mr Darryl Page, Director of Ordnance , Australian Defence Industries and Mr Robert Morley former SAA section Manager at Footscray in the 90’s and a current member of ADI’s Management Team. Robert kindly provided information on the 5.56mm program and the establishment of the

Benalla facility. Thanks also to Mr John Evans, former Senior Defence Quality officer for proof reading this book.

Chapter 1 *Pre Federation*

FIGURE 1. *Ammunition Factory Footscray circa 1985*

Figure 1 shows a view of the Footscray Munitions Site Circa 1985 looking East toward the Melbourne City area with Gordon street. traversing left to right in the foreground, the Maribyrnong river at the rear and the Flemington Racecourse in the distance. Also visible is Jack's Magazine to the left and

*the site of the original SAA factory at the centre of the scene on the river fl*ats.

The Colonies

The original Australian settlement in the British Colony of New South Wales was followed progressively by additional Colonies in Tasmania, Western Australia, South Australia, Victoria and Queensland during the early nineteenth century. Each of these new colonies eventually gained self government in their own right. The British Government had accepted overall responsibility for the external defence of these colonies up until self government was achieved. In 1862 the British House of Commons passed a resolution which in effect said that on reaching self government the colonies should undertake the main responsibility of providing their own internal order and security and ought to assist in their own external defence. Accordingly, the last British troops were withdraw from the Australian colonies in 1870.

The Gold Rush in Victoria in the 1850's had lifted the population of that colony ahead of that of New South Wales for a period and each of these two colonies had populations greater than all of the others combined.

It is not surprising then that the push toward greater local defence self reliance revolved around these two colonies. Local military units in each colony were modeled on the British 'pattern' in both organisation and equipment although their appeared to be a considerable time lag between introduction of new military equipment and weapons in Britain and its flow on to the Australian colonies.

In 1866 Victoria, followed by South Australia and Tasmania, imposed high tariffs on imported goods in order to protect its own small industries and markets. New South Wales (and Queensland to a lesser extent) continued to stay with a free-trade policy. Throughout the 1870s and 1880s, the arguments over free trade versus protection divided the press, the political parties, and the colonies. This, together with the continuing jealousies among them, hindered any significant attempts at cooperation and possible union among the six colonies until the 1890s

Major F.T.Sargood

The first record of an interest in Australia in Munitions Production is dated January 17, 1882 when an enquiry was initiated in England by a Victorian officer of the Volunteers, Major F. T. Sargood, a principal of a local softgoods firm.

Major Sargood was a man of vision and imagination, always very keenly interested in defence matters; afterwards he became Minister for Defence, and was knighted for his services to the State. It was because of his initiative and drive that Victoria became the most advanced Colony in respect of Defence matters, and responsible for the origin of an Australian Navy and of Munitions Production.

Major Sargood's enquiry, which was directed to plant and materials needed for making the .45 in. Martini-Henry ammunition, was the beginning of a correspondence, under the lead of the Colony of Victoria, extending over several years. This involved the colonial governments in Australia, New Zealand, Fiji, and even Canada; with an occasional enquiry to England for information.[1]

A key aspect of defence was the supply of small arms ammunition and as all ammunition supplies were at that time imported, certainty of supply was a real concern. After repeated failed attempts by the Colonies to reach agreement over the nature and location of a local factory to be established to supply the then current rifle calibre ammunition (577/450 Martini Henry), the Victorian Colonial Government

1. Reference 1 page 1

opted to go it alone with the establishment of a factory.

In 1885, the Victorian Colony sought expressions of interest from the British ammunition suppliers regarding establishment of a facility to supply the Martini Henry ammunition. It was prepared to provide a grant of land, an establishment incentive payment and exemption from certain import duties for the machinery which would need to be supplied. To encourage a response by potential suppliers, it was made known that the quantities of cartridges "consumes" required by Victoria during the year 1885-86 were:[2]

Ball cartridges	3,100,000
Blank cartridges	300,000
Carbine cartridges	200,000

and that it was expected that future consumption would be considerably greater.

The British suppliers generally felt that without the guaranteed orders from the other colonies, the Victorian demand did not justify a local factory.

2. Reference 2 page 2.

An offer from Greenwood & Batley

In July, 1887, the Victorian Government was advised that Greenwood & Batley Ltd. of Leeds, England - “manufacturers of all the Woolwich Arsenal cartridge machinery” - and certain other unnamed interests would form a private Company for the production in Victoria of small-arms ammunition “... and possibly later on of war stores generally”.

Further correspondence led to an invitation in February 1888 for Captain John Whitney of the Kynoch Company's ‘Colonial Ammunition Company ‘ in New Zealand to visit Victoria, to select a site for the proposed factory.

(The unnamed interests in addition to Messrs. Greenwood and Batley included Captain John Whitney and Sons of Auckland and Mr. W.T.Cartwright of Nottingham.)[3]

3. Reference 3 Munitions Supply Board Report for period 1/7/1926 to 30/6/1927 Pages 8-11

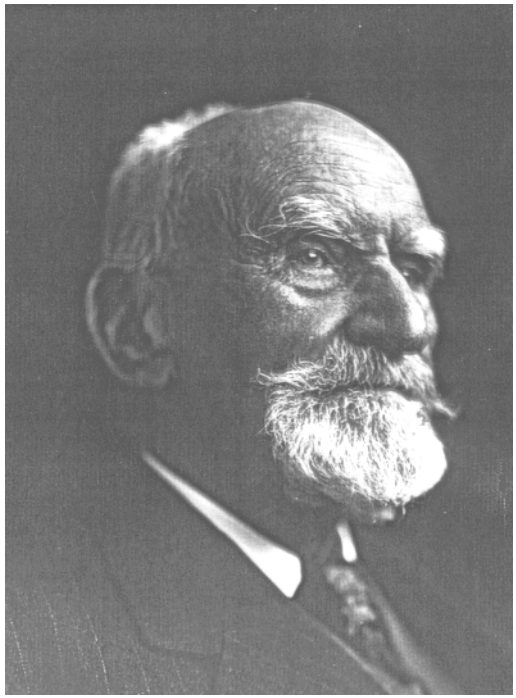


FIGURE 2. *Capt.John Whitney.*

Captain John Whitney.

John Whitney's letter to the Victorian Government on the 21st July 1887, offering to establish a plant in Victoria is reproduced below:-[4]

4. Reference 1 page 2

London. S.W.,

21st July, 1887.

Sir James Lorimer, K.C.M.G.,

8 Victoria Chambers,

Westminster.

Dear Sir,

Referring to the interview I had with you respecting the establishment of a small arms ammunition factory in the Colony of Victoria, I beg respectfully to make the following proposition, and shall be glad if you will lay the same before your Government.

As stated to you at our last meeting, I have been for some time engaged upon the manufacture of cartridges in Auckland for the New Zealand Government, and came to England a short time since to purchase additional machinery to increase production and prepare for the probable change in small arms. And whilst here have made arrangements with Messrs. Greenwood and Batley. “who make all the Woolwich Cartridge Machinery.” and some one or two other gentlemen who have ,joined me in forming a small private Company for the production of small arms ammunition and possibly later on of war stores generally.

Seeing that the Australian Colonies are desirous also of establishing a factory for supply of S.A. Ammunition, our Company would he prepared to start a factory in Colony of Victoria, if we could receive the support of the Government. What we should ask would be, first, a subsidy from Government, which, considering the costliness of the machinery required and its installation, should not be less than £5000.

A site in favorable position for all Colonies, and from Military point of view, with favorable terms for the introduction into Colony of plant and necessary material and contract for say, ten years.

If such a proposition is likely to be favorably considered by your Government, I shall be glad upon my approaching return to New Zealand to go over to Melbourne and treat with you personally on the subject.

I am taking out all new plant of latest inventions and expect to have it working before next year.

I am,

Dear Sir,

Yours faithfully.

Signed JOHN WHITNEY.

Victorian Colony commits to a Factory

The Victorian Government reacted favorably to this approach and a further more detailed proposal was submitted in February 1888 and three weeks later the Victorian Government indicated it's acceptance. The 'company' had registered the "Colonial Ammunition Company" with the registrar of Joint Stock Companies in England and the Certificate of Incorporation was dated January 30th 1888. It should be noted that a company also called 'Colonial Ammunition Company' had been established in New Zealand in 1885. The Australian and New Zealand Colonial Ammunition Companies were separate legal entities even though a number of personnel such as John Whitney, had interests in both. . Part of the proposal was that the new factory would supply at least three million rounds per year for 25 years. An Indenture dated 28th May 1889 was prepared by the Victorian Government including the above requirement together with the provision of a grant of £5,000 and a lease of 5 acres of land on a peppercorn rental basis.

CAC site chosen

Before the Indenture was signed, the site for the Factory - on the Saltwater River at Footscray, 4 miles from Melbourne - was selected by Captain Whitney after consideration of sites on the Murray River and at Sydney. The latter consideration arose out of suggestions that a factory to serve all of the Colonies should be established at a central point, but the negotiations fell through. The chosen site was also half a mile from the then existing Victorian Government explosives magazine which also utilised the river for explosives transport. Part of the 'arrangement' was for the new ammunition plant to draw its gunpowder (black powder) from the Government on a repayment basis. An act of the Victorian Parliament (Act 1022 of 4th November 1889) ratified the agreement with the company.

A description of CAC factory

The following description of the Factory appeared in "The Illustrated Australian News" of 8th November, 1890. 'The Saltwater River gives cheap and convenient transport, and is therefore an essential feature in the selection of this

site, as compared with the inland sites so strongly advocated. A wharf has been built, carrying a crane and a store house, and a 2-feet tramway connects it with the factory. The Factory is constructed using timbered structures clad with galvanised iron and sitting on brick piers to elevate the floors about 2 feet above ground level. (D.M. possibly to provide some protection from the flooding of the river which occurred from time to time). Eight separate buildings were constructed to cover the various stages of the ammunition production the largest of which being the case shop measured some 167 feet long by 72 feet wide.' As was the practice of the day, machinery was driven centrally from a single 'engine' driving shafting mounted in the rafters from which drive belts were connected to the individual machines. The factory had a 100 horsepower steam powered engine for this purpose. The cartridge machinery had been purchased from Greenwood and Batley in England. The workforce consisted of about 200 being mostly juniors (some boys and about 150 girls)

Hand drawn illustrations that accompanied the above article gave sketches of :-

-a general view of the factory,

-women cutting brass foil for the cartridge cases
-a woman shaping the cartridge cases
-'the automatic bullet machine'
-'a heading machine'
-'bullet canalluring machine'
-'riveting machine'
-'a wax wad machine', and
-a capping machine.

Production Commences

In July 1890 the factory was ready to commence production. It should be noted that the Victorian Colony's 'The Ammunition Factory Act 1889' (Act 1022/1889) required CAC to complete the factory and to deliver ammunition within 12 months from enacting this legislation on 4th November 1889.

The Martini-Henry ammunition undertaken at CAC was of the brass foil case body with steel head design and had a paper patched lead projectile as shown below. This design was approved in England as the Martini Henry Rolled Case Mark III in 1873. A drawn case variant was introduced in England in 1885 but CAC did not have the plant to produce

this type. Detail of the construction of the 'rolled case' variant is as follows:- The case is made of sheet brass of 0.004 inch in thickness, partially covered on the inner side with paper attached with cement. It also has a small band of 0.004 inch sheet brass attached to the inner side in such a way as that when the case is rolled up, it will be between the folds so as to prevent 'cutting' at the top of the base cup. There is a small hole punched in the case sheet so as the band can be seen to be in the correct position after forming. The brass sheet is assembled with brass base cups and a steel base disc which forms the rim. and inner paper annulus and a riveted primer arrangement hold the case together. The neck is closed down from .577 inch diameter to .45 inch to retain the bullet. The case is charged with 85 grains of blackpowder.

FIGURE 3. The rolled case Martini Henry Rifle cartridge.

On top of the charge is placed a glazeboard disc with a concave beeswax wad attached, after which two more glaze-

board wads are added. The bullet is secured by ‘choking’ the brass neck into the two bullet cannelures.

The bullet weight was 480 grains and the propellant was 85 grains of blackpowder.

The components of this assembly are shown in the following illustrations. (figures 3 & 4)

The CAC plant was still totally dependent on importation of metal strip and of primers from overseas.

After the commencement of production, difficulties and disputes arose between the Government and the Company as to the interpretation of various clauses of the Indenture, and to settle these a further agreement was signed on the 19th December, 1893 . Manufacture of the 0.45" Martini Henry ammunition proceeded successfully with some exceptions. There was, for instance, the deputation of employees which waited on the Victorian Minister for Defence (Sir Frederick Sargood) in October 1892 to complain about the cessation of operations at the factory following the arrival in Australia of 1,000,000 rounds of ammunition ordered in England some time previously.

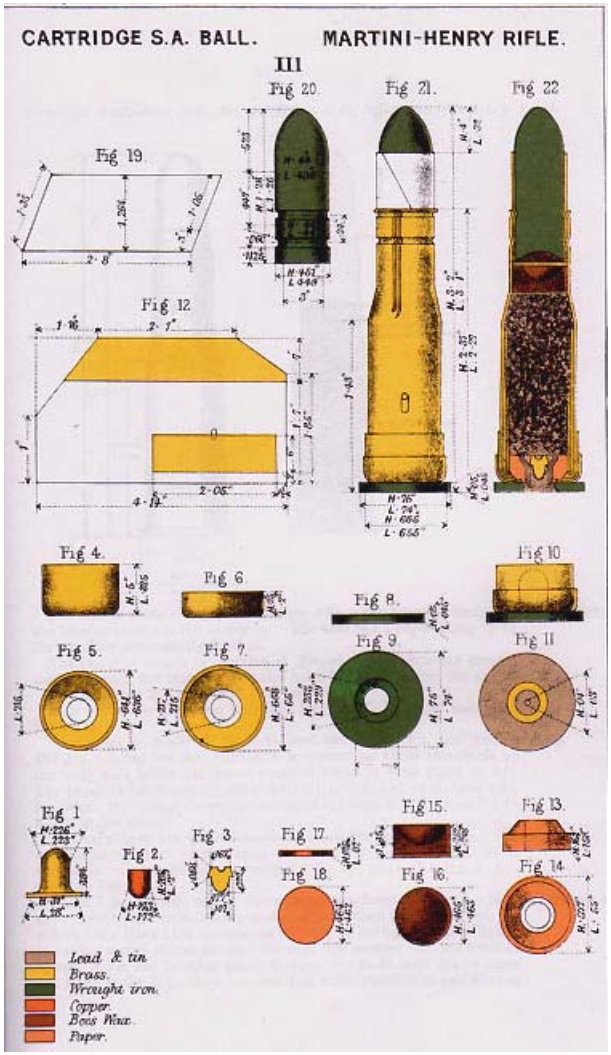


FIGURE 4. The component parts making up the rolled case

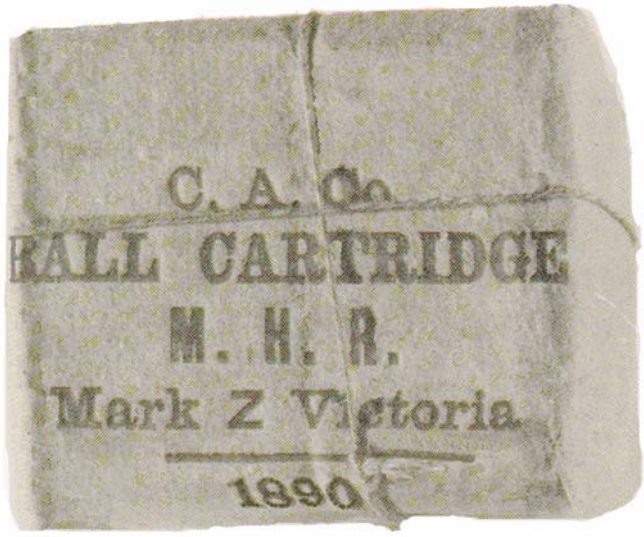


FIGURE 5. *Initial CAC Production in the form of a 1890 string tied paper wrapped bundle of 10 rounds of Martini Henry Rifle Cartridges made for the Colony of Victoria*.

I

A serious explosion occurred in a Finishing Room at the Factory on 23rd September, 1897 , destroying part of the Factory and killing 3 female employees. This incident was investigated by the Victorian Colony Chief Inspector of Explosives, Mr. Cecil Napier Hake. Hake arrived from England in 1890 and was an authority on explosives and on small arms ammunition in particular. He had co-authored the book "Smokeless Powder and its Influence on Gun

Construction" (J.A.Longridge London 1890) with W.Macnab.

The investigation found that CAC was lacking in it's safety procedures and corrective action was taken at the factory.

Planning for 303 Ammunition

During the 1890's considerable inter-colony friction existed over the use of the Melbourne factory to supply other than Victorian needs. The introduction of cordite loaded .303 calibre ammunition into British Service prompted New South Wales to agitate for a Government owned factory to be established to supply the new .303 requirements. At a Premier's Conference in March 1898, there was general agreement that NSW could proceed with this proposal, however the impending Federation of the Colonies stalled any further action in this regard. In any case the Victorian Government had already arranged for CAC to obtain the necessary new equipment to commence .303 manufacture and had not supported the NSW idea as its 25 year supply contract with CAC was still valid. At this time the Victorian requirement alone ran at 4 million rounds per year which was about 50% of the factory's expected annual output.

CAC's relationship with Greenwood and Batley in the UK resulted in initial .303 ammunition being supplied from GB in

Britain and repacked and labeled with CAC wrappers. This ammunition had either GB or CAC headstamps or was un-headstamped. It is reported that such packets of CAC Mark II .303 carried dates of 1898 through to 1900.[5]

The first locally made.303 ammunition (Mk. II ball) commenced into production in 1900 and the production of the Martini Henry ammunition was discontinued. The Mark II cartridge had a 215 grain cupronickel jacketed round nose projectile and a charge of 31 grains of cordite size 3 3/4 in 60 strands. A glazeboard wad was placed between the cordite charge and projectile.

The latest known surviving packet of CAC Martini Henry ammunition was dated 1901 and consisted of repacked English ammunition made at Eley Brothers Limitied. Surviving CAC .303 Mark II ammunition in collections are found largely without headstamps although limited numbers may be found with head-stamps as shown later in this book. Based on advice from cartridge collectors it is likely that the headstamped Mark II rounds were not locally produced but supplied as part of imported bridging stocks supplied through CAC but obtained from other sources.

5. Reference 4 Journal No. 80 1999.

Mark II and Mark VI .303 packets dated 1904 exist in collections thereby indicating that the changeover from Mk. II to Mk. VI occurred during 1904. It is believed that all Mk. VI ammunition was head-stamped and in May 1906 the month and year of production was added to the headstamp.

The Mark VI round was externally identical to the Mark II, the difference being in the design of the bullet in which the bullet jacket was thinned at the nose to provide greater 'upset' on impact to enhance its 'stopping power'.

FIGURE 6. A 1903 Mark II ball 10 round paper wrapped string tied packet. See latter chapter for further examples.

FIGURE 7. The components of MK II, VI and VII rounds. From top the Mark II with cordite size 3 3/4 (usually about 60 strands) , centre the Mark VI also with cordite size 3 3/4 and lower Mk VII with the 'thicker' cordite MDT size 5/2 (usually 36-40 strands). Note the glazeboard wads and that the Mk II and Mk VI projectiles are not externally different.

Chapter 2: *Federation*

CAC site expansion.

On the 23rd April 1901 a lease to extend the CAC site from approximately 5 acres to 40 acres was approved by the Victorian Colony.

The following graphic is a reproduction of the 'extended plan lease' signed by John Whitney at the Crown Solicitors Office Melbourne.

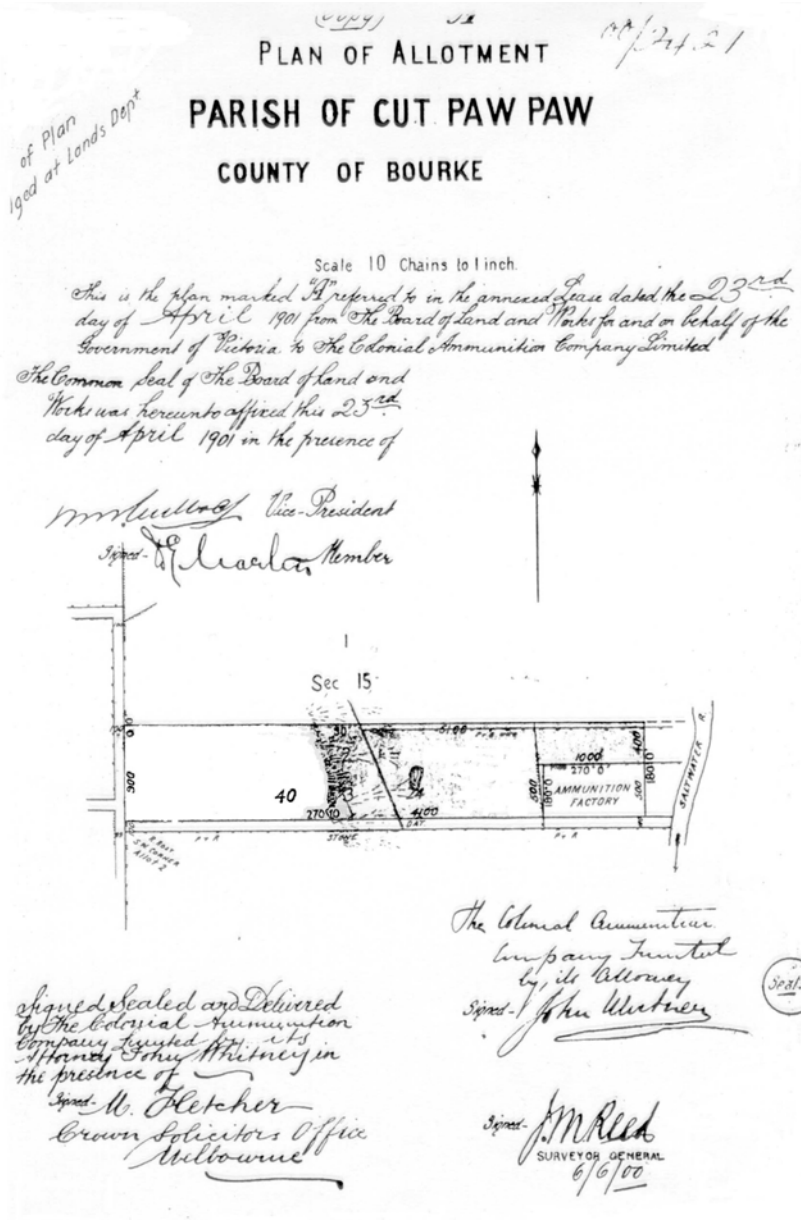


FIGURE 1. A copy of the 1901 'extended' lease for the Colonial Ammunition Company

Site Expansion Details

The original site of 5 acres was a rectangular site with about 100 metres of river frontage and depth extending due west approximately 260 metres. The new lease gave CAC approximately 180 metres of river frontage and a depth of 1100 metres extending due west across the river flat and up the valley wall to the edge of Gordon street.

The reason for the additional land was to provide extensions associated with the change to cordite propellant, and to cater for the increased demand generated by the South African War and the great expansion of Rifle Clubs.

With Federation of the Colonies, defence became a Commonwealth Government responsibility consequently the land leased to CAC and an amount of adjoining land was transferred to Commonwealth control.

After Federation, the new Federal Secretary of Defence accepted in principal the idea of a Federal Government owned Ammunition plant from which all Defence demands would be supplied. However due to the capital expenditure required and the operating costs involved he deferred any

action since there were already adequate facilities operating at CAC Footscray.

Dependency of supply from Overseas

The dependency of CAC on overseas supplied brass and cupronickel cups from which they produced cartridge cases and projectiles and also the importation of primer caps and cordite caused concern within the Defence Department. In 1902 the new Federal Government approved the continued association with CAC provided that it maintained a reserve of metal components equivalent to 10 million rounds of ammunition and that it undertook to establish primer cap manufacturing capability.By June 1906, the Commonwealth had agreed to maintain the reserve stocks of metal as a Government responsibility with the Company having the right to draw on these stocks from time to time, if necessary, but subject to replacement as soon as new stocks could be procured.

Mr. C.N.Hake.

The new Federal Defence Department began planning to expand the local defence capability. In April, 1907, Mr. C. N. Hake, on loan to the Commonwealth from the Victorian Government, was sent to England to investigate Cordite manufacture. In 1908, Engineer-Commander W. Clarkson (later Sir William Clarkson, Third Naval Member), who was visiting England about the same time on Naval matters, and who later arranged contracts for the first destroyers of the Royal Australian Navy, was requested to investigate the possible production of rifles in Australia.

Hake's cordite investigations in England indicated that deterioration of this material under the conditions of elevated temperature and humidity, such as could be expected in Australia, was a significant factor. The manufacture of cordite in Australia under Government control resulted from Hake's recommendation that the product manufactured by the Royal Gunpowder Factory at Waltham Abbey be preferred to offerings by commercial firms. He attributed the superiority of its product to good quality control, which prevented the inclusion of impurities which hastened deterioration at elevated temperature[1]

Another of Hake's recommendations concerning the setting up of explosives manufacture in Australia and accepted by the Commonwealth Government was the need to create an independent authority for the inspection and maintenance of the quality of explosive materials. He left the Victorian Government to be appointed (Commonwealth) Inspector of Explosives in 1907 and continued to act as Chemical Adviser to the Government. Marcus Bell was appointed as his assistant and succeeded him in the position when Hake retired in 1911

Probably the first attempt at scientific inquiry into munitions operational problems occurred under Hake's guidance when, with Dr. Thomas Lyle, Professor of Natural Philosophy at Melbourne University, they carried out experiments to prove his theory that the bursting of 0.303 inch magazine rifles was not caused by defective composition of ammunition from the Colonial Ammunition Company. Their examination showed that 'double bulleting' was possible with the automatic machines at CAC and that closer quality control could eliminate the problem.

1. Reference 10 pages 901-905

As considerable stocks of explosives were held throughout Australia - mostly for military purposes - Hake set up a testing laboratory at Victoria Barracks to check the state of preservation of these stocks, some of which had been held for over ten years. He reported that only ten per cent had deteriorated beyond acceptable limits and would have to be destroyed. These were held mostly in Queensland.

FIGURE 2. The original Victoria Barracks Laboratory Building

Hake's reports on cordite manufacture had been accepted by the Commonwealth and as a result the Maribyrnong Racecourse site was selected for the new factory. Mr. A. E. Leighton, then Assistant Manager of the Indian Government Cordite Factory at Aravankadu , had been nominated by Mr. Hake to be Manager.

Mr. A.E.Leighton

Mr. Leighton arrived in Australia in February. 1909, and commenced work on the design of the new cordite factory.

In February, 1910, Leighton left for England to select the plant for the factory. Mr. N. K. S. Brodribb joined as Chemist in October, 1910, and he too left for England in March, 1910, for assistance to Mr. Leighton in respect of plant and for study of processes. This was the beginning of the Munitions organisation in Australia.

FIGURE 3. Arthur Edgar Leighton (1873-1961)

Towards the end of 1910, the buildings were proceeding at the Cordite Factory Maribyrnong (CFM), and soon after that the plant commenced arriving.

Erection of CAC Rolling mills and Foundry

At the Colonial Ammunition Company, in an Agreement gazetted on June 11, 1910, CAC undertook to erect metal-rolling mills on the Footscray site, together with the necessary brass foundry, both of which were brought into operation in 1912. This was done only after the Commonwealth Government agreed to CAC's request that it be given a 99 year tenure over the 40 acres of land described in the Victorian Government lease of 1901. CAC also undertook to provide machinery for the manufacture of caps and paper wads.

The Small Arms Factory at Lithgow commenced manufacturing in February, 1912, and was formally opened in June, 1912. At the opening function Mr. Leighton announced that the first batch of cordite had been produced at CFM. The production of Mercury fulminate for primer cap production at CFM commenced on the 22 July 1915. It was then possible to produce primers at CAC and these were available later in 1915.

