This report describes a proposed 3-draw process utilizing the standard U.S. cup on a modified Small Caliber Ammunition Modernization Program (SCAMP) Case Sub-module at the City AAR to manufacture 7.62mm cartridge cases that would satisfy the U.S. NATO grain configuration requirements.
7.62 MM CARTRIDGE CASING FEASIBILITY STUDY

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**Abstract:**
This report describes a proposed 3-draw process utilizing the standard U.S. cup on a modified Small Caliber Ammunition Modernization Program (SCAMP) Case Sub-module at Lake City AAP to manufacture 7.62mm cartridge cases that would satisfy the U.S. NATO grain configuration requirements.

**Key Words:** Small Caliber Cartridge Case, Annealing brass for grain configuration, SCAMP
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1. **SUMMARY**

This document reports the activities and results of a program carried out by the Advanced Development and Engineering Center of GULF + WESTERN to develop a process to manufacture 7.62 mm cartridge cases on SCAMP equipment. The program was funded by ARRADCOM under Contract Number DAAK10-78-C-0165, which followed G+W Proposal Number 15506A.

The program plan was based on a tentative process mutually arrived at by ARRADCOM and G+W in which the critical tasks were: (a) developing a three-draw process from the specified standard U.S. cup using one inter-draw anneal; and, (b) developing an induction anneal system to satisfy the U.S. - N.A.T.O. grain specifications.

All development work was carried out at the G+W Folcroft facility using G+W press simulators and a specially designed induction anneal test rig. Although this equipment is manually operated, the various operations of the SCAMP equipment are closely simulated in terms of metalforming and heating functions.

The program was successful in accomplishing its objectives and culminated in the supply of a small quantity of cartridge cases to ARRADCOM for evaluation and test firing.
2. INTRODUCTION

Over the last decade, G+W has been responsible for the conception and development of high speed rotary ammunition systems as part of an extensive modernization program carried out under the auspices of the P.B.M. office of ARRADCOM.

The systems are now installed at L.C.A.A.P. and are producing 5.56 mm caliber ammunition. The systems were designed to be compatible with conversion to produce other caliber sizes. However, it was also recognized that some addition to, or modification of, the basic equipment may be necessary to accommodate differences in processes appropriate to other calibers.

G+W has supplied systems to overseas customers which produce 7.62 mm as well as 5.56 mm ammunition and, in doing so, has developed suitable processes. However, the U.S. - N.A.T.O. requirements define a specific grain structure and ARRADCOM also stipulated that the standard U.S. cup must be used. These factors introduced complications of process beyond those already developed.

G+W Proposal Number 15506 resulted in ARRADCOM placing a contract to develop a process which would fulfill the requirements and be compatible with SCAMP equipment.
3. **OBJECTIVE**

The objective of the program was to establish a process to produce 7.62 mm, M80 cartridge cases on a SCAMP sub-module at 1200 parts per minute.

Program completion would be recognized with submission of: (a) 1,000 acceptable 7.62 mm cases to Drawing Number 10521997 with applicable grain specification and, (b) a final technical report.

A contract modification added a test to evaluate the effect of voids (missing parts) in the transport chain on the performance of the anneal system.
4. PROGRAM PLAN

The plan which was prepared and generally followed is outlined below:

1. Identify differences between the proposed 7.62 mm process and the current 5.56 mm SCAMP process, then develop the proposed process and define the methods of showing compliance with the product specification.

2. Design and procure the necessary developmental tooling and equipment, including an induction anneal system.

3. Set up simulators, tool modules, induction anneal system and processing equipment.

4. Develop tooling and induction anneal process to obtain required dimensional and metallurgical properties.

5. Perform measurements of in-process dimensions, head hardness, hardness gradient and grain structure to define in-process part characteristics.

6. Produce a small batch of finished parts for Government evaluation and process approval.

7. Produce 1,000 parts to be test-fired by the Government.

8. Develop final recommended process flow diagrams and in-process part specifications.


10. Deliver items as follows:
   (i) Progress reports
   (ii) Final technical report
   (iii) 1,000 finished cases
   (iv) Tools and test equipment procured under the contract

The only significant deviation occurred in relation to Item 6, above, in that three series of samples were produced and evaluated before approval to proceed was granted.

Test series A produced parts with dimensional discrepancies. Test series B resulted in minor dimensional discrepancies and ARRADCOM requested a further series C which would use L.C.A.A.P. process specifications where appropriate, as well as correcting the deviations.

The actual timetable of activities is summarized in Figure 1.
5. PROPOSED PROCESS

Referring to Figure 2, the ARRADCOM stipulation was that the process should use the standard U.S. cup, Drawing Number 10522459. It was considered that the geometry of this cup, with consequent high area reduction through the final draw, mandated a three-draw process.

The second consideration was that, in order to attain the specified grain structure, an anneal would have to be performed between second draw and final draw.

The third consideration was the addition of a pre-pocket operation prior to heading so as to have a reliable primer pocket condition and adequate internal head hardness.

The remainder of the process is similar to the 5.56 mm SCAMP process.

By comparison, the conventional 7.62 mm process has an additional anneal between first draw and second draw, a machine trim instead of pinch trim and additional wash, lube and dry operations.
CUP
FIRST DRAW
SECOND DRAW
WASH, ANNEAL, QUENCH, PICKLE, RINSE/LUBE
THIRD DRAW/PINCH TRIM
POCKET
HEAD
HEAD TURN
PIERCING
WASH, BODY ANNEAL, QUENCH, LUBE
FIRST TAPER
SECOND TAPER, PLUG
FINAL TRIM
WASH, STRESS RELIEF ANNEAL
PICKLE, RINSE
NECK & MOUTH ANNEAL
FINISHED CASE

FIGURE 2 PROPOSED PROCESS
6. TOOLING DEVELOPMENT

Following the process selection described in Section 5, tentative in-process part specifications were generated. Using these as a basis, tooling was designed and fabricated to accomplish all operations. The development program began with these designs which were modified as the program progressed.

The development was an iterative process involving minor changes of tooling design and in-process part specifications to achieve the desired final case characteristics. Some of the detail effects of tool design changes will be briefly discussed.

6.1 Equipment

All development work was carried out using SCAMP tool modules and simulators.

A tool module is an assembly which contains all the tools necessary to perform a particular metal-working operation. By virtue of the design, tool adjustment is precisely controlled within the module and the whole assembly can be quickly installed in the SCAMP rotary presses. It can also be installed and used in a simulator, which is a single-station machine designed to duplicate the essential features (displacement, for example) of a rotary press.

The original reason for the tool module/simulator concept was to facilitate off-line tool check-out but it is also eminently suitable for tooling and process development, as in this program.

Experience has shown that there is good correlation between simulator and rotary press process performance so that the results of this program can be expected to be valid in predicting the effects of sub-module conversion.

A typical tool module is shown in Figure 3, and is shown installed in the appropriate simulator in Figure 4.

6.2 Effect of Tool Modifications

Changes were made to tool designs in three areas, affecting draw die angles, second draw punch profile and pre-pocket nib configuration.
FIGURE 4  TAPER SIMULATOR AND TOOL MODULE
6.2.1 Draw Die Angles

During test series A, various combinations of draw die angles were tried to achieve what was judged to be a desirable base thickness (and consequently web thickness). The resultant selection was also used for test Series B. However, the incorporation of the L.C.A.A.P. process guide in the scope of work prior to Series C, necessitated further changes (reduction of die entry angles) to achieve the increased base (and web) thickness.

6.2.2 Second Draw Punch

The surface hardness measurements of series A and B showed a dip at the 0.75 inch point which could not be eliminated by adjustments of the body anneal coil. Although the resulting hardness profile was within the prescribed limits, it was decided that a better safety margin would exist if the dip could be alleviated.

The approach taken was to study the second draw and final draw tooling to establish the degree of metal-working occurring from the second draw part to the final draw part at several axial locations. This revealed that the metal at the 0.75 inch point had undergone less working than adjacent points and, in fact, did not fit a smooth curve drawn through all points.