303 Charger Manufacture

TABLE 1. .303 Ball Production at CAC versus Rifle and Charger Production at SAF

Financial Year	303 Ball produced at CAC	303 Rifles produced at SAF	303 chargers produced at SAF
1910-1911	15,062,000	nil	nil
1911-1912	20,788,000	nil	nil
1912-1913	30,737,000	40	1,785,352
1913-1914	28,143,000	4,760	2,687,692
1914-1915	53,533,000	13,786	2,502,004
1915-1916	61,600,000	30,460	8,009,000
1916-1917	97,470,000	23,960	9,319,412
1917-1918	37,449,000	23,251	7,345,270
1918-1919	19,076,000	42,129	5,455,098
1919-1920	16,540,000	25,570	7,411,714
1920-1921	10,639,000	20,420	1,748,480
1921-1922	22,854,000	14,440	nil
1922-1923	2,830,000	2,700	nil
1923-1924	2,830,000	3,320	nil

With commencement of operations at the Small Arms Factory Lithgow, that establishment was tasked with the manufacture of .303 chargers for supply to CAC. Lithgow made chargers carried the Mark No of the charger together with an indentifier in the form of an asterisk. These symbols were stamped into the side of the charger as can be seen in the following photo-graph. The quantities of rifles and chargers manufactured at

SAF and the corresponding quantities of ball ammunition made by CAC by year are given in the previous table[2] -

2. Reference 3 1924 Report pages 12 & 17 for figures 1913-1923 and Reference 4 Journal No 73 page 17 for figures 1910-1912

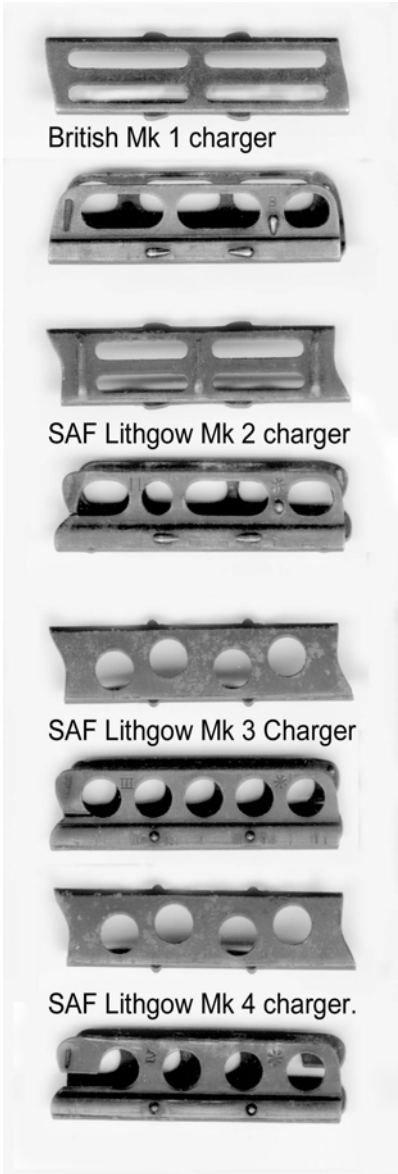


FIGURE 4. *English Mark I and SAF Lithgow made Mark II,III and IV .303 Chargers*

When considered with the advice that 303 Mk VI was offered from CAC in carton packed and wrapper packed form and that 303 Mk VII was offered as carton packed, bandolier packed or wrapper packed[3] the above table would indicate that perhaps as much as 50% of deliveries were charger packed with an overproduction of chargers (stockpiled ?) from 1917 on.

Wrapper packed ammunition consisted of 10 rounds enclosed head to tail within a printed paper wrapper tied with string.

FIGURE 5. A Typical paper wrapped 10 round packet from CAC (1912)

3. Reference 3 1924 Report page 13.

FIGURE 6. Typical WW1 20 round packets of 303 'carton packed' and charger packed

Carton packed Mk VI and Mk VII .303 ammunition shown above consisted of a small cardboard box containing 20 rounds with paper interleaving and the packet enclosed with a black bitumen like tape. Charger packed ammunition used the same carton as just described but enclosed four chargers of 5 rounds packed alternatively nose to tail. Neither carton normally carried an external identifying label. In the illustration above a packet is shown with a label affixed some 20

years later when these 1920 'out of life' rounds were released to Rifle Clubs in 1941. The label is a 'disclaimer' by the Department of Army as to the serviceability of the ammunition. Bandolier packing consisted of a cloth 'belt' containing 50 rounds consisting of 5 pockets each containing 2 chargers of 5 rounds.

A new Supply Contract for CAC

The original 25 year supply agreement established by the Victorian Government with CAC expired on the 27th May 1915 however the Commonwealth Government delayed entering into a further agreement with CAC as the question of a Government owned factory had again arisen. It was eventually decided to propose a further 5 year supply agreement commencing from 1st July 1917 whereby the Commonwealth agreed to take a minimum supply of 40 million rounds annually. The price to be paid to CAC would be that paid by Britain to it's suppliers plus an allowance for local manufacture. When this proposal was put before the Minister of Defence it was referred to the Board of Business Administration which re-examined the issues in detail and eventually came up with a new proposal acceptable to both the Govern-

ment and CAC, and which was duly signed by both parties. The agreement was for the supply of 40 million rounds per annum commencing on July 1st 1919. The pricing was changed to an arrangement calculated from actual costing figures with provision for a measure of profit to CAC.

Chapter 3: *CAC Pre- WW1 Miscellaneous Ammunition.*

.310 Cadet Ammunition

In 1906 the Defence Department placed an order on CAC for the production of ammunition for the .310 Cadet Training Rifle which had been in use since about 1902. Ammunition had been previously supplied from Britain. CAC production deliveries commenced in 1909 and continued each year until 1913 when resources were fully allocated to wartime .303 production. Both Ball and Blank loadings were produced with cases stamped " CAC 310" although some unheadstamped blank cases may be encountered. A table indicating quanti-

ties and timing of CAC .310 ammunition production is given below[1].

TABLE 1. Pre WW! .310 Cadet ammunition Production

Financial Year	Ball production	Blank Production
1910-1911	3,744,000	50,000
1911-1912	9,400,000	nil
1912-1913	9,500,000	4,250,000
1913-1914	13,225,000	1,775,000

The ball rounds had lead projectiles of 125 grains with a loading of 5.5 grains of Schultze[2] smokeless powder. The blank loading was 10 grains of Black powder.

1. Reference 4 Journal 73 page 18.
2. Reference 4 Journal 58 page 5, but also referred to as Nitrokol by Munitions Supply Reports .

FIGURE 1. Above: A 1911 packet of .310 ball ammunition

FIGURE 2. Below: A 1911 packet of .310 Blank ammunition-note that the ball label was used with a rubber stamp "BLANK" imprinted across the front

FIGURE 3. Typical CAC 310 Cadet Blank and Ball loadings

Aiming Tube Ammunition

CAC also used it's association with Greenwood and Batley to supply overseas sourced ammunition to the Defence Department and others. Aiming tube ammunition used in adapters in Military service rifles and in some early single shot Francotte Lever Action 'Cadet' Rifles is an example of this. Figure 5 shows a 1906 packet of the .297/.230 aiming tube ammunition carrying the Greenwood and Batley and CAC identifying Marks.

These cartridges were supplied in 'long' and 'short' variations as shown.

FIGURE 4. .297/.230 short and long Aiming Tube Cartridges.

FIGURE 5. *A typical packet of CAC supplied Aiming Tube cartridges made by Greenwood and Batley.*

Chapter 4: *World War 1 and Beyond.*

Local Self sufficiency

With the introduction of locally made primers in 1915, the major components of CAC 303 ammunition were for the first time Australian made. It is interesting to note the changes in primer appearance in the 1915-1916 CAC rounds. Some examples are shown below. Some smaller diameter than standard primers were used in production in May-July 1915 marked rounds, while the standard diameter primers also continued to be used.

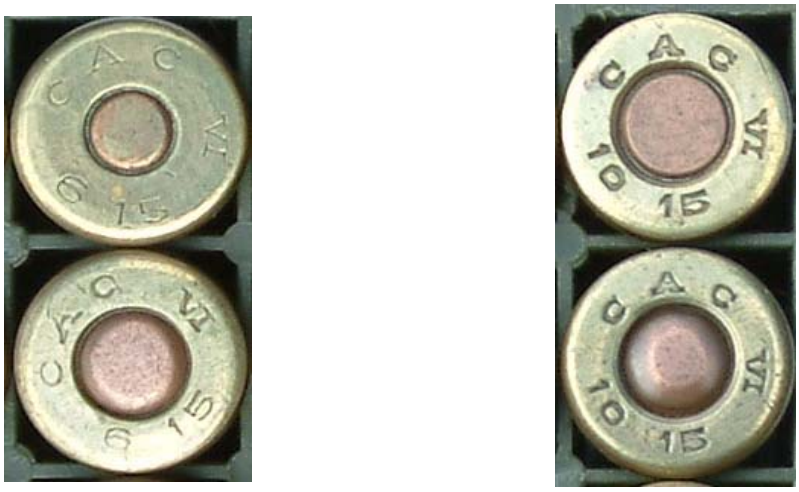


FIGURE 1. Left Small and normal primers of June 1915 and Right flat and normal primers of October 1915. The small primers may be found on May through July production. The flat primers appear from late 1915 to early 1916.

Later in the year, the primers took on a flattened appearance (local production phasing in?) but then settled down to a more rounded appearance but somewhat less that the pre 1915 heavily rounded imported form. 'Round-nose' Mark VI ammunition ceased production on January 1918 with the Mark VII rounds being introduced in February 1918. (see later chapter.). In addition to the .303 ball ammunition shown in Chapter 4 table 1, CAC manufactured quantities of Blank

and ‘Dummy’ rounds for training purposes during the WW1 period. These are included in the following table.

TABLE 1. .303 Blank and Dummy Production 1913 - 1926[a]

Financial Year	.303 Blank	.303 Dummy
1913-1914	8,818,000	1050
1914-1915	5,000	195,000
1915-1916	865,000	1,620,000
1916-1917	nil	5,000
1917-1918	nil	7,150
1918-1919	nil	5,000
1919-1920	nil	5,000
1920-1921	nil	4,000
1921-1922	nil	14,000
1922-1923	nil	nil
1923-1924	nil	8,000 Drill
1924-1925	131,527	5,000 dummy 69,000 drill
1925-1926	nil	10,000 drill.

a. Reference 3 Annual Reports July 1926-June 1927 page 15 & July 1924-June 1925 page 12.

Government considers purchase of CAC

During August 1916, the question of purchase of the Company's works by the Government was again raised with the Company in the context of the planning then in hand for the establishment of a Central Arsenal, including a new Small-Arms Ammunition Factory. The Company proposed that the business could be taken over for £350,000, plus all new capi-

tal issued after 31st December 1915; all capital expenditure since that date; all stores and materials in hand and on order; and partly-manufactured goods at cost price plus 100 per cent on the wages for establishment charges. Cabinet, however, decided that no action would be taken at that time and the Company was so informed on August 23, 1916. The Arsenal concept was destined to be abandoned at the end of the 1914-18 War

The Government Leases the CAC Site.

The proposed nationalisation of the Factory was revived again during the initial stages of the post-War recession when the Company informed the Government that, because of the paucity of orders for 0.303" rifle ammunition, it would be unable to maintain production without appropriate Government assistance. As the continued operation of the factory was regarded as an important element of the national Defence policy, the Commonwealth agreed to lease it from the Company and took over responsibility for its activities as from January 1, 1921 under a 7-year lease, at an annual rental of £20,000 plus rates, insurance and the like and with

the Company's Manager (G.A. Cartright) continuing to manage the works for the Commonwealth.

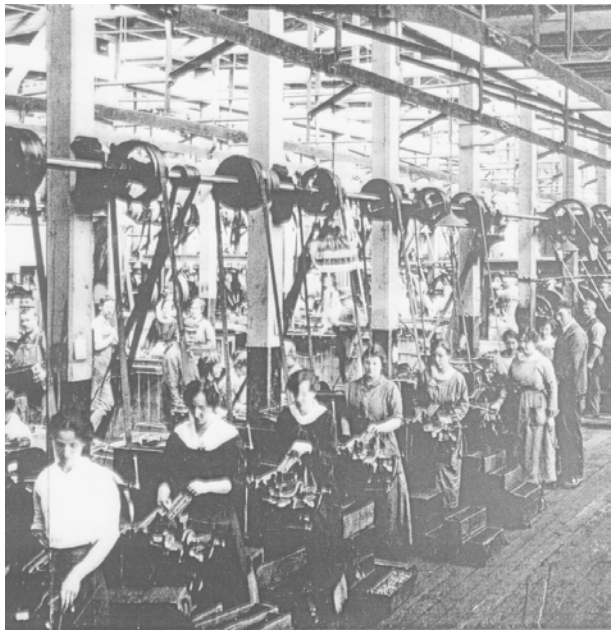


FIGURE 2. :The CAC bullet shop circa 1915


CARTRIDGES
S.A. BALL
·303 Inch
1920
Mark VII


CARTRIDGES
S.A. BALL
·303 Inch.
1920
1921
Mark VII
CAC
S.A.A.F.

FIGURE 3. The 3 packets above show the changes in marking as the Government took over running of the plant . A 1920 dated CAC packet , a 1920 CAC label overstamped as a 1921 S.A.A.F packet and a 1921 MF marked packet . The cartridges themselves did not acquire the MF mark until 1926. (see later chapter)

Mr G.Cartwright Manager1913-1927

The leasing arrangement was, however, terminated in 1927 when the Commonwealth purchased the factory as a going concern for £150,000 to be paid in installments spread over 10 years, including interest of 5 per cent per annum on the outstanding balance as from January 1st, 1927 - a total payment of £191,152.12, 0d.

FIGURE 4. Mr. G.Cartwright Factory manager 1913-1927

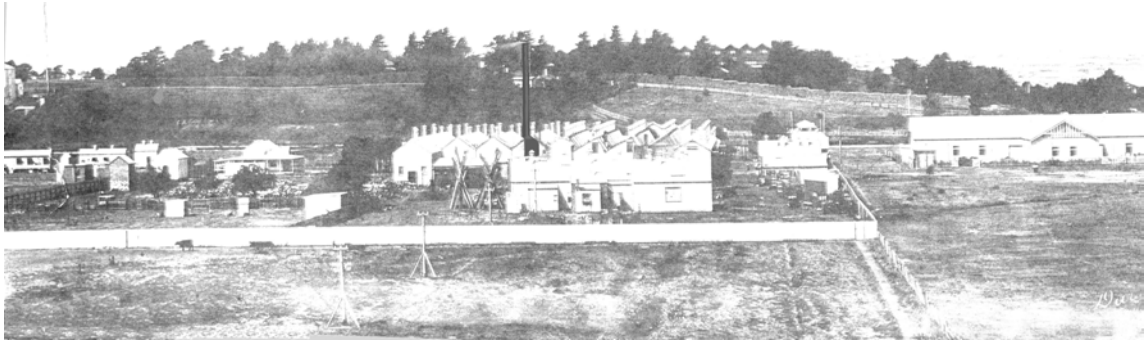


FIGURE 5. The CAC factory circa 1921 viewed from between the upper and lower factories looking in an easterly direction . The hill at the rear is the boundary of Flemington Racecourse. The river is obscured by the buildings. The Canteen is shown at the extreme right , the shooting houses are at the extreme left and the main SAA shop is in the centre behind the chimney.

Chapter 5: *The Munitions Development Programme.*

Commonwealth Reviews CAC

A survey of the CAC site was conducted and Drawing W1103 dated 21/10/1921 was prepared to record the layout at that time. Parts of that drawing have been reproduced below to depict the CAC buildings on the river flat area ('the lower factory') and the Cap factory and the Rolling Mill and foundry ('the upper factory') on the Gordon street frontage.

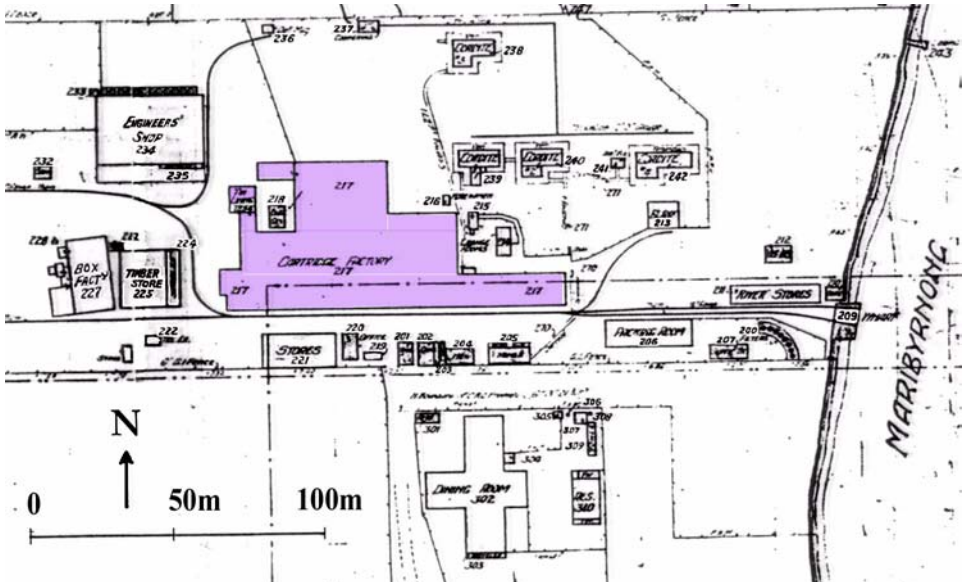


FIGURE 1. *A Plan view of the lower CAC Factory area showing the main Cartridge Shop colored for clarity. The wharf on the River is still evident. Cordite loading buildings are adjacent to the Cartridge Shop to the north. Firing Ranges are not in view but are immediately north of this area with shooting from near the river bank to the west with a stop butt against the valley wall. In the lower portion of the Plan outside the fence line is the factory Canteen. The cartridge shop shown measured some 300 ft. x 150 ft. indicating that the original case shop constructed in 1890 which was 167 ft. x 72ft no longer existed and most likely was replaced as part of the expansion for .303 production in the early 1900's or during the expansions of WW1.*

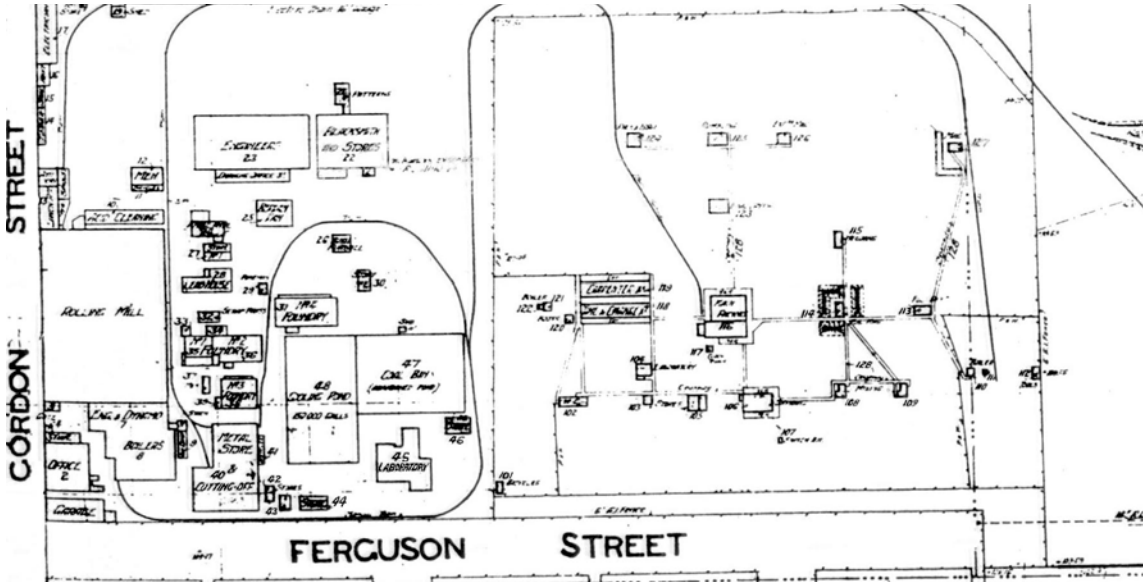


FIGURE 2. *The 'Top CAC Factory' comprising a Foundry and Rolling Mill (left) and a Cap Factory (right). Ferguson Street is now called Owen Street. Also shown is a narrow gauge tramway network which also extends to the lower factory. In the early 1920's the Federal Government commenced construction of a Gun Ammunition Factory on the 'CAC' northern boundary. The Gun Ammunition factory had its own Foundry and Rolling Mill. The CAC site was merged with the Gun Ammunition Site in 1928 under the Gun Ammunition Factory Manager J.H.Wrigley.*

Nucleus Production

The funds available for maintaining the Government Factories then operating were limited in the Government's 1922-23 Estimates to £192,200. The policy of "nucleus production", which had to be introduced during this depression period to ensure retention of essential skills, directly affected the Foot-

scray works in that the ammunition production programme there largely determined the quantity of cordite to be produced at the Government Cordite Factory.

It was consequently decided that the nucleus output would be 3,000,000 rounds annually of 0.303" ammunition. This decision involved the retrenchment over a two year period of 633 of the 810 persons employed at June 30, 1921, when production was at a depressed annual rate of approximately 10,000,000. The Military Board agreed to this reduced programme on the condition that the Factory would be capable of attaining full production again within six weeks. This low production rate together with the rifle cordite on hand at the Cordite Factory equivalent to some 10-12 years of supply at this rate resulted in investigations being initiated as to the shelf life of bulk cordite and a stop on production of further rifle cordite at CFM as from June 1922. Some small quantity of revolver cordite for the Webley .455 service revolver ammunition was in production. At June 1924 the Cordite Factory still held on hand 260,000 lb. of small arms cordite sufficient for approximately 40 million rounds of .303 ammunition.

Surplus British Munitions Plant

Several years earlier, in March, 1919, the Australian Minister for Defence, then Sir George Pearce, arrived in England in connection with the completion of demobilisation arrangements with the British Government.

Being very much concerned with the large amount of plant becoming available in England, Mr. J.K.Jensen, stationed in Australia's London Office, was sending forward various proposals to Australia and doing everything possible to direct attention to the possibilities of acquiring cheaply, large quantities of good munitions plant. Mr. Leighton was doing what he could in Australia, but it was only Senator Pearce who realised the possibilities, and he took the matter up with the Minister for Munitions, Lord Inverforth, and finally with Mr. Winston Churchill - at that time Secretary of State for the Dominions. At his arrangement, the British Government offered Australia £300,000 worth of munitions plant at a rebate of 50 per cent. on the cash valuation; thus it was to cost actually £150.000. J.K.Jensen spun the offer out to £340,000 and got 1600 machines of highest quality - a great many absolutely new, and even those second-hand were mostly in first-class condition. They ranged from a 1500-ton

forging press down to a wood lathe. They were bought at surplus market prices, and so there were occasions of machines being purchased at ridiculous prices -£30 for a machine costing £500 or £600 - and it is safe to say that on the then current market prices the value would be £1,500,000 for the £170,000 expended.

In July 1919 the London office was closed, and the returning men provided Australia with all the knowledge and the plant necessary to establish production of almost every type of munitions and even aeroplanes and engines of the types current at the time. The Office even sent out the information then available regarding metal aeroplanes, and while in due time the munitions plants were put into operation, nothing, unfortunately, was done about aeroplanes.

The Munitions Supply Board

Mr. Leighton was equally busy in Australia, his first step being to prepare a comprehensive report based upon his war experience, and upon the technical information acquired in London. The report was presented on May 27, 1919, one result being abandonment of the Central Arsenal Scheme in favour of a policy of decentralisation. When he returned to Australia

in 1919 Leighton expressed with some force his conviction that the location of an Arsenal near Canberra, remote from a labour and shipping centre, was unsound and that existing facilities should be developed and a balanced industrial complex formed with scientific support under a Munitions Supply Board. The Government accepted his ideas, the Arsenal Project as conceived was abandoned,

Despite the abandonment of the Central Arsenal proposal, Leighton retained the position of 'chairman , Board of Management, Government Factories,' and continued to approve drawings carrying the Commonwealth Arsenal title block into early 1921.

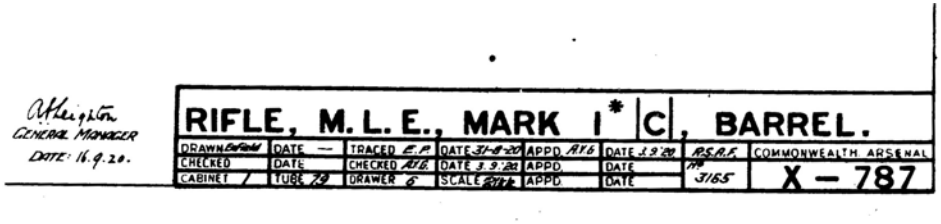


FIGURE 3. *An example of the Commonwealth Arsenal title block of Drawing X-785 approved by Leighton on 16/9/1920 is shown. Leightons signature as 'General Manager' is at the left*

Leighton's report contained a complete scheme for a Munitions Supply Organisation, but it was launched at a time of doubt and indecision, the prevalent belief of both Parliament and the people being that there would be no more wars. Disarmament was being discussed as public policy and opinion was decidedly adverse to Defence expenditure. Since such thought persisted for probably 15 years, the uphill effort of the Munitions Supply Board to develop the Australian Munitions capability has to be applauded.

Government Munition Laboratories Established

One section of Leighton's report which received favorable attention was the emphasis placed upon the need for scientific control of manufacturing, both in the quality of materials and the accuracy of measurement. Money was voted for the establishment of extensive laboratories modeled upon the National Physical Laboratory in England and the Bureau of Standards at Washington, and Australia should be very grateful to Mr. Leighton for the foresight which brought them into being. The laboratory was initially staffed with personnel from the Victoria Barracks Laboratory and with the young technologists who had been trained in England. Its official

functions, which reflected five years of planning by Marcus Bell (Hake's successor) , were to maintain standards of manufacture and supply, to promote by research the production of defence supplies from Australian raw materials, and to investigate special problems of manufacture, inspection and service use of defence stores and equipment.

With commencement of construction of the Maribyrnong laboratories in 1920, the Munitions Supply scheme thus became launched, but it was not until 1921 that the administrative body recommended in the report, the Munitions Supply Board, was constituted. The membership, was as follows:-

"Chairman: A. E. Leighton, F.I.C., Controller-General Munitions Supply.

"Deputy Chairman: Col. T. J. Thomas, O.B.E., Finance Secretary of the Department of Defence.

"Member: M. M. Maguire, Assistant Secretary of the Department of Defence.

"Secretary: J. K. Jensen.

Munitions Development Plan

Early in 1922 the Government, while giving attention to a general reduction of Defence expenditure, most of which was still connected with the aftermath of the war, was receptive to Army proposals which were aimed at enhancing local Defence capability rather than the stock piling of reserves.

The Munitions Supply Board devised a development plan whereby savings gained by reduction of the manufacturing programme were applied to a new construction programme. The MSB suggested a capital expenditure of £900,000, to be spread over six years, and this, added to some £360,000 which had already been spent on ‘surplus’ plant purchased in England, building laboratories in Australia, etc., made up a plan to cost £1,116,000. It was endorsed by the Government, but through one cause and another, including later additions to the original scheme, was not completed until 1930.

.As the new laboratories were taking place alongside the 'Cordite Factory” at Maribynong, action had commenced to create :-

- “a new Defence Inspection Organisation,

- “a new high explosive manufacturing capability at the Cordite Factory,
- “a new pistol and machine gun plant at the Small Arms Factory at Lithgow
- “a gun ammunition factory at Footscray adjacent to CAC
- “gun manufacturing and shell forging capability at Maribyrnong.(ie an Ordnance Factory)
- a central administration section at Maribyrnong located between the Ordnance factory and the Laboratories to house the Inspection Headquarters, a Central Drawing Office and Document Control and the Senior staff of the Munitions Organisation.

During 1921, at the request of the Military Board, the initial steps were taken at CAC for the manufacture of 0.455" ammunition for the Webley pistol and experimental work commenced on special 0.303" ammunition (known as “Red Label” or Air Service Ammunition) to be used with machine-guns mounted in aircraft.[1] These initiatives were assisted by the newly constructed Munitions Laboratories and the

1. Reference 3 Annual Report July 1924- June 1925 page 12

Inspection Service. Drawing Y-928 defining the .455 ammunition was prepared by Leighton's staff in January 1921 and a reproduction of this is on the next page.

The first deliveries of .455 ammunition of 665,000 rounds was reported in the 1923-24 Financial Year.[2] This included 40,000 rounds to the RAN with the balance to Army.