Accordingly, the second draw punch profile was slightly modified and was successful in producing the desired result.

6.2.3 Pre Pocket Nib

Two nib configurations were tried initially, one having a straight taper profile and one having a hemispherical profile. The former was selected on the basis of its attaining a slightly greater head hardness. At the conclusion of test series B, ARRADCOM engineers detected an imperfection of the final pocket in the form of a small groove about half-way down the pocket and extending for about one-quarter of the circumference. Ammunition manufacturing terminology refers to this condition as a "rill", and is thought to cause primer leaks.

It was found that the alternate configuration did not produce the defect and it was used for the remainder of the program.
6.3 Final Tool Designs

A list of drawings of the final recommended tool designs and a reduced copy of each is included as Attachment 1. The original tracings were supplied to ARRADCOM.
7. **Annealing Development**

7.1 **Equipment**

To properly conduct all the various annealing tests that had to be performed, a test rig was designed and constructed, see Figures 5, and 6. This facility has all the necessary instrumentation required to monitor and control all known annealing process parameters. Power, chainspeed, water temperature and pressure, time until quench, and coil dimensions are all adjustable to allow a thorough evaluation of the pertinent variables so that the process could be optimized. A brief description of each of the components in the system is given below:

7.1.1 **Inverter**

The inverter is a 200 kw, 10 kHz solid state unit with digital power monitor. It converts the 460 volt, 60 Hz, 3 phase electrical input into 440 volt, 10 kHz, single phase output, which is connected to the heat station.

7.1.2 **Heat Station**

The heat station is used to obtain an oscillating, or resonant, circuit with the induction coil so that efficiency is maximized. The impedance matching of the electrical characteristics of the coil is accomplished through the use of an auto-transformer with multiple taps to select the voltage, and sufficient capacitance in 220, 440, and 800 volt banks to vary the frequency. With this arrangement, a wide range of coil sizes and configurations can be efficiently tuned.

7.1.3 **Control Panel**

The control panel has all the necessary switches, indicator lights and buttons that are required to operate the inverter and heat station. Two analog meters monitor voltage and frequency, and a digital meter monitors power output. The panel also has the controls needed to operate the recirculating water system, the quench chamber, compressed air for the blow-off chamber, and the chain drive motor.

7.1.4 **Quench and Blow-off Chamber**

The quench and blow-off chamber, see Figure 7, is built out of aluminum plate with acrylic windows in the front and back to allow visual inspection of the quenching process. The entire unit is mounted on
FIGURE 5  INDUCTION ANNEAL SYSTEM DIAGRAM
moveable slides so that it can be moved toward or away from the coil. In this manner, the time required for full quenching can be varied to provide the optimum effect.

The quench chamber consists of a series of square-pattern spray nozzles arranged such that the cases are cooled quickly and uniformly. The blow-off chamber uses a series of wide-angle, flat-pattern air nozzles providing compressed air to dry the cases. All the nozzles are mounted in manifolds with a flexible connector so that they may be repositioned easily to accommodate the various annealing operations.

7.1.6 Transport System

Two 40-foot sections of nickel plated chain are used. The first chain has stainless steel pins on which the second draw parts are placed for the interdraw anneal operation. The second chain has beryllium copper clips which engage the extractor groove and is used for the body anneal, stress relief, and neck and mouth anneal operations. In both cases, part spacing is 0.75 inch and chain speed is 15 inches per second.

7.1.7 Accumulator Water System

An accumulator tank and a recirculating water system was incorporated to maintain constant cooling water temperature and pressure. The water from the inverter, heat station and coil is recirculated, but the water from the quench, which may wash off dirt, oxides or metal particles from the cases, is dumped into the drain to avoid contaminating or raising the conductivity of the recirculating water.

7.1.8 Principle of Operation

Although the tests were run on an intermittent basis, the characteristics of a continuous system were properly simulated. This was achieved by sandwiching the test pieces between quantities of non-test pieces. The purpose of the latter was to achieve coil load stability before the first test piece entered the coil, and maintain it until the last test piece exited.
With the 0.75 inch spacing and 15 inches per second chain speed, the simulated production rate was 1200 parts per minute.
7.2 Induction Coils

There are four coils used for the induction heat treating operations. These are:

1. interdraw anneal coil
2. body anneal coil
3. stress relief coil
4. neck and mouth anneal coil

Each coil is a channel configuration with multiple turns (except for the single-turn neck and mouth coil). In this manner, each turn only heats a portion of the case so that reliance on conduction and the effects of ambient conditions are minimized, while efficiency is improved.

Each unit has positive and independent adjustment of the vertical and horizontal position of each turn to provide more predictable and repeatable results. The relatively short coil lengths also make it easier to adjust and align the assembly. The coils are mounted in box-type frames to provide a structure having rigidity together with visibility and accessibility. The top of this box assembly houses the chain guide as an integral part of the structure to ensure case-to-coil position accuracy.

Each coil is mounted on a wooden spacer to facilitate simple removal and installation. Each spacer is mounted on an adjustable L-se plate to permit proper alignment of the coil assembly with the chain.

A list of coil drawings and a reduced copy of each assembly drawing is contained in Attachment 2.

7.2.1 Interdraw Anneal Coil

The interdraw anneal coil is two turns, 72 inches long and has iron lamination flux concentrators on the top turn. The entire top turn is utilized to heat the 1/4 inch point since the mass of metal in the base acts as a heat sink. The iron laminations direct and concentrate the lines of flux into this area. The bottom turn is slanted slightly to heat the rest of the case. The material for the case guide is a silicone/glass laminate that is nonconductive, withstands high temperatures, and has fairly good wear properties.
7.2.2 **Body Anneal Coil**

The body anneal coil is three turns and is 36 inches long. As with the interdraw anneal coil, the top turn is used solely to heat the 1/4 inch point, with the other two turns heating the rest of the case.

7.2.3 **Stress Relief Coil**

The stress relief coil is four turns and is 18 inches long. During the stress relief operation, the cases are heated to about 600°F to remove any residual stresses.

7.2.4 **Neck and Mouth Anneal Coil**

The neck and mouth anneal coil is a single turn and is 18 inches long. This coil is used to anneal only the 1-7/8 inch point, whose hardness was raised significantly in the tapering operation. The neck and mouth anneal also imparts the iris on the mouth of the case. A typical coil assembly is shown in Figure 8.
7.3 Final Configuration

As with the tooling, the anneal development was an iterative process carried out until the desired characteristics were achieved. The final coil settings are included on the appropriate assembly drawing. It should be noted that the settings should be used only as a guide. Other adjustments may be used depending on ambient conditions, water cooling effectiveness and changes in workpiece characteristics caused by tool wear.

Hardness readings were taken on a Wilson Tukon Hardness Tester and grain structures were observed using a Bausch and Lomb metallograph.

7.3.1 Interdraw Anneal

The objective of this development was to satisfy the specified grain structure on the final case. The specification is comparative in nature, with the actual grain size having to fall between a minimum and a maximum (as defined by reference photomicrographs) at each location.

It was found that no discernible grain distortion occurred in final draw or subsequent operations.

The only unexpected factor was that the required power output was 216 KW. This was 108% of the induction unit rating of 200 KW which was originally estimated to be adequate. Such a condition would be undesirable on a long term basis. However, the unit is basically a 250 KW model de-rated and could easily be upgraded to its normal rating.

7.3.2 Body Anneal

Consistent with previous experience, fulfillment of hardness gradient specifications was a time consuming process.

Power required was 112 KW.

7.3.3 Stress Relief

This operation is such that coil and power settings are not critical.
7.3.4 Neck and Mouth Anneal

The main problem encountered here was in maintaining an even and consistent iris. It is believed that the major cause was inconsistency of cleaning prior to the anneal and that this condition would not apply in a properly functioning production process.

Power required was 98 KW.

Recommended hardness profiles following the various anneals are shown with the in-process data of Section 8.

Note that these profiles are advisory only.
7.4 Void Test

Five tests were performed to evaluate the effects of voids (missing cases) on the ability of the annealing system to correctly heat treat the 7.62 mm cases. The five tests were performed in compliance with contract DAAK10-78-C-0165 modification P00001, and are repeated here for the convenience of the reader:

A. All twenty-four stations filled. Hardness data to be used as base line for Test B and D.

B. Four voids spaced evenly throughout the twenty-four station positions on the chain. Anneal power to be adjusted to the base line hardness data established in Test Condition A.

C. Four consecutive voids in the twenty-four station positions on the chain. Anneal coil power setting to be the same as used in Test Condition B.

D. Six voids evenly spaced throughout the twenty-four station positions on the chain. Anneal coil power to be adjusted to the base line hardness data established in Test Condition A.

E. Six consecutive voids out of the twenty-four station positions on the chain. The anneal coil power settings to be the same as used in Test Condition D.

Each test was run five times and six samples were taken from each test. The 1/2 and 1-1/2 inch points were checked for hardness on each of the 150 test pieces. To obtain results that reflected the worst possible condition, the samples were taken from the positions immediately adjacent to the voids. For example, in test (C), three groupings of 24 cases were run with a void of four missing cases in the middle of each group. Therefore, if each set was numbered 1 to 24, the cases in the position of 11 to 14 were removed to act as the void, and the cases in the positions of 10 and 15 were removed from each group as the test samples.

The results are summarized in Attachment 7, with the hardnesses given for each test being the average of 30 cases.
Because of the large number of samples and the time consuming nature of reading hardness, measurements were limited to the $\frac{1}{2}$ inch and 1-1/2 inch locations.

By comparing tests A, B and D, it is seen that the evenly spaced voids can be stabilized at the correct hardness by power adjustment to well within experimental scatter.

On the other hand, comparing C with B, it is seen that the A consecutive void arrangement produces a severe drop in hardness at the $\frac{1}{2}$ inch location of about 26 DPH, and very little change at the 1-1/2 inch location.

As may be expected, the condition is worse with 6 consecutive voids (comparing E with D), which produces a hardness drop of about 40 DPH at the $\frac{1}{2}$ inch location and a slight drop at the 1-1/2 inch location.
8. **IN-PROCESS PART DEFINITIONS**

As mentioned in section 6, the program began with tentative in-process specifications. As with the tooling, minor changes were made as the process development progressed. The final recommended definitions not covered by the L.C.A.A.P. in-process or final case dimensions are included as Attachment 3.

Also included for reference are copies of the cup drawing 10522459 and the case drawing 10521997.
9. FINISHED PART INSPECTION
A small random sample from the same batch as the 1,000 parts supplied to ARRADCOM was inspected for compliance to the required specifications.

9.1 Dimensional
Measurements are made on the in-process parts and on the finished cases. The resulting data is included in Attachment 4.

9.2 Metallurgical
Measurements of external surface hardness and internal head hardness, together with typical microphotographs of grain structure are included as Attachment 5.
10. TEST FIRINGS

A small sample from test series C was submitted to H.P. White Laboratory Inc. for test firing. They were loaded to M80 high pressure test specifications and fired in a pressure barrel. No deficiencies were noted in the subsequent inspection.

The test report is included as Attachment 6.
11. SCAMP EQUIPMENT CHANGES

11.1 Tooling

SCAMP tool modules were used throughout. Relative to 5.56 mm production, the additional draw operation was accomplished by using a standard first draw module and equipping it with second draw tooling; the pre-pocket tooling was installed in a standard header module.

The only change made in the tool module area related to non-metalworking components involved draw punch alignment. Test series A and B had shown some difficulty in maintaining wall thickness variation tolerance of the final draw part. Investigation showed this to be caused by punch-to-die misalignment. This, in turn, resulted from the restricted length of the punch shank-to-gland-to holder engagement and the clearances involved, which induced the misalignment when the retaining nut was tightened.

This condition was corrected by installing a re-designed sleeve which maximized engagement length. This modification is shown in Figure 9.

It may be noted that the sensitivity to misalignment is not present in the existing G+V 7.62 mm two-draw process which uses a cup with greater height: diameter ratio.

11.2 Basic Equipment

Relative to the 5.56 mm SCAMP case sub-modules operating at L.C.A.A.P., additions to the basic equipment would be provisionally as follows:

1. Draw press to perform the additional draw operation.
2. Additional drive motor and control system.
3. Interdraw anneal station consisting of 250 kw power unit, heat station, coil assembly, wash station, quench and blow-off stations, plus entry and exit re-spacers.
4. Header press to perform the pre-pocket operation.
5. Two transfer turrets to correct the pass-line changes introduced at the additional draw and pre-pocket presses.
5/16 X 24 U.N.F.
2 PLACES

+ .0002

.5620

A

32

1.2505 - .0003

0A .0004

32

.44 ± .01

± .005

2.500

MATERIAL
PRE-HEAT TREATED
4130 Rc28 - 32 or Equivalent

FIGURE 9 DRAW PUNCH SLEEVE
11.3 **Layout**

A possible equipment layout is shown schematically in Figure 10. In practical terms, location of the two additional presses could be most effectively provided for by excavation of the existing pit. The pit does have one "spare" station, so that excavation would be limited to extension by one station upstream.

The details of the sub-module changes, such as drive re-arrangement, provision of transport system supports and utilities are properly the subject of a study beyond the scope of this contract.
### Key

1. Cup Feeder
2. Initial Draw Press
4. Final Draw Press
5. Pre-Pocket Press
6. Header Press
7. Head-Turn Press
8. Pierce Press
10. Second Taper Press
11. Trim Press
12. Eject-Transfer Turret
13. Eject-Transfer Turret
14. Eject-Transfer Turret
15. Eject-Transfer Turret
16. Eject-Transfer Turret
17. Eject-Transfer Turret
18. Eject-Transfer Turret
19. Drive Motor
20. Drive Motor
21. Drive Motor
22. Re-Spacer
23. Re-Spacer
24. Re-Spacer
25. Re-Spacer
26. Re-Spacer
27. Interdraw Anneal Station
28. Body Anneal Station
29. Stress Relief Anneal, Neck & Mouth Anneal, & Clean Station

**FIGURE 10  EQUIPMENT LAYOUT SCHEMATIC**

(Continued)
12. **CONCLUSIONS**

The program has demonstrated the feasibility of producing 7.62 mm M80 cartridge cases to U.S. N.A.T.O. specifications on a SCAMP sub-module at 1200 parts per minute.

All final case dimensional and metallurgical specifications can be fulfilled without exception.

A critical factor in the process was the successful development of induction heating to stimulate re-crystallization and grain growth with a continuous work-piece flow in less than 5 seconds.

All tools are compatible with existing tool modules and sub-module presses and their fabrication requires only normal techniques.

Because of the stipulated use of the standard U.S. cup and incorporation of a pre-pocket operation, two additional presses are required and excavation of the pit will be necessary.