By 1926 the factory was able to report that .303 tracer ammunition had been successfully produced in small quantities and that work was proceeding on the experimental manufacture of .303 Grenade launching cartridges using a charge of 30 grains of Ballistite.[3]

2. Reference 3 June 1924 Confidential Report Pages 12 & 13
3. Reference 3 July 1924- June 1926 Confidential Report page 14

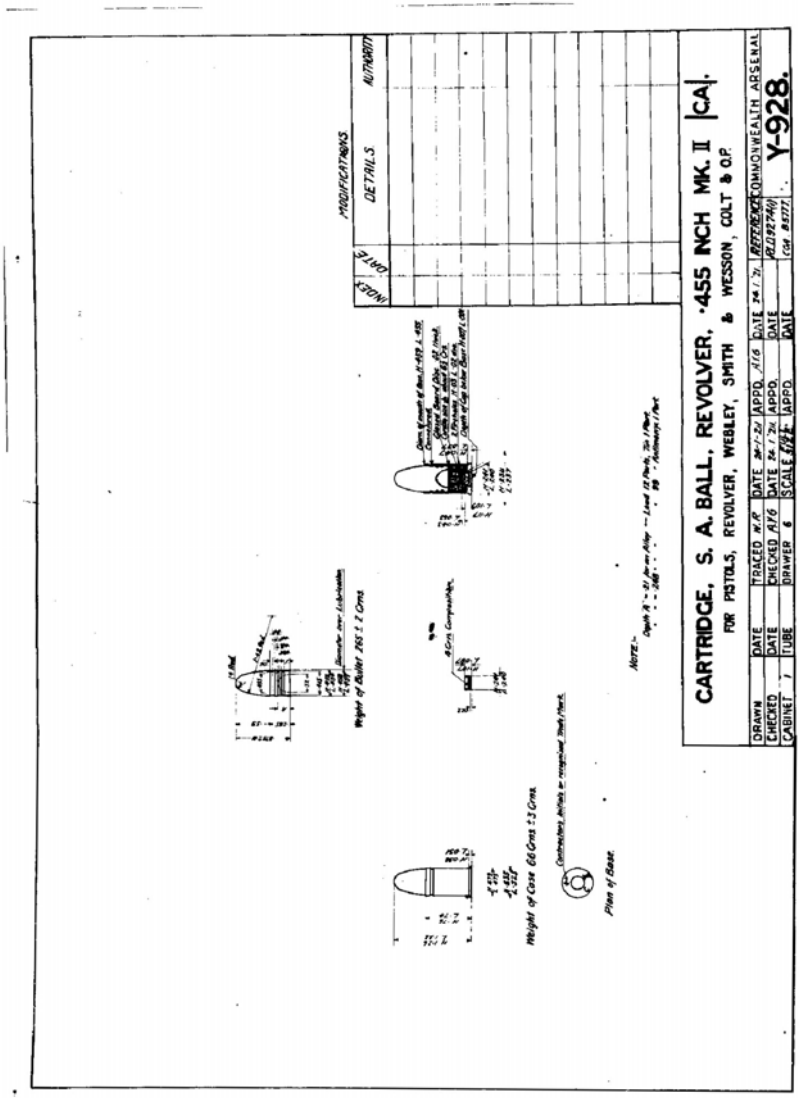


FIGURE 4. *Commonwealth Arsenal Drawing Y928 detailing the .455 Webley revolver round.*

Gun Ammunition Factory

While the leasing of CAC was continuing, the Defence Department had proceeded with the establishment of a Gun ammunition Factory on land it controlled immediately to the north of CAC and an Ordnance Factory on the former WW1 Royal Australian Field Artillery Depot in Maribynong. Both of these projects were connected to the local manufacture and supply of 18 pdr guns and ammunition. The new Ordnance factory was to manufacture the guns and the shell (projectiles) while the Gun ammunition plant was to make cartridge cases and fuses.

Utilising much of the equipment and plant acquired cheaply from England, construction of fuse and case workshops was initiated with supporting foundry and rolling mills to follow. By June 1926 the case shop was ready to manufacture 18 pdr. Cartridge cases subject to receipt of an annealing furnace from Britain and the fuse shop had about 75% of it's machinery installed. The foundry and rolling mill were approved for construction during 1926-1927.The following drawing depicts the general layout of the Gun Factory and it's location relative to CAC.

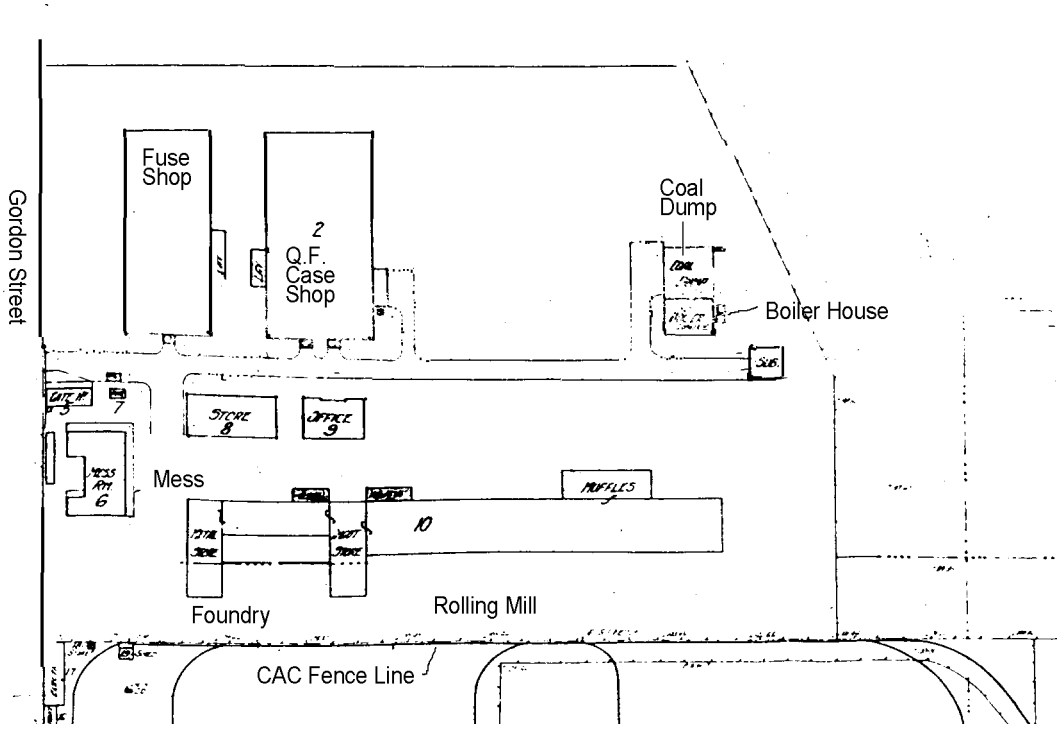


FIGURE 5. *The Footscray Gun Ammunition Factory*

Full ownership of CAC

When the Defence Department finally gained ownership of CAC in 1927 it coincided with the request by the then manager Mr. G.A.Cartright to relinquish his position as from 31st December 1927. Consequently in 1928 the 'CAC' plant was 'merged with the Gun Ammunition Factory under it's manager

Mr. J.H. Wrigley. This bought some duplication in the form of two foundries and two rolling mills. Consequently the older “CAC' facilities were phased out and decommissioned. In addition, the new Ordnance Factory had wood working facilities suited to the making of ammunition boxes. Consequently the 'box' workshop at the 'CAC' site was closed and it's operations transferred to the Ordnance factory.

Delayed Quality Problems.

In the MSB Annual Report for the Period 1927-1929 the Inspection Group reported that investigations were being carried out into a damaged rifle and ammunition at Williamstown, a burst cartridge from a Rifle Club, and burst rifles from Tasmania and Victoria. The outcome was that the problem was attributed to accidental double bulleting of MkVI .303 ammunition at CAC during the peak war time production effort of 1916-1917 when rates of 2 million rounds per week were achieved. A similar investigation some 20 years earlier had concluded that double bulleting was indeed possible. (see chapter 2). Existing stocks of ammunition from this period were ordered to be check weighed to attempt to detect any further potential problems. As ammunition cartons were

weighed and cleared they were stamped with a marking to indicate that the ammunition had been checked.

FIGURE 6. *A 'check weighed' ink stamping on a carton of 1917 CAC Mk VI .303 ammunition indicating the ammunition was check weighed in Melbourne 28-12-1930.*

Commercial Work

With the diminished orders from the Defence users, each of the Government Factories was encouraged to take on 'Commercial' work. Work which 'displaced' imported goods or supplies was given priority. Work which directly competed with local industry was discouraged. Arising out of complaints from the Associated Chamber of Manufactures the matter of Commonwealth Factories performing commercial work was considered by Federal Cabinet on 14th March 1932 and a

new instruction was issued in effect saying that the factories could only perform work not able to be done by Australian Industry. This did not satisfy the Victorian Chamber of Manufacturers and in June 1933 a writ was served upon the Commonwealth seeking to prevent any goods being made by the Commonwealth factories and supplied to the State of Victoria and other bodies. The issue appeared to be initiated by the Commonwealth Clothing Factory making and selling non-military clothing to non-military customers. The High Court of Victoria referred the matter to the Federal High Court which delivered it's judgement on 23rd May 1935. The judgement acknowledged the need for the Commonwealth to maintain skills within the factories through the maintenance of adequate workload and left the matter of 'commercial' work to the discretion of the Governor-General and the responsible Ministers.

The Ammunition Factory undertook a range of 'commercial' tasks including:-

- Production of a special order of jacked .310 Cadet rifle ammunition for Papua -New Guinea.
- Development and manufacture of .22 rimfire ammunition for Civilian Rifle Clubs through the period 1931 -1935.
- The production of large quantities of drawn brass lipstick 'containers' for the domestic cosmetics industry.

- Production of .32 Auto and .32 Smith and Wesson revolver ammunition for local police, bank security requirements, government department payroll 'minders' and the like.
- Rolling of brass and nonferrous alloy sheet and strip for local metal merchants. This item represented a rapidly growing revenue item as can be seen from the following table. This work was terminated in April 1938 due to the rising demand for Defence requirements.

TABLE 1. Commercial Metal Strip and Plate output from Ammunition factory Footscray[a].

Financial Year	Metal Output (ton)	Value (Pound)
1930-1931	22	3,690
1931-1932	162	25,905
1932-1933	320	50,887
1933-1934	387	59,898
1934-1935	485	70,475
1935-1936	547	74,506
1936-1937	828	114,333
1937-1938	762	107,387

a. Reference 3 July1937-June 1938 Annual Report

Australia moves toward War

Activity on Ammunition output increased markedly in the 1938-39 period as can be seen in the following table which lists .303 production over the period 1926-1939.[4] The following year production was put on a War footing.

TABLE 2. .303 Ball Production over the period 1926-1939

Year	Quantity Delivered	Year	Quantity Delivered
1925-1926	2,799,360	1933-1934	3,187,152
1926-1927	7,800,096	1934-1935	8,148,336
1927-1928	8,118,244	1935-1936	14,869,936
1928-1929	8,362,109	1936-1937	15,106,264
1929-1930	5,131,600	1937-1938	14,769,432
1930-1931	3,947,587	1938-1939	23,580,368
1931-1932	3,163,856		
1932-1933	2,511,056		

4. Reference 4 Journal No 73 1998.

Chapter 6: *The Wartime SAA factories*

The first Upgrade at Footscray

By the early 1930's the Munitions Supply Board had implemented the 1920's munitions plan. This had given Australia an updated explosives manufacturing capability, an updated small arms factory, new Munitions Laboratories, a new Ordnance factory, a Defence Quality Organisation and central planning and administration. Despite some upgrading of the 'CAC' ammunition factory in the form of new gun calibre cartridge and fuse shop, the small arms ammunition capability was essentially that acquired from CAC . This facility had reached a capacity of approximately 100 million rounds of SAA per annum at the peak of WW1 production in 1917. The

plant which had some buildings dating back to the 1890's was considered to be in less than ideal condition and a fire hazard. In 1934 the Munitions Supply Board proposed that a new modern SAA plant be built on the Footscray site near the Gordon Street boundary which would bring it closer to the foundry and rolling mill and bring certain efficiencies in the movement of product around the site. The modified site plan showing the 'new' case and bullet shop and assembly, loading and packing facilities was signed off by the then Munitions Controller General, Mr. A. Leighton on September 4th 1937. The more modern Footscray plant (ultimately using the identifier MG) and generally referred to as the No2 Factory, would share many of the Footscray facilities such as the foundry and rolling mill and firing and acceptance ranges. It was to be capable of 100 million rounds of SAA per year. The original intention was to close the old CAC 'lower' SAA plant as soon as the new plant came into production. The political situation in Europe however caused abandonment of the closure of the 'lower' factory. The new No.2 plant commenced deliveries early in 1940. Initially it had been decided to change the identification of small arms ammunition at Footscray by using MF1 as the Factory identifier of the original factory and MF2 for the No.2 plant. Some relatively small amount of cartridges were so marked from each plant before

a change was made to use the MG identifier for the No2 plant and revert to MF for the No1 plant. The following graphic of an early 1940 .303 proof round from the No1 plant illustrates the use of the MF1 identifier.

FIGURE 1. An example of the MF1 headstamp used in early 1940 for a short period. The item shown is a .303 proof Mk III round

FIGURE 2. .303 ball headstamps of the No2 SAAF Footscray 'MG' from 1940 to 1948

Hendon S.A. chosen for new SAA plant.

The Munitions Supply Board commenced examining options to increase SAA production in Australia. As a general strategy, any new facilities were as far as practicable, to be kept in the southern states to draw on 'untapped' labour resources. As the uneasy political situation in Europe deteriorated into war, the Munitions Board proposed that a new plant be built at Hendon in South.Australia, and Drawing W2689 dated 10th October 1939, was prepared at the Cen-

tral Drawing Office at Maribyrnong depicting a 'single factory' with supporting storage magazines and proof firing facilities located on a roughly triangular tract of land in the Adelaide suburb of Hendon. The site was bounded by Tapley Hill Road on the west, Gordon Street on the east and Farman Street on the northern boundary. An existing railway line was conveniently located near to the southwest corner of the site. The intention was to construct a plant at Hendon that would produce 100 million rounds of SAA per annum. This site often referred to as the No. 3 Plant, would use the identifier MH.

FIGURE 3. .303 ball headstamps of No 3 SAAF Hendon 'MH' 1940 -1945

Hendon Plant Duplicated

Construction at Hendon commenced almost immediately but by early 1940 it was obvious that even more production was needed and the decision was made to duplicate the Hendon Plant. The additional Hendon Plant again with a planned capacity of 100 million rounds per annum, was to be referred to as the No4 plant and would identify it's production with the MJ code. Drawing W2754 dated 21 August 1940 shows two SAA buildings (MH & MJ) side by side separated by a few hundred feet. Records show employment at the Hendon site was nil as at the end of June 1940 rising to 321 by end of October 1940. In a report to the Munitions Board in October 1940, the No3 plant was reported as complete with production commenced. The No4 plant was then reported as being 75% completed. The report also suggests that with both plants operational, employment at Hendon would rise to 2500 of which 80% would be female. This report indicated that Hendon would draw its metal requirements from the new Gun Ammunition Factory being constructed at Finsbury and cordite from the Explosives Factory Salisbury also under construction.

FIGURE 4. .303 ball headstamps of the No4 SAAF Hendon 'MJ' 1941-1944.

Reorganisation of the Munitions Supply Organisation

Meanwhile the organisational arrangements of the Munitions Group was changing as can be seen from the following passage written by Mr. J, K. Jensen :- "In July, 1939, the Department of Supply and Development was formed upon a nucleus provided by transfer from the Department of Defence of our Munitions Supply Board and the Principal Supply Officers Committee, together with the Contracts Board. Mr. Brodribb was included in the transfer, and resumed his appointment as Chairman of the Munitions Supply Board,

while Mr. Leighton (who had officially reached age retirement in 1938 -D.M.) was appointed a consultative member in order that his wide knowledge and wide experience might be retained. We have grown since, however, and whereas then the administrative staff of the Munitions section consisted of 18 people, it now approaches 6000. In July, 1939, we occupied two floors of 83 William street, Melbourne, and now we are located in 28 buildings in Melbourne, four in Sydney, and one in each of the remaining capital cities. We had four Government factories and the Departmental Laboratories, each one fitted with all essential equipment of the highest quality and precision, and there were 24 Armament Annexes being equipped, of which eight had commenced manufacturing. The war opened, therefore. with an organised Department, even though the directing staff may have been almost negligible in number."[1]

Munitions Ministry Created.

Not long after the split from the Defence Department, further massive organisational changes were initiated with a separate Ministry of Munitions being created. The following pas-

1. Reference 1 Page 8.

sage also by J.K.Jensen explains :- " In .June. 1940, came the great forward move; we were broken off from the Department of Supply and Development and set up as a separate Department of Munitions, with Mr. Essington Lewis as Director-General in charge of the production effort. Mr. Lewis was asked to prepare a plan for a large scale production of munitions, his first steps being to visit the factories and interview departmental officers while regulations were prepared giving him wide powers. Then on one historic night he called together the principal departmental officers and a plan was prepared for the munitions organisation as it stands today - practically unaltered - ample evidence that some very good planning was done on that .June day in 1940.

Eight Directorates were established for the development of commercial industry for munitions production, and we had also the Government Factories organisation which, throughout, has been under the direction of Mr. N. K. S. Brodribb as Chairman of the Board of Factory administration. Mr. A. E. Leighton, former Chairman of the Board, and now a consultative member, was appointed Consultant on Explosives, with particular supervision over commercial chemical production for munitions purposes.

Complementary to the central Directorates, we set up Boards of Area Management in each State, and here probably their respective functions should be explained. The focal point for the whole organisation is the Director-General of Munitions, assisted, as stated already, by the Factory Board for the Government Factories, and by the Directors, for the organisation of commercial industry. The Directors, as will be shown shortly, were given charge of production of certain groups of Munitions, or in some cases, of matters accessory thereto. The Director-General was to be the co-ordinating authority as between the Directors themselves, between the Directors and the Area Boards, and between commercial industry and the Government Factories."[2]

Finsbury comes on line to supply Hendon

In August 1941, the Finsbury Gun Ammunition plant was reported as just commencing production. Presumably since production had been underway at Hendon No3 for almost a year, it must have done so with metal supplies from the Footscray Rolling mills and the "Cordite" factory i.e. Explosives

2. Reference 1 Page 9.

Factory Maribyrnong. The Hendon and Finsbury plants were under a single Manager at that time i.e. Mr. W.M.B. Fowler.

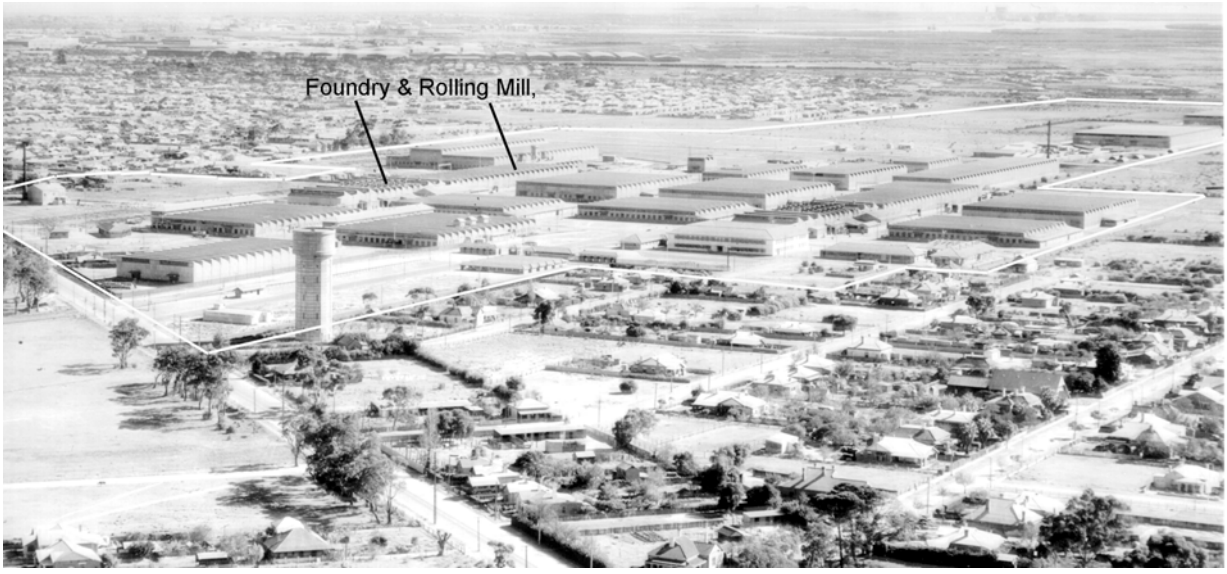


FIGURE 5. The Finsbury plant S.A. circa 1943 as viewed from above Torrens Road looking north-west. The enormous plant covered an area of approx 1.2Km x 0.8Km and provided the metal needs of Hendon and Welshpool SAA plants as well as its own needs as a large calibre case and fuse manufacturer. The feint white line added to the photo indicates the boundary fenceline.

Rebuild of Footscray No 1 Plant

By December 1940, total Australian 303 production had reached a rate of 200 million rounds per annum with expectations that a demand of 300 million rounds per annum

would be reached by March 41, 400 million by June 41 and 500 million by September 41. Approval was given to rebuild the No1 site at Footscray and production was moved to a large new SAA building constructed on the river flats area just north of the previous building.

Plants planned for Rocklea and Welshpool

As the estimates exceeded the total planned capacity of the previously mentioned 4 plants, by late '41 the Munitions Ministry had a further 3 plants planned. These were to be Factories No. 5 and 6 to be built at Rocklea, a suburb of Brisbane, and Factory No. 7 to be built at Welshpool a suburb of Perth and each was to be capable of 100 million rounds per year. The choice of the Rocklea site was at variance to earlier stated intentions of keeping plants in the southern states. The logic for this change was not given.

The Rocklea SAA plant which would come to use the MQ identifier was to be built together with a large calibre case shop, in undulating hills about one kilometer east of Rocklea Railway station and about 7km due south of the Brisbane city centre. It straddled Evans road. It was planned that the Rocklea plant would not require foundry or rolling mills and

would draw its metal needs from industry in Sydney and tooling from the Railway Workshops at Ipswitch. Detailed drawings for the Rocklea buildings carry dates of May 1941 while those for Welshpool August 1941. Both sites had access to railway facilities via spur lines entering into the factory boundaries.

The 1945 site layout for the Rocklea site which follows, shows only one SAA Building of 138,000 sq. ft. in area and a foundry and rolling mill and Toolroom thereby showing three contradictions to the original plan . The individual Hendon SAA buildings each had 'footprints' of 70,400 sq. ft. as did the single Welshpool SAA plant. Presumably the Board's intention to establish two Rocklea plants was modified to have one large facility of the required capacity. The presence of the foundry, rolling mill and toolroom also suggests a change in plan. The Rocklea site plan also shows a large Case Factory and Machine Shop of 230,000 sq. ft. (for large calibre gun cartridge cases). A photograph of the Rocklea site taken in March 1941 entitled 'Site Preparation' shows most of the Buildings in place. A photograph in the Government Archives shows the first SAA ammunition delivery from the Rocklea plant being made in February 1942.

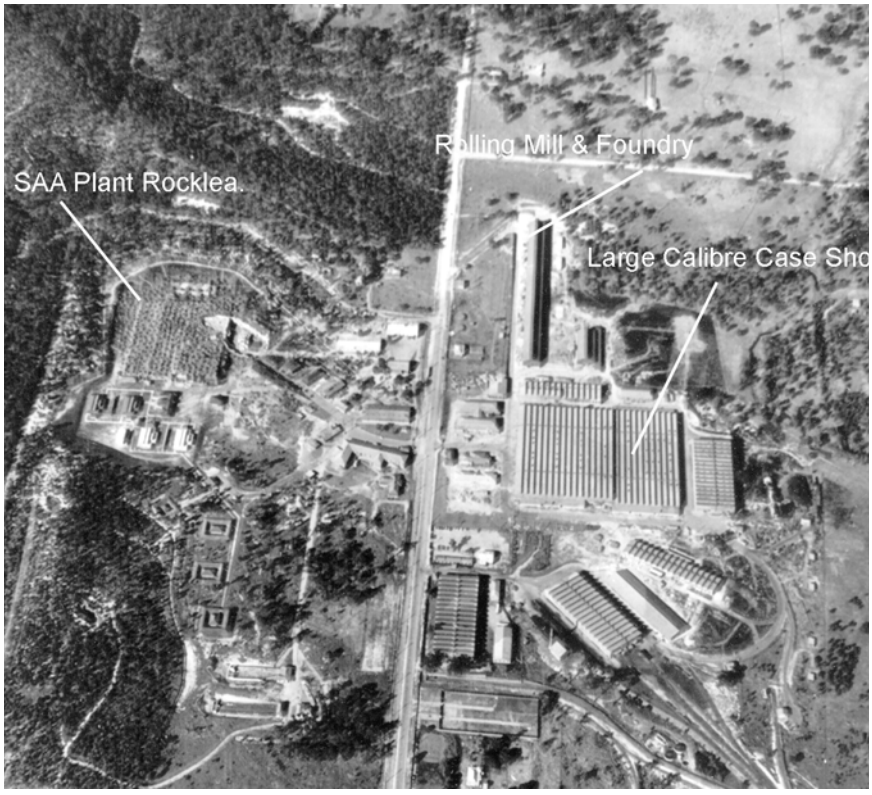


FIGURE 6. An aerial photo of the Rocklea site circa 1945 with the SAA buildings still partly shrouded in camouflage netting.

The Welshpool Plant which used the MW identifier, was to be located on site near the intersection of Welshpool Road and Rutland Avenue adjacent to the South Western Railway line from Perth. The Welshpool plant, in common with the Hendon plants, was to draw its metal needs from the Finsbury plant in South Australia. The Welshpool site layout as at

1945, featured in addition to the standard SAA facilities, a large building of approximately 56,000 sq. ft. designated as a 'Fuse' shop. Production deliveries from Welshpool commenced in June 1942.

By July 1942 the SAA production exceeded revised requirements and on the 6th of July the Minister of Munitions Norman. J. O. Makin, wrote to the Prime Minister John Curtin suggesting that the Footscray and Hendon Plants should reduce from 3 shifts per day to 2 shifts per day with the 'surplus' labour to be absorbed elsewhere, and that the proposed 3rd shifts at Rocklea and Welshpool be deferred indefinitely

FIGURE 7. .303 ball headstamps of SAAF Nos 6&7 Rocklea 'MQ' 1942-1943

FIGURE 8. .303 ball headstamps of SAAF No 7 Welshpool 'MW' 1942-1945

. Makin advised the PM that " A situation has arisen in connection with the operation of our Small Arms Ammunition Factories regarding which I consider you should be aware. We now have seven factories established each being designed for a nominal production of 100,000,000 rounds annually, but actually the seven factories working 24 hours per day should produce 800,000,000 rounds annually.....The production scheme upon which the factories were planned totalled at one time 1000,000,000 rounds annually, including substantial shipments to Malaya, Netherlands East Indies, New Zealand, Middle East, Eastern Group etc. but for obvious reasons some of these (requirements) have ceased. The cessation of shipments abroad has considerably improved the Australian position, and the reserve

stocks in Australia are now becoming satisfactory, whereas only a few months ago they were not so regarded. “

Makin went on to explain his proposal to reduce activity at the plants and sought advice as to how to handle the potential negative public comment. The Prime Minister replied on the 23rd of July setting out some guidelines for the reduction of ammunition production as determined by the ‘Chiefs of Staff’ of the Armed Forces and some guidance as to the form of the public statement On the 25th July a press release was issued advising of reductions in certain munition programmes.

At the Footscray site the workforce had peaked in 1941-42 at 9,323, (4,608 of whom were women) , but as a consequence of the ‘1942 cut-back’, the factory was required to make male employees available for military service and 1,100 were subsequently released. Further reductions in demand at Footscray resulted in employee numbers being reduced down to 2,507 by 1944.