Logically, this program should be followed by a design study which would be aimed at developing a realistic layout of the converted sub-module.
ATTACHMENT 1  TOOL DRAWINGS
## First Draw
- Punch: 11831357
- Bottom Die: 11831578
- Middle Die: 11831579
- Top Die: 11831360
- Stripper: 11831361
- Retainer: 11831362

## Second Draw
- Punch: 11831364
- Bottom Die: 11831365
- Middle Die: 11831366
- Top Die: 11831367
- Stripper: 11831368
- Retainer: 11831369

## Third Draw
- Punch: 11831371
- Bottom Die: 11831372
- Middle Die: 11831373
- Top Die: 11831374
- Stripper: 11831375
- Stripper: 11831376
- Retainer: 11831377
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<td>Stem</td>
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<td>Stripper</td>
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### First Taper
- **Body Die**: 11831400
- **Shoulder Die**: 11831401
- **Mandrel**: 11831402

### Second Taper
- **Body Die**: 11831403
- **Shoulder Die**: 11831404
- **Mandrel**: 11831405

### First/Second Taper
- **Mandrel Seat**: 11831406
- **Sleeve**: 11831407
NOTES:
1. SPEC MIL-A-2550 APPLIES.
2. FINISH OVER THIS LENGTH.
   DIAMETERS OVER THIS LENGTH
   OTHER DIAMETERS
4. HEAT TREAT RC 58-60.
NOTES:
1. SPEC. MIL-A-2550 APPLIES
2. INSERT TO BE .006 TO .008 SHRINK FIT IN HOLDER AND FLUSH WITH HOLDER
3. FINISH .02 UNLESS NOTED

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<td>7.62 MM CARTRIDGE CASE</td>
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<td>HOLDER</td>
<td>AISI-77556 TOOL STL.</td>
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MECHANICAL PROPERTIES

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DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES .006 (.004) FOR DECIMALS, .008 (.006) FOR FRACTIONS, .006 ANGLES ± .015

ORIG. DATE OF DRAWING: 79-4-6

U. S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

C-19200  T. 11831358
1. MIL-A-2350 APPLIES
2. INSERT TO BE .006 to .008 SHRINK FIT IN HOLDER AND FLUSH WITH HOLDER
3. FINISH #7 UNLESS NOTED

**PARTS LIST**

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<td>MIDDLE DIE</td>
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**NOTES**

- 1/8 WIDE X 1/8 DEEP GROOVE 4 PLACES
- 1/6 X 65° (TYP)
- SEE NOTE 2
NOTES:
1. SPEC MIL-A-2550 APPLIES.
2. FINISH 3V UNLESS NOTED.
3. INSERT TO BE .006 TO .003 SHRINK FIT IN HOLDER AND FLUSH WITH HOLDER.

\[ \text{1/8 WIDE \times 1/4 DEEP} \]
\[ \text{GROOVE IN PLACES} \]

\[ \frac{1}{16} \times 45^\circ (\text{TYP}) \]

SEE NOTE 3

\[ \text{PART NO. 11831360} \]

\[ \text{PARTS LIST} \]

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<td>HOLDER</td>
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\[ \text{MECHANICAL PROPERTIES:} \]

- UNLESS OTHERWISE SPECIFIED, TOLERANCES ARE IN INCHES.
- FRACTIONS \( \leq \frac{1}{4} \) ANGLES \( \leq 1^\circ \).

\[ \text{PART NO. 11831360} \]

\[ \text{TOP DIE FIRST DRAW} \]

\[ \text{7.62 MM CARTRIDGE CASE} \]
NOTES:
- SPEC MIL-A-2550 APPLIES
- DIAMETER DM'S APPLY BEFORE PART
- CUT INTO SEGMENTS.
- 3/16 EXCEPT AS NOTED.
- ROCKWELL HARDNESS 60-65
- MATERIAL- TOOL STEEL AISI - 01

SHARP CORNER

SECTION 'A-A'

PART NO. 11831361

762 CARTRIDGE CASE
STRIPPER SEGMENT
FIRST DRAW

MECHANICAL PROPERTIES

DO NOT SCALE DRAWING

ORIGINAL DATE OF DRAWING

79-4-9

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801
NOTE 3:
1. SPEC MIL - A - 2550 APPLIES
2. FINISH - CADIUM PLATE
3. MACHINE FINISH UNLESS OTHERWISE NOTED
4. HEAT TREAT RC 35 - 38
5. DIMENSIONS ARE AFTER PLATING
6. MATERIAL AISI 4140
7. BREAK ALL SHARP EDGES

DRILL 1/4 DIA. THRU (4) HOLES EQ. SP ON 1.250 P.C.D.

1/8-16 UN-2A

PD(A.002 TIR

1/16 X 45° (TYR)

1/8 WIDE X 1/16 DEEP GROOVE 4 PLACES

PART NO. 11831362

7.62 MM CARTRIDGE CASE DIE RETAINER GUIDE FIRST DRAW

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVES, NEW JERSEY 07801
NOTES:
1. SPEC.MIL-A- 2550 APPLIES.
2. √ FINISH OVER THIS LENGTH.
   DIAMETERS OVER THIS LENGTH
   QIA1.001
   OTHER DIAMETERS QIA1.004.
3. MATERIAL SPEC - TOOL STEEL AISI A-2.
4. HEAT TREAT - RC 58-60.

DETAIL "A"
SCALE 4/1

PART NO. 11831364

7.62 MM CARTRIDGE CASE
PUNCH
SECOND DRAW
NOTES:
1. SPEC. MIL-A-2550 APPLIES
2. INSERT TO BE .006 TO .008 SHRINK FIT IN HOLDER AND FLUSH WITH HOLDER
3. FINISH B2 UNLESS NOTED

PARTS LIST

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PART NO. 11831365

7.62 MM CARTRIDGE CASE BOTTOM DIE SECOND DRAW

MECHANICAL PROPERTIES

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DO NOT SCALE DRAWING 79-4-9

ORIGINAL DATE OF DRAWING 19-4-9

DRAFSTMAN CHECKER

ENGINEER ENGR

ENGINEER ENGR

APPLICATION

-0.005 .005

-0.005 .005
NOTES:
1. SPEC. MIL-A-2550 APPLIES.
2. INSERT TO BE .006 TO .008 SHRINK FIT IN HOLDER AND FLUSH WITH HOLDER.
3. FINISH 32' UNLESS NOTED.

1/8" WIDE x 1/16 DEEP GROOVE 4 PLACES

1/16 x 45° (TYP)

SEE NOTE 2

.060

.0005 .0002

.520 .500 ± .002

1/16 DIA.
1.675 DIA.

| PART NO. | 11831366
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PARTS LIST

3 1 11831366-1 INSERT C-10 CARBIDE
2 1 11831366-2 HOLDER W5C41K455 TOOL 5"-
1 1 11831366-1 MIDDLE DIE

- PART NO. 11831366
- 7.62 MM CARTRIDGE CASE
- MIDDLE DIE
- SECOND FORM
- U.S. ARMY AMMUNITION RESEARCH AND DEVELOPMENT COMMAND
- DOVER, NEW JERSEY 07801

- MECHANICAL PROPERTIES
- DO NOT SCALE DRAWING UNLESS OTHERWISE SPECIFIED
- DIMENSIONS ARE IN INCHES
- TOLERANCES ON DIAMETERS ± .001
- TOLERANCES ON LENGTHS ± .005
- FINISH .632 MACHINES ± .001

- MATERIAL:
- GRAIN: 1/4
- CHECKER: 1/4
- LHR: 1/4
NOTES:
1. SPEC. MIL-A-2550 APPLIES
2. INSERT TO BE .006 TO .008 SHRINK FIT IN HOLDER AND FLUSH WITH HOLDER
3. FINISH 3/16 UNLESS NOTED

PART NO. 11831367

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<td>11831367-2</td>
<td>HOLDER</td>
<td>TOOL STL.</td>
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<td>11831367-1</td>
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TOLERANCES ON DIMENSIONS:

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<td>+.001</td>
<td>+.002</td>
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<tr>
<td>.005</td>
<td>+.001</td>
<td>+.002</td>
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</table>

DRAFTSMAN: JO CHK: X: 7.62 MM CARTRIDGE CASE | TOP DIE |

SEPT 79-4-9 DOVER, NEW JERSEY 07801

7.62 MM CARTRIDGE CASE TOP DIE SECOND DRAW
NOTES:
1. SPEC MIL-A-2550 APPLIES
2. FINISH: CADMIUM PLATE
3. G3/MACHINE FINISH UNLESS OTHERWISE NOTED.
4. HEAT TREAT RC 35-38
5. DIMENSIONS ARE AFTER PLATING.
6. MATERIAL: AISI 4140
7. BREAK ALL SHARP EDGES.

DRILL 1/4 DIA. THRU (4) HOLES EQ SP ON 1.250 P.C.D.