The declining demands for SAA resulted in production at the Rocklea Plant being halted in October 1943 and the SAA buildings handed over to the Department of Aircraft Production for use as a repair and overhaul centre for aircraft

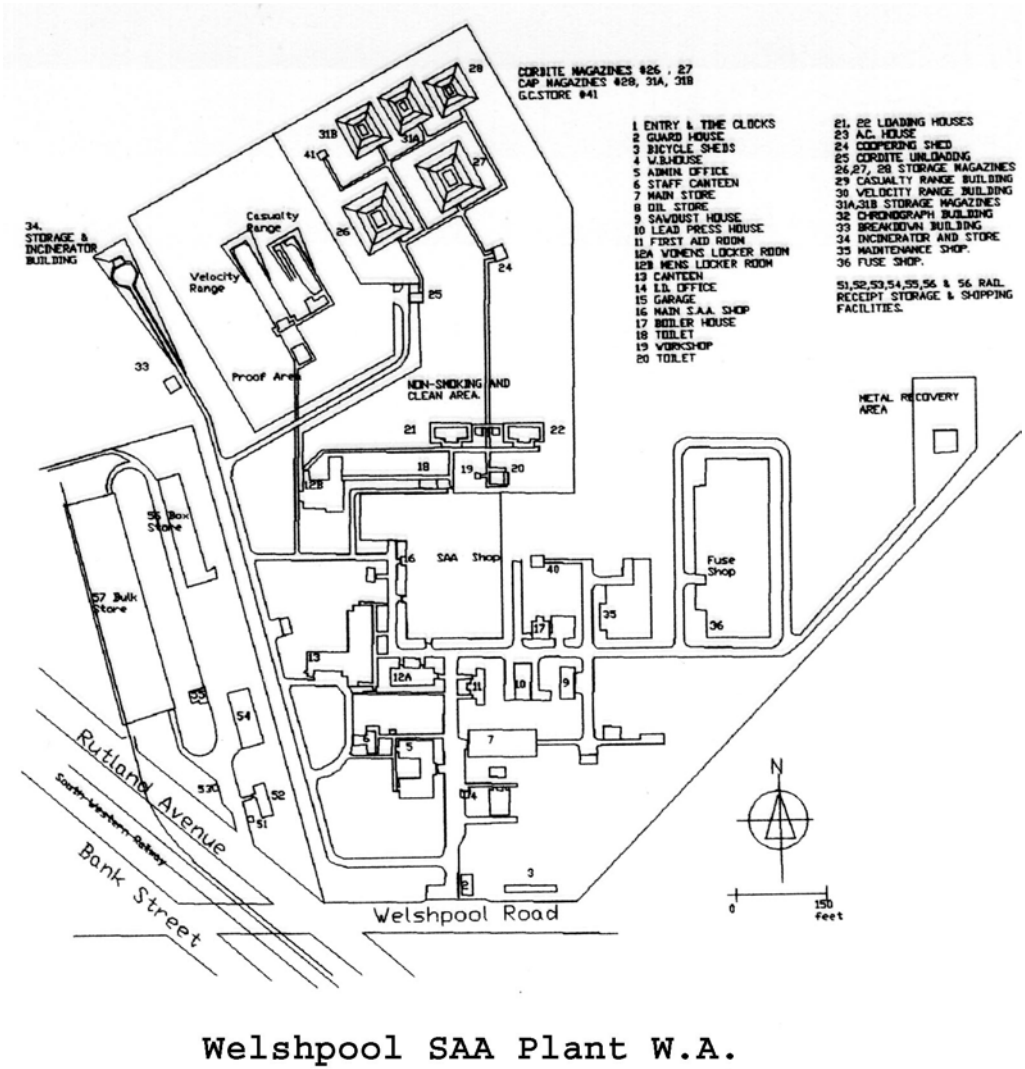
engines for the large number of allied aircraft (especially USAF) operated out of Australia's north. The large case shop had at least some of its orders transferred to the Rutherford (NSW) case factory. In its short career the Rocklea plant produced annually 220 million rounds of .303 ammunition, 2 million .455 revolver rounds, 9 million .380 revolver rounds 3 million cartridge cases for 25 pdr and 0.6 million smoke shell .

Site Plans for the WW2 SAA factories.

The following site plans show the general arrangement of each of the wartime SAA plants as they existed in 1945 except for Footscray which is a mid 60's layout. The main change from Footscray's WW2 layout is the addition of a large building in the lower Factory added by the Myer Company for use as a store during their post war lease of this area.

FIGURE 9. Changes to .303 projectile material and crimping: from top cupronickel with neck staking into low cannelure phased out in 1942 to be replaced by gilding metal neck staking which was in turn replaced by mouth coning into a high cannelure in 1944 which continued until cessation of production. The mouth coning of the cupronickel projectile (second from bottom) in 1944 was to use residual 'surplus' cupronickel stock.

FIGURE 10. Bullet retention in Tracer , Incendiary and Armour Piercing cartridges : from top cupronickel and guilding metal tracers with press fit and mouth coning, Blue tipped incendiary with press fit, cupronickel and guilding metal AP rounds with punch neck staking (prior to 1942) and AP with full neck staking



Welshpool SAA Plant W.A.

FIGURE 11. SAA Plant 'MW' at Welshpool W.A. c1945

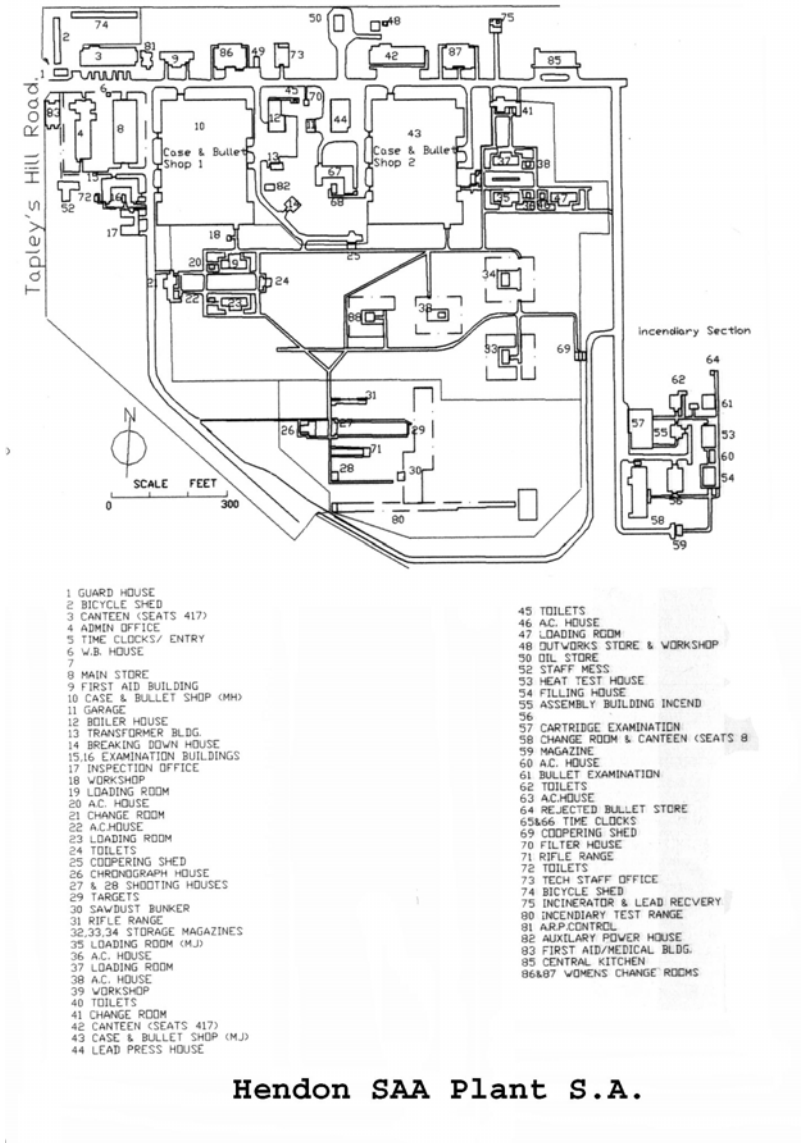


FIGURE 12. **SAA Plants 'MH & MJ' at Hendon S.A.**

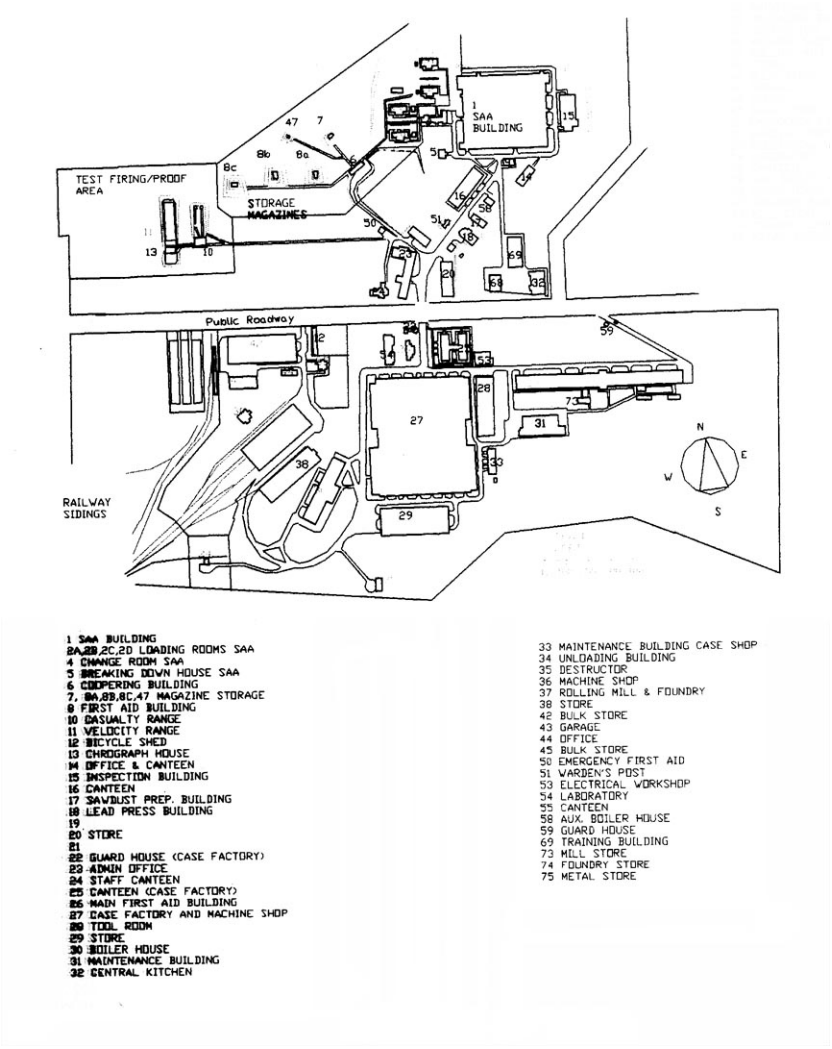


FIGURE 13. SAA Plants No5 & 6, 'MQ' at Rocklea Queensland.

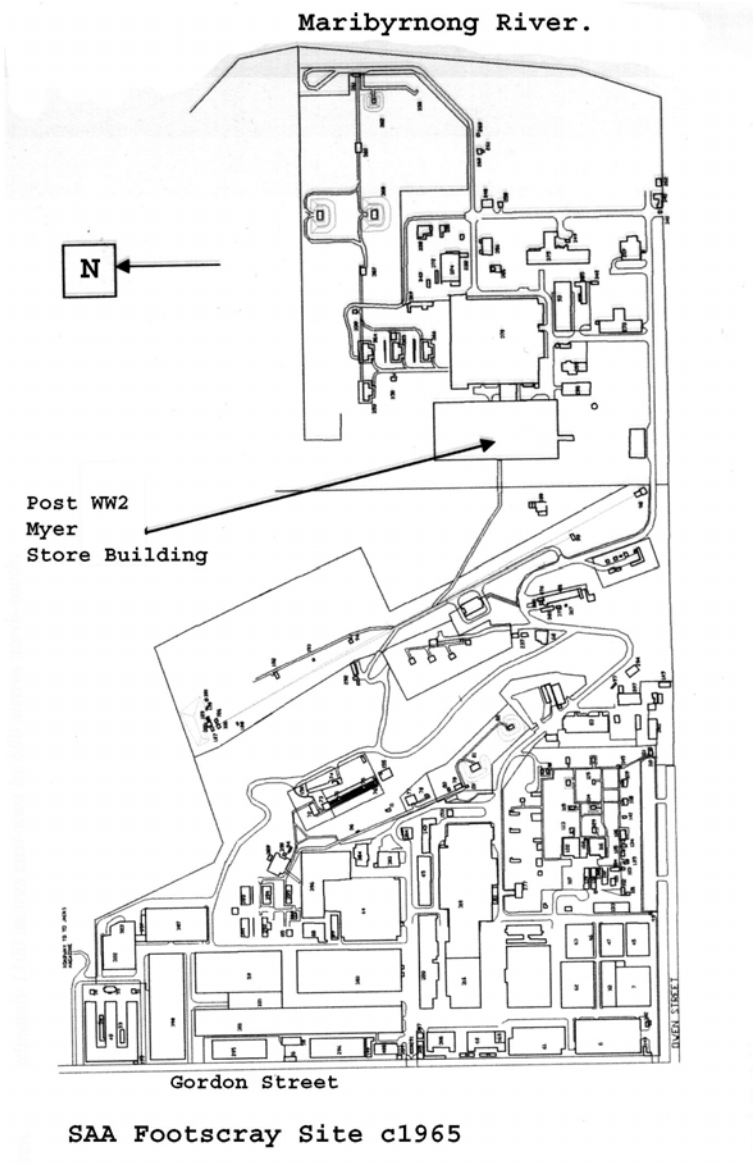


FIGURE 14. SAA Plants 'MF & MG" at Footscray Victoria.

Chapter 7 : *The end of .303 production.*

Closure of Wartime factories,

At the end of WW2, Australia had the production capacity of 500 million rounds of SAA per year. The Rocklea plant with it's capacity of 200 million rounds per annum had been closed in 1943 as noted in the previous chapter. The surviving SAA sites included two at Footscray in Victoria , two at Hendon in South Australia and the Welshpool plant in Western Australia. The large reserves of .303 and other ammunition on hand at the end of the war left no option but to immediately scale back production. Consequently all but the Footscray No2 plant (MG) were closed by the end of 1945.

As noted earlier, the original intention of building the No2 plant at Footscray was to bring the SAA operations away from the river flats area and place it closer to the supporting operations of foundry and rolling mill and the like. So even though the No1 Factory had been upgraded and expanded during the war it was marked for closure. Ultimately the No1 site was leased to the Myer retail organisation and the site was used for storage and some furniture manufacturing operations. The buildings were cleared prior to the lease with much equipment joining that from Rocklea, Welshpool and Hendon in the Government Disposals System. Myer erected a 'new' large warehouse alongside the No1 SAA building to increase floor space.

A good cross section of the surplus equipment was acquired by Mr. George Lansell who set up Super Cartridge Company at 151 Rayleigh Road Maribyrnong. It is interesting to note that on the eventual closure of Super Cartridge Company in the 80's some of this surplus war time equipment was still stored there as it was taken from the war time factories. Many of the machines still had wartime components in the feed hoppers.

Limited post war production of .303 ammunition.

Limited production of .303 ammunition continued at Footscray through 1946 to 1948 using the No2 plant identifier MG. Production of 9mm, .45Auto and .380 revolver ammunition was suspended until further notice. Employee numbers at the Footscray site had fallen below 1000 in 1948.

In 1948 The Munitions Ministry was 'absorbed' back into the Department of Supply together with elements of the Department of Aircraft Production.

In 1949 a decision was made at the Ammunition Factory Footscray to revert to the identifier MF for all subsequent SAA production. Production of .303 ramped upward during the Korean conflict and was maintained at reasonable levels to support Civilian Rifle Clubs usage, Military Cadet activities and National Service consumption.

The manufacture of charger clips for .303 which had been centred at the Ordnance Factory Maribyrnong since the 30's was discontinued in favour of ongoing production at the Ordnance Factory Bendigo. Bendigo product carried the 'BO' identifier and later 'MBO".

FIGURE 1. .303 Chargers: At the top a Mk IV made by MO (Maribyrnong Ordnance), with a drab olive and conventional black phosphated Mk 4 made at BO (Bendigo Ordnance)

During the early 50's the Defence Department was seeking to replace the .303 weapons with a new suite of weapons taking the new ammunition standardised across the NATO members. Although Australia was not a member of NATO it followed the USA and UK in adopting the 7.62mm x 51 ammunition. Australia chose the Belgian FN designed Self Loading rifle as the individual weapon and the United States M60 machine gun as the standard Army machine gun.

Preparations were made to commence production of 7.62 ball ammunition at Footscray. New cartridge manufacturing machinery was ordered from France and initial production got under way in 1956 in parallel with the .303 production lines.

The last production runs of .303

The last regular production of .303 ball and blank loadings ceased in 1960 however a special order for a quantity of .303 ball for the Cadet organisation was processed in 1962. Unfortunately the Cadet requirement was badly under estimated and subsequently imported English (Kynoch ICI) Mark 7 then Indian Mark 7 from the Kirkee Ammunition Factory was acquired for the Cadet movement. Much of the Indian ammunition was repacked by the Footscray factory in the late 60's and early 70's. Charger loaded Indian stocks were covered with a grease like material and at Footscray the rounds were 'de-clipped' and rumbled in sawdust to remove the 'grease' prior to repacking in cardboard packets of 48.

Cadet rifle training eventually became 'politically incorrect' and the .303 rifles and ammunition were withdrawn.

The end of .303 production.

Chapter 8: *Manufacture of 7.62 x 51 ammunition*

Commencement of 7.62 production

The first Australian production of the 7.62 round took place in 1956 at the Ammunition Factory Footscray. The British System of type marking was used on this ammunition and the first ammunition carried a designation of L2A1. This short lived pattern was replaced by the L2A2 in 1957. Production rate increased over subsequent years as the new weapons were distributed to the Defence Forces and the .303 weapons and ammunition were phased out.

Ball rounds and inspection rounds were produced in 1956 followed by fluted drill rounds, Inspection rounds, proof and grenade launching rounds in 1959. Footscray also made ballistic standard rounds for its own internal needs. A European designed full length 'plastic' blank with metal head insert was put into 'licensed' production in 1961 designated L1A1

The NATO symbol

In 1960 Footscray included the 'NATO'  symbol into the headstamp for the ball round. The Footscray plant was subsequently advised that the NATO symbol could only be included into the headstamp if the ammunition was independently tested and verified to fully conform to the NATO specification by one of the overseas approved testing authorities. The symbol was dropped from the headstamp part way through 1962. Subsequently several batches of ammunition were submitted overseas for test at considerable expense but 'the Defence System' was not committed to this concept and the quest for NATO approval was eventually dropped.

FIGURE 1. 7.62 Ball round headstamps 1959 through 1963 showing introduction then deletion of the NATO symbol .

The 7.62 ammunition was placed into maximum production in the late1960's as the USA purchased considerable stocks of Australian Defence Reserve ammunition to support its operations in Vietnam and the Footscray factory was given additional replenishment orders.

The ‘new’ ammunition required new charger clips for the rifle and disintegrating links for the M60 machine gun. These were put into production at the Bendigo Ordnance facility. The links for the M60 machine gun were the USA designed M13 link. The chargers for the rifle were of a ‘mauser style’. Both were black phosphated steel.

FIGURE 2. From top : 50 browning M9 link circa 1980’s , 7.62 charger made in 1964 and the 7.62 M13 link for the M60 machine gun made at Ordnance Factory Bendigo and carrying the MBO mark.

FIGURE 3. The 5 round 7.62 charger with black phosphated steel body and spring steel inner platform made at Ordnance Factory Bendigo from the early 60's.

Problems with pressure.

The Australian Army converted a quantity of otherwise surplus .303 BREN light machine guns to 7.62 calibre. This was quite a reasonable idea since the original weapon design was for the similar rimless 7.92 Mauser cartridge. Consequently these weapons were then included in the 'casualty' firing acceptance at the factory. Cartridge failures began to occur

with certain of the tests particulary the 'hot' test with the Bren. This problem lead to a detailed study of the cartridge case internal geometry and the propellant (AR2201) characteristics at high temperature. Part of the findings included a discovery that due to 'toolmaking liberties' in the cartridge drawing and forming tools, certain case dimensions had moved progressively toward low tolerance (i.e. minimum metal condition). This caused considerable embarrassment for the Factory and steps were taken to remedy the situation. An improved propellant (AR2206) was also introduced. The resultant round was designated as F4 and 1979 dated rounds carried this marking with the L2A2 marking ceasing in 1978.

The original Munitions Supply Laboratories had been renamed years earlier as ' Defence Standards laboratories' Whereas these laboratories were initiated as a support to the munitions industry with expertise in metrology, materials, gauge design etc., the years had seen their activities move across Defence matters generally. In the 70's these laboratories announced that they would no longer participate in industry support as such, and would concentrate on research. Consequently their metrology and gauge design section was disbanded.

Ammunition Factory Footscray picked up most of the Metrology role of the laboratories and became the prime metrology centre in Victoria.

Commercial Ammunition and Components

The 70's saw Footscray trying to supplement the diminishing defence workload by (once again) turning to commercial work. The Gun cartridge presses were used to make a variety of items including 'drawn' pressure cooker saucepans and components for domestic stoves. The SAA section developed a range of components for sporting shooters. This included Boxer primed cases for .223 Winchester (5.56mm), .243 Winchester , .308 Winchester, 30-06, 9mm and .38 Special. Tin coated lead projectiles were also made in .38 calibre and .45 calibre. The pistol cases and projectiles were aimed at local pistol clubs while the rifle cases were onsold to customers such as Super Cartridge Company which in turn loaded the cases and then sold the ammunition under their own trade name. One large consignment of .223 Winchester was sold to a distributor in the USA. A quantity of .308 was loaded and sold directly from the Factory.

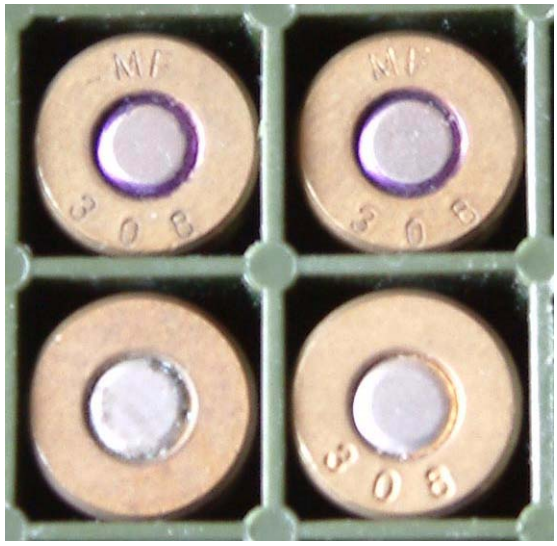


FIGURE 4. Commercial .308 produced by Footscray including loaded rounds (two top items) with headstamp MF 308 ; primed boxer cases with no headstamp (lower left) and bearing 308 only (lower right)

FIGURE 5. Some commercial handgun projectiles : from left .45 tinned lead projectile, .38 tinned lead wad cutter and jacketed .38 projectile.

FIGURE 6. .38 Special revolver cases : the top example carrying MFc (Commercial) identification the lower carrying MF only.

The Factory also supplied ammunition against 'non-military' orders particularly for the State and Territory Government departments responsible for eradication of feral animals. In the Northern Territory and Western Australia, eradication programmes were mounted against buffaloes, wild camels and donkeys. In some of the programmes helicopters were used with marksmen equipped with military self loading rifles. Initially military 7.62 ammunition was supplied but success was less than desirable because of the 'stiff' 144 grain full metal jacketed projectiles wounding rather than killing the animals. This situation lead to the Factory loading soft pointed and hollow pointed bullets and also heavier (170 grain) full metal

jacket projectiles in the ammunition supplied for these programmes.

FIGURE 7. Commercial Rifle Cases : from left 30-06, 308W, .243W (loaded by Super Cartridge Company) and .223W loaded at the Factory

FIGURE 8. Headstamps of Commercial Rifle cases : from left 30-06, 308 W and 243 W

FIGURE 9. Commercial .223 W (5.56) of the 70's headstanped MFc compared to Military 5.56 of 1988

FIGURE 10. Non military 7.62 projectiles from top 170grain FMJ , 150 Grain sopt point and hollow point.

FIGURE 11. Non-military 7.62 loads of the early 1990's from top 1990 full metal jacket 170 grain boat tail bullet, 1993 and 1991 hollow points, a 1991 soft point and an undated soft point.

FIGURE 12. **Animal eradication soft point loads circa 1985**

Chapter 9: *The New 5.56 ammunition and the end of AFF.*

Changing Government Plans

The post war Department of Supply was broken up in the 70's with the Laboratories moving back to Defence. The Factories were 'moved' through a range of new Government Departments, including Manufacturing Industry, Industry and Commerce, Department of Productivity and Defence Support. They became the 'test beds' for Government labour experiments such as 'industrial democracy'. They also became more and more remote from their customers. The factories were controlled by a remote Canberra head office bureaucracy. Successive Federal Governments were preoc-

cupied with other issues and there was no long term vision for defence manufacturing. With little or no perceived threat to Australia, Defence generally was 'on hold' and Defence Industry and the Government Factories had no clear future.

A New 5.56 Calibre and Weapons system.

Following moves by the NATO alliance to adopt a small calibre weapons system to replace the aging 7.62 weapons, the Australian Defence Department announced its intention to follow the NATO choice of a smaller calibre. After a series of Trials, NATO adopted the 5.56x45 calibre. The ammunition type chosen was the FN SS109 cartridge. This round featured a 4 gram (62 grain) projectile with a composite core comprising a hardened steel penetrator and lead slug enclosed in a gilding metal jacket. A muzzle velocity of 905 metres per second was achieved in the ballistics barrel fitted with "Kistler" type 6203 pressure transducers. NATO subsequently changed to type 6215 transducers and the barrel equipped in this manner produces a velocity approximately 10 metres per second faster.

The USA designated their round the M855 ball. The Footscray manufactured equivalent would eventually be known as F1 ball.

There was no agreement by the NATO allies as to common weapons and a number of the NATO partners chose their own locally made designs. This left the Australian Defence Department with the problem of choosing suitable weapons.

With the announcement of the choice of the 5.56 calibre, Winchester Australia a subsidiary of the large American Ammunition maker, lobbied the Australian Government to have the new ammunition made in their plant at Geelong in Victoria, as they had access to all of the necessary 'know-how' from their parent company. One of the key arguments was that double base propellant such as that made by Winchester, was essential to achieve the specified ballistics in the 5.56 ammunition, and Mulwala, the only surviving propellant manufacturing site was set up for single base (nitrocellulose) propellant. To their credit, the technical staff at Mulwala achieved what was thought impossible by developing a new single base propellant that could achieve the requirements of this new ammunition. Despite the lobbying, the Government tasked the Ammunition Factory Footscray

with supplying the new ammunition. Following consultation between Mulwala and Footscray, the initial production difficulties experienced with leakage of gas around the primer/ case interface when fired from the F89 Minimi weapon at low temperature when the cartridge was covered with ice or when wet, were overcome by reducing the primer firehole from 2mm diameter to 1.8mm diameter.

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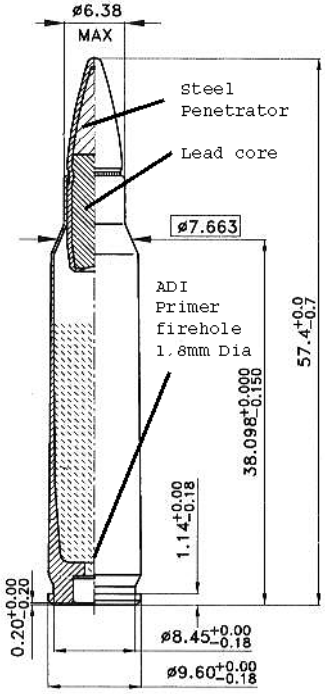

FIGURE 1. The arrangement of the FN SS109 5.56x45 cartridge noting the ADI modification to the primer firehole.

Through the 80's the Army was evaluating the range of 'contender' weapons in 5.56 calibre eventually choosing the Steyr F88 rifle as the individual weapon (IW) and the FN F89 Minimi as the light support weapon (LSW).

Browning 50 calibre machine gun ammunition.

Even though the Australian Defence forces had been using 50 calibre ammunition since WW2, manufacture was not initiated until the 80's. WW2 aircraft of USA origin were often equipped with 50 Brownings as were certain Army fighting vehicles supplied from the USA. While the 50 Browning vanished from post war aircraft, the Army retained the weapon as a heavy machine gun. The Navy introduced 50 brownings as 'removable' deck mounted guns on their Patrol Boats. The reason for the delay in local manufacture is unclear but the commencement of production in the 80's may have been made to supplement the diminishing workload at Footscray. Ball rounds were made for the services and some inert rounds were made up for internal purposes such as checking the M9 links made at the Ordnance Factory Bendigo.

FIGURE 2. Belted 50 Browning ammunition of late 80's manufacture exhibited at AIDEX, the Australian Industry Defence Exhibition in the early 90's

FIGURE 3. Top a 1988 50 Browning specimen headstamped with the AFF identifier and below an inert specimen with blind primer pocket dated 1985 and used at Ordnance Factory Bendigo during setting up the M9 link programme/

Gulf and Western Plant

The USA ammunition makers had been using automated plant to make their ammunition including 5.56 calibre for many years. After an overseas fact finding tour by Factory, Defence Quality and Purchasing representatives in 1983, the Footscray factory sought and obtained approval to obtain such plant to enable it to maintain competitive productivity and pricing. The Factory placed orders for a new 'high speed automated cartridge plant to be supplied by ADEC a division of the Gulf and Western company of the USA.

FIGURE 4. A View of the G+W plant from the operators console with the cartridge conveyor and tooling system behind the screens (from an AFF brochure)

The plant was installed and ready for trials in 1985 and a range of 7.62 cases were produced on this plant. The intention was to have universal 7.62 cases and subsequently 5.56 cases (i.e. without type markings) so cases made on this equipment carried only the factory indentifier and the last two digits of the year of manufacture. This plant also was designed around boxer primed cases and consequently the factory introduced boxer primers for 'Gulf cases'. 'Dots' appeared in the headstamp between the Factory identifier and date markings to assist in identification of cartridge cases produced from a particular tool station in the 12 station 600 parts per minute machine. (see following figure)

FIGURE 5. Gulf and Western Plant made 7.62 cases 1985-1988: Note the boxer primer configuration and the change of headstamp to AFF in 1988.

Limited quantities of 7.62 cases were made in 1985 through to 1988 while the berdan primed F4 7.62 cases continued in production on the conventional machines. The conventional machines were ultimately converted to manufacture boxer type cases. G+W cases can be positively identified from those made on conventional plant by examination of the internal surface of the cartridge head. During cutting of the extractor groove on the G+W machine, the case head was supported on a mandrel which had 'gripping' teeth to prevent

case rotation. G+W cases display such impressions on the inside of the case head.

Footscray's Centenary

In November 1987, the factory made a special batch of ammunition for use in the International 'Palma Match Competition' which was to be held in Sydney in March 1988. The cartridges were made on the conventional plant (berdan primed) and carried a special headstamp. These rounds were issued in a variety of forms including clear plastic 'film packs' and a commemorative 20 round packet (figures 6 and 7).

The Factory also celebrated it's 100th anniversary in 1988 and issued a commemorative batch of ammunition for the Civilian Rifle Clubs and others. This ammunition also carried a special headstamp and could be obtained in an attractive 20 round packet somewhat similar to the 'Palma' one. Figures 8 and 10 show this packet. It should be noted that an error occurred in the 'short history' of AFF which was printed on the rear of this packet (Fig 10) in that it refers to Major John Whitney as the factory founder instead of Captain John Whitney.

FIGURE 6. The front view of a twenty round packet of 'Palma Match ' ammunition.

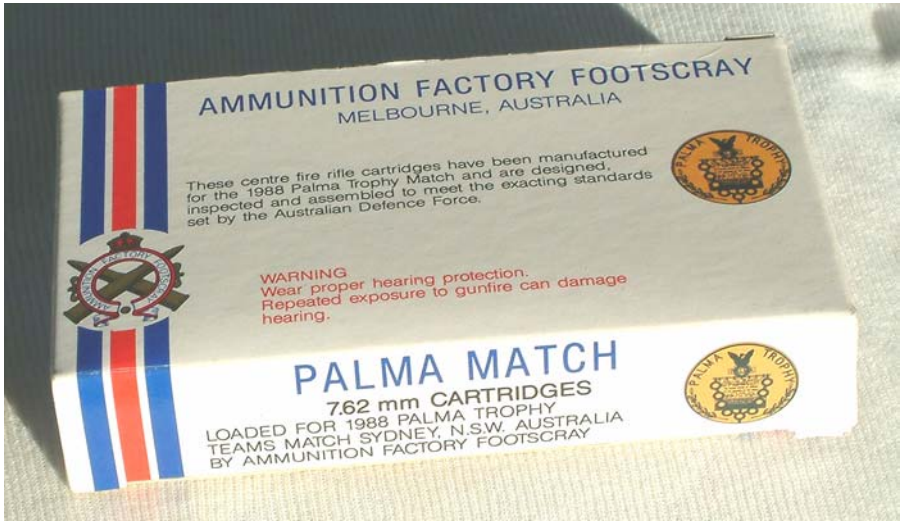

FIGURE 7. The rear and bottom panel of the 'Palma Match' packaging.

Employees were given a booklet including a short history of the factory and featuring photographs of all management and staff employed at that time. The booklet included a special medallion minted for the occasion. (figure 11)

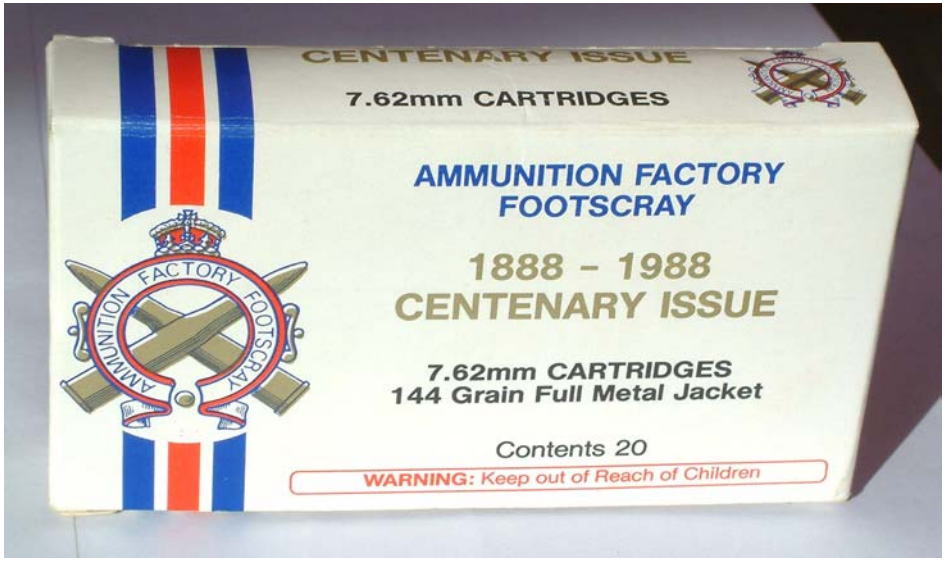

FIGURE 8. Front view of the 'Centenary Packet'

FIGURE 9. Headstamps of the Centenary and Palma Match 7.62 rounds also showing Berdan priming.

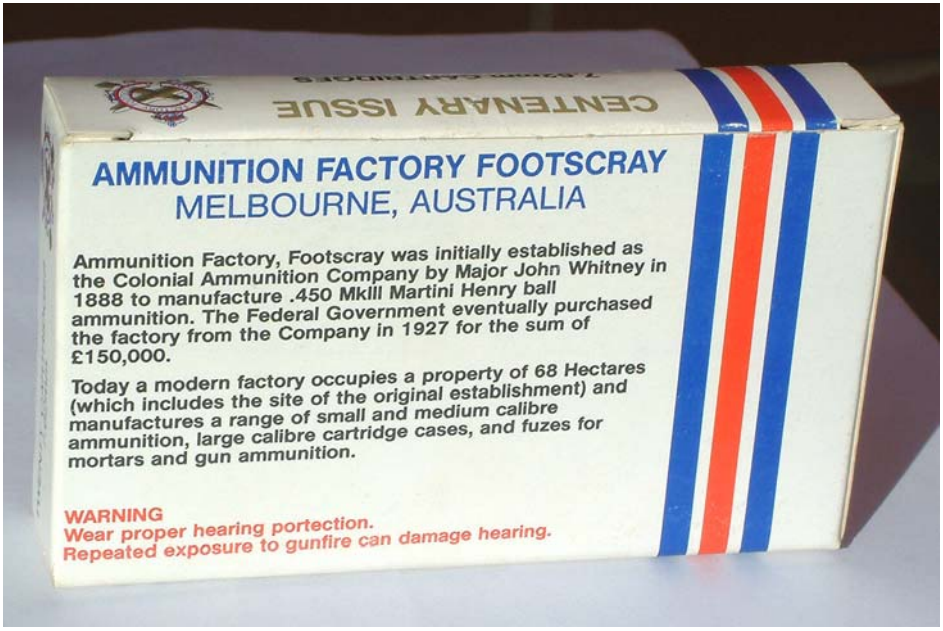

FIGURE 10. **Rear view of the 'Centenary packet"**

FIGURE 11. **The Centenary medallion issued to employees rear (left) and front view (right)**

The Gulf and Western Plant was designed for high speed continuous production with quick change modular tooling. The compromises necessary to gain this high rate of production from a single machine, included long and flimsy tool modules and complex part transfer systems. The operating efficiency obtained from the equipment rarely exceeded 50% while conventional machines consistently achieved 80%. Tool costs were around three times those required for conventional machines. Benchmarking against International users of similar integrated lines, confirmed that the Footscray plant was being operated close to “Worlds Best practice”.

Australian Defence Industries.

The Commonwealth Government began the process of ‘privatising’ defence industry when in the mid 80’s it disposed of the Williamstown Naval Dockyard to a private buyer. All personnel were retrenched and those employees required by the new owner were offered employment.

This was followed in August 1987 by the established of ‘Aerospace Technologies’ a fully Government owned company from the Government Aircraft Factories (GAF) . This was handled differently to the dockyard in that only certain

employees were retrenched and the balance 'transfered' to the new organisation.

On the 3rd May 1989 the Commonwealth Government placed the control of the Department of Defence Support munitions and certain other establishments under the control of a new fully Government owned company 'Australian Defence Industries'.The creation of ADI followed the 'GAF' pattern in that it commenced with a round of retrenchments to remove excess personnel from the sites, the balance of personnel being transfered to ADI. The top management of the new company had been given a direction to rationalise and streamline the operations of the munitions group and to operate on commercial principles. The new executive devised a plan to rationalise and condense the activities of the existing sprawling sites which essentially occupied the same space as during the operations of WW2.

Site Closures

In 1991 the rationalisation plan was announced surprising and shocking the site managers and employees. The result of ADI's analysis was that Ammunition Factory Footscray was marked for closure along with Ordnance Factory Mariby-

rnong, the Rocket Motor facility in Salisbury South Australia and St. Mary's Filling Factory NSW. A totally new site would be chosen for ammunition production and the necessary elements of SAA production, shell forging and machining , gun cartridge and fuse manufacture and filling of ammunition would be established in a logical layout. Floor space was planned for Fuze manufacture in the new plant but the commencement of fuze manufacture was not planned to commence in the foreseeable future. Of course one of the unstated reasons for the closures, was to start with a greenfield site where work practices and attitudes could be developed without the restrictive union and public service traditions of the existing sites. The land value of the closing sites was expected to exceed the cost of establishing the new facility ($120 Million)

Each site was given a closure date (OFM December 1993, AFF early 1994 etc.). In the time remaining to closure, each site had to complete its current orders and provide bridging stocks of components for the new factory which would bring products on line progressively after the 'old' sites had closed.

FIGURE 12. The change in headstamp from AFF to ADI occurred in 1992 on 7.62 rounds.

Problems with 5.56 Ammunition

As the AFF site was nearing closure, some problems were experienced by the Army with the AFF produced 5.56 ammunition. More than a dozen incidents of 'bullet in bore' had been reported by the Army. A round without propellant does not have enough energy in the primer to eject the projectile into the barrel however propellant fills below a certain amount can lead to projectiles entering but not exiting the barrel. This was a serious issue as not only did it render a soldier's weapon inoperable it also presented a risk of injury to users of the F88 Austeyr IW in the circumstance where (Instant Action Procedure) a user attempts to reload and fire a subsequent cartridge.

A subsequent investigation resolved that all 5.56mm F1 ball cartridges (70 million) be withdrawn from service and examined for correct charge. This examination was conducted by unpacking and using high speed checkweighers in the first instance. With the assistance of the University of Melbourne Physics Department, ADI developed automatic inspection equipment that used gamma rays to examine the propellant fill level in the packaged (Link Belt or Charger) ammunition. This examination revealed a defect rate of one cartridge in 800,000 with insufficient charge to cause the bullet to exit the barrel

The cartridge assembly machine used to load the 5.56mm cartridges at AFF was hand fed with propellant. The machine dispensed this propellant by volume and dropped a probe onto the propellant column at the next station. The position of this probe was required to be measured by the machine and cartridges containing a column plus or minus 3mm from the set height were required to be ejected while the machine continued to run. As a final confirmation that defectives were not being produced one in five cartridges were diverted by the machine from its output stream and passed over a checkweigher. Low charge cartridges were ejected from the checkweigher calling the operator's attention to the fault condition.

The defect had been produced due to a combination of factors :-

1. The machines were fed with propellant by hand. It was possible for the machine to run without propellant;
2. The propellant column height probes were prevented from falling excessively (and damaging the height sensor) by a cam. If the cam and sensor were set incorrectly or adjusted after setting (setting included passing empty cases through the machine and observing them being ejected) or the electronics suffered "drift" it was possible for the cam to prevent a no-propellant cartridge from being identified as defective
3. Ejection of defective cartridges by the checkweighers required the operators to verify the reason for ejection and take corrective action. Corrective action may not have occurred

ADI Benalla

When the intention to establish a new factory was made public a number of the State Governments and Local Government Authorities made representations to ADI seeking to have the factory in their locality. In 1992, ADI selected

Benalla in Victoria as the new site . Benalla had the advantage of being close to the Explosives Plant at Mulwala thus minimising the problem of hazardous transportation of explosives. Footscray closed in 1994 and the site was progressively cleared of buildings and industrial contamination.

FIGURE 13. The Benalla site Circa 2003 set in rural surroundings north of the Benalla township. The main plant is in the foreground with magazines and other facilities in the background.

The new site had recruited around twenty of the Footscray workers to assist in moving, installing and commissioning SAA facilities.

To assist planning the new facility, ADI negotiated a "long term agreement" (LTA) applicable over the forthcoming 20 years, to supply a defined range of ammunition after which it would have to compete openly with overseas suppliers. The Small Arms Ammunition portion of the contract required ADI to install and operate a single shift capability of 24 million rounds per annum (5.56mm or 7.62mm).

Given this requirement the suitability of the Gulf and Western plant was reviewed against the AFF and overseas experience. It was clear that significant cost and quality advantages were presented by traditional "conventional" machines. During the benchmarking tour of international manufacturers a complete production line of mid 1970's equipment was located in Switzerland. These "NOBS" machines were refurbished and formed the basis of the line installed at Benalla. Subsequent production has vindicated this decision with costs running around two thirds of those associated with the Gulf and Western machine.

The Gulf and Western machine had a theoretical single shift capability of 62 million per annum and a proven capability of around 27 million.The Small Arms Ammunition facility was the first to be installed and commissioned on the Benalla site.

Machines commenced installation in late September 1994 and first deliveries were made in April 1996. By the end of the 1995 / 96 financial year over 10 million rounds of 5.56mm Ball ammunition had been delivered from the Benalla facility.

FIGURE 14. The Benalla capping section showing the typical modern facilities and layout of the factory generally

Requirements have continued to grow with annual orders and deliveries averaging 30 million 5.56mm cartridges by 2003. The 0.50cal capability, originally not planned to be installed

until 2005, commenced deliveries in 2001 and is now capable of 2 million cartridges per annum single shift. The benefits of acquiring used equipment have also been applied to the 0.50cal line where plant from a closed Italian factory has been purchased and installed.

The commercial pricing pressure on ADI also resulted in certain supplies and / or components being obtained outside the company.

For example, no foundry or rolling mill was built at Benalla and brass stocks are consequently sourced from overseas as no Australian manufacturer is prepared to make the necessary investment. Primers are imported complete as the cost of metal parts would exceed the total cost of the item. However facilities are available for manufacture of primers, including their explosive constituents, at Benalla.

Sale of ADI

By the year 1998, ADI had been restructured to the point where the owner (the Australian Government) believed ADI was an attractive proposition for purchase by private enterprise. This was consistent with the unstated "second phase"

of the plan commenced with the establishment of ADI in 1989. That is, shedding of Government involvement with Defence manufacturing as had occurred in the UK and other OECD countries. In June 1998 ‘expressions of interest’ for the purchase of ADI were invited. In November 1999 Transfield Holdings and Thomson CSF assumed ownership and full operational control of ADI Limited.

The changing world political scene in 2001 through 2003 (conflicts in East Timor, Afghanistan, Iraq) resulted in the Australian Defence Department foreshadowing requirements for in the order of 50 million cartridges per annum, more than twice Benalla's design capacity.

Equipment for 9mm production was not installed (plant had been brought from Footscray) by agreement with Defence who preferred the funds be directed to a larger medium calibre capability. Conversion equipment and rapid changeover is available for manufacture of 7.62mm Ball if required.

By 2003, ADI offered only 5.56 F1 Ball and F3 Blank, and 50 Cal F1 Ball ammunition with 50 Cal Blank in development.

History Repeats Itself

In 115 years Australia has come full circle with SAA capability. From having nothing before 1888, to limited assembly capability in the early CAC days, and reliance on imported content through to 1910 to self sufficiency by the end of WW1. This was followed by a phase of expansion of capability through the 1920's ,1930's and WW2. Then post war contraction, loss of direction as the Public Service system pervaded the government factories together with fragmentation as the factories were shunted through a range of Government Ministries. Then 'privatisation' stripped the factories of all but essential profit making capability. We are thus approaching the original CAC scenario of a privately owned organisation undertaking limited ammunition manufacturing and assembly activities, delivering against a long term Government contract.

The Government factories and establishments had been over the years, a training ground for thousands of personnel, giving apprentices, tradesmen , technicians and engineers the opportunity to experience a diverse range of manufacturing processes and technologies. Many of these personnel took their training and knowledge into local industry spreading the

benefits of the leading edge technology and quality systems that they had experienced in Government Factories such as Ammunition Factory Footscray. Sadly these opportunities will be severely diminished or unavailable to future Australians

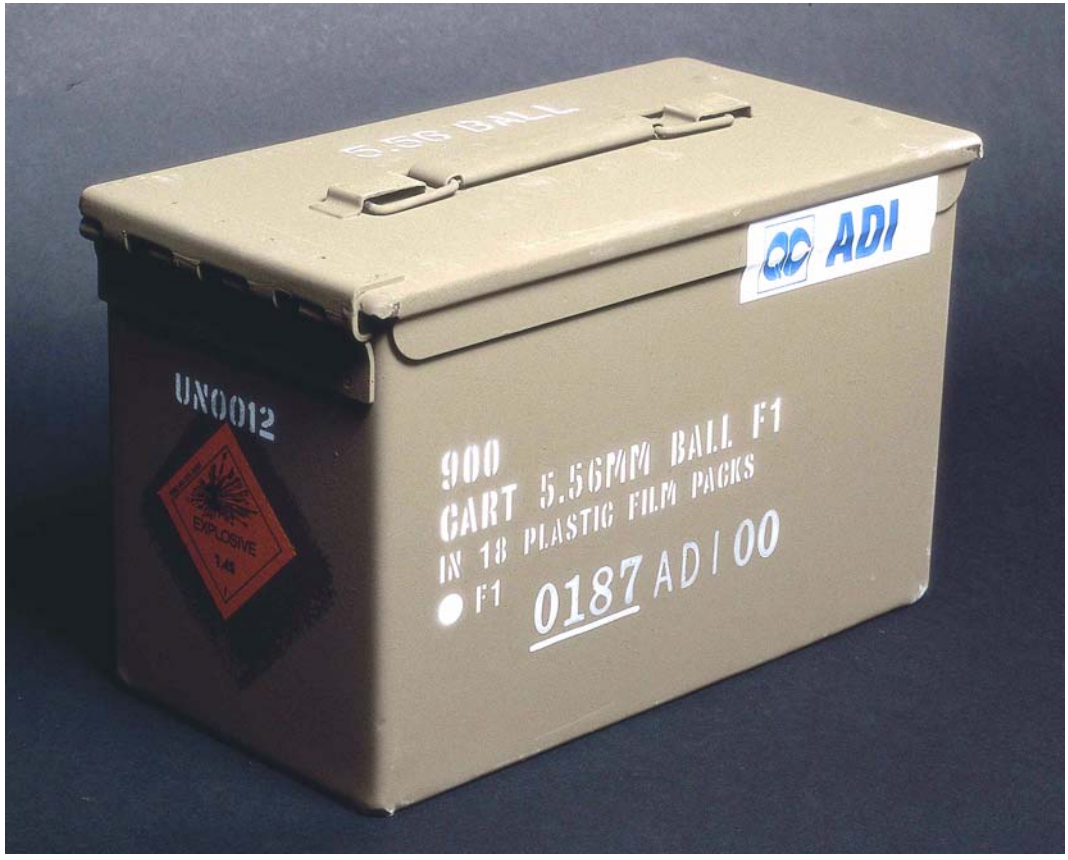

FIGURE 15. Current ADI production of 5.56mm F1 in 900 round package containing 'film packs' .

Chapter 10: *CAC Martini -Henry paper wrapped packets.*

Images of Martini Henry Packets

CAC's first production of Martini Henry ammunition for the Colony of Victoria in 1890 consisted of bundles of 10 rounds packed in a thick paper wrapper tied with string. In subsequent years CAC delivered to other Australian Colonies and in at least one instance to New Zealand. Some of these wrappers are shown in the following photographs.

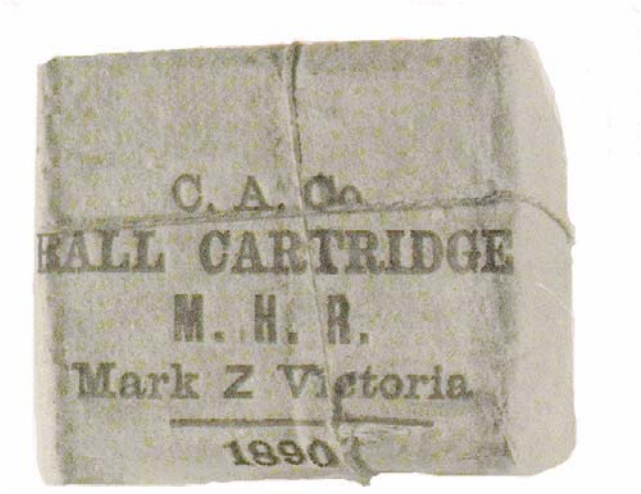

FIGURE 1. A 1890 Mark Z packet made for the Colony of Victoria.

FIGURE 2. A 1892 Mark A packet

FIGURE 3. **A 1894 Mark X packet.**

FIGURE 4. **A 1895 Mark X Packet.**

FIGURE 5. An Australian CAC 1985 Packet made for the Government of New Zealand

FIGURE 6. A 1896 Mark X packet.

FIGURE 7. A 1897 Packet of unspecified mark

FIGURE 8. A 1900 Packet of unspecified Mark.

FIGURE 9. A 1900 CAC 'repacked' packet of English Eley Brothers Mark III rounds.

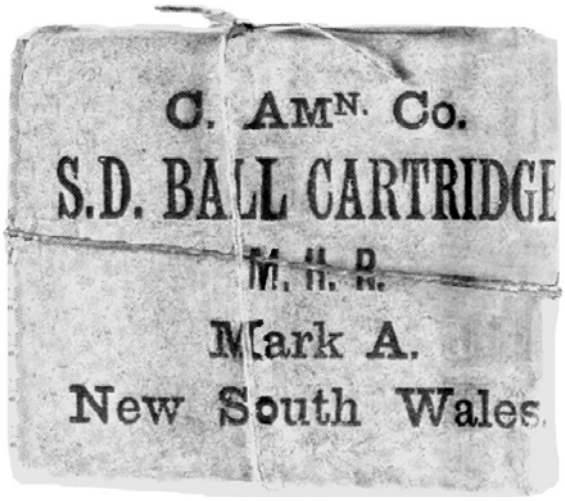

FIGURE 10. An Undated Mark A packet made for the New South Wales Colony.

FIGURE 11. An undated Packet of Mark A made for the Colony of South Australia.

Chapter 11: *CAC .303 Mk.VI packets.*

Images of CAC .303 Paper wrapped packets

CAC and Ammunition Factory Footscray, produced paper wrapped ‘bundles’ of .303 from initial production in 1900 through to the late 1930’s. This form of packaging was intended to provide a means of filling the ammunition pouches in vogue before and through the WW1 period but superseded by carton and charger loaded packaging by WW2. As can be seen from the following examples, waste was something to be avoided and re-use of out of date packaging was achieved by selective alteration of the ‘obsolete’ information by ‘over-printing’.

FIGURE 1. A string tied packet of CAC 1903 .303 Mark II production

FIGURE 2. CAC 1904 .303 Mk II wrapper converted from a 1903 wrapper.

FIGURE 3. A CAC 1904 .303 Mk VI wrapper converted from a MK II one.

FIGURE 4. A CAC 1906 Mk VI .303 Wrapper

FIGURE 5. A CAC 1908 .303 MK VI wrapper converted from a 1907 wrapper.

FIGURE 6. A CAC 1909 .303 MkVI wrapper.

FIGURE 7. A CAC 1912 .303 MK VI wrapper. Note the inclusion of 'cordite' into the symbol

FIGURE 8. A CAC 1915 .303 Mk VI paper wrapped packet

FIGURE 9. A CAC 1916 .303 MK VI paper wrapped packet

FIGURE 10. A CAC 1917 .303 MK VI paper wrapped packet.

FIGURE 11. An unusual wrapper in that the date is rubber stamped on to the wrapper rather than being pre printed. The contents are indeed 1-13 MK VI Australian rounds. This form of wrapper may have been used to 'repack' ammunition at some later date.

Chapter 12: .303 Mk.VII paper wrapped packets.

Images of .303 paper wrapped packets.

From 1918 to 1920, CAC produced paper wrapped 'bundles' of .303 Mk VII as well as the other forms of packaging. In 1921 with Commonwealth Government managing the site the identification of these wrappers began to change. As can be seen in the following graphics, the marking on wrappers changed from CAC to SAAF to MF then 'arrow F'. On full Government ownership the MF identifier was subsequently used.

FIGURE 1. A CAC 1920 Mk VII .303 Wrapper

FIGURE 2. CAC 1920 Mk VII wrapper overstamped 1921 SAAF

FIGURE 3. MF .303 Mk VII 1921 paper wrapped packet. Although the wrapper carried the MF identifier the cartridges were headstamped SAAF

FIGURE 4. A 1922 Mk.VII packet. Although the wrapper carried the MF identifier the cartridges were headstamped SAAF

FIGURE 5. A 1926 packet carrying the 'arrow F' marking.

Chapter 13: *CAC .303 Headstamps (1906-1926)*

Photographs of .303 Headstamps (1900-1926)

The following photographs give the actual headstamps of CAC-Ammunition Factory Footscray .303 production rounds from the Mk.II variants , the early Mk. VI undated type and the month dated Mk. VI from 5 06 (May 1906) and the Mark VII month dated rounds from 2 18 (Feb. 1918) until December 1926 . Specimens in collections would indicate almost all month - year combinations were made from May 1906 through to December 1926 with the possible exception of the first months of 1921 being the start of the Government Leasing period. The use of 'C' in the early Mark II rounds and Mark VI rounds up to November 1908 denotes 'cordite' propellant. The 'C' was dropped from headstamps in December

1908. The introduction of primer lacquering in August 1918 followed on the UK introduction a year or so earlier.

FIGURE 1. CAC Cartridge examples of early .303 Mk II and undated Mk VI (lower 2 rows) and month year dated examples from May 1906 to March 1909 (row 3 from bottom to top).

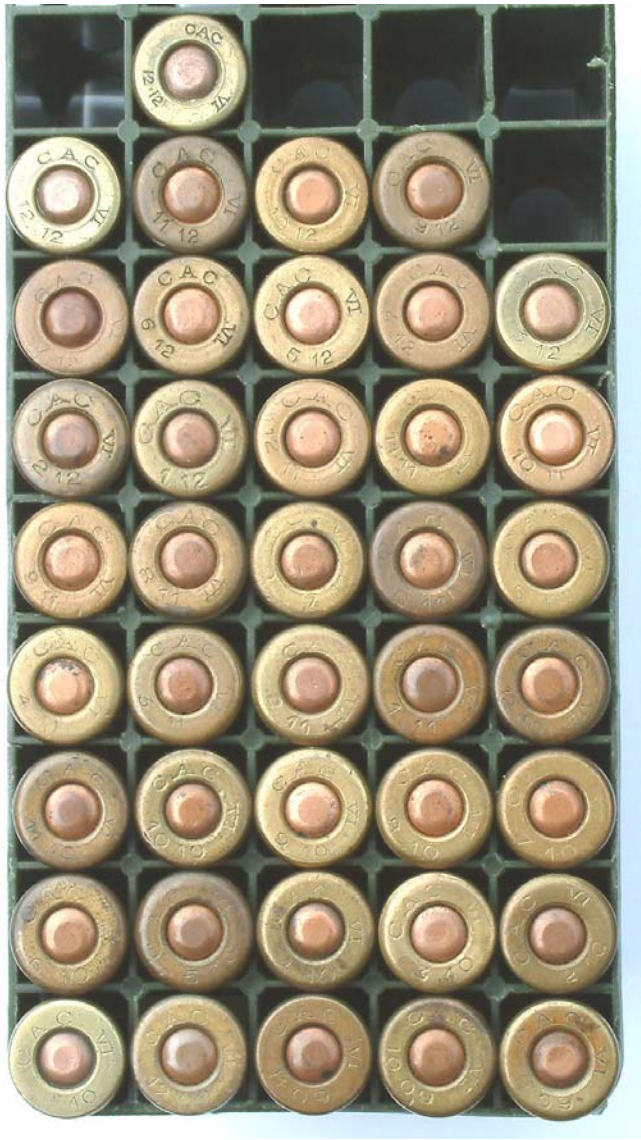

FIGURE 2. CAC .303 Mk VI month-year dated headstamps from Sept. 1909 to December 1912

FIGURE 3. CAC .303 MkVI month-year dated headstamps Jan. 1913 to December 1915

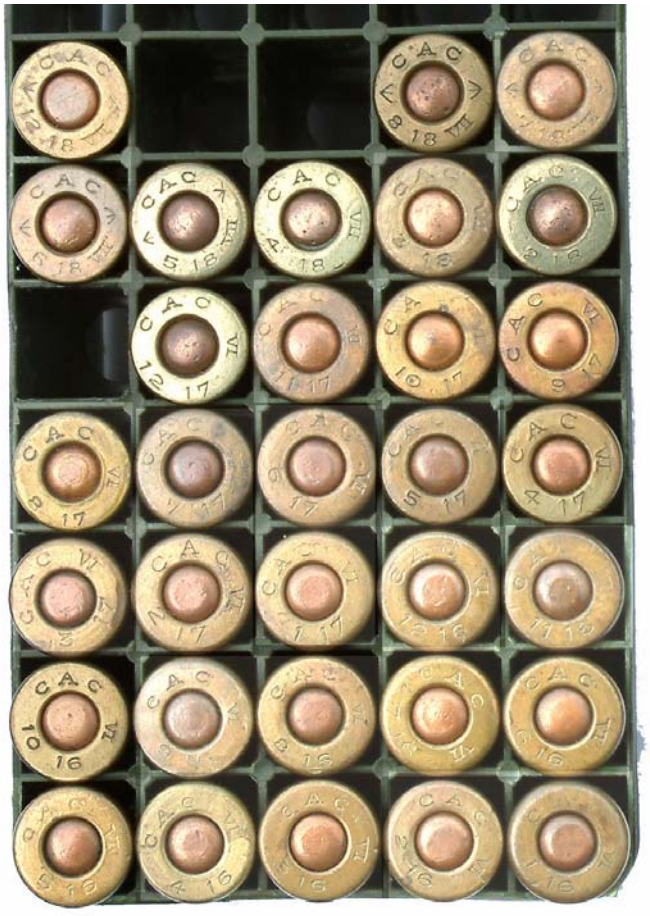

FIGURE 4. CAC Mk VI and Mk VII month dated headstamps Jan. 1916 to December 1918

The change from Mark VI to Mark VII on February 1918 and the introduction of the 'crows feet' or arrow-heads into the headstamp in May 1918 is also illustrated in figure 4.