PART NO. 11831369
7.62 MM CARTRIDGE CASE
DIE RETAINER GUIDE
SECOND DRAW

MECHANICAL PROPERTIES

DO NOT SCALE DRAWING UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS = .004
FRACTIONS = 1/16 ANGLES = 1/2 °

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

79-4-2

DRAFSTMAN
CHECKER
ENG
ENG

SIZE CODE IDENT NO
B: 19200 T 11831369

SCALE FULL APPLICATION
**NOTES:**
1. SPEC MIL-A-2550 APPLIES.
2. FLASH CHROME PLATE WORKING END OF PUNCH.
3. STRESS RELIEVE FOR HYDROGEN EMBRITTLEMENT.
   ALL DIMENSIONS APPLY AFTER CHROME PLATING.
4. FINISH OVER THIS LENGTH. DIAMETERS OVER THIS LENGTH [DIAL.001].
   ALL OTHER DIAMETERS [DIAL.002].
5. HEAT TREAT:
   ROCKWELL C 58-60
   DRAW BACK SHANK AREA TO RC 50-55.

**DETAIL A**

**SCALE 4:1**

**PART NO. 11831371**

**7.62 MM CARTRIDGE CASE PUNCH FINAL DRAW**
1. S.C. MIL-A-2350 APPLIES
2. INSERT TO BE .006 TO .008 SHRINK FIT IN HOLDER AND FLUSH WITH HOLDER
3. FINISH #8 UNLESS NOTED

**DIAGRAM**

- **WIDE:** 1/4 DEEP
- **GROOVE 4 PLACES**
- **1/16 x 45° (TYP)**
- **SEE NOTE 2**

**PARTS LIST**

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<td>HOLDER</td>
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**PART NO. 11831372**

- **7.62 M.M. CARTRIDGE CASE**
- **BOTTOM DIE**
- **FINAL DRAW**

**MECHANICAL PROPERTIES**

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**ORIGINAL DATE OF DRAWING**

79-4-7

**U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**

DOVER, NEW JERSEY 07821

**REVISIONS**

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**SCALE:** 1:1

**UNIT:** M1

**SHEET:** 1
NOTES:
1. SPEC. MIL-A-2550 APPUES
2. INSERT TO BE .006 TO .008 SHRINK FIT
   IN HOLDER AND FLUSH WITH HOLDER
3. FINISH %Y UNLESS NOTED

1/8 WIDE A 1/2 DEEP
4 PLACES

1/8 X 45° (TYP)
SEE NOTE 2

1/8 X 45° (TYP)
SEE NOTE 2

PARTS LIST

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<td>2: 1 11831373-2 HOLDER AISI 455 TOOL STEEL</td>
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APPLICATION

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07821

7.62 MM CARTRIDGE CASE
MIDDLE DIE
FINISH DRAF

S/N: 19200 7 11831373
NOTES:
1. SPEC. MIL-A-2550 APPLIES
2. INSERT TO BE .006 TO .005 SHRINK FIT IN HOLDER AND FLUSH WITH HOLDER
3. FINISH BY UNLESS NOTED

PART NO. 11831374
PART 5 MM CARTRIDGE CASE TOP DIE

PARTS LIST

ITEM NO. REQ. CODE IDENT. NO. PART NO. DESCRIPTION SPECIFICATION MATERIAL

8 1 11831374-3 INSERT C-10 CARBIDE
2 1 11831374-2 HOLDER ASS-61256 TOOL STL.
1 1 11831374-1 TOP DIE

MECHANICAL PROPERTIES

DO NOT SCALE DRAWING UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON DECIMALS ±.004
FRACTIONS ± 1/16 ANGLES ± 5°
NOTES:
1. SPEC. MIL-A-2550 APPLIES.
2. FINISH-Cadmium Plate
3. G/C MACHINE FINISH UNLESS OTHERWISE NOTED.
4. HEAT TREAT RC 35-38.
5. DIMENSIONS ARE AFTER PLATING.
6. MATERIAL: AISI 4140.
7. BREAK ALL SHARP EDGES.

DRILL 1/2 DIA. THRU (4) HOLES EQ. SR.
ON 1.250 P.C.D.

1/8 -16 UN-2A

PRO. A.002 TIR

1/8 R.

1/16 X 45° (TYP)

.50

1/8 WIDE X 1/16 DEEP GROOVE
4 PLACES

PART NO. 11831377

7.62 MM CARTRIDGE CASE
DIE RETAINER GUIDE
FINAL DRAW

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

DRAFTSMAN
CHECKER
ENG.
ENG.
ENG.
ENG.

79-4-2
79-4-5

TOLERANCES ON DECIMALS = .004
FRACTIONS = 1/64, ANGLES = 1/60

MECHANICAL
PROPERTIES

DO NOT SCALE DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

APPLICATION

NEXT ASSY

USED ON

RH
SPEC MIL-A-2550 APPLIES.
FINISH ALL SURFACES UNLESS OTHERWISE NOTED
MATERIAL: TOOL STEEL 4151-02
HARDEN AND DRAW RC 57-60.
1. SPEC MIL-A-2550 APPLIES.
2. HEAT TREAT - AIR COOL FROM 1625°F, DOUBLE DRAW TO 1100°F, 3±3 HRS TO RC 50-52.
3. 3/8" FINISH UNLESS NOTED.

SECTION A-A

<table>
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<td>H-11 OR H-13 TOOL STEEL</td>
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<td>11831380-1 POCKET &amp; HEAD DIE</td>
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**PARTS LIST**

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<td>H-11 OR H-13 TOOL STEEL</td>
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<td>H-11 OR H-13 TOOL STEEL</td>
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**MECHANICAL PROPERTIES**

- DO NOT SCALE DRAWING UNLESS OTHERWISE SPECIFIED
- DIMENSIONS ARE IN INCHES
- TOLERANCES ON DEGREES ± 1/4
- FRACTIONS 1/32 ANGLES ± 1°
- DRAFTSMAN: [CHECKER]
- ORIGINAL DATE OF DRAWING: 79-4-24
- [U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND]
- DOVER, NEW JERSEY 07602

**7.62 MM CARTRIDGE CASE POCKET & HEAD DIE**

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<td>11831380</td>
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NOTES:
1. SPEC. MIL.A-2550 APPLIES.
2. PUNCHES MADE BY EDM MUST BE
   RELIEVED AT 350° FOR 3 HOURS.
3. FINISH - EXCEPT WHERE NOTED.
4. MATERIAL: AISI M-2 RC60-63
NOTES:
1. SPEC MIL-A-2550 APPLIES.
2. MATERIAL: STEEL 4340.
3. HEAT TREAT TO RC 38-42.

SECTION A-A

- 62 DIA. TO CORNER BEFORE RIV.
- .53 DIA. (SHARP CORNER)
- 32 x 45° TYP.
- 32 R.
- 2-3/8 UN-2A
- .005

MECHANICAL PROPERTIES

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES

TOLERANCES ON DECIMALS = .004
FRACTIONS = 3/32, ANGLES = 1/8

7.62 MM CARTRIDGE CASE
POCKET & HEAD
DIE RETAINER NUT

PART NO. 11831382
NOTES:
1. SPEC MIL-A-2550 APPLIES.
2. FINISH 37/4 ALL SURFACES UNLESS OTHERWISE NOTED.
3. HARDEN & DRAW ITEMS 2 & 3 TO RC 57-60 PRIOR TO ASSEMBLY & FINAL GRINDING.
4. ITEM 2 TO BE SHRINK FITTED INTO ITEM 3.
5. SINTERCAST DIV. OF CHROMOCOR, OR EQUAL AMERICAN CORP, 169 WESTERN HWY, WEST NYACK, N.Y.

ITEM 2: +.0005 DIA.
ITEM 3: +.0005 DIA.

SEE ENLARGED VIEW A

PARTS LIST

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
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<tr>
<td>1</td>
<td>STEM ASSEMBLY</td>
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NOTES:
1. SPEC MIL-A-2550 APPLIES.
2. PUNCHES MADE BY EDM MUST BE RELIEVED AT 350° FOR 3 HRS.
3. MATERIAL TO BE AISI M-2, RC 60-63.
4. \( \frac{32}{32} \) FINISH UNLESS NOTED.