FIGURE 5. CAC - SAAF .303 Mk VII headstamps Jan. 1919 to Dec. 1922.

FIGURE 6. SAAF - AF - F -MF transitional headstamps Jan. 1923 to December 1926.

Figures 5 and 6 show the transition from the CAC headstamps which ceased on December 1920. With the Government leasing arrangement taking effect from the first of January 1921 the headstamp was changed to SAAF. On January 1924 the headstamp was changed to AF although for some unknown reason both the SAAF and AF headstamp was used in March 1924. In March 1925 the headstamp was again changed to ‘F’ then in May 1926 to ‘MF’. This format was to remain until 1936 as can be seen in the next chapter.

Chapter 14: *Footscray .303 Headstamps 1927 -1962*

Photographs of .303 'MF' Headstamps (1927-1962)

As can be seen in previous Chapter, the MF headstamp was introduced in May 1926. It continued on in this format until August 1937 after which month-year dating was abandoned in favour of year dating only. As mentioned elsewhere, the WW2 years saw the introduction of additional plants and new headstamps MG,MH,MJ,MQ and MW. These will be dealt with elsewhere however it should be noted that for a short time in 1940 the MF plant commenced using MF1 to distinguish itself from the No2 plant which had launched production with MF2. These arrangement were cancelled and MF

was restored to the No1 plant and MG to the No2 plant. The No1 plant was closed in 1945 so no further MF headstamps were used until 1949 when the wartime time No2 plant which by this time was the only operating plant, adopted the MF identifier and discarded the MG one. The following figures give examples of .303 cartridge headstamps from 1927 to the last production in 1962. Note that in figure 3 the change from month-year format to year only format is shown at 8-36 i.e. August 1936. Also note that no MF rounds were made in 1946 to 1948 inclusive as production was being carried out at the No2 SAA plant which was still using the ‘MG’ identifier.

FIGURE 1. MF .303 Headstamps from Jan. 1927 through to December 1930

FIGURE 2. **MF headstamps for the period January 1931 - December 1934**

FIGURE 3. MF .303 headstamps for the period January 1935 to 1962

Chapter 15: *Air Service Ammunition*

CAC starts work on Airservice Ammunition

Shortly after the Commonwealth had acquired control of CAC via it's leasing arrangement, work commenced on a range of 'new' deliverables required by the Defence Department. One of these requirements was to produce ammunition for aircraft mounted machine guns[1]. By 1926 quantities of Airservice ammunition were submitted for acceptance to the Inspection Group. In a report to the Munitions Supply Board for the year ending June 1926, The Inspection Group reported 'ammunition manufactured at the Small Arms Ammunition Factory was submitted for inspection and proof ... included in this was

1. Reference 3 July 1922-June 1923 Annual Report page 28

a special class of ammunition for the Air Force, manufactured for the first time in Australia.'[2] Packets of Airservice Ammunition made by Footscray in 1926 contain cartridges with normal headstamps. Special headstamping was adopted in 1928 and samples are given later.

WW1 aircraft and those of the 20's and early 30's normally had the guns mounted on the fuselage in front of or near the pilot for ease of aiming and for the clearance of jams or other malfunctions. This almost always resulted in the line of fire passing through the propeller arc and this required linking the permissible firing opportunities to periods when the blade was 'out of the way'. This was achieved through connection of the gun firing mechanism to the propeller shaft but also required use of ammunition of standard and uniform firing characteristics. Delayed ignition, hangfires etc. could result in projectiles striking the propeller with damaging results.

2. Reference 3 1925-1926 Annual Report Page 7,

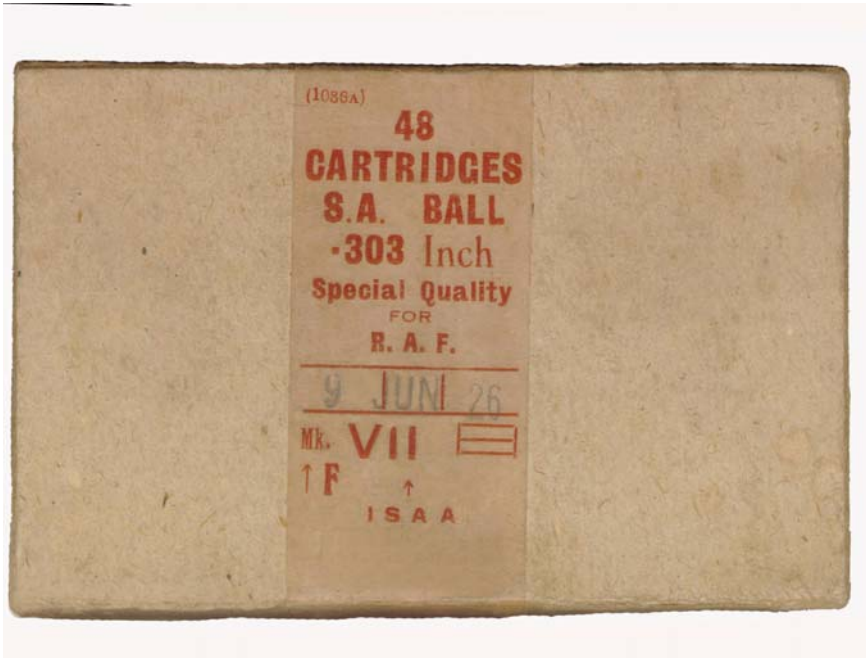

FIGURE 1. A Packet of June 1926 Footscray made 'Red Label' .303 Ball ammunition illustrating the 'Red Printing" and the 'Special Quality for R.A.F' statement.

Air Service Ammunition Testing.

The Footscray Factory adopted testing methods as described in the following passage taken from the British Text Book of Small Arms 1929 pages 259-261.

"Although it is not correct to say that the ammunition referred to under this heading is specially designed, all types of ser-

vice ammunition which are used by the Royal Air Force in controlled guns are made in two grades, and in the case of the Air Force or " Red label " ammunition, as this grade is called from its characteristic label, particular attention is paid to immunity, from hangfires, misfires and functioning defects in machine guns.

The term " controlled gun " refers to a machine gun mounted in an aeroplane, and arranged to fire between the blades of the propeller along the axis of the aeroplane only. Should a bullet hit a propeller the result would be most serious, and the gun is controlled. therefore, so that it can only fire when the propeller blades are not passing the muzzle. The controlling mechanism is hydraulic, and actuates the trigger of the gun by mean of impulses or energy waves, generated by a cam connected with the propeller shaft, and transmitted to the gun through a liquid contained in a tube. After the impulse is imparted to the liquid, a certain time elapses before the bullet passes the propeller, during this time the propeller blades rotate to an extent depending on the rate of revolution. At best the time lag cannot be reduced much below twelve-thousandths of a second, and a propeller revolving at 800 revolutions per minute would during this period rotate about 57°,

whilst at 1,600 revolutions per minute the rotation would be about 115° and so on.

The necessity for immunity from functioning defects in a machine gun is fairly obvious, as it will be realised that stoppages during an aerial engagement would be very serious, and owing to the inaccessibility of a machine gun in an aeroplane whilst in flight, any failure such as a separation might put the gun out of action until a landing could be effected .

The Test Method

Red label ammunition is accordingly most carefully inspected, and any which is not of really first-class quality is ruthlessly rejected. During proof the ammunition is required to pass a special test to verify that it is immune from hangfires. This test approximates very closely to the actual conditions obtaining in an aeroplane. A Vickers gun is used, controlled by an actual timing gear, actuated from a shaft driven by an electric motor. On the shaft in place of a propeller is mounted a steel disc on which are arranged two cardboard targets diametrically opposite to each other. The disc is rotated at a constant speed of 1,200 revolutions per minute,

and the posit ion and grouping of the shots is recorded on the targets. The gun is mounted so that the bullets pass at a radial distance of 14 inches from the centre of the disc, and it is required that all shots but one should be within an arc of 4 inches in length, and all shots within an arc of 6 inches. A 6-inch arc at this speed is equivalent to a variation in time lag of about three and a half-thousandths of a second, but in practice all shots but one are usually much closer than this. Special provision is made for one shot to be slightly later than the remainder, because the action of the timing gear is such that the first shot of any series is sometimes 2 or 3 inches behind the others and this abnormality is not the fault of the ammunition.

Actually all ammunition of the types in question manufactured under peace time conditions is up to Red Label standard of quality and there is no real difference in quality between the two grades when the ammunition is new. Owing to the fact however.that immunity from hangfires is largely dependent on caps and that any deterioration in the caps might make such ammunition unsuitable for else in controlled guns, a proof of each batch of Red label ammunition is taken annually and tested for hangfires. whereas this is not the case for ground service ammunition.

Any batch of Red Label ammunition which fails at this annual hang fire test is relegated to ground service.

For purposes of identification the bases of cartridges made for the Royal Air Force for use in controlled guns are stamped with all four figures of the date thus, “ 1918" whereas ammunition for ground service is stamped with the last two figures only thus “ 18." Ammunition containing all four figures of the date will, however, be found among ordinary stocks, as batches made for the Royal Air Force but rejected for that service are from time to time accepted for ordinary stocks, provided their quality is suitable.

Red Label ammunition is packed in 48-round cartons, which are enclosed in a. tin-lined wooden box. Two types of box are in use, one containing 26 cartons and thus holding 1,248 rounds, and the other containing two tin linings. each holding 8 cartons. or a, total of 768 rounds per box. Ammunition for use in controlled guns is labeled with a special red label, characteristic to ammunition up to Red Label standard, and all labels on the box and linings, and the wrappers closing each carton, contain the inscription “ Special for R.A.F.,” all labels except the distinguishing labels being printed in red. “

Changes to Air Service Ammunition.

In September 1931, The Secretary of Defence (Air Board) in Melbourne, was forwarded information on work being done in England to investigate the problems which has arisen with erosion damage to aircraft propellers caused by the glaze-board (a type of dense cardboard) wad over the cordite charge in .303 ammunition. This information detailed the testing of specially prepared batches of ammunition with a range of different over cordite wads including strawboard, cotton cloth and omission of the wad altogether. Strawboard was rated satisfactory from these tests and a batch was submitted to service trials with favorable results . The 'Committee of Small Arms' then recommended that 30,000 rounds be prepared with strawboard wads and fired against service ammunition. The Secretary Department of Defence on forwarded this information to the Secretary Munitions Supply Board. England adopted the strawboard wad for airservice ammunition as a result of the trials and Australia followed shortly thereafter.

Disintegrating Link Belts for Airservice Machine Guns.

In the early 1930's Small Arms Factory was tasked with the manufacture of the Air Service pattern .303 Vickers machine gun in left and right hand feed configuration. The Ordnance Factory Maribyrnong was given the task of producing the links.

FIGURE 2. An example of Vickers link belt showing Mk III links which were made at OFM.

FIGURE 3. **A small length of .303 Browning Link Belt.**

WW2 saw the Vickers aircraft mounted guns replaced by Browning designs. The link belts for these guns are a shown above. These links were also made at Ordnance Factory Maribyrnong for supply to SAA factories.

Green 'Red Label' Ammunition

FIGURE 4. An armour piercing packet dated 25 October 1938 , has no 'red label' despite being designated "Special for RAF" but instead carries the AP colour green. The cartridges are headstamped MF 1938 W1 as per airservice requirements.

Standardisation of all Ammunition to AS requirements.

In 1940 when all ammunition was standardised to air service requirements, a common over cordite wad and headstamp comprising the 4 digits of the year of manufacture was used.

This was changed again in 1944 when all headstamping reverted to the last two digits of the year of manufacture.

FIGURE 5. A 1928 Footscray made Airservice ball round.

In 1940 it was decided that all 303 ammunition should be standardized to air service requirements consequently straw-board wads were then universally used.

FIGURE 6. Headstamps of Footscray made Air Service .303 ammunition from 1930 -1939. Note variations in layout and format in the 1930 and 1937 specimens

Chapter 16: .303 Incendiary Ammunition

Interest in Incendiary Manufacture.

The first documented interest in incendiary ammunition manufacture is found in the Munition Supply Board Annual Report for the year ending June 1923 where in it notes that the Munitions Research Laboratories carried out an investigation into the manufacture of incendiary and armour piercing ammunition for its consideration.[1] By 1922 the English had settled on an incendiary design after numerous types were evaluated during WW1. A Mark IV 'Buckingham' design with a white phosphorus filling and with a distinctive stepped bullet had been adopted circa 1920 and was to remain in service

1. Reference 3 1922-1923 Annual Report page 11.

until the beginning of WW2. The MSB apparently decided against incendiary manufacture possibly due to the rather complex and costly projectile and the limited perceived requirement.

A dedicated WW2 incendiary factory

A requirement for local production of .303 incendiary ammunition for airservice use, was identified early after the outbreak of WW2. At this time the British were still manufacturing the 'obsolescent' Mark 4 white phosphorous incendiary but were experimenting with other improved designs. A mark 5 design had been discarded in the late 30's and work was proceeding on a mark 6 projectile. This variant used an incendiary mixture ignited by the force of impact rather than the 'flammable in air' white phosphorus material. The Mark 6 bullet was closed at the base with a screwed plug which under some situations would separate on firing causing damage to the aircraft firing it. A modified Mark 6 design with a pressed base plug and disk and other minor changes became the Mark 7 design to be ultimately manufactured in Australia. The Mark 7 incendiary projectile arrangement is shown below.

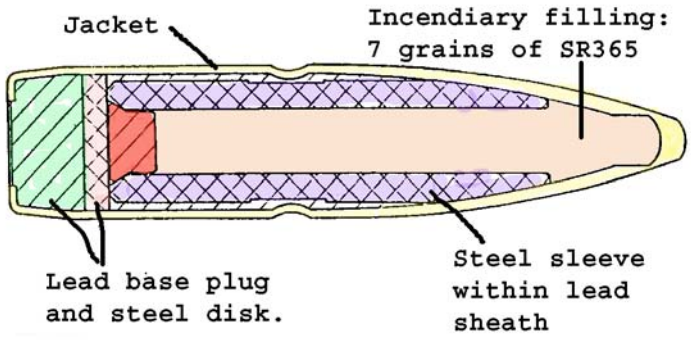

FIGURE 1. .303 Mark VII Incendiary projectile construction details

The Munitions Supply Board had schemes prepared for a new incendiary plant to be built alongside the Hendon plant in South Australia. This plant was sometimes referred to as the “Incendiary Annex”.

Two schemes were drawn up on Drawings X31856 dated 9-9-40 and Y31891 dated 10-9-40 which differed mainly in the 'standoff distance' of the incendiary facility from the Hendon plants. In October 1940 the Munition Supply Board, reported that the plant for .303 incendiary cartridges, to have a capacity of 8 million rounds per year, was at the planning stage.

Incendiary deliveries

In the “Australian Munitions programme - December 1940" , .303 incendiary ammunition was shown as having 3 million rounds on order but zero produced as at that date. The plan for 1941 showed production expected to commence in March 1941. A similar Report issued in September 1941 still showed nil produced to date but with production expected to come on line by December 1941 and reaching an annual rate of only 1.5 million by July 42. The report to the Munitions Board in August 41 stated that the Incendiary Buildings were nearing completion with plant soon to be installed.

The relationship of the plant to the Hendon No3 and No4 plants is shown on the Hendon site plan given in Chapter 6. It can be seen that the incendiary facility is adjacent to the No4 plant (MJ) and has only buildings designated to perform 'filling' and loading operations on the incendiary components. The metal components were made at the nearby Hendon case and bullet shops. The Munition Board Reports do not elaborate on the apparent delays to their plans. It would appear however that the delays in delivery resulted in the No1 and No2 SAA plants at Footscray being tasked with

assisting with the incendiary programme by commencing manufacture of the B Mark VII in parallel with Hendon.

FIGURE 2. An English Mark IV stepped projectile incendiary shown below a blue tipped Hendon Mk VII incendiary round.

Some 1942 dated Hendon cartridges were headstamped as Mark 4 incendiary i.e. “MJB 1942 BIV “but loaded with Mk7 ball projectiles suggesting perhaps a last minute change away from the aging design of the BMk.IV white phosphorus filled projectile to the latest BMk.VII projectile. Some 1942 ball cases headstamped MJ1942 VII may also be found as incendiary loads. Production of BMkVII incendiary rounds commenced in 1942 and continued until 1945. It is interesting to note that the early BIV cases mentioned above were head-stamped “MJB” as the Factory identifier but this was dropped in favour of “MJ” on the BVII rounds although 48 round

cardboard packets continued to carry a paper label with "MJB" as the factory Identifier.

FIGURE 3. A 48 round packet of Hendon made incendiary .303 Mk BVII of 12/2/1944. Note use of MJB identifier on packet label.

Test Firing of Incendiary Ammunition

The overall site plan for Hendon shows the incendiary test firing range along the southern boundary. A similar incendiary test range may be found only on the No1/No2 Factories site layout at Footscray. The design drawing numbers for the Footscray Incendiary "Target" and "Observation Hut" were Y52205 and Y52207 respectively and dated October 1942 .

Acceptance firing of incendiary ammunition consisted of an accuracy test (70% to fall within a 5 ft. circle at 500 yards) and an observation of the incendiary effect. The incendiary effect was watched from a special observation 'hut' placed adjacent to the incendiary target and stop butt. (Building numbers 190 & 191 on Footscray layout Drawing W-89504 and item 80 on the Hendon layout in Chapter 6)

In December 1942 testing at Footscray ran into problems with bullets breaking up on firing. The fault was determined to be problems with irregular depth of seating of the steel sleeve within the jacket, sometimes weakening the jacket to allow it to breakup under the stress of firing. As a result, changes were made in both Australia and England to delete the lead sheath around the steel sleeve and to thicken the steel sleeve and modify it's nose angle.

Footscray exits the incendiary programme

Records viewed at Footscray indicate that unfilled BVII projectiles were being made there from early 1942 at a rate of about 100,000 per week and on forwarded to Explosives Factory Maribyrnong for filling and return for loading into cases. Correspondence dated 1/6/1942 advised that 961,787

Footscray projectiles were shipped to Hendon. Later correspondence dated 3/6/1943 from EFM indicated that 4,492,252 projectiles had been filled to that date and returned to AFF with 281,571 having gone to SAA No1 (MF) and the balance to SAA No2 (MG). In September 1943, correspondence from Footscray to Hendon indicated Footscray had ceased production on the incendiary programme and offered Hendon the surplus stock of 675,000 projectiles, 336,000 envelopes and 181,000 cups. The offer was accepted and these were subsequently forwarded to Hendon. Incendiary Production at Hendon ceased in 1945.

Incendiary Headstamps

Examples of typical Footscray and Hendon headstamps are shown below

FIGURE 4. An early No1 plant (MF) incendiary round. A similar format MG 1942 and MH 1942 incendiary rounds are reported

FIGURE 5. An example of MJB 1942 BIV headstamped case usually found as Mk 7 ball loads.

FIGURE 6. An example of MJ 1942 BVII incendiary round headstamp. These rounds carried blue tip markings and blue primer lacquer

FIGURE 7. Example Headstamps for 1944 and 1945 Hendon incendiary production.

FIGURE 8. Examples of the No2 Plant (MG) incendiary headstamps.

Chapter 17: *Armour piercing .303 Ammunition*

MSB considers manufacture of AP ammunition.

The first documented interest in armour piercing .303 ammunition manufacture is found in the Munition Supply Board Annual Report for the year ending June 1923 where the report notes that the Munitions Research Laboratories carried out an investigation into the manufacture of incendiary and armour piercing ammunition for its consideration.[1]

1. Reference 3 1922-1923 Annual Report page 11

The first deliveries of locally made .303 AP occurred in the 1933-1935 MSB reporting period.[2]

WW2 production of .303 A.P. ammunition was carried out at the SAA No1 plant and at Hendon No 3 plant.

In the December 1940 MSB report on ammunition, the total forecast for .303 AP was only 7,250,000 with the current production running at only 1,000,000 for the whole of 1940. By September 1941 the forecast had lifted to 17 million with actual production running at only 106,000 per month. A side note on the report said " Increased production being arranged'.

Actual final production figures are unknown but data viewed at Footscray indicated the pacing factor at that plant was the production of the hardened steel cores. A Footscray report dated June 1941 indicated that their production was running at 300,000 cores per month with a target of 2 million per month to be reached by March 1942.

As mentioned previously, by July 1942 the Minister of Munitions was looking at cutting back on SAA production generally . In correspondence to the Prime Minister John Curtain

2. Reference 2 1933-1935 Annual Report page 10.

on July 6th 1942 the Minister states " ...a demand from the Eastern Group amounting to 120,000,000 rounds .303 Armour Piercing Ammunition which may not be required now if the example of the Australian Forces is to be followed." Footscray discontinued .303 AP production in early 1943 with Hendon (MH) also ceasing production in that year.

FIGURE 1. Headstamp markngs of Footscray made .303 AP showing examples 1935-1943

FIGURE 2. An example of Hendon 1943 .303AP production headstamp.

Chapter 18: *Tracer Ammunition.*

Experimental Manufacture

Australian production of tracer ammunition was initiated by the Munitions Supply Board in the 1922-23 financial year.

The Munitions Research Laboratories reported in the 1922-23 period that it was carrying out the 'experimental manufacture of .303 tracing ammunition and the mixing of tracer composition.'[1] The Inspection Group reported for the same period that it was 'testing tracer mixtures for aircraft ammunition'.[2]

1. Reference 3 1922-1923 Annual Report page 8.
2. Reference 3 1922-1923 Annual Report page 13

In 1923 -24 the Laboratories reported 'further experiments on tracing compositions and methods of mixing'[3] The Inspection Group reported 'test firing of experimental tracer ammunition'[4]. In 1924-25 the Ammunition Factory reported 'further experimental work on tracer ammunition'[5]and the Laboratories made reference to a special report on the 'Manufacture of Tracer Ammunition' prepared for the Munition Supply Board[6]. The Factory reported in the Confidential Annexure to the Annual Report of the MSB for the year ended 1926, that "tracer ammunition has been produced in very small quantities and results are satisfactory as far as can be judged by small scale experiments".

It should be noted that the British had gone through a range of developments of .303 tracer ammunition in WW1 and a design originally known as "Cartridge, Tracer, S.P.G. .303 Cordite Mark VIIG." introduced in 1917 continued into the 1920's. The British continued to mark this tracer round as 'VIIG' until 1928 after which they used the 'G1' identifier. It is

3. Reference 3 1923-1924 Annual Report Page 6.
4. Reference 3 1923-1924 Annual Report Page 9
5. Reference 3 1924-1925 Annual Report Page 10.
6. Reference 3 1924-1925 Annual Report Page 6

not known how the early Australian Tracer rounds were identified but 1931 samples were marked 'MF 1931 G1'.

FIGURE 1. Examples of Footscray and Hendon Tracer Headstamps showing early 30's examples and the change from GI to GII marks in 1941.

The Footscray factory continued to make the G1 tracer until 1941 during which a newer design, the GII, was introduced. The GII had been introduced in Britain in 1939.

As at September 1941 , total production of .303 tracer was running at only 150,000 per month, but was planned to lift to 1,000,000 rounds per month by January 1942 and hold at that rate until mid 1943. There was a total forecast requirement of 46 million rounds as at September 1941 a considerable increase on the total forecast of 12 million as at December 1940

Footscray ceased production of .303 tracer in 1943.

Production of the GII type was also carried out at Hendon in 1943 and continued until site closure in 1945.

FIGURE 2. A Mark GIIZ tracer marked 'MS" loaded at the Explosives and filling factory at Salisbury.

A 'special' batch of tracer ammunition with nitrocellulose propellant in lieu of cordite was made in South Australia in 1944. This was an unusual batch as it carried the Salisbury Explosives Factory identifier "MS" These rounds were heads-

tamped ‘MS 44 GII Z’. It is understood that some 4 million rounds were produced. The metal components such as projectile envelope and cartridge case were made at Hendon but the filling and loading was carried out at Salisbury. Salisbury had dedicated buildings for .303 tracer activities. Drawing Y55002 dated 20 Jan. 1943, shows details of the '.303 case store and lacquering house (Building 51 in the Pyro section) ', while drawing Y62650 dated 15 November 1943 shows details of plant layout for 'Varnishing and Waterproofing of Cart. S.A., Tracer, .303 G MK II /L' in the Pyro Section. Advice from a former Quality Assurance Officer stationed at Hendon indicated that during acceptance testing of this ammunition, problems arose with premature consumption of the tracing compound with excessive muzzle flash. After retesting and various investigations it was decided that the entire batch be sentenced unserviceable and be destroyed.

The Hendon 1945 output was the last tracer produced within the defence factories until the Footscray factory undertook manufacture of 7.62 tracer in the 1960’s.

The F3 Tracer

The Australian Defence Forces required a long range 7.62 tracer (1000yards plus) that was unfortunately not 'off the shelf'. In an attempt to achieve the requirement, a study was initiated to review the available overseas tracer projectiles and their performance. In 1961-1962 numerous trials were fired with these projectiles loaded into Footscray cases with various propellant charges. The end result of all of these trials lead to the adoption of a long 'blunt ogive' tracer bullet not dissimilar to the British .303 Mk. 8 tracer.

FIGURE 3. The Footscray made F3 tracer with blunt ogive shown against similar shaped .303 English G8 tracer .

The Mark 8 .303 tracer was a dark ignition type with trace from 110 yards +/- 40 yards to 1000 yards. The Footscray developed 7.62 tracer was designated as F3 . The 1967 pro-

duction of this round carried a red primer annulus and red bullet tip and the headstamp “MF 67 7.62” . From 1968 the cartridges were headstamped with the F3 designation i.e. “ MF 68 7.62 F3 “. The bullet form chosen engaged into the rifling of a standard barrel on chambering, resulting in the need to increase the lead on the barrels of the weapons intended to use this ammunition to avoid excessive chamber pressure. Unfortunately the 7.62 machine guns furnished with the German Leopard tank program were made for the more conventional bullet profiles and excessive chamber pressure problems were experienced in firing the F3 tracer from these weapons.

The logistics of trying to control the barrel lead on local and overseas supplied barrels and the difficulty in achieving the tracing range required, ultimately lead to the abandonment of the F3 tracer with last production taking place in 1972. Through this period Footscray was assembling mixed ball - tracer link belted ammunition for the M60 machine gun and much imported USA M62 tracer ammunition from Remington Arms Company was used in lieu of the F3 round

Chapter 19: *Blank Ammunition*

From the beginning of production at the CAC site in Footscray in 1890, blank ammunition has been made for the military. As noted in Chapter 1, the Colony of Victoria alone had at that time a requirement for 300,000 rounds of blank Martini Henry ammunition annually.

.303 blank ammunition.

With the introduction of .303 ammunition in 1900 , blank loadings were supplied. These blanks were made to the then current Mark V pattern which had 20 grains of sliced cordite size 20/SC with a strawboard wad pressed over the charge and

the mouth of the case closed with a ‘rosette’ crimp. Early CAC .303 blanks were loaded into unheadstamped cases or diverted ball cases. Production figures for 1913-1926 blank loadings are given in table 1 of Chapter 4

FIGURE 1. A 1934 paper wrapped bundle of 10 MkV blank cartridges made at Footscray.