**Mechanical Properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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<tbody>
<tr>
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<tr>
<td>TOL</td>
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<td>L12</td>
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<tr>
<td>FA</td>
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<tr>
<td>BH</td>
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**Tolerances**

- TOLERANCES ON DECELERALS
- FRACTIONS \( \pm \frac{1}{64} \) ANGLES \( \pm 2^\circ \)

**Drawing Information**

- PART NO: 11831385
- ORIGINAL DATE OF DRAWING: 79-4-26
- DRAFSTMAN: [Name]
- CHECKER: [Name]

**Dimensions**

- \( 0.15 \pm 0.005 \)
- \( 0.002 \)
- \( 0.002 \)
- \( 0.0002 \)
- \( 0.002 \)
- \( 0.0002 \)
- \( 0.005 \)
- \( 0.0002 \)
- \( 0.051 \)
- \( 0.002 \)
- \( 0.145 \)
- \( 0.202 \)

**Notes**

- TAPER ON NIB, NOT TO EXCEED 0.001. FRONT SHALL BE SMALL DIA.
- 1.058 REF.
- 1.188 -0.001
- .130 -0.001 @ 0.450 DTM DIA.
- 0.15 \( \pm \) 0.002

**Section A-A**

- 30°
- 72°

**Section B-B**

- 60°

**7.62MM CARTRIDGE CASE HEADER BUNTER**
NOTES:
1. SPEC. MIL-A-2550 APPLIES.
2. Surface Finish Unless Otherwise Noted
3. MATERIAL: AISI M-2, TOOL STEEL RC 60-63

ENLARGED VIEW OF PROFILE
\[\text{\(\pm\)} \text{0.005} \text{ R. MAX.}\]

PART NO. 11631471
7.62 MM CARTRIDGE CASE FORMING TOOL HEAD TURN

**MECHANICAL PROPERTIES**

- **Yielding Point (YP)**
- **Tensile Strength (TS)**
- **Elongation (EL2)**
- **Reduction of Area (RA)**
- **Impact (BH)**
- **Application (RH)**

**DO NOT SCALE DRAWING**

- UNLESS OTHERWISE SPECIFIED
- Dimensions are in inches

**Tolerances on Decimals**

- Decimal = 0.005
- Fractional = \(\frac{1}{8}\)
- Angles = \(\pm\frac{1}{2}\)°

**Original Date of Drawing**

- 60-12-10

**U.S. Army Armament Research and Development Command**

- Dover, New Jersey 07801

**Draftsman:**

- ACH

**Checker:**

- 0-12-12

**Engravers:**

- ENGR

**Size Code Identifier:**

- B 19200 T 11831388

**Scale:**

- 4:1

**Unit Weight:**

- Sheet
NOTE:
1. SPEC MIL-A-2550 APPLIES.
2. R/F FINISH UNLESS NOTED.
3. CADMIUM PLATE, MIL 1000 SPEC.
4. MATERIAL: STEEL A151 4130
RC 34-38.

---

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<thead>
<tr>
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| 7.62MM CARTRIDGE CASE |
| STRIPPER BLOCK |
| HEAD TURN |

---

SECTION A-A

---

[Diagram with dimensions and notes]
NOTES:
1. SPEC. MIL-A-2550 APPLIES.
2. \( \sqrt[2]{} \) FINISH UNLESS NOTED.
3. MATERIAL, TOOL STEEL AISI 01 RC 55-58

NOTES:

- \( \frac{3}{8} \) DIA.
- TOLERANCES ON DECIMALS = \( \pm 0.01 \)  \( \pm 0.02 \)
- FRACTIONS = \( \pm \frac{1}{64} \)  \( \pm \frac{1}{2} \)

PART NO. 11831474

7.62MM CARTRIDGE CASE
HEAD TURN ROLLER PIN

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NOTES:
1. SPEC. MIL-A-2550 APPLIES.
2. +3/4 FINISH ALL OVER.
3. MATERIAL: TOOL STEEL AISI S2, RC 52-56.

PART NO. 11831475
7.62MM CARTRIDGE CASE PLUG
HEAD TURN

DOE, NEW JERSEY 07801

70-12-11

DRAFTSMEN: TITLE
CHECKER: CODE: ENG
ENG

TOLERANCES ON DECIMALS = .010 \pm .004
FRACTIONS = \( \frac{1}{64} \) ANGLES = \( \frac{1}{2} \)°

SCALE 4:1 UNIT WGT SHEET
### Notes:
1. SPEC. MIL A-2550 APPLIES.
2. <1/16 FINISH ALL OVER.
3. CADMIUM PLATE, MIL. 1000 SPEC.
4. MATERIAL: STEEL AISI 4340
   RC 48-52

---

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NOTES:
1. SPEC. MIL-A-2550 APPLIES.
2. ASSEMBLE GROUND DRILL BUSHING & NEEDLE BEARING AS SHOWN WITH PILOT END OF BUSHING AT RETAINING RING OF ROLLER PIN.
3. POLISH O.D. OF DRILL BUSHING & BREAK SHARP CORNER 
5. ORDER FROM: MASTERCARR SUPPLY CO., PO. BOX 4355, CHICAGO, ILL. 60680.
7. ORDER FROM: WALDES-KOHINOOR, INC. 47-16 AUSTEL PLACE, LONG ISLAND CITY, N.Y. 11101.

BUSHING PILOT

PARTS LIST

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<td>SLIDE GUIDE HOLDER</td>
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<td>6</td>
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<td>11831472</td>
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<tr>
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<td>DRILL BUSHING - D-40.5%60% x 2%12% X%6%</td>
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<tr>
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<td>NEEDLE BEARING - B44</td>
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<td>NYLON WASHER # 95606A11 280%12%11%</td>
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<td>GUIDE ROLLER ASSY.</td>
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SEE SEPARATE PARTS LIST 11831472

PART NO. 11831472

7.62MM CARTRIDGE CASE GUIDE ROLLER ASSEMBLY HEAD TURN

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND DOVER, NEW JERSEY 07801

SCALE 2:1

SHEET
NOTES:
1. SPEC: MIL-A-2550 APPLIES
2. MATERIAL: STEEL AISI 4130
3. HEAT TREAT TO RC 54-38
LEAVE SHARP REMOVE BURR

.4520 ±.0005 DIA.

1.0602 ±.0002 DIA

.010 R MAX

.010 TYP

.015 x 45°

TAPER .013/INCH ON DIA (REF)

NOTES:
1. SPEC: MIL-A-2550 APPLIES
2. MATERIAL: STEEL 4130
3. CARBIDE C-10, INSERT TO BE .002 -.004 SHRINK FIT IN HOLDER AND TO BE FLUSH WITH HOLDER
4. HEAT TREAT TO RC 35-45
5. FINISH .5/ALL OVER UNLESS OTHERWISE NOTED

SECTION AA

2

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<td>CARBIDE INSERT</td>
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<td>HOLDER</td>
<td>1N6350 + 1/16 L8G</td>
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PART NO. 11831400

BODY DIE
FIRST TAPER

MECHANICAL PROPERTIES

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U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07951

SIZE CODE IDENT NO. 11831400
NOTES:
1. SPEC: MIL-A-2550 APPLIES
2. MATERIAL: STEEL 4130
3. CARBIDE C-10 INSERT TO BE .002 TO .004
   SHRINK FIT IN HOLDER AND TO BE FLUSH
   WITH HOLDER.
4. HEAT TREAT TO RC 35-45
5. FINISH 32/ALL OVER UNLESS OTHERWISE NOTED

SECTION A-A

PARTS LIST

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<td>CARBIDE INSERT</td>
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<td>HOLDER</td>
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MECHANICAL PROPERTIES

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TOLERANCES ON DECADES = .004
FRACTIONS = 1/64 ANGLES = 1/2°

SHOULDER DIE
FIRST TAPER

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07851

DIA. SEE NOTE 3

.06 TYP

.010 + .010 R

-625

.6530 + .0005 DIA

3.68 + .0005 DIA

20° ± 0° - 5°

5° TYP

16 X 45°

11/16

.602 - .002 DIA

1.0602 ± .002 DIA

1.16005 TIR.

1.16005 TIR.

11/16 TIR.

3.680 + .0005 DIA

DIA. SEE NOTE 3
NOTES:
1. SPEC: MIL-A-2550 APPLIES
2. MATERIAL TOOL STEEL AISI-02
3. HEAT TREAT TO RC 55-60
4. FINISH .43/ALL OVER UNLESS OTHERWISE SPECIFIED

SECTION A-A
NOTES:
1. SPEC: MIL-A-2550 APPLIES
2. MATERIAL - STEEL 4130
3. CARBIDE, C-10, INSERT TO BE .002-.004 SHRINK FIT IN HOLDER AND TO BE FLUSH WITH HOLDER
4. HEAT TREAT TO RC 55-58
5. FINISH .32/ ALL OVER UNLESS OTHERWISE NOTED
NOTES:
1. SPEC: MIL-A-2550 APPLIES
2. MATERIAL: STEEL 4130
3. CARBIDE C-10, INSERT TO BE .002 TO .004
   SHRINK, FIT IN HOLDER AND TO BE FLUSH WITH
   HOLDER.
4. HEAT TREAT TO RC 35-45
5. FINISH .25 ALL OVER UNLESS OTHERWISE NOTED

SECTION AA

PARTS LIST

PART NO. 11831404

MECHANICAL PROPERTIES

DO NOT SCALE DRAWING

TOLERANCES ON DECIMALS = .004

FRACTIONS = 1/4 ANGLES = 1/2

SPECIFICATIONS: MATERIAL

ORIGINAL DATE OF DRAWING

79-8-8

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

DOVER, NEW JERSEY 07834

SHOULDER DIE
SECOND TAPER

DRAWN
CHECKED
APPROVED

C 19200
T 1.83 .04
NOTES:
1. SPEC: MIL-A-2550 APPLIES
2. MATERIAL TOOL STEEL AISI 10
3. HEAT TREAT TO RC 55-60
4. FINISH 63/ALL OVER UNLESS OTHERWISE NOTED

SECTION A-A
NOTES:
1. SPEC MIL-A-2550 APPLIES
2. MATERIAL STEEL AISI 4130
3. HEAT TREAT TO RC 35-40
4. FINISH 32/ALL OVER UNLESS OTHERWISE NOTED

SECTION A-A

PART NO. 11831406

MANDREL SEAT
FIRST & SECOND TAPER

MECHANICAL
PROPERTIES

DO NOT SCALE DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

TOLERANCES ON DECIMALS = .004
FRACTIONS = 1/64 ANGLES = 1/2°

DRAFTSMAN: MBE
CHECKER: ENGR

sizes: CODE IDENT NO.
B 19200 T 11831406

SCALE: 2:1 UNIT WT: .26 SHEET
.6247 -.0002 DIA.
.1884 +.0005 DIA.

[Dimensions and notes on drawing]

NOTES:
1. SPEC: MIL-A-2550 APPLIES
2. MATERIAL STEEL AISI 4130
3. HEAT TREAT TO RC 35-40
4. FINISH 63 ALL OVER UNLESS OTHERWISE SPECIFIED

SECTION A-A

PART NO. 11831407
SLEEVE
FIRST & SECOND TAPER

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

SIZE CODE IDENT NO. B 19200 T 11831407

SCALE 2:1 UNIT WT. .25 SHEET
ATTACHMENT 2  COIL DRAWINGS
Interdraw Anneal Coil Assembly 11831410
Side Support 11831411
Bottom Support 11831412
Top Plate 11831413
Coil Winding Assembly 11831414
Output Buss Assembly 11831415
Chain Guide 11831416
Top Guide 11831417
Pin Guide Assembly 11831418
Spacer 11831419
Case Guide, Entrance 11831420
Case Guide, Exit 11831421
Ferrite Core, Solid 11831422
Ferrite Core, Cut Out 11831423
Ferrite Core, Cut Out - Front 11831424
Spacer Strip 11831425
Stress Relief 11831426
Base Plate 11831427
End Support Assembly 11831428
Bracket Assembly 11831429
Spacer - Buss Bar 11831430
Buss Bar - Intercoil 11831431
Buss Bar - Intercoil 11831432
Buss Bar - Connector 11831433
Buss Bar - Terminal 11831434
Neck & Mouth Anneal - Coil Assembly 11831435
Spacer, Coil 11831436
Coil Connector 11831437
Case Guide 11831438
Support Assembly, Case Guide 11831439
Clip Guide Assembly 11831440
Case Pressure Bar Assembly 11831441
Side Support Assembly 11831442
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<td>Laminated Magnetic Flux Concentrator</td>
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ATTACHMENT 3  IN-PROCESS PART DEFINITIONS
**REVISIONS**

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**NOTES:**

1. WALL THICKNESS VARIATION AROUND THE PERIPHERY AT ANY SPECIFIED POINT ALONG THE CYLINDRICAL LENGTH OF THE CUP SHALL NOT VARY MORE THAN .005

2. CUP SPEC MIL-C-10375(MU)

3. COPPER ALLOY NO. 260, ANNEALED, SPEC MIL-C-50

**PART NO. 10522459**

**CODE IDENT NO. 19200**

**PHYSICAL PROPERTIES**

| D10521997 | .025 | .002 |

**UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES**

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**ORIGINAL DATE OF DRAWING APRIL 13, 1962**

**CUP (3 DRAW)**

**ADEL SC**

**US ARMY FRANKFORD ARSENAL**

**SCALE: 2/1 UNIT WGT: 224 - 146GRS**

**DRAWING 10522459 B SHEET 1 OF 1**
<table>
<thead>
<tr>
<th>DRAW</th>
<th>Outside Diameter</th>
<th>Wall Thickness (Distance from Inside Base)</th>
<th>Base Thickness</th>
<th>Overall Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Draw</td>
<td>.539/.542</td>
<td>.030/.032 (.875)</td>
<td>.170/.174</td>
<td>1.19</td>
</tr>
<tr>
<td>Second Draw</td>
<td>.525/.527</td>
<td>.021/.023 (.875)</td>
<td>.170/.174</td>
<td>1.55</td>
</tr>
<tr>
<td>Third Draw</td>
<td>.468/.469</td>
<td>.032/.036 (.280)</td>
<td>.176/.180</td>
<td>2.075</td>
</tr>
</tbody>
</table>

| PRE-POCKET               | Web Thickness    | .036/.040                                  |                |

<table>
<thead>
<tr>
<th>HEADING</th>
<th>Web Thickness</th>
<th>Flat Diameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.072/.078</td>
<td>.46 minimum</td>
<td></td>
</tr>
</tbody>
</table>

| FIRST TAPER              | Head-to-Shoulder Length | 1.573/1.577                                |                |

**IN-PROCESS PART DEFINITIONS**
The average hardness readings of 10 finished cartridge cases at each position indicated shall fall within the range for that position defined by the maximum and minimum hardness gradients. The greatest probability of satisfactory function of cartridges assembled with these cases occurs when the graph of these average readings is generally parallel to the limit gradients and is free from sharp angular departures therefrom in the region .03 from the head to .1875 from the head.

Minimum hardness at point A to be 180 DPH. Minimum hardness at points B, C and D to be 180 DPH. Hardness shall be determined on sectioned case.

Dimensions given at intersection of lines.

Dimensions at plugging operation following taper (informational).

Include taper not to exceed .002 is allowable in neck due to variable expansion of brass.

Part Identification Mark:
Stamp initials of manufacturer or recognized trade mark.
Stamp last two figures of year of manufacture.
Stamping must be legible and not encroach on the primer crimp or head bevel.


Inside wall to be a continuous taper between .0505 min and .0505 max.