The first correctly identified .303 blanks were supplied in 1933 and were headstamped MF 33 LV. (L being the Code for Blank). .303 Blanks continued to be manufactured through to the end of WW2 with the wartime factories at Hendon and

Welshpool also making them from diverted ball cases and from cases specifically marked with the blank code. Footscray also made wood bulleted .303 blanks for use in Bren and Vickers machine guns which did not handle the shorter non-bulleted type satisfactorily. Examples of wood bulleted blanks loaded into ball cases dated 1944 and 1945 are believed to be Mark 7 blanks. Mark 7 blanks had wooden bullets with a hollow core containing oxidized copper dust sealed with a glued on paper disc. The bullet had a weight of 80 grains.The cartridges were loaded with 39 grains of cordite WT size 5/2 chopped into 0.045 inch lengths.

FIGURE 2. From left to right : Early CAC .303 blanks with short and long mouth crimp in unheadstamped cases, a 1944 Footscray wood bulleted blank, the last of the Mark 5 blanks of 1956 and the Mark 9 type 1957-1960.

FIGURE 3. A packet of Footscray made L Mk. 9Z blanks made in 1960.

FIGURE 4. Correctly identified L Mark V Blanks made at the WW2 factories Welshpool (MW) and Hendon (MH & MJ) . Many blanks were also made from redirected ball cases

FIGURE 5. A Murray Switch case : Primed ball cases were prepared with specially slit necks to be used in the Switch Combination Aust. Mark 1

While strictly not an item of small arms ammunition, mention should be made of a cartridge based on the .303 cartridge case and commonly called the Murray Switch cartridge. This was used as a triggering cartridge for a mechanism used in trip wires and the like. It consisted of a primed case with a T shaped slit cut into the neck as shown in figure 5. These were supplied by a number of the wartime factories. Cartridges made in 1942 were wrapped in bundles of 10 and the printed wrapper carried the words '10 Cartridges .303 inch Capped Cases for Switch Booby Trap Combination (Murray) Mark 1 Aust.' In 1945 the wrappers carried the words '10 Cartridges .303 inch Capped Cases for Switch Combination Aust Mark 1'. This device was used only by Australian troops.

Footscray stopped manufacture of .303 blanks at the end of WW2 but restarted Mark 5 production again in 1956 as a

Mark 5Z with nitrocellulose propellant in place of cordite. In 1957 the production was changed to the similar looking Mark 9Z type. The Mark 9Z blank used 14 grains of Ballistite as the charge but was otherwise identical to the Mark 5Z. Production of the Mark 9Z type continued until 1960

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FIGURE 6. This figure shows the headstamps of Footscray made L mark V blanks 1933 - 1956 and L mark 9 types made from 1957 to 1960.

FIGURE 7. A WW2 Packet of 50 L Mk V Blanks made at Welshpool W.A. in 1944

7.62 Plastic Blank cartridges

A German designed full length 'plastic' blank with metal head insert was put into 'licensed' production in 1961 designated L1A1. The cartridge had a brass head insert fitted into a black plastic body. The profile of the blank included the projectile form which had two grooves at right angles across the tip to rupture on firing. The plastic bodies were imported through an agent and the propellant was also imported.

The head insert was changed to aluminium in 1963 and the designation changed to L1A2. In 1964 the head was redesigned in brass with a deep extractor groove and given a Footscray Pattern number of F1. In 1966 the extractor groove was changed again and the pattern designated as F1A1. Part way through 1968 the head material was changed back to aluminium with no change in designation. Production continued in this form until 1982 when the designation was changed to F6. This blank had a poor service record with some weapons damaged due to the variability in the propellant and plastic bodies allowing blockage of the blank firing attachment with plastic fragments and unburned propellant . This in some cases lead to uncontrolled overpressure of the weapon and subsequent damage. The M60 machine guns were commonly damaged in this way.

FIGURE 8. The evolution of the plastic blanks at Footscray with the 1961 L1A1 at left through to the F6 at right illustrating the changes to base material and form.

Full length Brass 7.62 blank

The need arose for a full length brass blank and a new cartridge similar to the English L10A2 full length brass blank, was produced in the mid 80's and given the F8 designation.

Production of the F6 blank continued in parallel for some time.

FIGURE 9. Full length brass blanks : top Footscray F8 , bottom English L10A2

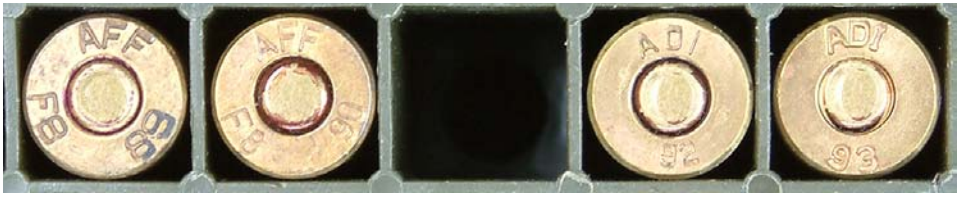

FIGURE 10. Some typical headstamps of the F8 blank (1989,1990, 1992 and 1993) showing the AFF transition to ADI and the dropping of the F8 identifier from the headstamp in the early 90's.

Chapter 20: *.303 Cartridges for propelling grenades and other devices.*

Photographs of .303 Grenade Launching Cartridges

The Munitions Supply Board reported in their Annual Report for the period ending June 1926, that “at the present time experimental manufacture of cartridges, S.A. .303 rifle grenades, 30 grains ballistite, is being carried out”. It was also reported at that time that the Inspection Group were conducting experimental firings of rifle grenade cartridges. Figure 1 top specimen shows a 1926 rifle grenade discharging cartridge. The Mark 1 cartridge had its origin in WW1 where it was, from late 1917, used to project grenades from a discharger cup mounted to the muzzle of the SMLE rifle.

Production of the Mark 1 in Australia, (designated from 1929 onward as H1Z, H being the code for rifle grenade cartridges and Z denoting nitrocellulose propellant) continued through to the end of WW2. The manufacture of the H1Z cartridges was transferred from the No1 to No2 Factory in 1943. Some examples are given in figures 2 and 3. Grenade cartridges were typically packed 14 to a small steel tin which carried a label or labels as shown in Figure 4. .

FIGURE 1. Rifle Grenade and other discharger cartridges: from top : 1926 rifle grenade Mk 1, 1935 rifle grenade Mk 1, 1941 unknown type , and 1940 Smoke discharger cartridge E1T.

FIGURE 2. Some typical H1Z Rifle Grenade Cartridges made by the No1 Factory showing 1937, 1940 and 1941 specimens.

In 1945 a requirement arose for Rifle Grenade cartridges Mark 4 . These were used to fire the No85 Anti-tank rifle grenade from a spigot attached to the muzzle of the SMLE rifle. Initial quantities of this cartridge were reported to be made with a wadded open mouth case.[1] Problems were experienced with the subsequent batch and after advice from England , the propellant was changed from chopped rod

1. Reference 4 Journal No.82 page 12

cordite WM.017-.019, to tubular cordite MDT 5-2 and the case mouth was rosette crimped. To distinguish this cartridge from the other types of discharger cartridges, it had the top and bottom third of its case stained black, the mouth closed by a rosette crimp and a red sealing applied to the crimp. It is shown in Figure 5 . It is also reported that the last batch of these cartridges carried the marking ‘HIV (Aust) ‘ in place of HIV.

The Central Drawing Office produced packaging stencilling drawings for this ammunition in August 1945. Drawing Y-73291 approved on 1/10/1945 indicated the Mk 4 Cartridge was to be used with rifle grenades M9A1, M19, T5, M17A1 and M22 fired from the No.1 or No.4 rifles only.

FIGURE 3. No2 Factory (MG) Grenade cartridges H1Z made in the period 1943-1945

In 1949 a limited production of the H Mark 2 cartridge was undertaken. Although carrying the 'H' code denoting rifle grenade cartridge, this round was in fact used as a line throwing cartridge by the Navy. It is shown in Figure 5.

When the Army introduced a new anti tank rifle grenade, the 'ENERGA' No.94, in the 50's, for use with .303 rifles, the propelling cartridges H Mark 7z were imported from Belgium and not made locally.

FIGURE 4. Tins of H1Z cartridges: Left a No1 Factory product of April 1940. Centre and right, product from the No2 Factory (MG) made in March and August 1945, but carrying on the top right corner of the label the MY code of the filling factory Explosives Factory Maribyrnong. The right tin also has a visual identification label with the Spades symbol being the visual symbol for H1Z cartridges

FIGURE 5. The last of the Australian made .303 grenade cartridges. Top an unheadstamped Mk IV drill from 1945 , the 1945 Mk IV round and the 1949 Mk 2 cartridge.

Chapter 21: *7.62mm Cartridges for propelling grenades.*

Photographs of 7.62mm grenade cartridges.

The Introduction of the FN Self loading Rifle generated a requirement for a new grenade launching cartridge. Initial specimens appeared in the late 50's using ball cases as shown in Figure 1. The early types were designated as L1A2 but this was changed to F2 in 1967 as shown in Figure 2. The cartridges were packed in sealed metal 'food style' tins as shown in Figure 3. Smaller quantities of cartridges were 'encapsulated' within sealed foil backed paper packs as shown in figure 4.

FIGURE 1. Grenade launching cartridges : From top un-blackened 1959 specimen using L2A2 ball case, then 1961, 1963,1964 and 1965 correctly identified L1A2 pattern with lower half of case dyed black.

FIGURE 2. Grenade cartridges : from top a 1967 L1A2 pattern, a 1967 F2 pattern then 1969 and 1971 F2 specimens and finally an unknown variant using un-blackened 1972 L2A2 ball cases. Note that the first 1967 F2 cartridges had the lower portion of the case blackened but this was changed to upper half blackened in later specimens

FIGURE 3. A tin of 15 Cartridges Grenade Rifle L1A2 of July 1963 manufacture. The 'key' attached to the top of tin was used to unwind the soldered seal on the lid to gain access to its contents. Note the similarity to preserved meat tins of the same period.

FIGURE 4. A paper/foil packet of 5 cartridges Grenade rifle L1A2 of 1965 manufacture.

Chapter 22: *Inert .303 Cartridges.*

Dummy and Drill Cartridges.

Over the years a range of inert cartridges have been made in Australia. These have included ‘dummies’, ‘drill’ and other inert cartridges for specific applications.

The items made were intended for ‘personnel weapons training’, ‘weapons inspection’, or ‘setting machines or evaluation of ammunition related items such as chargers, links or packaging’. The first of the inert rounds was made by CAC, production details of which are given in Chapter 4 table 1. These items were referred to as ‘Dummy’ cartridges[1] one of which is

1. Reference 3 Annual Report 1924 page 12.

shown in figure 1 below. Wooden round nosed (prior to 1918) or wooden pointed bullets (1918 and later) were secured to a service cartridge case which had cross holes drilled through it for easy identification purposes. These 'dummies' generally followed the British Dummy, Drill Mark III (round nose bullet) or Mark IV (pointed bullet) patterns.

FIGURE 1. .303 Drill Rounds : From top : A typical CAC era (1915) wooden bulleted Mark III drill, A 1924 Chromium plated Mk VI drill, A 1924 white metal Mk VI drill , A 1926 whitemetal Mk VI drill. a WW2 expedient drill Mk VIII and a 1940 whitemetal drill Mk VI

Such examples may be found with headstamped MkVI ball cases or with cases carrying no headstamp, or Mark VII cases for the pointed bullet variant. The item shown above is dated by it's small primer pocket, a characteristic of 1915 production. After leasing of the CAC plant to the Commonwealth, work started on the production of white-metal cartridges for the production of 'dummy' and 'drill' cartridges.[2] Figure 1 shows whitemetal Mark VI fluted drills of 1924 and 1926 production and also a 'chromium plated' brass case fluted drill carrying an 'X' in the headstamp (to denote experimental variant ?) . The distinction between use of the terms dummy and drill seems to have been made in this period where drill is used for fluted specimens and dummy for unfluted items to be used for weapons verification. An example of an early whitemetal dummy is given in figure 2 below. As can be seen in the 1927 specimen, the item carries 'V' in the headstamp denoting Inspector Dummy Mark V pattern. In 1928 the British introduced a letter coding system for .303 ammunition. Drills were assigned the letter 'D' and Inspector rounds the letter 'U'. This can be seen in post 1928 specimens in Figures 1 and 2.

2. Reference 3 Report for period July 1924- June 1926 page14.

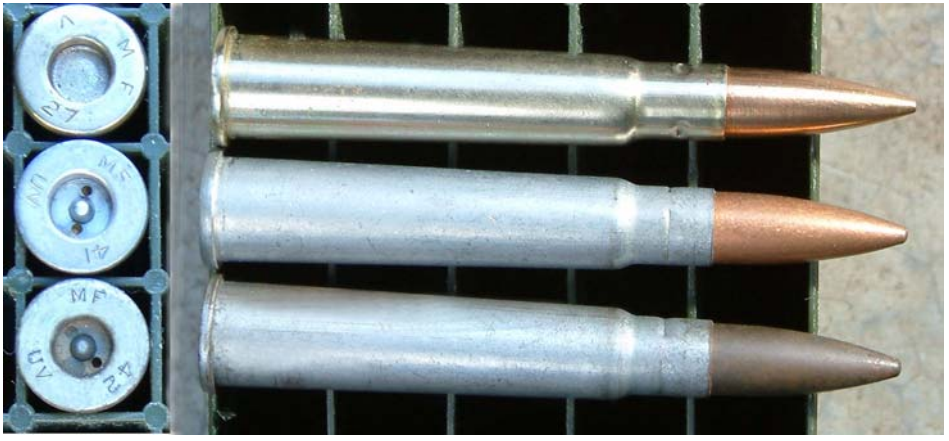

FIGURE 2. **Mark V Inspection Dummy Cartridges : From Top : a 1927 whitemetal case type. a 1941 tinned case UV and a 1942 tinned case UV specimen.**

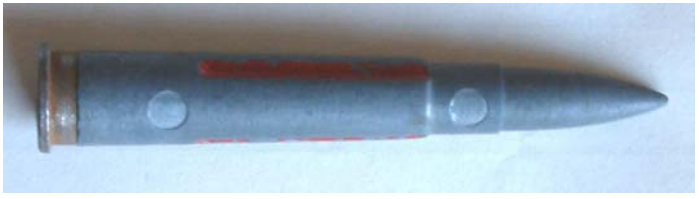

FIGURE 3. **A WW2 expedient drill made from die-cast alloy with steel rim. Designed at the Central Drawing Office Maribyrnong and detailed on Drawing Z-29691 dated May 1940. Officially described as 'Cartridge, S.A., Drill, .303 inch L.P. Mk 1.' (LP = Local Pattern)**

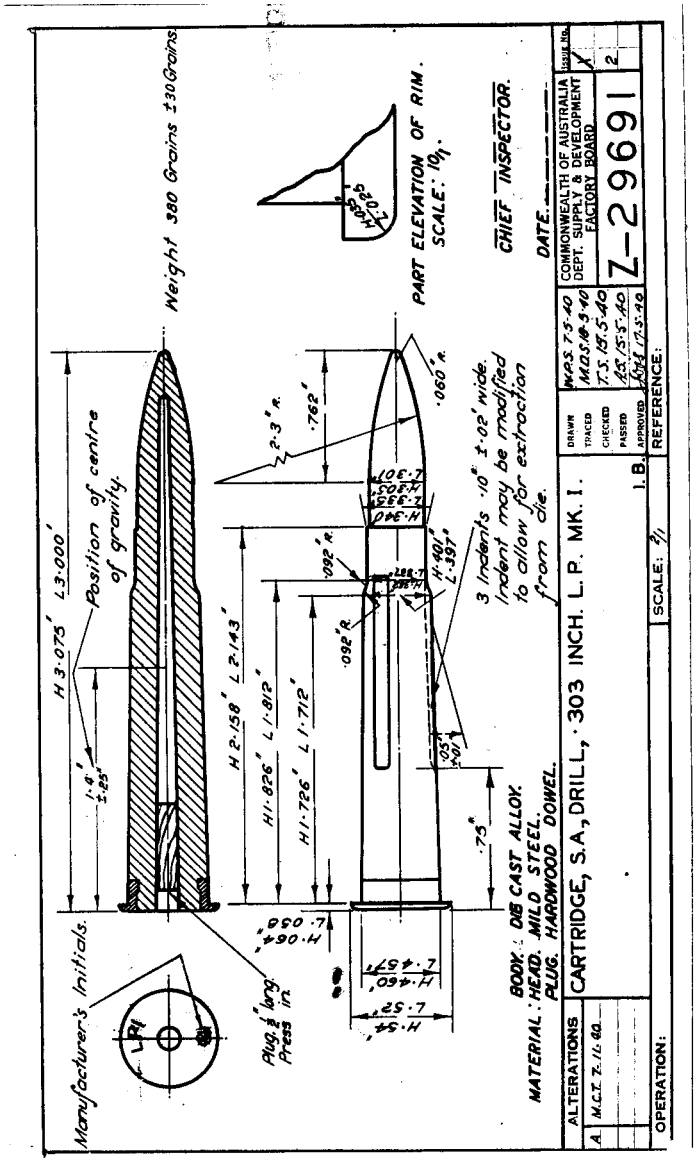

FIGURE 4. The wartime diecast drill cartridge 'LP Mark 1" made by 'Diecasters Ltd'

FIGURE 5. No 2 Factory drills and dummies: From top : Unheadstamped Mk V inspection dummy, two more Mk V Inspector dummies made from surplus ball and Incendiary cases respectively, A Mark VI* fluted drill circa 1944 and a Chromium plated Mk 7 drill circa 1948.

Whitemetal was used in the manufacture of the Inspector Dummy until WW2 where tin plated cases were used in lieu of whitemetal. Figure 3 shows examples of Inspector rounds made at the No2 Factory in 1943 using surplus cases suitably

tin plated. These may be found with both cupro-nickel and guilding metal projectiles.

FIGURE 6. Post WW2 specimens : From Top : Improvised inspection dummy, two Mark 7 Chromium plated drills (Naval Pattern) and the last .303 drill made at Footscray ; the Mk 10 Chromium plated drill made in 1955.

Toward the end of WW2, a batch of drills were made at the No2 factory and designated as Mark VI*. A sample is shown in figure 3. Strangely this round bears little resemblance to the British Drill Mark VI* pattern introduced in 1934 and which

had a chromium plated case intended for Naval use. Post WW2 saw the introduction of the Mark 7 drill, examples of which are given in figures 3 and 4. The Mark 7 was a chromium plated variant intended for Naval issue. The last batch of .303 drill rounds made in 1955 used the British pattern of the period which was designated as Mark 10. The differences between the Mark 7 and the Mark 10 were minor. The Footscray Mark 10 specimen is shown in Figure 4.

An unusual variant of the .303 inert cartridge is shown in Figure 5. This is not strictly a cartridge but more of a gauge for the checking of the geometry of Vickers or Browning machine gun disintegrating link belt components. The specimen shown carries the 'MF' identifier on the base and the words ' Links Belt Amm'n Mean Cartg.' on the side. It is made from ground steel.

FIGURE 7. Links, Belt, Ammunition, Mean Cartridge.

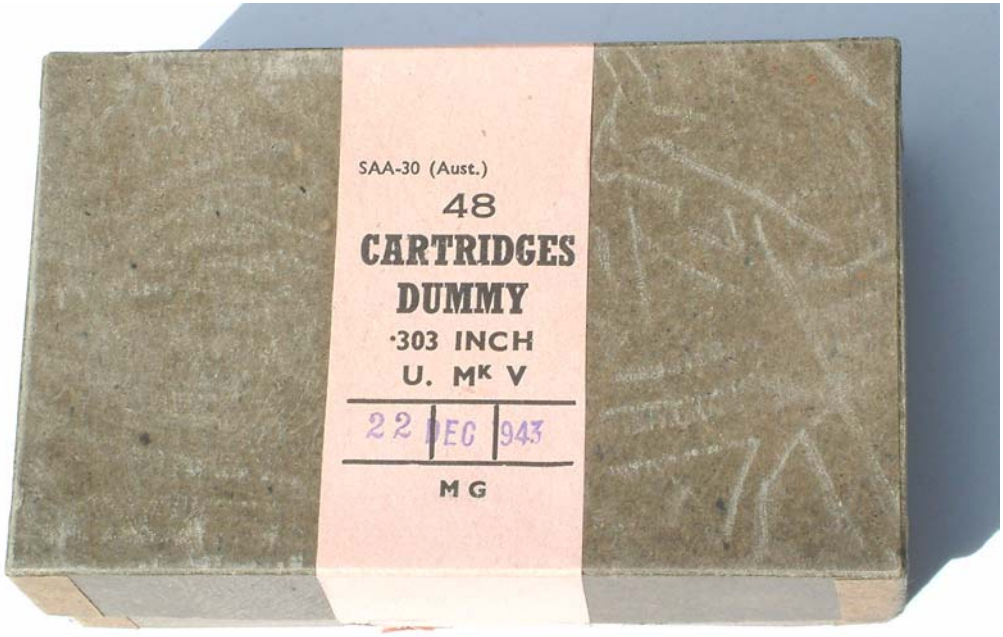

FIGURE 8. A Packet of tin plated .303 U Mark V 'inspection dummies' made at the No2 factory in December 1943

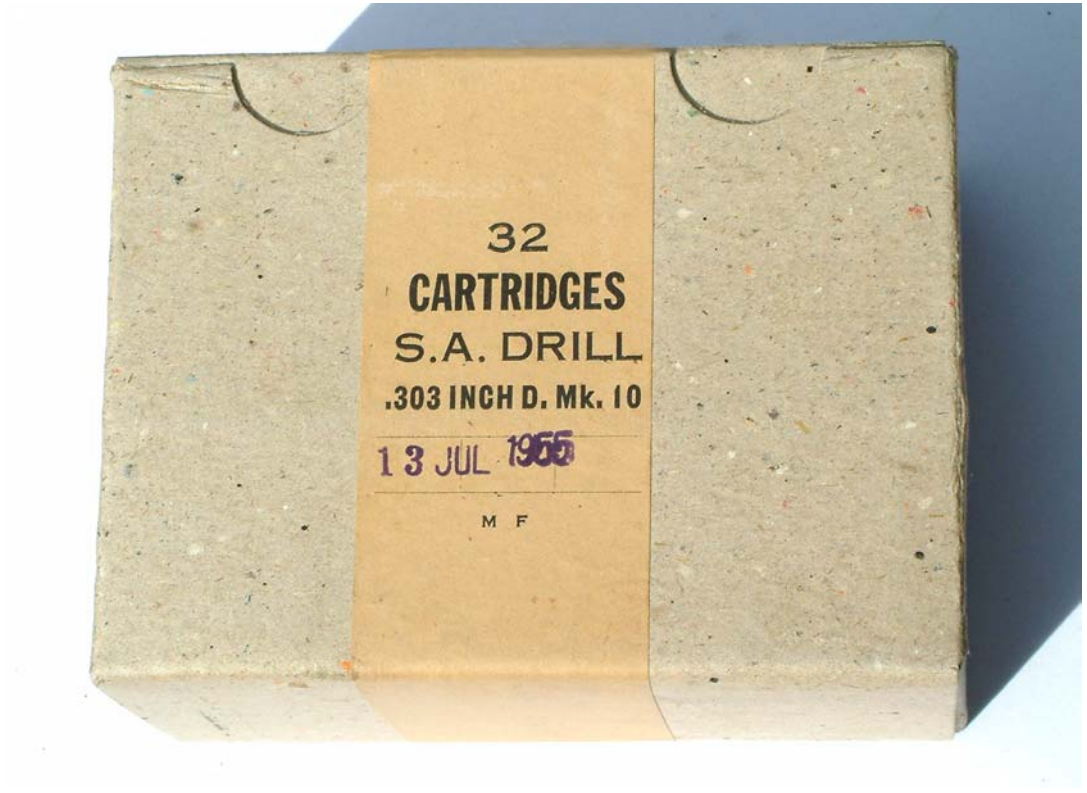

FIGURE 9. A packet of 32 .303 Drill Mark 10 made at Footscray 13 July 1955.

Chapter 23: *Inert 7.62 & 5.56 Cartridges*

Photographs of 7.62 & 5.56 Inert cartridges

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FIGURE 1. Early inert 7.62 cartridges : Top a 1956 tinned dummy made from L2A1 case, Bottom : a 1957 inert round made from a L2A2 case.

FIGURE 2. 1959 (top) and 1960 chrome plated dummies made from production ball cases.

A range of inert 7.62 cartridges were made between 1956 and the termination of 7.62 manufacture by ADI in the late 1990's.

FIGURE 3. Inert Dummies: Bottom 1961 specimen used by Defence QA and a black bulleted specimen of 1970 (purpose of blackened bullet unknown.)

Some of the inert rounds were made for 'internal consumption' by Defence Quality personnel rather than for Military Service issue. Some items were made against export orders e.g. from Israel and the USA.

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FIGURE 4. 7.62 inert rounds : at top two blackened M172 pattern circa 1969, a whitemetal L3A1 inspection dummy of 1973 and at bottom two chromium plated L3A1 dummies from 1979 and 1982 respectively.

One of the all blackened cartridges shown in figure 4, carries the American M172 designation.

The whitemetal L3A1 inert round shown in Figure 4 was reportedly made for Israel

FIGURE 5. Typical 7.62 fluted drill rounds From Bottom, 1959, 1961,1961,1964 and 1970 specimens

Black primer inert rounds were used within the Factory in 'visitor' displays and also used by the Engineering Design Establishment (Army) to evaluate packaging durability and test

alternative materials etc. These rounds sometimes had an inert filling (reported to be granulated sugar) to simulate the propellant loading. Black primer 5.56 inert rounds were also made up for display purposes. It is believed no formal 5.56 Drill or Inspector rounds have been made at Footscray or Benalla as at the time of writing.

FIGURE 6. Inert non-bulleted 7.62 : from top a black primer inert F2 grenade launching blank, a F5 Drill Grenade Launching Cartridge and an inert F8 blank

FIGURE 7. A black primer inert 5.56 round made by AFF in 1988 for the Australian Industry Defence Exhibition in the early 90's

FIGURE 8. Black Primer inert 7.62 rounds : from top 1984 inert F2,1984, 1969 1965 and 1966 inert ball loadings.

FIGURE 9. A Blackened Projectile inert round made at Footscray in 1984 - purpose unknown

Chapter 24: *Ballistic Standard and Pressure Test (Proof) Cartridges*

Ballistic Standard and High Pressure Test cartridges are seldom seen outside of the Ammunition and Small Arms Factories as they are associated with the manufacture and acceptance of ammunition and of weapons respectively. The Australian ammunition factories manufactured a range of these items as detailed below.

Ballistic Standard Ammunition

The 1928 Textbook of Small Arms describes Ballistic Standard ammunition as follows:- “Standard ammunition is very

carefully made up with specially selected components. Care is taken that the bullets are of uniform weight and diameter, and that the cases are of uniform capacity. The charges are very carefully weighed, and are taken from a batch of propellent which is known to be regular throughout, and which has been stored until its ballistic qualities have settled down and become constant. The loading is carried out with the greatest care, and in fact everything is done to ensure that the cartridges composing any one batch of standard ammunition are as far as possible identical in all respects. The outstanding requirement is uniformity, and the absolute values of the velocity and pressure obtained are of comparatively minor importance, provided that the velocities and pressures throughout the batch are as nearly as possible alike, and that their values are accurately known." Ballistic Standard ammunition provides a means of establishing the effect of equipment and atmospheric conditions on the results obtained of test firing production batches of ammunition . The pressure and velocity values of the Ballistic ammunition are known and a quantity is fired at the time of production testing. The difference in measured values of the Ballistic ammunition 'on the day' to it's known values gives the correction to be applied to the measured values of a production batch submitted for acceptance. After measuring the production batch velocity

and pressure values, the adjustments established from the Ballistic Standard ammunition are made to the production values. The corrected values must then fall within the acceptance range. Ballistic Standard ammunition can also be used to compare the performance of equipment such as test barrels.

Australian .303 'standard' ammunition carried the unusual 'S' code in the headstamp with the earlier rounds having the 's' enclosed within a circle. As will be seen, Australian 7.62 'standard' cartridges continued with the 's' identifier into the 1970's. In the 1970's the process of specially manufacturing standard ammunition was abandoned in favour of selecting a normal production batch of ammunition of high uniformity to be used as a 'defacto' standard. Specially marked standard ammunition thus disappeared from the scene in the 1970's

FIGURE 1. Examples of .303 Ballistic Standard rounds showing a June 1944 specimen from the No 2 plant (top left) , a June 1940 specimen from the No 1 plant (bottom left) , a 1958 specimen (top right) and an 'early' October 1925 specimen (bottom right.)

Standard .303 ammunition was also made at Hendon during WW2 and rounds similar to the above carrying the Hendon factory codes are in collections. At least one batch of .455 Webley revolver ammunition made at Rocklea (MQ) was identified as 'standard' and carries the 's' identifier.

FIGURE 2. A Ballistic Standard .455 Webley Round made at Rocklea.

FIGURE 3. A packet of Footscray Ballistic Standard .303 made 28 August 1958.

FIGURE 4. Examples of 7.62 Ballistic Standard cartridges from 1962 -1973, Note the 'yellow' primer lacquer which is a requirement of 'standard' ammunition

Proof ammunition

High Pressure test or 'Proof' ammunition is used to verify the structural integrity of weapons during initial manufacture or after significant modification. Proof rounds develop a higher than standard pressure thus stressing the weapon above what would be normally experienced with service ammunition. Proof .303 ammunition carries the proof type identifier 'Q'. The cases are normally copper washed to give further visual identification. In addition .303 proof rounds have the case 'peened' in around the primer to provide extra support for the higher than normal pressures generated. Australian .303 proof rounds were of Mark III and Mark IV types. The Mark III type featured the service 174 grain Mark VII ball projectile with a charge of 33 grains of cordite size 3 and developing a chamber pressure of 23-25 tons per square inch. The Mark IV type featured a 215 grain round nosed projectile and had a cordite charge developing 25-27 tons per square inch. The Mark IV appeared in England in the late 20's and was reported as being intended for proofing automatic weapons only. It was declared obsolete in the early 40's and the Mark III was then used across all .303 weapons. Figure 6 shows both the Mark IV and Mark III types.

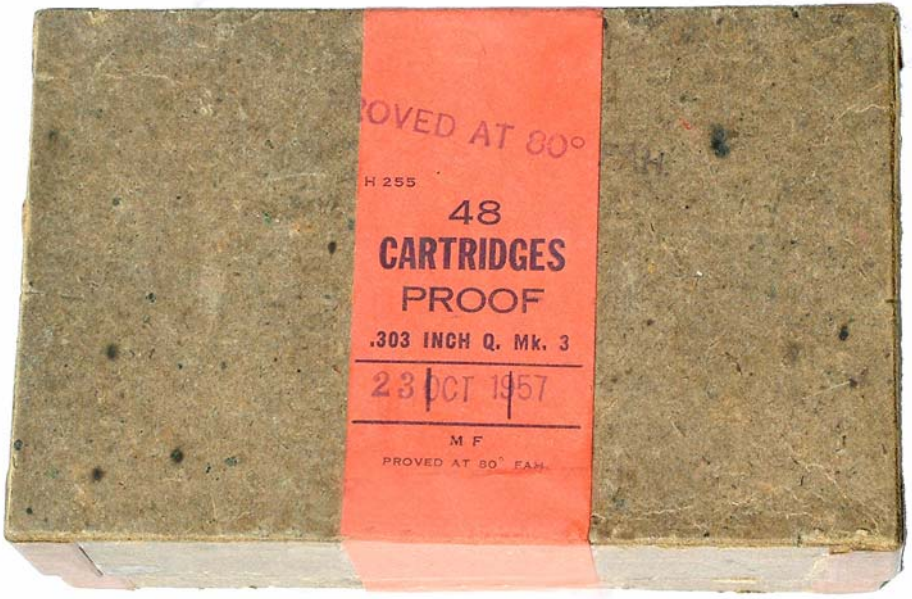

FIGURE 5. A packet of 48 cartridges .303 Proof Q Mark 3. Note the statement 'proved' at 80 degree F.

Specimens of 7.62 proof ammunition are shown in Figure 7. It can be seen that the L4A1 pattern was manufactured from the 1950's to the 70's.

FIGURE 6. Some .303 proof specimens : From top a Mark IV of 1939 manufacture, a mark III from 1940 and Mark 3's from 1956 and 1957.

FIGURE 7. Some copper washed 7.62 L4A1 Proof rounds : from top 1959, 1961,1965,1972, 1974 and 1976 specimens

Chapter 25: *.380 Revolver, 9mm and .45 Auto Ammunition*

.380 Revolver

In the early years of WW2, the .380 revolver, which had been in service in England for some years, was being introduced into the Australian Defence Forces to replace the .455 Webley. Britain had begun replacing their Webleys with .380 revolvers from 1930. The early British .380 ammunition was designated Mark I and had an unjacketed lead projectile but this was replaced in the mid 30's with the Jacketed mark II projectile.

In the December 1940 Munitions Programme, the quantity of .380 revolver ammunition produced for that year was shown as nil but with a requirement to reach 3.0 million rounds per year by the end of 1941. Production of .380 Mark II ammunition got underway at the Footscray No1 factory in 1941 with projectiles jacketed in cupro-nickel. In 1942 production was transferred to the 'new' Rocklea plant . The Rocklea ammunition had guilding metal projectiles. Production remained at Rocklea until the closure of that plant in October 1943. Quantities produced at Rocklea are given as approximately 9 million annually[1]. Production was returned to the Footscray No2 factory in 1944. No further production of .380 revolver ammunition was carried out after 1944 despite the weapon remaining in service into the 1960's. When reserves of the local ammunition had been consumed, ammunition was imported from the UK. (usually being of Radway Green and Kynoch manufacture.)

1. Reference 2 Page 17.

FIGURE 1. Local .380 ammuniton : from the right No1 Factory 1941 production, Rocklea 1942 & 1943 production and No2 Factory 1944 production. At top left is an undated tinned drill D Mark 1* made by the No2 factory and at bottom left an unmarked 'drill' reported as being made at Rocklea.

FIGURE 2. Local .380 ammunition; From right a cupronickel jacked specimen from the No1 factory (1941) , a Rocklea specimen (1942,43), a No2 factory specimen (1944) and a tinned , undated fluted drill from the No2 factory (circa 1944).

The .380 Mark II ammunition had a 178 grain jacket projectile with two cannelures and a loading of 4 grains of cordite size 1/05. As can be seen in Figure 2, the bullet is secured to the

case by coning the case mouth into the top cannelure and rolling the case into the lower cannelure. The ammuniton had to achieve a figure of merit of 3.5 inches at 50 yards and be able to penetrate two 1 inch boards at 10 yards

FIGURE 3. Typical .380 Mk II packets bearing the Rocklea identifier MQ

9MM ammunition.

The requirement for 9mm ammunition had not been noted in Munitions Programme Plans as late as mid 1941. The introduction into service of British submachine guns then the local Owen gun firing the 9mm parabellum cartridge generated a need for local production of this ammunition. Production got under way in 1942 at Footscray No1 plant and in 1943 at Hendon No3 plant. Data viewed at the Footscray Factory indicated that by December 1942 production of 9mm at that plant was running at a rate of 8 millions rounds per year. Production continued until 1945 at Footscray. The headstamping at Footscray and Hendon are shown in the following photographs

.

FIGURE 4. Hendon 9mm headstamps for 1943 and 1944 production

FIGURE 5. Footscray 9mm WW2 headstamps 1942-1945. Note cupronickel and copper primers on 1945 production with brass primers being used for 1942,43,and 44 production.

Large stocks on hand of local and overseas WW2 9mm rounds delayed the re-commencement of production until the 60's and continued through the 70's, 80's and 90's until discontinued by ADI. The Headstamp changed from MF to AFF in 1988. A range of drill and dummy rounds were made throughout the life of this programme, some of which are shown below.

FIGURE 6. 9mm Inspection rounds U Mark I: from right 1960 tin coated solid brass, 1955 all steel.

FIGURE 7. 9mm Drill D mark I and F2 types: From right 1943 tinned drill, 1943 ball case with holes and wooden distance piece, 1963 whitemetal case with blackened bullet, 1963 brass case with red primer pocket and typical F2 type with red flutes and primer pocket.(circa 1970-76)

FIGURE 8. Typical 9mm packaging of post WW2 production.

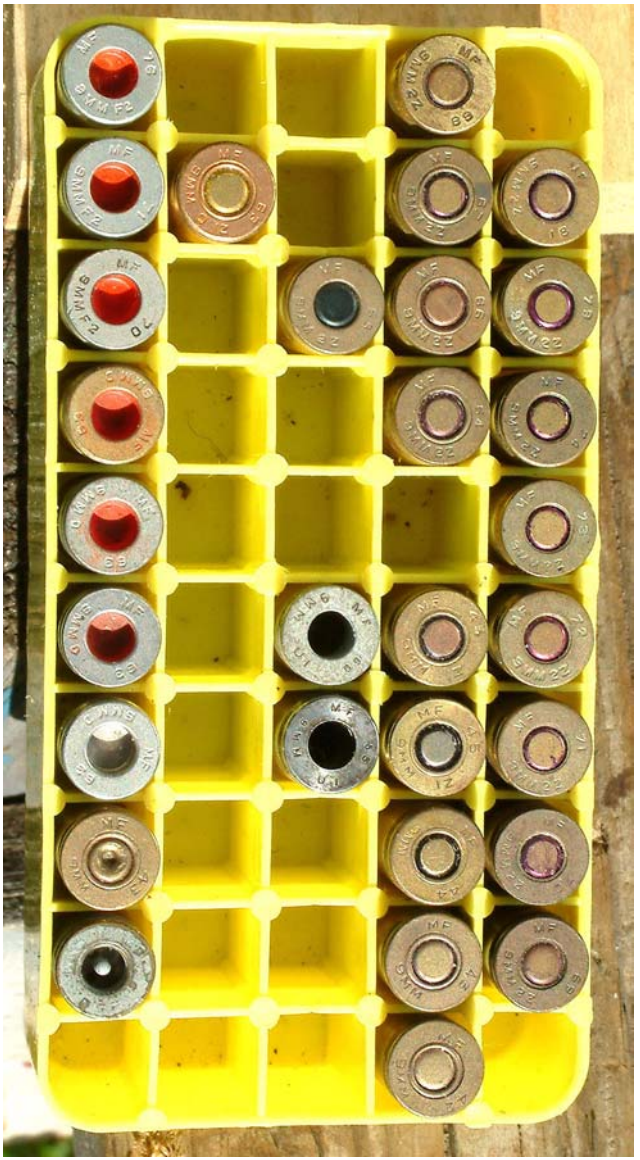

FIGURE 9. A selection of 9mm headstamps from 1942 -1980 used by the Footscray plant including drill, dummy and proof types. Also show is a black primer 'inert display cartridge'.

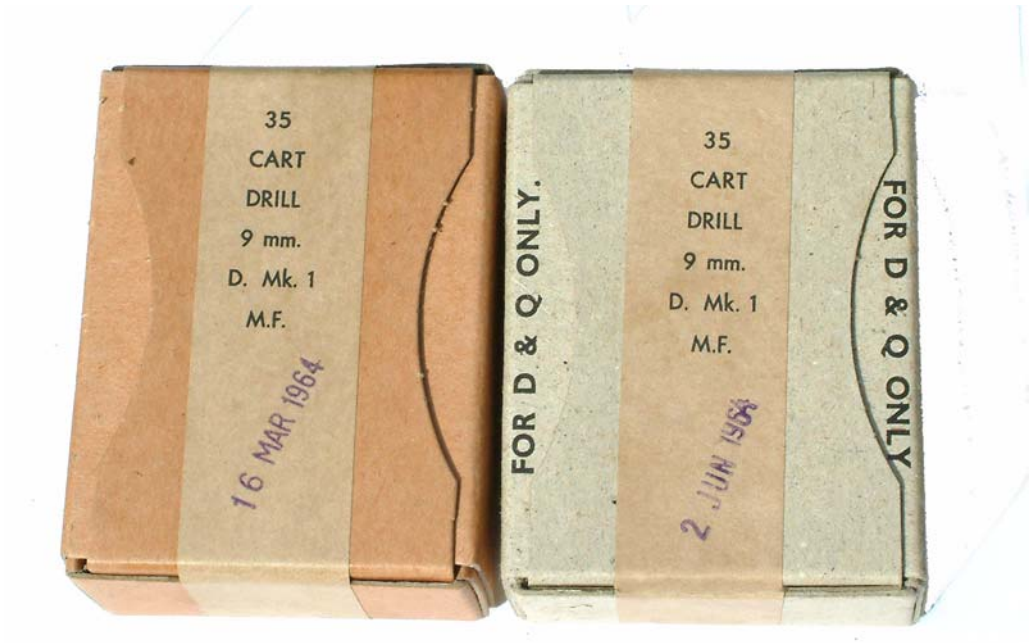

FIGURE 10. 9mm Drill packets packed in 1964 but carrying 1963 headstamps

FIGURE 11. Red tipped 9mm rounds made at the No1 Factory in 1943 and reported as being early proof rounds

.450 ACP ammunition

Supply of Thompson .45 submachine guns from the USA to the Australian forces during WW2 initiated the manufacture of .45 Auto ammunition at Footscray in 1943.

FIGURE 12. Footscray made .45 ammunition : Lower 3 examples made at No2 Factory in 1943 and 1944. Upper two made in 1955 and 1956 .

The WW2 ammunition carried ‘ IZ ‘ in the headstamp (Z denoting nitrocellulose propellant). The Thompson sub machine guns stayed in service with the RAAF until the 60’s and as a consequence, more ammunition was ordered from

Footscray in the mid 50's. Quantities were produced in 1955 and 56 and carried the mark 'I' (denoting cordite loading).

FIGURE 13. .45 Auto cartridges : right a typical WW2 No2 Factory round with case cannelure and a 50's 'MF' round without case cannelure.

FIGURE 14. A WW2 packet of .450 ammunition made at the No2 factory on 14 Jun. 1943.

Chapter 26: *.455 Webley ,.32 pistol, .22 Rimfire and .310 Cadet ammunition.*

.455 Webley

As noted previously, the Footscray factory commenced manufacture of the .455 Webley Revolver ammunition in the early 1920's. Initial quantities were submitted for testing on the 9th of February 1923.[1] A further four proof firings took place through to March 1923 during which adjustments were made to the propellant charge to achieve satisfactory muzzle velocity (600 feet per second) and to bullet retention as mea-

1. Reference 4 Journal No 81 2000 page 11.

sured by the force required to 'pull' the projectile from the case. The first deliveries are reported as being in the 1923-24 Financial year [2] when 625,000 rounds were delivered. This ammunition was packed in small cardboard cartons holding 12 rounds and closed with a paper tape label. Some early examples are shown below. Ammunition was headstamped with "A arrow F II" then " arrow F II " then "MF II".

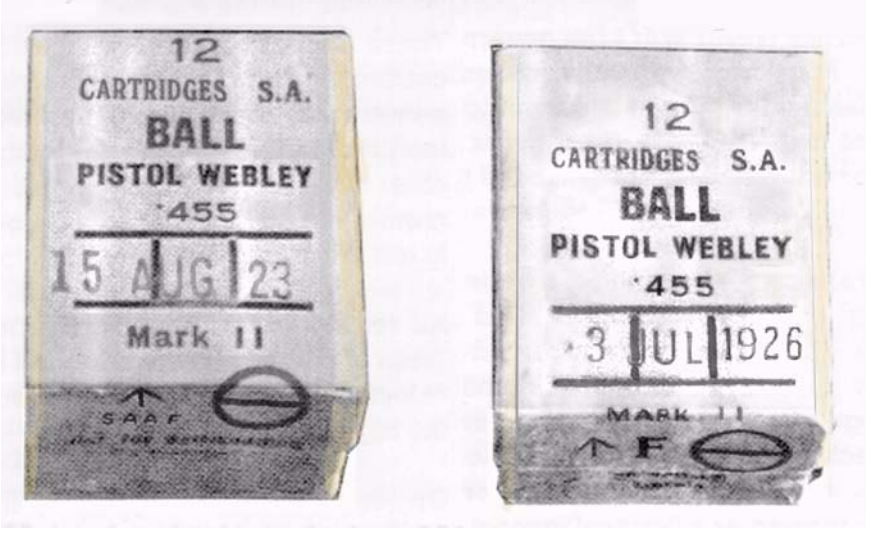

FIGURE 1. Two early .455 Webley Mark II packets: an August 1923 example carrying the 'arrow SAAF' factory identifier and a July 1926 packet carrying the 'arrow F' identifier: these being Footscray codes of that period.

2. Reference 3 July 1923-June 1924 Annual Report page13

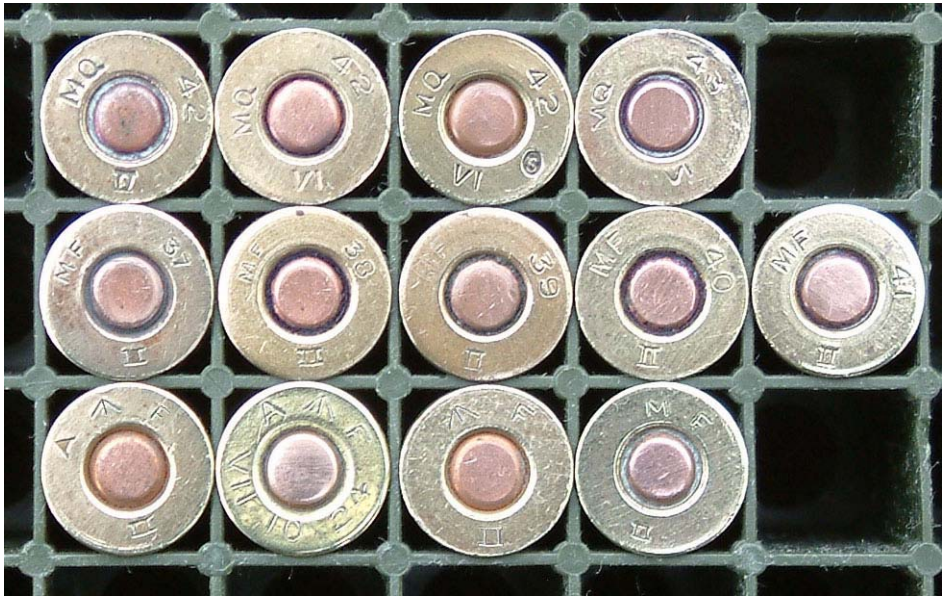

FIGURE 2. A selection of headstamps from first production at Footscray (bottom left) thought to last production at Rocklea (top right). Note the 'ballistic standard marking on the MQ 42 VI round and the use of a 303 headstamp on the second bottom left. (dated 10-24)

In 1931 the year of manufacture was added to the headstamp and production was carried out at Footscray in each subsequent year until 1941 when it was transferred to the 'new' Rocklea plant. Rocklea commenced manufacture of the Mark II cartridge in 1942 but this was soon replaced by the jacketed projectile Mk VI round later in 1942 after concerns

that the unjacketed Mk II projectile may be seen as contravening international conventions.

FIGURE 3. The Mark II unjacketed .455 round made at Footscray and for a short period at Rocklea and the gilding metal jacked mark VI round made at Rocklea.

TABLE 1. .455 Production from 1923 to 1939

Financial Year	Quantity	Financial Year	Quantity
1923-24	625,000	1932-33	56,556
1924-25	350,000	1934-35	80,640
1926-27	400,000	1935-36	131,840
1927-28	109,208	1936-37	73,400
1928-29	11,000	1937-38	166,320
1930-31	11,975	1938-39	192,960
1931-32	125,848		

In the December 1940 Munitions programme, the current annual production of .455 revolver ammunition was given as 1 million rounds with a plan to achieve a rate of 2 million rounds per annum by end of 1941. Production at Rocklea achieved approximately 2 million rounds per year for 1942 and 1943.

Production of Webley ammunition ceased in October 1943 with the closure of the Rocklea plant. The Webley pistol was at that time being displaced by the ‘new’ .380 service revolver.

After WW2, Civilian Pistol Clubs were given access to surplus .455 pistols and ammunition however these were replaced by modern pistols in due course.

The Mark II ammunition had a 265 grain lead projectile and had a nominal charge of 5.5 grain of cordite 1/05.

The Mark VI ammunition had a 265 grain jacketed projectile and had a nominal charge of 7.5 grains of cordite 1/05. The Mark VI had to be able to penetrate two 1 inch boards 1 inch apart at a range of 10 yards and have an accuracy of a 4 inch figure of merit at 50 yards

.320 Auto Pistol and .32 S&W Revolver Ammunition.

As part of the attempt to supplement the low workloads of the late 1920's and early 30's, the Footscray Factory took on the manufacture of .320 Auto pistol and .32 Smith and Wesson revolver ammunition. These weapons were commonly used by Federal and State Government Departments ,Police, Banks and generally in Industry to secure payroll offices and during the weekly or fortnightly distribution of cash wages and salaries to employees. The local manufacture also achieved the aim of displacing imports.

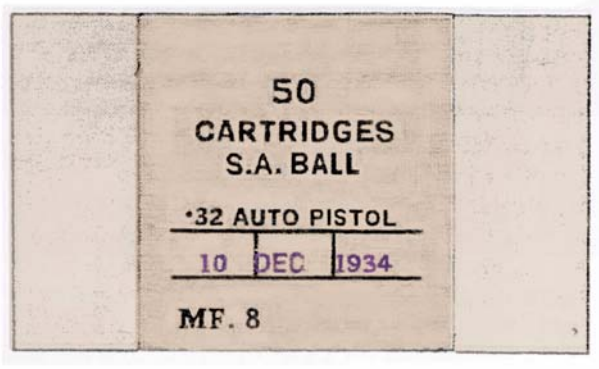

FIGURE 4. *Above: A packet of 50 .32 Auto made at Footscray in December 1934. .320 Smith & Wesson rounds were also produced but no surviving packet is known to exist. The significance of the "MF 8" is unknown but may be a lot number identification.*

.22 Rimfire Ammunition

Prior to 1930 all .22 rimfire ammunition used in Australia was imported. In an attempt to supplement workload and eliminate import expenditure, the Footscray factory undertook the manufacture of .22 rimfire ammunition. Information was obtained from the UK in June 1930 and planning for manufacture commenced. The lead projectile was designed by the Munition Supply Drawing Office in 1932. Drawing Z9521 dated 23-8-1932 was issued to define manufacture of the projectile. The Factory commenced production and testing was carried out using military small bore rifles (based on the Enfield .303 action) . As ammunition reached civilian rifle clubs, problems were experienced by rifle clubs members using other than military small bore rifles. This was subsequently identified as lack of sensitivity of the primer compound. Whilst the ammunition was satisfactory in the military Enfield small bore rifles, the commercial target rifles had less energetic strikers which often caused misfires and hangfires. Problems were solved but production stopped when ICI established local .22 production in 1935. The Government Factories were not encouraged to compete with local industry.

FIGURE 5. Above A packet of 100 .22 rimfire cartridges produced at Footscray in May 1934.

Jacketed .310 Cadet ammunition

The .310 cadet rifles used in pre WW1 were progressively withdrawn from Australian Cadet training as Lee-Enfield .303 rifles became available to the Cadets . These rifles had been used with ammunition made at CAC in 1909 -1913. Propellant was still in storage from this pre WW1 program but by 1926-27 the Munition Supply laboratories reported that ”Nitrokol from obsolete .310 small arms ammunition which has been in storage for many years was found to be unstable

and was sentenced unserviceable"[3] In 1929 the Administrator of the Territory of New Guinea requested the issue of .303 rifles to supplement those already on hand. Financial restraints prevented this request from being actioned but the Australian Government offered a free issue of 1000 .310 Cadet rifles.This offer was accepted. Consequently an order for 10,000 rounds of jacketed ammunition was placed on the Ammunition Factory Footscray by the Administrator. A round nose nickel jacketed projectile was made for this order

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FIGURE 6. Headstamps of Footscray .310 Cadet cartridges.From right an unprimed 1929 cartridge featuring provision for the .455 primer, A 1930's specimen with small copper primer and WW2 No1 and No2 Factory specimens with brass primers.

The only suitable primers in production at that time were of .240 inch diameter for the .455 revolver, and these were used in this initial order. A further quantity of 20,194 rounds were loaded with pointed nickel jacket projectiles. Further

3. Reference 3 July 1926 -June 1927 Annual Report page 5.

shipments were made through to late 1932 after which New Guinea was able to obtain .303 rifles and withdrew the .310 Cadet rifles and ammunition on hand. Availability of a smaller primer from the .32 pistol and revolver ammunition programme resulted in the smaller primer being incorporated into the .310 cartridge. Limited production continued through until 1939 when production ceased for other priority demands. After the bombing of Darwin in February 1942 , .310 rifles in storage were issued for 'home guard'[4] use.

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FIGURE 7. A side view of the cases shown in previous figure. Note the Nickel projectile from 1930's production and guilding metal projectiles in the WW2 production items

4. The VDC or Volunteer Defence Force acted as a type of Home Guard in WW2

This necessitated an order on Footscray for .310 ammunition .

The No1 Factory commenced on the order and ramped up to approximately 2 million rounds per month but in September 1942 production was switched to the No 2 factory. By Christmas 1942 only 4.4 million rounds were required to complete the .310 programme. By mid February only 2 million remained and by May 1943 the manufacturing programme was complete. This WW2 ammunition had a specification of 1170 feet per second plus or minus 50 feet per second measured at 90 feet from the muzzle at 80 degrees Fahrenheit. It was fired from a fixed rest and had to achieve a mean figure of merit of 6inches at 200 yards,

FIGURE 8. A 20 round .310 packet made at Footscray om 1st September 1942.

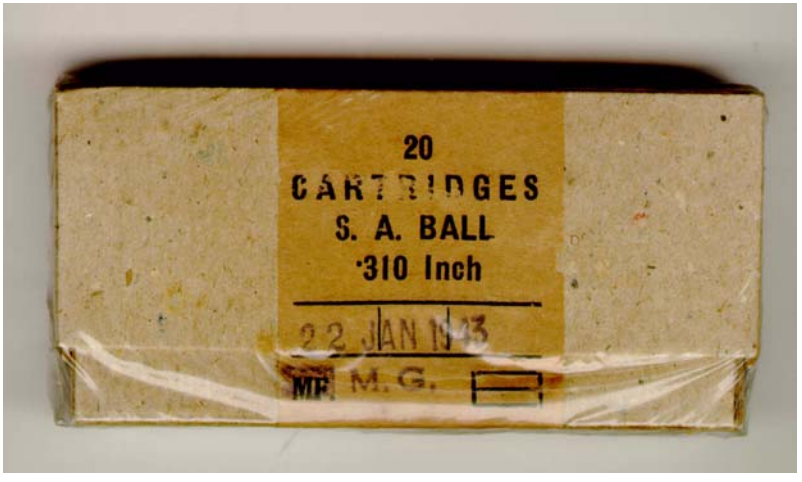

FIGURE 9. A 20 round packet of .310 made at the No2 Factory on 22 January 1943 using MF packaging overstamped with the MG identifier.

After WW2, rifles were withdrawn and disposed of. Many were converted to single shot sporting rifles through the 1950's and 60's

TABLE 2. Manufacture of .310 Jacket ammunition 1929-1939

Financial Year	Quantity Made	Financial Year	Quantity Made
1928-29	20,000	1934-35	31.240
1929-30	40,414	1935-36	15,000
1930-31	40,500	1936-37	10,000
1931-32	30,000	1937-38	9,500
1932-33	13,760	1938-39	12,500

Index

D

References

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2. Ammunition Factories in Australia 1880 -1945. By Mr. L.McLean. State Library of Victoria Reference SLTF 662.20994 AM6M

3. Commonwealth of Australia , Munition Supply Board Annual Reports from 1922 through 1938.

4 Australian Cartridge Collectors Association Journals.

5 Ammunition Factory Footscray Centenary Album 1888-1988 issued to all employees on the centenary of the site in 1988.

6 The Colonial Ammunition Factory (Australia) Ltd. 1888-1926 By J.K.Lyons State Library of Victoria reference LPT 358.3065 C71L

7 Textbook of Small Arms 1929 H.M Stationery Office London

8 Commonwealth of Australia Departmental Establishment site Plans: Department of Supply 1963 (covering site plans for Albion Explosives Factory, Ashley Street Transport Depot, Magazine area Derrimut, AFF, Munitions Supply Laboratories and EFM, and the Ordnance Factory Maribyrnong including Central Drawing Office and Maribynong Stores.)

9 WW2 “Location of Government Factories” Site Layouts 1945 (covering Ordnance Factory Bendigo, Ordnance Factory Echuca, SAAF Hendon, Gun Ammunition Factories at Finsbury and Rutherford, Ammunition Factory Derwent Park, SAAF Rocklea, SAAF Welshpool, Ammunition Factory Kalgoorlie, Ammunition Factory Hay, Small Arms Factory Bathhurst, Small Arms Factory Orange, Stores and Transport Ashley Street, Munitions Bulk Store Tottenham, Explosives Factory Ballarat, Stores and Transport Stafford, Stores and Transport Penfield.)

10 Technology in Australia 1788 - 1988 an online addition at www.austehc.unimelb.edu.au/tia/ originally published by the Australian Science and Technology Heritage Centre.