.0505 min and .0505 max are construction dimensions which insure the minimum permissible wall thickness.

Material: Copper Alloy No. 260, Annealed, Spec MIL-C-50
ATTACHMENT 4    DIMENSIONAL INSPECTION DATA
<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DWG. 10521997 TOLERANCE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Thickness</td>
<td>.059 min.</td>
<td>.076</td>
<td>.076</td>
<td>.078</td>
<td>.077</td>
<td>.077</td>
<td>.074</td>
<td>.076</td>
</tr>
<tr>
<td>Pocket Depth</td>
<td>.126 + .005</td>
<td>.130</td>
<td>.130</td>
<td>.130</td>
<td>.130</td>
<td>.130</td>
<td>.130</td>
<td>.130</td>
</tr>
<tr>
<td>Pocket Diameter</td>
<td>.2093 + .005</td>
<td>.2093</td>
<td>.2093</td>
<td>.2093</td>
<td>.2093</td>
<td>.2093</td>
<td>.2093</td>
<td>.2093</td>
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<tr>
<td>Head Diameter</td>
<td>.473 - .007</td>
<td>.468</td>
<td>.468</td>
<td>.469</td>
<td>.468</td>
<td>.469</td>
<td>.468</td>
<td>.468</td>
</tr>
<tr>
<td>Head Thickness</td>
<td>.054 - .007</td>
<td>.051</td>
<td>.051</td>
<td>.050</td>
<td>.052</td>
<td>.051</td>
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<tr>
<td>Wall Thickness (.250)</td>
<td>.0305 min.</td>
<td>.034</td>
<td>.033</td>
<td>.034</td>
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<td>.034</td>
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<td>.037</td>
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<td>.036</td>
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<tr>
<td>Mouth Wall Thickness</td>
<td>.017 - .004</td>
<td>.015</td>
<td>.016</td>
<td>.014</td>
<td>.015</td>
<td>.015</td>
<td>.015</td>
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<td>.017</td>
<td>.016</td>
<td>.016</td>
<td>.016</td>
<td>.016</td>
<td>.016</td>
<td>.016</td>
</tr>
<tr>
<td>Mouth Diameter</td>
<td>.3067 + .001</td>
<td>.3070</td>
<td>.3075</td>
<td>.3075</td>
<td>.3070</td>
<td>.3070</td>
<td>.3075</td>
<td>.3073</td>
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<tr>
<td>Length to Shoulder</td>
<td>1.634 - .006</td>
<td>1.631</td>
<td>1.632</td>
<td>1.632</td>
<td>1.632</td>
<td>1.631</td>
<td>1.631</td>
<td>1.631</td>
</tr>
<tr>
<td>Overall Length</td>
<td>2.015 - .015</td>
<td>2.007</td>
<td>2.006</td>
<td>2.007</td>
<td>2.008</td>
<td>2.006</td>
<td>2.008</td>
<td>2.007</td>
</tr>
<tr>
<td>Min./Max. Profile</td>
<td>OK</td>
<td></td>
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<td></td>
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</tbody>
</table>

DIMENSIONAL INSPECTION DATA
ATTACHMENT 5  METALLURGICAL INSPECTION DATA
ATTACHMENT 6 TEST FIRING DATA
Gulf and Western Industries, Inc.  
101 Chester Road  
Swarthmore, Pennsylvania 19081  
Attention: Mr. K. Hall

Gentlemen:

In accordance with your Purchase Order No. 78625-02, H.P. White Laboratory, Inc. conducted firing tests of twenty (20) experimental 7.62mm brass cartridge cases.

A propellant loading was developed which would produce the pressures specified for the caliber 7.62mm, M80 High Pressure Test (proof) cartridge. The cases were primed and loaded in accordance with that loading and the cartridges fired in a pressure barrel configured to determine peak chamber pressures in copper units of pressure (CUP). Table I is a summary of the attached data record of these firings.

<table>
<thead>
<tr>
<th>Propellant Load (1)</th>
<th>Number Fired</th>
<th>Pressure (CUP x 1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(grains)</td>
<td>Maximum</td>
<td>Minimum</td>
</tr>
<tr>
<td>41.0 to 44.0 (3)</td>
<td>62.2</td>
<td>56.5</td>
</tr>
<tr>
<td>41.5 to 42.0 (4)</td>
<td>62.2</td>
<td>61.3</td>
</tr>
<tr>
<td>42.5 (4)</td>
<td>69.0</td>
<td>64.4</td>
</tr>
</tbody>
</table>

(1) IMR 4475 propellant  
(2) MIL-Spec average pressure for M80: 67,500 ± 2500 PSI.  
(3) 150 grain bullet.  
(4) 180 grain bullet.
Subsequent to these tests the spent cases were examined for evidence of cracks, bulging, distortion, primer leakage, etc. No deficiencies were noted.

The spent cases are being returned via United Parcel Service under separate cover. Should you have any questions regarding this matter or if we may be of any further service, please do not hesitate to contact us.

Very truly yours,

H.P. WHITE LABORATORY, INC.

D.R. Dunn

DRD/1t
enclosures
## FIRING RECORD

**H. P. WHITE LABORATORY, INC.**

3114 Scarboro Road, Street, Maryland 21154

### Ammunition:
- **7.62** handloads
- **Cartridge:** 7.62mm, M80 HPT
- **Ammunition:** 7.62 handloads
- **Primer:** CCI 100
- **Powder:** gr. IMR 4475
- **Bullet:**

### Weapon:
- **Pressure barrel**

### Range Conditions:
- **Barometer:**
- **Wind:**
- **Chronograph No.:**
- **Range:** Indoor
- **Gunner:** Mitchom
- **Recorder:** Mitchom

### Velocity and Pressure

<table>
<thead>
<tr>
<th>Round No.</th>
<th>Time</th>
<th>f. p. s.</th>
<th>Over 20 ft.</th>
<th>@ 15</th>
<th>Le</th>
<th>p. s. i.</th>
<th>#247</th>
<th>PRESSURE</th>
<th>Propellant Load</th>
<th>Remarks</th>
<th>Bullet</th>
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<tbody>
<tr>
<td>1</td>
<td>.007381</td>
<td>2710.0</td>
<td>.323</td>
<td>56500</td>
<td>41.0</td>
<td>150 gr. PMC</td>
<td>2710.0</td>
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<td>2</td>
<td>.007184</td>
<td>2784.3</td>
<td>.318</td>
<td>58700</td>
<td>41.8</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>.007214</td>
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<td>.320</td>
<td>57800</td>
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<td>.007631</td>
<td>2621.2</td>
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<td>61300</td>
<td>41.5</td>
<td>180 gr. SP</td>
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<td>9</td>
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<td>62200</td>
<td>42.0</td>
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<tr>
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<td>69000</td>
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<td>64800</td>
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</tr>
</tbody>
</table>

### Average
- **Velocity:**
- **Pressure:**
- **Client:** Gulf and Western

US MIL Spec. Average pressure: 67,500 ± 2500 PSI.

Date: 30 October 1980

Form 21
ATTACHMENT 7 VOID TEST DATA
<table>
<thead>
<tr>
<th>Test</th>
<th>Power (KW)</th>
<th>1/2 in.</th>
<th>1-1/2 in.</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>104</td>
<td>173.3</td>
<td>131.5</td>
<td>All 24 stations</td>
</tr>
<tr>
<td>B</td>
<td>102</td>
<td>170.5</td>
<td>128.6</td>
<td>4 even voids</td>
</tr>
<tr>
<td>C</td>
<td>102</td>
<td>144.7</td>
<td>127.9</td>
<td>4 consecutive voids</td>
</tr>
<tr>
<td>D</td>
<td>101</td>
<td>170.7</td>
<td>130.2</td>
<td>6 even voids</td>
</tr>
<tr>
<td>E</td>
<td>101</td>
<td>130.8</td>
<td>123.7</td>
<td>6 consecutive voids</td>
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</tbody>
</table>

VOID TEST DATA